2012 Ohio River Pool Assessments

Emsworth, Pike Island, Meldahl, and Newburgh

ORSANCO Biological Programs

Ohio River Valley Water Sanitation Commission
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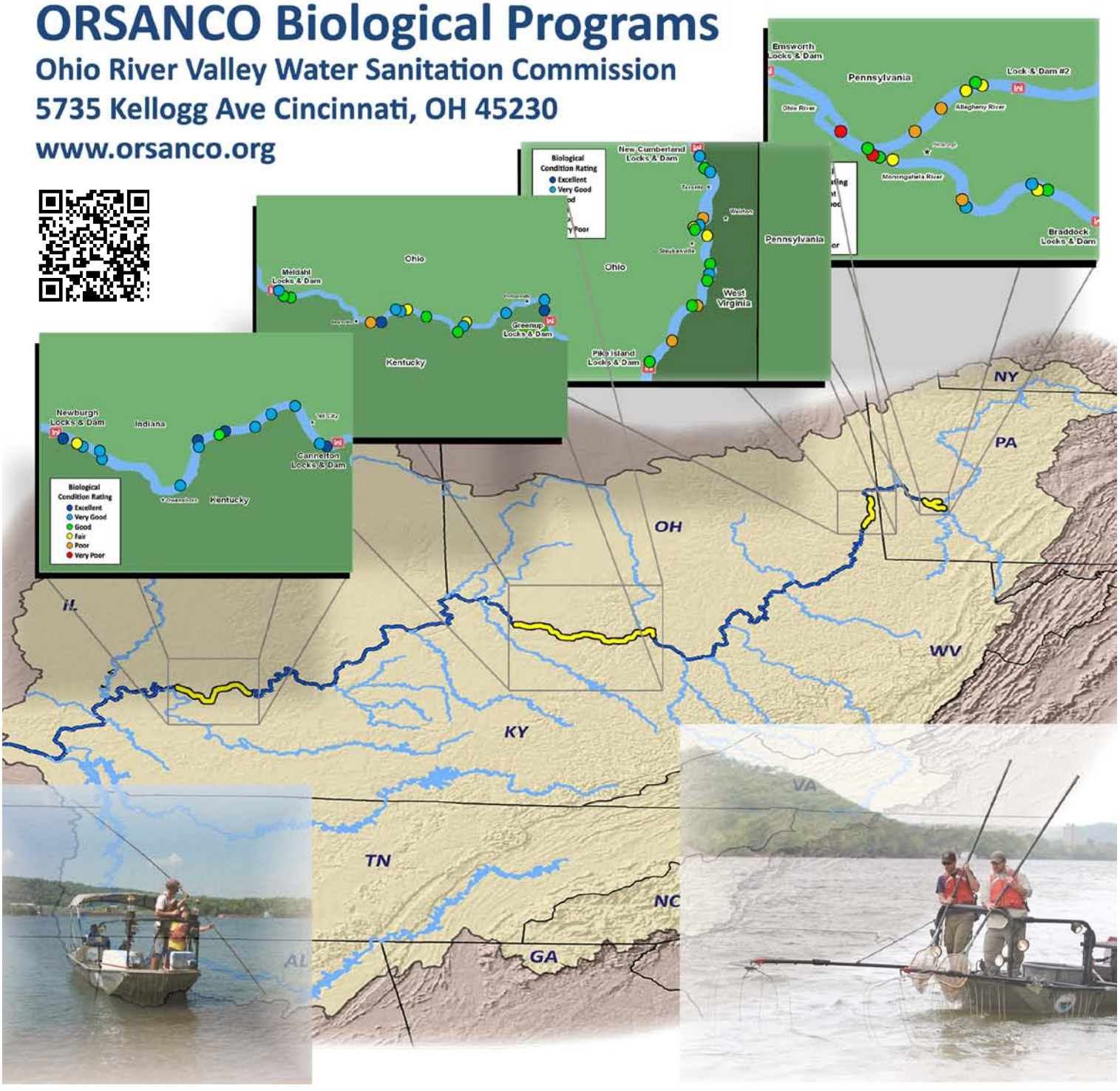

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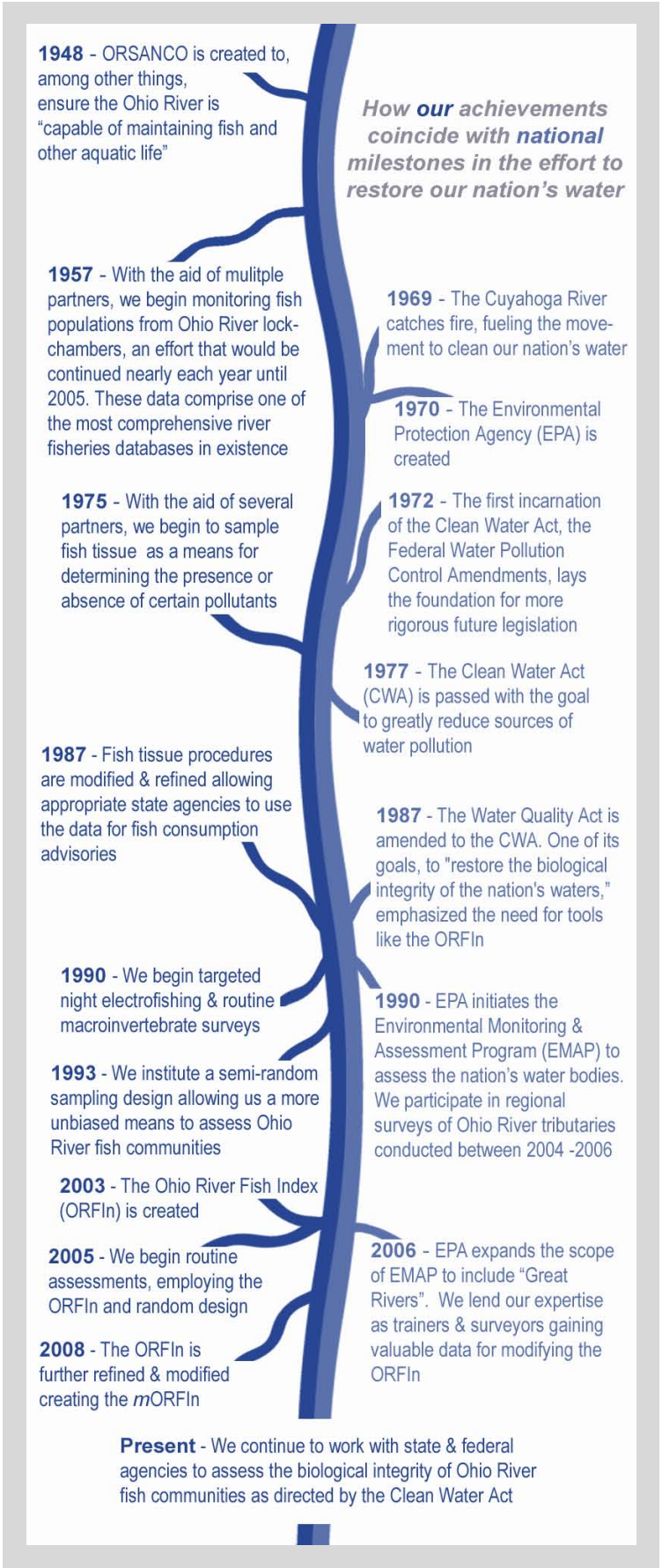
Introduction

Based in Cincinnati, 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. A primary goal of ORSANCO programs is to work with state agencies to develop a set of pollution control standards for the Ohio River. Monitoring programs were established to develop and refine these standards. One of these programs, the ORSANCO biological program, uses fish studies to establish biological criteria (biocriteria) for the Ohio River. These biocriteria are ultimately used to provide insight into the overall health of the river ecosystem.

In 1993, ORSANCO developed and implemented a survey design that used electrofishing methods designed for the Ohio River. After years of collecting fish population data on the Ohio River, we developed the original Ohio River Fish Index (ORFIn) which was subsequently modified (*m*ORFIn). Each year we collect fish and environmental data from various sections of the Ohio River and use these data to calculate *m*ORFIn scores, which are numerical representations of the relative condition of Ohio River fish communities based on a suite of measurable attributes. The resulting scores allow us to assess the biological condition of each section of the river. The information included in these assessments is further used for regulatory, restorative, and protective efforts within the Ohio River basin.



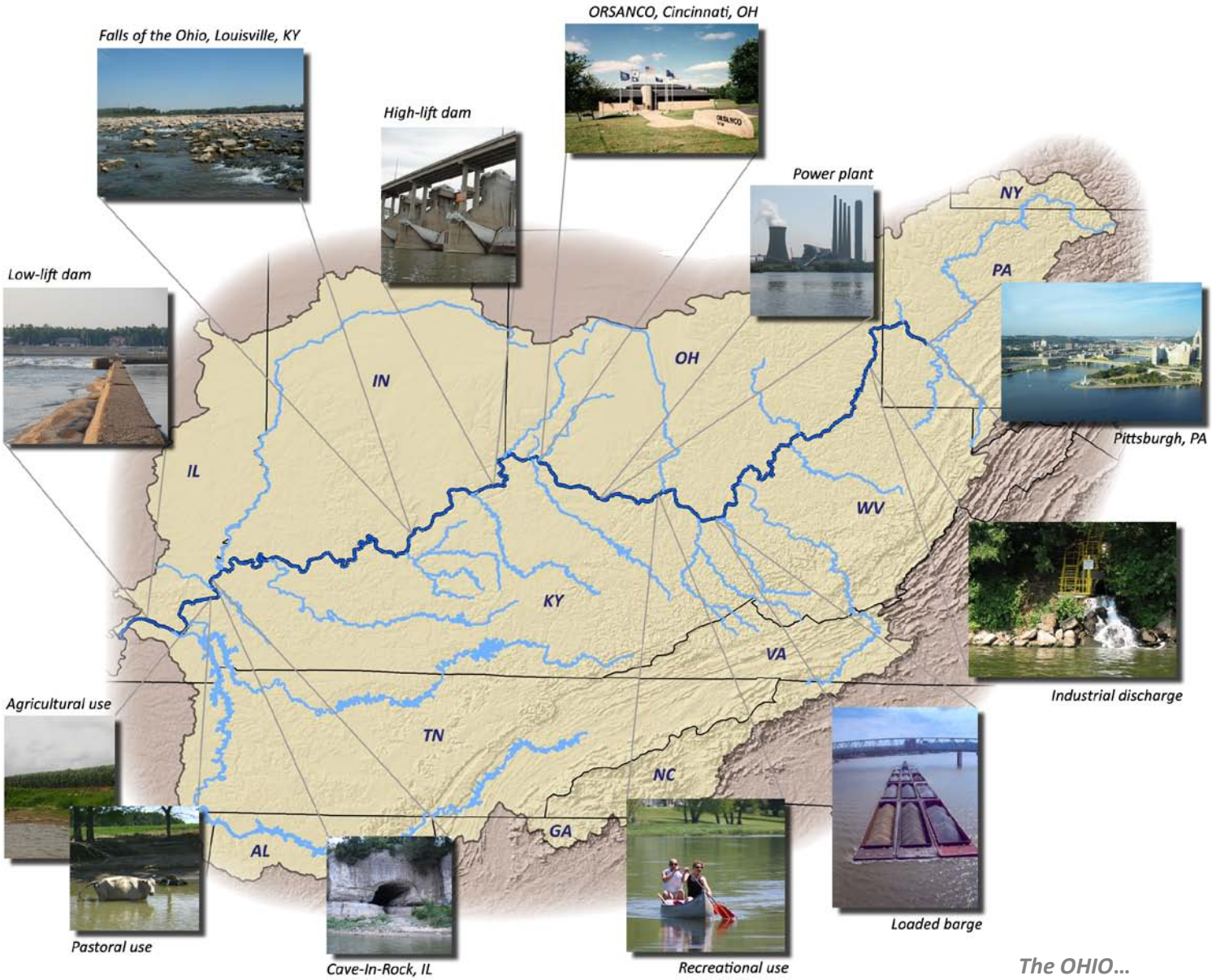
This report summarizes the findings of the 2012 surveys; the assessments of the Emsworth, Pike Island, Meldahl, Newburgh pools

The River

The Ohio River begins at the confluence of the Monongahela and Allegheny rivers in Pittsburgh and flows 981 miles in a southwesterly direction to its confluence with the Mississippi River near Cairo, IL. The Ohio has several additional large tributaries including the: Muskingum, Scioto, Kanawha, Kentucky, Green, Wabash, Cumberland and Tennessee rivers. The Ohio River itself runs through or borders six states; Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia. The river basin (>200,000 mi^2) covers an additional eight states; New York, Maryland, Virginia, North Carolina, Tennessee, Georgia, Alabama, and Mississippi. Nineteen high-lift locks and dams maintain a nine-foot minimum depth for commercial navigation throughout the river.

Facts

- Average depth 24 ft, max depth exceeding 90 ft
- Average width ½ mi, 1 mi max (Smithland Pool)
- ~344 fish species from Ohio River *basin* (18 exotic) = 40% of known N. American species (800 species)
- ~178 fish species found in the Ohio *River* (14 exotic)
- Deciduous forests continue to dominate the basin
- Major land uses: pastures, row crops, and urban development
- Basin holds ~10% of the nation (27 million people)
- 33 drinking water intakes provide drinking water for over 5 million people along the main stem
- ~600 permitted discharges to the Ohio River
- 49 power-generating facilities on the main stem
- Coal and energy products comprise 70% of the 250 million tons of cargo carried by barges each year



The OHIO…
Iroquoian for "great river"

METHODS

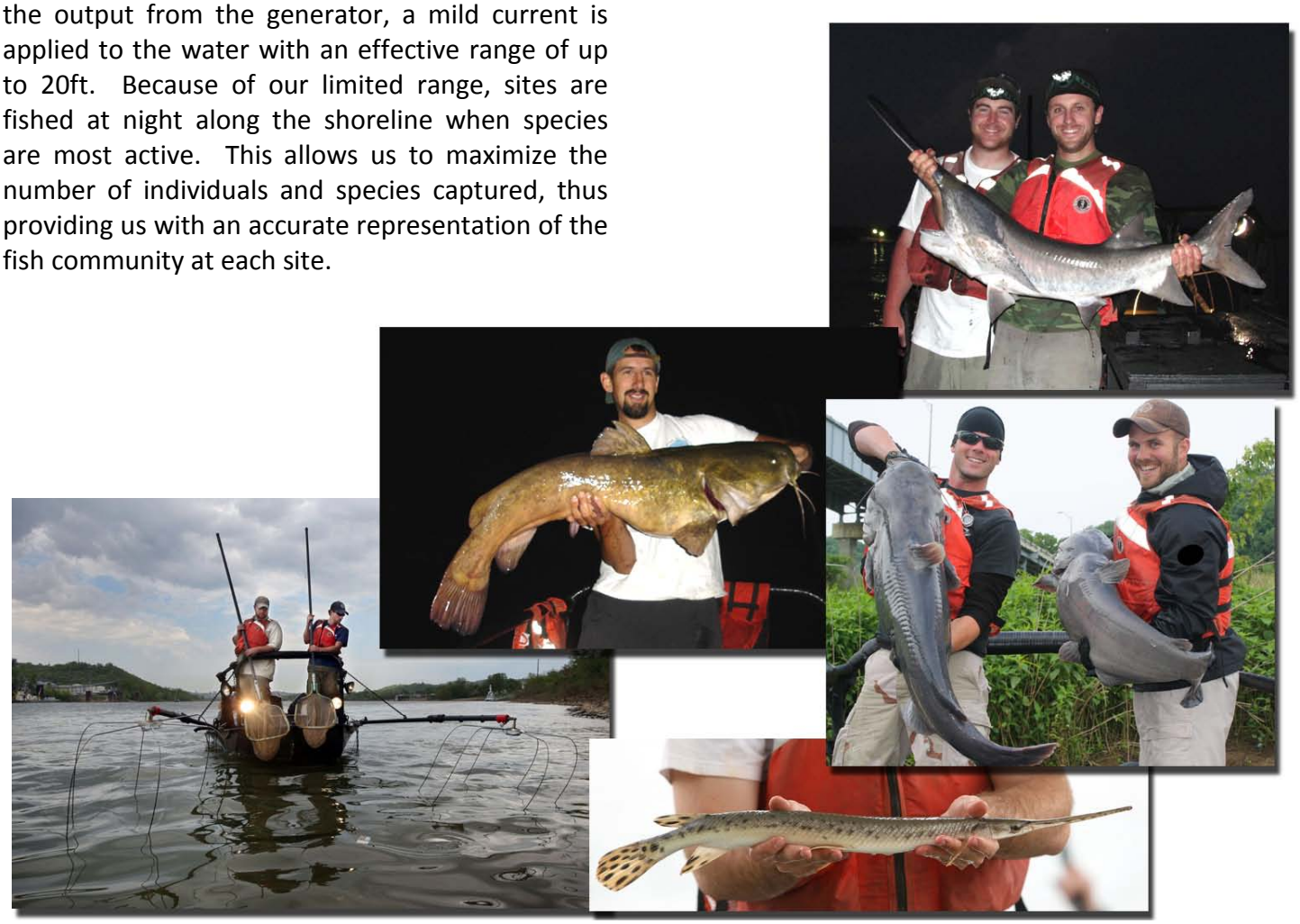
Site Selection

A random, probability-based survey design was used to select sampling site locations within each Ohio River navigational pool. The target areas of our surveys are both shorelines of each pool from the upstream dam to the downstream dam. The survey design provides coordinates for 15 sites (500m-long) in each of the selected pools. Biological and environmental data are then collected from these 15 sites and used to assess the biological condition of the pool.

Collecting the Fish

To maintain consistency across different sampling years, fish surveys are conducted between July 1st and October 31st and when water levels are within one meter of "normal flat pool". The fish are collected by a non-lethal method called boat electrofishing using an 18ft aluminum johnboat equipped with a generator and an electrofishing unit (standard equipment used by federal and state agencies). Using the electrofishing unit to regulate the output from the generator, a mild current is applied to the water with an effective range of up to 20ft. Because of our limited range, sites are fished at night along the shoreline when species are most active. This allows us to maximize the number of individuals and species captured, thus providing us with an accurate representation of the fish community at each site.

Sampling is conducted in a downstream manner for a minimum of 1800 seconds, during which all available habitats are sampled within 100ft from shore. When the fish encounter the electric field their muscles contract and they rise to the surface. The fish are then netted and placed into a live well were they remain until the entirety of the 500m zone is sampled. Each fish is measured, inspected for anomalies, and identified to lowest possible taxonomic level (e.g. species) before being returned to the water. A few small fish (less than 4cm) that cannot be confidently identified in the field (e.g. minnows) are preserved and identified in the laboratory. All recorded fish information is reviewed and imported into a database from which fish index scores are later generated.



METHODS

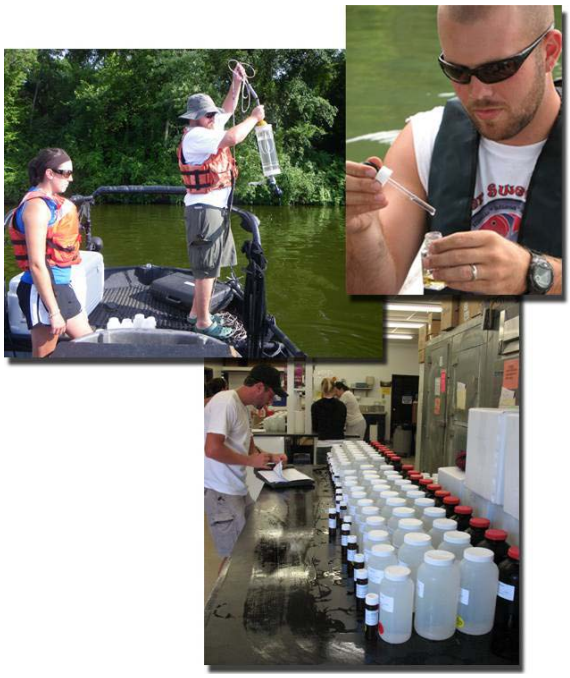
Characterizing Instream Habitat

Intensive habitat surveys are conducted which include measures of woody cover, depth, and prevalence of substrate types at each electrofishing site. Woody cover (submerged brush, logs, and stumps) is estimated visually. More quantitative measures of depth and substrate proportions are obtained through the use of a 20' copper pole. The pole is used to probe the bottom of the river to determine exact depth and the proportions of substrate types including: boulder, cobble, gravel, sand, fines, and hardpan (clay) that occur at each site.

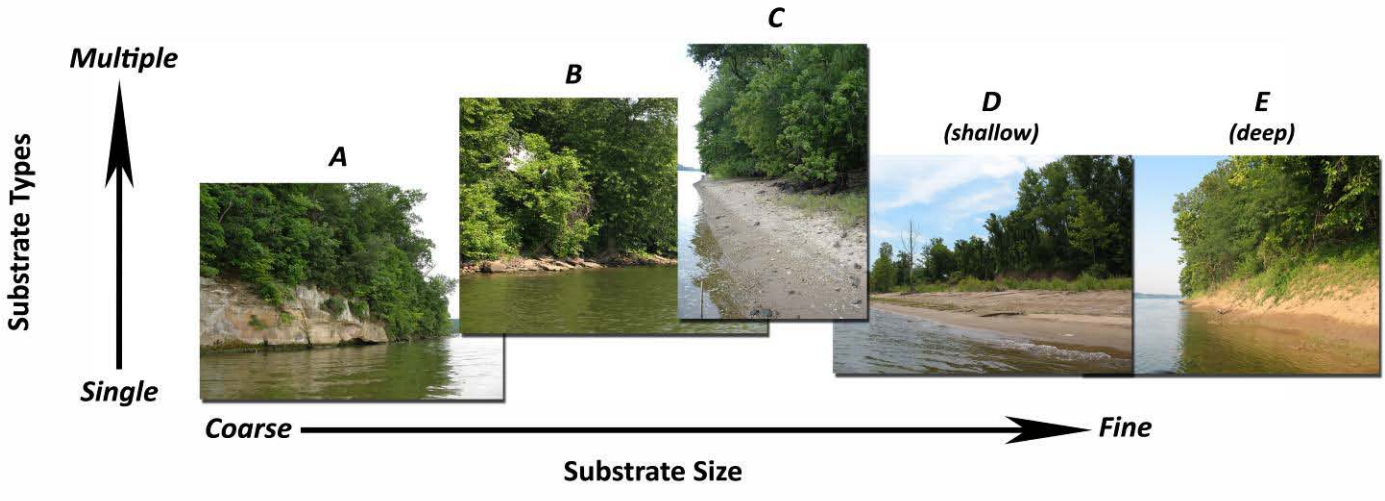
Because different fish species prefer different habitat types, it is important to classify the instream habitat at each of our sites to better understand *m*ORFIn score variability. Using the habitat survey data, we assign each site to one of five statistically derived habitat classes simply named: 'A', 'B', 'C', 'D' and 'E'. The five habitat classes represent a gradient from highly coarse Class 'A' habitats with high amounts of cobble and gravel, to the predominantly sandy/fine substrates of habitat classes 'D' and 'E' (which differ by water depth, see below).

Water Quality and Hydrology

Basic measures of water quality such as water temperature, clarity, pH, DO, and conductivity are measured at each site prior to electrofishing. Water samples may also be collected at the downstream end of each 500m zone approximately 100ft from shore to determine various water quality parameters (e.g. nutrient levels and hardness). River stage is monitored using data obtained from the U.S. Army Corps of Engineers, who also provide measures of predicted daily average flow volumes and velocities from the nearest-upstream sampling station to any particular site. These data are compiled to aid in the interpretation of the fish index results.



A look at our five habitat classes



Assessing Biological Condition

The original ORFIn, created in 2003, contained 13 measures (metrics) of various aspects of the fish community including: diversity, abundance, feeding and reproductive guilds, pollution tolerance, and fish health. Individual site performance was assessed using expectations established for only three original habitat classes.

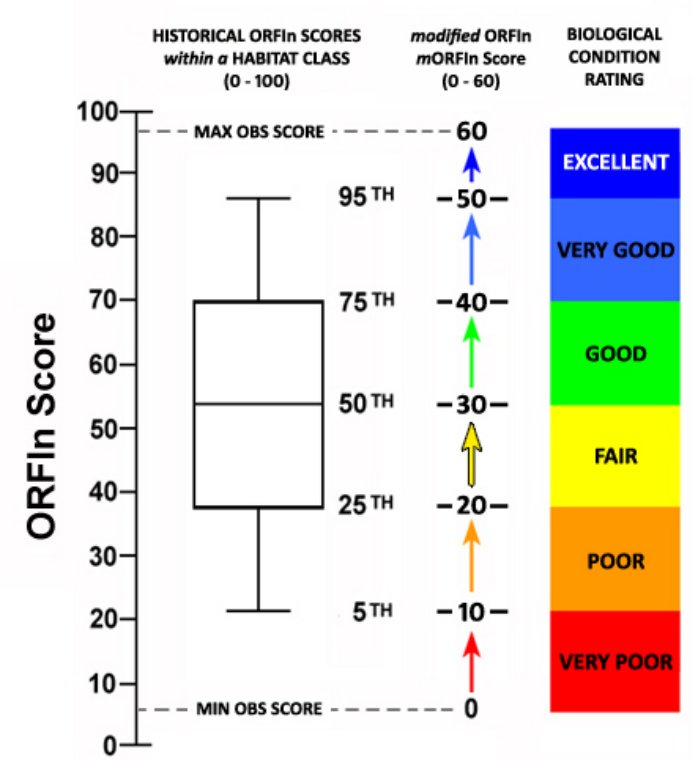
13 original ORFIn metrics used to generate *m*ORFIn scores

Metric Name	Definition
Native Species	No. of species native to the Ohio River
Intolerant Species	No. of species intolerant to pollution and habitat degradation
Sucker Species	No. of sucker species (e.g. redhorse and buffalo)
Centrarchid Species	No. of black bass, sunfish, and crappie species
Great River Species	No. of species primarily found in large rivers
% Piscivores	% of individuals (ind) that consume other fish
% Invertivores	% of ind that consume invertebrates
% Detritivores	% of ind that consume detritus (dead plant material)
% Tolerants	% of ind tolerant to pollution and habitat degradation
% Lithophils	% of ind belonging to breeding groups that require clean substrates for spawning
% Non-natives	% of ind not native to the Ohio River, including both exotics and hybrids
No. *DELT* anomalies	No. of ind with *D*eformities, *E*rosions, *L*esions, and *T*umors present
Catch per unit effort (*CPUE*)	Total abundance of individuals (minus exotics, hybrids, and tolerants)

In 2008, we *modified* the ORFIn (*m*ORFIn) by updating the scoring system, re-evaluating our habitat classes, and accounting for variations of ORFIn scores observed across the five new habitat classes previously described. With this modified tool we assess each navigational pool based upon the biological and environmental data collected from its 15 randomly selected sites. This involves a multi-step approach (detailed below) that converts the ORFIn scores (0-100) of each individual site into a *modified* ORFIn (*m*ORFIn) score (0-60) based on the varying expectations of the five different habitat classes. The *m*ORFIn scores of the 15 sites are then averaged to provide an overall *m*ORFIn score and rating for the navigational pool. This average *m*ORFIn score is then compared to the established biocriterion of 20.0.

The five distinct habitat classes ('A', 'B', 'C', 'D', and 'E') each exhibit different levels of historical ORFIn performance (i.e. different fish communities are found at each habitat). The ORFIn score of each survey site is compared to the range of historical ORFIn scores within its particular habitat class.

Then a *m*ORFIn score between 0 and 60 is calculated for each individual site based upon how its ORFIn score relates to statistical thresholds defined within the historical ranges. A biological condition rating (i.e. 'Poor', 'Very Poor', 'Fair', 'Good', 'Very Good', and 'Excellent') is given to each site based on its *m*ORFIn score.



To obtain a final bio-assessment of each pool, an average *m*ORFIn score is calculated. The 25th percentile is the statistical threshold commonly used by regulatory agencies for establishing biocriteria. Using this threshold, our established biocriterion (i.e. a representation of healthy Ohio River fish communities) is set at an average *m*ORFIn score of 20.0. The pool is assessed as meeting its aquatic life-use designation (i.e. possessing intact fish communities) if its average *m*ORFIn score is greater than or equal to 20.0 (i.e. a biological rating of 'Fair', 'Good', 'Very Good', or 'Excellent'). Any pool with an average *m*ORFIn score less than 20.0 (i.e. a rating of 'Poor' or 'Very Poor') is assessed as failing to meet its aquatic life-use designation.

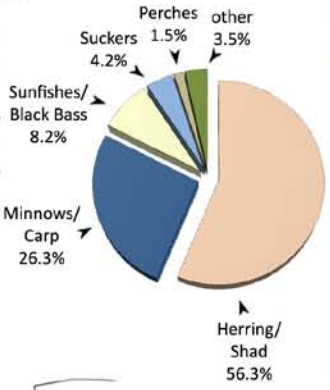
For more detailed information pertaining to our programs including survey design, field methods, past & present assessment results, or fish data contact one of our staff or visit: www.orsanco.org/index.php/biological-programs

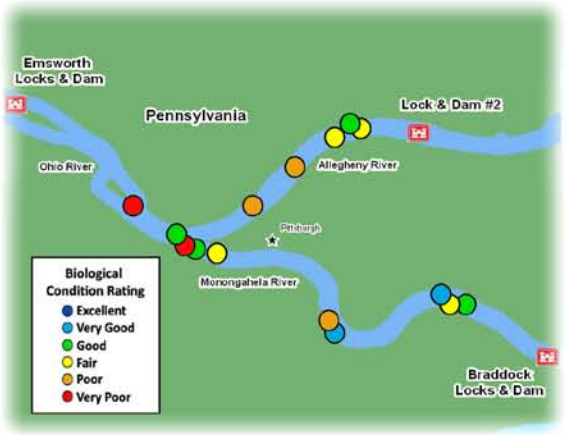
2012 Pool Survey Results

Above are the relative locations of the pools surveyed in 2012. The results of these biological surveys are detailed in the following pages. Included are brief descriptions of the land use and hydrology, site specific data pertaining to fish and instream habitat, ORFIn and mORFIn scores, and the overall biological assessment of each pool.

Emsworth Pool - *2012*

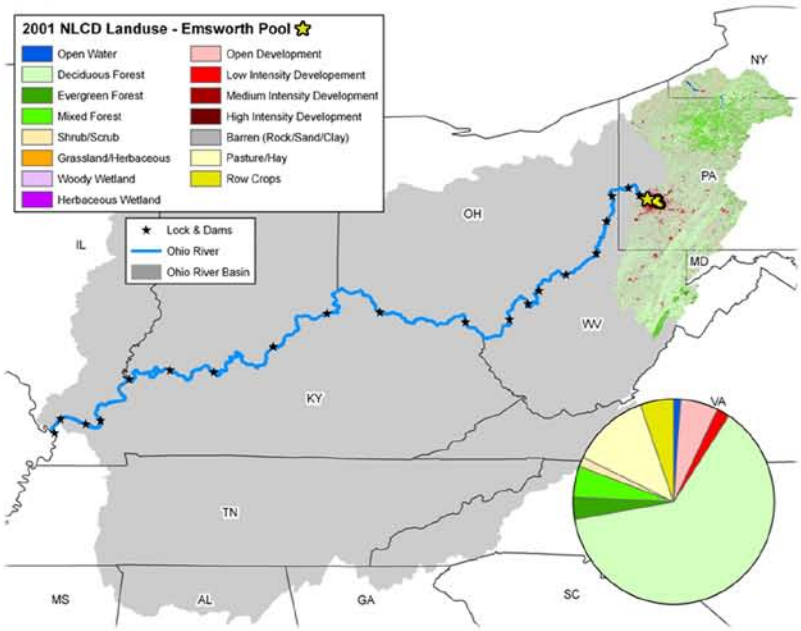
Emsworth Locks and Dam is the first lock system on the Ohio River below the confluence of the Allegheny and Monongahela rivers. The main stem portion of the pool is 6.2 miles long, extending from Pittsburgh Point (ORM 0.0) to Emsworth Locks and Dam (ORM 6.2). For the purpose of our biological assessment we extended this area beyond the confluence upstream to the first dams on the Allegheny (6.2 miles) and Monongahela rivers (11.2 miles). The Ohio River portion of the pool averages 1,456 feet wide and 21 feet deep (ORSANCO 1994). The entirety of the pool lies in Pennsylvania, in an area where the immediate land use consists of residential and industrial development (9.2%). However, the larger area draining into the pool is largely forested (68.9%) with some agricultural uses (17.3%). The shorelines of the main stem portion of Emsworth are highly modified; the tributaries are also modified, but to a lesser extent.



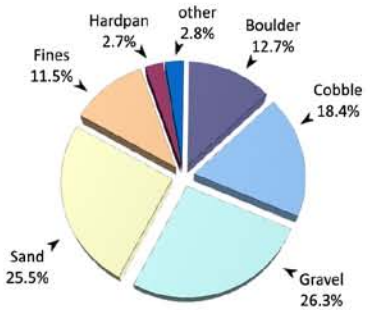


Locations of the 15 randomly chosen electrofishing sites in Emsworth Pool

The Ohio River originates in Pittsburgh, Pennsylvania at the confluence of the Monongahela and Allegheny rivers



Land-use types within the Emsworth Pool watershed



smallmouth bass (*Micropterus dolomieu*)

walleye (*Sander vitreus*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	ALL 5.2	B	46.71	52.98	27.5
2	ALL 5.2	A	50.03	56.48	30.8
3	ALL 4.6	D	41.80	42.97	21.5
4	ALL 3.3	C	44.55	39.81	16.7
5	ALL 1.8	B	46.71	45.00	18.1
6	MON 8.7	D	46.71	63.09	44.9
7	MON 8.2	C	44.55	47.52	23.9
8	MON 8.1	A	50.03	67.50	44.9
9	MON 5.1	A	50.03	71.21	48.7
10	MON 4.8	C	44.55	39.11	16.2
11	MON 0.8	B	46.71	53.33	27.9
12	MON 0.3	A	50.03	56.09	30.2
13	OH 0.1	B	46.71	31.43	7.2
14	OH 0.4	C	44.55	55.75	34.0
15	OH 1.7	A	50.03	33.22	7.2
			Average Pool *m*ORFIn Score		**26.6**

Emsworth Pool - Results Overview

Sampling Results

Environmental Measures

Dominant Habitat Class: A - dominated by coarse substrates

Notable Measures: Marinas/docks and recreational uses dominate streches of the "Three Rivers" area

Biological Measures

Total No. of Fish Species: 46

Average No. of Individuals: 108

Dominant Family (*minus herring/shad*): Minnows/Carp

Dominant Species (*minus shad/shiners*): smallmouth bass

Threatened and Endangered Species: mooneye & longear sunfish

Rare Ohio River Mainstem Species: streamline chub

Notable Catch: large ornamental common carp (a.k.a. "koi")

Assessment Results

Highest scoring ORFIn metric (*minus DELTs*): Centrarchid Species

Lowest scoring ORFIn metric: Great River Species

Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 11

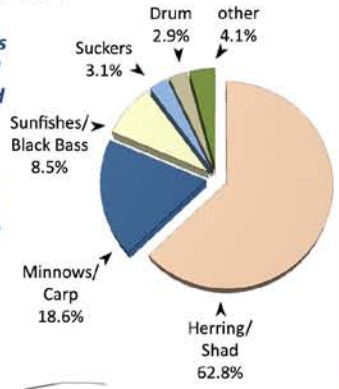
Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 4

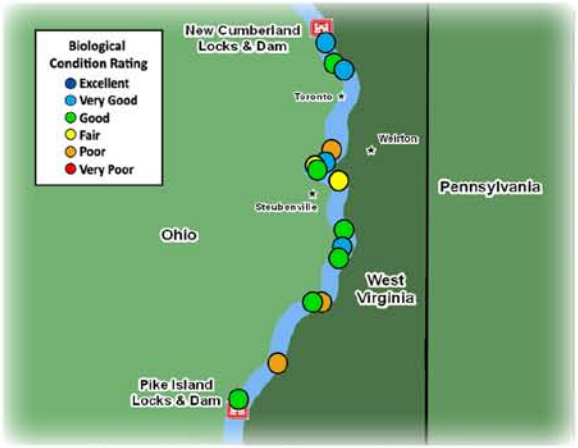
Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Fair

Pike Island Pool - *2012*

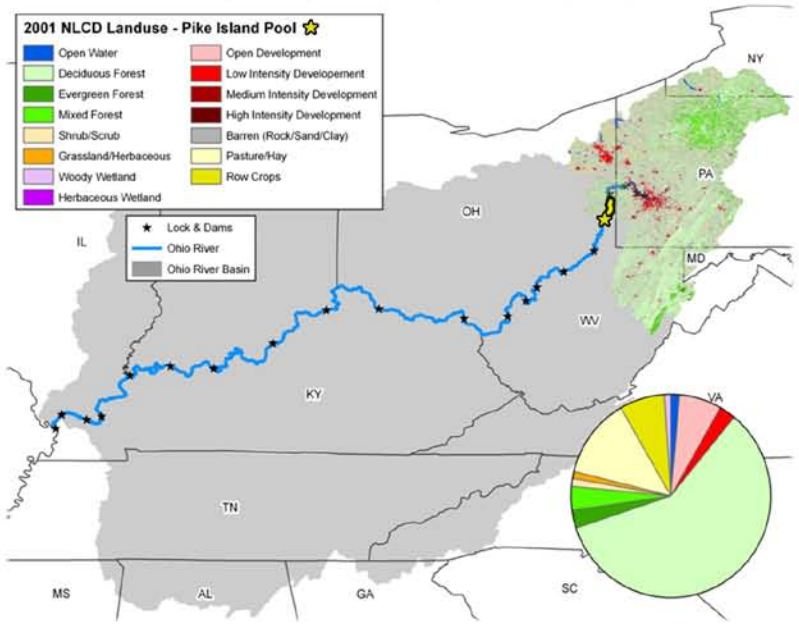
Pike Island pool is 29.8 miles long, extending from New Cumberland Locks and Dam (ORM 54.4) to Pike Island Locks and Dam (ORM 84.2). The pool has a gradient drop of 0.4 feet per mile and averages 1,338 feet wide and 19 feet deep (ORSANCO 1994). The pool flows adjacent to the states of West Virginia and Ohio. This pool lies in a portion of the Ohio River heavily influenced by industry with a large amount of barge activity. The shorelines of this pool support a moderate degree of aquatic vegetation, and littoral zones were dominated by invasive species (Hydrilla spp.). The Pike Island pool receives water from the following tributaries: Buffalo Creek at mile point 74.7 with a drainage area of 160 square miles, and Short Creek at mile point 81.4 with a drainage area of 147 square miles. These watersheds are primarily forested (64.4%), but also have a considerable amount of row crops (7.2%) and pasture lands (12.5%).



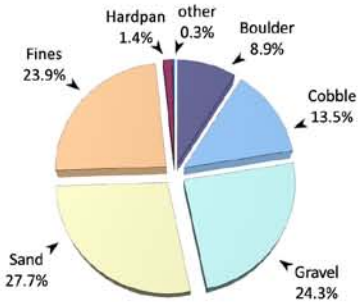


Locations of the 15 randomly chosen electrofishing sites in Pike Island Pool

Large road cuts in the surrounding ridgelines are visible on both the OH and WV sides of the Ohio River



Land-use types within the Pike Island Pool watershed



bluegill (*Lepomis macrochirus*)

northern pike (*Esox lucius*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	55.2	C	44.55	65.19	43.4
2	56.8	C	44.55	54.96	33.1
3	57.5	C	44.55	61.55	40.3
4	63.1	D	41.80	38.00	16.3
5	64.2	B	46.71	68.59	44.0
6	64.9	A	50.03	55.03	28.4
7	65.1	C	44.55	54.63	32.7
8	66.8	C	44.55	48.51	25.2
9	70.0	B	46.71	61.42	37.3
10	71.4	C	44.55	67.81	45.5
11	72.1	C	44.55	53.51	31.4
12	75.2	A	50.03	41.14	13.4
13	75.4	C	44.55	53.61	31.5
14	80.2	C	44.55	40.97	17.5
15	83.7	D	41.80	53.11	34.1
			Average Pool *mORFIn* Score		**31.6**

Pike Island Pool - Results Overview

Sampling Results

Environmental Measures

- Dominant Habitat Class: C - equal mix of coarse and fines
- Notable Measures: abundant aquatic vegetation (15 of 15 sites)

Biological Measures

- Total No. of Fish Species: 42
- Average No. of Individuals: 137
- Dominant Family (*minus herring/shad)*: Minnows/Carp
- Dominant Species (*minus shad/shiners*): smallmouth bass
- Species of Concern: river redhorse (OH)
- Rare Ohio River Mainstem Species: rainbow darter
- Notable Catch: northern pike

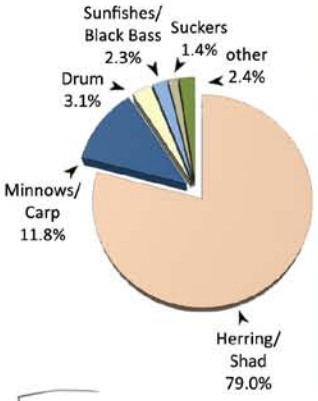
Assessment Results

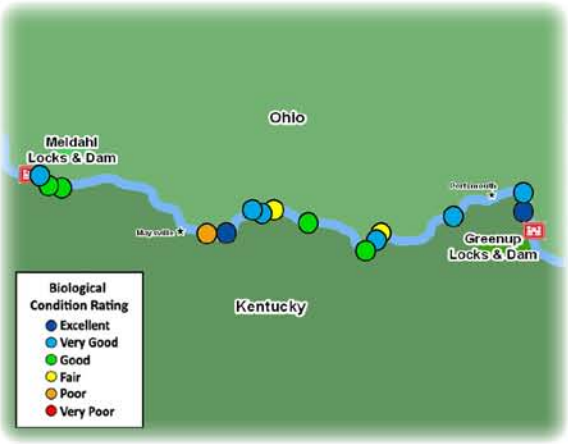
- Highest scoring ORFIn metric (*minus DELTs*): % Non-natives
- Lowest scoring ORFIn metric: Great River Species
- Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 12
- Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 3
- Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Good

Meldahl Pool - *2012*

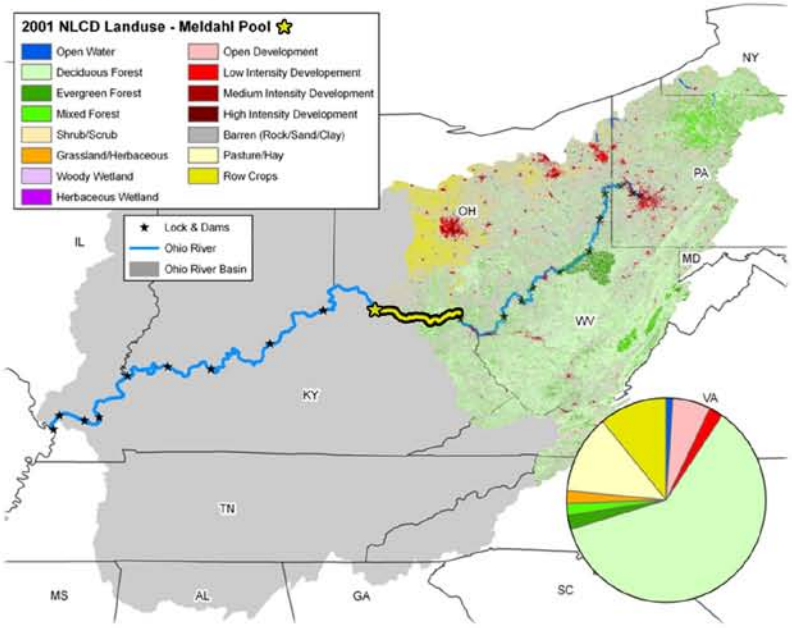
Meldahl pool is 95.2 miles long, extending from Greenup Locks and Dam (ORM 341.0) to Meldahl Locks and Dam (ORM 436.2). The pool has a gradient dropof 0.3 feet per mile, averages 1,603 feet wide and 23 feet deep. The pool flows adjacent to the states of Ohio and Kentucky. The shorelines of this pool support a moderate degree of aquatic vegetation in the littoral zone. 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 with a combined tributary drainage area of 8,340 square miles (ORSANCO 1994). Meldahl 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%). Historically, Meldahl is consistently rated as one of the better pools on the Ohio River.



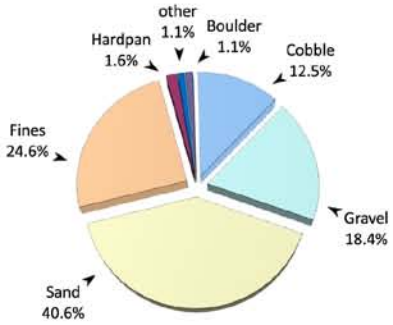


Locations of the 15 randomly chosen electrofishing sites in Meldahl Pool

Forested shorelines and woody cover are a common sight within Meldahl pool, like this photo taken near Vanceburg, KY



Land-use types within the Meldahl Pool watershed



freshwater drum (*Aplodinotus grunniens*)

sauger (*Sander canadensis*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	344.6	A	50.03	82.18	60.0
2	348.0	C	44.55	65.51	43.6
3	360.8	E	39.59	63.65	45.5
4	374.2	D	41.80	43.35	22.0
5	374.8	C	44.55	65.49	43.6
6	376.3	E	39.59	57.81	38.4
7	387.3	E	39.59	55.48	35.7
8	392.7	D	41.80	46.71	26.2
9	394.9	D	41.80	59.76	41.7
10	395.1	E	39.59	66.31	48.8
11	402.6	E	39.59	70.33	60.0
12	405.3	C	44.55	42.88	18.8
13	431.5	D	41.80	52.51	33.4
14	433.0	E	39.59	57.39	37.9
15	434.7	C	44.55	64.24	42.6
				Average Pool *mORFIn* Score	**39.9**

Meldahl Pool - Results Overview

Sampling Results

Environmental Measures

- Dominant Habitat Class: E - deep sand/fines
- Notable Measures: high occurance of woody structure

Biological Measures

- Total No. of Fish Species: 41
- Average No. of Individuals: 191
- Dominant Family (*minus herring/shad*): Minnows/Carp
- Dominant Species (*minus shad/shiners*): freshwater drum
- Threatened and Endangered Species: channel darter (T)
- Rare Ohio River Mainstem Species: slenderhead darter
- Notable Catch: walleye (more common upstream)

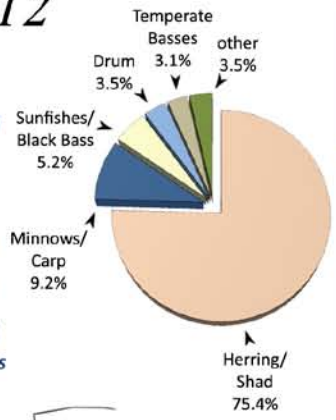
Assessment Results

- Highest scoring ORFIn metric (*minus DELTs*): % Non-natives
- Lowest scoring ORFIn metric: % Lithophils
- Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 14
- Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 1
- Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Good

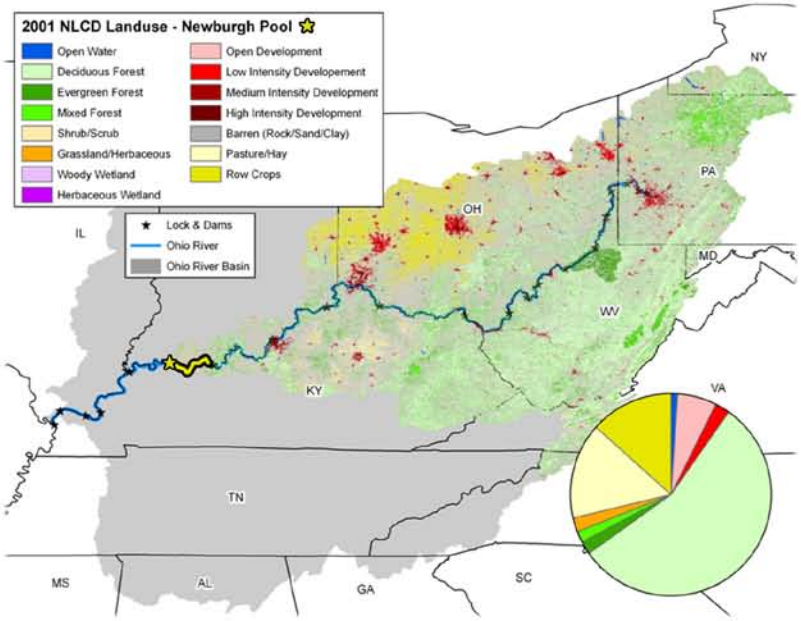
Newburgh Pool - *2012*

Newburgh pool is 55.4 miles long, extending from Cannelton Locks and Dam (ORM 720.7) to Newburgh Locks and Dam (ORM 776.1). The pool has a gradient drop of 0.3 feet per mile and averages 2,477 feet wide and 28 feet deep. The pool flows adjacent to the states of Indiana and Kentucky. The Newburgh pool receives water from the following tributaries: Anderson River at mile point 731.5 with a drainage area of 276 square miles, Blackford Creek at mile point 742.2 with a drainage area of 124 square miles and Little Pigeon Creek with a drainage area of 415 square miles (ORSANCO 1994). The shorelines of this pool support a slight degree of aquatic vegetation in the littoral zones. Newburgh pool lies in a portion of the Ohio River where the land use consists primarily of deciduous forest (53.9%), but also has a considerable amount of row crops (13.1%) and pasture lands (14.9%).

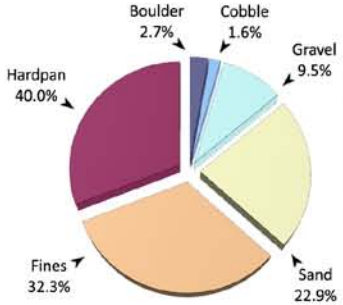


Locations of the 15 randomly chosen electrofishing sites in Newburgh Pool

Eroded clay banks are a common sight within Newburgh Pool, as shown here upstream of Owensboro, KY



Land-use types within the Newburgh Pool watershed



spotted gar (*Lepisosteus oculatus*)

paddlefish (*Polyodon spathula*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	722.4	D	41.80	76.22	59.1
2	723.4	E	39.59	61.60	43.0
3	730.6	B	46.71	66.92	42.6
4	734.4	D	41.80	57.91	40.0
5	737.5	D	41.80	68.21	49.7
6	741.3	D	41.80	77.02	60.0
7	742.6	D	41.80	56.58	38.4
8	745.5	D	41.80	70.66	52.5
9	746.4	D	41.80	65.26	46.9
10	754.4	C	44.55	61.23	40.1
11	768.1	E	39.59	60.98	42.2
12	769.5	D	41.80	68.02	49.5
13	772.1	D	41.80	61.05	42.9
14	772.4	D	41.80	44.96	24.0
15	774.6	D	41.80	75.80	58.6
			Average Pool *mORFIn* Score		**46.0**

Newburgh Pool - Results Overview

Sampling Results

Environmental Measures

- Dominant Habitat Class: D - shallow sand/fines
- Notable Measures: higher water velocities in the upper reaches

Biological Measures

- Total No. of Fish Species: 44
- Average No. of Individuals: 184
- Dominant Family (*minus herring/shad)*: Minnows/Carp
- Dominant Species (*minus shad/shiners*): freshwater drum
- Species of Concern: black buffalo (KY)
- Rare Ohio River Mainstem Species: spotted gar
- Notable Catch: large paddlefish

Assessment Results

- Highest scoring ORFIn metric (*minus DELTs*): % Tolerants
- Lowest scoring ORFIn metric: % Lithophils
- Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 15
- Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 0
- Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Very Good

CONCLUSIONS

Pool Surveys

The 2012 pool surveys were successfully completed between July 2nd and August 23rd. Typical weather conditions were experienced throughout the season. However all four pools experienced lower than average flows for the month of July. Overall, all four pools surveyed during the 2012 field season were assessed as *meeting* their aquatic life-use designations (i.e. containing healthy fish communities).

Emsworth Highlights (Fair)

Survey sites were distributed in the upper half of the pool with the majority of sites falling on the Monongahela and Allegheny rivers respectively. Coarse substrates (cobble & gravel) were the predominant substrate type. Gizzard shad made up over half (56.3%) of the individuals caught. An abundance of minnows and carp were also encountered. Notable species caught included channel darter (rare Ohio R. species), mooneye, brook silverside and longear sunfish (all three listed as threatened or endangered in PA), a large ornamental koi from the Monongahela main stem, and streamline chubs on the lower Monongahela and Allegheny rivers.

Meldahl Highlights (Good)

Survey sites were evenly distributed throughout the pool, with a few occurring in close proximity. Benthic composition was primarily fine substrates. The herring and shad family made up the majority of the catch (79%). Notable catches included channel darter (threatened in OH), black buffalo (special concern in KY), slenderhead darter (rare Ohio River species) and walleye which are more common in the upper third of the river.

Pike Island Highlights (Good)

Survey sites were evenly distributed throughout the pool, with a few occurring in close proximity. Coarse and fine substrates comprised the benthic composition in nearly equal proportions. Shallow areas were impacted by invasive aquatic vegetation (*Hydrilla spp.*). The herring and shad family comprised the majority of individuals caught (62.8%). Notable species included mooneye, highfin carpsucker, river carpsucker and river redhorse, all listed as species of concern in WV with the latter listed similarly in OH. A northern pike (rare main stem species) was also caught.

Newburgh Highlights (Very Good)

Survey sites were spread evenly with several sites in close proximity in the lower portion of the pool. Benthic composition was primarily hardpan (40%). Herring and shad made up the majority of the catch. Notable catches included black buffalo (special concern in KY), a large paddlefish and a spotted gar.

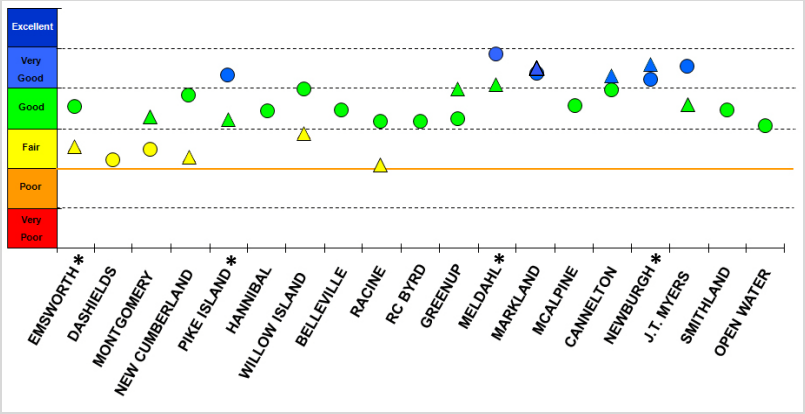
Assessment Comparisons

Between 2005 and 2009, all 19 Ohio River navigational pools were surveyed and assessed. The first cycle revealed the majority of the river to be in 'Good' condition. The 2012 surveys were conducted as part of the second full assessment of those same 19 pools. This second cycle allows us to not only rate the relative condition of each pool, but also compare past and present survey results, Some of the species variability observed across pools (see final table, pg 15), is likely due in part to variations in natural distributions, instream habitat, and annual variations in flow/weather conditions.

River-wide Assessment Comparison

The 2012 pools (*) had relatively similar condition ratings to their neighboring pools. Reasons for the variability of ratings across the pools include, but are not limited to varying degrees of anthropogenic land uses (which can affect habitat and water quality) and proximity to tributaries (which can affect species diversity based upon the biological condition of the tributary).

○ = 1st cycle (2005-2009)
△ = 2nd cycle (2010 - Present)



CONCLUSIONS

Present vs. Past Assessments

The focus of ORSANCO's biological assessments is to determine whether each pool 'meets' or 'fails to meet' its designated aquatic life use. To aid in interpretation, we apply six arbitrary ratings (from 'Very Poor' to 'Excellent') to the pools based on the relative condition of their fish communities. Shifts between years in these condition ratings may be due to variations in environmental factors other than water quality changes. By examining these factors (temperature, flows, etc.) and their effects on *m*ORFIn metrics, we attempt to provide plausible explanations for the differences in final condition ratings observed between years. Explanation common to the current pool assessments were the differences in the abundances of a few species between the two survey years (see summary tables), due to annual fluctuations in reproductive success. In particular, sauger which were very numerous in 2007 and rarely encountered in 2012.

Emsworth Pool (2012 vs. 2007)

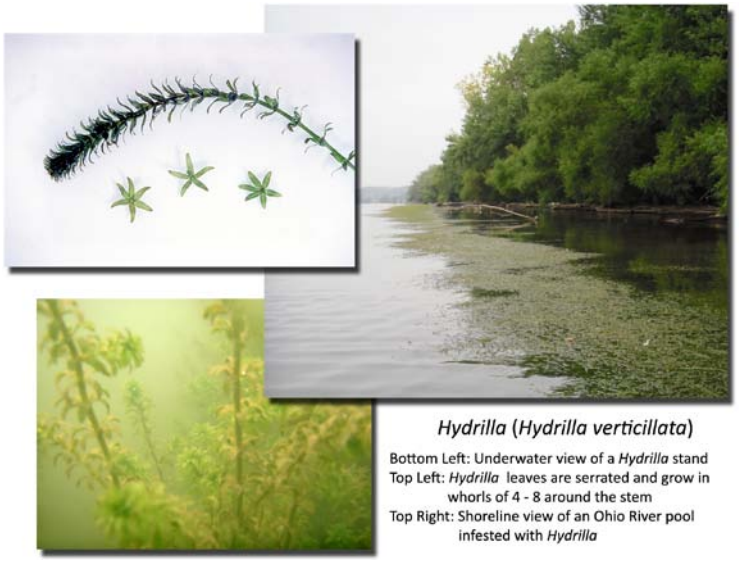
Variable	2012	2007	Difference
Environmental Factors			
Avg. seasonal flow	Low	Low	Same
Avg. conductivity (µS/cm)	488	446	34
Avg % of Site containing SAV	11.4%	0.0%	9.3%
% Tolerants score (0-100)	35.2	62.5	-27.3
No. of bluntnose minnows	120	0	-120
% Lithophils score (0-100)	26.8	59.9	-33.1
Great River Species score (0-100)	13.3	55.6	-42.2
Sucker species score (0-100)	49.6	60.9	-11.3
No. of redhorse	178	328	-150
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Fair**	**Good**	Lower

Emsworth pool was assessed to be in slightly lower condition in 2012 than in 2007. Other than an increase in conductivity, no environmental differences were observed that could account for lower metric performance. Unlike 2007 observations, several 2012 sites fell in areas with substantial habitat modification (concrete walls and steep drop-offs). Lower observed scores were driven by fewer simple lithophils/suckers (redhorse species) and great river species and more tolerant species. Change in condition rating may be partially attributable to seasonal differences as the 2007 survey was conducted in September as opposed to the 2012 collections completed in July.

Pike Island Pool (2012 vs. 2007)

Variable	2012	2007	Difference
Environmental Factors			
Avg. seasonal flow	Low	Low	Same
% Sites with SAV	100%	0%	100%
Avg % of Site containing SAV	8%	0%	8%
Sites dominated by *Hydrilla*	13	0	13
Sucker Species score (0-100)	43.3	69.8	-26.6
No. silver & smallmouth redhorse	39	106	-67
% Tolerants score (0-100)	62.1	90.9	-28.8
No. of bluntnose minnow	28	2	26
No. of common carp	36	15	21
Great River score (0-100)	4.4	48.9	-56.9
No. of mooneye	2	37	-35
No. of silver chub	0	11	-11
% Lithophils score (0-100)	14.0	39.5	-15.5
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Good**	**Very Good**	Lower

Pike Island pool received a lower condition rating in 2012 than in 2007. Substantially higher amounts of aquatic vegetation were observed throughout the pool in 2012. While the presence of submerged aquatic vegetation (SAV) typically enhances instream habitats, we believe the high abundance of vegetation may have caused a shift in the fish community structure and likely contributes to the lower rating. The densely vegetated shallow sites tend to enhance populations of tolerant and/or non-native species such as common carp and increase the abundance of sunfish and bass species. Increased vegetation may have also contributed to the decreased number of simple lithophils (sauger, saugeye and walleye), observed in 2012, as they forage over bare substrates. Lower numbers of pelagic piscivores and redhorse species were also observed and negatively impacted scores.



Hydrilla (*Hydrilla verticillata*)

Bottom Left: Underwater view of a *Hydrilla* stand
Top Left: *Hydrilla* leaves are serrated and grow in whorls of 4 - 8 around the stem
Top Right: Shoreline view of an Ohio River pool infested with *Hydrilla*

CONCLUSIONS

Meldahl Pool (2012 vs. 2007)

Variable	2012	2007	Difference
Environmental Factors			
Avg. seasonal flow	Low	Low	Same
CPUE score (0-100)	73.4	64.1	9.3
% Invertivores score (0-100)	35.8	20.0	15.8
Great River Species score (0-100)	57.8	77.8	-20.0
% Piscivores score (0-100)	32.4	62.1	-29.7
% Lithophils score (0-100)	17.9	74.6	-56.7
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Good**	**Very Good**	Lower

Meldahl pool was assessed to be in slightly lower condition in 2012 than it was in 2007. Again we observed species shifts similar to the other pools sampled, i.e. decreased simple lithophils (sauger) and decreased invertivores. Metric performance revealed low numbers of non-natives and low numbers of simple lithophils. The 2012 survey resulted in the highest scoring site we have observed in any of our assessments. All other metric scores exhibited insignificant changes. The lower condition rating is not considered significant as the pool demonstrates the inherent biological variability we would expect.

Newburgh Pool (2012 vs. 2007)

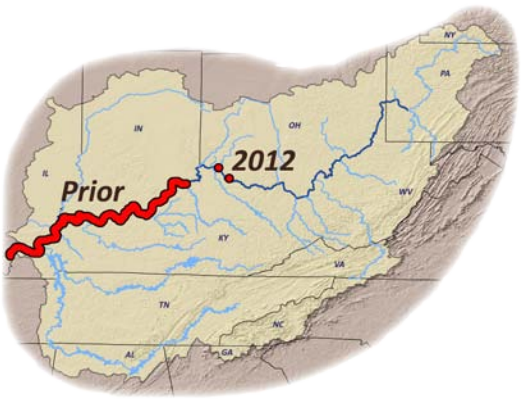
Variable	2012	2007	Difference
Environmental Factors			
Avg. seasonal flow	Low	Low	Same
CPUE score (0-100)	74.8	36.8	37.9
Centrarchid Species score (0-100)	63.3	23.3	40.0
% Invertivores score (0-100)	54.3	21.1	33.2
% Piscivores score (0-100)	41.2	80.0	-38.7
% Lithophils score (0-100)	11.7	71.3	-59.7
Sucker Species score (0-100)	49.9	60.9	-11.0
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Very Good**	**Very Good**	Same

Newburgh pool was assessed to be in the same condition in 2012 as it was in the previous assessment performed in 2007. As in the other three pools assessed, lower numbers of piscivores and simple lithophils were observed. Increased metric scores for centrarchids and invertivores had a positive effect on the final condition rating. The slight differences between the Newburgh assessments are likely artifacts of spatial and temporal variation that occur within a pool across years.

Field Notes For the 2012 field season, we began using an additional type of electrofishing unit (*Infinity* Control Box – Midwest Lake Electrofishing Systems) that has several new features. The new unit provides instantaneous voltage and amperage output readings. These readings coupled with paired conductivity measurements, allow us to more readily standardize our electrofishing effort over the range of conductivities encountered throughout the Ohio River main stem.

The unit also has a scroll function that allows for numerous duty cycle and frequency settings (previous units had only a few preset values). Duty cycle is the percentage of the time that the unit is applying current to the water. Frequency is the number of pulses per second that are being applied to the water during that period of time. These values are important because fish species respond differently to various settings. The ability to customize these values allows for the targeting of specific species in addition to our standard sampling regime.

Using these new functions we were able to target silver carp, a highly invasive exotic species, which was difficult to immobilize with the limited settings of our other units. We were able to confirm the presence of silver carp in portions of the Ohio River 150 miles upstream of their previously known range (see below). We hope to take advantage of these new capabilities to track the invasion of silver carp and target species for fish consumption advisories in the future (advisories available at http://www.orsanco.org/fca).



silver carp (*Hypophthalmichthys molitrix*)

Left: Netting silver carp with new EF unit
Center: Two fertile male silver carp caught on the Little Miami River upstream of Cincinnati, OH
Right: Current range of silver carp on the main stem Ohio R. (two most upstream captures from 2012 shown)

River-wide Catch Comparison (data from most recent survey year shown)

Group	Species (common name)	Emsworth '12	Dashields '08	Montgomery '10	New Cumberland '11	Pike Island '12	Hannibal '08	Willow Island '11	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '11	Meldahl '12	Markland '09	McAlpine '09	Cannelton '11	Newburgh '12	John T. Myers '10	Smithland '08	Open Water '09
GAR	Longnose Gar	**23**	11	8	19	**16**	49	30	49	61	27	33	**18**	14	38	20	**16**	13	16	40
	Spotted Gar																**1**	1	1	
	Shortnose Gar													1	1		**12**	24	13	75
SHAD	Skipjack Herring								2		2		**18**	2	2	1	**79**		1	8
	Gizzard Shad	**3417**	123	4058	1097	**5092**	1461	397	439	855	301	120	**17703**	185	394	709	**10834**	3039	409	325
	Threadfin Shad														1		**7**	1	25	3
CARP	Common Carp	**48**	36	44	19	**36**	15	40	36	43	12	12	**9**	28	12	4	**7**	16	17	51
	Grass Carp																			3
	Silver Carp																	12	4	6
	Bighead Carp																			2
	Goldfish																			
	Carp x Goldfish	**1**	1																	
MINNOW	Cyprinidae sp.																	1		
	Golden Shiner									1										
	Striped Shiner				1	**7**	2			2										
	Spottail Shiner			9	2		1	4										14		
	Spotfin Shiner	**77**		35	21	**62**		63	159	66	1	65	**26**	1		39	**39**	37	4	12
	Notropis sp.																		1	
	Emerald Shiner	**848**	5	171	1525	**892**	21	948	637	134	16	1557	**1837**	165	61	2195	**720**	140	28	25
	Silverband Shiner																			6
	Sand Shiner								1											
	Channel Shiner	**492**	1	159	685	**481**	16	532	795	178	1	944	**689**	33	30	2787	**465**	414		8
	River Shiner												**34**	11	10	94	**64**	16	2	9
	Shoal Chub																			
	Silver Chub		26	32	2		19		32	2	11	12	**24**	338	39	79	**22**	2	46	25
	Streamline Chub	**11**																		
	River Chub											8								
	Gravel Chub																			
	Creek Chub																			
	Central Stoneroller						3			2										
	Mississippi Silvery																			1
	Suckermouth Minnow													1						
	Bluntnose Minnow	**120**		21	98	**28**	4	190	11	7		4	**4**		1	2	**8**		1	
	Bullhead Minnow							2	1			25	**25**	8	1	36	**13**	14	2	19

River-wide Catch Comparison (data from most recent survey year shown)

Group	Species (common name)	Emsworth '12	Dashields '08	Montgomery '10	New Cumberland '11	Pike Island '12	Hannibal '08	Willow Island '11	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '11	Meldahl '12	Markland '09	McAlpine '09	Cannelton '11	Newburgh '12	John T. Myers '10	Smithland '08	Open Water '09
	Silverjaw Minnow						1													
SUCKER	Ictiobinae sp.																			
	Ictiobus sp.						19										**1**			
	Smallmouth Buffalo	**51**	99	79	68	**58**	45	50	75	42	40	25	**44**	109	95	23	**10**	58	77	76
	Bigmouth Buffalo			1												1		6	5	5
	Black Buffalo	**1**	13	3			1		1			1	**1**	1	1		**2**	9	4	7
	Carpiodes sp.		1			**1**			3											1
	Quillback	**1**	12	25	14	**9**	28	6	6	4	8	11	**12**	21	12	17	**9**	18	28	15
	River Carpsucker	**8**	18	28	23	**36**	64	16	12	21	25	55	**172**	85	85	363	**146**	43	114	218
	Highfin Carpsucker	**5**		14	5	**1**	13		1				**8**		17		**2**		24	
	Northern Hog Sucker	**3**	1	7	2	**6**	2		3		1	2	**1**	1	2					
	Moxostoma sp.											3				3				
	Shorthead Redhorse																		10	
	Smallmouth Redhorse	**33**	16	25	11	**16**	41	27	97	35	27	44	**14**	38	59	14	**1**	4		
	Silver Redhorse	**75**	93	132	70	**23**	105	12	55	4	11	19	**19**	3	38		**1**		1	
	River Redhorse	**14**	13	8		**2**	35	5	1	1	2	2			2					
	Black Redhorse	**8**		9		**3**			2											
	Golden Redhorse	**56**	33	282	216	**93**	204	63	115	31	33	34	**44**	213	182	2	**10**	11	3	1
	Spotted Sucker							4		3		1							7	
	White Sucker			1																
CATFISH	Yellow Bullhead							1		1										
	Brown Bullhead																			
	Northern Madtom																			
	Blue Catfish																		7	4
	Channel Catfish	**35**	17	17	201	**54**	62	91	89	79	53	295	**70**	111	79	287	**223**	103	291	165
	Flathead Catfish	**19**	11	12	15	**47**	38	17	27	29	42	37	**24**	23	11	32	**14**	19	16	15
SUNFISH	Lepomis sp.											1								
	Warmouth													2	1	1				
	Rock Bass	**75**	9	8	15	**24**	2	15	9	3		4		2						
	Bluegill	**154**	32	58	192	**131**	36	653	413	210	52	337	**212**	205	80	247	**94**	47	64	98
	Green Sunfish	**3**	3			**3**	2	1	8	3	6	3	**2**	9	3	7	**3**	4	1	2
	Pumpkinseed	**4**		2	2	**2**	2	25	1			2		1						1
	Orangespotted Sunfish				2			20	1	5	1	3	**2**					2		5
	Longear Sunfish	**2**			2	**8**	9	141	18	7	9	26	**73**	148	56	117	**293**	52	92	110

River-wide Catch Comparison (data from most recent survey year shown)

Group	Species (common name)	Emsworth '12	Dashields '08	Montgomery '10	New Cumberland '11	Pike Island '12	Hannibal '08	Willow Island '11	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '11	Meldahl '12	Markland '09	McAlpine '09	Cannelton '11	Newburgh '12	John T. Myers '10	Smithland '08	Open Water '09
SUNFISH	Redear Sunfish							1	4	1		1		1	1	15	**3**		20	
	Lepomis Hybrid					**1**						1								
	Bluegill X Longear							1											1	
	Bluegill X Green																			
	Longear X Green											1								
TEMPERATE BASS	Morone sp.	**50**		26	22	**110**	91	54	35	191	73	55	**289**	42	62	54	**361**	21	190	31
	White Perch						1	1						1						7
	Striped Bass						14										**4**	1	2	
	White Bass	**6**	16		37	**2**	3	13	41	5	29	19	**1**	18	24	6	**60**	44	76	54
	Yellow Bass															2			2	104
	Hybrid Striped Bass	**1**						7	3	9	1	10	**3**	14	6	2	**22**	8	2	45
BLACK BASS	Micropterus sp.	**57**						2		3			**79**				**3**	3	1	
	Smallmouth Bass	**167**	163	210	155	**431**	92	155	45	47	32	47	**30**	32	5	27	**33**	4		10
	Largemouth Bass	**8**	2	8	2	**8**		50	72	58	25	38	**21**	25	9	32	**72**	2	21	23
	Spotted Bass	**24**	34	5	48	**77**	38	79	43	20	30	127	**86**	102	20	58	**252**	41	31	36
DARTER	Johnny Darter																			
	Greenside Darter			1		**8**														
	Variegate Darter																			
	Rainbow Darter					**1**			1											
	Fantail Darter																			
	Bluebreast Darter																			
	Banded Darter																			
	Dusky Darter	**1**																	1	
	Channel Darter	**1**			1		1						**1**	3						
	Blackside Darter																			
	Slenderhead Darter												**1**	1						
	River Darter								2					7						
	Logperch	**29**	166	47	17	**40**	105	17	48	6	72	1	**2**	23	2			1	1	1
PERCH	Yellow Perch				5		3	2	2											
	Walleye	**20**	7	21	2	**2**	11	6	4		1	2	**2**			1				1
	Saugeye	**2**	8				1	44	1		1			13			**11**	3	2	16
	Sauger	**39**	192	92	29	**39**	317	68	133	51	259	91	**124**	368	177	138	**44**	81	105	127
MISC.	Silver Lamprey																		1	
	Ohio Lamprey								1											

River-wide Catch Comparison (data from most recent survey year shown)

Group	Species (common name)	Emsworth '12	Dashields '08	Montgomery '10	New Cumberland '11	Pike Island '12	Hannibal '08	Willow Island '11	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '11	Meldahl '12	Markland '09	McAlpine '09	Cannelton '11	Newburgh '12	John T. Myers '10	Smithland '08	Open Water '09
MISCELLANEOUS	Goldeye																	3	2	4
	Mooneye	**10**	11	7	11	**2**	10	6	4		7	4	**6**	9	10		**4**	1		1
	Paddlefish																**1**			1
	Northern Pike					**1**														
	Muskellunge																			
	White Crappie	**2**	1	1				1	3	2	1	7		2		21	**2**	6		13
	Black Crappie	**1**	1	1	1	**1**		5	2	5	1	4			4	7		6		3
	Inland Silverside																		26	
	Brook Silverside	**14**		1	11	**10**		2								5	**5**		1	
	Atlantic Needlefish																			5
	Trout-Perch								7	1										
	Banded Killifish							30		1										
	Western Mosquitofish																			1
	Bowfin											1								
	Freshwater Drum	**55**	58	84	201	**239**	211	172	33	206	83	329	**686**	509	171	520	**507**	103	837	236
Total No. of Individuals		**6071**	1232	5753	4849	**8103**	3198	4070	3583	2435	1296	4423	**22416**	2929	1804	7968	**14480**	4448	2636	2060
Total No. of Species		**46**	33	41	39	**42**	43	48	51	42	36	47	**41**	45	40	38	**44**	44	50	52

Look for our mobile 2,200 gallon educational aquarium displays filled with fishes from local areas at festivals and events along the Ohio River

To request a "Life Below the Waterline" display at your event, contact Jeanne Ison (jison@orsanco.org) for pricing and scheduling

Our assessments would not be possible without the guidance of our committee and hard work of our seasonal interns and contractual employees. For information on our yearly internships, available to current and recently graduated students, contact Rob Tewes (*rtewes@orsanco.org*).