2017 Ohio River Pool Assessments

New Cumberland, Meldahl, and Newburgh Pools

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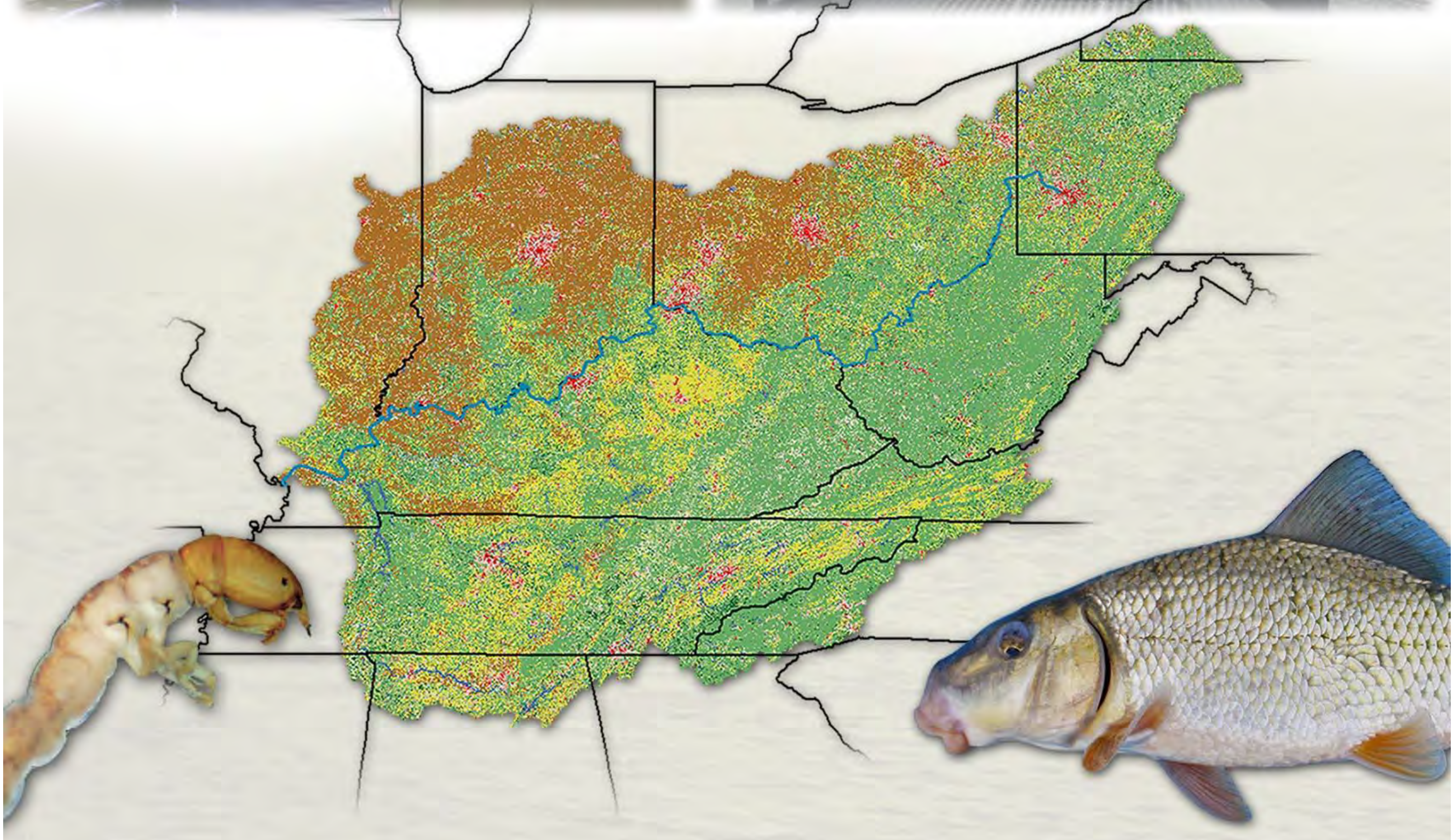

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Introduction

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.

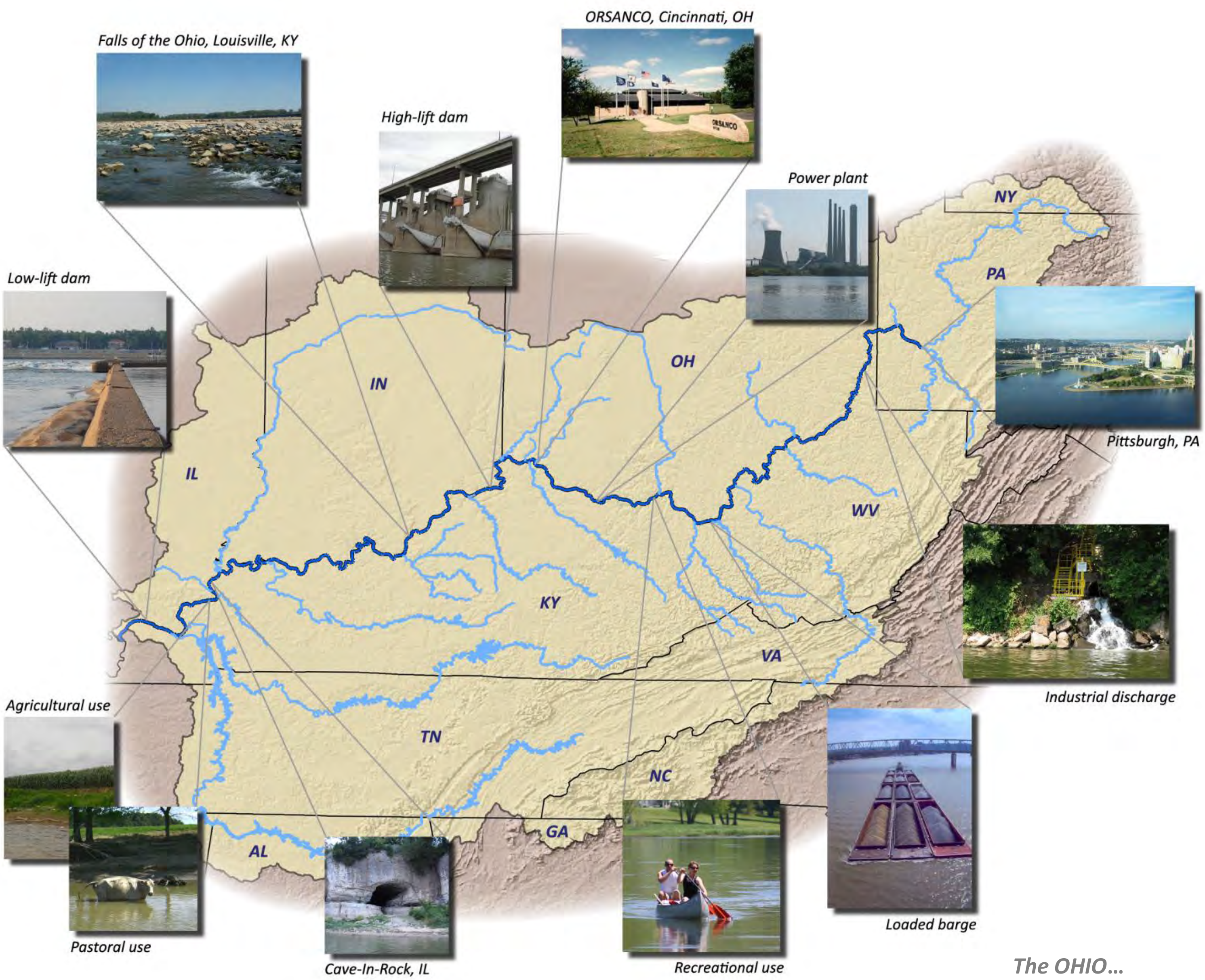
This report summarizes the 2017 New Cumberland, Meldahl and Newburgh pool assessment survey findings.

The River

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

Facts

- Average depth 24 ft, max depth exceeding 90 ft
- Average width ½ mi, 1 mi max (Louisville, KY)
- ~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 ~8% of the nation (27 million people)
- 33 drinking water intakes provide drinking water for over 5 million people along the main stem
- 589 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

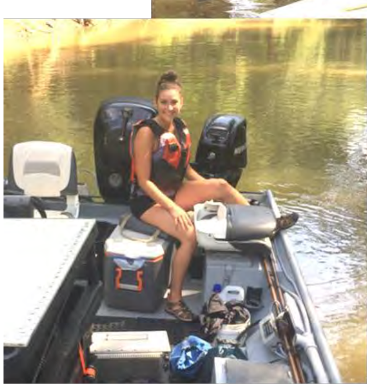
Site Selection

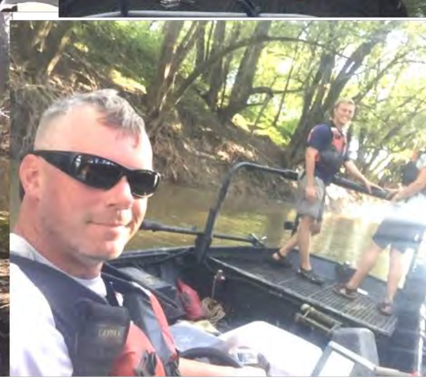
A random, probability-based survey design was used to select sampling site locations within each Ohio River navigational pool. The target areas of our surveys are both shorelines of each pool from the upstream dam to the downstream dam. The survey design provides coordinates for 15 sites (500m-long) 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.

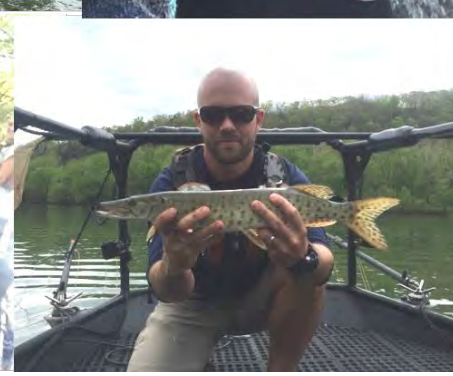
Fish Collection

To maintain consistency across different sampling years, fish surveys are conducted between July 1st and October 31st and when water levels are within two feet of "normal flat pool". 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 subsample of small fishes (i.e. less than 4cm) that cannot be confidently identified in the field (e.g. minnows) are preserved and identified in the laboratory. All information is reviewed and imported into a database from which fish index scores are later generated.



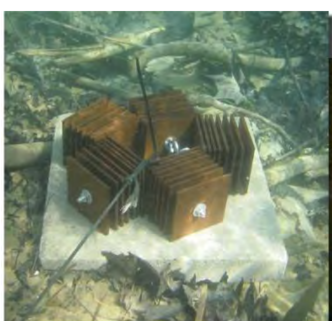




Collecting Macroinvertebrates

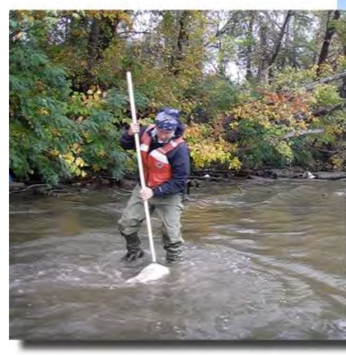
Macroinvertebrates (macros) are organisms that lack a true backbone and can be seen with the naked eye. They include aquatic insects, molluscs, arachnids, crustaceans, and worms. They can range from large adult forms (e.g. crayfish), to very small larval forms of terrestrial insects (e.g. flies).

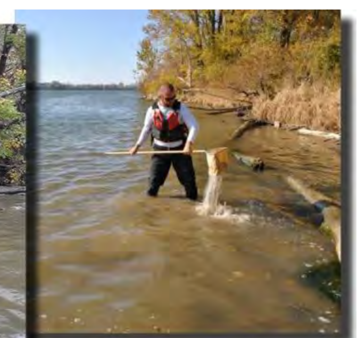
Two sampling methods are used to collect macroinvertebrates (macros); Hester-Dendy (HD) samplers and multi-habitat kicks (MH). HD samplers are constructed of tempered masonite cardboard cut into 3in square plates and 1in square spacers. Eight large plates and 12 spacers are stacked on a metal eyebolt 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.

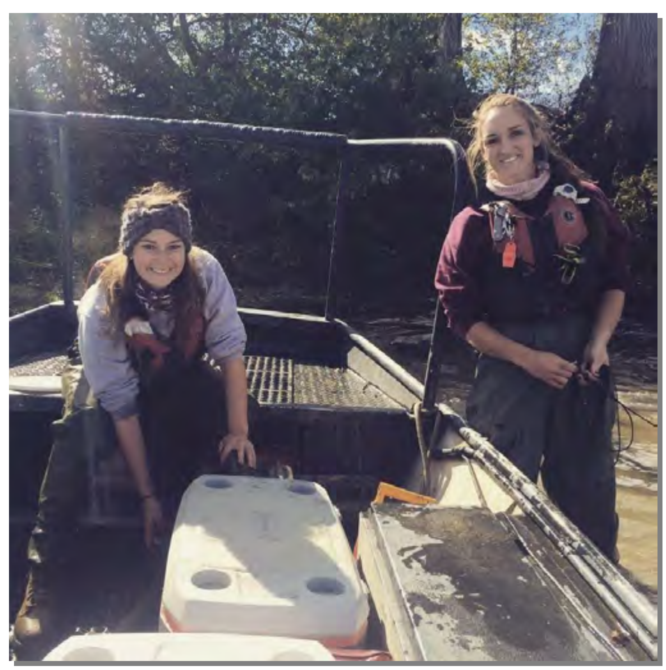


A MH kick is performed by actively disturbing the substrate and then sweeping a net through the resulting cloud. This technique allows the sampler to collect macros without compromising the sample with large amounts of sediment. To further exclude sediments, the net heads are "D" shaped (i.e. have flat 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.







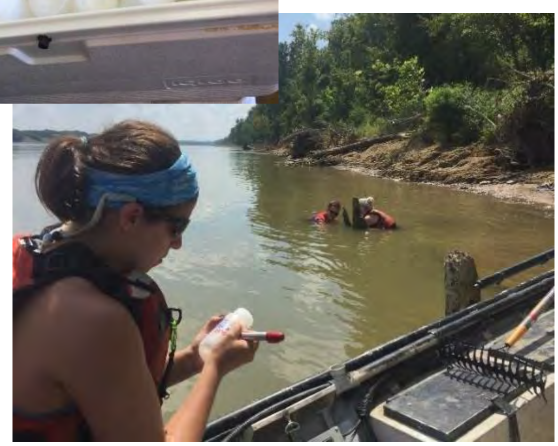
Characterizing Instream Habitat

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

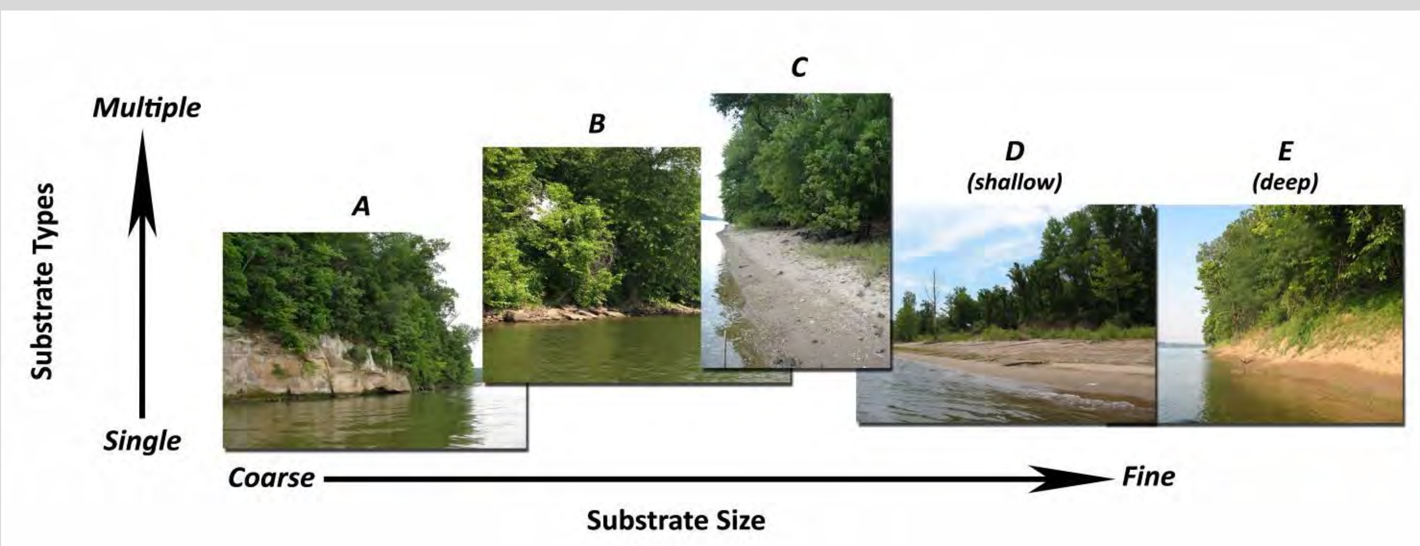
Because different fish species prefer different habitat types, it is important to classify the instream habitat at each of our sites to better understand *m*ORFIn score variability. Using the habitat survey data, we assign each site to one of five statistically derived habitat classes simply named: A,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

Water Quality and Hydrology

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



A look at our five habitat classes



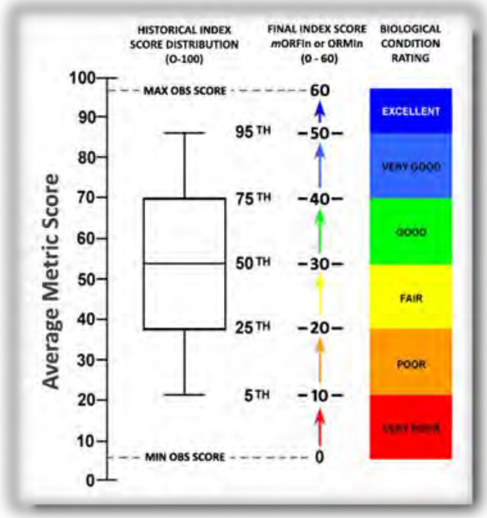
Assessing Biological Condition

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.



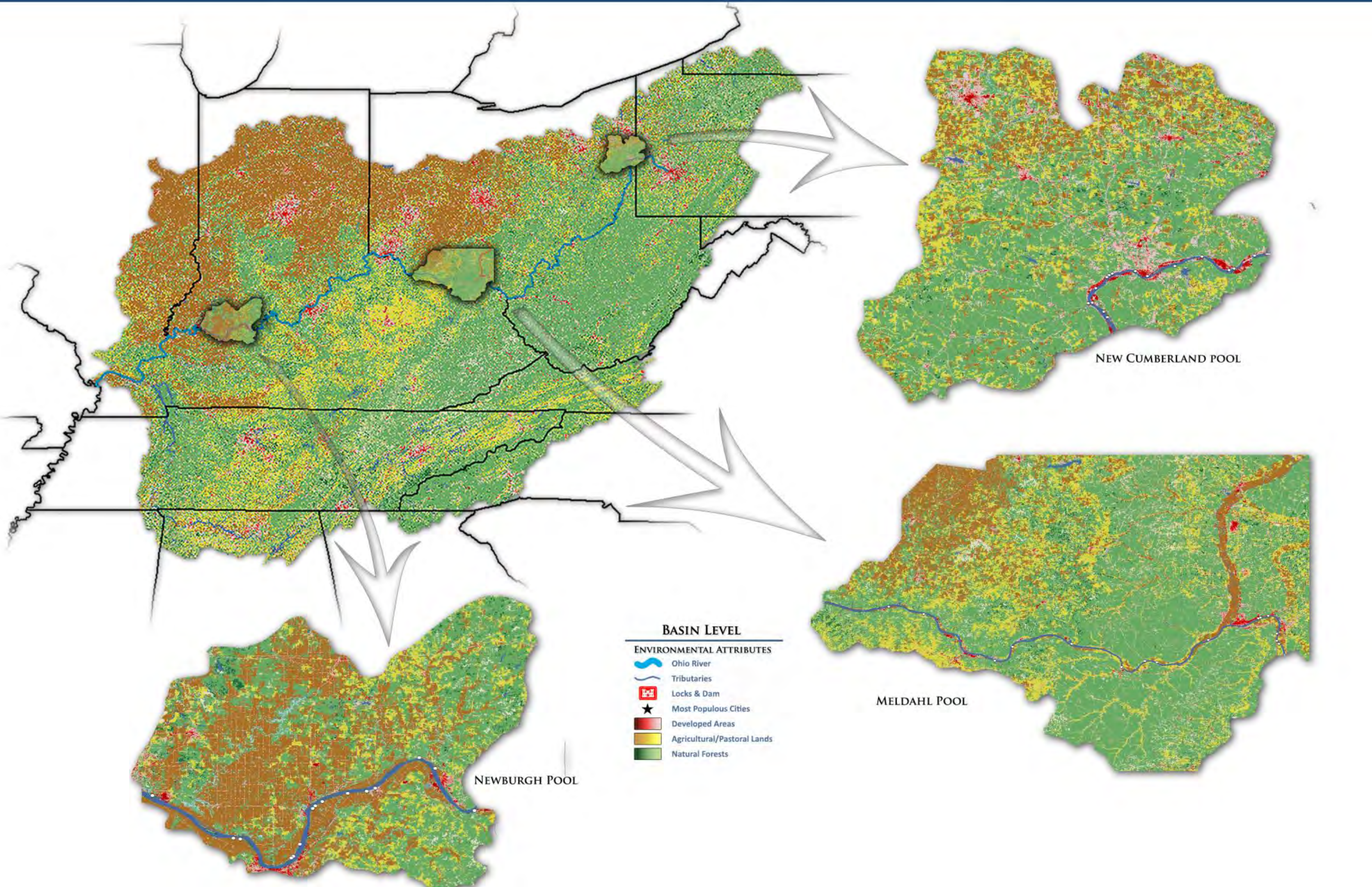
The presence of five distinct habitat classes A, B, C, D and E, coupled with the range of habitat preferences exhibited by individual fish and macro taxa required the translation of metric scores into relative index scores. By removing the effect of habitat, index scores can then be averaged within a 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.

2017 Pool Survey Results

The results of the 2017 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.



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

New Cumberland (2017) - Healthy Condition

This page summarizes the 2017 fish and macroinvertebrate (macro) surveys conducted by ORSANCO biologists in the New Cumberland 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 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.

Dominant Macro Groups

Mussels 40.6%

Dreissena polymorpha

Midges 25.4%

Dicrotendipes sp

Mayflies 7.3%

Stenacron sp

Snails 5.5%

Hydrobiidae sp

Scuds 5.3%

Gammarus sp

Dominant Fish Families

Minnows 46.7%

Channel Shiner

Sunfish & Bass 22.2%

Smallmouth Bass

Suckers 15.2%

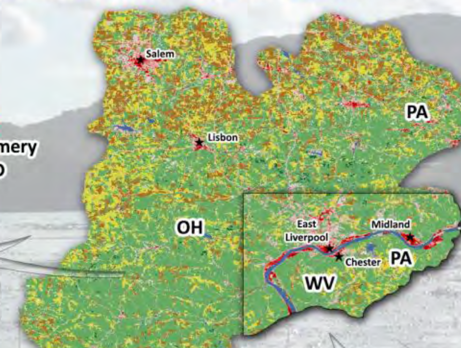
Golden Redhorse

Perches 4.7%

Sauger

Shad 2.3%

Gizzard Shad



New Cumberland Sub-Basin

Ohio River Basin

Aquatic Invasives Watch

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

Survey Summary

Electrofishing sampling occurred almost entirely in one week of July and extended partially into early August. Submerged vegetation was observed at all sites with invasive Hydrilla and Eurasion Water Milfoil observed at over 90% of sites. However, we do not believe this negatively affected the quality of 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*). Additionally, the invasive Eastern Banded Killifish (*Fundulus diaphanus diaphanus*) was found likely due to the increase in invasive vegetation. Notable macroinvertebrate collections include a high percentage of invasive mussels (*Dreissena polymorpha*) and pollution intolerant mayflies (*Stenacron sp*). Non-native filter-feeding scuds (*Apocorophium lascustre*) were also present. 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 New Cumberland Pool were in 'Fair' condition and the macros were in 'Fair' condition. Overall, while these results indicate that New Cumberland Pool harbored healthy aquatic communities, close attention will be paid to both assemblages in the future for signs of chronic degradation.

Pool Substrate Composition

Boulder 7.2%

Cobble 14.6%

Gravel 23.4%

Sand 23.0%

Fines 26.9%

Hardpan 3.3%

Other 1.5%

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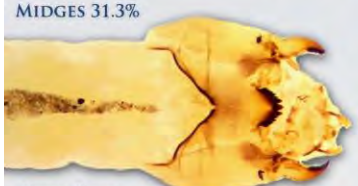
MELDAHL POOL (2017) - HEALTHY CONDITION

This page summarizes the 2017 fish and macroinvertebrate (macro) surveys conducted by ORSANCO biologists in the Meldahl 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 Meldahl pool is 95.2 miles long, extending from Greenup Locks and Dam (ORM 341.0) to Meldahl Locks and Dam (ORM 436.2). The pool has a gradient drop of 0.3 feet per mile, averages 1,603 feet wide and 23 feet deep. The pool flows adjacent to the states of Ohio and Kentucky. This scenic portion of the Ohio River has only a few small cities (Portsmouth, OH and Maysville, KY) and few anthropogenic impacts. The few impacts that do exist are agricultural (10.8%) and pastoral (12.1%) land uses. Deciduous forests are the dominant land cover (59.3%). As such, forested sandy shorelines are prevalent as well as instream woody cover. Meldahl receives water from one large tributary, the Scioto River (OH), and several smaller creeks in Ohio (Ohio Brush, Eagle, and Whiteoak) and Kentucky (Tygarts and Kinniconick).

DOMINANT MACRO GROUPS

MIDGES 31.3%



Dicrotendipes sp

MUSSELS 24.9%

Dreissena polymorpha

CADDISFLIES 13.5%

Cyrnellus fraternus

SNAILS 6.3%

Hydrobiidae sp

SCUDS 6.1%

Gammarus sp

DOMINANT FISH FAMILIES

MINNOWS 43.9%

Channel Shiner

SHAD 17.8%

Gizzard Shad

SUCKERS 8.2%

River Carpsucker

SUNFISH & BASS 7.4%

Bluegill

DRUM 4.7%

Freshwater Drum

AQUATIC INVASIVES WATCH

SURVEY SUMMARY

Electrofishing sampling occurred over an unusually long period of time, from early July to late August, due to extensive rain events. While average water clarity was lower than normal (28.3 inches) and water velocities were slightly elevated, neither negatively affected sampling. Notable catches include numerous Channel Shiners (*Notropis wickliffi*), the Ohio state endangered Shortnose Gar (*Lepisosteus platostomus*), and species of special concern River Redhorse (*Moxostoma carinatum*, OH) and Black Buffalo (*Ictiobus niger*, KY). Notable macroinvertebrate collections include a high percentage of fairly tolerant midges (*Dicrotendipes sp*), invasive mussels (*Dreissena polymorpha*), and tolerant caddisflies (*Cyrnellus fraternus*). Non-native filter-feeding scuds (*Apocorophium lascustre*) were also observed. 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 Meldahl Pool were in 'Good' condition and the macros were in 'Fair' condition. Overall, these results indicate that Meldahl Pool harbored healthy aquatic communities.

Newburgh Pool (2017) - Healthy Condition

This page summarizes the 2017 fish and macroinvertebrate (macro) surveys conducted by ORSANCO biologists in the Newburgh 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. Newburgh pool is 55.4 miles long, extending from Cannelton Locks and Dam (ORM 720.7) to Newburgh Locks and Dam (ORM 776.1). The pool has a gradient drop of 0.3 feet per mile and averages 2,477 feet wide and 28 feet deep. The pool flows adjacent to the states of Indiana and Kentucky. The Newburgh pool receives water from the following tributaries: Anderson River at mile point 731.5 with a drainage area of 276 square miles, Blackford Creek at mile point 742.2 with a drainage area of 124 square miles and Little Pigeon Creek with a drainage area of 415 square miles (ORSANCO 1994). The shorelines of this pool support a modicum of aquatic vegetation in the littoral zones. Newburgh Pool lies in a portion of the Ohio River where the land use consists primarily of deciduous forest (53.9%), but also has a considerable amount of row crops (13.1%) and pasture lands (14.9%).

Dominant Macro Groups

Mussels 40.6%

Dreissena polymorpha

Midges 30.6%

Tribelos sp

Caddisflies 15.5%

Cyrnellus fraternus

Snails 3.5%

Hydrobiidae sp

Mayflies 3.4%

Stenacron sp

Dominant Fish Families

Minnows 44.9%

Channel Shiner

Shad 13.1%

Gizzard Shad

Drum 9.4%

Freshwater Drum

Sunfish & Bass 8.7%

Spotted Bass

Suckers 6.2%

River Carpsucker

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 unusually late in the season and over a longer period of time (from early August to mid September) due to extensive rain events. While average water clarity was lower than normal (24 inches) and water velocities were slightly elevated, neither negatively affected fish sampling. Notable catches include numerous Channel Shiners (*Notropis wickliffi*) and Freshwater Drum (*Aplodinotus grunniens*). Otherwise, no threatened, endangered, or species of special concern were observed. High flow events occurred prior to Hester-Dendy (HD) retrieval and likely disrupted macroinvertebrate colonization and contributed to low macroinvertebrate scores. All recovered samplers and secondary kick net samples yielded far fewer than expected numbers of individuals. Notable macroinvertebrate collections included a high percentage of invasive mussels (*Dreissena polymorpha*) and tolerant caddisflies (*Cyrnellus fraternus*). Non-native filter-feeding scuds (*Apocorophium lascustre*) were also observed. Newburgh Pool macroinvertebrate results will remain unassessed due to negative impacts of flow on HD collections . Results (see above map) show that, on average, fish in Newburgh Pool were in 'Good' condition. While these results indicate that Newburgh Pool harbored healthy fish communities, close attention will be paid to macroinvertebrates in the future for signs of chronic degradation.

Pool Surveys

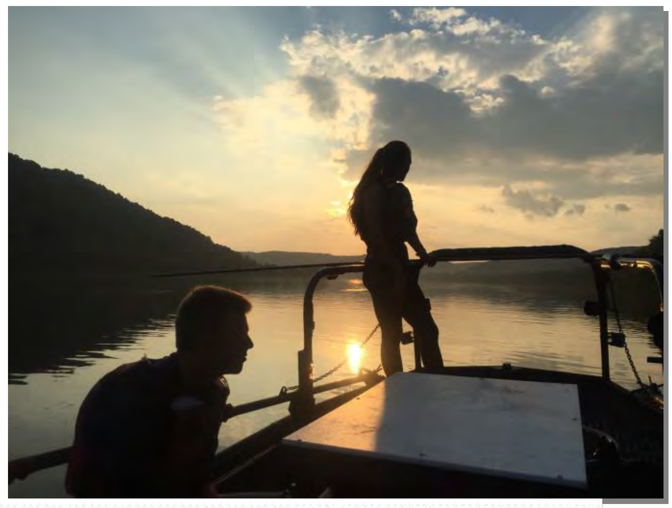
The 2017 pool surveys were successfully completed between July 5th and September 18th. Wet weather conditions were frequent, coupled with high flow rates and sedimentation. All three pools experienced fluctuating flow regimes and as a result sampling events were postponed numerous times throughout the season. Nonetheless, all three pools surveyed during the 2017 field season were assessed as *meeting* their aquatic life-use designations (i.e. containing healthy fish communities).

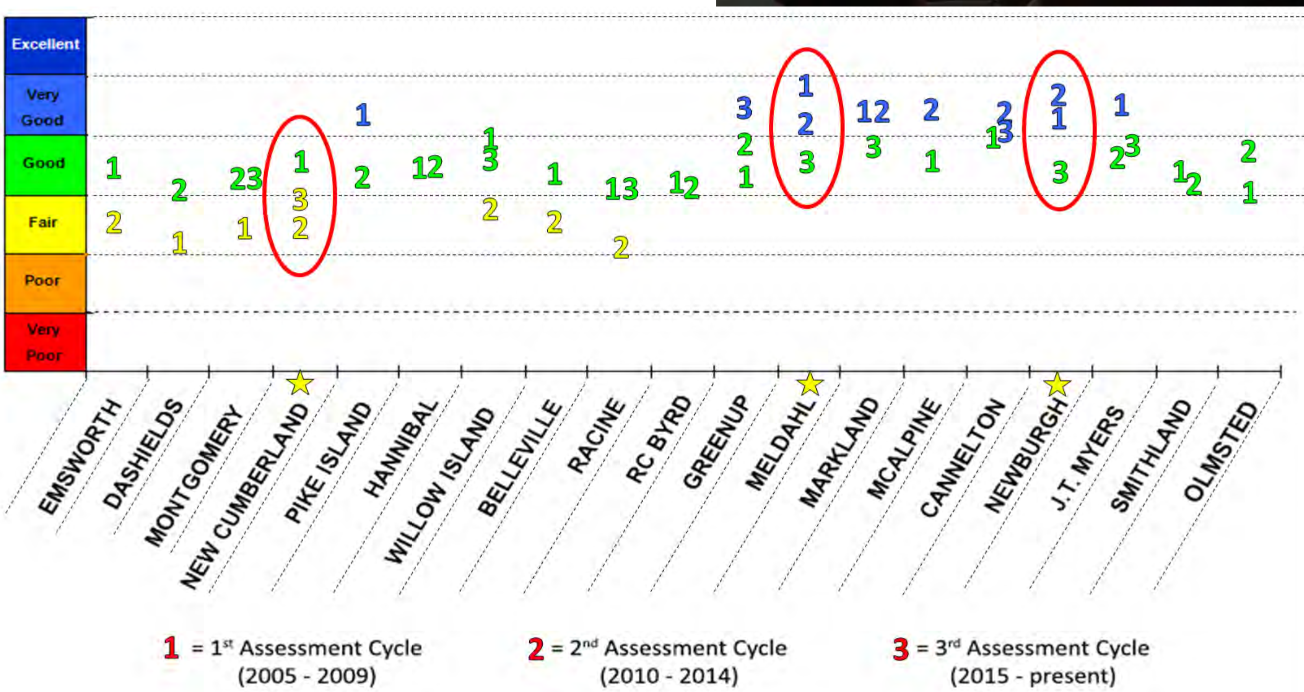
Assessment Comparisons

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 2017 surveys continued the third cycle, which enhances our ability to detect riverwide patterns. Some of the index and species variability observed across pools may be due in part to variations in natural distributions, instream habitat, invasive species distributions, annual variations in flow, weather conditions and water quality.

Present vs. Past Assessments

The focus of ORSANCO's biological assessments is to determine whether each pool "meets" or "fails to meet" its aquatic life use designation. To aid in interpretation, we assign one of six ratings (e.g. 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 (e.g. 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 assessments.





River-wide Assessment Comparison

The 2017 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), invasive aquatic vegetation, proximity to tributaries (which can affect species diversity based upon the biological condition of the tributary).

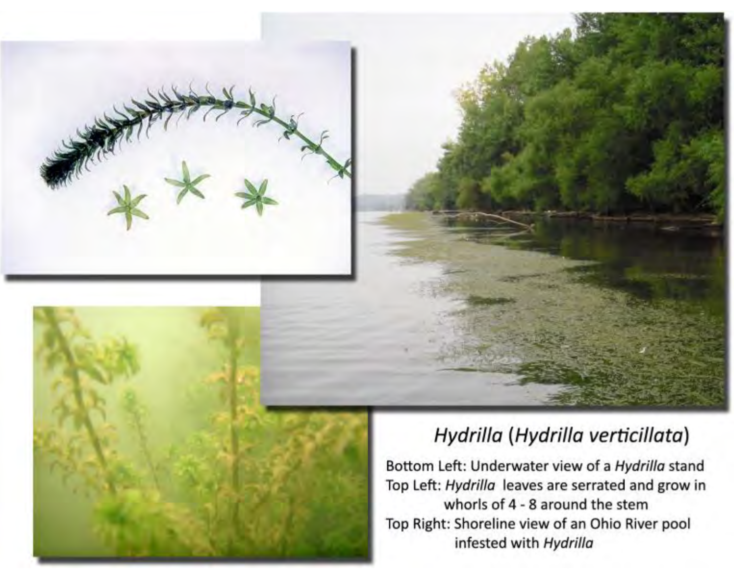
CONCLUSIONS

New Cumberland Pool

(Fish = FAIR, Macros = FAIR)

Variable	2005	2011	2017
Environmental Factors			
Avg. Conductivity	460	615	302
Avg. Secchi Depth	46.2	64	32
CPUE Score	**46.9**	**34.4**	**22.5**
Avg. % Tol Score	**91.8**	**61.5**	**28.4**
Bluntnose Minnow	1	19	23
Common Carp	23	18	55
Avg. % Piscivore Score	**38.8**	**21.6**	**29.9**
Sauger	48	29	54
Spotted Bass	35	17	20
Avg. Great River Species Score	**42.6**	**20.0**	**8.9**
Channel Darter	4	1	1
Mooneye	11	9	0
Silver Chub	7	2	0
Avg. Intolerant Score	**77.7**	**35.7**	**42.5**
Logperch	24	9	10
Northern Hog Sucker	32.0	2.0	14.0
Avg. Sucker Score	**77.4**	**30.9**	**54.7**
Total Suckers:	272	209	296
Assessment Result			
Avg. mORFIn Score	**36.3**	**24**	**27.8**
Fish Condition Rating	**Good**	**Fair**	**Fair**

Similar to 2011, New Cumberland Pool was assessed to be in Fair condition in 2017. Conductivity, average Secchi depth and CPUE have decreased with each assessment cycle, particularly in 2017 where the river as a whole was subject to numerous high water events. Since first noted after the first assessment cycle, abundant aquatic vegetation, primarily *Hydrilla verticillata,* is the primary environmental factor observed that could account for lower metric performance. Great river species observations continue to decline. Fewer intolerant species, greater numbers of observed piscivores and an improved average Sucker Score contributed to the elevated average mORFIn Score in 2017.



Hydrilla (*Hydrilla verticillata*)

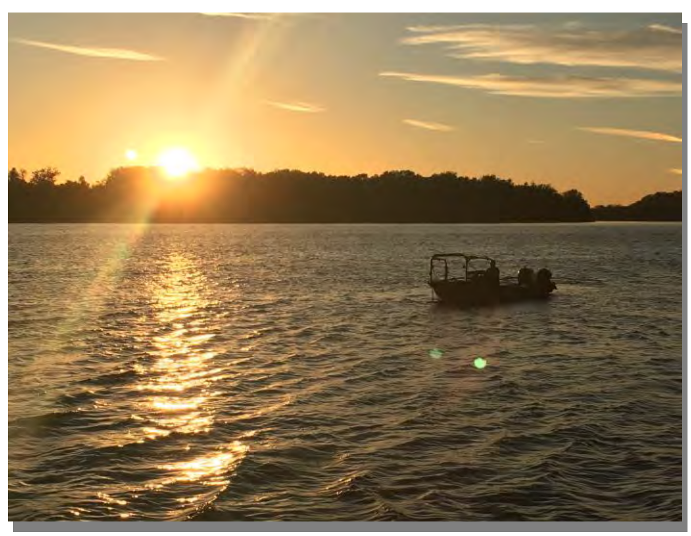
Bottom Left: Underwater view of a *Hydrilla* stand
Top Left: *Hydrilla* leaves are serrated and grow in whorls of 4 - 8 around the stem
Top Right: Shoreline view of an Ohio River pool infested with *Hydrilla*

Meldahl Pool

(Fish = GOOD, Macros = FAIR)

Variable	2007	2012	2017
Environmental Factors			
Avg. Conductivity	499	456	380
Avg. Secchi Depth	52.6	38.5	28.3
Avg. % Tolerant Score	**96.9**	**93.2**	**91.4**
Avg. % Non-Native Score	**98.1**	**95.7**	**78.5**
Common Carp	7	8	12
Redear Sunfish	0	0	2
Striped Bass	0	0	3
Avg. % Piscivore Score	**62.1**	**32.4**	**22.5**
Sauger	63	37	40
Flathead Catfish	40	21	26
Avg. Great River Species Score	**77.8**	**57.8**	**37.8**
Silver Chub	16	13	8
Mooneye	12	5	0
Assessment Result			
Avg. mORFIn Score	48.09	39.89	36.15
Fish Condition Rating	**Very Good**	**Good**	**Good**

Meldahl pool was again assessed to be in Good condition in 2017. Decreases in conductivity and average Secchi depth were similar to the other pools sampled as Meldahl Pool experienced the same inclement weather conditions and subsequent flow regime fluctuation. Metric performance revealed effects of increasing numbers of non-native species and low numbers of great river species. All other metric scores exhibited insignificant changes. The lower average mORFIn score is not considered significant as the pool demonstrates the inherent biological variability we would expect within a single condition rating.



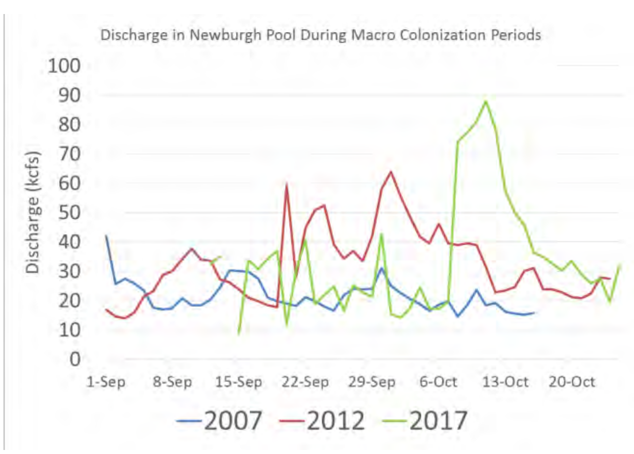
Newburgh Pool

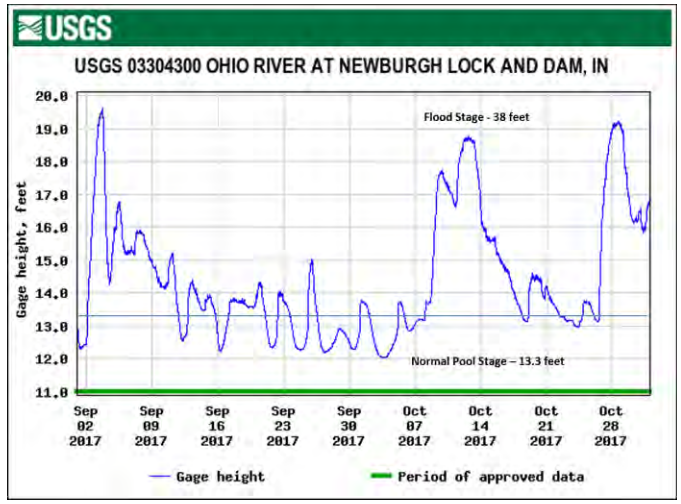
*(Fish = GOOD, Macros = **Unassessed**)*

Variable	2007	2012	2017
Environmental Factors			
Avg. Conductivity	460	615	302
Avg. Secchi Depth	46.2	64	32
Avg. CPUE Score	**36.8**	**72.9**	**21.1**
Avg. % Tol Score	**87.3**	**92.5**	**84.2**
# Tolerant individuals	56	108	60
Avg. Species Score	**49.1**	**74.2**	**50.8**
# Species	44	44	22
Total # Individuals:	530	775	565
Assessment Result			
Avg. mORFIn Score	**42**	**46.2**	**33.6**
Fish Condition Rating	Very Good	Very Good	Good

Newburgh pool was assessed to be in Good condition in 2017, dropping from the Very Good rating observed in the previous two assessment cycles. As in the other two pools assessed, unstable weather patterns throughout the basin affected not only ambient conditions, but also delayed ordinary sampling timeframe. Sampling was completed mid-September (under "normal" conditions sampling is typically completed during the month of July). The most notable metric performance difference in 2017 was a drop in average Species Score. Only 22 species were observed in 2017 as opposed to 44 species observed each of the previous two assessments.

Macroinvertebrate collections were severely depressed in Newburgh Pool in 2017. In 2017, a large discharge event took place during the second week of October just prior to retrieval. Likewise, gauge height at Newburgh Lock and Dam increased well above normal flat-pool height (13.3 feet) several times throughout the six week colonization period.





Low numbers of individuals collected were likely due to the higher 2017 discharge relative to previous assessment years. HD deployments in particular require passive colonization of drift organisms and individuals from the nearby benthos to be an effective sampling method, and are susceptible to high water velocities, discharge and subsequent scouring events. These high flow events likely scoured macroinvertebrates from and/or disturbed their colonization of the deployed Hester-Dendy (HD) samplers. As a result sampling efficiency was diminished and we were unable to collect a sample reflective of the six-week colonization period.

As the macro results were anomalous, and unreliable due to abiotic conditions (flow), we were unable to confidently assess the macroinvertebrate population. As a result, the Newburgh Pool assessment is based solely on *m*ORFIn (fish) scores and is in "Full Support" based this single biological indicator.

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 Right: black-shouldered spinyleg dragonfly (*Dromogomphus spinosus*)

Our assessments would not be possible without the guidance of our committee and hard work of our Seasonal Biologists. For information on seasonal employment opportunities available to recent graduates, contact Rob Tewes (*rtewes@orsanco.org).*

Life Below the Waterline

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 Rob Tewes (rtewes@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 '17**	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	**Meldahl '17**	Markland '14	McAlpine '14	Cannelton '16	**Newburgh '17**	John T. Myers '15	Smithland '13	Open Water '14
GAR	Longnose Gar	23	19	11	**31**	16	64	34	28	64	25	42	**59**	28	24	50	**30**	16	11	61
	Spotted Gar															1			2	
	Shortnose Gar												**1**				**12**	12	28	101
SHAD	Skipjack Herring		1				1	2			1				1	2	**3**	5	2	1
	Gizzard Shad	3417	37	26	**83**	5092	43	154	117	147	176	158	**591**	274	54	378	**216**	650	557	278
	Threadfin Shad																		14	74
CARP	Common Carp	48	70	45	**75**	36	46	11	26	3	32	7	**13**	5	4	3	**4**	8	7	2
	Grass Carp								1								**2**			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				**2**	7							**11**		5					
	Spottail Shiner			4				11	2	4	1	2			3					
	Spotfin Shiner	77	35	68	**165**	62	72	295	58	127	19	52	**19**	10	28	73	**8**	112	218	14
	Notropis sp.																			
	Emerald Shiner	848	46	216	**357**	892	79	1085	240	1208	172	221	**423**	470	227	407	**195**	102	86	20
	Silverband Shiner																			
	Sand Shiner																			
	Channel Shiner	492	108	323	**845**	481	167	1173	410	733	684	2017	**872**	897	609	1822	**426**	255	102	47
	River Shiner				**42**				5			16	**69**	156	30	145	**47**	104	8	15
	Shoal Chub																			
	Silver Chub								1		1	11	**38**	33	51	32	**10**	10	12	10
	Streamline Chub	11	1																	
	River Chub																			
	Gravel Chub																			

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	**New Cumberland '17**	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	**Meldahl '17**	Markland '14	McAlpine '14	Cannelton '16	**Newburgh '17**	John T. Myers '15	Smithland '13	Open Water '14
	Creek Chub											1								
	Central Stoneroller						1	9					**1**	1	3					
	Mississippi Silvery																		15	
	Suckermouth Minnow																			
	Bluntnose Minnow	120	1	30	**224**	28	98	227	8	12		2	**3**	4	2		**12**	9		2
	Bullhead Minnow				**0**			12	5		1	17	**14**	2	1	11	**13**	24	1	6
	Silverjaw Minnow																			
SUCKERS	Ictiobinae sp.																			
	Ictiobus sp.																**1**			
	Smallmouth Buffalo	51	84	82	**37**	58	40	26	38	33	32	19	**45**	89	31	17	**11**	32	106	32
	Bigmouth Buffalo											1					**1**	4	4	5
	Black Buffalo	1	4	18	**13**		4	3	7			3	**14**	5	4	2		2		10
	Carpiodes sp.					1			1					1		1				1
	Quillback	1	13	6	**13**	9	14	9	7	3	12	3	**28**	61	9	3	**3**	7	31	5
	River Carpsucker	8	47	47	**15**	36	33	18	33	20	26	38	**151**	221	161	19	**48**	187	263	139
	Highfin Carpsucker	5	14	12		1	5		3	8	1	6	**6**	4	4			3	91	3
	Northern Hog Sucker	3		6	**16**	6	6	8	1	5	2	1			6					
	Moxostoma sp.				**22**		3				1									
	Shorthead Redhorse																			10
	Smallmouth Redhorse	33	153	27	**3**	16	54	41	61	11	22	38	**114**	44	31	40	**13**			
	Silver Redhorse	75	252	215	**122**	23	59	42	31	16	22	39	**31**	19	14	5	**2**			
	River Redhorse	14	65	23	**6**	2	12	1		2	6	25	**4**		1	4				
	Black Redhorse	8	10	25	**27**	3	16	6												
	Golden Redhorse	56	155	156	**442**	93	273	219	64	56	56	124	**112**	26	67	17	**25**	8		1
	Spotted Sucker						4	13	8	1		2	**1**	1	1					
	White Sucker																			
CATFISH	Yellow Bullhead														1					
	Brown Bullhead																			

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	**New Cumberland '17**	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	**Meldahl '17**	Markland '14	McAlpine '14	Cannelton '16	**Newburgh '17**	John T. Myers '15	Smithland '13	Open Water '14
	Northern Madtom																			
	Blue Catfish													2		4		1	5	
	Channel Catfish	35	63	83	**59**	54	83	35	177	52	114	61	**98**	112	122	46	**68**	106	478	65
	Flathead Catfish	19	6	8	**9**	47	39	22	36	24	40	29	**26**	21	19	10	**19**	20	30	12
SUNFISH	Lepomis sp.													2	2					5
	Warmouth														3					
	Rock Bass	75	89	22	**238**	24	64	11	2											
	Bluegill	154	34	88	**215**	131	523	540	391	220	254	205	**73**	207	89	65	**32**	65	270	41
	Green Sunfish	3	3	1	**3**	3	2	1	1	4	4	2	**2**	1	1	2	**2**	1		4
	Pumpkinseed	4	4	3	**54**	2	33	14		2	6									
	Orangespotted Sunfish						5	197		5		5	**13**			2	**2**	6	1	
	Longear Sunfish	2	1		**1**	8	242	18	24	13	56	15	**17**	71	65	31	**32**	137	207	16
SUNFISH	Redear Sunfish		1					2	7	2	3	4	**2**	2	1	20	**8**	1	32	
	Lepomis Hybrid				**3**	1	2		1		2			1					2	
	Bluegill X Longear																			
	Bluegill X Green									1										
	Longear X Green																			
TEMPERATE BASS	Morone sp.	50		3		110	12	49	79	8	15	35	**25**	11	81	28	**37**	72	86	733
	White Perch																**2**			
	Striped Bass								1		1		**3**				**4**			
	White Bass	6	65	7	**3**	2	28	4	16	1	71	16	**59**	18	18	20	**43**	13	83	34
	Yellow Bass															1			15	25
	Hybrid Striped Bass	1	5	2			2		3	1	2	6	**16**	3	1	13	**6**	2	6	10
BLACK BASS	Micropterus sp.	57	1		**4**			5			9		**21**	10	18	12	**3**	14		16
	Smallmouth Bass	167	250	184	**241**	431	270	198	27	41	38	24	**55**	19	15	13	**11**	2	2	7
	Largemouth Bass	8	3	12	**16**	8	7	20	10	19	18	18	**6**	12	10	4		2	10	6
	Spotted Bass	24	18	6	**28**	77	99	46	26	17	60	59	**46**	51	38	48	**50**	133	48	26

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	**New Cumberland '17**	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	**Meldahl '17**	Markland '14	McAlpine '14	Cannelton '16	**Newburgh '17**	John T. Myers '15	Smithland '13	Open Water '14
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								
	Blackside Darter																			
	Slenderhead Darter																			
	River Darter						2							1						
	Logperch	29	15	26	**15**	40	89	73	5	9	5	16	**4**	14	9	2		2		2
PERCH	Yellow Perch			44	**15**		5	7	3											
	Walleye	20	74	68	**29**	2	10	1	13	1			**1**		1		**7**	5		
	Saugeye	2	11	42	**1**		1		25	25			**14**	22	8	2	**23**	4	4	6
	Sauger	39	264	110	**110**	39	147	73	89	15	128	194	**58**	116	226	94	**52**	225	23	46
MISC.	Silver Lamprey											1								
	Ohio Lamprey		2						1											
MISCELLANEOUS	Goldeye														1			10	1	
	Mooneye	10	1	26	**11**	2	2	2			3	2		5	1	5	**4**	1		1
	Paddlefish																**1**			
	Northern Pike					1														
	Muskellunge		1																	
	White Crappie	2			**2**			1	4	2	1	6	**2**	4	1	3	**3**	7	2	1
	Black Crappie	1	4	9	**8**	1	1	4	6	6		6	**10**	2			**2**	7	5	
	Inland Silverside																		16	14
	Brook Silverside	14			**4**	10	3	1							1		**2**	1	1	

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

Group	Species (common name)	Emsworth '12	Dashields '13	Montgomery '15	**New Cumberland '17**	Pike Island '12	Hannibal '13	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	**Meldahl '17**	Markland '14	McAlpine '14	Cannelton '16	**Newburgh '17**	John T. Myers '15	Smithland '13	Open Water '14
	Atlantic Needlefish																			
	Trout-Perch		11	137	**21**				2											
	Banded Killifish				**10**		5	14	1											
	Western Mosquitofish																	1		
	Bowfin																			
	Freshwater Drum	55	136	36	**34**	239	47	16	82	36	89	116	**158**	146	238	47	**157**	114	328	746
	Total No. of Individuals	**6071**	**2177**	**2260**	**6071**	**8103**	**2819**	**4755**	**2190**	**2957**	**2211**	**3666**	**3329**	**3205**	**2344**	**3507**	**1652**	**2518**	**3230**	**2680**
	Total No. of Species	**45**	**43**	**42**	**40**	**42**	**50**	**49**	**52**	**40**	**41**	**45**	**45**	**46**	**53**	**43**	**45**	**47**	**43**	**46**