



A Biological Study of the Emsworth Pool of the Ohio River



Executive Summary

- Since 2004, ORSANCO has been using a probabilistic (random) design for monitoring fish communities in the Ohio River and conducting biological assessments.
- The Ohio River was divided into 20 assessment units based primarily on the locations of navigational dams. Using a random design, each assessment unit was assigned 15 sampling locations.
- Once sampled, each site is graded as passing or failing. For an assessment unit to meet its aquatic life use designation, more than 75% of the sites assessed must be in passing condition.
- In 2007, the Emsworth pool met these criteria, with 100% of sites passing. Therefore, the Emsworth pool was reported to EPA as meeting (supporting) its aquatic life use designation.
- Previous analyses have identified a relationship between flow and ORFI_n (Ohio River Fish Index) scores and the need for sampling thresholds and/or flow calibration. Increased flows tend to cause lower ORFI_n scores due to decreased sampling efficiency and changes in fish behavior.
- Flows were stable in 2007 and were not elevated when sampling was conducted.
- Recommendations include accepting the assessment of Emsworth pool as meeting its aquatic life use designation and moving to the next pool to be sampled while continuing to monitor flow and its influence on assessment results.

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1.0 Introduction

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

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

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

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

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

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

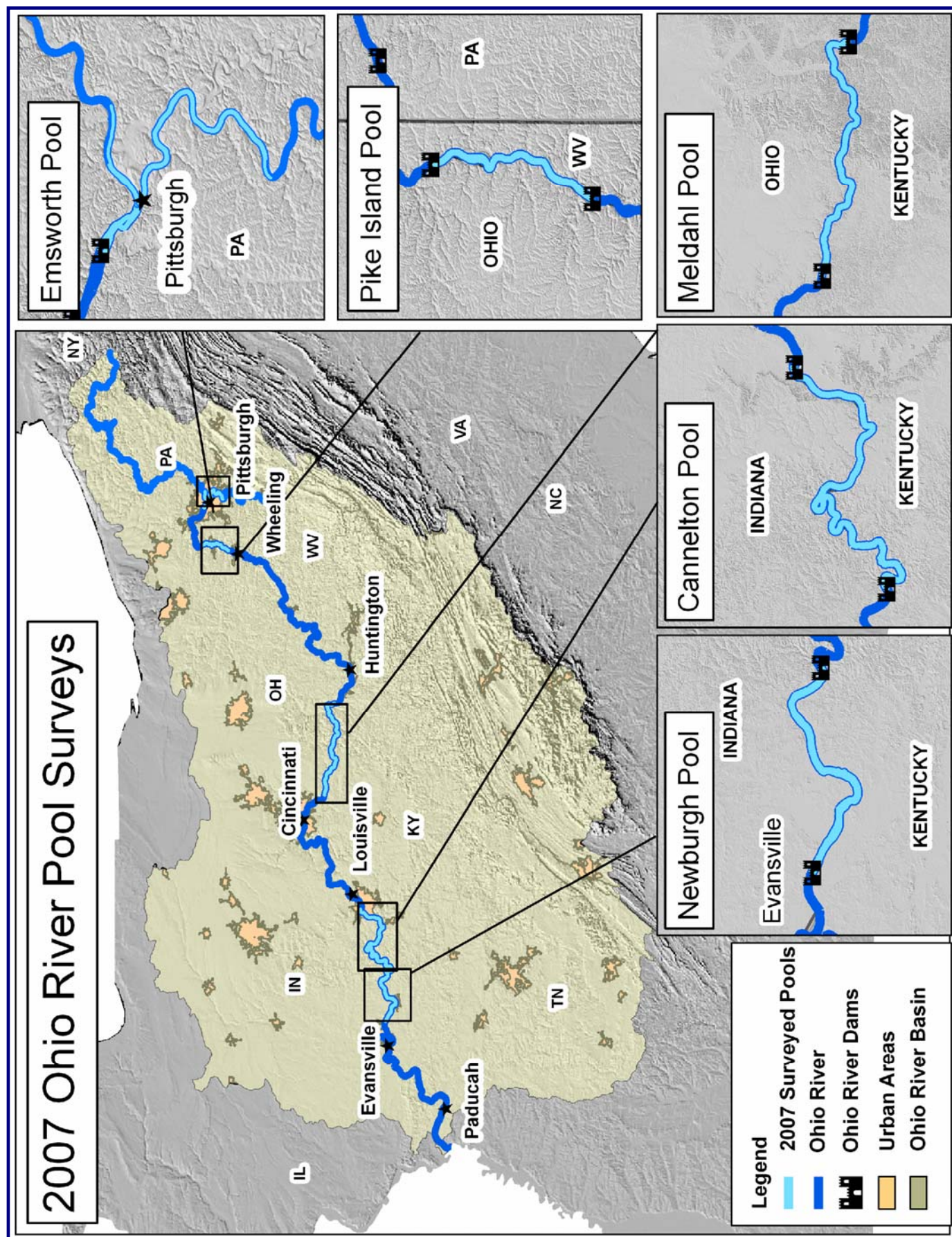


Figure 1. The Ohio River basin and the five pools selected for 2007 sampling.

2.2 Emsworth Pool

The Emsworth pool is 6.2 miles long, extending from Pittsburgh Point (ORM 0.0) to Emsworth Locks and Dam (ORM 6.2). The pool has a gradient drop of 0.0 feet per mile, averages 1,456 feet wide and 21 feet deep (ORSANCO 1994). The entirety of the pool lies in Pennsylvania. Emsworth pool extends upstream beyond the confluence of both the Allegheny (6.2 miles) and Monongahela rivers (11.2 miles) to the first dam respectively.

2.3. Emsworth Pool Land Use

This pool lies in a portion of the Ohio River where the immediate land use consists of residential and industrial development (9.2%), but the surrounding land use within the watershed is forested (68.9%) and agriculture (17.3%) (Figure 2).

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 Emsworth pool of the Ohio, Allegheny and Monongahela rivers to Ohio River mile 6.2 (Emsworth Locks and Dam). The total linear extent of the target population was approximately 47.2 miles. The sample frame was generated using RF3 river double lines for the Ohio River and river mile coverages provided by ORSANCO. A generalized

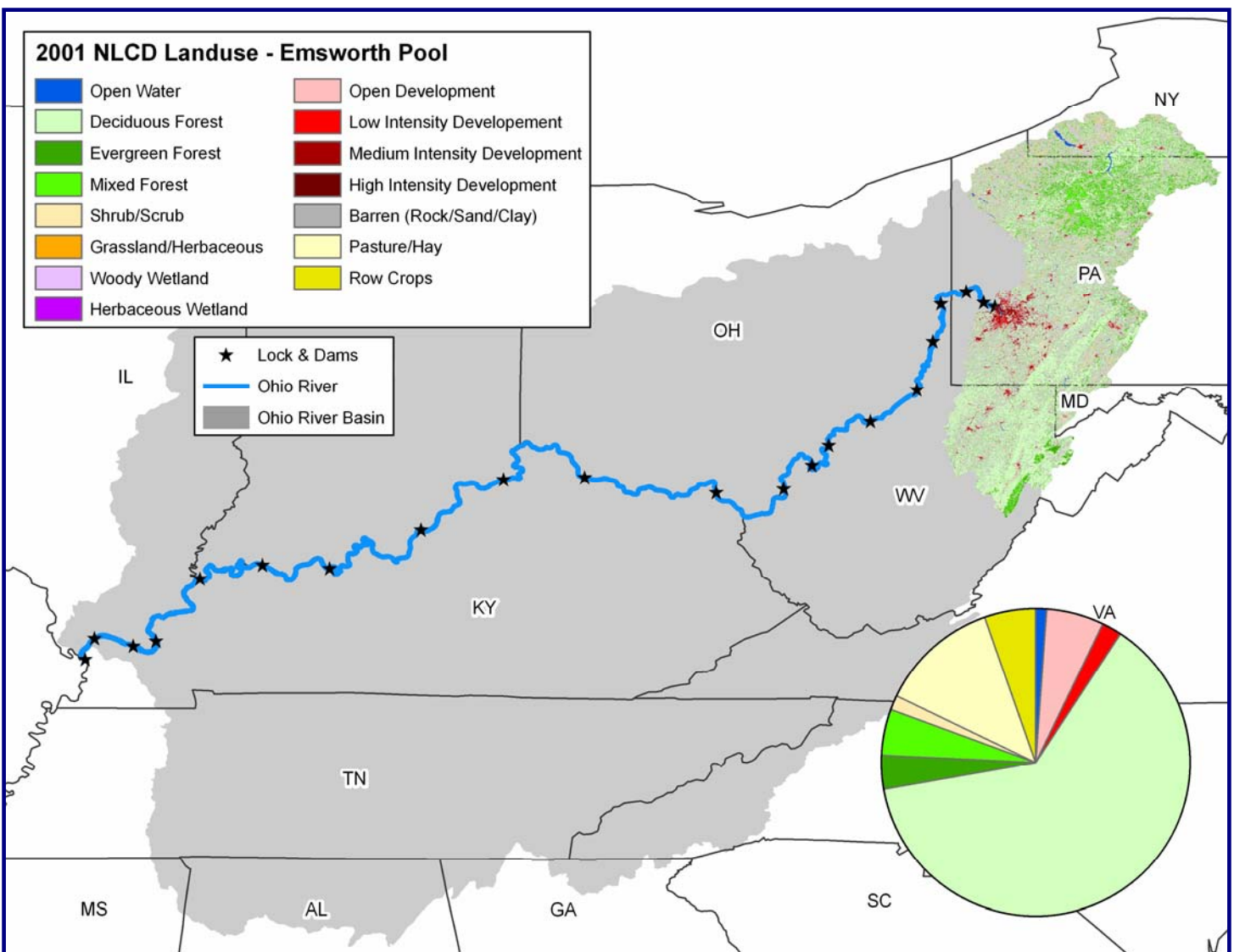


Figure 2. Land use within Emsworth pool catchment area.

random tessellation stratified (GRTS) survey design for a linear network with reverse hierarchical randomization (RHR) was used to select all sampling locations. This survey design provided coordinates for 15 sampling sites in each of the selected pools. The data collected from these sites were used to make an assessment of the pool (see Section 3.6 and Appendix A).

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 July 1 and October 31 when water levels were within one meter of “normal flat pool” and Secchi depths were greater than 12 inches. These sampling restrictions were used to reduce community variability by increasing the likelihood that samples were collected during the stable, low-flow conditions usually present on the Ohio River during the summer and early fall months.

3.3 Fish Collections

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

A sampling crew consisted of a three-person team working from an 18-foot aluminum johnboat. Each boat was equipped with a 5000-watt generator and a Smith-Root Type VI-A electrofishing unit. Sampling was conducted over a 500m long section of near-shore habitat (shoreline out to a maximum distance of 100 ft or a depth of 20 ft.) and was sampled for a minimum of 1800 seconds (Gammon 1998). Time could vary depending upon the complexity of the habitat within a given zone. Stunned fish were captured with nets and placed

into large, aerated tubs for processing. Each fish was measured, inspected for anomalies, and identified to lowest possible taxonomic level (species) before being returned to the water. Fish that could not be confidently identified in the field (e.g. minnows) were preserved in a ten percent formalin solution and identified in the laboratory.



ORSANCO crew conducting night-time electrofishing



Typical 500 meter electrofishing reach

3.4 Habitat Characterizations

Large rivers have distinct habitat types, including unique microhabitats (Reash 1999). Therefore, extensive habitat surveys were conducted for each electrofishing zone, including thorough substrate and depth measurements. Descriptions of the riparian corridor adjacent to the sampling zone and the presence of woody material available as fish cover were also recorded. Depth and substrate composition were measured at 66 points throughout each 500m zone. Six points along the shoreline were selected throughout the length of the zone, at 0, 100, 200, 300, 400 and 500m. From each of these points, depth was recorded at 10 ft intervals beginning at the shore/water interface and moving away from the shore for 100 ft. 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 (small substrates), and habitat class 'B' describes sites that fall between 'A' and 'C' with a mix of large and small substrate materials.

3.5 Water Quality and Flow Condition Data

Basic measures of water quality were collected at each site prior to sampling. The following parameters were measured with a YSI meter: water temperature, pH, dissolved oxygen (DO), and conductivity. Secchi depth was measured using a standard Secchi disk. Flow data were obtained from the U.S. Army Corps of Engineers. These included daily average flow volumes and velocities from the sampling station within or nearest to the sampled pool. Harmonic mean flow (HMF) values were determined by ORSANCO using 30-year means for the flow data obtained from the U.S. Army Corps of Engineers (ORSANCO 2003).

3.6 Pool Assessment

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

statistical distribution of data (ORFIn scores) gathered from 'least impacted' (reference) sites within each habitat class. The 25th percentile value for each habitat class was established as the criterion for determining whether an individual site 'passes' (meets its aquatic life use designation) or 'fails' (does not meet its aquatic life use designation, Figure 3).

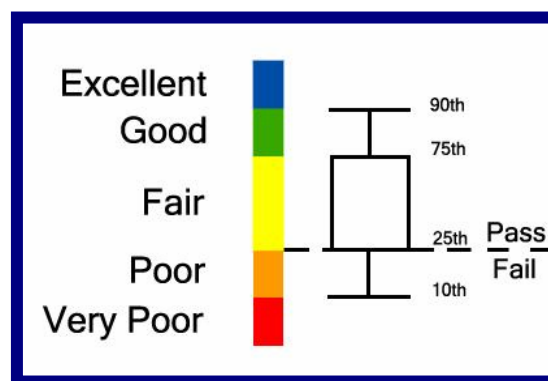


Figure 3. Approach used to assign site condition ratings.

Individual site scores were compared to expected values and the percentage of failing sites in the pool was then calculated. A precision estimate for the percentage of sites failing was also calculated (see Appendix A for a detailed explanation). The precision estimate was used to create a 90% confidence interval around the percentage of sites failing. The threshold for the pool assessment was set at 25% failure. The pool passed the assessment if the entire confidence interval fell below 25%. If the whole confidence interval was greater than 25%, the pool was assessed as failing. If the confidence interval overlapped the 25% threshold, the assessment required additional sampling to determine the result. To further characterize the condition of each pool, sites were given individual condition ratings. These ratings were based on the same distribution of data from 'least impacted' sites used to determine expectations and consisted of Excellent, Good, Fair, Poor and Very Poor. The 90th, 75th, 25th, and 10th percentiles were used as cutoff points for the different ratings. Any sites that were classified as Poor or Very Poor were also sites that failed to meet expectations (Figures 3 and 4).

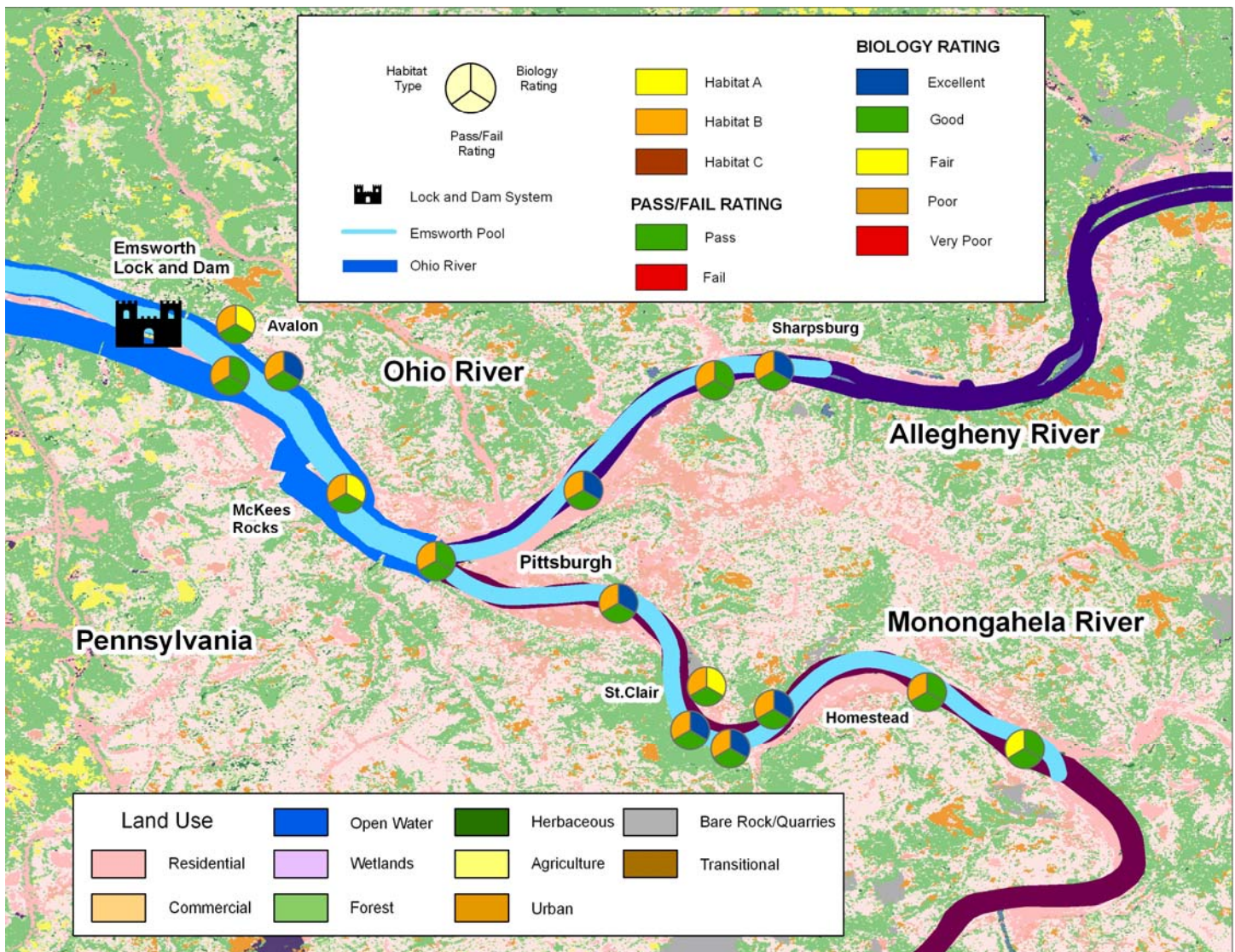


Figure 4. Locations and results of sampling at 15 sites within the Emsworth pool.

4.0 Results

4.1 Fish Population

In 2007, fish population data (Appendix B) were collected from 15 randomly selected locations throughout the length of the Emsworth pool (Table 1). These collections produced 42 species and 1 hybrid taxa, representing 11 different families (Table 2). Eight of the 42 species were listed in PA as either endangered, threatened, or of special concern. These included the silver chub (*Macrhybopsis storeriana*), river shiner (*Notropis blennius*), channel darter (*Percina copelandi*), smallmouth buffalo (*Ictiobus bubalus*), skipjack herring (*Alosa chrysochloris*), mooneye (*Hiodon*

tergisus), river redhorse (*Moxostoma carinatum*) and longnose gar (*Lepisosteus osseus*). No federally listed taxa were collected from the Emsworth pool. At the species level, the most abundant species were bluegill (*Lepomis macrochirus*), smallmouth bass (*Micropterus dolomieu*), and sauger (*Sander canadensis*), which comprised 14.5%, 12.9% and 10.8% of the catch respectively (Figure 5). The three dominant families were the sunfishes and black basses (Centrarchidae), perches and darters (Percidae), and suckers (Catostomidae) which comprised 33.7%, 18.9%, and 18.4% of the catch respectively (Figure 6).

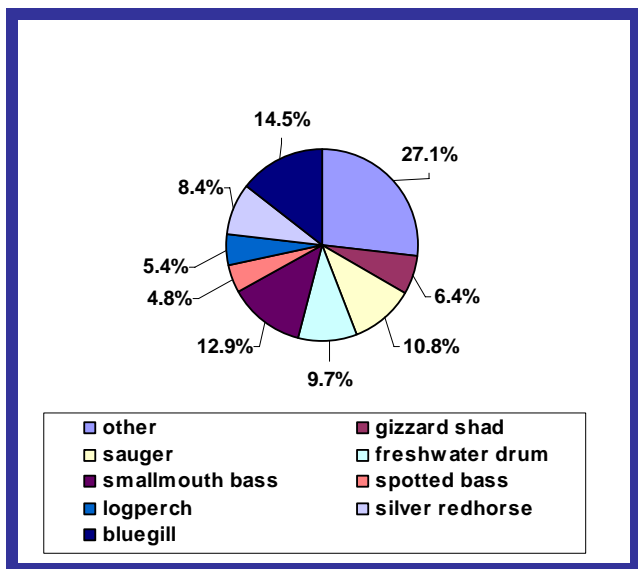


Figure 5. Species composition of fish sampled in the Emsworth pool.

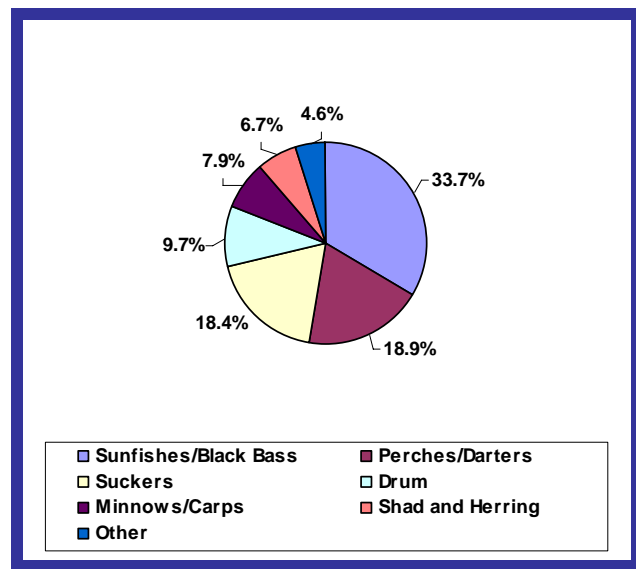


Figure 6. Sampled fish composition by family in the Emsworth pool.

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

River	Site #	River Mile	Bank	Date	Latitude	Longitude	Habitat Class	ORFIn Expectation	Observed ORFIn	Site Result	Rating
ALL	1	2.2	LDB	19-Sep-07	40.46007	79.97755	B	33	53	PASS	EXCELLENT
ALL	2	5.0	LDB	19-Sep-07	40.48827	79.94403	B	33	43	PASS	GOOD
ALL	3	5.7	LDB	19-Sep-07	40.49071	79.93171	B	33	55	PASS	EXCELLENT
MON	4	2.6	LDB	18-Sep-07	40.43119	79.96864	B	33	51	PASS	EXCELLENT
MON	5	4.5	RDB	18-Sep-07	40.40985	79.95130	B	33	39	PASS	FAIR
MON	6	4.8	RDB	18-Sep-07	40.40564	79.95028	B	33	53	PASS	EXCELLENT
MON	7	5.7	RDB	17-Sep-07	40.39817	79.93953	B	33	51	PASS	EXCELLENT
MON	8	6.3	RDB	17-Sep-07	40.40114	79.92939	B	33	51	PASS	EXCELLENT
MON	9	9.1	LDB	17-Sep-07	40.40836	79.88932	B	33	43	PASS	GOOD
MON	10	10.8	LDB	17-Sep-07	40.39380	79.86442	A	39	49	PASS	GOOD
OHIO	11	0.2	LDB	19-Sep-07	40.44190	80.01802	B	33	45	PASS	GOOD
OHIO	12	1.9	LDB	18-Sep-07	40.45927	80.03807	B	33	35	PASS	FAIR
OHIO	13	4.0	RDB	20-Sep-07	40.48638	80.05641	B	33	57	PASS	EXCELLENT
OHIO	14	4.3	LDB	20-Sep-07	40.48945	80.06071	B	33	45	PASS	GOOD
OHIO	15	5.1	RDB	20-Sep-07	40.49740	80.07104	B	33	41	PASS	FAIR

LDB = Left Descending Bank
RDB = Right Descending Bank

ALL = ALLEGHENY RIVER (river miles originate at confluence)
MON = MONONGAHELA RIVER (river miles originate at confluence)

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 26, with an average of 20.7 species per site. Eleven of the fifteen sites scored a 5 for the number of native species metric and the remaining scored a 3. The number of sucker species found at each site ranged from 3 to 7 and all of the sites scored either

3 or 5 for this metric. The number of centrarchid species varied from 3 to 8 and metric scores were mostly a 3. The number of great river species varied between 1 and 3 species per site. The number of intolerant species ranged from 4 to 9 and 6 sites scored a 5 and the remaining scored 3 for this metric. The percent of tolerant individuals ranged from 0% to 12.1%, and all but three sites scored a 3 or 5 for this metric. The percentage of simple lithophils was between 13.0% and 57.2%, and all but one site scored a 3 or 5 for this metric.

The percentage of non-native individuals ranged from 0% to 13.6% and most scored either a 3 or 5. The percent detritivores ranged from 1.3% to 16.5%, and all sites scored either 3 or 5. The percent invertivores ranged from 23.5% to 57.8%. The percent piscivores ranged from 26.8% to 48.7% and metric scores were either 3 or 5. Four of the

sites had at least one DELT (deformities, eroded fins, lesions and tumors) anomaly and all but 3 sites scored a 5. The CPUE (catch per unit effort) ranged from 66 to 448 individuals per site, and scores were mostly a 1 or 3, with one site scoring a 5 for the CPUE metric.

Table 2. Species collected in the Emsworth pool during the 2007 survey.

Family	Common Name	Latin Name	PA
Lepisosteidae	longnose gar	<i>Lepisosteus osseus</i>	SC
Hiodontidae	mooneye	<i>Hiodon tergisus</i>	T
Clupeidae	skipjack herring	<i>Alosa chrysochloris</i>	T
Clupeidae	gizzard shad	<i>Dorosoma cepedianum</i>	
Cyprinidae	common carp	<i>Cyprinus carpio</i>	
Cyprinidae	silver chub	<i>Macrhybopsis storeriana</i>	E
Cyprinidae	golden shiner	<i>Notemigonus chryssoleucas</i>	
Cyprinidae	emerald shiner	<i>Notropis atherinoides</i>	
Cyprinidae	river shiner	<i>Notropis blennius</i>	E
Cyprinidae	mimic shiner	<i>Notropis volucellus</i>	
Catostomidae	river carpsucker	<i>Carpionodes carpio</i>	
Catostomidae	quillback	<i>Carpionodes cyprinus</i>	
Catostomidae	northern hog sucker	<i>Hypentelium nigricans</i>	
Catostomidae	smallmouth buffalo	<i>Ictiobus bubalus</i>	T
Catostomidae	black buffalo	<i>Ictiobus niger</i>	
Catostomidae	silver redhorse	<i>Moxostoma anisurum</i>	
Catostomidae	smallmouth redhorse	<i>Moxostoma breviceps</i>	
Catostomidae	river redhorse	<i>Moxostoma carinatum</i>	SC
Catostomidae	black redhorse	<i>Moxostoma duquesnei</i>	
Catostomidae	golden redhorse	<i>Moxostoma erythrurum</i>	
Ictaluridae	channel catfish	<i>Ictalurus punctatus</i>	
Ictaluridae	flathead catfish	<i>Pylodictis olivaris</i>	
Esocidae	muskellunge	<i>Esox masquinongy</i>	
Moronidae	Morone sp	<i>Morone sp</i>	
Moronidae	white perch	<i>Morone americana</i>	
Moronidae	white bass	<i>Morone chrysops</i>	
Centrarchidae	rock bass	<i>Ambloplites rupestris</i>	
Centrarchidae	green sunfish	<i>Lepomis cyanellus</i>	
Centrarchidae	bluegill	<i>Lepomis macrochirus</i>	
Centrarchidae	smallmouth bass	<i>Micropterus dolomieu</i>	
Centrarchidae	spotted bass	<i>Micropterus punctulatus</i>	
Centrarchidae	largemouth bass	<i>Micropterus salmoides</i>	
Centrarchidae	white crappie	<i>Pomoxis annularis</i>	
Centrarchidae	black crappie	<i>Pomoxis nigromaculatus</i>	
Percidae	greenside darter	<i>Etheostoma blennioides</i>	
Percidae	fantail darter	<i>Etheostoma flabellare</i>	
Percidae	johnny darter	<i>Etheostoma nigrum</i>	
Percidae	logperch	<i>Percina caprodes</i>	
Percidae	channel darter	<i>Percina copelandi</i>	T
Percidae	sauger	<i>Sander canadensis</i>	
Percidae	walleye	<i>Sander vitreus</i>	
Percidae	saugeye	<i>Sander canadensis</i> x <i>S. vitreus</i>	
Sciaenidae	freshwater drum	<i>Aplodinotus grunniens</i>	

Table 3. ORFI metrics and scores from the 2007 Emsworth pool survey.

Site #	River	River Mile	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	ORFI Expectation	Observed ORFI	Site Result
1	A	2.2	L	188	180	177	18	3	6	5	3	3	1	1	7	5	1.1	5	52.2	5	1.7	5	1.7	5	51.1	3	40.6	5	0	5	185	3	33	53	PASS
2	A	5.0	L	130	115	110	22	5	6	5	4	3	2	3	5	3	4.3	3	40.0	3	4.3	3	15.7	3	23.5	1	48.7	5	1	5	125	1	33	43	PASS
3	A	5.7	L	156	144	141	23	5	6	5	5	3	1	1	6	5	2.1	5	52.1	5	2.1	5	8.3	5	38.9	3	45.8	5	0	5	153	3	33	55	PASS
4	M	2.6	L	128	118	118	21	5	7	5	3	3	1	1	5	3	0.0	5	55.9	5	0.0	5	6.8	5	31.4	3	41.5	5	0	5	128	1	33	51	PASS
5	M	4.5	R	140	127	120	20	5	5	3	5	3	2	3	5	3	5.5	3	40.2	3	4.7	3	16.5	3	37.0	3	26.8	3	2	3	133	1	33	39	PASS
6	M	4.8	R	223	208	202	22	5	7	5	3	3	2	3	5	3	2.9	5	57.2	5	2.9	5	10.6	3	35.1	3	41.3	5	0	5	217	3	33	53	PASS
7	M	5.7	R	212	171	167	22	5	6	5	3	3	2	3	5	3	2.3	5	48.0	5	2.3	5	13.5	3	33.3	3	33.3	3	0	5	208	3	33	51	PASS
8	M	6.3	R	165	155	150	24	5	4	3	5	3	3	3	6	5	3.2	5	45.2	5	3.2	5	12.3	3	37.4	3	34.8	3	0	5	160	3	33	51	PASS
9	M	9.1	L	171	147	137	21	5	5	3	4	3	2	3	5	3	6.8	1	34.0	3	5.4	3	7.5	5	38.1	3	43.5	5	2	3	161	3	33	43	PASS
10	M	10.8	L	149	132	122	24	5	7	5	6	5	2	3	8	5	7.6	1	25.8	3	2.3	5	3.8	5	43.9	3	44.7	5	3	3	139	1	39	49	PASS
11	O	0.2	L	78	72	71	17	3	3	3	3	3	2	3	6	5	1.4	5	27.8	3	1.4	5	13.9	3	26.4	1	45.8	5	0	5	77	1	33	45	PASS
12	O	1.9	L	75	66	57	13	3	3	3	3	3	1	1	5	3	12.1	1	22.7	3	13.6	1	12.1	3	30.3	3	48.5	5	0	5	66	1	33	35	PASS
13	O	4.0	R	455	453	446	26	5	6	5	8	5	2	3	9	5	1.5	5	13.0	1	0.9	5	1.3	5	57.8	5	28.3	3	0	5	448	5	33	57	PASS
14	O	4.3	L	230	181	173	21	5	6	5	4	3	1	1	5	3	3.9	3	35.9	3	4.4	3	9.9	5	34.3	3	30.4	3	0	5	222	3	33	45	PASS
15	O	5.1	R	118	100	99	16	3	4	3	3	3	1	1	4	3	1.0	5	36.0	3	1.0	5	12.0	3	32.0	3	36.0	3	0	5	117	1	33	41	PASS

A = Allegheny River

M = Monongahela River

O = Ohio River

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

4.3 Habitat Surveys

Intensive habitat surveys at each of the 15 sampling locations revealed that the bottom substrate in the Emsworth pool was mostly composed of gravel and sand, with a smaller percentage of cobble and fines (Figure 7).

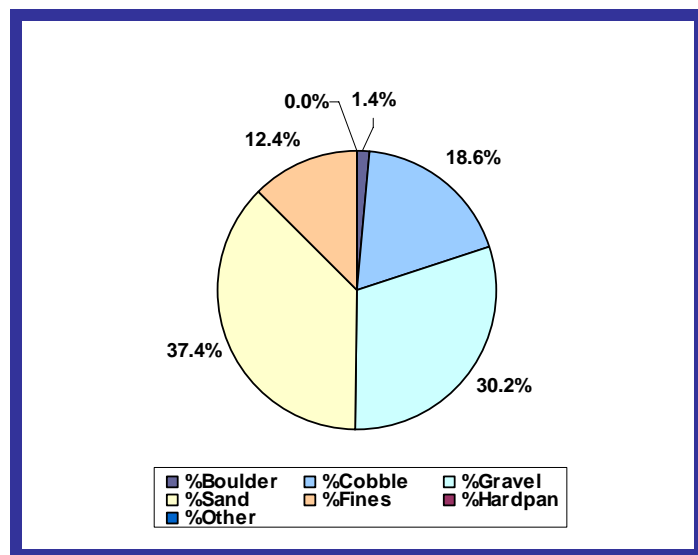


Figure 7. Substrate composition of the Emsworth pool.

However, there was some variation among the individual sites (Figure 8). The Emsworth pool was dominated by class 'B' habitats, which accounted for all but one of the samples. There were no class 'C' habitats sampled in the pool (Table 1). Woody cover was present in 14 of the sites sampled. Barges and/or mooring cells were present at 5 sites and were commonly observed throughout the pool. The riparian land use was primarily forest and industry (Additional data in Appendix C).

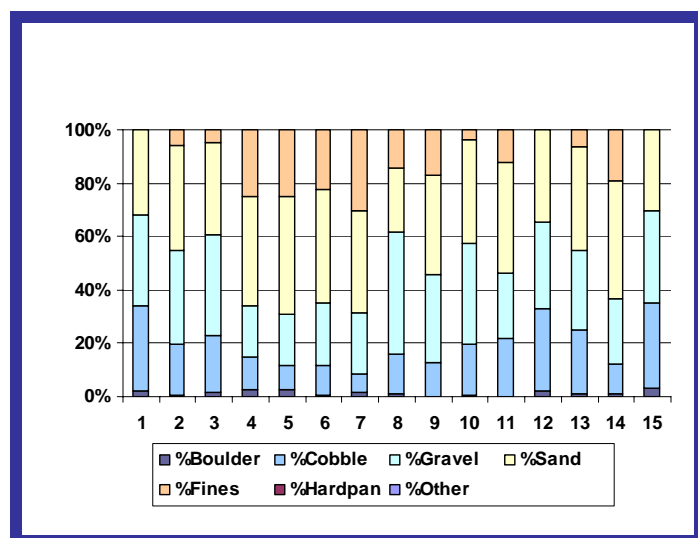


Figure 8. Substrate composition at each site sampled in the Emsworth pool.

4.4 Water Quality and Flow Conditions

Rain events were sparse throughout the sampling period in 2007 therefore river levels and flows were stable. Sampling was not conducted in Emsworth pool when flows were above the harmonic mean flow (HMF) for the pool. The HMF values used for this part of the river was 16.2 kcfs and sampling was conducted between 41.5% and 45.7% of the HMF (Figure 9). Measurements of water quality parameters did not reveal any unusual or poor water conditions present at the time of sampling (Appendix D). Secchi depths at the time of sampling ranged from 30 to 72 inches.

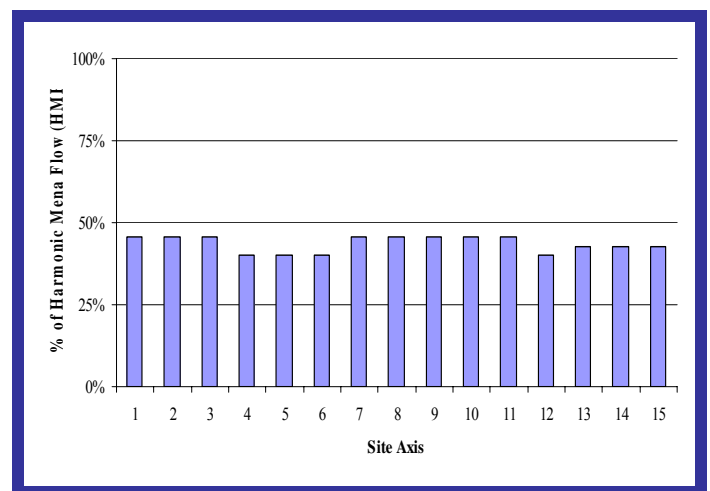


Figure 9. Relative flows (%HMF) at the time of sampling

4.5 Assessment of Condition

ORFIn scores were calculated for each of the sites sampled. Out of a possible 65, the maximum score achieved by any site in this pool was 57 and the minimum was 35. By comparing observed and expected ORFIn scores, ORSANCO assessed each site as either passing or failing (Table 3). All 15 sites sampled in 2007 scored higher than the minimum expected scores and received passing evaluations (Table 1). With 100% of the sites passing, the pool was assessed as supporting its aquatic life use designation (Figure 10). Seven sites received an excellent rating (47%), five sites were found to be in good condition (33%) and three were in fair (20%) condition (Figure 11).

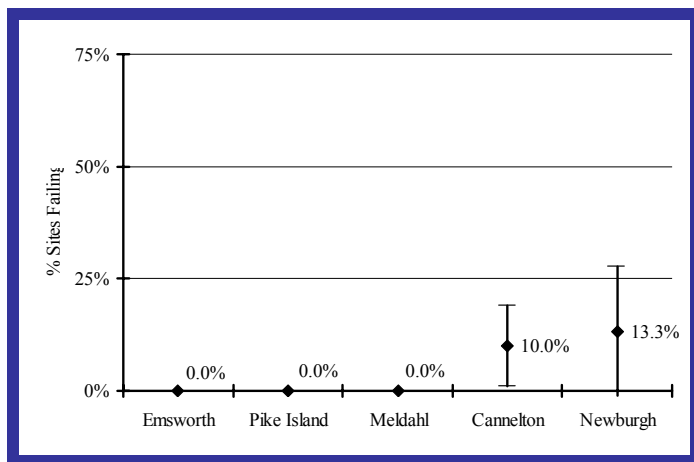


Figure 10. 2007 pool assessment results with 90% confidence intervals.

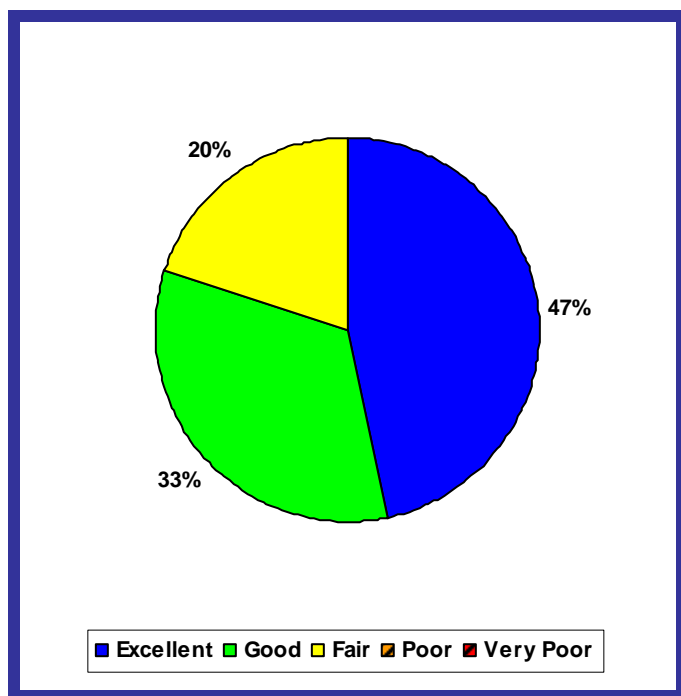


Figure 11. Condition of sites in the Emsworth pool based on ORFI scores at 15 sites (Pass=Excellent-Fair, Fail=Poor-Very Poor)

5.0 Discussion

5.1 Fish Population

According to the 2007 assessment, the fish population of Emsworth pool was in exceptional condition. The 42 species collected indicated a diverse community. Sunfishes and black basses (Centrarchidae) were the most common family. Bluegill and smallmouth bass were the two dominant species in the pool accounting for 27.4% of the total individuals collected. This was unexpected because forage fish (e.g. gizzard shad and minnows) typically outnumber other

species. In comparison to the other four pools surveyed in 2007, the centrarchid abundances were abnormally high. The presence of the two species indicated healthy populations in Emsworth pool. Furthermore, the abundance of sucker species was greater than expected. Typically, these species contribute a small fraction.

One noteworthy fish included a walleye of considerable size. This fish measured approximately 29" and weighed 2.9 kg (~6.5 lbs). A second walleye of similar size was also collected while sampling for ORSANCO's mobile aquarium which was temporarily on display in Pittsburgh.

Several species listed as threatened or endangered in PA were collected from the pool in moderate abundances. River shiners (*Notropis blennioides*) and silver chubs (*Macrhybopsis storeriana*) were considered endangered and collections yielded 1 and 26 individuals respectively. Three species of threatened status were collected. There were 97, 20, and 8 individuals of smallmouth buffalo (*Ictiobus bubalus*), mooneye (*Hiodon tergisus*), and skipjack herring (*Alosa chrysochloris*), respectively. Based on PA's list of imperiled species, the Ohio River proper and the lower portions of the Allegheny and Monongahela rivers provided suitable conditions for these species.

The presence of white perch (*Morone americana*) in the pool may be cause for concern. This is an invasive species that may threaten some of the species native to the Ohio River. It is known to feed on the eggs of other fish such as walleye. Only five individuals were collected in the 2007 surveys of Emsworth pool. Future monitoring will reveal if the white perch is increasing in numbers and threatening native species.

5.2 Metric Performance

Most of the metric scores for the sites assessed in Emsworth pool were good, with one exception. The pool scored low for the # of great river species metric across all sites. The upstream location and the comparatively small size of Emsworth pool may be responsible for lower metric scores. The highest scoring metrics were the % of non-native individuals, % piscivores, # of native species, # of sucker species, and # of DELT anomalies. These metrics indicated good overall health.

5.3 Habitat Surveys

The habitat assessments showed that most areas of Emsworth pool were classified as class ‘B’ habitats. The relatively heterogeneous substrate composition provided adequate habitat to support the diversity and populations of fishes in the pool.

5.4 Water Quality and Flow Conditions

The minor fluctuations in river levels did not affect the survey of Emsworth pool. Rain events were sparse throughout the field season therefore sampling was conducted during low flows. Furthermore, all Secchi depths indicated sufficient visibility for sampling. There were no water quality measurements that exceeded their respective criteria or provided any major insight into the assessment results for Emsworth pool.

5.5 Conclusions and Assessments of Condition

The data collected in 2007 indicated that the Emsworth pool met its aquatic life use designation and was in outstanding condition. All sites were in passing condition, with only three sites rated below good condition. Species diversity was high, with intolerant species

occurring commonly. The assessment of Emsworth pool met the criteria established by ORSANCO biologists (Appendix A) and was therefore accepted as complete. No further monitoring of Emsworth pool is required at this time.

6.0 Interpool Comparisons

6.1 Purpose

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

6.2 Land Use

Emsworth pool is the uppermost portion of the Ohio River and therefore has the smallest catchment area of any other pool. Despite the urbanization immediately surrounding the pool (Pittsburgh), the primary land use within the watershed is deciduous forest. A large portion of the pool’s basin drains forested areas of the Appalachian Mountains. Agricultural practices are secondary land uses but occur in less proportion than in pools near the mouth of the Ohio River (Figure 12).

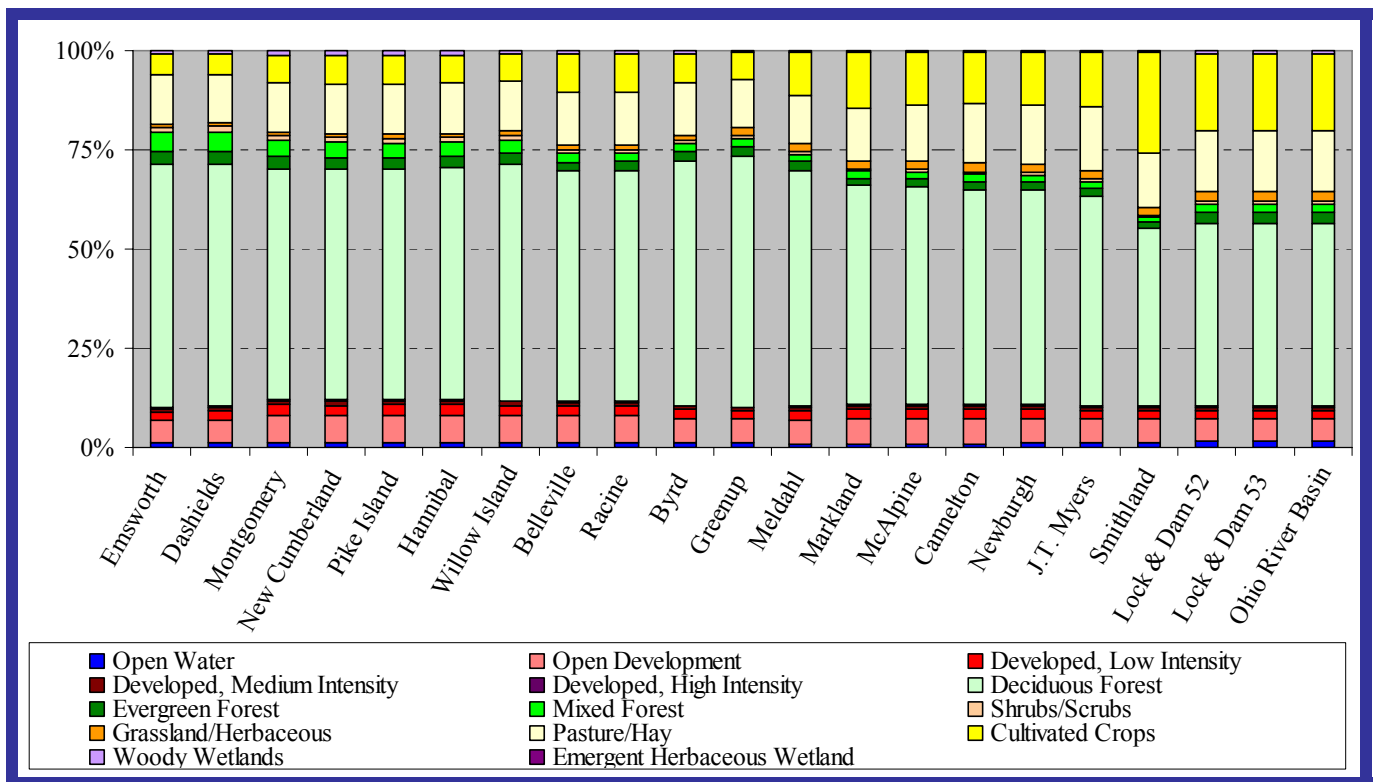


Figure 12. Land use within the catchment area of each pool of the Ohio River.

6.3 Substrate Composition

Similar to most other pools, Emsworth pool was dominated by gravel and sand substrates. However, this pool had the least proportion of smaller substrates (i.e. fines and sand: Figure 13). This could be attributed to the relatively small percentage of agricultural influences within the watershed and the majority of the catchment area draining from the Appalachian Mountains.

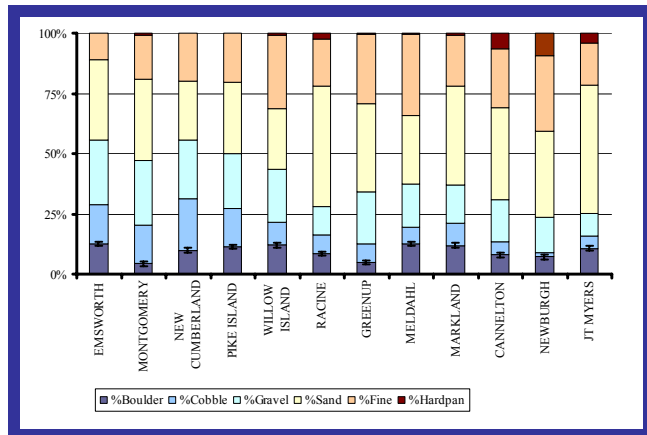


Figure 13. Substrate composition for each pool surveyed as of 2007.

6.4 Species Richness

Emsworth pool was similar to other surveyed pools in the average number of native species per site (20.7) and ranked 4th in comparison (Figure 14).

6.5 Number of Individuals

An average of 157.9 individuals (excluding gizzard shad and emerald shiners) was collected at each site in Emsworth pool (Figure 15) and it ranked 7th in comparison.

6.6 Noteworthy Fish Observations

Muskellunge was the only species unique to Emsworth pool. However, several other species were collected that were absent in many other pools such as the golden shiner, johnny darter, and white perch. Furthermore, several species occurred in Emsworth in greater abundances than other pools such as: black redhorse, river redhorse, silver redhorse, and spotted bass. The

two most abundant fishes (i.e. bluegill and smallmouth bass) were also collected in considerably higher proportions than in other pools (Table 4).

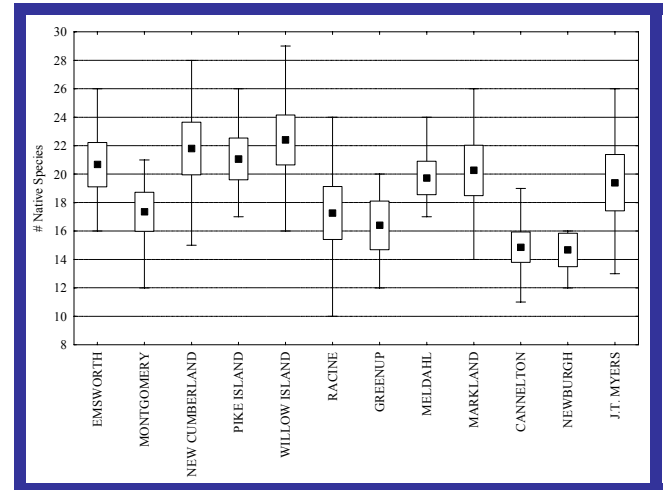


Figure 14. The average number of native species collected at each site within each pool surveyed as of 2007 (■=Average, □= 90% Confidence Interval, I=Non-Outlier Range).

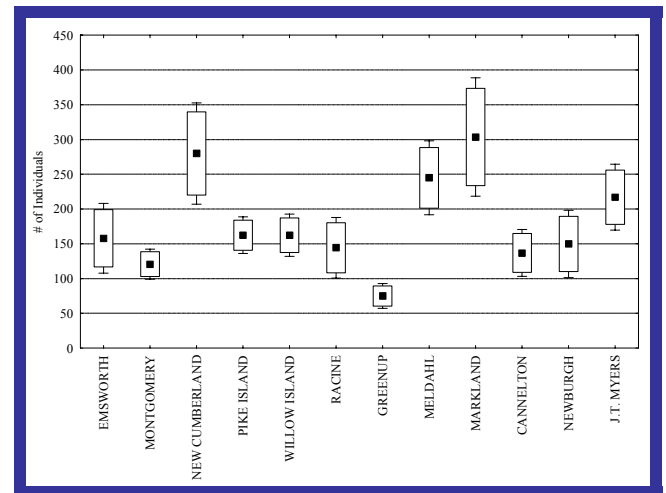


Figure 15. The average number of individuals (excluding gizzard shad & emerald shiner) collected at each site within each pool surveyed as of 2007 (■=Average, □= 90% Confidence Interval, I=Non-Outlier Range).

6.7 ORFIn Deviation

The ORFIn deviation is a measure of how well the pool performed in regard to expected ORFIn values. Positive values indicate that scores were greater than expected. Emsworth pool had an average deviation of 14.0 and was among the

highest of those pools surveyed as of 2007 (Figure 16). In comparison to other pools, the fish community was in outstanding condition.

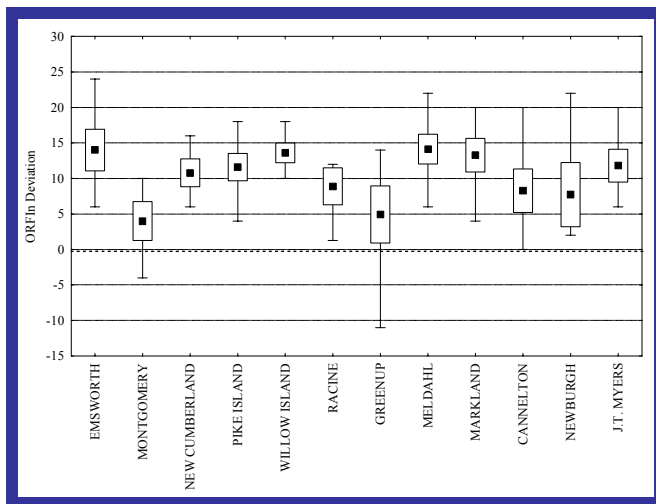


Figure 16. The average ORFI deviation of each site within pools surveyed as of 2007 (■=Average, □= 90% Confidence Interval, I=Non-Outlier Range).

6.8 Assessment of Condition

All sites in Emsworth pool were in passing condition. The nearest surveyed pool to Emsworth was Montgomery pool and, in 2006, it was assessed as being in marginally passing condition (Figure 17).

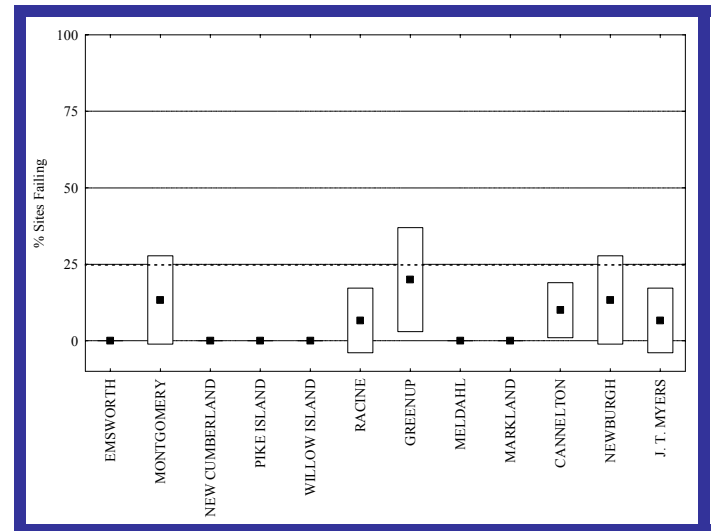


Figure 17. The percentage of sites (including +/- precision) failing in each pool surveyed as of 2007 (■=Average, □=90% Confidence Interval).

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

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
1	Silver Lamprey							1					
2	Paddlefish											1	
3	Spotted Gar											1	
4	Longnose Gar	13	10	11	43	46	24	23	22	15	48	20	
5	Shortnose Gar											9	2
6	Goldeye											12	
7	Mooneye	20	6	22	37		1		48	12	8	10	4
8	Skipjack Herring	8		3	6		1		64	145	174	70	249
9	Gizzard Shad	167	266	1202	7326	216	8048	267	2408	1743	3527	600	444
10	Threadfin Shad										1	9	112
11	Central Stoneroller			4		1				1			
12	Goldfish			1									
13	Grass Carp			1								1	
14	Spotfin Shiner		1	21	14	24	63	2	32	2	63	8	12

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

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
15	Common Carp	63	44	25	15	22	9	9	8	20	5	4	10
16	Gravel Chub								1				
17	Miss. Silvery Minnow												1
18	Silver Carp											2	
19	Bighead Carp											2	
20	Striped Shiner						2						
21	Silver Chub	26	12	20	11	57	44	33	90	171	130	126	206
22	River Chub			1	1								
23	Golden Shiner	1		1									
24	Emerald Shiner	82	8	342	197	728	795	50	637	303	1331	166	801
25	River Shiner	1							54	8	276	3	91
26	Spottail Shiner			6	2								
27	Mimic Shiner	35	13	76	162	306	402	61	7	5	195	6	43
28	Bluntnose Minnow			2	2	120	3	1	1		2		
29	Fathead Minnow						6						
30	Bullhead Minnow					4	5		23	2			8
31	Creek Chub			1					3				
32	Ictiobinae Sp			20									
33	Carpoides Sp				14		2		1		2		
34	River Carpsucker	18	13	46	36	18	50	49	87	47	122	179	86
35	Quillback	17	30	80	27	66	16	17	31	137	21	34	57
36	Highfin Carpsucker		37	3	10	1	7	4		2	1	12	3
37	Northern Hog Sucker	3	3	132	4	15				14	1	1	
38	Smallmouth Buffalo	97	217	283	94	60	96	49	123	150	147	72	314
39	Bigmouth Buffalo						1					3	7
40	Black Buffalo	1			5	2		1		2	1	7	3
41	Spotted Sucker					1	1	5	1		1		
42	Moxostoma Sp			58									
43	Silver Redhorse	221	157	63	78	51	11	12	25	19	3		
44	Smallmouth Redhorse	61	110	110	28	168	5	30	62	31	12	3	11
45	River Redhorse	39	3	5	27	2		6	1	1		1	
46	Black Redhorse	18		11		4				1	1		
47	Golden Redhorse	7	227	90	66	277	11	39	120	105	4	14	
48	Brown Bullhead							1					
49	Blue Catfish												1
50	Channel Catfish	32	34	123	40	61	70	58	89	247	48	11	330
51	Flathead Catfish	14	11	15	35	21	32	32	49	38	63	11	43
52	Muskellunge	1											
53	Trout-Perch						3						
54	Banded Killifish					1							
55	Brook Silverside						1			1	1	1	1

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

#	Species	Emsworth 07	Montgomery 06	New Cumberland 05	Pike Island 07	Willow Island 06	Racine 05	Greenup 06	Meldahl 07	Markland 05	Cannelton (30) 06-07	Newburgh 07	Myers 05
56	Morone Sp	27	6	568	419	17	561	2	152	250	625	403	253
57	White Perch	5		4		3				5			
58	White Bass	9	36	6	2	58	3	64	18	22	66	4	17
59	Striped Bass					1					6		12
60	Hybrid Striper		4	17		1	46			40	6		11
61	Rock Bass	16	8	5	1	3							1
62	Lepomis Hybrid		1			9							
63	Lepomis Sp					16	1				1		1
64	Green Sunfish	12	2	4	2	4	6	4	3	10	2	4	10
65	Pumpkinseed		2			18							
66	Warmouth					1			1	1			1
67	Orangespotted Sunfish			1		2	1		1	1			2
68	Bluegill	379	216	53	46	232	58	112	207	245	103	11	31
69	Longear Sunfish					23	3	14	35	53	39	3	11
70	Redear Sunfish		4		1	1	1	1		2	16		1
71	Bluegill X Green Sunfish				1						1		
72	Longear X Green Sunfish												1
73	Smallmouth Bass	339	185	262	208	61	6	7	4	28	7	1	4
74	Spotted Bass	125	15	79	74	62	22	43	90	123	53	49	104
75	Largemouth Bass	4	8	8	16	16	22	65	16	56	37	2	70
76	White Crappie	5						4		1	1	1	
77	Black Crappie	3	6	2	2		3			2	3		
78	Greenside Darter	5	2	11	5					1			
79	Rainbow Darter		4	1		2				8			12
80	Fantail Darter	3	1						1				
81	Johnny Darter	1				2							
82	Banded Darter		1	4						1			1
83	Yellow Perch		4	2									
84	Logperch	141	67	244	85	108	6	12	20	60	39	4	3
85	Channel Darter	16	1	9		3		20					1
86	Slenderhead Darter									5			5
87	Dusky Darter												3
88	River Darter				2	1	2	1	6	4	11		4
89	Sauger	283	243	180	244	341	173	220	1174	664	1314	747	484
90	Walleye	44	11	31	70	1	4	1	3	1		7	
91	Saugeye	2		5	4		4			17			7
92	Freshwater Drum	254	47	1468	496	120	375	121	1000	1778	435	378	612
	Total # of Taxa	43	42	53	43	51	46	38	41	51	46	44	50
	Total # of Individuals	2618	2076	5742	9958	3378	11006	1441	6718	6600	8953	3013	4501

Literature Cited

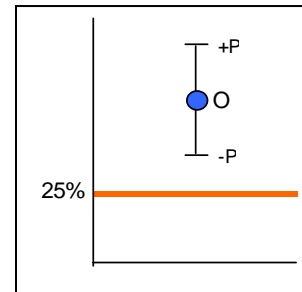
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Appendix A: Assessment Unit Criteria Details

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

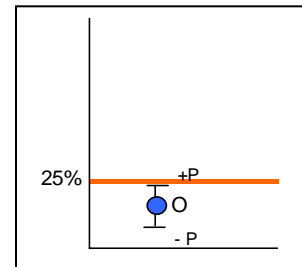
Situation ‘A’

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



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

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

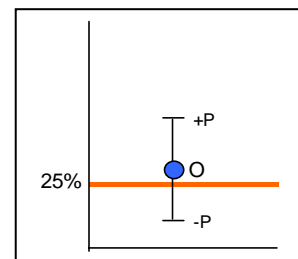


Situation ‘B’

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

Situation ‘C’

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



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

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

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

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

Appendix B. Fish survey data from the Emsworth pool.

Site #	River	River Mile	Bank	Date	Common Name	Latin Name	Count
1	Allegheny	2.2	LDB	19-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	1
1	Allegheny	2.2	LDB	19-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	7
1	Allegheny	2.2	LDB	19-Sep-07	common carp	<i>Cyprinus carpio</i>	2
1	Allegheny	2.2	LDB	19-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	1
1	Allegheny	2.2	LDB	19-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	1
1	Allegheny	2.2	LDB	19-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	8
1	Allegheny	2.2	LDB	19-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	6
1	Allegheny	2.2	LDB	19-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	5
1	Allegheny	2.2	LDB	19-Sep-07	black redhorse	<i>Moxostoma duquesnei</i>	4
1	Allegheny	2.2	LDB	19-Sep-07	golden redhorse	<i>Moxostoma erythrurum</i>	3
1	Allegheny	2.2	LDB	19-Sep-07	bluegill	<i>Lepomis macrochirus</i>	6
1	Allegheny	2.2	LDB	19-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	55
1	Allegheny	2.2	LDB	19-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	6
1	Allegheny	2.2	LDB	19-Sep-07	greenside darter	<i>Etheostoma blennioides</i>	2
1	Allegheny	2.2	LDB	19-Sep-07	fantail darter	<i>Etheostoma flabellare</i>	1
1	Allegheny	2.2	LDB	19-Sep-07	logperch	<i>Percina caprodes</i>	53
1	Allegheny	2.2	LDB	19-Sep-07	channel darter	<i>Percina copelandi</i>	4
1	Allegheny	2.2	LDB	19-Sep-07	sauger	<i>Sander canadensis</i>	10
1	Allegheny	2.2	LDB	19-Sep-07	saugeye	<i>Sander canadensis</i> x <i>S. vitreus</i>	1
1	Allegheny	2.2	LDB	19-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	12
2	Allegheny	5	LDB	19-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	1
2	Allegheny	5	LDB	19-Sep-07	mooneye	<i>Hiodon tergisus</i>	1
2	Allegheny	5	LDB	19-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	8
2	Allegheny	5	LDB	19-Sep-07	common carp	<i>Cyprinus carpio</i>	5
2	Allegheny	5	LDB	19-Sep-07	silver chub	<i>Macrhybopsis storeriana</i>	1
2	Allegheny	5	LDB	19-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	7
2	Allegheny	5	LDB	19-Sep-07	mimic shiner	<i>Notropis volucellus</i>	2
2	Allegheny	5	LDB	19-Sep-07	river carpsucker	<i>Carpionodes carpio</i>	2
2	Allegheny	5	LDB	19-Sep-07	quillback	<i>Carpionodes cyprinus</i>	6
2	Allegheny	5	LDB	19-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	5
2	Allegheny	5	LDB	19-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	18
2	Allegheny	5	LDB	19-Sep-07	black redhorse	<i>Moxostoma duquesnei</i>	2
2	Allegheny	5	LDB	19-Sep-07	golden redhorse	<i>Moxostoma erythrurum</i>	1
2	Allegheny	5	LDB	19-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	2
2	Allegheny	5	LDB	19-Sep-07	white bass	<i>Morone chrysops</i>	3
2	Allegheny	5	LDB	19-Sep-07	rock bass	<i>Ambloplites rupestris</i>	4
2	Allegheny	5	LDB	19-Sep-07	bluegill	<i>Lepomis macrochirus</i>	1
2	Allegheny	5	LDB	19-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	23
2	Allegheny	5	LDB	19-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	4
2	Allegheny	5	LDB	19-Sep-07	logperch	<i>Percina caprodes</i>	2
2	Allegheny	5	LDB	19-Sep-07	sauger	<i>Sander canadensis</i>	16
2	Allegheny	5	LDB	19-Sep-07	walleye	<i>Sander vitreus</i>	5
2	Allegheny	5	LDB	19-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	11
3	Allegheny	5.7	LDB	19-Sep-07	mooneye	<i>Hiodon tergisus</i>	1

Site #	River	River Mile	Bank	Date	Common Name	Latin Name	Count
3	Allegheny	5.7	LDB	19-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	10
3	Allegheny	5.7	LDB	19-Sep-07	common carp	<i>Cyprinus carpio</i>	3
3	Allegheny	5.7	LDB	19-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	2
3	Allegheny	5.7	LDB	19-Sep-07	mimic shiner	<i>Notropis volucellus</i>	2
3	Allegheny	5.7	LDB	19-Sep-07	river carpsucker	<i>Carpiodes carpio</i>	1
3	Allegheny	5.7	LDB	19-Sep-07	quillback	<i>Carpiodes cyprinus</i>	3
3	Allegheny	5.7	LDB	19-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	5
3	Allegheny	5.7	LDB	19-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	38
3	Allegheny	5.7	LDB	19-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
3	Allegheny	5.7	LDB	19-Sep-07	black redhorse	<i>Moxostoma duquesnei</i>	6
3	Allegheny	5.7	LDB	19-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	1
3	Allegheny	5.7	LDB	19-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	1
3	Allegheny	5.7	LDB	19-Sep-07	morone sp	<i>Morone sp</i>	2
3	Allegheny	5.7	LDB	19-Sep-07	white bass	<i>Morone chrysops</i>	3
3	Allegheny	5.7	LDB	19-Sep-07	rock bass	<i>Ambloplites rupestris</i>	1
3	Allegheny	5.7	LDB	19-Sep-07	bluegill	<i>Lepomis macrochirus</i>	3
3	Allegheny	5.7	LDB	19-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	32
3	Allegheny	5.7	LDB	19-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	1
3	Allegheny	5.7	LDB	19-Sep-07	white crappie	<i>Pomoxis annularis</i>	3
3	Allegheny	5.7	LDB	19-Sep-07	logperch	<i>Percina caprodes</i>	5
3	Allegheny	5.7	LDB	19-Sep-07	sauger	<i>Sander canadensis</i>	20
3	Allegheny	5.7	LDB	19-Sep-07	walleye	<i>Sander vitreus</i>	3
3	Allegheny	5.7	LDB	19-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	8
4	Monongahela	2.6	LDB	18-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	1
4	Monongahela	2.6	LDB	18-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	5
4	Monongahela	2.6	LDB	18-Sep-07	silver chub	<i>Macrhybopsis storeriana</i>	5
4	Monongahela	2.6	LDB	18-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	5
4	Monongahela	2.6	LDB	18-Sep-07	river carpsucker	<i>Carpiodes carpio</i>	2
4	Monongahela	2.6	LDB	18-Sep-07	quillback	<i>Carpiodes cyprinus</i>	3
4	Monongahela	2.6	LDB	18-Sep-07	northern hog sucker	<i>Hypentelium nigricans</i>	1
4	Monongahela	2.6	LDB	18-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	3
4	Monongahela	2.6	LDB	18-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	16
4	Monongahela	2.6	LDB	18-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
4	Monongahela	2.6	LDB	18-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	2
4	Monongahela	2.6	LDB	18-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	1
4	Monongahela	2.6	LDB	18-Sep-07	morone sp	<i>Morone sp</i>	3
4	Monongahela	2.6	LDB	18-Sep-07	white perch	<i>Morone americana</i>	1
4	Monongahela	2.6	LDB	18-Sep-07	bluegill	<i>Lepomis macrochirus</i>	5
4	Monongahela	2.6	LDB	18-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	5
4	Monongahela	2.6	LDB	18-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	6
4	Monongahela	2.6	LDB	18-Sep-07	logperch	<i>Percina caprodes</i>	6
4	Monongahela	2.6	LDB	18-Sep-07	sauger	<i>Sander canadensis</i>	32
4	Monongahela	2.6	LDB	18-Sep-07	walleye	<i>Sander vitreus</i>	2
4	Monongahela	2.6	LDB	18-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	22
5	Monongahela	4.5	RDB	18-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	1

Site #	River	River Mile	Bank	Date	Common Name	Latin Name	Count
5	Monongahela	4.5	RDB	18-Sep-07	mooneye	<i>Hiodon tergisus</i>	1
5	Monongahela	4.5	RDB	18-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	13
5	Monongahela	4.5	RDB	18-Sep-07	common carp	<i>Cyprinus carpio</i>	6
5	Monongahela	4.5	RDB	18-Sep-07	silver chub	<i>Macrhybopsis storeriana</i>	5
5	Monongahela	4.5	RDB	18-Sep-07	golden shiner	<i>Notemigonus chrysoleucas</i>	1
5	Monongahela	4.5	RDB	18-Sep-07	quillback	<i>Carpodes cyprinus</i>	1
5	Monongahela	4.5	RDB	18-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	14
5	Monongahela	4.5	RDB	18-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	19
5	Monongahela	4.5	RDB	18-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	3
5	Monongahela	4.5	RDB	18-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	1
5	Monongahela	4.5	RDB	18-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	8
5	Monongahela	4.5	RDB	18-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	1
5	Monongahela	4.5	RDB	18-Sep-07	bluegill	<i>Lepomis macrochirus</i>	13
5	Monongahela	4.5	RDB	18-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	11
5	Monongahela	4.5	RDB	18-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	4
5	Monongahela	4.5	RDB	18-Sep-07	largemouth bass	<i>Micropterus salmoides</i>	1
5	Monongahela	4.5	RDB	18-Sep-07	black crappie	<i>Pomoxis nigromaculatus</i>	1
5	Monongahela	4.5	RDB	18-Sep-07	logperch	<i>Percina caprodes</i>	6
5	Monongahela	4.5	RDB	18-Sep-07	sauger	<i>Sander canadensis</i>	16
5	Monongahela	4.5	RDB	18-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	14
6	Monongahela	4.8	RDB	18-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	2
6	Monongahela	4.8	RDB	18-Sep-07	skipjack herring	<i>Alosa chrysochloris</i>	3
6	Monongahela	4.8	RDB	18-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	6
6	Monongahela	4.8	RDB	18-Sep-07	common carp	<i>Cyprinus carpio</i>	6
6	Monongahela	4.8	RDB	18-Sep-07	silver chub	<i>Macrhybopsis storeriana</i>	2
6	Monongahela	4.8	RDB	18-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	9
6	Monongahela	4.8	RDB	18-Sep-07	river carpsucker	<i>Carpodes carpio</i>	3
6	Monongahela	4.8	RDB	18-Sep-07	quillback	<i>Carpodes cyprinus</i>	2
6	Monongahela	4.8	RDB	18-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	11
6	Monongahela	4.8	RDB	18-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	38
6	Monongahela	4.8	RDB	18-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	7
6	Monongahela	4.8	RDB	18-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	6
6	Monongahela	4.8	RDB	18-Sep-07	black redhorse	<i>Moxostoma duquesnei</i>	2
6	Monongahela	4.8	RDB	18-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	2
6	Monongahela	4.8	RDB	18-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	1
6	Monongahela	4.8	RDB	18-Sep-07	morone sp	<i>Morone sp</i>	5
6	Monongahela	4.8	RDB	18-Sep-07	bluegill	<i>Lepomis macrochirus</i>	11
6	Monongahela	4.8	RDB	18-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	14
6	Monongahela	4.8	RDB	18-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	7
6	Monongahela	4.8	RDB	18-Sep-07	logperch	<i>Percina caprodes</i>	7
6	Monongahela	4.8	RDB	18-Sep-07	sauger	<i>Sander canadensis</i>	39
6	Monongahela	4.8	RDB	18-Sep-07	walleye	<i>Sander vitreus</i>	18
6	Monongahela	4.8	RDB	18-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	22
7	Monongahela	5.7	RDB	17-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	3
7	Monongahela	5.7	RDB	17-Sep-07	skipjack herring	<i>Alosa chrysochloris</i>	2

Site #	River	River Mile	Bank	Date	Common Name	Latin Name	Count
7	Monongahela	5.7	RDB	17-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	24
7	Monongahela	5.7	RDB	17-Sep-07	common carp	<i>Cyprinus carpio</i>	4
7	Monongahela	5.7	RDB	17-Sep-07	silver chub	<i>Macrhybopsis storeriana</i>	8
7	Monongahela	5.7	RDB	17-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	17
7	Monongahela	5.7	RDB	17-Sep-07	mimic shiner	<i>Notropis volucellus</i>	3
7	Monongahela	5.7	RDB	17-Sep-07	river carpsucker	<i>Carpiodes carpio</i>	8
7	Monongahela	5.7	RDB	17-Sep-07	quillback	<i>Carpiodes cyprinus</i>	1
7	Monongahela	5.7	RDB	17-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	10
7	Monongahela	5.7	RDB	17-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	28
7	Monongahela	5.7	RDB	17-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
7	Monongahela	5.7	RDB	17-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	1
7	Monongahela	5.7	RDB	17-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	2
7	Monongahela	5.7	RDB	17-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	1
7	Monongahela	5.7	RDB	17-Sep-07	morone sp	<i>Morone sp</i>	5
7	Monongahela	5.7	RDB	17-Sep-07	bluegill	<i>Lepomis macrochirus</i>	13
7	Monongahela	5.7	RDB	17-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	3
7	Monongahela	5.7	RDB	17-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	4
7	Monongahela	5.7	RDB	17-Sep-07	logperch	<i>Percina caprodes</i>	2
7	Monongahela	5.7	RDB	17-Sep-07	sauger	<i>Sander canadensis</i>	39
7	Monongahela	5.7	RDB	17-Sep-07	walleye	<i>Sander vitreus</i>	2
7	Monongahela	5.7	RDB	17-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	30
8	Monongahela	6.3	RDB	17-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	1
8	Monongahela	6.3	RDB	17-Sep-07	mooneye	<i>Hiodon tergisus</i>	4
8	Monongahela	6.3	RDB	17-Sep-07	skipjack herring	<i>Alosa chrysochloris</i>	1
8	Monongahela	6.3	RDB	17-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	3
8	Monongahela	6.3	RDB	17-Sep-07	common carp	<i>Cyprinus carpio</i>	5
8	Monongahela	6.3	RDB	17-Sep-07	silver chub	<i>Macrhybopsis storeriana</i>	3
8	Monongahela	6.3	RDB	17-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	7
8	Monongahela	6.3	RDB	17-Sep-07	mimic shiner	<i>Notropis volucellus</i>	3
8	Monongahela	6.3	RDB	17-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	14
8	Monongahela	6.3	RDB	17-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	25
8	Monongahela	6.3	RDB	17-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	4
8	Monongahela	6.3	RDB	17-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	4
8	Monongahela	6.3	RDB	17-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	5
8	Monongahela	6.3	RDB	17-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	3
8	Monongahela	6.3	RDB	17-Sep-07	white bass	<i>Morone chrysops</i>	1
8	Monongahela	6.3	RDB	17-Sep-07	rock bass	<i>Ambloplites rupestris</i>	1
8	Monongahela	6.3	RDB	17-Sep-07	bluegill	<i>Lepomis macrochirus</i>	12
8	Monongahela	6.3	RDB	17-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	18
8	Monongahela	6.3	RDB	17-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	5
8	Monongahela	6.3	RDB	17-Sep-07	white crappie	<i>Pomoxis annularis</i>	1
8	Monongahela	6.3	RDB	17-Sep-07	johnny darter	<i>Etheostoma nigrum</i>	1
8	Monongahela	6.3	RDB	17-Sep-07	logperch	<i>Percina caprodes</i>	6
8	Monongahela	6.3	RDB	17-Sep-07	sauger	<i>Sander canadensis</i>	22
8	Monongahela	6.3	RDB	17-Sep-07	walleye	<i>Sander vitreus</i>	2

Site #	River	River Mile	Bank	Date	Common Name	Latin Name	Count
8	Monongahela	6.3	RDB	17-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	14
9	Monongahela	9.1	LDB	17-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	4
9	Monongahela	9.1	LDB	17-Sep-07	common carp	<i>Cyprinus carpio</i>	8
9	Monongahela	9.1	LDB	17-Sep-07	silver chub	<i>Macrhybopsis storeriana</i>	2
9	Monongahela	9.1	LDB	17-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	20
9	Monongahela	9.1	LDB	17-Sep-07	river shiner	<i>Notropis blennioides</i>	1
9	Monongahela	9.1	LDB	17-Sep-07	mimic shiner	<i>Notropis volucellus</i>	23
9	Monongahela	9.1	LDB	17-Sep-07	river carpsucker	<i>Carpionodes carpio</i>	1
9	Monongahela	9.1	LDB	17-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	2
9	Monongahela	9.1	LDB	17-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	6
9	Monongahela	9.1	LDB	17-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	3
9	Monongahela	9.1	LDB	17-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	1
9	Monongahela	9.1	LDB	17-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	2
9	Monongahela	9.1	LDB	17-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	1
9	Monongahela	9.1	LDB	17-Sep-07	morone sp	<i>Morone sp</i>	5
9	Monongahela	9.1	LDB	17-Sep-07	green sunfish	<i>Lepomis cyanellus</i>	2
9	Monongahela	9.1	LDB	17-Sep-07	bluegill	<i>Lepomis macrochirus</i>	13
9	Monongahela	9.1	LDB	17-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	13
9	Monongahela	9.1	LDB	17-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	15
9	Monongahela	9.1	LDB	17-Sep-07	logperch	<i>Percina caprodes</i>	7
9	Monongahela	9.1	LDB	17-Sep-07	sauger	<i>Sander canadensis</i>	26
9	Monongahela	9.1	LDB	17-Sep-07	walleye	<i>Sander vitreus</i>	4
9	Monongahela	9.1	LDB	17-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	12
10	Monongahela	10.8	LDB	17-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	skipjack herring	<i>Alosa chrysochloris</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	8
10	Monongahela	10.8	LDB	17-Sep-07	common carp	<i>Cyprinus carpio</i>	3
10	Monongahela	10.8	LDB	17-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	9
10	Monongahela	10.8	LDB	17-Sep-07	mimic shiner	<i>Notropis volucellus</i>	2
10	Monongahela	10.8	LDB	17-Sep-07	northern hog sucker	<i>Hypentelium nigricans</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	black buffalo	<i>Ictiobus niger</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	black redhorse	<i>Moxostoma duquesnei</i>	3
10	Monongahela	10.8	LDB	17-Sep-07	golden redhorse	<i>Moxostoma erythrurum</i>	3
10	Monongahela	10.8	LDB	17-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	rock bass	<i>Ambloplites rupestris</i>	1
10	Monongahela	10.8	LDB	17-Sep-07	green sunfish	<i>Lepomis cyanellus</i>	7
10	Monongahela	10.8	LDB	17-Sep-07	bluegill	<i>Lepomis macrochirus</i>	25
10	Monongahela	10.8	LDB	17-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	34
10	Monongahela	10.8	LDB	17-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	15
10	Monongahela	10.8	LDB	17-Sep-07	largemouth bass	<i>Micropterus salmoides</i>	2
10	Monongahela	10.8	LDB	17-Sep-07	greenside darter	<i>Etheostoma blennioides</i>	2
10	Monongahela	10.8	LDB	17-Sep-07	logperch	<i>Percina caprodes</i>	17

Site #	River	River Mile	Bank	Date	Common Name	Latin Name	Count
10	Monongahela	10.8	LDB	17-Sep-07	channel darter	<i>Percina copelandi</i>	3
10	Monongahela	10.8	LDB	17-Sep-07	sauger	<i>Sander canadensis</i>	5
10	Monongahela	10.8	LDB	17-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	2
11	Ohio	0.2	LDB	19-Sep-07	mooneye	<i>Hiodon tergisus</i>	1
11	Ohio	0.2	LDB	19-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	5
11	Ohio	0.2	LDB	19-Sep-07	common carp	<i>Cyprinus carpio</i>	1
11	Ohio	0.2	LDB	19-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	1
11	Ohio	0.2	LDB	19-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	9
11	Ohio	0.2	LDB	19-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	6
11	Ohio	0.2	LDB	19-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	2
11	Ohio	0.2	LDB	19-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	1
11	Ohio	0.2	LDB	19-Sep-07	morone sp	<i>Morone sp</i>	6
11	Ohio	0.2	LDB	19-Sep-07	white perch	<i>Morone americana</i>	2
11	Ohio	0.2	LDB	19-Sep-07	white bass	<i>Morone chrysops</i>	2
11	Ohio	0.2	LDB	19-Sep-07	bluegill	<i>Lepomis macrochirus</i>	5
11	Ohio	0.2	LDB	19-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	16
11	Ohio	0.2	LDB	19-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	4
11	Ohio	0.2	LDB	19-Sep-07	logperch	<i>Percina caprodes</i>	3
11	Ohio	0.2	LDB	19-Sep-07	channel darter	<i>Percina copelandi</i>	3
11	Ohio	0.2	LDB	19-Sep-07	sauger	<i>Sander canadensis</i>	5
11	Ohio	0.2	LDB	19-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	6
12	Ohio	1.9	LDB	18-Sep-07	mooneye	<i>Hiodon tergisus</i>	2
12	Ohio	1.9	LDB	18-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	7
12	Ohio	1.9	LDB	18-Sep-07	common carp	<i>Cyprinus carpio</i>	8
12	Ohio	1.9	LDB	18-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	2
12	Ohio	1.9	LDB	18-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	2
12	Ohio	1.9	LDB	18-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	3
12	Ohio	1.9	LDB	18-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	2
12	Ohio	1.9	LDB	18-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	1
12	Ohio	1.9	LDB	18-Sep-07	bluegill	<i>Lepomis macrochirus</i>	11
12	Ohio	1.9	LDB	18-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	19
12	Ohio	1.9	LDB	18-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	9
12	Ohio	1.9	LDB	18-Sep-07	logperch	<i>Percina caprodes</i>	2
12	Ohio	1.9	LDB	18-Sep-07	walleye	<i>Sander vitreus</i>	3
12	Ohio	1.9	LDB	18-Sep-07	saugeye	<i>Sander canadensis</i> x <i>S. vitreus</i>	1
12	Ohio	1.9	LDB	18-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	3
13	Ohio	4	RDB	20-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	1
13	Ohio	4	RDB	20-Sep-07	mooneye	<i>Hiodon tergisus</i>	3
13	Ohio	4	RDB	20-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	2
13	Ohio	4	RDB	20-Sep-07	common carp	<i>Cyprinus carpio</i>	4
13	Ohio	4	RDB	20-Sep-07	northern hog sucker	<i>Hypentelium nigricans</i>	1
13	Ohio	4	RDB	20-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	2
13	Ohio	4	RDB	20-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	4
13	Ohio	4	RDB	20-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	4
13	Ohio	4	RDB	20-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	6

Site #	River	River Mile	Bank	Date	Common Name	Latin Name	Count
13	Ohio	4	RDB	20-Sep-07	black redhorse	<i>Moxostoma duquesnei</i>	1
13	Ohio	4	RDB	20-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	2
13	Ohio	4	RDB	20-Sep-07	morone sp	<i>Morone sp</i>	1
13	Ohio	4	RDB	20-Sep-07	rock bass	<i>Ambloplites rupestris</i>	9
13	Ohio	4	RDB	20-Sep-07	green sunfish	<i>Lepomis cyanellus</i>	3
13	Ohio	4	RDB	20-Sep-07	bluegill	<i>Lepomis macrochirus</i>	221
13	Ohio	4	RDB	20-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	61
13	Ohio	4	RDB	20-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	34
13	Ohio	4	RDB	20-Sep-07	largemouth bass	<i>Micropterus salmoides</i>	1
13	Ohio	4	RDB	20-Sep-07	white crappie	<i>Pomoxis annularis</i>	1
13	Ohio	4	RDB	20-Sep-07	black crappie	<i>Pomoxis nigromaculatus</i>	1
13	Ohio	4	RDB	20-Sep-07	greenside darter	<i>Etheostoma blennioides</i>	1
13	Ohio	4	RDB	20-Sep-07	fantail darter	<i>Etheostoma flabellare</i>	2
13	Ohio	4	RDB	20-Sep-07	logperch	<i>Percina caprodes</i>	16
13	Ohio	4	RDB	20-Sep-07	channel darter	<i>Percina copelandi</i>	6
13	Ohio	4	RDB	20-Sep-07	sauger	<i>Sander canadensis</i>	17
13	Ohio	4	RDB	20-Sep-07	walleye	<i>Sander vitreus</i>	1
13	Ohio	4	RDB	20-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	50
14	Ohio	4.3	LDB	20-Sep-07	longnose gar	<i>Lepisosteus osseus</i>	1
14	Ohio	4.3	LDB	20-Sep-07	mooneye	<i>Hiodon tergisus</i>	7
14	Ohio	4.3	LDB	20-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	48
14	Ohio	4.3	LDB	20-Sep-07	common carp	<i>Cyprinus carpio</i>	7
14	Ohio	4.3	LDB	20-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	1
14	Ohio	4.3	LDB	20-Sep-07	river carpsucker	<i>Carpiodes carpio</i>	1
14	Ohio	4.3	LDB	20-Sep-07	quillback	<i>Carpiodes cyprinus</i>	1
14	Ohio	4.3	LDB	20-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	9
14	Ohio	4.3	LDB	20-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	16
14	Ohio	4.3	LDB	20-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	5
14	Ohio	4.3	LDB	20-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	4
14	Ohio	4.3	LDB	20-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	3
14	Ohio	4.3	LDB	20-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	2
14	Ohio	4.3	LDB	20-Sep-07	muskellunge	<i>Esox masquinongy</i>	1
14	Ohio	4.3	LDB	20-Sep-07	white perch	<i>Morone americana</i>	2
14	Ohio	4.3	LDB	20-Sep-07	bluegill	<i>Lepomis macrochirus</i>	29
14	Ohio	4.3	LDB	20-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	17
14	Ohio	4.3	LDB	20-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	9
14	Ohio	4.3	LDB	20-Sep-07	black crappie	<i>Pomoxis nigromaculatus</i>	1
14	Ohio	4.3	LDB	20-Sep-07	logperch	<i>Percina caprodes</i>	8
14	Ohio	4.3	LDB	20-Sep-07	sauger	<i>Sander canadensis</i>	22
14	Ohio	4.3	LDB	20-Sep-07	walleye	<i>Sander vitreus</i>	3
14	Ohio	4.3	LDB	20-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	33
15	Ohio	5.1	RDB	20-Sep-07	skipjack herring	<i>Alosa chrysochloris</i>	1
15	Ohio	5.1	RDB	20-Sep-07	gizzard shad	<i>Dorosoma cepedianum</i>	17
15	Ohio	5.1	RDB	20-Sep-07	common carp	<i>Cyprinus carpio</i>	1
15	Ohio	5.1	RDB	20-Sep-07	emerald shiner	<i>Notropis atherinoides</i>	1

Site #	River	River Mile	Bank	Date	Common Name	Latin Name	Count
15	Ohio	5.1	RDB	20-Sep-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	11
15	Ohio	5.1	RDB	20-Sep-07	silver redhorse	<i>Moxostoma anisurum</i>	2
15	Ohio	5.1	RDB	20-Sep-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	13
15	Ohio	5.1	RDB	20-Sep-07	river redhorse	<i>Moxostoma carinatum</i>	5
15	Ohio	5.1	RDB	20-Sep-07	channel catfish	<i>Ictalurus punctatus</i>	4
15	Ohio	5.1	RDB	20-Sep-07	flathead catfish	<i>Pylodictis olivaris</i>	1
15	Ohio	5.1	RDB	20-Sep-07	bluegill	<i>Lepomis macrochirus</i>	11
15	Ohio	5.1	RDB	20-Sep-07	smallmouth bass	<i>Micropterus dolomieu</i>	18
15	Ohio	5.1	RDB	20-Sep-07	spotted bass	<i>Micropterus punctulatus</i>	2
15	Ohio	5.1	RDB	20-Sep-07	logperch	<i>Percina caprodes</i>	1
15	Ohio	5.1	RDB	20-Sep-07	sauger	<i>Sander canadensis</i>	14
15	Ohio	5.1	RDB	20-Sep-07	walleye	<i>Sander vitreus</i>	1
15	Ohio	5.1	RDB	20-Sep-07	freshwater drum	<i>Aplodinotus grunniens</i>	15

Appendix C. Habitat survey data from the Emsworth pool.

Site #	River Mile	Bank	River	% Boulder	% Cobble	% Gravel	% Sand	% Fine	% Hardpan	Depth	% Submerged Vegetation	% Woody Cover	% Overhanging Vegetation	Land Use	Human Influence	Bank Profile	Bank Erosion
1	2.2	LDB	ALL	2.3	31.3	33.6	31.3	0.0	1.6	14.3	0	2.3	17.0	I, NF	none	steep	intact
2	5	LDB	ALL	0.7	19.1	34.8	39.7	5.7	0.0	6.5	0	1.2	27.0	NF, I, A	wall	steep	intact
3	5.7	LDB	ALL	1.4	21.7	37.8	34.3	4.9	0.0	6.4	0	0.7	22.5	I, NF	wall	sloped	intact
4	2.6	LDB	MON	2.7	12.2	18.9	41.2	25.0	0.0	5.5	0	8.6	45.0	R, NF	moorings, wall	gradual	intact
5	4.5	RDB	MON	2.6	9.4	18.8	44.4	24.8	0.0	6.7	0	4.0	8.8	I, NF, A	moorings, boats, docks	steep	intact
6	4.8	RDB	MON	0.7	11.2	23.1	42.7	22.4	0.0	4.4	0	1.3	6.3	NF, I, R	none	sloped	intact
7	5.7	RDB	MON	1.4	7.0	23.1	38.5	30.1	0.0	4.4	0	1.5	15.0	NF	none	steep	intact
8	6.3	RDB	MON	0.8	15.2	45.6	24.0	14.4	0.0	6.7	0	4.9	13.3	NF	wall	steep	intact
9	9.1	LDB	MON	0.0	12.6	33.3	37.1	17.0	0.0	8.8	0	6.6	55.0	NF, I	wall	steep	intact
10	10.8	RDB	MON	0.7	18.8	36.8	38.2	3.5	2.1	8.2	0	0.0	0.0	I, NF	barges, ramp, wall	steep	intact
11	0.2	LDB	Ohio	0.0	20.7	23.0	39.1	11.5	5.7	14.2	0	0.0	0.0	I, NF	barges, wall	steep	intact
12	1.9	LDB	Ohio	2.0	31.1	32.4	34.5	0.0	0.0	14.5	0	0.0	5.0	NF	none	steep	intact
13	4	RDB	Ohio	0.8	24.0	29.8	38.8	6.6	0.0	11.8	0	0.0	29.0	NF	moorings	cliff	intact
14	4.3	RDB	Ohio	0.9	11.4	24.6	43.9	19.3	0.0	12.3	0	2.6	33.0	NF	wall	steep	intact
15	5.1	RDB	Ohio	3.2	31.8	34.4	30.6	0.0	0.0	13.8	0	0.0	5.0	NF	none	cliff	intact

I = Industry, NF = Natural Forest, R = Residential lawns, A = Agriculture (Listed in order of prevalence)

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

River	Site #	River Mile	Bank	pH	Temp (C)	Dissolved Oxygen (mg/L)	Conductivity	Secchi (in)
Allegheny	1	2.2	LDB	6.4	23.47	9.00	365	60
Allegheny	2	5.0	LDB	6.4	23.47	9.00	365	42
Allegheny	3	5.7	LDB	7.6	22.71	8.00	367	36
Monongahela	4	2.6	LDB	7.9	22.65	8.85	444	36
Monongahela	5	4.5	RDB	7.7	22.66	9.02	465	48
Monongahela	6	4.8	RDB	6.7	22.41	9.00	464	36
Monongahela	7	5.7	RDB	6.7	22.41	9.00	464	30
Monongahela	8	6.3	RDB	7.1	22.74	8.90	463	48
Monongahela	9	9.1	LDB	7.6	23.06	8.79	462	42
Monongahela	10	10.8	LDB	7.6	22.99	8.71	580	48
Ohio	11	0.2	LDB	8.1	23.37	10.55	439	60
Ohio	12	1.9	LDB	8.0	22.82	9.36	387	72
Ohio	13	4.0	RDB	8.0	23.00	9.25	520	54
Ohio	14	4.3	LDB	5.2	23.09	9.00	440	54
Ohio	15	5.1	RDB	7.5	22.97	8.00	441	36