Minnesota Invasive Carp Action Plan

A plan to assess the threat posed by bighead, black, grass and silver carp, and actions to minimize their impact in Minnesota

Invasive Carp Work Group
Original Plan – 11/2/2011
Update - 12/15/2014

This plan lays out a step-wise approach to assess and minimize the threat posed by bighead, black, grass, and silver carp. It builds upon existing state and national Invasive Carp plans.

Introduction

Bighead, black, grass, and silver carp, collectively referred to as Invasive Carp[1] in this document, have the potential to impact native aquatic communities, local economies, and Minnesota's outdoor heritage, if they become established.

This plan lays out actions to assess population expansion of Invasive Carp and describes efforts to prevent and/or minimize their impact in Minnesota. It was developed by a work group that includes state and federal agencies, local governments, the Minnesota Aquatic Invasive Species Research Center (MAISRC), Nongovernmental organizations (NGO's), and other interests (see Appendix A for a list of participants and organizational statements of support).

Current technologies are not yet available to determine the abundance of Invasive Carp, nor are there technologies that have proven 100% effective to stop their upstream migration. In 2014, Congress authorized closing the lock at Upper St. Anthony Falls in an effort to prevent the spread of Invasive Carp up the Mississippi River. New evidence suggests that modified operating procedures at Lock and Dams #2 (Hastings), #5 (Minnesota City), and #8 (Genoa, WI) may also hold hope for halting or slowing their spread up the Mississippi River and subsequently into the Minnesota and St. Croix Rivers. This potential needs to be explored while other options and actions that might slow their spread and minimize their impact are pursued.

Accordingly, we must focus our attention on the actions we can take to slow their spread and minimize their impact. This plan focuses on those actions. It is considered a working document that addresses immediate needs and will be updated as needed to reflect new technologies, scientific advancements and the status of Invasive Carp in the state.

This plan is written for a broad audience so the terminology it uses is intended to convey meaning to a lay audience and may not always strictly follow scientific convention. Plan elements include: 1) early detection and monitoring of susceptible waters; 2) prevention and deterrence; 3) response preparation; 4) management and control; and 5) outreach and communication.

[1] 2014 Minnesota Session Law H.F. No. 2733 Chapter 289 Section 67

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Actions

1) Early Detection and Monitoring of Susceptible Waters

A comprehensive monitoring program should be able to: 1) detect range expansion and 2) population (abundance) changes. Early detection of species in new waters may allow for response actions before they become established. Monitoring existing populations informs managers when thresholds are reached that should trigger actions.

Individual Invasive Carp have been captured occasionally along the Minnesota and Wisconsin border in the Mississippi and St. Croix Rivers since the early 1990s (See Appendix D for a list of past captures). To date, Invasive Carp are not known to be in Minnesota waters in large numbers (numbers that can be estimated) and there has been no documented natural reproduction. The infested portion of the Missouri River has tributary watersheds that extend into Southwestern Minnesota. Silver and bighead carp were sampled in Okoboji Lake, Spirit Lake, and the Little Sioux River in Iowa, which have watersheds that extend into Southwestern Minnesota. To date, no Invasive Carp have been sampled in the Missouri River watershed portion of Minnesota.

Understanding the size and dynamics of the North American bighead, black, grass, and silver carp populations is important to decision-making for deterrent, rapid response, and management actions. Knowing where Invasive Carp populations exist and where they are reproducing are key components for making informed decisions. At this time, there is little published data on what population or characteristics of an Invasive Carp population are needed before it can sustainably reproduce. Because of the limited data, Invasive Carp will be considered sustainably reproducing if juveniles or young of the year are captured. The sampling of gametes or capture of mixed sex fish at the same location is alarming but does not necessarily indicate successful reproduction. Based on sampling data, the most upstream sustainably reproducing populations in the Mississippi River are somewhere in the Iowa/Illinois portion of the river. The most upstream reproducing populations in the Missouri River basin have moved into its tributaries: James River, Lower Big Sioux River, Rock River, and Little Sioux River (which originates in Minnesota).

Invasive Carp are difficult to catch with traditional sampling gears. Research and development are currently underway for new techniques and gear for Invasive Carp detection, but at this time there is no single method for reliable detection. Monitoring Invasive Carp populations is planned through an intensive program of ongoing fisheries surveys, targeted sampling,

monitoring commercial harvests, contracted commercial fishing, investigating public sightings, fish telemetry, and sampling for environmental DNA (eDNA). This information will be used collectively to determine fronts, expansion, and triggering actions. It is important to recognize that these techniques cannot yet provide population size estimates, and there is need for further research in this area.

Monitoring native fish leads to better understanding of the effects of Invasive Carp on native fish populations, the impacts on native fish of efforts to slow the advance of Invasive Carp, and even about the role native fish themselves play in the deterrence of Invasive Carp.

The objectives of monitoring are:

1) To determine the reproducing and population fronts for each of the Invasive Carp species.
2) Track Invasive Carp population expansion in Minnesota.
3) Continue collecting data to better understand native aquatic communities.
4) Continue improving techniques for detecting and quantifying Invasive Carp populations.
5) Use the information collected to trigger rapid response actions, implement management/control strategies, and/or heighten public awareness.

1.1 Continue systematic and coordinated annual fisheries monitoring programs.

These surveys include annual electrofishing, gill netting, seining, trammel netting, and hoop netting completed by the Minnesota Department of Natural Resources (DNR), Wisconsin Department of Natural Resources, United States Fish and Wildlife Service (USFWS), and the Long Term Resource Monitoring Program (Appendix C). While these surveys provide some information on incidental collections of Invasive Carp, the value is the information collected on native aquatic communities in the absence of Invasive Carp. Coordination with border states and federal agencies is needed to maximize limited resources.

1.2 Invasive Carp targeted sampling.

The DNR has three field biologists dedicated to Invasive Carp: two on the Mississippi River/St. Croix River and one on the Minnesota River. These specialists develop and execute yearly sampling plans including netting, electrofishing, and directing contracted commercial fishing. Coordination with border states and federal agencies is needed to maximize limited resources. Target areas will be determined based on historical sampling. It should not necessarily be limited to the lower Mississippi, St. Croix or Minnesota rivers, but should include other basins if evidence suggests these areas are at

high risk. Additionally, the DNR Fisheries Section has had an active Invasive Carp sampling plan in the Missouri River watershed portion of Minnesota since 2012. Maintain this level of effort.

1.3 Use commercial fishing catch records to aid surveillance.

Commercial anglers operating in Minnesota are required to notify the DNR if they capture any Invasive Carp. These records should be included in status, surveillance, and sampling reports.

1.4 Targeted commercial fishing to capture Invasive Carp at their leading edge.

The DNR awards a contract annually for Invasive Carp commercial fishing. Commercial anglers on the Minnesota or Wisconsin boundary waters of the Mississippi River have specialized equipment and intimate knowledge of the location. The DNR directs where efforts should be targeted. Sampling should be expanded to include winter. Efforts will be coordinated with other state agencies on boundary waters. Continue this practice.

1.5 Request public to report potential sightings.

Increasing awareness and requesting public assistance in reporting potential Invasive Carp sightings (i.e. jumping fish) could help identify Invasive Carp presence. The DNR will track and attempt to verify reported sightings.

1.6 Enter Invasive Carp collections into the USGS Nonindigenous Aquatic Species database.

The USGS maintains a database of Invasive Carp captures in the United States. The DNR will ensure that confirmed Invasive Carp contacts are entered into this database.

1.7 Apply environmental DNA (eDNA) sampling systematically.

The use of eDNA is an emerging and evolving technology, but it is not a routine management practice at the writing of this update. The eDNA technique is potentially a valuable tool in a strategic plan to limit the impact of Invasive Carp in Minnesota. The tool should be continually evaluated based on newly released documentation, conversations with experts, collaboration with the MAISRC, and internal discussion with DNR personnel dealing with Invasive Carp. The Asian Carp Regional Coordinating Committee is funding an eDNA calibration study (ECALS) to better understand eDNA. Results and documentation from this study will help determine the validity and usefulness of eDNA. Implementation or adjustment of eDNA field sampling for the coming year should be reviewed and discussed in January and February of each year by participating agencies.

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1.8 Maintain telemetry receiver network in the Mississippi River.

Individual Invasive Carp downstream of Minnesota have been implanted with a variety of tags including acoustic tags. The DNR has an acoustic receiver array stretching from Mississippi River Pools 1 - 3 and in the lower portions of the St. Croix and Minnesota rivers. The USFWS connected this array to those located further downstream in Iowa, Illinois, and Missouri. Telemetry work will be coordinated with USGS, USFWS, and neighboring states to maintain the network.

1.9 Support research on early detection and distribution of Invasive Carp.

Invasive Carp are difficult to capture using existing sampling methods, especially for providing quantifiable numbers. Research and development are critical for improved detection. Current areas where investments can be made include:

I. eDNA is currently unable to provide quantifiable estimates. Continued research is needed to fully develop eDNA and other metagenomic tools for detecting presence and abundance of Invasive Carp.
II. Explore algal attractants, pheromone attractants, and Judas Fish to increase sampling efficiencies. Field trials for application of these techniques are needed.
III. Risk assessments to aid in prioritizing management efforts.
IV. A quantified assessment of documented Invasive Carp captures (locations, dates, habitat characteristics, river conditions, other species present, etc.) in Minnesota waters to help identify and target high priority locations for future detection efforts.

2) Prevention and Deterrence

Prevention and deterrence includes permanent or temporary barriers and structures that prevent or slow the upstream movement of Invasive Carp. Mississippi River dams from Hastings to the Iowa border (Lock and Dam 2-8) are constructed and operated such that the gates are removed from the water during high flows, allowing Invasive Carp to potentially pass through the gates or the lock chamber2. Exceptions are Upper St. Anthony Falls and Lock and Dam #1. These are high dams, and the only way fish can migrate past is through the lock

[2] Tripp, S., Brooks, R., Herzog, D. and Garvey, J. (2013), PATTERNS OF FISH PASSAGE IN THE UPPER MISSISSIPPI RIVER. River Res. Applic.. doi: 10.1002/rra.2696

chambers. Opportunities may exist to modify gate operations and introduce deterrents into locks to inhibit upstream movement of Invasive Carp.

Alternative deterrent technologies could restrict or slow Invasive Carp, and in combination with permanent barriers and other removal techniques could help reduce impacts. These technologies are unproven in large river systems, and research is needed to test their effectiveness. Additionally, research on the threat posed by only a few adult carp is needed to adequately assess risk as it relates to the cost of deterrent barriers.

Most important, any deterrent strategy being considered should be weighed against the impact on native species. If the strategy has a greater negative impact than Invasive Carp on native communities, then it should not be implemented. Additional research is needed to better understand native communities. All deterrent projects should include monitoring following construction of the deterrent system.

Opportunities may also exist to reduce or prevent passage of invasive fish species not currently found above Lock and Dam #19 near Keokuk, IA. This dam is constructed and operated such that fish can pass only through the locks, and alternative technology barriers may be effective. Actions here will require working closely with downstream partners.

2.1 Develop a document outlining the various deterrent technologies.

The Asian Carp Regional Coordinating Committee is currently putting together a "toolbox" of options. This will include deterrent technologies. Depending on the breadth, the toolbox may need expanding to include: Estimates of effectiveness, current examples on the landscape, costs (real, estimated, or both), recommended applications, etc. Current technologies: Water guns, CO2, ozone, electrical, sound, Lock and Dam optimization.

2.2 St. Croix & Minnesota rivers - Explore modifying Lock and Dams 5 and 8 to improve capabilities to deter Invasive Carp

The main stem of the St. Croix River below Taylors Falls is not conducive to an effective deterrent system. Therefore, efforts need to be focused downstream of the confluence with the Mississippi River. An extensive lock and dam system exists on the Mississippi River up to Minneapolis, MN (Appendix H). Lock and Dam structures 2 through 18 contain tainter and/or roller gates in the dam section and a lock to pass river traffic. At this time, gates, locks, and high-water bypasses are potential pathways for Invasive Carp. The gates are opened during high flows, essentially creating run of the river conditions. These conditions occur least often at Lock and Dams 5 and 8 (structures

below the confluence). Explore the option of adjusting gate operation, installation of deterrent measures in locks, and evaluating high-water bypasses at Lock and Dams 5 and 8 to reduce the ability of Invasive Carp getting by these structures while limiting or mitigating the impact on native species.

2.3 Minnesota River - Explore modifying lock and dam 2 to improve capabilities to deter Invasive Carp

Apply knowledge gained from Lock and Dams 5 and 8 to increase capability of Lock and Dam 2 to deter Invasive Carp movement.

2.4 Minnesota River – Explore deterrence measures for high value aquatic resources in the Minnesota River watershed

The size of the Minnesota River and its floodplain makes it difficult to impossible to prevent movement of fish up the main stem. The DNR released a GIS-based map in December 2013 (Appendix H) showing the relative risk of areas to invasion by Invasive Carp swimming abilities. Using this project as a basis, identify locations where technologies would be effective in deterring Invasive Carp movement without causing larger negative impacts to native aquatic communities.

2.5 Mississippi River Pool 1 – Explore with partners minimizing use of Lock #1

With closure of the Upper St. Anthony Falls Lock and dam eminent and deterrent work not completed on Lock and Dams 2, 5, and 8, Pool 1 (Appendix H) is still vulnerable to Invasive Carp that may have passed existing locks. Recreational traffic will be the main users of Lock and Dam 1 with the expected decline of commercial traffic due to Upper St. Anthony Falls lock closure. Decrease lock usage through a public education campaign and exploring reduced lock operation hours.

2.6 Upper Mississippi River (above Coon Rapids) and Red River - Watershed breaches

Watersheds can periodically become connected under some high-flow conditions. This provides a pathway for fish to move into previously uninhabited watersheds. Map, ground truth, and prioritize breaches between major watersheds.

2.7 Support research on new technologies and approaches to selectively deter upstream movement of invasive fish.

A comprehensive approach that includes testing multiple technologies at different scales (main stem, tributaries, lake outlet, watershed breach) may provide the best opportunity to develop the most effective and least costly systems over the long-term. New technologies currently to be investigated include:

I. Carbon Dioxide
II. Seismic technologies
III. Ozone
IV. Complex sounds
V. Water guns
VI. Electrical
VII. Water velocities

Continue research to improve effectiveness and determine suitability for these technologies.

2.8 Increase knowledge on native aquatic communities including abundance, movement and barrier impacts.

Increasing knowledge on native aquatic community dynamics will help inform future decisions on actions. Establish a baseline for under-studied, native species pre-invasion. If Invasive Carp do become established, we will be able to more precisely identify impacts on the native fish community.

2.9 Work with multiple jurisdictions downstream of Minnesota to slow or prevent the expansion of invasive fish.

The Lock and Dam 19 structure does not contain gates, making the lock structure the only pathway for fish to swim upstream. Installing a deterrent system in this lock chamber would slow the movement of black carp and potential future invasive fish from moving upstream.

3) Response Preparation

Response actions are employed to gather more information or attempt to eradicate populations before they become established. Response actions are triggered by the capture of adults, juveniles, young of the year, or eggs. Triggered response actions may need to occur immediately or within a couple of months but typically occur before the next spawning season. Developing appropriate triggers and viable response actions is needed to facilitate promptness, maximize efficiency, and ensure appropriate expenditure of limited funds.

3.1 Develop a flow chart to guide response actions.

Response actions will be identified for positive indications of Invasive Carp presence from routine or targeted fisheries sampling, eDNA sampling, commercial fishing, public sightings, or other means. Identify actions and corresponding triggers to positive Invasive Carp contacts. Organize in a flow chart.

3.2 Develop standard operating procedures for response actions.

Develop standard operating procedures for actions. For example, work with USFWS to develop an Incident Command System (ICS) -based response plan. This type of plan is necessary to be eligible for federal funding, should a response be initiated.

3.3 Establish an account to fund response in a timely matter.

Response activities require action to occur in a relatively short time span, thus requiring readily available funding.

3.4 Support research that develops response options.

Few options exist for rapid response at present. Options need to be developed and those that we have (ex. rotenone) validated.

4) Management and Control

Managing and controlling populations of Invasive Carp is a critical element of this plan. Despite barriers and other technologies, there are pathways that may result in movement of Invasive Carp, including illegal or unintentional transport by bait dealers, anglers, and others. Developing new approaches and tools to control Invasive Carp populations and improving water quality and habitat for native species so they can compete with Invasive Carp are important long-term strategies. Control strategies are implemented in areas where Invasive Carp species become established.

4.1 Support and accelerate research on behavioral and long-term control methods.

Research is ongoing regarding Invasive Carp physiological and behavioral controls, such as attractants, toxicants, and deterrents. Conduct research to determine whether attractants are species-specific, conduct trials of attractants for Invasive Carp removal field applications. Research is also needed to better understand Invasive Carp population dynamics (recruitment, mortality, predation, immigration/emigration), food webs, and habitat usage, which may lead to the development of management and control tools. Funding, permitting, evaluation and other measures necessary to complete studies and implement projects are needed to support this work.

4.2 Physically remove Invasive Carp.

Evaluate the conditions needed to control established Invasive Carp populations in Minnesota waters. If warranted, utilize commercial fishing (consider supporting processing plants, intensive “control fishing” by commercial entities, etc.), intensive sampling by Minnesota and Wisconsin DNR and USFWS, and other potential control

methods to remove Invasive Carp. Support use of attractants, pheromones, and Judas fish to aid in "control fishing."

4.3 Improve water quality and habitat so native species can better compete with Invasive Carp and other invasive species.

A healthy native community may be our most effective (and sustainable long-term) defense against Invasive Carp, because strong native, aquatic communities are more resilient and/or resistant to invasion. While strategically placed barriers and deterrents are needed to stop upstream migration of Invasive Carp, they need to be balanced with connectivity that benefits native aquatic communities.

4.4 Analyze fish community data to determine susceptibility and resiliency of aquatic habitats.

Invasive Carp species have been in the Mississippi River since the 1970s. Population expansion has occurred more quickly in the Illinois River and Missouri River, however, than the Upper Mississippi River. The differences in fish communities may be contributing to varying expansion rates. Maximizing the benefits of key species through regulations may improve the size and age structure of some native fishes and increase predation on Invasive Carp, along with improving the health of commercial species that compete directly with Invasive Carp for food. Conduct a fish community analysis to determine susceptible aquatic habitats and fisheries management options to increase resiliency.

5) Outreach and Communication

Communication and outreach between agencies and with key audiences will be critical to the success of this action plan. Key audiences include commercial and recreational users of the Mississippi River and connected waters, media, legislators, local officials, and the general public. An informed public will improve our chances of preventing or minimizing impacts of Invasive Carp. Outreach and communication actions focus on establishing primary contacts, Web links, news releases, and media events.

5.1 Establish and maintain a contact list of agency staff for media access.

5.2 Link agency websites.

The Asian Carp Regional Coordinating Committee and the National Aquatic Nuisance Species Task Force have excellent websites that are updated frequently with information about Invasive Carp. Providing links to these websites will prevent

duplication of effort and provide access to the best available information. The DNR, Stopcarp.org, MAISRC, USGS, UMESC, and USFWS all have websites containing information, and efforts and should be linked as much as possible.

5.3 Prevent accidental introductions

Importation of Invasive Carp is prohibited by the Federal Lacey Act. Additionally, Minnesota has passed several laws to reduce the risk of accidental introductions (Appendix B). Increase public awareness and compliance.

5.4 Provide regular news releases, conduct media events, and communicate advances.

These actions will bring attention to Invasive Carp issues, highlight activities of participating groups, and communicate return on investment.

5.5 Provide a network to distribute scientific literature on carp in the Upper Mississippi watershed.

Sharing scientific research results will improve our understanding of Invasive Carp populations and control methods, and improve our ability to implement the actions in this and future plans.

5.6 Continue DNR participation in regional and national efforts.

The DNR should continue active participation in regional and national efforts: Asian Carp Regional Coordinating Committee, Upper Mississippi River Conservation Committee, Mississippi River Interstate Cooperative Resource Association, Upper Mississippi River Basin Association, conferences, workgroups, panels, etc.

5.7 Communicate the cost (long-term), risk, and time involved in developing solutions.

Researching and developing solutions for aquatic invasive species is not a simple endeavor. The work is costly and lengthy, with potential failures along the way. The benefits can be immense, as seen with sea lamprey control in the Great Lakes. Convey this message to policy makers and the public.

5.8 Recruit students to specialize in aquatic nuisance species fields.

Non-native introductions and expansions have been occurring for more than a century, but the development of professionals to find solutions is lacking. The establishment of the Minnesota Aquatic Invasive Species Research Center provides an excellent opportunity to train specialists in this field. Fund, recruit, and train people to fulfill this need.

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5.9 Maintain up-to-date information on actions, projects, and efforts.

Agencies, NGOs, and individuals are highly encouraged to help maintain updated information on action items. Disseminating information and updating this document can be achieved through the following:

I. The Minnesota Invasive Fish Coordinator will lead a formal update annually.
II. The Minnesota Invasive Fish Coordinator will request semi-annual updates from lead agencies.
III. An annual forum will be held to inform stakeholders and other interested parties on Minnesota's progress.

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Appendix A – Implementation Table

Acronyms

DNR – Minnesota Department of Natural Resources
MAISRC – Minnesota Aquatic Invasive Species Research Center
NPS – National Park Service
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
ACRCC – Asian Carp Regional Coordinating Committee
OHF – Outdoor Heritage Fund
ENRTF – Environment and Natural Resources Trust Fund
MSU – Minnesota State University, Mankato

Action	**Lead organization / Priority**	**Current Funding Source/ Needs (cost)**	**Timeframe**	**Current Status**	**Last Status Update**
1) Early Detection and Monitoring Susceptible Waters					
1.1 Continue systematic and coordinated annual fisheries monitoring	DNR	MN DNR / None (Base)	Continual	No Invasive Carp captured to date	1/15/2015
1.2 Invasive Carp targeted sampling	DNR	ENTRF / Funded through 2015 (~$200,000 yr)	Ongoing	No Invasive Carp captured to date	1/15/2015

1.3 Use commercial fishing catch records to aid surveillance	DNR	DNR / None (Base)	Continual	2014 - 3 captured 2013 - 10 captured	1/15/2015
1.4 Targeted commercial fishing to capture Invasive Carp at their leading edge	DNR	ENRTF / Funded through June 2015 (~$30,000 yr)	Annually	2014 - 4 captured 2013 - 1 captured	1/15/2015
1.5 Request public to report potential sightings	DNR	DNR / None (Base)	Continual	Confirmed sightings: 2014 - 0 2013 - 1	1/15/2015
1.6 Enter Invasive Carp collections into the USGS NAS database	USGS DNR USFWS	DNR / None (Base)	Continual	Minnesota captures are up to date	1/15/2015
1.7 Apply environmental DNA (eDNA) sampling purposefully	MAISRC USFWS	ENRTF, USFWS / Currently funded by USFWS (Base)	Ongoing	2014 - 500 total samples, 0 silver carp positives, 1 bighead carp positive (pool 8)	1/15/2015
1.8 Maintain telemetry receiver network in the Mississippi River	DNR USFWS	OHF, USFWS / Tags, maintenance costs - fully funded through 2015 ($5,000/yr)	Ongoing	Receivers in place from Pool 1 through Pool 19.	1/15/2015
1.9 Support research on early detection and distribution of Invasive Carp.	USGS MAISRC	ENTRF / MAISRC funded thru 2019 (variable)	Ongoing	Updates given at Minnesota Invasive Carp Forum	12/15/2014

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2) Prevention and Deterrence					
2.1 Develop a document outlining the various deterrent technologies	DNR ACRCC	None / Undetermined (Unknown)	Completed 2016	ACRCC putting together an Invasive Carp tool kit	7/1/2014
2.2 St. Croix River - Explore modifying Lock and Dams 5 and 8 to improve capabilities to deter Invasive Carp Explore modifying lock and dams to improve capabilities to deter Invasive Carp	MAISRC	ENRTF, OHF / Additional funding needed to complete full proposal (~$750,000, together with action 2.3, over the next 5-6 years)	Ongoing	Installation of speakers in June 2014, research through 2017	7/1/2014
2.3 Minnesota River - Explore modifying Lock and Dam 2 to improve capabilities to deter Invasive Carp	MAISRC	ENRTF, OHF / Additional funding needed to complete full proposal (see action 2.2)	2018		
2.4 Minnesota River – Explore deterrence measures for high value aquatic resources in the Minnesota River watershed	DNR	OHF / Additional funds needed for yet to be determined projects (typically $30,000 - $500,000 per project)	Ongoing	Minnesota State University, Mankato is conducting an evaluation of the Minnesota River maintstem.	1/15/2015

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2.5 Mississippi River Pool 1 - Explore with partners minimizing use of Lock #1	NPS	NPS / None (Base)	Ongoing		
2.6 Upper Mississippi River (above Coon Rapids) and Red River - Watershed breaches	DNR	OHF, MSU / Additional funds needed for yet to be determined projects (typically $30,000 - $500,000 per project)	Ongoing	Minnesota State University, Mankato is conducting an evaluation of the Minnesota River / Red River connection.	1/15/2015
2.7 Support research on new technologies to deter upstream movement	MAISRC USGS	ENRTF, State, Federal / Additional funding will be needed on a project basis (Variable)	Ongoing	Updates given at Minnesota Invasive Carp Forum	12/15/2014
2.8 Increase knowledge on native aquatic communities including abundance, movement, and barrier impacts	MAISRC USGS USFWS	OHF, ENRTF, State, Federal / Additional funding needed ($800,000)	Ongoing		
2.9 Work with multiple jurisdictions downstream of Minnesota to slow or prevent the expansion of invasive fish.	USFWS	USFWS / Unfunded ($1,000,000's)	2018		
3) Response Preparation					

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3.1 Develop a flow chart to guide response actions.	DNR USFWS	Needed / Undetermined (Unknown)	Completed by 2017		
3.2 Develop standard operating procedures for response actions.	DNR USFWS	Needed / Undetermined (Unknown)	Completed by 2017		
3.3 Establish an account to fund the response in a timely matter.		Needed / Undetermined (Unknown)	Completed by 2017		
3.4 Support research that develops response options	MAISRC	Needed / Additional funding will be needed on a project basis (Variable)	Ongoing	Updates given at Minnesota Invasive Carp Forum	12/15/2014
4) Management and Control					
4.1 Support and accelerate research on behavioral and long-term controls	MAISRC USGS	Various / Additional funding will be needed on a project basis (Variable)	Ongoing	Updates given at Minnesota Invasive Carp Forum	12/15/2014
4.2 Physically remove Asian carp	DNR	Various / Unfunded (~$30,000 - $100,00)	When triggered in response plan	Carp populations do not warrant a physical removal program at this time.	1/15/2015

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4.3 Improve water quality and habitat for native species	Various	Various / Additional funds needed for yet to be determined projects (typically $30,000 - $1,000,000's per project)	Ongoing		
4.4 Analyze fish community data to determine susceptibility and resiliency of aquatic habitats	MAISRC DNR USFWS	Needed / Post Doc Researcher ($200,000)	Completed by 2017		
5) Outreach and Communication					
5.1 Establish and maintain contact list	NPS	NPS / None (Base)	Ongoing		
5.2 Link agency websites	All groups	Various / None (Base)	Ongoing		
5.3 Prevent accidental introductions	MN AC Coalition	MN AC Coalition / None (Base)	Ongoing		
5.4 Provide regular news releases and media events	All groups	Various / None (Base)	As needed		
5.5 Provide a network to distribute scientific literature	MAISRC	MAISRC / Annual funding needed (Approx. $5,000/yr)	As soon as possible		

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5.6 Continue DNR participation in regional and national efforts	DNR	DNR / None (Base)	Ongoing	DNR participates in ACRCC, UMRCC, UMRBA, UMRACAP	1/15/2015
5.7 Communicate the cost (long term), risk, and time involved in developing solutions	MN AC Coalition	MN AC Coalition / None (Base)	Ongoing		
5.8 Recruit students to specialize in aquatic nuisance species fields	MAISRC	Various / Funding for students (Masters - $??,??? yr; Doctoral - $??,??? yr; Post Doc - $??,??? yr)	Ongoing		
5.9 Maintain up to date information on actions, projects, and efforts	DNR	DNR / None (Base)	Ongoing	Fall 2014 Invasive Carp Forum held on 12/15/2014	12/15/2014

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Appendix B – Accomplishments

Accomplishment	Description	Date
Upper St. Anthony Falls Lock Closure	A provision in the Water Resources Reform and Development Act instructs the Army Corps of Engineers to close the Upper St. Anthony Falls Lock within one year after passage of the law. The closure of the lock reestablishes the fish movement barrier that existed historically at the natural falls.	Signed into law 6/10/2014
Lock and Dam 1 Barrier Feasibility Study	A barrier at Lock and Dam 1 was seen as the best alternative to Upper St. Anthony Falls Lock closure. Given the uncertainty of federal legislation at the time, this was the first step in identifying the technology to apply at Lock and Dam 1.	Completed 1/4/2013
Lock and Dam 1 Electric Barrier Design	Following the Lock and Dam 1 barrier feasibility study, it was decided that an electric barrier was the best option. The DNR contracted with Smith-Root Inc. to design an electric barrier for Lock and Dam 1 utilizing the company's new "sweeping" electric technology.	Completed 11/2014
Coon Rapids Dam Upgrade	Coon Rapids Dam was an immediate action that would reduce fish movement. Though not 100% effective, it would be an improvement until a more effective solution could be implemented downstream. With the closure of the Upper St. Anthony Falls Lock, these upgrades provide a backup measure.	Completed 12/2014

Lower Gar Lake Outlet Barrier (Iowa)	Bighead and Silver carp were detected in Okoboji Lake in Iowa. Okoboji Lake is one of a series of lakes in northwestern Iowa whose watershed extends into Minnesota. They have a single outlet at Lower Gar Lake. DNR cost-shared an electric barrier to prevent further migration of Invasive Carp into the lakes.	Completed 5/2013
Minnesota Barrier Assessment Study - Invasive Carp Migration Potential	DNR fisheries conducted a GIS assessment of structures on Minnesota waterways. The map product shows the areas most susceptible to Invasive Carp expansion via their natural swimming ability. The map is posted at: http://www.dnr.state.mn.us/invasive-carp/migration.html	Completed 11/2013
Creation of the Minnesota Aquatic Invasive Species Research Center	The Legislature appropriated funding from the Clean Water Fund and the Environment and Natural Resources Trust Fund to a Center at the University of Minnesota to use innovative science to find solutions to Minnesota's AIS funding. Research funding in this first appropriation was almost entirely to support work on Asian carp. Subsequent appropriations have also included significant funding for research on Asian carp detection, prevention, and control.	Completed 6/2012
Statute 97C.417 Reporting Asian Carp	A person who takes bighead, grass, or silver carp must report to the capture to the DNR within seven days of taking.	2007 (Original version)
Statute 84D.03 Infested Waters	Statute pertaining to designating Minnesota waters as infested with invasive species and the limitations placed on such designated waters.	1996 (Original version)
Statute 97C.341 Certain Aquatic Life Prohibited for	Statute prohibiting the use of live minnows from out of state.	1986 (Original version)

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Bait		
Statute 84D.02 Invasive Species Management Program for Aquatic Plants and Wild Animals	Statute establishing an invasive species program.	1996 (Original version)
Statute 97C.515 Imported Minnows	Statute establishing further provision to prevent accidental introductions.	1986 (Original version)
Okabena Creek - Des Moines River Watershed Breach	Flowage easement acquired and culverts removed	Completed 9/10/2014
Little Sioux River - Des Moines River Watershed Breach	Earthen Dike raised to handle 100 year flood	Completed 10/2013
Little Sioux River - Okabena Creek Barrier	Electric barrier installed to prevent carp movement upstream	Completed 6/12/2014
Little Sioux River - Des Moines River Watershed Breach	Culvert screen and tile line caps installed	Completed 5/2014
Minnesota River - Des Moines River Watershed Breach	Ditch plug installed	Completed 2/27/2013
Minnesota Bighead, Black, Grass,	Plan developed to limit the impact of Invasive Carp on in	Original - 11/2/2011

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and Silver Carp Action Plan	Minnesota waters.	Update -

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Appendix C – Minnesota Invasive Carp Action Plan Workgroup

Participants

- National Park Service
- Minnesota Department of Natural Resources
- Minnesota Aquatic Invasive Species Research Center – University of Minnesota
- US Fish and Wildlife Service
- US Geological Survey
- City of Hastings
- US Army Corps of Engineers, St. Paul District
- Industry
- Minnesota Stop Invasive Carp Coalition
- Minnesota Citizen

Co-Chairs

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Appendix D – History of Invasive Carp captures

Month	Year	Location	Species	Count	Entity
October	2014	Mississippi River – Pool 4	bighead carp	1	Contracted Commercial Fisher
October	2014	Mississippi River – Pool 2	silver carp	1	Contracted Commercial Fisher
September	2014	St. Croix River	bighead carp	1	Contracted Commercial Fisher
July	2014	Mississippi River – Pool 2	silver carp	1	Contracted Commercial Fisher
July	2014	Mississippi River – Pool 2	bighead carp	1	Contracted Commercial Fisher
April	2014	Mississippi River - Pool 5a	grass carp	1	Commercial Fisher
April	2014	Mississippi River - Pool 5a	grass carp	1	Commercial Fisher
November	2013	Mississippi River - Pool 7	silver carp	1	Commercial Fisher
August	2013	Mississippi River - Pool 5a	silver carp	1	USFWS
June	2013	Mississippi River - Pool 2	grass carp	1	Contracted Commercial Fisher
May	2013	Mississippi River	grass carp	1	Angler
March	2013	Mississippi River - Pool 5	grass carp	1	Commercial Fisher
February	2013	Mississippi River - Pool 6	grass carp	1	Commercial Fisher
February	2013	Mississippi River - Pool 6	silver carp	1	Commercial Fisher
February	2013	Mississippi River - Pool 6	grass carp	1	Commercial Fisher
February	2013	Mississippi River - Pool 6	grass carp	1	Commercial Fisher
February	2013	Mississippi River - Pool 6	grass carp	1	Commercial Fisher
December	2012	Mississippi River - Pool 5	grass carp	2	Commercial Fisher
November	2012	Mississippi River - Pool 4	bighead carp	1	Commercial Fisher
April	2012	St. Croix River - Lake St. Croix	bighead carp	1	Commercial Fisher
March	2012	Mississippi River - Pool 6	silver carp	1	Commercial Fisher

Month	Year	Location	Species	Count	Entity
March	2012	Mississippi River - Pool 6	grass carp	3	Commercial Fisher
March	2012	Mississippi River - Pool 6	bighead carp	1	Commercial Fisher
May	2011	Lake Zumbro	grass carp	1	Commercial Fisher
April	2011	St. Croix River - Lake St. Croix	bighead carp	1	Commercial Fisher
February	2011	Mississippi River - Pool 9	silver carp	1	Commercial Fisher
March	2010	Mississippi River - Pool 6	grass carp	2	Commercial Fisher
April	2009	Mississippi River - Pool 5	grass carp	1	Commercial Fisher
April	2009	Mississippi River - Pool 6	grass carp	1	Commercial Fisher
April	2009	Mississippi River - Pool 6	grass carp	5	Commercial Fisher
March	2009	Mississippi River - Pool 8	silver carp	1	Commercial Fisher
March	2009	Mississippi River - Pool 5a	grass carp	2	Commercial Fisher
March	2009	Mississippi River - Pool 6	grass carp	5	Commercial Fisher
January	2009	Mississippi River - Pool 9	bighead carp	1	Commercial Fisher
January	2009	Mississippi River - Pool 5a	grass carp	17	Commercial Fisher
January	2009	Mississippi River - Pool 5a	bighead carp	1	Commercial Fisher
November	2008	Mississippi River - Pool 7	silver carp	1	Unknown
November	2008	Mississippi River - Pool 8	bighead carp	3	Commercial Fisher
November	2008	Mississippi River - Pool 8	silver carp	1	Commercial Fisher
November	2008	Mississippi River - Pool 8	grass carp	2	Commercial Fisher
October	2007	Mississippi River - Lake Pepin	bighead carp	1	Commercial Fisher
October	2003	Mississippi River - Lake Pepin	bighead carp	1	Commercial Fisher
October	1996	St. Croix River - Lake St. Croix	bighead carp	1	Commercial Fisher
January	1991	Okamanpeedan Lake	grass carp	1	Commercial Fisher

bighead carp	15
grass carp	51
silver carp	10

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Appendix E –Comments

Appendix F –Maps

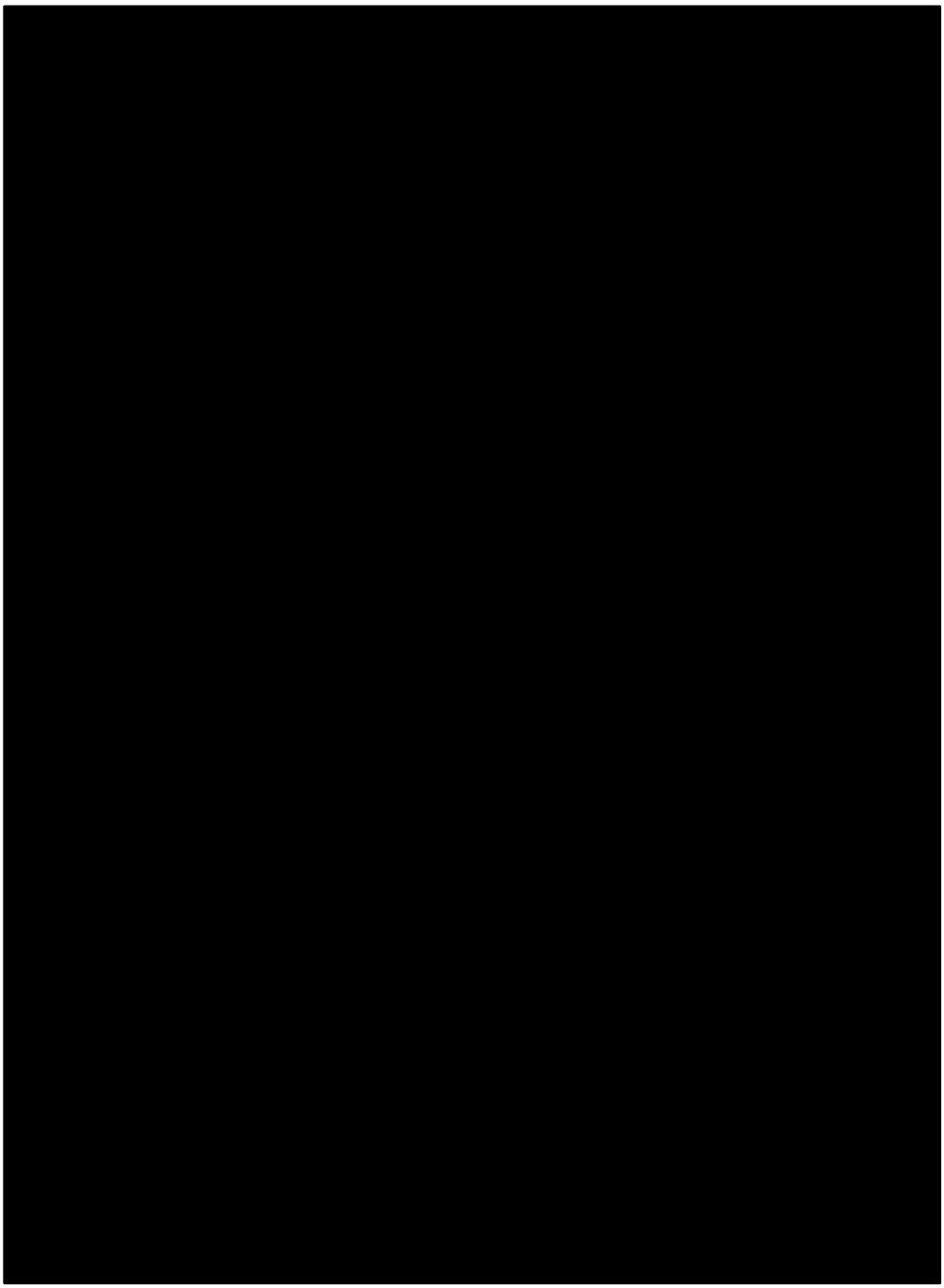

Figure 2. Locations and names of Lock and Dams on the Mississippi River (dark blue), St. Croix River (light blue), and Minnesota River (green).

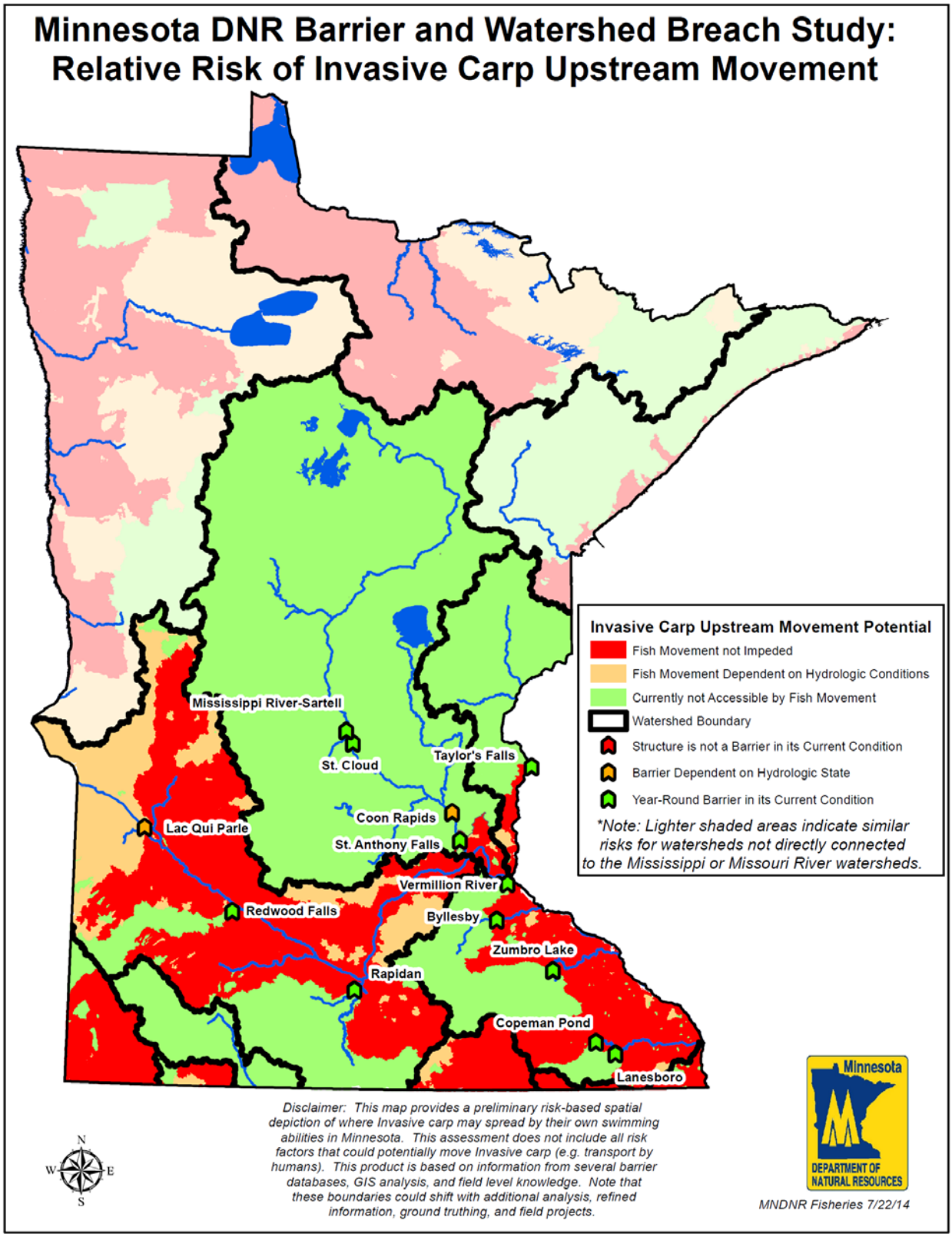

Figure 3. Map product from MN DNR Fisheries GIS barrier project.