

Ohio River Basin Asian Carp Control Strategy Framework

Ohio River Fisheries Management Team
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Overview

*Invasive Bighead Carp and Silver Carp are increasing in abundance and expanding their range in the Ohio River and the western Ohio River basin. Significant populations are established downstream of the McAlpine Locks and Dam near Louisville, Kentucky and adult fish are documented to be expanding their range upstream. The **Ohio River Basin Asian Carp Control Strategy Framework** briefly outlines actions for prevention, monitoring and response, population control, understanding impacts, and communication to collectively prevent further expansion, reduce populations, and better understand the impacts of Asian carp. Implementing the **Control Strategy Framework** is intended to minimize the social, ecological, and economic impacts of these invasive fishes. The coordinated strategies outlined in this document directly meet the goals, as specified by the United States Congress in Section 1039 (b) of the Water Resources Reform and Development Act of 2014 (WRRDA), of controlling the spread of Asian carp in the Upper Mississippi and Ohio River basins and tributaries by carrying out activities designed to slow and eventually eliminate the threat posed by these species.*

Introduction

The Ohio River, its tributaries, and the aquatic resources that they sustain are extensive and important (Stark 2011). The Ohio River forms at the confluence of the Allegheny and Monongahela rivers in Pittsburgh, Pennsylvania, and flows 981 miles to its confluence with the Mississippi River in Cairo, Illinois. The Ohio River is the second largest river in the United States as measured by annual discharge with a drainage basin. The Ohio River basin encompasses more than 204,000 square miles and 47,500 rivers and streams in portions of 14 states and is home to more than 25 million U.S. citizens in 67 Congressional Districts (USACE 2009; Figure 1).

The Ohio River and its tributaries have some of the world's most diverse riverine fish and mussel assemblages. Nearly one-half of the freshwater fish species and over one-third of all mussel species in the United States reside within the basin (NatureServe 2010). This rich biodiversity includes at least 350 fish species ranging from small, endemic darters and dace found in headwater streams to large, migratory, great river species such as Paddlefish, Blue Sucker, Blue Catfish, Lake Sturgeon, and Shovelnose Sturgeon found in the mainstem. More than 120 mussel species inhabit the basin, including many that are federally listed as threatened or endangered (Stark 2011). A number of resident fishes are important sport species, including Walleye, Sauger, Smallmouth Bass, Largemouth Bass, Spotted Bass, Striped Bass, White Bass, Hybrid Striped Bass, Channel Catfish, Flathead Catfish, and Blue Catfish. Sport fishing is a major recreational activity in the Ohio River and its tributaries. A 1991-92 creel survey documented over 2.5 million angling hours of effort, with a corresponding economic value of 34 million dollars, and 2.8 million fish caught in just the West Virginia, Ohio, Kentucky, and Indiana portions of the mainstem Ohio River (Schell et al. 1998). Additionally, commercial fisheries in Kentucky, Indiana, and Illinois harvest Paddlefish, Catfishes, Smallmouth Buffalo, Largemouth Buffalo, Freshwater Drum, and Common Carp. According to the USACE (2012), 1.4 million pounds per year are harvested with a dockside value of \$2.0 million.

Over the past 150 years, resident fishes and mussels have been impacted by water quality degradation and physical habitat destruction. Although the basin's riverine ecosystems have undergone various stages of recovery over the past several decades, new and continuing threats have the potential to impede any desired recoveries, including the invasion of Asian carp. In North America, the expression "Asian carp" ordinarily refers to a collection of four invasive species: Bighead Carp, Silver Carp, Black Carp, and Grass Carp. Asian carp were imported into the United States several decades ago primarily to

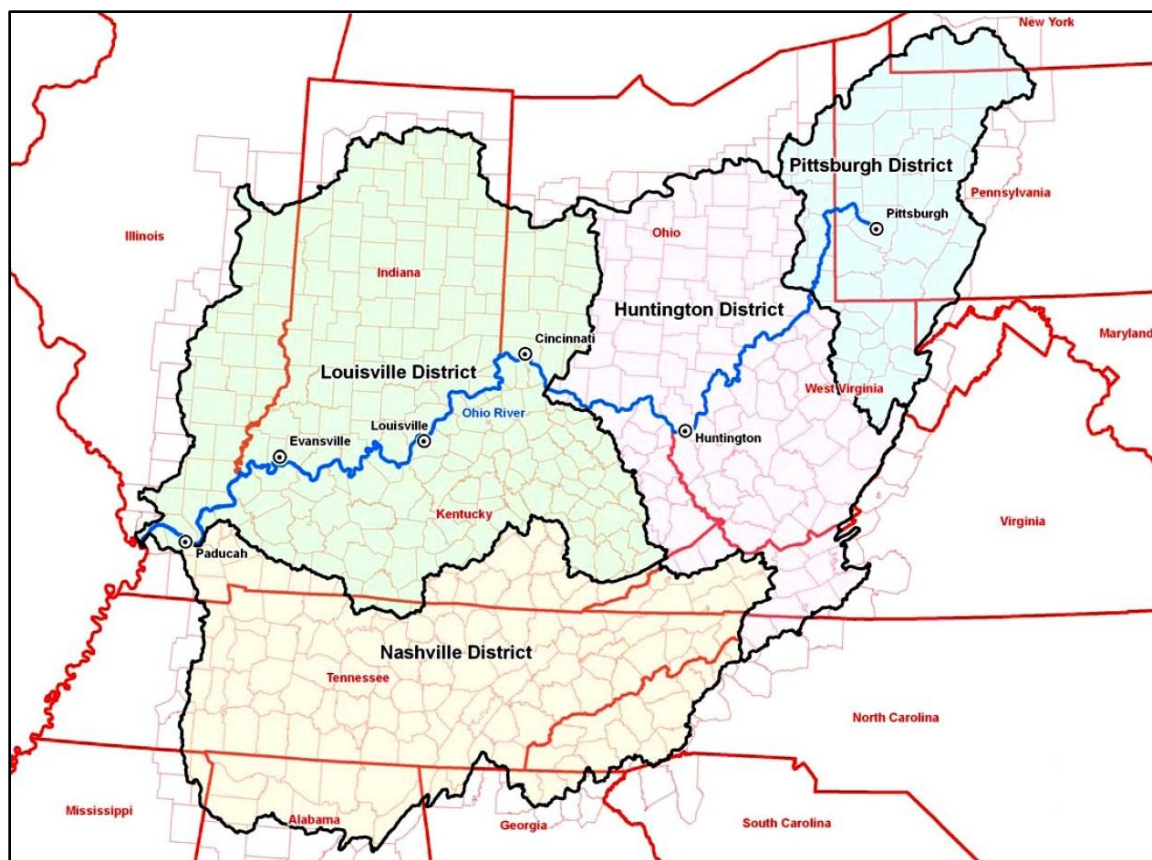


Figure 1. The Ohio River drainage basin includes 548 counties in 15 states and is managed by four U.S. Army Corps of Engineer Management Districts (Source: USACE).

be used in aquaculture and wastewater treatment plants for control of algae (Silver and Bighead Carp) and grubs (Black Carp), but subsequently escaped and are an increasing threat to the ecologic, recreational, and economic value of the Ohio River and its tributaries. The Aquatic Nuisance Species Task Force determined that Asian carp warrant active control by natural resources agencies and developed the *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States* (Conover et al. 2007) that identifies strategies to address Asian carp. This plan provides a concise summary of the biology, history of introduction, use, and potential adverse effects of Asian carp.

Multiple biological synopses and scientific risk assessments of the Asian carps (Kocovsky et al. 2012; Kohler et al. 2007; Nico et al. 2005; Cudmore and Mandrak 2004; Mandrak and Cudmore 2004) identify their potential for establishment and negative consequences to much of North America. The migration of Bighead and Silver Carp through the Illinois River via the Chicago Area Waterway System, Wabash River, Grand Calumet River, and possibly other pathways that connect the Mississippi River and Great Lakes basins is the most acute aquatic-invasive-species threat currently facing the region (ACRCC 2010). The federal government has implemented an unprecedented commitment to prevent Asian carp introduction into the Great Lakes and to ensure that viable Asian carp populations do not exist within the Great Lakes (ACRCC 2012; <http://asiancarp.us>). A similar commitment is urgently needed in the Ohio River basin given the regional implications of this problem. Minimizing the distribution and abundance of Asian carp in the Ohio River basin will reduce the risk of introduction into the Great Lakes as identified in the Great Lakes and Mississippi River Interbasin Study (<http://glmris.anl.gov/>).

The status and risks associated with Bighead, Silver, Black, and diploid Grass Carp in the Ohio River basin varies for each. This *Ohio River Basin Asian Carp Control Strategy Framework* (hereafter, *Control Strategy Framework*) is focused on actions to address the invasions of Bighead and Silver Carp because they currently pose the most immediate threats and many actions to address them are similar to those for the other species. Large numbers of Bighead and Silver Carps are now found in the lower Ohio River and tributaries below the McAlpine Locks and Dam near Louisville, Kentucky (Appendix A) and their abundance and distribution have been steadily increasing upstream in the Ohio River. Immediate actions are needed to prevent further upstream expansion and establishment of reproducing populations above the McAlpine Locks and Dam.

The Ohio River flows through or along the border of Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia that collaboratively manage fisheries in the mainstem through the Ohio River Fisheries Management Team (ORFMT). The ORFMT was formed in 1990 to develop an inter-jurisdictional perspective to management of Ohio River fisheries. Impetus for the formation of the team was United States Supreme Court settlements that changed jurisdiction of the Ohio River from the exclusive jurisdiction of Kentucky, West Virginia, and Pennsylvania to concurrent jurisdiction along the Kentucky border with Kentucky and Ohio, Indiana, and Illinois. The Ohio Decree was entered on April 15, 1985 (*Ohio v. Kentucky*, 471 U.S. 153); the Indiana Decree was entered on November 4, 1985 (*Indiana v. Kentucky*, 474 U.S. 1); and, the Illinois opinion was decided on May 28, 1991 (*Illinois v. Kentucky*, 500 U.S. 380, No. 106, Orig.) (www.megalaw.com/fed/usopinions.php3). Shared jurisdiction led to the development of a Memorandum of Understanding (MOU) among Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois for cooperative management of Ohio River fisheries.

The ORFMT recognized the magnitude of the Asian carp threat and the need for coordinated efforts to prevent the continued spread, explore strategies to reduce the abundance of established populations, and better understand the impacts of established populations. State natural resource agencies are responsible for protecting and managing fish and wildlife resources, but realize that they cannot effectively address this complex problem individually or without additional assistance and support. The *Control Strategy Framework* was developed as an Ohio River basin approach to support other regional plans and is consistent with the goals of these efforts. In particular, the coordinated strategies outlined in the *Control Strategy Framework* meet the goals - as specified in Section 1039 (b) *Aquatic Invasive Species Prevention* of the Water Resources Reform and Development Act of 2014 (WRRDA) - of controlling the spread of Asian carp in the Upper Mississippi and Ohio River basins and tributaries by carrying out activities designed to slow and eventually eliminate the threat posed by these species. Specifically the WRRDA language requires the Director of the USFWS in coordination with the Secretary, the Director of the National Park Service and Director of the USGS to lead a multiagency effort to slow the spread of Asian carp in the Upper Mississippi and Ohio River basins and tributaries by providing technical assistance, coordination, best practices, and support to State and local governments in carrying out activities designed to slow, and eventually eliminate, the threat posed by Asian carp. The ORFMT will work with federal partners (e.g., USFWS, USACE, USGS) to address the highest priorities within the basin that are identified in this Framework.

Five Ohio River basin states, Illinois, Indiana, New York, Ohio, and Pennsylvania, are also Great Lakes states. All five are active members of the Asian Carp Regional Coordinating Committee (ACRCC) that is focused on preventing establishment of Asian carp in the Great Lakes and the other states in the basin join them in this effort. One way to keep Asian carp out of the Great Lakes is to minimize the risk of them moving across the divide between the basins. To that end, the elements of this plan will help slow

the spread / movement of Asian carp to pathways highlighted in the Great Lakes Mississippi River Inter-basin Study.

The *Control Strategy Framework* includes approaches for: 1) prevention; 2) monitoring and response; 3) population control; 4) understanding impacts; and, 5) communication.

I. Prevention

To stop the expansion of Asian carp throughout the Ohio River basin, measures are needed to prevent range expansion, new introductions, and dispersal whether natural or human mediated. An assessment of the potential pathways for introduction and their relative risk is needed to identify prevention strategies.

1.1 Sever aquatic migration pathways between the Ohio River basin and the Great Lakes basin in Illinois, Indiana, and Ohio as identified in reports developed by the ACRC and GLMIS.

Prevention is the single most important means of preventing regional expansion of Asian carp populations. Aquatic pathways for aquatic invasive species transfer between the Ohio River basin and the Great Lakes basin have been identified in three of six ORFMT states. Permanent separation of these basins is the single greatest preventative measure available to contain Asian carp within the Ohio River basin.

1.2 Assess risk of human-mediated vectors for movement and introduction of Asian carp beyond the free-flowing Ohio River and its tributaries and develop strategies to address these vectors.

Human-mediated vectors are a significant threat to range expansion. The most likely vectors in the Ohio River basin include incidental bait-fish capture, live-food fish markets, the sale of live wild-caught fishes to pay/fee fishing lakes, and the production and transport of farm-raised Asian carp.

1.3 Coordinate state regulations and enforcement that prohibit the sale, transport, possession, production, and use of live Bighead, Silver, Black and diploid Grass Carp.

State regulations on the movement and sale of live Bighead, Silver, Black and diploid Grass Carp are variable or non-existent. Consistent regulations prohibiting these actions and the capability to effectively enforce those regulations are warranted.

1.4 Evaluate use of deterrent barriers at strategic locations to limit further dispersal of Asian carp in the Ohio River basin.

Alternative technologies, while untested in large river systems, offer potential solutions to slow passage. Acoustic, sound, light, and electric barriers, as well as new technologies currently being developed (e.g., hydroguns) could deter Asian carp. These technologies, alone or in combination, should be considered at strategic locations. Other potential sites, such as where flood control projects have confined the channel should also be considered. It is important to consider whether potential deterrent barriers would have negative impacts on native species.

1.5 Evaluate the use of operational changes at locks and dams to deter passage of Asian carp.

Low-usage locks, particularly in the Monongahela, Muskingum, and Allegheny rivers, should be evaluated for potential permanent closure or operational modification. Operational changes, while long-term solutions to prevent fish from moving through the locks are being developed, may limit the opportunity for Asian carp passage through lock chambers. Further investigation is warranted to reduce the passage of Asian carp through locks and dams.

II. Monitoring and Response

The early detection of Asian carp is necessary to determine if a response effort can be effectively implemented to prevent establishment and continued spread in the Ohio River basin. To date, detection within the basin has largely been the result of ongoing fisheries surveys, commercial harvest, and reported public sightings. Targeted surveillance efforts are needed to detect incipient populations and implement effective response measures.

Low abundances of Asian carp are difficult to detect in large systems. Molecular tools such as environmental DNA (eDNA) have potential as surveillance tools for detecting incipient populations; however, this nascent technology requires further development and refinement before managers can confidently implement response actions based solely on eDNA results. While eDNA offers some utility in informing early detection efforts, eDNA alone does not confirm the presence of live Asian carp, nor does it provide quantifiable estimates of abundance. Controlled studies are needed to better relate eDNA detection results to abundance and distribution of live fish.

Preventing Asian carp movement to new waters is the foremost management strategy to avoid their establishment in new areas. The detection of an incipient population will provide an opportunity to evaluate and implement response actions. A response action could range from an intensive survey for rapid assessment to attempted eradication, or involve simple reporting and communication depending upon the finding.

Inter-jurisdictional responses are often complex, costly, and controversial; therefore, extensive advanced planning may be necessary (MRBP 2010). Preparation may take considerable time and effort, particularly if the response involves an Incident Command System (ICS) as opposed to a routine joint-agency sampling exercise.

2.1 Develop a response plan for the Ohio River basin that identifies risk and return of actions when new information emerges.

A comprehensive response plan will assist states in determining what types of responses are warranted depending upon the type of new information found. This will allow agencies to implement pre-planned responses, most effectively implement appropriate actions, and communicate the response and the rationale for the response with the public. In rare instances, a rapid response may be necessary using an ICS for an inter-jurisdictional response. This may aid states when additional information or eradication is needed in a truncated time frame. When new detections occur within a single state, that state will be responsible for implementing any response action. The Mississippi River Basin Panel Model Rapid Response Plan for Aquatic Invasive Species in the Mississippi River Basin may be used as a template for the development of an Ohio River basin rapid response plan.

2.2 Continue annual fisheries monitoring programs conducted by state agencies in the Ohio River, its tributaries, and other waters throughout the basin as a general means of surveillance.

State fish and wildlife agencies conduct annual fisheries surveys in the Ohio River, other rivers and streams, and reservoirs throughout the basin using electrofishing, gill netting, seining, trammel netting, hoop netting, and trawling. These surveys may provide information through incidental collections or sightings of Asian carp.

2.3 Implement contract surveillance of targeted Asian carp sampling to monitor the distribution and abundance Asian carp.

Resources of state agencies are often limited regarding their ability to adopt new monitoring or surveillance programs. Contractually supported work to consulting firms or other organizations may help augment information needs through labor-intensive, targeted Asian carp surveys.

2.4 Contract commercial fishers to sample areas upstream of McAlpine Dam to enhance surveillance and early detection capabilities.

Commercial fishing has been a useful tool for gathering early detection information on Asian carp; however, the current distribution of Asian carp in the Ohio River is beyond waters open to commercial fishers. Contract fishers can be used to provide state fish and wildlife agencies with an additional means to verify unconfirmed reports (e.g., a positive eDNA sample or public report) of Asian carp in new locations. Contract fishing would employ experienced fishing crews, paid for their time only, to intensively fish a specific area. Contract fisheries may be useful in addition to, or in lieu of, resource management agency efforts. States should require observers with contract fishers to monitor the catch.

2.5 Promote public reporting of Asian carp in locations where these fishes are not established.

The public will be encouraged to report new sightings to the national aquatic nuisance species (ANS) hotline (877-STOP-ANS) through media campaigns and other awareness. New collection reports will be forwarded to appropriate state fish and wildlife agencies. Each state will forward any verified collections (public or agency) of Asian carp in new locations to the USGS Nonindigenous Aquatic Species database website. Historic collection data should also be submitted as soon as possible to provide for a more accurate and complete collection record for the Ohio River basin.

2.6 Use eDNA testing to guide early detection efforts.

Asian carp eDNA technology has been used as part of early-detection efforts for Bighead and Silver Carp in the Illinois and Mississippi rivers. It may prove useful in defining the extent of Bighead and Silver Carp distribution and for identifying high-priority areas for targeted fish sampling.

Otolith microchemistry and meta-genomic analysis of Asian carp tissue may have additional applications for early detection in the Ohio River basin by characterizing Asian carp populations and determining if the fish are from a reproducing population. Such technologies are in development, and further research is warranted to refine these tools.

2.7 Support research to improve capabilities to detect early stages of invasion and spawning populations of Asian carp.

Asian carp are difficult to capture using traditional sampling methods, especially when abundances are low. Research is needed to develop effective capture methods and sampling protocols. Additional research is needed to determine preferred habitats to guide early-detection sampling and surveillance for spawning populations of Bighead and Silver carp.

III. Population Control

Reducing the abundance of established populations of Asian carp may minimize their impacts and slow their spread. Numerous strategies have been identified as having the potential to reduce Asian carp populations; however, research and development are needed before most will be ready for field evaluation. Harvest may reduce Asian carp abundance over the near-term. Over the long-term, harvest may be an important component of an integrated approach to reduce Asian carp numbers, but is not without risks to public trust resources. Current research funded through the Great Lakes Restoration Initiative has provided insights regarding integrated control strategies and may lead to further development of sustainable and effective technologies for population control.

3.1 Encourage increased commercial harvest and implement contract fishing of Asian carp.

State fish and wildlife agencies will work within their authorities to increase opportunities for commercial harvest of Asian carp. Commercial harvest may provide an important source of information on Asian carp populations. State fish and wildlife agencies will continue to closely monitor commercial fishing effort and harvest. States that allow commercial fishing (IL, IN, KY) will work to develop standard reporting forms for captures of Asian carp that will aid in determining population trends as control efforts are implemented. States can assist, where appropriate, in the development of new markets for Asian carp. States should work with emerging businesses utilizing commercially harvested Asian carp to influence business plans, strategies, and ideologies that minimize risk associated with increased commercial harvest.

3.2 Support and accelerate research on sustainable, cost-effective means of long-term control methods.

Additional tools are needed for development and implementation of integrated control programs for the long-term reduction of Asian carp populations. Continued research in this discipline is encouraged.

IV. Understanding Impacts

The potential impacts of Asian carp on sportfish populations and aquatic ecosystems are not well understood. Conventional wisdom is clear that, as with other invasive species, they will become a detriment to aquatic communities where they do not belong and a social, economic, and ecological tax on society. However, specific research and long-term monitoring are necessary to understand their role and long-term effects in the Ohio River basin to facilitate mitigation and management.

4.1 Conduct collaborative inter-agency research to measure the distribution, movement, and habitat use of Asian carp in the middle Ohio River.

Quantifying rates of Asian carp population expansion, movement, and habitat use are integral to implementation of control strategies. Such insights will facilitate prioritization of approaches and selections of strategies.

4.2 Sponsor university research to explore the impacts of Asian carp on aquatic communities in the mainstem of the Ohio River and major tributaries.

Conventional wisdom indicates that Asian carp will have significant social, ecological, and economic impact on fisheries resources within the Ohio River basin and its tributaries. However, the impact of these fishes relative to their abundance and distribution is not well understood within the Ohio River basin complicating communication with stakeholders, agency messaging, public expectations, and mitigation needs.

V. Communication

Effective communication will facilitate implementation of the *Control Strategy Framework*. ORFMT partners must coordinate and plan actions, communicate status among regional partners, and provide information, education, and outreach to the public.

5.1 Maintain effective communication among the ORFMT, Ohio River basin partners, and regional coordinating groups.

Policy and technical staff must communicate routinely to clarify needs for funding, implement control strategies, and provide routine status on progress. Resolution of communication should be greatest among the ORFMT, but extend beyond this organization and the Ohio River basin.

5.2 Provide information to the public on prevention and control of Asian Carp in the Ohio River basin using the media and other communication tools to educate and engage the general public, user groups, and elected officials.

Public understanding and support is essential to preventing Asian carp expansion. An informed public will serve as a source of monitoring through reports of fish, take responsible actions to prevent the spread of Asian carp, and support state and federal efforts to address this issue.

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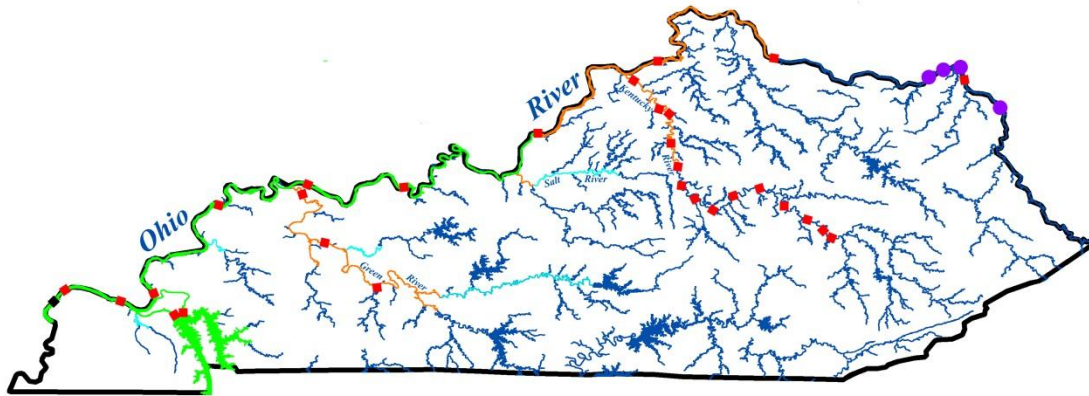
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Appendix A: Distribution of Invading Bighead and Silver Carps within Ohio River Basin States

Distribution of Invading Bighead Carp and Silver Carp within the Ohio River Basin of Indiana and Eastern Illinois



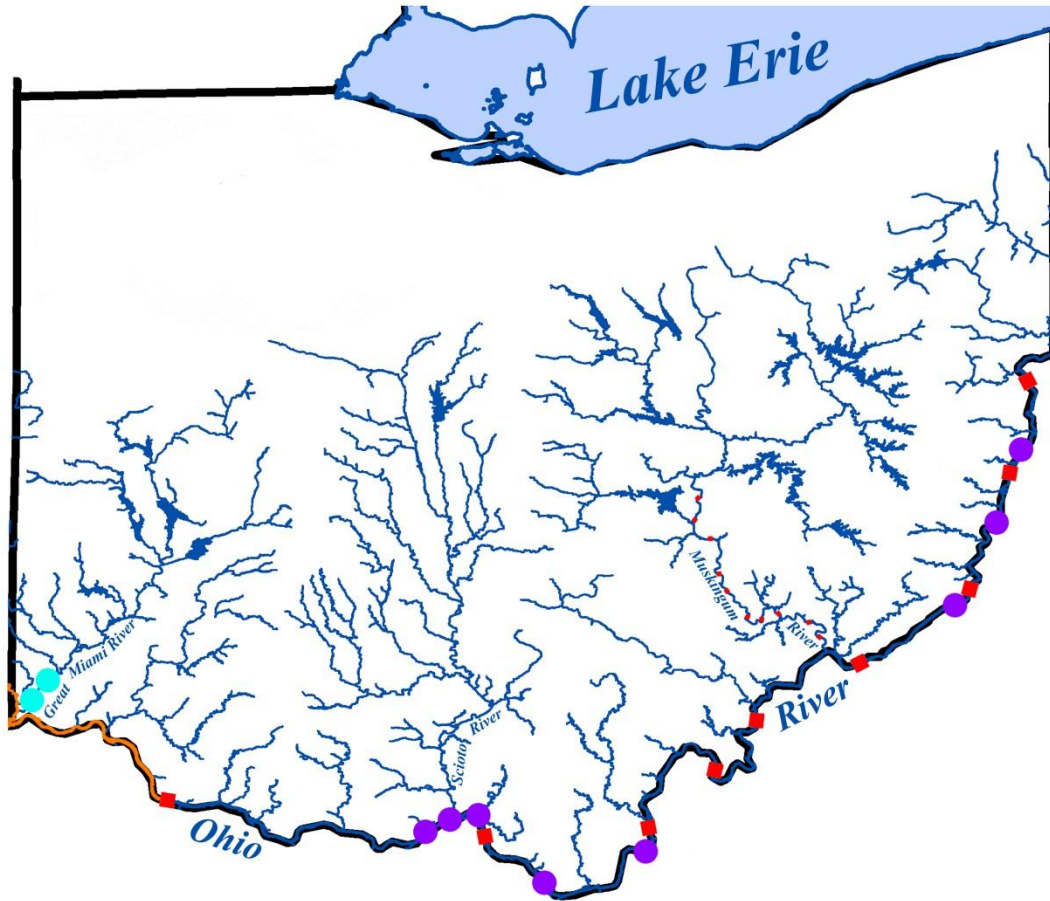
Distribution of Invading Bighead Carp and Silver Carp within the Ohio River Basin of Kentucky



- Run-Of-The-River Dams
- Bighead Carp & Silver Carp Reproduction Front (Spawning Populations)
- Bighead Carp & Silver Carp Invasion Front (High Abundance Populations)
- Bighead Carp Invasion Front
- Roaming Bighead Carp (Independent Reports)
- Silver Carp Invasion Front
- Roaming Silver Carp (Independent Reports)



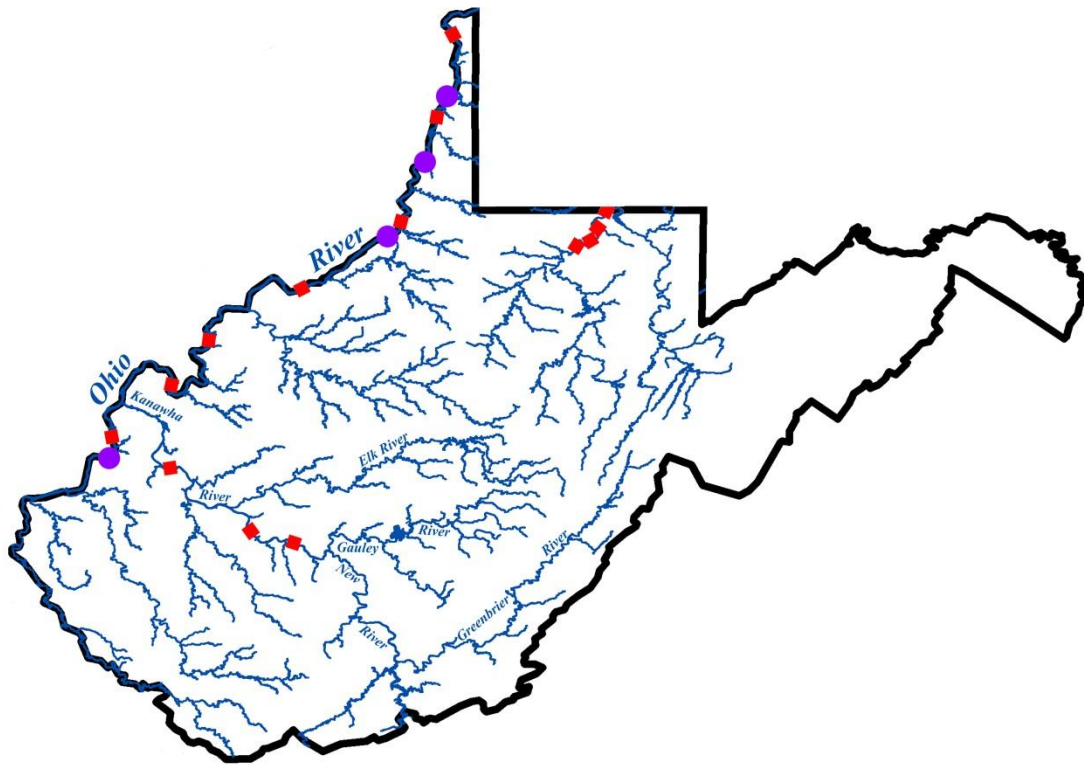
Distribution of Invading Bighead Carp and Silver Carp within the Ohio River Basin of Ohio



- Run-Of-The-River Dams
- Bighead Carp & Silver Carp Reproduction Front (Spawning Populations)
- Bighead Carp & Silver Carp Invasion Front (High Abundance Populations)
- Bighead Carp Invasion Front
- Roaming Bighead Carp (Independent Reports)
- Silver Carp Invasion Front
- Roaming Silver Carp (Independent Reports)



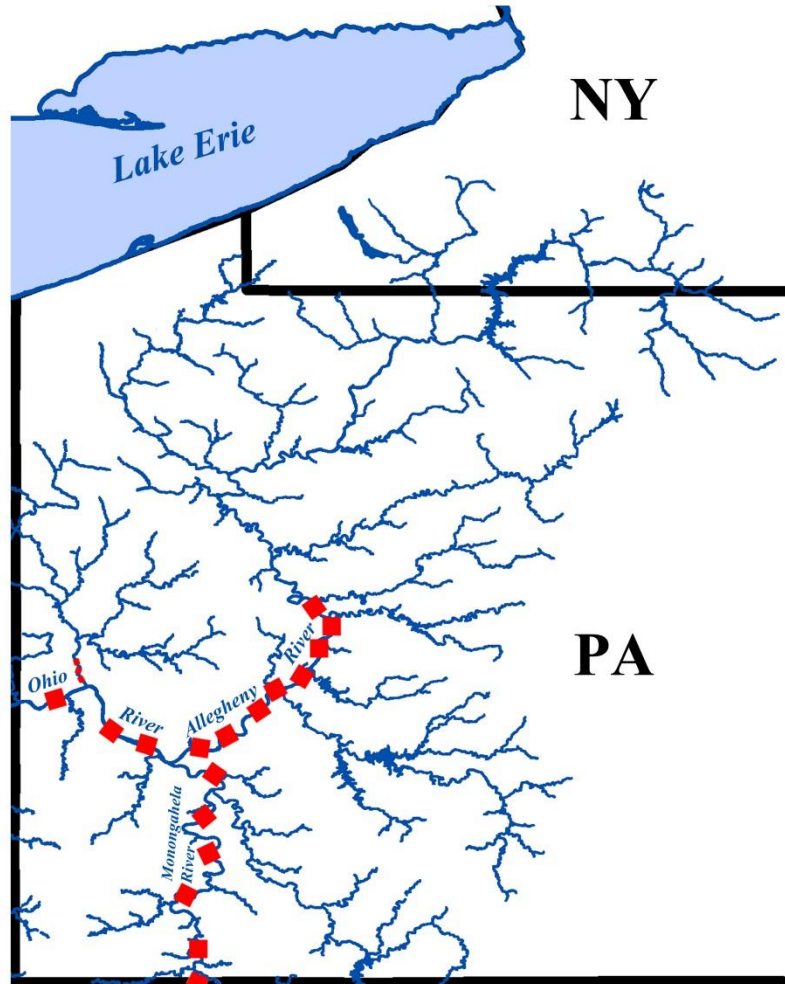
Distribution of Invading Bighead Carp and Silver Carp within the Ohio River Basin of West Virginia



- Run-Of-The-River Dams
- Bighead Carp & Silver Carp Reproduction Front (Spawning Populations)
- Bighead Carp & Silver Carp Invasion Front (High Abundance Populations)
- Bighead Carp Invasion Front
- Roaming Bighead Carp (Independent Reports)
- Silver Carp Invasion Front
- Roaming Silver Carp (Independent Reports)



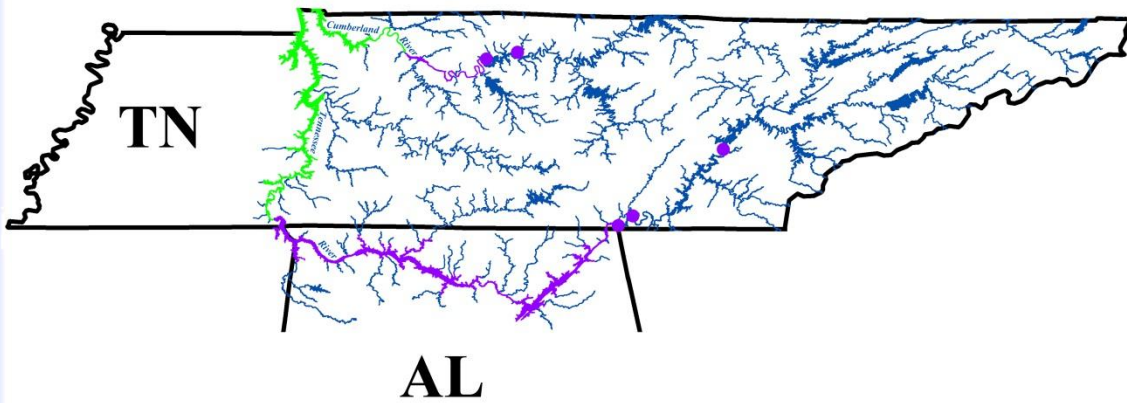
Distribution of Invading Bighead Carp and Silver Carp within the Ohio River Basin of Western Pennsylvania and Southern New York



- Run-Of-The-River Dams
- Bighead Carp Invasion Front
- Bighead Carp & Silver Carp Reproduction Front (Spawning Populations)
- Roaming Bighead Carp (Independent Reports)
- Bighead Carp & Silver Carp Invasion Front (High Abundance Populations)
- Silver Carp Invasion Front
- Roaming Silver Carp (Independent Reports)



Distribution of Invading Bighead Carp and Silver Carp within the Ohio River Basin of Tennessee



- Run-Of-The-River Dams
- Bighead Carp & Silver Carp Reproduction Front (Spawning Populations)
- Bighead Carp & Silver Carp Invasion Front (High Abundance Populations)
- Bighead Carp Invasion Front
- Roaming Bighead Carp (Independent Reports)
- Silver Carp Invasion Front
- Roaming Silver Carp (Independent Reports)

