



A Biological Study of the Meldahl 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 was 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 Meldahl pool met these criteria, with 100% of sites passing. Therefore, the Meldahl pool will be 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 Meldahl 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 Meldahl 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).

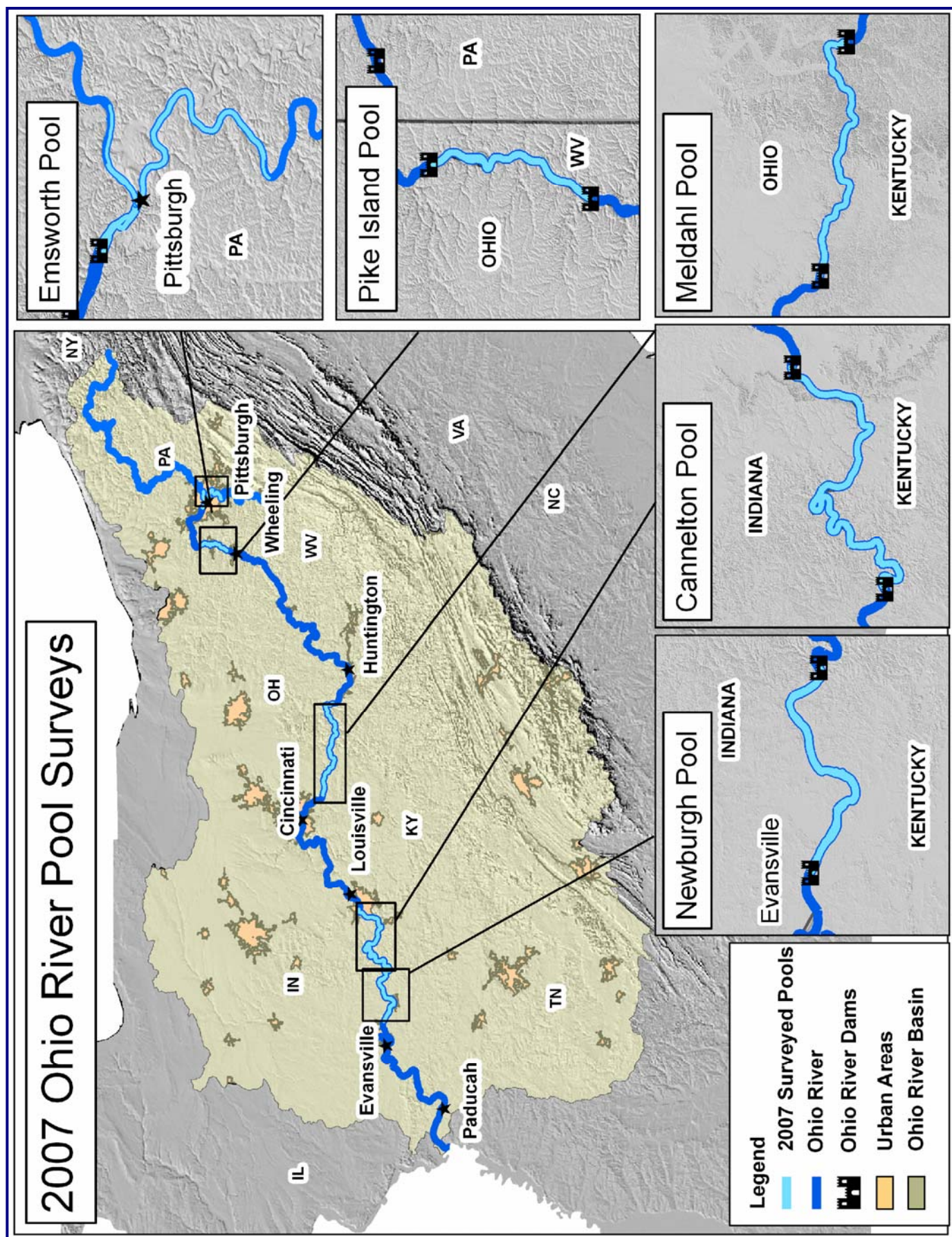


Figure 1. The Ohio River basin and the five pools selected for 2007 sampling

2.2 Meldahl Pool

The Meldahl pool is 95.2 miles long, extending from Greenup Locks and Dam (ORM 341.0) to Meldahl Locks and Dam (ORM 436.2). The pool has a gradient of 0.3 feet per mile, averages 1,603 feet wide and 23 feet deep. The pool flows adjacent to the states of Ohio and Kentucky. The Meldahl pool receives water from eight sub-basins: the Scioto and Little Scioto rivers, Pine, Tygarts, Kinniconick, Ohio Brush, Eagle, and White Oak creeks (ORSANCO 1994).

2.3 Meldahl Pool Land Use

This pool lies in a portion of the Ohio River where the land use consists primarily of deciduous forest (59.3%), but is also impacted by row crops (10.8%) and pasture lands (12.1%) (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 Meldahl pool of the Ohio River from mile marker 341.0 (Greenup Locks and Dam) to 436.2 (Meldahl Locks and Dam). The total linear extent of the target population was approximately 190.4 miles. The sample frame was generated using RF3 river double lines for the Ohio River and river mile

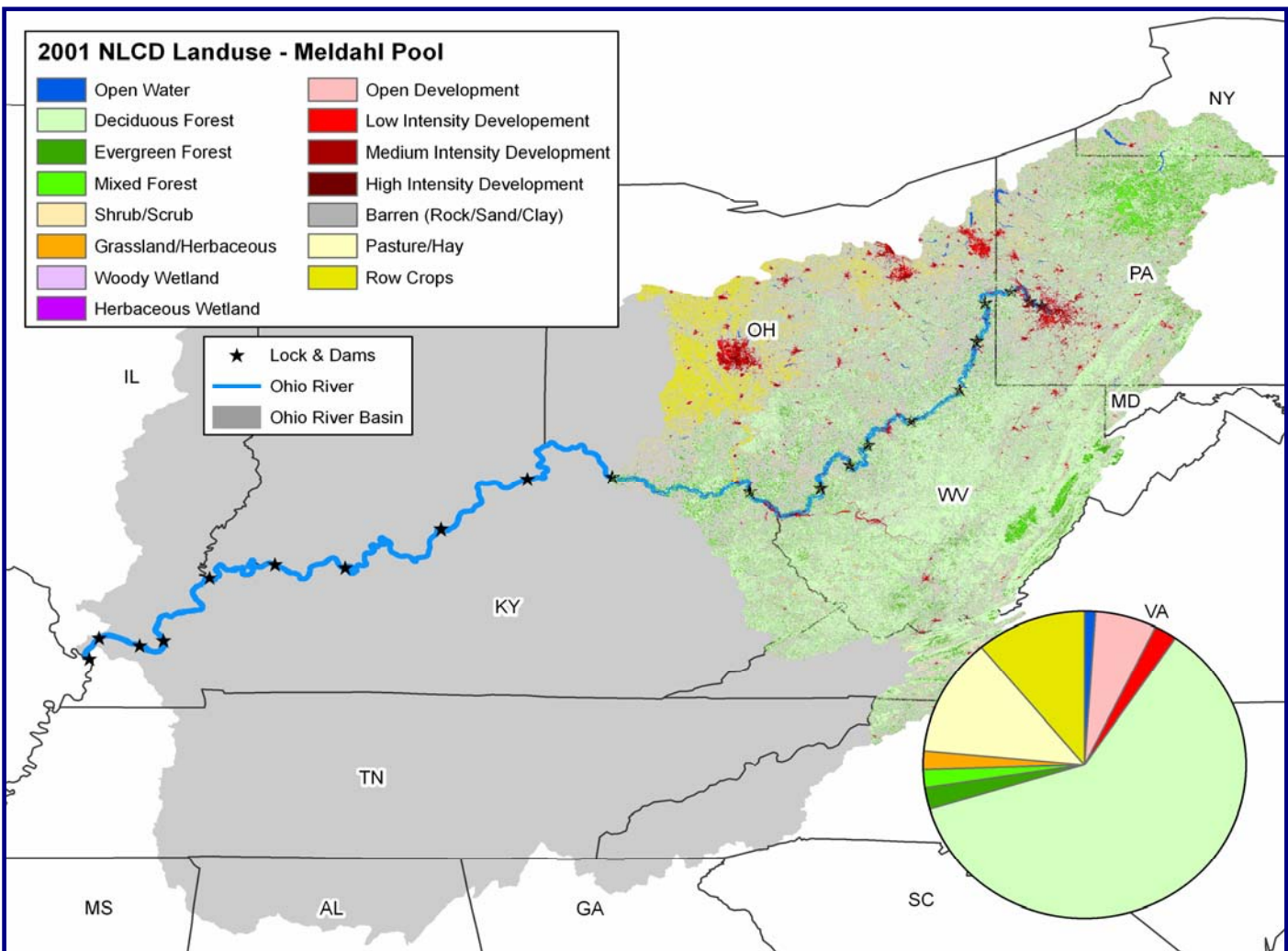


Figure 2. Land use in the Meldahl pool catchment area.

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

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).



ORSANCO crew conducting night-time electrofishing

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



Typical 500 meter electrofishing reach

3.4 Habitat Characterizations

Large rivers have distinct habitat types, including unique microhabitats (Reash 1999). Therefore, extensive habitat surveys were conducted for each electrofishing zone, including thorough substrate and depth measurements. Descriptions of the riparian corridor adjacent to the sampling zone and the presence of woody material available as fish cover were also recorded. Depth and substrate composition were measured at 66 points throughout each 500m zone. Six points along the shoreline were selected throughout the length of the zone, at 0, 100, 200, 300, 400 and 500m. From each of these points, depth was recorded at 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. Water samples were also collected using a Kemmerer and consisted of a single-point, mid-depth grab sample at the downstream end of each 500m zone. Samples were collected approximately 100ft from shore at each site on three separate occasions throughout the field season. Samples were kept at or below 4°C until sent off for laboratory analyses. Water quality parameters analyzed included: ammonia nitrogen, chloride, hardness, nitrate-nitrite, total Kjeldahl nitrogen (TKN), phenolics, sulfate, total suspended solids (TSS), total phosphorus, and total organic carbon (TOC).

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 Meldahl 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).

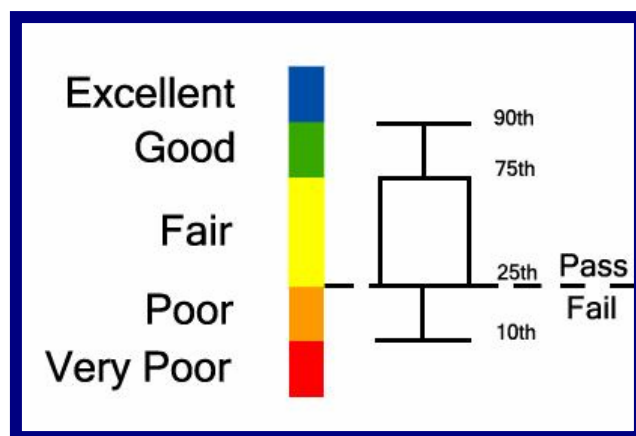


Figure 3. Approach used to assign site condition ratings.

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 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).

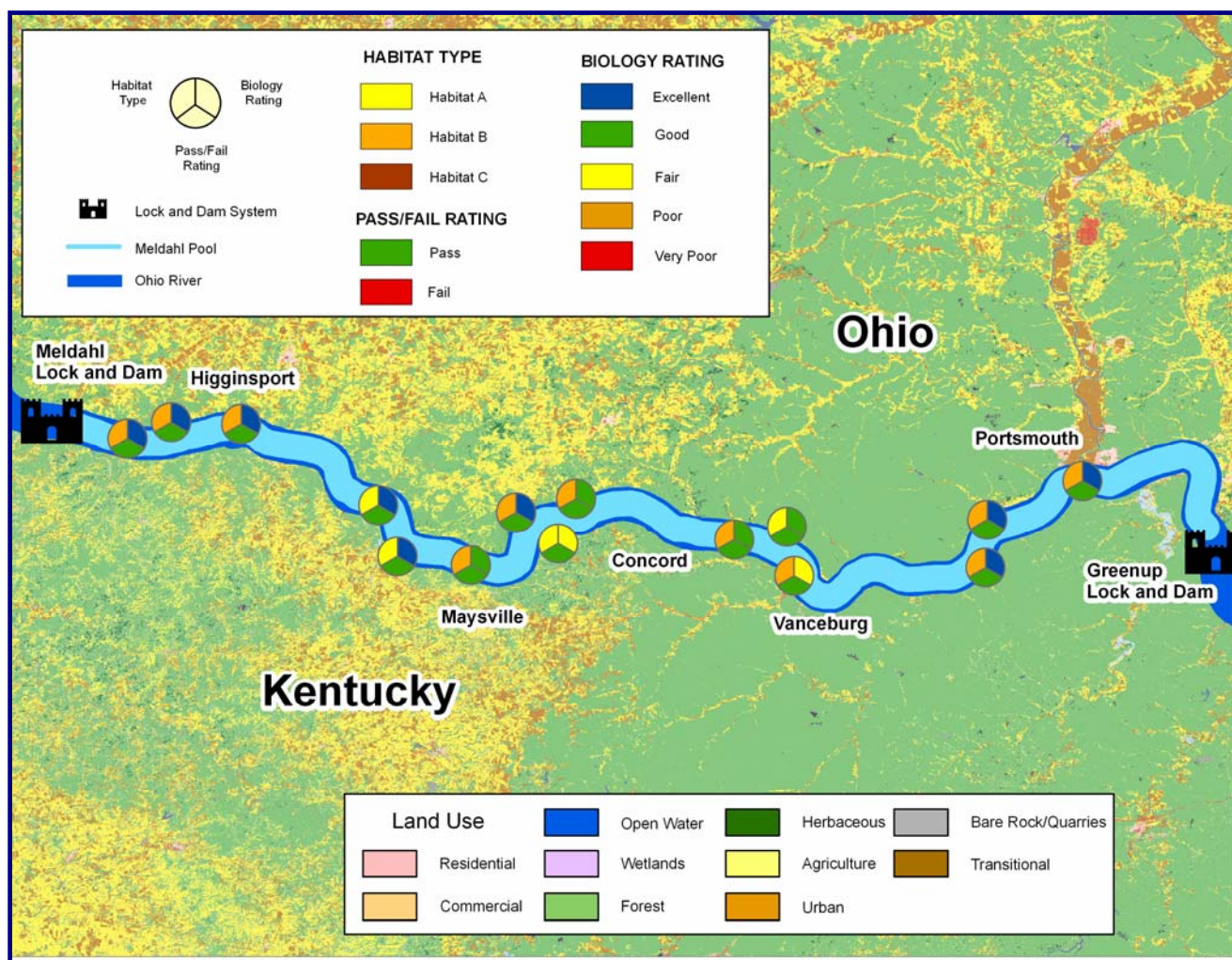


Figure 4. Locations and results of sampling at 15 sites within the Meldahl pool.

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 Meldahl pool (Table 1). These collections yielded 41 species representing 10 different families (Table 2). Two of the 41 species were listed in OH as either threatened or of special concern. These included the river redhorse (*Moxostoma carinatum*) and river darter (*Percina shumardi*). No federally listed taxa were collected

from the Meldahl pool. At the species level, the most abundant species were gizzard shad (*Dorosoma cepedianum*), sauger (*Sander canadensis*), and freshwater drum (*Aplodinotus grunniens*), which comprised 37.5%, 18.3%, and 15.6% of the catch respectively (Figure 5). The three dominant families were the shad and herring family (Clupeidae), the perches and darters family (Percidae) and the drum family (Sciaenidae), which comprised 36.8%, 17.9% and 14.9% of the catch respectively (Figure 6).

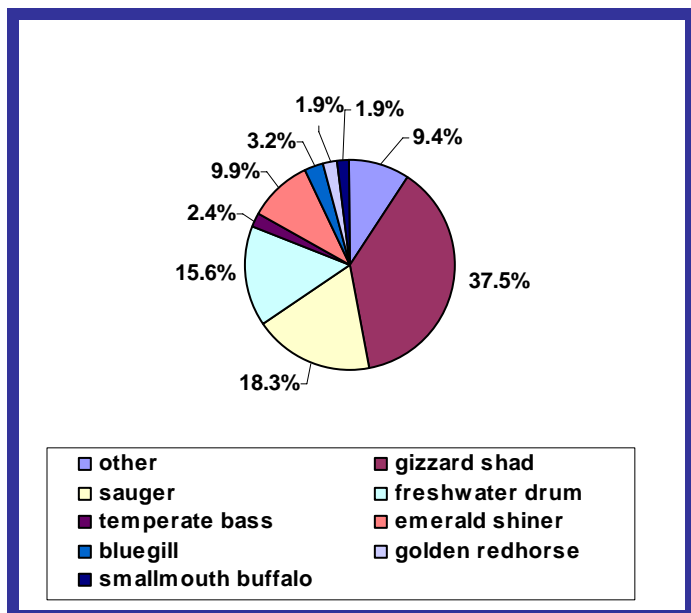


Figure 5. Species composition of fish sampled in the Meldahl pool.

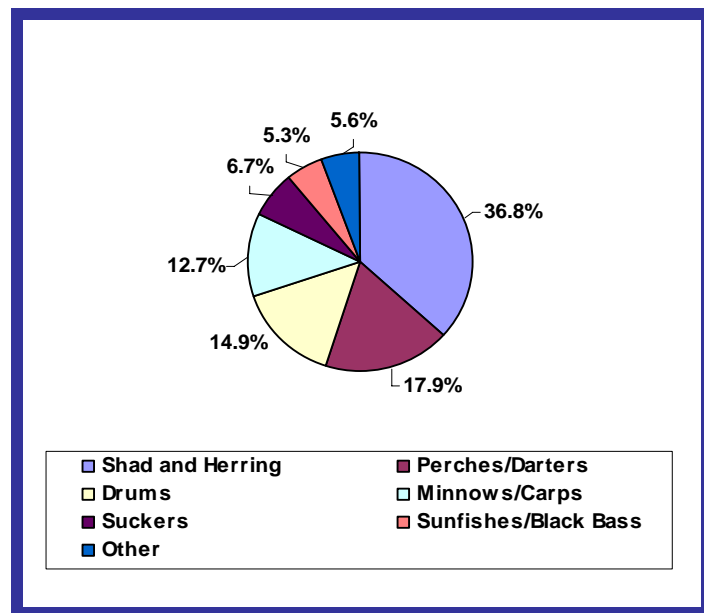


Figure 6. Sampled fish composition by family in the Meldahl pool.

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

Site #	River Mile	Bank	Date	Latitude	Longitude	Habitat Class	ORFIn Expectation	Observed ORFIn	Site Result	Rating
1	356.2	LDB	25-Jun-07	38.72698	83.00902	B	33	49	PASS	EXCELLENT
2	363.6	LDB	25-Jun-07	38.66846	83.10966	B	33	49	PASS	EXCELLENT
3	365.7	RDB	25-Jun-07	38.64193	83.12868	B	33	55	PASS	EXCELLENT
4	378.6	RDB	26-Jun-07	38.61132	83.31835	B	33	41	PASS	FAIR
5	380.4	RDB	26-Jun-07	38.63702	83.32660	A	39	49	PASS	GOOD
6	384.9	LDB	26-Jun-07	38.66101	83.40071	B	33	43	PASS	GOOD
7	395.1	LDB	26-Jun-07	38.68556	83.56812	B	33	45	PASS	GOOD
8	396.6	LDB	26-Jun-07	38.68203	83.59448	A	39	45	PASS	FAIR
9	397.4	LDB	02-Jul-07	38.68078	83.60990	B	33	51	PASS	EXCELLENT
10	404.8	LDB	11-Jul-07	38.63198	83.69702	B	33	45	PASS	GOOD
11	410.0	LDB	03-Jul-07	38.66523	83.77962	A	39	53	PASS	EXCELLENT
12	410.6	LDB	03-Jul-07	38.67417	83.78202	A	39	51	PASS	EXCELLENT
13	423.5	RDB	10-Jul-07	38.78472	83.94474	B	33	51	PASS	EXCELLENT
14	427.9	LDB	09-Jul-07	38.77171	84.02359	B	33	53	PASS	EXCELLENT
15	431.2	RDB	09-Jul-07	38.77451	84.08324	B	33	51	PASS	EXCELLENT

LDB = Left Descending Bank

RDB = Right Descending Bank

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

Family	Common Name	Latin Name	OH	KY
Lepisosteidae	longnose gar	<i>Lepisosteus osseus</i>		
Hiodontidae	mooneye	<i>Hiodon tergisus</i>		
Clupeidae	skipjack herring	<i>Alosa chrysochloris</i>		
Clupeidae	gizzard shad	<i>Dorosoma cepedianum</i>		
Cyprinidae	spotfin shiner	<i>Cyprinella spiloptera</i>		
Cyprinidae	common carp	<i>Cyprinus carpio</i>		
Cyprinidae	gravel chub	<i>Erimystax x-punctatus</i>		
Cyprinidae	silver chub	<i>Macrhybopsis storeriana</i>		
Cyprinidae	emerald shiner	<i>Notropis atherinoides</i>		
Cyprinidae	river shiner	<i>Notropis blennius</i>		
Cyprinidae	mimic shiner	<i>Notropis volucellus</i>		
Cyprinidae	bluntnose minnow	<i>Pimephales notatus</i>		
Cyprinidae	bullhead minnow	<i>Pimephales vigilax</i>		
Cyprinidae	creek chub	<i>Semotilus atromaculatus</i>		
Catostomidae	Carpiodes sp	<i>Carpiodes sp</i>		
Catostomidae	river carpsucker	<i>Carpiodes carpio</i>		
Catostomidae	quillback	<i>Carpiodes cyprinus</i>		
Catostomidae	smallmouth buffalo	<i>Ictiobus bubalus</i>		
Catostomidae	spotted sucker	<i>Minytrema melanops</i>		
Catostomidae	silver redhorse	<i>Moxostoma anisurum</i>		
Catostomidae	smallmouth redhorse	<i>Moxostoma breviceps</i>		
Catostomidae	river redhorse	<i>Moxostoma carinatum</i>	SC	
Catostomidae	golden redhorse	<i>Moxostoma erythrurum</i>		
Ictaluridae	channel catfish	<i>Ictalurus punctatus</i>		
Ictaluridae	flathead catfish	<i>Pylodictis olivaris</i>		
Moronidae	Morone sp	<i>Morone sp</i>		
Moronidae	white bass	<i>Morone chrysops</i>		
Centrarchidae	green sunfish	<i>Lepomis cyanellus</i>		
Centrarchidae	warmouth	<i>Lepomis gulosus</i>		
Centrarchidae	orangespotted sunfish	<i>Lepomis humilis</i>		
Centrarchidae	bluegill	<i>Lepomis macrochirus</i>		
Centrarchidae	longear sunfish	<i>Lepomis megalotis</i>		
Centrarchidae	smallmouth bass	<i>Micropterus dolomieu</i>		
Centrarchidae	spotted bass	<i>Micropterus punctulatus</i>		
Centrarchidae	largemouth bass	<i>Micropterus salmoides</i>		
Percidae	fantail darter	<i>Etheostoma flabellare</i>		
Percidae	logperch	<i>Percina caprodes</i>		
Percidae	river darter	<i>Percina shumardi</i>	T	
Percidae	sauger	<i>Sander canadensis</i>		
Percidae	walleye	<i>Sander vitreus</i>		
Sciaenidae	freshwater drum	<i>Aplodinotus grunniens</i>		

4.2 Metric Performance

Thirteen metrics were used to calculate ORFI scores for each electrofishing site (Emery et al. 2003). Each site's performance and scores for the ORFI metrics are shown in Table 3. The number of native species collected at each site ranged from 15 to 24, with an average of 19.8 species per site. Ten 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 2 to 6 and the majority of the sites scored a 3 for this metric. The number of centrarchid species varied from 0 to 6. The number of great river species varied between 0 and 4 species per site. The number of intolerant species ranged from 0 to 5 at the sampled sites. The percentage of tolerant individuals ranged from 0% to 0.82%, and all sites scored a 5 for this metric. The percentage of simple lithophils was between 0.0% and 74.5%, and 11 of the sites scored a 5. All sites had below 0.7% non-native individuals, and all sites scored a 5 for this metric. The percent detritivores ranged from 1.6% to 13.8%, and the majority of sites scored either a 3 or 5. The percent invertivores ranged from 0.0% to 38.6%, with all sites scoring less than a 3 for this metric. The percent piscivores ranged from 27.0% to 64.9% and metric scores were a mixture of 3's and 5's. Four of the sites had a single DELT (deformities, eroded fins, lesions and tumors) anomaly and all sites scored a 5. The CPUE (catch per unit effort) ranged from 203 to 1,196 individuals per site, and scores were mostly a 3 or 5 for the CPUE metric.

4.3 Habitat Surveys

Intensive habitat surveys at each of the 15 sampling locations revealed that the bottom substrate in the Meldahl pool was predominantly composed of sand and/or fines with small percentages of gravel and cobble (Figure 7). However, there was some variation among individual sites. The percentage of fines increased as river miles increased (Figure 8).

The percentages of substrate variables were used to give each site a habitat classification of 'A', 'B', or 'C' (Table 1). The Meldahl pool was dominated by class 'B' habitats which accounted for 11 of the 15 sites. The remaining samples

were classified as class 'A' habitats. There were no class 'C' habitats sampled in the pool (Table 1).

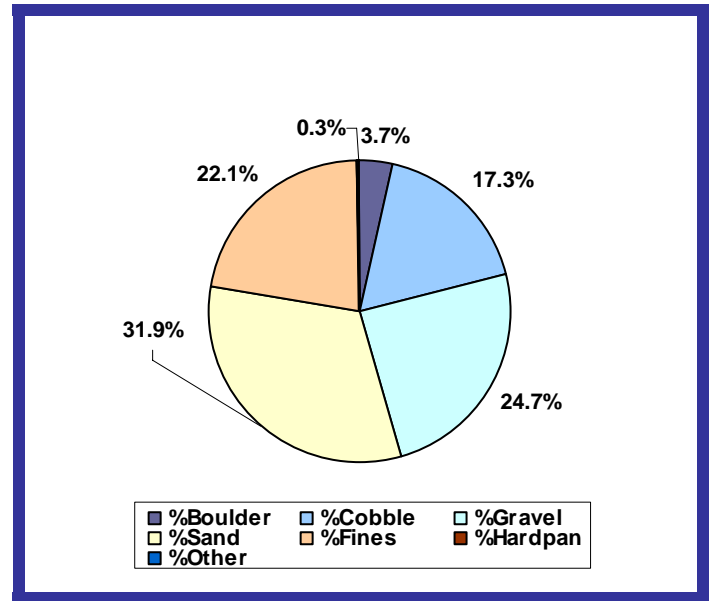


Figure 7. Substrate composition of the Meldahl pool.

Woody cover was present at all but three of the 15 sites sampled. Riparian land use was primarily natural forest with some residential and agricultural uses present. Barge activity was heavy throughout the pool, but no mooring structures were present in any of the sites sampled (see Appendix C).

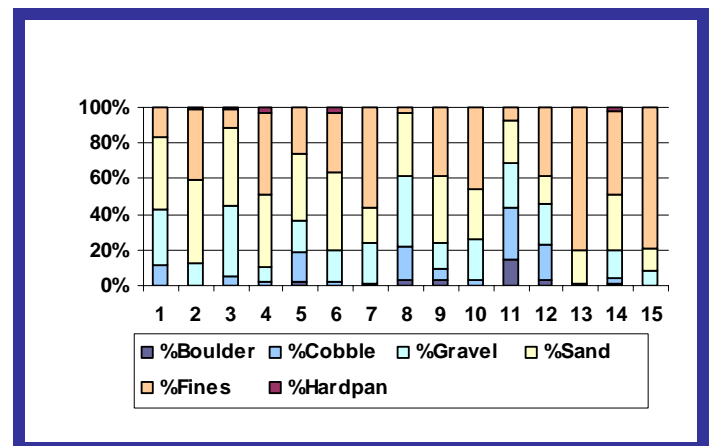


Figure 8. Substrate composition at each site sampled in the Meldahl Pool.

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

Site #	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	356.2	L	393	249	248	17	3	4	3	1	1	3	3	3	3	0.4	5	61.4	5	0.4	5	1.6	5	38.6	3	29.3	3	0	5	392	5	33	49	PASS
2	363.6	L	839	165	164	19	5	5	3	2	1	3	3	2	1	0.6	5	74.5	5	0.6	5	3.6	5	23.6	1	59.4	5	0	5	838	5	33	49	PASS
3	365.7	R	471	201	200	20	5	5	3	2	1	3	3	5	5	0.5	5	59.2	5	0.5	5	4.0	5	26.4	3	39.8	5	0	5	470	5	33	55	PASS
4	378.6	R	299	116	116	18	3	5	3	2	1	1	1	1	1	0.0	5	42.2	5	0.0	5	3.4	5	18.1	1	37.1	3	0	5	299	3	33	41	PASS
5	380.4	R	203	130	130	22	5	5	3	4	3	2	3	3	3	0.0	5	36.9	3	0.0	5	5.4	5	13.1	1	44.6	5	1	5	203	3	39	49	PASS
6	384.9	L	404	245	245	17	3	5	3	1	1	2	3	1	1	0.0	5	30.6	3	0.0	5	8.2	5	6.5	1	31.4	3	1	5	404	5	33	43	PASS
7	395.1	L	1196	129	129	15	3	5	3	0	1	2	3	0	1	0.0	5	58.9	5	0.0	5	13.2	3	5.4	1	61.2	5	0	5	1196	5	33	45	PASS
8	396.6	L	252	198	197	17	3	6	5	2	1	1	1	2	1	0.5	5	53.0	5	0.5	5	8.1	5	8.6	1	56.1	5	0	5	251	3	39	45	PASS
9	397.4	L	389	299	299	19	5	5	3	3	3	2	3	1	1	0.0	5	46.8	5	0.0	5	4.7	5	4.0	1	64.9	5	0	5	389	5	33	51	PASS
10	404.8	L	357	309	308	21	5	3	3	3	3	3	3	2	1	0.3	5	24.6	3	0.0	5	10.7	3	5.5	1	30.1	3	0	5	356	5	33	45	PASS
11	410.0	L	537	337	335	24	5	3	3	6	5	4	5	3	3	0.6	5	24.3	3	0.3	5	5.9	5	23.4	1	27.9	3	0	5	535	5	39	53	PASS
12	410.6	L	279	226	226	22	5	5	5	5	3	2	3	3	3	0.0	5	23.5	3	0.0	5	4.4	5	32.7	3	27.0	3	1	5	279	3	39	51	PASS
13	423.5	R	252	247	246	21	5	5	5	6	5	2	3	2	1	0.4	5	47.4	5	0.0	5	13.8	3	15.0	1	50.2	5	0	5	251	3	33	51	PASS
14	427.9	L	476	456	455	21	5	4	3	3	3	3	3	3	3	0.2	5	56.4	5	0.2	5	8.8	5	12.3	1	51.8	5	0	5	475	5	33	53	PASS
15	431.2	R	371	366	363	23	5	2	1	6	5	3	3	3	3	0.8	5	35.8	3	0.5	5	4.9	5	24.0	3	29.2	3	1	5	368	5	33	51	PASS

R = Right Descending Bank

L = Left Descending Bank

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

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

Centrarchid Species = black bass, sunfishes, crappie

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

Intolerant Species = species with low pollution/disturbance tolerance

Tolerant Individuals = individuals with high pollution/disturbance tolerance

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

Detritivore = fish that feed primarily on detritus

Invertivore = fish that feed primarily on invertebrates

Piscivore = fish that feed primarily on other fish

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

CPUE = Catch Per Unit Effort

4.4 Water Quality and Flow Conditions

Rain events were sparse throughout the sampling period in 2007; therefore river levels and flows were stable. Sampling was not conducted in Meldahl pool when flows were above the harmonic mean flow (HMF) for the pool. The HMF value used above the confluence of the Scioto River (site #1) was 38.9 kcfs and sites (2-15) downstream of the Scioto were 42.1 kcfs. Sampling was conducted between 39.2% and 69.8% 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 78 inches.

The water quality parameters measured from water samples, collected three times with Kemmerers, did not reveal any parameters exceeding water quality criteria (Appendix E).

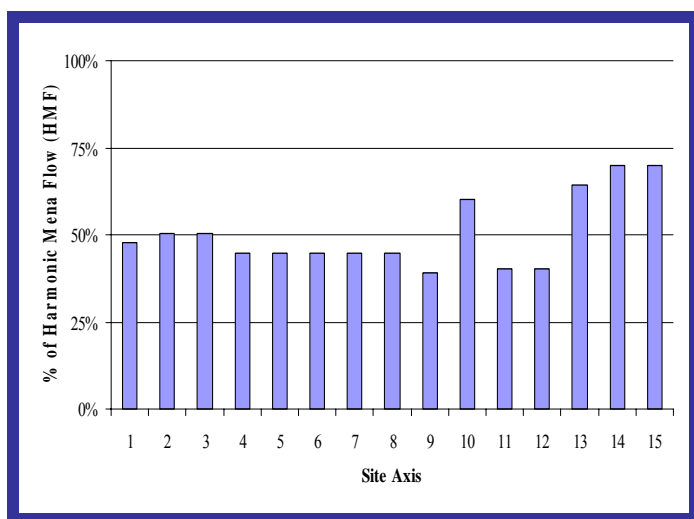


Figure 9. Relative flows (%HMF) at the time of sampling

4.5 Assessment of Condition

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 55 and the minimum was 41. 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). All of the Meldahl sites were in passing condition (Figure 10). Nine sites received an excellent rating (60%), four sites were found to be in good condition (26.7%) and two sites were in fair condition (Figure 11).

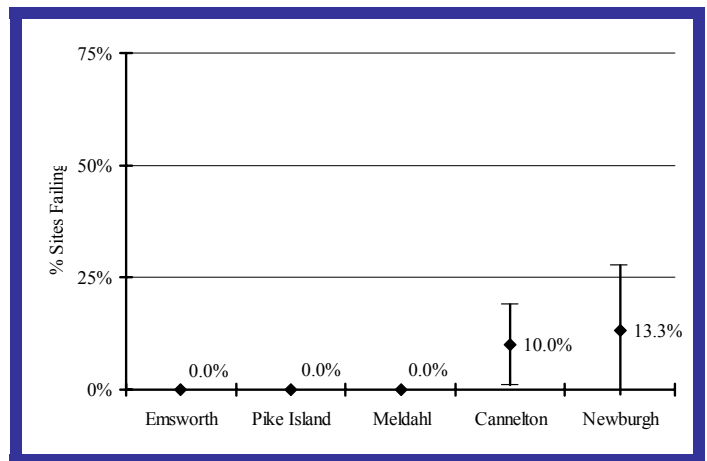


Figure 10. 2007 pool assessment results with 90% confidence intervals.

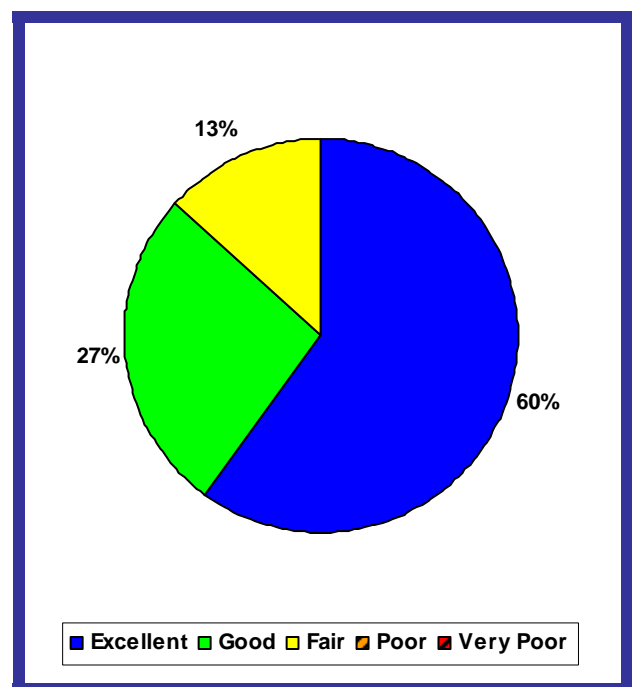


Figure 11. Condition of sites in the Meldahl pool based on ORFIn scores at 15 sites (Pass=Excellent-Fair, Fail=Poor-Very Poor)

5.0 Discussion

5.1 Fish Population

In 2007, the fish population of Meldahl pool was in good condition. This was supported by the diversity and types of species collected from the pool. Very few intolerant and non-native fishes were collected from the pool. Common carp (*Cyprinus carpio*) was the only non-native species collected.

A relatively large percentage of piscivorous individuals were collected from the pool (22.7% by abundance). Sauger (*Sander canadensis*), juvenile striped/white bass (*Morone* sp.), and spotted bass (*Micropterus punctulatus*) were the 3 most abundant piscivores. The majority of the individuals of these species were young-of-year, suggesting favorable reproductive conditions existed in early 2007.

5.2 Metric Performance

Most of the metric scores for the sites assessed in Meldahl pool were good, with two exceptions. The pool scored low for the % invertivorous individuals and the # of intolerant species metrics across all sites. Most of the invertivorous species were also considered intolerant, therefore it was understandable how both metrics produced low scores. However, there was no known reason or explanation for these low scores.

The highest scoring metrics were the % of non-native individuals, % tolerance individuals, # of native species, catch per unit effort (CPUE), and # of DELT anomalies. These metrics indicate good overall health of the Meldahl pool.

5.3 Habitat Surveys

Habitat assessments show that small substrate types (fines, sand) were most common in Meldahl pool. Larger substrates (gravel, cobble) were present at all sites, but in lower proportions. This indicated less than ideal habitat; however, common presence of woody cover may have provided adequate habitat to support the diverse populations of fishes in the pool.

5.4 Water Quality and Flow Conditions

The minor fluctuations in river level did not affect the survey of Meldahl pool. Because rain events were sparse throughout the field season, sampling was conducted during low flows. 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 Meldahl pool.

5.5 Conclusions and Assessments of Condition

The data collected in 2007 indicated that the Meldahl pool met its aquatic life use designation

and was in excellent condition. All sites were in passing condition, with only two sites rated below good condition. The assessment of Meldahl pool met the criteria established by ORSANCO biologists (Appendix A) and was therefore accepted as complete. No further monitoring of Meldahl 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 Meldahl pool to other previously surveyed pools in the Ohio River.

6.2 Land Use

Meldahl pool lies in the middle third of the Ohio River and the primary land use within the watershed is deciduous forest. Many small cities and towns are interspersed along the length of this pool. With the addition of the Scioto River in this pool, the percentage of agricultural practice slightly increases in comparison to upstream pools. The Scioto's watershed drains a considerable amount of Ohio's farmland. However, these practices are less common than in pools nearer the mouth of the Ohio River (Figure 12).

6.3 Substrate Composition

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

6.4 Species Richness

Meldahl pool was similar to other surveyed pools in the average number of native species per site (19.7) and ranked 6th in comparison (Figure 14).

6.5 Number of Individuals

Meldahl was ranked 3rd highest in the average number of individuals (244.9: excluding gizzard shad and emerald shiners) collected at each site (Figure 15).

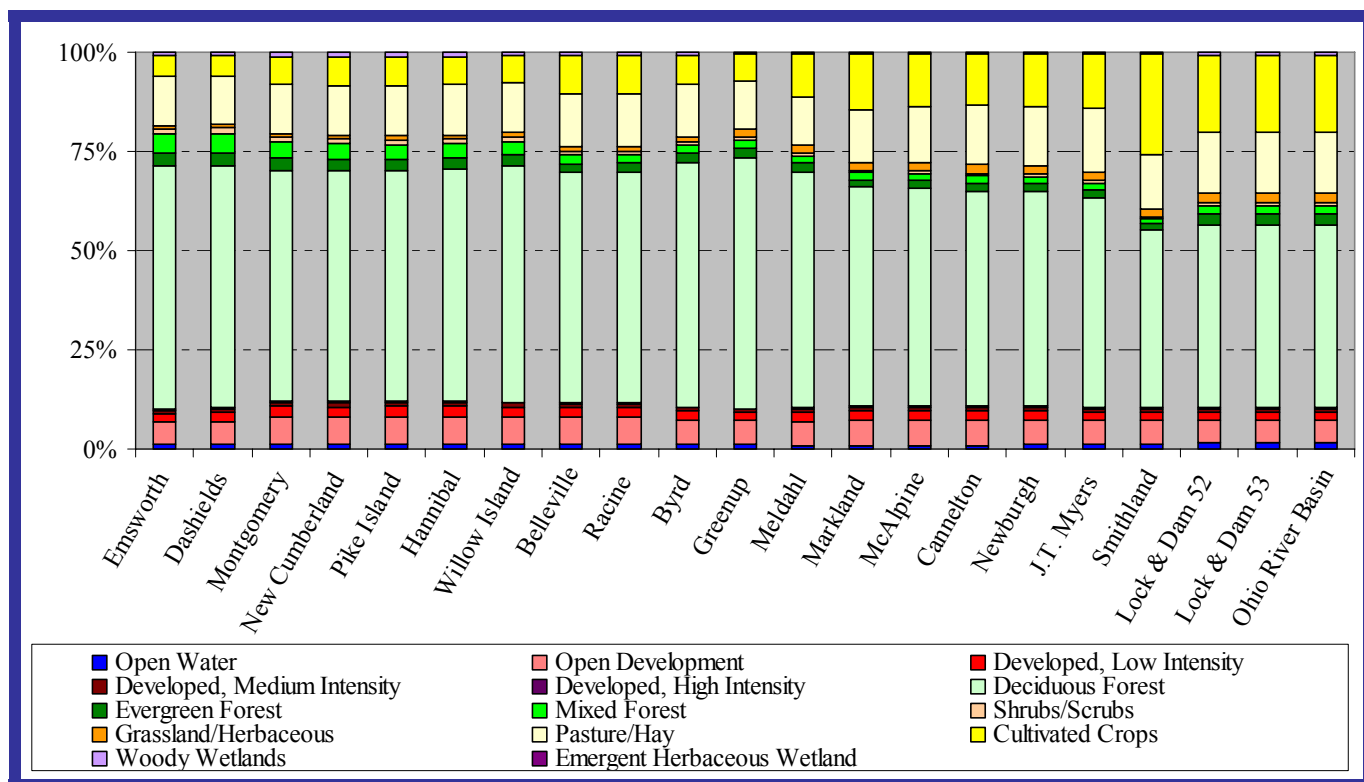


Figure 12. Land use within the catchment area of each pool of the Ohio River.

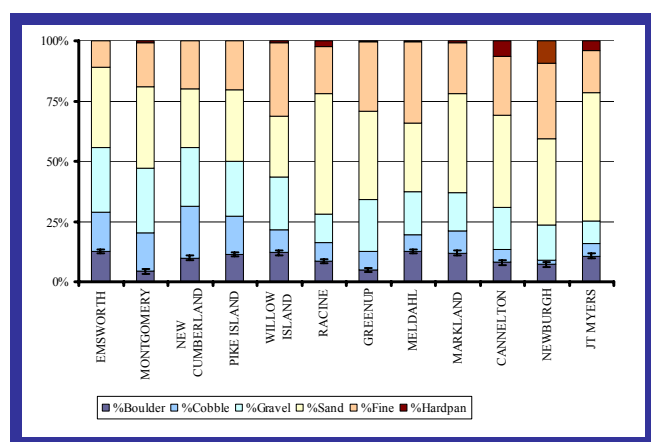


Figure 13. Substrate composition for each pool surveyed as of 2007.

6.6 Noteworthy Fish Observations

One species (gravel chub) was collected in Meldahl that was unique to the pool. Several other species were quite abundant in the pool in comparison to others such as: creek chub, bullhead minnow, mooneye, river darter, and sauger (See Table 4).

6.7 ORFIn Deviation

The ORFIn deviation is a measure of how well the pool performed in regard to expected ORFIn values. Positive values indicate that scores were greater than expected. Meldahl pool had an

average deviation of 14.1 and was among the highest of other pools surveyed as of 2007 (Figure 16). In comparison to other pools, the fish community is in better condition.

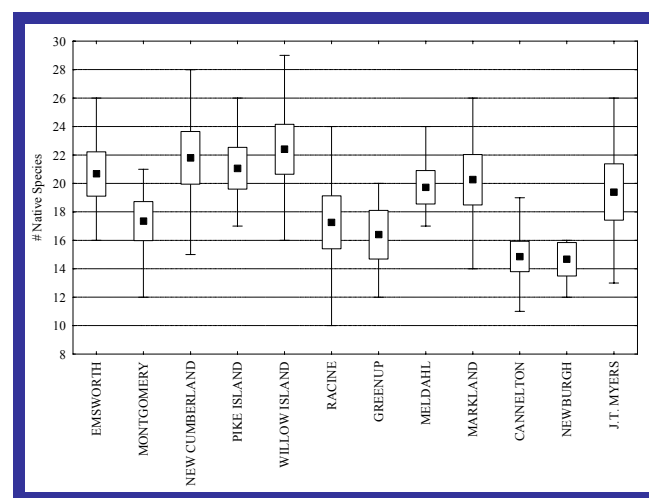


Figure 14. The average number of native species collected at each site within each pool surveyed as of 2007 (■=Average, □= 90% Confidence Interval, I=Non-Outlier Range).

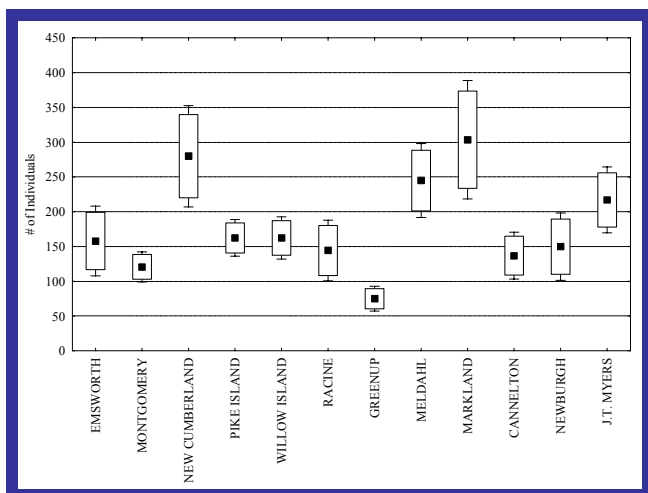


Figure 15. The average number of individuals (excluding gizzard shad & emerald shiner) collected at each site within each pool surveyed as of 2007 (■=Average, □=90% Confidence Interval, I=Non-Outlier Range).

6.8 Assessment of Condition

All sites in Meldahl pool were in passing condition. The nearest surveyed pools to Meldahl were Greenup (immediately upstream) and Markland (immediately downstream) pools. Greenup pool was assessed as being in marginally passing condition while Markland was in passing condition (Figure 17).

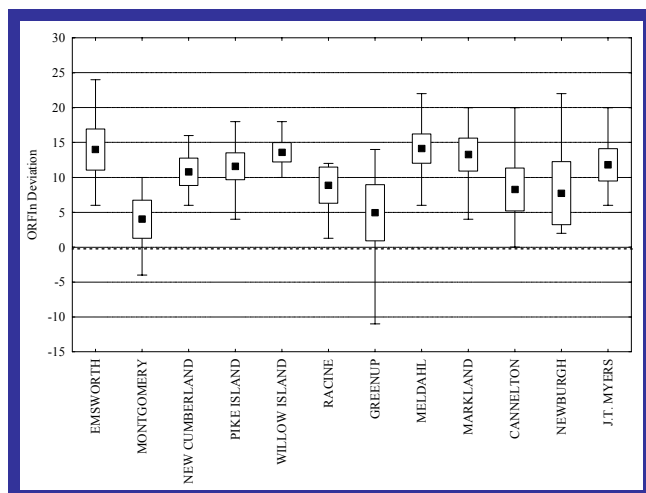


Figure 16. The average ORFIn deviation of each site within pools surveyed as of 2007 (■=Average, □=90% Confidence Interval, I=Non-Outlier Range).

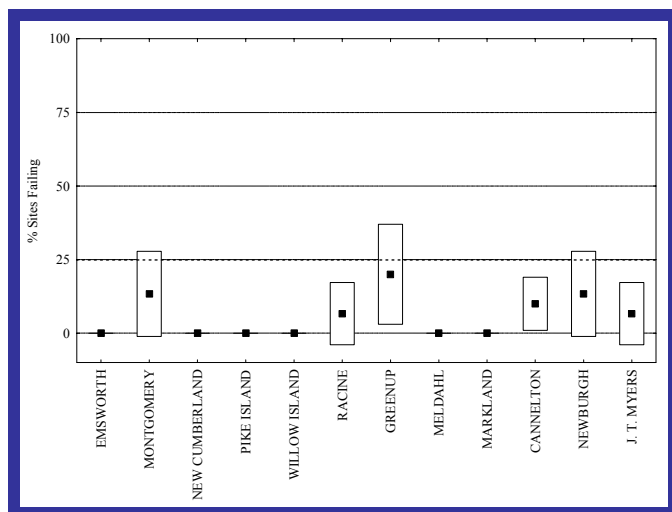


Figure 17. The percentage of sites (including +/- precision) failing in each pool surveyed as of 2007 (■=Average, □=90% Confidence Interval).

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

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

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

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
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

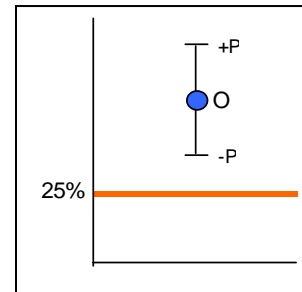
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Appendix A: Assessment Unit Criteria Details

- 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):

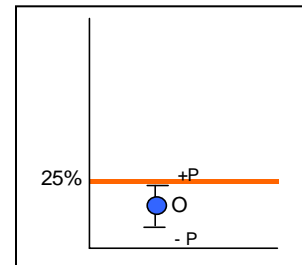
Situation ‘A’

- 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)

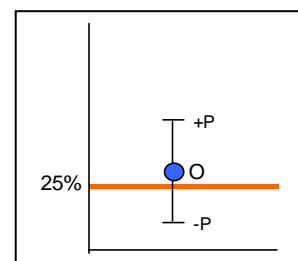


Situation ‘B’

- 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 Meldahl pool.

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
1	356.2	LDB	25-Jun-07	skipjack herring	<i>Alosa chrysochloris</i>	1
1	356.2	LDB	25-Jun-07	gizzard shad	<i>Dorosoma cepedianum</i>	1
1	356.2	LDB	25-Jun-07	common carp	<i>Cyprinus carpio</i>	1
1	356.2	LDB	25-Jun-07	emerald shiner	<i>Notropis atherinoides</i>	143
1	356.2	LDB	25-Jun-07	river shiner	<i>Notropis blennioides</i>	31
1	356.2	LDB	25-Jun-07	mimic shiner	<i>Notropis volucellus</i>	3
1	356.2	LDB	25-Jun-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	3
1	356.2	LDB	25-Jun-07	silver redhorse	<i>Moxostoma anisurum</i>	5
1	356.2	LDB	25-Jun-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	37
1	356.2	LDB	25-Jun-07	golden redhorse	<i>Moxostoma erythrurum</i>	16
1	356.2	LDB	25-Jun-07	channel catfish	<i>Ictalurus punctatus</i>	6
1	356.2	LDB	25-Jun-07	flathead catfish	<i>Pylodictis olivaris</i>	6
1	356.2	LDB	25-Jun-07	morone sp	<i>Morone sp</i>	6
1	356.2	LDB	25-Jun-07	spotted bass	<i>Micropterus punctulatus</i>	1
1	356.2	LDB	25-Jun-07	logperch	<i>Percina caprodes</i>	3
1	356.2	LDB	25-Jun-07	river darter	<i>Percina shumardi</i>	1
1	356.2	LDB	25-Jun-07	sauger	<i>Sander canadensis</i>	60
1	356.2	LDB	25-Jun-07	freshwater drum	<i>Aplodinotus grunniens</i>	69
2	363.6	LDB	25-Jun-07	longnose gar	<i>Lepisosteus osseus</i>	1
2	363.6	LDB	25-Jun-07	mooneye	<i>Hiodon tergisus</i>	4
2	363.6	LDB	25-Jun-07	gizzard shad	<i>Dorosoma cepedianum</i>	610
2	363.6	LDB	25-Jun-07	spotfin shiner	<i>Cyprinella spiloptera</i>	1
2	363.6	LDB	25-Jun-07	common carp	<i>Cyprinus carpio</i>	1
2	363.6	LDB	25-Jun-07	silver chub	<i>Macrhybopsis storeriana</i>	4
2	363.6	LDB	25-Jun-07	emerald shiner	<i>Notropis atherinoides</i>	64
2	363.6	LDB	25-Jun-07	river shiner	<i>Notropis blennioides</i>	13
2	363.6	LDB	25-Jun-07	river carpsucker	<i>Carpionodes carpio</i>	2
2	363.6	LDB	25-Jun-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	3
2	363.6	LDB	25-Jun-07	silver redhorse	<i>Moxostoma anisurum</i>	1
2	363.6	LDB	25-Jun-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
2	363.6	LDB	25-Jun-07	golden redhorse	<i>Moxostoma erythrurum</i>	18
2	363.6	LDB	25-Jun-07	channel catfish	<i>Ictalurus punctatus</i>	3
2	363.6	LDB	25-Jun-07	flathead catfish	<i>Pylodictis olivaris</i>	3
2	363.6	LDB	25-Jun-07	morone sp	<i>Morone sp</i>	6
2	363.6	LDB	25-Jun-07	white bass	<i>Morone chrysops</i>	3
2	363.6	LDB	25-Jun-07	bluegill	<i>Lepomis macrochirus</i>	1
2	363.6	LDB	25-Jun-07	spotted bass	<i>Micropterus punctulatus</i>	4
2	363.6	LDB	25-Jun-07	sauger	<i>Sander canadensis</i>	81
2	363.6	LDB	25-Jun-07	freshwater drum	<i>Aplodinotus grunniens</i>	14
3	365.7	RDB	25-Jun-07	longnose gar	<i>Lepisosteus osseus</i>	4
3	365.7	RDB	25-Jun-07	mooneye	<i>Hiodon tergisus</i>	1
3	365.7	RDB	25-Jun-07	skipjack herring	<i>Alosa chrysochloris</i>	2
3	365.7	RDB	25-Jun-07	gizzard shad	<i>Dorosoma cepedianum</i>	194
3	365.7	RDB	25-Jun-07	spotfin shiner	<i>Cyprinella spiloptera</i>	4
3	365.7	RDB	25-Jun-07	common carp	<i>Cyprinus carpio</i>	1

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
3	365.7	RDB	25-Jun-07	emerald shiner	<i>Notropis atherinoides</i>	76
3	365.7	RDB	25-Jun-07	river shiner	<i>Notropis blennius</i>	2
3	365.7	RDB	25-Jun-07	mimic shiner	<i>Notropis volucellus</i>	1
3	365.7	RDB	25-Jun-07	river carpsucker	<i>Carpionodes carpio</i>	4
3	365.7	RDB	25-Jun-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	3
3	365.7	RDB	25-Jun-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	13
3	365.7	RDB	25-Jun-07	river redhorse	<i>Moxostoma carinatum</i>	1
3	365.7	RDB	25-Jun-07	golden redhorse	<i>Moxostoma erythrurum</i>	34
3	365.7	RDB	25-Jun-07	channel catfish	<i>Ictalurus punctatus</i>	5
3	365.7	RDB	25-Jun-07	morone sp	<i>Morone sp</i>	4
3	365.7	RDB	25-Jun-07	white bass	<i>Morone chrysops</i>	2
3	365.7	RDB	25-Jun-07	bluegill	<i>Lepomis macrochirus</i>	1
3	365.7	RDB	25-Jun-07	spotted bass	<i>Micropterus punctulatus</i>	3
3	365.7	RDB	25-Jun-07	logperch	<i>Percina caprodes</i>	1
3	365.7	RDB	25-Jun-07	sauger	<i>Sander canadensis</i>	67
3	365.7	RDB	25-Jun-07	freshwater drum	<i>Aplodinotus grunniens</i>	48
4	378.6	RDB	26-Jun-07	longnose gar	<i>Lepisosteus osseus</i>	2
4	378.6	RDB	26-Jun-07	gizzard shad	<i>Dorosoma cepedianum</i>	103
4	378.6	RDB	26-Jun-07	spotfin shiner	<i>Cyprinella spiloptera</i>	5
4	378.6	RDB	26-Jun-07	silver chub	<i>Macrhybopsis storeriana</i>	8
4	378.6	RDB	26-Jun-07	emerald shiner	<i>Notropis atherinoides</i>	80
4	378.6	RDB	26-Jun-07	quillback	<i>Carpionodes cyprinus</i>	3
4	378.6	RDB	26-Jun-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	1
4	378.6	RDB	26-Jun-07	silver redhorse	<i>Moxostoma anisurum</i>	4
4	378.6	RDB	26-Jun-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	5
4	378.6	RDB	26-Jun-07	golden redhorse	<i>Moxostoma erythrurum</i>	1
4	378.6	RDB	26-Jun-07	channel catfish	<i>Ictalurus punctatus</i>	2
4	378.6	RDB	26-Jun-07	flathead catfish	<i>Pylodictis olivaris</i>	2
4	378.6	RDB	26-Jun-07	morone sp	<i>Morone sp</i>	6
4	378.6	RDB	26-Jun-07	bluegill	<i>Lepomis macrochirus</i>	3
4	378.6	RDB	26-Jun-07	spotted bass	<i>Micropterus punctulatus</i>	2
4	378.6	RDB	26-Jun-07	sauger	<i>Sander canadensis</i>	29
4	378.6	RDB	26-Jun-07	walleye	<i>Sander vitreus</i>	2
4	378.6	RDB	26-Jun-07	freshwater drum	<i>Aplodinotus grunniens</i>	41
5	380.4	RDB	26-Jun-07	longnose gar	<i>Lepisosteus osseus</i>	4
5	380.4	RDB	26-Jun-07	skipjack herring	<i>Alosa chrysochloris</i>	2
5	380.4	RDB	26-Jun-07	gizzard shad	<i>Dorosoma cepedianum</i>	40
5	380.4	RDB	26-Jun-07	spotfin shiner	<i>Cyprinella spiloptera</i>	1
5	380.4	RDB	26-Jun-07	emerald shiner	<i>Notropis atherinoides</i>	33
5	380.4	RDB	26-Jun-07	river carpsucker	<i>Carpionodes carpio</i>	1
5	380.4	RDB	26-Jun-07	quillback	<i>Carpionodes cyprinus</i>	4
5	380.4	RDB	26-Jun-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	2
5	380.4	RDB	26-Jun-07	silver redhorse	<i>Moxostoma anisurum</i>	1
5	380.4	RDB	26-Jun-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
5	380.4	RDB	26-Jun-07	channel catfish	<i>Ictalurus punctatus</i>	2
5	380.4	RDB	26-Jun-07	flathead catfish	<i>Pylodictis olivaris</i>	4
5	380.4	RDB	26-Jun-07	morone sp	<i>Morone sp</i>	2

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
5	380.4	RDB	26-Jun-07	bluegill	<i>Lepomis macrochirus</i>	12
5	380.4	RDB	26-Jun-07	longear sunfish	<i>Lepomis megalotis</i>	1
5	380.4	RDB	26-Jun-07	smallmouth bass	<i>Micropterus dolomieu</i>	1
5	380.4	RDB	26-Jun-07	spotted bass	<i>Micropterus punctulatus</i>	3
5	380.4	RDB	26-Jun-07	logperch	<i>Percina caprodes</i>	1
5	380.4	RDB	26-Jun-07	river darter	<i>Percina shumardi</i>	1
5	380.4	RDB	26-Jun-07	sauger	<i>Sander canadensis</i>	43
5	380.4	RDB	26-Jun-07	walleye	<i>Sander vitreus</i>	1
5	380.4	RDB	26-Jun-07	freshwater drum	<i>Aplodinotus grunniens</i>	43
6	384.9	LDB	26-Jun-07	skipjack herring	<i>Alosa chrysochloris</i>	5
6	384.9	LDB	26-Jun-07	gizzard shad	<i>Dorosoma cepedianum</i>	158
6	384.9	LDB	26-Jun-07	spotfin shiner	<i>Cyprinella spiloptera</i>	1
6	384.9	LDB	26-Jun-07	emerald shiner	<i>Notropis atherinoides</i>	1
6	384.9	LDB	26-Jun-07	river shiner	<i>Notropis blennioides</i>	5
6	384.9	LDB	26-Jun-07	mimic shiner	<i>Notropis volucellus</i>	1
6	384.9	LDB	26-Jun-07	river carpsucker	<i>Carpionodes carpio</i>	1
6	384.9	LDB	26-Jun-07	quillback	<i>Carpionodes cyprinoides</i>	6
6	384.9	LDB	26-Jun-07	smallmouth buffalo	<i>Ictalurus nebulosus</i>	13
6	384.9	LDB	26-Jun-07	silver redhorse	<i>Moxostoma valenciennesi</i>	5
6	384.9	LDB	26-Jun-07	golden redhorse	<i>Moxostoma valenciennesi</i>	5
6	384.9	LDB	26-Jun-07	channel catfish	<i>Ictalurus punctatus</i>	2
6	384.9	LDB	26-Jun-07	flathead catfish	<i>Pylodictis olivaris</i>	1
6	384.9	LDB	26-Jun-07	morone sp	<i>Morone sp</i>	13
6	384.9	LDB	26-Jun-07	white bass	<i>Morone chrysops</i>	2
6	384.9	LDB	26-Jun-07	spotted bass	<i>Micropterus punctulatus</i>	1
6	384.9	LDB	26-Jun-07	sauger	<i>Sander canadensis</i>	60
6	384.9	LDB	26-Jun-07	freshwater drum	<i>Aplodinotus grunniens</i>	124
7	395.1	LDB	26-Jun-07	longnose gar	<i>Lepisosteus osseus</i>	1
7	395.1	LDB	26-Jun-07	skipjack herring	<i>Alosa chrysochloris</i>	8
7	395.1	LDB	26-Jun-07	gizzard shad	<i>Dorosoma cepedianum</i>	1011
7	395.1	LDB	26-Jun-07	silver chub	<i>Macrhybopsis storeriana</i>	1
7	395.1	LDB	26-Jun-07	emerald shiner	<i>Notropis atherinoides</i>	56
7	395.1	LDB	26-Jun-07	river carpsucker	<i>Carpionodes carpio</i>	5
7	395.1	LDB	26-Jun-07	quillback	<i>Carpionodes cyprinoides</i>	2
7	395.1	LDB	26-Jun-07	smallmouth buffalo	<i>Ictalurus nebulosus</i>	10
7	395.1	LDB	26-Jun-07	silver redhorse	<i>Moxostoma valenciennesi</i>	1
7	395.1	LDB	26-Jun-07	golden redhorse	<i>Moxostoma valenciennesi</i>	5
7	395.1	LDB	26-Jun-07	channel catfish	<i>Ictalurus punctatus</i>	1
7	395.1	LDB	26-Jun-07	flathead catfish	<i>Pylodictis olivaris</i>	2
7	395.1	LDB	26-Jun-07	morone sp	<i>Morone sp</i>	6
7	395.1	LDB	26-Jun-07	white bass	<i>Morone chrysops</i>	1
7	395.1	LDB	26-Jun-07	sauger	<i>Sander canadensis</i>	69
7	395.1	LDB	26-Jun-07	freshwater drum	<i>Aplodinotus grunniens</i>	17
8	396.6	LDB	26-Jun-07	mooneye	<i>Hiodon tergisus</i>	1
8	396.6	LDB	26-Jun-07	gizzard shad	<i>Dorosoma cepedianum</i>	39
8	396.6	LDB	26-Jun-07	spotfin shiner	<i>Cyprinella spiloptera</i>	1
8	396.6	LDB	26-Jun-07	common carp	<i>Cyprinus carpio</i>	1

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
8	396.6	LDB	26-Jun-07	emerald shiner	<i>Notropis atherinoides</i>	15
8	396.6	LDB	26-Jun-07	river carpsucker	<i>Carpionodes carpio</i>	4
8	396.6	LDB	26-Jun-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	11
8	396.6	LDB	26-Jun-07	spotted sucker	<i>Minytrema melanops</i>	1
8	396.6	LDB	26-Jun-07	silver redhorse	<i>Moxostoma anisurum</i>	5
8	396.6	LDB	26-Jun-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
8	396.6	LDB	26-Jun-07	golden redhorse	<i>Moxostoma erythrurum</i>	9
8	396.6	LDB	26-Jun-07	channel catfish	<i>Ictalurus punctatus</i>	5
8	396.6	LDB	26-Jun-07	flathead catfish	<i>Pylodictis olivaris</i>	4
8	396.6	LDB	26-Jun-07	morone sp	<i>Morone sp</i>	12
8	396.6	LDB	26-Jun-07	white bass	<i>Morone chrysops</i>	2
8	396.6	LDB	26-Jun-07	bluegill	<i>Lepomis macrochirus</i>	2
8	396.6	LDB	26-Jun-07	spotted bass	<i>Micropterus punctulatus</i>	5
8	396.6	LDB	26-Jun-07	sauger	<i>Sander canadensis</i>	88
8	396.6	LDB	26-Jun-07	freshwater drum	<i>Aplodinotus grunniens</i>	46
9	397.4	LDB	02-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	12
9	397.4	LDB	02-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	1
9	397.4	LDB	02-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	1
9	397.4	LDB	02-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	78
9	397.4	LDB	02-Jul-07	carpiodes sp	<i>Carpionodes sp</i>	1
9	397.4	LDB	02-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	4
9	397.4	LDB	02-Jul-07	quillback	<i>Carpionodes cyprinus</i>	8
9	397.4	LDB	02-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	1
9	397.4	LDB	02-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	2
9	397.4	LDB	02-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	3
9	397.4	LDB	02-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	3
9	397.4	LDB	02-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
9	397.4	LDB	02-Jul-07	morone sp	<i>Morone sp</i>	50
9	397.4	LDB	02-Jul-07	bluegill	<i>Lepomis macrochirus</i>	3
9	397.4	LDB	02-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	8
9	397.4	LDB	02-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	1
9	397.4	LDB	02-Jul-07	logperch	<i>Percina caprodes</i>	2
9	397.4	LDB	02-Jul-07	river darter	<i>Percina shumardi</i>	1
9	397.4	LDB	02-Jul-07	sauger	<i>Sander canadensis</i>	131
9	397.4	LDB	02-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	75
10	404.8	LDB	11-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	2
10	404.8	LDB	11-Jul-07	mooneye	<i>Hiodon tergisus</i>	14
10	404.8	LDB	11-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	34
10	404.8	LDB	11-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	34
10	404.8	LDB	11-Jul-07	gravel chub	<i>Erimystax x-punctatus</i>	1
10	404.8	LDB	11-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	14
10	404.8	LDB	11-Jul-07	bluntnose minnow	<i>Pimephales notatus</i>	1
10	404.8	LDB	11-Jul-07	creek chub	<i>Semotilus atromaculatus</i>	3
10	404.8	LDB	11-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	10
10	404.8	LDB	11-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	22
10	404.8	LDB	11-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	7
10	404.8	LDB	11-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	2

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
10	404.8	LDB	11-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
10	404.8	LDB	11-Jul-07	morone sp	<i>Morone sp</i>	24
10	404.8	LDB	11-Jul-07	white bass	<i>Morone chrysops</i>	1
10	404.8	LDB	11-Jul-07	bluegill	<i>Lepomis macrochirus</i>	6
10	404.8	LDB	11-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	9
10	404.8	LDB	11-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	2
10	404.8	LDB	11-Jul-07	logperch	<i>Percina caprodes</i>	1
10	404.8	LDB	11-Jul-07	river darter	<i>Percina shumardi</i>	3
10	404.8	LDB	11-Jul-07	sauger	<i>Sander canadensis</i>	51
10	404.8	LDB	11-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	112
11	410	LDB	03-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
11	410	LDB	03-Jul-07	mooneye	<i>Hiodon tergisus</i>	4
11	410	LDB	03-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	5
11	410	LDB	03-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	149
11	410	LDB	03-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	3
11	410	LDB	03-Jul-07	common carp	<i>Cyprinus carpio</i>	1
11	410	LDB	03-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	5
11	410	LDB	03-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	51
11	410	LDB	03-Jul-07	river shiner	<i>Notropis blenni</i>	2
11	410	LDB	03-Jul-07	bullhead minnow	<i>Pimephales vigilax</i>	1
11	410	LDB	03-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	8
11	410	LDB	03-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	11
11	410	LDB	03-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	8
11	410	LDB	03-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	3
11	410	LDB	03-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
11	410	LDB	03-Jul-07	morone sp	<i>Morone sp</i>	4
11	410	LDB	03-Jul-07	white bass	<i>Morone chrysops</i>	1
11	410	LDB	03-Jul-07	green sunfish	<i>Lepomis cyanellus</i>	1
11	410	LDB	03-Jul-07	bluegill	<i>Lepomis macrochirus</i>	53
11	410	LDB	03-Jul-07	longear sunfish	<i>Lepomis megalotis</i>	7
11	410	LDB	03-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	1
11	410	LDB	03-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	19
11	410	LDB	03-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	5
11	410	LDB	03-Jul-07	logperch	<i>Percina caprodes</i>	4
11	410	LDB	03-Jul-07	sauger	<i>Sander canadensis</i>	59
11	410	LDB	03-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	127
12	410.6	LDB	03-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	5
12	410.6	LDB	03-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	42
12	410.6	LDB	03-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	7
12	410.6	LDB	03-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	1
12	410.6	LDB	03-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	11
12	410.6	LDB	03-Jul-07	river shiner	<i>Notropis blenni</i>	1
12	410.6	LDB	03-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	5
12	410.6	LDB	03-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	5
12	410.6	LDB	03-Jul-07	silver redhorse	<i>Moxostoma anisurum</i>	1
12	410.6	LDB	03-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	2
12	410.6	LDB	03-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	7

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
12	410.6	LDB	03-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	3
12	410.6	LDB	03-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	2
12	410.6	LDB	03-Jul-07	morone sp	<i>Morone sp</i>	3
12	410.6	LDB	03-Jul-07	white bass	<i>Morone chrysops</i>	1
12	410.6	LDB	03-Jul-07	bluegill	<i>Lepomis macrochirus</i>	58
12	410.6	LDB	03-Jul-07	longear sunfish	<i>Lepomis megalotis</i>	2
12	410.6	LDB	03-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	1
12	410.6	LDB	03-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	7
12	410.6	LDB	03-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	3
12	410.6	LDB	03-Jul-07	logperch	<i>Percina caprodes</i>	2
12	410.6	LDB	03-Jul-07	sauger	<i>Sander canadensis</i>	39
12	410.6	LDB	03-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	71
13	423.5	RDB	10-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
13	423.5	RDB	10-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	1
13	423.5	RDB	10-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	5
13	423.5	RDB	10-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	6
13	423.5	RDB	10-Jul-07	bullhead minnow	<i>Pimephales vigilax</i>	2
13	423.5	RDB	10-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	18
13	423.5	RDB	10-Jul-07	quillback	<i>Carpionodes cyprinus</i>	4
13	423.5	RDB	10-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	12
13	423.5	RDB	10-Jul-07	smallmouth redhorse	<i>Moxostoma breviceps</i>	1
13	423.5	RDB	10-Jul-07	golden redhorse	<i>Moxostoma erythrurum</i>	4
13	423.5	RDB	10-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	17
13	423.5	RDB	10-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
13	423.5	RDB	10-Jul-07	morone sp	<i>Morone sp</i>	1
13	423.5	RDB	10-Jul-07	white bass	<i>Morone chrysops</i>	2
13	423.5	RDB	10-Jul-07	green sunfish	<i>Lepomis cyanellus</i>	1
13	423.5	RDB	10-Jul-07	warmouth	<i>Lepomis gulosus</i>	1
13	423.5	RDB	10-Jul-07	bluegill	<i>Lepomis macrochirus</i>	24
13	423.5	RDB	10-Jul-07	longear sunfish	<i>Lepomis megalotis</i>	2
13	423.5	RDB	10-Jul-07	smallmouth bass	<i>Micropterus dolomieu</i>	1
13	423.5	RDB	10-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	9
13	423.5	RDB	10-Jul-07	sauger	<i>Sander canadensis</i>	106
13	423.5	RDB	10-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	30
14	427.9	LDB	09-Jul-07	longnose gar	<i>Lepisosteus osseus</i>	1
14	427.9	LDB	09-Jul-07	mooneye	<i>Hiodon tergisus</i>	6
14	427.9	LDB	09-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	2
14	427.9	LDB	09-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	8
14	427.9	LDB	09-Jul-07	common carp	<i>Cyprinus carpio</i>	1
14	427.9	LDB	09-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	37
14	427.9	LDB	09-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	12
14	427.9	LDB	09-Jul-07	mimic shiner	<i>Notropis volucellus</i>	1
14	427.9	LDB	09-Jul-07	bullhead minnow	<i>Pimephales vigilax</i>	14
14	427.9	LDB	09-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	18
14	427.9	LDB	09-Jul-07	quillback	<i>Carpionodes cyprinus</i>	4
14	427.9	LDB	09-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	17

Site #	River Mile	Bank	Date	Common Name	Latin Name	Count
14	427.9	LDB	09-Jul-07	golden redbreast	<i>Moxostoma erythrurum</i>	3
14	427.9	LDB	09-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	13
14	427.9	LDB	09-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	5
14	427.9	LDB	09-Jul-07	morone sp	<i>Morone sp</i>	12
14	427.9	LDB	09-Jul-07	bluegill	<i>Lepomis macrochirus</i>	13
14	427.9	LDB	09-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	6
14	427.9	LDB	09-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	3
14	427.9	LDB	09-Jul-07	logperch	<i>Percina caprodes</i>	2
14	427.9	LDB	09-Jul-07	sauger	<i>Sander canadensis</i>	209
14	427.9	LDB	09-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	89
15	431.2	RDB	09-Jul-07	mooneye	<i>Hiodon tergisus</i>	18
15	431.2	RDB	09-Jul-07	skipjack herring	<i>Alosa chrysochloris</i>	4
15	431.2	RDB	09-Jul-07	gizzard shad	<i>Dorosoma cepedianum</i>	2
15	431.2	RDB	09-Jul-07	spotfin shiner	<i>Cyprinella spiloptera</i>	8
15	431.2	RDB	09-Jul-07	common carp	<i>Cyprinus carpio</i>	2
15	431.2	RDB	09-Jul-07	silver chub	<i>Macrhybopsis storeriana</i>	27
15	431.2	RDB	09-Jul-07	emerald shiner	<i>Notropis atherinoides</i>	3
15	431.2	RDB	09-Jul-07	mimic shiner	<i>Notropis volucellus</i>	1
15	431.2	RDB	09-Jul-07	bullhead minnow	<i>Pimephales vigilax</i>	6
15	431.2	RDB	09-Jul-07	river carpsucker	<i>Carpionodes carpio</i>	7
15	431.2	RDB	09-Jul-07	smallmouth buffalo	<i>Ictiobus bubalus</i>	9
15	431.2	RDB	09-Jul-07	channel catfish	<i>Ictalurus punctatus</i>	22
15	431.2	RDB	09-Jul-07	flathead catfish	<i>Pylodictis olivaris</i>	4
15	431.2	RDB	09-Jul-07	morone sp	<i>Morone sp</i>	3
15	431.2	RDB	09-Jul-07	white bass	<i>Morone chrysops</i>	3
15	431.2	RDB	09-Jul-07	green sunfish	<i>Lepomis cyanellus</i>	1
15	431.2	RDB	09-Jul-07	orangespotted sunfish	<i>Lepomis humilis</i>	1
15	431.2	RDB	09-Jul-07	bluegill	<i>Lepomis macrochirus</i>	31
15	431.2	RDB	09-Jul-07	longear sunfish	<i>Lepomis megalotis</i>	23
15	431.2	RDB	09-Jul-07	spotted bass	<i>Micropterus punctulatus</i>	13
15	431.2	RDB	09-Jul-07	largemouth bass	<i>Micropterus salmoides</i>	2
15	431.2	RDB	09-Jul-07	fantail darter	<i>Etheostoma flabellare</i>	1
15	431.2	RDB	09-Jul-07	logperch	<i>Percina caprodes</i>	4
15	431.2	RDB	09-Jul-07	sauger	<i>Sander canadensis</i>	82
15	431.2	RDB	09-Jul-07	freshwater drum	<i>Aplodinotus grunniens</i>	94

Appendix C. Habitat survey data from the Meldahl pool.

Site #	River Mile	Bank	% Boulder	% Cobble	% Gravel	% Sand	% Fine	% Hardpan	Depth	% Submerged Vegetation	% Woody Cover	% Overhanging Vegetation	Land Use	Human Influence	Bank Profile
1	356.2	LDB	0.0	11.8	30.9	40.8	16.4	0.0	4.8	4.3	0.0	0.0	NF, R	none	sloped
2	363.6	LDB	0.0	0.0	12.9	46.8	39.6	0.7	7.2	0.0	6.4	0.0	NF, A	none	steep
3	365.7	RDB	0.0	5.6	39.6	43.1	11.1	0.7	9.4	0.0	2.0	0.0	R, NF	none	steep
4	378.6	RDB	0.0	2.4	8.3	40.5	45.2	3.6	14.6	0.0	7.3	35.0	NF	none	sloped
5	380.4	RDB	2.2	16.5	17.3	38.1	25.9	0.0	8.7	0.0	0.0	0.0	NF, R	none	sloped
6	384.9	LDB	0.0	1.6	18.0	43.4	33.6	3.3	9.7	0.0	0.0	0.0	NF, R	none	steep
7	395.1	LDB	0.0	1.0	22.9	19.8	56.3	0.0	5.8	0.0	2.8	20.0	NF	none	steep
8	396.6	LDB	3.2	18.3	40.5	34.9	3.2	0.0	11.5	0.0	0.8	10.0	NF	none	steep
9	397.4	LDB	3.5	6.2	14.2	38.1	38.1	0.0	13.4	0.0	2.3	12.5	NF, R	none	steep
10	404.8	LDB	0.0	3.5	22.1	29.1	45.3	0.0	10.6	0.0	1.4	6.0	NF	none	steep
11	410.0	LDB	3.3	19.6	22.8	16.3	38.0	0.0	11.5	12.0	3.0	18.0	NF	none	steep
12	410.6	LDB	14.5	28.9	25.3	24.1	7.2	0.0	17.7	0.0	3.7	13.8	NF	none	steep
13	423.5	RDB	0.0	0.0	1.2	18.5	80.2	0.0	1.6	0.0	32.7	0.0	A, NF	none	steep
14	427.9	LDB	0.8	3.1	15.6	31.3	47.7	1.6	2.9	0.0	5.6	23.0	A, NF	none	steep
15	431.2	RDB	0.0	0.0	8.4	12.0	79.5	0.0	1.9	0.0	10.3	31.0	A, NF	none	steep

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

Appendix D. Parameters measured at sites in Meldahl pool.

River Mile	Bank	pH	Temp (C)	Dissolved Oxygen (mg/L)	Conductivity
356.2	LDB	6.9	26.21	7.58	N/A
363.6	LDB	7.4	26.41	7.34	N/A
365.7	RDB	7.4	26.53	7.35	N/A
378.6	RDB	7.3	26.14	7.55	N/A
380.4	RDB	7.3	26.28	7.58	N/A
384.9	LDB	7.6	26.34	7.60	N/A
395.1	LDB	7.9	26.82	7.83	N/A
396.6	LDB	7.9	26.82	7.83	N/A
397.4	LDB	8.0	26.56	7.55	464
404.8	LDB	7.9	28.25	7.26	496
410.0	LDB	8.0	28.58	7.99	489
410.6	LDB	8.0	28.63	8.10	489
423.5	RDB	7.9	28.34	7.68	480
427.9	LDB	7.9	29.60	8.26	507
431.2	RDB	7.8	28.97	7.90	500

Appendix E. Water quality parameters analyzed from Meldahl pool in 2007. Values in bold exceed water quality criteria for respective analyte.

Site #	River Mile	Round	Ammonia	Chloride	Hardness	Nitrate-Nitrite	Phenolics	Sulfate	TKN	TOC	Phosphorus	TSS
1	356.2	1	0.10	38	160	0.67	<5.0	51	0.446	2.89	0.017	1.6
		2	0.05	48	160	0.92	<5.0	122	0.290	2.68	0.010	6.8
		3	0.03	32	136	0.88	<5.0	88	0.608	4.93	0.032	6.0
2	363.6	1	0.07	32	156	0.67	<7.0	50	0.456	3.05	0.084	2.3
		2	0.06	36	160	0.91	<5.0	134	0.350	2.79	0.010	8.8
		3	0.03	32	160	0.87	<5.0	84	0.594	4.26	0.092	7.2
3	365.7	1	0.06	36	160	0.71	<7.0	60	0.427	2.54	0.038	1.8
		2	0.07	36	156	0.82	<5.0	122	0.571	2.90	0.016	8.2
		3	0.03	32	136	0.89	<5.0	90	0.476	4.16	0.046	7.8
4	378.6	1	0.06	40	176	0.71	<5.0	110	0.464	3.15	0.019	4.5
		2	0.08	46	156	0.59	<5.0	120	0.510	9.51	0.010	3.4
		3	0.04	34	140	0.95	<5.0	92	0.626	5.12	0.043	6.2
5	380.4	1	0.07	34	168	0.72	<5.0	68	0.413	3.05	0.010	2.0
		2	0.08	40	160	0.65	<5.0	104	0.481	4.38	0.010	3.4
		3	0.03	34	136	0.99	<5.0	88	0.602	5.22	0.048	7.6
6	384.9	1	0.08	42	192	0.69	<5.0	122	0.369	3.10	0.010	2.5
		2	0.09	44	156	0.68	<5.0	112	0.448	3.90	0.010	4.4
		3	0.03	28	140	0.97	<5.0	88	0.462	5.41	0.047	8.6
7	395.1	1	0.05	34	164	0.61	<7.0	53	0.100	2.78	0.035	5.0
		2	0.10	32	160	0.61	<5.0	96	0.404	3.10	0.024	6.2
		3	0.03	32	152	0.99	<5.0	82	0.639	4.78	0.046	10.2
8	396.6	1	0.05	34	160	0.58	<7.0	58	0.460	2.60	0.023	7.6
		2	0.09	36	160	0.60	<5.0	112	0.450	3.34	0.010	4.6
		3	0.04	32	152	1.00	<5.0	98	0.565	4.60	0.070	12.0
9	397.4	1	0.05	30	160	0.61	<5.0	57	0.656	2.65	0.023	4.6
		2	0.09	46	152	0.62	<5.0	124	0.624	3.19	0.010	4.2
		3	0.03	46	148	0.96	<5.0	84	0.579	5.84	0.046	9.8
10	404.8	1	0.06	30	144	0.64	<7.0	53	0.747	2.28	0.028	4.0
		2	0.09	44	160	0.70	<5.0	108	0.558	3.04	0.020	3.8
		3	0.03	36	156	1.10	<5.0	82	0.832	4.65	0.045	7.0
11	410.0	1	0.04	30	152	0.54	<7.0	50	1.180	2.43	0.030	3.8
		2	0.09	46	160	0.71	<5.0	110	0.607	3.14	0.024	4.8
		3	0.04	36	148	0.96	<5.0	88	0.913	4.74	0.042	7.6
12	410.6	1	0.04	28	148	0.63	<7.0	57	0.393	2.39	0.016	2.6
		2	0.08	42	156	0.73	<5.0	130	0.525	2.94	0.025	3.8
		3	0.03	36	152	1.00	<5.0	92	0.672	4.87	0.040	7.6
13	423.5	1	0.03	30	144	0.58	<7.0	46	0.461	2.49	0.026	3.8
		2	0.06	44	148	0.77	<5.0	126	0.580	3.16	0.014	5.4
		3	0.03	36	140	1.00	<5.0	86	0.705	5.21	0.058	10.2
14	427.9	1	0.08	34	164	0.62	<5.0	82	0.481	2.71	0.240	6.0
		2	0.04	38	160	0.61	<5.0	112	0.534	3.40	0.022	8.6
		3	0.06	38	148	1.01	<5.0	92	0.645	4.93	0.066	15.8
15	431.2	1	0.05	34	168	0.54	<5.0	78	0.481	2.59	0.068	7.3
		2	0.04	38	144	0.60	<5.0	125	0.594	3.49	0.011	7.0
		3	0.04	26	152	1.05	<5.0	92	0.699	4.50	0.045	7.4

TKN = Total Kjeldahl Nitrogen

TOC = Total Organic Carbon

TSS = Total Suspended Solids