2016 Ohio River Pool Assessments

Willow Island, Greenup, & Cannelton

ORSANCO Biological Programs
Ohio River Valley Water Sanitation Commission
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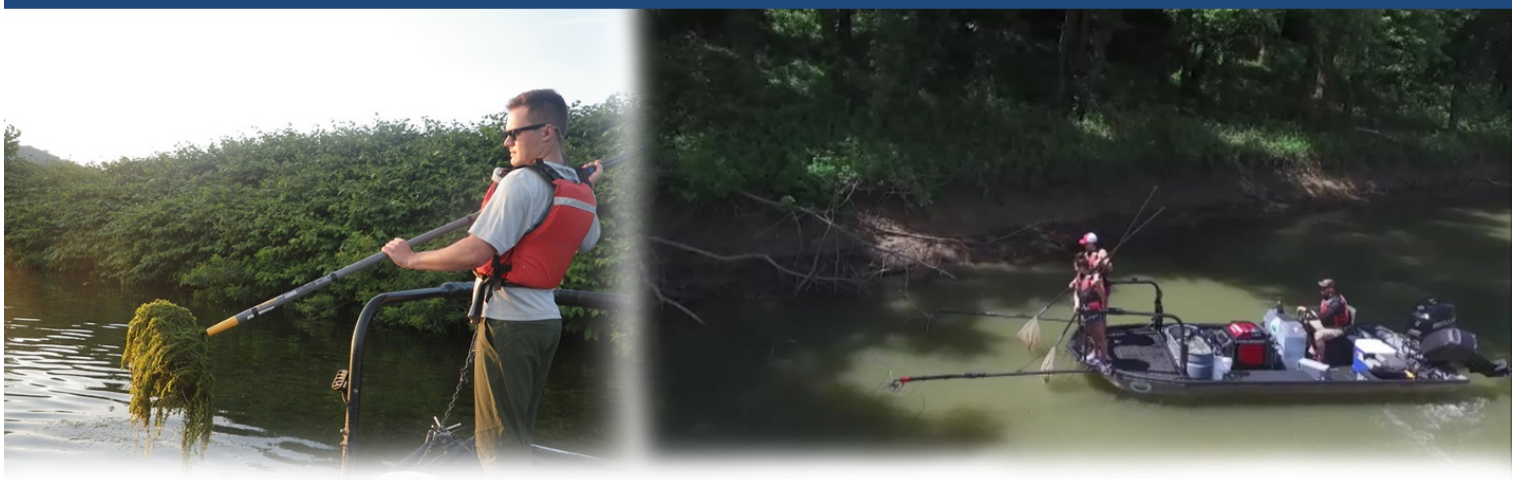

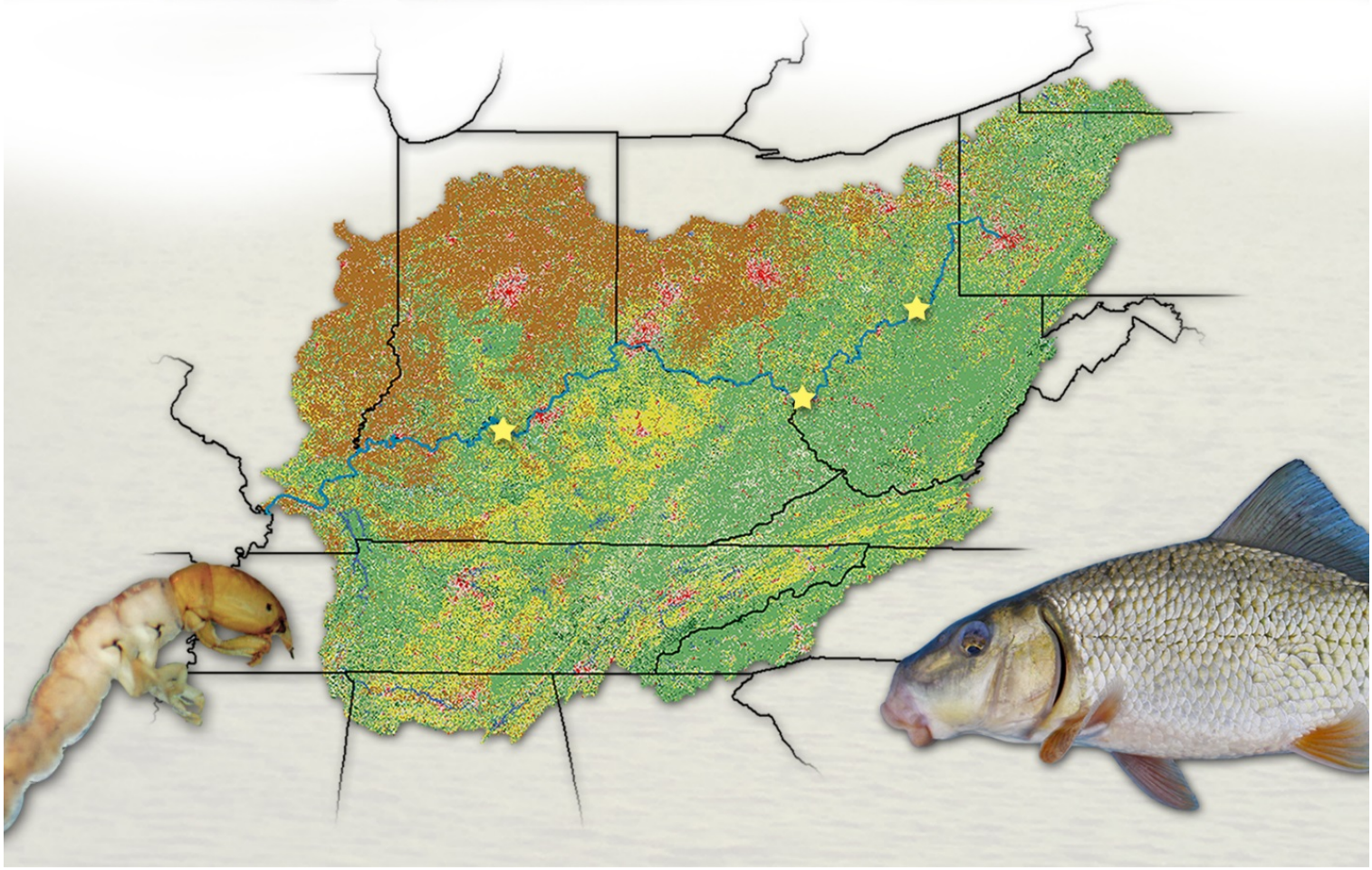

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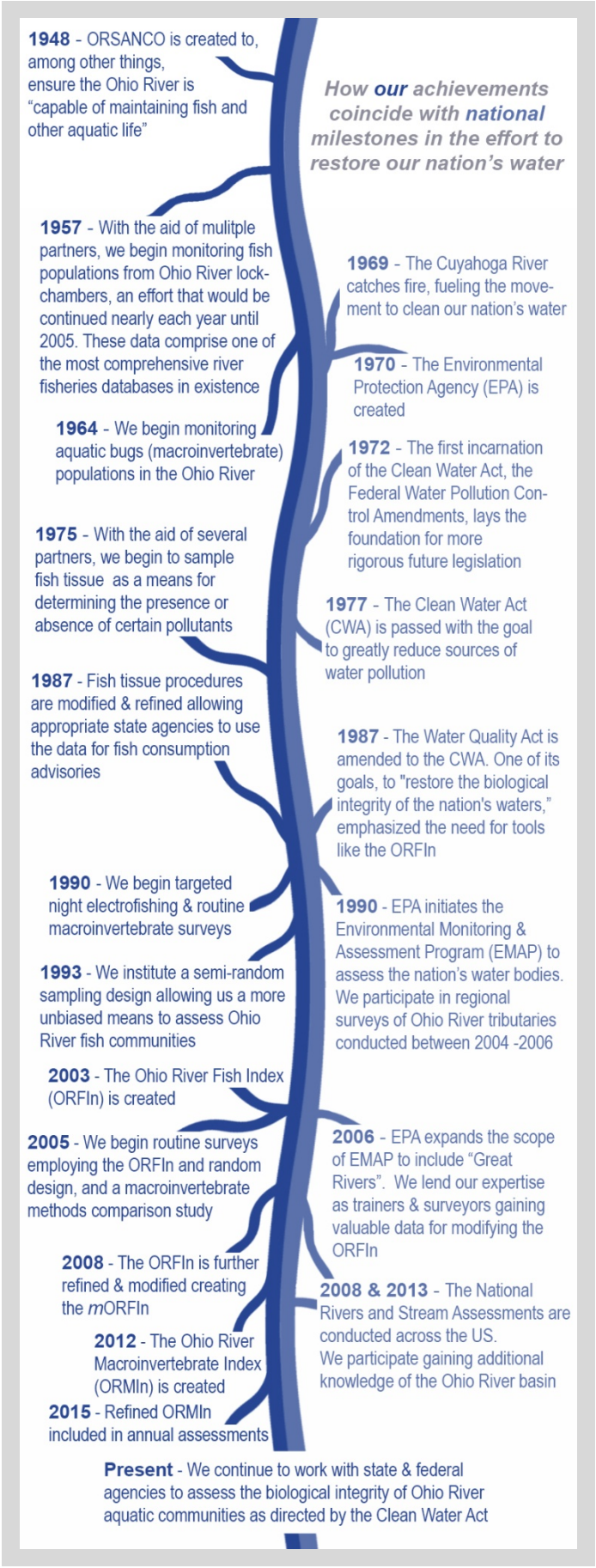
Introduction

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 and macroinvertebrate (macro) 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. Preexisting macro sampling was augmented to prescribe to this new random survey design. After years of biological collections on the Ohio River, two biological indices were developed (see figure on right for specifics). Each year we collect fish, macro, and environmental data from various sections of the Ohio River. These data are used to calculate index scores, which are numerical representations of the relative condition of Ohio River biological 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.



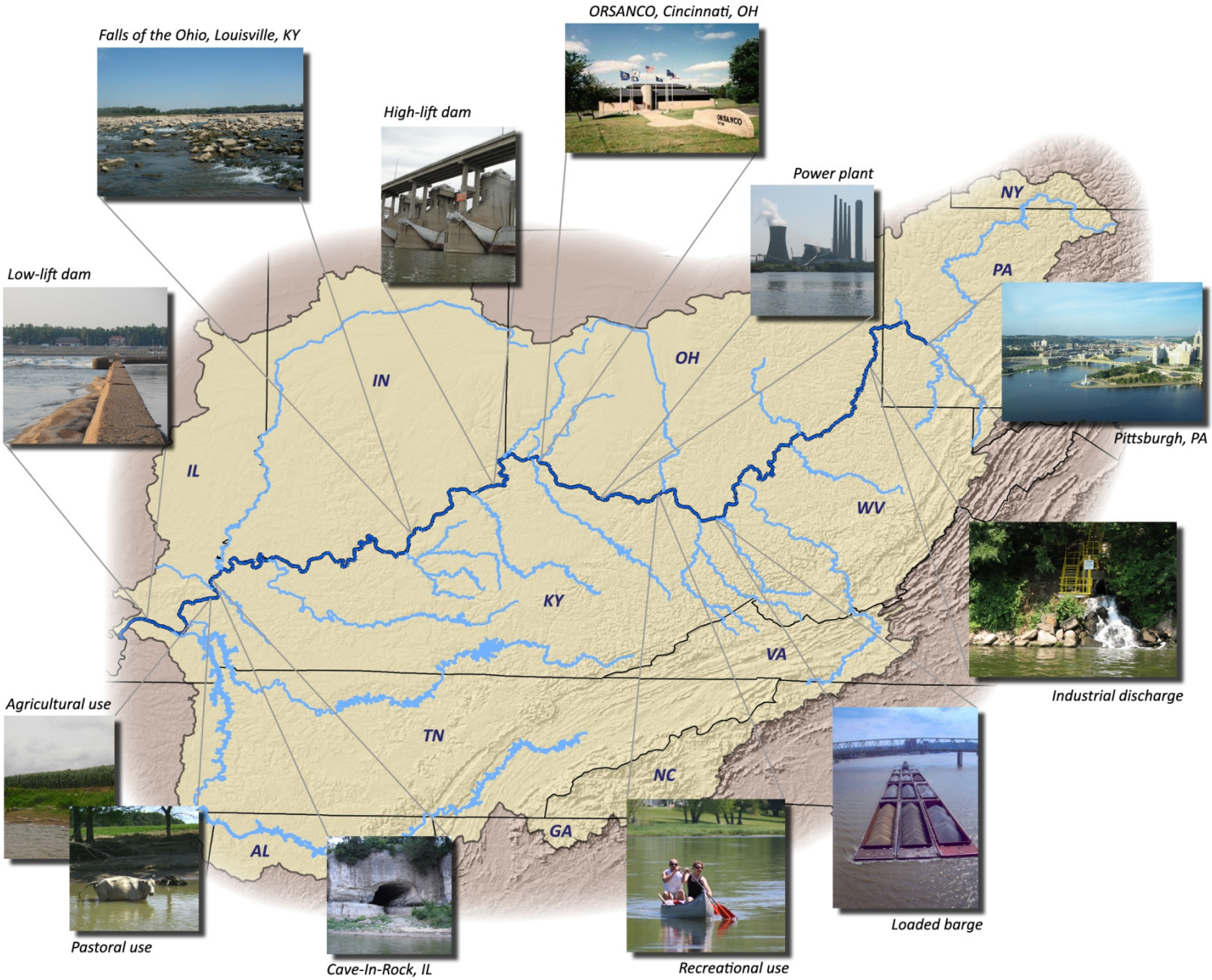
This report summarizes the findings of the 2016 surveys; the assessments of the Willow Island, Greenup, and Cannelton pools

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 (>200,000 mi^2) covers an additional eight states; New York, Maryland, Virginia, North Carolina, Tennessee, Georgia, Alabama, and Mississippi. Nineteen high-lift locks and dams maintain a nine foot minimum depth for commercial navigation throughout the river.

Facts

- Average depth 24 ft; max depth exceeds 90 ft
- Average width ½ mi; 1 mi max (Smithland Pool)
- ~350 fish species from Ohio River *basin* (24 exotic) = 37% of native U.S. fauna (881 species)
- ~180 fish species found in the Ohio *River* (17 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 along the main stem provide drinking water for over 5 million people
- ~600 permitted discharges to the Ohio River
- 28 coal-fired power plants on the main stem
- Coal and energy products comprise 70% of the 250 million tons of cargo carried by barges each year



METHODS

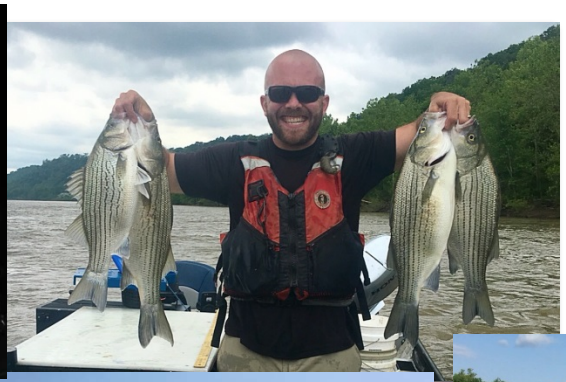
Site Selection

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 2 ft 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 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. 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.



Collecting Macroinvertebrates

Two sampling methods are used to collect macroinvertebrates (macros); Hester-Dendy (HD) samplers and multi-habitat kicks (MH). HD samplers are constructed of tempered masonite cardboard cut into 3in square plates and 1in square spacers. Eight large plates and 12 spacers are stacked on a metal eyebolt to provide varying degrees of space for macro colonization. Five HDs are attached, in a ring, to a concrete paver. The paver is then placed on the river bottom in 10ft of water at the downstream end of each 500m sampling site and secured to the shore. Similar to the fish, macro sampling is restricted to a defined season within each year. HDs are deployed for six weeks, beginning September 1st allowing adequate time for macro colonization. After the six week colonization period, HDs are retrieved and MH kick surveys are conducted.

A MH kick is performed by actively disturbing the substrate and then sweeping a net through the resulting cloud. This technique allows the sampler to collect macros without compromising the sample with large amounts of sediment. To further exclude sediments, the net heads are "D" shaped (i.e. have flat bottoms), which also eases the scraping of woody debris and boulders. Samplers disturb/scrape 10 linear meters of substrate at each 100m interval of a site in depths 1m or shallower. At each of these intervals, every attempt is made to sample available habitats (e.g. sand flats, woody debris, boulders, etc.) relative to the proportion of their availability. The kicks conducted at each 100m interval are then combined to represent the community present at the site.

Once the kicks are completed and the HDs have been retrieved, the samples are preserved. The HDs are disassembled in the field. The plates from the HDs and large debris from the MH samples are rinsed and drained through a 500µm sieve. The macros trapped by the sieve are then transferred to a preservative jar with 70% ethanol to be identified in a laboratory. At the lab, macros are identified to species level when possible; in all other cases the highest level of taxonomic resolution is obtained. The macro information is then reviewed and imported into a database from which index scores are generated, keeping HD and MH data separate.

METHODS

Characterizing Instream Habitat

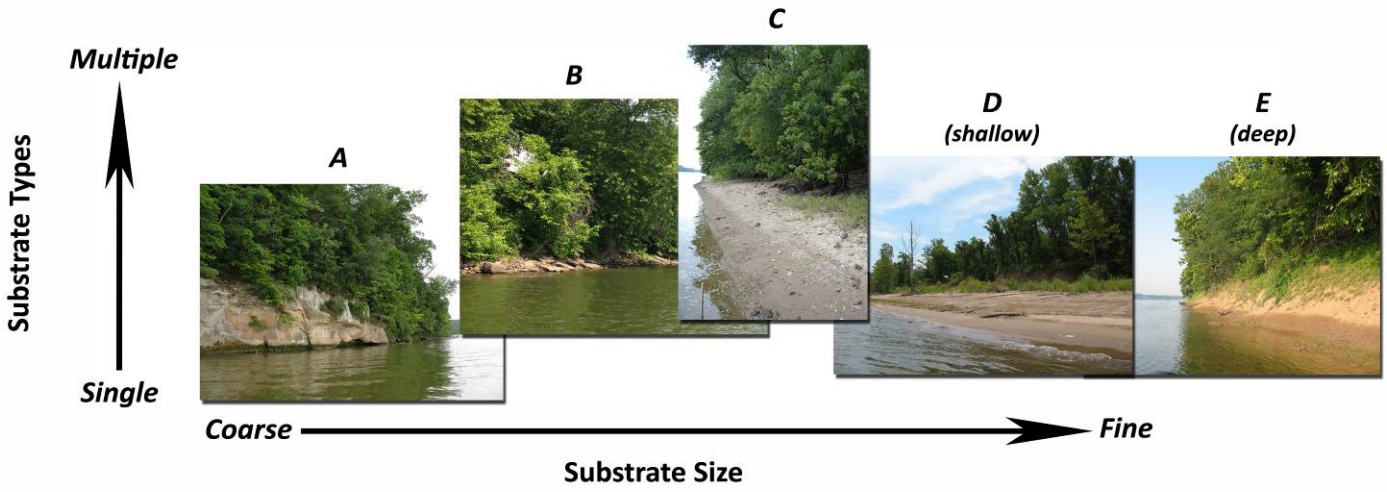
Intensive habitat surveys are conducted which include measures of woody cover, depth, and prevalence of substrate types at each site. Woody cover (submerged brush, logs, and stumps) is estimated visually. More quantitative measures of depth and substrate proportions are obtained through the use of a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

It is important to classify the instream habitat at each of our sites because different fish and macro species prefer different habitat types, creating index 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, dissolved oxygen (DO), and conductivity, are measured at each site prior to electrofishing. Water chemistry samples may also be collected at the downstream end of each 500m zone approximately 100ft from shore to measure 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. They also provide measures of predicted daily average flow volumes and velocities from the nearest upstream modeled location to any particular site. These data are compiled to help interpret index results.

A Look At Our Five Habitat Classes

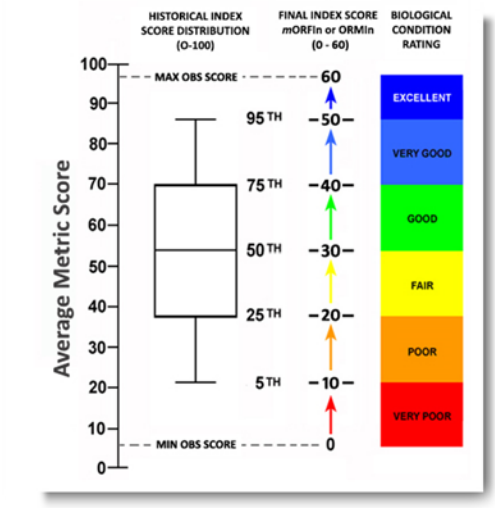


Assessing Biological Condition

ORSANCO uses two biological indices to assess the condition of the Ohio River. The modified Ohio River Fish Index (*m*ORFIn) and the Ohio River Macroinvertebrate Index (ORMIn using HD data only) were established in 2003 and 2012, respectively. Both indices include various measures (metrics) of the fish and macro communities such as: diversity, abundance, feeding and reproductive guilds, pollution tolerance, habits, and health.

13 metrics used to generate *m*ORFIn scores	
Fish Metric	**Definition**
Native Species	Number (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 ind. (minus exotics, hybrids, and tolerants)
8 metrics used to generate ORMIn scores	
Macro Metric	**Definition**
No. Taxa	Number (No.) of unique taxa
EPT Taxa	No. of taxa that belong to are either the Ephemeroptera, Plecoptera, or Trichoptera orders
Predator Taxa	No. of taxa that are predators
% Collector-Gatherer Taxa	% of taxa that feed on fine particulate organic matter
% Caenids	% of individuals (ind.) that belong to the pollution tolerant *Caenidae* family of Ephemeropterans
% Odonates	% of ind. that belong to the Odonata order
% Intolerants	% of ind. intolerant to pollution and habitat degradation
% Clingers	% of ind. that cling to instream habitat

Each navigational pool is separately assessed with each index based upon the biological and environmental data collected from its 15 randomly selected sites. This involves a multi-step approach (depicted top right) that converts average metric scores (0-100) of each individual site into final index scores (0-60), based on varying expectations of the five different habitat classes. Index scores of the 15 sites are then averaged to provide an overall score and rating for the navigational pool specific to each index.



The presence of five distinct habitat classes ('A', 'B', 'C', 'D', and 'E') coupled with the range of habitat preferences exhibited by individual fish and macro taxa required the translation of metric scores into relative index scores. By removing the effect of habitat, index scores can then be averaged within a pool to represent the overall condition of the biological community in question.

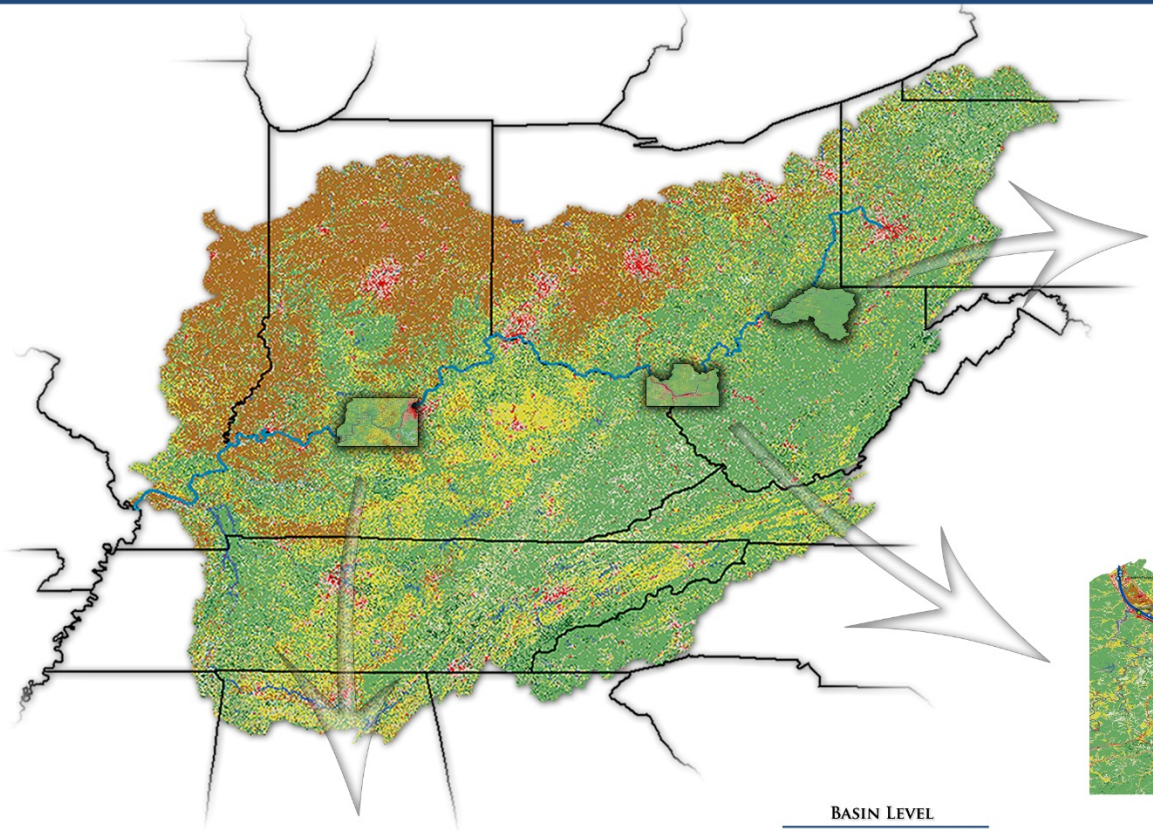
The averaged scores for both the *m*ORFIn and ORMIn are then compared to a biocriterion. The 25th percentile is the statistical threshold commonly used by regulatory agencies for establishing biocriteria. Using this threshold, our established biocriterion (i.e. a representation of healthy Ohio River fish communities) is set at an average index score of 20.0.

A pool is assessed to be in **full support** of its aquatic life-use (ALU) designation (i.e. possessing intact biological communities) if both the *m*ORFIn and ORMIn scores are greater than or equal to 20.0 (i.e. a biological rating of 'Fair', 'Good', 'Very Good', or 'Excellent'). A pool is in **partial support** of its ALU designation if only one of the indices' scores greater than or equal to 20.0, while the other index score falls within 10.0 - 19.9 (i.e. a 'Poor' rating). Any pool in which both indices score below a 20.0, or in which at least one index scores below 10.0 (i.e. a 'Very Poor' rating), would be considered in **non-support** of its ALU designation.

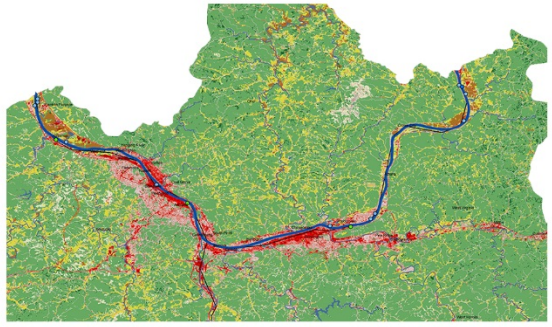
For more detailed information pertaining to our programs including survey design, field methods, past & present assessment results, or biological data contact one of our staff or visit: www.orsanco.org/biological-programs

2016 Pool Survey Results

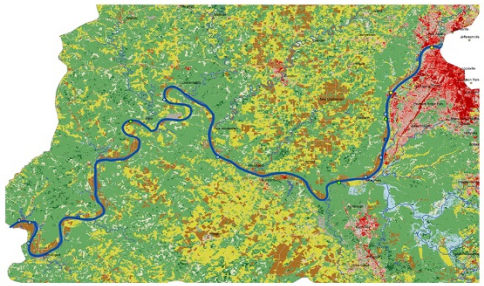
The results of the 2016 biological surveys are detailed in the following pages (relative pool locations shown below). Included are brief descriptions of the land use & hydrology, site level mORFIn & ORMIn ratings, summaries of notible catches & instream habitat, and the overall biological condition of each pool.



Willow Island Pool



Greenup Pool



Cannelton Pool

Basin Level

Environmental Attributes

- Ohio River
- Tributaries
- Locks & Dam
- Most Populous Cities
- Developed Areas
- Agricultural/Pastoral Lands
- Natural Forests

For more detailed catch, metric, and index scores visit www.orsanco.org/programs/biological-programs

Willow Island Pool (2016) - Healthy Condition

This page summarizes the 2016 fish and macroinvertebrate (macro) **surveys conducted by ORSANCO biologists in the Greenup Pool of the Ohio River. Fish are collected via non-lethal electrofishing in the summer. Macros are collected in the fall from artificial substrate samplers placed in the water in late summer. 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 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 resource extraction. 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).

Dominant Macro Groups

Mussels 85.6%

Dreissena polymorpha

Midges 5.0%

Dicrotendipes sp

Snails 4.0%

Hydrobiidae sp

Caddisflies 1.9%

Cyrnellus fraternus

Scuds 1.0%

Gammarus sp

Boulder 9.0%

Cobble 4.6%

Gravel 13.0%

Sand 30.0%

Fines 40.3%

Other 1.5%

Hardpan 1.5%

Pool Substrate Composition

Dominant Fish Families

Minnows 59.3%

Emerald Shiner

Sunfish & Bass 22.2%

Bluegill

Suckers 8.1%

Golden Redhorse

Perches 3.3%

Logperch

Shad 3.3%

Gizzard Shad

Basin Level	Site Level	
Environmental Attributes	Biological Condition Ratings	
	Fish	Macros
Ohio River	Excellent	
Tributaries	Very Good	
Locks & Dam	Good	
Most Populous Cities	Fair	
Developed Areas	Poor	
Agricultural/Pastoral Lands	Very Poor	
Natural Forests		

Aquatic Invasives Watch

- ☐ Silver Carp
- ☐ Bighead Carp
- ☑ Asiatic Clams
- ☑ Zebra Mussels
- ☑ Marine Scuds
- ☑ Hydrilla

Survey Summary

Water clarity was exceptional during electrofishing averaging over four feet of visibility. Notable catches include the Ohio state threatened Channel Darter (*Percina copelandi*)**, several River Redhorse** (*Moxostome carinatum*, WV and OH special concern species)**, and a large abundance of Logperch** (*Percina caprodes*)**. Notable macroinvertebrate collections included an over-abundance of zebra mussels** (*Dreissena polymorpha*)**, high numbers of limpets** (*Ferrissia sp*) **and a relatively wide diversity and good abundance of damselfly and dragonfly larvae. These observations coupled with the large number of minnows and sunfish collected are becoming indicative of Ohio River pools possessing large quantities of aquatic vegetation. Willow Island Pool, in particular, is at the epicenter of non-native aquatic vegetation infestation** (namely, *Hydrilla verticillata* and *Myriophyllum spicatum*)**. Independent biological indices were used to apply numeric values to important components of fish and macro assemblages and assess their relative status. The results** (see above map) **show that, on average, fish in Willow Island Pool were in 'Good' condition and the macros were in 'Fair' condition. Overall, while these results indicate that Willow Island Pool harbored healthy aquatic communities, close attention will be paid in the future to the effects of invasive aquatic vegetation or any sign of chronic degradation.**

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Greenup Pool (2016) - Healthy Condition

This page summarizes the 2015 fish and macroinvertebrate (macro) **surveys conducted by ORSANCO biologists in the Greenup Pool of the Ohio River. Fish are collected via non-lethal electrofishing in the summer. Macros are collected in the fall from artificial substrate samplers placed in the water in late summer. 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 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. Greenup Pool receives water from several tributaries** (Guyandotte, Big Sandy, and Little Sandy rivers)**. 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 River** (KY) **also provide great wetland and backwater habitat for rare mainstem species like the bowfin.**

Dominant Macro Groups

Mussels 45.4%

Dreissena polymorpha

Caddisflies 26.3%

Cyrnellus fraternus

Midges 12.8%

Dicrotendipes sp

Scuds 7.0%

Apocorophium lacustre

Snails 2.7%

Hydrobiidae sp

Boulder 11.3%

Cobble 7.4%

Gravel 16.9%

Sand 32.2%

Fines 26.6%

Hardpan 4.2%

Other 1.4%

Dominant Fish Families

Minnows 64.0%

Channel Shiner

Sunfish & Bass 9.4%

Bluegill

Suckers 8.2%

Golden Redhorse

Perches 5.8%

Sauger

Shad 4.3%

Gizzard Shad

Ohio River Basin

Greenup Pool

Basin Level	Site Level
Environmental Attributes	Biological Condition Ratings
	Fish / Macros
Ohio River	Excellent
Tributaries	Very Good
Locks & Dam	Good
Most Populous Cities	Fair
Developed Areas	Poor
Agricultural/Pastoral Lands	Very Poor
Natural Forests	

Aquatic Invasives Watch

- ☐ Silver Carp
- ☐ Bighead Carp
- ☑ Asiatic Clams
- ☑ Zebra Mussels
- ☑ Marine Scuds
- ☑ Hydrilla

Survey Summary

Electrofishing sampling occurred after a rain event as high waters were receding. While average water clarity was lower than normal (20 inches) **and water velocities were slightly elevated, neither negatively affected sampling. Notable catches include numerous Channel Shiners** (*Notropis wickliffi*)**, the Ohio state threatened Channel Darter** (*Percina copelandi*)**, and species of special concern River Redhorse** (*Moxostoma carinatum*, WV and OH) **and Highfin Carpsucker** (*Carpiodes velifer*, OH)**. Notable macroinvertebrate collections include a high percentage of non-native filter-feeding scuds** (*Apocorophium lascustre*) **and tolerant caddisflies** (*Cyrnellus fraternus*)**. Independent biological indices were used to apply numeric values to important components of fish and macro assemblages and assess their relative status. The results** (see above map) **show that, on average, fish in Greenup Pool were in 'Good' condition and the macros were in 'Fair' condition. Overall, while these results indicate that Greenup Pool harbored healthy aquatic communities, close attention will be paid to macroinvertebrates in the future for signs of chronic degradation.**

Pool Substrate Composition

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Cannelton Pool (2016) - Healthy Condition

This page summarizes the 2016 fish and macroinvertebrate (macro) surveys conducted by ORSANCO biologists in the Cannelton Pool of the Ohio River. Fish are collected via non-lethal electrofishing in the summer. Macros are collected in the fall from artificial substrate samplers placed in the water in late summer. 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.

Dominant Macro Groups

Caddisflies 27.0%

Cyrnellus fraternus

Midges 26.3%

Tribelos sp

Mussels 18.2%

Dreissena polymorpha

Snails 9.3%

Hydrobiidae sp

Scuds 5.5%

Apocorophium sp

Dominant Fish Families

Minnows 71.2%

Channel Shiner

Herring 10.8%

Gizzard Shad

Sunfish & Bass 5.7%

Bluegill

Suckers 3.1%

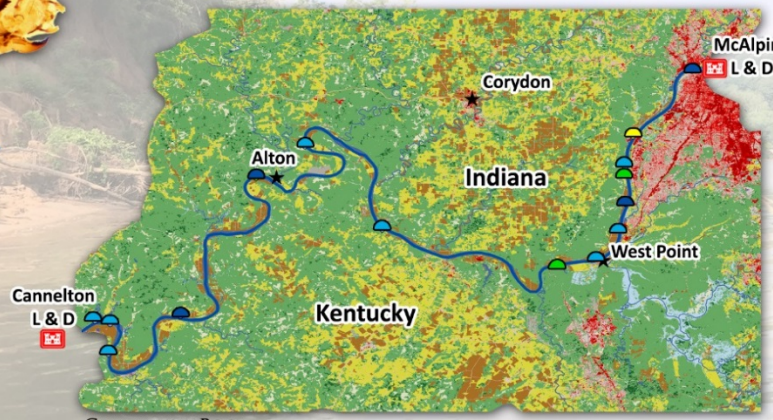
Smallmouth Redhorse

Perch 2.8%

Sauger

Cannelton Pool Sub-Basin

Ohio River Basin



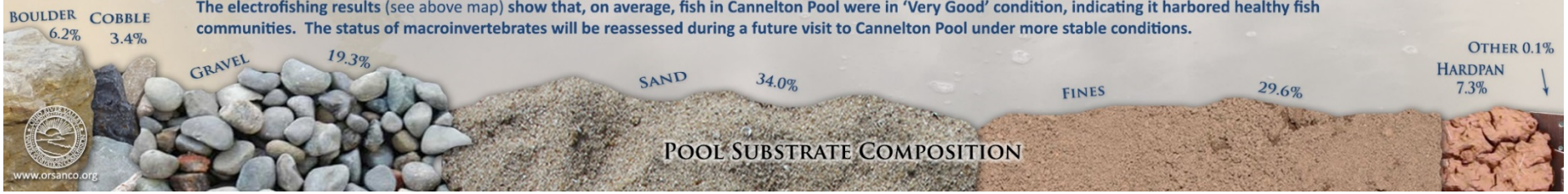
Cannelton Pool

Basin Level	Site Level	
Environmental Attributes	Biological Condition Ratings	
	Fish	Macros
Ohio River	Excellent	
Tributaries		
Locks & Dam	Very Good	
Most Populous Cities	Good	
Developed Areas	Fair	
Agricultural/Pastoral Lands	Poor	
Natural Forests	Very Poor	

Aquatic Invasives Watch

Survey Summary

Electrofishing sampling occurred as high waters were receding, after an extremely wet preceding spring. While the velocity of the water was still slightly elevated and water clarity was slightly less than normal (25 inches), neither negatively affected sampling. Notable catches include Indiana state threatened River Redhorse (*Moxostoma carinatum*), Kentucky state threatened Black Buffalo (*Ictobus niger*), and a Kentucky and Indiana state threatened species the Northern Madtom (*Noturus stigmosus*). High flows during the fall period drastically effected the success of the macroinvertebrate samples. A third of our Hester-Dendy samplers were not retrieved. All recoverd samplers and secondary kick net samples yielded far less than expected numbers of individuals. Because of the negative effect of the late fall rains on sampling success, Cannelton Pool was assessed using only the fish data (macro group information can still be seen on left). The electrofishing results (see above map) show that, on average, fish in Cannelton Pool were in 'Very Good' condition, indicating it harbored healthy fish communities. The status of macroinvertebrates will be reassessed during a future visit to Cannelton Pool under more stable conditions.



Pool Substrate Composition

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CONCLUSIONS

Pool Surveys

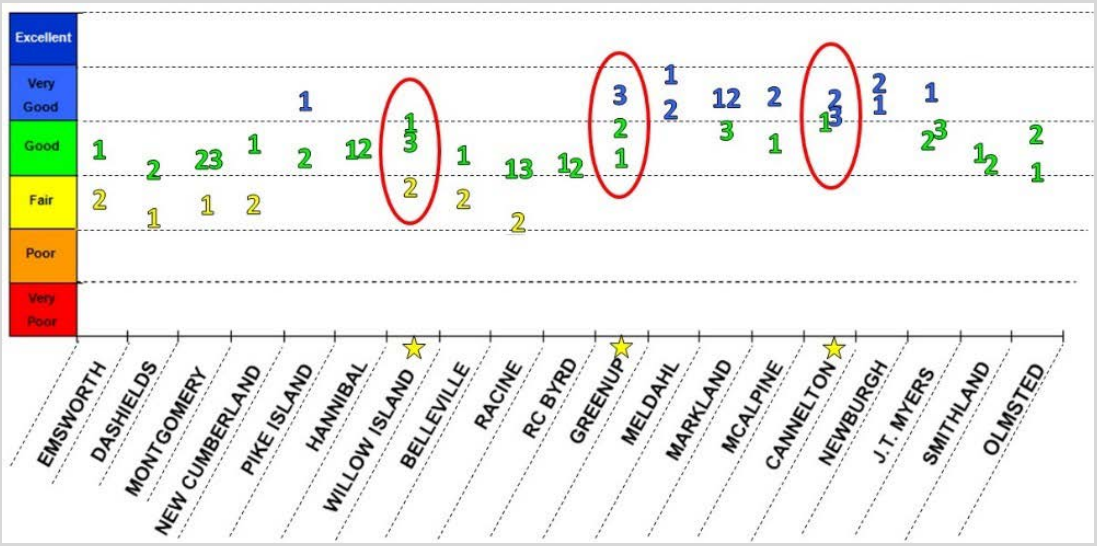
The 2016 pool surveys for fish populations were successfully completed between July 20th and August 6th as the river recovered from unseasonably high early summer flows. Macro sampling was completed between September 3rd and October 15th. ORSANCO's Biological Water Quality Subcommittee recommended that all three pools surveyed during the 2016 field season be assessed as *meeting* their aquatic life-use designations (i.e. containing healthy fish and macro communities).

Assessment Comparison

Between 2005 and 2014, all 19 Ohio River navigational pools were surveyed and assessed twice. Both cycles revealed the majority of the river to be in 'Good' condition, even though some pools changed in condition rating between surveys. The 2016 surveys continued the third cycle which enhances our ability to detect riverwide patterns. Some of the index and species variability observed across pools (see final table, pg 14) may be due in part to variations in natural distributions, instream habitat, invasive species distributions, annual variations in flow, weather conditions and water quality differences.

Past vs. Present 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 ratings (from 'Very Poor' to 'Excellent') to the pools based on the relative condition of their fish communities. Shifts between years in these condition ratings may be due to variations in environmental factors other than water quality. By examining these factors (invasive species, flows, etc.) and their effects on *m*ORFIn metrics, we attempt to provide defensible explanations for the differences in final condition ratings observed between years.



River-wide Assessment Comparison

The 2016 surveys (☆) had 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).

1 = 1st cycle (2005 - 2009) 2 = 2nd cycle (2009 - 2014) 3 = 3rd cycle (2015 - 2021)

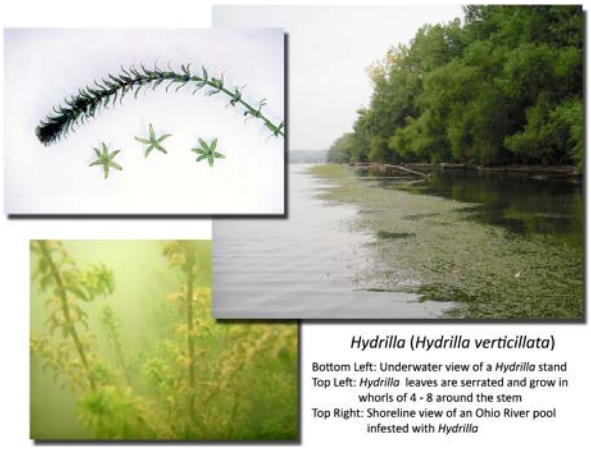
CONCLUSIONS

Willow Island (2006, 2011, 2016)

(Fish = GOOD, Macros = VERY GOOD)

Variable	2006	2011	2016
Environmental Factors			
Avg. seasonal flow (cfs)	low	moderate	very low
Avg. Conductivity	350	412	482
Avg. Secchi Depth	48.3	42.6	58.3
Avg. Sucker Score	75.2	49.6	66.5
Golden Redhorse	277	63	219
Avg. Species Score	78.8	77.4	81.7
Avg. % Non-Native Score	86.8	66.3	92.7
Banded Killifish	1	30	14
Common Carp	22	40	11
Avg. Intolerant Score	59.4	45.7	57.3
Logperch	306	532	1173
Avg. % Simple Lithophyl Score	65.5	8.6	18.8
Logperch	108	16	73
Golden Redhorse	277	63	219
Silver Redhorse	51	12	42
Assessment Result			
Avg. mORFIn Score	39.4	27.7	35.8
Fish Condition Rating	Good	Fair	Good

The Willow Island Pool was sampled and assessed in 2006, 2011 and 2016. Fish condition ratings varied with flow regimes. Average *m*ORFIn score in 2006 was 39.4 (**Good**) under low flow conditions, 27.6 (**Fair**) in 2011 under moderate flows and, 35.8 (**Good**) in 2016 under very low flow condition. The primary drivers behind metric score decline, from 2006 to 2011 and the rebound in 2016, were Sucker Score, Species Score, % Non-Native score, Intolerant Score and % Simple Lithophyl Score. The **Fair** fish condition rating observed in 2011 reflects fewer suckers (namely Redhorses) and a higher number of Common Carp observed in the surveys. Increasing *Hydrilla verticillata* presence within the pool corresponds to an increased substrate for aquatic macroinvertebrates This may have positive effects on Redhorse species and thus influence metric performance as these species factor into % Invertivore, Sucker and Simple Lithophyl scores.



Hydrilla (*Hydrilla verticillata*)

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

Greenup Pool (2006, 2011, 2016)

(Fish = VERY GOOD, Macros = GOOD)

Variable	2006	2011	2016
Environmental Factors			
Avg. seasonal flow (cfs)	moderate	low	high
Avg. Conductivity	352	423	333
Avg. Secchi Depth	24.1	40.2	19.4
Avg. CPUE Score (0-100)	9.4	41.4	32.8
Channel Shiner	61	944	2017
Emerald Shiners	50	1557	221
Golden Redhorse	39	34	124
Avg. Species Score	46.8	70.9	76.8
Avg. Centrarchid Score	51.1	75.6	72.2
Bluegill	112	337	205
Spotted Bass	43	127	59
Avg. Intolerant Score	34.4	41.2	53.6
Channel Shiner	61	944	2017
Avg. % Invertivore Score	35.5	63.8	91.1
Channel Shiner	61	944	2017
Redhorses	87	101	227
Assessment Result			
Avg. mORFIn Score	32.3	38.0	44.5
Fish Condition Rating	Good	Good	Very Good

The Greenup Pool was sampled and assessed in 2006, 2011 and 2016. Over the course of the three assessments, fish condition ratings steadily improved despite varying flow conditions. Average *m*ORFIn scores increased from 32.3 in 2006 (**Good**), under moderate flow conditions, to 38 (**Good**), under low flow, in 2011. High flows and corresponding low average Secchi depth readings (12”-24”) in 2016 had no negative effects on fish condition rating as the average *m*ORFIn score increased to 44.5 (**Very Good**). The primary metric score drivers behind increased fish condition were Species Score, CPUE Score, % Tolerant Score, % Detritivore and % Invertivore Score. Increased numbers of Redhorses in 2011, and especially in 2016, had a positive effect on fish condition ratings. The effect of submerged aquatic vegetation (namely *Hydrilla verticillata)* on final fish condition ratings is still being explored. As the invasive plant provides substrate for numerous aquatic macroinvertebrate species, invertivores such as Redhorses are likely to take advantage of increased forage availability. Thus metric scores corresponding to these species could see an increase.

Golden Redhorse (*Moxostoma erythrurum*)

Cannelton Pool (2006/7, 2011, 2016)

(Fish = VERY GOOD, Macros = GOOD)

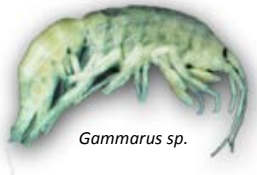
Variable	2006/2007	2011	2016
Environmental Factors			
Avg. seasonal flow (cfs)	high/low	moderate	moderate
Avg. Conductivity	494	461	347
Avg. Secchi Depth	55.6	29.7	24.9
Avg. CPUE Score (0-100)	38.9	75.0	39.5
Gizzard Shad	3527	709	378
Emerald Shiners	1331	2195	407
Avg. % Non-Native Score	89.8	94.4	77.0
Common Carp	5	4	3
Redear Sunfish	16	15	20
Silver Carp	0	0	3
Avg. % Invertivore Score	37.2	81.3	96.7
Channel Shiner	195	2787	1822
Bluegill	103	247	65
Avg. Species Score	47.7	75.8	60.8
Assessment Result			
Avg. mORFIn Score	39.6	43.6	41.8
Fish Condition Rating	Good	Very Good	Very Good

The Cannelton Pool was sampled in 2006 and again in 2007 due to high flow conditions during the 2006 index period. The 15 sites sampled in each year were combined as a single 30-site assessment for 2006/2007. The pool was again assessed in 2011 and 2016, each under more moderate flow conditions. Fish condition ratings were **Good**, **Very Good** and **Very Good** respectively, with *m*ORFIn scores averaging 39.6, 43.6 and 41.8, respectively. The primary metric score drivers for the improved fish condition ratings in 2011 and 2016 were Species Score, % Invertivore Score and CPUE Score. When sampled and assessed under moderate flow regimes, the Cannelton Pool's fish community reflects higher condition ratings.

Another Biological Indicator

A third five year cycle of surveys and assessments was initiated in 2014 and continued in 2015. It will be during this new cycle that ORSANCO Biological staff will incorporate an additional indicator into the annual assessment process…macroinvertebrates.

Macroinvertebrates (macros) are organisms that lack a true backbone and can be seen with the naked eye. They include aquatic insects, molluscs, arachnids, crustaceans, and worms. They can range from large adult forms (e.g. crayfish), to very small larval forms of terrestrial insects (e.g. flies).



Gammarus sp.

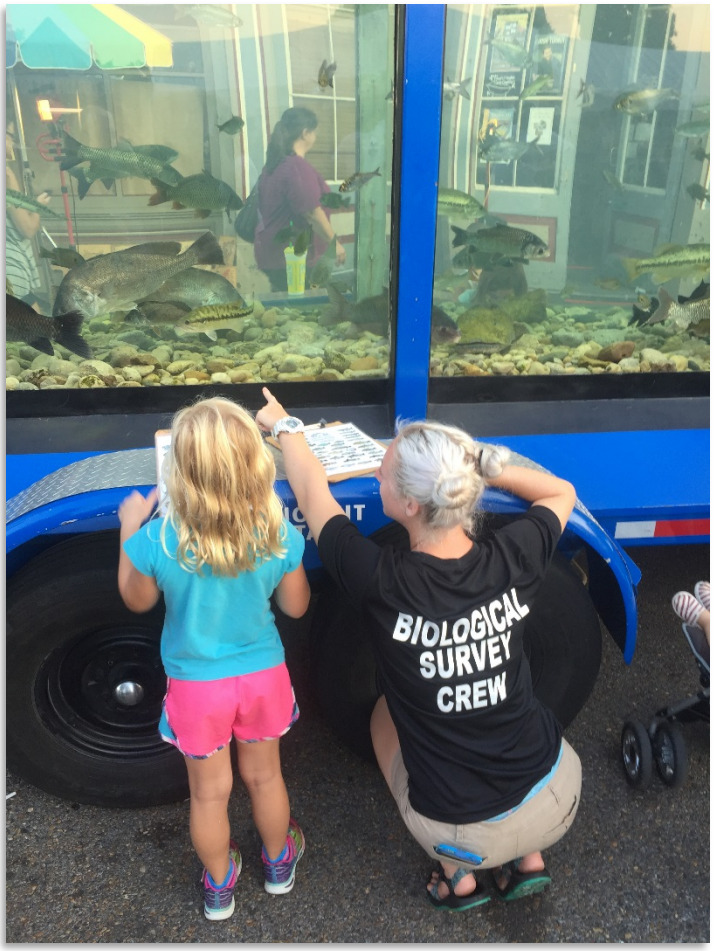
Select Ohio River Macroinvertebrates
Left: non-biting midge (*Tribelos fuscicorne*), Top Middle: long-horned caddisflies (*Oecetis sp.*), Top Right: scud (*Gammarus fasciatus*)
Bottom Middle: burrowing mayfly (*Hexagenia limbata)*, Bottom Left: black-shouldered spinyleg dragonfly (*Dromogomphus spinosus*)

ORSANCO Biological staff have surveyed macro populations in the Ohio River since 1964 due to their importance as water quality indicators. Current sampling involves both an active and passive technique. The passive technique employs Hester-Dendy (HD) samplers. Named for the scientists that developed this simple device, an HD is constructed of compressed particle board squares layered on a threaded eye bolt. Clusters of five HDs are placed in 10ft of water near each electrofishing site and are retrieved after six weeks. During this period, the textured surface and spacing of the layers provides ample area for the colonization of nearby macros.

The second technique involves actively "kicking and sweeping" for macros with a D-frame net. These kicks are performed in the fall, when the HDs are retrieved, and are stratified throughout the 500m zone to ensure a representative sample. Macros are sampled from a variety of habitats (e.g. tiny cracks of rocky shorelines to vegetated mud flats) by disturbing the substrate and sweeping through the resulting eddies, hence the name for this method: multi-habitat (MH) sampling.

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

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



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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	New Cumberland '11	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	Meldahl '12	Markland '14	McAlpine '14	Cannelton '16	Newburgh '12	John T. Myers '15	Smithland '13	Open Water '14
GAR	Longnose Gar	23	19	11	19	16	**64**	**34**	28	64	25	**42**	18	28	24	**50**	16	16	11	61
	Spotted Gar															**1**	1		2	
	Shortnose Gar																12	12	28	101
SHAD	Skipjack Herring		1				**1**	**2**			1		18		1	**2**	79	5	2	1
	Gizzard Shad	3417	37	26	1097	5092	**43**	**154**	117	147	176	**158**	17703	274	54	**378**	10834	650	557	278
	Threadfin Shad																7		14	74
CARP	Common Carp	48	70	45	19	36	**46**	**11**	26	3	32	**7**	9	5	4	**3**	7	8	7	2
	Grass Carp								1											1
	Silver Carp														1	**3**		15	17	25
	Bighead Carp																			
	Goldfish								1									1		
	Carp x Goldfish	1																		
MINNOW	Cyprinidae sp.																			
	Golden Shiner								1											1
	Striped Shiner				1	7									5					
	Spottail Shiner			4	2			**11**	2	4	1	**2**			3					
	Spotfin Shiner	77	35	68	21	62	**72**	**295**	58	127	19	**52**	26	10	28	**73**	39	112	218	14
	Notropis sp.																			
	Emerald Shiner	848	46	216	1525	892	**79**	**1085**	240	1208	172	**221**	1837	470	227	**407**	720	102	86	20
	Silverband Shiner																			
	Sand Shiner																			
	Channel Shiner	492	108	323	685	481	**167**	**1173**	410	733	684	**2017**	689	897	609	**1822**	465	255	102	47
	River Shiner								5			**16**	34	156	30	**145**	64	104	8	15
	Shoal Chub																			
	Silver Chub				2				1		1	**11**	24	33	51	**32**	22	10	12	10
	Streamline Chub	11	1																	
	River Chub																			
	Gravel Chub																			
	Creek Chub											**1**								
	Central Stoneroller						**1**	**9**						1	3					
	Mississippi Silvery																		15	
	Suckermouth Minnow																			
	Bluntnose Minnow	120	1	30	98	28	**98**	**227**	8	12		**2**	4	4	2		8	9		2
	Bullhead Minnow							**12**	5		1	**17**	25	2	1	**11**	13	24	1	6

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	New Cumberland '11	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	Meldahl '12	Markland '14	McAlpine '14	Cannelton '16	Newburgh '12	John T. Myers '15	Smithland '13	Open Water '14
	Silverjaw Minnow																			
SUCKER	Ictiobinae sp.																			
	Ictiobus sp.																1			
	Smallmouth Buffalo	51	84	82	68	58	**40**	**26**	38	33	32	**19**	44	89	31	**17**	10	32	106	32
	Bigmouth Buffalo											**1**						4	4	5
	Black Buffalo	1	4	18			**4**	**3**	7			**3**	1	5	4	**2**	2	2		10
	Carpiodes sp.					1			1					1		**1**				1
	Quillback	1	13	6	14	9	**14**	**9**	7	3	12	**3**	12	61	9	**3**	9	7	31	5
	River Carpsucker	8	47	47	23	36	**33**	**18**	33	20	26	**38**	172	221	161	**19**	146	187	263	139
	Highfin Carpsucker	5	14	12	5	1	**5**		3	8	1	**6**	8	4	4		2	3	91	3
	Northern Hog Sucker	3		6	2	6	**6**	**8**	1	5	2	**1**	1		6					
	Moxostoma sp.						**3**				1									
	Shorthead Redhorse																			10
	Smallmouth Redhorse	33	153	27	11	16	**54**	**41**	61	11	22	**38**	14	44	31	**40**	1			
	Silver Redhorse	75	252	215	70	23	**59**	**42**	31	16	22	**39**	19	19	14	**5**	1			
	River Redhorse	14	65	23		2	**12**	**1**		2	6	**25**			1	**4**				
	Black Redhorse	8	10	25		3	**16**	**6**												
	Golden Redhorse	56	155	156	216	93	**273**	**219**	64	56	56	**124**	44	26	67	**17**	10	8		1
	Spotted Sucker						**4**	**13**	8	1		**2**		1	1					
	White Sucker																			
CATFISH	Yellow Bullhead														1					
	Brown Bullhead																			
	Northern Madtom																			
	Blue Catfish													2		**4**		1	5	
	Channel Catfish	35	63	83	201	54	**83**	**35**	177	52	114	**61**	70	112	122	**46**	223	106	478	65
	Flathead Catfish	19	6	8	15	47	**39**	**22**	36	24	40	**29**	24	21	19	**10**	14	20	30	12
SUNFISH	**Lepomis sp.**													2	2					5
	Warmouth														3					
	Rock Bass	75	89	22	15	24	64	**11**	2											
	Bluegill	154	34	88	192	131	523	**540**	391	220	254	**205**	212	207	89	**65**	94	65	270	41
	Green Sunfish	3	3	1		3	2	**1**	1	4	4	**2**	2	1	1	**2**	3	1		4
	Pumpkinseed	4	4	3	2	2	33	**14**		2	6									
	Orangespotted Sunfish				2		5	**197**		5		**5**	2			**2**		6	1	
	Longear Sunfish	2	1		2	8	242	**18**	24	13	56	**15**	73	71	65	**31**	293	137	207	16

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	New Cumberland '11	Pike Island '12	**Hannibal '13**	**Willow Island '16**	**Belleville '14**	**Racine '15**	**Robert C. Byrd '13**	**Greenup '16**	**Meldahl '12**	**Markland '14**	**McAlpine '14**	**Cannelton '16**	**Newburgh '12**	**John T. Myers '15**	**Smithland '13**	**Open Water '14**
SUNFISH	Redear Sunfish		1					**2**	7	2	3	**4**		2	1	**20**	3	1	32	
	Lepomis Hybrid					1	2		1		2			1					2	
	Bluegill X Longear																			
	Bluegill X Green									1										
	Longear X Green																			
TEMPERATE BASS	Morone sp.	50		3	22	110	12	**49**	79	8	15	**35**	289	11	81	**28**	361	72	86	733
	White Perch																			
	Striped Bass								1		1						4			
	White Bass	6	65	7	37	2	28	**4**	16	1	71	**16**	1	18	18	**20**	60	13	83	34
	Yellow Bass															**1**			15	25
	Hybrid Striped Bass	1	5	2			2		3	1	2	**6**	3	3	1	**13**	22	2	6	10
BLACK BASS	Micropterus sp.	57	1					**5**			9		79	10	18	**12**	3	14		16
	Smallmouth Bass	167	250	184	155	431	270	**198**	27	41	38	**24**	30	19	15	**13**	33	2	2	7
	Largemouth Bass	8	3	12	2	8	7	**20**	10	19	18	**18**	21	12	10	**4**	72	2	10	6
	Spotted Bass	24	18	6	48	77	99	**46**	26	17	60	**59**	86	51	38	**48**	252	133	48	26
DARTER	Johnny Darter			1																
	Greenside Darter					8	1													
	Variegate Darter																			
	Rainbow Darter			2		1		**1**							1					
	Fantail Darter													1	1					
	Bluebreast Darter																			
	Banded Darter																			
	Dusky Darter	1																		
	Channel Darter	1			1		1	**1**	1			**1**	1							
	Blackside Darter																			
	Slenderhead Darter												1							
	River Darter						2							1						
	Logperch	29	15	26	17	40	89	**73**	5	9	5	**16**	2	14	9	**2**		2		2
PERCH	Yellow Perch			44	5		5	**7**	3											
	Walleye	20	74	68	2	2	10	**1**	13	1			2		1			5		
	Saugeye	2	11	42			1		25	25				22	8	**2**	11	4	4	6
	Sauger	39	264	110	29	39	147	**73**	89	15	128	**194**	124	116	226	**94**	44	225	23	46
MISC.	Silver Lamprey											**1**								
	Ohio Lamprey		2						1											

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	New Cumberland '11	Pike Island '12	**Hannibal '13**	**Willow Island '16**	**Belleville '14**	**Racine '15**	**Robert C. Byrd '13**	**Greenup '16**	**Meldahl '12**	**Markland '14**	**McAlpine '14**	**Cannelton '16**	**Newburgh '12**	**John T. Myers '15**	**Smithland '13**	**Open Water '14**
MISCELLANEOUS	Goldeye														1			10	1	
	Mooneye	10	1	26	11	2	2	**2**			3	**2**	6	5	1	**5**	4	1		1
	Paddlefish																1			
	Northern Pike					1														
	Muskellunge		1																	
	White Crappie	2						**1**	4	2	1	**6**		4	1	**3**	2	7	2	1
	Black Crappie	1	4	9	1	1	1	**4**	6	6		**6**		2				7	5	
	Inland Silverside																		16	14
	Brook Silverside	14			11	10	3	**1**							1		5	1	1	
	Atlantic Needlefish																			
	Trout-Perch		11	137					2											
	Banded Killifish						5	**14**	1											
	Western Mosquitofish																	1		
	Bowfin																			
	Freshwater Drum	55	136	36	201	239	47	**16**	82	36	89	**116**	686	146	238	**47**	507	114	328	746
	Total No. of Individuals	6071	2177	2260	4849	8103	2819	**4755**	2190	2957	2211	**3666**	22416	3207	2345	**3507**	14480	2518	3230	2680
	Total No. of Species	46	38	42	39	42	48	**49**	52	40	33	**45**	41	47	54	**43**	44	47	36	46

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	New Cumberland '11	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	Meldahl '12	Markland '14	McAlpine '14	Cannelton '16	Newburgh '12	John T. Myers '15	Smithland '13	Open Water '14
GAR	Longnose Gar	23	19	11	19	16	**64**	**34**	28	64	25	**42**	18	28	24	**50**	16	16	11	61
	Spotted Gar															**1**	1		2	
	Shortnose Gar																12	12	28	101
SHAD	Skipjack Herring		1				**1**	**2**			1		18		1	**2**	79	5	2	1
	Gizzard Shad	3417	37	26	1097	5092	**43**	**154**	117	147	176	**158**	17703	274	54	**378**	10834	650	557	278
	Threadfin Shad																7		14	74
CARP	Common Carp	48	70	45	19	36	**46**	**11**	26	3	32	**7**	9	5	4	**3**	7	8	7	2
	Grass Carp								1											1
	Silver Carp														1	**3**		15	17	25
	Bighead Carp																			
	Goldfish								1									1		
	Carp x Goldfish	1																		
MINNOW	Cyprinidae sp.																			
	Golden Shiner								1											1
	Striped Shiner				1	7									5					
	Spottail Shiner			4	2			**11**	2	4	1	**2**			3					
	Spotfin Shiner	77	35	68	21	62	**72**	**295**	58	127	19	**52**	26	10	28	**73**	39	112	218	14
	Notropis sp.																			
	Emerald Shiner	848	46	216	1525	892	**79**	**1085**	240	1208	172	**221**	1837	470	227	**407**	720	102	86	20
	Silverband Shiner																			
	Sand Shiner																			
	Channel Shiner	492	108	323	685	481	**167**	**1173**	410	733	684	**2017**	689	897	609	**1822**	465	255	102	47
	River Shiner								5			**16**	34	156	30	**145**	64	104	8	15
	Shoal Chub																			
	Silver Chub				2				1		1	**11**	24	33	51	**32**	22	10	12	10
	Streamline Chub	11	1																	
	River Chub																			
	Gravel Chub																			
	Creek Chub											**1**								
	Central Stoneroller						**1**	**9**						1	3					
	Mississippi Silvery																		15	
	Suckermouth Minnow																			
	Bluntnose Minnow	120	1	30	98	28	**98**	**227**	8	12		**2**	4	4	2		8	9		2
	Bullhead Minnow							**12**	5		1	**17**	25	2	1	**11**	13	24	1	6

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	New Cumberland '11	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	Meldahl '12	Markland '14	McAlpine '14	Cannelton '16	Newburgh '12	John T. Myers '15	Smithland '13	Open Water '14
	Silverjaw Minnow																			
SUCKER	Ictiobinae sp.																			
	Ictiobus sp.																1			
	Smallmouth Buffalo	51	84	82	68	58	**40**	**26**	38	33	32	**19**	44	89	31	**17**	10	32	106	32
	Bigmouth Buffalo											**1**						4	4	5
	Black Buffalo	1	4	18			**4**	**3**	7			**3**	1	5	4	**2**	2	2		10
	Carpiodes sp.					1			1					1		**1**				1
	Quillback	1	13	6	14	9	**14**	**9**	7	3	12	**3**	12	61	9	**3**	9	7	31	5
	River Carpsucker	8	47	47	23	36	**33**	**18**	33	20	26	**38**	172	221	161	**19**	146	187	263	139
	Highfin Carpsucker	5	14	12	5	1	**5**		3	8	1	**6**	8	4	4		2	3	91	3
	Northern Hog Sucker	3		6	2	6	**6**	**8**	1	5	2	**1**	1		6					
	Moxostoma sp.						**3**				1									
	Shorthead Redhorse																			10
	Smallmouth Redhorse	33	153	27	11	16	**54**	**41**	61	11	22	**38**	14	44	31	**40**	1			
	Silver Redhorse	75	252	215	70	23	**59**	**42**	31	16	22	**39**	19	19	14	**5**	1			
	River Redhorse	14	65	23		2	**12**	**1**		2	6	**25**			1	**4**				
	Black Redhorse	8	10	25		3	**16**	**6**												
	Golden Redhorse	56	155	156	216	93	**273**	**219**	64	56	56	**124**	44	26	67	**17**	10	8		1
	Spotted Sucker						**4**	**13**	8	1		**2**		1	1					
	White Sucker																			
CATFISH	Yellow Bullhead														1					
	Brown Bullhead																			
	Northern Madtom																			
	Blue Catfish													2		**4**		1	5	
	Channel Catfish	35	63	83	201	54	**83**	**35**	177	52	114	**61**	70	112	122	**46**	223	106	478	65
	Flathead Catfish	19	6	8	15	47	**39**	**22**	36	24	40	**29**	24	21	19	**10**	14	20	30	12
SUNFISH	**Lepomis sp.**													2	2					5
	Warmouth														3					
	Rock Bass	75	89	22	15	24	64	**11**	2											
	Bluegill	154	34	88	192	131	523	**540**	391	220	254	**205**	212	207	89	**65**	94	65	270	41
	Green Sunfish	3	3	1		3	2	**1**	1	4	4	**2**	2	1	1	**2**	3	1		4
	Pumpkinseed	4	4	3	2	2	33	**14**		2	6									
	Orangespotted Sunfish				2		5	**197**		5		**5**	2			**2**		6	1	
	Longear Sunfish	2	1		2	8	242	**18**	24	13	56	**15**	73	71	65	**31**	293	137	207	16

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	New Cumberland '11	Pike Island '12	**Hannibal '13**	**Willow Island '16**	**Belleville '14**	**Racine '15**	**Robert C. Byrd '13**	**Greenup '16**	**Meldahl '12**	**Markland '14**	**McAlpine '14**	**Cannelton '16**	**Newburgh '12**	**John T. Myers '15**	**Smithland '13**	**Open Water '14**
SUNFISH	Redear Sunfish		1					**2**	7	2	3	**4**		2	1	**20**	3	1	32	
	Lepomis Hybrid					1	2		1		2			1					2	
	Bluegill X Longear																			
	Bluegill X Green									1										
	Longear X Green																			
TEMPERATE BASS	Morone sp.	50		3	22	110	12	**49**	79	8	15	**35**	289	11	81	**28**	361	72	86	733
	White Perch																			
	Striped Bass								1		1						4			
	White Bass	6	65	7	37	2	28	**4**	16	1	71	**16**	1	18	18	**20**	60	13	83	34
	Yellow Bass															**1**			15	25
	Hybrid Striped Bass	1	5	2			2		3	1	2	**6**	3	3	1	**13**	22	2	6	10
BLACK BASS	Micropterus sp.	57	1					**5**			9		79	10	18	**12**	3	14		16
	Smallmouth Bass	167	250	184	155	431	270	**198**	27	41	38	**24**	30	19	15	**13**	33	2	2	7
	Largemouth Bass	8	3	12	2	8	7	**20**	10	19	18	**18**	21	12	10	**4**	72	2	10	6
	Spotted Bass	24	18	6	48	77	99	**46**	26	17	60	**59**	86	51	38	**48**	252	133	48	26
DARTER	Johnny Darter			1																
	Greenside Darter					8	1													
	Variegate Darter																			
	Rainbow Darter			2		1		**1**							1					
	Fantail Darter													1	1					
	Bluebreast Darter																			
	Banded Darter																			
	Dusky Darter	1																		
	Channel Darter	1			1		1	**1**	1			**1**	1							
	Blackside Darter																			
	Slenderhead Darter												1							
	River Darter						2							1						
	Logperch	29	15	26	17	40	89	**73**	5	9	5	**16**	2	14	9	**2**		2		2
PERCH	Yellow Perch			44	5		5	**7**	3											
	Walleye	20	74	68	2	2	10	**1**	13	1			2		1			5		
	Saugeye	2	11	42			1		25	25				22	8	**2**	11	4	4	6
	Sauger	39	264	110	29	39	147	**73**	89	15	128	**194**	124	116	226	**94**	44	225	23	46
MISC.	Silver Lamprey											**1**								
	Ohio Lamprey		2						1											

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

Group Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	New Cumberland '11	Pike Island '12	**Hannibal '13**	**Willow Island '16**	**Belleville '14**	**Racine '15**	**Robert C. Byrd '13**	**Greenup '16**	**Meldahl '12**	**Markland '14**	**McAlpine '14**	**Cannelton '16**	**Newburgh '12**	**John T. Myers '15**	**Smithland '13**	**Open Water '14**
MISCELLANEOUS	Goldeye														1			10	1	
	Mooneye	10	1	26	11	2	2	**2**			3	**2**	6	5	1	**5**	4	1		1
	Paddlefish																1			
	Northern Pike					1														
	Muskellunge		1																	
	White Crappie	2						**1**	4	2	1	**6**		4	1	**3**	2	7	2	1
	Black Crappie	1	4	9	1	1	1	**4**	6	6		**6**		2				7	5	
	Inland Silverside																		16	14
	Brook Silverside	14			11	10	3	**1**							1		5	1	1	
	Atlantic Needlefish																			
	Trout-Perch		11	137					2											
	Banded Killifish						5	**14**	1											
	Western Mosquitofish																	1		
	Bowfin																			
	Freshwater Drum	55	136	36	201	239	47	**16**	82	36	89	**116**	686	146	238	**47**	507	114	328	746
	Total No. of Individuals	6071	2177	2260	4849	8103	2819	**4755**	2190	2957	2211	**3666**	22416	3207	2345	**3507**	14480	2518	3230	2680
	Total No. of Species	46	38	42	39	42	48	**49**	52	40	33	**45**	41	47	54	**43**	44	47	36	46

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