2010 Ohio River Pool Assessments

Montgomery, Racine, and John T. Myers

ORSANCO Biological Programs

Ohio River Valley Water Sanitation Commission
5735 Kellogg Ave Cincinnati, OH 45230
www.orsanco.org

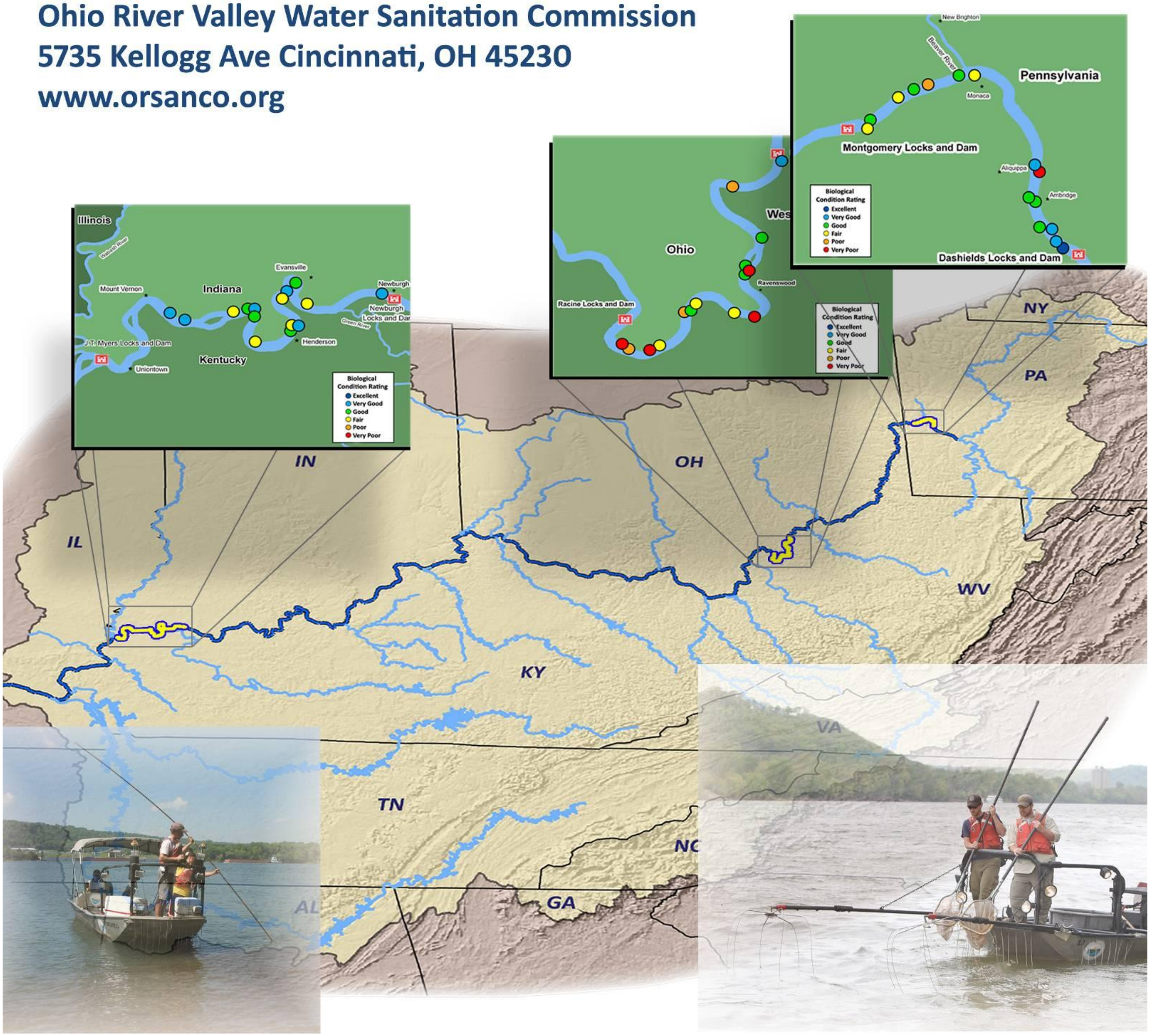
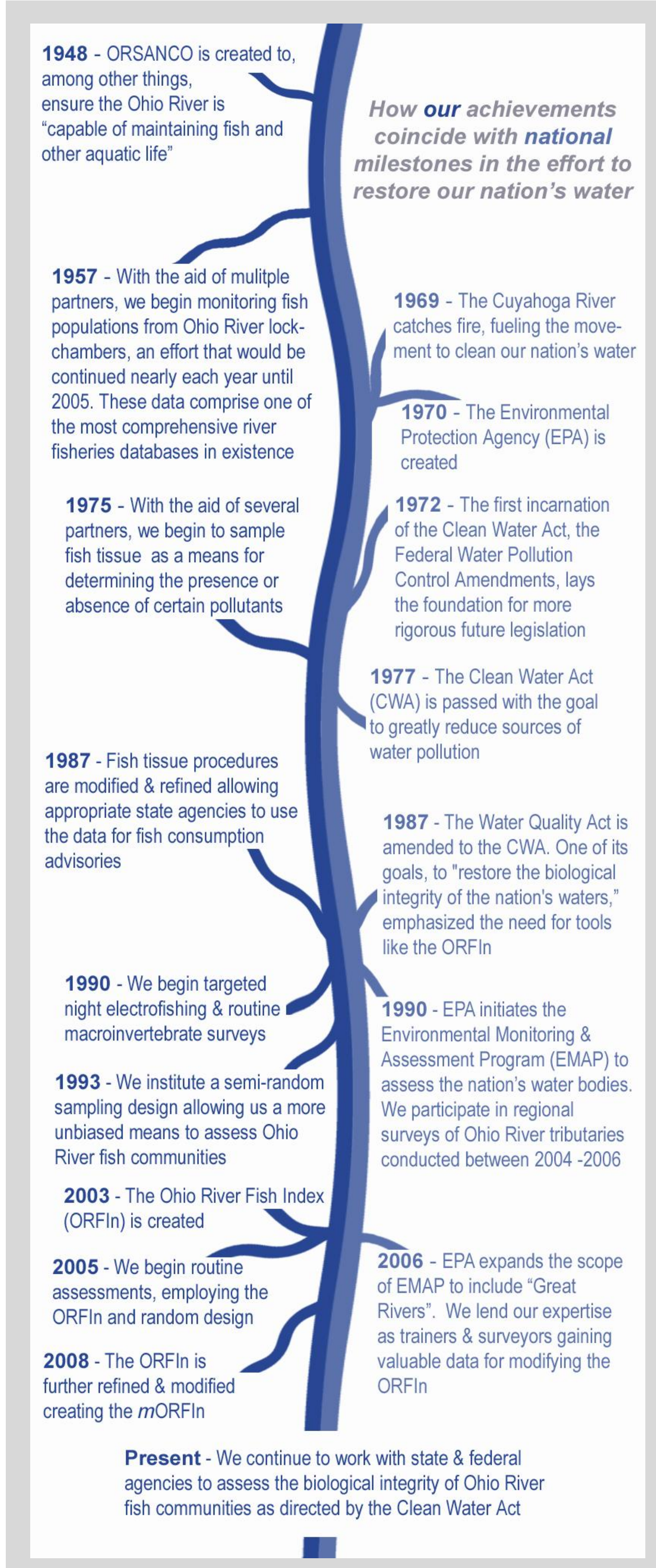


Table of Contents

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.



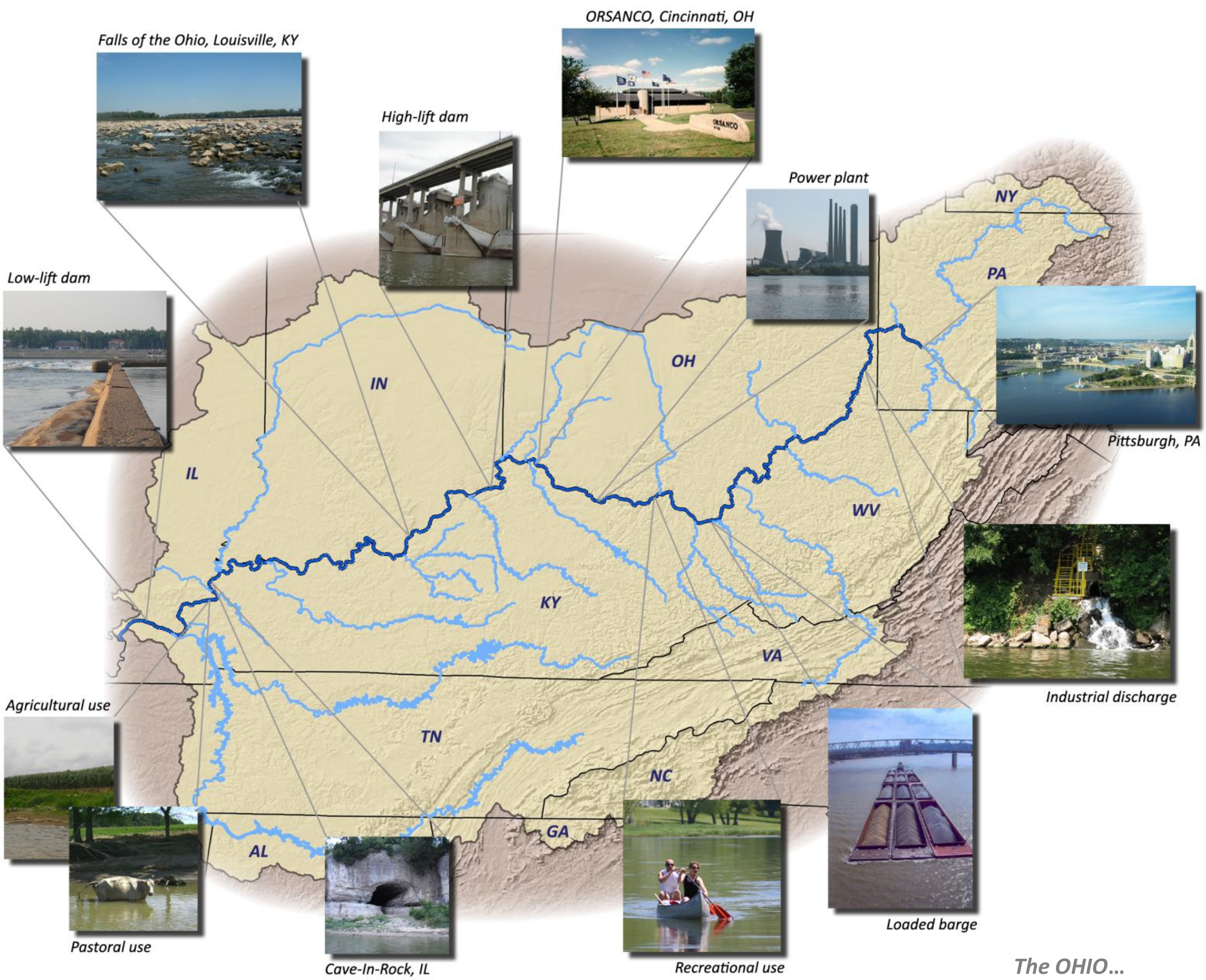
This report summarizes the findings of the 2010 surveys, including the assessments of the Montgomery, Racine, and John T. Myers pools

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 Teneeessee rivers. The Ohio River itself runs through or borders six states; Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia. The river basin (>203,000 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"

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 *m*ORFIn scores are later generated.

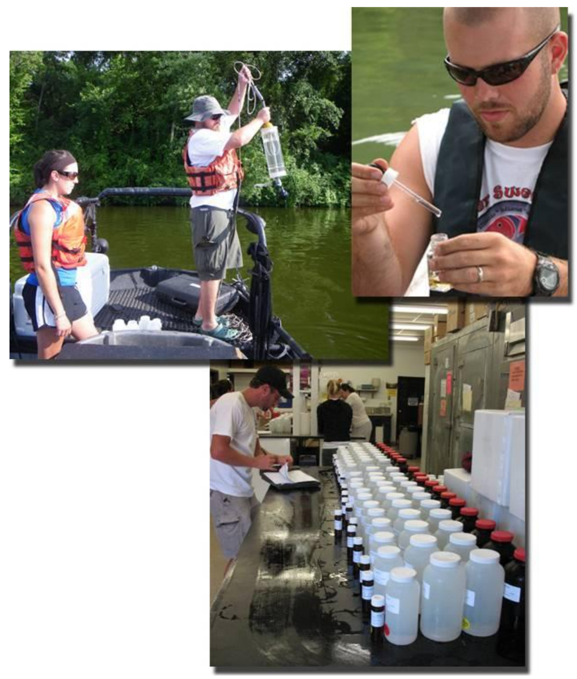
Characterizing Instream Habitat

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.

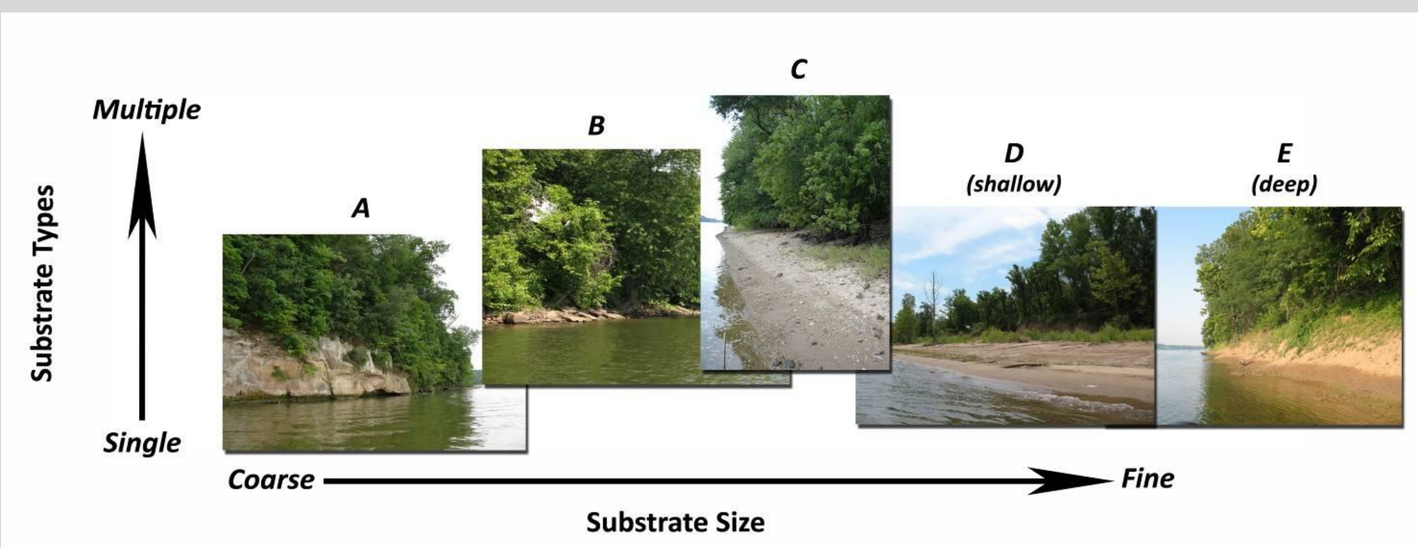
Because different fish species prefer different habitat types, it is important to classify the instream habitat at each of our sites to better understand *m*ORFIn score variability. Using the habitat survey data, we assign each site to one of five statistically derived habitat classes simply named: ‘A’, ‘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 are also 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 *m*ORFIn results.



A look at our five habitat classes



Assessing Biological Condition

The original ORFIn, created in 2003, contained 13 measures (called 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.

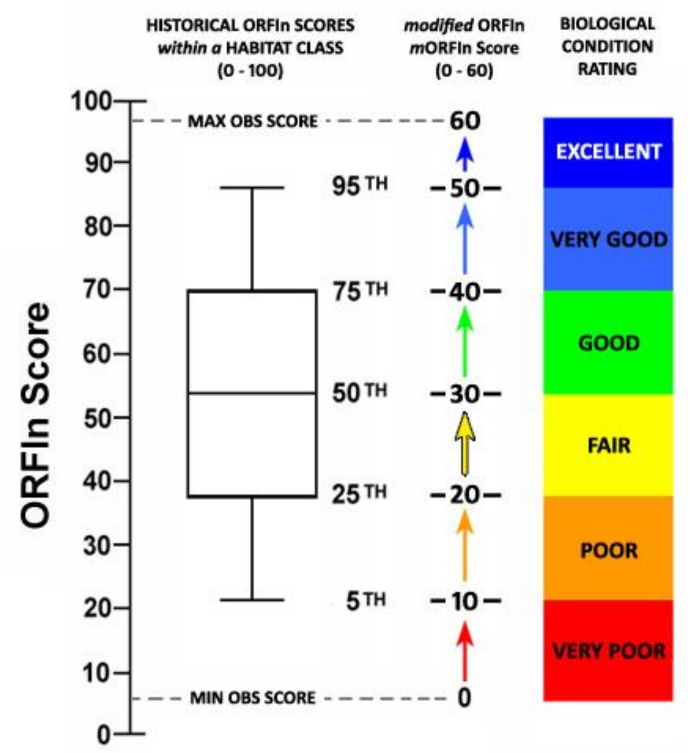
13 original ORFIn metrics used to generate *m*ORFIn scores

Metric Name	Definition
Native Species	No. of species native to the Ohio
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 and sunfish 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.

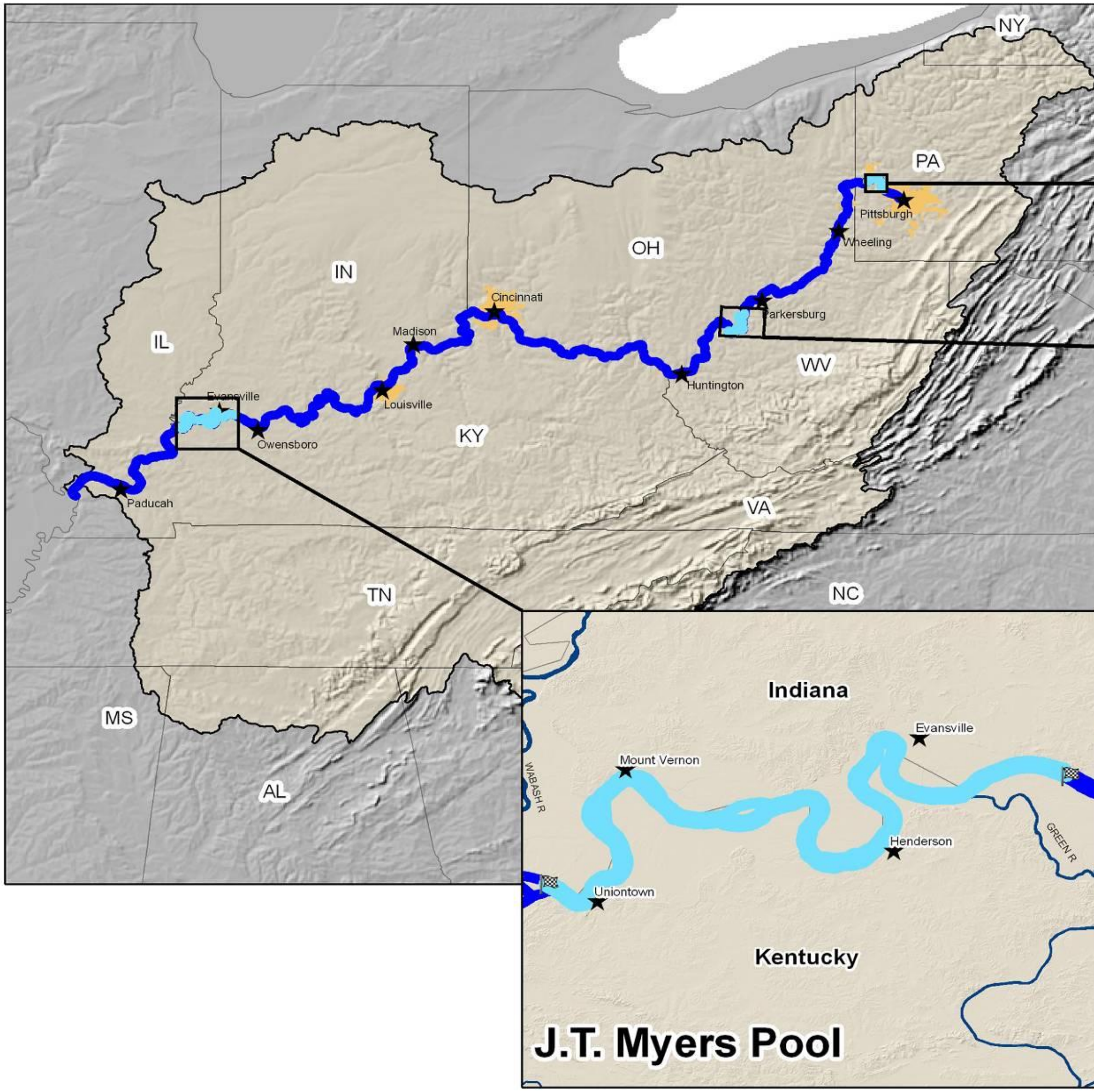
Then a *m*ORFIn score between 0 and 60 is calculated for each individual site based upon how its ORFIn score relates to statistical thresholds defined within the historical ranges. Biological condition ratings (i.e. 'Poor', 'Very Poor', 'Fair', 'Good', 'Very Good', and 'Excellent') are given to each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

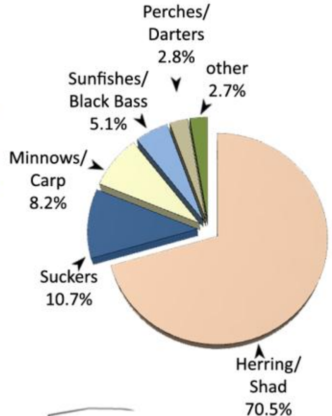
2010 Pool Survey Results

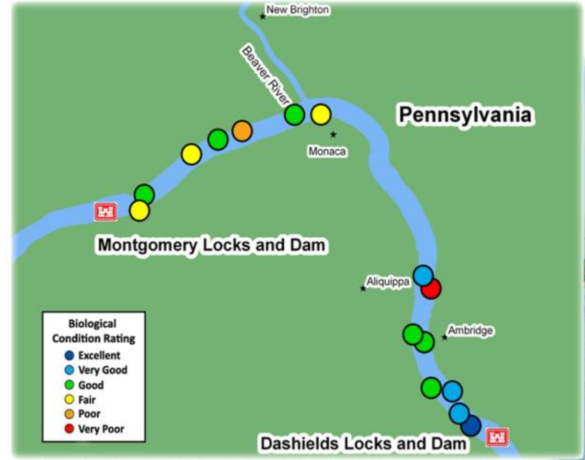


Above are the relative locations of the pools surveyed in 2010. The results of these biological surveys are detailed in the following pages. Included are brief descriptions of the land use and hydrology, site specific data pertaining to fish and instream habitat, ORFIn and mORFIn scores, and the overall biological assessment of each pool.

Montgomery Pool

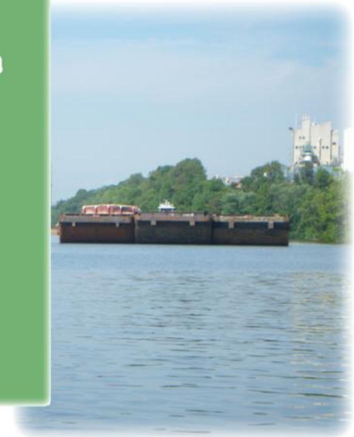
The Montgomery pool is 18.5 miles long, extending from Dashields Locks and Dam (ORM 13.2) to Montgomery Locks and Dam (ORM 31.7). The pool has a gradient drop of 0.2 feet per mile and averages 1,376 feet wide and 25 feet deep, and is contained entirely within the state of Pennsylvania. The surrounding area of this pool is best described as an urban extension of Pittsburgh. This proximity to the largest metropolitan area on the river results in a high volume of industry, barge activity, and recreational boaters. Most of the pool's shorelines are modified, to some extent, with large rocks to curb shoreline erosion. Outside of these rocky shorelines and a few pockets of aquatic vegetation, the most abundant aquatic habitat is fallen timber (e.g. trees and stumps). A major tributary to this pool, the Beaver River, is also heavily influenced by industry yet is still a valuable fishery and provides recreational access.

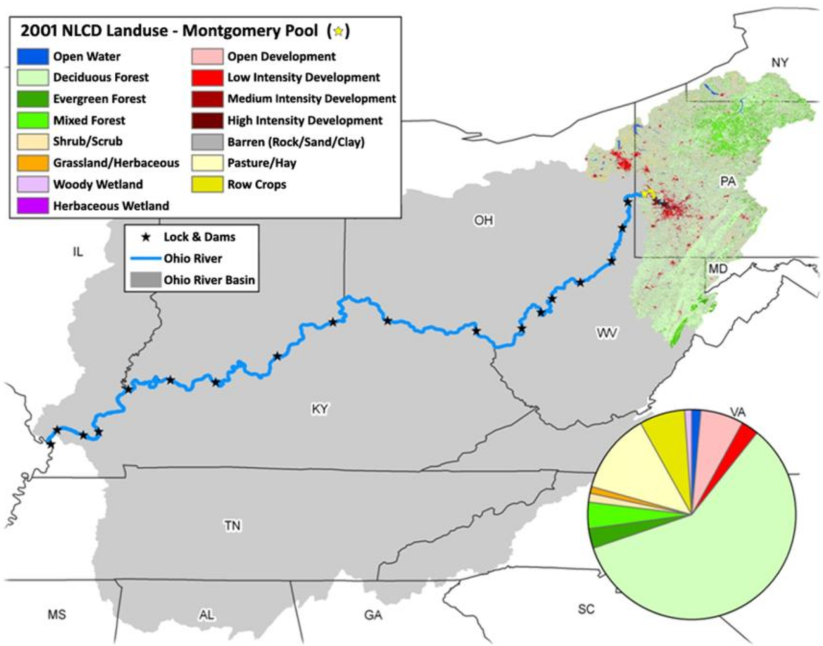




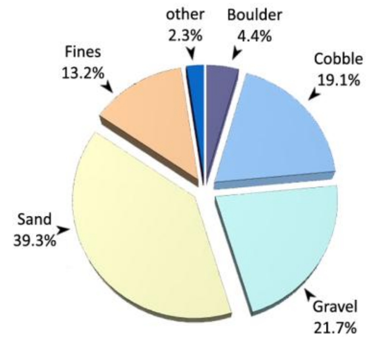
Locations of the 15 randomly chosen electrofishing sites in Montgomery Pool

Barge traffic is very common in Montgomery Pool due to its proximity to Pittsburgh, PA





Land-use types within the Montgomery Pool watershed



bigmouth buffalo (*Ictiobus cyprinellus*)

white sucker (*Catostomus commersonii*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	13.7	B	46.71	78.78	55.3
2	14.1	B	46.71	73.12	47.8
3	14.8	D	41.80	61.53	43.4
4	15.3	B	46.71	55.45	30.5
5	16.5	C	44.55	59.09	37.7
6	16.8	B	46.71	59.46	35.1
7	18.3	B	46.71	28.76	6.1
8	18.6	C	44.55	70.83	48.0
9	25.3	D	41.80	43.43	22.1
10	25.9	B	46.71	55.69	30.7
11	27.3	B	46.71	46.33	19.6
12	27.9	C	44.55	55.76	34.0
13	28.7	C	44.55	50.13	27.3
14	30.4	C	44.55	52.98	30.8
15	30.7	C	44.55	48.03	24.5
			Average Pool *m*ORFIn Score		**32.9**

Montgomery Pool - Results Overview

Sampling Results

Environmental Measures

Dominant Habitat Class: B – moderately coarse
Notable Measures: relatively high amounts of rocky shorelines

Biological Measures

Total No. of Fish Species: 41
Average No. of Individuals: 102
Dominant Family (*minus herring/shad*): Suckers
Dominant Species (*minus gizzard shad*): golden redhorse
Threatened & Endangered Species: mooneye, silver chub
Rare Ohio River Mainstem Species: white sucker
Notable Catch: bigmouth buffalo (*endangered*)

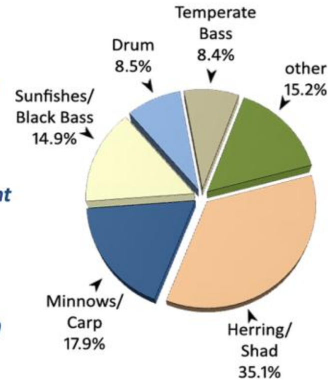
Assessment Results

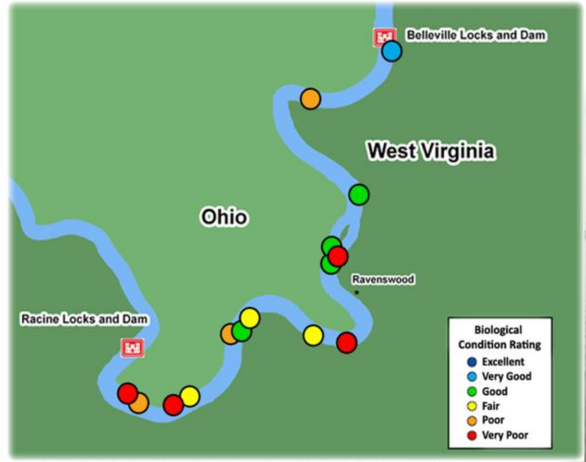
Highest scoring ORFIn metric: No. of Suckers
Lowest scoring ORFIn metric: Great River species
Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 13
Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 2
Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Good

Racine Pool

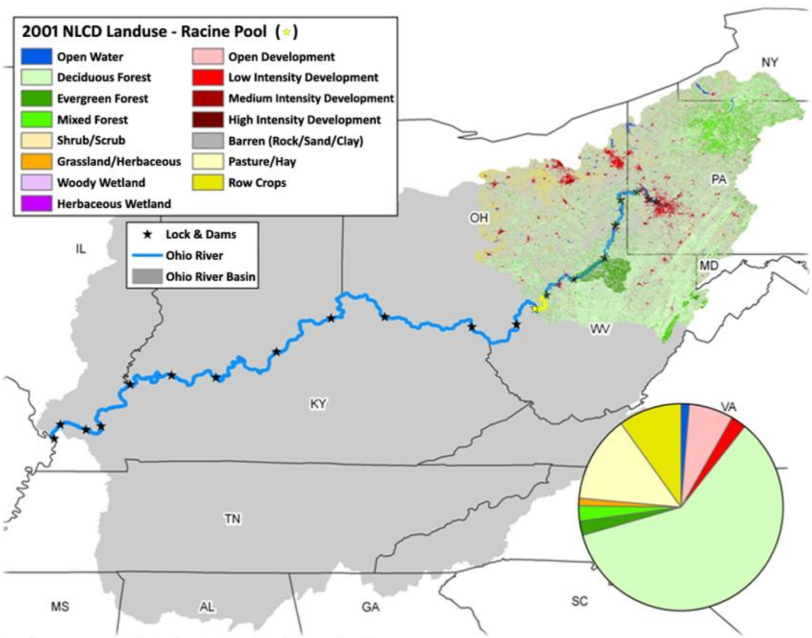
The Racine pool is 33.6 miles long, extending from Belleville Locks and Dam (ORM 203.9) to Racine Locks and Dam (ORM 237.5). The pool has a gradient drop of 0.5 feet per mile and averages 1,275 feet wide and 24 feet deep. The pool is bordered by the states of Ohio and West Virginia, and lies in a relatively undeveloped portion of the basin, with little influence of industry. Amid the naturally forested areas, the little development that is present is mostly residential. The majority of the pool shorelines are relatively shallow with a mix of fines and sand. These shoreline conditions are conducive to the growth of aquatic vegetation, which is found in large quantities throughout the pool. The Racine pool receives water from several small tributaries with drainage areas all less than 230 square miles: Shade River (OH), Shady Creek (WV), and Mill Creek (WV).



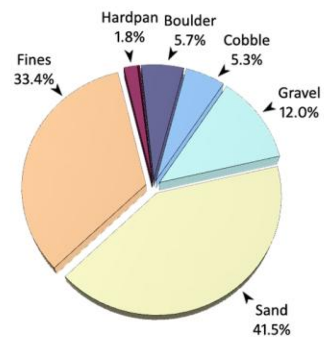


Locations of the 15 randomly chosen electrofishing sites in Racine Pool

Large expanses of submerged aquatic vegetation are common along the shallow shorelines of Racine Pool



Land-use types within the Racine Pool watershed



yellow bullhead (*Ameiurus natalis*)

spotted sucker (*Minytrema melanops*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	204.4	B	46.71	64.53	40.6
2	208.6	B	46.71	41.36	13.9
3	215.3	B	46.71	56.83	32.0
4	217.7	D	41.80	52.45	33.3
5	218.1	E	39.59	26.36	0.0
6	218.5	C	44.55	55.86	34.1
7	222.7	D	41.80	30.07	8.9
8	223.9	C	44.55	49.94	27.0
9	227.1	E	39.59	45.63	25.5
10	227.9	D	41.80	55.11	36.6
11	228.0	D	41.80	41.28	19.5
12	231.7	E	39.59	43.71	23.8
13	232.5	D	41.80	27.10	6.7
14	234.1	D	41.80	32.91	11.3
15	234.7	D	41.80	23.43	4.0
				Average Pool *m*ORFIn Score	**21.2**

Racine Pool - Results Overview

Sampling Results

Environmental Measures

- Dominant Habitat Class: D - shallow sand/fines
- Notable Measures: aquatic vegetation found at 100% of sites

Biological Measures

- Total No. of Fish Species: 42
- Average No. of Individuals: 97
- Dominant Family (*minus herring/shad*): Minnows/Carp
- Dominant Species (*minus gizzard shad*): bluegill sunfish
- Threatened & Endangered: banded killifish (OH)
- Rare Ohio River Mainstem Species: yellow bullhead
- Notable Catch: spotted sucker

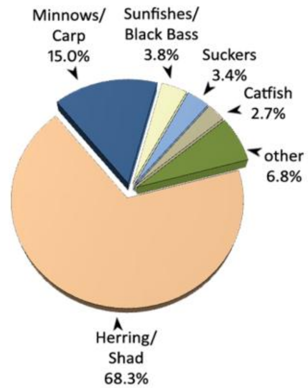
Assessment Results

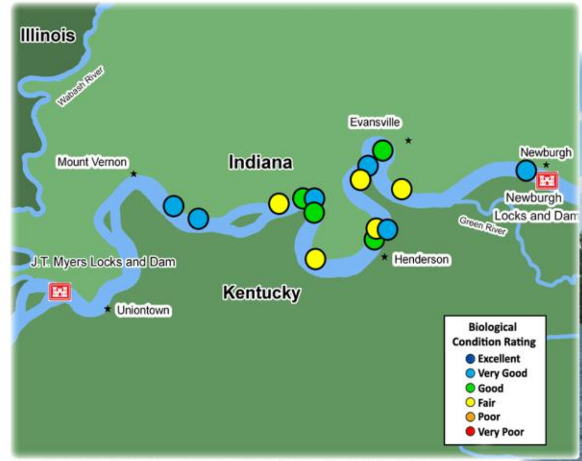
- Highest scoring ORFIn metric: Centrarchid species
- Lowest scoring ORFIn metric: Great River species
- Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 8
- Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 7
- Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Fair

John T. Myers Pool

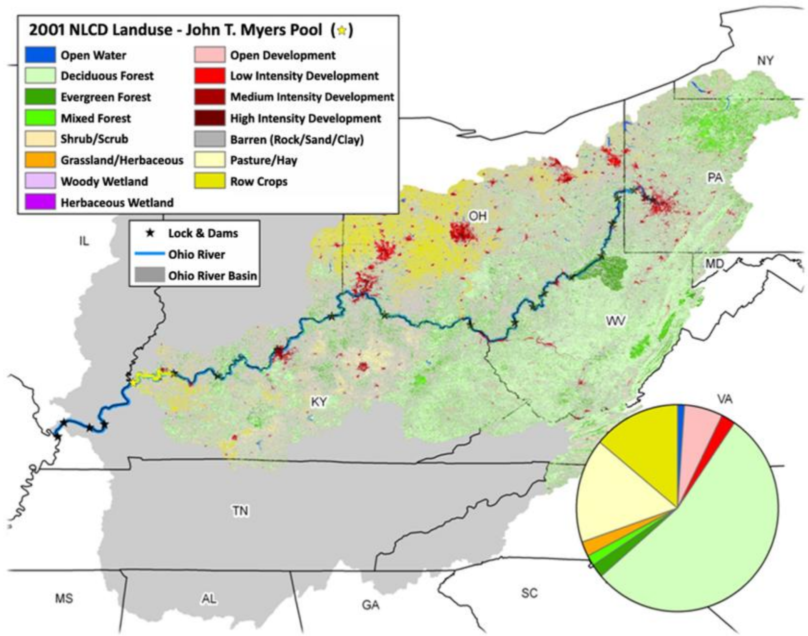
The John T. Myers pool is 69.9 miles long, extending from Newburgh Locks and Dam (ORM 776.1) to John T. Myers Locks and Dam (ORM 846.0). The pool has a gradient drop of 0.3 feet per mile and averages 2,401 feet wide and 28 feet deep. The pool is bordered by the states of Kentucky and Indiana and lies in a moderately developed portion of the river heavily influenced by agricultural practices and related industry/barge activity. The city of Evansville, IN is located downstream of the pool's largest tributary, the Green River (KY) which has a drainage area over 9,000 square miles. Backwater areas (near Uniontown) and oxbows (Hovey Lake FWA) in the pool's lower section provide habitat for uncommon Ohio River species like the bowfin. The instream habitat throughout John T. Myers pool is noticeably uniform (sand and fines) with only a few small pockets of natural rocky shorelines and woody cover.



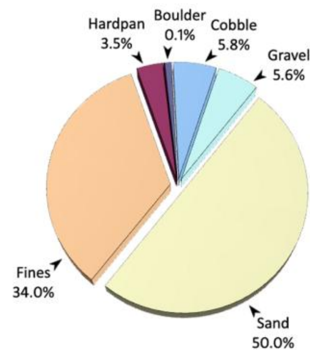


Locations of the 15 randomly chosen electrofishing sites in John T. Myers Pool

Typical shoreline in John T. Myers Pool



Land-use types within the John T. Myers Pool watershed



blue catfish (*Ictalurus furcatus*)

black buffalo (*Ictiobus niger*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	778.1	C	44.55	71.01	48.2
2	787.4	D	41.80	47.58	27.3
3	792.2	D	41.80	57.21	39.2
4	795.3	D	41.80	58.59	40.6
5	796.5	D	41.80	46.45	25.9
6	801.9	C	44.55	62.65	41.2
7	802.4	D	41.80	47.23	26.9
8	802.8	D	41.80	56.98	38.9
9	808.9	D	41.80	45.83	25.1
10	813.7	D	41.80	54.17	35.4
11	814.6	C	44.55	61.17	40.0
12	814.9	C	44.55	53.91	31.9
13	816.9	E	39.59	48.93	28.5
14	823.4	E	39.59	60.73	41.9
15	825.5	D	41.80	65.13	46.8
			Average Pool *m*ORFIn Score		35.9

John T. Myers Pool - Results Overview

Sampling Results

Environmental Measures

Dominant Habitat Class: D - shallow sand/fines
Notable Measures: woody cover present in the lower section

Biological Measures

Total No. of Fish Species: 44
Average No. of Individuals: 85
Dominant Family (*minus herring/shad*): Minnows/Carp
Dominant Species (*minus gizzard shad*): mimic shiner
Species of Concern: black buffalo, spottail shiner
Rare Ohio River Mainstem Species: spottail shiner
Notable Catch: spotted gar

Assessment Results

Highest scoring ORFIn metric: Percent Invertivores
Lowest scoring ORFIn metric: Percent Simple Lithophils
Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 15
Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): Ø
Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Good

CONCLUSIONS

Pool Surveys

The 2010 pool surveys were successfully completed between June 28th and October 4th. Primarily, typical weather/flow conditions were experienced, with slightly hotter and drier than normal conditions occurring between mid July and early August. Overall, all three pools surveyed during the 2010 field season were assessed as *meeting* their aquatic life-use designations (i.e. containing healthy fish communities).

Montgomery Highlights (Good)

The 15 random survey sites fell largely in the extreme upper and lower sections of the pool. At these sites, larger substrates (boulder, cobble & gravel) comprised a significant proportion of the river bottom. Suckers were one of the dominant families as they prefer these coarser substrates. Notable species caught included bigmouth buffalo (PA endangered & typically found in the lower river) and white sucker (typically found in smaller tributaries).

Racine Highlights (Fair)

The majority of the 15 random survey sites fell in the middle and lower sections of the pool. These shallow sandy sites were heavily laden in aquatic vegetation and moderate amounts of woody cover. As a result, sunfishes and black basses (e.g. largemouth, spotted bass) were regularly captured. Notable species caught included banded killifish (OH endangered and also favor vegetated areas) and yellow bullhead (common in smaller streams). Despite the pool meeting its aquatic life-use designation, seven sites scored below their relative expectations (i.e. the 25th percentile). A possible explanation may be that the extremely warm water temperatures (>90^{o}F) may have driven fish from shallow vegetated areas to cooler, deeper water, thereby decreasing our catches. Lastly, the vast amounts of submerged aquatic vegetation may have negatively affected our sampling efficiency.

John T. Myers Highlights (Good)

Most of the 15 random survey sites were in the middle section of the pool with several occurring in close proximity and no sites in the lower 20 miles. These sites were almost entirely shallow, sandy, mud flats. By comparison to other pools, catfish made up a substantial proportion of the fish community. Notable catches include a spottail shiner and a black buffalo (KY species of special concern). A spotted gar was also captured (a species common in the Mississippi and Open Water section of the Ohio River).

Assessment Comparisons

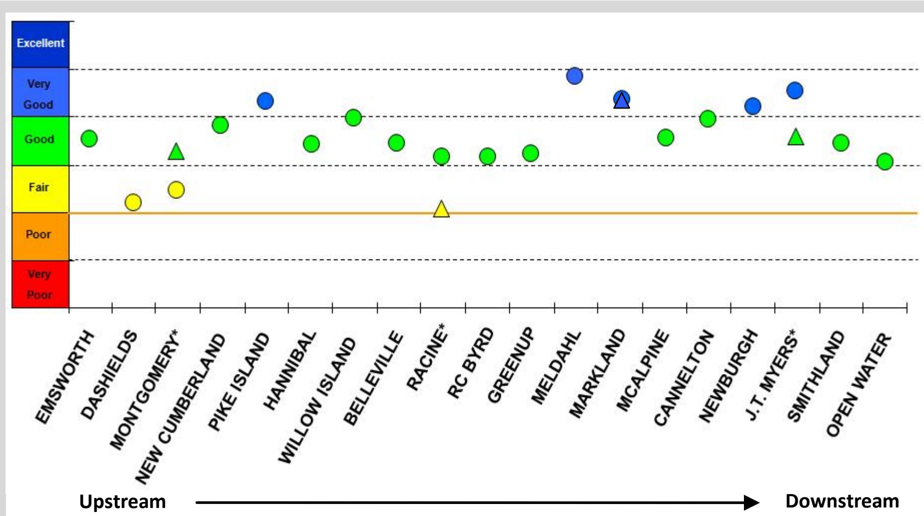
The 2010 surveys were conducted as part of the second full assessment of the 19 Ohio River navigational pools. Between 2005 and 2009, all 19 pools were surveyed and assessed using the same random design. This allows us to not only rate the relative condition of each pool, but also compare past and present survey results. Overall, the majority of the river is in Good condition. Some of the variability in catches & species richness across the 19 pools (see final table, pg 14), is likely due in part to variations in natural distributions, instream habitat, and annual variations in flow/weather conditions.

River-wide Assessment Comparison

The 2010 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 assessments (2005-2009)

△ = 2nd assessments (Began 2009)



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 are often likely due to variations in environmental factors rather 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.

Montgomery Pool (2010 vs. 2006)

Variable	2010	2006	Difference
Environmental Factors			
Avg. seasonal flow	Normal	High	Lower
Water clarity (inches)	55.5	35.3	20.1
CPUE score (0-100)	41.2	9.1	32.1
No. of gizzard shad	4159	266	3893
No. of emerald shiners	447	8	439
Native species score (0-100)	60.1	42.7	17.4
No. of native species	46	38	8
No. of minnow species	8	4	4
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Good**	**Fair**	Higher

Montgomery pool was assessed to be in a higher condition in 2010 than in 2006. In 2010, we encountered lower flows and better water clarity which may have increased our sampling efficiency enough to explain increased "CPUE" (number of individuals) and "Native species" scores. The lower flows may have also made 2010 more favorable for the recruitment of minnows and shad, a difference which is also reflected in these scores.

channel shiner
(*Notropis wickliffi*)

emerald shiner
(*Notropis atherinoides*)

gizzard shad
(*Dorosoma cepedianum*)

Overall, the variation in condition ratings between the two years is likely due to flow conditions rather than an improvement in water quality. We continue to investigate the influence of flows on Ohio River fish communities and hope to account for these effects in future assessments.

Racine Pool (2010 vs. 2005)

Variable	2010	2005	Difference
Environmental Factors			
Avg. seasonal flow	Normal	Low	Higher
% Sites with Aquatic Veg.	100%	5%	95%
Water clarity (inches)	38.0	53.4	-15.4
CPUE score (0-100)	17.4	70.7	-53.3
No. of gizzard shad	855	8048	-7193
No. of emerald & channel shiners	312	1197	-885
% Tolerant score (0-100)	58.5	88.3	-29.8
No. of common carp	43	9	34
% Piscivore score (0-100)	48.2	63.4	-15.2
No. of temperate bass ind.	191	561	-370
No. of sauger	51	173	-122
Centrarchid species score (0-100)	71.1	43.3	27.8
No. of Centrarchid ind.	229	70	159
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Fair**	**Good**	Lower

Racine pool received a lower condition rating than in 2005. Substantially higher amounts of aquatic vegetation largely were observed throughout the pool in 2010. This increased vegetation, coupled with decreased water clarity, may have negatively affected our sampling efficiency. Both of these can potentially reduce our boat maneuverability and visibility enough to lower "CPUE" scores. The abundant vegetation appears to have also caused a shift in the fish community. The densely vegetated shallow sites are favored foraging areas of common carp and small centrarchid species (i.e. sunfishes), which was reflected in the change of "% Tolerant" and "Centrarchid species" scores, respectively. The number of sauger and white bass (i.e. temperate bass) collected decreased from 2005. Sauger can be found foraging over cleaner substrates in moderate depths. White bass tend to be found in deeper open water. The scarcity of these types of habitats in the pool, in addition to a relative absence of minnows and shad in 2010, likely led to the observed decrease in the "% Piscivores" scores.

While the presence of aquatic vegetation typically enhances instream habitats resulting in greater species diversity, we believe the extreme amounts of vegetation may have caused a shift in the fish community structure and, coupled with a potential decrease in sampling efficiency, likely explains the observed lower rating. Further studies are required to identify the causes for the proliferation of vegetation (of which most was the invasive, exotic species *Hydrilla verticillata*) and to determine the extent and permanence of the community shift.

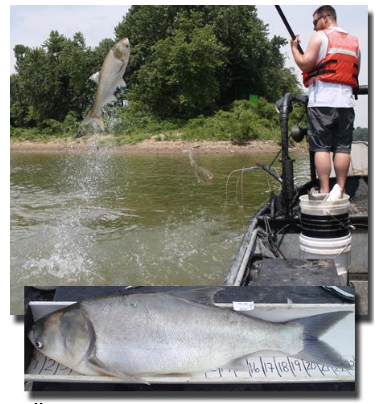
John T. Myers Pool (2010 vs. 2005)

Variable	2010	2005	Difference
Environmental Factors			
Month Sampled	July	October	Earlier
Avg. seasonal flow	Normal	Very Low	Higher
Water temp (C)	28.0	22.9	5.1
CPUE score (0-100)	31.0	53.2	-22.2
YOY Ind (select species)	116	1782	-1666
Mature Ind (select species)	292	919	-627
Great river species score (0-100)	48.9	95.6	-46.7
No. of silver chub	2	206	-204
% Non-natives score (0-100)	68.0	85.3	-17.3
No. of Silver Carp	12	0	12
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Good**	**V. Good**	Lower

John T. Myers also received a lower condition rating than in 2005. In 2010, all sites were surveyed at the beginning of our field season (before the end of July), whereas the 2005 survey was completed entirely in October (at the end of the field season). July 2010 was exceptionally hot, largely accounting for the 5°C (9°F) difference in average water temperature observed between years. Water temperatures frequently exceeded 30°C (86°F) during 2010 at the time of survey, which are some of the highest natural temperatures we have recorded during random surveys on the Ohio River. The first three metric scores listed in the table reveal the seasonal effects of earlier sampling and the influence of high water temperatures observed in 2010.

The "CPUE" metric was lower in 2010 due largely to a lack of 'young of year' (YOY) individuals collected in the surveys. The YOY numbers in the table refer to six long-lived species that should commonly inhabit the areas surveyed (channel catfish, smallmouth buffalo, largemouth bass, spotted bass, sauger, and freshwater drum). YOY individuals are not expected to be as numerous in our collections earlier in the year (2010) as later in the year (2005) for two reasons: (1) YOY use habitats that can vary slightly from adults, and (2) they can be simply too small for collection with our nets. However, YOY still should have been more numerous than observed in 2010. A possible explanation for this difference (also observed in the "Great River species" metric) is that the higher water temperatures may have driven mature and YOY fish (including silver chub, a major component of the "Great river species" metric) to deeper, cooler waters not found within the shallow sandy sites commonly encountered in this survey.

Another difference between the two survey years was the collection of silver carp. This highly invasive, exotic species was observed prior to 2010, but not recorded in our previous survey of John T. Myers pool. The number of individuals collected this year (12) is far less than we actually observed and an underestimate of their true densities at our sites. This discrepancy can be attributed to their impressive breaching behavior, which allows them to evade large portions of our electrical field.



silver carp (*Hypophthalmichthys molitrix*)

Overall, the variation in the condition ratings is likely an artifact of the time of year in which the surveys were conducted, compounded by warmer than normal water temperatures. While we attempt to minimize seasonal effects to our surveys by restricting our sampling season, we continue to investigate the influence of these variables on our assessments in hopes that their effects will be fully addressed in the future. Additionally, we may be beginning to see the negative effects of the arrival of a highly invasive species. In the future we will continue to monitor the presence, spread, and ecological impacts of exotic species, particularly silver carp, on the structure and condition of native fish communities.

Closing Remarks

The *m*ORFIn is a proven and accepted assessment tool for use on the Ohio River. However, we recognize that certain environmental factors, currently unaccounted for, cause variability in fish assemblages and ultimately our assessments of pool condition. As such, we continually strive to better understand these relationships in order to further increase the sensitivity of our existing index and accuracy of our assessments.

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

Group	Species (common name)	Emsworth '07	Dashields '08	Montgomery '10	New Cumberland '05	Pike Island '07	Hannibal '08	Willow Island '06	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '06	Meldahl '07	Markland '09	McAlpine '09	Cannelton '06-'07 (30 random sites)	Newburgh '07	John T. Myers '10	Smithland '08	Open Water '09
GAR	Longnose Gar	13	11	**8**	11	43	49	46	49	**61**	27	30	22	14	38	48	20	**13**	16	40
	Spotted Gar																1	**1**	1	
	Shortnose Gar													1	1		9	**24**	13	75
SHAD	Skipjack Herring	8			3	6			2		2		64	2	2	174	70		1	8
	Gizzard Shad	167	123	**4058**	1202	7464	1461	216	439	**855**	301	325	2947	185	394	3527	609	**3039**	409	325
	Threadfin Shad														1	2	9	**1**	25	3
CARP	Common Carp	63	36	**44**	25	15	15	22	36	**43**	12	10	8	28	12	5	4	**16**	17	51
	Grass Carp				1												1			3
	Silver Carp																2	**12**	4	6
	Bighead Carp																2			2
	Carp X Goldfish			**1**																
MINNOW	Cyprinidae sp.											2						**1**		
	Goldfish				1															
	Golden Shiner	1			1					**1**										
	Striped Shiner						2			**2**										
	Spottail Shiner			**9**	6	2	1											**14**		
	Spotfin Shiner			**35**	21	14		24	159	**66**	1	2	32	1		63	8	**37**	4	12
	Notropis sp.					3						1							1	
	Emerald Shiner	82	5	**171**	342	197	21	728	637	**134**	16	85	638	165	61	1331	167	**140**	28	25
	Silverband Shiner																			6
	Sand Shiner								1											
	Channel Shiner	35	1	**159**	76	164	16	417	795	**178**	1	216	7	33	30	209	8	**414**		8
	River Shiner	1											54	11	10	276	3	**16**	2	9
	Shoal Chub											14				158				
	Silver Chub	26	26	**32**	20	11	19	63	32	**2**	11	58	99	338	39	140	126	**2**	46	25
	River Chub				1	1														
	Gravel Chub												1							
	Creek Chub				1								3							
	Central Stoneroller				4		3	1		**2**										
	Mississippi Silvery																			1
	Suckermouth Minnow													1						
	Bluntnose Minnow			**21**	2	2	4	120	11	**7**		2	1		1	2			1	
	Bullhead Minnow							4	1				23	8	1			**14**	2	19
	Silverjaw Minnow						1													

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

Group	Species (common name)	Emsworth '07	Dashields '08	Montgomery '10	New Cumberland '05	Pike Island '07	Hannibal '08	Willow Island '06	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '06	Meldahl '07	Markland '09	McAlpine '09	Cannelton '06-'07 (30 random sites)	Newburgh '07	John T. Myers '10	Smithland '08	Open Water '09
SUCKER	Ictiobinae sp.				20															
	Ictiobus sp.						19													
	Smallmouth Buffalo	97	99	**79**	283	94	45	60	75	**42**	40	54	123	109	95	147	72	**58**	77	76
	Bigmouth Buffalo			**1**													3	**6**	5	5
	Black Buffalo	1	13	**3**		5	1	2	1			1		1	1	1	7	**9**	4	7
	Carpiodes sp.		1			14			3				1			2				1
	Quillback	17	12	**25**	80	27	28	66	6	**4**	8	17	31	21	12	21	34	**18**	28	15
	River Carpsucker	18	18	**28**	46	36	64	18	12	**21**	25	55	87	85	85	123	179	**43**	114	218
	Highfin Carpsucker			**14**	3	10	13	1	1			4			17	1	12		24	
	Northern Hog Sucker	3	1	**7**	132	4	2	15	3		1			1	2	1	1			
	Moxostoma sp.				58															
	Shorthead Redhorse																		10	
	Smallmouth Redhorse	61	16	**25**	110	28	41	168	97	**35**	27	36	62	38	59	12	3	**4**		
	Silver Redhorse	221	93	**132**	63	79	105	51	55	**4**	11	12	25	3	38	3			1	
	River Redhorse	39	13	**8**	5	27	35	2	1	**1**	2	6	1		2		1			
	Black Redhorse	18		**9**	11			4	2							1				
	Golden Redhorse	7	33	**282**	90	66	204	277	115	**31**	33	40	120	213	182	8	14	**11**	3	1
	Spotted Sucker							1		**3**		5	1			1			7	
	White Sucker			**1**																
CATFISH	Yellow Bullhead									**1**										
	Brown Bullhead											1								
	Northern Madtom															11				
	Blue Catfish															11			7	4
	Channel Catfish	32	17	**17**	123	40	62	69	89	**79**	53	94	92	111	79	241	12	**103**	291	165
	Flathead Catfish	14	11	**12**	15	36	38	21	27	**29**	42	36	49	23	11	64	11	**19**	16	15
SUNFISH	Lepomis sp.							16				1				1				
	Warmouth							1					1	2	1					
	Rock Bass	16	9	**8**	5	1	2	3	9	**3**				2						
	Bluegill	379	32	**58**	53	46	36	798	413	**210**	52	115	208	205	80	103	11	**47**	64	98
	Green Sunfish	12	3		4	2	2	4	8	**3**	6	5	3	9	3	2	4	**4**	1	2
	Pumpkinseed			**2**	1		2	18	1					1						1
	Orangespotted Sunfish							2	1	**5**	1		1					**2**		5
	Longear Sunfish						9	46	18	**7**	9	14	41	148	56	39	4	**52**	92	110
	Redear Sunfish					1		1	4	**1**		1		1	1	16			20	

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

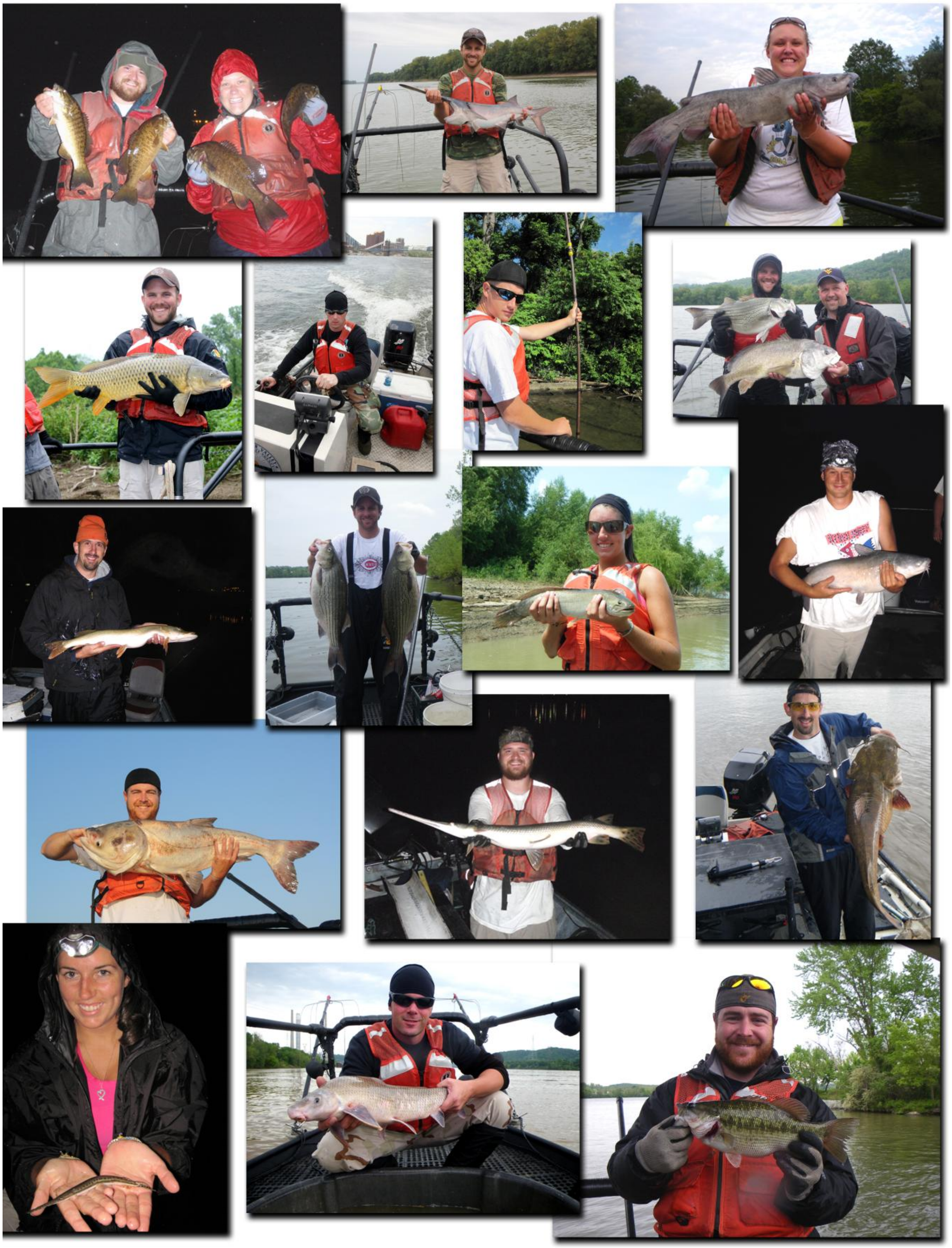
Group	Species (common name)	Emsworth '07	Dashields '08	Montgomery '10	New Cumberland '05	Pike Island '07	Hannibal '08	Willow Island '06	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '06	Meldahl '07	Markland '09	McAlpine '09	Cannelton '06-'07 (30 random sites)	Newburgh '07	John T. Myers '10	Smithland '08	Open Water '09
SUN-FISH	Lepomis Hybrid							9												
	Bluegill X Longear																		1	
	Bluegill X Green					1										1				
TEMPERATE BASS	Morone sp.	27		**26**	568	419	91	17	35	**191**	73	3	152	42	62	625	408	**21**	190	31
	White Perch	5			4		1	3						1						7
	Striped Bass						14	1				1				6		**1**	2	
	White Bass	9	16		6	2	3	58	41	**5**	29	69	19	18	24	66	4	**44**	76	54
	Yellow Bass																		2	104
	Hybrid Striped Bass				17			1	3	**9**	1			14	6	6		**8**	2	45
BLACK BASS	Micropterus sp.									**3**								**3**	1	
	Smallmouth Bass	339	163	**210**	262	208	92	61	45	**47**	32	8	4	32	5	7	1	**4**		10
	Largemouth Bass	4	2	**8**	8	16		16	72	**58**	25	67	16	25	9	37	2	**2**	21	23
	Spotted Bass	125	34	**5**	79	75	38	64	43	**20**	30	47	92	102	20	53	50	**41**	31	36
DARTER	Johnny Darter	1						2												
	Greenside Darter	5		**1**	11	5														
	Variegate Darter					1														
	Rainbow Darter				1			2	1											
	Fantail Darter	3											1							
	Bluebreast Darter					5														
	Banded Darter				4															
	Dusky Darter																		1	
	Channel Darter	16			9	37	1	33				29		3			1			
	Blackside Darter					1														
	Slenderhead Darter											3		1						
	River Darter					21		13	2			3	21	7		14				
	Logperch	141	166	**47**	244	101	105	114	48	**6**	72	13	20	23	2	39	5	**1**	1	1
PERCH	Yellow Perch				2		3		2											
	Walleye	44	7	**21**	31	70	11	1	4		1	1	3				7			1
	Saugeye	2	8		5	4	1		1		1			13		1		**3**	2	16
	Sauger	283	192	**92**	180	249	317	341	133	**51**	259	249	1178	368	177	1315	747	**81**	105	127
MISC.	Silver Lamprey											1							1	
	Ohio Lamprey								1											
	Goldeye																12	**3**	2	4
	Mooneye	20	11	**7**	22	37	10		4		7		48	9	10	8	10	**1**		1

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

Group	Species (common name)	Emsworth '07	Dashields '08	Montgomery '10	New Cumberland '05	Pike Island '07	Hannibal '08	Willow Island '06	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '06	Meldahl '07	Markland '09	McAlpine '09	Cannelton '06-'07 (30 random sites)	Newburgh '07	John T. Myers '10	Smithland '08	Open Water '09
MISCELLANEOUS	Paddlefish																1			1
	Muskellunge	1																		
	White Crappie	5	1	**1**					3	**2**	1	4		2		1	1	**6**		13
	Black Crappie	3	1	**1**	2	2			2	**5**	1				4	6		**6**		3
	Inland Silverside																		26	
	Brook Silverside			**1**												2	1		1	
	Atlantic Needlefish																			5
	Trout-Perch								7	**1**										
	Banded Killifish							1		**1**										
	Western Mosquitofish																			1
	Freshwater Drum	254	58	**84**	1468	498	211	166	33	**206**	83	686	1014	509	171	538	383	**103**	837	236
Total No. of Individuals		2618	1232	**5753**	5742	10190	3198	4188	3583	**2435**	1296	2426	7313	2929	1804	9469	3040	**4448**	2636	2060
Total No. of Unique Species		43	33	**41**	53	48	43	51	51	**42**	36	44	41	45	40	50	45	**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 & hard work of our seasonal interns. For information on our yearly internships, available to current and recently graduated students, contact Rob Tewes.

rtewes@orsanco.org