2023 Ohio River Pool Assessments

New Cumberland and Cannelton Pools

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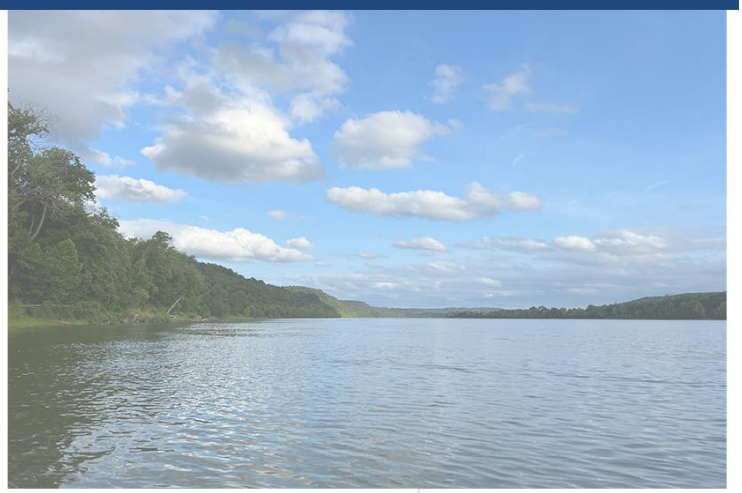

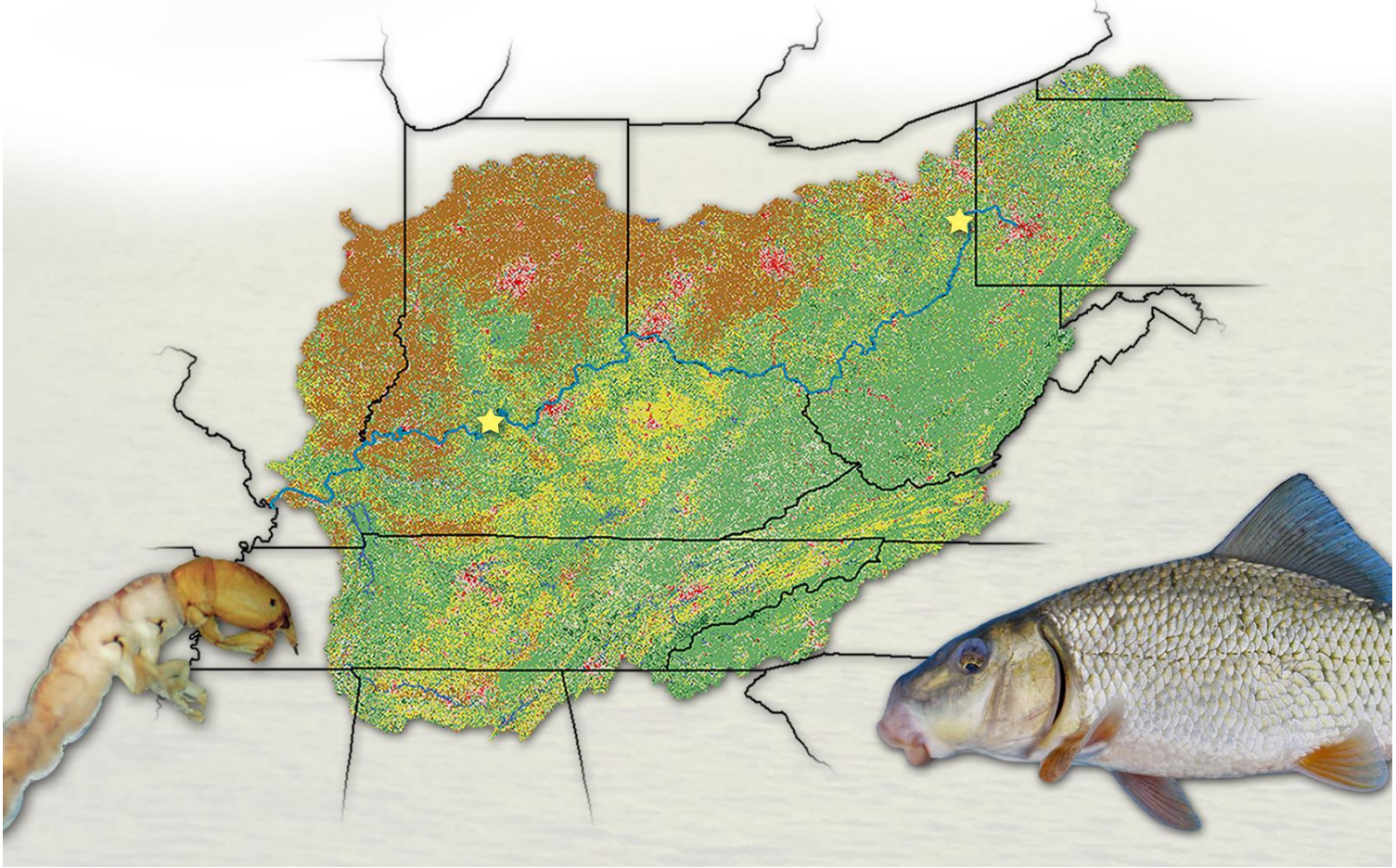

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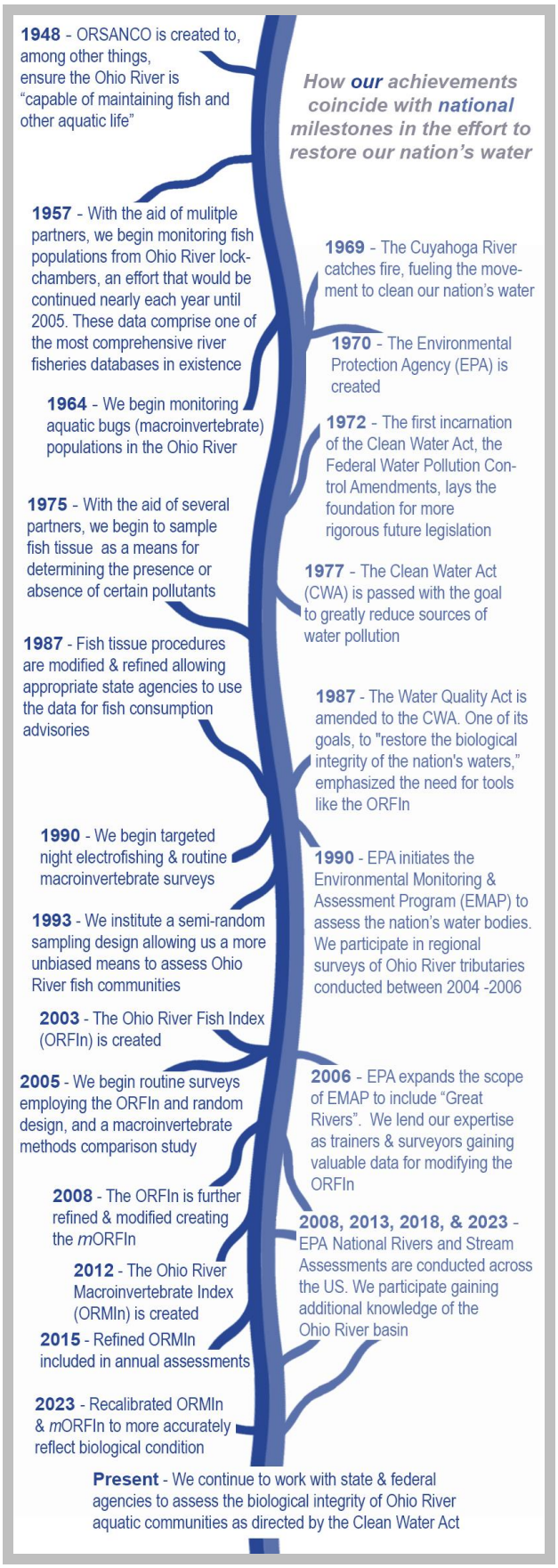
Introduction

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.



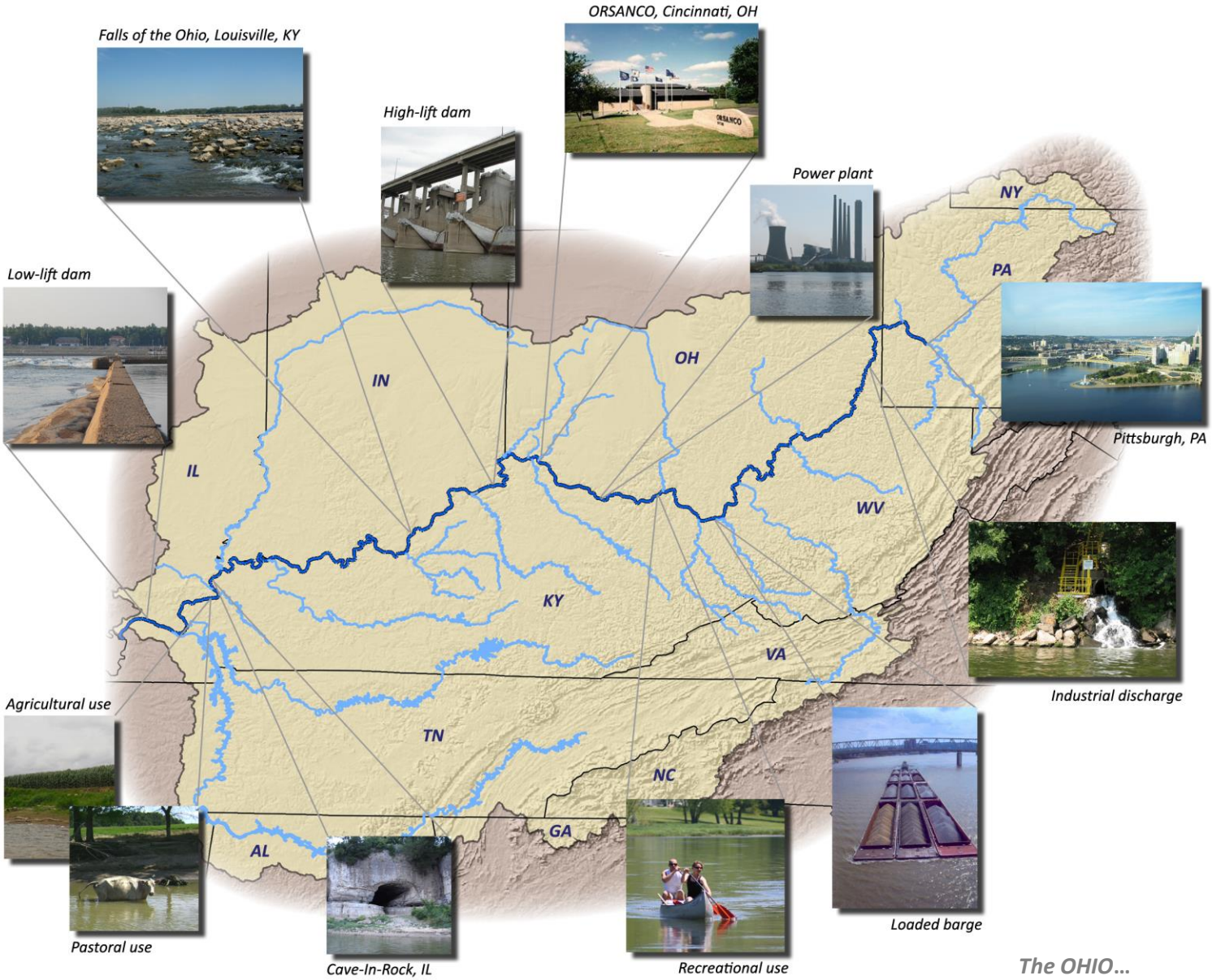
This report summarizes the 2023 New Cumberland and Cannelton pool assessment survey findings.

The River

The Ohio River begins at the confluence of the Monongahela and Allegheny rivers in Pittsburgh, PA 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

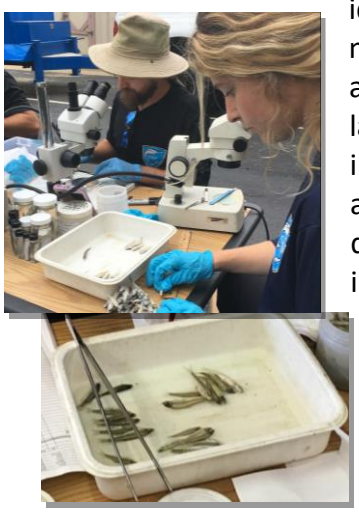
Site Selection

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 collected information is reviewed and imported into a database from which fish index scores are later generated.



Native Ohio River fishes. Left: Members of the genus Lepomis. Bluegill, Redear Sunfish, Orangespotted Sunfish, Warmouth, Longear Sunfish.
Right: Members of the genus Lepisosteus. Juvenile Shortnose Gar, Longnose Gar, Spotted Gar, Shortnose Gar.

METHODS

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 macros: Hester-Dendy (HD) samplers and multi-habitat kicks (MH). HD samplers are constructed of tempered masonite cardboard cut into 3-inch square plates and 1-inch 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

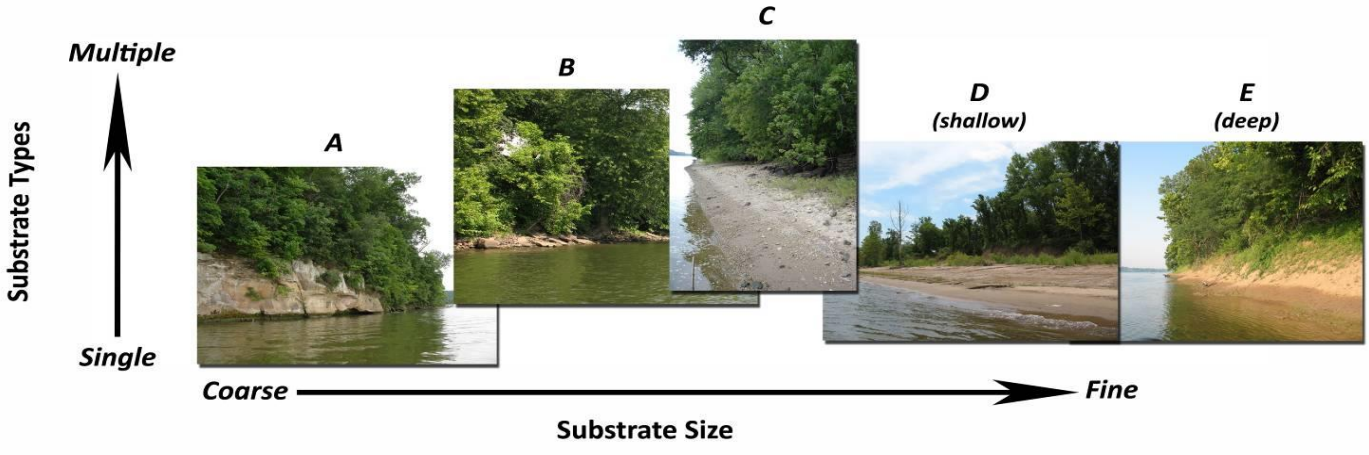
Intensive habitat surveys are conducted which include measures of woody cover, depth, prevalence of substrate types at each electrofishing site. Woody cover (e.g. submerged brush, logs, stumps) is estimated visually. More quantitative measures of depth and substrate proportions are obtained through the 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



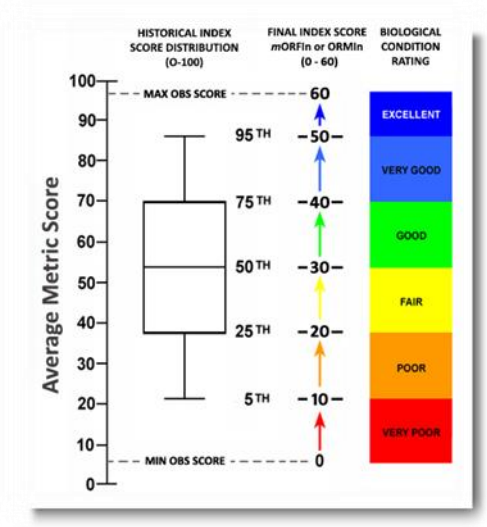
METHODS

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, 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, 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, *T*umors present
Catch per unit effort (*CPUE*)	Total abundance of ind. (minus exotics, hybrids, 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.

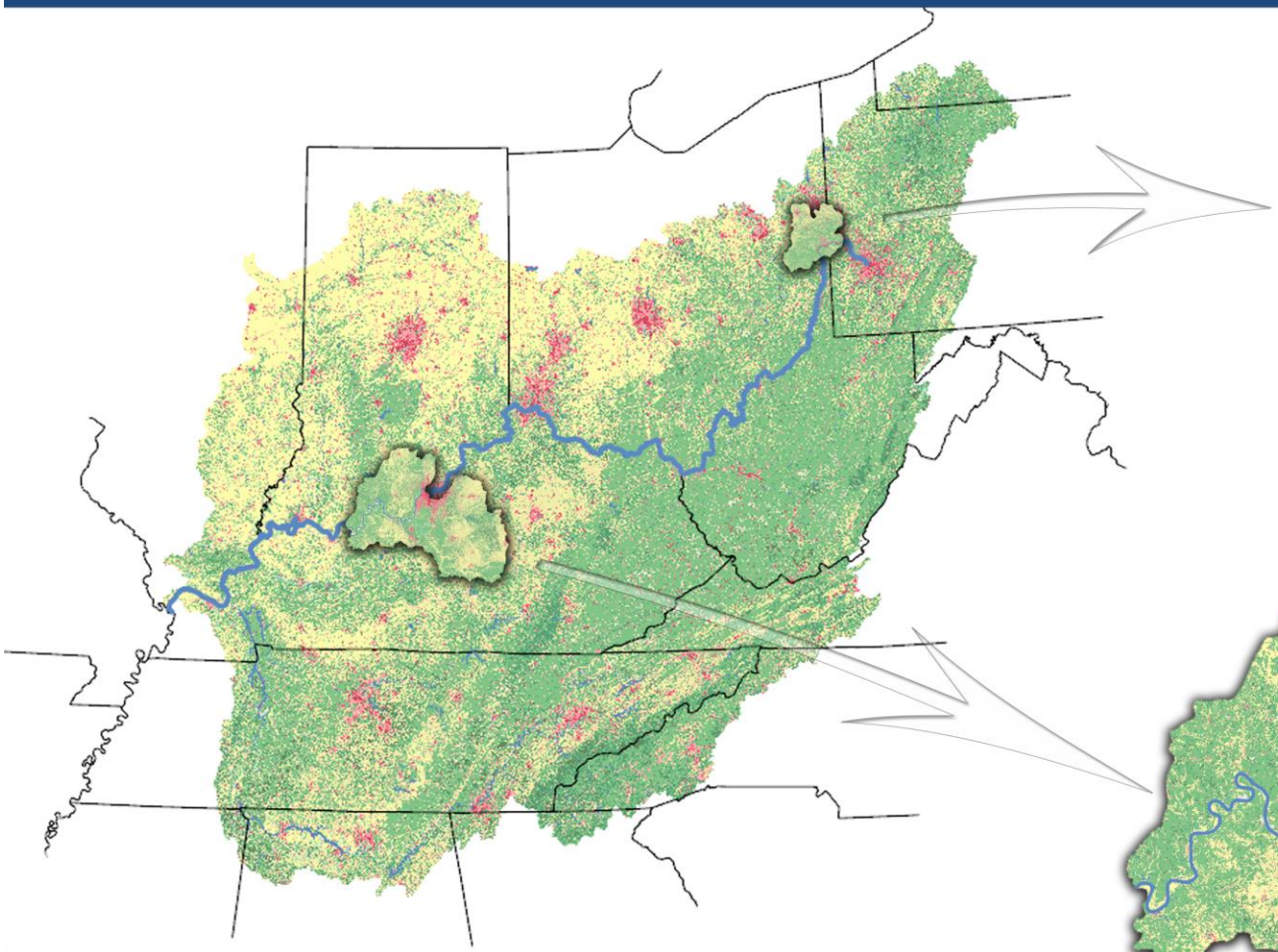
The averaged scores for both the *m*ORFIn and ORMIn are then compared to a biocriterion. The 25th percentile is the statistical threshold commonly used by regulatory agencies for establishing biocriteria. Using this threshold, our established biocriterion (i.e. a representation of healthy Ohio River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

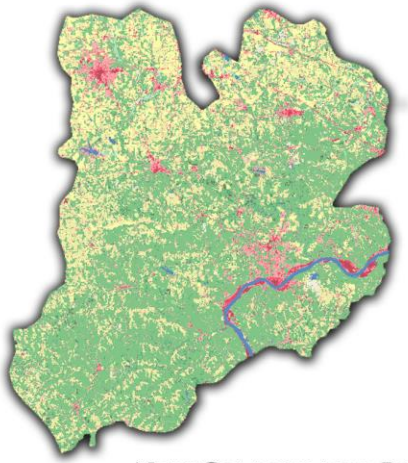
A pool is assessed to be in **full support** of its aquatic life-use (ALU) designation (i.e. possessing intact biological communities) if both the *m*ORFIn and ORMIn scores are greater than or equal to 20.0 (i.e. a biological rating "Fair", "Good", "Very Good", or "Excellent"). A pool is in **partial 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

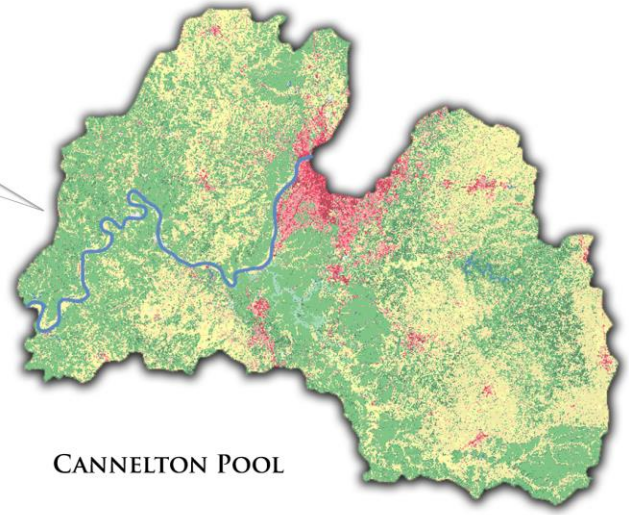
2023 Pool Survey Results

The results of the 2023 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.





New Cumberland 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

New Cumberland Pool (2023) - Healthy Condition

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 and averages 1,439 feet wide and 22 feet deep (ORSANCO 1994). The pool flows within the state of Pennsylvania for the first nine miles, and is bordered by Ohio and West Virginia for the remaining 13.7 miles. Though there are few metropolises within the pool (East Liverpool, OH), New Cumberland is only 31.7 miles downstream of Pittsburgh and lies in a portion of the Ohio River heavily influenced by industry with a large amount of barge activity. The New Cumberland Pool receives water from two small tributaries: Little Beaver Creek and Yellow Creek. The pool's watershed is primarily forested (54.8%) but also has a considerable amount of pasture (21.1%) and developed land (12.0%). New Cumberland pool has experienced shifts in substrate composition, an average increase in fine sediments from 22% to 37% between 2011 and 2023.

Dominant Macro Groups

Midges 33.2%

Dicrotendipes neomodestus

Scuds 19.0%

Gammarus fasciatus

Mussels 12.0%

Dreissena polymorpha

Worms 7.6%

Naididae sp
Photo by Krieger and Stearns (2010)

Caddisflies 7.3%

Cyrnellus fraternus

Boulder 4.5%

Cobble 10.9%

Gravel 22.1%

Sand 23.9%

Fines 37.2%

Other 0.7%

Hardpan 0.8%

Pool Substrate Composition

Dominant Fish Families

Herring and Shad 66.3%

Gizzard Shad

Sunfish & Bass 10.5%

Smallmouth Bass

Minnows 8.9%

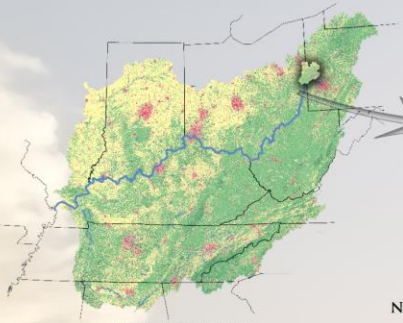
Emerald Shiner

Suckers 7.0%

Golden Redhorse

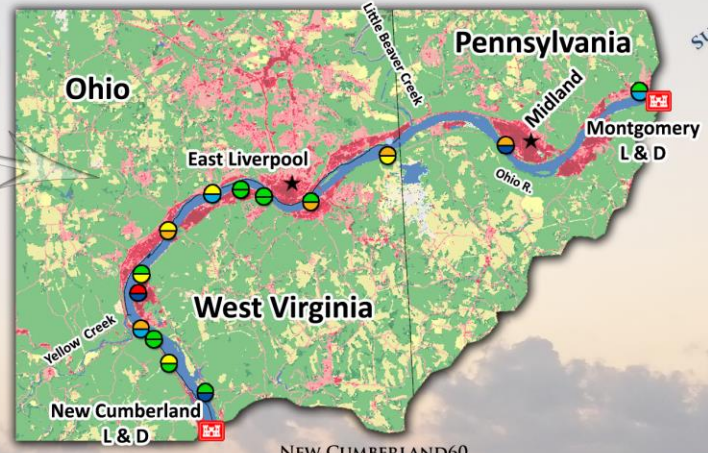
Perches 5.1%

Logperch



Ohio River Basin

New Cumberland Pool Sub-Basin



New Cumberland60 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

Survey Summary

Electrofishing sampling occurred during normal sampling conditions during the second week of July during moderate flow conditions. Notable observations over the last three asessment cycles included an increased abundance of Perches (*Percidae*) and Gizzard Shad (*Dorosoma cepedianum*). Declines in catfish (*Ictalurus punctatus* and *Pylodictis olivaris*) populations were observed, as well as a decline in cyprinid diversity and abundance. Two species of concern listed in the states of PA and OH were observed: Bowfin (*Amia calva*; n=1) and River Redhorse (*Moxostoma carinatum*; n=6). A species once thought to be extirpated in Ohio, Longhead Darter (*Percina macrocephala*), was observed four times this assessment. Notable macroinvertebrate collections include the presence of 6 species that are highly intolerant of pollution (tolerance value <4); these include 3 species of caddisfly (*Polycentropus sp*, n=143; *Mystacides sp*, n=21; *Triaenodes injustus*, n=38), one species of prosobranch snails (*Pleurocera sp*, n=74), one species of mayfly (*Heptageniidae sp*, n=1), and one species of midge (*Ablabesmyia annulata*, n=48). Additionally, 8 different Odonata taxa were observed, predominated by the presence of Bluet Damselflies (*Enallagma sp*, n=143). Independent biological indices were used to apply numeric values to important components of fish and macroinvertebrate assemblages and assess their relative status. The results (see above map) show that, on average, fish populations in New Cumberland Pool were in 'Fair' condition and macroinvertebrate populations were in 'Good' condition.

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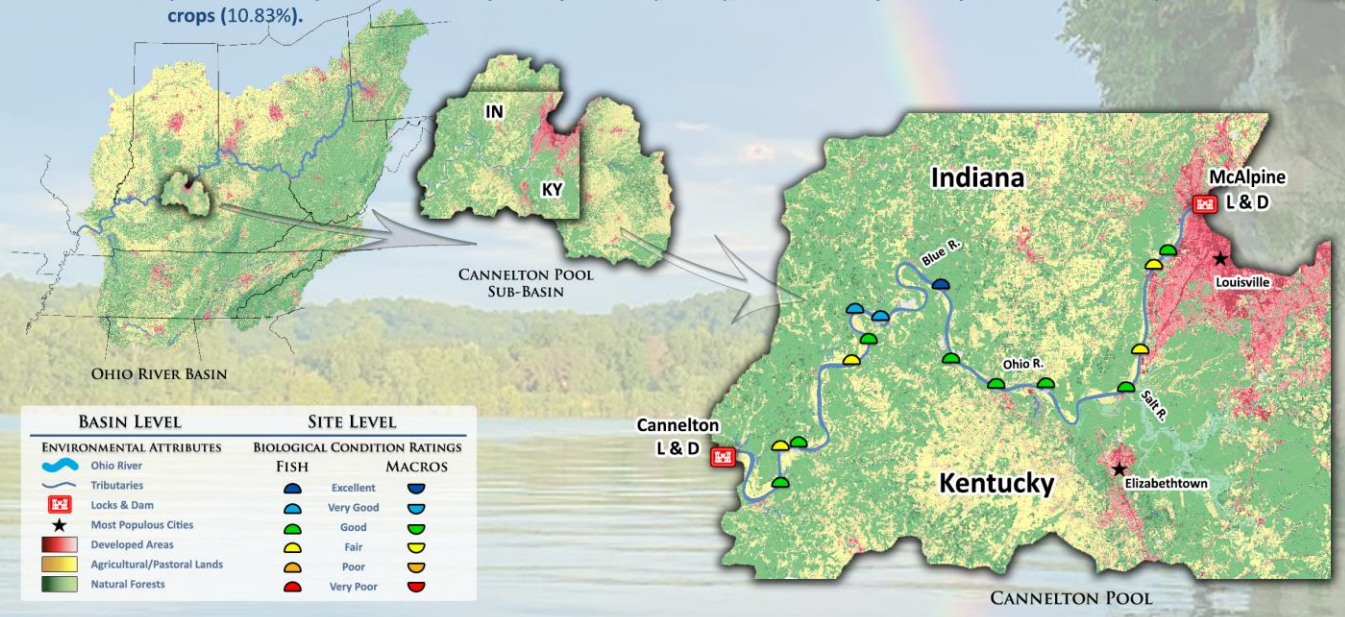
Cannelton Pool (2023) - assessment pending

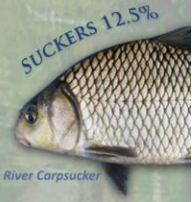
Dominant Macro Groups

Dominant Fish Families

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 drop of 0.3 feet per mile and averages 1,674 feet wide and 32 feet deep (ORSANCO 1994). The pool is bordered by Indiana and Kentucky, with and the largest city in the pool is Louisville, KY. The Cannelton pool has four large tributaries, the Salt River, Big Indian Creek, Sinking River, and the Blue River. The Falls of the Ohio (Clarksville, IN) located in Cannelton Pool provides unique habitat that is most akin to the historical, pre-impoundment conditions that were once intermitent along the entirety of the river, marked by high velocity, shallow water. This riffle-like habitat supports concentrated populations of Blue Suckers (*Cycleptus elongatus*) and Striped Bass (*Morone saxatilis*). The watershed is primarily forested (48.51%), and is also comprised of pasture lands (26.74%) and row crops (10.83%).



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

Survey Summary

Electrofishing sampling took place over the third week in July during the index period (July-Oct). Sampling conditions were favorable marked by low flows and high Secchi readings, with average readings for temperature, conductivity, and disolved oxygen. Three species considered to be "irruptive species" comprised 75.9% of the total catch: Gizzard Shad (*Dorosoma cepedianum*, n=1,034), Channel Shiner (*Notropis wickliffi*, n=318), and Emerald Shiner (*Notropis atherinoides*, n=278). Notable catches included one Ohio species of concern (River Redhorse, *Moxostoma carinatum*, n=1) and one individual that typically inhabits small-medium rivers was captured in between the Muskingum and Little Kanawha Rivers at RMI 176.4 (Silverjaw Minnow, *Notropis buccatus*). The results (see above map) show that, on average, fish populations in Cannelton Pool were in 'Good' condition. Macroinvertebrate collections in the Cannelton Pool did not meet the requisite number of samples necessary for application of the Ohio River Macroinvertebrate Index (ORMIn), with only 7 of the 15 samplers retrieved at the end of the colonization period. Macroinvertebrate will be resampled in 2025. Final assessment of the pool will remain "pending" until the results of the 2025 macroinvertebrate survey are known.

CONCLUSIONS

Pool Surveys

The fish assessment portion of the 2023 pool surveys was successfully completed during the normal sampling timeframe. Fish sampling took place from July 10th-13th (New Cumberland) and July 17th-20th (Cannelton) Electrofishing surveys took place under normal stage and flow conditions. Conditions allowed for adequate sampling of fish and macroinvertebrates during the respective index periods. The macroinvertebrate sampling for both pools was completed between August 28th- Oct. 20th. New Cumberland Pool was assessed as *meeting* its aquatic life-use designation for both fish and macroinvertebrates (i.e. containing healthy fish and macroinvertebrate communities). Cannelton Pool was assessed as meeting its aquatic life-use designation for fish, however due to human interference with the HDD samplers, macroinvertebrates will remain unassessed until 2025 when we are able to collect additional macroinvertebrate samples.

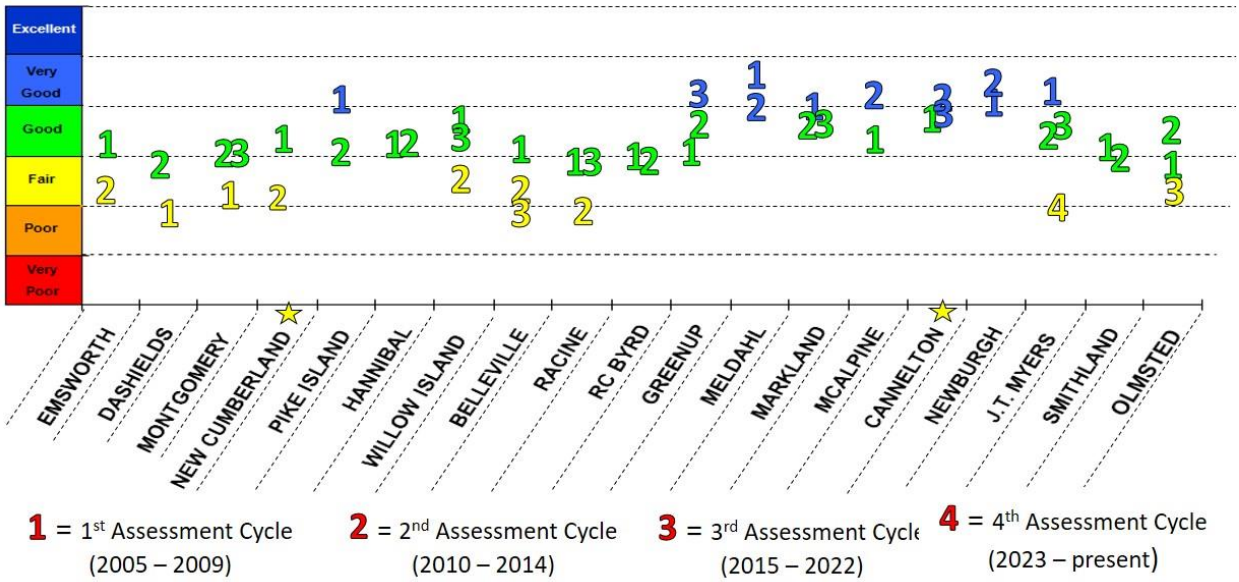
Assessment Comparisons

2023 was the first year of the 4th assessment cycle. All three cycles revealed the majority of the river to be in 'Good' condition, even though some pools changed in condition rating between surveys. The 2022 surveys concluded 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, and annual variations in flow, weather, and water quality.

Present vs. Past Assessments

The focus of ORSANCO's biological assessments is to determine whether each pool is in full support, partial support or non support of its ALU. 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.

A Mayfly hatch (*Hexagenia limbata*) oberserved in New Cumberland Pool.



CONCLUSIONS

New Cumberland Pool

(Fish = FAIR, Macros =GOOD)

Variable	2011	2017	2023
Environmental Factors			
Avg. seasonal flow (cfs)	--	High	Moderate
Range of Temperature (C)	24.7 - 25.8	24.7 - 25.9	25.8 - 27.7
Avg. Conductivity	685.5	302.2	424.9
Avg. Secchi Depth	66.5	31.4	85.1
Avg. % Non-Native Score	**90.0**	**76.6**	**64.7**
Eastern Banded Killifish	0	10	24
Avg. Great River Species Score	**20.0**	**8.9**	**2.2**
Species Richness	3	2	1
Number of Individuals	14	43	2
Avg. % Simple Lithophil Score	**23.0**	**37.0**	**54.3**
Logperch	15	15	190
Walleye	2	29	44
Avg. % Piscivore Score	**21.6**	**29.9**	**62.0**
% Total Catch	6.9%	19.4%	11.5%
Species Richness	9	11	12
Smallmouth Bass	142	241	301
Assessment Result			
Avg. mORFIn Score	**24.0**	**27.9**	**26.2**
Fish Condition Rating	**Fair**	**Fair**	**Fair**

New Cumberland Pool's fish community was assessed to be in "Fair" condition in 2023, exhibiting an unchanged condition rating over the past three assessments. The 15 randomly drawn sites were distributed fairly evenly throughout the 22.7 mile long pool, with five sites upstream and ten sites downstream of East Liverpool, OH. There was little change in abiotic water quality parameters over the three assessments, though higher Secchi depth was observed this year accompanied by low-moderate flows.

The fish community has demonstrated shifts in species composition over the past three assessments. Gizzard Shad abundance was substantially higher this year than in the previous two assessments, representing over two-thirds of the total catch. In 2011, Gizzard Shad represented 22.9% of the fish community with 96% of these individuals being comprised of juveniles (size class 1-3); in 2017, 2.3% of the observed fishes were Gizzard Shad with 88% being mature individuals (size classes 6-9); and in 2023 Gizzard Shad represented 68.1% of the sampled fishes with 100% of those individuals being juveniles (size class 1-2). The high occurrence of juveniles this assessment (n=3,995) is an example of an "irruptive species", which is not uncommon to observe with schooling fishes during a successful recruitment year, however it is a demonstration of how CPUE Score can be impacted or skewed. The CPUE Score remained fairly stable.

However, once the number of individual fish surpasses the 95th percentile (n=666.99) at any given site, additional fish have a diminishing impact on the CPUE score.

The % Simple Lithophil Score showed steady improvement over the past three assessments. The relative abundance of the predominant families in this breeding guild (Catostomidae and Percidae) were more evenly distributed among species in 2023 as opposed to being dominated by only a few taxa. This was partially unexpected due to the shifts in substrate composition known to be inhospitable to simple lithophils: declines in boulder, cobble, and gravel substrates, and an approximate 10% increase in fine sediments were observed throughout the pool.

Historical river conditions on the Ohio River lacked vegetation, however submerged aquatic vegetation (SAV) is well established in the New Cumberland pool presently. SAV increased between the second and third assessments, from 30.1% and 59.3% occurrence. The most abundant species was the invasive species, *Hydrilla verticillata*, which was present at all 15 sites and increased by 13%, from 13.6% to 27%, between the two assessments. Native species of SAV were also observed in higher abundances, specifically Eelgrass, Najas spp, and Waterstargrass. Cumulatively, these species comprised 8.9% and 29.2% of the observed SAV during the 2017 and 2023 surveys, respectively. It is speculated that this shift in available fish habitat has bolstered populations of non-native fishes like Eastern Banded Killifish, which we have observed in increasing numbers over the past three assessments (n=0, n=10, n=24, respectively).

CONCLUSIONS

Cannelton Pool

(Fish = GOOD, Macros =Unassessed)

Variable	2011	2016	2023
Environmental Factors			
Avg. seasonal flow (cfs)	**Moderate**	**Moderate**	**Moderate**
Range of Temperature (C)	29.1 – 30.5	27.1 – 28.6	27.0– 28.9
Avg. Conductivity	460.9	347.0	488.8
Avg. Secchi Depth	29.7	24.9	30.9
Avg. % Invert Score	**81.3**	**96.7**	**47.5**
Channel Shiner	2,787	1,822	176
Bluegill	241	65	113
Silver Chub	79	32	23
Avg. % Simple Lithophil Score	**13.3**	**29.6**	**66.5**
Sander	139	96	672
Moxostoma	19	66	109
Avg. Sucker Score	**44.5**	**51.0**	**57.7**
Species Richness	7	9	12
River Redhorse	0	4	14
% Piscivore Score	**5.7**	**14.4**	**51.2**
% Total Catch	4.8%	8.5%	34.8%
Percidae	139	96	672
Assessment Result			
Avg. mORFIn Score	**43.6**	**41.8**	**35.0**
Fish Condition Rating	**Very Good**	**Very Good**	**Good**

The Cannelton Pool has exhibited a decreasing *m*ORFIn score over the past three assessments, and was assessed to be in "Good" condition in 2023. The 15 randomly drawn sites were evenly distributed throughout the 113.9 mile long pool, with the three highest scoring sites in close proximity and situated close to tributaries: one site located just upstream of the Blue River and two sites just downstream of Wolf Creek. Abiotic water quality parameters did not seem to have an effect on the assessment, and little change occurred over the three assessments, though slightly lower temperatures and lower dissolved oxygen were observed this year.

Despite the decline in overall *m*ORFIn score, there are numerous fish metrics that increased over the past three assessments: Average Sucker Score, Average Great River Score, Percent Lithophil Score, and Percent Piscivore Score. Throughout the three assessments there has been an increasing presence of suckers (Catostomidae) exhibiting higher species diversity. Suckers comprised 5.3%, 3.08%, and 12.5% of the total catch, with an increase from 6, 8, to 10 species, respectively. Notable within this group is the reappearance of River Redhorse (n=14) and Highfin Carpsucker (n=1). The Great River Species Score was the highest of all three assessments this year, driven by the presence of Skipjack Herring (n=9), Mooneye (n=3), and the imperiled migratory Paddlefish (n=1). Simple lithophils comprised 4.2%, 9.9%, and 36.9% of the fish assemblage between the three assessments, respectively. The elevated abundance of simple lithophils in the 2023 assessment was primarily driven by Saugeye (n=612, mostly in size classes 4 and 5), which are around the size usually stocked by state wildlife agencies; however, the possibility of natural reproduction does exist as 16 individuals were captured within size classes 6-10. With removal of size class 4 and 5 fishes, under the premise that they could be classified as an "irruptive species", the abundance is much closer to that of the previous two assessments (10.3% of the total catch). The high occurrence of Saugeye was also the primary influence driving up the Percent Piscivore Score, but even if this outlier is removed, the piscivore abundance still exceeds those of the previous two assessments.

Fish metrics that have decreased over the past three assessments are as follows: Percent Non-native Score, Percent Invertivore Score, and Average CPUE Score. The number of fish surveyed steadily decreased over the past three assessments (n=7,948; n=3,507; n=2,402); this coupled with the presence of tolerant and exotic species, which are not included in the CPUE score, caused the the Average CPUE score to decrease by 54.1 points (75.0, 39.5, and 20.9, respectively). Additionally, the Percent Invertivore Score was lower this year compared to previous assessments, primarily reflected in the decreased abundance of invertivorous Cyprinids (n=2,960; n=1,999; n=248), specifically a decline in Channel Shiners, River Shiners, and Silver Chub.

CONCLUSIONS

Macroinvertebrates

As per ORSANCO's Biological Assessment protocol, a minimum of 15 fish samples and/or 10 macro samples are required to be collected in each pool in order to derive a viable assessment. The ten macro samples must be deep Hester-Dendy samples (HDD). Although multihabitat kick samples (MH) are collected they can only be used to provide a means of scoring single visit sites, such as fixed stations. These MH samples must contain at least 200 individuals to be used for assessment purposes. Minimum sample number criteria (15 fish and 10 macro respectively) are standardized and necessary to ensure comparability between assessments.

An Adult Burrowing Mayfly (*Hexagenia limbata*).

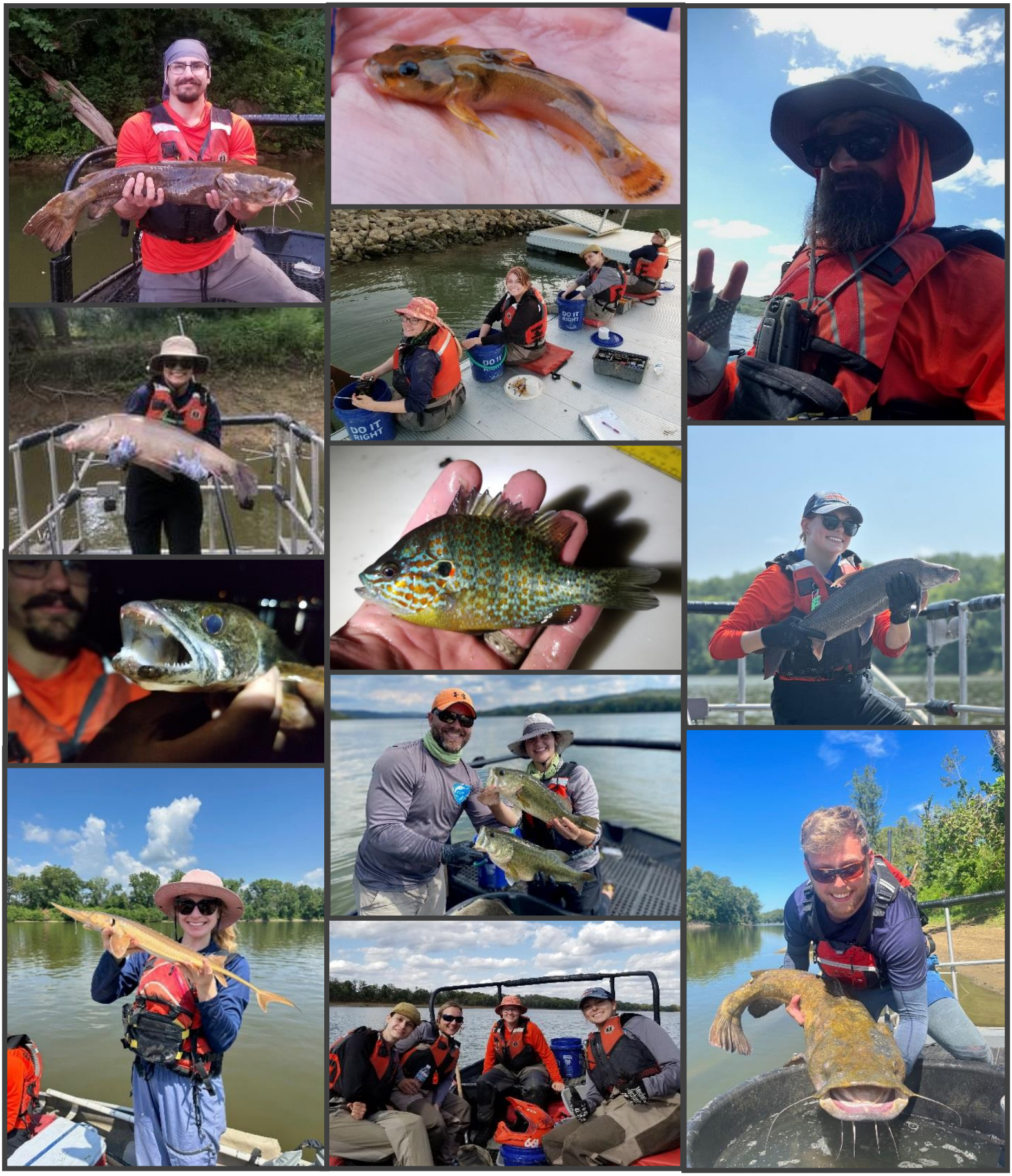
New Cumberland Pool

Macroinvertebrate collections in the New Cumberland Pool met the minimum number of samples with 14 HDD samplers recovered at the end of the colonization period. The Ohio River Macroinvertebrate Index (ORMIn) indicates that the macroinvertebrate community in New Cumberland Pool is in "Good" condition, with an average ORMIn score of 39.47. Three sites attained a score of 60, which is the maximum attainable ORMIn score; these sites were highly influenced by the following index metrics: Number of Taxa score, % Caenidae score, and Predators Taxa score. The macroinvertebrate community was characterized by a healthy balance of functional feeding groups, in terms of both diversity and abundance. New Cumberland demonstrated above average species richness, with 74 unique taxa present. Dipteran larvae (n=2,826) comprised 33.2% of the community, containing individuals from 24 different genera. Of the 16 EPT taxa observed, the majority of these were of the Ephemeroptera and Trichoptera orders. The Plecoptera representatives were Winter Stoneflies (*Taeniopteryx sp*; n=48), which are sprawler/clinger detritivores that are generally intolerant to pollution, though some species are adapted to large polluted rivers.

Seasonal biologists retrieve a Hester Dendy sampler at the end of the colonization period.

Cannelton Pool

Macroinvertebrate collections in the Cannelton Pool did not meet the requisite number of samples necessary for application of the ORMIn, with only 7 of the 15 HDDs retrieved at the end of the colonization period. The HDDs were deployed slightly above normal summer stage but after the colonization period was complete, river stage had dropped by approximately five feet, which resulted in the HDD sampler deployment lines being more visible than usual. Despite efforts to conceal the lines, many of them had been pulled out of the water by curious individuals, rendering them inefficatious. Due to inadequate HDD retrieval and recent analyses indicating that HDD and MH samples should not be used in conjunction with one another for producing final assessments, macroinvertebrates remain "Unassessed" for the 2023 assessment. Plans are in place to resample macroinvertebrates in Cannelton Pool in 2025, placing additional effort on HDD retrievel by deploying secondary HDDs at each site that can be used in the event that the primary HDD has been tampered with or lost. Final assessment of the pool will remain pending until the results of the 2025 survey are known.



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*).

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

Life Below the Waterline

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

Group	Species (common name)	Emsworth '18	Dashields '21	Montgomery '15	New Cumberland '17	Pike Island '18	Hannibal '21	Willow Island '16	Belleville '14	Racine '15	Robert C. Byrd '13	Greenup '16	Meldahl '17	Markland '21	McAlpine '21	Cannelton '16	Newburgh '17	John T. Myers '15	Smithland '13	Open Water '14
GAR	Longnose Gar	18	16	11	31	54	54	34	28	64	25	42	59	31	21	50	30	16	11	61
	Spotted Gar															1			2	
	Shortnose Gar												1				12	12	28	101
SHAD	Skipjack Herring							2			1				1	2	3	5	2	1
	Gizzard Shad	6	11	26	83	37	24	154	117	147	176	158	591	616	312	378	216	650	557	278
	Threadfin Shad																		14	74
CARP	Common Carp	12	25	45	75	16	11	11	26	3	32	7	13	15	3	3	4	8	7	2
	Grass Carp								1					1	1		2			1
	Silver Carp														1	3		15	17	25
	Bighead Carp																			
	Goldfish								1									1		
	Carp x Goldfish																			
MINNOW	Cyprinidae sp.																			
	Golden Shiner								1					1	1					1
	Striped Shiner				2		1						11							
	Spottail Shiner			4				11	2	4	1	2								
	Spotfin Shiner	76	81	68	165	61	60	295	58	127	19	52	19	8	18	73	8	112	218	14
	Notropis sp.																			
	Emerald Shiner	238	748	216	357	75	376	1085	240	1208	172	221	423	133	185	407	195	102	86	20
	Silverband Shiner																			
	Sand Shiner					70														
	Channel Shiner	1071	1423	323	845	484	391	1173	410	733	684	2017	872	685	145	1822	426	255	102	47
	River Shiner	1			42		1		5			16	69	47	94	145	47	104	8	15
	Shoal Chub																			
	Silver Chub	1							1		1	11	38	44	55	32	10	10	12	10
	Streamline Chub	6	4			5														
	River Chub																			
	Gravel Chub																			
	Creek Chub											1								
	Central Stoneroller					2		9					1							
	Mississippi Silvery																		15	
	Suckermouth Minnow																			
	Bluntnose Minnow	10	47	30	224	33	61	227	8	12		2	3	4			12	9		2
	Bullhead Minnow				0		3	12	5		1	17	14	11	1	11	13	24	1	6
	Silverjaw Minnow																			
SUCKER	Ictiobinae sp.																			

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

	Ictiobus sp.																1			
	Smallmouth Buffalo	22	43	82	37	42	14	26	38	33	32	19	45	24	9	17	11	32	106	32
	Bigmouth Buffalo											1			1		1	4	4	5
	Black Buffalo	5	20	18	13	13	1	3	7			3	14	21	9	2		2		10
	Carpiodes sp.						2		1							1				1
	Quillback	2	11	6	13	3	10	9	7	3	12	3	28	41	10	3	3	7	31	5
	River Carpsucker	4	43	47	15	5	8	18	33	20	26	38	151	181	92	19	48	187	263	139
	Highfin Carpsucker		1	12			3		3	8	1	6	6	8	1			3	91	3
	Northern Hog Sucker	7	8	6	16	4	1	8	1	5	2	1		1	5					
	Moxostoma sp.				22						1									
	Shorthead Redhorse																			10
	Smallmouth Redhorse	48	216	27	3	27	62	41	61	11	22	38	114	46	17	40	13			
	Silver Redhorse	131	189	215	122	26	118	42	31	16	22	39	31	26	7	5	2			
	River Redhorse	12	10	23	6	5		1		2	6	25	4	6	1	4				
	Black Redhorse	5		25	27	4		6												
	Golden Redhorse	34	177	156	442	116	439	219	64	56	56	124	112	65	31	17	25	8		1
	Spotted Sucker							13	8	1		2	1	1						
	White Sucker						2													
CATFISH	Yellow Bullhead																			
	Brown Bullhead																			
	Northern Madtom																			
	Blue Catfish															4		1	5	
	Channel Catfish	9	16	83	59	45	59	35	177	52	114	61	98	107	58	46	68	106	478	65
	Flathead Catfish	8	7	8	9	10	12	22	36	24	40	29	26	39	24	10	19	20	30	12
SUNFISH	Lepomis sp.																			5
	Warmouth													1						
	Rock Bass	31	28	22	238	35	14	11	2											
	Bluegill	20	105	88	215	138	129	540	391	220	254	205	73	490	154	65	32	65	270	41
	Green Sunfish	3	2	1	3	2	3	1	1	4	4	2	2	9	6	2	2	1		4
	Pumpkinseed		1	3	54	6	1	14		2	6									
	Orangespotted Sunfish		1				17	197		5		5	13	76		2	2	6	1	
	Longear Sunfish				1	20	173	18	24	13	56	15	17	134	88	31	32	137	207	16
SUNFISH	Redear Sunfish							2	7	2	3	4	2	13	3	20	8	1	32	
	Lepomis Hybrid				3	1			1		2				1				2	
	Bluegill X Longear																			
	Bluegill X Green									1										
	Longear X Green																			
TEMPERATE BASS	Morone sp.			3		1		49	79	8	15	35	25	140	36	28	37	72	86	733
	White Perch																2			
	Striped Bass								1		1		3				4			
	White Bass	3	10	7	3		27	4	16	1	71	16	59	95	41	20	43	13	83	34
	Yellow Bass															1			15	25

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

	Hybrid Striped Bass			2			6		3	1	2	6	16	13	7	13	6	2	6	10
BLACK BASS	Micropterus sp.	2			4	3		5			9		21	2		12	3	14		16
	Smallmouth Bass	229	177	184	241	169	58	198	27	41	38	24	55	65	20	13	11	2	2	7
	Largemouth Bass	3		12	16	17		20	10	19	18	18	6	19	20	4		2	10	6
	Spotted Bass	7	17	6	28	25	18	46	26	17	60	59	46	120	74	48	50	133	48	26
DARTER	Johnny Darter			1																
	Greenside Darter					1								1						
	Variegate Darter																			
	Rainbow Darter		1	2				1						1						
	Fantail Darter																			
	Bluebreast Darter																			
	Banded Darter																			
	Dusky Darter																			
	Channel Darter				1			1	1			1								
	Blackside Darter																			
	Slenderhead Darter																			
	River Darter																			
	Logperch	59	91	26	15	35	85	73	5	9	5	16	4	14	1	2		2		2
PERCH	Yellow Perch	1		44	15	9	1	7	3					1						
	Walleye	26	19	68	29	9	5	1	13	1			1		12		7	5		
	Saugeye		16	42	1	1	12		25	25			14	78	152	2	23	4	4	6
	Sauger	13	85	110	110	31	76	73	89	15	128	194	58	58	8	94	52	225	23	46
MISC.	Silver Lamprey	1	1									1								
	Ohio Lamprey								1											
MISCELLANEOUS	Goldeye																	10	1	
	Mooneye	2		26	11	3		2			3	2		2	12	5	4	1		1
	Paddlefish													1			1			
	Northern Pike	1																		
	Muskellunge	4																		
	White Crappie				2			1	4	2	1	6	2	3	1	3	3	7	2	1
	Black Crappie	1		9	8		1	4	6	6		6	10	1	2		2	7	5	
	Inland Silverside																		16	14
	Brook Silverside		1		4			1									2	1	1	
	Atlantic Needlefish																			
	Trout-Perch	9	22	137	21	14	3		2											
	Banded Killifish				10	1	16	14	1											
	Western Mosquitofish																	1		
	Bowfin																			
	Freshwater Drum	17	20	36	34	8	44	16	82	36	89	116	158	151	86	47	157	114	328	746
	Total No. of Individuals	**2158**	**3693**	**2260**	**3675**	**1666**	**2402**	**4755**	**2190**	**2957**	**2211**	**3666**	**3329**	**3650**	**1827**	**3507**	**1652**	**2518**	**3230**	**2680**
	Total No. of Species	**41**	**37**	**42**	**48**	**43**	**42**	**49**	**52**	**40**	**41**	**45**	**45**	**49**	**45**	**43**	**45**	**47**	**43**	**46**