Biological Programs 2005
Intensive Survey Results
Series 2
Report 4

A Biological Study of the J.T. Myers Pool of the Ohio River

ORSANCO
OHIO RIVER VALLEY ★ AN INTERSTATE AGENCY ★ WATER SANITATION COMMISSION
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Executive Summary

- In 2004, ORSANCO began using a probabilistic (random) design for monitoring fish communities in the Ohio River.

- 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 was graded as passing or failing. For an assessment unit to meet it aquatic life use designation, more than 75% of the sites assessed must be in passing condition.

- The J.T. Myers pool sites sampled in 2004 failed to meet these criteria, with only 47% of sites passing. Therefore, the J.T. Myers pool could have been reported to EPA as failing to meet its aquatic life use designation.

- The 2004 assessment was questioned based on unusually high flows that occurred during the sampling season. The 2004 J.T. Myers report recommended re-sampling the pool in 2005 with intense analysis of flow and its correlation to assessment results.

- In 2005, 100% of the sites assessed in J.T. Myers pool were in passing condition, which was contradictory to the 2004 assessment results.

- The flow analysis 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 efficiency and changes in fish behavior.

- After considering this relationship, the 2005 results were accepted over the 2004 results. J.T. Myers pool was reported as supporting its aquatic life use designation.

- Recommendations include moving to the next pool to be sampled while continuing to monitor flow and its influence on assessment results.

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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 could 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 (fish and macroinvertebrate 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 (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.

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). It is ORSANCO's goal to implement this approach on the Ohio River for its biological monitoring.

An objective of this program is to employ a probability-based monitoring design on the Ohio River to assess individual pool reaches based on the fish population. In 2005, the New Cumberland, Racine, Markland, and J.T. Myers pools were sampled as part of ORSANCO's normal monitoring. These four pools were selected because unusual river conditions (high rainfall and elevated water levels) occurred in 2004 when they were originally assessed. The higher than usual rainfall amounts and higher flows in the Ohio River in 2004 led biologists to question the accuracy of the data and the assessment results obtained in 2004. This report presents the data and assessment results obtained in 2005 and compares the 2005 results to the results from the 2004 assessment.

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 9-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 10 percent of the nation's population, more than 25 million people, and acts 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 J.T. Myers Pool

The J.T. Myers pool is 69.9 miles long, extending from Newburgh Locks and Dam (ORM 776.1) to J.T. Myers Locks and Dam (ORM 846.0) (Figure 2). The pool has a gradient drop of 0.3 feet per mile, averages 2401 feet wide and 28 feet deep. The pool is bordered by the states of Kentucky and Indiana for its entire length. This pool receives water from one major sub-basin; the Green River in KY, which has agriculture and forest as the major land uses. The primary land use of the pool is agriculture, but the metropolitan area of Evansville, IN is located mid-pool, also subjecting it to urban runoff.

A Bluegill collected by electrofishing

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 J.T. Myers pool of the Ohio River from mile marker 776.1 (Newburgh Locks and Dam) to 846.0 (J.T. Myers Locks and Dam). The total linear extent of the target population was approximately 139.8 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 utilized 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 initial assessment of the pool (see Section 3.6 and Appendix A).

Sites were to be sampled as close as possible to the location generated from the design, but in cases of restricted access or unsafe sampling conditions (i.e. barge loading/mooring area), sampling zones could be shifted (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 with 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 1m 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 30m or a depth of 20ft.) and was sampled for a minimum of 2000 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 weighed, 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.

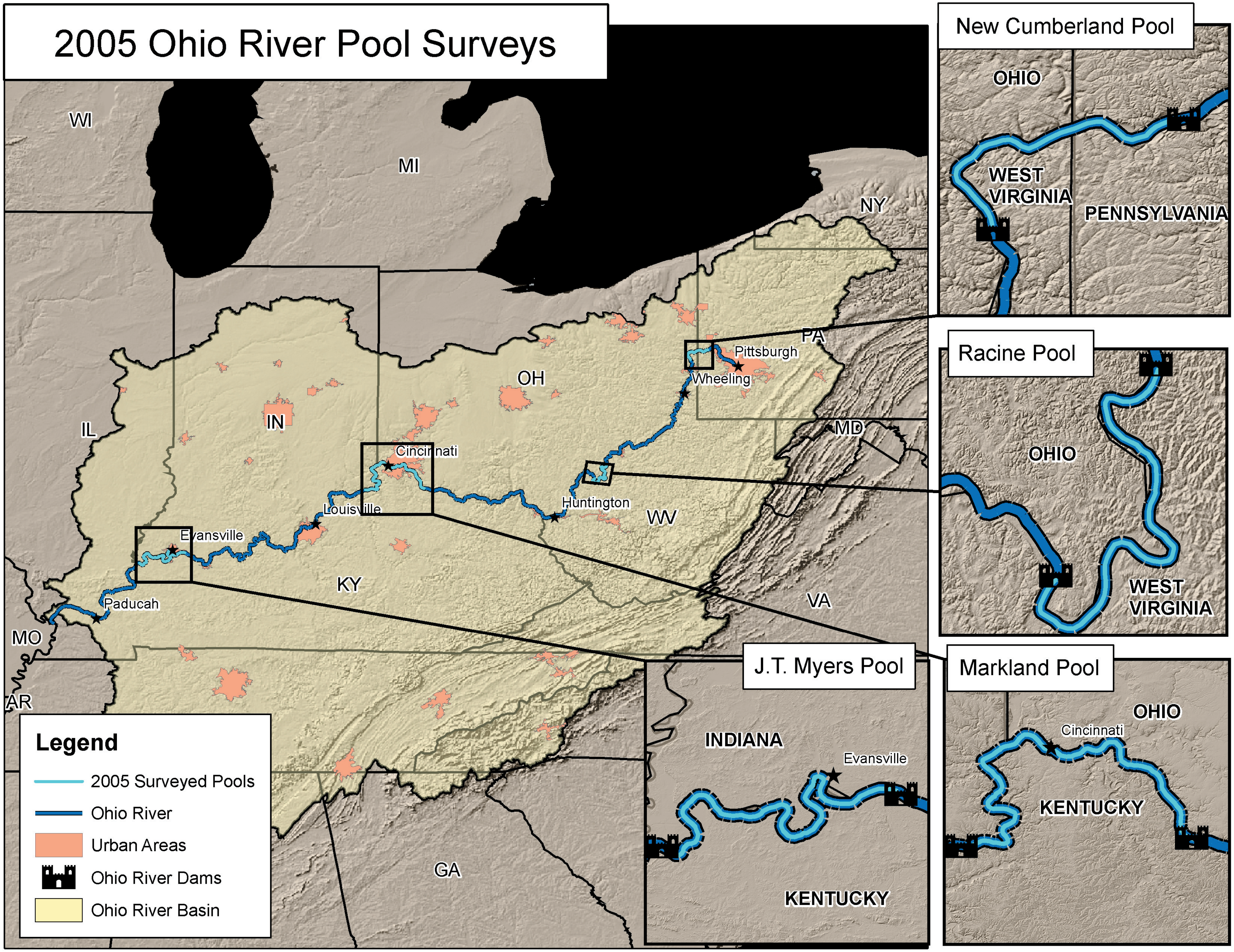

Figure 1. The Ohio River Basin and the four pools selected for 2005 sampling.

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 3m intervals beginning at the shore/water interface and moving out away from the shore for 30m. 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 flows 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 2005, 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 J.T. Myers 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).

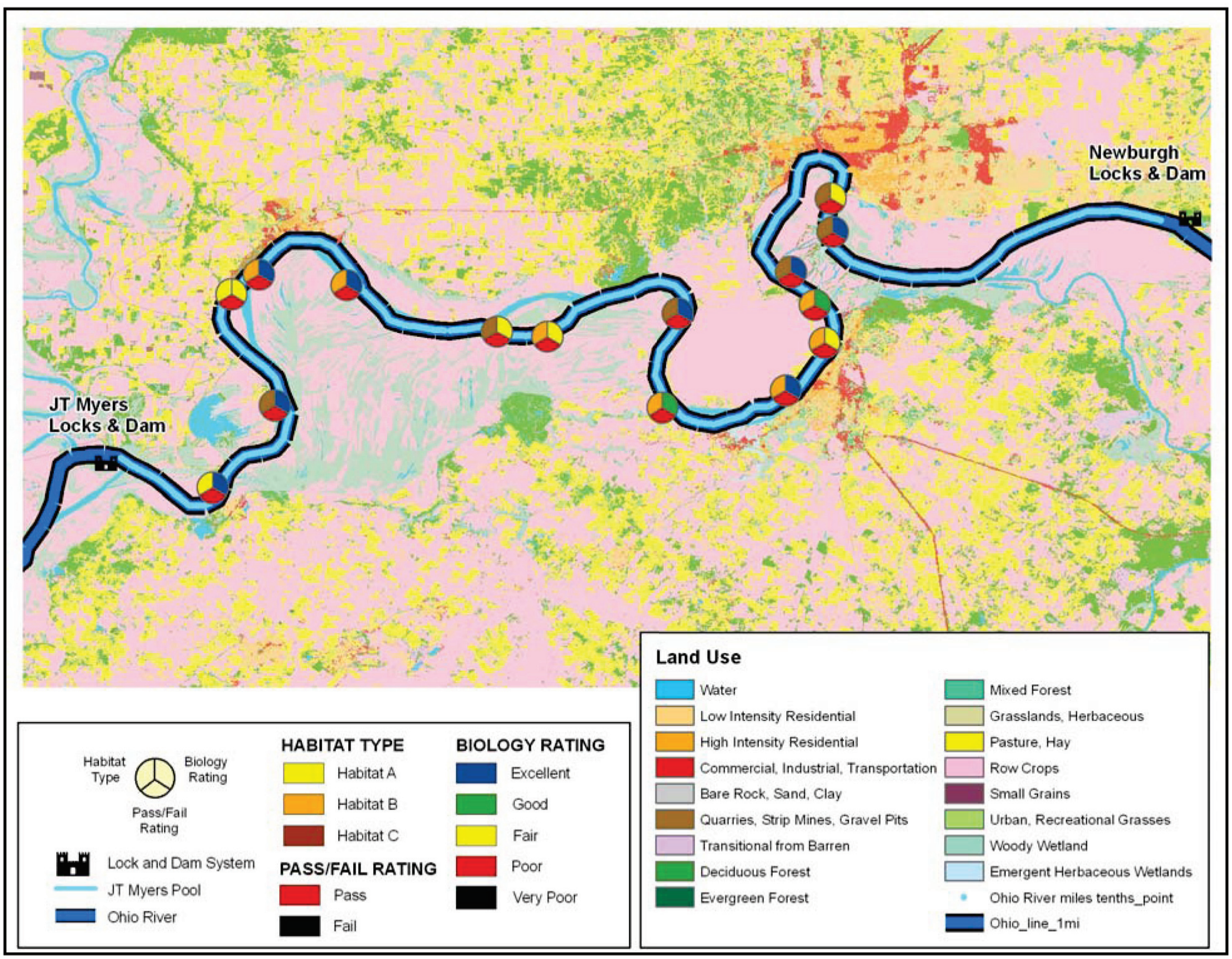

Figure 2. Results of sampling at 15 sites within the JT Myers pool.

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). 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. If any part of the confidence interval contained 25%, the assessment required additional sampling. If the entire confidence interval was higher than 25%, the pool was assessed as failing. The pool passed the assessment if the whole confidence interval fell below 25%.

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 (Figure 3) 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.

4.0 Results

The results presented in Sections 4.1 to 4.5 are based on the 15 sites selected with the probability-based design for the 2005 assessment of the J.T. Myers pool. Three sites sampled in 2004 were resampled in 2005 and the results for these sites are included only in 4.6 for a comparison of the two years.

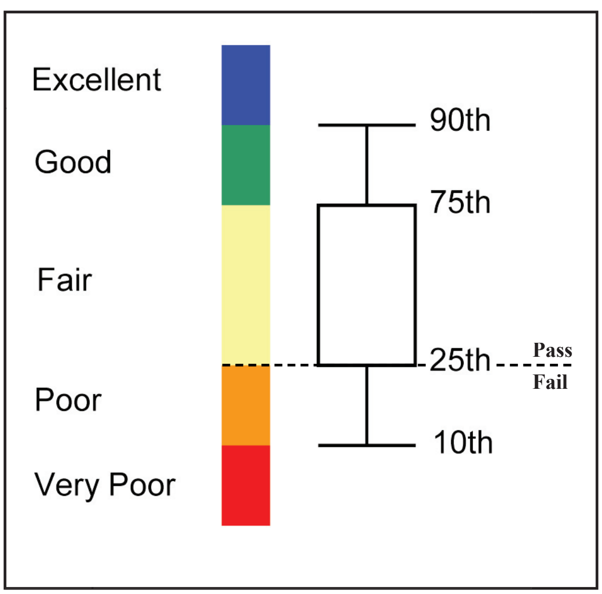

Figure 3: Illustration showing the approach used for assigning the various condition ratings.

Typical 500 meter electrofishing reach.

4.1 Fish Population

In 2005, fish population data (Appendix B) were collected from 15 randomly selected locations throughout the length of the J.T. Myers pool (Table 1). These collections produced 45 taxa, representing 11 different families (Table 2). Only one of the species collected is given special status in the bordering states. This is the black buffalo (*Ictiobus niger*), which is a species of special concern in the state of Kentucky.

At the species level, the most abundant species were emerald shiner (*Notropis atherinoides*) and freshwater drum (*Aplodinotus grunniens*), which comprised 17.8% and 13.6% of the catch respectively (Figure 4). The minnow family (Cyprinidae) led in abundance, making up 26.0% of the total catch, followed by the shad and herring family (Clupeidae) which made up 17.9% of the catch (Figure 5).

4.2 Metric Performance

Thirteen metrics were used to calculate ORFIn scores for each electrofishing site (Emery et al. 2003). Each site's performance and scores for the ORFIn metrics are shown in Table 3. The number of native species collected at each site ranged from 13 to 29, with an average of 19.9 species per site. No site scored lower than three for the number of native species metric. The number of sucker species found at each site ranged from zero to six and scores ranged from one to five. The number of centrarchid

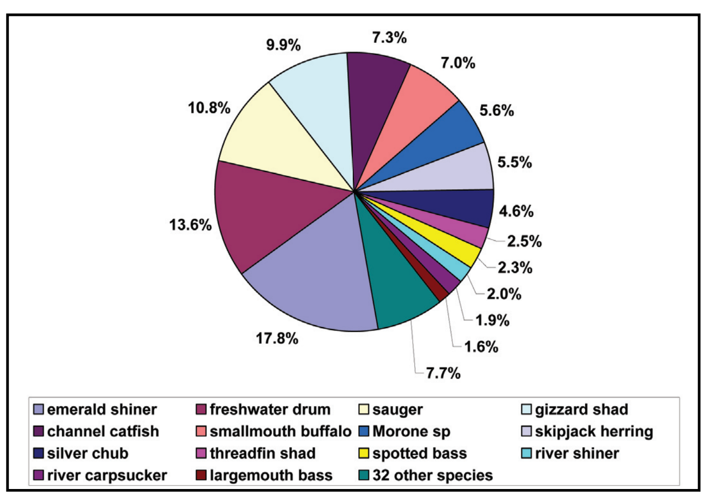

Figure 4. Species compositions of fish sampled in the J.T. Myers Pool.

Table 1: Electrofishing site list for the J.T. Myers Pool, including habitat designations, ORFIn scores and status

River Mile	Bank	Date	Latitude	Longitude	Habitat Class	Expected ORFIn	Obs. ORFIn	Site Result	Condition Rating
789.4	RDB	10/3/05	37.930	87.582	C	30.7	47	Pass	Excellent
790.2	RDB	10/3/05	37.941	87.583	C	30.4	37	Pass	Fair
799.2	LDB	10/5/05	37.902	87.603	C	31.0	45	Pass	Excellent
800.4	RDB	10/10/05	37.887	87.593	B	33	43	Pass	Good
802.3	RDB	10/10/05	37.865	87.587	B	33	39	Pass	Fair
804.9	RDB	10/11/05	37.837	87.610	B	33	47	Pass	Excellent
809.3	LDB	10/11/05	37.827	87.682	B	33	45	Pass	Good
813.1	LDB	10/18/05	37.882	87.673	C	32.5	43	Pass	Excellent
819.4	LDB	10/18/05	37.869	87.749	B	33	41	Pass	Fair
821.0	RDB	10/19/05	37.872	87.779	C	32.6	41	Pass	Fair
826.6	LDB	10/19/05	37.899	87.867	B	33	47	Pass	Excellent
831.3	LDB	10/17/05	37.905	87.918	B	33	53	Pass	Excellent
831.5	RDB	10/17/05	37.904	87.925	A	39	41	Pass	Fair
837.6	RDB	10/12/05	37.829	87.909	C	31.8	51	Pass	Excellent
842.2	RDB	10/12/05	37.781	87.945	A	39	55	Pass	Excellent

Rmi – River mile
RDB – Right Descending Bank
LDB – Left Descending Bank
Exp ORFIn – Expected ORFIn Score
Obs ORFIn – Observed ORFIn Score

species varied from zero to eight which produced scores of one to five. The number of great river species varied between one and six species per site, with most sites scoring a three or five. There were between zero and four intolerant species found at the sampled sites and scores ranged from one to five. All sites had less than 2.4% tolerant individuals and scored a five for the percent of tolerant individuals. The percentage of simple lithophils was between 9.7 and 34.9 % and scores ranged from one to five. All sites had below 8% non-native individuals and all but one site scored five. The percent detritivores was as low as 0% and as high as 42.2% and sites received scores of one, three, and five. The percent invertivores ranged from 1.2% to 28.0% with most sites scoring one for this metric. The percent piscivores ranged from 18.7% to 59.7% and metric scores ranged from one to five. There were between zero and four DELT anomalies found at each site and most sites received a score of five for the DELT metric. The CPUE (catch per unit effort) ranged from 155 to 639 individuals per site, with scores of three and five.

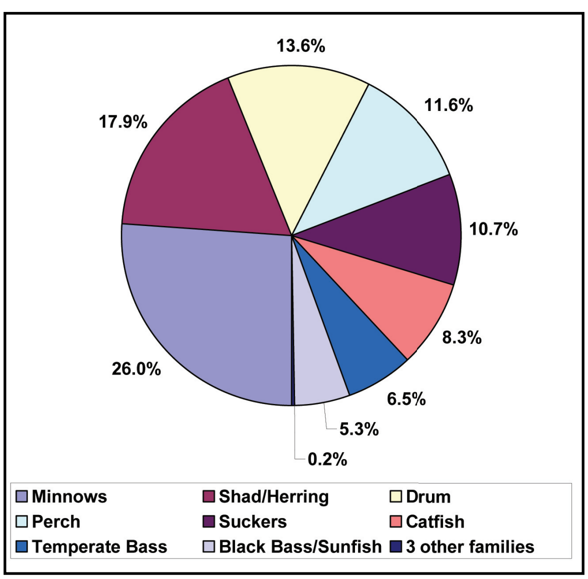

Figure 5. Fish composition by family in the J.T. Myers Pool.

4.3 Habitat Surveys

Intensive habitat surveys at each of the 15 sampling locations revealed that the bottom substrate in J.T. Myers pool was mostly composed of sand and other small substrates like fines and gravel (Figure 6). The percentages of substrate variables were used to give each site a habitat classification of A, B, or C (Table 1, Figure 7). There was enough variation among the individual sites that all three habitat classes were present in the J.T. Myers pool (Figures 7 and 8). Large portions of the riparian areas where sampling was conducted were characterized and agricultural and forested land and bank erosion was common throughout the pool (additional data in Appendix C).

4.4 Water Quality and Flow Conditions

Flow conditions were generally stable throughout the 2005 sampling period and river levels were at or below normal. There were very few rain events to cause increases in river flow and water levels throughout the Ohio River valley (Figures 9 and 10). No sampling was conducted when flows were above the harmonic mean for the pool. The HMF for this part of the river is 60.9 kcfs and sampling was conducted between 40% and 86% of the HMF (Figure 11). Measurements of water quality parameters did not reveal any unusual or poor water conditions present at the time of sampling (Table 4). Secchi depths at the time of sampling ranged from 24 to 40 inches.

Table 2. Species list for J.T. Myers pool in 2005.

Family	Common Name	Scientific Name	# Caught	KY	IN
Lepisosteidae	shortnose gar	*Lepisosteus platostomus*	2		
Clupeidae	skipjack herring	*Alosa chrysochloris*	249		
Clupeidae	gizzard shad	*Dorosoma cepedianum*	444		
Clupeidae	threadfin shad	*Dorosoma petenense*	112		
Hiodontidae	mooneye	*Hiodon tergisus*	4		
Cyprinidae	common carp	*Cyprinus carpio*	10		
Cyprinidae	miss. silvery minnow	*Hybognathus nuchalis*	1		
Cyprinidae	spotfin shiner	*Cyprinella spiloptera*	12		
Cyprinidae	emerald shiner	*Notropis atherinoides*	801		
Cyprinidae	mimic shiner	*Notropis volucellus*	43		
Cyprinidae	river shiner	*Notropis blennius*	91		
Cyprinidae	silver chub	*Macrhybopsis storeriana*	206		
Cyprinidae	bullhead minnow	*Pimephales vigilax*	8		
Catostomidae	quillback	*Carpiodes cyprinus*	57		
Catostomidae	river carpsucker	*Carpiodes carpio*	86		
Catostomidae	highfin carpsucker	*Carpiodes velifer*	3		
Catostomidae	smallmouth redhorse	*Moxostoma breviceps*	11		
Catostomidae	smallmouth buffalo	*Ictiobus bubalus*	314		
Catostomidae	bigmouth buffalo	*Ictiobus cyprinellus*	7		
Catostomidae	black buffalo	*Ictiobus niger*	3	SC	
Ictaluridae	blue catfish	*Ictalurus furcatus*	1		
Ictaluridae	channel catfish	*Ictalurus punctatus*	330		
Ictaluridae	flathead catfish	*Pylodictis olivaris*	43		
Atherinopsidae	brook silverside	*Labidesthes sicculus*	1		
Moronidae	morone sp	*Morone sp*	253		
Moronidae	striped bass	*Morone saxatilis*	12		
Moronidae	hybrid striper	*Morone saxatilis x M. chrysops*	11		
Moronidae	white bass	*Morone chrysops*	17		
Centrarchidae	rock bass	*Ambloplites rupestris*	1		
Centrarchidae	lepomis sp	*Lepomis sp*	1		
Centrarchidae	green sunfish	*Lepomis cyanellus*	10		
Centrarchidae	warmouth	*Lepomis gulosus*	1		
Centrarchidae	bluegill	*Lepomis macrochirus*	31		
Centrarchidae	orangespotted sunfish	*Lepomis humilis*	2		
Centrarchidae	longear sunfish	*Lepomis megalotis*	11		
Centrarchidae	longear x green sunfish	*Lepomis megalotis x L. cyanellus*	1		
Centrarchidae	redear sunfish	*Lepomis microlophus*	1		
Centrarchidae	smallmouth bass	*Micropterus dolomieu*	4		
Centrarchidae	largemouth bass	*Micropterus salmoides*	70		
Centrarchidae	spotted bass	*Micropterus punctulatus*	104		
Percidae	rainbow darter	*Etheostoma caeruleum*	12		
Percidae	banded darter	*Etheostoma zonale*	1		
Percidae	logperch	*Percina caprodes*	3		
Percidae	dusky darter	*Percina sciera*	3		
Percidae	channel darter	*Percina copelandi*	1		
Percidae	slenderhead darter	*Percina phoxocephala*	5		
Percidae	river darter	*Percina shumardi*	4		
Percidae	saugeye	*Sander canadensis x S. vitreus*	7		
Percidae	sauger	*Sander canadensis*	484		
Sciaenidae	freshwater drum	*Aplodinotus grunniens*	612		

45 taxa were collected, representing 11 families

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 was 55 and the minimum was 37. By comparing observed and expected ORFIn scores, ORSANCO assesses each site as either passing or failing (Table 3). All 15 sampled in 2005 scored higher than the minimum expected scores and received passing evaluations (Table 1, Figure 12). With 100% of the sites passing, the pool was also assessed as passing. Eight sites received an excellent condition rating, two sites were found to be in good condition and five were in fair condition (Figure 13).

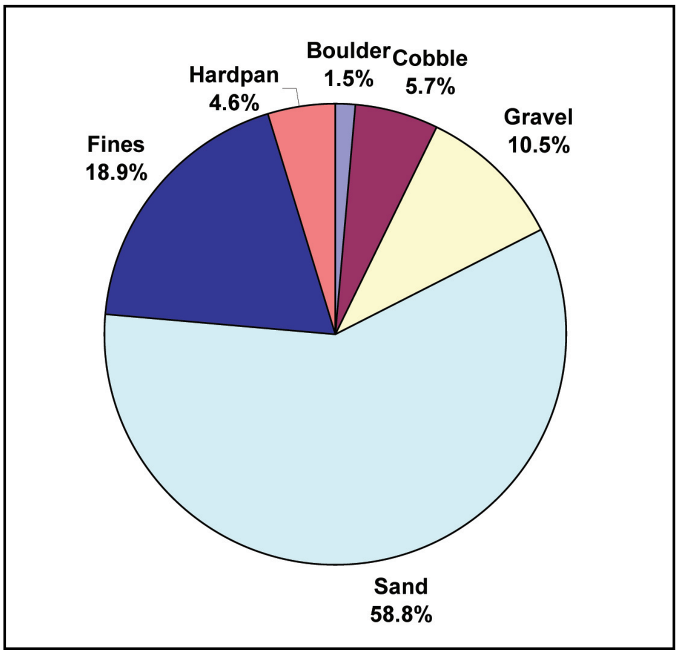

Figure 6. Average substrate composition of J.T. Myers Pool sites in 2005.

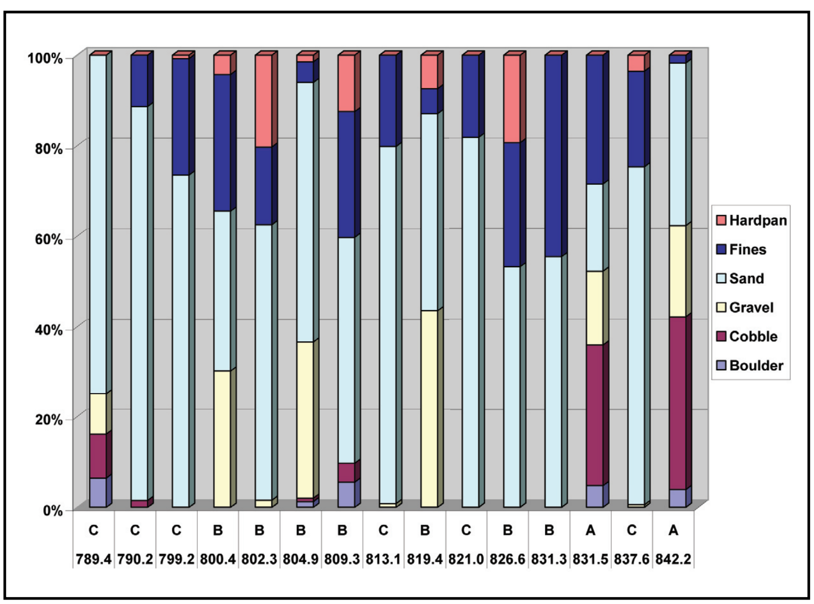

Figure 7. Substrate composition and habitat class at each of the 15 sites in J.T. Myers Pools.

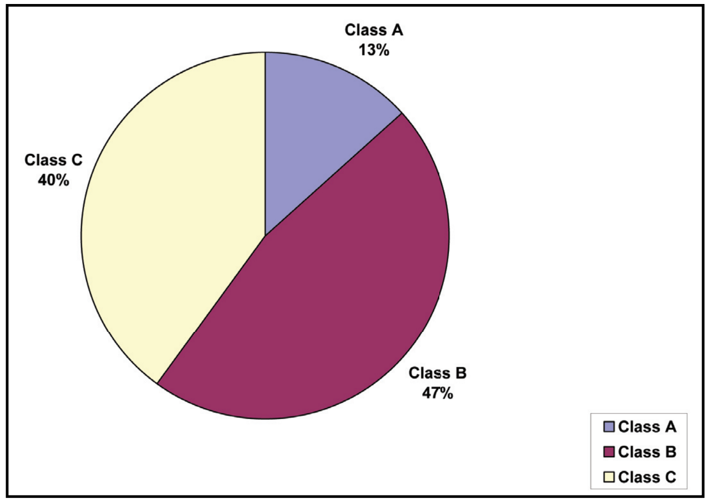

Figure 8. Habitat classification for J.T. Myers Pool.

4.6 Revisits
The three sites that were sampled in both years scored between four points lower and 14 points higher in 2005 compared to 2004 (Table 5, Figure 14). In 2004, one site was in failing condition, but in 2005 all three passed. The 2005 scores for the revisit sites were similar to scores achieved by the other sites sampled in 2005 (Table 1).

5.0 Summary and Discussion of 2004 J.T. Myers Pool Results
This section provides a concise summary of the results from 2004 for the sake of comparison to 2005. These results are fully explained in the report "A Biological Study of the J.T. Myers Pool of the Ohio River (2004)" (ORSANCO 2006).

5.1 Fish Population
In 2004, the catch was dominated by the drum family (Sciaenidae) with freshwater drum being the most common species. The minnow family (Cyprinidae) was the second most abundant with emerald shiner (*Notropis atherinoides*) being the second most abundant species. At many of the sites sampled, the number of fish caught was below normal. At two of the fifteen sites, the numbers were low enough to cause the sites to be low-end scored (see Emery et al. 2003), which penalizes sites for not supporting a large enough fish population.

5.2 Metric Performance
The sites scored lowest on the percent piscivores, invertivores, and simple lithophils metrics. The percent tolerant individuals and the number of DELT anomalies were the highest scoring metrics throughout the pool.

5.3 Habitat Surveys
The habitat surveys showed that fines (40%) were the most common bottom substrate, with notable percentages of sand (40%), gravel (13%), and cobble (13%). Most (60%) of the sites were class B habitats and 33% were class A. There was only one class C habitat.

Table 3. ORFIn metrics and scores from the J.T. Myers Pool 2005 study.

River Mile	Bank	# Individuals	# Individuals w/o gizzard shad and emerald shiners	# Individuals w/o gizzard shad, emerald shiners, and exotic, hybrid, and tolerant species	# Native Species	Native Species Score	# Sucker Species	Sucker 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	# of DELTs	DELTs Score	CPUE	CPUE Score	Expected ORFIn Score	Observed ORFIn Score	Site Score Pass/Fail
789.4	RDB	161	144	138	18	5	5	5	3	3	3	3	2	3	1.4	5	9.7	1	4.2	5	10.4	3	7.6	1	59.7	5	0	5	155	3	30.72	47	Pass
790.2	RDB	205	165	163	16	3	2	1	3	3	3	3	2	3	0.6	5	15.2	1	1.2	5	16.4	3	8.5	1	28.5	3	2	3	203	3	30.36	37	Pass
799.2	LDB	214	144	143	22	5	2	1	6	5	3	3	1	1	0.7	5	26.4	3	0.0	5	6.3	5	18.1	1	30.6	3	0	5	213	3	30.96	45	Pass
800.4	RDB	262	247	241	19	5	2	1	4	3	3	3	1	1	1.2	5	26.7	3	2.0	5	3.2	5	9.7	1	32.8	3	1	5	256	3	33	43	Pass
802.3	RDB	325	205	205	13	3	0	1	2	1	3	3	2	3	0.0	5	10.7	1	0.0	5	0.0	5	2.0	1	26.8	3	2	3	325	5	33	39	Pass
804.9	RDB	346	257	256	24	5	5	5	5	3	3	3	3	3	0.0	5	28.8	3	0.4	5	24.9	1	14.4	1	31.5	3	0	5	345	5	33	47	Pass
809.3	LDB	260	134	129	19	5	3	3	3	3	4	5	0	1	1.5	5	17.9	3	3.7	5	10.4	3	3.0	1	36.6	3	0	5	255	3	33	45	Pass
813.1	LDB	269	212	212	21	5	2	1	4	3	3	3	2	3	0.0	5	27.8	3	0.0	5	9.4	3	16.5	1	40.1	5	2	3	269	3	32.52	43	Pass
819.4	LDB	431	143	132	14	3	3	3	0	1	3	3	1	1	0.0	5	17.5	3	7.7	3	7.0	5	11.9	1	21.7	3	0	5	420	5	33	41	Pass
821.0	RDB	365	287	287	16	3	3	3	1	1	3	3	2	3	0.0	5	23.0	3	0.0	5	42.2	1	5.9	1	25.4	3	0	5	365	5	32.64	41	Pass
826.6	LDB	166	132	131	20	5	5	5	3	3	3	3	1	1	0.8	5	34.1	5	0.0	5	23.5	1	20.5	3	29.5	3	0	5	165	3	33	47	Pass
831.3	LDB	280	252	250	26	5	4	3	5	3	6	5	4	5	0.8	5	34.9	5	0.0	5	16.3	3	20.2	3	24.2	3	0	5	278	3	33	53	Pass
831.5	RDB	168	167	160	17	3	4	3	5	3	1	1	2	3	2.4	5	24.6	3	3.0	5	12.6	3	1.2	1	35.9	3	0	5	161	3	39	41	Pass
837.6	RDB	400	343	343	24	5	6	5	3	3	4	5	3	3	0.0	5	30.6	5	0.0	5	21.3	1	28.0	3	18.7	3	3	3	400	5	31.8	51	Pass
842.2	RDB	649	424	414	29	5	4	5	8	5	4	5	4	5	0.9	5	32.8	5	1.7	5	6.1	5	14.2	1	35.9	3	4	1	639	5	39	55	Pass
778.5 Revisit	RDB	267	264	255	23	5	4	3	8	5	1	1	4	5	3.0	5	13.6	1	0.4	5	25.0	1	9.1	1	40.9	5	1	5	258	3	39	45	Pass
783.8 Revisit	RDB	394	260	256	24	5	5	5	6	5	1	1	5	5	0.4	5	16.5	3	1.2	5	19.6	1	15.4	1	50.0	5	4	1	390	5	33	47	Pass
799.2 Revisit	RDB	249	218	209	19	5	2	1	6	5	2	3	4	5	4.1	3	10.6	1	0.0	5	1.4	5	5.0	1	34.9	3	4	1	240	3	39	41	Pass

RDB – Right Descending Bank
LDB – Left Descending Bank
Centrarchid Species – black bass, sunfishes, crappie
Great River Species – fish expected to predominate in great rivers
Intolerant Species – species of fish with low pollution/disturbance tolerance
Tolerant Individuals – individuals with high pollution/disturbance tolerance

Simple Lithophils – reproductive grouping of fish species that are sensitive to substrate disturbance
Detritivore – feeding guild of fish species that feed primarily on detritus
Invertivore – feeding guild of fish species that feed primarily on invertebrates
Piscivore – feeding guild of fish species that feed primarily on fish
DELT – Deformities, Eroded fins, Lesions, and Tumors
CPUE – Catch Per Unit Effort

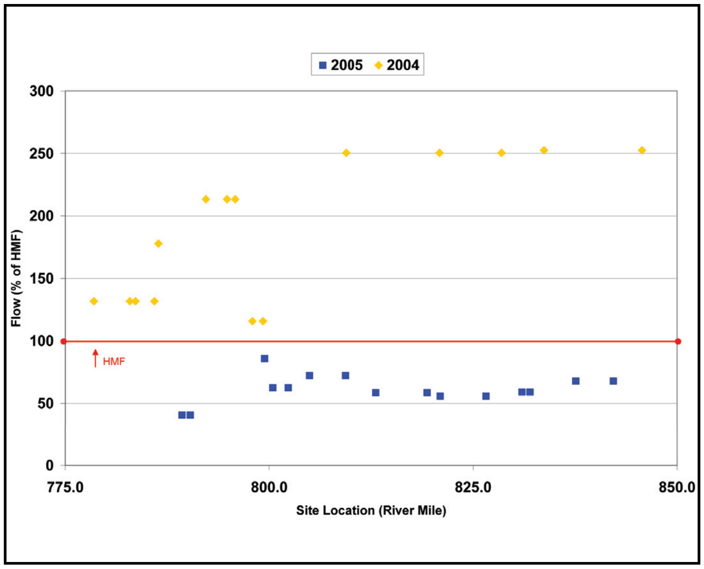

Figure 9. Daily harmonic mean flows (HMF) near sampling locations over the 2004 and 2005 sampling seasons.

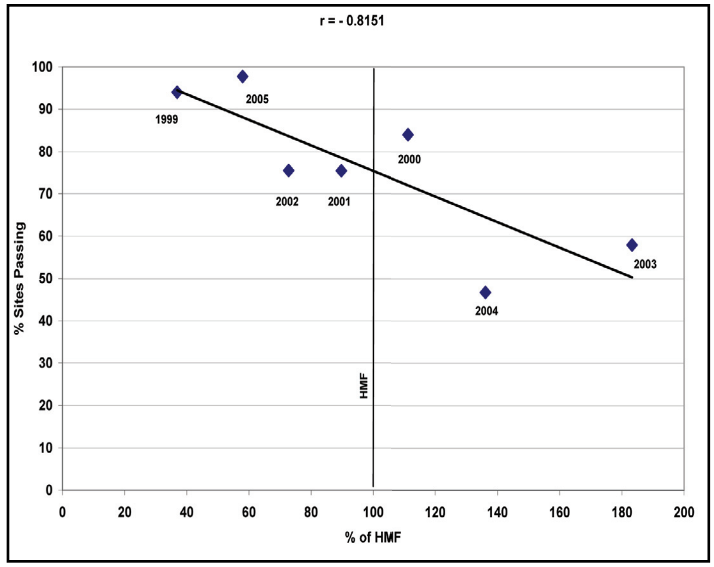

Figure 10. Correlation of harmonic mean flow (HMF) and percentage of sites passing for different years of sampling in multiple pools.

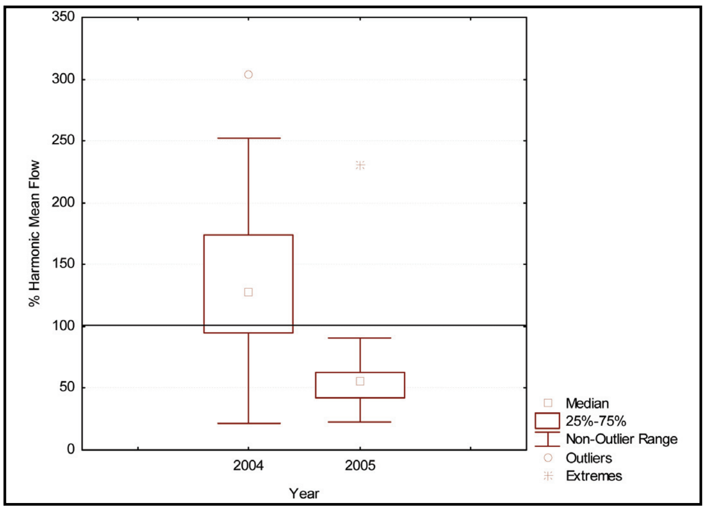

Figure 11. Flows relative to harmonic mean flow (HMF) on day of sampling for 2004 and 2005 in JT Myers pool.

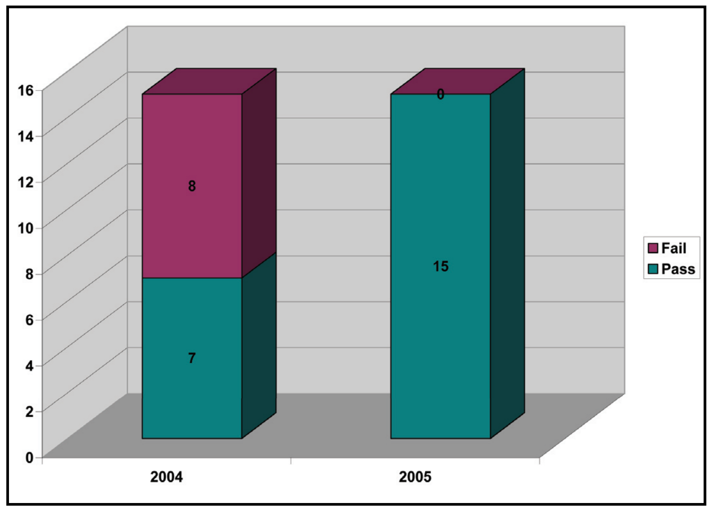

Figure 12. Comparison of site assessment results for 2004 and 2005.

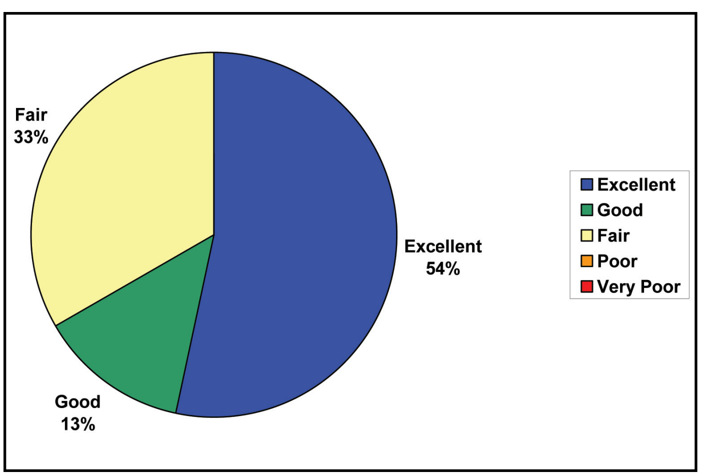

Figure 13. Condition ratings for sites in J.T. Myers Pool, based on ORFIn scores at 15 sites in 2005.

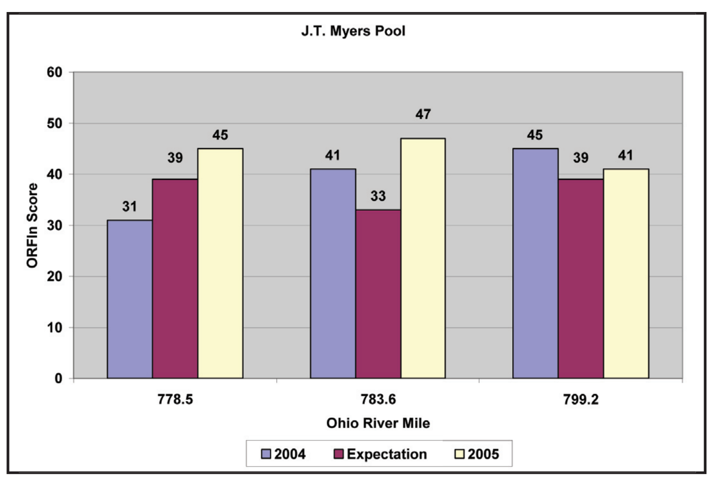

Figure 14. ORFIn scores and expectations for sites sampled in 2004 and 2005.

Table 4. Comparison of sites sampled in J.T. Myers Pool in both 2004 and 2005.

Year	River Mile	Bank	Date	Latitude	Longitude	Secchi (in)	Habitat Class	Exp. ORFIn	Obs ORFIn	Result	Condition Rating
2004	778.5	RDB	10/6/04	37.945	87.414	12	A	39	31	Fail	Poor
2005	778.5	RDB	10/4/05	37.945	87.414	38	A	39	45	Pass	Fair
2004	783.6	RDB	10/6/04	37.913	87.497	12	B	33	41	Pass	Fair
2005	783.8	RDB	10/4/05	37.913	87.497	39	B	33	47	Pass	Excellent
2004	799.2	RDB	9/9/04	37.898	87.607	36	A	39	45	Pass	Fair
2005	799.2	RDB	10/5/05	37.898	87.607	36	A	39	41	Pass	Fair

5.4 Water Quality and Flow Conditions

In 2004 multiple heavy rainfall events in the spring and summer caused both the water levels and flow volume to become elevated. These were sustained at moderately high levels throughout the sampling season and resulted in much higher flow volumes in 2004 than are normally encountered (Figure 10). Despite the higher flows and water levels, sampling was only conducted under the conditions required by Emery et al. (2003). No unusual measurements for temperature, pH, DO, and conductivity were recorded in 2004. Secchi depths ranged from 6 to 36 inches.

5.5 Assessment of Condition

In 2004, only seven sites met expectations (passed) and only one site received a rating higher than fair. With only 47% of the sites passing, the J.T. Myers pool was assessed as failing to meet its aquatic life use designation. However, concerns were raised that the data may have been influenced by the higher than normal flows seen in 2004.

6.0 Discussion

6.1 Fish Population

The collections from J.T. Myers pool showed several notable differences between 2004 and 2005. First, the number of individuals caught in 2005 was 50% higher than that from 2004. Second, the dominance of drum in 2004 was not seen in 2005. In 2005 drum were eclipsed by emerald shiners as the most common species. At the family level, both the minnow and shad and herring families were more common in 2005. The fish population would not normally be expected to change so much within one year's time but it is possible that these differences reflect an actual change in the overall fish population. However, it seems more likely that something affected the sampling efficiency and accuracy in 2004. It is believed that the lower flow conditions in 2005 were more conducive to efficient sampling and allowed for a better representation of the fish population than the conditions of 2004. It is also suspected that fish move to different locations during periods of higher flow as seen in 2004, similar to seeking refugia in the winter (Garvey et al. 2003).

6.2 Metric Performance

In 2005, the diversity and abundance were better at the site level, which resulted in metric scores that were generally higher than the 2004 metric scores. The percent detritivores was the exception with slightly lower scores in 2005. The percentage of tolerant individuals remained the highest scoring metric indicating that pollution tolerant fish are not out-competing intolerant species due to stress from pollutants. The most notable improvements were seen in the percent piscivores and percent simple lithophils metrics. These individuals might comprise the increased numbers of fish seen in 2005, indicating that they are more affected by increased flows than other species types. The low scoring metric was the percent invertivores, which may indicate a lack of macroinvertebrates for these fish to feed on.

6.3 Habitat Surveys

Overall, there is limited high quality habitat available to support the fish population of J.T. Myers pool. The habitat assessments of both years show that most areas in J.T. Myers pool are classified as class 'B' and class 'C' habitats, with only a few class 'A' habitats. Most of the available habitat is sand and fines. The 2004 habitat surveys showed a higher percentage of fines than were seen in the 2005 assessments. The difference in the percentage of fines is probably an artifact of the probabilistic design. There is variation throughout the pool and the sites selected in 2005 happened to have fewer fines present. Still, the habitat assessments in both years showed similar results, with small substrates being very common throughout the pool.

6.4 Water Quality and Flow Conditions

There were no water quality measurements that were out of the ordinary or that provide any major insight into the assessment results for either year. The differing amounts of rainfall in each year affected the flow conditions under which the biological data were collected. Higher stage and flow conditions are generally associated with higher turbidity levels, which can hinder effective fish collection. All Secchi depths indicated sufficient visibility for sampling; however measurements were lower in 2004. Sites in 2004 may have experienced lower visibility, slightly reducing the catch at some sites, but not enough to explain the differences alone. Swift flows can also adversely affect capture efficiency by making boat maneuvering and fish netting more difficult. Finally, these periods of high flow may alter the habits and locations of the fish (see Section 6.5)

6.5 Assessments of Condition and Conclusions

The assessments conducted in the J.T. Myers pool over 2004 and 2005 have provided a lot of information about the fish population and the overall biological condition of the pool. However, the information provided does not agree between the two years. In 2004, nearly 53% of the J.T. Myers pool sites were deemed as failing, therefore this assessment unit (AU) would be reported as impaired (and not supporting its designated aquatic life use). The

2005 assessment found all of the sample sites to be in passing condition and so the pool would be considered as passing (or fully supporting its aquatic life use). The sites that were revisited also showed that scores were better in 2005, highlighting the difference between the years.

It is important to understand why the 2004 and 2005 assessments are so different because each result has different implications. An AU that is considered passing or unimpaired receives no sanctions, but impaired AU's are viewed negatively and are subjected to further sampling, 303(d) listing and possible TMDL (Total Maximum Daily Load) development.

At this time an explanation for the differences in the assessments is not certain, but flow volume has been identified as one very important factor. It appears that increases in flow are associated with lower assessment scores. A better understanding of the relationship between flow and assessment scores is needed. This includes determining under what flow conditions sampling should be conducted and calibrating the assessments for certain flow levels. As this relationship is better understood, ORSANCO will be able to provide more accurate assessments of biological condition.

It is believed that the higher than normal flows seen in 2004 reduced the overall catch and caused bias in the species that were caught. The higher flow made sampling more difficult by decreasing the visibility in the water, which reduced the number of fish that were seen and netted. Sampling can also be made difficult by the swift current which reduces the maneuverability of the boat. Additionally, the high flows altered the movement of the fish. At normal summer flow levels, fish orient to the near shore habitat, where the electrofishing is conducted. However, when flows are increased and the water is turbid, some species behave differently. It is probable that during the high flows of 2004, the fish sought refugia in different parts of the pool (e.g. deeper water, embayments, etc.) and therefore different catch rates were encountered.

The assessment was successfully conducted in the J.T. Myers pool. The primary goals of this method were to adequately assess a given AU while minimizing resource expenditure, reduce/eliminate human bias and provide statistically valid results. Although further sampling is needed to confirm our results, this design appears to have accomplished these goals.

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