2018 Ohio River Pool Assessments

Emsworth and Pike Island Pools

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Ohio River Valley Water Sanitation Commission
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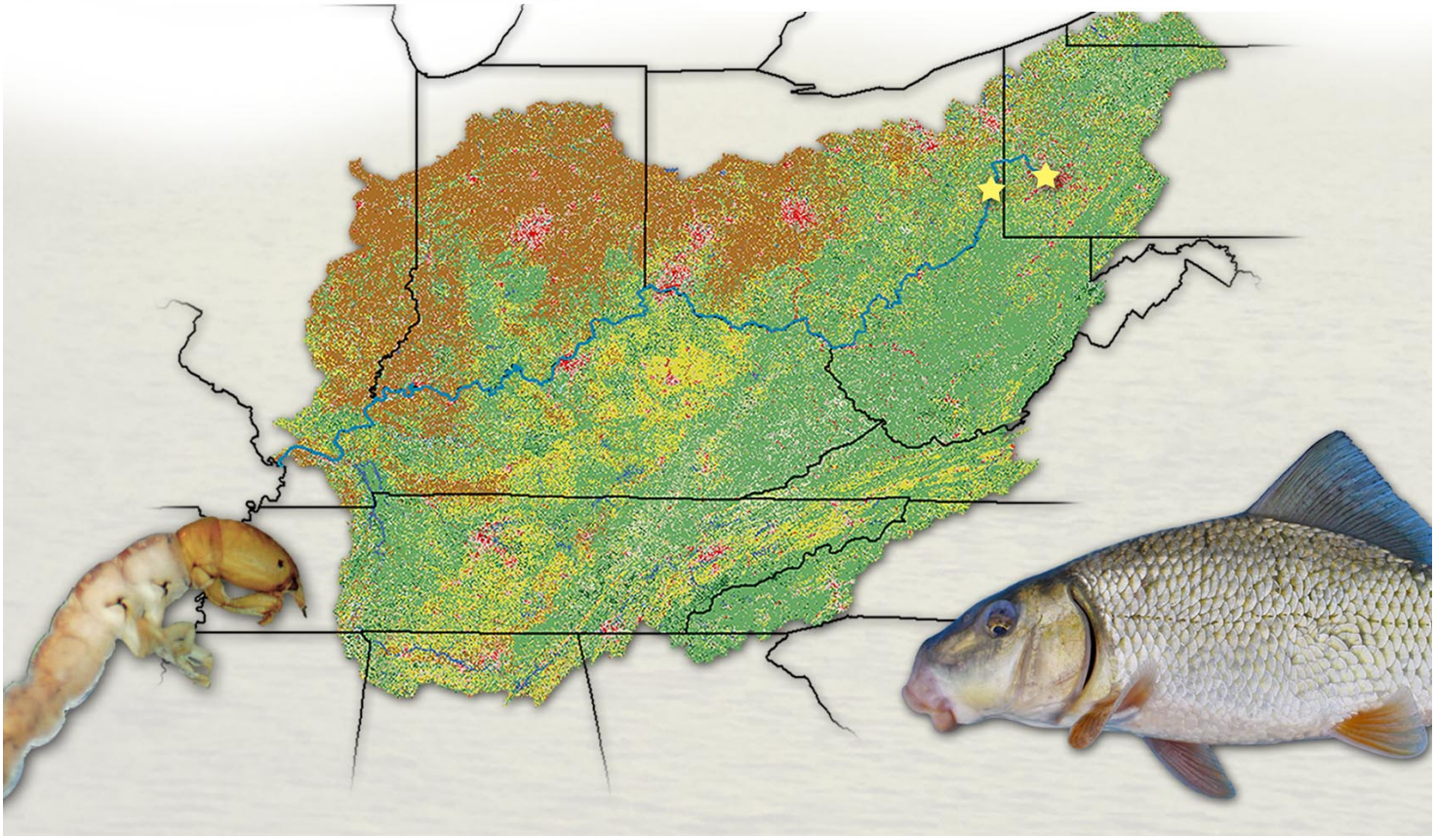

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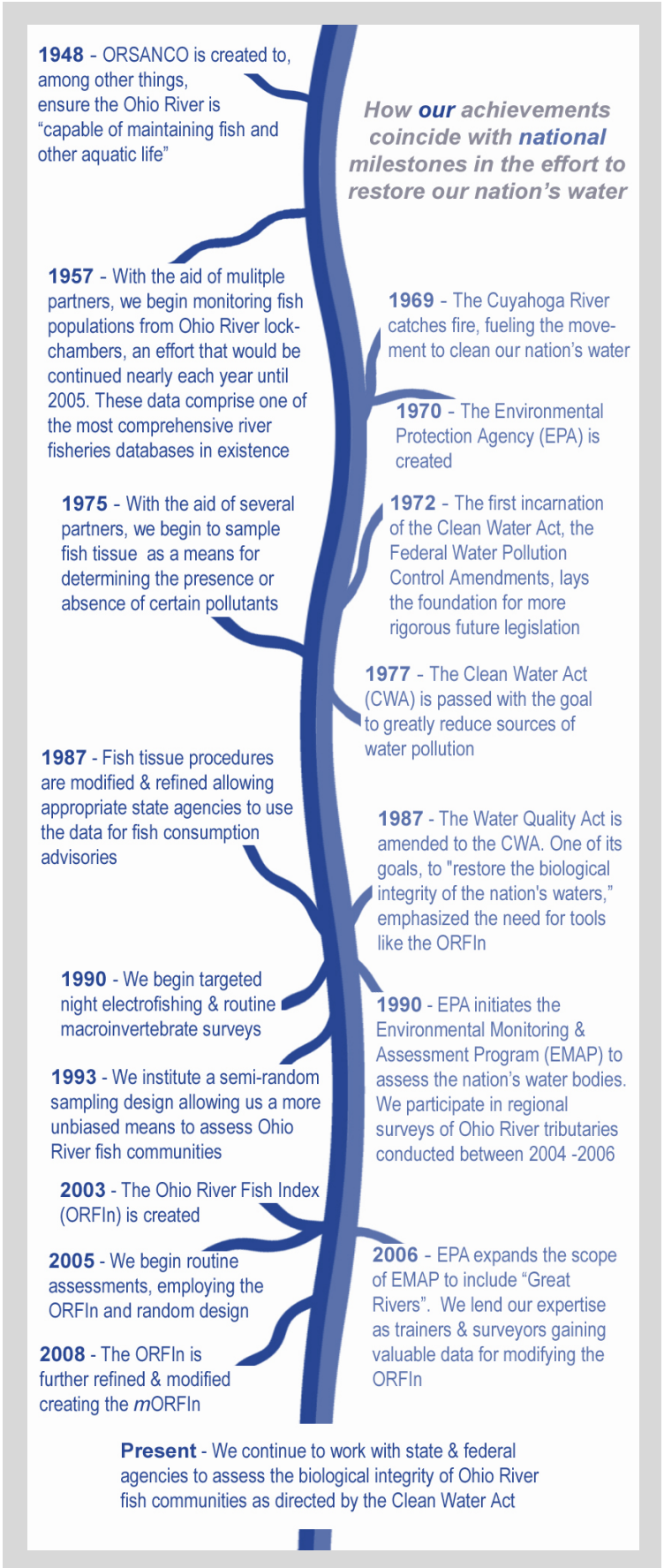
Introduction

Based in Cincinnati, the Ohio River Valley Water Sanitation Commission (ORSANCO) is an interstate water pollution control agency created in 1948 by an act of Congress to monitor and improve the water quality of the Ohio River. A primary goal of ORSANCO programs is to work with state agencies to develop a set of pollution control standards for the Ohio River. Monitoring programs were established to develop and refine these standards. One of these programs, the ORSANCO biological program, uses fish studies to establish biological criteria (biocriteria) for the Ohio River. These biocriteria are ultimately used to provide insight into the overall health of the river ecosystem.

In 1993, ORSANCO developed and implemented a survey design that used electrofishing methods designed for the Ohio River. After years of collecting fish population data on the Ohio River, we developed the original Ohio River Fish Index (ORFIn) which was subsequently modified (*m*ORFIn). Each year we collect fish and environmental data from various sections of the Ohio River and use these data to calculate *m*ORFIn scores, which are numerical representations of the relative condition of Ohio River fish communities based on a suite of measurable attributes. The resulting scores allow us to assess the biological condition of each section of the river. The information included in these assessments is further used for regulatory, restorative, and protective efforts within the Ohio River basin.



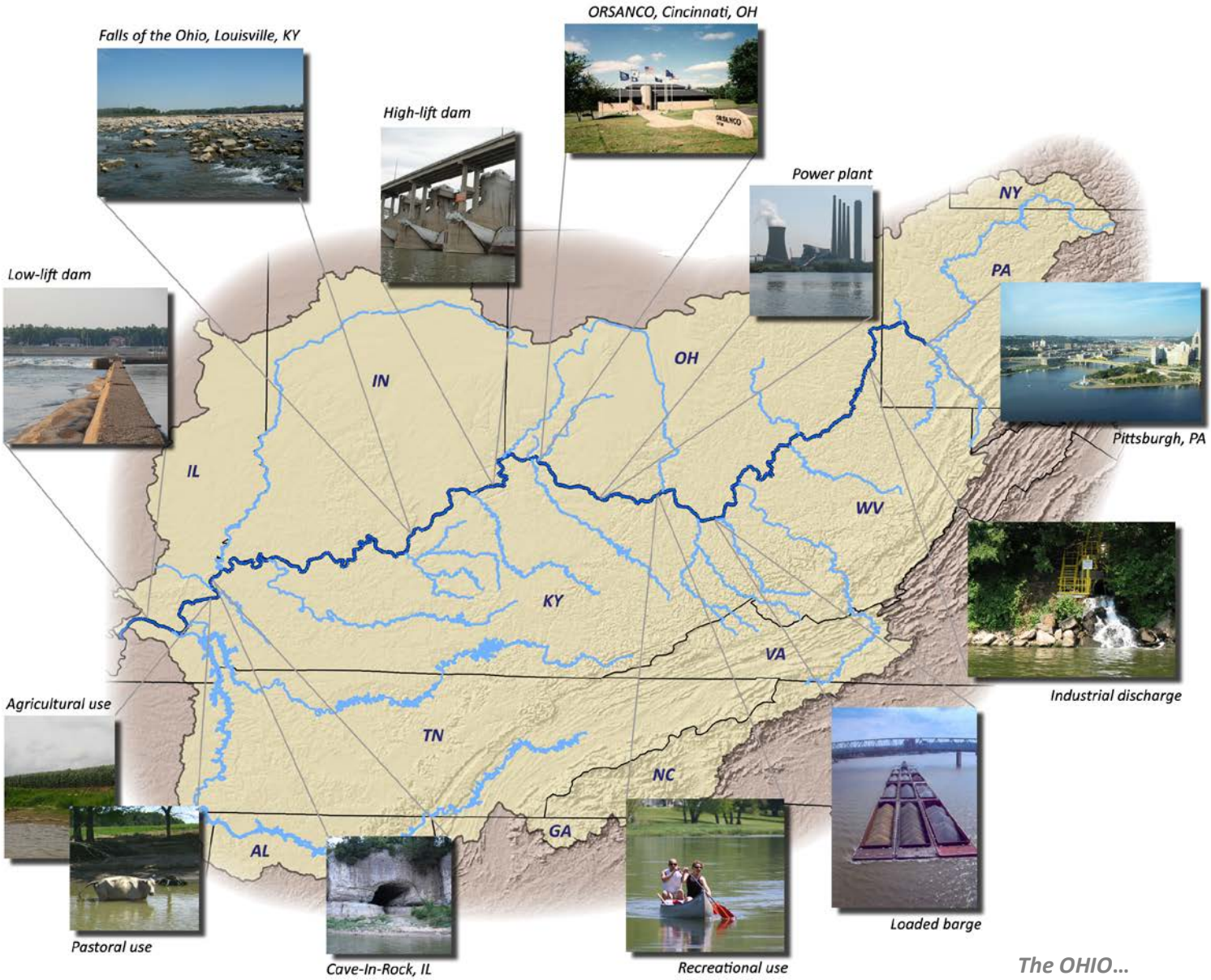
This report summarizes the 2018 Emsworth and Pike Island pool assessment survey findings.

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

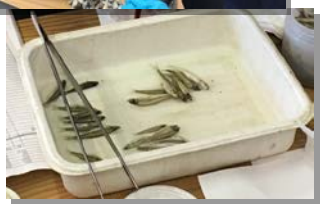
Site Selection

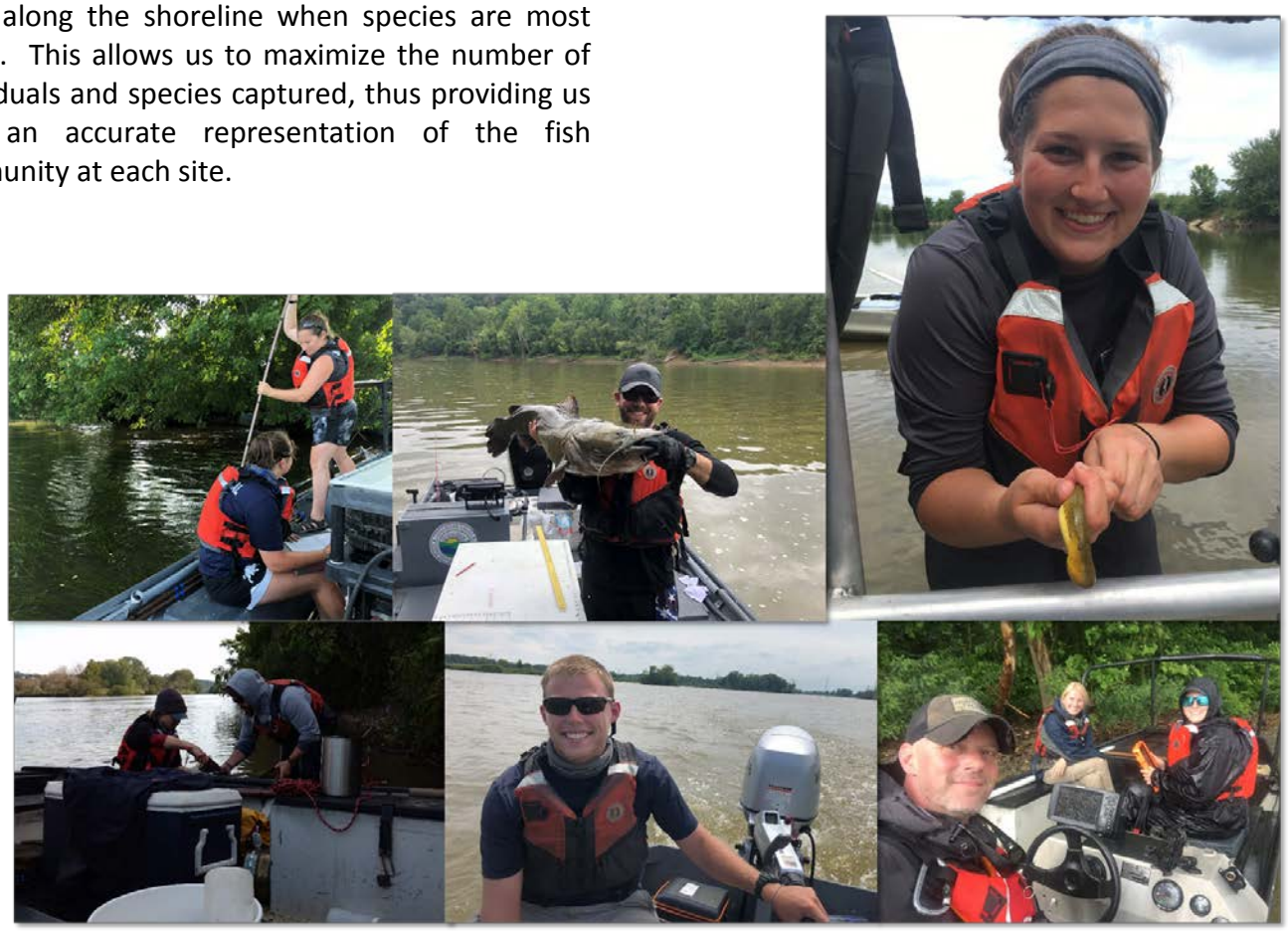
A random, probability-based survey design was used to select sampling site locations within each Ohio River navigational pool. The target areas of our surveys are both shorelines of each pool from the upstream dam to the downstream dam. The survey design provides coordinates for 15 sites (500m-long)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





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.

METHODS

Characterizing Instream Habitat

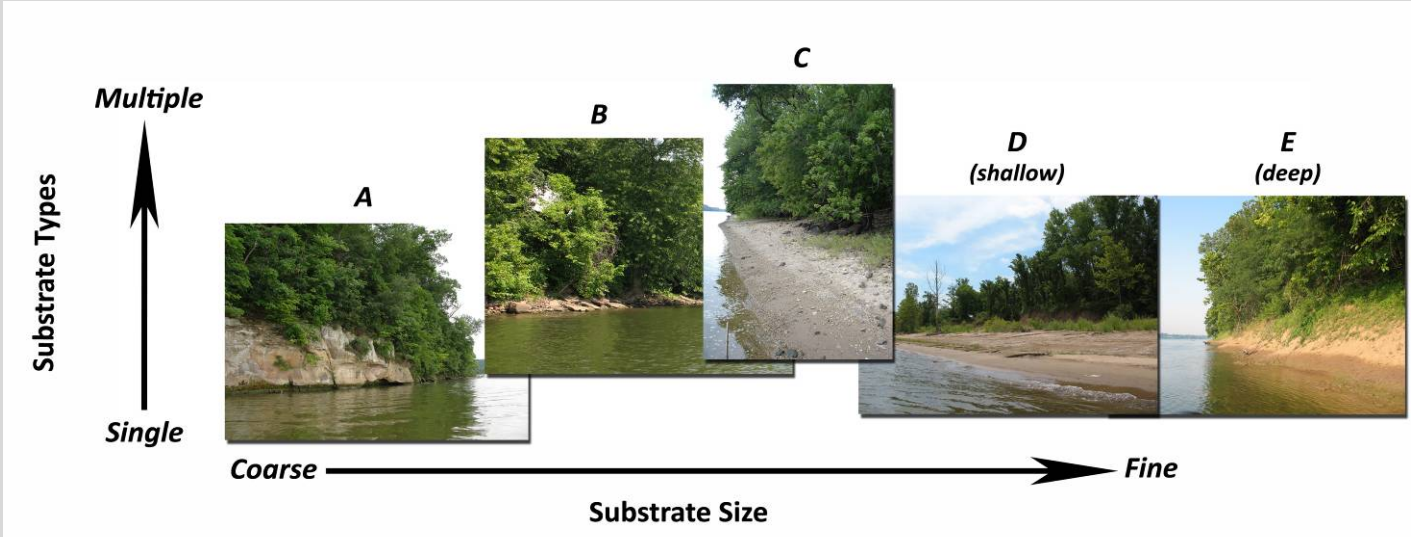
Intensive habitat surveys are conducted which include measures of woody cover, depth, prevalence of substrate types at each electrofishing site. Woody cover (e.g. submerged brush, logs, stumps) is estimated visually. More quantitative measures of depth and substrate proportions are obtained through the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



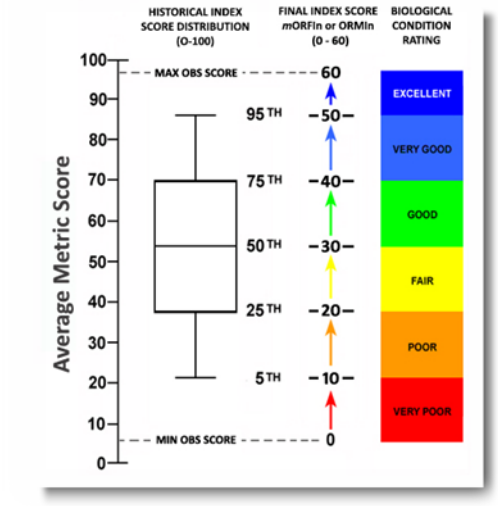
METHODS

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.

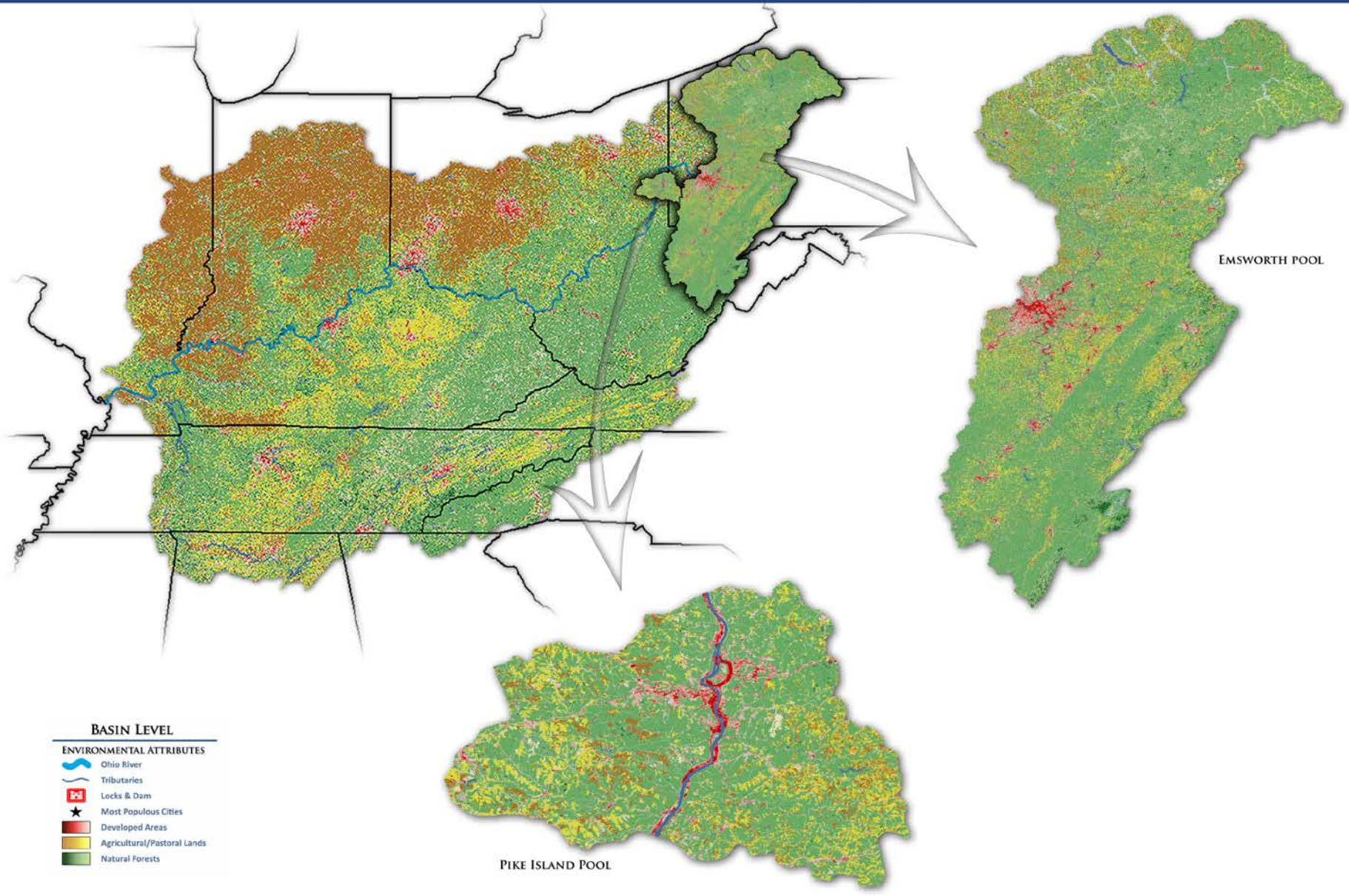
The averaged scores for both the *m*ORFIn and ORMIn are then compared to a biocriterion. The 25th percentile is the statistical threshold commonly used by regulatory agencies for establishing biocriteria. Using this threshold, our established biocriterion (i.e. a representation of healthy Ohio River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

2018 Pool Survey Results

The results of the 2018 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

Emsworth Pool (2018) - Healthy Condition

This page summarizes the 2018 fish and macroinvertebrate (macro) surveys conducted by ORSANCO biologists in the Emsworth 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. Emsworth Locks and Dam is the first lock system on the Ohio River below the confluence of the Allegheny and Monongahela rivers. The main stem portion of the pool is 6.2 miles long, extending from Pittsburgh Point (ORM 0.0) to Emsworth Locks and Dam (ORM 6.2). For the purpose of our biological assessment we extended this area upstream to the first dams on the Allegheny (6.2 miles) and Monongahela rivers (11.2 miles). The Ohio River portion of the pool averages 1,456 feet wide and 21 feet deep. The entirety of the pool lies in Pennsylvania, in an area where the immediate land use consists of residential and industrial development. However, the larger sub-basin of the pool is largely forested with some agricultural uses. The shorelines of the main stem portion of Emsworth are highly modified; the tributaries are also modified, but to a lesser extent.

Dominant Macro Groups

CADDISFLIES 34.2%

Cheumatopsyche sp

SCUDS 17.7%

Gammarus sp

MIDGES 14.7%

Dicrotendipes sp

MAYFLIES 14.5%

Stenacron sp

MUSSELS 4.2%

Dreissena polymorpha

Dominant Fish Families

MINNOWS 65.5%

Channel Shiner

SUNFISH & BASS 13.7%

Smallmouth Bass

SUCKERS 12.5%

Silver Redhorse

PERCHES 4.8%

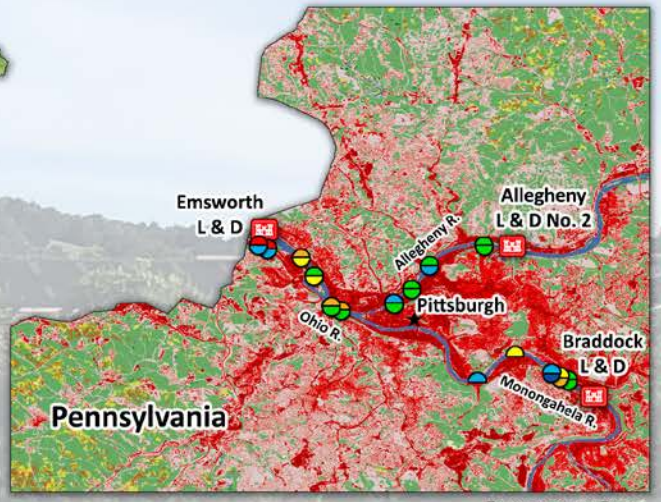
Walleye

GAR 0.8%

Longnose Gar

OHIO RIVER BASIN

EMSWORTH POOL SUB-BASIN



EMSWORTH 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

Though the pool was sampled at normal conditions during the normal index period, the water level had just returned to normal conditions after months of high flow events when sampling commenced. Notable catches include members of the genus Esox (Muskellunge and Northern Pike; 5 individuals collected), as well as a species not collected in previous surveys of Emsworth Pool, the Longhead Darter (*Percina macrocephala*; 4 individuals collected). Notable macroinvertebrate collections from Emsworth Pool included large numbers of several tolerant species (Scuds-*Gammarus sp*, Caddisflies-*Cyrnellus fraternus*, and Midges-*Dicrotendipes sp.*) as well as low numbers of rarely observed intolerant species (Midges-*Ablabesmyia annulata* and Snails-*Pleurocera acuta*). 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 populations in Emsworth Pool were in 'Fair' condition and macro communities were in 'Good' condition. Overall, these results indicate that Emsworth Pool harbored healthy aquatic communities.

POOL SUBSTRATE COMPOSITION

www.orsanco.org

Pike Island Pool (2018) - Healthy Condition

Dominant Macro Groups

MUSSELS 22.8%

Dreissena polymorpha

MAYFLIES 20.5%

Stenacron sp

MIDGES 13.4%

Dicrotendipes sp

SCUDS 10.3%

Gammarus sp

SNAILS 5.2%

Amnicola sp

BOULDER 4.7%

COBBLE 15.8%

GRAVEL 26.4%

SAND 28.0%

FINES 21.4%

HARDPAN 1.4%

OTHER 2.3%

Pool Substrate Composition

This page summarizes the 2018 fish and macroinvertebrate (macro) surveys conducted by ORSANCO biologists in the Pike Island 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 Pike Island pool is 29.8 miles long, extending from New Cumberland Locks and Dam (ORM 54.4) to Pike Island Locks and Dam (ORM 84.2). The pool has a gradient drop of 0.4 feet per mile and averages 1,338 feet wide and 19 feet deep. The pool flows adjacent to the states of West Virginia and Ohio. The area is heavily influenced by industry with a large amount of barge activity. The shorelines of this pool support a moderate degree of aquatic vegetation, and littoral zones are dominated by invasive species (*Hydrilla sp.*). The Pike Island pool receives water from several small tributaries (Buffalo and Short creeks) and its sub-basin is largely forested with a considerable amount of row crops and pasture lands.

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

Though the pool was sampled during the normal index period and normal conditions, the water level had just returned to normal conditions after months of significant high flow events when sampling commenced. The combination of long periods of high flows and low water clarity are likely major contributing factors to the lower than average CPUE score. The 2018 fish results continued the trends of decreasing pelagic predators (White Bass - *Morone chrysops*, Sauger - *Sander canadensis*) **and increasing sunfishes (**Bluegill - *Lepomis macrochirus*, Rock Bass – *Ambloplites rupestris*) **observed since the arrival of the invasive aquatic plant *Hydrilla verticillata*. Notable macroinvertebrate collections from Pike Island Pool included numerous odonates and snails, as well as large numbers of the tolerant scud *Gammarus fasciatus*. High flows during the macro sampling period drastically affected the recovery rate of Hester-Dendy samplers (HDs), only 9/15 were recovered. Because there were not enough HDs recovered for proper analysis, Pike Island Pool was assessed using only fish data to apply numeric values to important components of the fish assemblages and assess their relative status** (macro group information can still be seen on left)**. The results (see above map) show that, on average, fish populations in Pike Island Pool were in 'Fair' condition.**

Dominant Fish Families

MINNOWS 44.8%

Channel Shiner

SUNFISH & BASS 13.7%

Smallmouth Bass

SUCKERS 5.2%

Golden Redhorse

PERCHES 5.0%

Sauger

CATFISH 2.6%

Channel Catfish

CONCLUSIONS

Pool Surveys

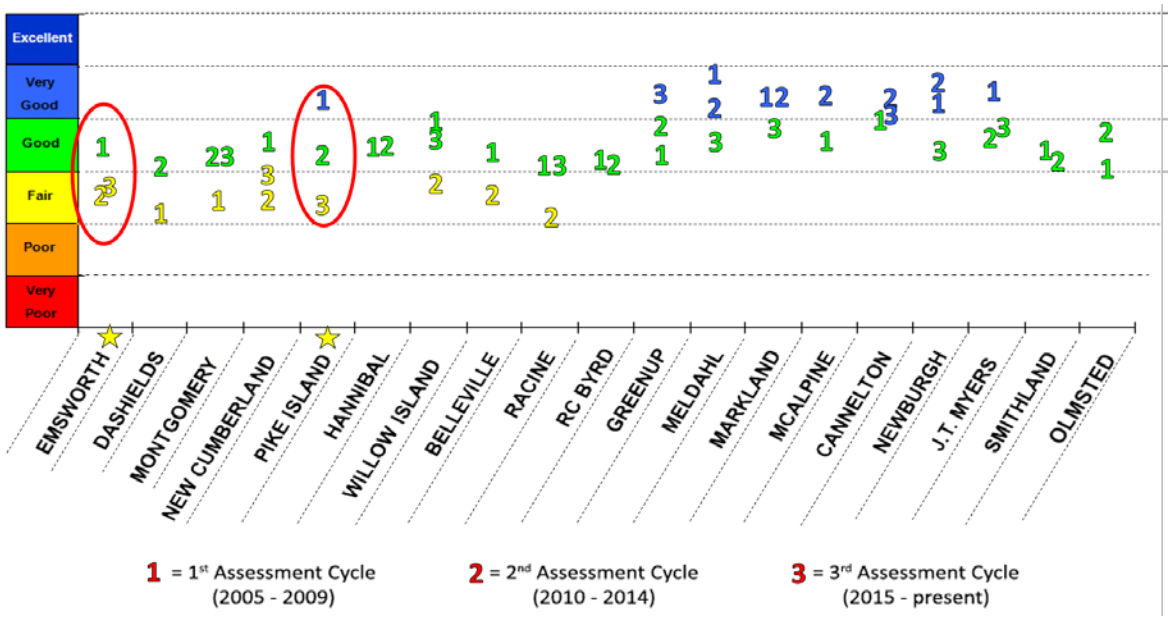
The fish assessment portion of the 2018 pool surveys was successfully completed between July 9th and 18th. Due to frequent rain events, flows were elevated most of spring, summer and fall. Stage returned to close to normal levels the week before electrofishing commenced. Long periods of high flow events prior to sampling are likely major contributing factors to low CPUE scores and lower mORFIn scores than previously observed. The macroinvertebrate assessment was completed between September 4th and October 25th. Emsworth Pool was assessed as *meeting* its aquatic life-use designation for both fish and macroinvertebrates. (i.e. containing healthy fish and macroinvertebrate communities). Pike Island Pool met its aquatic life-use designation for fish while macroinvertebrates were unassessed in 2018

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 2018 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 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.



River-wide Assessment Comparison

The 2018 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

Emsworth Pool

(Fish = GOOD, Macros = GOOD)

Variable	2007	2012	2018
Environmental Factors			
Avg. seasonal flow (cfs)	**low**	**low**	
Avg. Conductivity	441.1	488.2	383.5
Avg. Secchi Depth	46.8	45.7	33.1
Avg. % Tolerant Score	**62.5**	**35.2**	**81.9**
Avg. % Non-Native Score	**68.1**	**64.9**	**93.6**
Common Carp	63	48	12
White Perch	5	0	0
Avg. % Simple Lithophil	**59.9**	**26.8**	**23.5**
Avg. % Piscivore Score	**59.4**	**52.0**	**42.2**
Sauger	283	39	13
Spotted Bass	125	24	7
Avg. Great River Species Score	**55.6**	**13.3**	**8.9**
Silver Chub	26	0	1
Mooneye	20	10	2
Assessment Result			
Avg. mORFIn Score	34.20	26.63	27.83
Fish Condition Rating	Good	Fair	Fair

Emsworth pool was assessed in Fair condition in 2018, which was the same condition rating assessed in 2012, dropping one condition rating from the 2007 assessment. The 15 sites were evenly distributed throughout the pool. Shorelines were highly modified with the least amount of littoral anthropogenic disturbance observed at sites located on the Monongahela River. The primary influential factor in the decline of the biological condition rating was the Great River Species metric score, namely, fewer observed Silver Chub and Mooneye. Scores were likely affected by numerous rain events and subsequent high stage and flooding prior to and during the index period.

Pike Island Pool

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

Variable	2007	2012	2018
Environmental Factors			
Avg. seasonal flow (cfs)	**low**	**low**	
Avg. Conductivity	541.9	517.1	353.1
Avg. Secchi Depth	47.6	56	37.5
CPUE Score	**63.8**	**69.7**	**7.0**
Avg. % Tol Score	**90.9**	**63.9**	**63.3**
Bluntnose Minnow	2	28	33
Common Carp	15	36	16
Avg. % Piscivore Score	**70.5**	**52.8**	**39.4**
Sauger	244	39	31
Morone sp.	419	110	1
Flathead Catfish	35	47	10
Avg. GrRiver Score	**48.9**	**4.8**	**6.7**
Mooneye	37	2	3
Silver Chub	11	0	0
Avg. Intolerant Score	**57.7**	**57.2**	**43.8**
Logperch	85	40	35
Avg. Sucker Score	**69.8**	**46.4**	**34.0**
Total Round Bodied Suckers	203	143	182
Total Deep Bodied Suckers	186	105	63
Assessment Result			
Avg. mORFIn Score	**43.0**	**32.9**	**24.2**
Fish Condition Rating	Very Good	Good	Fair

Pike Island Pool was assessed to be in Fair condition in 2018. Conductivity and average Secchi depth declines were similar to Emsworth Pool as both pools experienced the same inclement weather conditions and subsequent flow regime fluctuations. Metric performance revealed effects of low numbers of great river species. 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. Conductivity, average Secchi depth and CPUE have decreased with each assessment cycle. Great river species observations continue to decline. 2018 habitat observations revealed a greater number of higher rated habitats (i.e. more B versus C class habitat types) than in previous assessments, therefore increasing metric performance expectations. Although the observed fish community observations were similar, the higher expectation associated with more favorable habitat class designations demonstrates a lower overall condition rating for 2018.

Native Ohio River Fish collected in 2018. Left Top: Silver Chub; Left Bottom: Mooneye; Right Bottom: Muskellunge (juvenile)

CONCLUSIONS

Pike Island Pool Macroinvertebrates

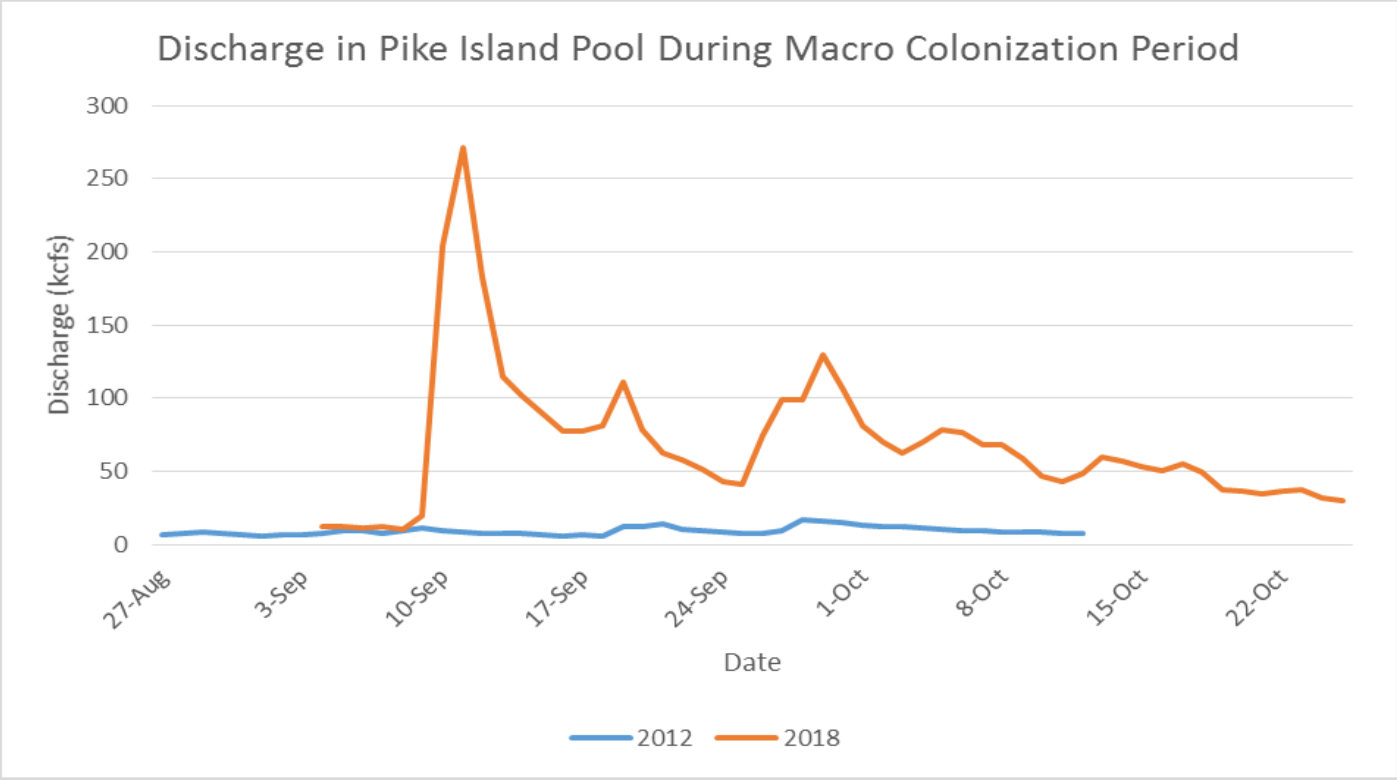
As per ORSANCO's Biological Assessment protocol, a minimum of 15 fish samples and / or 10 macro samples are required to be collected in each pool in order to derive a viable assessment. The 10 macro samples must be comprised of deep Hester-Dendy samplers and / or multihabitat kick samples. Multihabitat kick samples will only be used when deep Hester-Dendy samples are lost, unrecoverable or otherwise disturbed, provided the multihabitat kick samples contain at least 200 individuals. Minimum sample number criteria (15 fish and 10 macro respectively) are standardized and necessary to ensure comparability between assessments.

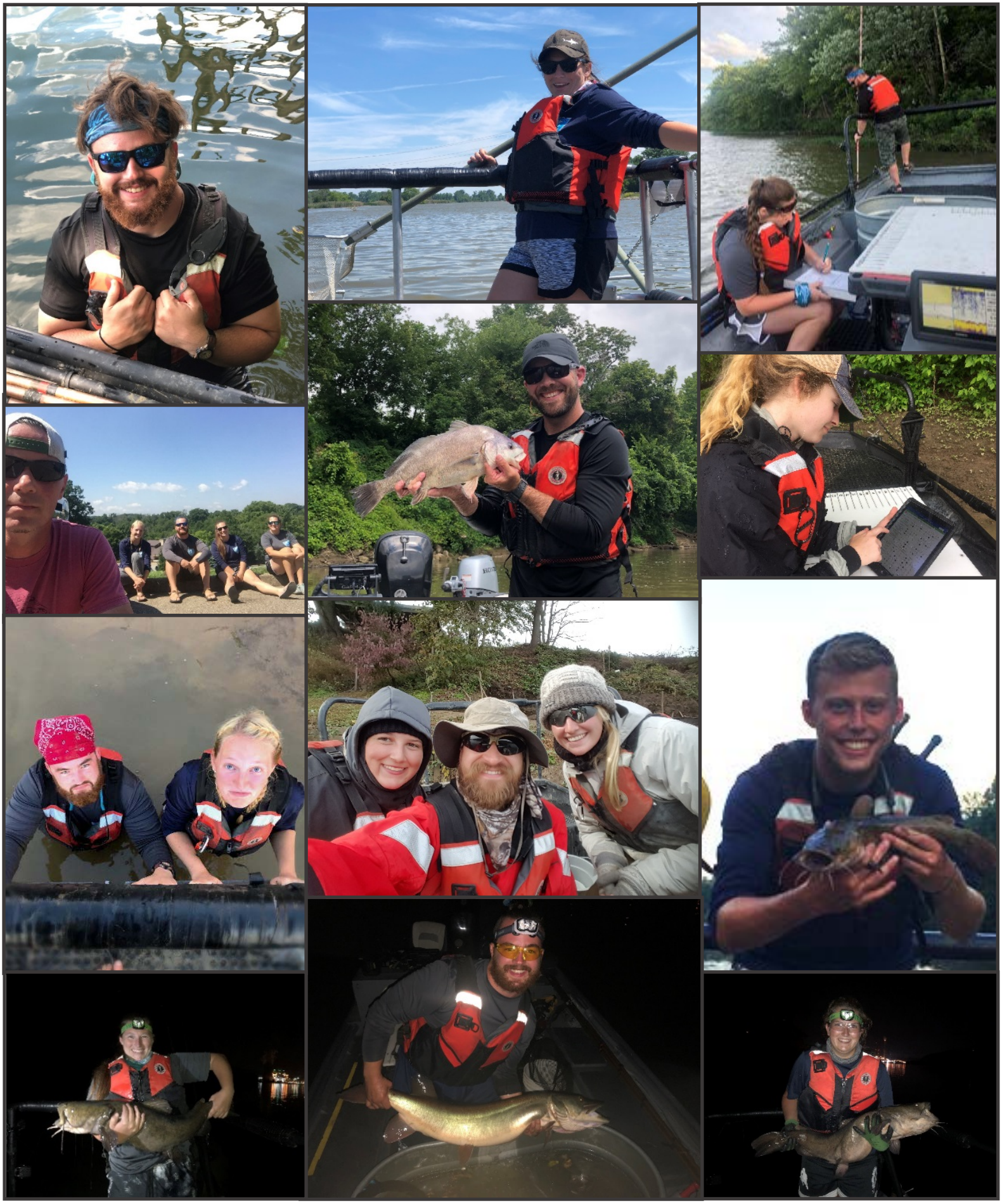
Macroinvertebrate collections in Pike Island Pool did not yield the minimum number of samples in 2018. Only nine of 15 deep Hester Dendy samplers were recovered at the end of the colonization period, and none of the remaining six multihabitat kick samples contained the minimum 200 individuals.

During the previous Pike Island Pool macro colonization period in 2012, Ohio River discharge was more in line with historic stable conditions than the 2018 colonization period, were rain events produced much higher flow fluctuations.

Increased discharge and river velocities buried five of the unrecovered deep Hester Dendy samplers under sediment and debris, while the sixth was displaced onto shore by strong current and was thus unusable. Although the collected samples produced index scores reflective of healthy macro populations in Pike Island Pool, without the minimum number of samples required, a proper assessment could not be performed using the ORMIn. As such the Pike Island Pool was not assessed using macro data in 2018. However, based on the fish data and the results calculated using the *m*ORFIn, the pool met its aquatic life use designation for this assessment cycle.

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*).

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 '13	Montgomery '15	New Cumberland '17	Pike Island '18	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	**18**	19	11	31	**54**	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	**6**	37	26	83	**37**	43	154	117	147	176	158	591	274	54	378	216	650	557	278
	Threadfin Shad																		14	74
CARP	Common Carp	**12**	70	45	75	**16**	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																			
MINNOW	Cyprinidae sp.																			
	Golden Shiner								1											1
	Striped Shiner				2								11		5					
	Spottail Shiner			4				11	2	4	1	2			3					
	Spotfin Shiner	**76**	35	68	165	**61**	72	295	58	127	19	52	19	10	28	73	8	112	218	14
	Notropis sp.																			
	Emerald Shiner	**238**	46	216	357	**75**	79	1085	240	1208	172	221	423	470	227	407	195	102	86	20
	Silverband Shiner																			
	Sand Shiner					**70**														
	Channel Shiner	**1071**	108	323	845	**484**	167	1173	410	733	684	2017	872	897	609	1822	426	255	102	47
	River Shiner	**1**			42				5			16	69	156	30	145	47	104	8	15
	Shoal Chub																			
	Silver Chub	**1**							1		1	11	38	33	51	32	10	10	12	10
	Streamline Chub	**6**	1			**5**														
	River Chub																			
	Gravel Chub																			
	Creek Chub											1								
	Central Stoneroller					**2**	1	9					1	1	3					
	Mississippi Silvery																		15	
	Suckermouth Minnow																			
	Bluntnose Minnow	**10**	1	30	224	**33**	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																			
SUCKER	Ictiobinae sp.																			

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

	Ictiobus sp.																1			
	Smallmouth Buffalo	**22**	84	82	37	**42**	40	26	38	33	32	19	45	89	31	17	11	32	106	32
	Bigmouth Buffalo											1					1	4	4	5
	Black Buffalo	**5**	4	18	13	**13**	4	3	7			3	14	5	4	2		2		10
	Carpiodes sp.								1					1		1				1
	Quillback	**2**	13	6	13	**3**	14	9	7	3	12	3	28	61	9	3	3	7	31	5
	River Carpsucker	**4**	47	47	15	**5**	33	18	33	20	26	38	151	221	161	19	48	187	263	139
	Highfin Carpsucker		14	12			5		3	8	1	6	6	4	4			3	91	3
	Northern Hog Sucker	**7**		6	16	**4**	6	8	1	5	2	1			6					
	Moxostoma sp.				22		3				1									
	Shorthead Redhorse																			10
	Smallmouth Redhorse	**48**	153	27	3	**27**	54	41	61	11	22	38	114	44	31	40	13			
	Silver Redhorse	**131**	252	215	122	**26**	59	42	31	16	22	39	31	19	14	5	2			
	River Redhorse	**12**	65	23	6	**5**	12	1		2	6	25	4		1	4				
	Black Redhorse	**5**	10	25	27	**4**	16	6												
	Golden Redhorse	**34**	155	156	442	**116**	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																			
	Northern Madtom																			
	Blue Catfish													2		4		1	5	
	Channel Catfish	**9**	63	83	59	**45**	83	35	177	52	114	61	98	112	122	46	68	106	478	65
	Flathead Catfish	**8**	6	8	9	**10**	39	22	36	24	40	29	26	21	19	10	19	20	30	12
SUNFISH	Lepomis sp.													2	2					5
	Warmouth														3					
	Rock Bass	**31**	89	22	238	**35**	64	11	2											
	Bluegill	**20**	34	88	215	**138**	523	540	391	220	254	205	73	207	89	65	32	65	270	41
	Green Sunfish	**3**	3	1	3	**2**	2	1	1	4	4	2	2	1	1	2	2	1		4
	Pumpkinseed		4	3	54	**6**	33	14		2	6									
	Orangespotted Sunfish						5	197		5		5	13			2	2	6	1	
	Longear Sunfish		1		1	**20**	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.			3		**1**	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	**3**	65	7	3		28	4	16	1	71	16	59	18	18	20	43	13	83	34
	Yellow Bass															1			15	25

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

	Hybrid Striped Bass		5	2			2		3	1	2	6	16	3	1	13	6	2	6	10
BLACK BASS	Micropterus sp.	**2**	1		4	**3**		5			9		21	10	18	12	3	14		16
	Smallmouth Bass	**229**	250	184	241	**169**	270	198	27	41	38	24	55	19	15	13	11	2	2	7
	Largemouth Bass	**3**	3	12	16	**17**	7	20	10	19	18	18	6	12	10	4		2	10	6
	Spotted Bass	**7**	18	6	28	**25**	99	46	26	17	60	59	46	51	38	48	50	133	48	26
DARTER	Johnny Darter			1																
	Greenside Darter					**1**	1													
	Variegate Darter																			
	Rainbow Darter			2				1							1					
	Fantail Darter													1	1					
	Bluebreast Darter																			
	Banded Darter																			
	Dusky Darter																			
	Channel Darter				1		1	1	1			1								
	Blackside Darter																			
	Slenderhead Darter																			
	River Darter						2							1						
	Logperch	**59**	15	26	15	**35**	89	73	5	9	5	16	4	14	9	2		2		2
PERCH	Yellow Perch	**1**		44	15	**9**	5	7	3											
	Walleye	**26**	74	68	29	**9**	10	1	13	1			1		1		7	5		
	Saugeye		11	42	1	**1**	1		25	25			14	22	8	2	23	4	4	6
	Sauger	**13**	264	110	110	**31**	147	73	89	15	128	194	58	116	226	94	52	225	23	46
MISC.	Silver Lamprey	**1**										1								
	Ohio Lamprey		2						1											
MISCELLANEOUS	Goldeye														1			10	1	
	Mooneye	**2**	1	26	11	**3**	2	2			3	2		5	1	5	4	1		1
	Paddlefish																1			
	Northern Pike	**1**																		
	Muskellunge	**4**	1																	
	White Crappie				2			1	4	2	1	6	2	4	1	3	3	7	2	1
	Black Crappie	**1**	4	9	8		1	4	6	6		6	10	2			2	7	5	
	Inland Silverside																		16	14
	Brook Silverside				4		3	1							1		2	1	1	
	Atlantic Needlefish																			
	Trout-Perch	**9**	11	137	21	**14**			2											
	Banded Killifish				10	**1**	5	14	1											
	Western Mosquitofish																	1		
	Bowfin																			
	Freshwater Drum	**17**	136	36	34	**8**	47	16	82	36	89	116	158	146	238	47	157	114	328	746
	Total No. of Individuals	**2158**	**2177**	**2260**	**6071**	**1666**	**2819**	**4755**	**2190**	**2957**	**2211**	**3666**	**3329**	**3205**	**2344**	**3507**	**1652**	**2518**	**3230**	**2680**
	Total No. of Species	**41**	**43**	**42**	**40**	**43**	**50**	**49**	**52**	**40**	**41**	**45**	**45**	**46**	**53**	**43**	**45**	**47**	**43**	**46**