Biological Programs 2004
Intensive Survey Results
Series 1
Report 4

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

Executive Summary

- In 2004, ORSANCO introduced the utilization of a random probabilistic design for sampling fish communities in the Ohio River.
- The Ohio River was divided into assessment units based on the locations of navigational dams.
- Based on the random design, each assessment unit was assigned 15 sampling locations.
- Once sampled, each site is graded as passing or failing to meet it aquatic life use designation.
- For an assessment unit to be considered in passing condition, more than 75% of the sites assessed must be in passing condition.
- In 2004, the sites sampled in the J.T. Myers pool failed to meet these criteria, with 53% of sites failing.
- Therefore, J.T. Myers pool would be reported as failing to meet its aquatic life use designation.
- This assessment, however, is questionable based on unusually high flows that occurred during the 2004 sampling seasons.
- Recommendations include the re-sampling of the J.T. Myers pool in 2005 and more intense analysis of flow data and its relationship to sampling outcome, in order to validate the results from 2004.

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TABLE OF CONTENTS

APPENDICES

TABLES

FIGURES

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 suited 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 is a collection of 13 attributes, or metrics, of the fish community that when compiled provide an accurate representation of the overall condition of the Ohio River 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 utilize 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.

An objective of this program is to apply the probability-based monitoring design to the Ohio River to assess individual pool reaches based on the fish population. In 2004, four pools in the Ohio River were surveyed: New Cumberland, Racine, Markland, and J.T. Myers. This report will focus on the fish assemblage, the performance of ORFIn, and the effectiveness of the probabilistic design in the J.T. Myers pool.

2.0 Study Area

2.1 Ohio River

The Ohio River (Figure 1) begins at the confluence of the Monongahela and Allegheny rivers and flows 981 miles in a southwesterly direction to the confluence with the Mississippi River. Twenty navigational dams maintain a nine-foot minimum depth for commercial navigation throughout the entire length of the river. There are over 600 permitted discharges to the Ohio River, 49 of which are power-generating facilities. The Ohio River Basin contains nearly ten percent of the nation's population, more than 25 million people, and 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 extends from Newburgh Lock and Dam (ORM 776.1) to J.T. Myers Lock and Dam (ORM 846.0), for a total length of 69.9 miles. The pool has a gradient drop of 0.3 feet per mile, averages 2,401 feet wide and 28 feet deep. The pool is bordered by the states of Kentucky and Indiana throughout its entire length. This pool receives water from the major sub-basin of the Green River in KY, of which land use is primarily agriculture and forest based. The metropolitan area of Evansville, IN is located mid-pool, subjecting the pool urban runoff, but land use in this pool is primarily agriculture.

Barge unloading facility on the Ohio River

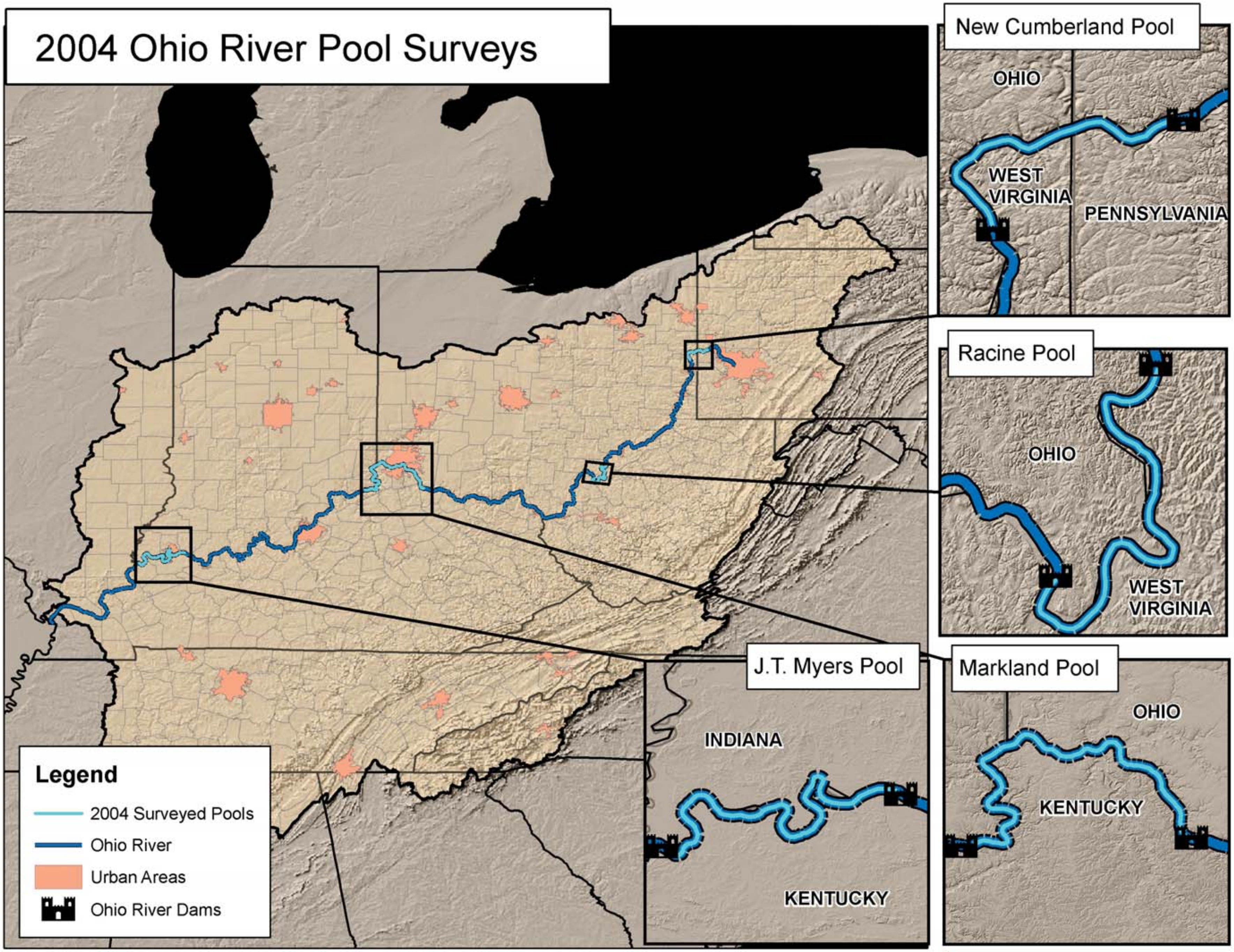


Figure 1. The Ohio River Basin and the four pools selected for 2004 sampling.

3.0 Methods

3.1 Survey Design

A random, probability-based survey design was used to select sampling site locations within each of the navigational pools of the Ohio River. 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 Lock and Dam) to 846 (J.T. Myers Lock 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 used to select all sampling locations.

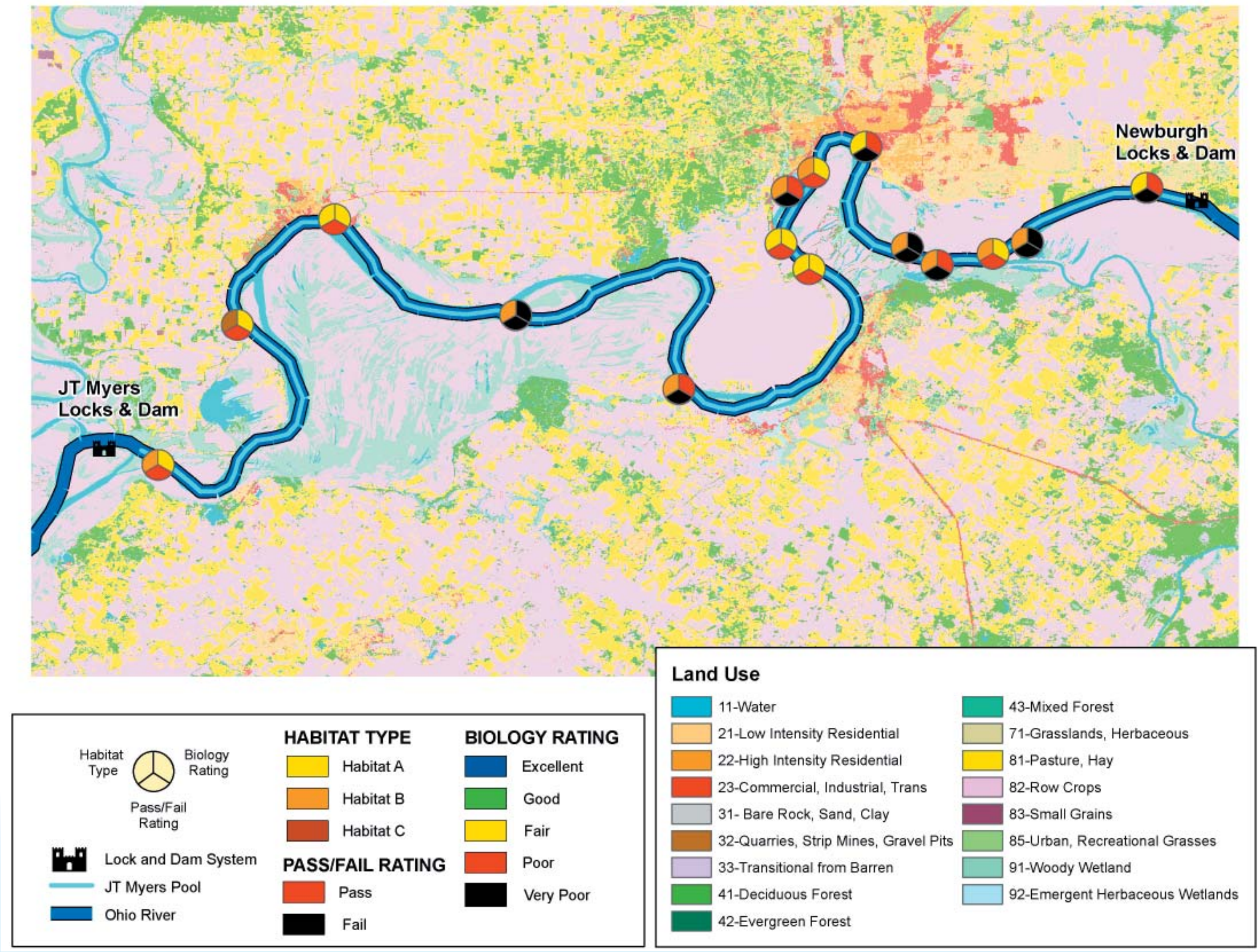
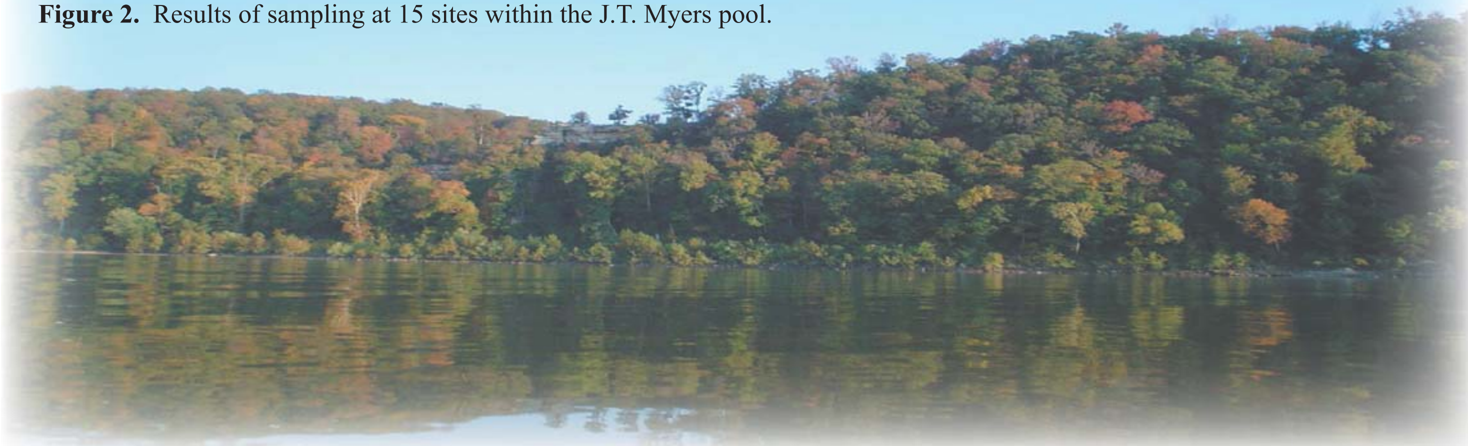


Figure 2. Results of sampling at 15 sites within the J.T. Myers pool.



3.2 Index Period and Sampling Frequency

All sampling was conducted between July 1 and October 31, 2004. This sampling period reduces community variability by increasing the likelihood that samples are collected during the stable, low-flow conditions usually present on the Ohio River during the summer and early fall months. Seventy-four electrofishing events were conducted from July through October, 15 of which were in J.T. Myers pool. Most sites were sampled exactly in the location generated from the design, but in a few cases sampling zones were shifted (maximum 500m up- or downstream) due to restricted access or unsafe sampling conditions.

Typical 500 meter electrofishing reach.

3.3 Fish Collections

Standard collection techniques were employed throughout the surveys as described by ORSANCO's Standard Operating Procedures (1999). Fish were collected using boat electrofishing techniques at night. Nighttime electrofishing typically yields samples of increased diversity and richness (Sanders 1992). Two three-person crews collected samples from 18-foot aluminum johnboats. Each boat was equipped with a 5000-watt generator and a Smith-Root Type VI-A electrofishing unit. Sampling was conducted over a section of 500-meter near-shore habitat for a minimum of 2000 seconds (Gammon 1998). Time could vary depending upon the density 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 taxonomic level before being returned to the water. Fish that could not confidently be identified in the field (e.g. minnows) were preserved in a ten percent formalin solution and identified in the laboratory.

3.4 Habitat Characterizations

Large rivers have distinct habitat zones, including unique microhabitats (Reash 1999). Therefore, extensive habitat surveys were conducted for each electrofishing zone. The surveys included thorough substrate and depth measurements, as well as woody cover estimates, and riparian zone descriptions. Depth and substrate composition were measured at 66 points throughout each 500m zone. Six points along the shoreline were selected 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 this data, each zone was assigned a habitat classification of "A", 'B', or 'C'. 'A' habitats tend to be deeper, with more course substrate such as cobble and gravel. 'C' habitats tend to be shallow and dominated by finer substrates such as sand. 'B' habitats tend to be a mix of several depths and substrates. This habitat information will be used by biologists to describe the influence of habitat on fish communities and to determine if trends observed in populations are habitat induced or result from other factors.

3.5 Water Quality and Flow

Basic measures of water quality were measured at each sampling 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 crew conducting night-time electrofishing.

3.6 Assessment

As described above, each electrofishing site is classified as containing 'A', 'B', or 'C' habitat characteristics. Based on this habitat designation, the longitudinal location of a given site, and the time of year (Julian day) the sample was collected, an expectation is developed for each electrofishing site in the form of a predicted ORFIn score. By comparing this expected ORFIn score to the observed ORFIn score, biologists are able to determine whether or not a given site is meeting its aquatic life use designation. Each site is then labeled as either passing or failing and given a condition rating of excellent, good, fair, poor, or very poor. Once each site has been designated as passing or failing, all sites sampled within the pool are aggregated. If upon aggregation more than 25% (within a particular confidence interval, see Appendix C) of the sites are deemed in failing condition, then the entire pool would be designated as being in failing condition, and therefore subject to further sampling.

4.0 Results

4.1 Fish Population

In 2004 crews collected fish population data (Appendix A) from 15 sites throughout the length of the J.T. Myers pool (Table 1). These collections produced 47 taxa representing 10 families (Table 2). Among these taxa, there is one species listed as special concern in KY, the black buffalo (*Ictiobus niger*) and one listed as special concern in IN, the blue sucker (*Cycleptus elongatus*). The drum family (Sciaenidae) was the most abundant within the collections made, comprising 40.2% of the total abundance captured (Figure 3). The minnow family (Cyprinidae) and the catfish family (Ictaluridae) were next most abundant groups making up 26.9% and 12.1% of the total abundance respectively (Figure 3). Specifically, abundance was dominated by the freshwater drum (*Aplodinotus grunniens*) and the emerald shiner (*Notropis atherinoides*), comprising 26.1 and 21.7% respectively (Figure 4). The gizzard shad (*Dorosoma cepedianum*) comprised 10.8% of samples collected, followed by temperate bass (*Morone sp*) comprising 10.4% (Figure 4). Raw fish population data for each site sampled is displayed in Appendix 1.

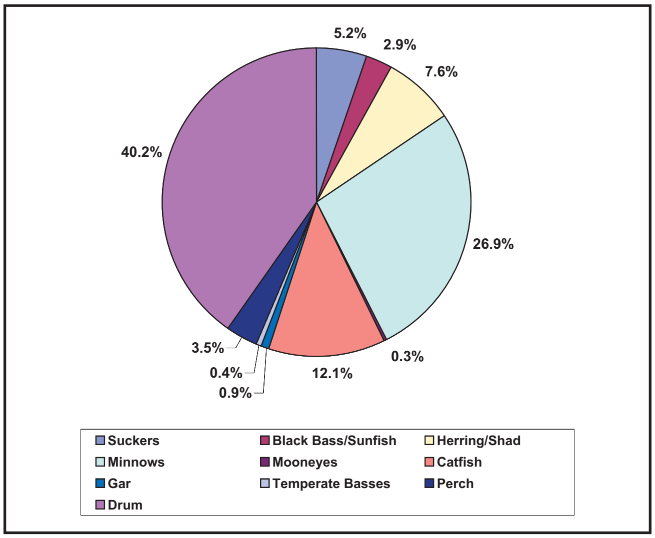


Figure 3. Fish composition by family in the J.T. Myers Pool

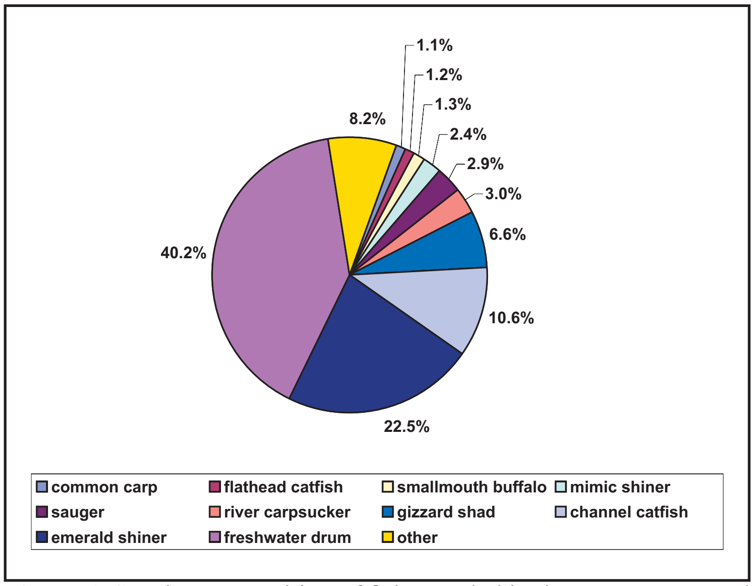


Figure 4. Species composition of fish sampled in the J.T. Myers Pool

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

Rmi	Bank	Date	Latitude	Longitude	Habitat Type	Exp ORFIn	Obs ORFIn	Site Pass/Fail	Rating
778.5	RDB	06-Oct-04	37.945	87.413	A	39	31	FAIL	Poor
782.9	LDB	06-Oct-04	37.913	87.482	B	33	19	FAIL	Very Poor
783.6	RDB	06-Oct-04	37.913	87.496	B	33	41	PASS	Fair
785.9	LDB	06-Oct-04	37.900	87.534	B	33	31	FAIL	Poor
786.4	RDB	05-Oct-04	37.905	87.542	B	33	21	FAIL	Very Poor
792.2	RDB	05-Oct-04	37.968	87.575	A	39	35	FAIL	Poor
794.8	RDB	05-Oct-04	37.953	87.605	B	33	37	PASS	Fair
795.8	RDB	05-Oct-04	37.941	87.614	B	33	29	FAIL	Poor
797.9	RDB	09-Sep-04	37.913	87.624	A	39	39	PASS	Fair
799.2	RDB	09-Sep-04	37.898	87.607	A	39	45	PASS	Good
809.4	LDB	04-Oct-04	37.829	87.683	B	33	29	FAIL	Poor
820.9	RDB	04-Oct-04	37.871	87.777	B	33	20	FAIL	Very Poor
828.5	RDB	04-Oct-04	37.926	87.881	A	39	39	PASS	Fair
833.7	RDB	25-Aug-04	37.866	87.937	C	26	33	PASS	Fair
845.7	LDB	25-Aug-04	37.785	87.983	B	33	37	PASS	Fair

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

Table 2. Species collected in the J.T. Myers pool in the 2004 survey.

Family	Common name	Latin name	IN status	KY status
Lepisosteidae	longnose gar	*Lepisosteus osseus*		
Lepisosteidae	shortnose gar	*Lepisosteus platostomus*		
Clupeidae	skipjack herring	*Alosa chrysochloris*		
Clupeidae	gizzard shad	*Dorosoma cepedianum*		
Clupeidae	threadfin shad	*Dorosoma petenense*		
Hiodontidae	goldeye	*Hiodon alosoides*		
Hiodontidae	mooneye	*Hiodon tergisus*		
Cyprinidae	common carp	*Cyprinus carpio*		
Cyprinidae	miss. silvery minnow	*Hybognathus nuchalis*		
Cyprinidae	striped shiner	*Luxilus chrysocephalus*		
Cyprinidae	emerald shiner	*Notropis atherinoides*		
Cyprinidae	mimic shiner	*Notropis volucellus*		
Cyprinidae	river shiner	*Notropis blennius*		
Cyprinidae	silver chub	*Macrhybopsis storeriana*		
Cyprinidae	bullhead minnow	*Pimephales vigilax*		
Catostomidae	quillback carpsucker	*Carpiodes cyprinus*		
Catostomidae	river carpsucker	*Carpiodes carpio*		
Catostomidae	smallmouth redhorse	*Moxostoma breviceps*		
Catostomidae	northern hog sucker	*Hypentelium nigricans*		
Catostomidae	blue sucker	*Cycleptus elongatus*	**SC**	
Catostomidae	smallmouth buffalo	*Ictiobus bubalus*		
Catostomidae	bigmouth buffalo	*Ictiobus cyprinellus*		
Catostomidae	black buffalo	*Ictiobus niger*		**SC**
Ictaluridae	blue catfish	*Ictalurus furcatus*		
Ictaluridae	channel catfish	*Ictalurus punctatus*		
Ictaluridae	stonecat	*Noturus flavus*		
Ictaluridae	flathead catfish	*Pylodictis olivaris*		
Moronidae	morone sp	*Morone sp*		
Moronidae	hybrid striper	*Morone saxatilis x chrysops*		
Moronidae	white bass	*Morone chrysops*		
Centrarchidae	green sunfish	*Lepomis cyanellus*		
Centrarchidae	bluegill	*Lepomis macrochirus*		
Centrarchidae	orangespotted sunfish	*Lepomis humilis*		
Centrarchidae	longear sunfish	*Lepomis megalotis*		
Centrarchidae	redear sunfish	*Lepomis microlophus*		
Centrarchidae	smallmouth bass	*Micropterus dolomieu*		
Centrarchidae	largemouth bass	*Micropterus salmoides*		
Centrarchidae	spotted bass	*Micropterus punctulatus*		
Centrarchidae	white crappie	*Pomoxis annularis*		
Centrarchidae	black crappie	*Pomoxis nigromaculatus*		
Percidae	logperch	*Percina caprodes*		
Percidae	blackside darter	*Percina maculata*		
Percidae	slenderhead darter	*Percina phoxocephala*		
Percidae	river darter	*Percina shumardi*		
Percidae	saugeye	*Sander canandensis x vitreus*		
Percidae	sauger	*Sander canadensis*		
Sciaenidae	freshwater drum	*Aplodinotus grunniens*		

47 taxa, representing 10 Families

SC= Special Concern

T=Threatened

E=Endangered

4.2 Metric Performance

Thirteen metrics were used to produce ORFIn scores at each electrofishing site (Emery et al. 2003). The performance of each metric and its score is listed in Table 3. The total number of native species ranged from 7 to 19 per site, with an average of just over 12. The number of sucker species ranged from 1 to 4, averaging just over two per site. The number of centrarchid species ranged from 0 to 7 with an average of fewer than 2. The number of great river species recorded for each site ranged from 0 to 4, averaging just over one per site. The number of intolerant species ranged from 0 to 3, averaging just over one per site. The percent tolerant individuals ranged from 0 to 5.49%, averaging 1.7% per site. The percent simple lithophils ranged from 0 to 21.5% with an average value of 6%. The percent non-native individuals ranged from 0 to 7.6% and averaged 13%. The three feeding guild metrics of percent detritivores, percent invertivores and percent piscivores averaged 10.5%, 8.2% and 10.3% respectively. The number of

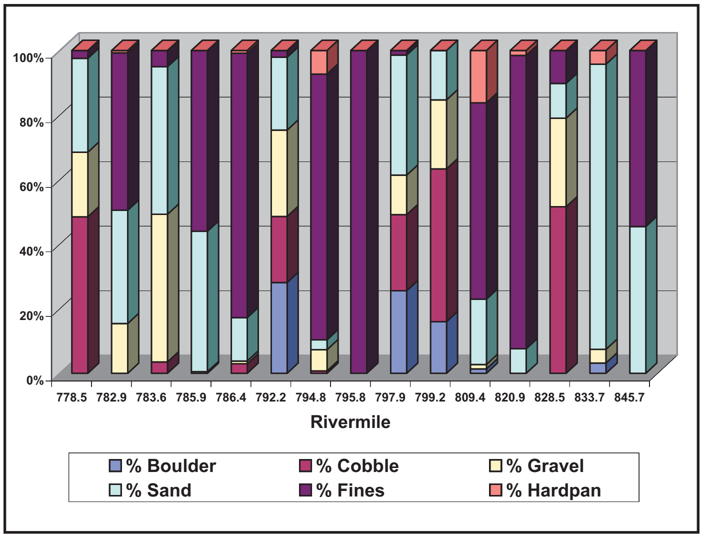


Figure 5. Sediment composition at each site.

DELT (deformities, eroded fins, lesions and tumors) ranged at each site from 0 to 5, averaging just over one per site. The CPUE metric (catch per unit effort) ranged from 48 to 416 individuals per site, averaging just over 192 individuals per site. Additonally, of the 15 sites sampled, two were subjected to the low-end scoring mechanism built into the ORFIn that applies when a given site produces less than 50 individuals (Emery et al. 2003).

4.3 Habitat Surveys

Intensive habitat surveys at each of the 15 sampling locations (Figure 5) revealed that the bottom substrate in the Myers pool was dominated by fines, making up 40% of the substrate (Figure 6). Cobble and gravel substrates were also fairly common, making up 13% and 13%, respectively (Figure 6). Boulder and hardpan substrates were the least common found, combining to comprise only 7% of the sites sampled (Figure 6). Woody cover was present in 9 of the 15 sites sampled, riparian land use was primarily agricultural, with the city of Evansville, IN centrally located within the pool contributing urban and storm-water run-off (Appendix B). The variables mentioned were compiled within a habitat index to give each site a habitat classification of A, B, or C (Table 1). The J.T. Myers pool was dominated by B habitats, which accounted for 60% of the samples (Figure 7). Habitat types A and C made up 33% and 7% of the samples respectively (Figure 7).

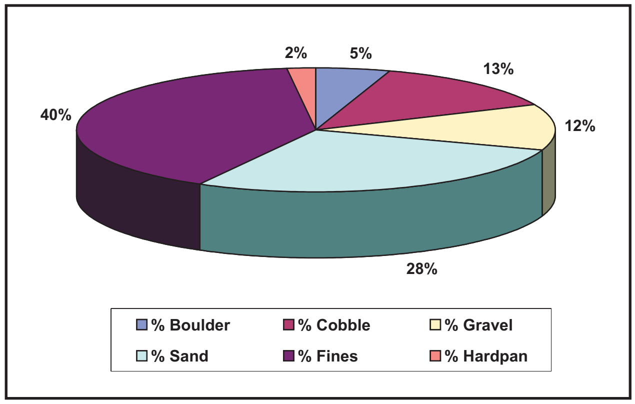


Figure 6. Substrate composition in the J.T. Myers Pool

4.4 Water Quality and Flow

The basic water quality parameters of temperature, dissolved oxygen (DO), conductivity and pH were recorded at the electrofishing sites (Table 4). Additionally, secchi depth readings were collected as a measure of turbidity before each electrofishing event. Temperature ranged from 19.1◦ C to 26.4◦ C and average 21.4◦C. DO ranged from 8.52 mg/l to 11.51 mg/l with an average of 9.9 mg/l. Conductivity readings ranged from 250 µS/cm to 426 µS/cm and averaged 301.7 µS/cm. Readings for pH ranged from 7.11 to 8.25 and averaged 7.51. Secchi depth readings ranged from 15.2 cm to 91.4 cm and averaged 40.6 cm. The harmonic mean flow (HMF) of the Ohio River used for this area is 60.9 kcfs based on stream-flow data analyzed by USGS. Flows for the Markland pool during our sampling season ranged from 70.5 % to 310.7 of the HMF, averaging 133.6 % of the HMF. Figure 8 displays this data as a percentage +/- the HMF.

4.5 Assessment of Condition

The data collected from each zone was used to calculate an ORFIn score (Emery et al 2003). The performance of each metric can be viewed in appendix C. Each zone had an expected ORFIn score, based on habitat type, and final score generated (Table 1). Based on expectations, ORFIn scores in the J.T. Myers pool should have averaged just over 34, but only averaged slightly over 32. ORSANCO has developed criteria, based on observed and expected ORFIn scores, which assign sites a grade of passing or failing, as well as condition ratings (Figure 9). Of the 15 sites sampled in 2004, seven of them received passing evaluations (Table 1). The eight failing sites (53%) received site evaluations of either poor (eight sites) or very poor, with six (40%) passing sites rated as fair and one as good (7%) (Figure 7).

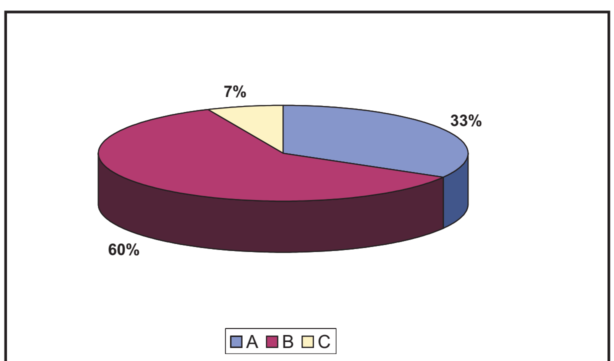


Figure 7. Habitat classes sampled in the J.T. Myers Pool

Table 3. ORFIn metrics and scores from the J.T. Myers Pool 2004 study.

River Mile	Bank	# Indindividuals	# Individuals w/o gizzard shad and emerald shiners	# Individuals w/o gizzard shad, emerald shiners, exotics, hybrid, and tolerant species	# Species	# 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	# DELTs	DELT Score	CPUE	CPUE Score	Expected ORFIn Score	Observed ORFIn Score	Site Score Pass/Fail
783.6	RDB	212	175	175	15	3	3	3	1	1	4	5	1	1	0.00	5	1.14	1	0.00	5	8.00	5	26.86	3	6.86	1	0	5	212	3	33	41	PASS
799.2	RDB	264	177	171	19	5	3	3	6	5	3	3	3	3	1.70	5	3.95	1	1.70	5	6.21	5	10.17	1	15.82	1	1	5	258	3	39	45	PASS
778.5	RDB	176	174	171	13	3	2	1	3	3	0	1	3	3	1.15	5	3.45	1	1.72	5	14.37	3	5.75	1	6.32	1	5	1	173	3	39	31	FAIL
782.9	LDB	50	32	30	10	3	4	3	0	0	1	1	1	1	3.13	1	0.00	0	6.25	1	31.25	1	6.25	1	15.63	1	1	5	48	1	33	19	FAIL
828.5	RDB	425	280	271	10	3	3	3	0	1	1	1	3	3	2.86	5	0.71	1	3.21	5	5.00	5	0.71	1	3.21	1	0	5	416	5	39	39	PASS
795.8	RDB	123	109	108	7	1	1	1	0	1	1	1	1	1	0.92	5	0.00	1	0.92	5	2.75	5	0.92	1	0.92	1	0	5	122	1	33	29	FAIL
797.9	RDB	200	165	156	15	3	1	1	7	5	0	1	2	3	3.03	5	16.36	3	5.45	3	6.67	5	16.36	1	27.88	3	2	3	191	3	39	39	PASS
786.4	RDB	110	94	88	14	3	3	3	1	1	1	1	1	1	4.26	3	3.19	1	6.38	3	19.15	1	5.32	1	9.57	1	4	1	104	1	33	21	FAIL
785.9	LDB	97	64	63	12	3	1	1	2	1	1	1	1	1	0.00	5	3.13	1	1.56	5	1.56	5	7.81	1	7.81	1	0	5	96	1	33	31	FAIL
794.8	RDB	187	167	164	13	3	3	3	0	1	3	3	3	3	1.80	5	21.56	3	1.80	5	9.58	3	2.99	1	18.56	1	2	3	184	3	33	37	PASS
820.9	RDB	75	47	47	11	3	3	3	0	0	2	3	1	1	0.00	0	10.64	1	0.00	0	14.89	1	21.28	1	10.64	1	0	5	75	1	33	20	FAIL
792.2	RDB	307	263	260	9	3	2	1	1	1	0	1	2	3	1.14	5	5.32	1	1.14	5	6.46	5	1.90	1	4.18	1	2	3	304	5	39	35	FAIL
809.4	LDB	94	91	84	11	3	3	3	0	1	3	3	1	1	5.49	3	2.20	1	7.69	3	17.58	3	1.10	1	8.79	1	1	5	87	1	33	29	FAIL
845.7	LDB	341	147	138	11	3	2	3	3	3	1	1	0	1	0.00	5	7.48	1	6.12	3	7.48	5	4.76	1	10.20	1	0	5	332	5	33	37	PASS
833.7	RDB	290	106	104	13	3	2	1	2	1	1	1	0	1	0.94	5	12.26	1	1.89	5	6.60	5	11.32	1	8.49	1	0	5	288	3	26	33	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

Table 4. Water quality data from sites sampled in the J.T. Myers pool.

Rmi	pH	Temp (C)	Dissolved Oxygen (mg/L)	Conductivity	Secchi (cm)
778.5	7.11	19.29	10.8	255	30.48
782.9	7.2	19.33	11.52	255	30.48
783.6	7.2	19.33	11.52	255	30.48
785.9	7.2	19.33	11.52	255	30.48
786.4	7.12	19.2	10.31	258	30.48
792.2	7.12	19.18	10.16	260	30.48
793.5	N/A	N/A	N/A	N/A	N/A
794.8	N/A	19.91	9.16	269	15.24
795.8	N/A	19.91	9.16	269	30.48
797.9	8.25	26.41	8.52	412	76.2
799.2	8.25	26.41	8.52	412	91.44
809.4	7.24	19.6	10.29	250	30.48
820.9	N/A	19.96	8.64	262	30.48
828.5	N/A	19.96	8.64	262	30.48
833.7	8.01	26.45	N/A	426	76.2
845.7	8.01	26.45	N/A	426	45.72

5.0 Discussion

5.1 Fish Population

In general, the fish population appeared healthy, as evidenced by the lack of external anomalies present. Of the 47 species collected, two are currently listed as species of concern on state threatened and endangered lists. The blue sucker (*Cycleptus elongatus*), listed as special concern in Indiana, and the black buffalo (*Ictiobus niger*), listed as special concern in Kentucky, were collected in low numbers. Both of these species are dependant on large rivers, and we believe that they are more prevalent than our sampling indicates. The status of the species may be a function of the limitations imposed by our particular sampling methods. It is also important to note the low increasing presence of non-native species. Recent invasions of exotic species, such as the silver and big-head carp (*Hypophthalmichthys molitrix*) and (*H. nobilis*), which are becoming more dominant in the lower stretches of the Ohio River. Although not collected during electrofishing surveys conducted in 2004, visual observations of the species by biologists confirms there ever increasing presence. A primary concern with the presence of these fish regards their competition with other native fish, such as the paddlefish (*Polydon spatula*). These have similar feeding habits, and could potentially out-compete native fish for food.

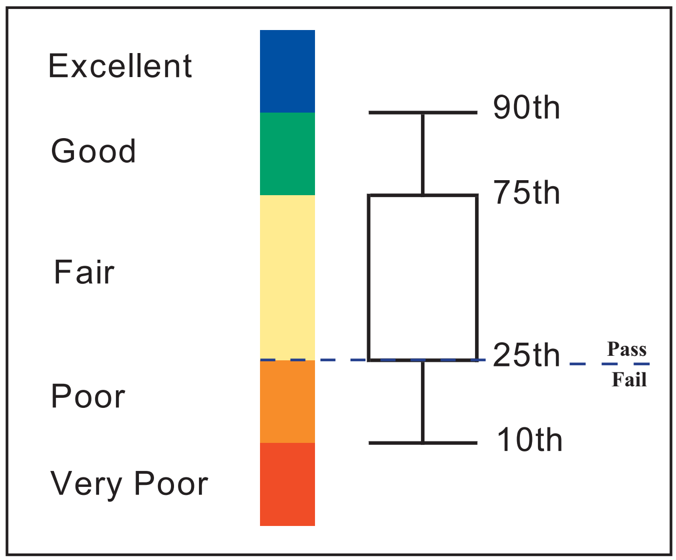


Figure 9. The approach used for assigning various conditions ratings using data from least impacted sites for each of the three habitiat classes.

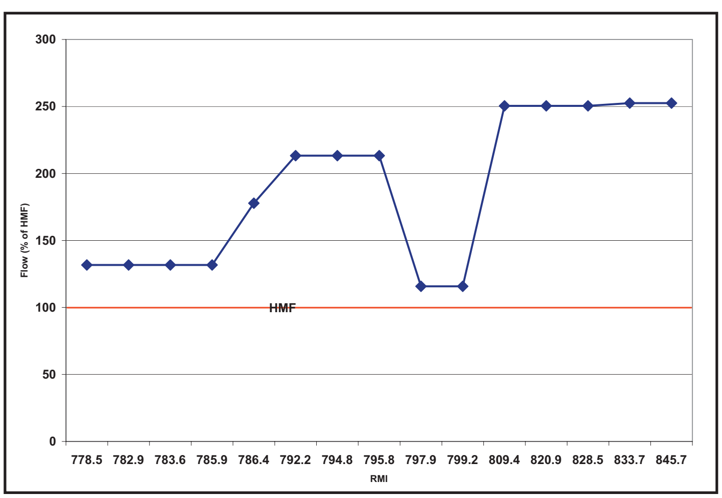


Figure 8. Daily flow for sampling events in the J.T. Myer Pool.

5.2 Metric Performance

The "low-end" scoring technique (Emery et al. 2003) caused lower overall ORFIn scores at two sites. This was most notable in the number of centrarchid species metric and percent simple lithophils metric, scoring a 0 on more than one occasion. Other metrics associated with low ORFIn scores include the percent invertivores and percent piscivores, with each having only one site that scored above 1. Based on the combined experience of the biologists conducting this survey, and findings of Emery et al. (2003), better evenness within the community was expected.

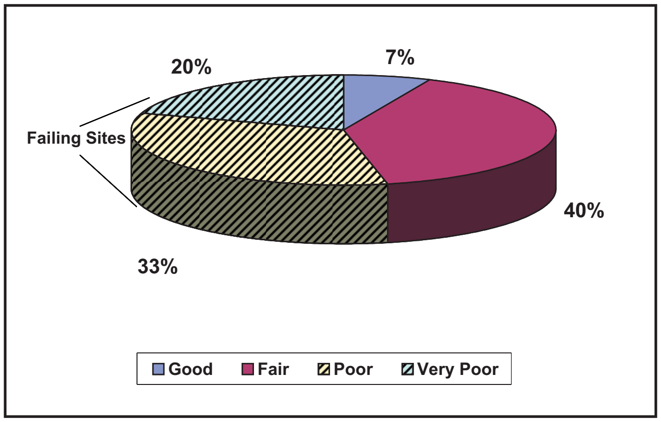


Figure 10. Condition of the J.T. Myers pool based on ORFIn scores at 15 sites

This is exemplified within the feeding guild metrics, which was dominated by detritivores. It was anticipated that 15 sites concentrated within a relatively small spatial area and encompassing diverse habitat types would have produced higher abundance and diversity. Again, since this was the first application of a probability design and since unusual flow and weather conditions were encountered, it is not known which factor(s) singularly or in concert contributed to the observed conditions.

5.3 Habitat

Three distinct habitat classes, 'A', 'B', and 'C', have been identified on the Ohio River. 'A' habitats are generally deeper and dominated by more course substrates. Additionally, 'A' habitats generally score higher than 'B' or 'C'. Generally speaking, 'A' and 'B' habitats tend to support a more diverse and abundant fish population (unpublished data). In the Myers pool, 'B' habitats were dominant, with 'A' more abundant than 'C' habitat types. It would be expected that a pool dominated by more course substrates would produce more diverse fish populations and higher ORFIn scores. This leads researchers to believe that poor metric performance, and subsequently, poor ORFIn performance is not a function of poor habitat.

5.4 Water Quality and Flow

Parameters measured at each electrofishing site provided no conclusions for the low ORFIn scores generated from the data at these sites. Values for temperature, DO, conductivity, and pH all fell into a range that would be considered normal or background for this section of the river. In addition, other monitoring activities conducted by ORSANCO provided no data that could account for low ORFIn scores being attributed to water quality. Flow values, in contrast, were elevated during the majority of the time period when sampling occurred. In some cases, flows reached values were over twice that of the harmonic mean flow. Higher flows can cause several problems during sampling, including reducing capture efficiency, which could potentially reduce metric and index performance.

5.5 Assessment and Conclusions

The probabilistic design was implemented on the Ohio River in order to biologically assess a navigation pool. Hence, each navigational pool will serve as a distinct assessment unit (AU) and will be reported on individually in the 305(b) report to EPA.

The criteria for reporting on the condition of an AU are based on the performance of the ORFIn in relation to the habitat at the 15 sites sampled in each unit. Each site, based upon its habitat classification, will have an "expected" ORFIn score generated. This score reflects how a particular site should perform. The observed score for each of the sites within the AU is then compared to the expected score, with each site then assigned as passing or failing. The sites are then aggregated and the AU is viewed as a percentage of sites passing and failing. If an AU is assessed and exhibits greater than 25%, + or – the estimated precision (see Appendix C), of the sites as failing, then the assessment is accepted as valid, and the AU would be reported as failing to meet the established aquatic life use designation. If the estimated precision was not achieved, then the AU would be considered unassessed and further sampling would be needed. Less than 25% failing sites would indicate that the AU meets the aquatic life use designation.

In the J.T. Myers pool, 53% of the sites sampled (Figure 10) were deemed as failing, and therefore the pool would be reported as impaired and not supporting its designated aquatic life use criteria. Designating the AU as impaired leads to implications that would require the AU being included in the 305(b) report on stream condition required by the Clean Water Act (CWA). By reporting this stream segment as impaired, it would require that it be placed on the list of impaired streams as directed by section 303(d) of the CWA. This list has several categories within it for classifying streams based on the type of stressor involved and whether or not a specific stressor

or pollutant can be identified as the source of the impairment. It is likely that the J.T. Myers Pool AU would be placed on the 303(d) list in category 5a, which states that an impaired biological condition has been detected, but due to an unknown stressor or cause. By listing the AU in category 5a, it would require that follow up/additional sampling efforts (i.e. intense chemical and/or physical habitat measurements) be undertaken in order to identify the cause. If this follow up work identifies the source of impairment as a pollutant, then the AU would be reclassified as category 5c, which would require the development of a Total Maximum Daily Load (TMDL) for that stressor. If it is determined that impairment is caused by something other than a pollutant (i.e. habitat, natural, hydrologic, etc.), then the AU would be reclassified as category 4c, again requiring additional sampling to allow for a more precise determination of cause, without TMDL development.

An explanation for the high proportion of failing sites remains unclear. By design, the probability based method eliminates human bias in the selection of sample sites. Sampling locations avoided in the past, due to elevated human activity, were sampled in this design. The J.T. Myers Pool was designated as "fully supporting" the aquatic life use based on water quality. This assessment was determined using water quality data form bimonthly and dissolved metals sampling sites. Parameters such as dissolved oxygen, ammonia, and various dissolved metals have criteria that must be met to provide protection of warm water aquatic life. No violations of the aquatic life criteria for dissolved metals or bimonthly parameters were observed. This indicates that multiple factors, other than water quality, may be influencing fish populations and therefore affecting ORFIn scores.

As described above, water quality results did not indicate impairment during 2004, nor were any significant differences in parameters observed during this time period that could have led to a drastic change in the fish community. This suggests that based on ORSANCO's monitoring, water quality conditions did not affect the fish community in 2004. Explanations for low ORFIn scores other than water quality may include elevated flows and river stage that occurred during the 2004 sampling season. Higher stage and flow conditions are generally associated with higher turbidity levels, which can hinder effective fish collection. Swift flows can also adversely affect capture efficiency by making both boat operation and netting more difficult. Additionally, many species normally common in the mainstem seek refuge during these periods of high flow. Future sampling and more intense analysis of flow data may offer better explanations to the lower observed scores.

The probabilistic assessment design 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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