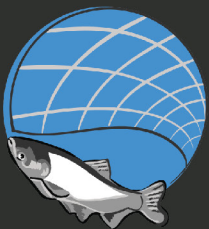


2025



INVASIVE CARP
REGIONAL COORDINATING
COMMITTEE

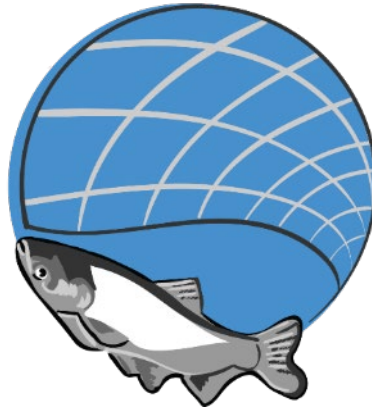
INVASIVE CARP

ACTION PLAN

Invasive Carp Action Plan for Fiscal Year 2025

August

Invasive Carp Regional Coordinating Committee



ICRCC Member Agencies:

Illinois Department of Natural Resources
Illinois Environmental Protection Agency
Indiana Department of Natural Resources
Michigan Department of Natural Resources
Michigan Department of Environment, Great Lakes &
Energy
Minnesota Department of Natural Resources
New York Department of Environmental Conservation
Ohio Department of Natural Resources
Pennsylvania Department of Environmental
Protection
Pennsylvania Fish and Boat Commission
Wisconsin Department of Natural Resources
Grand Traverse Band of Ottawa and Chippewa Indians
Ontario Ministry of Natural Resources and Forestry

Quebec Ministère de l'Environnement, de la Lutte
contre les changements climatiques, de la Faune
et des Parcs
National Oceanic and Atmospheric Administration
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Department of Transportation
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
National Park Service
Fisheries and Oceans Canada
Great Lakes Fishery Commission
Great Lakes Commission
Metropolitan Water Reclamation District of Greater
Chicago

Invasive Carp Action Plan: Fiscal Year 2025

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Invasive Carp Action Plan: Fiscal Year 2025

EXECUTIVE SUMMARY

This Invasive Carp Action Plan (Action Plan) outlines a comprehensive management strategy to protect the Great Lakes from the threat posed by Silver Carp, Bighead Carp, Grass Carp, and Black Carp—collectively referred to in this document as “invasive carp.”

The Action Plan was developed by the 26 U.S. and Canadian federal, state, provincial, tribal, regional, and local agencies that comprise the Invasive Carp Regional Coordinating Committee (ICRCC). The ICRCC is convened by the U.S. Fish and Wildlife Service and the U.S. Environmental Protection Agency to assist its members in implementing their authorities to prevent the introduction and establishment of invasive carp in the Great Lakes.

Projects in the Fiscal Year (FY) 2025 Action Plan are implemented through \$28,805,712 in agency funding and further supported by \$21,000,000 in Great Lakes Restoration Initiative funding, which has been pivotal in allowing state agencies to expand their efforts within their jurisdictional waters for the benefit of the entire region. These U.S. domestic projects protect a commercial and recreational Great Lakes fishery valued at almost \$5.1 billion annually.

The activities conducted by the U.S. ICRCC member agencies under this Action Plan are geographically focused to accomplish key goals:

- **Blocking invasive carp movement through the Illinois Waterway**, with a focus on efforts conducted by the State of Illinois and its partners to reduce overall populations within the Illinois River and the U.S. Army Corps of Engineers and its partners’ efforts to maintain the Electric Dispersal Barrier System and construct the Brandon Road Interbasin Project.
- **Installing hydrologic barriers to prevent invasive carp movement through intermittent waterways**, with a focus on the State of Ohio’s closure of the intermittent connection at Little Killbuck Creek (Medina, Ohio) and the ongoing maintenance of previously constructed barriers by the State of Indiana and its partners at Eagle Marsh (Fort Wayne, Indiana) and the State of Ohio at the Ohio & Erie Canal (Akron, Ohio).

THE CHALLENGE

Invasive carp—Silver Carp, Bighead Carp, Grass Carp, and Black Carp—have increased in abundance and migrated hundreds of miles upstream through the Mississippi River and its tributaries toward the Great Lakes. Natural resource management agencies in the Great Lakes region are working to prevent further spread of these species. Management of invasive carp at this scale is unprecedented and has required the development of many new prevention, detection, and control techniques. Preventing the introduction and establishment of invasive carp in the Great Lakes is a daunting challenge.

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- **Preventing the establishment of Grass Carp in the Great Lakes**, with a focus on efforts conducted by the States of Ohio and Michigan and their partners within the western basin of Lake Erie and its tributaries.
- **Better understanding Black Carp populations to inform management strategies**, with a focus on better understanding the population within the lower Illinois River.

FY 2025 funding also supports the basic coordination and communication activities of the ICRCC, including the development of this Action Plan.

Developed annually since 2010, the Action Plan has incorporated the most current science on invasive carp populations, control technologies, and management techniques. The 2025 Action Plan continues to reflect this adaptive approach.

Through the projects implemented through this Action Plan, the U.S. member agencies of the ICRCC remain committed to protecting our environment, our favorite pastimes, and our economic prosperity.

Appendix A includes the FY 2025 Project Funding Matrix.

Appendix B includes FY 2025 agency projects with project descriptions and intended outcomes. Any references to project implementation in future years are subject to the availability of appropriations. An acronym list is also included in Appendix B.

Appendix C includes the ICRCC Principles of Coordination.

Invasive Carp Action Plan: Fiscal Year 2025

1. INTRODUCTION

The Fiscal Year (FY) 2025 Invasive Carp Action Plan (Action Plan) is the 16th consecutive iteration of the Invasive Carp Regional Coordinating Committee's (ICRCC) annual strategy for Great Lakes protection. The 46 projects in the FY 2025 Action Plan address priority management and monitoring projects focused on one or more of the four invasive carp species further described below and are supported by a combination of \$28,805,712 in agency funding and \$21,000,000 in Great Lakes Restoration Initiative (GLRI) funding. These projects help protect the Great Lakes commercial and recreational fishery, valued at almost \$5.1 billion annually.

Additional general information on invasive carp can be found at [Homepage | Invasive Carp Regional Coordinating Committee](#). Information available on the website includes:

- [Who We Are](#)
- [What We Do](#)
- ICRCC Principles of Coordination

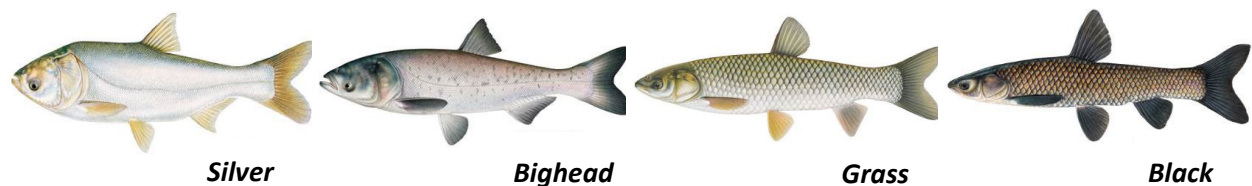
Invasive Carp Action Plan: Fiscal Year 2025

2. INVASIVE CARP AND THE GREAT LAKES — THE THREAT

Invasive carp have posed a growing challenge to North America's aquatic ecosystems and the communities that depend on healthy aquatic resources. Ongoing management efforts are needed to protect our environment, our favorite pastimes, and our economic prosperity.

The general term "invasive carp" in this document refers to four species: Silver Carp, Bighead Carp, Grass Carp, and Black Carp (Figure 1). The following sections provide an overview of the biology, the distribution of each of these carp in North America, and the potential impacts they could cause if they spread into the Great Lakes.

Figure 1 — Invasive Carp



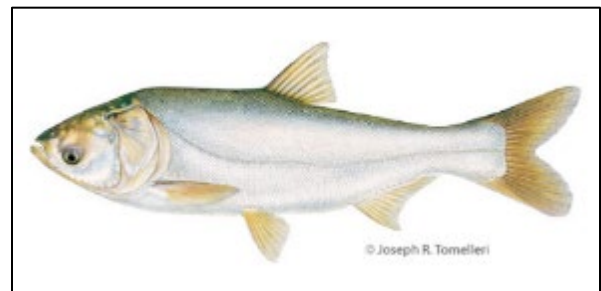
Throughout this document, the term "invasive carp" refers to the following four species: Silver Carp (*Hypophthalmichthys molitrix*), Bighead Carp (*H. nobilis*), Grass Carp (*Ctenopharyngodon idella*), and Black Carp (*Mylopharyngodon piceus*). Illustration by Joseph R. Tomelleri.

2.1 Silver Carp

Silver Carp (Figure 2) can grow to 60 or more pounds and feed primarily on phytoplankton, as well as zooplankton, invertebrates, detritus, and bacteria. They efficiently filter suspended material from the water with highly specialized gill rakers.

Silver Carp adversely affect many native species because they feed on plankton, the primary food source for mussels, larval fish, and certain adult

Figure 2 — Silver Carp



Silver Carp. Illustration by Joseph R. Tomelleri.

fish. The establishment of large populations of Silver Carp in the Great Lakes could compromise recreational and commercial fishing due to impacts on existing species and pose a threat to human safety due to their jumping behavior when startled. These fish, sometimes referred to as "flying carp," have caused numerous personal injuries and property damage from collisions with people and their boats during recreational boating and fishing (Figure 3).

Invasive Carp Action Plan: Fiscal Year 2025

Silver Carp are now well established throughout much of the Mississippi River basin, and range expansion has been observed in the Ohio River and other major sub-basins in recent years (Figure 4).

The Silver Carp population within the Illinois Waterway (IWW) currently poses the greatest threat to the Great Lakes. The population front (or upstream “leading edge”) of adult Silver Carp in the IWW remains within Dresden Island Pool, approximately 47 miles and two lock structures from Lake Michigan. This population front has remained unchanged for over 10 years.

For more information on Silver Carp, visit [Silver Carp | Invasive Carp Regional Coordinating Committee](#).

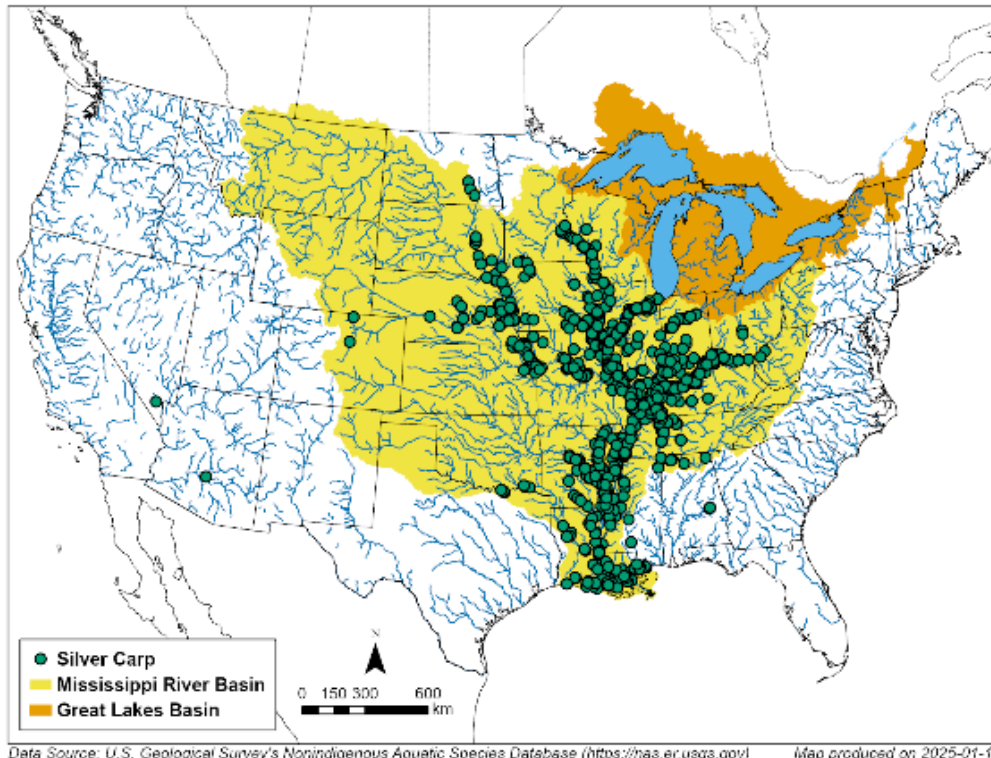
An animated map of the spread of Silver Carp in the United States may be viewed here: <https://nas.er.usgs.gov/queries/SpeciesAnimatedMap.aspx?speciesID=549>.

Figure 3 — Jumping Silver Carp



Invasive carp jumping from the water at Barkley Dam. Photo courtesy of Kentucky DFWR

Figure 4 — Documented Occurrence of Silver Carp



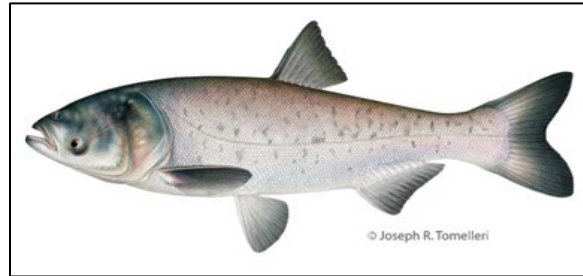
Documented occurrence of Silver Carp (reported through January 13, 2025). USGS Nonindigenous Aquatic Species Database). Note: This map represents historical collection records that indicate one or more fish were captured but does not necessarily mean that fish are reproducing or have a population in the area.

Invasive Carp Action Plan: Fiscal Year 2025

2.2 Bighead Carp

Bighead Carp (Figure 5) can grow to 100 pounds or more and feed on or near the surface of the water, as well as in midwater and benthic (bottom) environments, consuming primarily zooplankton, blue-green algae, aquatic insects, and detritus. They efficiently filter suspended material from the water with highly specialized gill rakers.

Figure 5 — Bighead Carp



Bighead Carp. Illustration by Joseph R. Tomelleri.

Bighead Carp adversely affect many native species because they feed on plankton, the primary food source for mussels, larval fish, and certain adult fish. The establishment of large populations of Bighead Carp in the Great Lakes could compromise recreational and commercial fishing due to impacts on existing species.

Like Silver Carp, Bighead Carp are now well established throughout much of the Mississippi River basin, with range expansion documented in several river sub-basins (Figure 6).

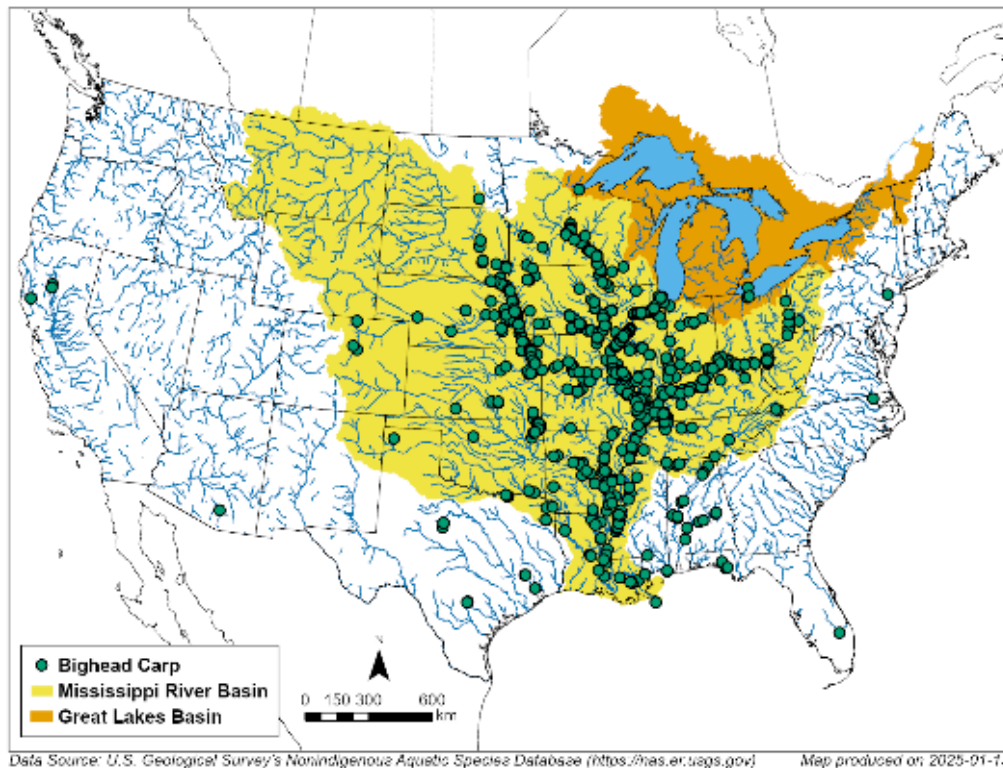
The established population within the IWW currently poses the greatest threat for the introduction of Bighead Carp into the Great Lakes. The adult population front of Bighead Carp in the IWW remains within Dresden Island Pool, approximately 47 miles and two lock structures from Lake Michigan. The population front has remained unchanged for over 10 years.

For more information on Bighead Carp, visit [Bighead Carp | Invasive Carp Regional Coordinating Committee](#).

An animated map of the spread of Bighead Carp in the United States may be viewed here: <https://nas.er.usgs.gov/queries/SpeciesAnimatedMap.aspx?speciesID=551>.

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Figure 6 — Documented Occurrence of Bighead Carp



Documented occurrence of Bighead Carp (reported through January 13, 2025). USGS Nonindigenous Aquatic Species Database). Note: This map represents historical collection records that indicate one or more fish were captured but does not necessarily mean that fish are reproducing or have a population in the area.

2.3 Grass Carp

Grass Carp (Figure 7) can grow to more than 80 pounds and feed primarily on submerged aquatic vegetation.

Adults can consume over 20 percent of their body weight in vegetation per day. Because of this feeding behavior, Grass Carp have been stocked in small lakes and ponds to control nuisance aquatic plants; however, this feeding behavior can also make Grass Carp invasive. To limit the reproduction and spread of Grass Carp used for aquatic plant control, aquaculture providers have created infertile adult Grass Carp. These infertile Grass Carp are also referred to as “triploid” because they have three sets of chromosomes rather than the normal two sets, which prevents the fish from reproducing. Illinois, Indiana, Ohio, Pennsylvania, and New York only allow triploid Grass Carp to be used for vegetative control in ponds in compliance with applicable state regulations. Michigan,

Figure 7 — Grass Carp



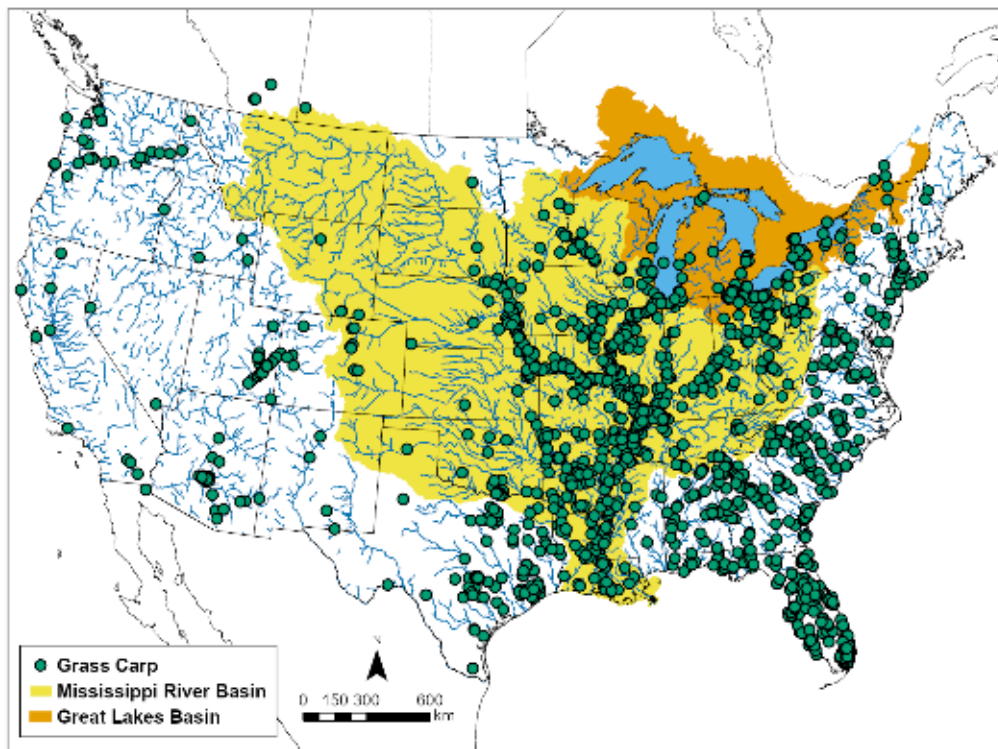
Grass Carp. Illustration by Joseph R. Tomelleri.

Invasive Carp Action Plan: Fiscal Year 2025

Wisconsin, and Minnesota prohibit live possession of any Grass Carp (neither diploid nor triploid). There are other midwestern states outside of the Great Lakes that allow for the stocking of reproductive (diploid) and sterile (triploid) Grass Carp.

Occurrences of Grass Carp are widely documented throughout much of the contiguous United States. Populations of Grass Carp are now reproducing in major rivers near the Great Lakes, including the Mississippi, Missouri, and Ohio rivers and many other smaller tributaries (Figure 8).

Figure 8 — Documented Occurrence of Grass Carp



Data Source: U.S. Geological Survey's Nonindigenous Aquatic Species Database (<https://nas.er.usgs.gov/>) Map produced on: 2025-01-13
Documented occurrence of Grass Carp (reported through January 13, 2025). USGS Nonindigenous Aquatic Species Database) Note: This map represents historical collection records that indicate one or more fish were captured but does not necessarily mean that fish are reproducing or have a population in the area.

Grass Carp pose a significant environmental risk to the Great Lakes, as described in the [Ecological Risk Assessment of Grass Carp \(*Ctenopharyngodon idella*\) for the Great Lakes Basin](#), a binational, peer-reviewed risk assessment published in 2017. The risk assessment indicated that it is "very likely" that Grass Carp will become established in Lakes Erie, Huron, Michigan, and Ontario within 10 years unless a program can be developed that could control the population growth and dispersal. Table 1 provides an estimated timeframe of Grass Carp establishment in the Great Lakes absent any control program. U.S. and Canadian agencies are actively developing and implementing Grass Carp control programs within their jurisdictional waters. Positive correlations between mortality and the number of fish harvested through this program in past years suggest that removal is driving increases in the mortality rate.

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Table 1 — Risk Assessment of Grass Carp Establishment in the Great Lakes

Location	Timeframe
Lake Erie	High – by 5 years
Lakes Michigan, Huron, Erie, and Ontario	Very Likely – by 10 years
Lake Superior	Low – at 50 years

Source: Ecological Risk Assessment of Grass Carp (Ctenopharyngodon idella) for the Great Lakes Basin, 2017

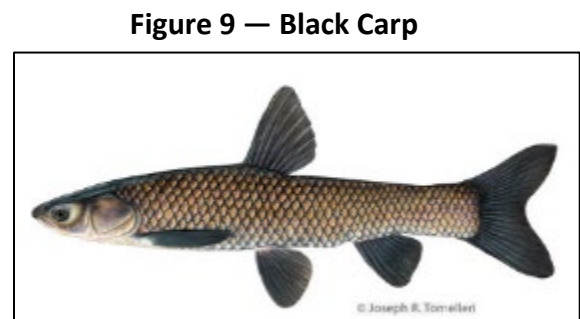
Grass Carp have been historically detected and captured in all the Great Lakes except Lake Superior. To date, there is no evidence of Grass Carp spawning activity outside of Lake Erie. Grass Carp are occasionally removed from the Chicago Area Waterway System (CAWS) during Seasonal Intensive Monitoring (SIM) activities. Grass Carp are regularly detected and captured in Lake Erie, with reproduction documented in the Sandusky, Maumee, and Huron rivers. Lake Erie Grass Carp tend to stay within the lake and the rivers where they spawn; however, there are two known instances of Grass Carp originating in Lake Erie traveling into other lake basins. In one case, the analysis of the otoliths (earbones) of a Grass Carp captured from Lake Michigan showed a micro-chemistry profile indicative of previously living in Lake Erie. In another case, a fish with an implanted transmitter was detected by a telemetry array in Lake Huron. The population within the western basin of Lake Erie currently poses the greatest threat to the Great Lakes from this species.

For more information on Grass Carp, visit [Grass Carp | Invasive Carp Regional Coordinating Committee](#).

An animated map of the spread of Grass Carp in the United States may be viewed here: <https://nas.er.usgs.gov/queries/SpeciesAnimatedMap.aspx?speciesID=514>.

2.4 Black Carp

Adult Black Carp (Figure 9) can grow to upwards of 150 pounds and feed primarily on mollusks and snails, using their molar-like pharyngeal teeth to crush the shells. Its preference is to occupy benthic (bottom) areas of rivers. Because of its known feeding ecology, its escape into the Mississippi River raised significant concern among resource managers for the long-term viability of the historical



Black Carp. Illustration by Joseph R. Tomelleri.

native mussel fauna in the Upper Mississippi River basin, of which over 70 percent are already imperiled or extinct. If Black Carp were to eventually enter the Great Lakes, there would be

Invasive Carp Action Plan: Fiscal Year 2025

serious concern for native mollusk populations already impacted by invasive dreissenid mussels (quagga and zebra mussels).

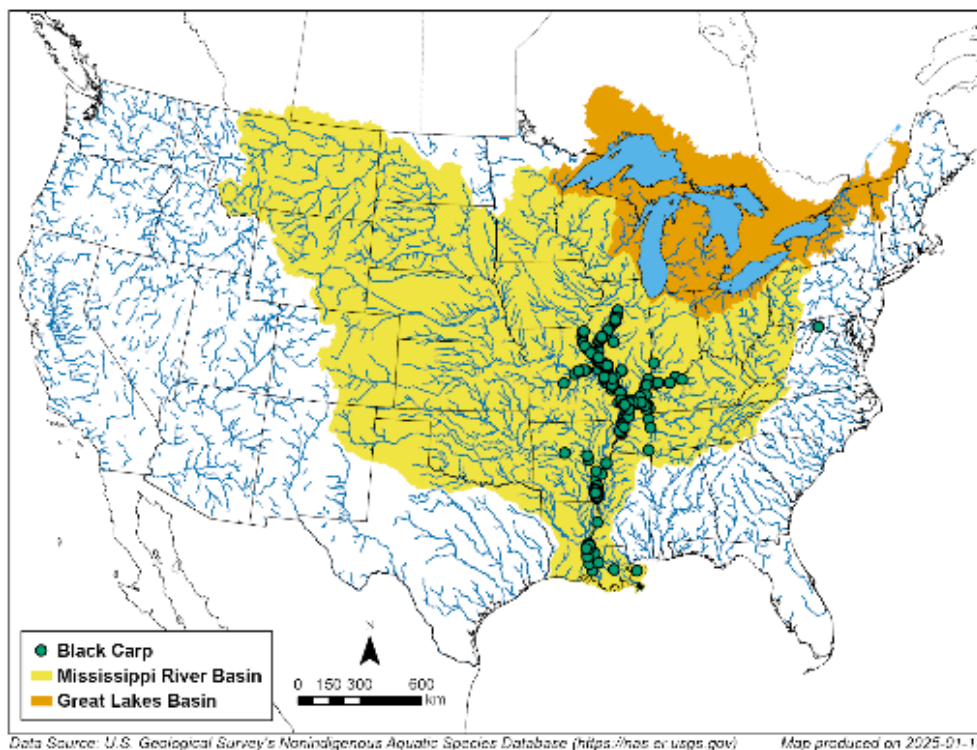
Black Carp detections are gradually increasing within the Mississippi River basin, including in the Illinois and Ohio rivers.

Large juvenile and adult Black Carp were initially reported in the Illinois River in 2010. Since 2015, the Illinois Department of Natural Resources (ILDNR) has augmented monitoring of the range expansion of Black Carp within the Upper Mississippi River basin through incentive payments to Black Carp anglers and commercial fishers. Recorded captures have increased throughout the lower 183 miles of the Illinois River as a result of these incentives. The furthest upstream capture in the Illinois River occurred in 2023, approximately 8.5 miles upstream of Henry, Illinois, within the Peoria Pool and approximately 124 river miles and six lock structures away from Lake Michigan (Figure 10).

For more information on Black Carp, visit [Black Carp | Invasive Carp Regional Coordinating Committee](#).

An animated map of the spread of Black Carp in the United States may be viewed here: <https://nas.er.usgs.gov/queries/SpeciesAnimatedMap.aspx?speciesID=573>.

Figure 10 — Documented Occurrence of Black Carp



Documented occurrence of Black Carp (reported through January 13, 2025), USGS Nonindigenous Aquatic Species Database). Note: This map represents historical collection records that indicate one or more fish were captured but does not necessarily mean that fish are reproducing or have a population in the area.

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3. SUMMARY OF 2025 ICRCC MEMBER AGENCY ACTIONS

The activities conducted by the U.S. ICRCC member agencies under this Action Plan are geographically focused to accomplish key goals:

- **Blocking invasive carp movement through the Illinois Waterway**, with a focus on the efforts conducted by the State of Illinois and its partners to reduce overall populations within the Illinois River and the U.S. Army Corps of Engineers (USACE) and its partners efforts to maintain the Electric Dispersal Barrier System (EDBS) and construct the Brandon Road Interbasin Project (BRIP).
- **Installing hydrologic barriers to prevent invasive carp movement through intermittent waterways**, with a focus on the State of Ohio's closure of the intermittent connection at Little Killbuck Creek (Medina, Ohio) and the ongoing maintenance of previously constructed barriers by the State of Indiana and its partners at Eagle Marsh (Fort Wayne, Indiana) and by the State of Ohio at the Ohio & Erie Canal (Akron, Ohio).
- **Preventing the establishment of Grass Carp in the Great Lakes**, with a focus on efforts conducted by the States of Ohio and Michigan and their partners within the western basin of Lake Erie and its tributaries.
- **Better understanding Black Carp populations to inform management strategies**, with a focus on better understanding the population within the lower Illinois River.
- **Support basic coordination and communication activities of the ICRCC**, including the development of this Action Plan.

The following sections provide additional detail on the activities which support each of these goals. At the end of each section is a table of the funded actions with links to more detail on each action in Appendix B.

3.1 Blocking Invasive Carp Movement through the Illinois Waterway

The IWW consists of over 300 miles of navigable water from the confluence of the Mississippi River and Illinois River at Grafton, Illinois to several rivers and canals in the Chicago region. At the northeast end of the IWW, the CAWS provides a year-round aquatic connection to Lake Michigan (Figure 11). Lake Michigan is hydrologically connected to the other four Great Lakes.

The coordinated interagency effort to address the risk of invasive carp in the Illinois Waterway began in 2009 with a prevention and fish suppression effort conducted in the Chicago Area Waterway System that supported maintenance actions on the USACE's Electric Dispersal Barrier System. This was the impetus for creating the ICRCC, which brought together the agencies potentially affected by the expansion of invasive carp into the Great Lakes region. The scope of the Action Plan has since evolved beyond a singular focus on the CAWS; however, preventing the movement of invasive carp through the IWW remains a major focus.

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Figure 11 — CAWS Waterbodies



Map showing the CAWS. Source: Great Lakes Commission

A series of locks managed by USACE controls water flow within the IWW. Figure 12 identifies the locks and dams making up the IWW.

Figure 12 — Lock and Dams within the Illinois Waterway

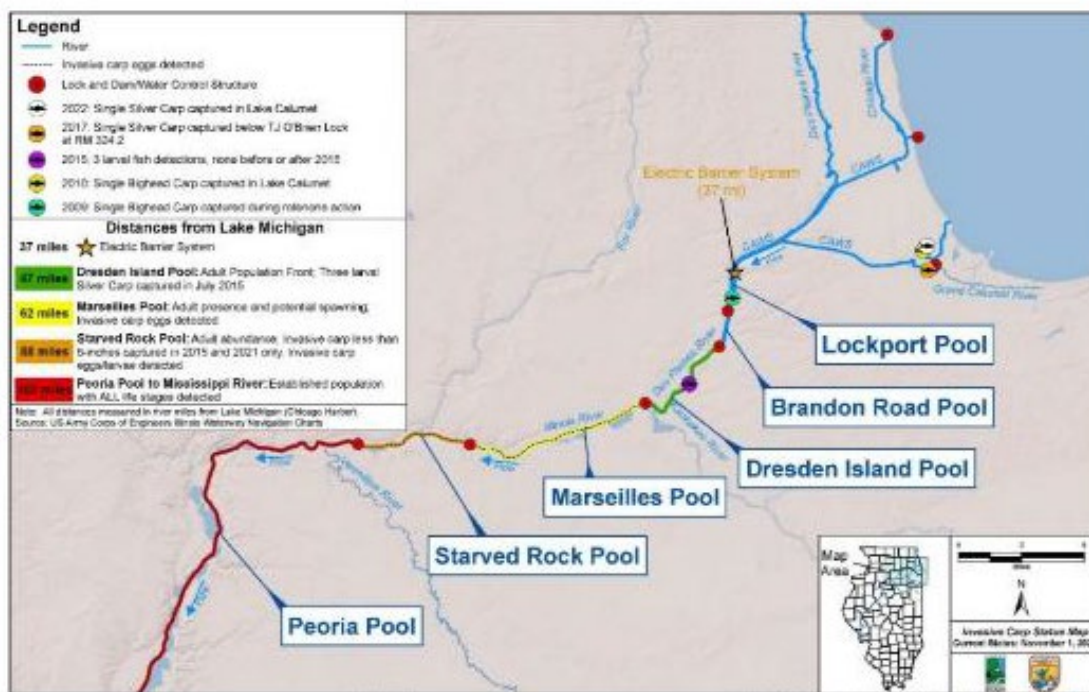


Map showing the locks and dams in the Illinois Waterway. Source: ILDNR

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Each of these locks creates a “pool” upstream, which bears the name of the downstream lock. For example, the Peoria Lock and Dam creates the Peoria Pool upstream, and this pool extends from the Peoria Lock & Dam to the Starved Rock Lock & Dam, the next furthest lock upstream. Populations of invasive carp in the IWW are generally characterized by pool. For reference, Figure 13 illustrates the pools in the upper IWW and the population status of Silver Carp and Bighead Carp. As shown in the figure, the adult population front in the IWW remains within Dresden Island Pool, approximately 47 miles and two lock structures from Lake Michigan. The population front has remained unchanged for over 10 years.

Figure 13 — Upper IWW Pools and Stages of Silver Carp and Bighead Carp Invasion



Map showing the locks and dams in the Illinois Waterway. Source: ILDNR

The Monitoring and Response Work Group (MRWG) is the principal body that supports the extensive coordination needed for work in the IWW. The MRWG is co-chaired by ILDNR and the Great Lakes Fishery Commission (GLFC).

The 2025 actions for “Preventing Invasive Carp Movement through the Illinois Waterway” are grouped into three categories of activity, which are described in more detail in the following sections:

- Illinois Waterway Deterrent Technology Operation and Development
- Illinois Waterway Removal Actions
- Illinois Waterway Monitoring and Decision Support

Invasive Carp Action Plan: Fiscal Year 2025

3.1.1 Illinois Waterway Deterrent Technology Operation and Development

The USACE has operated the EDBS within the Chicago Sanitary and Ship Canal (CSSC) in Romeoville, Illinois, since 2002. It was the first technology used to prevent the upstream movement of invasive carp in the IWW. The barrier system is located approximately 37 miles from Lake Michigan and is formed of steel electrodes that are secured to the bottom of the CSSC. The electrodes are connected to a control building that generates a DC pulse through the electrodes, creating an electric field in the water that discourages fish from crossing.

Because the Illinois Waterway forms a continuous connection between the Great Lakes and Mississippi River basins, a major management goal has been the development of technologies that deter the upstream migration of invasive carp without harming native fish or water quality. Successfully developed and tested technology will be used in the Brandon Road Interbasin Project, which began construction in 2025.

Over the years, several operational and procedural improvements have been implemented to improve the effectiveness and continuously deliver an uninterrupted flow of electricity to the water to deter fish. The demonstration dispersal barrier (Barrier I) has been operating since 2002. A more permanent dispersal barrier was constructed in two segments, Barriers IIA and IIB, which began full-time operation in 2009 and 2011, respectively. Construction of a more permanent Barrier I, which includes two new electrode arrays and the original demonstration barrier with upgrades, was completed in 2024 (Figure 14).

Figure 14 — USACE EDBS in the CSSC



Schematic of the USACE Electric Dispersal Barrier in the Chicago Sanitary and Ship Canal. Source: USACE

As another line of defense, the Brandon Road Lock and Dam near Joliet, Illinois, was identified as the critical pinch point where layered technologies could be used to stop invasive carp populations from moving into the Great Lakes. USACE and the State of Illinois, with support from the State of Michigan, have signed the project partnership agreement and begun construction of the BRIP. The BRIP project plan includes multiple deterrents, including an electric barrier, acoustic deterrents, a bubble curtain, and a flushing lock (Figure 15).

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The first phase, which begins in 2025, involves site preparation and riverbed rock removal for the engineered channel. This multi-year project is expected to be completed in 2033.

To support the later stages of the BRIP, agencies are testing and refining deterrent technologies that could be used at this location. This work is also being coordinated with the MRWG's Deterrent Work Group.

Figure 15 — Recommended Structural Plan – USACE Brandon Road



Note: ABC Deterrent refers to Automated Barge Clearing Deterrent, and RDB Guidewall refers to the Right Descending Bank Guidewall. Source: USACE

Acoustic deterrents have been the subject of a multi-year investigation. The Bio-acoustic Fish Fence (BAFF) and the Underwater Acoustic Deterrent System (uADS) have been piloted as two different technologies intended to deter invasive carp. The BAFF project is the large-scale experimental deployment of an integrated sound, bubble, and light deterrent system at Barkley Lock and Dam on the Cumberland River near Grand Rivers, Kentucky (Figure 16). The uADS has been installed experimentally in the approach channel at Lock No. 19 near Keokuk, Iowa (Figure 17). Both locations are high-head dam structures with no overflow conditions and where an established population of invasive carp exists. Available information suggests that acoustic deterrents reduce the passage of Silver Carp and Bighead Carp through these dam structures by about 50 percent. The more detailed results of these studies are expected to be completed in 2025 (BAFF) and 2026 (uADS).

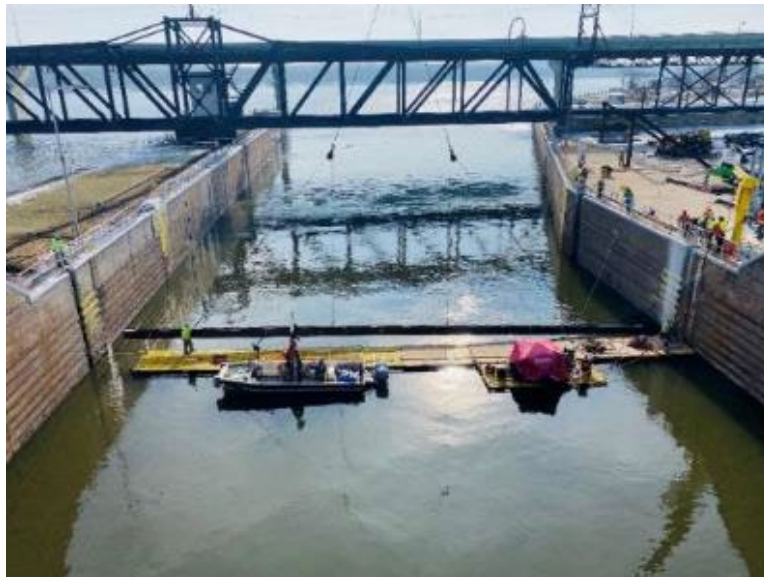
Invasive Carp Action Plan: Fiscal Year 2025

Figure 16 — Downbound Tow Traversing uADS – Lock No. 19 (Keokuk, Iowa)



A downbound tow and barges traversing downstream lock approach channel over the UADS at Lock No. 19. Photo credit: Christa Woodley, USACE ERDC

Figure 17 — Soundbar Installation – Lock No. 19 (Keokuk, Iowa)



Installation of the soundbar portion of the underwater acoustic deterrent system in the lock approach channel of Lock No. 19 in February 2021. Photo credit: Marybeth Brey, USGS

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In addition, the use of carbon dioxide injected into water is being investigated as a non-lethal behavioral deterrent. The temporary application of a carbon dioxide infusion system at a navigational lock in Wisconsin has shown this deterrent to be promising. Researchers are exploring delivery mechanisms and using fluid dynamic models to determine how to create the appropriate dose and duration to be effective in supporting fish clearing at the EDBS as it undergoes annual maintenance.

Table 2 lists the Illinois Waterway Deterrent Technology Operation and Development projects supported by the 2025 Action Plan.

Table 2 — Illinois Waterway Deterrent Technology Operation and Development Projects

Project Number	Lead Agency	Project Title <i>(Click on Project Title to go to the project in Appendix B)</i>
ID1-25	USACE	Operation and Maintenance of the Electric Dispersal Barrier System
ID2-25	USACE	Brandon Road Lock and Dam Aquatic Nuisance Species Barrier Project
ID3-25	USGS	Water Quality and Velocity Monitoring in Support of Brandon Road Project
ID4-25	USACE	Further Evaluation of Underwater Acoustics as a Deterrent for Invasive Carp
ID5-25	USGS	Technical Support for Testing of Acoustic Deterrents
ID6-25	USACE	USACE Planning for Field Demonstration of Carbon Dioxide Deterrent at the Electric Dispersal Barrier System
ID7-25	USGS	USGS Planning for Field Demonstration of Carbon Dioxide Deterrent at the Electric Dispersal Barrier System

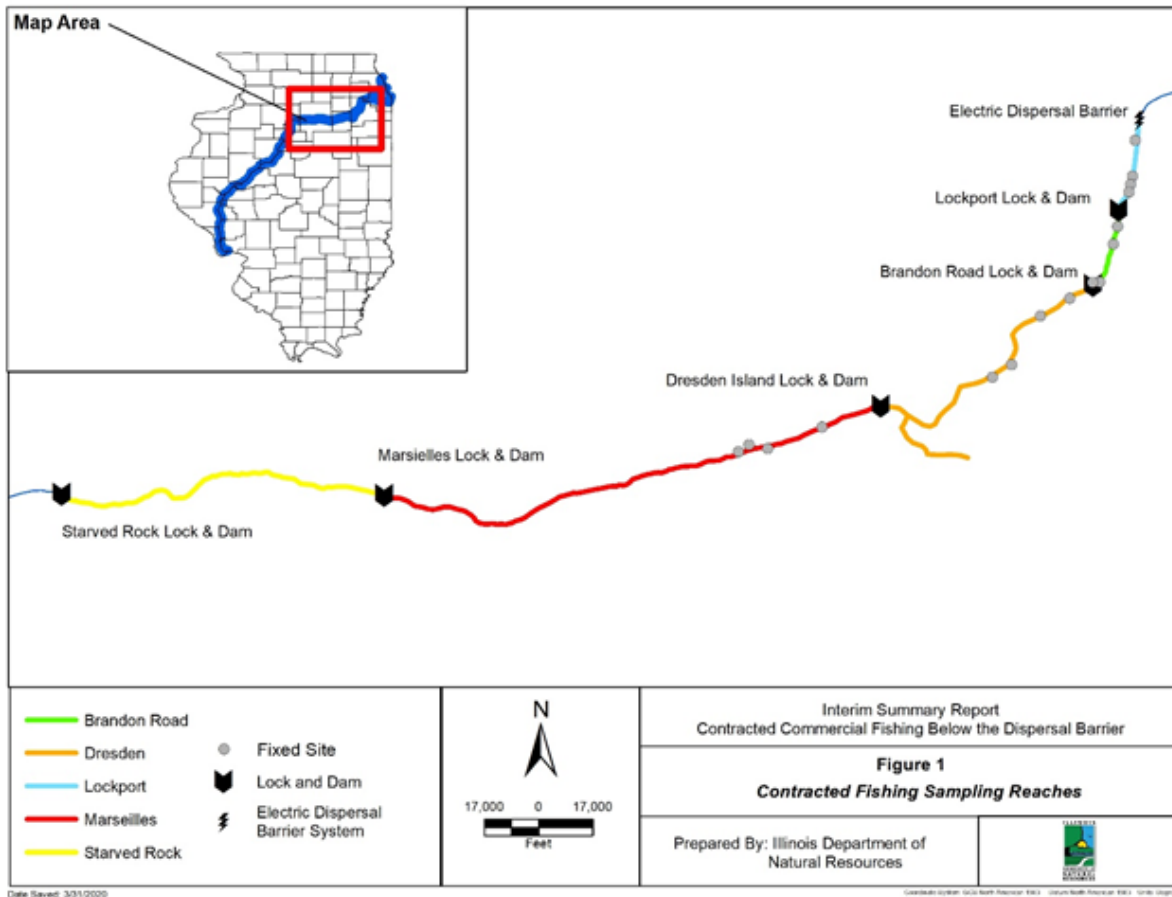
3.1.2 Illinois Waterway Removal Actions

The State of Illinois and its partners actively remove invasive carp from the IWW to stop the expansion of populations of invasive carp and reduce population pressure threatening the EDBS and the Great Lakes basin. Removal actions are needed annually because invasive carp from the Mississippi River continue to swim into the lower Illinois River and invasive carp naturally tend to swim upstream toward the EDBS. This work is led by the Removal Work Group of the MWRG.

Two different removal programs in the upper and lower Illinois River. In the upper river above Starved Rock Dam, fish densities are lower, and removal is specifically targeted through contracted fishing operations. As experience has grown, so has the effectiveness of this program. These fishers have learned how to optimize fishing efforts by targeting specific areas during times of the year when invasive carp congregate (Figure 18). This led to a record-breaking harvest of Silver Carp in the 10-day period in the fall of 2023.

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Figure 18 — Contracted Commercial Fishing Sampling Area



Map of fishing areas used by contracted commercial fishers in the Illinois Waterway. Source: ILDNR

The harvest used a seine fishing net (Figure 19) that surrounds fish on the sides and underneath and brings them to the bank. The seine is proving to be an effective removal technique in cool water when silver carp cannot jump out over the net. The goal is to remove at least one million pounds of invasive carp annually with contracted fishing to minimize the populations near the EDBS (Figure 20).

In the lower river below Starved Rock Dam, there are higher fish densities, and it is most cost-effective to incentivize invasive carp harvest by legally licensed Illinois commercial fishers. The Enhanced Invasive Carp Fishing Program offers Illinois-licensed commercial fishermen a financial incentive for each pound of invasive carp removed from the Peoria Pool and sold to fish processors or other buyers.

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Figure 19 — Commercial Fishing Seine Net



Photo of seine net. Source: ILDNR

Figure 20 — Contract Fishing on the IWW



Photo of contract fishers removing invasive carp from the Illinois River. Source: ILDNR

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Table 3 lists the Removal Actions – Contract Fishing projects supported by the 2025 Action Plan.

Table 3 — Removal Actions – Contract Fishing Projects

Project Number	Lead Agency	Project Title <i>(Click on Project Title to go to the project in Appendix B)</i>
IR1-25	ILDNR	Contract Fishing for Invasive Carp Removal Near the Electric Dispersal Barrier System
IR2-25	ILDNR	Enhanced Invasive Carp Removal in the Lower Illinois River

3.1.3 Monitoring and Decision Support

The continued monitoring and assessment of invasive carp in the IWW is critical for assessing the threat of upstream movement and informing decisions on where to target prevention and control actions. Surveillance upstream and downstream of the EDBS ensures no invasive carp have moved beyond this critical control point.

This work is led by several work groups of the MRWG, including:

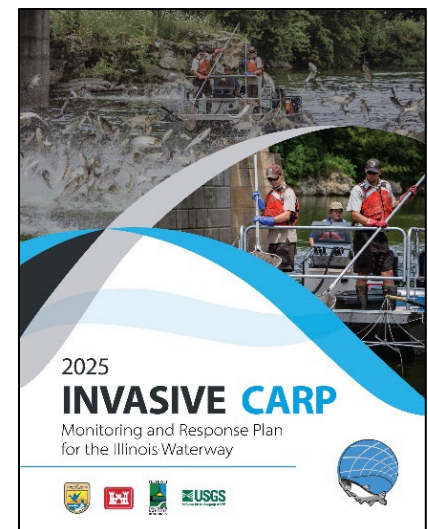
- Contingency Response Work Group
- Detection Work Group
- Hydroacoustics Work Group
- Telemetry Work Group
- Monitoring Work Group
- Modeling Work Group

The MRWG's Monitoring Response Plan (MRP) (Figure 21) is developed annually to coordinate the Work Groups' efforts to evaluate invasive carp status on a pool-by-pool basis within the IWW and target monitoring and control efforts accordingly. (When the 2025 MRP is available, it will be published on [Homepage | Invasive Carp Regional Coordinating Committee](#)) The following sections provide a brief overview of this work.

Contingency Planning and Response

While performing their normal invasive carp efforts, the ICRCC member agencies remain prepared to implement contingency (rapid response) actions through the MRWG Contingency Response Plan (CRP) for the Upper IWW and CAWS. The CRP is triggered if a change is detected in the status/risk of invasive carp in the Starved Rock, Marseilles, Dresden Island, Brandon Road, and Lockport pools. For more information on the CRP, see [Homepage | Invasive Carp Regional](#)

Figure 21 — Monitoring and Response Plan Cover



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[Coordinating Committee](#). Agencies are prepared to shift resources from other activities to support response actions deemed necessary by the appropriate jurisdictional authority in the event of new invasive carp detections.

An interagency CRP tabletop exercise is planned for 2025 to ensure agency personnel are prepared to implement appropriate response actions if needed.

Should there be any detections of invasive carp in nearshore waters or open waters of Lake Michigan, the ICRCC relies on the Great Lakes Fishery Commission (GLFC) and its Lake Michigan Committee members to coordinate actions and strategies to address fisheries management and invasive carp in Lake Michigan.

Early Detection

Early detection work consists of a semi-annual intense monitoring effort in the CAWS and ongoing surveillance work in the upper Illinois River. This work is complemented by enforcement activities to detect illegal activities that could transport and spread invasive carp.

SIM is the planned intensive surveillance of the CAWS upstream of the EDBS conducted in the spring and fall. This effort ensures that no invasive carp have moved past the EDBS. Prior to the SIM events, the U.S. Fish and Wildlife Service (USFWS) conducts environmental deoxyribonucleic acid (eDNA) monitoring as an added level of screening. Then, the SIM effort uses targeted sampling with various gears, including seines, trammel nets, and hoop nets, to detect, capture, and remove any invasive carp from upstream locations. On rare occasions, individual live Bighead Carp or Silver Carp have been captured during targeted sampling conducted upstream of the EDBS. In 2010, an adult Bighead Carp was captured during sampling in Lake Calumet within the CAWS; in 2017, an adult Silver Carp was captured in the CAWS below T.J. O'Brien Lock and Dam during SIM sampling; and, in 2022, an adult Silver Carp was captured during sampling by USACE and ILDNR in Lake Calumet ([Invasive silver carp removed from Lake Calumet | Invasive Carp Regional Coordinating Committee](#)). Based on an analysis of the chemical markers of these fish, it is probable that they originated in the Illinois River and then moved or were transported above the EDBS. In addition to early detection monitoring, ILDNR continues to investigate possible human-mediated pathways that could spread invasive carp.

To further support early detection, the ICRCC member agencies also sample downstream of the EDBS, including surveillance in the Lockport, Brandon Road, Dresden Island, and Marseilles pools, utilizing boat electrofishing, electrified dozer trawling, hoop netting, and mini-fyke netting. This work helps detect upstream migrations of small and juvenile Silver Carp and Bighead Carp. USFWS particularly focuses surveillance in the upstream reaches (Marseilles and Dresden Island Pools) where small (less than 6 inches in total length) fish are not known to be currently present.

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The use of eDNA continues to be an important early detection monitoring tool. USFWS maintains program capacity through agency funding to support strategic eDNA surveillance for invasive carp in the Great Lakes and Mississippi River basins. The U.S. Geological Survey (USGS) and USFWS are also exploring the use of environmental ribonucleic acid (eRNA), which may provide additional information, including if a live fish is or has recently been in the area, what life history stages are present, and if fish are in a reproductive state. RNA molecules degrade faster than DNA, which has the advantage of being a reliable indicator of living organisms; however, the applied use of the technology may be more difficult than eDNA.

Looking beyond the Illinois Waterway with eDNA. As an added level of surveillance, USFWS continues to work in close collaboration with Great Lakes states and tribes to plan and collect water samples for detection of Bighead Carp and Silver Carp eDNA material in Great Lakes tributaries. USFWS also implements a broader early detection program for aquatic invasive species, including invasive carp, using traditional nets in the nearshore U.S. waters of the Great Lakes.

Recognizing that invasive carp can be transported through illegal activities, ILDNR law enforcement will continue robust education and enforcement activities at bait shops, bait production/distribution facilities, fish processors, and fish markets or other food establishments known to prefer live fish for release or food preparation.

Hydroacoustics

Hydroacoustic monitoring of invasive carp in the Alton through Lockport pools continues to be an important source of information for quantifying the movement and size of populations in the IWW.

Hydroacoustic sampling, which survey fish populations by using sound waves, will also be used to gain greater temporal resolution on fish abundance and distribution. Hydroacoustic sampling will be conducted in the upper Illinois River throughout the Marseilles, Dresden Island, Brandon Road, and Lockport pools to identify areas with high densities of large-bodied fish that could potentially be invasive carp. Hydroacoustic sampling will also occur in Alton to Dresden Island pools in October to quantify pool-wide invasive carp densities for comparison to long-term data collected since 2012. Sampling within the EDBS and in the area immediately downstream (approximately 1.2 miles) of the barrier occurs every two weeks throughout the year. These surveys are intended to identify the presence of any large-bodied fish (fish larger than 12 inches in total length) near the EDBS and help evaluate the potential risk of fish passage in the event of operational changes at the barrier (e.g., maintenance events).

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Telemetry

Telemetry tracking in the IWW continues to be an important source of information quantifying the movement and size of populations. Through the telemetry project, invasive carp are implanted with acoustic transmitters (captured and released in areas where they are already established), and their movement is tracked across an acoustic receiver array (Figure 22).

Population Monitoring and Modeling

One of the ongoing challenges for invasive carp management in the IWW is estimating population size within the system. This is complicated due to the concurrent effects of invasive carp migrating in from the Mississippi River, reproduction and population growth occurring within the IWW, the upstream and downstream movement of fish between pools, the effect of removal actions, and naturally occurring mortality.

Agencies are using standardized methods to collect total length, weight, age, sex, and maturity data for invasive carp captured in the lower six pools of the river to develop the demographic information needed to model the population. Many years of data are required to develop enough information to support accurate estimates of invasive carp populations.

Additional monitoring efforts collect data associated with invasive carp populations, including invasive carp eggs, native zooplankton, and associated hydrological data. Several experiments will also be done with a mobile fish transfer system with associated technology to support fish scanning and sorting capabilities.

Using the information from several of the monitoring programs, quantitative fishery analysis tools, including the Spatially Explicit Invasive Carp Population (SEICarP) model and the Statistical Catch-at-Age (SCAA) model, are being developed to assess the population trends over time within the IWW. The SEICarP model was developed to provide managers with a tool for predicting the effect of various management strategies by evaluating invasive carp populations and generating estimates of large-scale pool-to-pool movement. The SCAA model will use catch statistics, age and growth data, and telemetry-based movement data to provide a finer quantitative estimate of invasive carp populations within the IWW. This model can be used iteratively to set management targets, estimate the effectiveness of management actions, and recalibrate management targets based on new information.

Figure 22 — Acoustic Transmitter Being Surgically Implanted into an Invasive Carp



Photo shows USGS personnel surgically implanting an acoustic transmitter into an invasive carp. Photo credit: Marybeth Brey, USGS

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Table 4 lists the Monitoring and Decision Support Projects supported by the 2025 Action Plan.

Table 4 — Monitoring and Decision Support Projects

Project Number	Lead Agency	Project Title <i>(Click on title to go to the project in Appendix B)</i>
IM1-25	ILDNR	Early Detection Monitoring and Contingency Response in the Illinois Waterway
IM2-25	USFWS	Support for Early Detection in the Upper Illinois Waterway
IM3-25	USFWS	Invasive Carp eDNA Sampling and Processing
IM4-25	USGS	Invasive Carp eRNA Development for Detection of Spawning and Larvae
IM5-25	USFWS	Early Detection Monitoring for Invasive Carp in the Great Lakes
IM6-25	ILDNR	Alternate Pathway Surveillance in Illinois – Law Enforcement
IM7-25	ILDNR	Invasive Carp Stock Assessment in the Illinois River Using Hydroacoustics
IM8-25	USFWS	USFWS Hydroacoustic Surveys of Fish Abundance and Distribution in the Upper Illinois Waterway
IM9-25	USGS	Real-Time Telemetry Alert System and Refinement of the Spatially Explicit Invasive Carp Population Model (SEICarP)
IM10-25	USFWS	Telemetry Tracking in the Illinois Waterway to Support the Spatially Explicit Invasive Carp Population Model (SEICarP)
IM11-25	USFWS	Invasive Carp Demographics in the Illinois Waterway
IM12-25	USGS	Evaluation of Invasive Carp Spawning Dynamics and Collection of Associated Hydrological Data
IM13-25	ILDNR	Assessment of Invasive Carp Reproduction and Ecosystem Response in the Illinois Waterway
IM14-25	ILDNR	Evaluation of Fish Transfer System to Promote Native Species Movement and Invasive Carp Harvest
IM15-25	USGS	USGS Support for Invasive Carp Population Modeling in the Illinois River
IM16-25	USFWS	USFWS Support for Invasive Carp Population Modeling in the Illinois River
IM17-25	USGS	Invasive Carp Database Management and Integration Support

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3.2 Hydrologic Barriers to Prevent Invasive Carp Movement through Intermittent Waterways

ICRCC member agencies are involved with building and maintaining hydrologic barriers that prevent the spread of invasive carp between the Mississippi River and Great Lakes basin through intermittent waterways.

Using previous funding, Ohio Department of Natural Resources (OHDNR) will complete the berm design, permitting, wetland mitigation, and construction of a rock berm at highest risk for flooding (Phase 1) on Little Killbuck Creek in northwest Ohio. The remaining project (Reaches 2 through 7, Phases 2 through 6) will be phased over multiple years and will further stabilize and maintain the current earthen berm and upgrade related infrastructure. Phase 1 of the project was initiated in October 2024 and will be a new rock berm on Medina County Park District property. Phase 2 of the project will be completed using FY 2024 funding and will address the second highest aquatic invasive species (AIS) risk, including purchasing an easement for the current earthen berm, raising Garden Isle Road, upgrading a pumping facility to ensure dry conditions, improving the access road for future construction phases, and screening a structure for a culvert. Later phases will include the maintenance of the current earthen berm and additional measures. Two additional barriers constructed in prior years are the Eagle Marsh (Fort Wayne, Indiana) and the Ohio & Erie Canal Aquatic Nuisance Species Barrier project (Akron, Ohio) (Figure 23). Working with local agencies, the Indiana DNR and OHDNR will continue to maintain those barriers, respectively.

Figure 23 — Alternate Pathways for Potential Interbasin Movement of Aquatic Invasive Species



Map identifying Great Lakes and Ohio River watersheds and status of interbasin pathways projects. Source: OHDNR

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Table 5 lists the Hydrologic Barriers to Prevent Invasive Carp Movement through Intermittent Waterways projects supported by the 2025 Action Plan.

Table 5 — Hydrologic Barriers to Prevent Invasive Carp Movement through Intermittent Waterways Projects

Project Number	Lead Agency	Project Title <i>(Click on Project Title to go to the Project in Appendix B)</i>
HB1-25	OHDNR	Construction of Structures at Little Killbuck Creek, Ohio, to Prevent Inter-Basin Movement of Invasive Carp
HB2-25	OHDNR	Maintenance of Structures at Ohio & Erie Canal to Prevent Inter-Basin Movement of Invasive Carp

3.3 Preventing Establishment of Grass Carp in the Great Lakes

Grass Carp have been historically detected and captured in all the Great Lakes except Lake Superior. However, populations are significantly larger in Lake Erie, and there has been evidence of Grass Carp spawning activity.

The GLFC's Lake Erie Committee (LEC) of fishery managers coordinates efforts to monitor, assess, understand, and control the Grass Carp population in Lake Erie through the implementation of its [Grass Carp Adaptive Response Strategy 2024-2028 FINAL.pdf](#). The binational LEC, comprised of fishery managers from Michigan, Ohio, Pennsylvania, New York, and Ontario and supported by Canadian and U.S. federal agencies, adopted this 5-year adaptive response strategy to prevent Grass Carp from attaining densities capable of adversely affecting vegetated habitats and associated fish communities and fisheries in Lake Erie. In addition, the GLFC's Grass Carp Advisory Committee (GCAC) helps coordinate actions that address specific LEC priorities and provides advice on maintaining surveillance activities where appropriate in other lakes.

The major focus in Lake Erie is the removal of Grass Carp, led by U.S. agency and University of Toledo strike teams. According to the Grass Carp Adaptive Response Strategy ([Grass Carp Adaptive Response Strategy 2024-2028 FINAL.pdf](#)), overall abundance appears below a threshold of causing detectable levels of adverse impacts and may have declined since 2018 in the Sandusky River (OH) owing to intensive response efforts. The 'SpawnCast' web-based decision support tool produces forecasts of potential Grass Carp spawning events to help target strike team control actions.

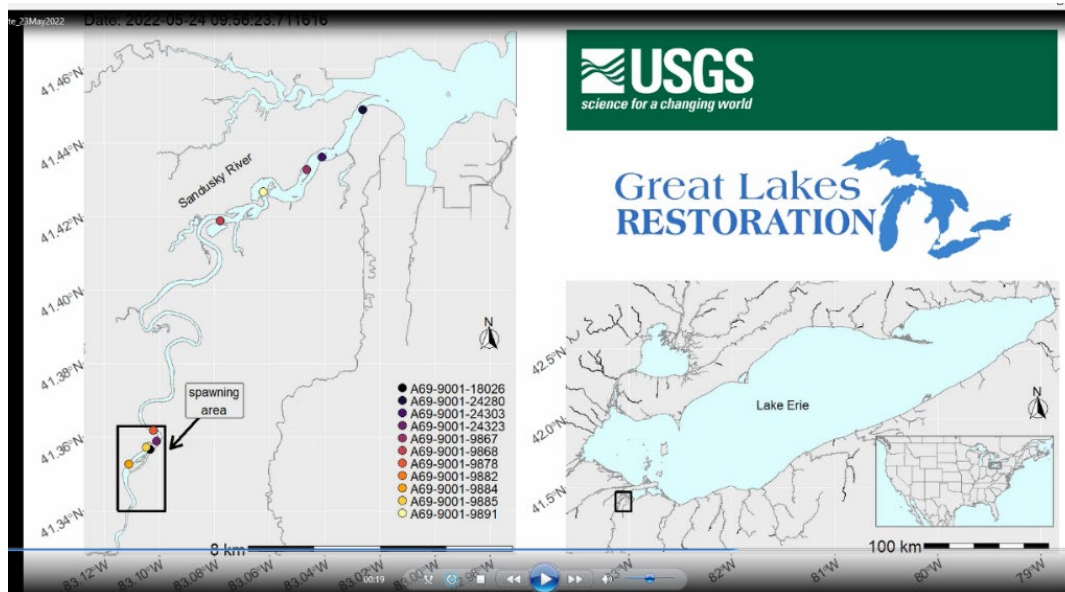
Ongoing monitoring of tagged Grass Carp indicate that they are continuing to mostly inhabit the western basin of Lake Erie, with limited movement to eastern areas of Lake Erie, minimally to Lake Huron, and some fish return to western Lake Erie. Monitoring and telemetry studies will

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continue to be used to guide response actions, and models will continue to be developed to help track the effectiveness of the response effort. An animated video depicting a one-day Grass Carp spawning event in the Sandusky River may be viewed here:

<https://www.usgs.gov/media/videos/telemetered-grass-carp-ctenopharyngodon-idella-movements-during-a-known-spawning-event>

Figure 24 — Telemetered Grass Carp Movements During a Spawning Event



Telemetered Grass Carp movements during a known spawning event on 23 May 2022, in the Sandusky River, Ohio. Source: USGS

To ensure that no other significant populations exist in the Great Lakes, agencies will continue to implement targeted Grass Carp surveillance and removal actions (capture and removal when encountered in sampling gears). In Lake Michigan, partners include the Michigan Department of Natural Resources (MIDNR), the GLFC, USFWS, and the Lake Michigan Committee. U.S. State and federal agency partners will continue Grass Carp surveillance and removal efforts in Lake Ontario.

Table 6 lists the Preventing Establishment of Grass Carp in the Great Lakes projects supported by the 2025 Action Plan.

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Table 6 — Preventing Establishment of Grass Carp in the Great Lakes Projects

Project Number	Lead Agency	Project Title <i>(Click on Project Title to go to the Project in Appendix B)</i>
GC1-25	OHDNR	Removal of Grass Carp in Ohio Waters of the Lake Erie Western Basin and Early Detection Monitoring in Other Lake Erie Tributaries
GC2-25	MIDNR	Removal of Grass Carp in the Lake Erie Western Basin and Early Detection Monitoring in Great Lakes Tributaries
GC3-25	USFWS	Support for Removal of Grass Carp in the Lake Erie Western Basin and Early Detection Monitoring in Great Lakes Tributaries
GC4-25	USFWS	Invasive Carp Ploidy Analysis to Assess Reproductive Risk of Detected Populations
GC5-25	USGS	Reproduction Characteristics, Vegetation Impacts, and Removal Efficiency of Grass Carp in Western Lake Erie
GC6-25	USGS	Refinement of the Grass Carp Spawning Event Prediction Tool
GC7-25	USGS	Using Telemetry to Better Understand Grass Carp Movements and Habitat Use
GC8-25	USGS	Development and Testing of Deterrent Technologies for Grass Carp
GC9-25	NOAA	Characterization of In-Lake Grass Carp Movement Patterns in Response to Habitat Conditions Using Biophysical Models
GC10-25	USGS	Spatiotemporal Variability of Strontium Isotope Ratios in Sandusky Bay Water
	GLFC	Grass Carp Control in the Lake Erie Basin

3.4 Understanding Black Carp Population Dynamics to Inform Management Strategies

Naturally reproducing populations of Black Carp are present and increasing their range in the Mississippi River basin, and a population exists in the lower Illinois River. U.S. ICRCC member agencies continue to focus on effectively locating and removing Black Carp from the lower Illinois River using eDNA surveillance and traditional fishery gear. In addition, a collaboration with commercial fishers is helping to collect data from their captures of Black Carp around the Mississippi River and Illinois River Confluence. These collections, along with other monitoring

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information, provides information on Black Carp population dynamics to further inform management strategies.

Table 7 lists the Understanding Black Carp Population Dynamics to Inform Management Strategy projects supported by the FY 2025 Action Plan.

Table 7 — Understanding Black Carp Population Dynamics to Inform Management Strategy Projects

Project Number	Lead Agency	Project Title (Click on Project Title to go to the project in Appendix B)
BC1-25	ILDNR	Enhanced Detection of Black Carp in the Lower Illinois River
BC2-25	ILDNR	Data Collection from Commercial Fishers and Recreational Angler Captures of Black Carp in the Lower Illinois River
BC3-25	USGS	Support for Black Carp Monitoring and Population Assessment
BC4-25	USFWS	Support for Black Carp Monitoring and Interagency Coordination
BC5-25	USACE	Estimation of Black Carp Population Sizes

3.5 ICRCC Communications and Support

The FY 2025 Action Plan includes key activities to continue effective communication and partnership coordination efforts in support of the ICRCC's purpose of Great Lakes' protection from invasive carp.

The Communication Work Group (CWG), co-chaired by the USFWS and ILDNR, will continue to develop and provide timely and relevant information to the public, government agencies and officials, and other stakeholders. Continuing this outreach and communication approach is a key component of the ICRCC's strategy to promote transparency and accountability and support effective and timely communications on key ongoing and emerging invasive carp issues. A goal of the CWG is to contribute to key audiences' understanding and appreciation for the ICRCC's purpose and ultimately increase stakeholder engagement and support for efforts to protect the Great Lakes from invasive carp. This includes providing timely and substantive technical information to Congress, the public, the media, and other stakeholders about the status of the invasive carp threat and the coordinated strategic actions undertaken by the ICRCC to address the threat.

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The CWG includes communications expertise from both U.S. and Canadian ICRCC member agencies, serving to coordinate messaging and communications in a complex multi-agency response and management setting. A primary platform within the ICRCC’s communications approach is the partnership’s designated website, [Homepage | Invasive Carp Regional Coordinating Committee](#). As the site administrator, USFWS will continue to lead efforts to develop and update relevant website content in collaboration with partner agencies.

Additional support for achieving the ICRCC’s purpose is provided through the FY 2025 Action Plan for general partnership operational and logistical needs, including contractor staffing capacity, as needed.

Additionally, the ICRCC will continue to collaborate with other invasive carp management efforts and partnerships outside the Great Lakes to leverage opportunities, best practices, strategies, and resources on invasive carp prevention and control across multiple basins in support of the goals of the national *Management and Control Plan for Bighead, Black, Grass, and Silver Carp in the United States* (National Plan). These collaborative efforts will further support the efforts of partners to identify and leverage expertise, share data, and increase capacity to address the challenge of preventing the introduction and establishment of invasive carp more broadly and holistically on a multi-basin, regional, and national scale.

Table 8 lists the ICRCC Communications and Support projects supported by the FY 2025 Action Plan.

Table 8 — ICRCC Communications and Support Projects

Project Number	Lead Agency	Project Title (<i>Click on Project Title to go to the project in Appendix B</i>)
MS1-25	USFWS	ICRCC Strategic Communications with Partners and Stakeholders
MS2-25	USFWS	ICRCC Mission Support

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4. NATIONAL INVASIVE CARP MANAGEMENT

The ICRCC's efforts to prevent the introduction and establishment of invasive carp in the Great Lakes take place within a greater U.S. and Canadian context. Invasive carp represent a significant challenge to natural resource managers across much of the U.S. and Canada.

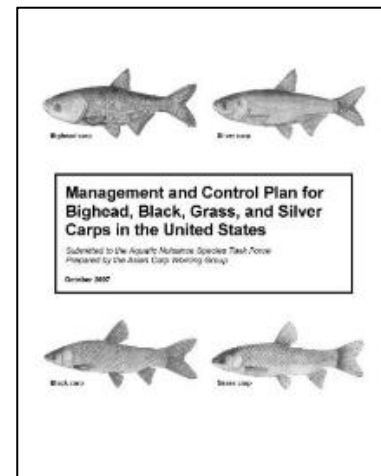
4.1 U.S. National Invasive Carp Management

In the U.S., the river corridors of the Mississippi River basin provide an expansive network of interconnected pathways for the potential movement of invasive carp into the watershed's 31 states. Geographically-focused management strategies are being implemented, stepped down from the national guidance provided in the *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States* (Figure 25). ([Action Plans and Reports | Invasive Carp Regional Coordinating Committee](#)).

Figure 25 demonstrates the extent of Bighead Carp and Silver Carp populations within the Mississippi River basin's mainstem rivers. Working through the Mississippi Interstate Cooperative Resource Association (MICRA) framework, interagency invasive carp partnerships were initially formed in 2014 to address the threat of invasive carp in the Upper Mississippi River and Ohio River sub-basins and are now operating in all major river sub-basins of the Mississippi River basin (Figure 26).

Monitoring, tracking, and managing multiple populations of the four species across large, complex, multi-jurisdictional watersheds underscore the challenging and evolving nature of effectively addressing the threat posed by invasive carp. Accordingly, agencies have developed strategies and approaches to scientifically assess invasive carp and collect critically needed information to inform actions while continuing to focus on aggressive measures to prevent and control further introduction and range expansion. Additional information can be found at: <http://micrarivers.org/invasivecarp/>.

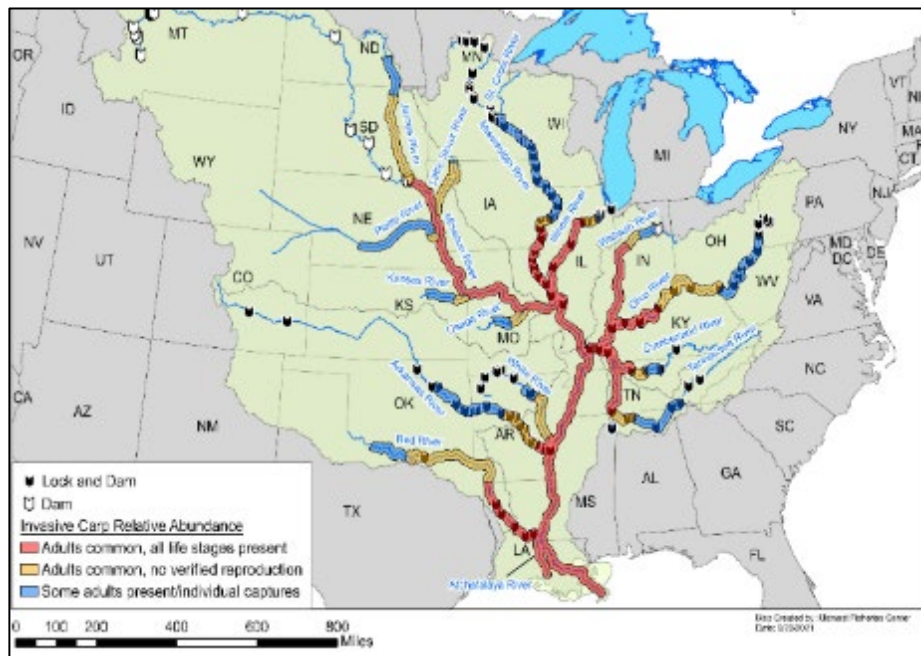
Figure 25 — Management and Control Plan Cover



Management and Control Plan developed by the Aquatic Nuisance Species Task Force, Washington, D.C., 2007

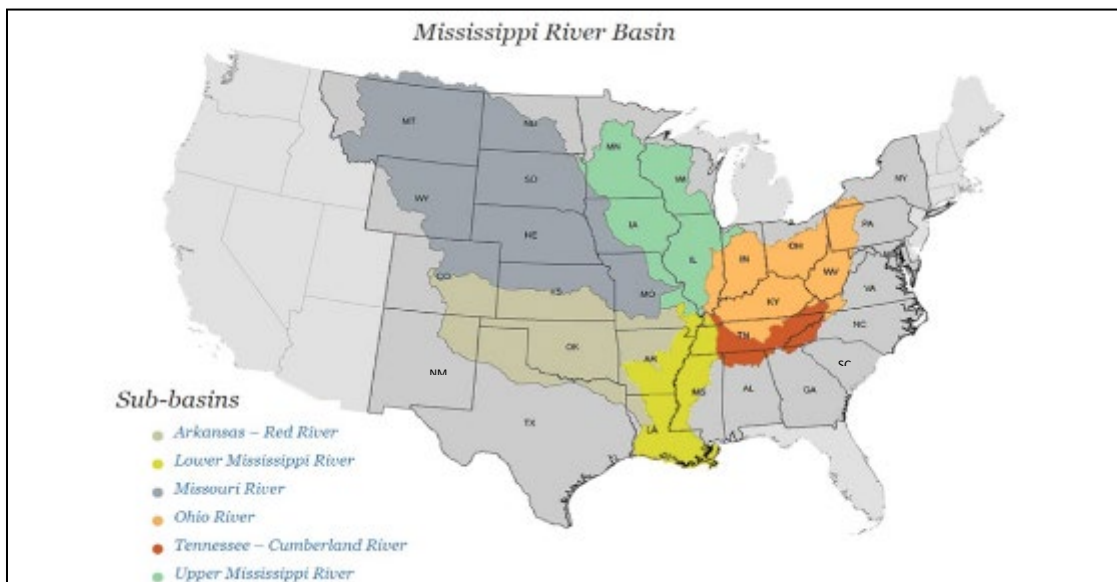
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Figure 26 — Status of Bighead Carp and Silver Carp – Mississippi River Basin



Map showing the status of Bighead Carp and Silver Carp in the Mississippi River basin.
Source: USFWS

Figure 27 — Delineation of Mississippi River Sub-Basins with Invasive Carp Partnerships



U.S. map showing states with Mississippi River sub-basin invasive carp partnerships. Source: USFWS

4.2 Canadian National Invasive Carp Management

Within Canada, Fisheries and Oceans Canada (DFO), the Ontario Ministry of Natural Resources and Forestry (OMNRF), and the Québec Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs (MELCCFP) are key Canadian Federal and Provincial ICRC partner agencies working to address the threat of Grass Carp, Bighead Carp, Silver Carp, and Black Carp to the Great Lakes and St. Lawrence River. Their efforts include policy, prevention, early detection surveillance, research, and scientific oversight activities in the Canadian waters of the Great Lakes and St. Lawrence River, representing a critical component to ensuring a basin-wide approach to addressing the threat. More information on these efforts can be found at the following agency websites:

- The official website of [Fisheries and Ocean Canada](#)
- The official Quebec website [Welcome to Québec.ca | Gouvernement du Québec](#)
- Ontario's pamphlet on [Asian Carps](#)

The response plan of [Asian Carp Response Plan – Asian Carp Canada](#)

Appendix A

FY 2025 Funding Matrix

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Table A-1 – Funding by Project*

	Action	Lead Agency	Project Title	GLRI Funding	Agency Funding
Preventing Invasive Carp Movement through the Illinois Waterway	ID1-25	USACE	Operation and Maintenance of the Electric Dispersal Barrier System	\$0	\$17,979,000
	ID2-25	USACE	Brandon Road Lock and Dam Aquatic Nuisance Species Barrier Project	\$0	\$0**
	ID3-25	USGS	Water Quality and Velocity Monitoring in Support of Brandon Road Project	\$80,000	\$0
ID – Illinois Waterway Deterrent Technology Operation and Development	ID4-25	USACE	Further Evaluation of Underwater Acoustics as a Deterrent for Invasive Carp	\$1,070,000	\$0
	ID5-25	USGS	Technical Support for Testing of Acoustic Deterrents	\$1,320,000	\$615,000
	ID6-25	USACE	USACE Planning for Field Demonstration of Carbon Dioxide Deterrent at the Electric Dispersal Barrier System	\$200,000	\$0
IR – Removal Actions – Contract Fishing	ID7-25	USGS	USGS Planning for Field Demonstration of Carbon Dioxide Deterrent at the Electric Dispersal Barrier System	\$345,000	\$360,000
IM – Monitoring and Decision Support	IR1-25	ILDNR	Contract Fishing for Invasive Carp Removal Near the Electric Dispersal Barrier System	\$2,310,000	\$0
	IR2-25	ILDNR	Enhanced Invasive Carp Removal in the Lower Illinois River	\$2,000,000	\$0
	IM1-25	ILDNR	Early Detection Monitoring and Contingency Response in the Illinois Waterway	\$4,200,000	\$0
	IM2-25	USFWS	Support for Early Detection in the Upper Illinois Waterway	\$695,000	\$675,000
	IM3-25	USFWS	Invasive Carp eDNA Sampling and Processing	\$0	\$2,400,000
	IM4-25	USGS	Invasive Carp eRNA Development for Detection of Spawning and Larvae	\$145,000	\$200,000
	IM5-25	USFWS	Early Detection Monitoring for Invasive Carp in the Great Lakes	\$355,000	\$1,400,000
	IM6-25	ILDNR	Alternate Pathway Surveillance in Illinois-Law Enforcement	\$157,500	\$0
	IM7-25	ILDNR	Invasive Carp Stock Assessment in the Illinois River Using Hydroacoustics	\$750,000	\$0

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	Action	Lead Agency	Project Title	GLRI Funding	Agency Funding
Preventing Invasive Carp Movement through the Illinois Waterway IM – Monitoring and Decision Support	IM8-25	USFWS	USFWS Hydroacoustic Surveys of Fish Abundance and Distribution in the Upper Illinois Waterway	\$120,000	\$0
	IM9-25	USGS	Real-Time Telemetry Alert System and Refinement of the Spatially Explicit Invasive Carp Population Model (SEICarP)	\$178,000	\$0
	IM10-25	USFWS	Telemetry Tracking in the Illinois Waterway to Support the Spatially Explicit Invasive Carp Population Model (SEICarP)	\$155,000	\$400,000
	IM11-25	USFWS	Invasive Carp Demographics in the Illinois Waterway	\$450,000	\$250,000
	IM12-25	USGS	Evaluation of Invasive Carp Spawning Dynamics and Collection of Associated Hydrological Data	\$80,000	\$75,000
	IM13-25	ILDNR	Assessment of Invasive Carp Reproduction and Ecosystem Response in the Illinois Waterway	\$480,500	\$0
	IM14-25	ILDNR	Evaluation of Fish Transfer System to Promote Native Species Movement and Invasive Carp Harvest	\$230,000	\$0
	IM15-25	USGS	USGS Support for Invasive Carp Population Modeling in the Illinois River	\$133,000	\$304,000
	IM16-25	USFWS	USFWS Support for Invasive Carp Population Modeling in the Illinois River	\$100,000	\$200,000
	IM17-25	USGS	Invasive Carp Database Management and Integration Support	\$161,000	\$436,000
Hydrologic Barriers to Prevent Invasive Carp Movement through Intermittent Waterways	HB1-25	OHDNR	Construction of Structures at Little Killbuck Creek, Ohio, to Prevent Inter-Basin Movement of Invasive Carp	\$0	\$0
	HB2-25	OHDNR	Maintenance of Structures at Ohio & Erie Canal to Prevent Inter-Basin Movement of Invasive Carp	\$20,000	\$0

Invasive Carp Action Plan: Fiscal Year 2025

	Action	Lead Agency	Project Title	GLRI Funding	Agency Funding
Preventing Establishment of Grass Carp in the Great Lakes	GC1-25	OHDNR	Removal of Grass Carp in Ohio Waters of the Lake Erie Western Basin and Early Detection Monitoring in Other Lake Erie Tributaries	\$625,000	\$0
	GC2-25	MIDNR	Removal of Grass Carp in the Lake Erie Western Basin and Early Detection Monitoring in Great Lakes Tributaries	\$410,000	\$150,000
	GC3-25	USFWS	Support for Removal of Grass Carp in the Lake Erie Western Basin and Early Detection Monitoring in Great Lakes Tributaries	\$1,470,000	\$850,000
	GC4-25	USFWS	Invasive Carp Ploidy Analysis to Assess Reproductive Risk of Detected Populations	\$80,000	\$40,000
	GC5-25	USGS	Reproduction Characteristics, Vegetation Impacts, and Removal Efficiency of Grass Carp in Western Lake Erie	\$520,000	\$274,500
	GC6-25	USGS	Refinement of the Grass Carp Spawning Event Prediction Tool	\$85,000	\$20,000
	GC7-25	USGS	Using Telemetry to Better Understand Grass Carp Movements and Habitat Use	\$200,000	\$519,412
	GC8-25	USGS	Development and Testing of Deterrent Technologies for Grass Carp	\$125,000	\$254,800
	GC9-25	NOAA	Characterization of In-Lake Grass Carp Movement Patterns in Response to Habitat Conditions Using Biophysical Models	\$241,000	\$86,000
	GC10-25	USGS	Spatiotemporal Variability of Strontium Isotope Ratios in Sandusky Bay Water	\$30,000	\$67,000
--	N/A	GLFC	Grass Carp Control in the Lake Erie Basin	\$0	\$1,000,000

Invasive Carp Action Plan: Fiscal Year 2025

	Action	Lead Agency	Project Title	GLRI Funding	Agency Funding
Understanding Black Carp Population Dynamics to Inform Management Strategies	BC1-25	ILDNR	Enhanced Detection of Black Carp in the Lower Illinois River	\$228,000	\$0
	BC2-25	ILDNR	Data Collection from Commercial Fishers and Recreational Angler Captures of Black Carp in the Lower Illinois River	\$42,000	\$0
	BC3-25	USGS	Support for Black Carp Monitoring and Population Assessment	\$475,000	\$140,000
	BC4-25	USFWS	Support for Black Carp Monitoring and Interagency Coordination	\$91,000	\$10,000
	BC5-25	USACE	Estimation of Black Carp Population Sizes	\$293,000	\$0
ICRCC Communications and Support	MS1-25	USFWS	ICRCC Strategic Communications with Partners and Stakeholders	\$175,000	\$100,000
	MS2-25	USFWS	ICRCC Mission Support	\$175,000	\$0
Total Funding	--	--	--	\$21,000,000	\$28,805,712

* FY2025 Obligation levels shown are notional. The President reserves his authority under the “Full-Year Continuing Appropriations and Extensions Act, 2025” (P.L. 119-4) to revise 2025 spending within the amounts provided by Congress.

** BRIP funding in FY 2025 is \$0. Carryover funds of \$274M and non-Federal funds of \$114M will be used for construction.

Invasive Carp Action Plan: Fiscal Year 2025

Table A-2 – Funding by Agency*

Agency	GLRI Funding FY 2025 (\$)	Agency Funding FY 2025 (\$)
Illinois DNR	\$10,398,000	\$0
Ohio DNR	\$645,000	\$0
Michigan DNR	\$410,000	\$150,000
NOAA	\$241,000	\$86,000
GLFC	\$0	\$1,000,000
USACE	\$1,563,000	\$17,979,000
USFWS	\$3,866,000	\$6,325,000
USGS	\$3,877,000	\$3,265,712
TOTALS	\$21,000,000	\$28,805,712

* FY2025 Obligation levels shown are notional. The President reserves his authority under the “Full-Year Continuing Appropriations and Extensions Act, 2025” (P.L. 119-4) to revise 2025 spending within the amounts provided by Congress.

Appendix B¹

FY 2025 Invasive Carp Action Plan Projects

¹ FY2025 Obligation levels shown are notional. The President reserves his authority under the “Full-Year Continuing Appropriations and Extensions Act, 2025” (P.L. 119-4) to revise 2025 spending within the amounts provided by Congress.

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ACRONYM LIST

Acronym	Definition
AIS	Aquatic Invasive Species
ANS	Aquatic Nuisance Species
BAFF	Bio-Acoustic Fish Fence
BCWG	Black Carp Work Group
BRIP	Brandon Road Interbasin Project
BRLD	Brandon Road Lock and Dam
CAWS	Chicago Area Waterway System
CO2	Carbon Dioxide
CRP	Contingency Response Plan
CSSC	Chicago Sanitary and Ship Canal
CWG	Communications Work Group
DFO	Department of Fisheries and Oceans Canada
DNR	Department of Natural Resources
EDBS	Electric Dispersal Barrier System
eDNA	Environmental Deoxyribonucleic Acid
EDM	Early Detection Monitory
ERDC	Engineer Research and Development Center
FBC	Fish & Boat Commission
FY	Fiscal Year
GLATOS	Great Lakes Acoustic Telemetry Observation System
GLFC	Great Lakes Fishery Commission
GLMRIS	Great Lakes and Mississippi River Interbasin Study
GLRI	Great Lakes Restoration Initiative
IADNR	Iowa Department of Natural Resources
ICRCC	Invasive Carp Regional Coordinating Committee

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Acronym	Definition
ILDNR	Illinois Department of Natural Resources
Indiana DNR	Indiana Department of Natural Resources
ILRCdb	Illinois River Catch Database
INHS	Illinois Natural History Survey
ISU	Invasive Species Unit
IWW	Illinois Waterway
KDFWR	Kentucky Department of Fish and Wildlife Resources
LTRM	Long-term Resource Monitoring
MAM	Multi-Agency Monitoring
MI DNR	Michigan Department of Natural Resources
MNDNR	Minnesota Department of Natural Resources
MDC	Missouri Department of Conservation
MRWG	Monitoring and Response Work Group
MSU	Michigan State University
NWIS	National Water Information System
NYDEC	New York Department of Environmental Conservation
NOAA	National Oceanic and Atmospheric Administration
OH DNR	Ohio Department of Natural Resources
PVC	Polyvinyl chloride
qPCR	Quantitative polymerase chain reaction
SCAA	Statistical Catch-at-Age
SEICarP	Spatially Explicit Invasive Carp Population
SIM	Seasonal Intensive Monitoring
SIU	Southern Illinois University
SIUC	Southern Illinois University Carbondale
TNWRA	Tennessee Wildlife Resources Agency

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Acronym	Definition
TWG	Technology Work Group
U.S.	United States
UADS	Underwater Acoustic Deterrent System
UMN	University of Minnesota
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UT	University of Toledo
WIDNR	Wisconsin Department of Natural Resources

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Migration Deterrents and Technology Development

ID1-25: Operation and Maintenance of the Electric Dispersal Barrier System

- **Lead Agency:** USACE
- **Agency Collaboration:**
- **GLRI Funding:** \$0
- **Agency Funding:** \$17,979,000

Project Summary

This project involves the operation and maintenance of the EDBS on the CSSC in Romeoville, Illinois. This project provides the last line of defense to prevent the establishment of invasive carp in the Great Lakes by maintaining a constant electrical current in the water of the CSSC. Funding supports continuous operations as well as efforts to improve the efficacy of the system.

Project Description

The CSSC is a man-made waterway creating the only continuous connection between Lake Michigan and the Mississippi River basin. The EDBS was developed to prevent the spread of invasive fish species between these watersheds. USACE has operated electric barriers in the CSSC since 2002 (Figure 1). Over the years, several operational and procedural improvements have been implemented to improve the effectiveness and continuously deliver an uninterrupted flow of electricity to the water to deter fish. Barrier I construction was completed in 2024. Final safety testing of the system is underway and scheduled for completion in 2025. In 2025, USACE will activate the new components of Barrier I for full time operation and continue to operate and maintain existing barriers. Additionally, in 2025, USACE plans to acquire permanent real estate interest of the leased project site.

Figure 1 — USACE EDBS in the CSSC



Map showing the location of EDBS electrodes in the CSSC and supporting facilities. Source: USACE

Invasive Carp Action Plan: Fiscal Year 2025

Figure 2 — Bank of Capacitors



Photo of a bank of capacitors that provides continuous power to the IGBT switches that is then sent to the electrodes in the canal.

Source: USACE

Figure 3 — IGBT Switches

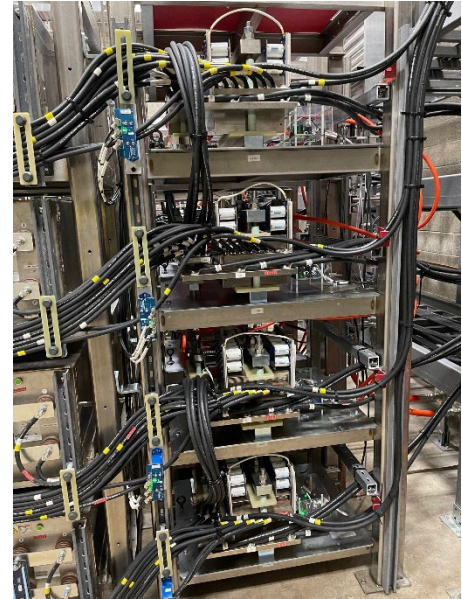


Photo of the IGBT switches that pulse the electricity into the CSSC.

Source: USACE

Invasive Carp Action Plan: Fiscal Year 2025

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Migration Deterrents and Technology Development

ID2-25: Brandon Road Lock and Dam Aquatic Nuisance Species Barrier Project

- **Lead Agency:** USACE
- **Agency Collaboration:** N/A
- **GLRI Funding:** \$0
- **Agency Funding:** \$0 (This project received \$225.838 million from the FY 2022 Bipartisan Infrastructure Law and \$47.880 million from the FY 2023 work plan.)

Project Summary

This project will support the design, construction, and implementation of structural and nonstructural measures near BRLD near Joliet, Illinois, which will prevent, to the maximum extent possible, the upstream transfer of ANS from the Mississippi River basin into the Great Lakes basin while minimizing impacts to waterway uses and users. Construction of the project has begun since the Project Partnership Agreement with the local sponsors (State of Illinois and State of Michigan) was signed on July 1, 2024. Federal funds received to date (include \$225.838 million from the Bipartisan Infrastructure Law and \$47.88 million from the FY 2023 work plan) , in conjunction with local sponsor funds (\$114 million, \$50 million from IL and \$64 million from MI), will be used to complete design of the entire project and complete construction of the first of three increments, which consist of an automated barge clearing deterrent, a bubble deterrent, and an acoustic deterrent as well as site preparation work. The contract for site preparation or rock excavation was awarded in November 2024.

Project Description

The project includes a layered system of structural controls and non-structural measures. The structural plan includes a new control point at BRLD in addition to the control point that is already provided by the CSSC EDBS in Romeoville, Illinois. The new structural control point would include an acoustic fish deterrent, a bubble deterrent, an engineered channel, an electric deterrent, a flushing lock, and an automated barge clearing (barge entrainment) deterrent. The project includes managing the waterway below the BRLD as a “population reduction zone,” where monitoring and overfishing would occur.

Non-structural measures that may be implemented, primarily by other federal and state agencies, include public education and outreach, non-structural monitoring, integrated pest management, piscicides, manual or mechanical removal of fish, research, and development of two boat launches.

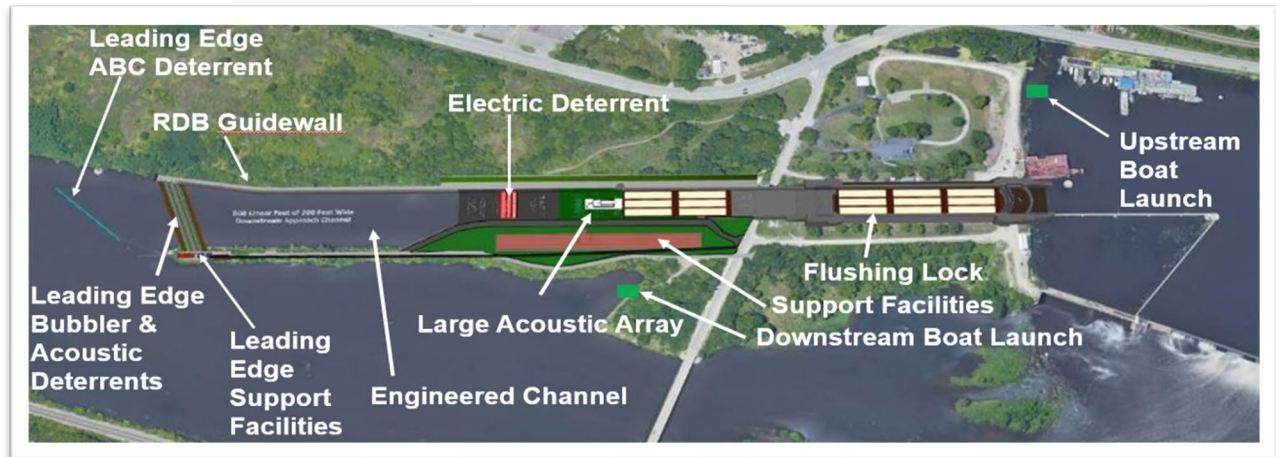
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The project is anticipated to be constructed in three increments:

- Increment I-A: bubble deterrent, acoustic deterrent, automated barge clearing (entrainment) deterrent, support facilities, and upstream boat launch.
- Increment I-B: site prep and channel rock excavation.
- Increment II: electric deterrent, large acoustic deterrent, engineered channel floor and wall for electric & large acoustic deterrent, flushing lock, downstream boat launch, and support facilities.
- Increment III: the completion of the engineered channel floor and walls.

The proposed project also includes fishery management efforts to offset impaired migration of native fish between the upper and lower Des Plaines River. Project performance will be defined by the success of the physical construction that is within the control of USACE and annual operation and maintenance costs upon completing the project.

Figure 4 — Overall Project Features



Overhead view of Brandon Road Lock and Dam depicting the locations of the deterrents and the support features. Source: USACE

Invasive Carp Action Plan: Fiscal Year 2025

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Migration Deterrents and Technology Development

ID3-25: Water Velocity and Quality Monitoring Station in Support of the Brandon Road Interbasin Project

- **Lead Agency:** USGS
- **Agency Collaboration:** USACE
- **GLRI Funding:** \$80,000
- **Agency Funding:** \$0

Project Summary

This project will support the operation and maintenance of a water-velocity and water-quality streamgaging station in the downstream approach channel to BRLD on the IWW and the temporary relocation of this streamgage due to construction planned at the Brandon Road Lock and Dam. This project will provide essential data documenting pre-construction hydrologic, hydrodynamic, and water chemistry conditions in the approach channel and temporal variations associated with the river and lock and dam operations, including potential impacts and engineering challenges associated with the deployment of multiple barrier technologies (e.g., UADS, electric barrier, bubble curtains) in the downstream approach channel.

This year's funding will produce real-time and historic water-velocity and water-quality data in the downstream approach channel (pre-relocation) and real-time and historic water-quality data at the upstream bullnose to Brandon Road Lock (post-relocation) served via the USGS NWIS. Temporary relocation of the streamgage is necessary due to planned construction in the approach channel in 2025.

Project Description

Additional data on the CAWS are being collected to support implementation of the BRIP, which includes the planned deployment of deterrent technologies in an engineered approach channel to BRLD. The project plan is now in the pre-construction engineering and design phase with construction beginning as early as January 2025. In 2025, the USGS will continue monitoring water velocity and water quality in the downstream approach channel to Brandon Road Lock. Data include water temperature, specific conductance, dissolved oxygen, pH, turbidity, chlorophyll-a, phycocyanin, and dissolved carbon dioxide concentrations and water velocity. As the construction phase in the downstream approach channel begins (in 2025), the streamgage will be temporarily relocated to the upstream bullnose location. As part of this effort, USGS will provide hydrologic science support and expertise for the BRIP, as needed.

Invasive Carp Action Plan: Fiscal Year 2025

Figure 5 — The USGS Streamgage 05538020



USGS streamgage 05538020 located in the downstream approach channel to Brandon Road Lock on the Des Plaines River. Source: USACE

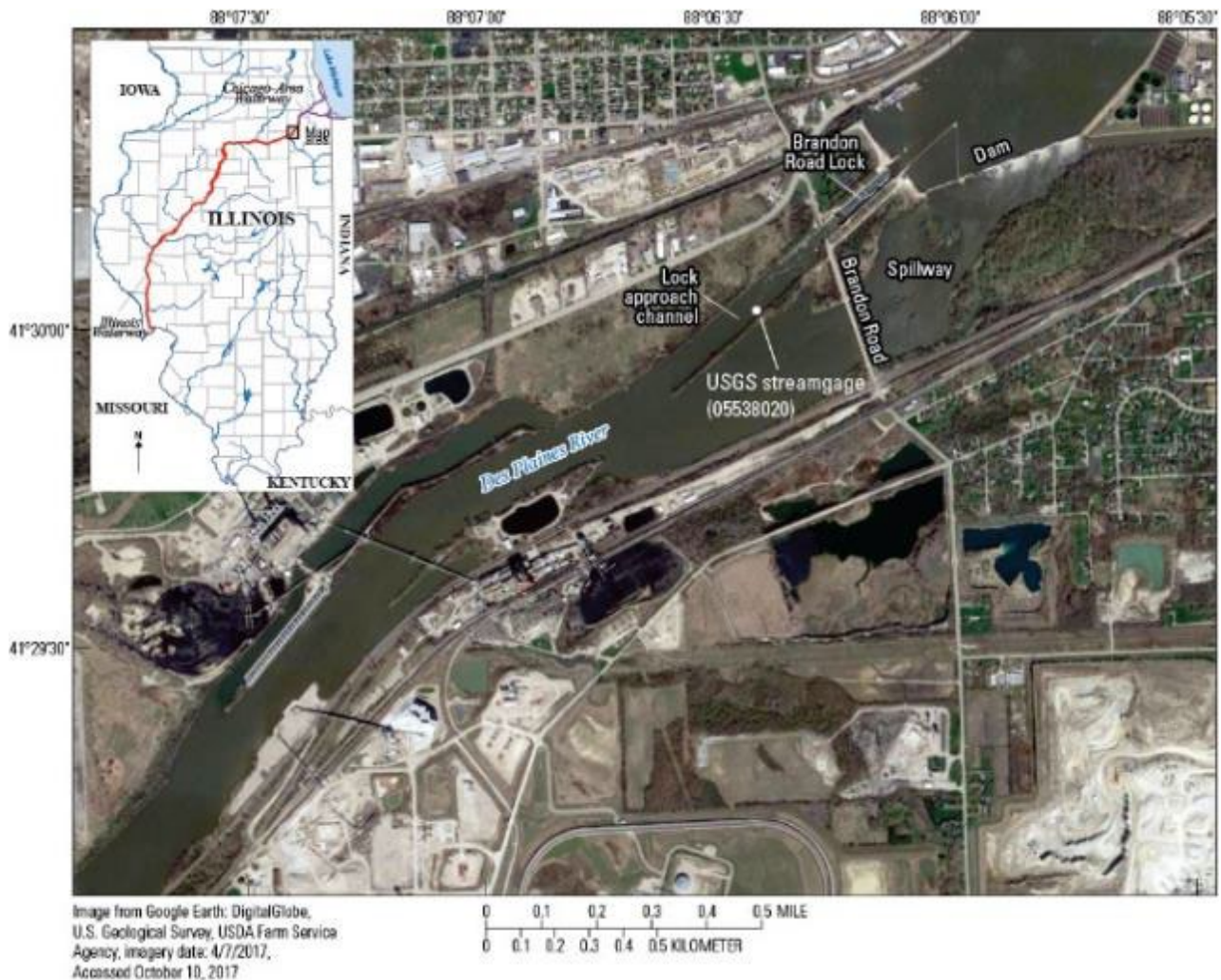
Figure 6 — The USGS Streamgage 05538010



USGS streamgage 05538010 located at the upstream bullnose of Brandon Road Lock on the Des Plaines River. Source: USACE

Invasive Carp Action Plan: Fiscal Year 2025

Figure 7 — USGS Streamgage 05538020 in Des Plaines River near Brandon Road Lock and Dam



Aerial image of the Des Plaines River, Illinois near Brandon Road Lock and Dam and the location USGS streamgage 05538020 and 05538010. Modified from [Engel et al. \[2017\]](#).

Invasive Carp Action Plan: Fiscal Year 2025

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Migration Deterrents and Technology Development

ID4-25: Further Evaluation of Underwater Acoustics as a Deterrent for Invasive Carp and Impacts on Native Species

- **Lead Agency:** USACE
- **Agency Collaboration:** USFWS, USGS
- **GLRI Funding:** \$1,070,000
- **Agency Funding:** \$0

Project Summary

This project will further develop uADS for deterrence of invasive carp through examination of efficacy of deterrence, impacts on native species, development of acoustic planning and noise models, and technology transfer of underwater acoustic deterrents at (1) Lock No. 19 (Mississippi River, Keokuk, Iowa); at the (2) uADS and EDBS (CSSC, Romeoville, Illinois); and at the (3) ERDC Behavioral Engineering Laboratory (BEL) and flume (Vicksburg, Mississippi) where several species are cultured (Bighead Carp, Grass Carp, Common Carp, Black Carp, Paddlefish, Smallmouth Buffalo, and other native species) for use in small-scale studies to be inform to Lock No. 19, BRLD, uADS, and other secondary river reaches of concern.

This project will result in greater efficacy, improved operations and maintenance (O&M), and ultimately the technology transfer of underwater acoustics as a method to prevent invasive carp from becoming established in the Great Lakes by better engagement of the lateral line and hearing sensory systems of invasive carp. The data from these studies will inform underwater acoustics planning and deployment efforts within the IWW and secondary locations that would impact the Great Lakes (i.e., Ohio River basin) and reducing the forward migration from tertiary locations (Tennessee River and Lower Mississippi River basins).

Project Description

Results from uADS studies will result in fully functional systems installed at “pinch points” in the river system, such as Lock No. 19 or BRLD, where invasive carp are only able to swim upstream through a lock chamber because the head height of the dam structure is impassable. In collaboration with federal, state, university, and private collaborators and stakeholders, there are five objectives from separate projects that help to address very different potential deployment locations, such as lock approaches (highly refractive environment), soft bottom (less

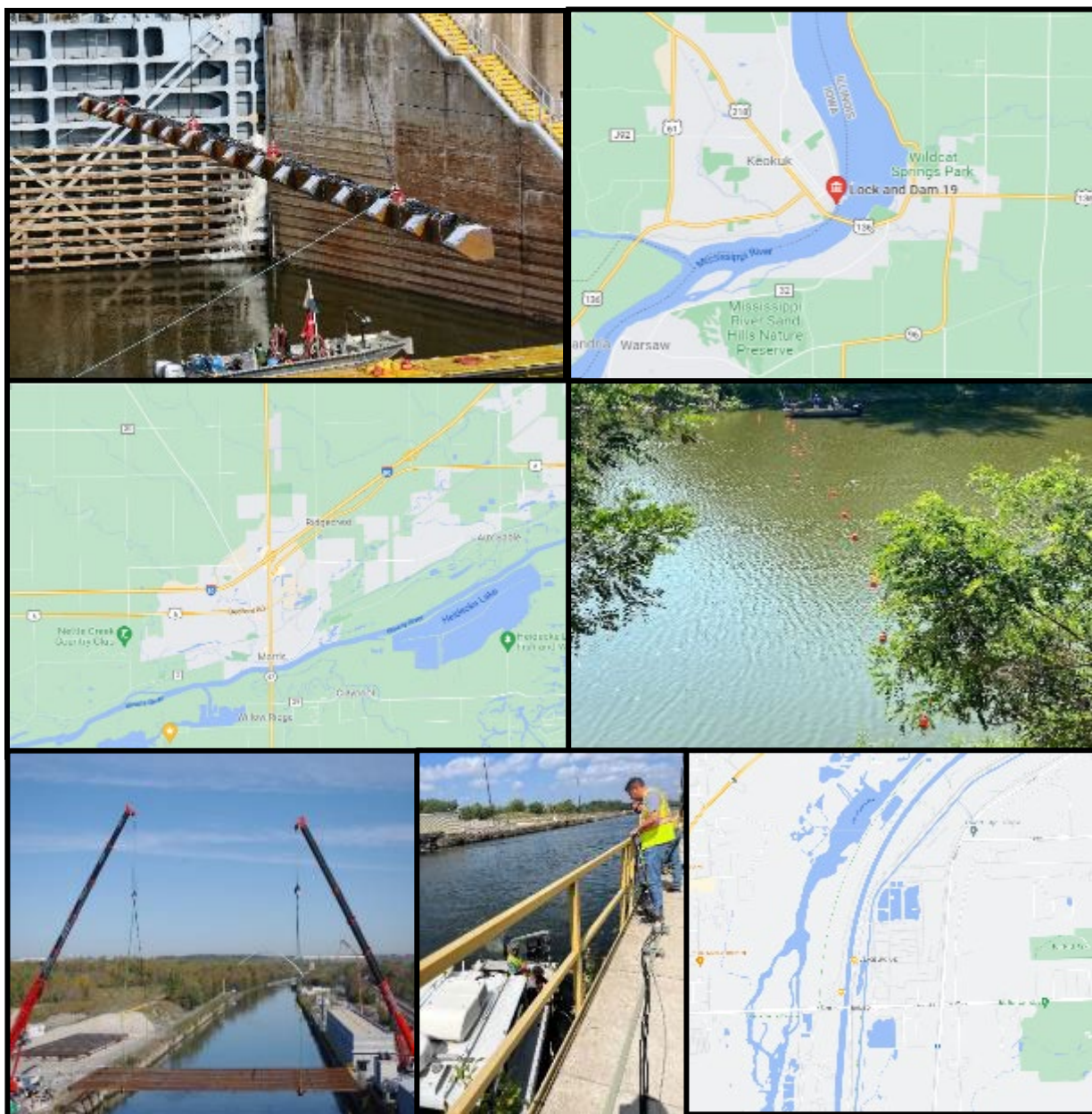
Invasive Carp Action Plan: Fiscal Year 2025

refractive), and multi-deterrent physics challenges. All lessons learned and technology gains are transferable to other locations. The following activities will occur in 2025:

- Evaluation of a BAFF at Barkley Lock and Dam (Grand Rivers, KY)
- Evaluation of an uADS at Lock No. 19 (Mississippi River)
- Evaluation of an uADS at HMS-E (Mississippi River; aka “Morris”)
- Evaluation of an uADS at the EDBS (Romeoville, IL).
- Research and development related to uADS and associated components.

Invasive Carp Action Plan: Fiscal Year 2025

Figure 8 — Underwater Acoustics Deterrent Systems and Maps



(Upper Left) Photo of the UADS speaker weldment (e.g., soundbar) during deployment (Photo by Mark Cornish, USACE-MVR). (Upper Right) Location of the UADS at Lock No. 19, Keokuk Iowa – Google Maps. (Middle Left) Location of the UADS in the HMS East Pit, Morris, IL – Google Maps. (Middle Right) Photo of the UADS deployment at Morris (Photo by Christa Woodley, ERDC). (Lower Left) Installation of the Parasitic Barrier, Romeoville, IL. (Lower Middle) Installation of the system over the parasitic array, Romeoville, IL. (Lower Right) Location of isolation UADS deployed over the Parasitic Array, Romeoville, IL – Google Maps.

Invasive Carp Action Plan: Fiscal Year 2025

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Migration Deterrents and Technology Development

ID5-25: Technical Support for Testing of Acoustic Deterrents

- **Lead Agency:** USGS
- **Agency Collaboration:** USACE, USFWS, IA DNR, ILDNR, KY DFWR, TN-WRA, MDC, UMN-Duluth, UMN, Wisconsin DNR
- **GLRI Funding:** \$1,320,000
- **Agency Funding:** \$615,000

Project Summary

This project will continue the research, deployment, and evaluation of different acoustic deterrent technologies at riverine locations with known established populations of invasive carp. Technologies being tested include the BAFF on the Cumberland River in Kentucky, uADS on the upper Mississippi River in Illinois/Iowa, and the playback of engineered signals in the Illinois River. This project will result in deployments and rigorous testing of experimental deterrents in rivers (specifically locks and dams) and prevent invasive carp from becoming established in the Great Lakes by discouraging upstream movement. This year's funding will produce (1) final quantitative measurements of fish movement at Barkley Lock and Dam and fine-scale analysis of Silver Carp passage/behavior in response to the BAFF over the past three years; (2) four-year summary/publications of fish passage at Lock 19 and detailed fine-scale movement of Silver Carp and bigmouth buffalo; and (3) summaries and publications of research and development on uADS use in a Illinois River backwater, sound-CO2 pond studies, and feasibility studies for deploying acoustic deterrents at non-lock approach locations. These efforts will complement the ongoing design and construction of the multi-deterrent engineered channel at the BRLD (within the BRIP).

Project Description

This project will continue to advance previous research to identify potential deterrent technologies that discourage the movement of invasive carp. Large-scale experimental acoustic structures have been previously deployed at critical passage points in rivers to help managers understand the effectiveness of acoustic deterrents in natural settings where invasive carp populations are already established. For two large-scale deployments (uADS at Lock 19 and BAFF at Barkley L&D), underwater sound equipment was installed at movement bottlenecks in the river system where carp are only able to swim upstream through a lock chamber because the head height of the dam structure is impassable. Migration of fish was then confined to a single passage point and could be monitored with the use of telemetry and hydroacoustic equipment.

Invasive Carp Action Plan: Fiscal Year 2025

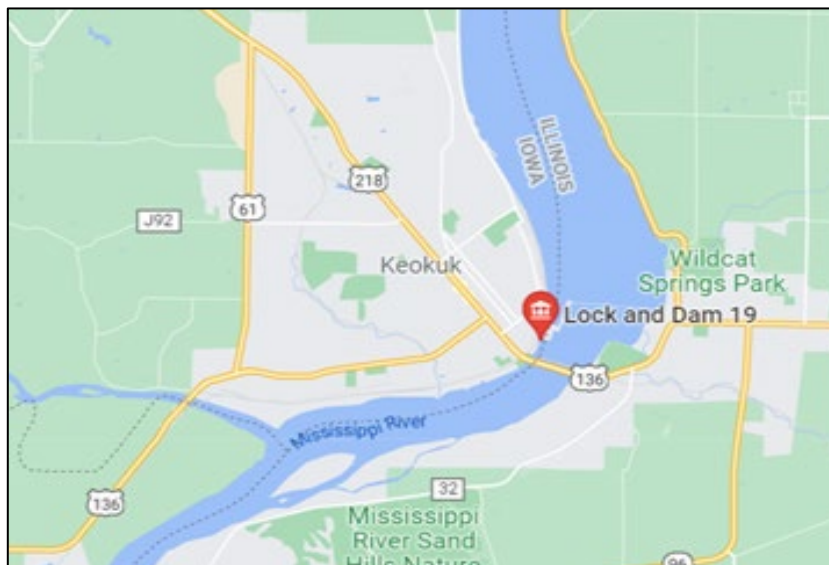
In addition to field-testing of uADS, research efforts in the lab will continue to refine and optimize sound frequencies, sound pressure levels, and speaker designs to repel invasive carp while limiting or eliminating undesirable effects on native species. Future actions will focus on refining the sound characteristics that elicit the greatest response in these species in biologically motivated states (i.e., hunger, reproduction, etc.). The goal is to limit upstream passage, specifically in areas with access to the Great Lakes.

Figure 9 — Underwater Speaker Placement



Divers replacing an underwater speaker during annual maintenance activities at Lock No. 19. Photo credit: USGS

Figure 10 — Location of the uADS at Lock No. 19



Map showing the location of the uADS at Lock No. 19 on the Upper Mississippi River near Keokuk, Iowa. Source: USGS

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Migration Deterrents and Technology Development

ID6-25: USACE Planning for Field Demonstration of Carbon Dioxide Deterrent at the Electric Dispersal Barrier

- **Lead Agency:** USACE
- **Agency Collaboration:**
- **GLRI Funding:** \$200,000
- **Agency Funding:** \$0

Project Summary

This project will complete the planning for implementation of a carbon dioxide (CO₂) injection system in the CAWS as a backup carp deterrent at the EDBS. This project will assess the feasibility of using CO₂ as a deterrent to prevent invasive carp from becoming established in the Great Lakes by clearing fish from the EDBS during or after electrical outages (e.g., planned or unplanned system maintenance). This year's funding will continue project team coordination, assess regulatory requirements, refine model simulations, and evaluate behavioral responses of carp in response to CO₂.

Project Description

CO₂ injected into water is being evaluated as a behavioral deterrent for invasive carp. In 2019, USGS, USACE, and other partners demonstrated the temporary application of a CO₂ infusion system at a navigational lock in Wisconsin. This project is focused on assessing the feasibility of CO₂ as a potential method to clear fish from the EDBS within the CAWS. The EDBS undergoes regular annual maintenance, which can require portions of the system to be temporarily taken offline (powered down), presenting a potential opportunity for fish to move upstream toward Lake Michigan. This project will determine if CO₂ could be applied during or after maintenance events to further reduce the risk of upstream expansion toward the Great Lakes. Also, if successful, CO₂ could enhance general safety by eliminating the need to place agency fishing boats and crews within the electrified field to manually remove fish. Activities include work by the project team to coordinate with regulatory authorities to identify, complete, and acquire all necessary permits for field testing; validate fluid dynamic models; identify locations and specifications for structural modifications to allow installation of invasive carp deterrents (e.g., identify locations where the canal wall could be modified/notched to allow installation of invasive carp deterrents without risk for interference with vessels); and develop needed contract documents for field testing.

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Migration Deterrents and Technology Development

ID7-25: Planning for a Field Demonstration of Carbon Dioxide Deployment at the EDBS

- **Lead Agency:** USGS
- **Agency Collaboration:** ERDC, USFWS
- **GLRI Funding:** \$345,000
- **Agency Funding:** \$360,000

Project Summary

This project will complete the planning for implementation of a carbon dioxide injection system in the CAWS as a backup carp deterrent at the EDBS. This project will assess the feasibility of CO₂ as a deterrent to prevent invasive carp from becoming established in the Great Lakes by clearing fish from the EDBS during or after electrical outages (e.g. planned or unplanned system maintenance). This year's funding will continue project team coordination, assess regulatory requirements, refine model simulations, and evaluate behavioral responses of invasive carp in response to CO₂.

Project Description

CO₂ injected into water is being evaluated as a behavioral deterrent for invasive carp. In 2019, the USGS, USACE, and other partners demonstrated the temporary application of a CO₂ infusion system at a navigational lock in Wisconsin. The next step to transfer this technology from research to management is to develop more permanent systems that can be utilized for management actions. This includes well-defined startup costs and engineering designs for CO₂ infusion systems at key management points that can be deployed to keep invasive carps from moving into new areas.

This project is focused on assessing the feasibility of CO₂ as a potential method to clear fish from the electric fish dispersal barrier within the CAWS. The EDBS undergoes annual maintenance and sporadic outages, which could present an opportunity for fish to move upstream towards Lake Michigan. This project will determine if CO₂ could be applied during or after maintenance to further reduce the risk of upstream expansion towards the Great Lakes. Additionally, if

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successful, the use of CO₂ could enhance general safety by eliminating the need to place boats within the electrified field to manually remove fish.

Figure 11 — General Area for Carbon Dioxide Planning and Implementation



Red box shows general area for carbon dioxide planning and implementation. This area is adjacent to the current EDBS in the CAWS. Source: Google Earth

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

REMOVAL – CONTRACT FISHING

IR1-25: Contract Fishing for Invasive Carp Removal Near the EDBS

- **Lead Agency:** ILDNR
- **Agency Collaboration:** None
- **GLRI Funding:** \$2,310,000
- **Agency Funding:** \$0

Project Summary

This project will continue the use of contracted commercial fishing to remove invasive carp from the upper IWW. The goal is to remove at least 1 million pounds of invasive carp from the upper IWW annually, especially targeting the Starved Rock and Marseilles pools. The project prevents invasive carp from becoming established in the Great Lakes by reducing the population pressure on the EDBS.

Project Description

Contract commercial fishing will be deployed primarily in the Starved Rock and Marseilles pools to suppress adult populations of invasive carp present in these pools which are above the reproductive front and present an opportunity to reduce the risk of upstream expansion. Reducing numbers of adult fish in this area where small fish have only rarely been found suppresses propagule pressure towards upstream migration, reducing the risk of invasive carp nearing the EDBS. Twenty-four weeks of contracted removal in these pools is scheduled annually resulting in roughly 1 million pounds of invasive carp removed per year. Contract commercial fishing begins in the spring following ice-out and continues to mid-summer, when temperatures become too warm to harvest fish effectively. Effort resumes in September until freeze up. Agency staff develop a harvest schedule in the spring of each year. An agency biologist directs contract commercial fishing effort to maximize removal in the target reaches. Fish removed provide the opportunity to collect valuable

Figure 12 — Capturing Invasive Carp

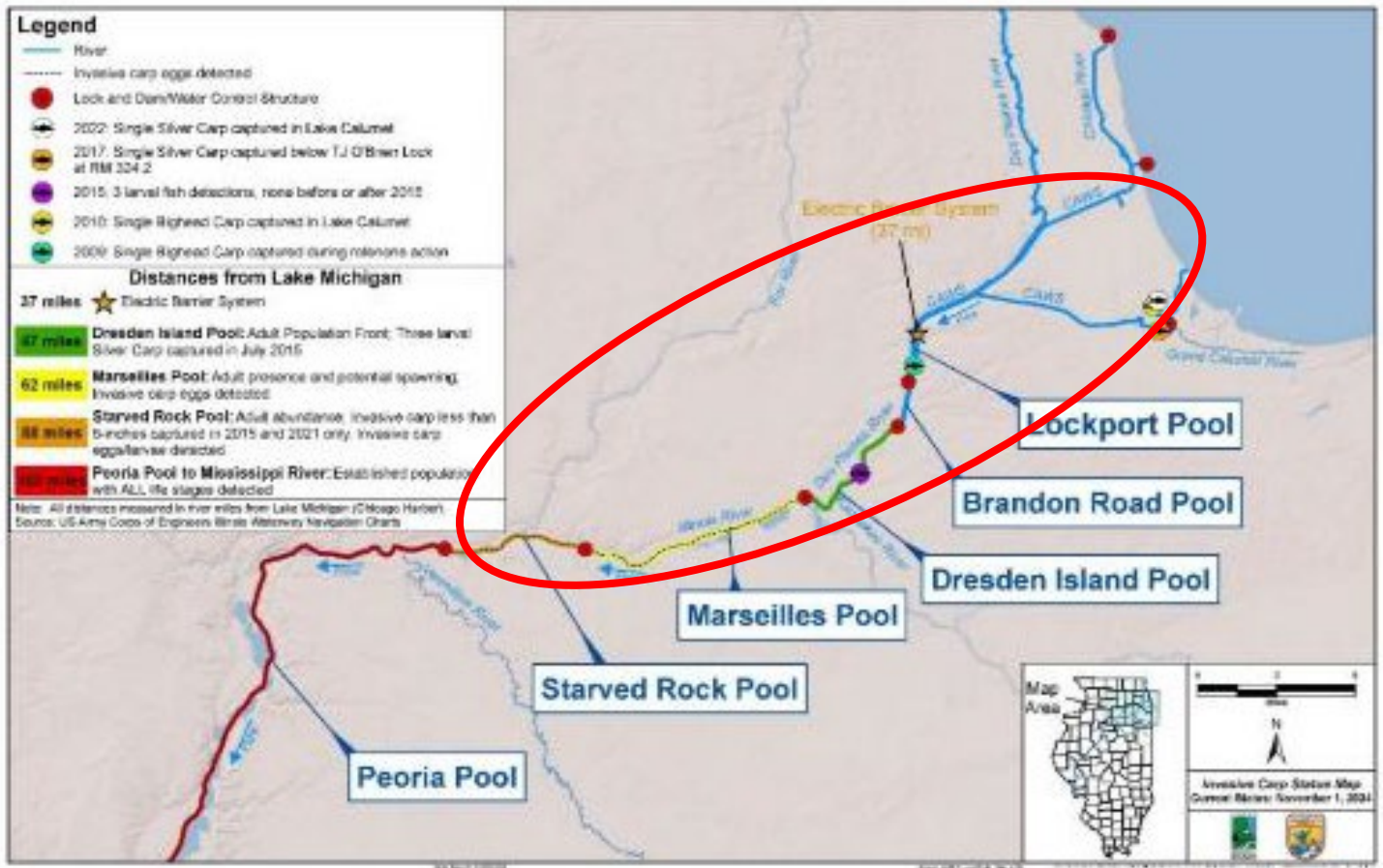


Commercial fishers removing adult invasive carp from gill nets on the IWW. Source: ILDNR

Invasive Carp Action Plan: Fiscal Year 2025

biological information on fish condition, age, and demographics. This harvest is expected to result in populations in the Dresden Island Pool that are below 90 percent of levels observed in 2015 through the use of advanced hydroacoustics. The contracted fishers are also available as rapid responders and can be called up to participate in a coordinated contingency effort if information indicates further investigation is warranted or if additional harvest is needed.

Figure 13 — Location of Commercial Fishing Areas



The red oval shows the approximate coverage of contract fishing, from Starved Rock up through the CAWS.

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

REMOVAL – CONTRACT FISHING

IR2-25: Enhanced Contract Fishing and Contracted Facilitation for Invasive Carp Removal in the Lower Illinois River

- **Lead Agency:** ILDNR
- **Agency Collaboration:** None
- **GLRI Funding:** \$2,000,000
- **Agency Funding:** \$0

Project Summary

This project will continue the ILDNR Enhanced Contract Fishing Program and add contracted facilitation for fish processors to support transportation of invasive carp caught in the Alton, LaGrange, and Peoria pools of the Illinois River. These pools cover approximately 240 miles of the river from Peoria to Cairo, Illinois. This project will result in significant removal of invasive carp from these areas and prevent invasive carp from becoming established in the Great Lakes by reducing the number of individual fish reaching the upper Illinois River. This year's funding will produce removal of five to seven million pounds of invasive carp.

Project Description

This project will continue the Enhanced Contract Fishing Program in Illinois in the Alton, LaGrange, and Peoria pools of the Illinois River; and implementation of contracted facilitation for transporting harvested invasive carp from water to facility.

This funding supports use of a contractor to subcontract 40-50 commercial fishers on behalf of ILDNR, with the goal of removal of an aggregate average total of approximately 400,000 pounds of invasive carp per week. Contract fishers will be compensated per pound of invasive carp removed and sold to fish processors. Additionally, the contractor will subcontract fish processors

Figure 14 — Invasive Carp Removal



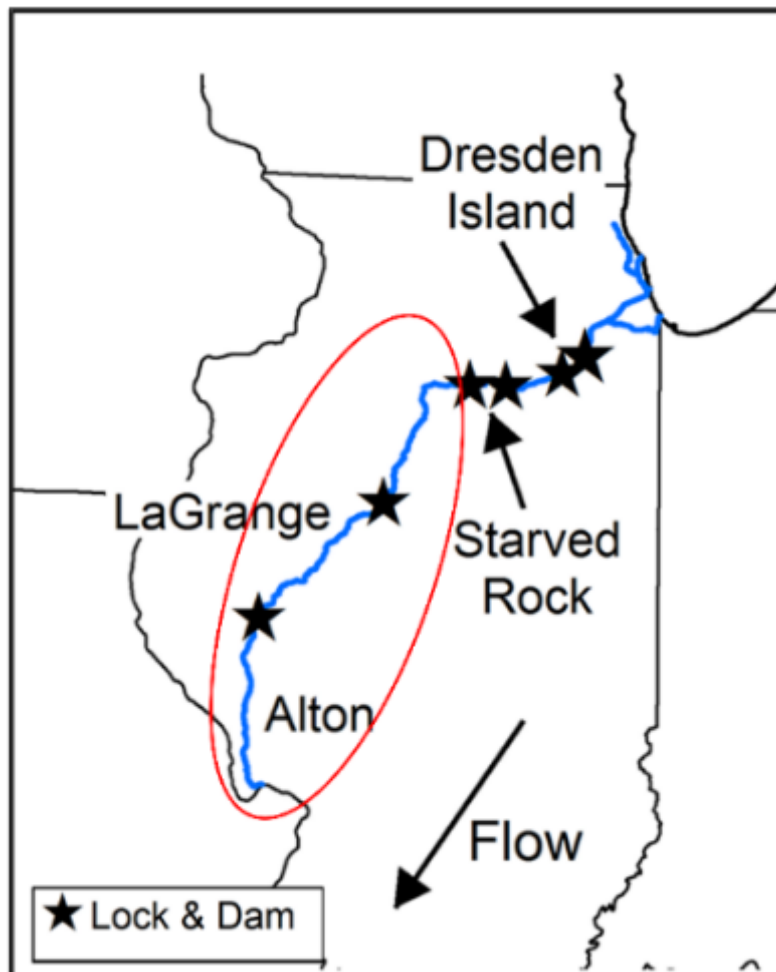
Commercial fishing boat containing harvested invasive carp on the lower Illinois River. Photo credit: ILDNR

Invasive Carp Action Plan: Fiscal Year 2025

(2-3) who pick up invasive carp or have facilities or buying stations within 10 miles of the river in the Alton, LaGrange, and Peoria pools.

This project will result in the removal of approximately five to seven million pounds of invasive carp in the lower Illinois River, subject to market forces, and reduce the number of fish reaching the upper Illinois River

Figure 15 — Invasive Carp Removal



Map showing Alton, LaGrange, Starved Rock, and Dresden Island lock and dams. The Enhanced Contract Fishing Program locations are circled in red. Source: ILDNR

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM1-25: Early Detection, Management, and Control, and Contingency Response in the Illinois Waterway

- **Lead Agency:** ILDNR
- **Agency Collaboration:** INHS-IRBS, USACE, USFWS, USGS
- **GLRI Funding:** \$4,200,000
- **Agency Funding:** \$0

Project Summary

This project will implement monitoring and early detection in the upper Illinois River within the State of Illinois. This project will result in monitoring for invasive carp above the EDBS, monitoring of invasive carp population changes within the pools above Starved Rock, and agency support for contract commercial fishing in these same areas to suppress populations and prevent invasive carp from becoming established in the Great Lakes. This year's funding will produce two 2-week Seasonal Intensive Monitoring (SIM) surveillance efforts above the EDBS and three periods of multi-gear sampling below the EDBS to monitor for the presence of invasive carp and changes to population numbers. These efforts support implementation of the Illinois River Contingency Response Plan (CRP). The CRP supports agency efforts to rapidly deploy staff, equipment and contract fishers should an invasive carp be reported above the EDBS.

Project Description

Since 2010, two Silver Carp and one Bighead Carp have been collected above the EDBS in the CAWS. This project supports comprehensive early detection monitoring to detect and remove invasive carp potentially present above the EDBS in coordination with other partner efforts.

This project will implement a multi-pronged approach of early detection, monitoring, and control of invasive carp in the upper Illinois River. Intensive monitoring will occur in the Spring and Fall using both conventional and eDNA monitoring in the CAWS above the EDBS. Monitoring and removal of invasive carp will be

Figure 16 — Capturing Silver Carp

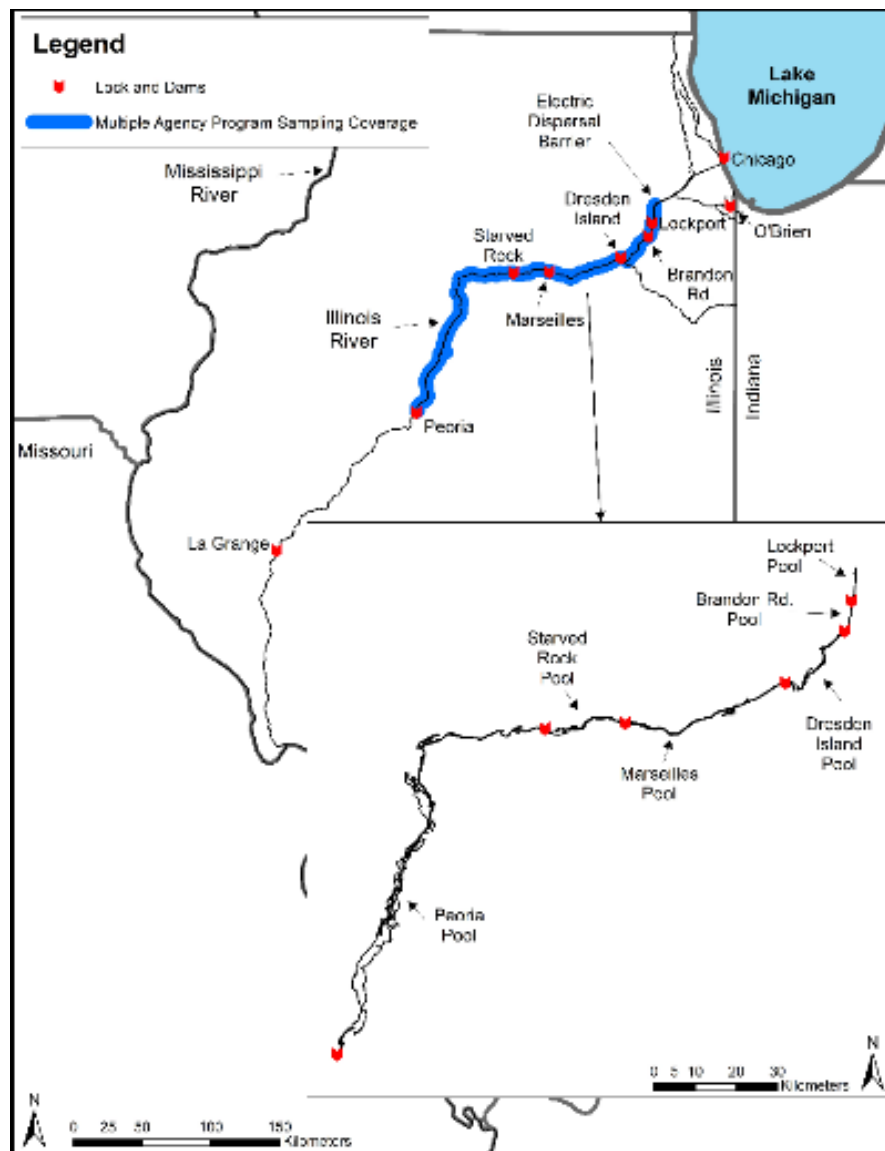


Agency biologists' using electrofishing to catch Silver Carp on the Illinois River. Photo credit: ILDNR

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conducted below the EDBS where adult invasive carp are present utilizing semi-annual unified method approach as well as deployment of contract commercial fishers in conjunction with agency staff. Electrofishing, hoop nets, mini-fykes will be deployed weekly to monitor for the presence of small invasive carp above the reproductive front. This project will prevent invasive carp from becoming established in the Great Lakes by preventing the movement of invasive carp through to Lake Michigan. Contingency planning, rapid response and training are also supported by this effort.

Figure 17 — Multiple Agency Program Sampling Locations



Map showing the sampling locations in the Illinois Waterway. Source: ILDNR

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM2-25: Support for Early Detection of Invasive Carp in the Upper Illinois Waterway

- **Lead Agency:** USFWS
- **Agency Collaboration:** USACE, INHS, ILDNR, SIU, USGS
- **GLRI Funding:** \$695,000
- **Agency Funding:** \$675,000

Project Summary

This project will support monitoring for the early detection of invasive carp in the Illinois, Kankakee, Des Plaines, and Chicago rivers in Illinois. This project will result in targeted surveillance for invasive carp in areas where life stages are not currently known to exist and prevent invasive carp from becoming established in the Great Lakes by informing the potential need for response (as per the CRP) if invasive carp are found in new locations. This year's funding will support comprehensive invasive carp monitoring effort in the uppermost pools of the IWW to increase the likelihood of detecting potential range expansion; early detection monitoring in the Des Plaines River to prevent invasive carp from bypassing the EDBS via movement between the river and the CSSC during high-water events; and USFWS participation in the biannual SIM in the CAWS and Unified Method and contingency response efforts in the upper IWW.

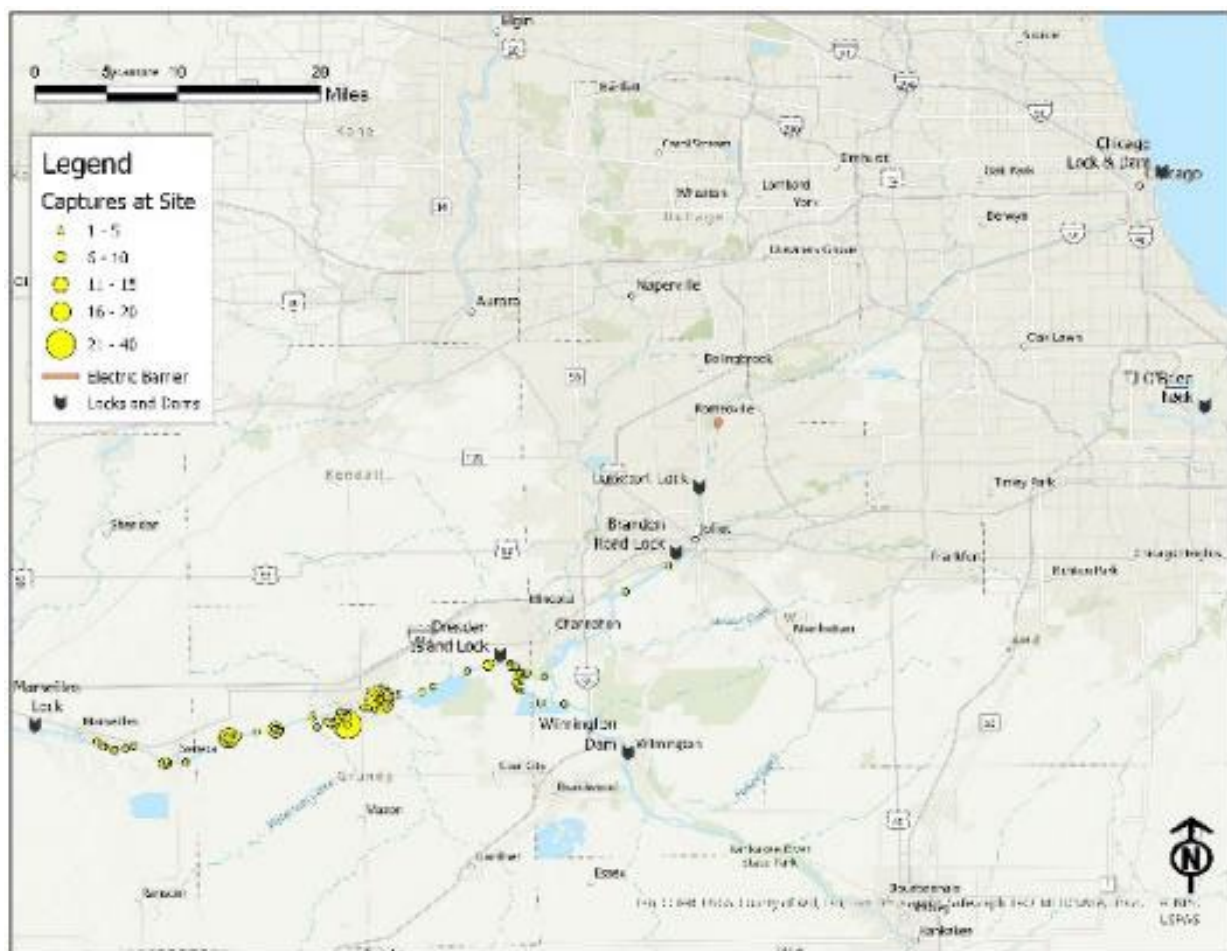
Project Description

This project will support early detection monitoring for invasive carp in targeted locations between the EDBS and Lake Michigan and provide enhanced monitoring for juvenile and adult Bighead Carp and Silver Carp in the Lockport, Brandon Road, Dresden Island, and Marseilles pools, and the Kankakee River. Monitoring results will inform evaluations of the current invasion risk to the Great Lakes via the CAWS and the Illinois River CRP. This project increases the coverage of monitoring for both large and small invasive carp by sampling each of the uppermost pools utilizing electrofishing, dozer trawling, gill netting, and mini-fyke netting. Also, USFWS will conduct early detection monitoring in the Des Plaines River, focused on detecting invasive carp that might move into the river prior to overflow events to reduce the risk of invasive carp transfer between the Des Plaines River and the CSSC near the EDBS during high-water events. Sites will be monitored during the 2025 field season utilizing boat electrofishing, fyke netting, and gill netting. When Des Plaines River conditions indicate overflows, physical inspections of the barrier between the river and the CSSC will occur, as well as ichthyoplankton sampling. USFWS will be

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notified of the location of potential overflow events by the USACE so that monitoring teams may be deployed. Additionally, USFWS will participate in the biannual interagency SIM effort conducted in the CAWS during Spring and Fall; assist in the Unified Method in the IWW, as planned by the ILDNR; and continue to maintain readiness if a contingency response action in the IWW/CAWS is needed and requested by the MRWG.

Figure 18 — Project Area and Invasive Carp Captures



Map showing the project area and invasive carp captures from 2023 (Note: Data for 2024 will be available soon and be included in the final 2025 Action Plan). Source: USFWS

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM3-25: Invasive Carp eDNA Sampling and Processing

- **Lead Agency:** USFWS
- **Agency Collaboration:** States and Tribes
- **GLRI Funding:** \$0
- **Agency Funding:** \$2,400,000

Project Summary

This project will continue monitoring for the presence of Bighead Carp and Silver Carp eDNA in the Great Lakes, Upper Mississippi River, and Ohio River basins. USFWS will process water samples collected by our field offices, in collaboration with our state and tribal partners, to detect the presence of Bighead Carp and Silver Carp DNA in Great Lakes tributaries of concern to help provide a warning of species presence prior to establishment. This year's USFWS funding will produce results for 9,000-10,000 collected and analyzed water samples. This project will support early detection monitoring efforts for Bighead Carp and Silver Carp to prevent their introduction and establishment in the Great Lakes.

Project Description

The USFWS applies the science of eDNA as an early detection and monitoring tool in support of the ICRCC strategic approach for protecting the Great Lakes from invasive carp. This work includes the continued refinement and development of state-of-the-art tools, field sampling and laboratory protocols, and expanded analytical capacity. This project supports a robust eDNA monitoring program for efficiently sampling high-priority locations for the presence of Bighead Carp and Silver Carp within the U.S. waters of the Great Lakes basin and select locations within the Upper Mississippi River and Ohio River basins. Building upon existing genetics-based work for these species, this project will also continue to support the development of techniques for Grass Carp and Black Carp eDNA surveillance.

Figure 19 — USFWS Personnel Collecting eDNA Water Samples



USFWS staff collecting eDNA water samples from a surveillance boat during invasive carp monitoring. Photo credit: USFWS

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Figure 20 — USFWS Great Lakes eDNA Sampling for Bighead Carp and Silver Carp



Map of Great Lakes eDNA sampling areas. Source: USFWS

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM4-25: Invasive Carp eRNA Development for Detection of Spawning and Larvae

- **Lead Agency:** USGS
- **Agency Collaboration:** USFWS
- **GLRI Funding:** \$145,000
- **Agency Funding:** \$200,000

Project Summary

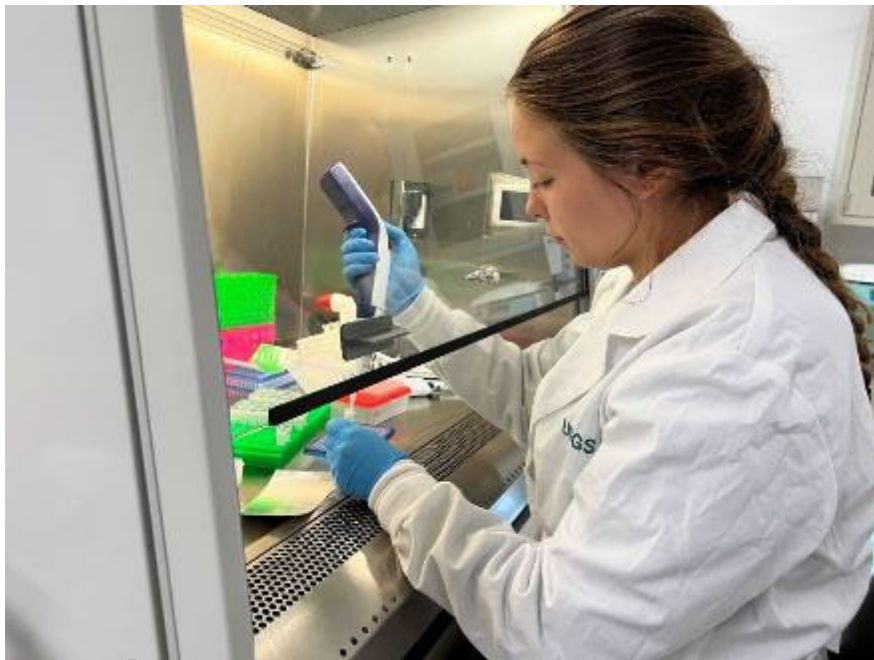
This project will develop and test eRNA markers to detect live individual invasive carp, including targeting genes associated with spawning, in the Mississippi River and Illinois River in Illinois and Iowa. This project will result in an easily deployable tool to detect live and reproducing invasive carp and prevent invasive carp from becoming established in the Great Lakes by identifying locations where control efforts can be targeted. This year's funding will produce eRNA assay tests that can be implemented as part of eDNA monitoring for invasive carp in outyears.

Project Description

Environmental DNA provides a valuable surveillance tool to track the presence and range of occurrence of invasive species. However, on the Illinois Waterway or other developed waterways, factors such as the use of carp as food and the upstream/downstream movement of commercial barges through locations where invasive carp are present can potentially introduce invasive carp DNA into waters flowing into the Great Lakes, potentially influencing eDNA detections. Additionally, in areas at the front of the invasion range, there are critical surveillance questions for management related to bigheaded carp life history, most notably whether spawning, reproduction, and recruitment are occurring. eDNA cannot distinguish these life stages or determine if a detection originated from a live fish, but eRNA has the potential to identify whether reproduction and recruitment are occurring or if the detection originated from a living fish.

This project will support a literature review of RNA studies related to bigheaded carp genes associated with reproduction and early life history as well as genes associated with basic physiological functions. Once identified, candidate genes will be tested on bigheaded carp across life stages to demonstrate efficacy and to test eRNA isolated through carp mesocosms, which is an outdoor experimental system that examines the natural environment under controlled conditions. Results from this work will inform subsequent field testing in outyears at priority sites for invasive carp presence or reproduction.

Figure 21 — Laboratory Preparation of eRNA Samples



USGS researcher preparing a sample plate for eRNA analysis. Photo credit: Chris Merkes (public domain).

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM5-25: Early Detection Monitoring for Invasive Carp in the Great Lakes and Environmental Ribonucleic Acid (eRNA) Exploration

- **Lead Agency:** USFWS
- **Agency Collaboration:** ILDNR, MIDNR, IN DNR, USGS
- **GLRI Funding:** \$335,000
- **Agency Funding:** \$1,400,000

Project Summary

This project will implement a comprehensive early detection surveillance program for invasive carp species in the Great Lakes at high-risk locations in southern Lake Michigan (Calumet River, Burns Harbor, and Burns Ditch) and western Lake Erie. USFWS biologists will employ an array of fishery sampling gears targeting all life stages of invasive carp to maximize detection probability if invasive carp species are present. This program complements the invasive carp eDNA monitoring program implemented by the USFWS and partners in the U.S. waters of the Great Lakes and key tributaries. This project will prevent invasive carp from becoming established in the Great Lakes by providing targeted, comprehensive early detection monitoring effort to inform potential contingency response actions if needed. This project will be conducted in close coordination with the Great Lakes fishery management agencies of the respective jurisdictions in which sampling is being conducted.

This project (in collaboration with USGS) will also examine existing eRNA science to inform development of baseline tools targeting live Silver Carp and Bighead Carp surveillance through the use of eRNA technology. This project will result in a state of the science document that will help inform decision makers on applicability of this technology and provide bighead carp and silver carp eRNA detection tests for future field testing. This funding will support work by USFWS and USGS laboratories to explore eRNA technology development and application.

Figure 22 — Using Fyke Net to Survey for Invasive Carp



Biologists from the USFWS Alpena Fish and Wildlife Conservation Office using a fyke net to survey for invasive carp in Lake Erie. Photo credit: USFWS

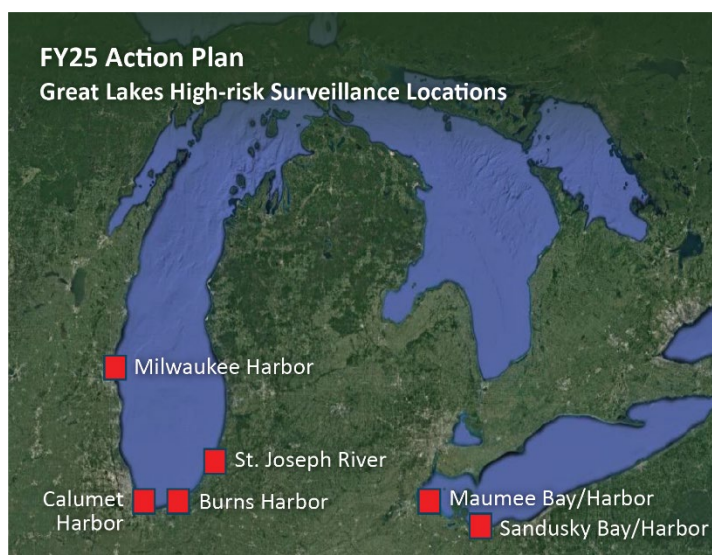
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Project Description

USFWS will continue to implement a comprehensive early detection surveillance program for Bighead Carp, Silver Carp, Grass Carp, and Black Carp in and near select locations in the U.S. waters of the Great Lakes. This program complements the invasive carp eDNA and early detection monitoring programs currently implemented by the USFWS and partners in the Great Lakes basin. Sampling will continue to target areas of high concern in the Great Lakes (e.g., southern Lake Michigan, western Lake Erie, areas with past positive eDNA results) and use a wide array of traditional and novel gears to target all potential life stages of invasive carp species (eggs, larvae, juveniles, and adults).

This project also supports work by the USFWS Whitney Genetics Lab to conduct a literature review and interview genetic experts to develop a state of the science document that will describe the potential value of eRNA, the challenges of developing the technology into a monitoring tool, and how it could mesh with the existing monitoring programs. Testing for eDNA (genetic material shed by organisms) is currently used for species detection. However, this technique does not allow for the identifying if the specimen was alive or dead. Ribonucleic acid (RNA) is only produced by living cells, therefore has great promise to confirm the presence of living species, or to identify unique life history stages, such as eggs or larvae. However, eRNA is less stable in the environment, making its application more difficult than eDNA. The stability of eRNA has been shown in prior research to depend on gene region, which would need to be tested for each species. As of yet, there have not been reliable eRNA tests developed for invasive carp. This project will help inform researchers, managers, and decision makers on eRNA development and usage decisions. Audio Visual Rental 2.4.25

Figure 23 — Great Lakes High Risk Sampling Locations



Map showing aquatic invasive species sampling surveillance locations in the Great Lakes. Source: USFWS

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM6-25: Alternate Pathway Surveillance in Illinois – Law Enforcement

- **Lead Agency:** ILDNR
- **Agency Collaboration:** N/A
- **GLRI Funding:** \$157,500
- **Agency Funding:** \$0

Project Summary

This project will deliver enforcement of regulations enacted to prevent AIS introduction or expansion within the waters of the State of Illinois and jurisdictions throughout the Great Lakes basin, including invasive carp. This project will result in the prevention and detection of illegal human activities that increase the likelihood of invasive carps becoming established in Illinois waters and the Great Lakes. This year's funding will produce surveillance details, enforcement operations, and program law enforcement support.

Project Description

The ILDNR ISU specializes in closely regulating water-related industries that are likely to cause future introductions or expansion of invasive species into state waters. Industries include sport and commercial fishing, aquaculture, fish transportation, bait, pet, aquarium, fish stocking, and live food markets. ISU efforts to date have identified substantial violations in each of the above-listed industries, with many offenders routinely demonstrating a disregard for regulations. Unfortunately, industry newcomers hoping to make quick money too often fill the void. A substantial risk to the state's natural resources remains for the foreseeable future, mitigated only by the efforts of specialized organisms in trade law enforcement units. ISU coordinates with other state and federal partners to protect this region and can quickly assemble a trained team of officers when necessary. Developing and implementing aquatic organisms in trade law enforcement training is an important element of this project because it creates a force multiplier for detection and prevention. ISU works alongside its non-law

Figure 24 — Inspecting a Delivery of Live Fish



ILDNR ISU inspects a fish truck delivering live fish in Chicago's Chinatown. Photo credit: ILDNR

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enforcement partners within this program to provide any necessary law enforcement support. This year's funding will produce a minimum of 10 aquatic organisms in trade industry inspections, a minimum of five intelligence-based enforcement operations, and continued responses to all AIS law enforcement related threats throughout the year. In 2025, an enforcement initiative targeting the illegal trade of "least wanted" AIS designated by the Great Lakes and St. Lawrence Governors and Premiers will be developed and implemented. The high-risk aquatic invasive species designated on the list which include all four invasive carp species present an ongoing threat to the waterways of the Great Lakes.

Figure 25 — Illegal Shipment Seized



ILDNR ISU seizes illegal live shipment of cray fish. Photo credit: ILDNR

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM7-25: Invasive Carp Stock Assessment in the Illinois River Using Hydroacoustics

- **Lead Agency:** ILDNR
- **Agency Collaboration:** SIU, USACE, USGS, INHS
- **GLRI Funding:** \$750,000
- **Agency Funding:** \$0

Project Summary

This project uses a combination of fisheries hydroacoustics and telemetry tracking of tagged fish to estimate the density and movement of Bighead Carp and Silver Carp in the Alton through Dresden Island pools of the Illinois River. This project will result in the identification of high-density locations of invasive carp, a long-term assessment of population trends, and quantification of upstream movements. This project will prevent invasive carp from becoming established in the Great Lakes by directing harvest to high-density locations near the invasion front, aiding decisions on current levels and locations of removal and deterrents for achieving MRWG goals and determining when invasive carp move into upstream pools in the Illinois River. Additionally, this information will help determine whether contingency response actions are necessary. This year's funding will produce "heat maps" of Bighead Carp and Silver Carp densities, informing where harvest can be targeted to maximize fish removal. Information from this project will be compared to trend data that have been collected since 2012 to assess for changes in density over time.

Project Description

This project will assess invasive car populations in the Alton through Dresden Island pools of the Illinois River. Research has shown that using hydroacoustic surveys in the Illinois River provide accurate estimates of the abundance of invasive carp and the effect of harvest removal efforts. In addition, placing acoustic transmitters into individual invasive carp and following their movements with the river provides further data for managers to determine how harvest and other control methods may reduce the likelihood

Figure 26 — Research Vessel Shovelnose

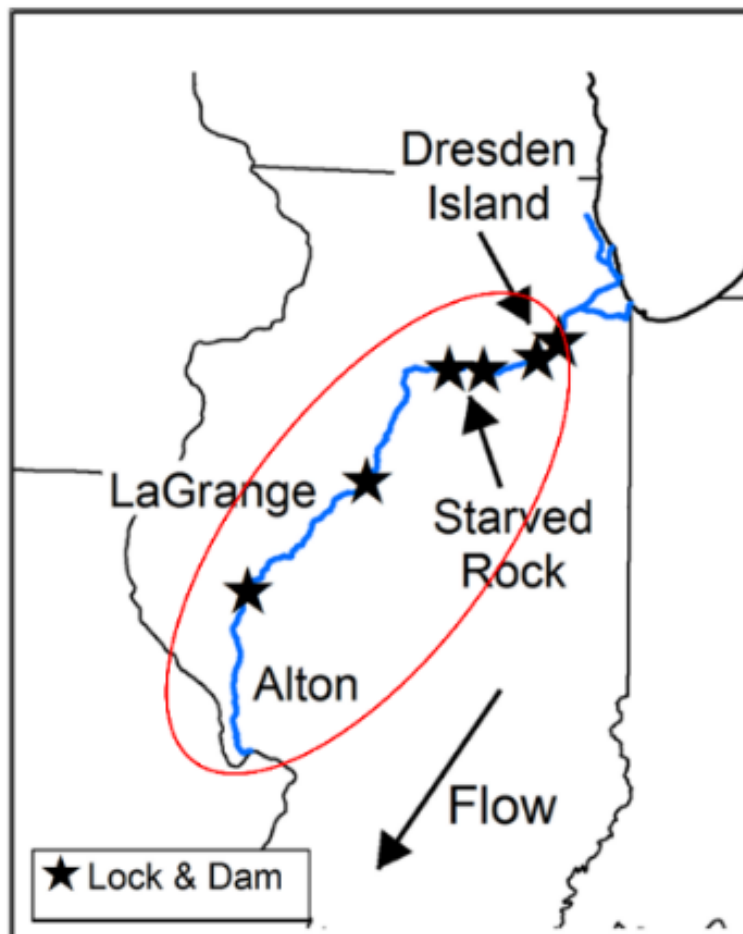


Southern Illinois University research vessel "Shovelnose" collecting fish density data on the Illinois River. Source: ILDNR

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that invasive carp will accumulate in the upper river. Results from this monitoring, which has been conducted since 2012, will allow managers to continue to assess the relative effects of harvest and other control efforts conducted throughout the Illinois River.

Figure 27 — Project Location Areas



Map showing Alton, LaGrange, Starved Rock, and Dresden Island lock and dams. The hydroacoustic and telemetry sampling locations are circled in red Source: ILDNR

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM8-25: USFWS Hydroacoustic Surveys of Fish Abundance and Distribution in the Upper Illinois Waterway

- **Lead Agency:** USFWS
- **Agency Collaboration:** SIU, USACE, USGS, ILDNR
- **GLRI Funding:** \$120,000
- **Agency Funding:** \$0

Project Summary

This project will provide estimates of large fish abundance and distribution in the proximity of the EDBS; and in the Dresden, Brandon Road, and Lockport pools of the Upper IWW. This project will ensure that changes to operation of the EDBS are informed by data on current fish presence in proximity to the system. This project will prevent invasive carp from becoming established in the Great Lakes by ensuring that abundances of large fish near the EDBS and in the Lockport Pool are monitored, and results made available for decision-making regarding potential changes to EDBS operations. Rapid communications to the ICRCC on moderate or substantial changes in fish community species composition or fish behavioral observations near the EDBS will continue. Additionally, data will help inform the locations of large aggregations of invasive carp for targeting harvest and removal actions in the pools of the Upper IWW.

Project Description

This project will provide data to inform and enhance invasive carp management in the Upper IWW by reporting spatial and temporal patterns of fish abundance using hydroacoustic assessments. Results from this project will be used to inform operation, maintenance, and response (if needed) at the EDBS, and allow managers to annually assess the risk of further upstream spread of invasive carp by assessing fish populations in upstream pools. Estimates of

Figure 28 — Deploying Hydroacoustic Transducers



USFWS biologist deploying hydroacoustic transducers. Photo credit: USFWS

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length and depth of targets made by hydroacoustic surveys are used with corresponding telemetry data to allow managers to make inferences about possible fish species identified as targets. USFWS hydroacoustic surveys at the EDBS will be conducted monthly, and Upper IWW pool scans will be conducted annually in the fall. Additional scans will be conducted upon request at the need of the partnership for management activities.

Figure 29 — 2025 Proposed Hydroacoustic Coverage Area



Map of the 2025 proposed IWW hydroacoustic coverage area.

Source: USFWS

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM9-25: Real-Time Telemetry Alert System

- **Lead Agency:** USGS
- **Agency Collaboration:** USACE, USFWS, SIU, ILDNR, INHS, GLFC
- **GLRI Funding:** \$178,000
- **Agency Funding:** \$0

Project Summary

This project will inform decisions on management actions to control the abundance of invasive carp in the Illinois River system. This project will result in (1) updated transition (movement between pools) probability estimates from telemetry data to parameterize population models used to evaluate alternative management actions, (2) management and maintenance of the real-time alert system for tagged invasive carp, (3) measurement of immigration/emigration of invasive carp to/from the Illinois River, and (4) development of a framework for using either existing telemetry data or planning future studies to refine population model parameter estimates (e.g., fishing mortality) to prevent invasive carp from becoming established in the Great Lakes. This year's funding will support maintenance of real-time telemetry to inform contingency actions (including replacement of outdated receivers), summarize immigration and emigration estimates, review and format additional years of telemetry data for future updates to transition probabilities, provide guidance for efficient distribution of tagging effort and receiver placement in the Illinois River, and develop a framework for estimating or refining additional model parameters that may use acoustic telemetry data.

Project Description

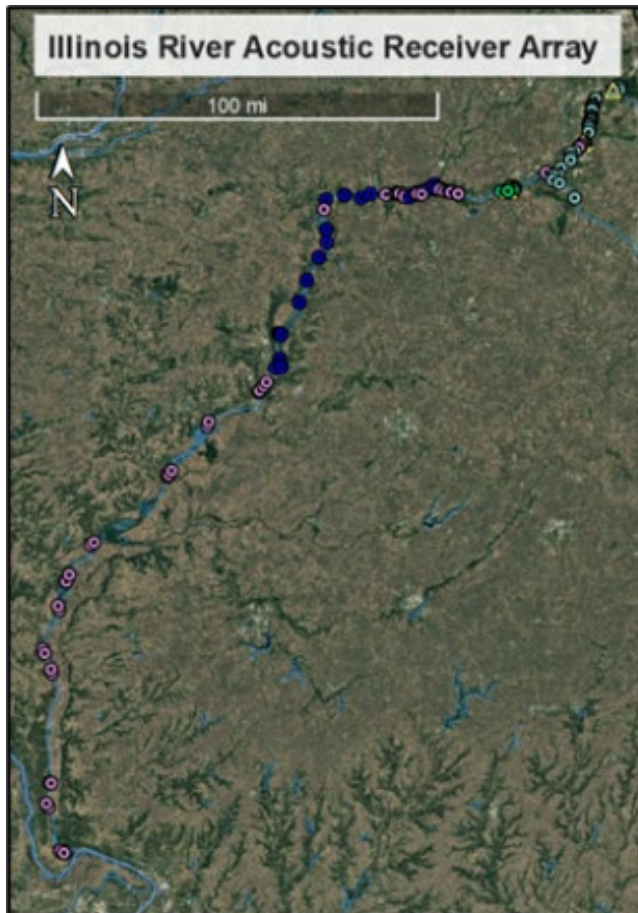
This project provides acoustic telemetry detection and movement data from invasive carp to (1) support population modeling efforts and (2) provide real-time telemetry in support of barrier evaluations and contingency planning. USGS works with the MRWG Telemetry Work Group and Modeling Work Group in support of the SEICarP model and other modeling efforts to inform management actions (e.g., contract fishing or behavioral deterrents).

USGS has published an updated model for estimating transition probabilities from telemetry data collected through a multi-agency network of acoustic receivers in the Illinois River. Transition probability estimates and their associated uncertainty will be updated again after 2025. Additionally, telemetry data will be used to estimate fishing or natural mortality and immigration/emigration to/from the Illinois River. These data are also actively used by the MRWG

Invasive Carp Action Plan: Fiscal Year 2025

Telemetry Work Group as decision support for guiding tagging plans and receiver placement. Additionally, funding will support maintenance of a network of the real-time telemetry receivers and an alert system to inform contingency actions in the upper Illinois River.

Figure 30 — Illinois River Acoustic Receiver



Map of the Illinois River with colored dots indicating the locations of acoustic telemetry receivers. Each color represents a different agency responsible for maintaining the individual receivers (pink = SIU, dark blue = USFWS, green = USGS, light blue = USACE, yellow triangles = USGS real-time receivers). Source: M. Brey; USGS.

Figure 31 — Real-time Telemetry Receiver



The real-time telemetry receiver installed upstream of Brandon Road Lock and Dam to inform contingency actions.

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM10-25: Telemetry Tracking in the Illinois Waterway to Support the SEICarP

- **Lead Agency:** USFWS
- **Agency Collaboration:** SIU, USACE, USGS
- **GLRI Funding:** \$155,000
- **Agency Funding:** \$400,000

Project Summary

This project will provide telemetry data support for a statistical fishery model that estimates invasive carp population status in the IWW. This project will result in estimates of the movement of invasive carp in the Peoria and Starved Rock pools of the IWW. The telemetry data will support model predictions used to inform agencies on potential management options. This project will include the collection of data describing the movement of telemetry-tagged invasive carp in the IWW that will be used to populate and refine the SEICarP model. Funding will support tagging of an additional 150 invasive carp (100 in Peoria Pool and 50 in Starved Rock Pool) as well as the deployment, operation, and retrieval of 20 acoustic receivers in these pools.

Project Description

The SEICarP model was developed to provide managers with a tool for assessing invasive carp population status and predicting the effect of various management (control) strategies in the IWW.

In 2025, USFWS crews will implant an additional 150 Silver Carp and Bighead Carp with acoustic transmitters in and around the Peoria and Starved Rock pools. The information gained from these fish will improve the accuracy of models, which estimate the invasive carp population and carp movement through lock and dams. Receiver locations and ideal lengths of fish are decided collaboratively by the MRWG Telemetry Work Group. Fish will be tracked using 15 acoustic

Figure 32 — Implanting an Acoustic Tag

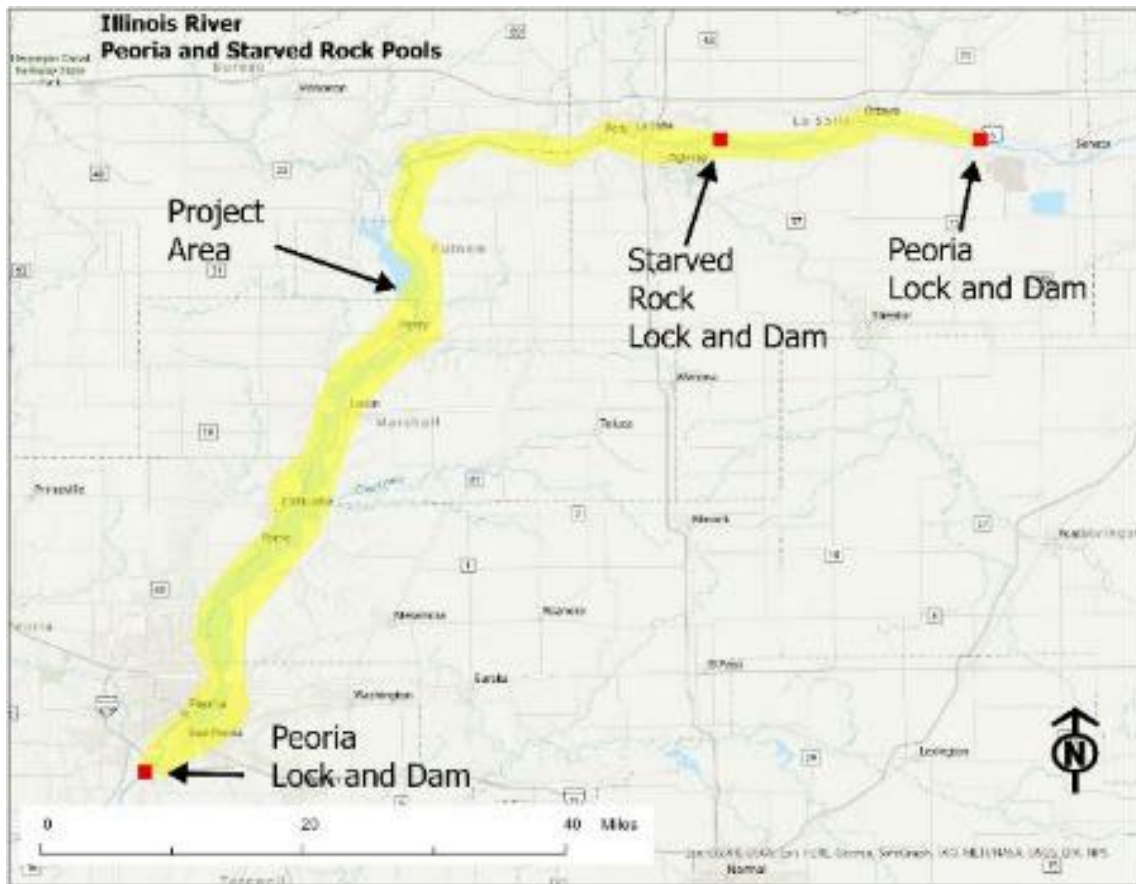


USFWS biologists surgically implanting an acoustic transmitter in Silver Carp. Source: USFWS

Invasive Carp Action Plan: Fiscal Year 2025

receivers in the Peoria Pool and five acoustic receivers in the Starved Rock Pool of the IWW. Some receivers will be placed in areas with reduced coverage, and the Telemetry Work Group will be consulted prior to deployment. Funding will be used to purchase acoustic transmitters and surgery supplies and will support operational costs associated with telemetry fieldwork.

Figure 33 — Pools of the Illinois River with Area for Acoustic Receiver Deployments



Map showing pools of the Illinois River with area for acoustic receiver deployments highlighted in yellow. Source: USFWS

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM11-25: Invasive Carp Demographics in the Illinois Waterway

- **Lead Agency:** USFWS
- **Agency Collaboration:** ILDNR, INHS
- **GLRI Funding:** \$450,000
- **Agency Funding:** \$250,000

Project Summary

This project will provide additional fisheries monitoring capacity for the Multiagency Monitoring program (MAM), an existing standardized interagency sampling effort utilized by MRWG in the Illinois River and support the collection of key demographic data (e.g., total length, weight, age, sex, and maturity) for invasive carp captured in the lower six pools of the river.

This project will collect fisheries data and process aging structures used to evaluate and inform invasive carp management in the Illinois River to prevent invasive carp from becoming established in the Great Lakes. This year's funding will produce community data collected from 633 samples to be integrated into the MAM program database as well as age and growth data derived from 1,600 invasive carp for use by the Modeling Work Group to inform models that evaluate potential management actions in the Illinois River. In addition, spectroscopy will be assessed for potential use to improve and streamline the process of annual aging of fish.

Project Description

Fisheries independent data be collected from non-commercially harvested fish by USFWS personnel and transferred to the MAM program and the MRWG invasive carp database to provide trend data along with standardized capture gears associated with the MAM program. This project will also process invasive carp age structures (i.e., lapilli otoliths) from MAM program fisheries-independent collections, as well as fisheries-dependent (commercial harvest) collections in the lower six pools of the Illinois River. Age structures from both sources will be

Figure 34 — Electrified Dozer Trawl



USFWS crew preparing for an electrified dozer trawl sample on the Illinois River. Photo credit: USFWS

Invasive Carp Action Plan: Fiscal Year 2025

collected and analyzed by USFWS staff. After ages are assigned to all samples, age and growth data will be provided to the MRWG Modeling Work Group to inform invasive carp population models for the Illinois River. Such models will be used to evaluate the relative importance of fishing mortality, fish movement, and natural mortality to observed declines in Silver Carp abundance. Results will be used to inform intensive invasive carp harvest efforts and other management in the Illinois River to prevent introduction and establishment in the Great Lakes.

This project will provide a statistically robust number of Silver Carp collected in a standardized fashion for modeling and assessments. These standardized collections help provide reliable metrics for evaluating the status of the Silver Carp populations along the entire Illinois River which can then be used to identify areas where control and containment efforts will be most valuable in the Illinois River, ultimately helping ensure Silver Carp do not enter the Great Lakes.

Figure 35 — Project Work Locations



Illinois River sampling occurs from Alton to Lockport as indicated in blue. All fish are processed at the USFWS fish aging lab in Columbia, Missouri. Source: USFWS

Invasive Carp Action Plan: Fiscal Year 2025

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM12-25: Evaluation of Invasive Carp Spawning Dynamics and Collection of Associated Hydrological Data

- **Lead Agency:** USGS
- **Agency Collaboration:** ILDNR, INHS, USACE, USFWS, NOAA
- **GLRI Funding:** \$80,000
- **Agency Funding:** \$75,000

Project Summary

This project will assess the influence of river hydraulics and water-quality on the population range, movement, and spawning/recruitment success of invasive carp in the IWW of the State of Illinois and other priority areas. This project will result in essential hydrologic and hydrographic data and an evaluation of invasive carp spawning location variability and prevent invasive carp from becoming established in the Great Lakes by providing critical information to inform the design and evaluation of barrier technologies and guide control efforts. This year's funding will produce real-time and synoptic data in the IWW to support specific partner needs, publication of an assessment of interannual variability in invasive carp spawning locations in the IWW in relation to environmental conditions over several years, and FluEgg modeling support for state and federal partners.

Project Description

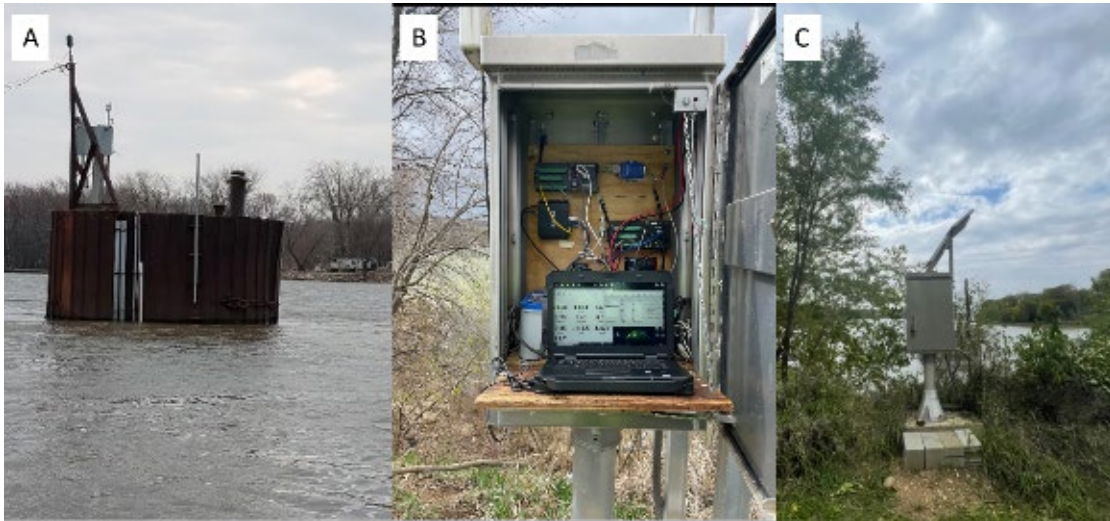
This project encompasses data collection and analysis aimed at understanding how invasive carp interact with the hydraulics and water quality of a river. These data inform efforts to deter and control invasive carp through novel barrier technologies, commercial fishing, mass harvest, and management of habitat factors. A portion of this project focuses on the IWW and includes real-time water quality monitoring and identification of probable spawning areas of sampled invasive carp eggs/larvae using the FluEgg model. This project will provide a wide range of science support to federal and state partners on invasive carp technology development and control efforts, including FluEgg modeling support. Actions in 2025 include:

- Continuous water quality monitoring to support control efforts
- Application of reverse FluEgg simulations to identify spawning locations from ichthyoplankton data in the IWW and publication of results

Invasive Carp Action Plan: Fiscal Year 2025

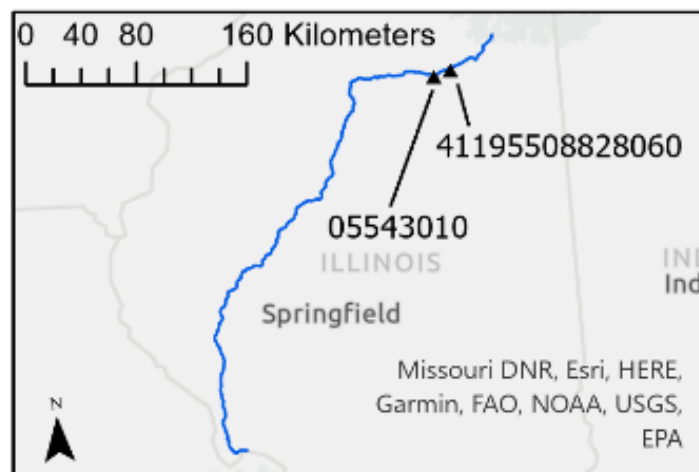
- Hydrographic surveys and other science support to our federal and state partners on invasive carp technology development projects and control efforts
- FluEgg model maintenance and user support

Figure 36 — Water Quality Monitoring Stations



(A) Photograph of the real-time, continuous water quality monitoring station 05543010 Illinois River at Seneca. (B) Interior and (C) exterior of the gage house at the real-time continuous water quality monitoring station 411955088280601 Hanson Gravel Pit at Culvert Near Morris, IL. Source: USGS

Figure 37 — Water Quality Monitoring Stations in Marseilles Pool



The blue line is the centerline of the Illinois River. The two black triangles show two real-time, continuous water quality monitoring stations in the Marseilles Pool of the IWW, (05543010 Illinois River at Seneca and 41195508828060 Hanson West Pit near Morris, IL). Source: USGS

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM13-25: Assessment of Invasive Carp Reproduction and Ecosystem Response in the IWW

- **Lead Agency:** ILDNR
- **Agency Collaboration:** INHS, EIU, SIU-C, USGS, USFWS Laboratory
- **GLRI Funding:** \$480,500
- **Agency Funding:** \$0

Project Summary

This project will monitor for invasive carp reproduction in the Illinois River, Des Plaines River, and CSSC and select tributaries of the IWW including Kankakee, Fox, Vermilion, Mackinaw, Spoon, and Sangamon rivers). This project will result in (1) detection of any invasive carp reproduction in the Upper IWW (upstream of Starved Rock Lock and Dam); (2) early detection of Black Carp reproduction in the Illinois River; (3) an evaluation of the spatial and temporal extent and magnitude of invasive carp reproduction in the IWW and its tributaries; (4) quantification of the relationships between density of adult invasive carp, reproductive productivity, and subsequent recruitment. This project will also prevent invasive carp from becoming established in the Great Lakes through rapid detection of invasive carp spawning in the IWW, guiding targeted responses to disrupt invasive carp reproduction, and in combination with harvest and removal efforts in the IWW, assessing removal levels that will diminish invasive carp population growth rate, thereby slowing expansion of the invasion front towards the Great Lakes via the IWW. This year's funding will produce (1) rapid detection of any invasive carp reproduction in the IWW, which will be reported through regular progress reports as well as rapid communication of detected reproduction to the MRWG of the ICRCC; (2) detection of any Black Carp reproduction in the IWW; and (3) quantified relationships between adult invasive carp densities, reproductive productivity, juvenile invasive carp abundance, and recruitment to inform invasive carp removal efforts.

Project Description

During 2025, ichthyoplankton sampling will be conducted to monitor for the presence of invasive carp eggs and larvae to assess the extent, location, timing, and magnitude of invasive carp reproduction in the IWW. Samples are collected with ichthyoplankton push nets at weekly intervals during late April through early July and bi-weekly from mid-July through October, with more frequent sampling effort during periods when temperature and flow conditions are thought

Invasive Carp Action Plan: Fiscal Year 2025

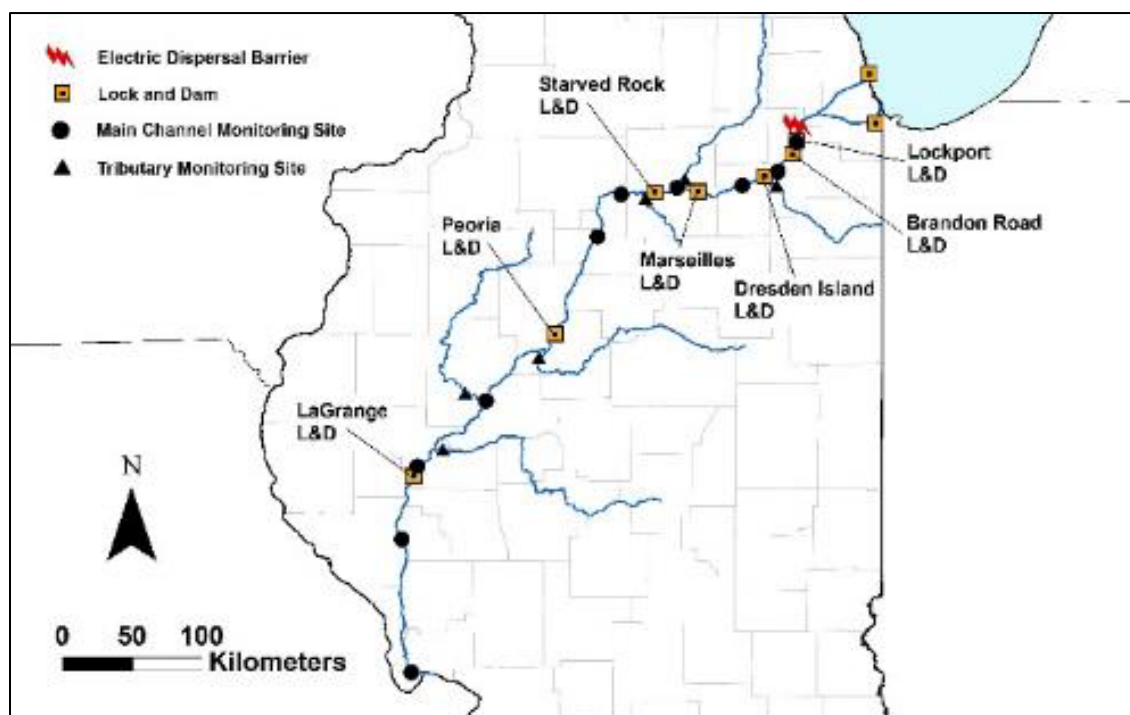
to be optimal for invasive carp spawning. Potential presence of invasive carp eggs and larvae in each sample will be assessed using qPCR methodology to prioritize samples for rapid processing and provide information on the individual species identity of invasive carp eggs and larvae present in samples. Microscopy will be used to quantify the overall numbers of invasive carp eggs and larvae. These data are used as an early detection system for monitoring the upstream expansion or contraction of reproductive Bighead Carp and Silver Carp populations and potential reproduction by the newly expanding Black Carp population in Illinois, as well as to quantify relationships between invasive carp adult densities, reproductive output, and subsequent recruitment to assess the level of removal needed to reduce the ability of invasive carp establish self-sustaining populations.

Figure 38 — Deploying an Ichthyoplankton Push Net



An INHS technician deploying an ichthyoplankton push net mounted to the front of a sampling boat. Photo credit: INHS

Figure 39 — Main Channel and Tributary Monitoring Sites



Map of Illinois River identifying location of locks and dams, and main channel and tributary ichthyoplankton monitoring sites. Source: INHS

PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM14-25: Evaluation of Fish Transfer System to Promote Native Species Movement and Invasive Carp Harvest

- **Lead Agency:** ILDNR
- **Agency Collaboration:** INHS-IRBS, USGS USACE
- **GLRI Funding:** \$230,000
- **Agency Funding:** \$0

Project Summary

This project will evaluate invasive carp attraction to and utilization of a mobile fish movement system/ladder with associated technology to support fish scanning and sorting capabilities in the Illinois and adjacent waterways. This project will result in implementation of a mobile pilot fish passage system that supports fish passage while facilitating invasive carp harvest. Additionally, conditions necessary to promote utilization of the fish ladder will be identified. This project will prevent invasive carp from becoming established in the Great Lakes by use of this technology as a management tool to attract invasive carp and selectively remove them from the Illinois waterways, while promoting passage of native fishes at strategic locations (i.e., lock and dam pinchpoints, deterrent locations). This year's funding will support the operation and project oversight of the mobile, pilot fish passage system that supports fish passage and carp harvest and identifies conditions necessary to promote invasive carp and native species utilization of the fish ladder.

Project Description

INHS and ILDNR will evaluate invasive carp attraction and use of a mobile fish movement system/ladder with associated technology to support fish scanning and sorting capabilities. A floating mobile platform to support the fish ladder will allow for the unit to be evaluated in multiple locations as needed and help determination of optimum height/angle and overcome limitations of a fixed design and the mobile. Prior work has shown that Silver Carp and Grass Carp will climb a

Figure 40 — Alaskan Steeppass Fish Ladder with Scanner



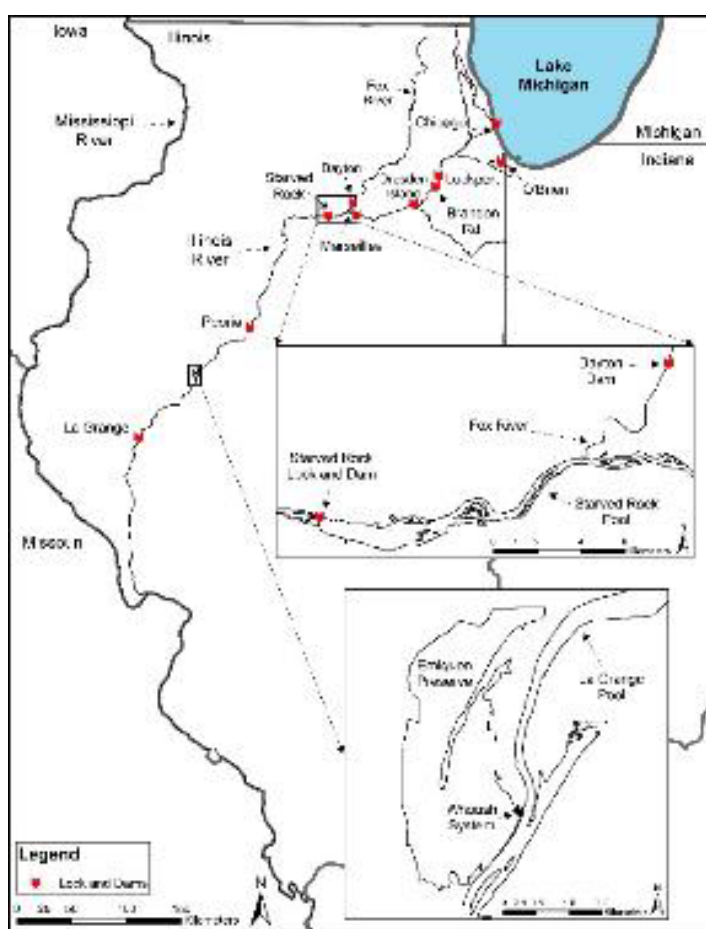
Mobile fish transfer system (Alaskan steeppass fish ladder with scanner/AI species identification software) to promote invasive carp removal and facilitate native fish movement. Photo credit: ILDNR

Invasive Carp Action Plan: Fiscal Year 2025

fish ladder, but native fishes outperformed the invasive ones in the pilot study. The more flexible design will allow us to try to optimize the fish ladder for invasive carp movement while also assessing the conditions necessary to selectively pass natives. As deterrents are configured to stop invasive carp, there is desire at some locations to selectively pass native fish at these locations. This technology could automate the process and increase connectivity to native fish and mussels while further constraining invasive fish. It is likely that scanning technology can distinguish multiple invasive species, not limiting to carp management applications. Collaboration among research agencies will contribute to the evaluation of fish movement technology and advance management tools for invasive carp and native fishes in the Illinois River Basin.

This funding will support continued testing of the system and further optimization for invasive carp passage and removal. A series of experiments controlling for multiple variables including, angle of steeppass, flow rate and depth of water in the steeppass, flow rate and depth of water in the flow box, elevation of steeppass distal end to or in the water's surface, invasive carp attractants, and environmental conditions conducive to invasive carp movement will be conducted. Funding will support electricity for steeppass operation, site excavation, project oversight, and implementation of experimental design. Once proof of concept is demonstrated, ILDNR will explore opportunities to move the mobile selective passage system to pinchpoint dam locations to evaluate (Dayton Dam on the Fox River or Starved Rock Lock and Dam on the Illinois River).

Figure 41 — Project Location Areas



Map of the State of Illinois, showing mobile fish transfer system project areas (see map insets). Red symbols indicate lock/dam structures. Source: Brandon Harris, IRBS

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM15-25: USGS Support for Invasive Carp Modeling in the Illinois River

- **Lead Agency:** USGS
- **Agency Collaboration:** USFWS, ILDNR, INHS, SIU
- **GLRI Funding:** \$133,000
- **Agency Funding:** \$304,000

Project Summary

This project will develop objective, data-driven tools to inform management decisions concerning bigheaded carp control efforts in the Illinois River. This project will result in population status estimates and will identify management recommendations to reduce the risk of the establishment of bigheaded carp populations in the Great Lakes. The project will produce sampling guidance for invasive carp monitoring in the upper Illinois River and updated scenario planning for bigheaded carp management throughout the Illinois River. Through guiding the magnitude and location of harvest efforts and sampling for monitoring efforts, this project will help guide efforts to prevent the establishment of bigheaded carp in the Great Lakes.

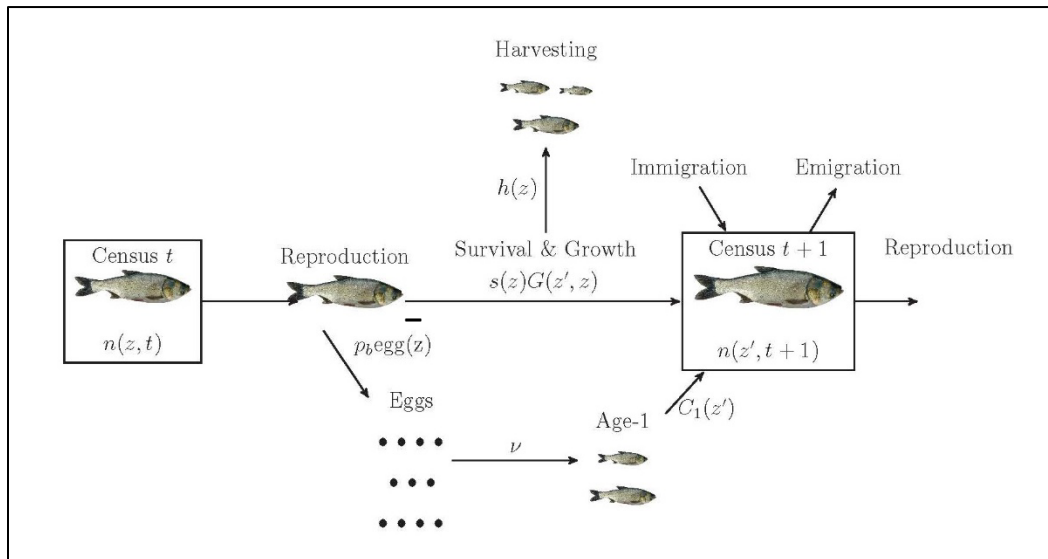
Project Description

This project supports ongoing modeling efforts to provide recommendations regarding the magnitude and spatial allocation of fishing effort and movement deterrents to reduce the risk of bigheaded carp introduction to the Great Lakes. This project will provide estimates of harvest mortality that can be used to determine the effectiveness of current management actions. In addition, these efforts will provide estimates of sampling efforts necessary to guide bigheaded carp monitoring in the upper Illinois River. Together these products will help inform future decision making regarding the allocation of resources and efforts to improve the effectiveness of bigheaded carp management and monitoring in the Illinois River.

Initial management recommendations from the SEICarP model, which has entered production phase, have been provided to the MRWG and ICRCC. This project continues to update that model to answer additional management questions (e.g., what is the importance of the connection between Alton Pool of the Illinois River and the Mississippi River). This project will also continue to support the development of a SCAA model to estimate bigheaded carp population size and harvest mortality. Once operational, the SCAA and SEICarP models can be used iteratively to set management targets, estimate the effectiveness of management actions, and recalibrate management targets based on new information.

Invasive Carp Action Plan: Fiscal Year 2025

Figure 42 — Life Cycle Diagram



Life cycle diagram and census points for pre-reproduction census of Silver Carp. The diagram is a visualization of the Meta-population Integral Projection Model kernel. Individuals undergo growth, survival, and reproduction between every census. At census time, individuals also may immigrate to or emigrate from the populations. Image courtesy of Dan O'Keefe, Michigan Sea Grant (CC BY-NC-ND 2.0)

Figure 43 — Illinois River System



Map of the Illinois River, including the six pools with known established Silver Carp populations that were included in the population model: Alton, La Grange, Peoria, Starved Rock, Marseilles, and Dresden Island. Recruitment takes place in the lower three pools. Source: Kallis et al. (2023).

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM16-25: USFWS Support for Invasive Carp Population Modeling in the Illinois River

- **Lead Agency:** USFWS
- **Agency Collaboration:** USGS, ILDNR, INHS, SIU
- **GLRI Funding:** \$100,000
- **Agency Funding:** \$200,000

Project Summary

This project will develop objective, data-driven tools to inform management decisions concerning bigheaded carp control efforts in the Illinois River. This project will result in population status estimates and will identify management recommendations to reduce the risk of the establishment of bigheaded carp populations in the Great Lakes. The project will produce sampling guidance for invasive carp monitoring in the upper Illinois River and updated scenario planning for bigheaded carp management throughout the Illinois River. Through guiding the magnitude and location of harvest efforts and sampling for monitoring efforts, this project will help guide efforts to prevent the establishment of bigheaded carp in the Great Lakes.

Project Description

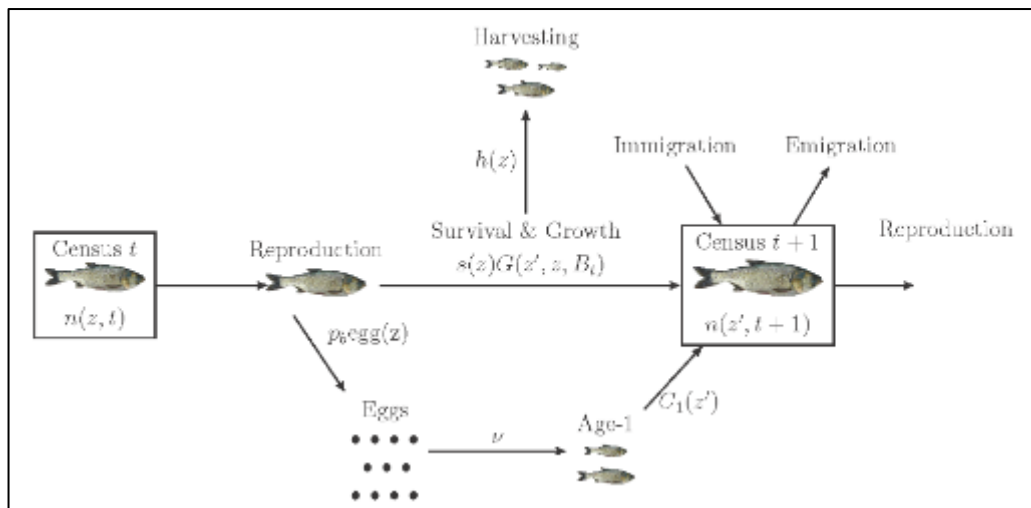
This project supports ongoing modeling efforts to provide recommendations regarding the magnitude and spatial allocation of fishing effort and movement deterrents to reduce the risk of bigheaded carp introduction to the Great Lakes. This project will provide estimates of harvest mortality that can be used to determine the effectiveness of current management actions. In addition, these efforts will provide estimates of sampling efforts necessary to guide bigheaded carp monitoring in the upper Illinois River. Together these products will help inform future decision making regarding the allocation of resources and efforts to improve the effectiveness of bigheaded carp management and monitoring in the Illinois River.

Initial management recommendations from the SEICarP model, which has entered production phase, have been provided to the MRWG and ICRCC. This project continues to update that model to answer additional management questions (e.g., what is the importance of the connection between Alton Pool and the Mississippi River?). This project will also continue to support the development of a SCAA model to estimate bigheaded carp population size and harvest mortality. Once operational, the SCAA and SEICarP models can be used iteratively to set management

Invasive Carp Action Plan: Fiscal Year 2025

targets, estimate the effectiveness of management actions, and recalibrate management targets based on new information.

Figure 44 — Life Cycle Diagram



Life cycle diagram and census points for pre-reproduction census of Silver Carp. The diagram is a visualization of the Meta-population Integral Projection Model kernel. Individuals undergo growth, survival, and reproduction between every census. At census time, individuals also may immigrate to or emigrate from the populations. Image courtesy of Dan O'Keefe, Michigan Sea Grant (CC BY-NC-ND 2.0)

Figure 45 — Illinois River System



Map of the Illinois River, including the six pools with known established Silver Carp populations that were included in the population model: Alton, La Grange, Peoria, Starved Rock, Marseilles, and Dresden Island. Recruitment takes place in the lower three pools. Source: Kallis et al. (2023).

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PREVENTING INVASIVE CARP MOVEMENT THROUGH THE ILLINOIS WATERWAY

Monitoring and Decision Support

IM17-25: Invasive Carp Database Management and Integration Support

- **Lead Agency:** USGS
- **Agency Collaboration:** USFWS, USACE, ILDNR, Iowa DNR, INHS, SIU, ISU
- **GLRI Funding:** \$161,000
- **Agency Funding:** \$436,000

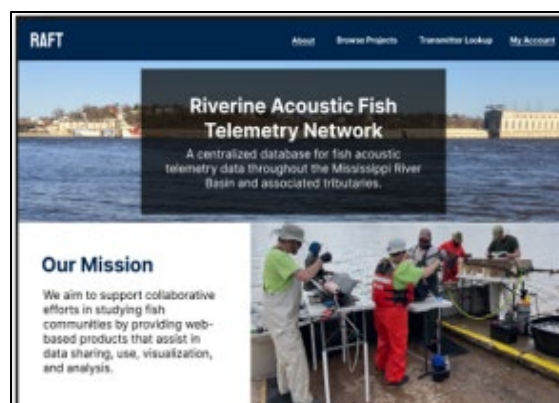
Project Summary

This project will provide invasive carp data management and decision support tools for the Illinois River with extensions to the entire Mississippi River Basin. This project will result in (1) a shared, multi-agency telemetry database called the RAFT Network, (2) a data catalog for invasive carp data (CarpDAT), and (3) maintenance of the ILRCdb. This project will help prevent invasive carp from becoming established in the Great Lakes by providing partners access to data and tools to analyze, visualize, model, and understand invasive carp movements and life history. This year's funding will support improvements and updates to the RAFT Network, development of CarpDAT, and maintenance of the ILRCdb.

Project Description

The goal of this project is to provide data management, informational products, and decision support tools to aid and inform the management and removal of invasive carp in the Illinois River to help prevent invasive carp from reaching the Great Lakes. The funding for this project will be used to develop and maintain several complementary invasive carp data systems. The RAFT Network (formerly FishTracks) is intended to be a common repository for invasive carp researchers and resource managers who are using acoustic telemetry tags to track and monitor carp. CarpDAT is expected to be a centralized reference for sharing information about research and projects involving invasive carp. The ILRCdb tracks invasive carp catch numbers in the Illinois River.

Figure 46 — RAFT Network Webpage



Screenshot of the RAFT Network Homepage.

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Integrating and transforming invasive carp-related data sets into actionable information requires a clear understanding of invasive carp life history. The tools developed on top of these data systems will allow researchers to evaluate the impact of different control methods and create integrated pest management plans. The accumulated data can also be used to inform modeling efforts in the Illinois River and other surrounding basins.

Specific objectives for 2025 include:

1. Develop additional features for RAFT by integrating a data download feature for transmitters and receivers, completing development of the detections query and download feature, creating an Application Programming Interface to support regular data retrieval, adding notifications and administrative functions for project owners, and incorporating continuous integration and continue delivery and development, security, and operations procedures into the database development process.
2. Complete RAFT data integration with the Ocean Tracking Network (OTN) and leverage OTN expertise to begin development of invasive carp analysis tools.
3. Work with USFWS to develop and deploy public CarpDAT data catalog and ensure invasive carp information is findable, accessible, interoperable, and reusable.
4. Continue maintenance of the ILRCdb application.

Figure 47 — Project Area



Map of the Upper Mississippi River Basin project area and Illinois River.

HYDROLOGIC BARRIERS TO PREVENT INVASIVE CARP MOVEMENT THROUGH INTERMITTENT WATERWAYS

HB1-25: Construction of Structures at Little Killbuck Creek, Ohio, to Prevent Inter-Basin Movement of Invasive Carp

- **Lead Agency:** Ohio DNR
- **Agency Collaboration:** NA
- **GLRI Funding:** \$0
- **Agency Funding:** \$0

Project Summary

The GLMRIS, completed by USACE in 2014, determined Little Killbuck Creek as a medium-risk connection for the transfer of Bighead Carp, Silver Carp, and Black Carp from the Mississippi River basin (Little Killbuck Creek) to the Great Lakes basin (Black River). The Little Killbuck Creek connection is a low-lying area that supplies a direct water connection between the two watersheds during high-water events. The connection will be closed using a combination of a rock and earthen berm to separate the basins and close this connection through a phased approach that will address the highest risk areas based on flood risk (AIS transfer risk).

Project Description

Using previous funding, OHDNR completed the berm design, permitting, wetland mitigation, and construction of a rock berm that is at the highest risk for flooding (Phase 1). The remaining project (Reaches 2 through 7, Phases 2 through 6) will be phased over multiple years and further stabilize and maintain the current earthen berm and upgrade related infrastructure. Phase 1 of the project will be completed in the spring of 2025 and will include constructing a new rock berm on Medina County Park District property and raising a roadway (Franchester). Later phases will include maintaining the current earthen berm and additional measures on adjacent private property. Phase 2 of the project will be initiated in 2025 using FY 2024 funding and will address the second highest AIS risk, including the purchase of an easement for maintenance of the current earthen berm, the raising of a second roadway (Garden Isle), the upgrade of a pumping facility to ensure dry conditions for future construction activities, improvements to an access road for future construction phases, and a screening of a structure for a culvert on the east end of the project. Future funding requests will be paused to allow for FEMA floodplain mapping that will be required for Phases 3 through 6.

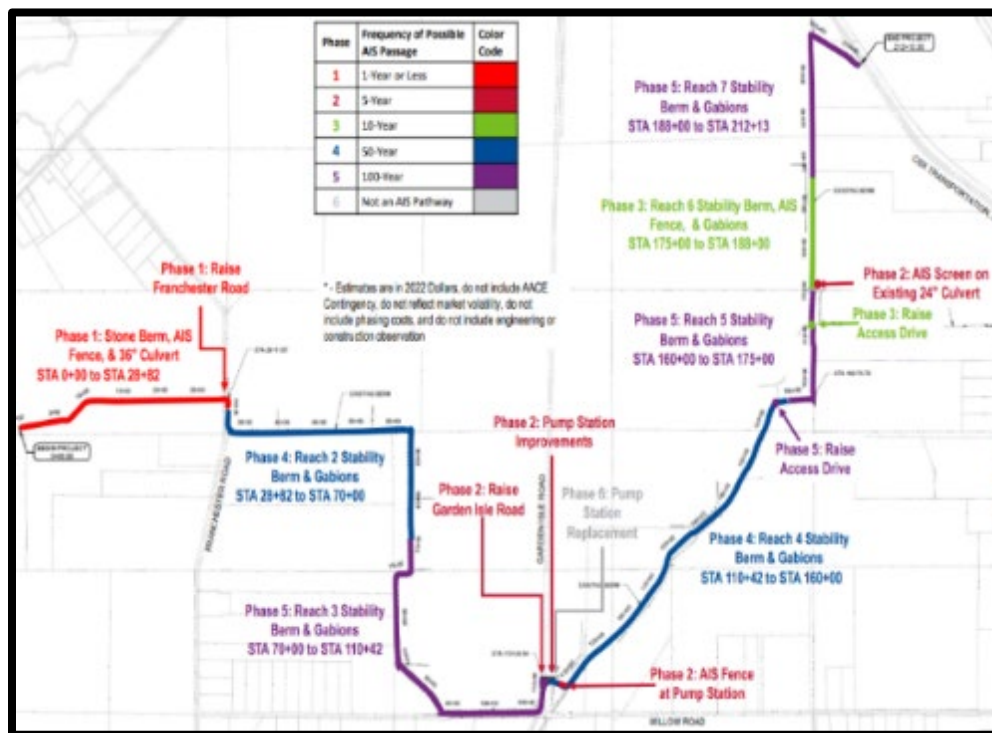
Invasive Carp Action Plan: Fiscal Year 2025

**Figure 48 — Little Killbuck Creek
GLMRIS Connection**



Map showing the Little Killbuck Creek connection and the Great Lakes and Mississippi River basins. Source: OHDNR

Figure 49 — Little Killbuck Creek Barrier – Risk Based Phases



Schematic identifying the risk-based phases for the Little Killbuck Creek barrier project. Source: OHDNR

HYDROLOGIC BARRIERS TO PREVENT INVASIVE CARP MOVEMENT THROUGH INTERMITTENT WATERWAYS

HB2-25: Closure of GLMRIS Connection at Ohio Erie Canal

- **Lead Agency:** Ohio DNR
- **Agency Collaboration:** NA
- **GLRI Funding:** \$20,000
- **Agency Funding:** \$0

Project Summary

This project will help prevent invasive carp from entering Lake Erie via a watershed connection between the Ohio River and Lake Erie at the Ohio Erie Canal, Akron, Ohio. Following completion of the engineering component of this project, annual maintenance is necessary to continue effective prevention measures at this area in the Ohio Erie Canal.

Project Description

Invasive carp, specifically Bighead Carp and Silver Carp, have been confirmed downstream in the Ohio River and these fish could move upstream toward Lake Erie through a series of tributaries in the coming years. Taking proactive steps now help prepare for what could eventually become a greater threat to the ecology and economy of the Great Lakes. It's important to keep these fish out because they are fast growing and prolific feeders capable of out-competing native fish for food.

The GLMRIS, completed by the USACE in 2014, determined the Ohio Erie Canal as a medium risk connection for transfer of Bighead Carp, Silver Carp, and Black Carp from the Mississippi River basin to the Great Lakes basin. The Ohio Erie Canal project included design and construction of various structural measures to prevent or reduce the probability of these invasive aquatic nuisance species moving from the Tuscarawas River Watershed (headwaters of the Muskingum River) into the Cuyahoga River Watershed, and eventually Lake Erie, via the Ohio-Erie Canal.

Construction of physical barriers was initiated by the USACE in the spring of 2019 using Great Lakes Restoration Initiative funding and was completed in the spring of 2020. Close coordination of the study, design, and construction was maintained with the OHDNR and Summit County Metro Parks. Once the project was completed in 2020, the OHDNR took over maintenance of the invasive control structures.

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Figure 50 — Ohio & Erie Canal – Gabion Basket Barrier



*Photo of the Gabion Basket Barrier at the Ohio & Erie Canal.
Source: OHDNR*

Figure 51 — Little Killbuck Creek GLMRIS Connection



*Map showing Little Killbuck Creek connection
and the Great Lakes and Mississippi River
basins. Source: OHDNR*

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PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC1-25: Removal Grass Carp in Ohio Waters of the Lake Erie Western Basin and Early Detection Monitoring in Other Lake Erie Tributaries

- **Lead Agency:** OHDNR
- **Agency Collaboration:** University of Toledo, GLFC, MDNR, USFWS, USGS
- **GLRI Funding:** \$625,000
- **Agency Funding:** \$0

Project Summary

This project will conduct aggressive control actions in locations of known Grass Carp spawning in the Sandusky and Maumee Rivers in Ohio, as well as other Lake Erie tributaries. Funding will be used for three Grass Carp strike teams and research at the University of Toledo that will contribute to the multi-agency goal of removing 373 diploid Grass Carp annually from Lake Erie. This project reduces the risk of spread and establishment of Grass Carp in the Great Lakes by reducing the number of spawning fish, while also collecting information to inform future adaptive response actions. Number collected to date include:

2018	2019	2020	2021	2022	2003	2024
Lake Erie: 48	Lake Erie: 176	Lake Erie: 111	Lake Erie: 176	Lake Erie: 142	Lake Erie: 173	Lake Erie: 206

Project Description

This project supports monitoring and control work by field crews to remove Grass Carp from the Western basin of Lake Erie, specifically in the Sandusky and Maumee Rivers, as well as other Lake Erie tributaries. The goal is to work with agency partners to remove 373 diploid Grass Carp annually from Lake Erie. The project will also help coordinate with the USACE on the feasibility of a Sandusky River Grass Carp Behavioral Barrier to disrupt Grass Carp spawning. This coordination includes facilitating the Grass Carp Barrier/Deterrents Task Group and determining the potential impact of the barrier on native fish. Both the removal and barrier goals were identified through the Structured Decision-Making process facilitated by Michigan State University. The long-term goal of this work is to suppress and/or eradicate the Grass Carp population in Lake Erie and prevent this member of the invasive carp family from becoming established in the Great Lakes.

Priorities to our approaches have been established by the Lake Erie Committee's (LEC) Lake Erie Grass Carp Adaptive Response Strategy 2024-2028. Planning for continued Grass Carp actions is being conducted in collaboration with the GLFC, Council of Great Lakes Fishery Agencies Invasive Fishes Executive Committee (IFEC), and the Council of Lake Committees Lake Erie Committee.

Invasive Carp Action Plan: Fiscal Year 2025

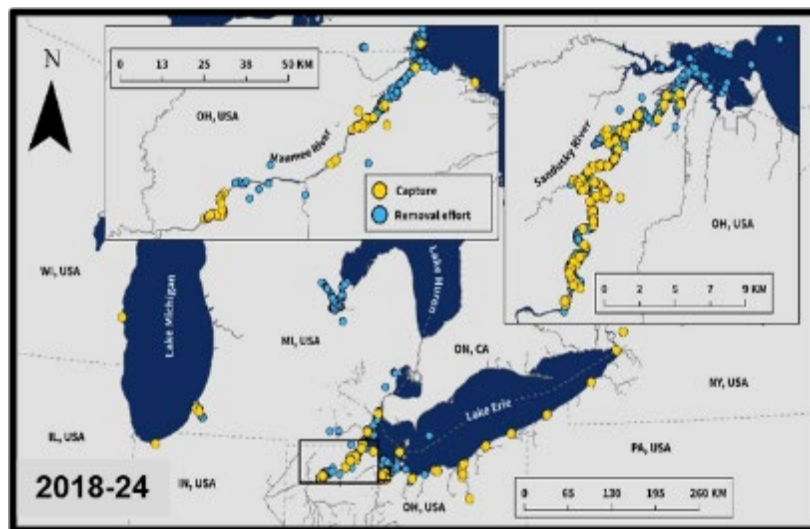
Coordination of Grass Carp activities in Lake Erie will be through the Grass Carp Advisory Committee (GCAC) which is facilitated by OHDNR and MIDNR. Per the Terms of Reference, GCAC Task Groups “undertake and coordinate special focused activities needed to achieve GCAC and individual lake committees’ objectives.” There are five Task Groups within the GCAC: Data Management, Field Work, Telemetry, Modeling, and Barriers/Deterrents.

Figure 52 — Grass Carp Strike Team



OHDNR Grass Carp Strike Team sampling for Grass Carp in the Sandusky River. Source: OHDNR

Figure 53 — Great Lakes Basin Grass Carp Collections



Map showing Grass Carp captures and removal effort at multiple locations in the Great Lakes basin, 2018-2024. Source: OHDNR

Invasive Carp Action Plan: Fiscal Year 2025

PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC2-25: Removal of Grass Carp in the Lake Erie Western Basin and Early Detection Monitoring in Great Lakes Tributaries

- **Lead Agency:** MIDNR
- **Agency Collaboration:** OHDNR, USFWS, USGS, GLFC, University of Toledo, Michigan State University
- **GLRI Funding:** \$410,000
- **Agency Funding:** \$150,000

Project Summary

This project will implement Grass Carp response actions in Michigan and Ohio waters of Lake Erie and connecting waters. This project will result in removal of Grass Carp and enable the evaluation of removal efforts and prevent invasive carp from becoming established in the Great Lakes by reducing the number of spawning fish and allow for data collection that will address important uncertainties in the adaptive management process. This year's funding will produce support to staff a MIDNR field crew that will contribute towards the multi-agency goal of removing 373 (based on Summer 2022 model update from Michigan State University) Grass Carp from the Western Basin of Lake Erie to reduce the risk of spread and establishment of Grass Carp in the Great Lakes.

Project Description

Grass Carp pose a risk to native species and habitat in the Great Lakes due to their ability to consume large amounts of aquatic vegetation. Evidence of Grass Carp reproduction has been observed in multiple tributaries of the Great Lakes, which increases the concern about their establishment and impacts. In 2019, the Lake Erie Committee (LEC), a collaborative group tasked with managing Lake Erie Fisheries, developed a 5-year response plan. While the initial 5-year response plan has concluded, the LEC established a new 5-year Grass Carp response plan (2024-2028) to continue learning and implementing actions that aim to reduce local populations and minimize their potential impacts in Lake Erie. Objectives of the plan included implementing control to minimize expansion of Grass Carp in Lake Erie, improving the understanding of Grass Carp dynamics to inform effective management actions, and minimizing the likelihood of introduction and establishment of new populations of Grass Carp. Since that initial adaptive response plan in 2019, MIDNR and partner agency response strategies focused on implementing the plan which has led to the removal of over 900 Grass Carp from Lake Erie and have also continued to address critical uncertainties surrounding Grass Carp life history and effectiveness

Invasive Carp Action Plan: Fiscal Year 2025

of response strategies. MIDNR will continue contributing to the new 5-year response plan and collaborating with partner agencies on Grass Carp response efforts.

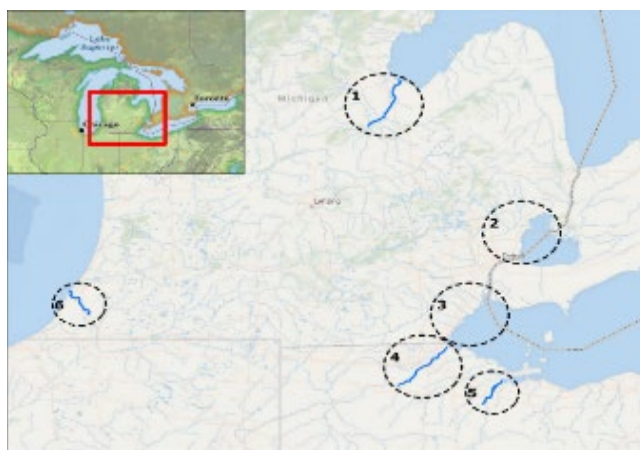
This project will support a year of capacity to implement the new 5-year response plan developed by the LEC and this funding will support the MIDNR's ability to implement that plan. Efforts will be coordinated with regional partners (USFWS, University of Toledo, USGS, MSU, and OHDNR) using the protocols developed by the Grass Carp Advisory Committee Task Group. Response strategies will be implemented to maximize removal of Grass Carp while simultaneously collecting important information about Grass Carp relative abundance, Grass Carp movement and distribution, and gear effectiveness including new gear types. Information gained through movement data (acoustic and satellite telemetry data) will also be incorporated into response strategies, including spawning event timing, seasonal aggregation and dispersal patterns of Grass Carp. The majority of efforts will be concentrated within the Western Basin of Lake Erie, and occasional surveillance in Lake Huron and Lake Michigan tributaries to monitor potential spread to other Great Lakes. Primary methods will focus on electrofishing with occasional pairing of trammel nets and deploying new passive techniques (gill nets) for Grass Carp. Collaborations with commercial and recreational groups will also increase capacity to remove Grass Carp while collecting information on their spatial distribution.

Figure 54 — Electrofishing for Grass Carp Removal



Michigan DNR Grass Carp crew conducting electrofishing for Grass Carp removal. Source MIDNR

Figure 55 — 2025 Grass Carp Areas of Focus



Map showing the areas of focus for 2025 including: (1) the Saginaw River and major tributaries, (2) select areas of Lake St. Clair, (3) the Western Basin of Lake Erie, (4) the Maumee River, (5) the Sandusky River, (6) the St. Joseph River. Source: MIDNR.

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PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC3-25: Support for Removal of Grass Carp in the Lake Erie Western Basin and Early Detection Monitoring in Great Lakes Tributaries

- **Lead Agency:** USFWS
- **Agency Collaboration:** USACE, USGS, IN DNR, MIDNR, NY DEC, OH DNR, PA FBC, WIDNR, GLFC, SIU, Michigan State University, University at Buffalo, University of Toledo
- **GLRI Funding:** \$1,470,000
- **Agency Funding:** \$850,000

Project Summary

This project supports the Grass Carp removal efforts in the Lake Erie, Lake Michigan, and Lake Ontario basins and tributaries. Funding will support the needed capacity to implement Grass Carp response actions in support of State-led Grass Carp management strategies, including those under the Grass Carp Advisory Committee (GCAC) and the Lake Erie Grass Carp Adaptive Response Strategy 2024-2028. This project will result in increased targeted monitoring and removal of Grass Carp as well as support of State and GCAC led initiatives, reducing the threat of this species in the Great Lakes by reducing population size and suppressing reproduction.

Project Description

This project will provide field crews, vessel support, and laboratory assistance to support partners and implement State-led Grass Carp early detection and removal actions in Lake Erie, Lake Michigan, and Lake Ontario. Conservation Offices will (1) coordinate with partners to plan and implement innovative detection and control techniques and actions; (2) support GCAC data management and QAQC plans; (3) collect biological samples for ageing, health, virology, and determination if the fish are fertile or nonfertile (ploidy analysis); (4) contribute to the multiagency goal of removing 373 Grass Carp from the Lake Erie Western Basin and connecting waters; (5) assist with the implementation of telemetry (e.g., GLATOS, satellite, acoustic, VPS) efforts to track movements of Grass Carp; and 6) provide support for coordination and management groups.

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Figure 56 — Adult Grass Carp Jumping from Submerged Woody Debris



Adult Grass Carp jumping from submerged woody debris during boat electrofishing on the St. Joseph River, Michigan. Photo credit: USFWS

PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC4-25: Invasive Carp Ploidy Analysis to Assess Reproductive Risk of Detected Populations

- **Lead Agency:** USFWS
- **Agency Collaboration:** USGS, Great Lakes Grass Carp Committee
- **GLRI Funding:** \$80,000
- **Agency Funding:** \$40,000

Project Summary

This project assesses the reproductive capability of wild caught Grass Carp and Black Carp by determining the ploidy, or sets of chromosomes, of captured carps. Diploid invasive carp, those with two (2) sets of chromosomes, are able to reproduce; triploid invasive carps, those with three (3) sets of chromosomes, are sterile and unable to reproduce. This information is used by managers to plan activities to prevent invasive carp from becoming established in the Great Lakes by allowing managers to target removal and control efforts to areas of highest risk for reproduction based on results from analysis, whether wild populations present risk or no risk for establishment.

This project will provide ploidy determinations for captured wild Grass Carp in the Great Lakes basin and states of Wisconsin, Illinois, Michigan, Ohio, Pennsylvania, and New York. The same methods will be applied for ploidy determinations of captured Black Carp that threaten to invade the Great Lakes basin via Upper Mississippi River and Ohio River basins. This year's funding will produce more than two hundred flow cytometric analyses of Grass Carp to determine threat for reproduction in the Great Lakes, and up to 100 Black Carp from leading edge of invasion in Great Lakes states (Mississippi and Ohio River basins).

Project Description

Ploidy determination is a genetic analysis of the reproductive capabilities of captured Grass Carp and Black Carp using flow cytometry. Analysis of captured Grass Carp or Black Carp determines if the fish are sterile triploids (e.g., escaped from intentional stockings for aquatic weed or snail control), or if the fish are naturally reproducing diploids and may establish invasive populations. Results are used by partner agencies to inform on the risk of new population establishment or range expansion, and to focus the implementation of potential response and control actions on areas of need where diploid fish threaten to establish reproductive populations. Ploidy results, along with collection data and images, are reported to the Great Lakes Grass Carp Committee,

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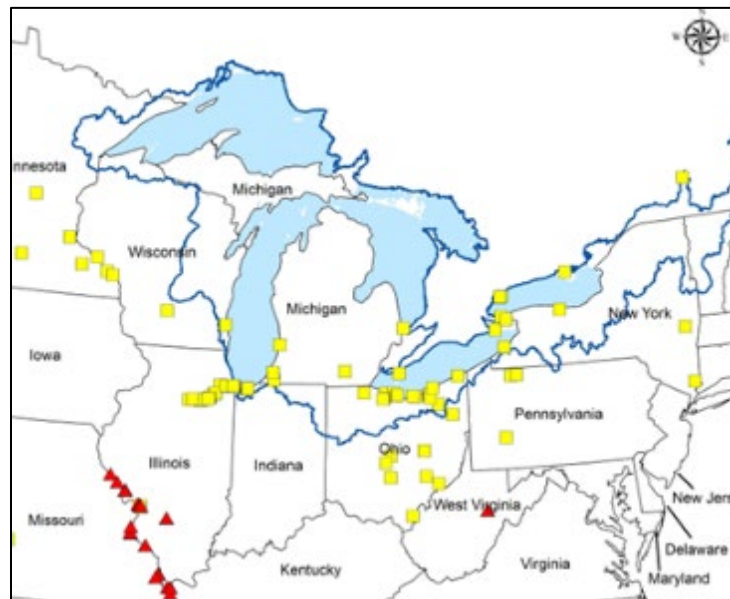
coordinating and sample submitting partners, and USGS Non-indigenous Aquatic Species (NAS) Database: <https://nas.er.usgs.gov/>.

Figure 57 — Captured Grass Carp



Photo of a person holding a large Grass Carp captured from the Great Lakes. Source: USFWS

Figure 58 — Map of Black Carp and Grass Carp Capture Locations



Map identifies locations where Grass Carp were captured for ploidy analysis (yellow squares) and where Black Carp were captured for ploidy analysis (red triangles). Source: USFWS

PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC5-25: Reproduction Characteristics, Vegetation Impacts, and Removal Efficiency of Grass Carp in Western Lake Erie

- **Lead Agency:** USGS
- **Agency Collaboration:** MIDNR, OHDNR, USFWS, University of Toledo, INHS, Great Lakes Grass Carp Advisory Committee, GLFC, USACE, NOAA
- **GLRI Funding:** \$520,000
- **Agency Funding:** \$274,500

Project Summary

The proposed project will address critical data gaps related to Grass Carp management in the Great Lakes. Project objectives and focus topics include:

- Investigating Grass Carp reproduction and identifying spawning areas to prioritize control efforts.
- Characterizing the hydrodynamics of Sandusky Bay to enhance understanding of the fate and transport of Grass Carp eggs and larvae, thereby improving risk assessments and informing new control methods.
- Analyzing how various sampling strategies can improve the detection probability of invasive carp eggs/larvae using existing drift simulation results in regulated and unregulated rivers of different scales.
- Conducting a comprehensive comparison of gear efficiency for capturing Grass Carp in western Lake Erie and the Mississippi River to optimize removal strategies.
- Quantifying the impacts of Grass Carp on aquatic vegetation in Ohio and Michigan wetlands, developing a novel bioenergetics model to understand growth thresholds that could lead to habitat degradation.
- Optimizing the efficacy of bubble screens to deter the upstream passage of adult and sub-adult Grass Carp, creating field-ready technology for seasonal deployment in spawning tributaries to limit or prevent spawning. Funding will support the design of a deterrent capable of functioning under typical spawning flow conditions.

Collectively, this funding will significantly aid in preventing the establishment of invasive carp in the Great Lakes through improved management strategies and data-driven approaches.

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Project Description

This project includes activities addressing Grass Carp information needs to support management decision-making. Sampling of early life stages (eggs and larvae) will occur in tributaries to the Great Lakes to support Grass Carp removal associated with spawning activity. New spawning locations will also be identified to enhance control measures. Existing hydrodynamic models will be evaluated to understand how environmental conditions affect egg and larval transport in Sandusky Bay.

As sampling for early life stage invasive carp is crucial for understanding reproductive productivity, spawning cues, and control effectiveness, this project will also address the challenges of collecting this information near “invasion fronts” due to low detection probabilities. Agencies are seeking to improve sampling strategies by targeting locations where eggs and larvae aggregate due to hydraulic processes. To obtain needed data, this project will enhance detection probability using existing egg and larval drift simulations from various river systems, including the Sandusky, Maumee, Illinois, Upper Mississippi, and St. Croix rivers. This information is crucial for informing management strategies and better understanding the recruitment dynamics of Grass Carp populations, including risk of recruitment, when eggs leave the Sandusky River and enter Lake Erie.

Additionally, the project will optimize gear types for capturing Grass Carp by conducting comparative assessments between sites in the western Lake Erie basin and Pool 19 of the Mississippi River. With adjustments based on telemetry data indicating that Grass Carp are more active at night, multiple gear types will be deployed to maximize removal efficiency. Data gathered will improve capture probability estimates, enhancing future population assessments and management actions. The project will also evaluate how electrofishing can disrupt spawning and ultimately minimize the establishment of new breeding populations.

This project will also assess the potential impacts of Grass Carp on aquatic vegetation in Great Lakes wetlands. A project goal is to establish thresholds for effective management by quantifying the per-capita effects of Grass Carp and determining the abundance levels that could lead to habitat degradation. The development of a dynamic bioenergetics model will allow researchers to understand the growth and reproductive parameters of Grass Carp, facilitating better predictions of their impacts on native aquatic habitats.

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Figure 59 — Ichthyoplankton Netting on the Cuyahoga River



A USGS technician rinses bongo net contents into a collection jar on the Cuyahoga River in Ohio during an ichthyoplankton survey. Photo credit: USGS

Figure 60 — USGS Columbia Environmental Research Center



Map of the USGS Columbia Environmental Research Center (CERC) in Columbia, Missouri where the continuous racetrack flume is located. The Eco-flume (A) has an overall length of 11.4 meters and width of 4.3 meters, with depths up to 1.0 meter and a total capacity of 34 m³ (9,000 gallons). Each straight section (B) is 7 meters long and 1.5 meters wide. Source: USGS

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PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC6-25: Refinement of the Grass Carp Spawning Event Prediction Tool

- **Lead Agency:** USGS
- **Agency Collaboration:** NOAA-NWS-ORFC, OHDNR, U of Toledo, ILDNR, INHS, Minnesota DNR, Indiana DNR
- **GLRI Funding:** \$85,000
- **Agency Funding:** \$20,000

Project Summary

This project will continue the development of USGS SpawnCast, a web-based decision support tool that provides 5-to-10-day forecasts of potential invasive carp spawning events in tributaries to the Great Lakes and adjacent river basins with known interbasin connections to the Great Lakes (Illinois, Upper Mississippi, Ohio). This project will result in the ability of management agencies to make informed decisions about when and where to deploy Grass Carp strike teams in the Great Lakes basin and prevent invasive carp from becoming established in the Great Lakes by providing advanced warning of spawning events, guiding early detection monitoring efforts near invasion fronts, and identifying when and where control efforts can have the greatest impact on invasive carp populations in the Great Lakes and adjacent basins. This year's funding will be used to maintain and operate the USGS SpawnCast webpage for existing forecast sites and to deploy a new, interactive dashboard utilizing NOAA's National Water Model and spawning suitability index models to produce reach-based invasive carp spawning forecasts for stream networks throughout the Great Lakes, Upper Mississippi, Illinois, and Ohio River basins.

Project Description

The discovery of evidence of reproduction of invasive Grass Carp in the Great Lakes Basin in 2011 led to the development of a multi-agency response and control strategy that includes removal of adult Grass Carp and monitoring of tributaries for signs of Grass Carp spawning. According to the Great Lakes GCAC, capturing Grass Carp in tributaries during spawning is the most successful and efficient method for strike teams fighting to reduce invasive Grass Carp populations in the Great Lakes. The collection of ichthyoplankton data (eggs and larvae) is critical to locating new spawning areas, assessing range expansion, and estimating population size of invasive carp in North America. In 2021, the GCAC expressed broad support for the development of a web- and mobile-accessible decision support tool capable of forecasting Grass Carp spawning events up to 5-days in advance to provide resource management agencies time to mobilize and deploy Grass Carp strike teams and ichthyoplankton sampling crews effectively and efficiently. In May 2021, USGS SpawnCast, a Grass Carp spawning prediction tool, went online and has since been a key

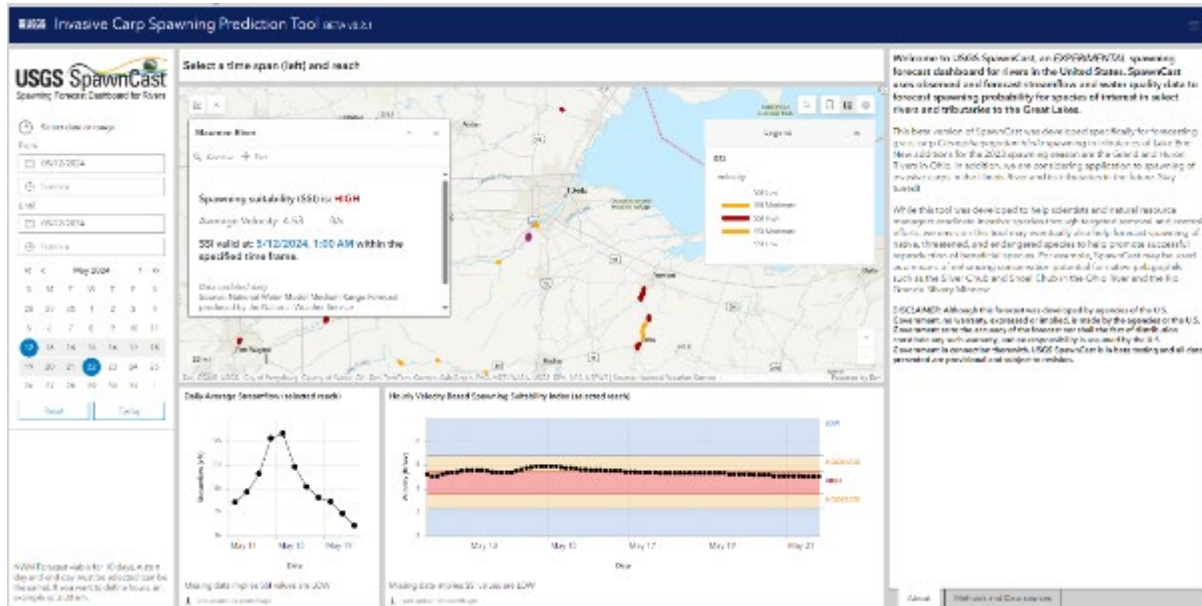
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tool for agency response coordinators. In the years since, agencies monitoring invasive carp reproduction in the Illinois, Upper Mississippi, and Ohio River Basins expressed interest in expansion of USGS SpawnCast to these basins and to bighead and silver carp. Agency funds will support the proposed expansion of USGS SpawnCast outside of the Great Lakes and Illinois River Basins.

In its most general form, USGS SpawnCast is a first-generation spawning forecast dashboard for rivers that is broadly applicable to rivers and aquatic species throughout the United States. USGS SpawnCast uses observed and forecast hydrologic, hydraulic, and water-quality conditions combined with species-specific spawning requirements to forecast spawning probability for species of interest in select rivers and tributaries to the Great Lakes. USGS SpawnCast currently provides hourly forecasts for Grass Carp spawning in five tributaries to Lake Erie (the Sandusky, Maumee, Cuyahoga, Grand, and Huron rivers). USGS has developed an interactive dashboard that utilizes output from the NOAA National Water Model to produce reach-based Grass Carp spawning forecasts for tributaries throughout the Great Lakes basin (the beta version is currently offline and awaiting USGS review and approval for online publication). This expansion of USGS SpawnCast provides users with detailed Grass Carp spawning forecasts for thousands of river reaches around the Great Lakes allowing more efficient use of human resources for the collection of ichthyoplankton samples and targeted removal of adult Grass Carp. Furthermore, the broad coverage of the National Water Model allows the application of USGS SpawnCast to other river basins currently under invasion by invasive carp and with known interbasin connections to the Great Lakes (Illinois, Upper Mississippi, Ohio). Development of species-specific spawning suitability index models in 2025 (the Grass Carp model was completed in 2024) will allow USGS SpawnCast to predict when and where bighead, silver, and Grass Carp spawning is possible throughout the Great Lakes and adjacent river basins up to 10 days in advance. Advanced notice allows partner agencies to ensure control and monitoring assets are deployed with the maximum potential for success.

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Figure 61 — Screen Shot of the USGS SpawnCast Interactive Dashboard



Screen shot of the USGS SpawnCast interactive dashboard (beta) [multipaneled graphical user interface with a forecast period selection panel, an interactive map with highlighted river reaches that have moderate and high spawning suitability index (SSi) values during the forecast period, and timeseries plots of streamflow and velocity for the highlighted reach].

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PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC7-25: Using Telemetry to Better Understand Grass Carp Movements and Habitat Use

- **Lead Agency:** USGS
- **Agency Collaboration:** OHDNR, MIDNR, GLFC, Michigan State University
- **GLRI Funding:** \$200,000
- **Agency Funding:** \$519,412

Project Summary

This project will address the threat of invasive Grass Carp by developing a comprehensive understanding of seasonal movements and habitat use to determine when and where eradication efforts would be most effective in Ohio, Michigan, Pennsylvania, and New York within Lakes Erie and Huron and tributaries to these lakes. This project will result in detailed observations of Grass Carp spawning, feeding, and overwinter behavior and prevent invasive carp from becoming established in the Great Lakes by determining when and where eradication efforts would be most effective. This year's funding will produce a publication examining detailed Grass Carp movement and habitat use during spawning periods in the Sandusky River, a summary of Grass Carp seasonal movements and locations in lake and tributary habitats, real-time tracking of Grass Carp movement in spawning tributaries and some nearshore habitats, and an analysis of satellite transmitter accuracy and utility. An animated video depicting a one-day Grass Carp spawning event in the Sandusky River may be viewed here:

<https://www.usgs.gov/media/videos/telemetered-grass-carp-ctenopharyngodon-idella-movements-during-a-known-spawning-event>

Project Description

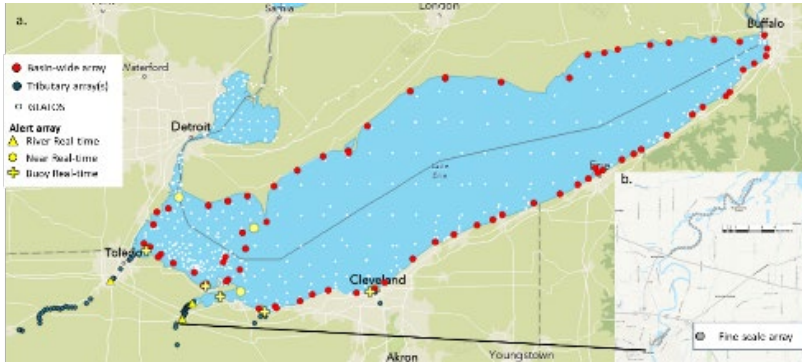
The goal of this project is to address the threat of invasive Grass Carp by developing a comprehensive understanding of seasonal movements, habitat use, and areas of aggregation to determine when and where removal efforts would be most effective. The work will be accomplished with primarily acoustic telemetry, leveraging the Great Lakes Acoustic Telemetry Observation System (GLATOS) in a basin-wide interagency collaboration. The goal of this project directly addresses a top priority of the Council of Great Lakes Fishery Agencies.

Information on Grass Carp spawning, feeding, and overwinter behavior is highly sought by managers to inform the development of control and removal strategies and efforts. Detailed observations of the location and timing of Grass Carp movements will also be compared to abiotic conditions to explore potential cues to these observed patterns. Our approach to address these

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questions was to create a tiered network of telemetry receivers. Information from detections of tagged Grass Carp from this array will be used in analyses of seasonal habitat use and fine-scale tributary habitat use with applications to inform and improve removal efforts.

Figure 62 — Location of Grass Carp Tiered Telemetry Arrays



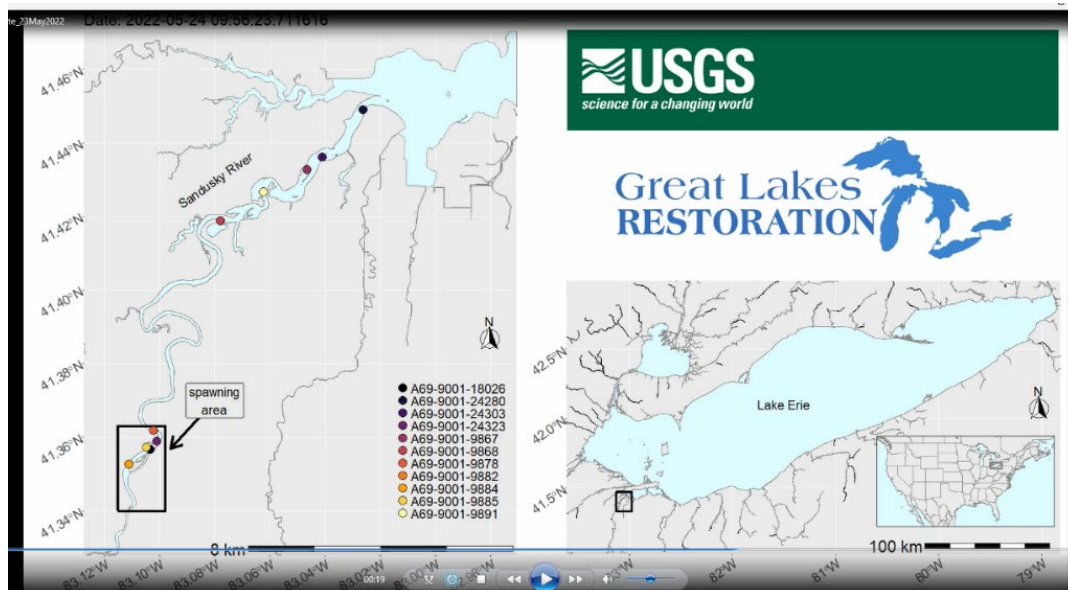
Location of Grass Carp Tiered Telemetry Arrays in Lake Erie (a.) and a close-up of the Fine-scale array (b.). The Grass Carp receivers and arrays are shown in red, blue, gray, and yellow while other existing strategically located GLATOS receivers are shown in white. Source: USGS

Figure 63 — Tagged Grass Carp



Grass Carp tagged with a tethered satellite telemetry tag in an experimental pond. Source: USGS

Figure 64 — Telemetered Grass Carp Movements During a Spawning Event



Telemetered Grass Carp movements during a known spawning event on 23 May 2022, in the Sandusky River, Ohio. Source: USGS

PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC8-25: Development and Testing of Deterrent Technologies for Grass Carp

- **Lead Agency:** USGS
- **Agency Collaboration:** USFWS, KDFWR, GLFC, Sandusky Grass Carp Barrier Team, OH DNR, MIDNR
- **GLRI Funding:** \$125,000
- **Agency Funding:** \$254,800

Project Summary

This project will evaluate Grass Carp response to an experimental BAFF at Barkley Lock and Dam in the Cumberland River near Grand Rivers, Kentucky and an experimental uADS at Lock No. 19 in the Mississippi River near Keokuk, Iowa. This project will result in a better understanding of fine-scale Grass Carp behavioral response to two experimental deterrent systems. This could further assist in preventing invasive carp from becoming established in the Great Lakes by providing data and information to the Great Lakes Grass Carp Advisory Committee to inform the design of a seasonal barrier for the Sandusky River or other Great Lakes tributaries that could prevent grass carp from accessing spawning areas. This year's funding will be used to finalize analyses to assess experimental deterrent effectiveness (i.e., BAFF and uADS) for upstream movement and fine-scale behavior of Grass Carp.

Project Description

This project will leverage the ongoing effort testing the BAFF at Barkley Dam and uADS at Lock No. 19 to gain additional information to inform the design and deployment of a Sandusky River deterrent for Grass Carp. Efforts to date have resulted in successfully tagging Grass Carp at Barkley Lock and Dam and Lock No. 19 with two types of telemetry transmitters. This work has demonstrated the feasibility of examining the fine-scale behavior of Grass Carp and determining the efficacy of the BAFF and uADS for Grass Carp deterrence within dynamic, large-river systems. The focus for 2025 will include data analysis, presentations, and publications to wrap up this study. These data will be used to inform the applicability of using a BAFF or uADS as a component of a Grass Carp control program in the Sandusky River and other tributaries of the Great Lakes.

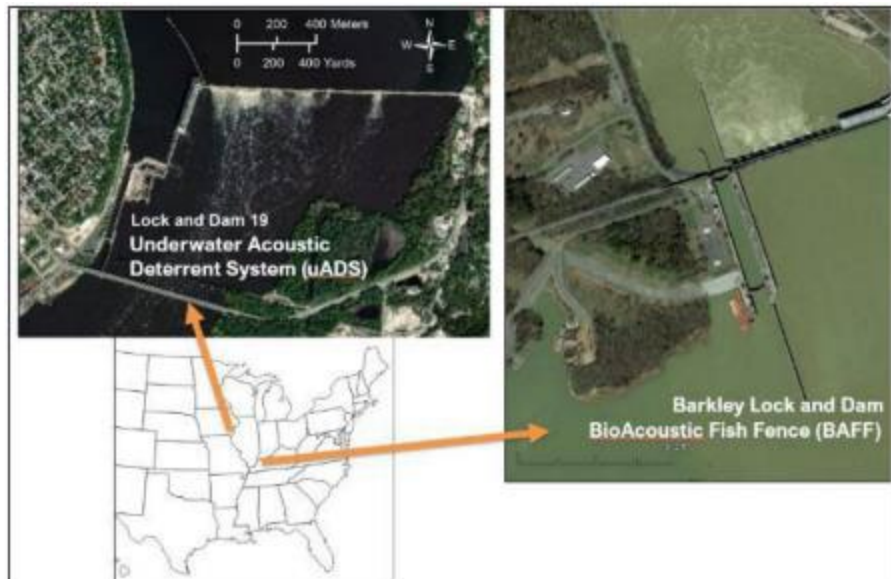
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Figure 65 — Implanting a Transmitter into a Grass Carp



A Biologist surgically implants a transmitter into a Grass Carp near Mississippi River Lock No. 19. Source: USGS

Figure 66 — Map of Mississippi River Lock No. 19 and Barkley Lock and Dam



Overview map showing the location of the two main deterrent evaluations; Mississippi River Lock No. 19 and Barkley Lock and Dam. Source: USGS

PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC9-25: Characterization of In-Lake Grass Carp Movement Patterns in Response to Habitat Conditions Using Biophysical Models

- **Lead Agency:** NOAA
- **Agency Collaboration:** Michigan State University-Quantitative Fisheries Center
- **GLRI Funding:** \$241,000
- **Agency Funding:** \$86,000

Project Summary

This project will characterize patterns of Grass Carp movement in Lake Erie. This project will result in a better understanding of what factors regulate in-lake Grass Carp movement and prevent invasive carp from becoming established in the Great Lakes by providing insights into where the species is more likely to spread from already inhabited tributaries. This year's funding will produce new analyses of Grass Carp telemetry data in comparison with NOAA model products describing Lake Erie Habitat conditions.

Project Description

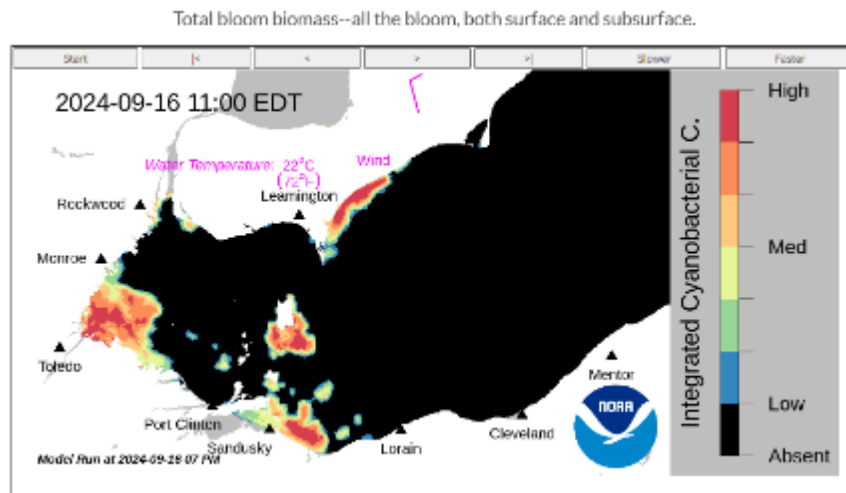
As efforts to control Grass Carp in Lake Erie are ongoing, it is critical to conduct risk assessments of where individuals may spread from existing aggregation areas. To provide such information, acoustic telemetry has been employed to develop a better understanding of individual carp movements within the Lake and its tributaries. While many Grass Carp with implanted acoustic transmitters spent a large amount of time in tributaries, a substantial fraction of the studied population made extensive movements both within Lake Erie and, in some cases, into Lake Huron. It is these wide-ranging movements that pose the greatest risk for establishing new aggregations of Grass Carp in other parts of the Great Lakes. However, the observed movement patterns are quite variable and may not provide a clear picture of the areas of greatest invasion likelihood. There remains a need to better understand what factors regulate these large-scale, in-Lake movements to identify what new habitats Grass Carp may move to both now and in the future.

Through a broad portfolio of research efforts, NOAA GLERL has produced several biophysical model products describing temperature and other physical conditions, the distribution and severity of hypoxia, and the dynamics of harmful algal blooms (HABs) in Lake Erie. These data provided a dynamic, three-dimensional view of how Lake Erie habitats change throughout the seasonal cycle and provide an opportunity to better understand patterns of fish habitat use. In this project, we propose to compare existing Grass Carp telemetry data collected by MSU with

Invasive Carp Action Plan: Fiscal Year 2025

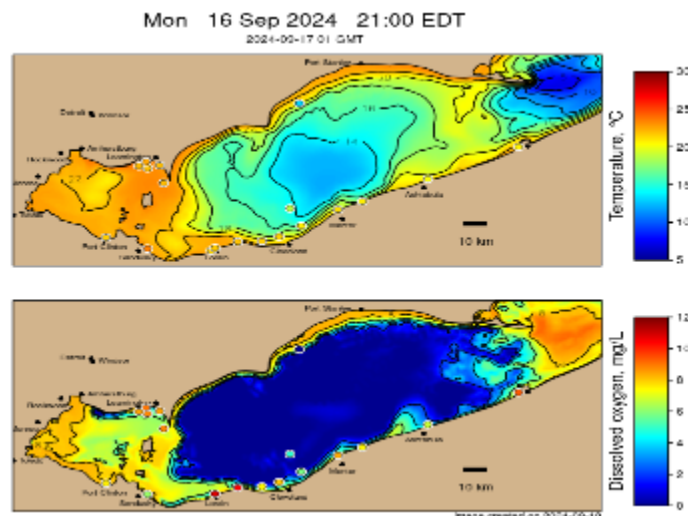
data from NOAA GLERL's models of HABs, hypoxia, temperature, and other habitat conditions in Lake Erie. For the subset of Grass Carp observed to have made in-Lake movements, we will seek to identify common habitat conditions occupied or avoided while in these environments. These insights will then be used to suggest when and where Grass Carp are more likely to spread in Lake Erie and beyond from existing aggregations. The results of this work will inform risk assessments for candidate habitats for invasion and help to target ongoing and new monitoring and control efforts for Grass Carp.

Figure 67 — Snapshot of Late Summer Harmful Algal Bloom



A snapshot of late summer harmful algal bloom conditions grass carp may encounter while moving through Lake Erie. Shows forecasted cyanobacterial bloom biomass integrated throughout the water column derived from satellite imagery and the NOAA Lake Erie Operational Forecast System. Source: NOAA

Figure 68 — Snapshot of Temperature and Dissolved Oxygen Conditions



Map of Lake Erie with bottom temperature (top) and dissolved oxygen (bottom) conditions simulated by the NOAA Lake Erie Hypoxia Forecast.

PREVENTING THE ESTABLISHMENT OF GRASS CARP IN THE GREAT LAKES

GC10-25: Spatiotemporal Variability of Strontium Isotope Ratios in Sandusky Bay Water

- **Lead Agency:** USGS
- **Agency Collaboration:** NOAA, USFWS, OHDNR, MIDNR
- **GLRI Funding:** \$30,000
- **Agency Funding:** \$67,000

Project Summary

This project will analyze the spatiotemporal variability in strontium isotope ratios ($^{87}\text{Sr}/^{86}\text{Sr}$) in the waters of Sandusky Bay, Ohio. This project will result in a better understanding of the potential for Grass Carp egg hatching and recruitment within Sandusky Bay, Ohio, and prevent invasive carp from becoming established in the Great Lakes by addressing a key uncertainty in Grass Carp risk assessment—hatching and recruitment in open waters of the Great Lakes. This year's funding will be used to analyze strontium isotope ratios in 139 water samples collected during three surveys of Sandusky Bay in 2024, analyze the spatiotemporal variability of strontium isotope ratios, test the hypothesis of DiPuccio (2022) that Grass Carp egg hatching is occurring in the bay, and summarize the results of the study in a peer reviewed journal article.

Project Description

An underlying assumption in early life history of Grass Carp is that eggs are required to remain in suspension until hatching for successful recruitment. Impoundments and lakes downstream from Grass Carp spawning sites in rivers have been generally considered to lack sufficient velocity and turbulence to maintain Grass Carp eggs in suspension. As such, many Grass Carp risk assessments have modeled recruitment based on the probability of in-river hatching. However, recent research examining natal origins of adult Grass Carp captured in Lake Erie using strontium isotope ratios has challenged this assumption by concluding that some Grass Carp eggs are likely hatching within Sandusky Bay and recruiting to the population. DiPuccio (2022) found that the strontium isotope ratios in otolith cores (formed 1-3 hours prior to hatching) are not consistent with strontium isotope ratios in Sandusky River water or other tributaries to the Western Basin of Lake Erie. Trends in strontium isotope ratios along the Sandusky River and assessments of the underlying geology of Sandusky Bay led to the hypothesis that the otoliths cores formed in Sandusky Bay. However, strontium isotope ratio measurements were lacking within Sandusky Bay waters, so a definitive conclusion was not possible.

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In 2025 data will be analyzed to understand how the ratios vary in space and time within Muddy Creek and Sandusky Bays. Distributions of $^{87}\text{Sr}/^{86}\text{Sr}$ and Sr/Ca within Sandusky Bay will be used to test the DiPuccio (2022) hypothesis that Grass Carp egg hatching and recruitment is possible within Sandusky Bay. These data will also serve as a benchmark dataset for evaluation and interpretation of otolith microchemistry results from year classes in the future.

Figure 69 — Survey Sampling Grid



A survey sampling grid overlaid on an aerial image of Sandusky Bay with a visible sediment plume from the Sandusky River in July 2007. Source: Google Earth

Figure 70 — Map of Sandusky Bay



Map showing Sandusky Bay in relation to Lake Erie and the Sandusky River. Source: USGS

UNDERSTANDING BLACK CARP POPULATION DYNAMICS TO INFORM MANAGEMENT STRATEGIES

BC1-25: Enhanced Detection of Black Carp in the Lower Illinois River

- **Lead Agency:** ILDNR
- **Agency Collaboration:** INHS-IRBS, USGS
- **GLRI Funding:** \$228,000
- **Agency Funding:** \$0

Project Summary

This project will monitor for invasive Black Carp and determine their abundance in the Alton Pool of the Illinois River. This project will result in relative abundance estimates that can be used to assess impacts of management activities. This year's funding will produce estimates of Black Carp relative abundance in the Alton Pool and establish a baseline to quantify changes in abundance in response to management activities and help direct appropriate management activities. In addition, ILDNR will assist with telemetry-informed rapid response removal efforts in the Illinois River as necessary.

Project Description

Invasive Black Carp have been detected in portions of the Illinois River system, with recent captures in the Alton, La Grange, and Peoria pools of the lower river. Currently, the invasion of Black Carp is represented by only a few reported individuals, and little is known about the size of the population or potential scope of ecosystem changes that may result from the invasion. The range expansion of Black Carp has been closely monitored up the Illinois River, despite limited catches reported to date. The limited number of Black Carp reported have resulted from incidental commercial fishermen catches while targeting other species. More robust estimates of the current population level are essential to management and potential control of Black Carp in the Illinois River. Fishery-independent Black Carp population abundance estimates in the Illinois River were identified as a priority information need through the BCWG's structured decision-making process. Relative abundance estimates will be used to detect Black Carp population status changes and to help inform and assess management actions.

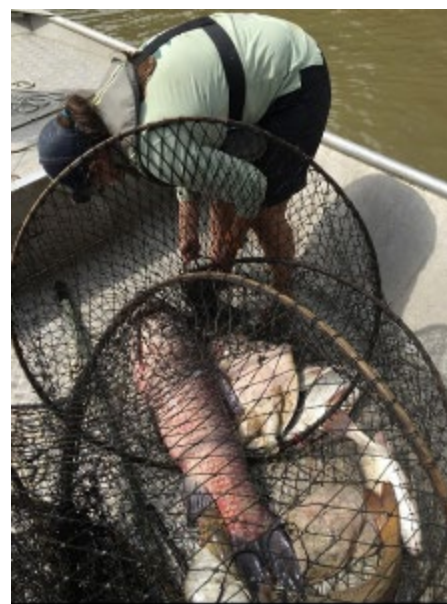
In 2025, ILDNR will continue sampling for Black Carp using hoop nets augmented with experimental baits to assess the population in the lower Illinois River, as well as the efficacy of different specific baits. Selection of the preferred bait may be further informed by laboratory

Invasive Carp Action Plan: Fiscal Year 2025

investigations at USGS and INHS. Black Carp sampling efforts will be doubled in the Alton Pool, closer to the source population to increase the probability of capture. To further increase the ability to assess the population and compare trends across years, this will be the second year targeting a Black-Carp likely stratum that is built and delineated by habitat features conducive to black carp aggregation as informed by telemetry and commercial captures. This stratum will continue to be refined as more spatially explicit habitat preference is identified through current and future telemetry and netting efforts.

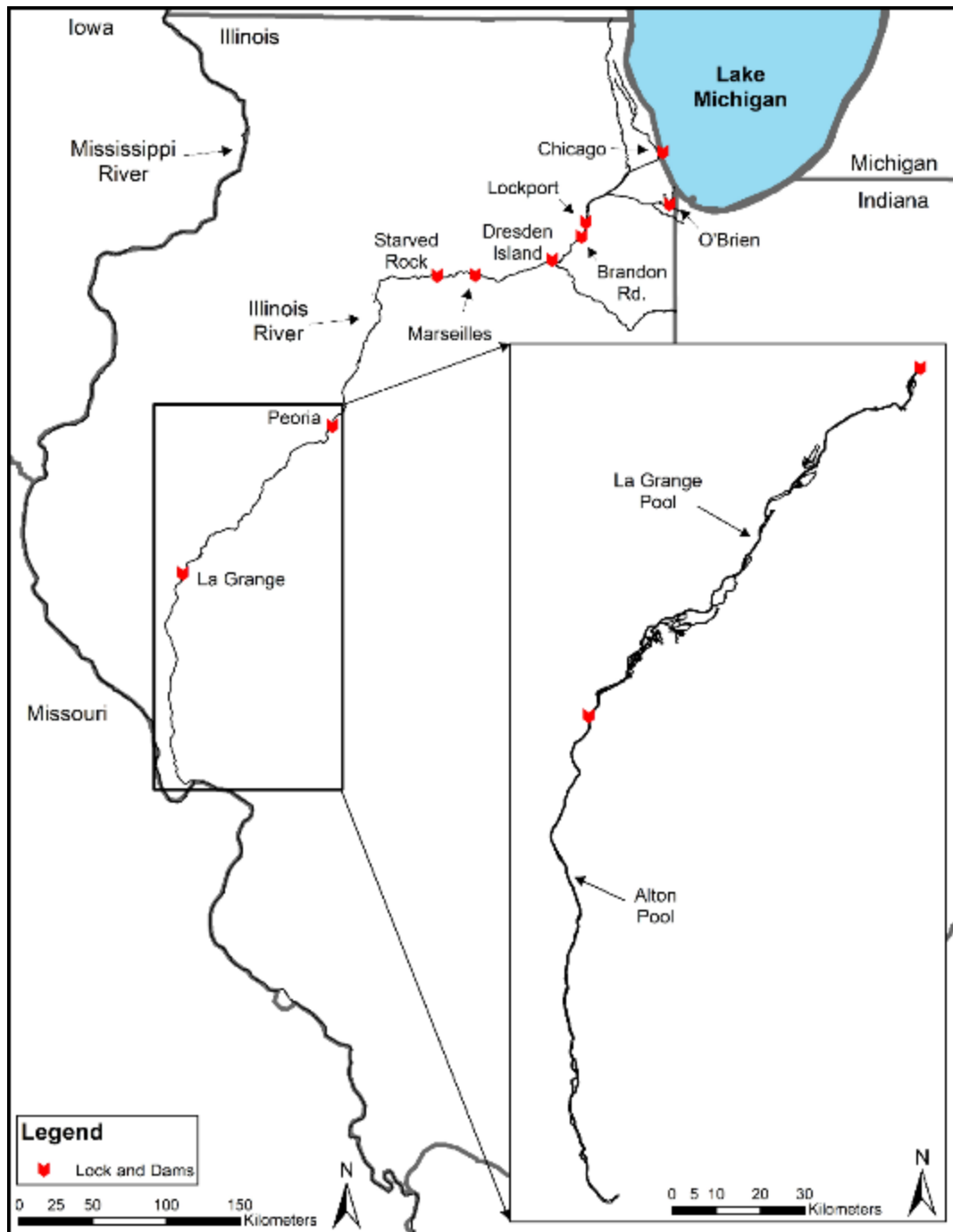
In the Alton Pool, ILDNR will expand upon the existing Upper Mississippi River Restoration Program's LTRM and MAM standardized hoop netting efforts and make direct comparisons using experimentally baited hoop nets to target Black Carp to better detect their presence, abundance, and expansion up the lower Illinois River. This additional netting will include the use of clam-based and cottonseed-based baits deployed in main- and side-channel habitats. Expanded hoop netting efforts will be randomly fished in main- and side-channel border habitats in three time periods (June through October 2025), similar to ongoing standardized LTRM hoop netting efforts. Relative abundance estimates of Black Carp will be used to detect status changes and to help direct and assess management actions. Increased presence on the Alton Pool and other Illinois River reaches through MAM and current Black Carp sampling will further support rapid response and telemetry-informed netting in these regions, especially as the number of fish with implanted transmitters is expected to increase in the Pool 26 of the Mississippi River, which is contiguous with the Alton Reach of the Illinois River.

Figure 71 — Black Carp



Staff pulling baited hoop net with Black Carp capture below Lock and Dam 26. Source: ILDNR

Figure 72 — Project Locations



Map of Alton and La Grange reaches in the Illinois River. Alton reach will be the primary target pool for fishery-independent monitoring in this funding request. Source: Brandon Harris, IRBS.

UNDERSTANDING BLACK CARP POPULATION DYNAMICS TO INFORM MANAGEMENT STRATEGIES

BC2-25: Data Collection from Commercial Fishers and Recreational Angler Captures of Black Carp in the Lower Illinois River

- **Lead Agency:** ILDNR
- **Agency Collaboration:** INHS, USFWS, USGS
- **GLRI Funding:** \$42,000
- **Agency Funding:** \$0

Project Summary

This project will provide support for incentive payments to recreational anglers and commercial fishers who submit captured Black Carp for agency analysis in the upper Mississippi River basin. This project will result in the acquisition of additional biological information and key data regarding the potential range expansion of Black Carp and prevent invasive carp from becoming established in the Great Lakes by functioning as an early detection and monitoring tool. This year's funding will produce Black Carp specimens for range mapping, evaluation, and research.

Project Description

The ILDNR will continue monitoring the occurrence and potential range expansion of Black Carp within the upper Mississippi River basin (including the Illinois River) through incentive payments to recreational anglers and commercial fishers who submit harvested Black Carp for data collection and analysis. The majority of Black Carp data points this collaborative effort with anglers and commercial fishers. Currently, the invasion of Black Carp is represented by only a few reported individual fish, and little is known about the overall size of the population or potential scope of ecosystem changes that may result from their introduction. Data generated from this project will provide needed information on the status, range, and population trends of Black Carp in the Mississippi River basin. The geographic scope of the Black Carp reward program will include all waters in the Mississippi River basin, including the Illinois River.

Personnel will travel to confirm any Black Carp specimens collected by commercial fishers at locations on or near major rivers in the Mississippi River basin, from fish processing facilities in the State of Illinois, or from agency facilities (e.g., ILDNR, INHS) to which Black Carp are taken by

Figure 73 — Captured Black Carp

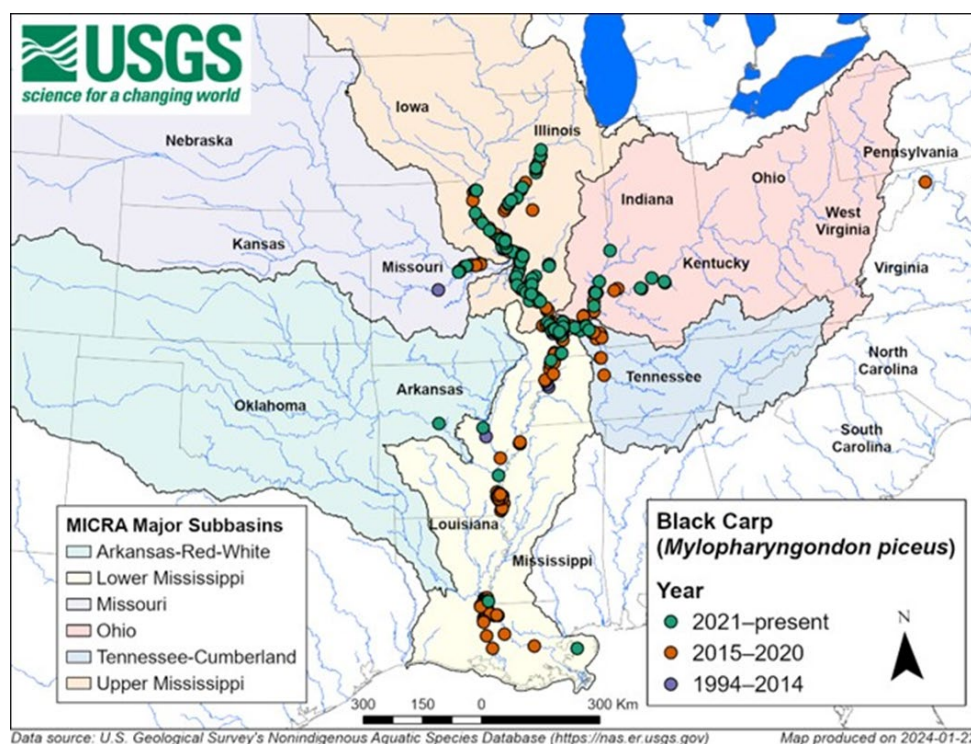


Photo of captured Black Carp. Source: ILDNR

Invasive Carp Action Plan: Fiscal Year 2025

commercial fishers. Depending on capture location, some fish carcasses may be identified by personnel from USGS or shipped to the USGS for processing. Anglers and commercial fishers will be asked to provide information on capture methods, collection date, and collection location. A payment of \$100 will be provided for each wild-caught Black Carp that they report and submit. There is a maximum of \$1,000 in reward payments to any individual for Black Carp collected in a given location during a one-week period. Photos of each fish, along with collection information (date, location, and capture method) and fish length, weight and ploidy data will be sent to the USGS for inclusion in their Nonindigenous Aquatic Species database.

Figure 74 — Black Carp Bounty Program Area



U.S. map showing Black Carp Bounty Program areas. Source: USGS

UNDERSTANDING BLACK CARP POPULATION DYNAMICS TO INFORM MANAGEMENT STRATEGIES

BC3-25: Support for Black Carp Monitoring and Population Assessment

- **Lead Agency:** USGS
- **Agency Collaboration:** USFWS, USACE, ILNHS, ILDNR
- **GLRI Funding:** \$475,000
- **Agency Funding:** \$140,000

Project Summary

This project will build toward understanding the life history, behavior, and catchability of Black Carp in the Illinois River and adjacent Mississippi River. This project will assess catch by entanglement and entrapment techniques, movement between the Illinois River and the Mississippi River, reproductive development, aging methods, and potential attractants for Black Carp. The activities within this project address ongoing research priorities collaboratively identified through the Illinois River Black Carp SDM model. This project will assist in the transition of SDM results to an adaptive management program. The information collected by this project will help prevent Black Carp from becoming established in the Great Lakes by identifying management actions within the species' current range in the Mississippi River and expanding range in the Illinois River.

This year's funding will be used for analyses of catch by entanglement and entrapment gears; support the capture, transmitter implanting, and monitoring of Black Carp for tracking within a passive telemetry array; a manuscript on reproductive development; validate Black Carp aging methods; identify potential attractants; and operationalize the adaptive management program for Illinois River Black Carp control actions.

Project Description

In 2025, USGS will conduct work to address ongoing research projects informed by priorities identified by the SDM. An operational decision support framework is now needed to transition to an operational adaptive management program that routinely integrates monitoring and

Figure 75 — Black Carp Captured



USGS captured a Black Carp and implanted with telemetry transmitters in the Mississippi River.

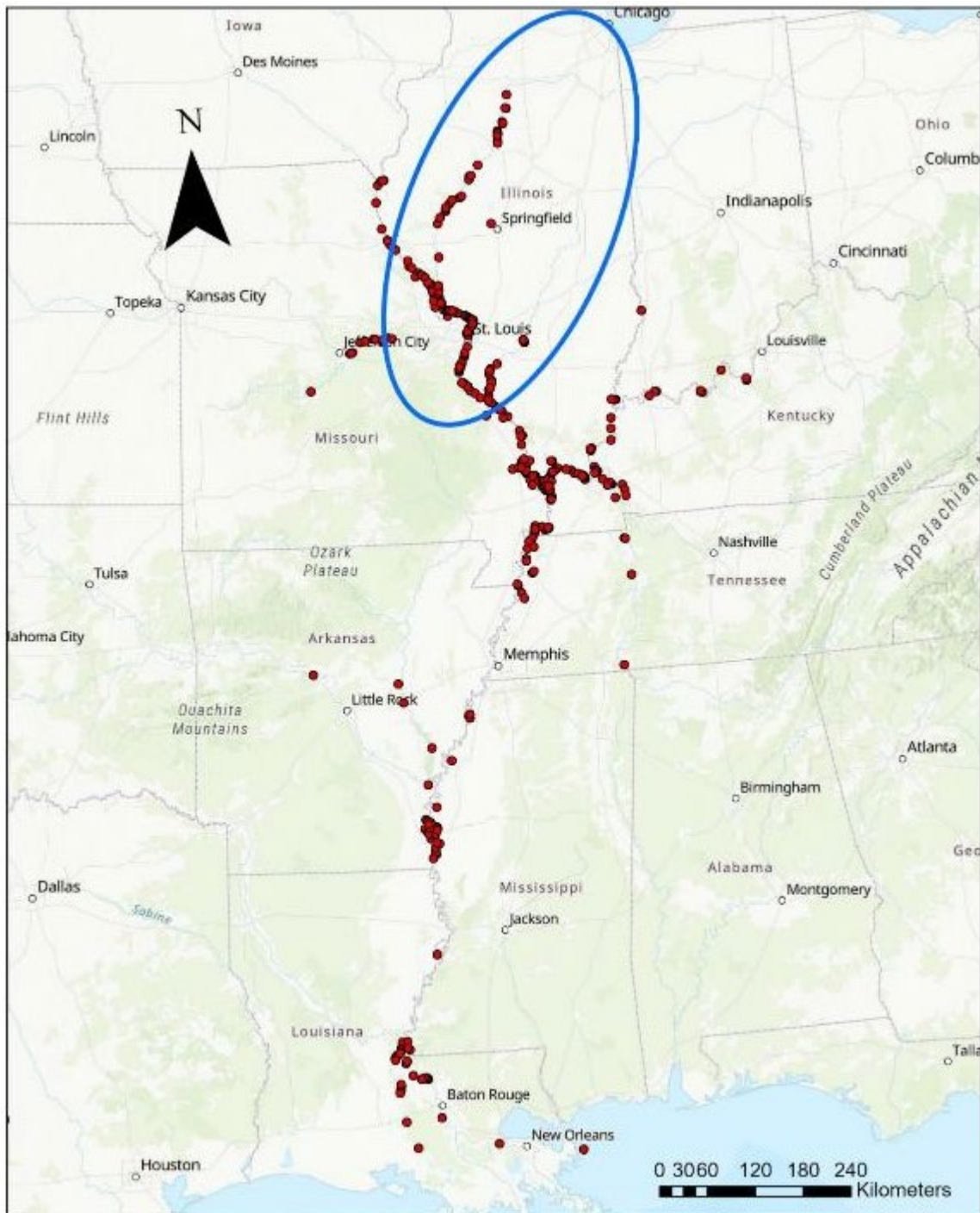
Invasive Carp Action Plan: Fiscal Year 2025

research results (e.g., annual updating of the decision support framework) to inform the annual evaluation of Illinois River Black Carp control strategies within management units and update and adapt the Illinois River research and monitoring efforts.

Prior Black Carp field research followed a progression from documentation of commercial capture locations and methods, to adapting hoop nets for Black Carp capture. This method was tested, and individuals tagged for habitat use and movement research. Proposed hoop net sampling in Pool 26 will address the number of fish caught per event and movement of Black Carp between the Upper Mississippi and Illinois rivers. USGS will continue to work with INHS scientists on development of fisheries independent monitoring methods in the Upper Mississippi and Illinois rivers, and on development of a Black Carp specific bait for increasing catchability via comparison of the amino acid composition of existing commercial baits. Existing data from entanglement and entrapment efforts for capture and recapture of telemetry tagged Black Carp to assess potential for catchability estimates and for development of a targeted tool for rapid response with context on the habitats and gear characteristics will be used. Additionally, funding will support completion of analyses and the manuscript on size and age at maturation of Black Carp. A pond study will be conducted to assess the efficacy of oxytetracycline to produce a discernible fluorescent mark on calcified structures of Black Carp to confirm annual deposition of growth rings for validation of aging methods.

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Figure 76 — Area of Focused Black Carp Monitoring and Research



The reported distribution of Black Carp in North America (red dots) as of 9/27/2024. The blue oval represents the extent of focused research.

UNDERSTANDING BLACK CARP POPULATION DYNAMICS TO INFORM MANAGEMENT STRATEGIES

BC4-25: Support for Black Carp Monitoring and Interagency Coordination

- **Lead Agency:** USFWS
- **Agency Collaboration:** Black Carp Work Group (Over 70 contacts from 15 U.S. agencies), USGS
- **GLRI Funding:** \$91,000
- **Agency Funding:** \$10,000

Project Summary

This project will provide coordination support to the Black Carp Work Group and the continued development of electrified sampling gears to improve agency (fishery-independent) captures of Black Carp. Additionally, the USFWS will assist domestic partners in monitoring changes in distribution and assessment of demographic trends of adult Black Carp present in the Mississippi River basin to inform overall understanding of risk to the Illinois River. These efforts will result in better coordination and identification of management actions and research and monitoring needs for protection of the Great Lakes from Black Carp. This year's funding will produce a minimum of six interagency coordination meetings; test a prototype electrified trawl Black Carp sampling approach to address the limitations identified with current gears; and coordinate receipt of age structures to provide age assignments of captured Black Carp from across the range, prioritizing Illinois River captured fish.

Figure 77 — Prototype Electrified Deepwater Beam Trawl



Prototype Electrified Deepwater Beam Trawl depicting the trawl beam, control surfaces, trawl net, anode array, cathodic loop, and power cables. Source: USFWS

Project Description

In 2025, USFWS will continue to coordinate the multi-jurisdictional Black Carp Work Group, which convenes regularly to share key results, provide project updates, discuss challenges and potential solutions to collective issues, consider future direction of Black Carp management and research,

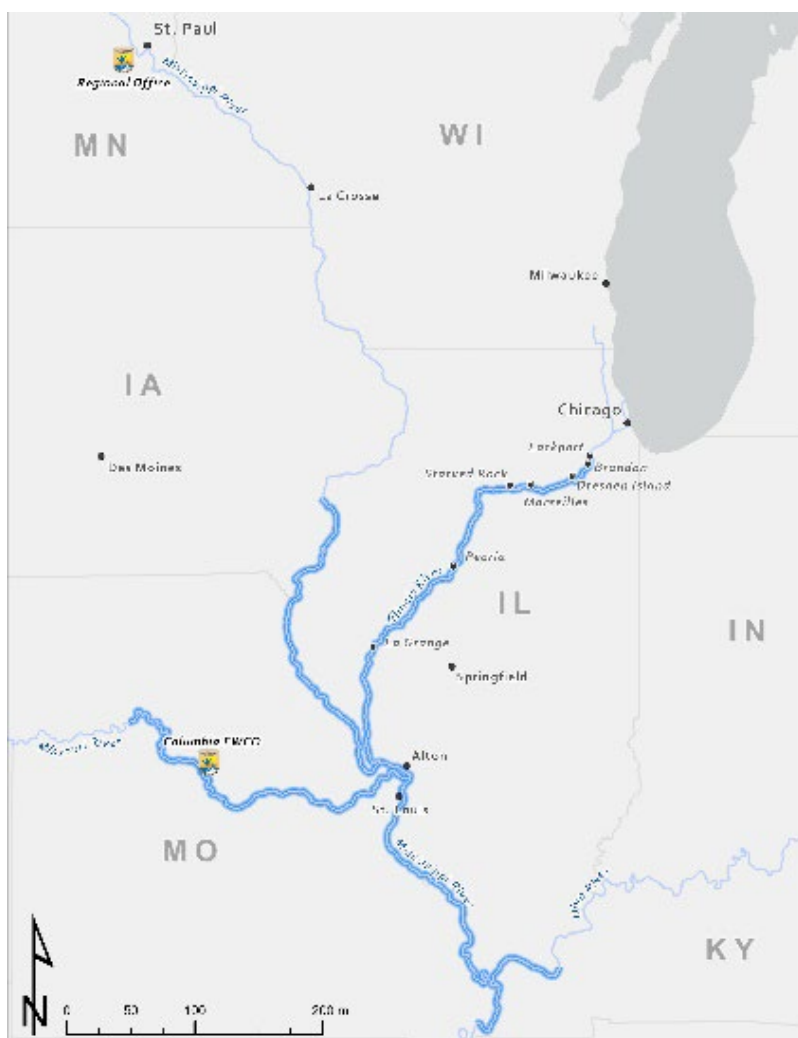
Invasive Carp Action Plan: Fiscal Year 2025

and coordinate projects for funding consideration. These efforts are designed to identify and improve collaborative Black Carp management, control, and monitoring efforts.

Understanding Black Carp population dynamics to inform management strategies relies on effective capture of target fish from across the range. Electrofishing is currently deployed for other invasive carp species, yet habitat preferred by Black Carp is not well sampled by electrofishing. Building off previous work, a prototype trawl gear will be tested utilizing optimum electrical settings identified in prior-year Black Carp Work Group supported projects to determine its utility in situations previously excluded from effective sampling.

Additionally, USFWS staff will continue to coordinate with partners on receipt of demographic data and age structures and to assign ages to captured Black Carp from across the range through a national invasive carp database. This effort will inform managers of spawning and recruitment locations for small fish captures, inform managers of fish condition and growth rates through length and age and inform managers of changes in age distribution.

Figure 78 — Primary Focus Area for Black Carp Captures



Map identifying the primary focus area of the Illinois River and tertiary areas for potential Black Carp captures, the location of the fish aging lab in Columbia, Missouri, and the USFWS Midwest Regional Office for coordination support. Source: USFWS

UNDERSTANDING BLACK CARP POPULATION DYNAMICS TO INFORM MANAGEMENT STRATEGIES

BC5-25: Estimation of Black Carp Population Sizes

- **Lead Agency:** USACE
- **Agency Collaboration:** USFWS
- **GLRI Funding:** \$293,000
- **Agency Funding:** \$0

Project Summary

This project is comprised of two tasks that explore two approaches for estimating population size or density of Black Carp. Task 1 will evaluate Black Carp populations for potential application of Close-Kin Mark-Recapture (CKMR) methods for estimating Black Carp population numbers using DNA genotypes and pedigree reconstruction. Task 2 will focus on how strategic eDNA surveys may provide comparative density estimates for Black Carp populations, including those in key reaches from the middle Mississippi River and much of the Illinois River. These two tasks help characterize the size of the Black Carp population at the invasion front.

Project Description

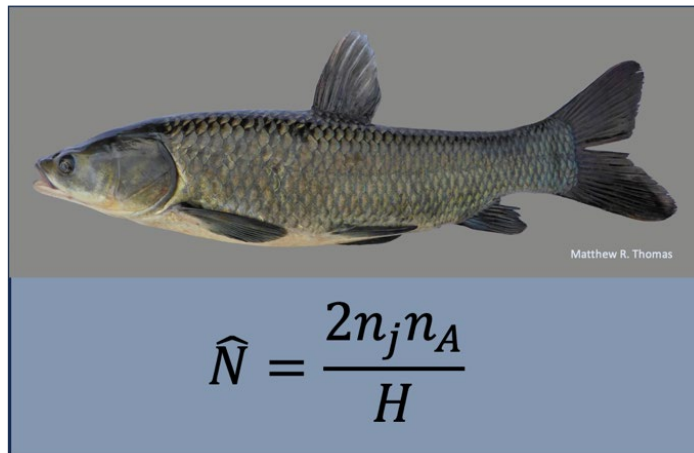
Task 1 focuses on CKMR, an approach that provides an indirect method for estimating population size (or density) using one-off samples such as when Black Carp are captured and physically removed from a system. One method, CKMR-POP (parent-offspring-pair), is based on using genotypes in combination with age estimates to identify parent-offspring pairs and to estimate the number of breeding-age individuals at the time the offspring were spawned. Black Carp microsatellite genotypes can be used with Black Carp age estimates to produce these population size or density estimates.

Task 2 follows a basic approach for evaluating black carp population density by comparing eDNA densities among sites where black carp are more or less established (and more or less abundant). While the eDNA concentrations for a particular species likely vary widely from sample point to sample point in an aquatic system, overall patterns are likely informative. Task 2 specifically focuses on comparing relative black carp eDNA “hit” (detected) frequencies among reaches in the Mississippi River and Lower Illinois River where black carp have long been established and are frequently captured and reaches in the middle and upper Illinois River where black carp have only recently invaded or that represent the leading edge of invasion. These surveys will be conducted over a short time frame to minimize seasonally driven variation in eDNA production.

Invasive Carp Action Plan: Fiscal Year 2025

Simple adjustments to standard eDNA protocols that our prior studies demonstrated to substantially increase Black Carp eDNA detection probabilities will also be employed.

Figure 79 — Black Carp with CKMR Equation



Individual Black Carp with the basic CKMR equation. Source: USGS

Figure 80 — eDNA Sample Locations



Map showing location where eDNA samples will be sampled with segment. Source: USGS

Invasive Carp Action Plan: Fiscal Year 2025

ICRCC COMMUNICATIONS AND SUPPORT

MS-1: ICRCC Strategic Communications with Partners and Stakeholders

- **Lead Agency:** USFWS
- **Agency Collaboration:** ILDNR
- **GLRI Funding:** \$175,000
- **Agency Funding:** \$100,000

Project Summary

The strategic communications project facilitates better internal coordination among members of this broad partnership, consolidates information and effectively explains the most significant activities of the partnership, and provides the means to share that information effectively outside the partnership.

Project Description

This project will provide staffing and logistical assistance for key coordination, communication, and outreach activities to support the day-to-day operations of the ICRCC in close coordination with the ICRCC co-chairs (USFWS and USEPA) and ICRCC member agencies. This includes:

- Organizing and facilitating regular virtual and in-person meetings of ICRCC member agencies' communications professionals to share information and collaborate on emerging issues and needs as well as communications products;
- Supporting coordination and timely development and delivery of ICRCC planning and communication products, including the annual Action Plan, Congressional briefing materials, and content and imagery for the ICRCC website; and
- Maintaining the content management system for the ICRCC website, the main communications platform and consolidated source of information on the activities of ICRCC member agencies.

Figure 81 — Public Meeting on Invasive Carp



A public meeting on invasive carp held in Chicago in 2011, during the early phase of the partnership. Photo credit: USFWS

Invasive Carp Action Plan: Fiscal Year 2025

ICRCC COMMUNICATIONS AND SUPPORT

MS-2: ICRCC Mission Support

- **Lead Agency:** USFWS
- **Agency Collaboration:** USEPA
- **GLRI Funding:** \$175,000
- **Agency Funding:** \$0

Project Summary

This project will provide staffing and logistical assistance on key coordination, communication, and outreach activities to support the day-to-day operations of the ICRCC in close coordination with the ICRCC co-chairs (USFWS and USEPA). This effort supports the coordinated and timely development and delivery of ICRCC planning and communication products in coordination with participating ICRCC member agencies. Staffing provided through this project supports the development of the annual Invasive Carp Action Plan and other strategies and planning documents, the scheduling and convening of regular partnership meetings and communications (in-person and virtual), and other activities led by the ICRCC co-chair team for the effective operation of the ICRCC partnership.

Project Description

This project provides key staffing to support the effective operation of the ICRCC.

Actions in 2025 include:

- Assist in developing and releasing the ICRCC's FY 2025 Invasive Carp Action Plan and initial scoping and planning for the draft FY 2026 Action Plan.
- Assist with convening ICRCC virtual meetings once a month (or as needed) for interagency discussion of relevant updates on invasive carp management.
- Assist in convening ICRCC face-to-face meetings for interagency discussion and coordination of invasive carp research, management, and communications actions.
- Assist in developing informational materials to support interagency congressional briefings as needed and as directed by the ICRCC co-chairs.
- Assist in convening public updates with agencies and stakeholders across the Great Lakes as directed by the ICRCC co-chairs.
- Provide additional support, as needed, to the ICRCC co-chairs on day-to-day partnership operation activities of the ICRCC.

Appendix C

Principles of Coordination



Invasive Carp Regional Coordinating Committee *Principles of Coordination* March 2025

*Note: In this document “invasive carp” refers to four species: Silver Carp (*Hypophthalmichthys molitrix*), Bighead Carp (*H. nobilis*), Grass Carp (*Ctenopharyngodon idella*), and Black Carp (*Mylopharyngodon piceus*).*

PURPOSE OF THE ICRCC: The Invasive Carp Regional Coordinating Committee (ICRCC) is convened by U.S. Fish and Wildlife Service (USFWS) and U.S. Environmental Protection Agency (USEPA) for the purpose of assisting ICRCC members in implementing their authorities to reduce and/or eliminate the threats posed by invasive carp to the Great Lakes.

ICRCC MEMBERSHIP: Agencies eligible for membership in the ICRCC will: (1) have legal authority or mandate to coordinate and/or implement measures to prevent, control, monitor or assess movement of invasive carp in connection with the Great Lakes and associated water bodies; and (2) must be a federal, state, provincial, local, or federally-recognized tribal governmental agency or organization of tribal governmental agencies. A complete list of member agencies is provided in Attachment 1.

AUTHORITIES: To achieve its purpose, the ICRCC relies on the coordination of activities conducted under the existing authorities of its member agencies. Nothing in this document shall be interpreted to alter existing agency missions or authorities.

ACTIVITIES OF THE ICRCC: The central activity of the ICRCC is the annual development and publication of an Invasive Carp Action Plan (Action Plan) that summarizes planned activities of ICRCC member agencies that address the threats posed by invasive carp to the Great Lakes. The development of the Action Plan helps the ICRCC accomplish its purpose through information sharing, planning and budgeting discussions, and coordination of future implementation activities. Action Plan development is initiated in early fall of each year, which coincides with the end of the field season and the beginning of the U.S. federal fiscal year. This allows agencies to consider the most recent field data and projected available funding levels into the development of the Action Plan. The Action Plan is typically released in the first quarter of the calendar year or when relevant annual Congressional budgetary actions have been completed.

The majority of activities conducted by the ICRCC under the Action Plan are geographically focused to mitigate the most significant threats of invasive carp introduction and/or spread. In addition, technology development, communication, and support for ICRCC coordination and operations are also included in the Action Plan. A brief summary of the main activities follows:

Invasive Carp Action Plan: Fiscal Year 2025

Principles of Coordination

Blocking invasive carp movement through the Illinois Waterway (IWW), with a focus on efforts conducted by the State of Illinois and its partners to reduce overall populations within the Illinois River and the U.S. Army Corps of Engineers and its partners' efforts to maintain the Electric Dispersal Barrier System and implement the Brandon Road Interbasin Project.

The U.S. Army Corps of Engineers' Great Lakes and Mississippi River Interbasin Study (GLMRIS) identified the IWW as the highest risk potential pathway for invasive carp introduction. The IWW includes the Illinois River and the Chicago Area Waterway System (CAWS). The Action Plan identifies the Monitoring and Response Work Group (MRWG) as the principal body that supports the extensive coordination needed for work in the IWW. The MRWG is co-chaired by the Illinois Department of Natural Resources (ILDNR) and the Great Lakes Fishery Commission (GLFC).

The USACE's Electric Dispersal Barrier System (EDBS) in Romeoville, Illinois uses several electrical fields to prevent the upstream migration of invasive carp through the IWW to the Great Lakes. The MRWG co-chairs are regularly updated on operation and status of the EDBS. The MRWG supports USACE's operations of the EDBS by conducting regularly-scheduled monitoring for invasive carp in the IWW. In the event of disruptions to the EDBS, the MRWG co-chairs are consulted on the need for any additional monitoring and/or control activities.

The USACE's Brandon Road Interbasin Project at the Brandon Road Lock and Dam near Joliet, Illinois, being in partnership with the State of Illinois and the State of Michigan is using layered technologies to prevent upstream movement of invasive carp and other aquatic nuisance species from the IWW into the Great Lakes. The USACE and its partners coordinate regularly in the design and construction of the project. As implementation proceeds, the ICRCC's annual Action Plan will be informed by the observed effects of this project.

The MRWG implements coordinated invasive carp monitoring, response, control, and management efforts in the IWW and CAWS. Significant removal efforts downstream of the EDBS suppress the number of invasive carp potentially swimming upstream towards the barrier system. The MRWG performs Seasonal Intensive Monitoring upstream of the EDBS during the spring and fall to detect and remove any invasive carp in the Upper IWW. The MRWG also ensures preparedness to implement effective contingency actions through its Contingency Response Plan for the Upper IWW.

Should there be any detections of invasive carp in nearshore waters or open waters of Lake Michigan, the ICRCC relies on the GLFC and its Lake Michigan Committee members to coordinate actions and strategies to address fisheries management and invasive carp in Lake Michigan.

Installing hydrologic barriers to prevent invasive carp movement through intermittent waterways to the Great Lakes

GLMRIS also identified three medium risk locations where flood conditions can temporarily create direct hydraulic connections between the Great Lakes and Mississippi River watershed, thereby providing a potential pathway for invasive carp introduction. Previous state-led work has reduced the pathway risk at two of these locations: Eagle Marsh (Fort Wayne, Indiana) and Ohio & Erie Canal (Akron, Ohio). Work is ongoing at the remaining site at Little Killbuck Creek (near Wooster, Ohio).

Invasive Carp Action Plan: Fiscal Year 2025

Principles of Coordination

Preventing the establishment of Grass Carp in the Great Lakes, with a focus on efforts conducted by the State of Ohio and the State of Michigan and their partners within the western basin of Lake Erie and its tributaries, and supplemented by early detection surveillance in the Great Lakes

The Action Plan notes that Grass Carp have been captured in low numbers in all of the Great Lakes except Lake Superior; however, Grass Carp in the Western Basin of Lake Erie show periodic evidence of spawning and is the population of Grass Carp posing the greatest threat to the Great Lakes. The Action Plan identifies the GLFC Lake Erie Committee (LEC) as the principal body that supports the coordination to prevent the establishment of Grass Carp in Lake Erie. The LEC is comprised of jurisdictional agency fishery managers from Michigan, Ohio, Pennsylvania, New York, and Ontario, and supported by Canadian and U.S. federal agencies. Their work is guided by the *Lake Erie Grass Carp Adaptive Response Strategy 2024- 2028*. The Adaptive Response Strategy was developed to reduce the threat of Grass Carp to Lake Erie through common and coordinated efforts.

The Action Plan is also informed by the GLFC's Grass Carp Advisory Committee (GCAC) and its Task Groups that "undertake and coordinate special focused activities needed to achieve GCAC and individual Lake Committees' objectives." These activities include collecting information from commercial fishers and additional reconnaissance monitoring outside of Lake Erie by State agencies and their federal partners to better understand the distribution of Grass Carp.

Should there be any significant range expansion of Grass Carp within the Great Lakes, the ICRCC relies on the GLFC, its individual Lake Committees, and the GCAC to coordinate actions and strategies to address any such expansion.

Better understanding Black Carp populations to inform management strategies, with a focus on better understanding the population within the lower Illinois River.

Activities of the ICRCC are focused on evaluating and tracking the status of populations of Black Carp in the Illinois River, including its confluence with the Mississippi River. The lower Illinois River represents the current location of the Black Carp population closest to the Great Lakes. In recognition of the need to develop and share monitoring and management techniques for this species, the Action Plan identifies the Black Carp Working Group as a primary interagency body to help inform and coordinate future activities.

Development of Control Management Technologies

The Action Plan includes projects which relate to the development, refinement, and evaluation of new technologies for invasive carp prevention and control. The goal is to test and identify proven technologies that could further enhance the effectiveness of Great lakes protection strategies.

Multi-Agency Communications

The ICRCC's Communications Work Group (CWG) facilitates communications on key issues among ICRCC members and to stakeholders. The CWG is chaired by the USFWS and co-chaired by ILDNR. The CWG also facilitates the development and dissemination of communication materials to external audiences, including the media. The CWG provides oversight and maintenance of the U.S. website, <https://icrcc.fws.gov> and coordination with the Canadian website – www.asiancarp.ca.

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Principles of Coordination

Ongoing ICRCC Coordination

In addition to the coordination work that occurs as part of developing the annual Action Plan, the ICRCC promotes ongoing coordination of member agency activities through monthly calls and occasional in-person meetings.

FUNDING: ICRCC member agencies are funded through their respective agency budgeting processes, subject to any legislative direction provided as part of appropriations. Enhanced funding of Action Plan activities through the Great Lakes Restoration Initiative (GLRI) is coordinated by USEPA and USFWS, subject to any Congressional direction provided as part of appropriations. Nothing in this document shall be interpreted to alter existing agency or GLRI budgeting processes, nor alter legislative/Congressional direction. The mention of activities in this document should not be interpreted to be a commitment to future funding nor any specific funding level. Discussions of the ICRCC will help inform, but will not direct, agency decisions on how they allocate their respective funding or resources.

WORKING METHOD: To accomplish its Purpose, the ICRCC member agencies will coordinate and work collaboratively. Consistent with their authorities, policies, and available resources, member agencies will:

- Work to develop the annual Action Plan.
- Participate in virtual meetings of the full ICRCC membership to provide for an exchange of relevant information between all member agencies, review progress, and develop recommendations for future ICRCC efforts.
- Attend ICRCC meetings and workgroup meetings, as appropriate. It is acknowledged that member agency participation may be limited due to travel budgets and/or workload.
- Share data and information (including planning documents, monitoring results, response actions, control activities and research) within the course of relevant discussions, consistent with applicable laws and regulations. Members will respect that some information or data may be provisional and should be used only to help inform agency activities.
- Strive to provide other ICRCC member agencies at least 10 business days to review and comment on documents/deliverables of ICRCC-wide relevance prior to publication/release.

ROLES OF THE ICRCC CO-CHAIRS: The ICRCC is co-chaired by a representative of the USFWS and the USEPA.

The roles of the ICRCC Co-chairs include:

- Facilitate, in collaboration with member agencies, the development of the annual Action Plan.
- Convene regular virtual meetings of the ICRCC to support Action Plan development and implementation and to provide an opportunity for agencies to share other relevant information.
- Coordinate and lead face-to-face ICRCC partnership meetings, as needed.
- Provide *ad hoc* coordination and communication on invasive carp-related issues, as requested and appropriate, to assist ICRCC member agencies' efforts.
- Coordinate and lead Congressional briefings on the Action Plan, as requested.
- Seek opportunities to leverage invasive carp efforts and to share lessons learned with other jurisdictions working on invasive carp, including initiatives under the national *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States*.

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Principles of Coordination

Attachment 1 – Invasive Carp Regional Coordinating Committee Member Agencies

- Illinois Department of Natural Resources
- Illinois Environmental Protection Agency
- Indiana Department of Natural Resources
- Michigan Department of Natural Resources
- Michigan Department of Environmental, Great Lakes and Energy
- Minnesota Department of Natural Resources
- New York Department of Environmental Conservation
- Ohio Department of Natural Resources
- Pennsylvania Department of Environmental Protection
- Pennsylvania Fish and Boat Commission
- Wisconsin Department of Natural Resources
- Grand Traverse Band of Ottawa and Chippewa Indians
- Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry
- Quebec Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs
- National Oceanic and Atmospheric Administration
- U.S. Army Corps of Engineers
- U.S. Coast Guard
- U.S. Department of Transportation
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- National Park Service
- Fisheries and Oceans – Canada
- Great Lakes Fishery Commission
- Great Lakes Commission
- Metropolitan Water and Reclamation District of Greater Chicago