Biological Programs 2009
Intensive Survey Results
Series 6
Report 1

A Biological Study of the Belleville 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 19 assessment units based on the locations of high-lift navigational dams. Using the random design, each assessment unit was assigned 15 sampling locations.

- Once fish assemblages are sampled, each site is assessed using a site quality score (0- 5) which is generated from an Ohio River fish index (MORFIn). The expectations for the MORFIn are based on each site's substrate composition. For an assessment unit (i.e. pool) to meet its aquatic life-use designation, the average of the quality scores for the pool must be greater than 2.0.

- In 2009, fish population data from Belleville yielded 52 species and 2 hybrid taxa, representing 12 different families. Three of these taxa were listed in OH as either endangered [Ohio lamprey (*Ichthyomyzon bdellium*)], threatened [river darter (*Percina shumardi*)] or of special concern [river redhorse (*Moxostoma carinatum*)]. WV has no official system for listing species.

- At the species level, two species of shiner (mimic and emerald) were the most abundant, comprising 39.8% of the catch.

- Previous analyses have identified a relationship between flow and MORFIn scores and the need for sampling thresholds and/or flow calibration. These analyses demonstrated that increased flows appeared to cause lower MORFIn scores due to decreased sampling efficiency and changes in fish behavior.

- Flows were variable in 2009. When sampling was conducted, flows were relatively low and did not appear to affect electrofishing surveys.

- In 2009, 93.3% of the sites assessed in Belleville pool had site quality scores $\geq$2.0 and the pool had an average quality score of 2.9 (out of 5.0). This score indicates the pool was in 'Fair' biological condition. Therefore, the Belleville pool will be reported to EPA as meeting its aquatic life-use designation.

- As of 2009, all 19 pools (AUs) have been assessed which comprises 981 miles or 100% of the resource.

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A Biological Study of the Belleville Pool of the Ohio River (2009)

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 fish populations of the Ohio River, ORSANCO developed the Ohio River Fish Index (ORFIn, Emery et al. 2003). The ORFIn 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. In 2008, ORSANCO recalibrated the original ORFIn and adjusted for more-detailed habitat classifications and a contemporary means of scoring the fish metrics (i.e. continuous in lieu of discrete scoring). A new assessment approach was also adopted for the modified ORFIn (MORFIn).

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 2009, the Belleville, Markland, McAlpine pools and the Open Water section were sampled as part of ORSANCO's normal monitoring. This report presents the 2009 survey of the Belleville pool including the data collected and assessment results based on the 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

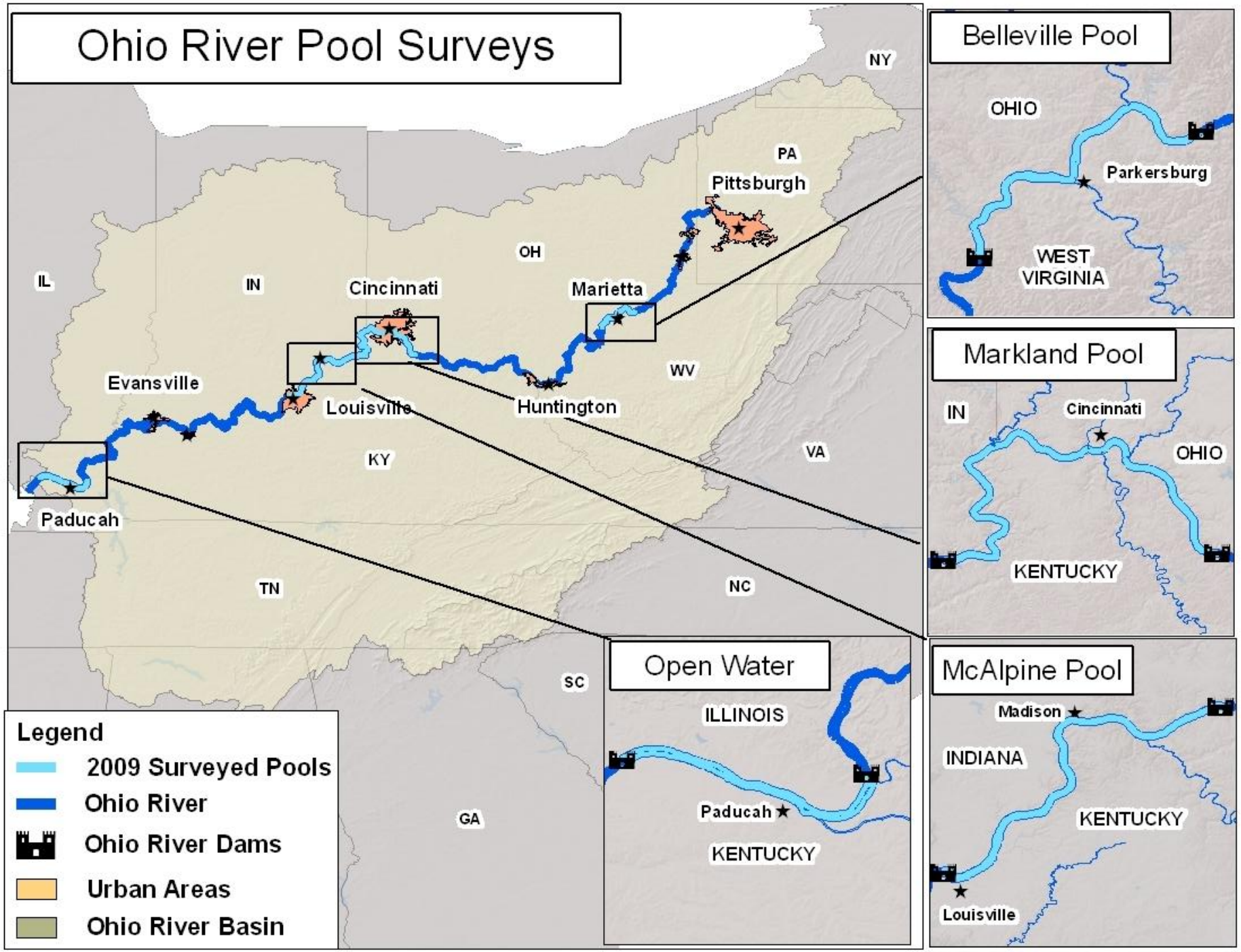


Figure 1. *The Ohio River basin and the four pools selected for 2009 sampling.*

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

2.2 Belleville Pool

The Belleville pool is 42.2 miles long, extending from Willow Island Locks and Dam (ORM 161.7) to Belleville Locks and Dam (ORM 203.9). The pool has a gradient drop of 0.5 feet per mile and averages 1,327 feet wide and 24 feet deep (ORSANCO 1994). The pool is bordered by the states of West Virginia and Ohio.

2.3 Belleville Pool Land Cover

This pool lies in a portion of the Ohio River is moderately influenced by industry and barge activity. The Belleville pool receives water from the following tributaries: Duck Creek in Ohio at mile point 170.7 with a drainage area of 228 square miles, the Muskingum River in Ohio at mile point 172.2 with a drainage area of 8,040 square miles, the Little Kanawha River in West Virginia at mile point 184.6 with a drainage area of 2,320 square miles, the Little Hocking River in Ohio at mile point 191.8 with a drainage area of 103 square miles, and the Hocking River in Ohio at mile point 199.3 with a drainage area of 1,190 square miles. These watersheds are primarily forested (57.8%) but also have a considerable amount of pasture lands (13.1%) and row crops (9.8%; Figure 2).

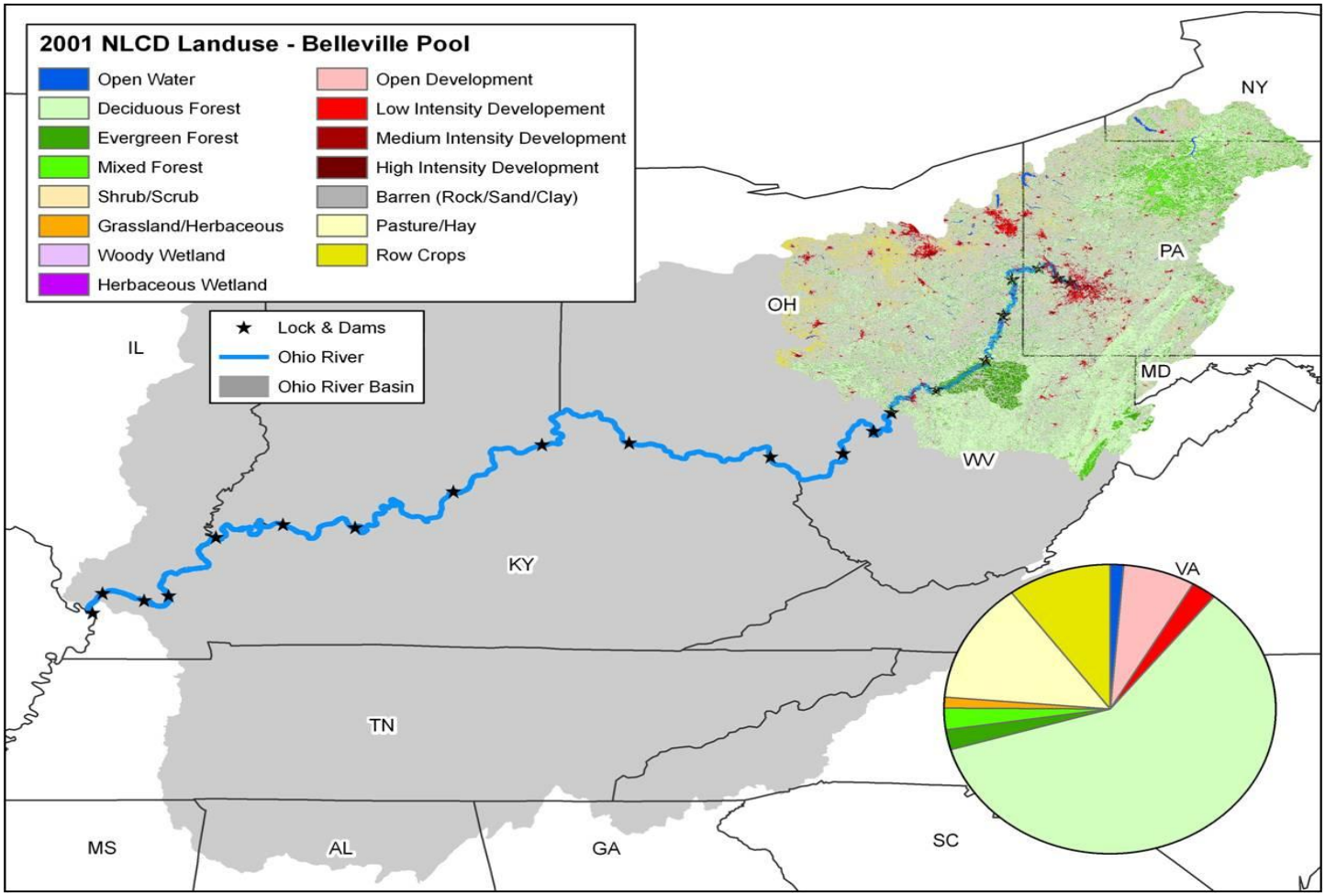


Figure 2. *Land cover within the Belleville pool catchment area.*

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 Belleville pool of the Ohio River from mile marker 161.7 (Willow Island Locks and Dam) to 203.9 (Belleville Locks and Dam). The total linear extent of the target population was approximately 84.4 miles. The sample frame was generated using RF3 river double lines for the Ohio River and river mile coverage provided by ORSANCO. A generalized random tessellation stratified survey design for a linear network with reverse hierarchical randomization 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).

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 to be used if a site could not be placed within 500m of the original location.

3.2 Index Period and Sampling Restrictions

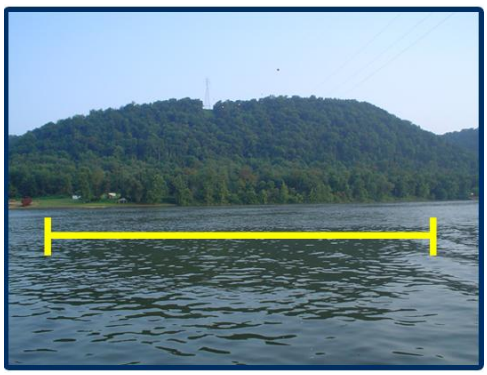
All sampling was conducted under the required conditions as described by Emery et al. (2003). This included sampling between June 29 and October 31 when water levels were within one meter of "normal flat pool" and Secchi depths were greater than 0.3m (12 in). These sampling restrictions were used to 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 night sampling typically yields samples of increased diversity and richness (Sanders 1992).

ORSANCO crew conducting night-time electrofishing

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 5.0 GPP 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.



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 five existing classes of habitat: 'A', 'B', 'C', 'D' or 'E' (Emery et al, in prep). By assigning each sampling site to one of five habitat categories, biologists can reduce the amount of assessment variability, or 'noise', because each habitat class has a slightly different expectation (see 3.6). Sites assigned to habitat class 'A' are characterized by a >81% presence of boulder, cobble, and gravel at depths <10 feet. Sites assigned to habitat class 'B' are characterized by a ≤81% and >50% presence of boulder, cobble, and gravel at depths <10 feet. Classes 'C', 'D', and 'E' each exhibit substrate compositions of boulder, cobble, and gravel that are ≤50%. Sites that fall in habitat class 'C' exhibit a lower percentage of smaller substrates (≤77%; sand, fines, and hardpan) at depths <10 feet. Class 'D' and 'E' sites similarly exhibit large amounts of sand and fine substrates (>77%), however these two classes differ with respect to depth. Habitat class 'D' sites are relatively shallow while class 'E' sites are deeper (depths exceeding 20 feet).

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 and an optical dissolved oxygen (DO) meter: water temperature, pH, DO, and conductivity. Water samples were also collected using a Kemmerer and consisted of a single-point, mid-depth grab sample at the downstream end of each 500m zone. Samples were collected approximately 100ft from shore at each site on three separate occasions throughout the field season. Samples were kept at or below 4ºC until sent off for laboratory analyses. Water quality parameters analyzed included: ammonia (nitrogen), chloride, hardness, nitrate-nitrite, total Kjeldahl nitrogen (TKN), sulfate, total suspended solids (TSS), total phosphorus, and total organic carbon (TOC).

Secchi depth was measured using a standard Secchi disc just prior to electrofishing. Flow was also monitored and data were obtained from the U.S. Army Corps of Engineers. These included daily average flow volumes and velocities from the nearest upstream sampling station to any particular site. There are 234 flow stations on the mainstem of the Ohio River from which data is recorded or modeled. Harmonic mean flow (HMF), the 22-year average flow, was calculated for every Julian day and flow station by ORSANCO using raw flow data obtained from the U.S. Army Corps of Engineers (ORSANCO 2003).

3.6 Pool Assessment

In 2009, ORSANCO employed a probabilistic design to provide a thorough assessment of biological condition. Individual navigational pools served as the primary assessment units. Therefore, the Belleville 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). Observed MORFIn scores were compared to habitat derived expectations for each site (Emery et al. 2003).

The five distinct habitat classes (A, B, C, D, and E) each exhibit different levels of historical MORFIn performance (i.e. different fish assemblages are found at each habitat). To account for these variations in our assessment, the condition of each site was determined by comparing its performance (i.e. MORFIn score) to those of previously sampled sites within its particular habitat class. The distribution of historical MORFIn scores was determined by compiling reference fish data (i.e. data from least-disturbed sites) from the five

distinct habitat classes over a fifteen year period. A fish quality score between 0 and 5 was given to each individual site based upon how each site scored relative to the statistical distribution (5^{th}, 25^{th}, 50^{th}, 75^{th}, and 95^{th} percentiles) of historical MORFIn scores (see Appendix A for a detailed explanation). For example, a fish quality score of 3 is applied to a site whose score falls between the 50^{th} and 75^{th} percentiles of the historical MORFIn scores specific to that habitat class (Figure 3). To further aid in interpretation, condition ratings were applied to each site quality score as follows: 0='Very Poor', 1='Poor', 2='Fair', 3='Good', 4='Very Good' and 5='Excellent'. Essentially, a site is considered in 'Good' biological condition when its MORFIn score is equal to or slightly better than the historical average.

To obtain a final bio-assessment of each pool, an average fish quality score was calculated. The 25^{th} percentile (average fish quality score of at least 2.0) was established as the criterion for determining whether a pool 'passes' (meets its aquatic life-use designation) or 'fails' (does not meet its aquatic life-use designation). The pool was assessed as 'passing' if its average fish quality score was above the 25^{th} percentile (≥2.0). Any pool with an average fish quality score less than 2.0 (i.e. a rating of 'Poor' or ''Very Poor') was assessed as failing to meet its aquatic life-use designation.

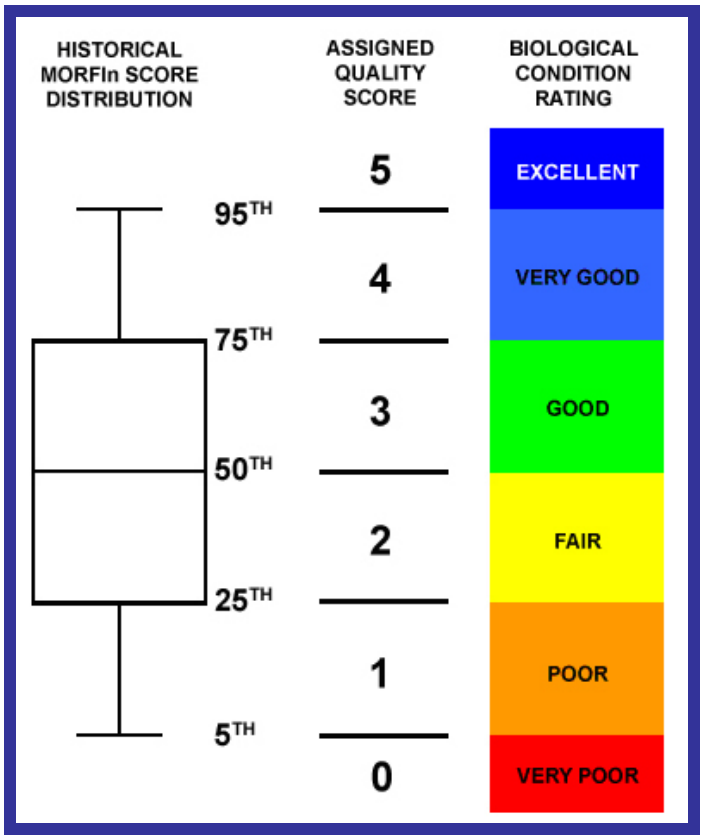


Figure 3. *Approach used to assign fish quality scores for each habitat class.*

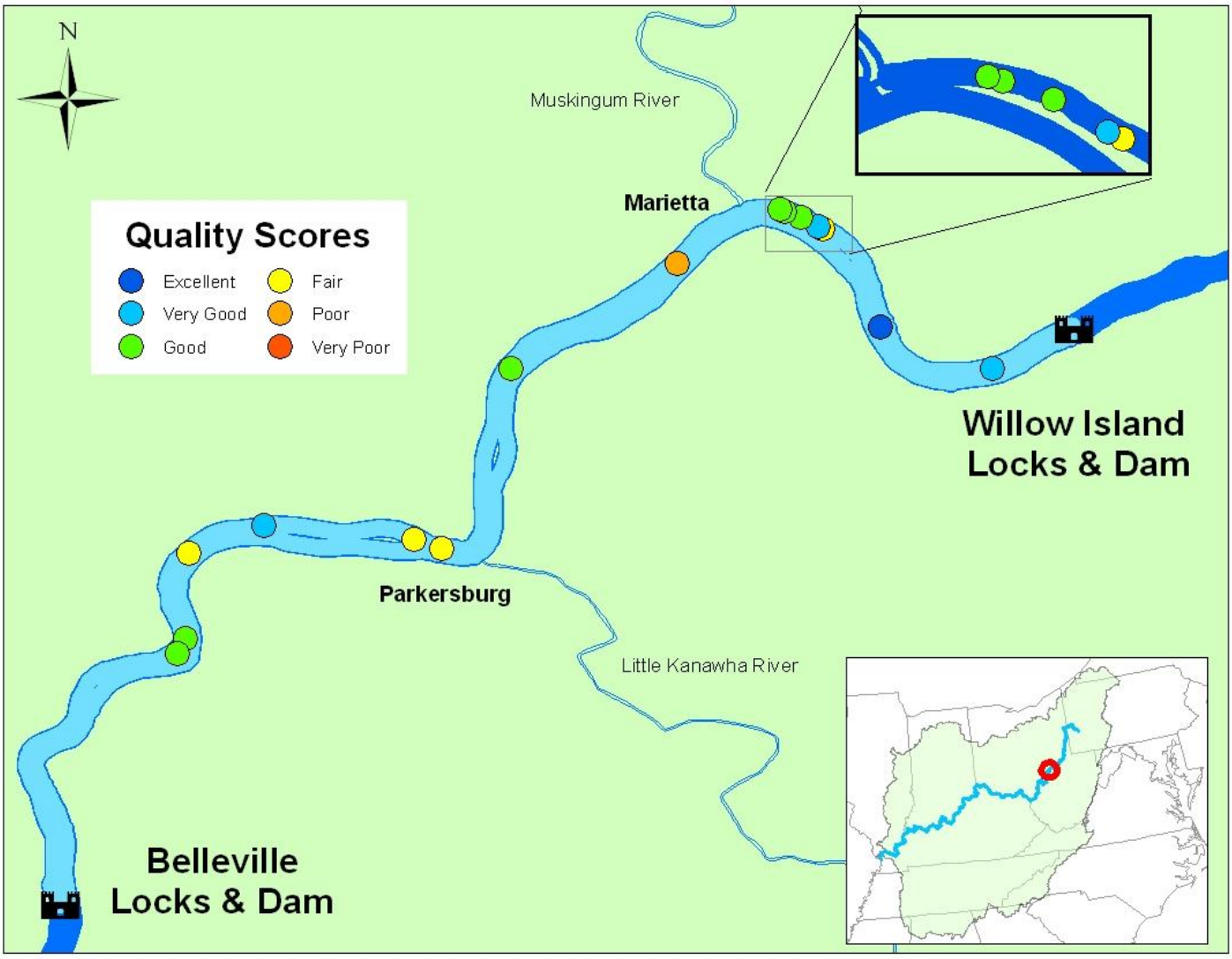


Figure 4. *Locations and results of sampling at 15 sites within Belleville pool.*

4.0 Results

4.1 Fish Population

In 2009, fish population data (Appendix B) were collected from 15 randomly selected locations throughout the length of the Belleville pool (Figure 4). These collections produced 51 species and 2 hybrid taxa, representing 12 different families (Table 2). Three of these taxa were listed in OH as either endangered [Ohio lamprey (*Ichthyomyzon bdellium*), threatened [river darter (*Percina shumardi*)] or of special concern [river redhorse (*Moxostoma carinatum*)]. WV has no official system for listings species. No federally listed taxa were collected from the Belleville pool. At the species level, two species of shiner (mimic and emerald) were the most abundant, comprising 39.8% of the catch (Figure 5). As a result, the minnow and carp family (Cyprinidae), made up 46.7% of the total catch, followed by the sunfish / black bass family (Centrarchidae) which made up 17.3% of the catch (Figure 6).

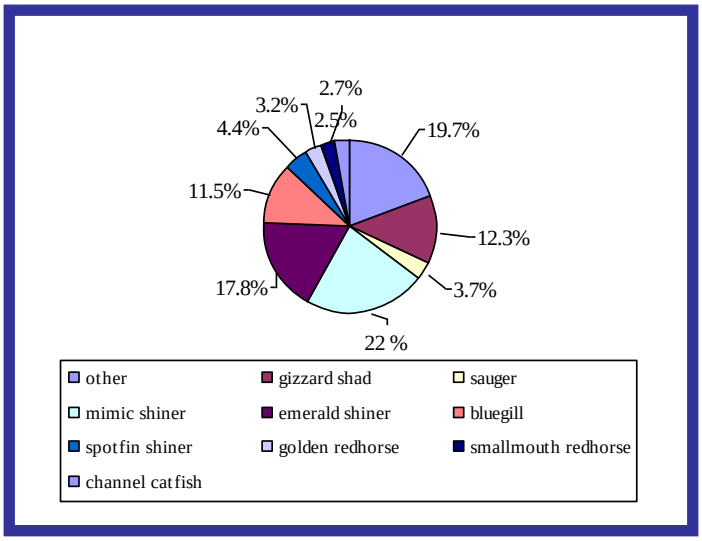


Figure 5. *Species composition of fish sampled in Belleville pool.*

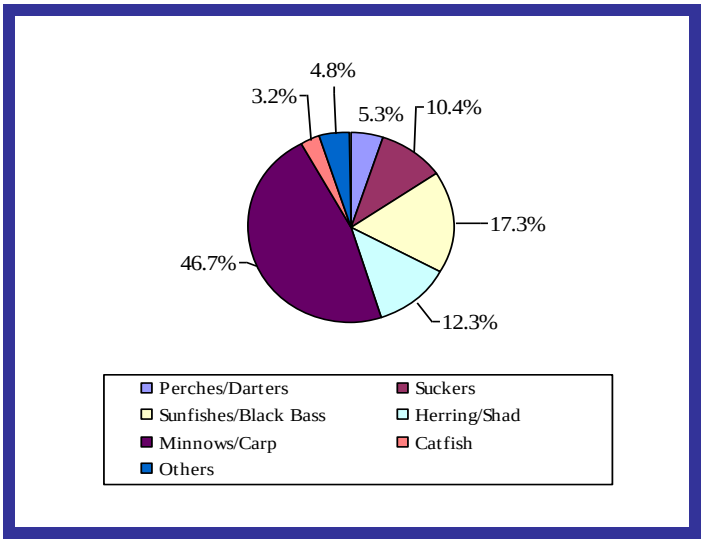


Figure 6. *Sampled fish composition by family in Belleville pool.*

Table 1. *Electrofishing site list for the Belleville pool including habitat designation, MORFIn scores, and quality scores.*

Site #	River Mile	Bank	Date	Latitude	Longitude	Habitat Class	MORFin Expectation	MORFin	Quality Values	Quality Score
1	163.9	LDB	29-Jun-09	39.34322	81.351613	C	44.55	67.39	4	Very Good
2	166.9	RDB	29-Jun-09	39.360426	81.398894	D	41.80	70.74	5	Excellent
3	170.3	RDB	30-Jun-09	39.401518	81.423088	C	44.55	50.49	2	Fair
4	170.4	LDB	29-Jun-09	39.402502	81.425043	C	44.55	63.62	4	Very Good
5	170.8	RDB	29-Jun-09	39.406738	81.432362	C	44.55	54.89	3	Good
6	171.3	RDB	29-Jun-09	39.409166	81.439077	C	44.55	57.53	3	Good
7	171.4	LDB	29-Jun-09	39.409789	81.441075	D	41.80	56.38	3	Good
8	174.3	LDB	01-Jul-09	39.387192	81.483952	C	44.55	37.35	1	Poor
9	179.3	RDB	01-Jul-09	39.343379	81.553684	C	44.55	54.53	3	Good
10	185.1	LDB	30-Jun-09	39.267733	81.582443	B	46.71	48.42	2	Fair
11	186.4	RDB	30-Jun-09	39.271605	81.593992	D	41.80	48.62	2	Fair
12	189.3	LDB	30-Jun-09	39.277349	81.657216	C	44.55	61.99	4	Very Good
13	191	RDB	01-Jul-09	39.265782	81.6886	B	46.71	54.98	2	Fair
14	193.5	RDB	01-Jul-09	39.230251	81.689762	C	44.55	57.50	3	Good
15	194.6	LDB	01-Jul-09	39.223906	81.693509	B	46.71	59.54	3	Good

Table 2. *Species collected in the Belleville pool during the 2009 survey. Species information are determined by and relative to the state of Ohio (E = 'Endangered'- one species; T = 'Threatened'- one species; and SC = 'Species of Concern'- one species;).*

Family	Species	Latin Name	OH
Petromyzontidae	Ohio Lamprey	*Ichthyomyzon bdellium*	E
Lepisosteidae	Longnose Gar	*Lepisosteus osseus*	
Hiodontidae	Mooneye	*Hiodon tergisus*	
Clupeidae	Skipjack Herring	*Alosa chrysochloris*	
Clupeidae	Gizzard Shad	*Dorosoma cepedianum*	
Cyprinidae	Spotfin Shiner	*Cyprinella spiloptera*	
Cyprinidae	Common Carp	*Cyprinus carpio*	
Cyprinidae	Silver Chub	*Macrhybopsis storeriana*	
Cyprinidae	Emerald Shiner	*Notropis atherinoides*	
Cyprinidae	Sand Shiner	*Notropis stramineus*	
Cyprinidae	Mimic Shiner	*Notropis volucellus*	
Cyprinidae	Bluntnose Minnow	*Pimephales notatus*	
Cyprinidae	Bullhead Minnow	*Pimephales vigilax*	
Catostomidae	Carpiodes Sp	*Carpiodes sp.*	
Catostomidae	River Carpsucker	*Carpiodes carpio*	
Catostomidae	Quillback	*Carpiodes cyprinus*	
Catostomidae	Highfin Carpsucker	*Carpiodes velifer*	
Catostomidae	Northern Hog Sucker	*Hypentelium nigricans*	
Catostomidae	Smallmouth Buffalo	*Ictiobus bubalus*	
Catostomidae	Black Buffalo	*Ictiobus niger*	
Catostomidae	Silver Redhorse	*Moxostoma anisurum*	
Catostomidae	Smallmouth Redhorse	*Moxostoma breviceps*	
Catostomidae	River Redhorse	*Moxostoma carinatum*	SC
Catostomidae	Black Redhorse	*Moxostoma duquesnei*	
Catostomidae	Golden Redhorse	*Moxostoma erythrurum*	
Ictaluridae	Channel Catfish	*Ictalurus punctatus*	
Ictaluridae	Flathead Catfish	*Pylodictis olivaris*	
Percopsidae	Trout-Perch	*Percopsis omiscomaycus*	
Moronidae	Morone Sp	*Morone sp.*	
Moronidae	White Bass	*Morone chrysops*	
Moronidae	Hybrid Striper	*Morone saxatilis x M. chrysops*	
Centrarchidae	Rock Bass	*Ambloplites rupestris*	
Centrarchidae	Green Sunfish	*Lepomis cyanellus*	
Centrarchidae	Pumpkinseed	*Lepomis gibbosus*	
Centrarchidae	Orangespotted Sunfish	*Lepomis humilis*	
Centrarchidae	Bluegill	*Lepomis macrochirus*	
Centrarchidae	Longear Sunfish	*Lepomis megalotis*	
Centrarchidae	Redear Sunfish	*Lepomis microlophus*	
Centrarchidae	Smallmouth Bass	*Micropterus dolomieu*	
Centrarchidae	Spotted Bass	*Micropterus punctulatus*	
Centrarchidae	Largemouth Bass	*Micropterus salmoides*	
Centrarchidae	White Crappie	*Pomoxis annularis*	
Centrarchidae	Black Crappie	*Pomoxis nigromaculatus*	
Percidae	Rainbow Darter	*Etheostoma caeruleum*	
Percidae	Yellow Perch	*Perca flavescens*	
Percidae	Logperch	*Percina caprodes*	
Percidae	River Darter	*Percina shumardi*	T
Percidae	Sauger	*Sander canadensis*	
Percidae	Walleye	*Sander vitreus*	
Percidae	Saugeye	*Sander canandensis x S. vitreus*	
Sciaenidae	Freshwater Drum	*Aplodinotus grunniens*	

4.2 Metric Performance

Thirteen metrics were used to calculate MORFIn scores for each electrofishing site (See Emery et al. 2003). Each site's performance and scores for the MORFIn metrics are shown in Table 3. The number of native species collected at each site ranged from 15 to 25, with an average of 20 species per site. The number of sucker species found at each site ranged from 1 to 7 and the number of centrarchid species varied from 1 to 8. The number of great river species ranged from 0 to 3. The number of intolerant species ranged from 2 to 6 at the sampled sites. The percentage of tolerant individuals at each site did not exceed 13.1% and the percentage of simple lithophils ranged between 4.9% and 59.9%. All sites had below 11.6% non-native individuals and the percent detritivores ranged from 0.6% to 20.8%. The percent invertivores ranged between 13.4% to 90%, and the percent piscivores ranged from 6.8% to 50.8%. Two of the sites had two DELT (deformities, eroded fins, lesions and tumors) anomalies. The CPUE (catch per unit effort) ranged from 96 to 548 individuals and averaged 234.6 individulas per site.

4.3 Habitat Surveys

Intensive habitat surveys at each of the 15 sampling locations revealed that the benthic substrate in Belleville pool was primarily sand, gravel and fines (Figure 7). There was some variation among the individual sites and the percentage of sand and fines dominated the upper and middle portions of the pool (Figure 8). The percentages of substrate variables were used to give each site a habitat classification of 'A', 'B', 'C', 'D', or 'E'. No sites in the Belleville pool was classified as class 'A' habitats, 3 sites were class 'B' habitats, 9 sites were class 'C' habitats, and 3 sites were class 'D' habitats. There were zero 'E' habitat classes sampled in the pool (Table 1).

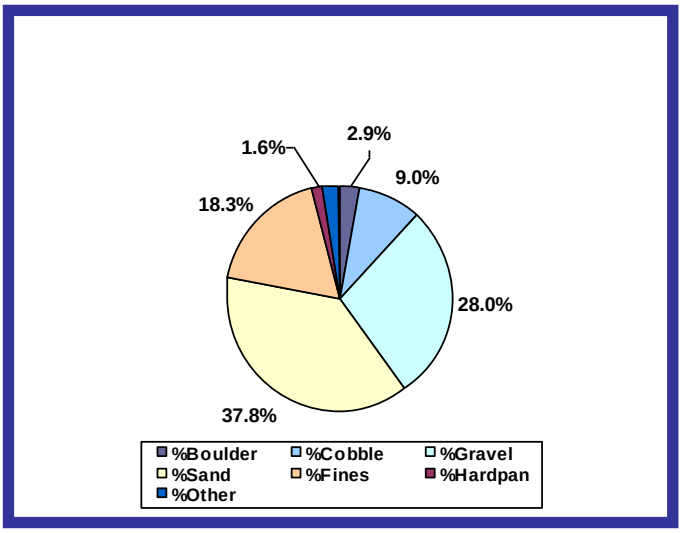


Figure 7. *Substrate composition of the Belleville pool.*

Woody cover was present at all but one of the 15 sites sampled and overhanging vegetation was present at 11 of 15 sites. Riparian land cover was primarily natural forest and urban cover with some residential and agricultural uses present. Barge activity was moderate throughout the pool. Mooring structures, docks, boats or ramps were present at all but one of the sites (see Appendix C).

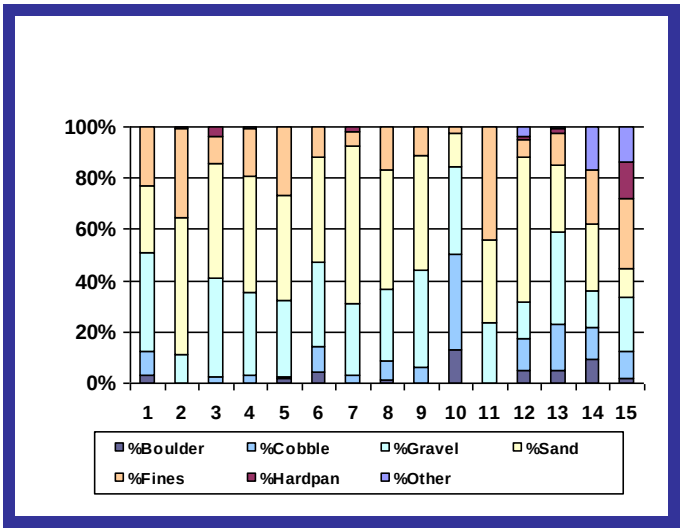


Figure 8. *Substrate composition at each site sampled in the Belleville pool.*

Table 3. *MORFIn metrics and scores from the 2009 survey of Belleville pool.*

Site #	Rmi	Bank	# Individuals	# Individuals w/o G & E	# Individuals w/o GETHEx	# Species	# Species Score	# Suckers	Suckers 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	Expected MORFIn	Observed MORFIn
1	163.9	L	233	169	166	25	100.0	6	81.7	6	100	0	0	5	71.9	1.8	81.2	23.1	33.8	1.8	83.6	4.7	85.1	65.1	81.0	23.1	30.0	0	100	230	27.7	44.5	67.4
2	166.9	R	551	467	464	20	67.6	7	100.0	2	33	1	33	6	90.7	0.2	97.7	16.1	21.3	0.6	94.0	0.6	99.5	90.1	100.0	7.3	2.7	0	100	548	79.4	41.8	70.7
3	170.3	R	376	227	216	17	45.9	4	43.4	3	50	1	33	4	53.8	4.8	48.6	8.4	7.5	4.4	59.2	5.3	83.1	78.4	0.0	9.7	6.8	1	75	365	49.8	44.55	50.5
4	170.4	L	240	162	162	16	38.6	4	43.5	3	50	1	33	3	35.2	0.0	100.0	59.9	100.0	0.0	100.0	1.9	95.2	84.6	100.0	6.8	1.8	0	100	240	29.5	44.55	63.6
5	170.8	R	250	112	111	18	53.1	4	43.5	3	50	0	0	3	35.2	0.0	100.0	18.8	26.2	0.9	91.7	8.0	73.4	75.0	96.3	13.4	13.2	0	100	249	31.0	44.55	54.9
6	171.3	R	206	52	52	17	45.9	4	43.5	5	83	0	0	3	35.2	0.0	100.0	26.9	40.9	0.0	100.0	3.8	88.2	50.0	58.6	36.5	53.3	1	75	206	24.0	44.55	57.5
7	171.4	L	301	123	119	15	31.3	6	82.2	1	17	1	33	5	72.4	2.4	74.1	39.8	64.1	3.3	69.9	3.3	90.3	84.6	100.0	11.4	9.8	2	50	297	38.8	41.8	56.4
8	174.3	L	151	61	53	19	60.5	4	43.7	6	100	0	0	2	0.0	13.1	0.0	29.5	45.6	11.5	0.0	16.4	43.9	21.3	0.0	50.8	77.9	0	100	143	13.8	44.55	39.8
9	179.3	R	99	77	74	21	75.3	4	44.0	6	100	1	33	4	54.4	3.9	58.7	39.0	62.7	3.9	63.9	20.8	28.5	39.0	42.4	28.6	39.4	0	100	96	6.3	44.55	54.5
10	185.1	L	126	97	93	20	68.2	2	5.6	6	100	0	0	2	17.6	4.1	56.3	22.7	33.5	1.0	90.5	7.2	76.3	13.4	4.2	44.3	66.6	0	100	122	10.7	46.71	48.4
11	186.4	R	116	72	71	18	53.7	3	25.1	3	50	1	33	4	54.9	1.4	85.3	31.9	50.2	1.4	87.1	16.7	43.0	40.3	44.7	31.9	45.2	2	50	115	9.6	41.80	48.6
12	189.3	L	158	123	122	23	90.2	3	25.2	5	83	3	100	4	55.1	0.8	91.4	28.5	43.9	0.0	100.0	13.8	53.0	32.5	33.2	28.5	39.1	1	75	157	16.5	44.55	62.0
13	191	R	251	246	237	21	75.7	4	44.6	7	100	0	0	3	36.6	2.8	69.8	8.5	8.1	1.6	84.9	5.7	81.7	59.3	73.7	25.6	34.2	1	75	242	30.3	46.71	55.0
14	193.5	R	311	307	298	20	68.5	1	0.0	8	100	2	67	4	55.4	2.3	75.8	4.9	1.6	1.6	84.9	4.9	84.5	62.5	78.6	15.3	16.4	1	75	302	40.1	44.55	57.5
15	194.6	L	214	212	206	23	90.3	2	6.2	7	100	3	100	3	36.9	2.8	70.0	9.4	9.8	0.9	91.3	6.1	80.1	34.4	36.3	22.2	28.2	0	100	208	24.9	46.71	59.5

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

While rain events were relatively common throughout the sampling period in 2009, river levels and flows remained relatively low when sampling was conducted. Flow conditions during sampling varied from 51% to 77% of the HMF (Figure 9). In Belleville pool, flows were below the harmonic mean flow (HMF).

Measurements of water quality parameters did not reveal any unusual or poor water conditions present at the time of fish sampling although conductivity and dissolved oxygen measurements were somewhat elevated at some locations (Appendix D). Secchi depths at the time of sampling ranged from 26 to 46 inches.

The water quality parameters measured from water samples, collected three separate times throughout the field season (June/July, August, September/October) with Kemmerers, did not reveal any parameters exceeding water quality criteria (Appendix E).

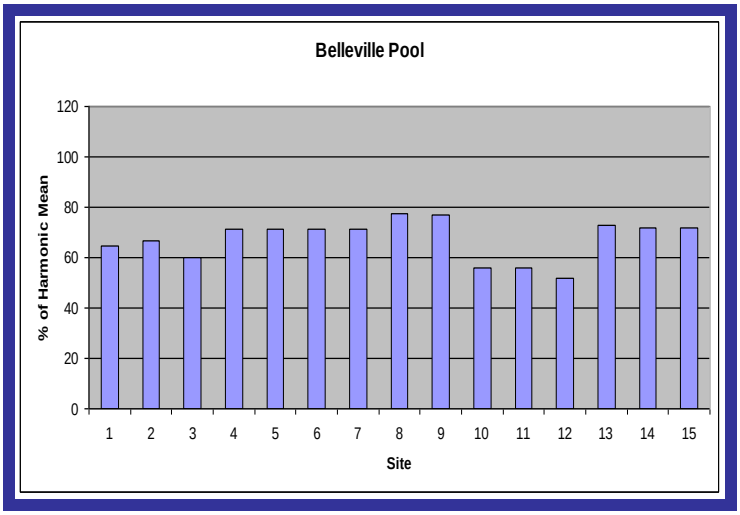


Figure 9*. Relative flows (%HMF) at the time of sampling.*

4.5 Assessment of Condition

MORFIn scores were calculated for each of the sites sampled. The maximum score achieved by any site in this pool, out of a possible 100, was 70.74 and the minimum was 37.33. By comparing observed and expected MORFIn scores, ORSANCO determined if a site met its expectations (based on habitat class) or not (Table 3). One site was assessed in 2009 that scored less than the minimum expected score and was assessed as poor (Table 1; Figure 4). The remaining 14 sites received a fair, good, or very good quality rating (Figure 4).

5.0 Discussion

5.1 Fish Population

In 2009, the fish population of Belleville pool was in 'Fair' condition. This was supported by the diversity and types of species collected. Multiple pollution intolerant species such as smallmouth redhorse (*Moxostoma breviceps*), river redhorse (*M. carinatum*), northern hogsucker (*Hypentelium nigricans*), mimic shiner (*Notropis volucellus*), smallmouth bass (*Micropterus dolomieu*), logperch (*Percina caprodes*), and mooneye (*Hiodon tergisus*) were collected. This suggests that pollution may not be a problem in the area as indicated by fish populations. Common carp (*Cyprinus carpio*) was the only non-native species collected during the survey.

The three most abundant species in the survey were mimic shiner (*Notropis volucellus,* 795 individuals), emerald shiner (*Notropis atherinoides,* 637 individuals), and gizzard shad (*Dorosoma cepedianum*; 439 individuals).

5.2 Metric Performance

Most of the metric scores in Belleville pool were relatively high with the exception of four metrics: CPUE, % piscivores, % simple lithophils, and % invertivores. The distance of Belleville pool from the Mississippi River may be responsible for the lower great river species metric scores. There was no explanation for the low percentage of % invertivorous or % intolerant individuals. Gizzard shad and emerald shiners were two of the dominant species collected (by abundance) and the CPUE metric does not include these species in its calculation. Therefore CPUE metric scores are low.

Three metrics stood out as the highest performing in Belleville pool; DELTs, the % non-native individuals, and % detritivores. Very few DELT anomalies were found in this survey, suggesting the majority of fishes are not experiencing environmental stressors severe enough to decrease

their health. Low proportions of non-native individuals and a high number of centrarchid species were collected. These metrics indicate that Belleville pool is in 'Fair' condition. Other metrics that performed relatively well include: # tolerant individuals, and # species.

5.3 Habitat Surveys

The habitat assessments show that in Belleville pool there was a relatively high number of sites classified as class 'C', and the remainder were classified as 'B', and 'D' habitats. This indicates that the majority of the benthic substrate is comprised of gravel, sand, and fines. The heterogeneous substrate compositions, supplemented with the presence of woody cover, provided adequate habitat to support the diverse populations of fishes in the pool.

5.4 Water Quality and Flow Conditions

There is no indication that flow parameters affected the survey of Belleville pool, and Secchi depths indicated sufficient visibility for sampling. No water quality measurements exceeded their respective criteria or provided any major insight into the assessment results for Belleville pool.

5.5 Conclusions and Assessments of Condition

The overall average quality score in Belleville pool was 2.9, indicating the pool is in 'Fair' biological condition. This assessment demonstrated that the Belleville pool met the criteria established by ORSANCO's Biological Water Quality Subcommittee (Appendix A), and therefore met its aquatic life-use designation.

6.0 Interpool Comparison

6.1 Purpose

As of 2009, all 19 of the pools have been surveyed and assessed. This section was developed to compare Belleville pool to other previously surveyed pools in the Ohio River.

6.2 Land Cover

Belleville lies in the upper portion of the Ohio River and therefore has a relatively small catchment area. Despite many industrial facilities immediately surrounding the pool, the primary land cover within the watershed is deciduous forest. Urban areas are secondary land uses but in higher proportions than pools in the lower third of the Ohio River (Figure 10).

6.3 Substrate Composition

This pool had a relatively equal percentage of cobble, gravel, sand, and fine substrates. The heterogeneous substrate composition is most similar to its closest upstream pool (Willow Island). However, these percentages are quite different from the pools assessed in the lower third of the river (Figure 11).

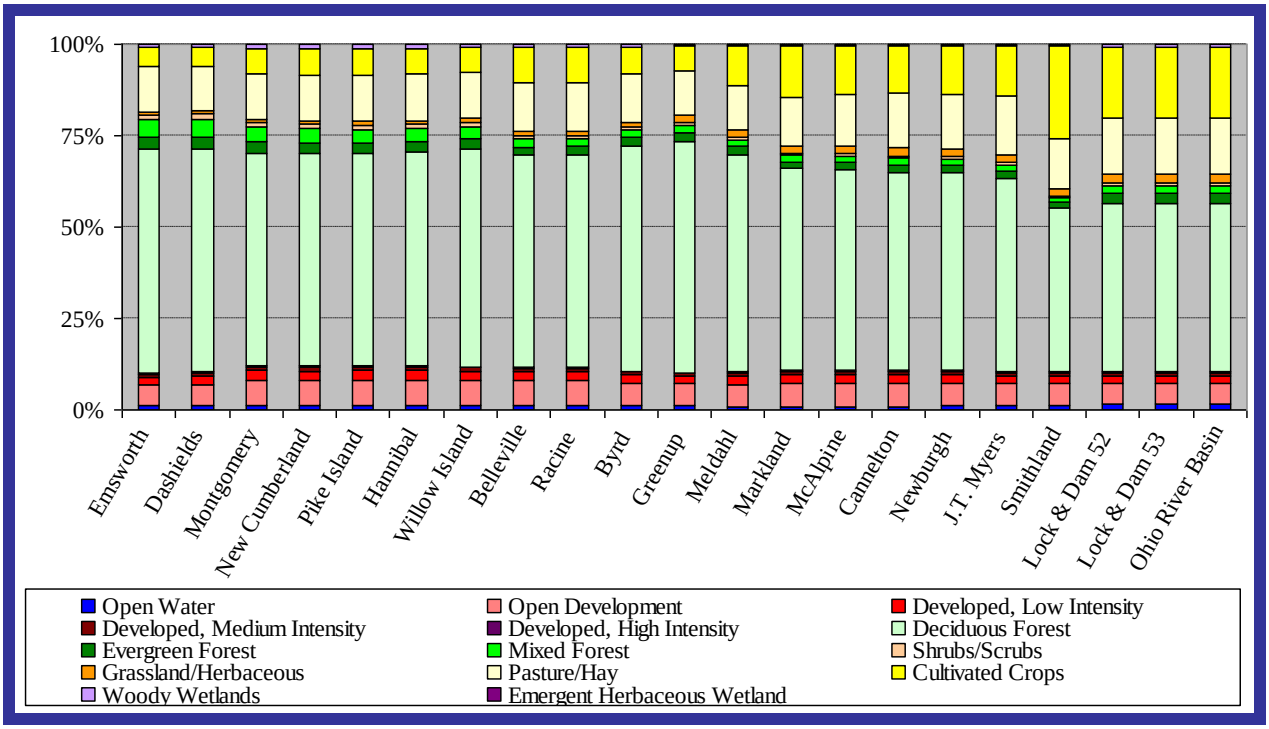


Figure 10. *Cumulative land-cover within the catchment area of each pool of the Ohio River.*

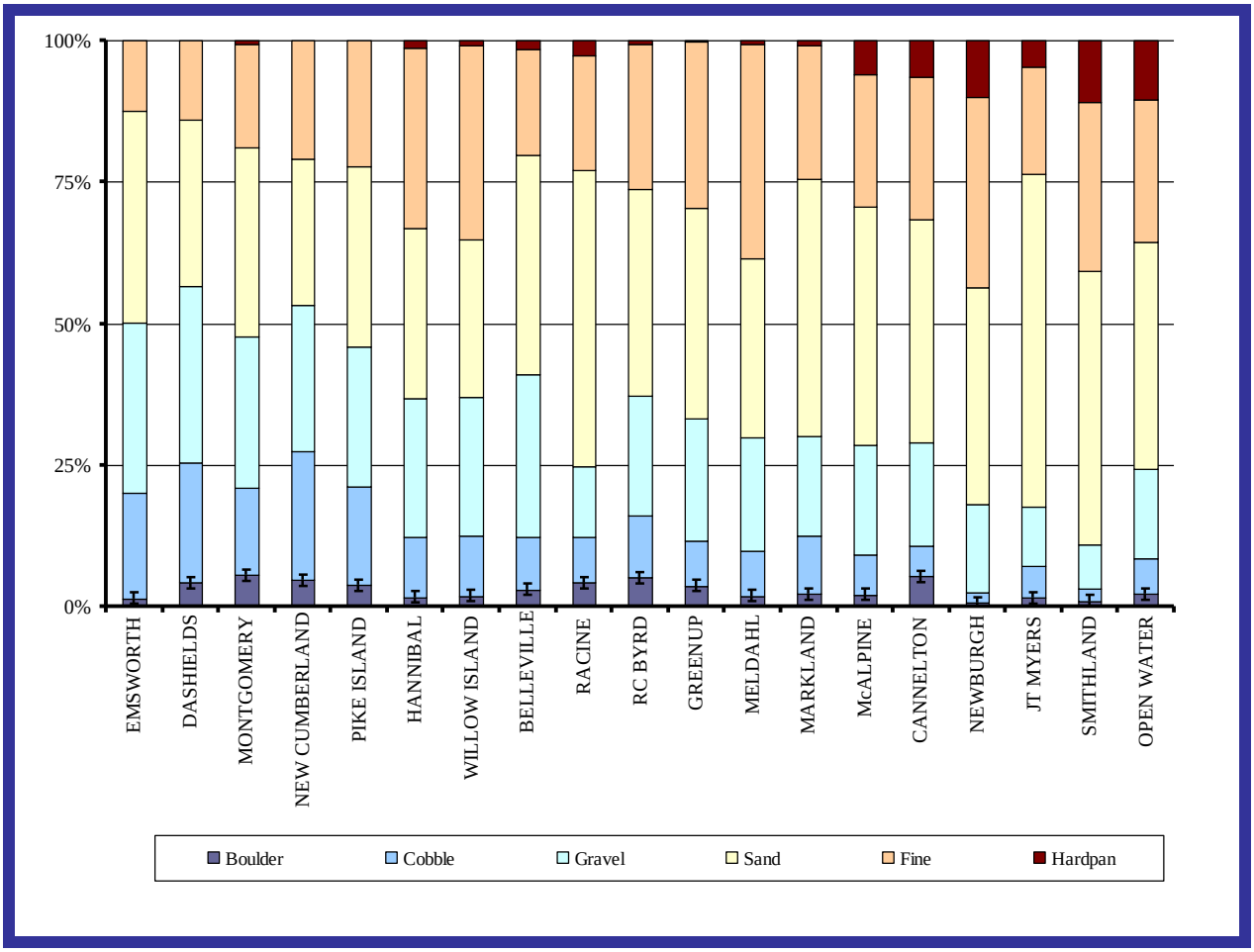


Figure11. *Substrate composition for each pool surveyed as of 2009.*

6.4 Species Richness

Belleville pool was similar to other surveyed pools with respect to the average number of native species per site (20.0) and ranked 7th in comparison (Figure 12).

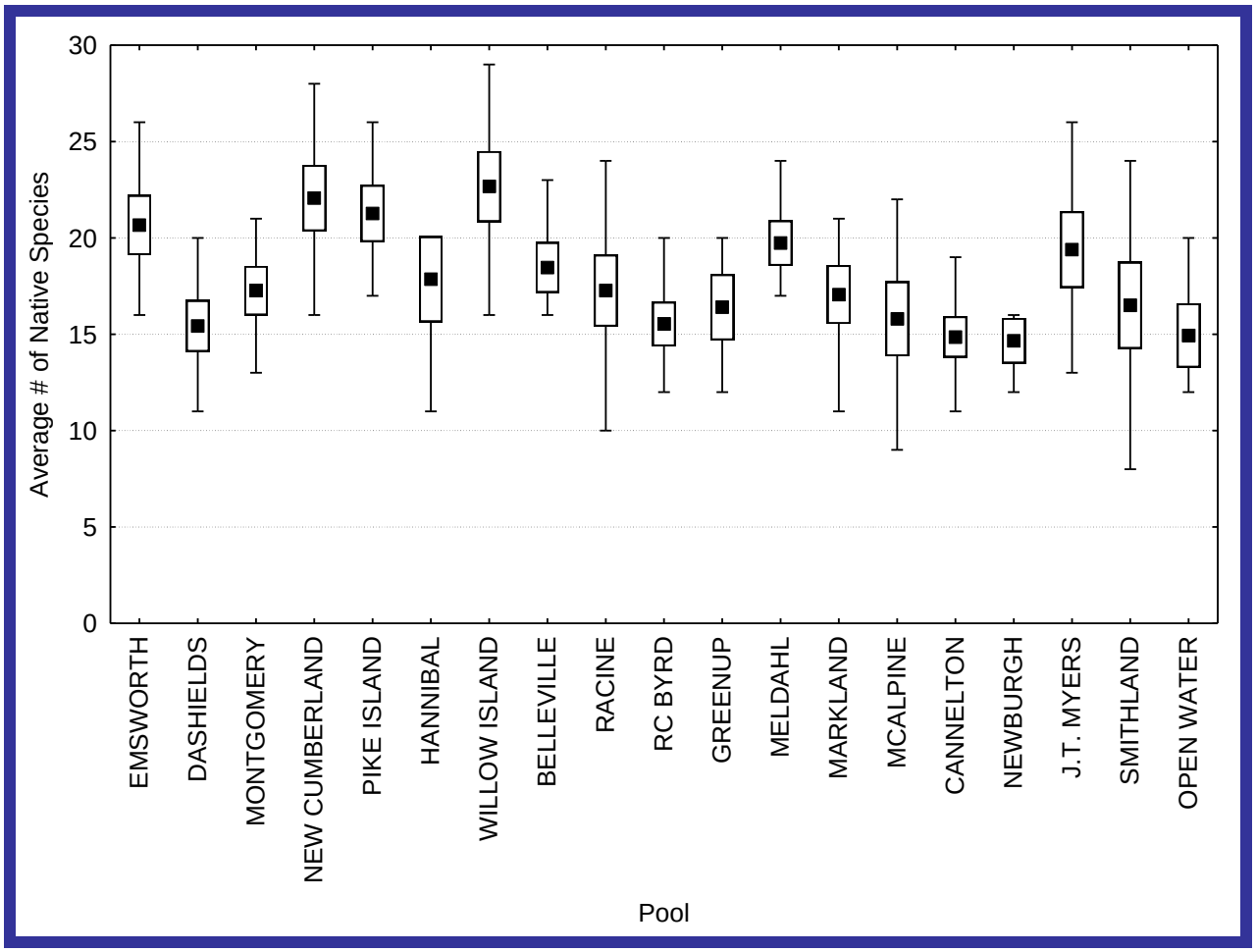


Figure 12. *The average number of native species collected at each site within each pool surveyed as of 2009 (■=Average, □= 90% Confidence Interval, I=Non-Outlier Range).*

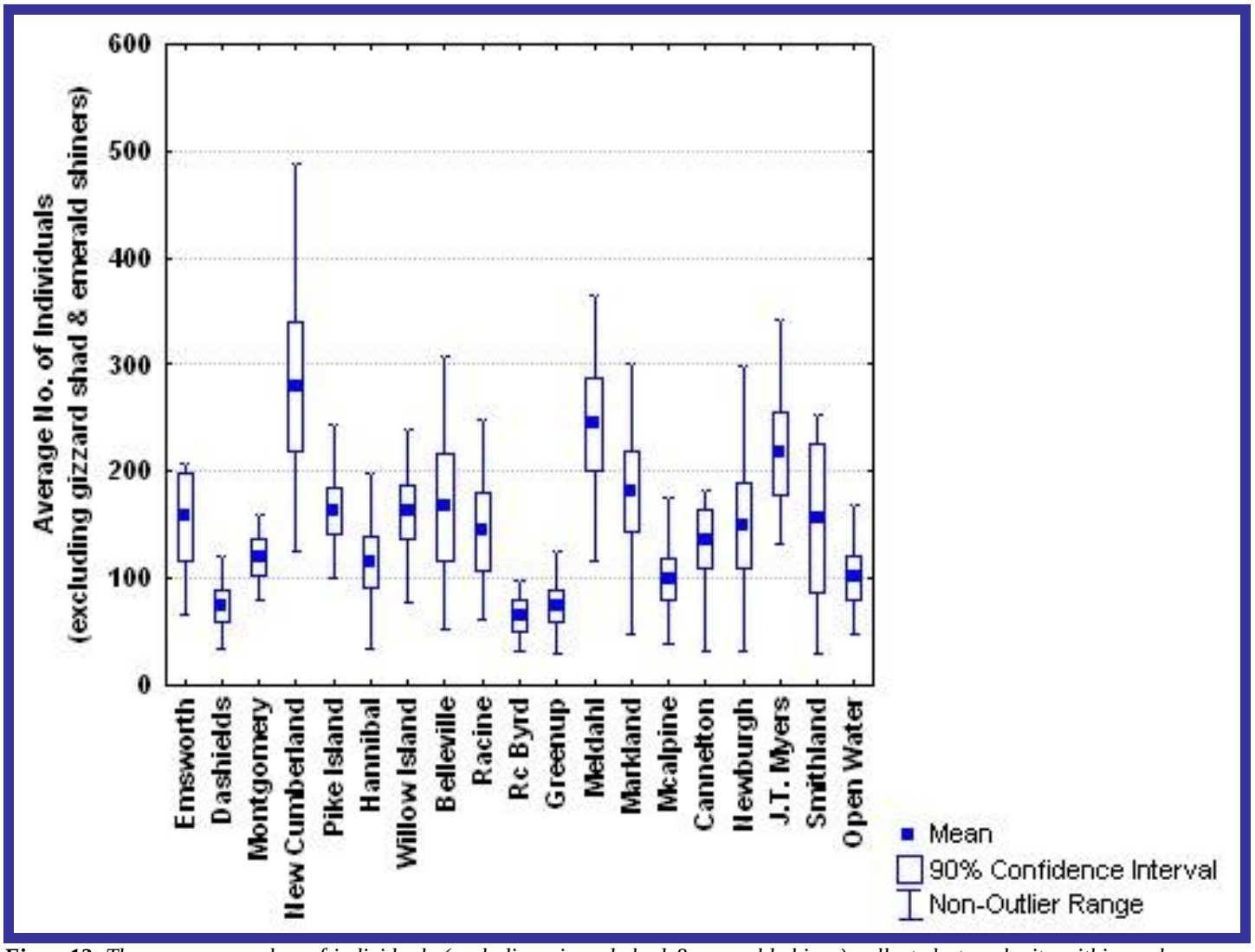


Figure13*. The average number of individuals (excluding gizzard shad & emerald shiner) collected at each site within each pool surveyed as of 2009.*

6.5 Number of Individuals

An average of 167.0 individuals (excluding gizzard shad and emerald shiner) was collected at each site in Belleville pool which ranked 5th in comparison (Figure 13).

6.6 Noteworthy Fish Observations

A couple of the species collected in Belleville pool that were unique to the 2009 surveys included yellow perch (*Perca flavescens)*, and the Ohio lamprey (*Ichthyomyzon bdellium*). A couple species were collected from this pool that are largely endemic to the upper portions of the Ohio River. These include rock bass and yellow perch. (Table 4). Multiple large (>30lbs) flathead catfish were sampled. Using supplemental sampling, one other notable catch was a muskellunge (*Esox masquinongy*) collected from the mainstem of the Ohio that was 40 inches long. During macro-invertebrate sampling, two common mudpuppies (*Necturus maculosus*) were also found within the Hester-Dendy samplers.

6.7 Assessment of Condition

The average quality value in Belleville pool was 2.9 and it was assessed as being in 'Fair' condition. The nearest surveyed pool upstream (Willow Island) and downstream (Racine) of Belleville pool were considerd to be in 'Good' and 'Fair' condition respectively. (Figure 14).

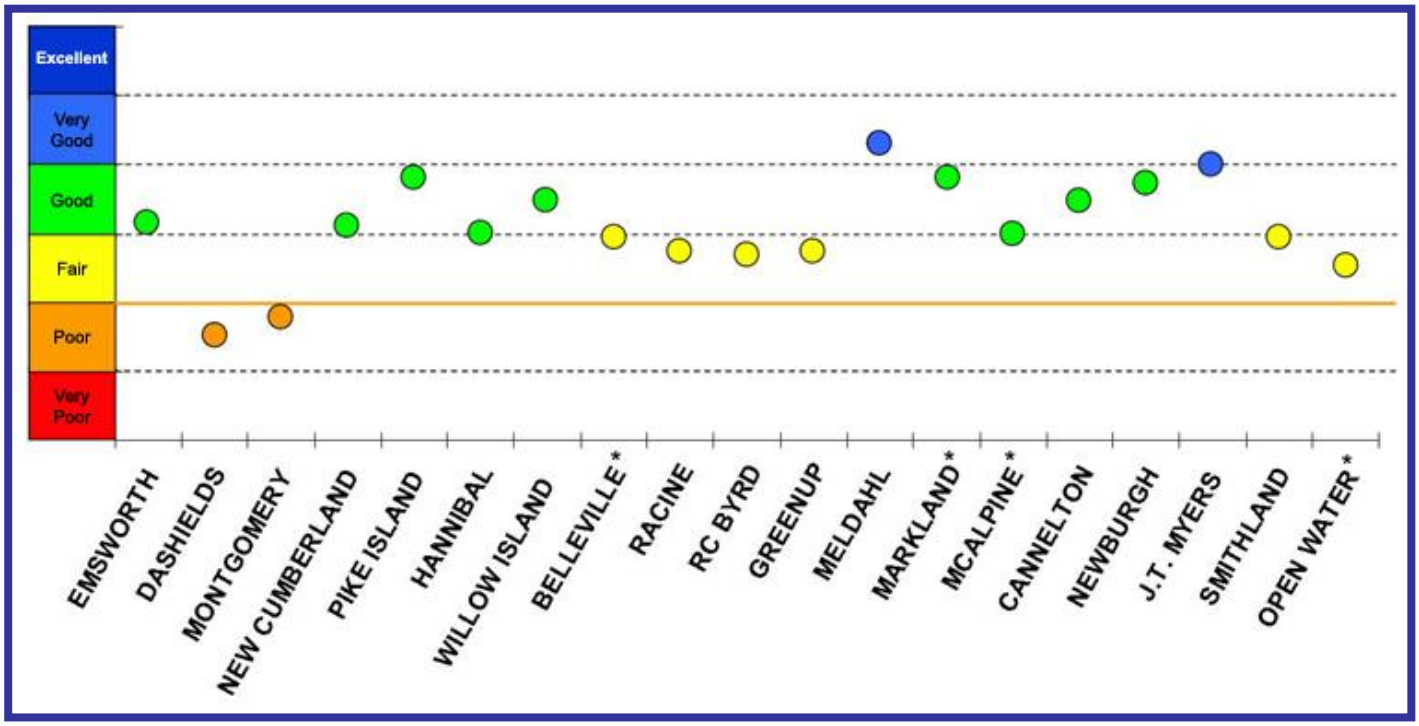


Figure 14. *The average quality score for each pool surveyed as of 2009 (* = pool surveyed in 2009). Data points are color-coded to indicate the biological condition of a pool*.

Table 4. *A compiled species list containing the number of individuals collected per pool as of 2009*

#	Species	Emsworth 07	Dashields 08	Montgomery 06	New Cumberland 05	Pike Island 07	Hannibal 08	Willow Island 06	**Belleville 09**	Racine 05	R.C. Byrd 08	Greenup 06	Meldahl 07	**Markland 09**	**McAlpine 09**	Cannelton (30) 06-07	Newburgh 07	Myers 05	Smithland 08	**Open Water 09**
1	Ohio Lamprey								**1**											
2	Silver Lamprey											1							1	
3	Paddlefish																1			**1**
4	Spotted Gar																1		1	
5	Longnose Gar	13	11	10	11	43	49	46	**49**	24	27	23	22	**15**	**40**	48	20		16	**40**
6	Shortnose Gar													**1**	**1**		9	2	13	**75**
7	Goldeye																12		2	**4**
8	Mooneye	20	11	6	22	37	10		**4**	1	7		48	**9**	**10**	8	10	4		**1**
9	Skipjack Herring	8			3	6			**2**	1	2		64	**2**	**6**	174	70	249	1	**8**
10	Gizzard Shad	167	123	266	1202	7326	1461	216	**439**	8048	301	267	2408	**185**	**490**	3527	600	444	409	**325**
11	Threadfin Shad														**1**	1	9	112	25	**3**
12	Central Stoneroller				4		3	1												
13	Goldfish				1															
14	Grass Carp				1												1			**3**
15	Spotfin Shiner			1	21	14		24	**159**	63	1	2	32	**1**	**6**	63	8	12	4	**12**
16	Common Carp	63	36	44	25	15	15	22	**36**	9	12	9	8	**28**	**12**	5	4	10	17	**51**
17	Gravel Chub												1							
18	Miss. Silvery Minnow																	1		**1**
19	Silver Carp																2		4	**6**
20	Bighead Carp																2			**2**
21	Striped Shiner						2			2										
22	Silver Chub	26	26	12	20	11	19	57	**32**	44	11	33	90	**372**	**39**	130	126	206	47	**25**
23	River Chub				1	1														
24	Golden Shiner	1			1															
25	Emerald Shiner	82	5	8	342	197	21	728	**637**	795	16	50	637	**204**	**67**	1331	166	801	28	**25**

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26	River Shiner	1											54	**12**	**10**	276	3	91	2	**9**
27	Silverjaw Minnow						1													
28	Spottail Shiner				6	2	1													
29	Silverband Shiner																			**6**
30	Sand Shiner								**1**											
31	Mimic Shiner	35	1	13	76	162	16	306	**795**	402	1	61	7	**45**	**30**	195	6	43		**8**
32	Suckermouth Minnow													**1**						
33	Bluntnose Minnow				2	2	4	120	**11**	3		1	1		**1**	2			1	
34	Fathead Minnow									6										
35	Bullhead Minnow							4	**1**	5			23	**9**	**1**			8	2	**19**
36	Creek Chub				1								3							
37	Ictiobinae Sp				20															
38	Carpiodes Sp		1			14			**3**	2			1			2				**1**
39	River Carpsucker	18	18	13	46	36	64	18	**12**	50	25	49	87	**85**	**88**	122	179	86	114	**218**
40	Quillback	17	12	30	80	27	28	66	**6**	16	8	17	31	**21**	**12**	21	34	57	28	**15**
41	Highfin Carpsucker			37	3	10	13	1	**1**	7		4			**18**	1	12	3	24	
42	Northern Hog Sucker	3	1	3	132	4	2	15	**3**		1			**1**	**2**	1	1			
43	Ictiobus Sp.						19													
44	Smallmouth Buffalo	97	99	217	283	94	45	60	**75**	96	40	49	123	**110**	**102**	147	72	314	77	**76**
45	Bigmouth Buffalo									1							3	7	5	**5**
46	Black Buffalo	1	13			5	1	2	**1**			1		**1**	**1**	1	7	3	4	**7**

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#	Species	Emsworth 07	Dashields 08	Montgomery 06	New Cumberland 05	Pike Island 07	Hannibal 08	Willow Island 06	**Belleville 09**	Racine 05	R.C. Byrd 08	Greenup 06	Meldahl 07	**Markland 09**	**McAlpine 09**	Cannelton (30) 06-07	Newburgh 07	Myers 05	Smithland 08	**Open Water 09**
47	Spotted Sucker							1		1		5	1			1			7	
48	Moxostoma Sp				58															
49	Silver Redhorse	221	93	157	63	78	105	51	**55**	11	11	12	25	**3**	**41**	3			1	
50	Smallmouth Redhorse	61	16	110	110	28	41	168	**97**	5	27	30	62	**38**	**66**	12	3	11		
51	Shorthead Redhorse																		10	
52	River Redhorse	39	13	3	5	27	35	2	**1**		2	6	1		**2**		1			
53	Black Redhorse	18			11			4	**2**							1				
54	Golden Redhorse	7	33	227	90	66	204	277	**115**	11	33	39	120	**219**	**194**	4	14		3	**1**
55	Brown Bullhead											1								
56	Blue Catfish																	1	7	**4**
57	Channel Catfish	32	17	34	123	40	62	61	**89**	70	53	58	89	**113**	**84**	48	11	330	291	**165**
58	Flathead Catfish	14	11	11	15	35	38	21	**27**	32	42	32	49	**24**	**11**	63	11	43	16	**15**
59	Muskellunge	1																		
60	Trout-Perch								**7**	3										
61	Banded Killifish							1												
62	Western Mosquitofish																			**1**
63	Brook Silverside									1						1	1	1	1	
64	Inland Silverside																		26	
65	Atlantic Needlefish																			**5**
66	Morone Sp	27		6	568	419	91	17	**35**	561	73	2	152	**44**	**63**	625	403	253	190	**31**
67	White Perch	5			4		1	3						**1**	**1**					**7**
68	White Bass	9	16	36	6	2	3	58	**41**	3	29	64	18	**19**	**26**	66	4	17	76	**54**
69	Yellow Bass																		2	**104**
70	Striped Bass						14	1								6		12	2	
71	Hybrid Striper			4	17			1	**3**	46	1			**15**	**6**	6		11	2	**45**
72	Rock Bass	16	9	8	5	1	2	3	**9**					**2**				1		

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73	Lepomis Hybrid			1				9												
74	Lepomis Sp					1		16		1						2		2	1	
75	Green Sunfish	12	3	2	4	2	2	4	**8**	6	6	4	3	**9**	**3**	2	4	10	1	**2**
76	Pumpkinseed			2			2	18	**1**					**1**						**1**
77	Warmouth							1					1	**2**	**1**			1		
78	Orangespotted Sunfish				1			2	**1**	1	1		1					2		**5**
79	Bluegill	379	32	216	53	46	36	232	**413**	58	52	112	207	**206**	**105**	103	11	31	64	**98**
80	Longear Sunfish						9	23	**18**	3	9	14	35	**149**	**91**	39	3	11	92	**110**
81	Redear Sunfish			4		1		1	**4**	1		1		**1**	**1**	16		1	20	
82	Micropterus Sp																		1	
83	Smallmouth Bass	339	163	185	262	208	92	61	**45**	6	32	7	4	**32**	**7**	7	1	4		**10**
84	Spotted Bass	125	34	15	79	74	38	62	**43**	22	30	43	90	**102**	**23**	53	49	104	31	**36**
85	Largemouth Bass	4	2	8	8	16		16	**72**	22	25	65	16	**25**	**11**	37	2	70	21	**23**
86	White Crappie	5	1						**3**		1	4		**2**		1	1			**13**
87	Black Crappie	3	1	6	2	2			**2**	3	1				**4**	3				**3**
88	Greenside Darter	5		2	11	5														
89	Rainbow Darter			4	1			2	**1**									12		
90	Fantail Darter	3		1									1							
91	Johnny Darter	1						2												
92	Banded Darter			1	4													1		
93	Yellow Perch			4	2		3		**2**											
94	Logperch	141	166	67	244	85	105	108	**48**	6	72	12	20	**24**	**7**	39	4	3	1	**1**
95	Channel Darter	16		1	9		1	3				20		**3**				1		
96	Slenderhead Darter													**1**				5		
97	Dusky Darter																	3	1	
98	River Darter					2		1	**2**	2		1	6	**7**	**1**	11		4		

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99	Sauger	283	192	243	180	244	317	341	**133**	173	259	220	1174	**378**	**184**	1314	747	484	105	**127**
100	Walleye	44	7	11	31	70	11	1	**4**	4	1	1	3		**5**		7			**1**
101	Saugeye	2	8		5	4	1		**1**	4	1			**13**				7	2	**16**
102	Freshwater Drum	254	58	47	1468	496	211	120	**33**	375	83	121	1000	**572**	**177**	435	378	612	837	**236**
	Total # of Individuals	2618	1232	2076	5742	9958	3198	3378	**3582**	11006	1296	1441	6718	**3107**	**2051**	8953	3013	4501	**2636**	**2060**
	Total # of Taxa	43	33	42	53	43	43	51	**50**	46	36	38	41	**45**	**44**	45	44	49	**49**	**52**

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Appendix A
Assessment Unit Criteria Details

- Each individual navigational pool will serve as a separate and distinct Assessment Unit (AU), with the exception of the area below Smithland dam will also be considered one distinct AU.

    - This is based on the observation that biologically, each pool more closely resembles a lake, and not a free-flowing river. Therefore, biological condition becomes more homogeneous throughout, exhibiting little longitudinal change.

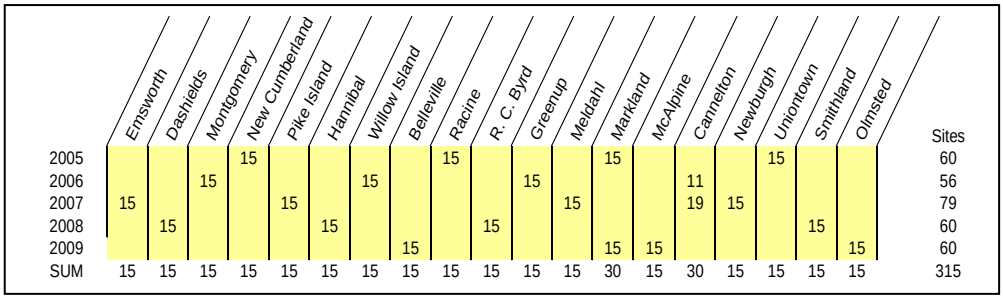
    - The dams are seen as the only real barriers that isolate individual populations. This observation is supported by research at the University of Louisville indicating little or no synchrony between pools. Each pool behaves independent of even its nearest neighbor, indicating isolated and independent populations among pools.

    - Isolated pockets, or areas, with poorly performing biotic communities have not been observed over the last ten years of sampling.

    - The BWQSC believes that a subset of randomly selected sites within each pool can accurately describe the condition of the target population (the fish population of that pool).

- All AUs will be sampled and assessed on a 5-year rotating basis. This is consistent with state schedules, and it will allow ORSANCO (after one full rotation) in each 305(b) report, to incorporate 5 years worth of data and report on 100% of the resource.

    - It is acceptable to EPA to include the most recent 5 years of data in each 305(b) report.



	Emsworth	Dashields	Montgomery	New Cumberland	Pike Island	Hannibal	Willow Island	Belleville	Racine	R. C. Byrd	Greenup	Meldahl	Markland	McAlpine	Cannelton	Newburgh	Uniontown	Smithland	Olmsted	Sites
2005				15					15				15		11		15			60
2006			15				15				15				19					56
2007	15				15							15				15				79
2008		15				15				15								15		60
2009								15					15	15					15	60
SUM	15	15	15	15	15	15	15	15	15	15	15	15	30	15	30	15	15	15	15	315

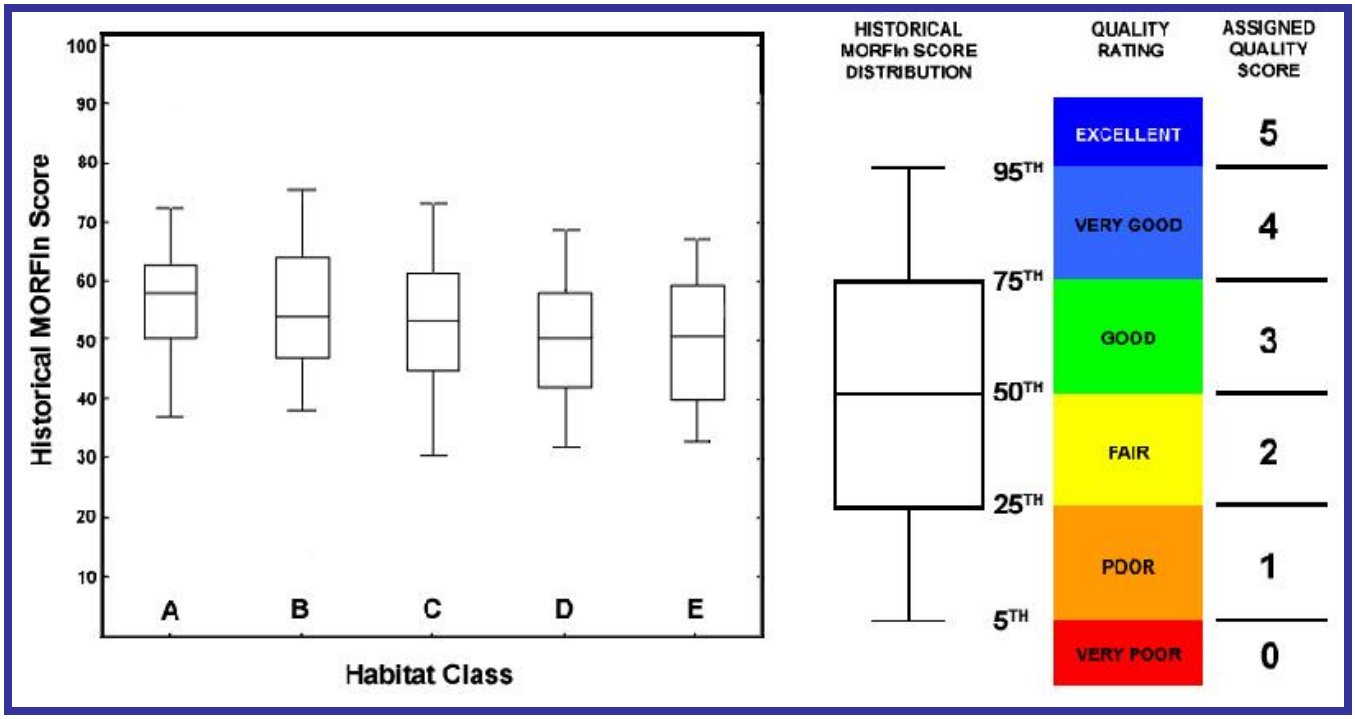
- Assessment Units that yield an average quality score that is less than 2.0 will be listed as failing to meet (support) its aquatic life-use designation. The process of conducting a bioassessment and determining an AU's biological condition is outlined below:

    - Individual sites were assigned to a habitat class ('A', 'B', 'C', 'D' and 'E') based on its substrate composition. Each of these 5 habitat classes exhibits a different range of historical MORFIn scores and expectations. Therefore, the expected MORFIn score changes for each of the habitat classes (see table below). These MORFIn expectations for each habitat are the 25th percentiles of historical MORFIn scores for each habitat.

Quality Score Constants	Class A	Class B	Class C	Class D	Class E
95th Percentile	72.53610	75.70669	73.19395	68.57603	67.26375
75th Percentile	62.59448	63.77092	61.13696	57.90023	59.17819
50th Percentile	55.97259	55.05460	52.23313	49.71604	50.53237
25th Percentile	50.03279	46.71055	44.54931	41.80374	39.59005
5th Percentile	36.62273	37.89377	30.12705	31.55379	32.57287

- A quality score (between 0 and 5) was assigned to a site based on its score relative to the statistical distribution of historical MORFIn scores. Each quality score corresponds to the ranges between the 5th, 25th, 50th, 75th, or 95th percentiles of historical MORFIn scores. For example, the range less than the 25th percentile receives a quality score <2.0 (see figure below).

- Those sites with MORFIn scores less than the 25th percentile are considered to be in poor or very poor condition and fail to meet its expected MORFIn score. The quality scores for individual sites are averaged within an AU (pool) to determine the AU's biological condition.



Appendix B. Fish survey data from the Belleville pool.

Site #	Rmi	Bank	Date	Common Name	Latin Name	Count
1	163.9	LDB	29-Jun-09	Bluegill	*Lepomis macrochirus*	3
1	163.9	LDB	29-Jun-09	Common Carp	*Cyprinus carpio*	3
1	163.9	LDB	29-Jun-09	Emerald Shiner	*Notropis atherinoides*	57
1	163.9	LDB	29-Jun-09	Flathead Catfish	*Pylodictis olivaris*	4
1	163.9	LDB	29-Jun-09	Freshwater Drum	*Aplodinotus grunniens*	8
1	163.9	LDB	29-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	7
1	163.9	LDB	29-Jun-09	Golden Redhorse	*Moxostoma erythrurum*	15
1	163.9	LDB	29-Jun-09	Largemouth Bass	*Micropterus salmoides*	1
1	163.9	LDB	29-Jun-09	Logperch	*Percina caprodes*	12
1	163.9	LDB	29-Jun-09	Longear Sunfish	*Lepomis megalotis*	1
1	163.9	LDB	29-Jun-09	Longnose Gar	*Lepisosteus osseus*	10
1	163.9	LDB	29-Jun-09	Mimic Shiner	*Notropis volucellus*	75
1	163.9	LDB	29-Jun-09	Morone Sp	*Morone sp*	1
1	163.9	LDB	29-Jun-09	Ohio Lamprey	*Ichthyomyzon bdellium*	1
1	163.9	LDB	29-Jun-09	Quillback	*Carpiodes cyprinus*	2
1	163.9	LDB	29-Jun-09	Rainbow Darter	*Etheostoma caeruleum*	1
1	163.9	LDB	29-Jun-09	River Carpsucker	*Carpiodes carpio*	1
1	163.9	LDB	29-Jun-09	Rock Bass	*Ambloplites rupestris*	2
1	163.9	LDB	29-Jun-09	Sauger	*Sander canadensis*	8
1	163.9	LDB	29-Jun-09	Silver Redhorse	*Moxostoma anisurum*	1
1	163.9	LDB	29-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	11
1	163.9	LDB	29-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	2
1	163.9	LDB	29-Jun-09	Smallmouth Redhorse	*Moxostoma breviceps*	2
1	163.9	LDB	29-Jun-09	Spotfin Shiner	*Cyprinella spiloptera*	2
1	163.9	LDB	29-Jun-09	Spotted Bass	*Micropterus punctulatus*	1
1	163.9	LDB	29-Jun-09	White Bass	*Morone chrysops*	1
1	163.9	LDB	29-Jun-09	Yellow Perch	*Perca flavescens*	1
2	166.9	RDB	29-Jun-09	Black Redhorse	*Moxostoma duquesnei*	2
2	166.9	RDB	29-Jun-09	Channel Catfish	*Ictalurus punctatus*	5
2	166.9	RDB	29-Jun-09	Common Carp	*Cyprinus carpio*	1
2	166.9	RDB	29-Jun-09	Emerald Shiner	*Notropis atherinoides*	69
2	166.9	RDB	29-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	15
2	166.9	RDB	29-Jun-09	Golden Redhorse	*Moxostoma erythrurum*	37
2	166.9	RDB	29-Jun-09	Highfin Carpsucker	*Carpiodes velifer*	1
2	166.9	RDB	29-Jun-09	Hybrid Striper	*Morone saxatilis x M. chrysops*	2
2	166.9	RDB	29-Jun-09	Logperch	*Percina caprodes*	3
2	166.9	RDB	29-Jun-09	Longnose Gar	*Lepisosteus osseus*	7
2	166.9	RDB	29-Jun-09	Mimic Shiner	*Notropis volucellus*	354
2	166.9	RDB	29-Jun-09	Morone Sp	*Morone sp*	13
2	166.9	RDB	29-Jun-09	Northern Hog Sucker	*Hypentelium nigricans*	1
2	166.9	RDB	29-Jun-09	Quillback	*Carpiodes cyprinus*	1
2	166.9	RDB	29-Jun-09	Sand Shiner	*Notropis stramineus*	1
2	166.9	RDB	29-Jun-09	Sauger	*Sander canadensis*	9
2	166.9	RDB	29-Jun-09	Silver Chub	*Macrhybopsis storeriana*	5
2	166.9	RDB	29-Jun-09	Silver Redhorse	*Moxostoma anisurum*	9
2	166.9	RDB	29-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	2
2	166.9	RDB	29-Jun-09	Smallmouth Redhorse	*Moxostoma breviceps*	9
2	166.9	RDB	29-Jun-09	Spotfin Shiner	*Cyprinella spiloptera*	4
2	166.9	RDB	29-Jun-09	White Crappie	*Pomoxis annularis*	1
3	170.3	RDB	30-Jun-09	Bluegill	*Lepomis macrochirus*	5
3	170.3	RDB	30-Jun-09	Channel Catfish	*Ictalurus punctatus*	12
3	170.3	RDB	30-Jun-09	Common Carp	*Cyprinus carpio*	10
3	170.3	RDB	30-Jun-09	Emerald Shiner	*Notropis atherinoides*	127

3	170.3	RDB	30-Jun-09	Flathead Catfish	*Pylodictis olivaris*	1
3	170.3	RDB	30-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	22
3	170.3	RDB	30-Jun-09	Golden Redhorse	*Moxostoma erythrurum*	6
3	170.3	RDB	30-Jun-09	Green Sunfish	*Lepomis cyanellus*	1
3	170.3	RDB	30-Jun-09	Longnose Gar	*Lepisosteus osseus*	5
3	170.3	RDB	30-Jun-09	Mimic Shiner	*Notropis volucellus*	164
3	170.3	RDB	30-Jun-09	Morone Sp	*Morone sp*	3
3	170.3	RDB	30-Jun-09	Northern Hog Sucker	*Hypentelium nigricans*	1
3	170.3	RDB	30-Jun-09	Sauger	*Sander canadensis*	10
3	170.3	RDB	30-Jun-09	Silver Chub	*Macrhybopsis storeriana*	1
3	170.3	RDB	30-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	1
3	170.3	RDB	30-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	2
3	170.3	RDB	30-Jun-09	Smallmouth Redhorse	*Moxostoma breviceps*	1
3	170.3	RDB	30-Jun-09	Spotfin Shiner	*Cyprinella spiloptera*	2
3	170.3	RDB	30-Jun-09	White Bass	*Morone chrysops*	2
4	170.4	LDB	29-Jun-09	Bluegill	*Lepomis macrochirus*	1
4	170.4	LDB	29-Jun-09	Channel Catfish	*Ictalurus punctatus*	8
4	170.4	LDB	29-Jun-09	Emerald Shiner	*Notropis atherinoides*	51
4	170.4	LDB	29-Jun-09	Freshwater Drum	*Aplodinotus grunniens*	3
4	170.4	LDB	29-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	27
4	170.4	LDB	29-Jun-09	Golden Redhorse	*Moxostoma erythrurum*	15
4	170.4	LDB	29-Jun-09	Longnose Gar	*Lepisosteus osseus*	1
4	170.4	LDB	29-Jun-09	Mimic Shiner	*Notropis volucellus*	42
4	170.4	LDB	29-Jun-09	Sauger	*Sander canadensis*	3
4	170.4	LDB	29-Jun-09	Silver Chub	*Macrhybopsis storeriana*	3
4	170.4	LDB	29-Jun-09	Silver Redhorse	*Moxostoma anisurum*	11
4	170.4	LDB	29-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	3
4	170.4	LDB	29-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	3
4	170.4	LDB	29-Jun-09	Smallmouth Redhorse	*Moxostoma breviceps*	65
4	170.4	LDB	29-Jun-09	Spotted Bass	*Micropterus punctulatus*	3
4	170.4	LDB	29-Jun-09	White Bass	*Morone chrysops*	1
5	170.8	RDB	29-Jun-09	Bluegill	*Lepomis macrochirus*	1
5	170.8	RDB	29-Jun-09	Channel Catfish	*Ictalurus punctatus*	1
5	170.8	RDB	29-Jun-09	Emerald Shiner	*Notropis atherinoides*	44
5	170.8	RDB	29-Jun-09	Flathead Catfish	*Pylodictis olivaris*	1
5	170.8	RDB	29-Jun-09	Freshwater Drum	*Aplodinotus grunniens*	2
5	170.8	RDB	29-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	94
5	170.8	RDB	29-Jun-09	Golden Redhorse	*Moxostoma erythrurum*	10
5	170.8	RDB	29-Jun-09	Hybrid Striper	*Morone saxatilis x M. chrysops*	1
5	170.8	RDB	29-Jun-09	Logperch	*Percina caprodes*	1
5	170.8	RDB	29-Jun-09	Mimic Shiner	*Notropis volucellus*	68
5	170.8	RDB	29-Jun-09	Rock Bass	*Ambloplites rupestris*	1
5	170.8	RDB	29-Jun-09	Sauger	*Sander canadensis*	4
5	170.8	RDB	29-Jun-09	Silver Redhorse	*Moxostoma anisurum*	1
5	170.8	RDB	29-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	9
5	170.8	RDB	29-Jun-09	Smallmouth Redhorse	*Moxostoma breviceps*	3
5	170.8	RDB	29-Jun-09	Spotfin Shiner	*Cyprinella spiloptera*	1
5	170.8	RDB	29-Jun-09	Spotted Bass	*Micropterus punctulatus*	1
5	170.8	RDB	29-Jun-09	Walleye	*Sander vitreus*	2
5	170.8	RDB	29-Jun-09	White Bass	*Morone chrysops*	5
6	171.3	RDB	29-Jun-09	Bluegill	*Lepomis macrochirus*	3
6	171.3	RDB	29-Jun-09	Channel Catfish	*Ictalurus punctatus*	5
6	171.3	RDB	29-Jun-09	Emerald Shiner	*Notropis atherinoides*	20
6	171.3	RDB	29-Jun-09	Flathead Catfish	*Pylodictis olivaris*	5
6	171.3	RDB	29-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	134
6	171.3	RDB	29-Jun-09	Golden Redhorse	*Moxostoma erythrurum*	6

6	171.3	RDB	29-Jun-09	Largemouth Bass	*Micropterus salmoides*	1
6	171.3	RDB	29-Jun-09	Longear Sunfish	*Lepomis megalotis*	1
6	171.3	RDB	29-Jun-09	Longnose Gar	*Lepisosteus osseus*	1
6	171.3	RDB	29-Jun-09	Mimic Shiner	*Notropis volucellus*	12
6	171.3	RDB	29-Jun-09	Pumpkinseed	*Lepomis gibbosus*	1
6	171.3	RDB	29-Jun-09	Sauger	*Sander canadensis*	5
6	171.3	RDB	29-Jun-09	Silver Redhorse	*Moxostoma anisurum*	2
6	171.3	RDB	29-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	2
6	171.3	RDB	29-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	2
6	171.3	RDB	29-Jun-09	Smallmouth Redhorse	*Moxostoma breviceps*	1
6	171.3	RDB	29-Jun-09	White Bass	*Morone chrysops*	5
7	171.4	LDB	29-Jun-09	Channel Catfish	*Ictalurus punctatus*	1
7	171.4	LDB	29-Jun-09	Common Carp	*Cyprinus carpio*	3
7	171.4	LDB	29-Jun-09	Emerald Shiner	*Notropis atherinoides*	105
7	171.4	LDB	29-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	73
7	171.4	LDB	29-Jun-09	Golden Redhorse	*Moxostoma erythrurum*	18
7	171.4	LDB	29-Jun-09	Longnose Gar	*Lepisosteus osseus*	3
7	171.4	LDB	29-Jun-09	Mimic Shiner	*Notropis volucellus*	60
7	171.4	LDB	29-Jun-09	Northern Hog Sucker	*Hypentelium nigricans*	1
7	171.4	LDB	29-Jun-09	River Redhorse	*Moxostoma carinatum*	1
7	171.4	LDB	29-Jun-09	Sauger	*Sander canadensis*	4
7	171.4	LDB	29-Jun-09	Saugeye	*Sander canandensis x S. vitreus*	1
7	171.4	LDB	29-Jun-09	Silver Chub	*Macrhybopsis storeriana*	1
7	171.4	LDB	29-Jun-09	Silver Redhorse	*Moxostoma anisurum*	11
7	171.4	LDB	29-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	2
7	171.4	LDB	29-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	1
7	171.4	LDB	29-Jun-09	Smallmouth Redhorse	*Moxostoma breviceps*	12
7	171.4	LDB	29-Jun-09	White Bass	*Morone chrysops*	4
8	174.3	LDB	01-Jul-09	Black Crappie	*Pomoxis nigromaculatus*	1
8	174.3	LDB	01-Jul-09	Channel Catfish	*Ictalurus punctatus*	3
8	174.3	LDB	01-Jul-09	Common Carp	*Cyprinus carpio*	7
8	174.3	LDB	01-Jul-09	Emerald Shiner	*Notropis atherinoides*	82
8	174.3	LDB	01-Jul-09	Freshwater Drum	*Aplodinotus grunniens*	1
8	174.3	LDB	01-Jul-09	Gizzard Shad	*Dorosoma cepedianum*	8
8	174.3	LDB	01-Jul-09	Golden Redhorse	*Moxostoma erythrurum*	1
8	174.3	LDB	01-Jul-09	Green Sunfish	*Lepomis cyanellus*	1
8	174.3	LDB	01-Jul-09	Largemouth Bass	*Micropterus salmoides*	1
8	174.3	LDB	01-Jul-09	Longear Sunfish	*Lepomis megalotis*	1
8	174.3	LDB	01-Jul-09	Longnose Gar	*Lepisosteus osseus*	1
8	174.3	LDB	01-Jul-09	Mimic Shiner	*Notropis volucellus*	8
8	174.3	LDB	01-Jul-09	Quillback	*Carpiodes cyprinus*	1
8	174.3	LDB	01-Jul-09	Sauger	*Sander canadensis*	14
8	174.3	LDB	01-Jul-09	Silver Redhorse	*Moxostoma anisurum*	3
8	174.3	LDB	01-Jul-09	Smallmouth Bass	*Micropterus dolomieu*	3
8	174.3	LDB	01-Jul-09	Smallmouth Buffalo	*Ictiobus bubalus*	2
8	174.3	LDB	01-Jul-09	Spotfin Shiner	*Cyprinella spiloptera*	1
8	174.3	LDB	01-Jul-09	Spotted Bass	*Micropterus punctulatus*	3
8	174.3	LDB	01-Jul-09	White Bass	*Morone chrysops*	9
9	179.3	RDB	01-Jul-09	Bluegill	*Lepomis macrochirus*	6
9	179.3	RDB	01-Jul-09	Channel Catfish	*Ictalurus punctatus*	8
9	179.3	RDB	01-Jul-09	Common Carp	*Cyprinus carpio*	3
9	179.3	RDB	01-Jul-09	Emerald Shiner	*Notropis atherinoides*	4
9	179.3	RDB	01-Jul-09	Flathead Catfish	*Pylodictis olivaris*	1
9	179.3	RDB	01-Jul-09	Freshwater Drum	*Aplodinotus grunniens*	1
9	179.3	RDB	01-Jul-09	Gizzard Shad	*Dorosoma cepedianum*	18
9	179.3	RDB	01-Jul-09	Golden Redhorse	*Moxostoma erythrurum*	5

9	179.3	RDB	01-Jul-09	Largemouth Bass	*Micropterus salmoides*	2
9	179.3	RDB	01-Jul-09	Logperch	*Percina caprodes*	1
9	179.3	RDB	01-Jul-09	Longnose Gar	*Lepisosteus osseus*	2
9	179.3	RDB	01-Jul-09	Mimic Shiner	*Notropis volucellus*	1
9	179.3	RDB	01-Jul-09	Morone Sp	*Morone sp*	1
9	179.3	RDB	01-Jul-09	Rock Bass	*Ambloplites rupestris*	2
9	179.3	RDB	01-Jul-09	Sauger	*Sander canadensis*	7
9	179.3	RDB	01-Jul-09	Silver Chub	*Macrhybopsis storeriana*	1
9	179.3	RDB	01-Jul-09	Silver Redhorse	*Moxostoma anisurum*	14
9	179.3	RDB	01-Jul-09	Smallmouth Bass	*Micropterus dolomieu*	1
9	179.3	RDB	01-Jul-09	Smallmouth Buffalo	*Ictiobus bubalus*	13
9	179.3	RDB	01-Jul-09	Smallmouth Redhorse	*Moxostoma breviceps*	2
9	179.3	RDB	01-Jul-09	Spotted Bass	*Micropterus punctulatus*	4
9	179.3	RDB	01-Jul-09	White Bass	*Morone chrysops*	1
9	179.3	RDB	01-Jul-09	White Crappie	*Pomoxis annularis*	1
10	185.1	LDB	30-Jun-09	Bluegill	*Lepomis macrochirus*	6
10	185.1	LDB	30-Jun-09	Bluntnose Minnow	*Pimephales notatus*	1
10	185.1	LDB	30-Jun-09	Bullhead Minnow	*Pimephales vigilax*	1
10	185.1	LDB	30-Jun-09	Common Carp	*Cyprinus carpio*	1
10	185.1	LDB	30-Jun-09	Emerald Shiner	*Notropis atherinoides*	1
10	185.1	LDB	30-Jun-09	Flathead Catfish	*Pylodictis olivaris*	3
10	185.1	LDB	30-Jun-09	Freshwater Drum	*Aplodinotus grunniens*	6
10	185.1	LDB	30-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	28
10	185.1	LDB	30-Jun-09	Golden Redhorse	*Moxostoma erythrurum*	1
10	185.1	LDB	30-Jun-09	Green Sunfish	*Lepomis cyanellus*	2
10	185.1	LDB	30-Jun-09	Largemouth Bass	*Micropterus salmoides*	2
10	185.1	LDB	30-Jun-09	Logperch	*Percina caprodes*	6
10	185.1	LDB	30-Jun-09	Longnose Gar	*Lepisosteus osseus*	2
10	185.1	LDB	30-Jun-09	Morone Sp	*Morone sp*	1
10	185.1	LDB	30-Jun-09	Rock Bass	*Ambloplites rupestris*	2
10	185.1	LDB	30-Jun-09	Sauger	*Sander canadensis*	14
10	185.1	LDB	30-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	6
10	185.1	LDB	30-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	5
10	185.1	LDB	30-Jun-09	Spotfin Shiner	*Cyprinella spiloptera*	25
10	185.1	LDB	30-Jun-09	Spotted Bass	*Micropterus punctulatus*	3
10	185.1	LDB	30-Jun-09	Walleye	*Sander vitreus*	1
10	185.1	LDB	30-Jun-09	White Bass	*Morone chrysops*	9
11	186.4	RDB	30-Jun-09	Bluegill	*Lepomis macrochirus*	7
11	186.4	RDB	30-Jun-09	Channel Catfish	*Ictalurus punctatus*	3
11	186.4	RDB	30-Jun-09	Common Carp	*Cyprinus carpio*	1
11	186.4	RDB	30-Jun-09	Emerald Shiner	*Notropis atherinoides*	31
11	186.4	RDB	30-Jun-09	Flathead Catfish	*Pylodictis olivaris*	1
11	186.4	RDB	30-Jun-09	Gizzard Shad	*Dorosoma cepedianum*	13
11	186.4	RDB	30-Jun-09	Logperch	*Percina caprodes*	1
11	186.4	RDB	30-Jun-09	Longnose Gar	*Lepisosteus osseus*	1
11	186.4	RDB	30-Jun-09	Mimic Shiner	*Notropis volucellus*	6
11	186.4	RDB	30-Jun-09	Morone Sp	*Morone sp*	2
11	186.4	RDB	30-Jun-09	Sauger	*Sander canadensis*	10
11	186.4	RDB	30-Jun-09	Silver Chub	*Macrhybopsis storeriana*	8
11	186.4	RDB	30-Jun-09	Silver Redhorse	*Moxostoma anisurum*	3
11	186.4	RDB	30-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	1
11	186.4	RDB	30-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	11
11	186.4	RDB	30-Jun-09	Smallmouth Redhorse	*Moxostoma breviceps*	1
11	186.4	RDB	30-Jun-09	Spotfin Shiner	*Cyprinella spiloptera*	5
11	186.4	RDB	30-Jun-09	Spotted Bass	*Micropterus punctulatus*	8
11	186.4	RDB	30-Jun-09	Trout-Perch	*Percopsis omiscomaycus*	3

12	189.3	LDB	30-Jun-09	Bluegill	*Lepomis macrochirus*	8
12	189.3	LDB	30-Jun-09	Bluntnose Minnow	*Pimephales notatus*	1
12	189.3	LDB	30-Jun-09	Carpiodes Sp	*Carpiodes sp*	3
12	189.3	LDB	30-Jun-09	Channel Catfish	*Ictalurus punctatus*	5
12	189.3	LDB	30-Jun-09	Emerald Shiner	*Notropis atherinoides*	35
12	189.3	LDB	30-Jun-09	Freshwater Drum	*Aplodinotus grunniens*	3
12	189.3	LDB	30-Jun-09	Largemouth Bass	*Micropterus salmoides*	6
12	189.3	LDB	30-Jun-09	Logperch	*Percina caprodes*	11
12	189.3	LDB	30-Jun-09	Longnose Gar	*Lepisosteus osseus*	1
12	189.3	LDB	30-Jun-09	Mimic Shiner	*Notropis volucellus*	4
12	189.3	LDB	30-Jun-09	Mooneye	*Hiodon tergisus*	1
12	189.3	LDB	30-Jun-09	Morone Sp	*Morone sp*	13
12	189.3	LDB	30-Jun-09	Orangespotted Sunfish	*Lepomis humilis*	1
12	189.3	LDB	30-Jun-09	Quillback	*Carpiodes cyprinus*	2
12	189.3	LDB	30-Jun-09	River Carpsucker	*Carpiodes carpio*	10
12	189.3	LDB	30-Jun-09	River Darter	*Percina shumardi*	1
12	189.3	LDB	30-Jun-09	Sauger	*Sander canadensis*	11
12	189.3	LDB	30-Jun-09	Silver Chub	*Macrhybopsis storeriana*	11
12	189.3	LDB	30-Jun-09	Smallmouth Bass	*Micropterus dolomieu*	3
12	189.3	LDB	30-Jun-09	Smallmouth Buffalo	*Ictiobus bubalus*	1
12	189.3	LDB	30-Jun-09	Spotfin Shiner	*Cyprinella spiloptera*	21
12	189.3	LDB	30-Jun-09	Spotted Bass	*Micropterus punctulatus*	1
12	189.3	LDB	30-Jun-09	Trout-Perch	*Percopsis omiscomaycus*	4
12	189.3	LDB	30-Jun-09	Yellow Perch	*Perca flavescens*	1
13	191	RDB	01-Jul-09	Black Buffalo	*Ictiobus niger*	1
13	191	RDB	01-Jul-09	Bluegill	*Lepomis macrochirus*	133
13	191	RDB	01-Jul-09	Bluntnose Minnow	*Pimephales notatus*	4
13	191	RDB	01-Jul-09	Channel Catfish	*Ictalurus punctatus*	13
13	191	RDB	01-Jul-09	Common Carp	*Cyprinus carpio*	2
13	191	RDB	01-Jul-09	Emerald Shiner	*Notropis atherinoides*	5
13	191	RDB	01-Jul-09	Flathead Catfish	*Pylodictis olivaris*	6
13	191	RDB	01-Jul-09	Freshwater Drum	*Aplodinotus grunniens*	1
13	191	RDB	01-Jul-09	Golden Redhorse	*Moxostoma erythrurum*	1
13	191	RDB	01-Jul-09	Green Sunfish	*Lepomis cyanellus*	1
13	191	RDB	01-Jul-09	Largemouth Bass	*Micropterus salmoides*	22
13	191	RDB	01-Jul-09	Logperch	*Percina caprodes*	5
13	191	RDB	01-Jul-09	Longear Sunfish	*Lepomis megalotis*	4
13	191	RDB	01-Jul-09	Longnose Gar	*Lepisosteus osseus*	6
13	191	RDB	01-Jul-09	Morone Sp	*Morone sp*	1
13	191	RDB	01-Jul-09	Redear Sunfish	*Lepomis microlophus*	2
13	191	RDB	01-Jul-09	Rock Bass	*Ambloplites rupestris*	1
13	191	RDB	01-Jul-09	Sauger	*Sander canadensis*	14
13	191	RDB	01-Jul-09	Smallmouth Bass	*Micropterus dolomieu*	5
13	191	RDB	01-Jul-09	Smallmouth Buffalo	*Ictiobus bubalus*	7
13	191	RDB	01-Jul-09	Smallmouth Redhorse	*Moxostoma breviceps*	1
13	191	RDB	01-Jul-09	Spotfin Shiner	*Cyprinella spiloptera*	8
13	191	RDB	01-Jul-09	Spotted Bass	*Micropterus punctulatus*	7
13	191	RDB	01-Jul-09	White Bass	*Morone chrysops*	1
14	193.5	RDB	01-Jul-09	Bluegill	*Lepomis macrochirus*	174
14	193.5	RDB	01-Jul-09	Bluntnose Minnow	*Pimephales notatus*	2
14	193.5	RDB	01-Jul-09	Channel Catfish	*Ictalurus punctatus*	12
14	193.5	RDB	01-Jul-09	Common Carp	*Cyprinus carpio*	3
14	193.5	RDB	01-Jul-09	Emerald Shiner	*Notropis atherinoides*	4
14	193.5	RDB	01-Jul-09	Flathead Catfish	*Pylodictis olivaris*	3
14	193.5	RDB	01-Jul-09	Green Sunfish	*Lepomis cyanellus*	2
14	193.5	RDB	01-Jul-09	Largemouth Bass	*Micropterus salmoides*	21

14	193.5	RDB	01-Jul-09	Logperch	*Percina caprodes*	4
14	193.5	RDB	01-Jul-09	Longear Sunfish	*Lepomis megalotis*	10
14	193.5	RDB	01-Jul-09	Longnose Gar	*Lepisosteus osseus*	4
14	193.5	RDB	01-Jul-09	Mimic Shiner	*Notropis volucellus*	1
14	193.5	RDB	01-Jul-09	Mooneye	*Hiodon tergisus*	1
14	193.5	RDB	01-Jul-09	Redear Sunfish	*Lepomis microlophus*	2
14	193.5	RDB	01-Jul-09	River Darter	*Percina shumardi*	1
14	193.5	RDB	01-Jul-09	Rock Bass	*Ambloplites rupestris*	1
14	193.5	RDB	01-Jul-09	Sauger	*Sander canadensis*	9
14	193.5	RDB	01-Jul-09	Smallmouth Bass	*Micropterus dolomieu*	2
14	193.5	RDB	01-Jul-09	Smallmouth Buffalo	*Ictiobus bubalus*	10
14	193.5	RDB	01-Jul-09	Spotfin Shiner	*Cyprinella spiloptera*	38
14	193.5	RDB	01-Jul-09	Spotted Bass	*Micropterus punctulatus*	6
14	193.5	RDB	01-Jul-09	White Crappie	*Pomoxis annularis*	1
15	194.6	LDB	01-Jul-09	Black Crappie	*Pomoxis nigromaculatus*	1
15	194.6	LDB	01-Jul-09	Bluegill	*Lepomis macrochirus*	66
15	194.6	LDB	01-Jul-09	Bluntnose Minnow	*Pimephales notatus*	3
15	194.6	LDB	01-Jul-09	Channel Catfish	*Ictalurus punctatus*	13
15	194.6	LDB	01-Jul-09	Common Carp	*Cyprinus carpio*	2
15	194.6	LDB	01-Jul-09	Emerald Shiner	*Notropis atherinoides*	2
15	194.6	LDB	01-Jul-09	Flathead Catfish	*Pylodictis olivaris*	2
15	194.6	LDB	01-Jul-09	Freshwater Drum	*Aplodinotus grunniens*	8
15	194.6	LDB	01-Jul-09	Green Sunfish	*Lepomis cyanellus*	1
15	194.6	LDB	01-Jul-09	Largemouth Bass	*Micropterus salmoides*	16
15	194.6	LDB	01-Jul-09	Logperch	*Percina caprodes*	4
15	194.6	LDB	01-Jul-09	Longear Sunfish	*Lepomis megalotis*	1
15	194.6	LDB	01-Jul-09	Longnose Gar	*Lepisosteus osseus*	5
15	194.6	LDB	01-Jul-09	Mooneye	*Hiodon tergisus*	2
15	194.6	LDB	01-Jul-09	River Carpsucker	*Carpiodes carpio*	1
15	194.6	LDB	01-Jul-09	Sauger	*Sander canadensis*	11
15	194.6	LDB	01-Jul-09	Silver Chub	*Macrhybopsis storeriana*	2
15	194.6	LDB	01-Jul-09	Skipjack Herring	*Alosa chrysochloris*	2
15	194.6	LDB	01-Jul-09	Smallmouth Bass	*Micropterus dolomieu*	3
15	194.6	LDB	01-Jul-09	Smallmouth Buffalo	*Ictiobus bubalus*	7
15	194.6	LDB	01-Jul-09	Spotfin Shiner	*Cyprinella spiloptera*	52
15	194.6	LDB	01-Jul-09	Spotted Bass	*Micropterus punctulatus*	6
15	194.6	LDB	01-Jul-09	Walleye	*Sander vitreus*	1
15	194.6	LDB	01-Jul-09	White Bass	*Morone chrysops*	3

Appendix C. Habitat survey data from the Belleville pool.

Site #	River Mile	Bank	% Boulder	% Cobble	% Gravel	% Sand	% Fine	% Hardpan	% Other	Depth	% Submerged Vegetation	% Woody Cover	% Overhanging Vegetation	Landuse	Human Influence	Bank Profile
1	163.9	LDB	2.9	9.6	38.5	26.0	23.1	0.0	0.0	7.6	14.6	0.2	0.0	NF, R, A	mooring cells, ramps	Slope
2	166.9	RDB	0.0	0.0	11.2	53.4	34.5	0.9	0.0	8.7	10.6	0.0	0.0	NF, R	boats/docks, mooring cells, ramps	Gradual
3	170.3	RDB	0.0	2.7	38.4	44.6	10.7	3.6	0.0	6.1	17.6	1.4	2.0	U, NF, R	ramps, boats/docks	Slope
4	170.4	LDB	0.0	3.4	32.2	44.9	18.6	0.0	0.8	7.5	15.2	0.5	0.7	U, NF, R	ramps, boats/docks	Slope
5	170.8	RDB	1.9	0.9	29.6	40.7	26.9	0.0	0.0	6.8	3.4	0.8	0.0	U, NF, R	ramps, boats/docks	Slope
6	171.3	RDB	4.3	10.3	32.5	41.0	12.0	0.0	0.0	7.8	2.0	1.9	2.6	U, NF, R	ramps, boats/docks	Slope
7	171.4	LDB	0.0	3.1	28.1	61.5	5.2	2.1	0.0	8.2	0.4	1.2	2.0	U, NF, R	ramps, boats/docks	Slope
8	174.3	LDB	0.9	7.5	28.3	46.2	17.0	0.0	0.0	6.4	12.4	0.4	3.5	NF, R	mooring cells, boats/docks	Steep
9	179.3	RDB	0.0	6.1	37.7	44.7	11.4	0.0	0.0	7.3	6.4	1.6	0.0	NF, R, I	barges, mooring cells, boats/docks	Steep
10	185.1	LDB	13.0	37.4	34.1	13.0	2.4	0.0	0.0	11.6	0.0	1.3	4.8	R, U, NF	boats/docks, mooring cells	Steep
11	186.4	RDB	0.0	0.0	23.8	32.1	44.0	0.0	0.0	13.6	0.0	1.8	11.0	NF, R, U	ramps	Steep
12	189.3	LDB	4.7	12.9	14.1	56.5	7.1	1.2	3.5	10.6	0.0	0.9	2.3	NF, R, I	barges, boats/docks, mooring cells	Slope
13	191	RDB	4.8	18.4	36.0	25.6	12.8	1.6	0.8	11.2	8.4	1.2	3.0	NF, I, R	mooring cells	Steep
14	193.5	RDB	9.3	12.4	14.4	25.8	21.6	0.0	16.5	13.0	20.0	2.8	4.8	NF, R, A	none	Cliff
15	194.6	LDB	2.1	10.4	20.8	11.5	27.1	14.6	13.5	14.6	4.8	2.8	5.4	NF, R, A	barges	Steep

A = Agriculture, I = Industry, NF = Natural Forest, P = Pasture, R = Residential, U = Urban (Listed in order of prevalence.)

Appendix D. Water quality parameters measured prior to fish sampling in Belleville pool.

Site #	Rmi	Bank	pH	Temp(C)	Dissolved Oxygen(mg/L)	Conductivity	Secchi(in)
1	163.9	LDB	6.77	24.89	7.58	386	30
2	166.9	RDB	8.63	24.86	7.52	384	36
3	170.3	RDB	7.55	24.29	8	710	39
4	170.4	LDB	7.42	24.41	7.23	714	32
5	170.8	RDB	7.64	23.71	8.39	725	32
6	171.3	RDB	7.61	23.81	8.18	728	32
7	171.4	LDB	7.62	24.03	8.25	719	32
8	174.3	LDB	7.84	24.2	7.79	860	30
9	179.3	RDB	7.59	24.5	7.32	807	30
10	185.1	LDB	10.24	25.53	8.42	439	36
11	186.4	RDB	10.91	25.4	7.5	443	36
12	189.3	LDB	11.05	25.25	7.51	452	36
13	191	RDB	10.91	25.03	7.28	442	40
14	193.5	RDB	10.61	24.8	7.02	441	46
15	194.6	LDB	10.59	24.85	7.48	443	26

Appendix E. Water quality parameters analyzed from Belleville in 2009.

Site #	River Mile	Round	Ammonia	Chloride	Hardness	Nitrate-Nitrite	Sulfate	TKN	TOC	Phosphorus	TSS
1	163.9	1	0.08	32	124	0.76	70	0.705	3.18	0.045	11
		2	0.10	40.0	144	0.918	84	0.578	4.26	0.065	30.8
		3	0.10	42	106	0.819	78	1.08	4.01	0.046	8.80
2	166.9	1	0.06	34	128	0.774	86	0.554	2.76	0.041	8.6
		2	0.11	40.0	148	0.927	66	0.528	3.82	0.063	18.6
		3	0.10	40	108	0.728	78	0.553	3.88	0.050	7.00
3	170.3	1	0.06	32	128	0.792	92	0.587	3.04	0.042	9
		2	0.10	40.0	148	0.925	90	0.545	4.00	0.055	18.8
		3	0.10	42	108	0.850	78	0.566	3.99	0.037	5.80
4	170.4	1	0.06	32	128	0.789	72	0.57	2.75	0.047	9.4
		2	0.10	38.0	176	0.927	96	1.09	3.85	0.069	25.0
		3	0.10	42	104	0.826	82	0.560	3.93	0.045	8.00
5	170.8	1	0.06	X	148	0.792	X	0.47	2.74	0.041	X
		2	0.09	42.0	152	0.911	80	0.560	4.20	0.063	19.2
		3	0.09	42	106	0.829	80	0.659	3.91	0.059	7.60
6	171.3	1	0.05	34	140	0.803	82	0.868	2.8	0.058	8.6
		2	0.10	38.0	140	0.907	84	0.586	5.16	0.063	21.1
		3	0.09	41	108	0.866	84	0.550	3.84	0.069	8.20
7	171.4	1	0.06	32	128	0.797	72	0.515	2.62	0.048	9
		2	0.11	38.0	140	0.925	96	0.667	4.22	0.067	26.0
		3	0.09	41	102	0.785	80	0.721	3.84	0.041	7.40
8	174.3	1	0.07	34	152	0.876	80	0.519	3.22	0.052	12.6
		2	0.11	40.0	156	0.936	80	0.683	4.28	0.086	33.3
		3	0.09	46	106	0.826	84	0.635	4.17	0.053	14.0
9	179.3	1	0.1	36	168	0.984	76	0.486	3.28	0.077	16.8
		2	0.11	44.0	168	0.677	110	0.717	12.6	0.060	13.6
		3	0.12	53	146	0.836	88	0.731	4.58	0.068	17.0
10	185.1	1	0.08	32	144	0.936	72	0.646	3.49	0.063	11.8
		2	0.11	40.0	136	0.873	96	0.572	4.23	0.062	18.4
		3	0.10	50	128	0.825	84	0.688	4.16	0.052	10.6
11	186.4	1	0.08	34	200	1.01	72	0.729	3.3	0.06	8.8
		2	0.08	40.0	152	0.787	80	0.725	4.51	0.058	20.5
		3	0.10	48	128	0.777	86	0.532	4.27	0.050	10.0
12	189.3	1	0.08	30	104	1.06	56	0.625	3.56	0.06	10
		2	0.10	36.0	148	0.812	92	0.711	19.8	0.074	37.0
		3	0.11	49	138	0.794	86	0.548	4.02	0.059	14.0
13	191	1	0.07	26	152	1.1	76	0.536	3.59	0.067	9.8
		2	0.10	36.0	140	0.808	80	0.603	22.0	0.064	25.4
		3	0.11	51	134	0.910	96	0.526	5.54	0.058	13.4
14	193.5	1	0.09	20	152	1.14	76	0.507	3.76	0.065	8.8
		2	0.10	36.0	152	0.813	86	0.709	7.04	0.062	21.0
		3	0.09	50	132	0.834	88	0.592	3.98	0.054	11.4
15	194.6	1	0.09	20	148	1.16	74	0.813	3.74	0.076	12.2
		2	0.10	36.0	148	0.844	74	0.613	5.24	0.065	23.8
		3	0.10	50	130	0.797	86	0.669	4.08	0.069	11.2