



A Biological Study of the Cannelton Pool of the Ohio River



Executive Summary

- Since 2004, ORSANCO has been using a probabilistic (random) design for monitoring fish communities in the Ohio River and conducting biological assessments.
- The Ohio River was divided into 20 assessment units based primarily on the locations of navigational dams. Using the random design, each assessment unit was assigned 15 sampling locations.
- Once sampled, each site is graded as passing or failing. For an assessment unit to meet its aquatic life use designation, more than 75% of the sites assessed must be in passing condition.
- Twenty-seven of the 30 sites (90%) assessed in Cannelton pool were in passing condition. The percent of sites passing, even when accounting for the precision of the measurement (+/- 9%), indicates the pool will be reported to EPA as supporting its aquatic life use designation.
- Previous analyses have identified a relationship between flow and ORFIn scores and the need for sampling thresholds and/or flow calibration. Increased flows appeared to cause lower ORFIn scores due to decreased sampling efficiency and changes in fish behavior.
- Flows fluctuated in 2006 but were stable in 2007. Sampling was not conducted when flows were elevated.
- Recommendations include accepting the assessment of Cannelton pool as meeting its aquatic life use designation and moving to the next pool to be sampled while continuing to monitor flow and its influence on assessment results.

Table of Contents

	Executive Summary	i
1.0	Introduction.....	1
2.0	Study Area	
2.1	Ohio River.....	1
2.1.1	Figure 1. Ohio River Basin	2
2.2	Cannelton Pool	3
2.3	Cannelton Pool Land Use	3
2.3.1	Figure 2. Landuse in Cannelton pool catchment area.....	3
3.0	Methods	
3.1	Survey Design and Site Location	4
3.2	Index Period and Sampling Restrictions.....	4
3.3	Fish Collections	4
3.4	Habitat Characterizations	5
3.5	Water Quality and Flow Condition Data	5
3.6	Pool Assessment.....	5
3.6.1	Figure 3. Biological Condition Ratings.....	5
3.6.2	Figure 4. Sites within Cannelton Pool.....	6
4.0	Results	
4.1	Fish Population.....	7
4.1.1	Figure 5. Species Composition	7
4.1.2	Figure 6. Family Composition.....	7
4.1.3	Table 1. Electrofishing Sites	8
4.1.4	Table 2. Species List.....	9
4.2	Metric Performance	10
4.3	Habitat Surveys.....	10
4.3.1	Figure 7. Substrate Composition by Pool.....	10
4.3.2	Figure 8. Substrate Composition by Site	10
4.3.3	Table 3. ORFIn Metrics and Scores.....	11
4.4	Water Quality and Flow Conditions.....	13
4.4.1	Figure 9. Flow conditions.....	13
4.5	Assessment of Condition.....	13
4.5.1	Figure 10. Pool Assessment Results	13
4.5.2	Figure 11. Condition of the Cannelton Pool.....	13
5.0	Discussion	
5.1	Fish Population.....	13
5.2	Metric Performance	14
5.3	Habitat Surveys	14
5.4	Water Quality and Flow Conditions	14
5.5	Conclusions and Assessment of Conditions.....	14
6.0	Interpool Comparisons	
6.1	Purpose.....	14
6.2	Land Use	14
6.2.1	Figure 12. Land-use within catchment area of each pool of the Ohio River	15
6.3	Substrate Composition.....	15
6.3.1	Figure 13. Substrate composition for each pool	15
6.4	Species Richness	15
6.4.1	Figure 14. Average number of native species.....	15
6.5	Number of Individuals.....	15
6.5.1	Figure 15. Average number of individual species	16
6.6	Noteworthy Fish Observations.....	16
6.6.1	Table 4. Compiled species list per pool.....	17
6.7	ORFIn Deviation	16
6.7.1	Figure 16. Average ORFIn Deviation.....	16
6.8	Assessment of Condition.....	16
6.8.1	Figure 17. Percentage of sites failing	16
	Literature Cited.....	20
	Appendix A. Assessment Criteria Details.....	21
	Appendix B. Fish Survey Data	23
	Appendix C. Habitat Survey Data	34
	Appendix D. Water Quality Data.....	35

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1.0 Introduction

The Ohio River Valley Water Sanitation Commission (ORSANCO) is an interstate water pollution control agency created in 1948 by an act of Congress to monitor and improve the water quality of the Ohio River. Until that time, water quality issues on the Ohio River had been charged to state water quality agencies. However, due to large-scale interstate implications and large pollution loads received by the Ohio River, these agencies were not sufficiently equipped to work with such a system. ORSANCO's role is to work in conjunction with state agencies to develop a set of pollution control standards exclusive to the Ohio River. The creation of these standards requires the establishment of monitoring programs that can efficiently be used on the Ohio River.

The routine ambient monitoring programs of ORSANCO are primarily directed at three monitoring and assessment priorities: spill detection (through an organics detection system), trend assessment (manual sampling system), and aquatic resource characterization (macroinvertebrate and fish studies). Another priority, water quality impacts assessment, is achieved through entire watershed intensive surveys.

In 1993, following direction from state and federal agencies, ORSANCO staff developed and implemented an intensive survey design that used electrofishing methods designed for the navigational pools of the Ohio River. This entailed extensive sampling of fish communities throughout the entire length of a particular pool. The surveys were intended to provide background information on fish populations and lay a foundation for establishing biological criteria (biocriteria) for the Ohio River. With appropriate biocriteria in place, information on the biological community provides insight into the health of the Ohio River.

After several years of collecting background data on the fish population of the Ohio River, ORSANCO developed the Ohio River Fish Index (ORFI_n, Emery et al. 2003). The ORFI_n incorporates 13

attributes, or metrics, of the fish community that when compiled provide an accurate representation of the overall condition of the Ohio River fish community. These 13 metrics take into account several different aspects of the fish population, including diversity, abundance, feeding and reproductive guilds, pollution tolerance/intolerance, and fish health.

An important aspect of biological monitoring is the reduction of human induced bias in the samples. The use of probability-based sample site selection was designed to reduce this bias. Within this design, sample sites are randomly selected by computer generation, eliminating the tendency to sample only in the best or worst locations. Many states already have programs in place that use this design for sampling on smaller streams, and it is also used by the U.S. Environmental Protection Agency's (USEPA) Environmental Monitoring and Assessment Program (EMAP). ORSANCO has now begun using this approach on the Ohio River for its biological monitoring. In 2007, the Emsworth, Pike Island, Meldahl, Cannelton, and Newburgh pools were sampled as part of ORSANCO's normal monitoring. Cannelton pool was selected to be surveyed in 2006; however completion was interrupted by high water conditions. This report presents the 2006 and 2007 survey of Cannelton pool including the data collected and assessment results based on both fish population surveys.

2.0 Study Area

2.1 Ohio River

The Ohio River (Figure 1) begins at the confluence of the Monongahela and Allegheny rivers and flows 981 miles in a southwesterly direction to the confluence with the Mississippi River. Twenty navigational dams maintain a nine-foot minimum depth for commercial navigation throughout the entire length of the river. There are over 600 permitted discharges to the Ohio River, 49 of which are power-generating facilities. The Ohio River Basin contains nearly ten percent of the nation's population, more than 25 million people, and serves as an avenue for transportation of approximately 250 million tons of cargo each year (ORSANCO 1994). The Ohio River dissects four ecoregions: the

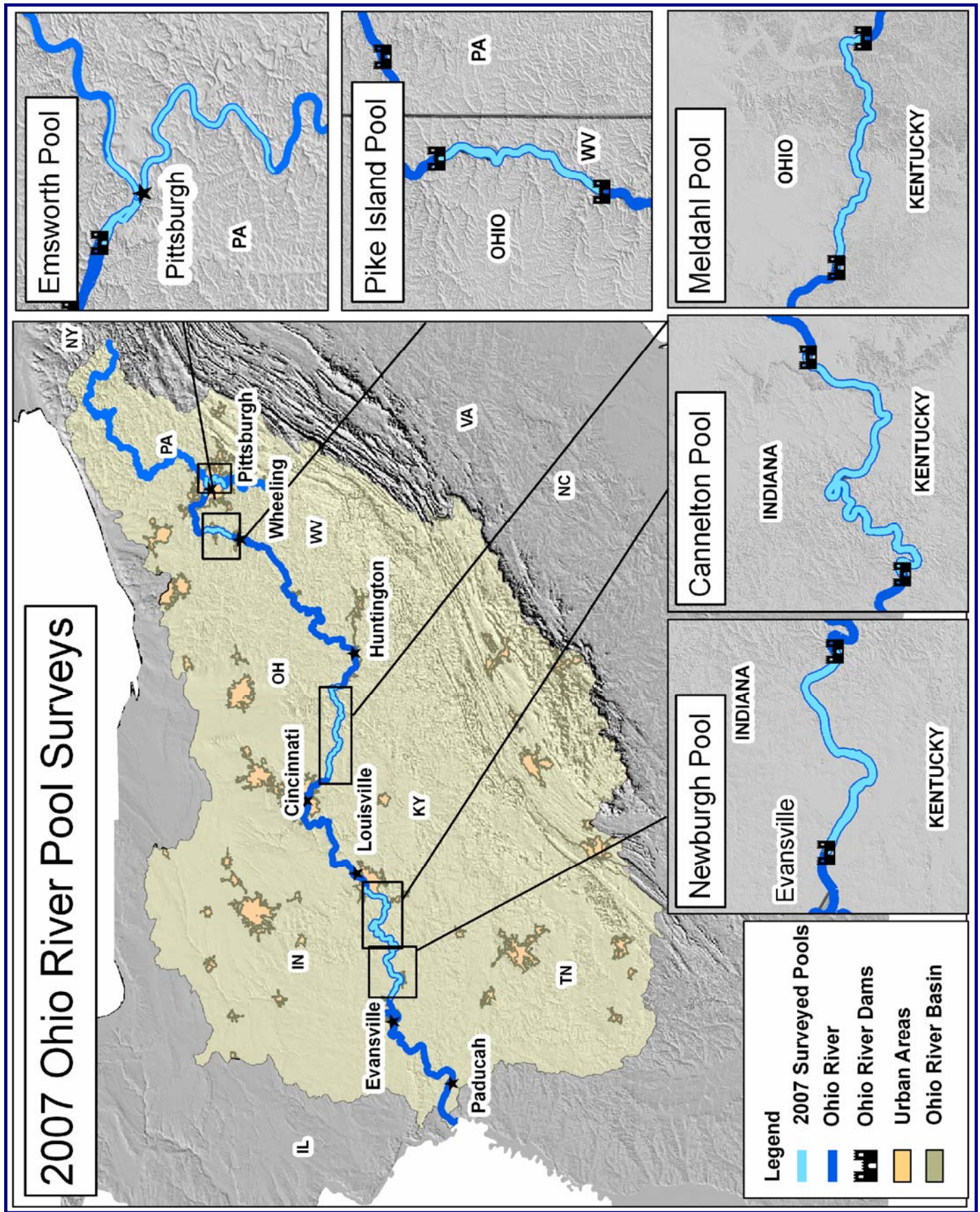


Figure 1. The Ohio River basin and the five pools selected for 2007 sampling.

Western Allegheny Plateau, the Interior Plateau, the Interior River Lowland, and the Mississippi Alluvial Plain (Omernik 1987).

2.2 Cannelton Pool

The Cannelton pool is 113.9 miles long, extending from McAlpine Locks and Dam (ORM 606.8) to Cannelton Locks and Dam (ORM 720.7). The pool has a gradient of 0.3 feet per mile and averages 1674 feet wide and 32 feet deep. The pool is bordered by the states of Kentucky and Indiana. The Cannelton pool receives water from the Salt River, Big Indiana Creek, Sinking Creek, and Blue Creek (ORSANCO 1994).

The Falls of Ohio (Clarksville, Indiana) is located in Cannelton pool and provides a unique habitat in the river therefore a unique fish community is also present. Many species such as blue suckers (*Cycleptus elongatus*) and striped bass (*Morone saxatilis*) take advantage of the high flows and shallow water. This riffle-like habitat offers quasi-natural, historical conditions that were once intermittent along the entire length of the river.

2.3 Cannelton Pool Land Use

This pool lies in a portion of the Ohio River where the land use consists largely of deciduous forest (54.1%), but also row crops (12.8%) and pasture lands (15%: Figure 2).

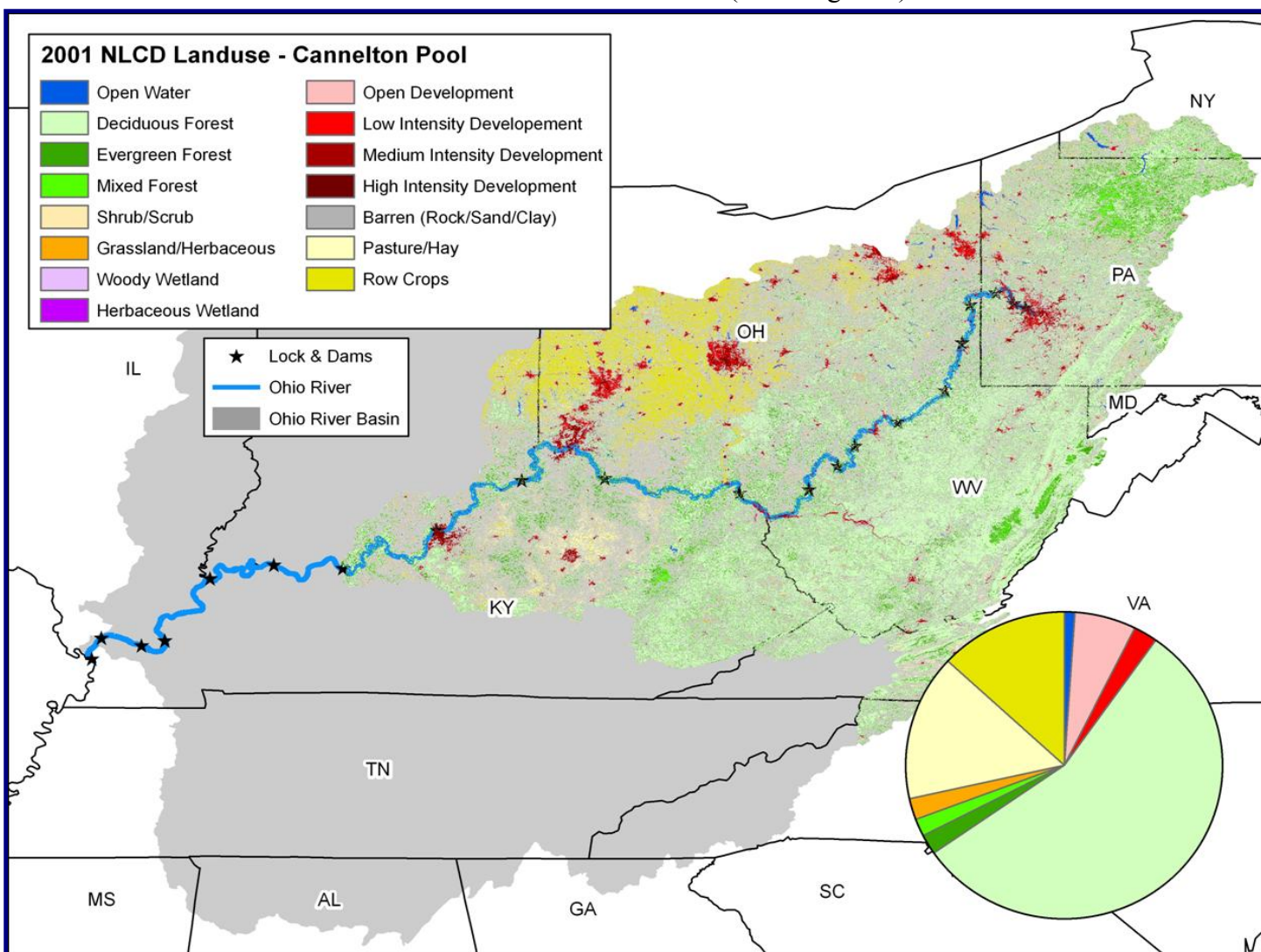


Figure 2. Land use within Cannelton pool catchment area.

3.0 Methods

3.1 Survey Design and Site Location

A random, probability-based survey design was used to select sampling site locations within each Ohio River survey pool. The USEPA National Health and Environmental Effects Laboratory, Western Ecology Division provided assistance by generating the survey design for this project. The target population was the linear shorelines of the Cannelton pool of the Ohio River from mile marker 606.8 (McAlpine Locks and Dam) to 720.7 (Cannelton Locks and Dam). The total linear extent of the target population was approximately 227.8 miles. The sample frame was generated using RF3 river double lines for the Ohio River and river mile coverages provided by ORSANCO. A generalized random tessellation stratified (GRTS) survey design for a linear network with reverse hierarchical randomization (RHR) was used to select all sampling locations. This survey design provided coordinates for 15 sampling sites in each of the selected pools. The data collected from these sites were used to make an assessment of the pool (see Section 3.6 and Appendix A). In the survey of Cannelton, this included two sets of 15 sites.

Sites were sampled as closely as possible to the location generated from the design, but in cases of restricted access or unsafe sampling conditions (e.g. barge loading/mooring area), sampling zones were shifted if possible (up to a maximum of 500m up- or downstream). The survey design supplied additional sampling sites that were used if a site could not be placed within 500m of the original location.

3.2 Index Period and Sampling Restrictions

All sampling was conducted under the required conditions as described by Emery et al. (2003). This included sampling between July 1 and October 31 when water levels were within one meter of “normal flat pool” and Secchi depths were greater than 0.3m. These sampling restrictions were used to reduce community variability by increasing the likelihood that samples were collected during the stable, low-flow conditions usually present on the Ohio River during the summer and early fall months.

3.3 Fish Collections

Standard collection techniques were employed throughout the surveys as described by Emery et al. (2003). Fish were collected using boat electrofishing techniques at night because nighttime electrofishing typically yields samples of increased diversity and richness (Sanders 1992).

A sampling crew consisted of a three-person team working from an 18-foot aluminum johnboat. Each boat was equipped with a 5000-watt generator and a Smith-Root Type VI-A electrofishing unit. Sampling was conducted over a 500m long section of near-shore habitat (shoreline out to a maximum distance of 100 ft or a depth of 20 ft.) and was sampled for a minimum of 1800 seconds (Gammon 1998). Time could vary depending upon the complexity of the habitat within a given zone. Stunned fish were captured with nets and placed into large, aerated tubs for processing. Each fish was measured, inspected for anomalies, and identified to lowest possible taxonomic level (species) before being returned to the water. Fish that could not be confidently identified in the field (e.g. minnows) were preserved in a ten percent formalin solution and identified in the laboratory.



ORSANCO crew conducting night-time electrofishing



Typical 500 meter electrofishing reach

3.4 Habitat Characterizations

Large rivers have distinct habitat types, including unique microhabitats (Reash 1999). Therefore, extensive habitat surveys were conducted for each electrofishing zone, including thorough substrate and depth measurements. Descriptions of the riparian corridor adjacent to the sampling zone and the presence of woody material available as fish cover were also recorded. Depth and substrate composition were measured at 66 points throughout each 500m zone. Six points along the shoreline were selected throughout the length of the zone, at 0, 100, 200, 300, 400 and 500m. From each of these points, depth was recorded at 10ft intervals beginning at the shore/water interface and moving away from the shore for 100ft. Woody cover, which included submerged brush, logs, and stumps, was estimated visually. Using these data, each site, or electrofishing zone, was assigned to one of three existing classes of habitat: 'A', 'B', or 'C'. By assigning each sampling site to one of three habitat categories, biologists can reduce the amount of assessment variability, or 'noise', because each habitat class has a slightly different expectation. Sites assigned to habitat class 'A' are characterized by the presence of large substrates such as cobble and boulders. Sites that fall in habitat class 'C' are dominated by sand and other small substrates, and habitat class 'B' describes sites that fall between 'A' and 'C' with a mix of large and small substrate materials.

3.5 Water Quality and Flow Condition Data

Basic measures of water quality were collected at each site prior to sampling. The following parameters were measured with a YSI meter: water temperature, pH, dissolved oxygen (DO), and conductivity. Secchi depth was measured

using a standard Secchi disk. Flow data were obtained from the U.S. Army Corps of Engineers. These included daily average flow volumes and velocities from the sampling station within or nearest to the sampled pool. Harmonic mean flow (HMF) values were determined by ORSANCO using 30-year means for the flow data obtained from the U.S. Army Corps of Engineers (ORSANCO 2003).

3.6 Pool Assessment

In 2006 and 2007, ORSANCO employed a probability-based sampling and assessment approach to provide a thorough assessment of biological condition. For the purpose of assessment, individual navigational pools served as the primary assessment units. Therefore, the Cannelton pool served as one distinct assessment unit (AU) and will be reported on as such in the 305(b) report issued to EPA. The approach to assessing each AU involved sampling a statistically determined number of sites (15) and comparing observed ORFIn scores to habitat derived expectations for each site (Emery et al. 2003).

The three distinct habitat classes ('A', 'B', and 'C') each exhibit different levels of ORFIn performance. Performance expectations for each habitat class were determined based on the statistical distribution of data (ORFIn scores) gathered from 'least impacted' (reference) sites within each habitat class. The 25th percentile value for each habitat class was established as the criterion for determining whether an individual site 'passes' (meets its aquatic life use designation) or 'fails' (does not meet its aquatic life use designation, Figure 3).

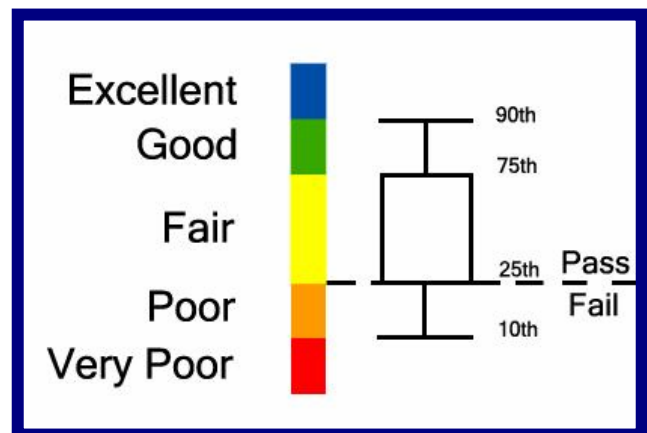


Figure 3. Approach used to assign habitat condition ratings.

Individual site scores were compared to expected values and the percentage of failing sites in the pool was then calculated. A precision estimate for the percentage of sites failing was also calculated (see Appendix A for a detailed explanation). The precision estimate was used to create a 90% confidence interval around the percentage of sites failing. The threshold for the pool assessment was set at 25% failure. The pool passed the assessment if the entire confidence interval fell below 25%. If the whole confidence interval was greater than 25%, the pool was assessed as failing.

If the confidence interval overlapped the 25% threshold, the assessment required additional sampling to determine the result. To further characterize the condition of each pool, sites were given individual condition ratings. These ratings were based on the same distribution of data from 'least impacted' sites used to determine expectations and consisted of Excellent, Good, Fair, Poor and Very Poor. The 90th, 75th, 25th, and 10th percentiles were used as cutoff points for the different ratings. Any sites that were classified as Poor or Very Poor were also sites that failed to meet expectations (Figures 3 and 4).

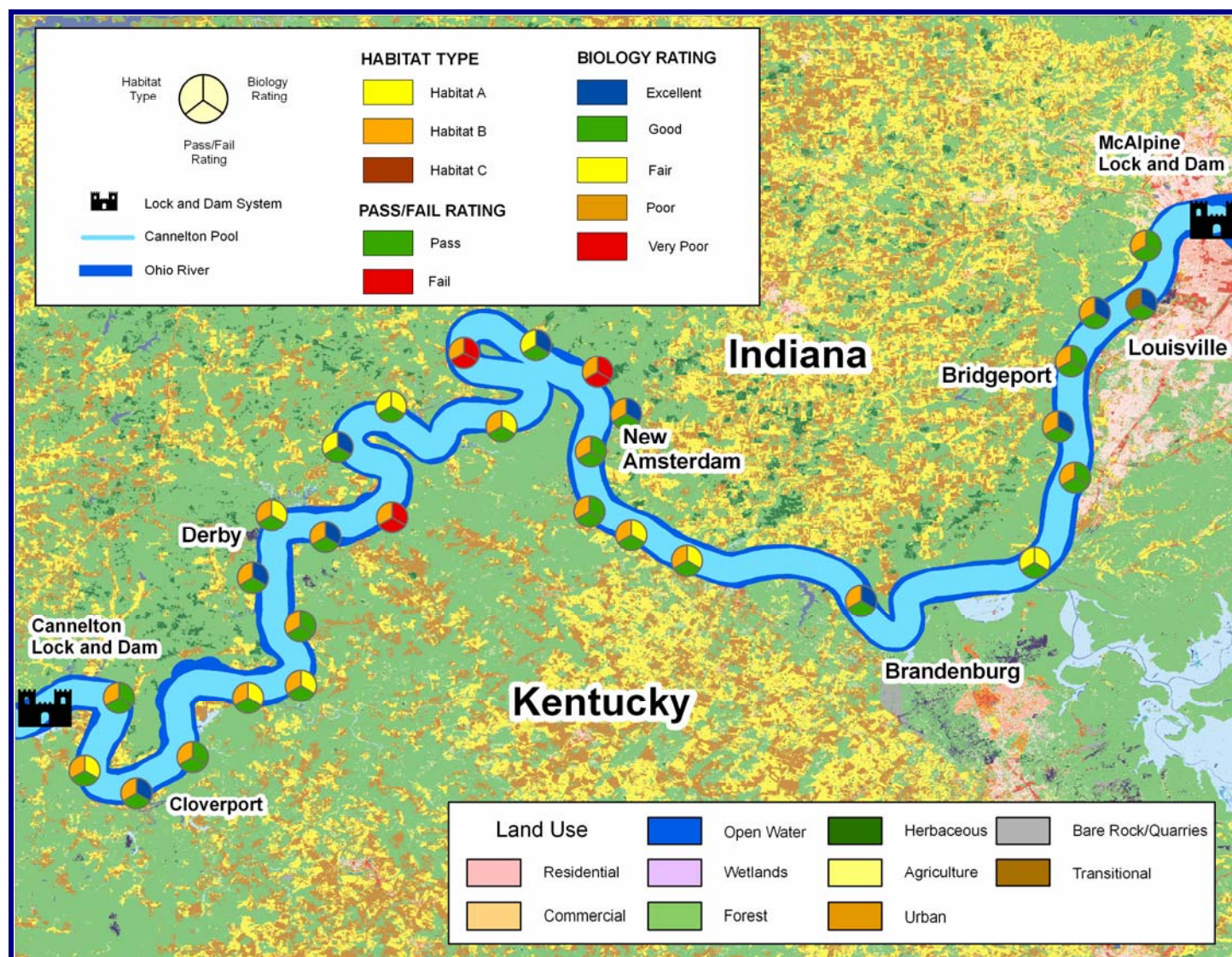


Figure 4. Locations and results of sampling at 30 sites within the Cannelton pool.

4.0 Results

4.1 Fish Population

In 2006 and 2007, fish population data (Appendix B) were collected from a total of 30 randomly selected locations throughout the length of the Cannelton pool (Table 1). These collections produced 44 species and 2 hybrid taxa, representing 11 different families (Table 2). The black buffalo (*Ictiobus niger*) was the only taxa collected that was listed in KY (special concern). No federally listed taxa were collected from the Cannelton pool. At the

species level, the most abundant species were gizzard shad (*Dorosoma cepedianum*), sauger (*Sander canadensis*), and emerald shiner (*Notropis atherinoides*) which comprised 43.3%, 15.5%, and 15.3% of the catch respectively (Figure 5). The dominance of these three species was reflected at the family level. The shad and herring family (Clupeidae) dominated in abundance, making up 44.9% of the total catch, followed by the minnow family (Cyprinidae) and the perches and darters family (Percidae), 22.5% and 15.8% respectively (Figure 6).

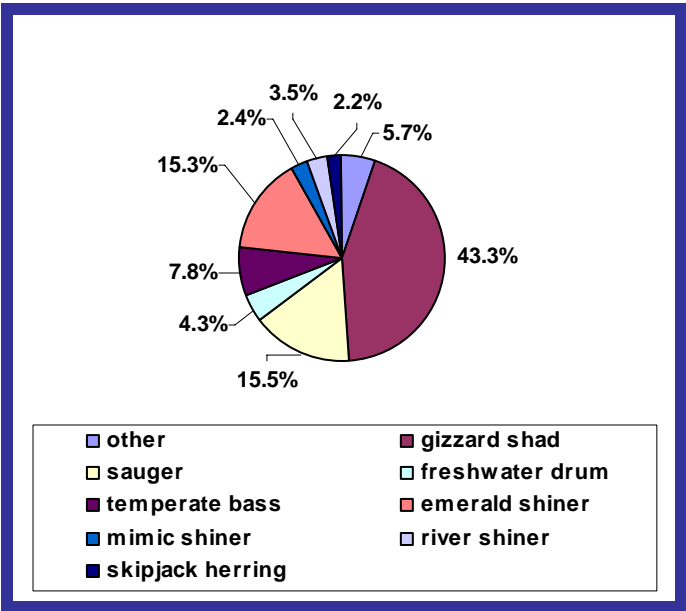


Figure 5. Species composition of fish sampled in Cannelton pool.

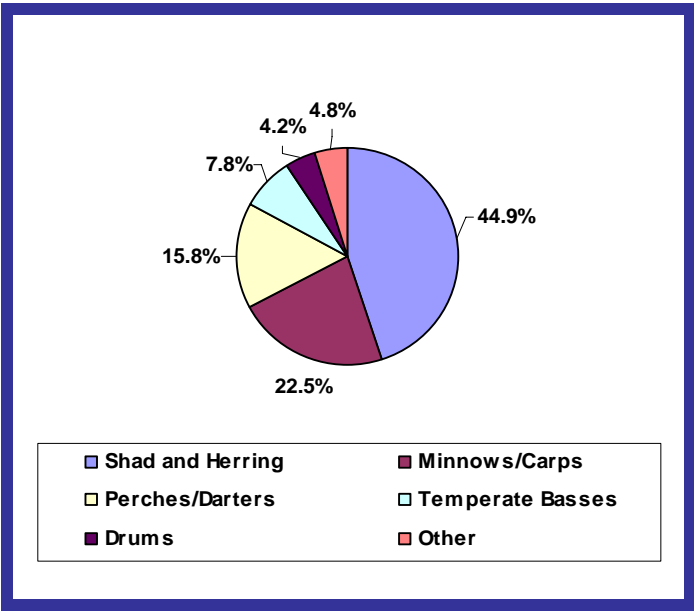


Figure 6. Sampled fish composition by family in the Cannelton pool.

Table 1. Electrofishing site list for the Cannelton pool, including habitat designation, ORFIn scores and status.

Site #	River Mile	Bank	Date	Latitude	Longitude	Habitat Class	ORFIn Expectation	Observed ORFIn	Site Result	Rating
1	612.1	RDB	03-Jul-07	38.23428	85.84271	B	33	45	PASS	GOOD
2	612.2	LDB	03-Jul-07	38.22978	85.84005	C	19.68	43	PASS	EXCELLENT
3	614.1	LDB	03-Jul-07	38.20999	85.86351	B	33	49	PASS	EXCELLENT
4	617.7	LDB	02-Jul-07	38.16985	85.90579	B	33	45	PASS	GOOD
5	621.2	RDB	02-Jul-07	38.11923	85.90715	B	33	49	PASS	EXCELLENT
6	623.8	RDB	02-Jul-07	38.08368	85.90911	B	33	45	PASS	GOOD
7	628.2	LDB	17-Jul-07	38.01880	85.92308	A	39	43	PASS	FAIR
8	639.7	RDB	17-Jul-07	37.98382	86.06837	B	33	53	PASS	EXCELLENT
9	648.6	RDB	18-Jul-07	38.02430	86.20990	B	33	39	PASS	FAIR
10	650.3	LDB	01-Aug-06	38.03561	86.23661	B	33	39	PASS	FAIR
11	652.9	RDB	01-Aug-06	38.05572	86.26462	B	33	45	PASS	GOOD
12	655.8	LDB	02-Aug-06	38.09980	86.27774	B	33	45	PASS	GOOD
13	656.4	RDB	18-Jul-07	38.10917	86.27625	B	33	53	PASS	EXCELLENT
14	660.9	LDB	02-Aug-06	38.16067	86.30438	B	33	20	FAIL	VERY POOR
15	661.6	RDB	18-Jul-07	38.17108	86.31185	A	39	51	PASS	EXCELLENT
16	667.7	LDB	31-Jul-06	38.16713	86.36864	B	33	15	FAIL	VERY POOR
17	672.8	RDB	31-Jul-06	38.12936	86.33653	B	33	35	PASS	FAIR
18	680.7	LDB	23-Jul-07	38.12316	86.45065	A	39	41	PASS	FAIR
19	682.3	RDB	23-Jul-07	38.10522	86.46631	A	39	55	PASS	EXCELLENT
20	687.3	RDB	26-Jul-06	38.05462	86.44637	B	33	19	FAIL	VERY POOR
21	689.8	LDB	25-Jul-07	38.03888	86.48703	B	33	47	PASS	EXCELLENT
22	692.0	RDB	26-Jul-06	38.03420	86.52371	B	33	33	PASS	FAIR
23	694.5	RDB	25-Jul-07	37.99822	86.52659	B	33	49	PASS	EXCELLENT
24	696.1	LDB	25-Jul-07	37.97442	86.51870	B	33	43	PASS	GOOD
25	697.9	LDB	25-Jul-06	37.95103	86.51026	B	33	35	PASS	FAIR
26	698.3	LDB	25-Jul-06	37.94639	86.50656	B	33	35	PASS	FAIR
27	707.5	LDB	24-Jul-07	37.87726	86.59245	B	33	45	PASS	GOOD
28	709.8	LDB	24-Jul-07	37.84842	86.61403	B	33	49	PASS	EXCELLENT
29	711.6	RDB	24-Jul-06	37.84249	86.64360	B	33	39	PASS	FAIR
30	720.3	LDB	24-Jul-07	37.90486	86.69081	B	33	45	PASS	GOOD

LDB = Left Descending Bank

RDB = Right Descending Bank

Table 2. Species collected in the Cannelton pool during the 2006 and 2007 survey.

Family	Species	Latin Name	IN	KY
Lepisosteidae	longnose gar	<i>Lepisosteus osseus</i>		
Hiodontidae	mooneye	<i>Hiodon tergisus</i>		
Clupeidae	skipjack herring	<i>Alosa chrysochloris</i>		
Clupeidae	gizzard shad	<i>Dorosoma cepedianum</i>		
Clupeidae	threadfin shad	<i>Dorosoma petenense</i>		
Cyprinidae	spotfin shiner	<i>Cyprinella spiloptera</i>		
Cyprinidae	common carp	<i>Cyprinus carpio</i>		
Cyprinidae	silver chub	<i>Macrhybopsis storeriana</i>		
Cyprinidae	emerald shiner	<i>Notropis atherinoides</i>		
Cyprinidae	river shiner	<i>Notropis blennius</i>		
Cyprinidae	mimic shiner	<i>Notropis volucellus</i>		
Cyprinidae	bluntnose minnow	<i>Pimephales notatus</i>		
Catostomidae	Carpiodes sp	<i>Carpiodes sp</i>		
Catostomidae	river carpsucker	<i>Carpiodes carpio</i>		
Catostomidae	quillback	<i>Carpiodes cyprinus</i>		
Catostomidae	highfin carpsucker	<i>Carpiodes velifer</i>		
Catostomidae	northern hog sucker	<i>Hypentelium nigricans</i>		
Catostomidae	smallmouth buffalo	<i>Ictiobus bubalus</i>		
Catostomidae	black buffalo	<i>Ictiobus niger</i>		SC
Catostomidae	spotted sucker	<i>Minytrema melanops</i>		
Catostomidae	silver redhorse	<i>Moxostoma anisurum</i>		
Catostomidae	smallmouth redhorse	<i>Moxostoma breviceps</i>		
Catostomidae	black redhorse	<i>Moxostoma duquesnei</i>		
Catostomidae	golden redhorse	<i>Moxostoma erythrurum</i>		
Ictaluridae	channel catfish	<i>Ictalurus punctatus</i>		
Ictaluridae	flathead catfish	<i>Pylodictis olivaris</i>		
Atherinopsidae	brook silverside	<i>Labidesthes sicculus</i>		
Moronidae	Morone sp	<i>Morone sp</i>		
Moronidae	white bass	<i>Morone chrysops</i>		
Moronidae	striped bass	<i>Morone saxatilis</i>		
Moronidae	hybrid striper	<i>Morone saxatilis x M. chrysops</i>		
Centrarchidae	Lepomis sp	<i>Lepomis sp</i>		
Centrarchidae	green sunfish	<i>Lepomis cyanellus</i>		
Centrarchidae	bluegill	<i>Lepomis macrochirus</i>		
Centrarchidae	longear sunfish	<i>Lepomis megalotis</i>		
Centrarchidae	redeer sunfish	<i>Lepomis microlophus</i>		
Centrarchidae	bluegill x green sunfish	<i>Lepomis macrochirus x L. cyanellus</i>		
Centrarchidae	smallmouth bass	<i>Micropterus dolomieu</i>		
Centrarchidae	spotted bass	<i>Micropterus punctulatus</i>		
Centrarchidae	largemouth bass	<i>Micropterus salmoides</i>		
Centrarchidae	white crappie	<i>Pomoxis annularis</i>		
Centrarchidae	black crappie	<i>Pomoxis nigromaculatus</i>		
Percidae	logperch	<i>Percina caprodes</i>		
Percidae	river darter	<i>Percina shumardi</i>		
Percidae	sauger	<i>Sander canadensis</i>		
Sciaenidae	freshwater drum	<i>Aplodinotus grunniens</i>		

4.2 Metric Performance

Thirteen metrics were used to calculate ORFI scores for each electrofishing site (Emery et al. 2003). Each site's performance and scores for the ORFI metrics are shown in Table 3. The number of native species collected at each site ranged from 8 to 22, with an average of 14.9 species per site. Twenty-two of the thirty sites scored a 3 for the number of native species metric, only one site scored a 1 and seven scored a 5. The number of sucker species found at each site ranged from 0 to 6 and all but two sites scored a 1 or 3 for this metric. The number of centrarchid species varied from 0 to 7 and the majority of the metric scores were either a 1 or 3 (three sites were 5). Great river species ranged from 0 to 4 species per site. The number of intolerant species ranged from 0 to 5 at the sampled sites. The percentage of tolerant individuals at each site ranged between 0 and 2.4%, and all sites scored a 5 for this metric, with three scoring zero. The percentage of simple lithophils was between 7.0% and 78.9%, and scores for this metric were a 1, 3 or 5. Twenty-eight sites had below 3.0% non-native individuals. Two sites had 6.7% and 9.6% non-native individuals and the majority of sites scored 5 for this metric. The percent detritivores ranged from 0% to 41.0% and all sites scored a 1, 3, or 5. The percent invertivores ranged from 0.7% to 47.7%, with the majority of sites scoring a 1 or 3 for this metric. The percent piscivores had a large range from 17.9% to 91.2%. All but nine sites scored a 5 for the percent piscivores metric. Six sites scored a 3 and three sites scored a 1. Seven sites had a single DELT (deformities, eroded fins, lesions and tumors) anomaly, and one site had 3. All but one site scored a 5. The CPUE (catch per unit effort) ranged from 33 to 2,392 individuals per site. Sites with CPUE's greater than 131 scored a 3 or 5 for the metric.

4.3 Habitat Surveys

Intensive habitat surveys at each of the 30 sampling locations revealed that the bottom substrate in the Cannelton pool was in nearly equal proportions of sand, fines, and gravel with a smaller percentage of hardpan, cobble and boulders (Figure 7). However, there was some variation among the individual sites (Figure 8).

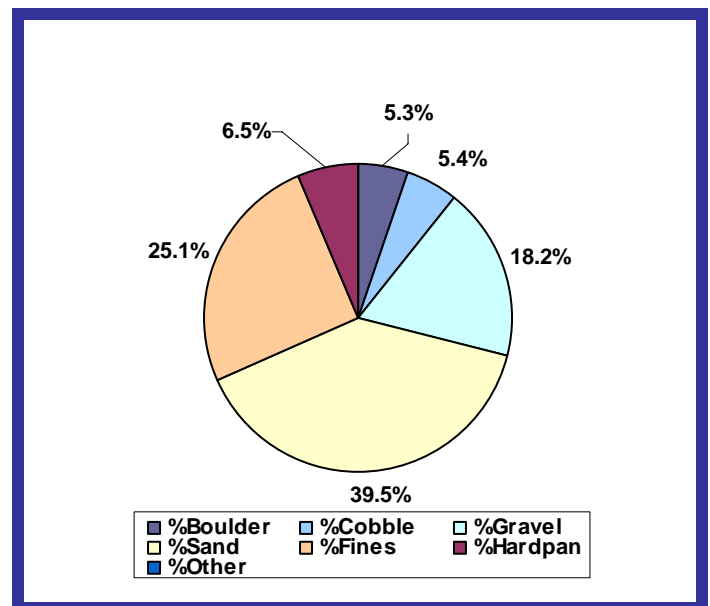


Figure 7. Substrate composition of the Cannelton pool.

The percentages of substrate variables were used to give each site a habitat classification of 'A', 'B', or 'C' (Table 1). Twenty-five sites in the Cannelton pool were classified as class 'B' habitats and four sites were class 'A' habitats. There was only one class 'C' habitat sampled in the pool.

Woody cover was present in 21 of the 30 sites sampled. Riparian land use was primarily natural forest with some agricultural uses present. Despite heavy barge activity throughout the pool, mooring structures were present at only two of the sites sampled (see Appendix C).

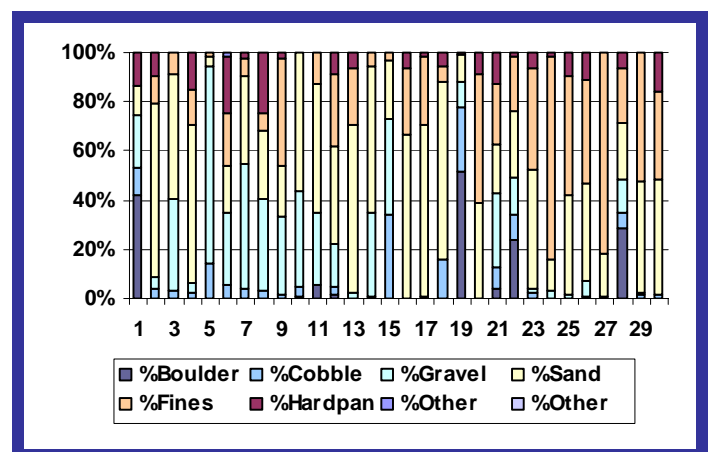


Figure 8. Substrate composition at each site sampled in the Cannelton pool.

Table 3. ORFIn metrics and scores from the Cannelton pool 2006 and 2007 survey.

Site #	Year	River Mile	Bank	# Individuals	# Individuals w/o G & E	# Individuals w/o GETHEX	# Species	# Species Score	# Suckers	Suckers Species Score	# Centrarchid Species	Centrarchid Species Score	# Great River Species	Great River Species Score	# Intolerant Species	Intolerant Species Score	% Tolerant Individuals	Tolerant Individuals Score	% Simple Lithophils	Simple Lithophils Score	% Non-native Individuals	Non-native Individuals Score	% Detritivores	Detritivores Score	% Invertivores	Invertivores Score	% Piscivores	Piscivores Score	# DELTs	DELT Score	CPUE	CPUE Score	ORFIn Expectation	Observed ORFIn	Site Result
1	2007	612.1	R	408	273	273	16	3	2	1	3	3	2	3	1	1	0.0	5	20.9	3	0.0	5	1.8	5	31.1	3	26.4	3	0	5	408	5	33	45	PASS
2	2007	612.2	L	112	99	99	13	3	2	1	0	1	2	3	1	1	0.0	5	60.6	5	0.0	5	2.0	5	30.3	3	48.5	5	0	5	112	1	19.7	43	PASS
3	2007	614.1	L	387	331	330	10	3	0	1	0	1	3	3	1	1	0.3	5	74.0	5	0.3	5	0.3	5	47.7	5	43.2	5	0	5	386	5	33	49	PASS
4	2007	617.7	L	181	106	106	11	3	2	1	0	1	2	3	1	1	0.0	5	71.7	5	0.0	5	2.8	5	33.0	3	44.3	5	0	5	181	3	33	45	PASS
5	2007	621.2	R	505	182	182	15	3	3	3	1	1	3	3	3	3	0.0	5	62.6	5	0.0	5	1.6	5	19.8	1	54.4	5	0	5	505	5	33	49	PASS
6	2007	623.8	R	249	72	72	13	3	2	1	0	1	3	3	2	3	0.0	5	55.6	5	0.0	5	6.9	5	16.7	1	48.6	5	0	5	249	3	33	45	PASS
7	2007	628.2	L	204	168	168	14	3	1	1	1	1	3	3	1	1	0.0	5	60.1	5	0.0	5	0.0	5	20.8	1	48.8	5	0	5	204	3	39	43	PASS
8	2007	639.7	R	489	397	396	18	5	3	3	1	1	4	5	2	3	0.0	5	59.4	5	0.3	5	2.0	5	18.9	1	68.0	5	0	5	488	5	33	53	PASS
9	2007	648.6	R	151	147	146	8	1	2	1	2	1	0	1	0	1	0.7	5	78.9	5	0.7	5	8.2	5	0.7	1	91.2	5	0	5	150	3	33	39	PASS
10	2006	650.3	L	81	54	54	16	3	4	3	2	1	1	1	2	3	0.0	5	40.7	5	0.0	5	22.2	1	40.7	3	22.2	3	0	5	81	1	33	39	PASS
11	2006	652.9	R	112	65	64	18	5	5	5	5	3	1	1	0	1	0.0	5	35.4	5	1.5	5	27.7	1	23.1	3	43.1	5	0	5	111	1	33	45	PASS
12	2006	655.8	L	152	83	73	21	5	6	5	4	3	2	3	3	3	2.4	5	33.7	5	9.6	1	25.3	1	24.1	3	43.4	5	0	5	142	1	33	45	PASS
13	2007	656.4	R	343	282	282	19	5	4	3	4	3	2	3	2	3	0.0	5	39.0	5	0.0	5	5.0	5	4.6	1	87.2	5	0	5	343	5	33	53	PASS
14	2006	660.9	L	33	33	33	10	3	3	3	0	0	2	3	1	1	0.0	0	48.5	1	0.0	0	21.2	1	39.4	1	24.2	1	0	5	33	1	33	20	FAIL
15	2007	661.6	R	411	257	257	16	3	3	3	3	3	2	3	3	3	0.0	5	39.3	5	0.0	5	4.7	5	5.4	1	87.9	5	1	5	411	5	39	51	PASS
16	2006	667.7	L	42	39	39	10	3	2	1	0	0	1	1	0	0	0.0	0	10.3	1	0.0	0	12.8	1	2.6	1	17.9	1	1	5	42	1	33	15	FAIL
17	2006	672.8	R	82	63	63	14	3	3	3	1	1	1	1	1	1	0.0	5	33.3	5	0.0	5	33.3	1	17.5	1	36.5	3	1	5	82	1	33	35	PASS
18	2007	680.7	L	2392	87	87	11	3	4	3	1	1	1	1	0	1	0.0	5	20.7	3	0.0	5	18.4	3	1.1	1	44.8	5	0	5	2392	5	39	41	PASS
19	2007	682.3	R	961	158	154	22	5	1	1	7	5	4	5	5	5	1.3	5	31.0	3	1.3	5	0.0	5	28.5	3	26.6	3	0	5	957	5	39	55	PASS

Table 3 (cont'd). ORFIn metrics and scores from the Cannelton pool 2006 and 2007

Site #	Year	River Mile	Bank	# Individuals	# Individuals w/o G & E	# Individuals w/o GETHEX	# Species	# Species Score	# Suckers	Suckers Species Score	# Centrarchid Species	Centrarchid Species Score	# Great River Species	Great River Species Score	# Intolerant Species	Intolerant Species Score	% Tolerant Individuals	Tolerant Individuals Score	% Simple Lithophils	Simple Lithophils Score	% Non-native Individuals	Non-native Individuals Score	% Detritivores	Detritivores Score	% Invertivores	Invertivores Score	% Piscivores	Piscivores Score	# DELTs	DELT Score	CPUE	CPUE Score	ORFIn Expectation	Observed ORFIn	Site Result
20	2006	687.3	R	49	42	41	12	3	3	3	1	1	1	1	0	0	0.0	0	21.4	1	2.4	1	35.7	1	2.4	1	40.5	1	0	5	48	1	33	19	FAIL
21	2007	689.8	L	132	81	80	19	5	3	3	6	5	1	1	3	3	0.0	5	37.0	5	1.2	5	9.9	3	16.0	1	51.9	5	0	5	131	1	33	47	PASS
22	2006	692.0	R	116	100	98	14	3	2	1	5	3	1	1	2	3	0.0	5	7.0	1	2.0	5	41.0	1	29.0	3	19.0	3	3	3	114	1	33	33	PASS
23	2007	694.5	R	169	158	156	18	5	4	3	6	5	2	3	1	1	0.6	5	28.5	3	1.3	5	3.2	5	7.6	1	73.4	5	0	5	167	3	33	49	PASS
24	2007	696.1	L	168	145	145	14	3	2	1	1	1	3	3	1	1	0.0	5	49.7	5	0.0	5	5.5	5	4.8	1	60.7	5	0	5	168	3	33	43	PASS
25	2006	697.9	L	109	96	95	13	3	2	1	3	3	0	1	0	1	0.0	5	14.6	1	1.0	5	10.4	3	8.3	1	58.3	5	0	5	108	1	33	35	PASS
26	2006	698.3	L	93	70	70	14	3	2	1	3	3	1	1	0	1	0.0	5	25.7	3	0.0	5	20.0	1	4.3	1	44.3	5	1	5	93	1	33	35	PASS
27	2007	707.5	L	372	174	173	16	3	2	1	3	3	3	3	1	1	0.0	5	28.2	3	0.6	5	6.3	5	10.3	1	73.6	5	0	5	371	5	33	45	PASS
28	2007	709.8	L	203	133	129	17	3	2	1	5	3	2	3	3	3	0.0	5	40.6	5	3.0	5	1.5	5	32.3	3	51.9	5	1	5	199	3	33	49	PASS
29	2006	711.6	R	137	103	96	17	3	2	1	7	5	1	1	1	1	1.0	5	30.1	3	6.8	3	16.5	3	45.6	5	22.3	3	1	5	130	1	33	39	PASS
30	2007	720.3	L	118	105	104	17	3	2	1	4	3	3	3	1	1	1.0	5	36.2	5	1.0	5	4.8	5	29.5	3	38.1	5	1	5	117	1	33	45	PASS

R = Right Descending Bank

L = Left Descending Bank

w/o G & E = Individuals minus gizzard shad and emerald shiners

w/o GETHEX = Individuals minus gizzard shad, emerald shiners, tolerants, hybrids, and exotics

Centrarchid Species = black bass, sunfishes, crappie

Great River Species = fish expected to be predominant in great rivers

Intolerant Species = species with low pollution/disturbance tolerance

Tolerant Individuals = individuals with high pollution/disturbance tolerance

Simple Lithophils = fish that are sensitive to substrate disturbance based on reproductive needs

Detritivore = fish that feed primarily on detritus

Invertivore = fish that feed primarily on invertebrates

Piscivore = fish that feed primarily on other fish

DELT = individuals with Deformities, Eroded fins, Lesions, and/or Tumors

CPUE = Catch Per Unit Effort

4.4 Water Quality and Flow Conditions

Rain events were sparse throughout the sampling period in 2007; therefore river levels and flows were stable. However, flow conditions were unstable throughout the 2006 sampling period and river levels were frequently above normal. There were several rain events that caused increased river flow and water levels throughout the Ohio River valley. Some sampling occurred in the Cannelton pool when flows were above the harmonic mean flow (HMF) for the pool. The HMF values used for the upstream (sites 1-15) and downstream (sites 16-30) portions of this pool were 49.0 and 53.4 kcfs respectively; and sampling was conducted between 37.3% and 154.9% of the HMF (Figure 9). Measurements of water quality parameters did not reveal any unusual or poor water conditions present at the time of sampling (Appendix D). Secchi depths at the time of sampling ranged from 24 to 96 inches.

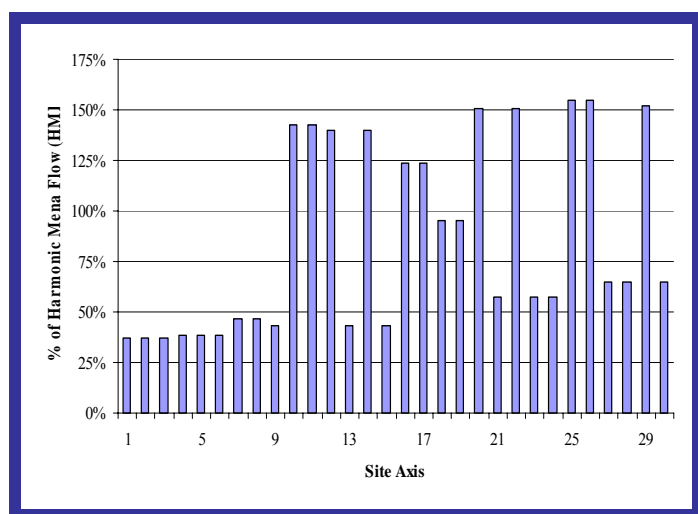


Figure 9. Relative flows (%HMF) at the time of sampling.

4.5 Assessment of Condition

ORFIn scores were calculated for each of the sites sampled. The maximum score achieved by any site in this pool out of a possible 65 was 55 and the minimum was 15. By comparing observed and expected ORFIn scores, ORSANCO assessed each site as either passing or failing (Table 3). All but three of the 30 sites sampled in Cannelton pool scored higher than the minimum expected scores and received passing evaluations (Table 1). Ninety-percent of the sites were in passing condition with an estimated precision of $\pm 9\%$ (Figure 10). Ten sites (33%) received an excellent

condition rating, seven sites (27%) were found to be in good condition, nine (30%) were in fair condition, and three sites (10%) were in 'very poor' condition (Figure 11).

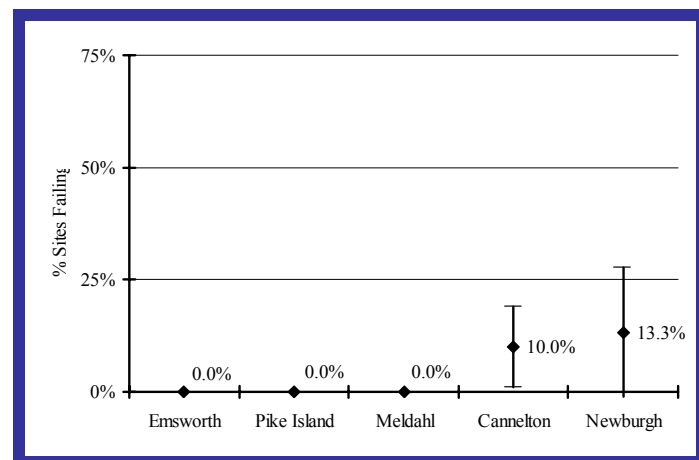


Figure 10. 2007 pool assessment results with 90% confidence intervals.

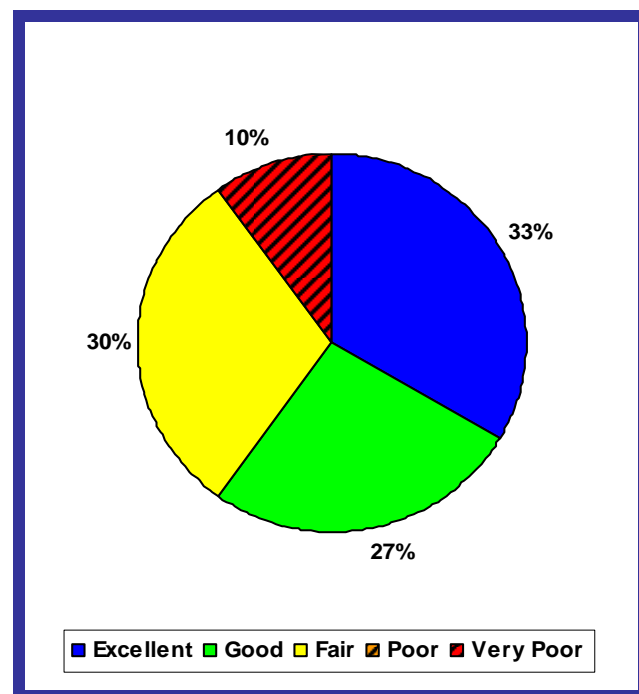


Figure 11. Condition of the Cannelton pool based on ORFIn scores at 15 sites (Pass=Excellent-Fair, Fail=Poor-Very Poor).

5.0 Discussion

5.1 Fish Population

In 2006 and 2007, the fish population of Cannelton pool was in good condition. This was supported by the diversity and types of species collected from the pool. Only 2 invasive species were collected including: common carp (*Cyprinus*

carpio) and redear sunfish (*Lepomis microlophus*). Other invasive species such as white perch (*Morone americana*) or Asian carp species (*Hypophthalmichthys sp.*) were not found in the survey of the pool.

5.2 Metric Performance

Two metrics stood out as the lowest performing in Cannelton pool; the % invertivores and the % intolerant individuals metrics. For these metrics, most sites scored a 1. Most of the invertivorous species were also considered intolerant; therefore it was understandable how both metrics produced low scores. However, there was no known reason or explanation for these low scores.

5.3 Habitat Surveys

The habitat assessments show that most areas of Cannelton pool are classified as class 'B' habitats and that there are some 'A' habitats. The dominance of small substrate particles (fines and sand) was less than ideal; however, there was adequate habitat to support the fish diversity and populations in Cannelton pool. At some sites, the quality of the available habitat was supplemented by the presence of woody cover.

5.4 Water Quality and Flow Conditions

The fluctuating river levels in 2006 may have affected the survey of Cannelton pool. Although sampling was conducted between rain events when river levels were near normal pool, occasionally flows were elevated. However, all

Secchi depths indicated sufficient visibility for sampling. There were no water quality measurements that exceeded their respective criteria or provided any major insight into the assessment results for Cannelton pool.

5.5 Conclusions and Assessments of Condition

The data collected in 2006 and 2007 indicated that the Cannelton pool met its aquatic life use designation and was in excellent condition. The analysis of Cannelton pool estimated that 10% (+/- 9%) of the pool was in failing condition. The assessment of Cannelton pool met the criteria established by ORSANCO biologists (Appendix A) and was therefore accepted as complete. No further monitoring of Cannelton pool is required at this time.

6.0 Interpool Comparisons

6.1 Purpose

As of 2007, 12 of 20 pools have been surveyed and assessed. This section was developed to compare Cannelton pool to other previously surveyed pools in the Ohio River.

6.2 Land Use

Cannelton pool lies in the downstream third of the Ohio River and the primary land use within the catchment is deciduous forest (Figure 12). However, the area immediately surrounding the pool is heavily influenced by agriculture.

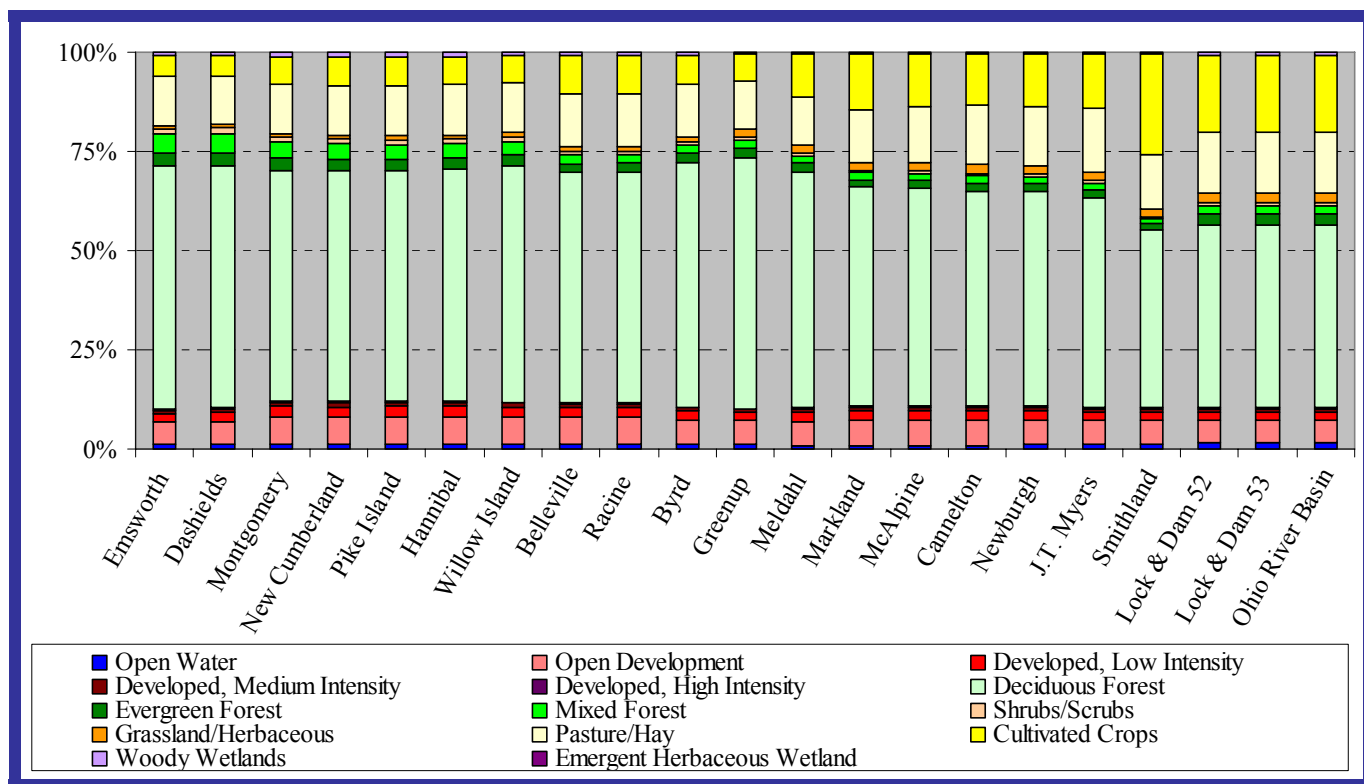


Figure 12. Land use within the catchment area of each pool of the Ohio River.

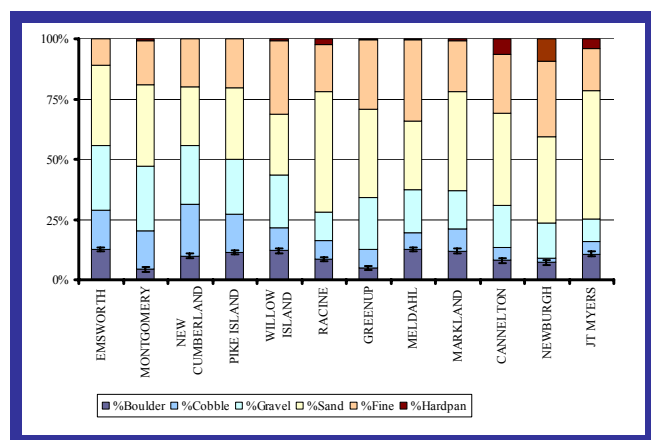


Figure 13. Substrate composition for each pool surveyed as of 2007.

6.3 Substrate Composition

The substrate composition in this pool was dominated by sand and fines. This is the longest pool on the Ohio River. In the downstream portions of this pool, suspended solids settle to the bottom contributing to the higher proportions of smaller substrates. However, these percentages were quite similar to other pools near this portion of the river (Figure 13).

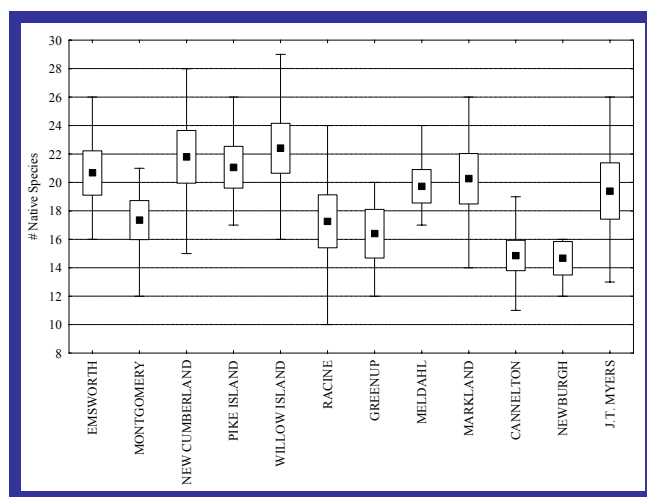


Figure 14. The average number of native species collected at each site within each pool surveyed as of 2007 (■=Average, □= 90% Confidence Interval, I=Non-Outlier Range).

6.4 Species Richness

Cannelton pool was lower than most other surveyed pools in the average number of native species per site (14.9) and ranked 11th in comparison (Figure 14).

6.5 Number of Individuals

An average of 136.8 individuals (excluding gizzard shad and emerald shiners) was

collected at each site in Cannelton pool and ranked 10th in comparison (Figure 15).

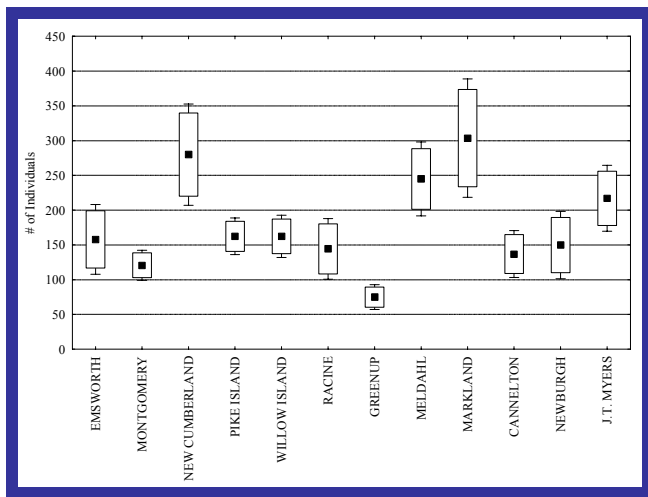


Figure 15. The average number of individuals (excluding gizzard shad & emerald shiner) collected at each site within each pool surveyed as of 2007 (■=Average, □=90% Confidence Interval, I=Non-Outlier Range).

6.6 Noteworthy Fish Observations

None of the species collected in Cannelton were unique to the pool. However, several species were quite abundant in the pool by comparison such as redear sunfish, longnose gar, river darters, and river shiners. This was the uppermost pool where threadfin shad were collected. This species is most common in the lower third of the river (See Table 4).

6.7 ORFIn Deviation

The ORFIn deviation is a measure of how well the pool performed in regard to expected ORFIn values. Positive values indicate that scores were greater than expected. Cannelton pool had an average deviation of 8.3 and was among the lowest of other pools surveyed as of 2007 (Figure 16). In comparison to other pools, the fish community was in satisfactory condition.

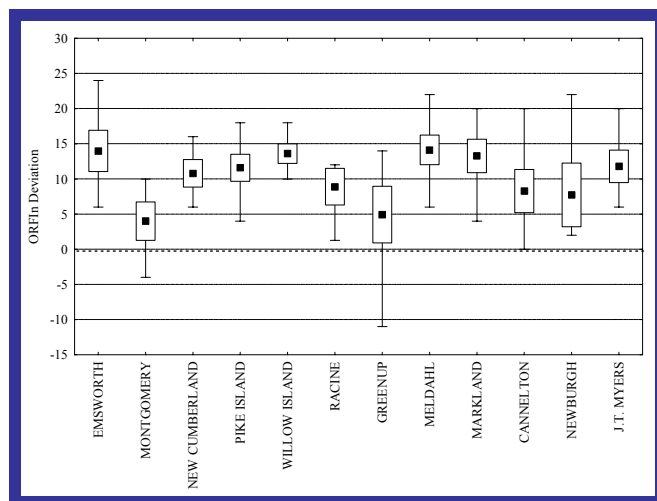


Figure 16. The average ORFIn deviation of each site within pools surveyed as of 2007 (■=Average, □=90% Confidence Interval, I=Non-Outlier Range).

6.8 Assessment of Condition

In Cannelton pool, 90% of the sites were in passing condition. The nearest surveyed pool to Cannelton was Newburgh pool (immediately downstream) which was assessed as being in marginally passing condition with 87% of the sites passing (Figure 17).

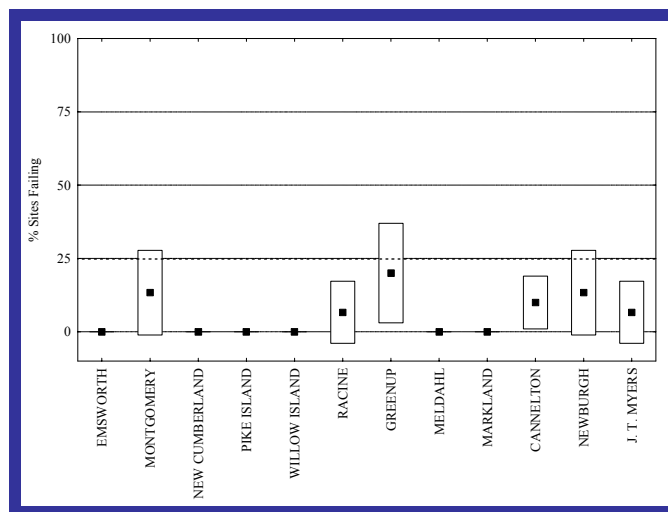


Figure 17. The percentage of sites (including +/- precision) failing in each pool surveyed as of 2007 (■=Average, □=90% Confidence Interval).

Table 4. A compiled species list containing the number of individuals collected per pool.

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
1	Silver Lamprey							1					
2	Paddlefish											1	
3	Spotted Gar											1	
4	Longnose Gar	13	10	11	43	46	24	23	22	15	48	20	
5	Shortnose Gar											9	2
6	Goldeye											12	
7	Mooneye	20	6	22	37		1		48	12	8	10	4
8	Skipjack Herring	8		3	6		1		64	145	174	70	249
9	Gizzard Shad	167	266	1202	7326	216	8048	267	2408	1743	3527	600	444
10	Threadfin Shad										1	9	112
11	Central Stoneroller			4		1				1			
12	Goldfish			1									
13	Grass Carp			1								1	
14	Spotfin Shiner		1	21	14	24	63	2	32	2	63	8	12
15	Common Carp	63	44	25	15	22	9	9	8	20	5	4	10
16	Gravel Chub								1				
17	Miss. Silvery Minnow												1
18	Silver Carp											2	
19	Bighead Carp											2	
20	Striped Shiner						2						
21	Silver Chub	26	12	20	11	57	44	33	90	171	130	126	206
22	River Chub			1	1								
23	Golden Shiner	1		1									
24	Emerald Shiner	82	8	342	197	728	795	50	637	303	1331	166	801
25	River Shiner	1							54	8	276	3	91
26	Spottail Shiner			6	2								
27	Mimic Shiner	35	13	76	162	306	402	61	7	5	195	6	43
28	Bluntnose Minnow			2	2	120	3	1	1		2		
29	Fathead Minnow						6						
30	Bullhead Minnow					4	5		23	2			8
31	Creek Chub			1					3				
32	Ictiobinae Sp			20									
33	Carpoides Sp				14		2		1		2		
34	River Carpsucker	18	13	46	36	18	50	49	87	47	122	179	86
35	Quillback	17	30	80	27	66	16	17	31	137	21	34	57
36	Highfin Carpsucker		37	3	10	1	7	4		2	1	12	3
37	Northern Hog Sucker	3	3	132	4	15				14	1	1	
38	Smallmouth Buffalo	97	217	283	94	60	96	49	123	150	147	72	314

Table 4. A compiled species list containing the number of individuals collected per pool.

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
39	Bigmouth Buffalo						1					3	7
40	Black Buffalo	1			5	2		1		2	1	7	3
41	Spotted Sucker					1	1	5	1		1		
42	Moxostoma Sp			58									
43	Silver Redhorse	221	157	63	78	51	11	12	25	19	3		
44	Smallmouth Redhorse	61	110	110	28	168	5	30	62	31	12	3	11
45	River Redhorse	39	3	5	27	2		6	1	1		1	
46	Black Redhorse	18		11		4				1	1		
47	Golden Redhorse	7	227	90	66	277	11	39	120	105	4	14	
48	Brown Bullhead							1					
49	Blue Catfish												1
50	Channel Catfish	32	34	123	40	61	70	58	89	247	48	11	330
51	Flathead Catfish	14	11	15	35	21	32	32	49	38	63	11	43
52	Muskellunge	1											
53	Trout-Perch						3						
54	Banded Killifish					1							
55	Brook Silverside						1			1	1	1	1
56	Morone Sp	27	6	568	419	17	561	2	152	250	625	403	253
57	White Perch	5		4		3				5			
58	White Bass	9	36	6	2	58	3	64	18	22	66	4	17
59	Striped Bass					1					6		12
60	Hybrid Striper		4	17		1	46			40	6		11
61	Rock Bass	16	8	5	1	3							1
62	Lepomis Hybrid		1			9							
63	Lepomis Sp					16	1				1		1
64	Green Sunfish	12	2	4	2	4	6	4	3	10	2	4	10
65	Pumpkinseed		2			18							
66	Warmouth					1			1	1			1
67	Orangespotted Sunfish			1		2	1		1	1			2
68	Bluegill	379	216	53	46	232	58	112	207	245	103	11	31
69	Longear Sunfish					23	3	14	35	53	39	3	11
70	Redear Sunfish		4		1	1	1	1		2	16		1
71	Bluegill X Green Sunfish				1						1		
72	Longear X Green Sunfish												1
73	Smallmouth Bass	339	185	262	208	61	6	7	4	28	7	1	4
74	Spotted Bass	125	15	79	74	62	22	43	90	123	53	49	104
75	Largemouth Bass	4	8	8	16	16	22	65	16	56	37	2	70
76	White Crappie	5						4		1	1	1	
77	Black Crappie	3	6	2	2		3			2	3		

Table 4. A compiled species list containing the number of individuals collected per pool.

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
78	Greenside Darter	5	2	11	5					1			
79	Rainbow Darter		4	1		2				8			12
80	Fantail Darter	3	1						1				
81	Johnny Darter	1				2							
82	Banded Darter		1	4						1			1
83	Yellow Perch		4	2									
84	Logperch	141	67	244	85	108	6	12	20	60	39	4	3
85	Channel Darter	16	1	9		3		20					1
86	Slenderhead Darter									5			5
87	Dusky Darter												3
88	River Darter				2	1	2	1	6	4	11		4
89	Sauger	283	243	180	244	341	173	220	1174	664	1314	747	484
90	Walleye	44	11	31	70	1	4	1	3	1		7	
91	Saugeye	2		5	4		4			17			7
92	Freshwater Drum	254	47	1468	496	120	375	121	1000	1778	435	378	612
	Total # of Taxa	43	42	53	43	51	46	38	41	51	46	44	50
	Total # of Individuals	2618	2076	5742	9958	3378	11006	1441	6718	6600	8953	3013	4501

Literature Cited

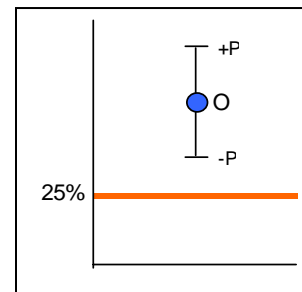
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Appendix A: Assessment Unit Criteria Details

- Each individual navigational pool will serve as a separate and distinct Assessment Unit (AU).
- All AUs will be sampled and assessed on a 5-year rotating basis. This is consistent with state schedules, and it allows ORSANCO (after one full rotation) in each 305(b) report, to incorporate 5 years worth of data and report on 100% of the resource. USEPA accepts 305(b) reports which use the most recent 5 years of data.
- AUs that yield >25% failure will be considered for listing as non-supporting.
 - Recognizing that even the least impacted (LI) sites in the Ohio River exhibit variability in condition, the 25th percentile of LI sites is used as the biocriteria within each habitat class.
 - Even among a random draw of LI sites, up to 25% of sites could be expected to fail, or fall below the criterion.
 - AUs with more than 25% failure rate could be listed as impaired if the BWQSC feels an “adequate assessment”, as defined below, is made.
- Characteristics of “Adequate Assessments”
 - Each AU is assessed with a minimum of 15 sites, regardless of pool length.
 - 1 of 3 situations occurs after sampling 15 sites (illustrated in figure below):

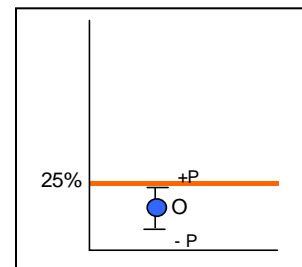
Situation ‘A’

- If an observation ‘O’ of > 25% of the sites failing is made and O minus (-) the estimated precision (P) is >25%, the assessment is accepted as valid, the AU is listed as ‘Assessed’ and failing to meet the established aquatic life use. The entire AU will be properly listed on the 303(d) list.
 - If $O - P > 25\%$ then AU fails.



$$\text{Precision } (P) = Z_{1-\alpha} * 100 * \text{Sqrt}[p(1-p)/n]$$

$Z_{1-\alpha}$ is related to the desired level of confidence
1.645 is used for 90% confidence
(use 1.96 for 95% confidence)

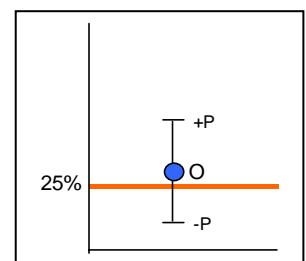


Situation ‘B’

- If an observation ‘O’ of < 25% of the sites failing is made and O + P (precision) is <25%, the assessment is accepted as valid, the AU is listed as ‘Assessed’ and as meeting the established aquatic life use.
 - If $O + P < 25\%$ then AU passes.

Situation ‘C’

- If after sampling 15 sites, O +/- P includes (overlaps) the criterion (25%), 1 of 2 scenarios will occur:
 - **C1:** if resources allow, an “Optimal Assessment” as defined below, will be conducted.
 - Additional probability sites will be sampled the next year to increase the sample size and improve precision (reducing the error bars).



- This process is repeated until one of the following occurs:
 - either Situation A or Situation B (above) is achieved.
 - precision of +/- 12 is achieved.
 - maximum of 45 samples is reached.
 - At that point the AU will be considered 'Assessed', the results will be considered valid and accepted, and condition will be reported.
- **C2:** in cases where resources are limited, the BWQSC will consider other available and relevant information when deciding to accept the assessment as valid or to require more sampling.
 - Additional information to be considered in these cases include (but are not limited to):
 - additional available statistics from the current assessment
 - additional available biological & water chemistry data
 - prior performance
 - presence of known impacts
 - In these cases, ORSANCO biologists will provide a narrative justification explaining how information other than the assessment in question was used to make the assessment
 - If O + P includes 25% and multiple lines of evidence indicate that the AU is in acceptable condition, then the AU may be listed as attaining.
 - If O – P includes 25% and multiple lines of evidence indicate that the AU is in unacceptable condition, then the AU may be listed as impaired.
 - If O +/- P includes 25% and multiple lines of evidence are inconclusive, then the AU will be listed as “unassessed” and additional samples would be needed.
- Listing on the 303(d) list as
 - 4a if the determined case already has an approved TMDL in place
 - 4b if the impairment is expected to be removed by other programs (SF, RCRA, NPDES, 319, harbor dredging)
 - 4c if the impairment is caused by something other than a pollutant
 - Habitat, natural, hydrologic, etc.
 - 5a if there is an impaired biological condition due to unknown stressor/cause.
 - Follow-up work would be needed.
 - e.g., examining WQ/Habitat/Bio interactions as a data exercise or through additional field work.
 - 5b if it is determined impairment is based on fish tissue contamination, in which case no TMDL is required.
 - 5c if a pollutant is positively identified, triggering the need for the development of a TMDL for that pollutant.

It is most likely that if any of the AUs fail, it will be listed as Category 5a.

- If follow-up work determines that a pollutant is the cause, it will be listed as Category 5c.
- If follow-up work shows impairment due to something other than a pollutant, it will be listed as Category 4c.

It will be possible to list an AU under any one of the categories shown above, although listing in any category other than 5a will require additional work, data integration, and the utmost certainty beforehand because of the resource implications of potentially triggering the need to develop a TMDL.

Appendix B. Fish survey data from the Cannelton pool.

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
1	612.1	RDB	03-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
1	612.1	RDB	03-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	9
1	612.1	RDB	03-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	1
1	612.1	RDB	03-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	134
1	612.1	RDB	03-Jul-07	river shiner	<i>Notropis blennioides</i>	8
1	612.1	RDB	03-Jul-07	mimic shiner	<i>Notropis volucellus</i>	74
1	612.1	RDB	03-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	5
1	612.1	RDB	03-Jul-07	golden redbreast	<i>Moxostoma erythrum</i>	1
1	612.1	RDB	03-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	1
1	612.1	RDB	03-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	1
1	612.1	RDB	03-Jul-07	morone sp	<i>Morone sp</i>	18
1	612.1	RDB	03-Jul-07	longear sunfish	<i>Lepomis megalotis</i>	2
1	612.1	RDB	03-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	2
1	612.1	RDB	03-Jul-07	sauger	<i>Sander canadensis</i>	48
1	612.1	RDB	03-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	101
2	612.2	LDB	03-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	2
2	612.2	LDB	03-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	11
2	612.2	LDB	03-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	1
2	612.2	LDB	03-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	12
2	612.2	LDB	03-Jul-07	river shiner	<i>Notropis blennioides</i>	28
2	612.2	LDB	03-Jul-07	mimic shiner	<i>Notropis volucellus</i>	2
2	612.2	LDB	03-Jul-07	river carpsucker	<i>Carpodes carpio</i>	1
2	612.2	LDB	03-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	1
2	612.2	LDB	03-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	1
2	612.2	LDB	03-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	1
2	612.2	LDB	03-Jul-07	morone sp	<i>Morone sp</i>	12
2	612.2	LDB	03-Jul-07	white bass	<i>Morone chrysops</i>	1
2	612.1	RDB	03-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	2
2	612.2	LDB	03-Jul-07	sauger	<i>Sander canadensis</i>	32
2	612.2	LDB	03-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	7
3	614.1	LDB	03-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	2
3	614.1	LDB	03-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	5
3	614.1	LDB	03-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	3
3	614.1	LDB	03-Jul-07	common carp	<i>Cyprinus carpio</i>	1
3	614.1	LDB	03-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	5
3	614.1	LDB	03-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	53
3	614.1	LDB	03-Jul-07	river shiner	<i>Notropis blennioides</i>	108
3	614.1	LDB	03-Jul-07	mimic shiner	<i>Notropis volucellus</i>	45
3	614.1	LDB	03-Jul-07	morone sp	<i>Morone sp</i>	9
3	614.1	LDB	03-Jul-07	sauger	<i>Sander canadensis</i>	132
3	614.1	LDB	03-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	24
4	617.7	LDB	02-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	2
4	617.7	LDB	02-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	1
4	617.7	LDB	02-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	2
4	617.7	LDB	02-Jul-07	Emerald shiner	<i>Notropis atherinoides</i>	73

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
4	617.7	LDB	02-Jul-07	river shiner	<i>Notropis blenni</i>	34
4	617.7	LDB	02-Jul-07	mimic shiner	<i>Notropis volucellus</i>	1
4	617.7	LDB	02-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	2
4	617.7	LDB	02-Jul-07	black buffalo	<i>Ictiobus niger</i>	1
4	617.7	LDB	02-Jul-07	morone sp	<i>Morone sp</i>	3
4	617.7	LDB	02-Jul-07	sauger	<i>Sander canadensis</i>	42
4	617.7	LDB	02-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	20
5	621.2	RDB	02-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	4
5	621.2	RDB	02-Jul-07	mooneye	<i>Hiodon tergisus</i>	1
5	621.2	RDB	02-Jul-07	Skipjack herring	<i>Alosa chrysochloris</i>	1
5	621.2	RDB	02-Jul-07	Spotfin shiner	<i>Cyprinella spiloptera</i>	8
5	621.2	RDB	02-Jul-07	Emerald shiner	<i>Notropis atherinoides</i>	323
5	621.2	RDB	02-Jul-07	river shiner	<i>Notropis blenni</i>	30
5	621.2	RDB	02-Jul-07	mimic shiner	<i>Notropis volucellus</i>	5
5	621.2	RDB	02-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	1
5	621.2	RDB	02-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	2
5	621.2	RDB	02-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
5	621.2	RDB	02-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	1
5	621.2	RDB	02-Jul-07	morone sp	<i>Morone sp</i>	11
5	621.2	RDB	02-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	1
5	621.2	RDB	02-Jul-07	sauger	<i>Sander canadensis</i>	82
5	621.2	RDB	02-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	34
6	623.8	RDB	02-Jul-07	mooneye	<i>Hiodon tergisus</i>	1
6	623.8	RDB	02-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	5
6	623.8	RDB	02-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	7
6	623.8	RDB	02-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	8
6	623.8	RDB	02-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	170
6	623.8	RDB	02-Jul-07	river shiner	<i>Notropis blenni</i>	9
6	623.8	RDB	02-Jul-07	mimic shiner	<i>Notropis volucellus</i>	3
6	623.8	RDB	02-Jul-07	carpiodes sp	<i>Carpionodes sp</i>	1
6	623.8	RDB	02-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	3
6	623.8	RDB	02-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	1
6	623.8	RDB	02-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
6	623.8	RDB	02-Jul-07	morone sp	<i>Morone sp</i>	1
6	623.8	RDB	02-Jul-07	sauger	<i>Sander canadensis</i>	30
6	623.8	RDB	02-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	6
7	628.2	LDB	17-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
7	628.2	LDB	17-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	1
7	628.2	LDB	17-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	2
7	628.2	LDB	17-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	2
7	628.2	LDB	17-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	2
7	628.2	LDB	17-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	34
7	628.2	LDB	17-Jul-07	river shiner	<i>Notropis blenni</i>	31
7	628.2	LDB	17-Jul-07	northern hog sucker	<i>Hypentelium nigricans</i>	1
7	628.2	LDB	17-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	2
7	628.2	LDB	17-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	3

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
7	628.2	LDB	17-Jul-07	morone sp	<i>Morone sp</i>	11
7	628.2	LDB	17-Jul-07	longear sunfish	<i>Lepomis megalotis</i>	1
7	628.2	LDB	17-Jul-07	sauger	<i>Sander canadensis</i>	67
7	628.2	LDB	17-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	46
8	639.7	RDB	17-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
8	639.7	RDB	17-Jul-07	mooneye	<i>Hiodon tergisus</i>	1
8	639.7	RDB	17-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	3
8	639.7	RDB	17-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	1
8	639.7	RDB	17-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	2
8	639.7	RDB	17-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	7
8	639.7	RDB	17-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	91
8	639.7	RDB	17-Jul-07	river shiner	<i>Notropis blennioides</i>	12
8	639.7	RDB	17-Jul-07	mimic shiner	<i>Notropis volucellus</i>	53
8	639.7	RDB	17-Jul-07	river carpsucker	<i>Carpodes carpio</i>	3
8	639.7	RDB	17-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	5
8	639.7	RDB	17-Jul-07	golden redbreast	<i>Moxostoma erythrum</i>	2
8	639.7	RDB	17-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	1
8	639.7	RDB	17-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	1
8	639.7	RDB	17-Jul-07	morone sp	<i>Morone sp</i>	54
8	639.7	RDB	17-Jul-07	bluegill	<i>Lepomis macrochirus</i>	1
8	639.7	RDB	17-Jul-07	bluegill x green sunfish	<i>Lepomis macrochirus</i> x <i>L. cyanellus</i>	1
8	639.7	RDB	17-Jul-07	sauger	<i>Sander canadensis</i>	214
8	639.7	RDB	17-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	36
9	648.6	RDB	18-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	4
9	648.6	RDB	18-Jul-07	common carp	<i>Cyprinus carpio</i>	1
9	648.6	RDB	18-Jul-07	river carpsucker	<i>Carpodes carpio</i>	4
9	648.6	RDB	18-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	7
9	648.6	RDB	18-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	1
9	648.6	RDB	18-Jul-07	morone sp	<i>Morone sp</i>	14
9	648.6	RDB	18-Jul-07	longear sunfish	<i>Lepomis megalotis</i>	1
9	648.6	RDB	18-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	3
9	648.6	RDB	18-Jul-07	sauger	<i>Sander canadensis</i>	116
10	650.3	LDB	01-Aug-06	longnose gar	<i>Lepisosteus osseus</i>	2
10	650.3	LDB	01-Aug-06	gizzard shad	<i>Dorosoma cepedianum</i>	14
10	650.3	LDB	01-Aug-06	silver chub	<i>Macrhybopsis storeriana</i>	16
10	650.3	LDB	01-Aug-06	emerald shiner	<i>Notropis atherinoides</i>	13
10	650.3	LDB	01-Aug-06	mimic shiner	<i>Notropis volucellus</i>	5
10	650.3	LDB	01-Aug-06	river carpsucker	<i>Carpodes carpio</i>	3
10	650.3	LDB	01-Aug-06	quillback	<i>Carpodes cyprinus</i>	7
10	650.3	LDB	01-Aug-06	smallmouth buffalo	<i>Ictiobus bubalus</i>	2
10	650.3	LDB	01-Aug-06	silver redbreast	<i>Moxostoma anisurum</i>	1
10	650.3	LDB	01-Aug-06	channel catfish	<i>Ictalurus punctatus</i>	1
10	650.3	LDB	01-Aug-06	flathead catfish	<i>Pylodictis olivaris</i>	1
10	650.3	LDB	01-Aug-06	morone sp	<i>Morone sp</i>	2
10	650.3	LDB	01-Aug-06	smallmouth bass	<i>Micropterus dolomieu</i>	1
10	650.3	LDB	01-Aug-06	spotted bass	<i>Micropterus punctulatus</i>	1

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
10	650.3	LDB	01-Aug-06	sauger	<i>Sander canadensis</i>	5
10	650.3	LDB	01-Aug-06	freshwater drum	<i>Aplodinotus grunniens</i>	7
11	652.9	RDB	01-Aug-06	longnose gar	<i>Lepisosteus osseus</i>	3
11	652.9	RDB	01-Aug-06	gizzard shad	<i>Dorosoma cepedianum</i>	23
11	652.9	RDB	01-Aug-06	silver chub	<i>Macrhybopsis storeriana</i>	11
11	652.9	RDB	01-Aug-06	emerald shiner	<i>Notropis atherinoides</i>	24
11	652.9	RDB	01-Aug-06	river carpsucker	<i>Carpodes carpio</i>	11
11	652.9	RDB	01-Aug-06	quillback	<i>Carpodes cyprinus</i>	2
11	652.9	RDB	01-Aug-06	highfin carpsucker	<i>Carpodes velifer</i>	1
11	652.9	RDB	01-Aug-06	smallmouth buffalo	<i>Ictiobus bubalus</i>	4
11	652.9	RDB	01-Aug-06	silver redhorse	<i>Moxostoma anisurum</i>	1
11	652.9	RDB	01-Aug-06	flathead catfish	<i>Pylodictis olivaris</i>	1
11	652.9	RDB	01-Aug-06	morone sp	<i>Morone sp</i>	4
11	652.9	RDB	01-Aug-06	white bass	<i>Morone chrysops</i>	5
11	652.9	RDB	01-Aug-06	longear sunfish	<i>Lepomis megalotis</i>	2
11	652.9	RDB	01-Aug-06	redeer sunfish	<i>Lepomis microlophus</i>	1
11	652.9	RDB	01-Aug-06	spotted bass	<i>Micropterus punctulatus</i>	1
11	652.9	RDB	01-Aug-06	largemouth bass	<i>Micropterus salmoides</i>	3
11	652.9	RDB	01-Aug-06	black crappie	<i>Pomoxis nigromaculatus</i>	1
11	652.9	RDB	01-Aug-06	sauger	<i>Sander canadensis</i>	11
11	652.9	RDB	01-Aug-06	freshwater drum	<i>Aplodinotus grunniens</i>	3
12	655.8	LDB	02-Aug-06	longnose gar	<i>Lepisosteus osseus</i>	2
12	655.8	LDB	02-Aug-06	gizzard shad	<i>Dorosoma cepedianum</i>	45
12	655.8	LDB	02-Aug-06	silver chub	<i>Macrhybopsis storeriana</i>	5
12	655.8	LDB	02-Aug-06	emerald shiner	<i>Notropis atherinoides</i>	24
12	655.8	LDB	02-Aug-06	river shiner	<i>Notropis blenni</i>	2
12	655.8	LDB	02-Aug-06	bluntnose minnow	<i>Pimephales notatus</i>	2
12	655.8	LDB	02-Aug-06	river carpsucker	<i>Carpodes carpio</i>	7
12	655.8	LDB	02-Aug-06	quillback	<i>Carpodes cyprinus</i>	2
12	655.8	LDB	02-Aug-06	smallmouth buffalo	<i>Ictiobus bubalus</i>	10
12	655.8	LDB	02-Aug-06	silver redhorse	<i>Moxostoma anisurum</i>	1
12	655.8	LDB	02-Aug-06	smallmouth redhorse	<i>Moxostoma breviceps</i>	5
12	655.8	LDB	02-Aug-06	golden redhorse	<i>Moxostoma erythrurum</i>	3
12	655.8	LDB	02-Aug-06	flathead catfish	<i>Pylodictis olivaris</i>	2
12	655.8	LDB	02-Aug-06	white bass	<i>Morone chrysops</i>	11
12	655.8	LDB	02-Aug-06	striped bass	<i>Morone saxatilis</i>	4
12	655.8	LDB	02-Aug-06	hybrid striper	<i>Morone saxatilis x M. chrysops</i>	4
12	655.8	LDB	02-Aug-06	bluegill	<i>Lepomis macrochirus</i>	1
12	655.8	LDB	02-Aug-06	longear sunfish	<i>Lepomis megalotis</i>	1
12	655.8	LDB	02-Aug-06	smallmouth bass	<i>Micropterus dolomieu</i>	1
12	655.8	LDB	02-Aug-06	spotted bass	<i>Micropterus punctulatus</i>	2
12	655.8	LDB	02-Aug-06	logperch	<i>Percina caprodes</i>	2
12	655.8	LDB	02-Aug-06	sauger	<i>Sander canadensis</i>	10
12	655.8	LDB	02-Aug-06	freshwater drum	<i>Aplodinotus grunniens</i>	6
13	656.4	RDB	18-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	3
13	656.4	RDB	18-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	1

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
13	656.4	RDB	18-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	1
13	656.4	RDB	18-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	60
13	656.4	RDB	18-Jul-07	river shiner	<i>Notropis blennioides</i>	4
13	656.4	RDB	18-Jul-07	mimic shiner	<i>Notropis volucellus</i>	1
13	656.4	RDB	18-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	8
13	656.4	RDB	18-Jul-07	quillback	<i>Carpionodes cyprinoides</i>	1
13	656.4	RDB	18-Jul-07	smallmouth buffalo	<i>Ictalurus punctatus</i>	5
13	656.4	RDB	18-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
13	656.4	RDB	18-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	1
13	656.4	RDB	18-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	3
13	656.4	RDB	18-Jul-07	morone sp	<i>Morone sp</i>	112
13	656.4	RDB	18-Jul-07	white bass	<i>Morone chrysops</i>	1
13	656.4	RDB	18-Jul-07	bluegill	<i>Lepomis macrochirus</i>	2
13	656.4	RDB	18-Jul-07	longear sunfish	<i>Lepomis megalotis</i>	3
13	656.4	RDB	18-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	21
13	656.4	RDB	18-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	3
13	656.4	RDB	18-Jul-07	sauger	<i>Sander canadensis</i>	103
13	656.4	RDB	18-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	8
14	660.9	LDB	02-Aug-06	longnose gar	<i>Lepisosteus osseus</i>	5
14	660.9	LDB	02-Aug-06	silver chub	<i>Macrhybopsis storeriana</i>	10
14	660.9	LDB	02-Aug-06	river shiner	<i>Notropis blennioides</i>	2
14	660.9	LDB	02-Aug-06	river carpsucker	<i>Carpionodes carpio</i>	4
14	660.9	LDB	02-Aug-06	quillback	<i>Carpionodes cyprinoides</i>	2
14	660.9	LDB	02-Aug-06	smallmouth buffalo	<i>Ictalurus punctatus</i>	1
14	660.9	LDB	02-Aug-06	channel catfish	<i>Ictalurus punctatus</i>	2
14	660.9	LDB	02-Aug-06	logperch	<i>Percina caprodes</i>	1
14	660.9	LDB	02-Aug-06	sauger	<i>Sander canadensis</i>	3
14	660.9	LDB	02-Aug-06	freshwater drum	<i>Aplodinotus grunniens</i>	3
15	661.6	RDB	18-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	7
15	661.6	RDB	18-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	5
15	661.6	RDB	18-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	1
15	661.6	RDB	18-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	1
15	661.6	RDB	18-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	149
15	661.6	RDB	18-Jul-07	river shiner	<i>Notropis blennioides</i>	7
15	661.6	RDB	18-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	5
15	661.6	RDB	18-Jul-07	smallmouth buffalo	<i>Ictalurus punctatus</i>	7
15	661.6	RDB	18-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
15	661.6	RDB	18-Jul-07	morone sp	<i>Morone sp</i>	120
15	661.6	RDB	18-Jul-07	bluegill	<i>Lepomis macrochirus</i>	1
15	661.6	RDB	18-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	2
15	661.6	RDB	18-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	9