2011 Ohio River Pool Assessments

New Cumberland, Willow Island, Greenup, and Cannelton

ORSANCO Biological Programs

Ohio River Valley Water Sanitation Commission
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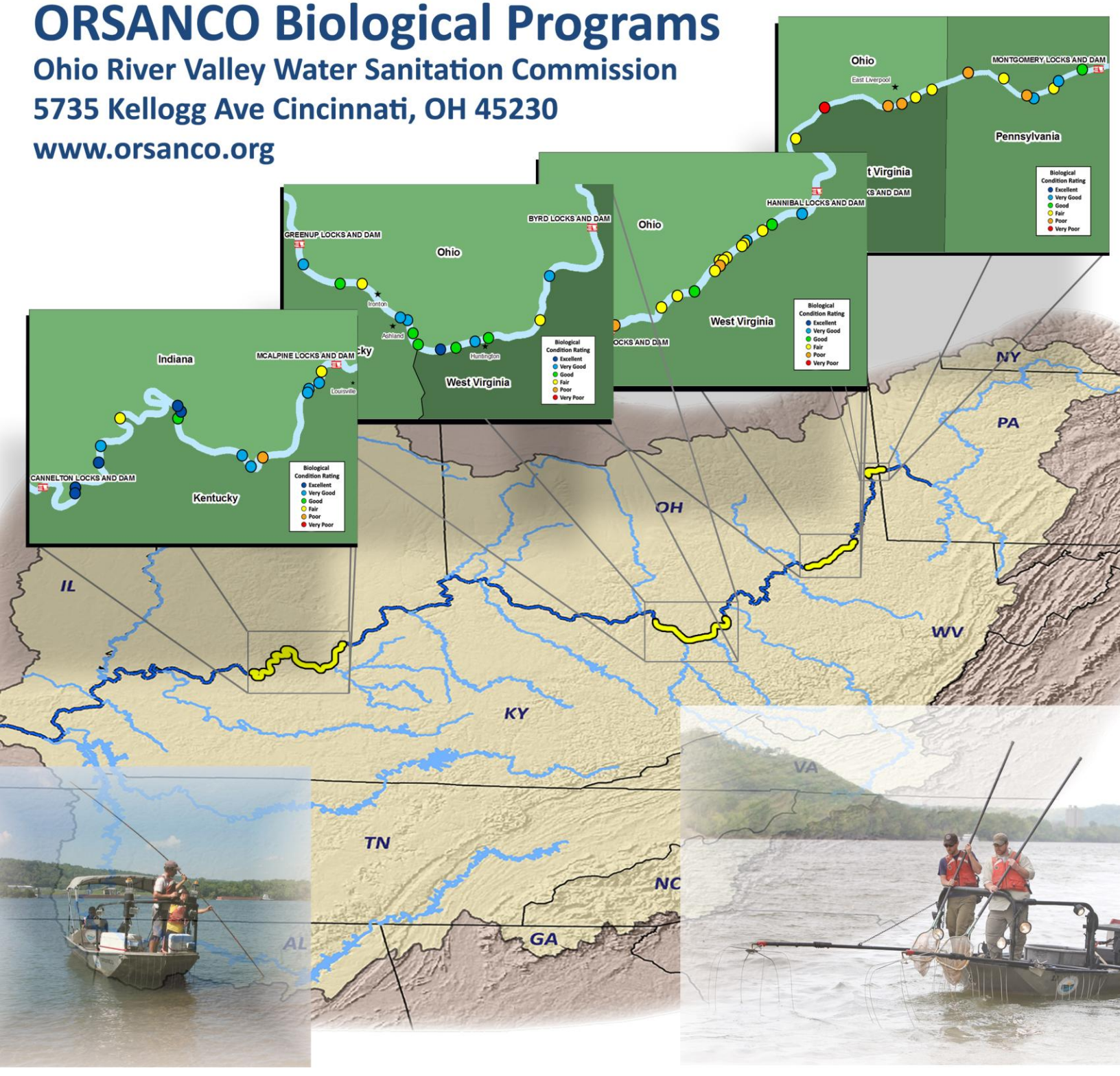

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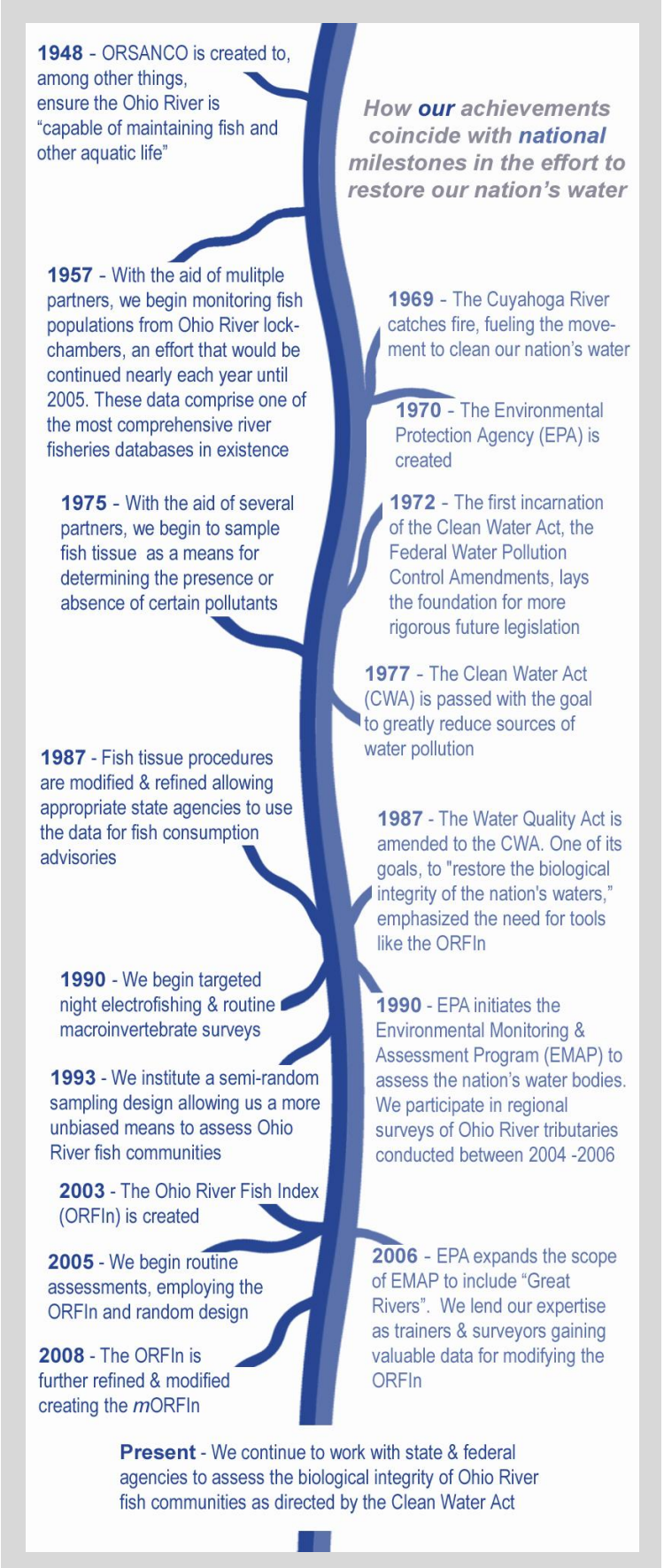
Introduction

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.



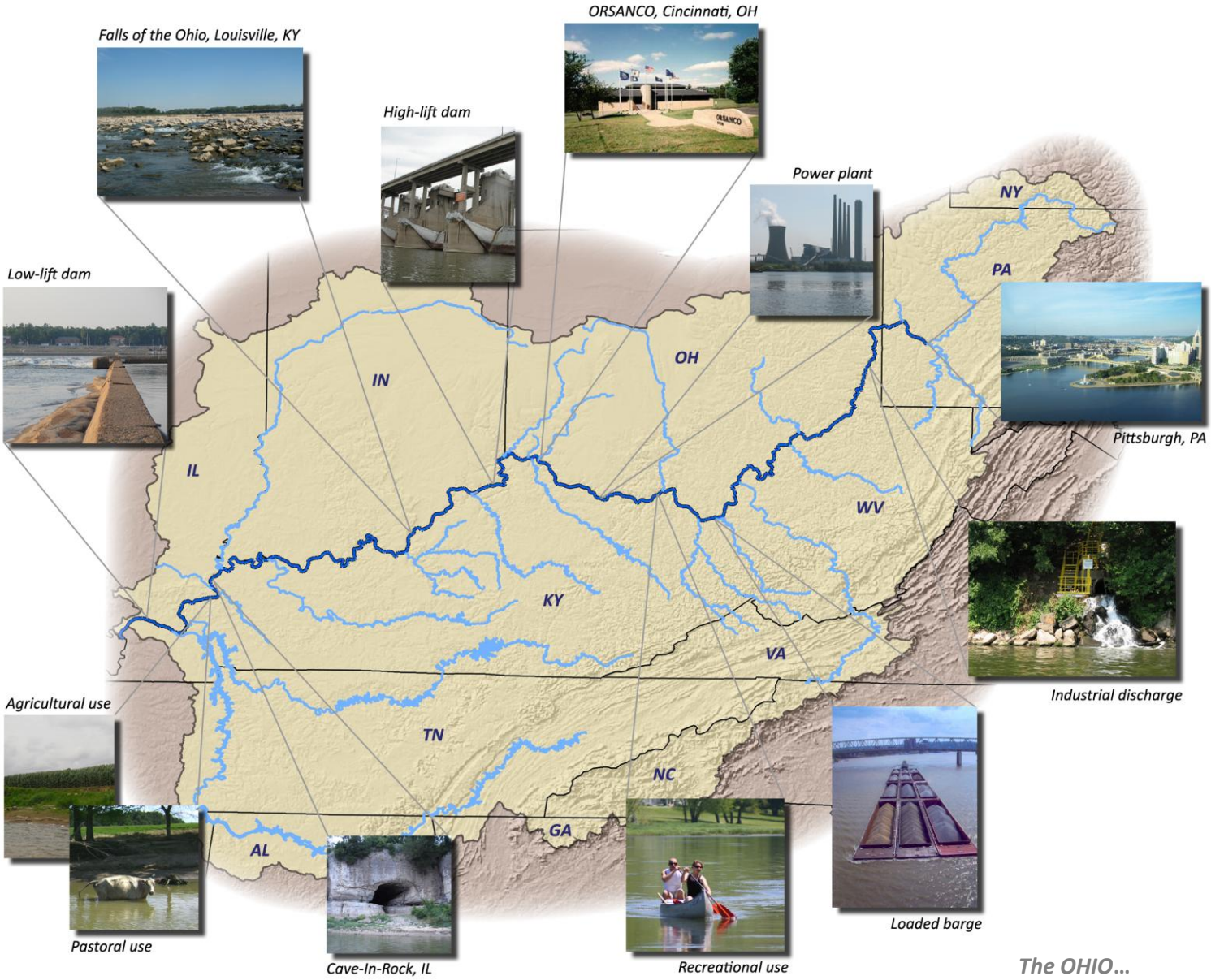
This report summarizes the findings of the 2011 surveys; the assessments of the New Cumberland, Willow Island, Greenup, and Cannelton pools

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 (>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"

METHODS

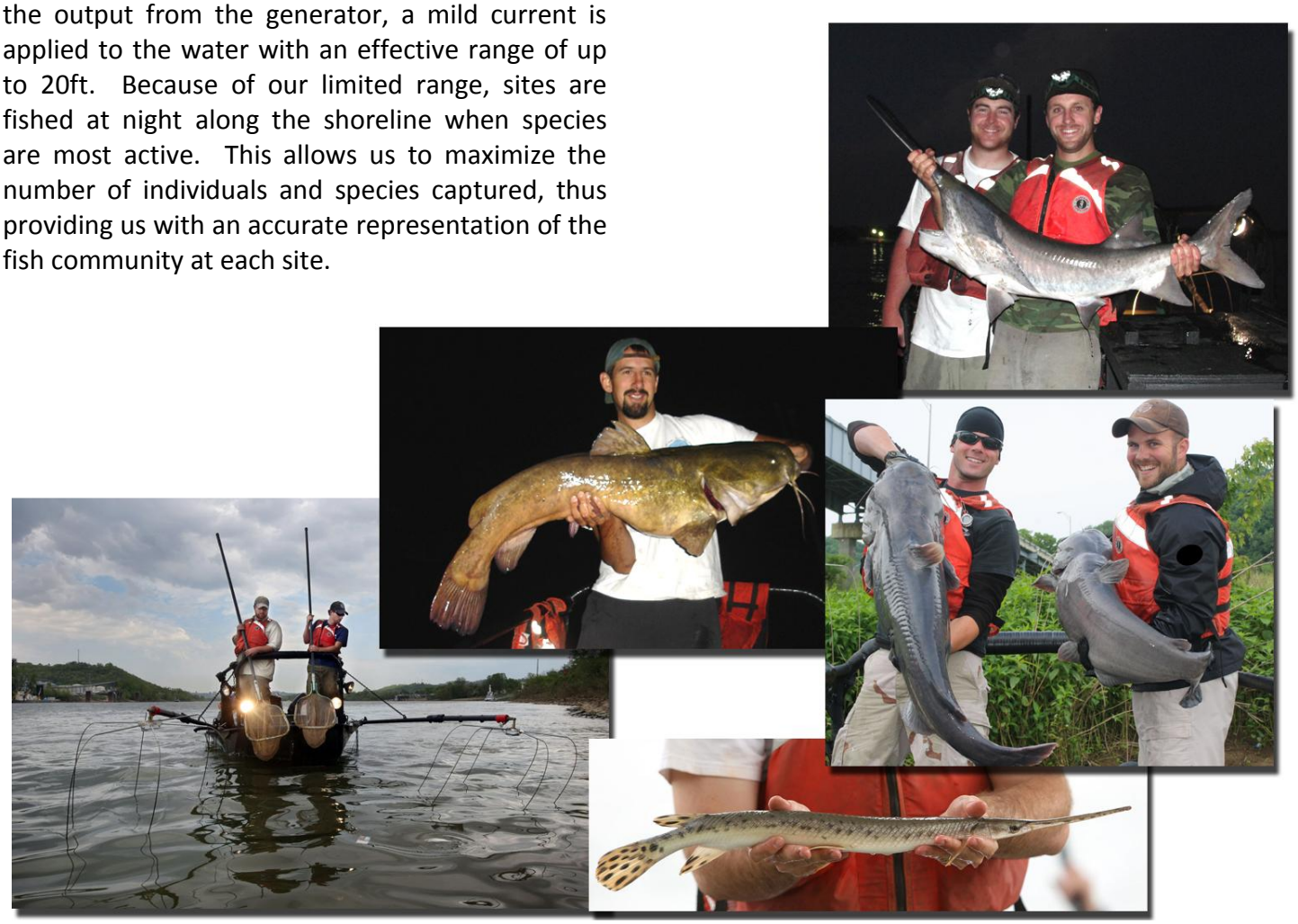
Site Selection

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

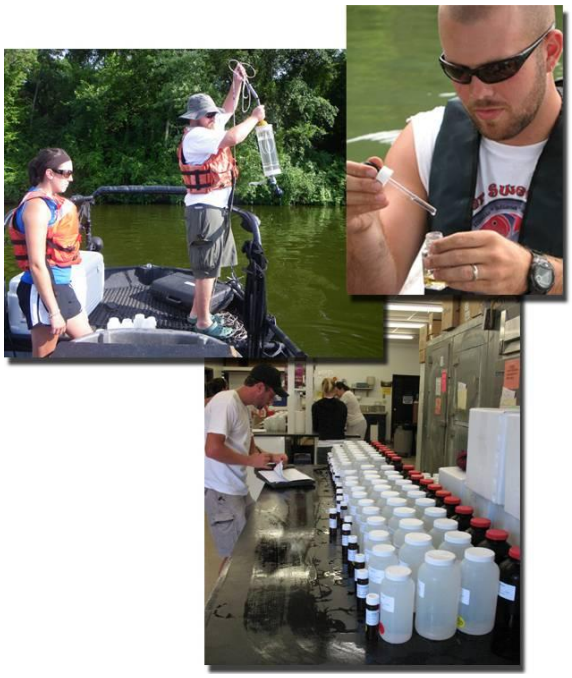
Characterizing Instream Habitat

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.

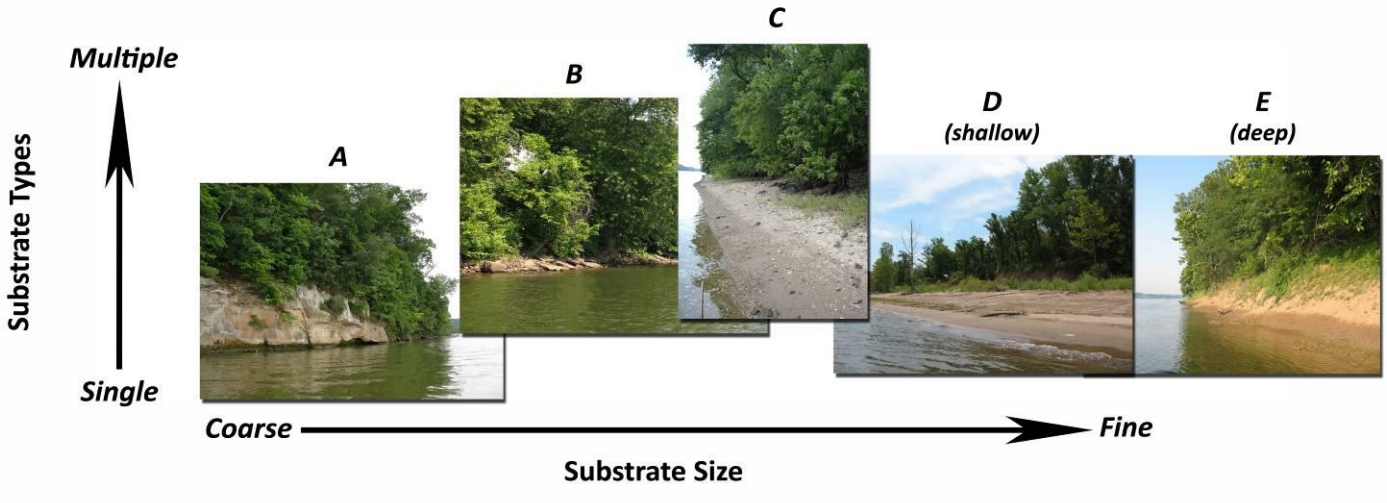
Because different fish species prefer different habitat types, it is important to classify the instream habitat at each of our sites to better understand *m*ORFIn score variability. Using the habitat survey data, we assign each site to one of five statistically derived habitat classes simply named: 'A',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

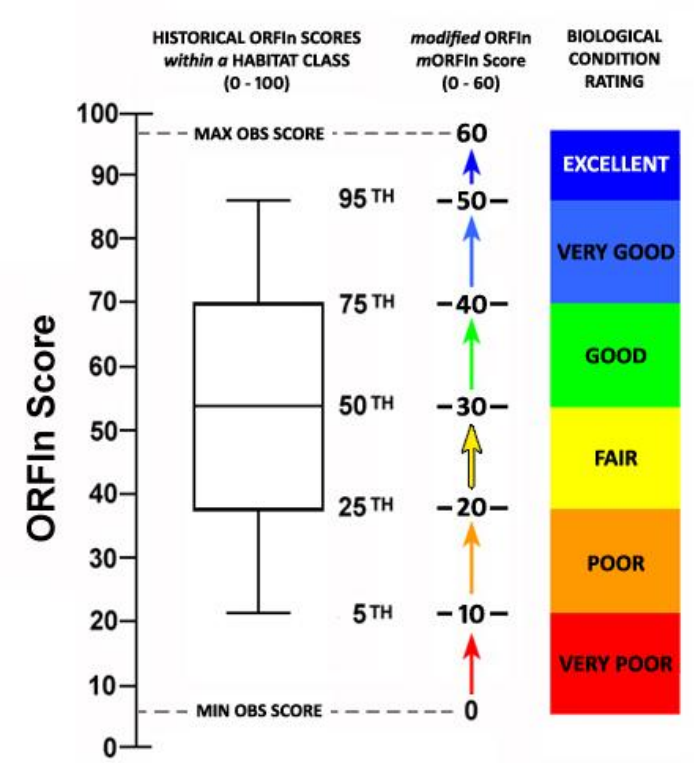
13 original ORFIn metrics used to generate *m*ORFIn scores

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

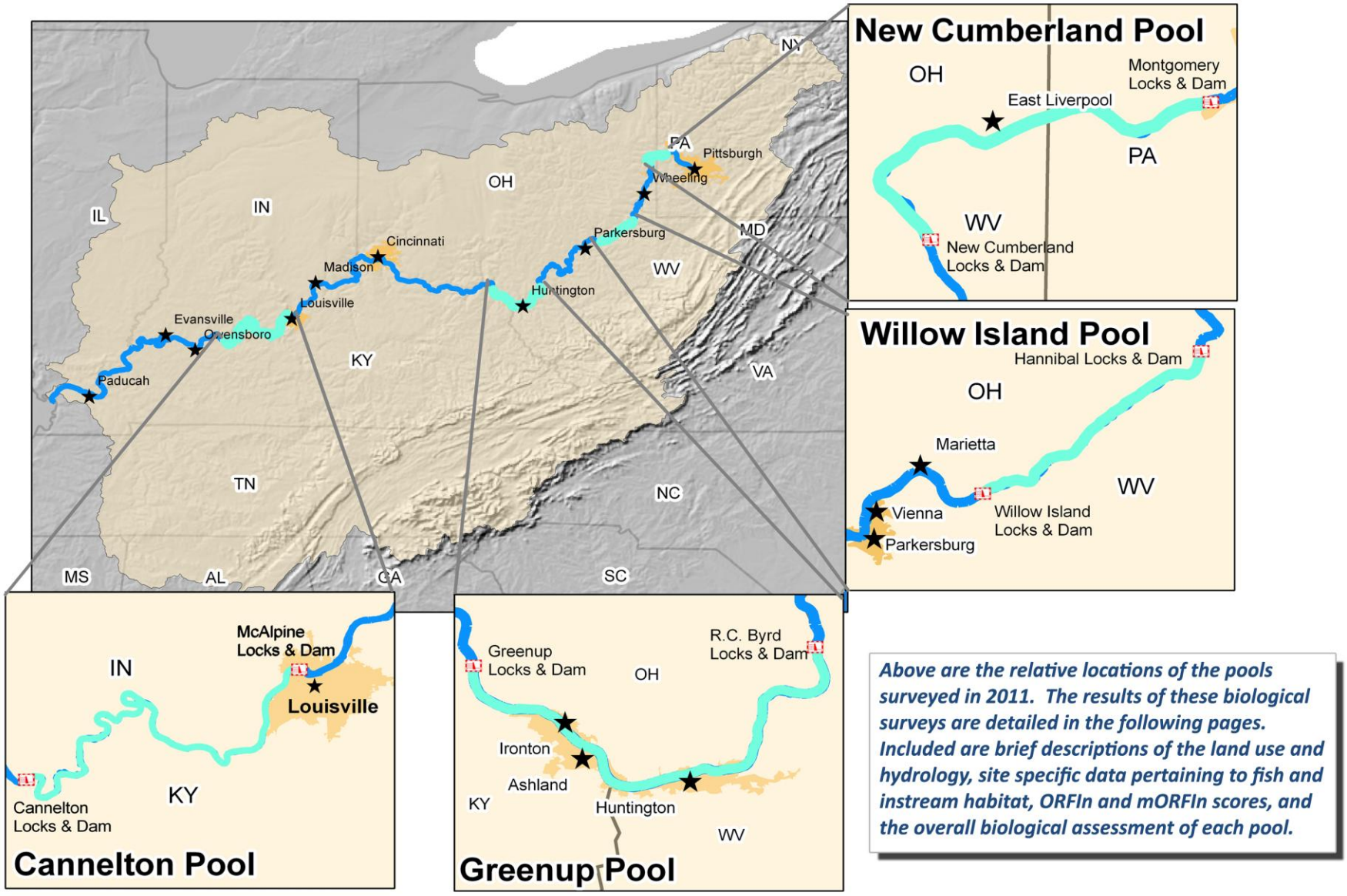
Then a *m*ORFIn score between 0 and 60 is calculated for each individual site based upon how its ORFIn score relates to statistical thresholds defined within the historical ranges. Biological condition ratings (i.e. 'Poor', 'Very Poor', 'Fair', 'Good', 'Very Good', and 'Excellent') are given to each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

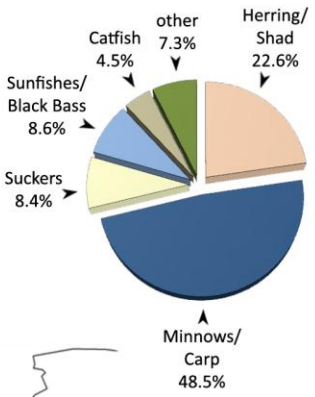
2011 Pool Survey Results

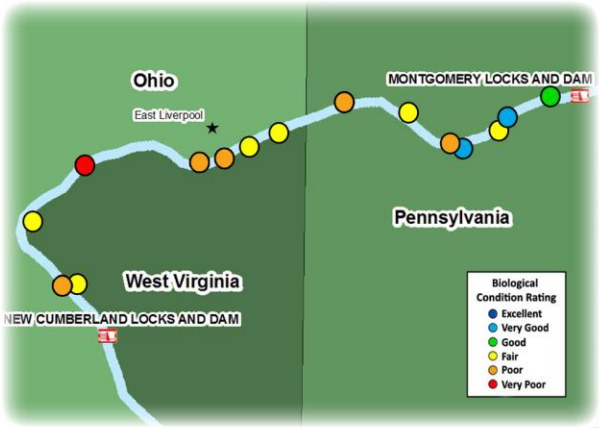


Above are the relative locations of the pools surveyed in 2011. The results of these biological surveys are detailed in the following pages. Included are brief descriptions of the land use and hydrology, site specific data pertaining to fish and instream habitat, ORFIn and mORFIn scores, and the overall biological assessment of each pool.

New Cumberland Pool - *2011*

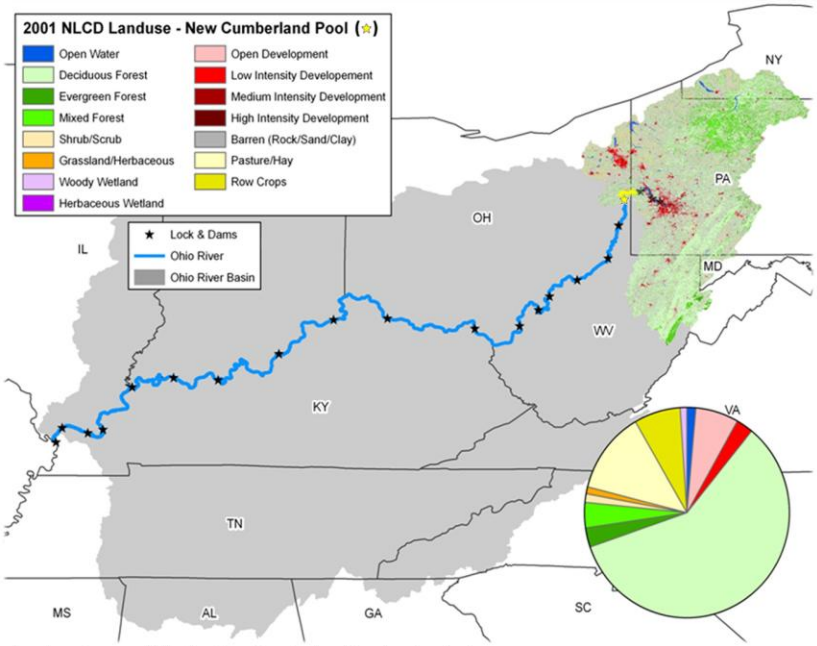
The New Cumberland pool is 22.7 miles long, extending from Montgomery Locks and Dam (ORM 31.7) to New Cumberland Locks and Dam (ORM 54.4). The pool has a gradient drop of 0.2 feet per mile, averages 1,439 feet wide and 22 feet deep. The pool flows within the state of Pennsylvania for the upper nine miles and is bordered by Ohio and West Virginia for the remaining 13.7 miles. Though the pool has few major metropolises (East Liverpool, OH), New Cumberland lies in a portion of the Ohio River heavily influenced by industry and is just 31.7 miles below the city of Pittsburgh. The New Cumberland pool receives water from two small tributaries: Little Beaver Creek and Yellow Creek. The pool's watershed is primarily forested with some agricultural land usage (crops and pasture), but also has significant urban influences. In unmodified sections of the pool the shoreline largely consists of coarse substrates.



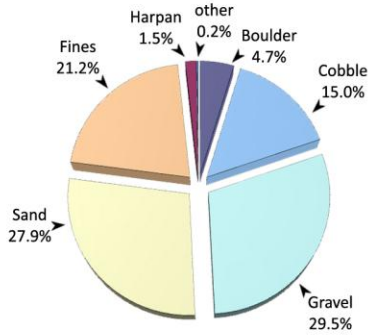


Locations of the 15 randomly chosen electrofishing sites in New Cumberland Pool

Shippingsport, PA which lies in the northern reach of New Cumberland Pool, is home to the only nuclear power plant on the mainstem



Land-use types within the New Cumberland Pool watershed



rock bass (*Ambloplites rupestris*)

yellow perch (*Perca flavescens*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	32.3	D	41.80	54.20	35.47
2	33.6	C	44.55	64.03	42.40
3	34.2	C	44.55	48.72	25.43
4	35.2	C	44.55	67.13	44.97
5	35.6	B	46.71	42.49	15.21
6	37.2	D	41.80	45.35	24.48
7	39.0	C	44.55	35.67	13.84
8	41.0	C	44.55	49.91	26.98
9	42.0	B	46.71	50.62	24.69
10	42.7	B	46.71	45.35	18.46
11	43.5	B	46.71	43.16	15.97
12	47.0	A	50.03	34.70	8.40
13	49.4	C	44.55	45.24	20.90
14	52.2	A	50.03	40.69	13.03
15	52.5	B	46.71	54.70	29.57
			Average Pool *mORFIn* Score		**23.9**

New Cumberland Pool - Results Overview

Sampling Results

Environmental Measures

- Dominant Habitat Class: C – equal mix of coarse and fines
- Notable Measures: relatively high percentage of coarse shoreline

Biological Measures

- Total No. of Fish Species: 39
- Average No. of Individuals: 149
- Dominant Family (*minus herring/shad*): Minnows/Carp
- Dominant Species (*minus shad/shiners*): golden redhorse
- Threatened & Endangered Species: mooneye, silver chub (PA)
- Rare Ohio River Mainstem Species: channel darter
- Notable Catch: abundant game fishes (sm. bass and bluegill)

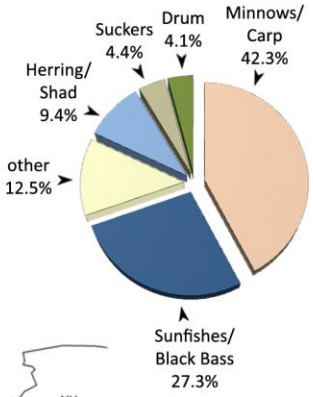
Assessment Results

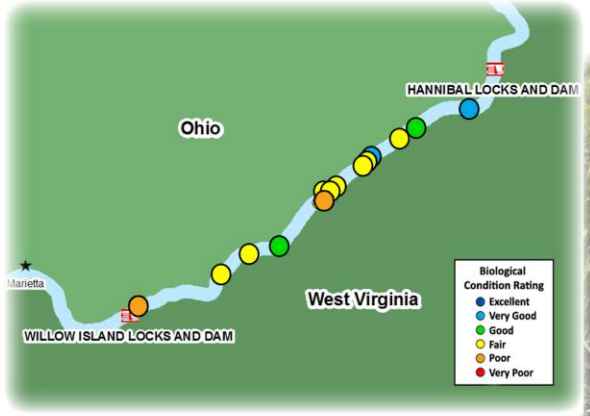
- Highest scoring ORFIn metric (*minus DELTs*): % Non-natives
- Lowest scoring ORFIn metric: % Piscivores
- Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 9
- Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 6
- Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Fair

Willow Island Pool - *2011*

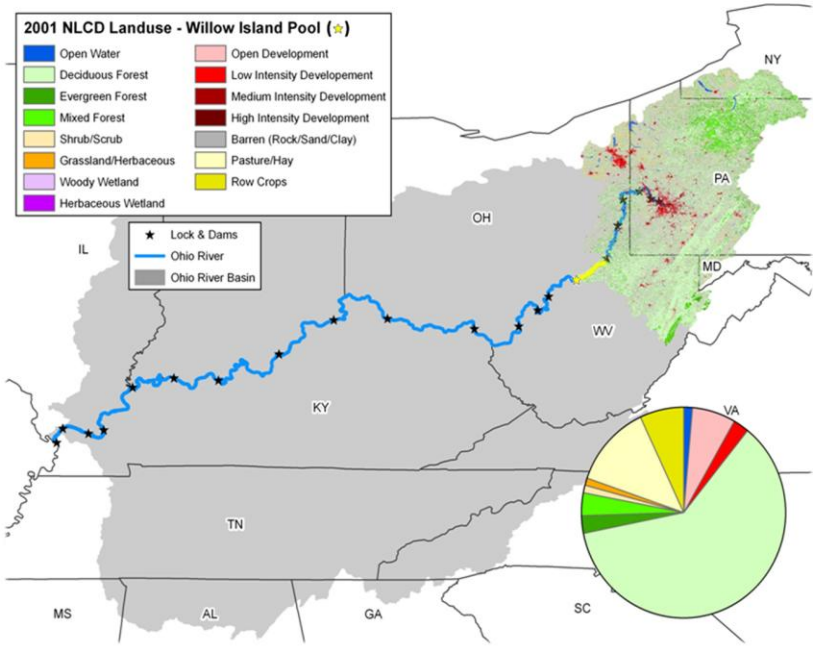
The Willow Island pool is 35.3 miles long, extending from Hannibal Locks and Dam (ORM 126.4) to Willow Island Locks and Dam (ORM 161.7). The pool has a gradient drop of 0.6 feet per mile, averages 1,194 feet wide and 21 feet deep. The pool flows adjacent to the states of Ohio and West Virginia. The Willow Island pool receives water from two sub-basins: the Fishing and Middle Island creeks, both draining parts of West Virginia. This pool lies in a portion of the Ohio River where the land use consists primarily of forested and cropland activities, but is also impacted by the presence of animal farming and urban influences. Almost the entire Ohio shoreline of Willow Island pool is a federally protected national forest (Wayne National Forest), and only a few smaller towns border the West Virginia shoreline (St. Marys, Sistersville, and New Martinsville).



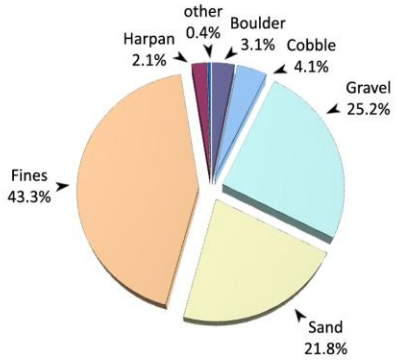


Locations of the 15 randomly chosen electrofishing sites in Willow Island Pool

An abundance of wildlife was observed throughout Willow Island pool, including various species of waterfowl, raptors, and mammals



Land-use types within the Willow Island Pool watershed



longear sunfish (*Lepomis megalotis*)

largemouth bass (*Micropterus salmoides*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	130.7	D	41.80	65.76	47.36
2	134.9	C	44.55	52.88	30.73
3	136.4	C	44.55	50.34	27.54
4	139.1	D	41.80	60.31	42.26
5	139.4	D	41.80	43.92	22.68
6	139.8	D	41.80	42.50	20.89
7	142.6	D	41.80	48.85	28.90
8	142.9	D	41.80	48.72	28.74
9	143.0	B	46.71	52.41	26.83
10	143.8	C	44.55	32.73	11.80
11	144.1	D	41.80	44.04	22.83
12	148.7	D	41.80	54.95	36.40
13	150.9	C	44.55	45.99	21.87
14	153.8	D	41.80	48.22	28.11
15	160.8	B	46.71	45.88	19.06
				Average Pool *mORFIn* Score	**27.7**

Willow Island Pool - Results Overview

Sampling Results

Environmental Measures

- Dominant Habitat Class: D - shallow sand/fines
- Notable Measures: abundant inshore structure and vegetation

Biological Measures

- Total No. of Fish Species: 48
- Average No. of Individuals: 182
- Dominant Family (*minus herring/shad*): Minnows/Carp
- Dominant Species (*minus shad/shiners*): bluegill
- Species of Concern: river redhorse (OH)
- Rare Ohio River Mainstem Species: yellow bullhead
- Notable Catch: abundant game fishes (bass and bluegill)

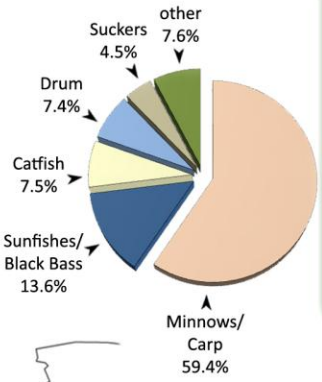
Assessment Results

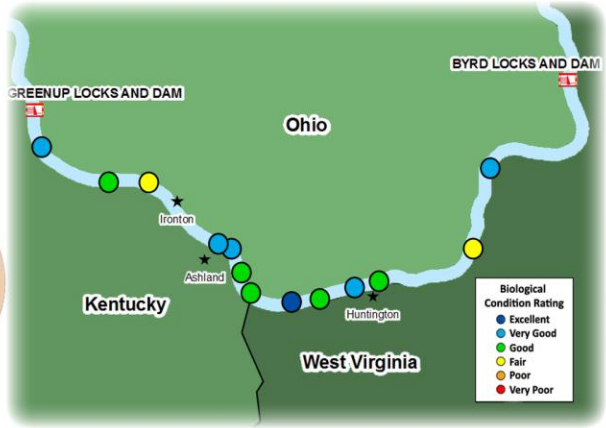
- Highest scoring ORFIn metric (*minus DELTs*): Centrarchid score
- Lowest scoring ORFIn metric: % Lithophils
- Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 13
- Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 2
- Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Fair

Greenup Pool - *2011*

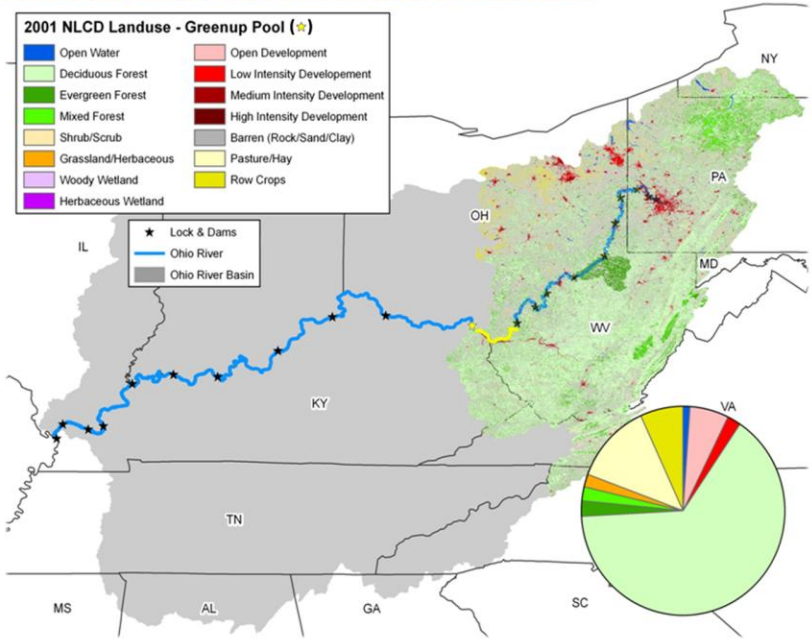
The Greenup pool is 61.8 miles long, extending from Robert C. Byrd Locks and Dam (ORM 279.2) to Greenup Locks and Dam (ORM 341.0). The pool has a gradient drop of 0.4 feet per mile and averages 1,111 feet wide and 26 feet deep. The pool is bordered by the states of West Virginia and Ohio at the upper end and by Ohio and Kentucky downstream of the Big Sandy River. This pool is heavily influenced by industry with a large amount of barge activity near urban centers. The Greenup pool receives water from five major sub-basins: the Guyandotte, Big Sandy, and Little Sandy rivers and Twelvepole and Symmes creeks. These watersheds are primarily forested, but also have significant urban influences including the cities of Huntington, WV and Ashland, KY. Green Bottom Wildlife Management Area (WV) and the mouth of the Little Sandy (KY) provide great wetland and backwater habitat for rare mainstem species like the bowfin.



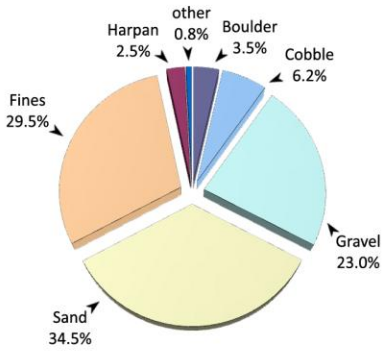


Locations of the 15 randomly chosen electrofishing sites in Greenup Pool

Sunset over the bridges connecting two of the larger cities in Greenup Pool, Ashland (KY) and Ironton (OH)



Land-use types within the Greenup Pool watershed



spotted bass (*Micropterus punctulatus*)

bowfin (*Amia calva*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	283.0	C	44.55	49.85	26.90
2	288.2	C	44.55	57.21	35.59
3	292.4	C	44.55	63.53	41.98
4	299.3	C	44.55	48.37	24.98
5	307.3	D	41.80	50.98	31.55
6	309.1	D	41.80	60.01	41.97
7	311.6	C	44.55	60.81	39.63
8	313.6	D	41.80	73.01	55.26
9	316.8	D	41.80	53.63	34.78
10	318.9	C	44.55	54.73	32.81
11	321.1	B	46.71	74.49	48.98
12	322.0	C	44.55	72.81	49.69
13	329.2	E	39.59	47.69	27.41
14	331.8	D	41.80	56.03	37.72
15	337.6	E	39.59	60.29	41.37
			Average Pool *mORFIn* Score		**38.0**

Greenup Pool - Results Overview

Sampling Results

Environmental Measures

- Dominant Habitat Class: C – equal mix of coarse and fines
- Notable Measures: relatively high percentage of barge traffic

Biological Measures

- Total No. of Fish Species: 47
- Average No. of Individuals: 183
- Dominant Family (*minus herring/shad)*: Minnows/Carp
- Dominant Species (*minus shad/shiners*): bluegill
- Species of Concern: river redhorse (OH), black buffalo (KY)
- Rare Ohio River Mainstem Species: bowfin
- Notable Catch: river redhorse, numerous catfish and basses

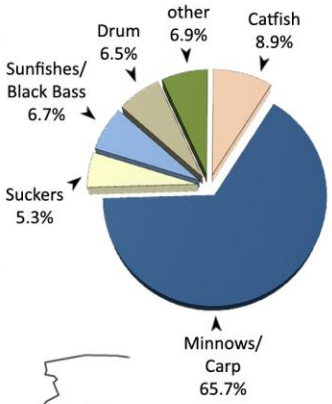
Assessment Results

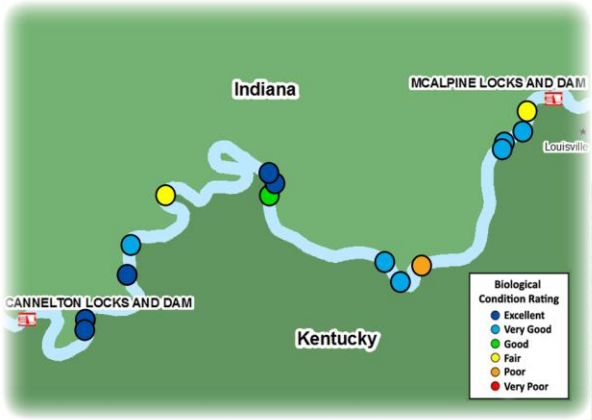
- Highest scoring ORFIn metric (*minus DELTs*): % Tolerants
- Lowest scoring ORFIn metric: % Lithophils
- Sites Above 25th percentile (i.e. *m*ORFIn Score = 20): 15
- Sites Below 25th percentile (i.e. *m*ORFIn Score = 20): 0
- Aquatic Life-Use Designation: Met

Overall Biological Condition Rating: Good

Cannelton Pool - *2011*

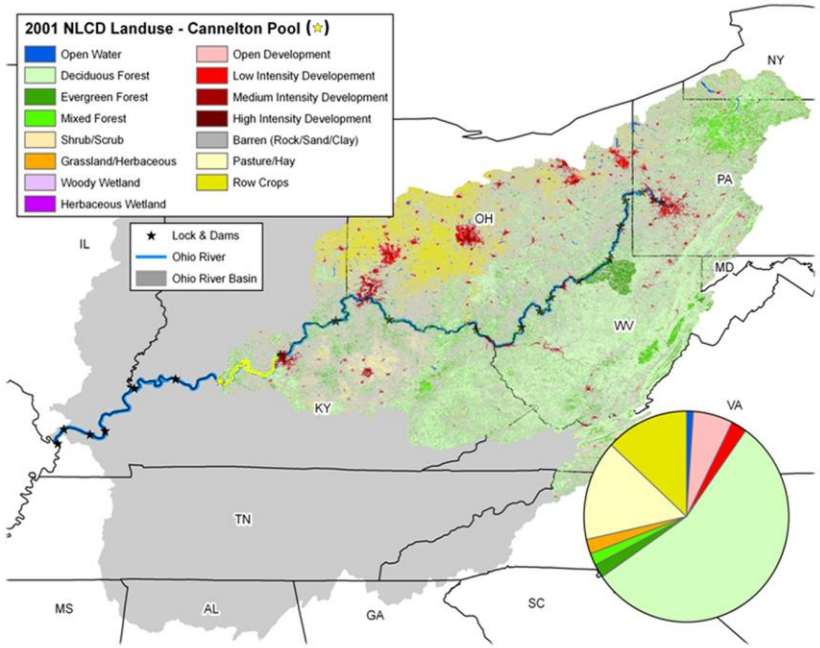
The Cannelton pool is 113.9 miles long, extending from McAlpine Locks and Dam (ORM 606.8) to Cannelton Locks and Dam (ORM 720.7). The pool has a gradient of 0.3 feet per mile and averages 1,674 feet wide and 32 feet deep. The pool is bordered by the states of Kentucky and Indiana. The Cannelton pool receives water from the Salt River, Big Indiana Creek, Sinking Creek, and Blue River. The Falls of Ohio (Clarksville, Indiana) is located in Cannelton pool and provides a unique habitat in the river, therefore a unique fish community is also present. Many species such as blue suckers (Cycleptus elongatus) and striped bass (Morone saxatilis) take advantage of the high velocities and shallow water. This riffle-like habitat offers quasi-natural, historical conditions that were once intermittent along the entire length of the river.



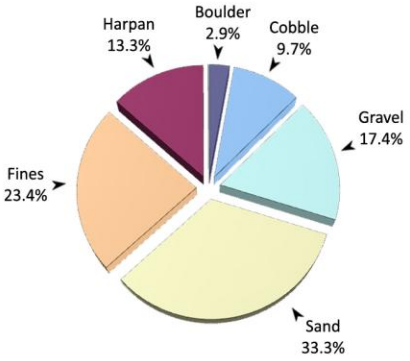


Locations of the 15 randomly chosen electrofishing sites in Cannelton Pool

Densely wooded shorelines with natural rocky cover are a common sight throughout the scarcely populated middle and lower portions of Cannelton Pool



Land-use types within the Cannelton Pool watershed



redear sunfish (*Lepomis microlophus*)

longnose gar (*Lepisosteus osseus*)

Site Performance

Site No.	River Mile	Habitat Class	ORFIn Exp	ORFIn Obs	*m*ORFIn Score
1	610.5	B	46.71	54.42	29.25
2	612.8	D	41.80	59.17	41.19
3	614.9	D	41.80	68.22	49.67
4	615.6	C	44.55	61.70	40.46
5	634.1	D	41.80	40.39	18.63
6	638.1	D	41.80	62.53	44.34
7	641.0	D	41.80	65.94	47.52
8	656.8	C	44.55	58.02	36.50
9	658.2	B	46.71	75.87	50.27
10	659.7	D	41.80	72.41	54.56
11	681.7	D	41.80	47.29	26.93
12	692.4	D	41.80	66.36	47.92
13	695.9	D	41.80	70.88	52.73
14	705.8	D	41.80	71.38	53.33
15	707.4	E	39.59	71.14	60.00
			Average Pool *mORFIn* Score		**43.6**

Cannelton Pool - Results Overview

Sampling Results

Environmental Measures

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

Biological Measures

- Total No. of Fish Species: 48
- Average No. of Individuals: 182
- Dominant Family (*minus herring/shad*): Minnows/Carp
- Dominant Species (*minus shad/shiners*): freshwater drum
- Threatened and Endangered Species: none were captured
- Rare Ohio River Mainstem Species: warmouth
- 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: Very Good

CONCLUSIONS

Pool Surveys

The 2011 pool surveys were successfully completed between June 26th and October 12th. Primarily, typical weather/flow conditions were experienced, throughout the season. However, the entire basin experienced a major, prolonged late winter/early spring rainy season resulting in some of the largest flooding events in the basin's recorded history. Overall, all four pools surveyed during the 2011 field season were assessed as *meeting* their aquatic life-use designations (i.e. containing healthy fish communities).

New Cumberland Highlights (Fair)

Survey sites were distributed fairly evenly with the pool. An equal mix of coarse (cobble & gravel) and fines comprised a significant portion of the river bottom. The minnow and carp family made up approximately half (48.5%) of the species caught. In addition to the minnows and carp, an abundance of game fish (smallmouth bass and bluegill) were encountered. Notable species caught included channel darter (rare Ohio mainstem species), mooneye, brook silverside, longear sunfish and silver chub (all four listed as threatened or endangered in PA).

Willow Island Highlights (Fair)

The majority of sites were concentrated in the upper and middle portions of the pool, with several occurring in very close proximity. The shallow sandy sites were heavily laden with vegetation and inshore structure, and accordingly an abundance of game fish were caught (bass and bluegill). The minnow and carp family comprised the majority of the species caught. Notable species caught included banded killifish (OH endangered) and yellow bullhead (more common in small streams).

Greenup Highlights (Good)

The 15 random survey sites were distributed primarily in the middle section of the pool. The sites had an equal mixture of coarse and fines. There was a large amount of barge traffic relative to the other pools surveyed. The minnow and carp family made up the majority of the catch. Notable catches included river redhorse (OH) and black buffalo (KY) (both species of concern), bowfin (rare mainstem Ohio River species), as well as numerous catfish and basses.

Cannelton Highlights (Very Good)

The 15 random survey sites were spread throughout the pool, with several sites being in close proximity in the upper portion of the pool. The pool was characterized by shallow sands and fines, as well as high current velocities in upper reaches. Freshwater drum were the most dominant species, although the minnow and carp family made up the majority of the catch. Notable catches were warmouth (rare mainstem Ohio River species) and walleye (more common upstream).

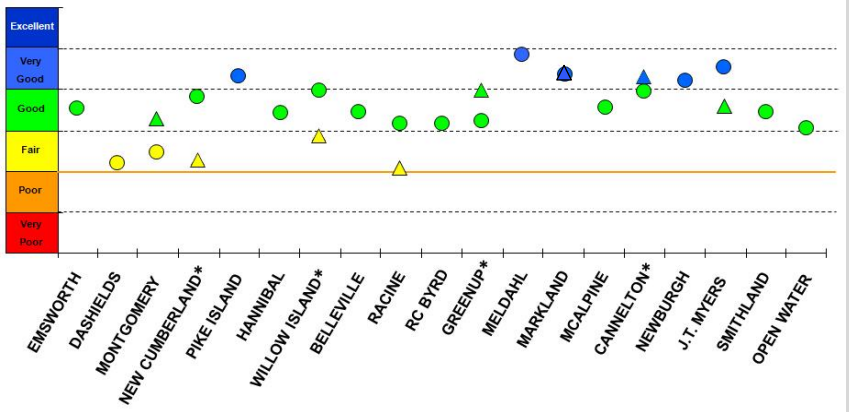
Assessment Comparisons

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 2011 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 variability observed across 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 2011 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 (Began 2009)



CONCLUSIONS

Present vs. Past Assessments

The focus of ORSANCO's biological assessments is to determine whether each pool 'meets' or 'fails to meet' it's 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 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.

New Cumberland Pool (2011 vs. 2005)

Variable	2011	2005	Difference
Environmental Factors			
Avg. seasonal flow	Normal	Very Low	Higher
% Sites with SAV	80%	20%	60%
Avg % of Site containing SAV	9.5%	0.2%	9.3%
CPUE score (0-100)	34.4	49.0	-15
No. of sauger	29	202	-173
No. freshwater drum	201	1728	-1527
Intolerant species score (0-100)	35.7	80.6	-46.7
No. of smallmouth redhorse	11	111	-100
Sucker species score (0-100)	39.9	79.3	-17.3
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Fair**	**Good**	Lower

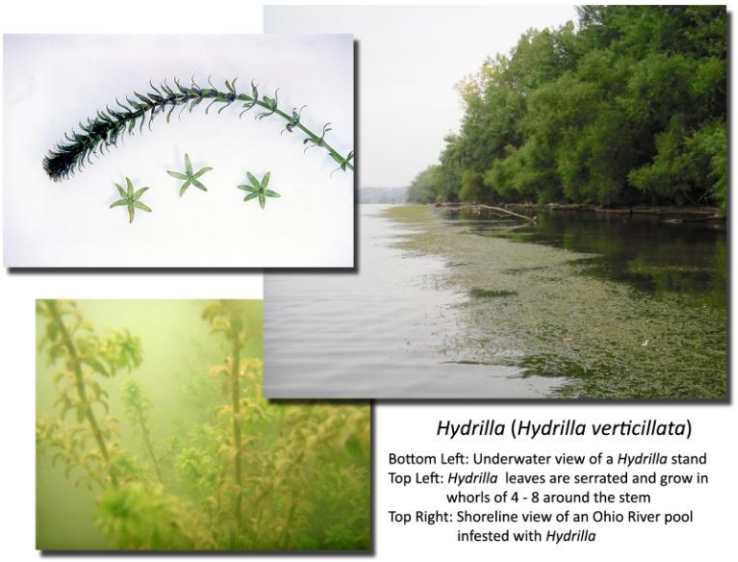
New Cumberland pool was assessed to be in lower condition in 2011 than in 2005. In 2011, we encountered moderate flows and higher densities of submerged aquatic vegetation (SAV). While the increase in aquatic vegetation may account for decreases in some metric scores at a couple of sites, at this time there exists no clear environmental factors (for which we currently collect data) that would account for the changes in metric performance. Additionally, 2005 sites were sampled during extreme low-flow conditions which can compress populations and increase biomass density. As such, most scores from 2005 were higher. The 2011 assessment, having been completed under more normal flow conditions may in fact be a more accurate representation of the biological condition of the pool.

We continue to investigate the influence of flows and aquatic vegetation on Ohio River fish communities and hope to account for these effects in future assessments.

Willow Island Pool (2011 vs. 2006)

Variable	2011	2006	Difference
Environmental Factors			
Avg. seasonal flow	Normal	High	Lower
% Sites with SAV	100%	60%	40%
Avg % of Site containing SAV	17.8%	11.3%	6.5%
% Non-natives score (0-100)	66.3	86.8	-20.5
No. of banded killifish	30	1	29
No. of common carp	40	22	18
% Tolerants score (0-100)	22.3	64.3	-42.0
No. of bluntnose minnow	190	120	70
No. of common carp	40	22	18
% Lithophils score (0-100)	8.6	65.5	-56.9
No. of redhorse	107	502	-395
No. of sauger	68	341	-273
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Fair**	**Good**	Lower

Willow Island pool received a lower condition rating than in 2006. Substantially higher amounts of aquatic vegetation were observed throughout the pool in 2011. While the presence of submerged aquatic vegetation (SAV) typically enhances instream habitats resulting in greater species diversity, we believe the abundance of vegetation may have caused a shift in the fish community structure and, likely contributes to 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. The densely vegetated shallow sites tend to enhance populations of tolerant and/or non-native species such as bluntnose minnows, banded killifish, and common carp. Increased vegetation may have also contributed to the decreased number of sauger and saugeye observed in 2011, as they forage over bare substrates.



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

Greenup Pool (2011 vs. 2006)

Variable	2011	2006	Difference
Environmental Factors			
Avg. seasonal flow	Normal	Slightly High	Lower
% Sites with SAV	86.7%	6.7%	Higher
Avg % of Site containing SAV	9.1%	0.1%	Higher
CPUE score (0-100)	41.4	9.4	32.0
% Invertivores score (0-100)	63.8	35.5	28.3
Native species score (0-100)	70.9	46.8	24.1
% Piscivores score (0-100)	19.1	62.4	-43.3
% Lithophils score (0-100)	12.4	57.5	-45.1
Assessment Result			
Aquatic life-use designation	Met	Met	Same
Condition Rating	**Good**	**Good**	Same

Greenup pool was assessed to be in slightly higher condition in 2011 than it was in 2006. Although the pool graded out slightly higher it still remained in 'good' condition. Metric performance revealed increases in CPUE, % Invertivores, % Detritivores and Native Species scores in 2011, while % Lithophils and % Piscivores scores decreased significantly. All other metric scores exhibited insignificant changes. Overall, the pool exhibited the biological stability one would expect from a mature system.

Cannelton Pool (2011 vs. 2007)

Variable	Survey 2	Survey 1		Difference
	2011	2006	2007	
Environmental Factors				
Avg. seasonal flow	Normal	High	Low	n/a
CPUE score (0-100)	75.0	38.9		36.1
% Invertivores score (0-100)	81.3	31.2		44.1
Centrarchid species score (0-100)	78.9	38.9		40.0
% Piscivores score (0-100)	5.7	64.4		-58.7
% Lithophils score (0-100)	13.3	67.8		-54.5
Assessment Result				
Aquatic life-use designation	Met	Met		Same
Condition Rating	**Very Good**	**Good**		Higher

Cannelton pool was also assessed in slightly higher condition in 2011 than it was in its previous 2-year assessment performed in 2006 / 2007. Differences in metric scores followed a nearly identical trend to those exhibited in Greenup pool with increased CPUE, % Invertivores, and Centrarchid Species scores. Likewise % Lithophils and % Piscivores scores decreased significantly. The slight differences between the Cannelton assessments are likely artifacts of spatial and temporal variation that occurs within pools across years.

Field Notes For the 2011 field season, we switched to using sphere anodes (bottom photo) on our electrofishing boats to defray cost and minimize fish injury associated with higher voltage gradients sometimes produced by the "spider" anode arrays (top photo) that we have used in the past. Because electricity leaves the anodes in a perpendicular manner, changing the shape of our arrays ultimately changed the shape of our electrical field. With the spheres generating a field that extended further down into the water column than the spider arrays, we hypothesized that this may have led to an increase in benthic (bottom dwelling) species in our surveys. As we did not observe these patterns across all of our sites we concluded that differences in metric performance are likely not gear-related, and are better explained by environmental and temporal variations previously mentioned.

As with most electrofishing boats arm extensions on the bow support the anodes, while some portion of boat's hull acts as the cathode

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

Group	Species (common name)	Emsworth '07	Dashields '08	Montgomery '10	New Cumberland '11	Pike Island '07	Hannibal '08	Willow Island '11	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '11	Meldahl '07	Markland '09	McAlpine '09	Cannelton '11	Newburgh '07	John T. Myers '10	Smithland '08	Open Water '09
GAR	Longnose Gar	13	11	8	**19**	43	49	**30**	49	61	27	**33**	22	14	38	**20**	20	13	16	40
	Spotted Gar																1	1	1	
	Shortnose Gar													1	1		9	24	13	75
SHAD	Skipjack Herring	8				6			2		2		64	2	2	**1**	70		1	8
	Gizzard Shad	167	123	4058	**1097**	7464	1461	**397**	439	855	301	**120**	2947	185	394	**709**	609	3039	409	325
	Threadfin Shad														1		9	1	25	3
CARP	Common Carp	63	36	44	**19**	15	15	**40**	36	43	12	**12**	8	28	12	**4**	4	16	17	51
	Grass Carp																1			3
	Silver Carp																2	12	4	6
	Bighead Carp																2			2
	Goldfish																			
	Carp x Goldfish		1																	
MINNOW	Cyprinidae sp.																	1		
	Golden Shiner	1								1										
	Striped Shiner				**1**		2			2										
	Spottail Shiner			9	**2**	2	1	**4**										14		
	Spotfin Shiner			35	**21**	14		**63**	159	66	1	**65**	32	1		**39**	8	37	4	12
	Notropis sp.					3													1	
	Emerald Shiner	82	5	171	**1525**	197	21	**948**	637	134	16	**1557**	638	165	61	**2195**	167	140	28	25
	Silverband Shiner																			6
	Sand Shiner								1											
	Channel Shiner	35	1	159	**685**	164	16	**532**	795	178	1	**944**	7	33	30	**2787**	8	414		8
	River Shiner	1											54	11	10	**94**	3	16	2	9
	Shoal Chub																			
	Silver Chub	26	26	32	**2**	11	19		32	2	11	**12**	99	338	39	**79**	126	2	46	25
	River Chub					1						**8**								
	Gravel Chub												1							
	Creek Chub												3							
	Central Stoneroller						3			2										
	Mississippi Silvery																			1
	Suckermouth Minnow													1						
	Bluntnose Minnow			21	**98**	2	4	**190**	11	7		**4**	1		1	**2**			1	
	Bullhead Minnow							**2**	1			**25**	23	8	1	**36**		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 '11	Pike Island '07	Hannibal '08	Willow Island '11	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '11	Meldahl '07	Markland '09	McAlpine '09	Cannelton '11	Newburgh '07	John T. Myers '10	Smithland '08	Open Water '09
SUCKER	Ictiobinae sp.																			
	Ictiobus sp.						19													
	Smallmouth Buffalo	97	99	79	**68**	94	45	**50**	75	42	40	**25**	123	109	95	**23**	72	58	77	76
	Bigmouth Buffalo			1												**1**	3	6	5	5
	Black Buffalo	1	13	3		5	1		1			**1**		1	1		7	9	4	7
	Carpiodes sp.		1			14			3				1							1
	Quillback	17	12	25	**14**	27	28	**6**	6	4	8	**11**	31	21	12	**17**	34	18	28	15
	River Carpsucker	18	18	28	**23**	36	64	**16**	12	21	25	**55**	87	85	85	**363**	179	43	114	218
	Highfin Carpsucker			14	**5**	10	13		1						17		12		24	
	Northern Hog Sucker	3	1	7	**2**	4	2		3		1	**2**		1	2		1			
	Moxostoma sp.											**3**				**3**				
	Shorthead Redhorse																		10	
	Smallmouth Redhorse	61	16	25	**11**	28	41	**27**	97	35	27	**44**	62	38	59	**14**	3	4		
	Silver Redhorse	221	93	132	**70**	79	105	**12**	55	4	11	**19**	25	3	38				1	
	River Redhorse	39	13	8		27	35	**5**	1	1	2	**2**	1		2		1			
	Black Redhorse	18		9					2											
	Golden Redhorse	7	33	282	**216**	66	204	**63**	115	31	33	**34**	120	213	182	**2**	14	11	3	1
	Spotted Sucker							**4**		3		**1**	1						7	
	White Sucker			1																
CATFISH	Yellow Bullhead							**1**		1										
	Brown Bullhead																			
	Northern Madtom																			
	Blue Catfish																		7	4
	Channel Catfish	32	17	17	**201**	40	62	**91**	89	79	53	**295**	92	111	79	**287**	12	103	291	165
	Flathead Catfish	14	11	12	**15**	36	38	**17**	27	29	42	**37**	49	23	11	**32**	11	19	16	15
SUNFISH	Lepomis sp.											**1**								
	Warmouth												1	2	1	**1**				
	Rock Bass	16	9	8	**15**	1	2	**15**	9	3		**4**		2						
	Bluegill	379	32	58	**192**	46	36	**653**	413	210	52	**337**	208	205	80	**247**	11	47	64	98
	Green Sunfish	12	3			2	2	**1**	8	3	6	**3**	3	9	3	**7**	4	4	1	2
	Pumpkinseed			2	**2**		2	**25**	1			**2**		1						1
	Orangespotted Sunfish				**2**			**20**	1	5	1	**3**	1					2		5
	Longear Sunfish				**2**		9	**141**	18	7	9	**26**	41	148	56	**117**	4	52	92	110
	Redear Sunfish					1		**1**	4	1		**1**		1	1	**15**			20	

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

Group	Species (common name)	Emsworth '07	Dashields '08	Montgomery '10	New Cumberland '11	Pike Island '07	Hannibal '08	Willow Island '11	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '11	Meldahl '07	Markland '09	McAlpine '09	Cannelton '11	Newburgh '07	John T. Myers '10	Smithland '08	Open Water '09
SUNFISH	Lepomis Hybrid											**1**								
	Bluegill X Longear							**1**											1	
	Bluegill X Green					1														
	Longear X Green											**1**								
TEMPERATE BASS	Morone sp.	27		26	**22**	419	91	**54**	35	191	73	**55**	152	42	62	**54**	408	21	190	31
	White Perch	5					1	**1**						1						7
	Striped Bass						14											1	2	
	White Bass	9	16		**37**	2	3	**13**	41	5	29	**19**	19	18	24	**6**	4	44	76	54
	Yellow Bass															**2**			2	104
	Hybrid Striped Bass							**7**	3	9	1	**10**		14	6	**2**		8	2	45
BLACK BASS	Micropterus sp.							**2**		3								3	1	
	Smallmouth Bass	339	163	210	**155**	208	92	**155**	45	47	32	**47**	4	32	5	**27**	1	4		10
	Largemouth Bass	4	2	8	**2**	16		**50**	72	58	25	**38**	16	25	9	**32**	2	2	21	23
	Spotted Bass	125	34	5	**48**	75	38	**79**	43	20	30	**127**	92	102	20	**58**	50	41	31	36
DARTER	Johnny Darter	1																		
	Greenside Darter	5		1		5														
	Variegate Darter					1														
	Rainbow Darter								1											
	Fantail Darter	3											1							
	Bluebreast Darter					5														
	Banded Darter																			
	Dusky Darter																		1	
	Channel Darter	16			**1**	37	1							3			1			
	Blackside Darter					1														
	Slenderhead Darter													1						
	River Darter					21			2				21	7						
	Logperch	141	166	47	**17**	101	105	**17**	48	6	72	**1**	20	23	2		5	1	1	1
PERCH	Yellow Perch				**5**		3	**2**	2											
	Walleye	44	7	21	**2**	70	11	**6**	4		1	**2**	3			**1**	7			1
	Saugeye	2	8			4	1	**44**	1		1			13				3	2	16
	Sauger	283	192	92	**29**	249	317	**68**	133	51	259	**91**	1178	368	177	**138**	747	81	105	127
MISC.	Silver Lamprey																		1	
	Ohio Lamprey								1											
	Goldeye																12	3	2	4

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

Group	Species (common name)	Emsworth '07	Dashields '08	Montgomery '10	New Cumberland '11	Pike Island '07	Hannibal '08	Willow Island '11	Belleville '09	Racine '10	Robert C. Byrd '08	Greenup '11	Meldahl '07	Markland '09	McAlpine '09	Cannelton '11	Newburgh '07	John T. Myers '10	Smithland '08	Open Water '09
	Mooneye	20	11	7	**11**	37	10	**6**	4		7	**4**	48	9	10		10	1		1
MISCELLANEOUS	Paddlefish																1			1
	Muskellunge	1																		
	White Crappie	5	1	1				**1**	3	2	1	**7**		2		**21**	1	6		13
	Black Crappie	3	1	1	**1**	2		**5**	2	5	1	**4**			4	**7**		6		3
	Inland Silverside																		26	
	Brook Silverside			1	**11**			**2**								**5**	1		1	
	Atlantic Needlefish																			5
	Trout-Perch								7	1										
	Banded Killifish							**30**		1										
	Western Mosquitofish																			1
	Bowfin											**1**								
	Freshwater Drum	254	58	84	**201**	498	211	**172**	33	206	83	**329**	1014	509	171	**520**	383	103	837	236
Total No. of Individuals		2618	1232	5753	**4849**	10190	3198	**4070**	3583	2435	1296	**4423**	7313	2929	1804	**7968**	3040	4448	2636	2060
Total No. of Unique Species		43	33	41	**39**	48	43	**48**	51	42	36	**47**	41	45	40	**38**	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