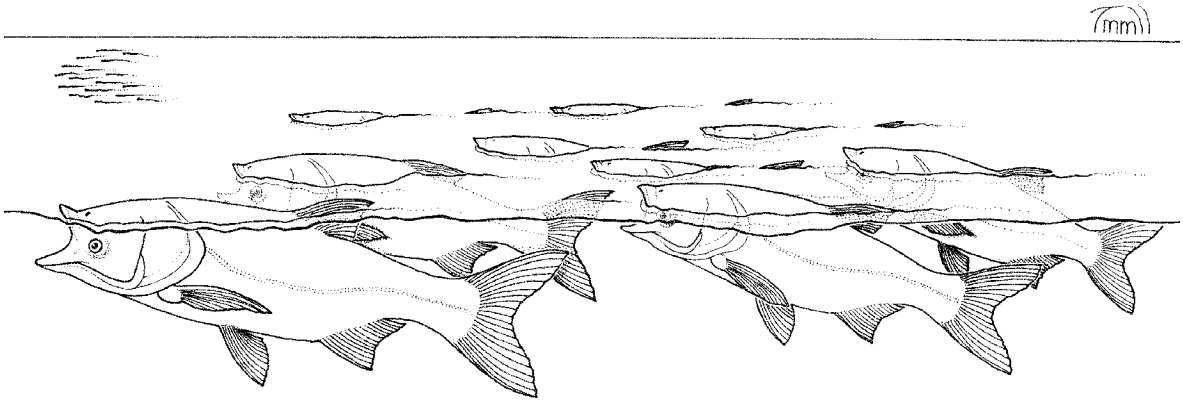
Preventing the Introduction of Asian Carp into Minnesota



A plan prepared by the
Minnesota Department of Natural Resources

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ACKNOWLEDGEMENTS

This document was developed by comprehensive examination of the *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States* (Conover, Simmonds, and Whalen 2007), which served as a valuable reference. Close attention was paid to the national plan, because considerable energy and a broad range of expertise was involved in its development. Many portions of the national plan are cited in this plan. Other portions of this plan resemble the national plan for consistency, but are not specifically cited.

The illustration by Susan Trammel of ram-feeding bighead carp on the cover of this plan was used with permission from the American Fisheries Society.

EXECUTIVE SUMMARY

Minnesota state legislation directed the Minnesota Department of Natural Resources (DNR) to develop a plan to prevent the introduction of Asian carp into Minnesota by November 1, 2007 (Laws of 2007, Chapter 57, Sec. 4, Subd. 8). For over ten years, the DNR has been concerned about the introduction of Asian carp into the state and has been actively working on this issue. To date, the DNR has designated four Asian carp as prohibited invasive species, described the issue in annual reports, formed a working group of upper Mississippi River agencies, co-funded a feasibility study on the issue, provided funds to support a barrier to keep Asian carp from entering the Great Lakes, participated in working groups to develop a national Asian carp plan, sought federal funds for an Asian carp barrier in the Mississippi River, and participated in several conferences and symposia on Asian carp.

Our conclusions, based on past state efforts, involvement with efforts at regional and national levels, and discussion within the state, are the following.

Preventing the introduction of Asian carp into Minnesota waters is a daunting challenge and unlikely to be successful over the long-term. Prevention efforts, however, have the potential to slow or delay the introduction of Asian carp providing immediate environmental, economical and social benefits. Delaying the introduction of Asian carp would allow the State to develop management strategies such as control techniques and habitat improvement for native species. Asian carp are currently in the Mississippi River as far north as Iowa and are also poised to enter Lake Michigan through the Chicago Sanitary and Ship Canal. While the State desires to interrupt these pathways to Minnesota waters, preventative actions depend upon efforts of other states, federal agencies and Congress. Recognizing the scale of challenge and these obstacles, this plans lays out the best options to attempt to curb the introduction of Asian Carp into Minnesota.

There are many carp species native to Asia, including seven that have been introduced to the United States. In this document, the term “Asian carp” will refer to the black carp (*Mylopharyngodon piceus*), bighead carp (*Hypophthalmichthys nobilis*), grass carp (*Ctenopharyngodon idella*), and silver carp (*H. molitrix)*. Bighead, grass, and silver carps have all established reproducing populations in several major rivers of the United States including the Mississippi River. There have been collections of adult black carp by commercial fishers in the United States and unconfirmed reports of repeated captures of adult black carp in southern portions of the Mississippi River and its tributaries over the past 13 years.

Currently, there are no known populations of Asian carp in Minnesota waters, although individual Asian carp have been captured in the state’s border waters. In 1996, a bighead carp was caught in the St. Croix River, and in 2004 a 23-pound bighead was caught in Lake Pepin. On October 3, 2007, a commercial seine operation netted a 39-inch, 28-pound bighead carp in Lake Pepin near Frontenac. Grass carp have also been caught in Minnesota border waters on a few occasions. The most recent was a large grass carp caught by a commercial fisherman in the St. Croix River on April 7, 2006.

Populations of these fish are expanding their geographic range and are moving up the Mississippi River towards Minnesota. There is also concern that these fish could enter the Great Lakes through the Illinois waterways that connect the Mississippi River basin with the Great Lakes Basin. Risk assessments that have been completed for Asian carp by federal agencies indicate these carp species could establish populations in Minnesota waters. Many natural

resources managers are concerned that Asian carp have the potential to cause extensive and irreversible changes to the aquatic environment, thereby jeopardizing the long-term sustainability of native aquatic species, including threatened and endangered species.

There are a variety of potential pathways of introduction and spread of Asian carp. A national Asian Carp Working Group identified 22 pathways. The working group also developed 48 strategies and 136 recommendations to address prevention and management of Asian carp. These are now components of the *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States* (Conover, Simmonds, and Whalen 2007). That national plan, as well as a draft *Minnesota Invasive Species Plan*, and a *Feasibility Study to Limit the Invasion of Asian Carp into the Upper Mississippi River Basin* (FishPro 2004) have been reviewed as part of the development of this plan (see Appendix A and Appendix B). After review of those documents, several priority pathways of introduction were identified including 1) spread of wild populations via interstate waters; 2) spread via wild-caught baitfish; 3) importation; 4) incidental inclusion of Asian carp in shipments of farm-raised fish into the state; and 5) unauthorized releases by individuals.

Both ongoing and new recommended responses for the state are identified that address each of these priority issues. Key responses are summarized below according to the pathway they address (see Prevention Plan chapter and Implementation Table for more detail):

1) Spread of wild populations via interstate waters

Ongoing efforts by DNR and others:

- Pursue development, installation, testing, and evaluation of behavioral fish barriers to prevent migration into the Great Lakes and Minnesota from the Mississippi River.

New recommendation:

- Pursue restoration of a physical fish barrier to prevent Asian carp from migrating upstream past St. Anthony Falls in the Mississippi River.
- Evaluate the effectiveness of barriers and impacts to non-target species

2) Spread via wild-caught baitfish:

In place:

- Prohibition on import of live baitfish.
- Prohibit release of live bait into state waters.

Ongoing efforts by DNR and others:

- Provide information to anglers about state laws related to prohibited invasive species and live bait, and the precautions to take.

New recommendation:

- Develop and provide information to commercial and recreational baitfish harvesters.

3) Importation

In place:

- State prohibition on import, possession, sale, purchase, and introduction of Asian carp.
- Federal injurious wildlife designation for silver, large-scale silver, and black carp.

Ongoing efforts by DNR and others:

- Monitor markets for prohibited products and when found, conduct investigation.
- State and non-governmental entities pursue and support passage of more comprehensive federal regulations to limit importation and interstate movement of

Asian carp species through Congressional acts or additional designations of Asian carp as injurious wildlife by the USFWS.

New recommendation:

- Inform potential importers of applicable state and federal laws and associated risks with international shipments of live Asian carps.

4) Incidental inclusion of Asian carp in shipments of farm-raised fish into the state

In place:

- Include requirements in DNR contracts for the purchase of fish for stocking and also conditions in importation permits for commercial import of farm-raised fish.
- Conduct random inspections of live fish shipments into and within the state.

5) Unauthorized releases by individuals

In place:

- State prohibition on import, possession, sale, purchase, and introduction of Asian carp.

Ongoing efforts by DNR and others:

- Use educational campaigns such as Habitattitude™ to convey messages to the public that they should not release live fish including Asian carps.

New recommendation:

- Develop information materials for producers, growers, marketers, food fish consumers, and others to help prevent accidental and deliberate unauthorized introductions.

In summary, the implementation of this plan has the potential to delay the introduction of Asian carp into the state and limit the spread within the state. However, it is unlikely that it will be able to prevent the introduction of Asian carp into Minnesota waters over the long term. Once Asian carp populations are established in Minnesota waters, it is unlikely that they could be eliminated and management to suppress their populations will be very expensive. This plan will be most effective if it is implemented in a comprehensive manner, focusing on all priority pathways.

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INTRODUCTION

Scope of Plan

Goal – The goal of this plan, as required by state legislation enacted in 2007, is to prevent the introduction of Asian carp into Minnesota waters (Laws of 2007, Chapter 57, Sec. 4, Subd. 8). The benefit of implementing the plan is to protect native aquatic species, aquatic ecosystems, water recreation, and other benefits these resources provide society. Recommendations for management of Asian carp, should they establish in the state, are not addressed by this plan.

Species - There are many carp species native to Asia and seven have been introduced to the United States. For the purposes of this document the term "Asian carp" includes four carp: the grass carp (*Ctenopharyngodon idella*), black carp (*Mylopharyngodon piceus*), bighead carp (*Hypophthalmichthys nobilis*), and silver carp (*H. molitrix)*. Brief descriptions of the four species are included in the chapter below. In-depth summaries of each of the four Asian carp species including overviews of biology, introduction into the United States, present distribution and abundance, present uses, and potential adverse effects are presented in the *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States* (herein referred to as the national plan); (Connover, Simmonds, and Whalen 2007). This document and the national plan do not address common carp (*Cyprinus carpio*) or goldfish (*Carassius auratus*), which are carp species originating in Asia, established in North America, and present in some Minnesota waters. The crucian carp (*Carassius carassius*), which was introduced, but is apparently extirpated, is not addressed because there appears to be little threat. This plan and the national plan do not address largescale silver carp (*H. harmandi*) because it is not present in the US and is now illegal to import under federal laws.

Past Efforts on Asian Carp Prevention

For over ten years, the Department of Natural Resources (DNR) has been concerned about the introduction of Asian carp into the state and has been engaged in prevention efforts in various ways. For example, the DNR has done the following:

- designated four Asian carp as prohibited invasive species;
- commented to the USFWS in support of designating Asian carp as injurious wildlife at the federal level;
- described the threat of Asian carp in annual reports;
- formed a working group of upper Mississippi River agencies;
- co-funded a feasibility study on the issue (FishPro 2004);
- funded audiograms of native paddlefish and lake sturgeon to determine the potential for acoustic barriers to be selective (Nedwell 2005b);
- provided funds to support a barrier to keep Asian carp from entering the Great Lakes;
- worked with the Governor's Office, several Minnesota Congressional members, and others to get a federal mandate and funding to install a behavior barrier in the Mississippi River to delay northward movement of Asian carp;
- investigated the potential and cost for installing a bioacoustic barrier at the mouth of the St. Croix River as an alternative to a barrier in the Mississippi River;
- participated in working groups to develop a national Asian carp plan; and
- participated in several conferences and symposia on Asian carp.

Some of these efforts have concluded and resulted in regulations or informational products, while many of these efforts, such as fish barriers, are still ongoing. Professors and students at the University of Minnesota are involved in research related to common carp that could have future application to management of Asian carp.

Review of Other Plans and Studies

While developing this plan, two other plans and one feasibility study were reviewed for previously identified recommendations/actions specific to preventing introductions of Asian carp or invasive species : the draft Minnesota State Invasive Species Plan; the national Management and Control Plan for Bighead, Black, Grass, and Silver Carps (Conover, Simmonds, and Whalen 2007); and a Feasibility Study to Limit the Invasion of Asian Carp into the Upper Mississippi River Basin (FishPro 2004).

National Asian Carp Plan - The Aquatic Nuisance Species Task Force (ANS Task Force) is an intergovernmental entity established under the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 (Act, 16 U.S.C. 4701-4741). In 2002, the ANS Task Force requested the USFWS develop a *national* management and control plan for Asian carps. In early 2004, the USFWS and ANS Task Force organized an Asian Carp Working Group with broad and diverse representation from partners and stakeholders to participate in the collaborative development of the national management and control plan.

The *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States* is divided into 7 sections based on goals necessary to comprehensively address Asian carp issues: 1) prevent accidental and deliberate unauthorized introductions; 2) contain and control; 3) reduce abundance of feral populations; 4) minimize potential adverse effects; 5) education and outreach; 6) research; and 7) implementation. Strategies were developed by an Asian Carp Working Group to address each goal and numerous recommendations were developed to address each strategy.

For prevention, the working group identified 22 pathways of potential introduction. These pathways had their national priority ranked by the working group's prevention team and the subsequently by the full working group. Upon review of the pathways for this prevention plan, five high-priority pathways were selected.

The table in Appendix A, which was adapted from the national plan, reviews each recommendation from the national plan that relates to introduction and spread of Asian carp and indicates whether that recommendation is: relevant to Minnesota; whether the state has already taken action to address that recommendation, and whether the recommendation should be addressed in Minnesota. Similar to the review of pathways/issues, this review of the national recommendations acts as a triage to identify the most pressing recommendations that the state should address in terms of prevention.

State Invasive Species Plan – The Minnesota Invasive Species Advisory Council has developed a draft Minnesota State Plan for Invasive Species. This Minnesota Asian carp prevention plan addresses the following desired outcome in the state invasive species plan — "*Participants will actively seek to prevent the introduction of new invasive species in Minnesota*." A table in Appendix B reviews each strategy and action from the state plan that relates to introduction of Asian carp into Minnesota and indicates whether the state has already taken action to address that action and whether the action should be addressed to help prevent introduction of Asian carp into Minnesota. As with the national plan, the review of this plan acts as a triage to identify the most pressing recommendations that the state should address in terms of prevention. Those priority items, which should be addressed, are described in the Prevention Plan portion of this document.

Feasibility Study to Limit the Invasion of Asian Carp into the Upper Mississippi River Basin – In 2004, the USFWS, Minnesota DNR, and Wisconsin DNR funded a study (FishPro 2004) to provide direction and focus on the feasibility of limiting the invasion of Asian carp into the Upper Mississippi River. Key recommendations from the study are below.

- Recommendations for preventing or slowing spread via the Mississippi River
  An acoustic deterrent (SPA) based acoustic curtain (SPA/BAFF) downstream of a lock location, perhaps in conjunction with attractants (ie., pheromones, plankton, lights, etc.), and an integrated management/harvest plan may provide the most feasible opportunity to limit or slow the upstream invasion of Asian carp.

  A SPA based acoustic deterrent should be considered for installation within close proximity to the spillway gates.

- Recommendations for Tributaries
  "In addition to the alternatives recommended for limiting Asian carp upstream via the Mississippi River Lock and Dam system, tributary scale barrier/deterrent systems (ie., SPA/BAFF acoustic bubble curtains or graduated field electric barrier/deterrent systems) should be considered to limit movement into key tributaries such as the Minnesota River, the St. Croix River ..."

- "In addition to the barrier/deterrent alternatives for limiting upstream movement as discussed above, it is imperative that an integrated approach be implemented with suitable long- and short-term management alternatives that include regulation, education and public outreach, research and implementation of population control approaches ..."

ASIAN CARP SPECIES OVERVIEWS

Distribution

Asian carp have been introduced into waters of the United States via: authorized stocking by various agencies and unauthorized stocking by private individuals, as well as unintentional escapes from university research facilities, federal and state agency facilities, and private aquaculture operations. Asian carp have the potential to disperse widely in connected waters, potentially affecting waters beyond where the original introduction occurred.

Grass carp are present in most states. They have been found in Minnesota in three border waters: the Mississippi River near Winona, the St. Croix River, and in Okamanpeedan Lake on the border with Iowa. These occurrences are likely individual fish that moved into Minnesota waters from Iowa waters and do not reflect reproducing populations. The most recent find was a large grass carp caught by a commercial fisherman in the St. Croix River on April 7, 2006.

Silver carp are known to exist in the Mississippi River in southeastern Iowa. They were also found in the Des Moines River near Ottumwa, Iowa and in the Missouri River near Yankton, South Dakota. No silver carp have been confirmed to be in Minnesota.

Bighead carp are in the Mississippi River and its tributaries downstream from Minnesota and are likely to move upstream in the Minnesota portion of the basin. Iowa DNR reports that bighead carp are found in large numbers in the Mississippi River below Lock and Dam 19. They are less common in Mississippi River Pools 17 and 18. In 2002, there was an unconfirmed report from a commercial fisherman that he caught a 13-pound bighead carp in Pool 9 near Lansing, IA — just below the Minnesota border. In 1996, a bighead carp was caught in the St. Croix River, and in 2003 a 23-pound bighead was caught in Lake Pepin. A commercial seine operation netted a 39-inch, 28-pound. bighead carp on Oct. 3, 2997 in Lake Pepin near Frontenac.

There have been collections of adult black carp by commercial fishers in the United States and unconfirmed reports of repeated captures of adult black carp in southern portions of the Mississippi River and its tributaries over the past 13 years, but there is not evidence of reproduction (Nico et al. 2005).

Species Descriptions

Bighead Carp

Bighead carp caught in Lake Pepin
Photo: DNR

The bighead carp is a large, deep-bodied fish that can grow to lengths of 1.5 m and weights of 40 kg. It has a large toothless mouth and eyes located far forward and low on the head. Coloration of the body is dark gray above and cream-colored below with dark gray to black irregular blotches on the back and sides. They are native to eastern China's large lowland rivers, preferring temperatures between 39-79^{o}F. The species schools and occupies the upper to middle layers of the water column. They are extremely hardy and can readily adapt to many temperate freshwater environments. The bighead carp feeds in benthic, mid-water, and surface environments on zooplankton, but also consumes large quantities of blue-green algae, aquatic insects (adults

and larvae), and detritus. Gill rakers are long, comb-like and close-set, allowing it to strain planktonic organisms from the water for food. Bighead carp must feed almost continuously because they lack a true stomach. Spawning activity is associated with high spring flows and spawning areas have high water velocity (0.6-2.3 m/s), turbid water, and temperatures in the range of 64-86°F. Bighead carp eggs are semi-buoyant and require current to keep them from sinking to the bottom. Floodplains associated with rising water levels provide nursery areas for larvae and juvenile forms. Egg production ranging from 478,000-1,100,000 per fish has been documented.

Black Carp

The black carp is large, elongated, and laterally compressed. It has a pointed head with a flattened anterior portion and a small toothless mouth. They can exceed 1.8 m and 70 kg. The coloration of the body varies from brown to black, grading to a bluish-grey or nearly white belly. The fins are darker than the body and most often described as black or brownish-black with lighter hues at the base.

Black carp are native to eastern Asia between 22 and 51°N latitudes. Its range extends from the Pearl River Basin in China north to the Amur River and its major tributaries of China and far eastern Russia, including possibly the Red River of northern Viet Nam. They inhabit lowland lakes and rivers.

Black carp have been reported to tolerate dissolved oxygen concentrations as low as 2 ppm. Optimal feeding temperatures for black carp range from 77-86°F; feeding ceases at temperatures < 37°F. Temperatures less than 33°F or above 104°F are lethal.

Recently-hatched black carp fry feed primarily on zooplankton. At 26+ days after hatching (3.1-33 cm), the pharyngeal teeth have fully formed and the fish begin feeding on a larger variety of benthos, insect larvae, and organic detritus. Adult black carp feed primarily on mollusks, using their molar like pharyngeal teeth to crush the shells.

Spawning occurs in rivers with water velocities of 0.8-1.8 m/s and water temperatures of 62-86°F. Increased water flow and temperatures trigger an upstream spawning migration in spring and early summer. Females can produce a range of 1.3 to 3.4 million eggs per fish depending upon their size. Black carp eggs are non-adhesive, semi-buoyant, and drift with water currents. The eggs and larvae are carried into floodplain lakes, smaller streams, and channels with little or no current that serve as nursery areas for larval and juvenile fish.

Grass Carp

The grass carp is a large, elongated fish that can grow to lengths of 1.6 m and weights of 37 kg. Their head is slightly flattened with eyes centered on the side of the head. Coloration of the body varies from blackish or olive-brown, grading to brassy or silvery-white on the sides and belly.


Grass carp caught in St. Croix River

They are native to the large rivers of eastern Asia. The grass carp is most commonly reported to inhabit lower and middle reaches of rivers and prefers large, slow flowing water bodies with vegetation.

Grass carp have comb-like pharyngeal teeth used to grind vegetation. Adults prefer to feed on submerged plants with soft leaves and will consume filamentous algae and firmer macrophytes such as Eurasian milfoil when preferred forage has been exhausted. Grass carp can consume

up to 40% of their body weight per day in aquatic vegetation. If aquatic vegetation is not available, grass carp have been reported to consume organic detritus, insects, small fish, earthworms, and other invertebrates.

Spawning activity is associated with high spring flows, and spawning areas have high water velocity, turbid water, and temperatures in the range of 59-86°F. Grass carp spawn primarily in the main river channel in the upper part of the water column over rapids or sand bars during times of turbulent water currents.

Grass carp eggs are non-adhesive and semi-buoyant, requiring flowing water for incubation. Eggs can become dispersed widely from the spawning site and have reportedly traveled downstream as far over 100 miles. Successful reproduction requires long stretches of warm, flowing water for egg incubation and suitable backwater habitats for larval development. Floodplains associated with rising water levels provide nursery habitat areas for larvae and juvenile forms.

Silver Carp


Silver carp
Photo: Chris Young
State Journal Register

The silver carp is a large, deep-bodied fish that can grow to lengths of 1 m and weights of 27 kg. It has a toothless upturned lower jaw, and the eyes are located below the axis of the body. They are native to several major Pacific drainages in eastern Asia and prefer standing or slow-flowing water of impoundments or river backwaters, ranging in temperature from 43-82°F. They are a very active, schooling species and well known for their habit of leaping out of the water when disturbed. Silver carp very efficiently strain suspended material from the water with highly specialized gill rakers. They feed primarily on phytoplankton, but also feed on zooplankton, invertebrates, detritus, and bacteria, especially when phytoplankton abundance is low. Similar to bighead carp, silver carp lack a true stomach so they must feed almost continuously. Spawning activity is associated with high spring flows, and spawning areas have high water velocity, turbid water, and a temperature in the range of 64-86°F; optimal water temperature for spawning is 71-82°C. Silver carp produce eggs that are semi-buoyant and require current to prevent the eggs from sinking to the bottom. Floodplains associated with rising water levels provide nursery habitat areas for larvae and juvenile forms. Egg production per female ranges from 50,000 to 5,000,000 depending upon the location and body size.

PREVENTION PLAN

The goal of this plan, as required by state legislation enacted in 2007, is to prevent the introduction of Asian carp into Minnesota waters. The benefit of implementing the plan is to protect native aquatic species, aquatic ecosystems, water recreation, and other benefits these resources provide society.

The issues, strategies, actions, and recommendations below have been compiled by reviewing existing plans and studies related to Asian carp, and by consulting with individuals who have expertise in invasive species or fisheries management. Several issues, or pathways of spread, that could lead to introduction of Asian carp were identified and prioritized in the national plan. Some of those national pathways are applicable in Minnesota and others are not applicable because of actions already taken in Minnesota. Appendix A provides explanations about the applicability of prevention strategies in the national plan to Minnesota.

The highest priority issues, or pathways of spread, that could lead to introduction of Asian carp into Minnesota waters are described in this chapter, followed by current strategies and actions that the state has taken, or is taking. Lastly, additional recommendations that the state could take to address each issue are provided.

The priority pathways/issues for Minnesota are presented by the following subject headings: 1) spread of wild populations via interstate waters; 2) spread via wild-caught baitfish; 3) importation; 4) incidental inclusion of Asian carp in shipments of farm-raised fish into the state; and 5) unauthorized releases by individuals.

SPREAD OF WILD POPULATIONS VIA INTERSTATE WATERS

Description of Issue

The national plan includes a goal specific to the containment of wild populations of Asian carp. The plan states,

> *"Feral bighead, black, silver, and grass carps are spreading by larval dispersion and/or migration throughout the Mississippi River Basin and threaten to expand to additional watersheds via interbasin connections (e.g., canals and waterways) and human-mediated spread."*
>
> *"The best protection for native aquatic ecosystems is to minimize the distribution of feral Asian carp populations and prevent their access to additional waters. Because existing feral Asian carps populations are dispersing and will not wait to be contained, implementation of this strategy is urgent and immediate actions are warranted to prevent the expansion of feral Asian carp populations throughout the Mississippi River Basin and into new watersheds. Navigation locks and dam systems have slowed but not stopped the upriver migration of these fishes."*

Current Minnesota strategies

State actions in partnership with others have been taken or are ongoing to support the following strategies.

Ongoing efforts:

1. Pursue development and installation of behavioral fish barriers to prevent migration into Minnesota from the Mississippi River south of the state border.

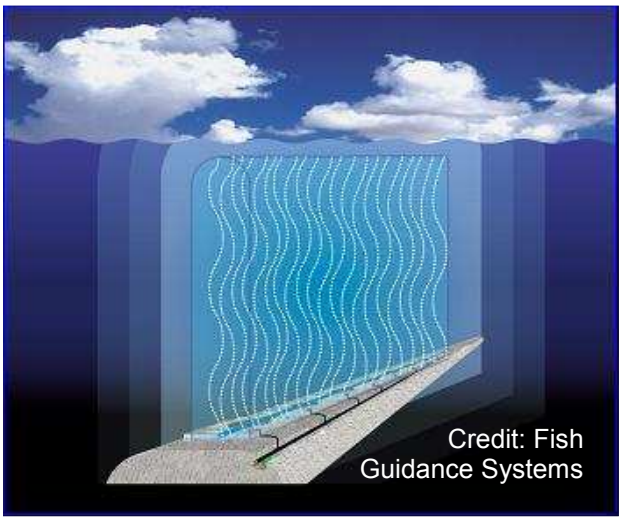
2. Support efforts to prevent spread of Asian carp from the Mississippi River basin into the Great Lakes using behavioral and/or physical fish barriers
3. Anticipate and address consequences of specific containment actions on native biological communities.

Additional recommendations to address this issue:

4. Pursue restoration of a physical fish barrier to prevent Asian carp from migrating upstream past St. Anthony Falls in the Mississippi River.
5. Encourage the ACOE to keep downstream locks closed when vessels have exited downstream.
6. Develop effective physical and behavioral barriers for controlling the movement of Asian carps
7. Evaluate the effectiveness afforded by alternative technical containment measures (i.e., physical and behavioral barriers).
8. Promote, support, and provide technical analysis and comment for the field testing of novel containment methods.

Discussion

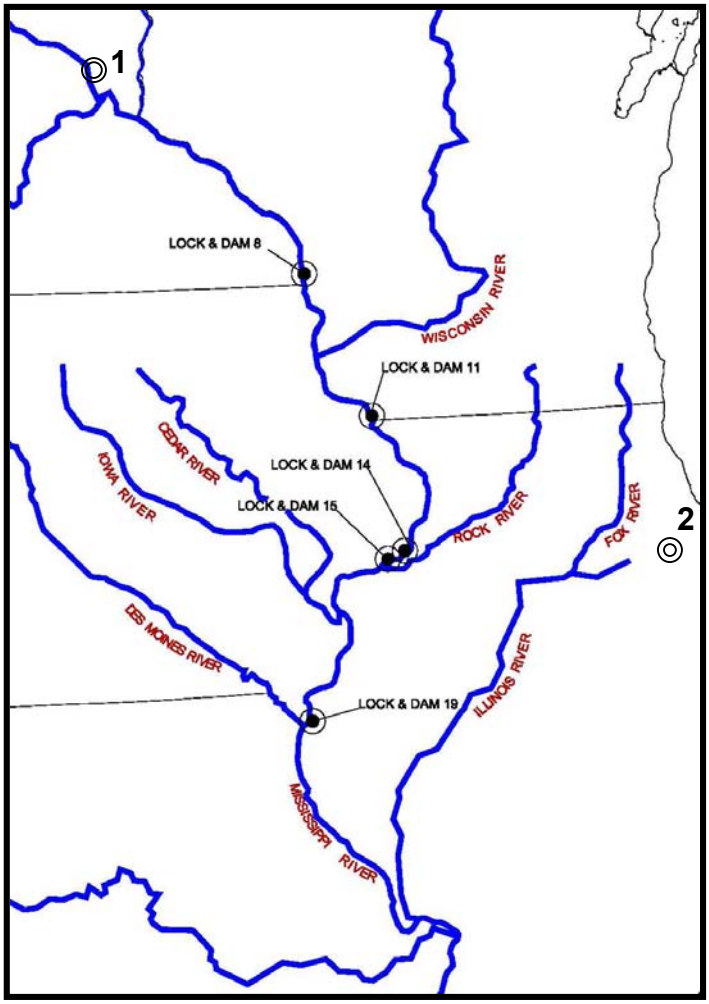
Behavioral barrier in Mississippi River - A feasibility study, funded by the states of Minnesota and Wisconsin and the USFWS, was conducted by a consulting firm to evaluate existing and new technologies that could be used for "stopping the northward movement" of Asian carps in the Upper Mississippi River (FishPro 2004). Both physical and behavioral barriers were evaluated. The study ranked sound projector array-based, acoustic bubble curtains (figure right) downstream of locks and dams as the most feasible and potentially most effective barrier to slow the spread of wild populations of Asian carps from infested areas of the Mississippi River. Several potential sites were suggested in the study due to their low frequency of flooding. Lock and Dam 11 is now the preferred location that is upstream of known populations of bighead and silver carp. The FishPro (2004) feasibility study and the national plan have matrices that provide information about types, costs, and efficacy of barriers that could be used.



The US Army Corp of Engineers (USACE) is authorized to construct and maintain locks and dams in the Upper Mississippi River. With the passage of the Water Resources Development Act by Congress in 2007, the USACE, "in consultation with appropriate Federal and State agencies, shall study, design, and carry out a project to delay, deter, impede, or restrict the dispersal of aquatic nuisance species into the northern reaches of the Upper Mississippi River system. The Secretary shall complete the study, design, and construction of the project not later than 6 months after the date of enactment of this Act." While the act authorizes $4 million, Congress has not provided funding to carry out the project. It has been three years since this project was first proposed and the window of opportunity is closing as populations of bighead and silver carp move closer to Minnesota.

There are other issues related to this strategy. The recommended technologies have not been tested in rivers the size of the Mississippi River. It would be beneficial to test the proposed technology in various scenarios. The proposed behavioral barrier would be experimental in the potential location and therefore, similar to the first electrical fish barrier in Chicago, would be a demonstration project. Demonstration projects of this type are operated for relatively short

periods of time (less than 3-years) to test new technologies. If after testing, the project is considered beneficial, additional authorization and appropriation would be required to install, operate and maintain permanent deterrent systems. The responsibility for operation and maintenance of these systems could fall upon other federal agencies or on the non-federal project sponsor. If the project was ineffective and populations of Asian carp become established upstream of the barrier, it could be decommissioned or moved to another upstream location.



While much could be learned from a demonstration project of this type, over the long term, this technology in combination with a lock and dam is unlikely to prevent all upstream spread of Asian carp.

Physical barrier in Mississippi River - The window of opportunity to stop the migration of Asian carp into the lower reaches of the Mississippi River in Minnesota using behavioral barriers may be closing, yet there could be opportunity to prevent Asian carp from invading the upper portions of the Mississippi River. St. Anthony Falls, on the Mississippi River in Minneapolis (see No. 1 on map), was an effective, natural fish barrier for about 10,000 years (Eddy, Moyle, and Underhill 1963). Historically, there were 123 fish species known to be present below the falls, but only 64 species upstream of it. In the early 1960s, a lock system was constructed at St. Anthony Falls to allow upstream navigation, thereby eliminating the fish barrier.

The Coon Rapids Dam is now the de-facto barrier to upstream migration of fish that were formerly blocked by St. Anthony Falls; however, this is a manmade structure that will likely be breached some day. When and if the Coon Rapids Dam is breached, fish, including Asian carp, will have further access to the Upper Mississippi River and major tributaries, such as the Rum River. There are other dams above Coon Rapids that will impede upstream migration of fish, but these too are manmade structures that are vulnerable to being breached in the future. If Asian carp can gain access to the Rum River, they could spread to Mille Lacs Lake some day.

It would be desirable to explore the feasibility of restoring St. Anthony Falls to be the effective fish barrier it once was. While this would eliminate navigation past the falls, it would prevent upstream migration of Asian carp and other invasive fish species that will undoubtedly show up in the lower Mississippi River in future years. A project of this type would affect the shipping industry and would need involvement and approval of many entities, particularly the USACE.

Barriers in Illinois – Many natural resources managers and entities in the Great Lakes region are concerned about the potential introduction of Asian carps into the Great Lakes through the

Chicago Sanitary and Ship Canal that connects the Illinois River with Lake Michigan (see No. 2 on map). Bighead carp have been collected from the Illinois River within 45 miles of Lake Michigan. The Chicago Sanitary and Ship Canal is the key to stopping large numbers of Asian carp from dispersing into Lake Michigan and the other Great Lakes. An initial dispersal barrier (Barrier I) was constructed on the Chicago Sanitary and Ship Canal as a demonstration project. It is intended to deter fish movements in the canal by repelling them with electroshock. The manufacturer estimates the barrier's efficiency in the mid 80% range, and has stated a need for two or three more such barriers downstream to gain 100% efficiency. Funding has been an ongoing issue both for construction and operation of the barriers. The Water Resource Development Act of 2007, recently passed and if enacted would authorize funds for: (1) improvements to Barrier I to make it "permanent;" (2) full federal funding for the construction, operation, and maintenance of Barrier II; and (3) reimbursement of the eight Great Lakes states that contributed the non-federal funds for construction of Barrier II. It is in Minnesota's interest to support completion of effective barriers to help prevent the establishment of Asian carp populations in the Great Lakes. Other more effective technologies such as the creation of a 3-5 mile anaerobic zone in the canal should be investigated, as should the construction of a physical dam or levee to separate the two ecosystems.

New Technology - In addition to evaluating and applying existing technologies, research is needed to explore innovative methods to contain feral Asian carp populations and prevent their further spread.

Evaluation – For a number of reasons, evaluation of the barrier technology should be undertaken to determine effectiveness in preventing passage of target species and to determine the impacts to non-target species and ecosystems. Natural resources managers and decision makers must consider the negative effects that may be associated with containment actions. In addition to the desired effects on Asian carps, planning, design, and evaluation of containment measures must anticipate and address the probable consequences to native fish communities. Planners must do their best to determine if the consequences of containment actions are too great for the future sustainability and health of native aquatic resources before projects are implemented. Containment actions implemented without due consideration of the consequences to native communities may do more harm than good.

SPREAD VIA WILD-CAUGHT BAITFISH

Description of Issue

The national plan identified activities related to wild-caught baitfish as a high-priority pathway. The plan states,

> ***"****The transport and release of wild-caught baitfish by anglers and commercial dealers represents one of the highest risk pathways for introduction of Asian carps because live fish can easily be released into new waters. To the untrained eye, juvenile bighead and silver carps can be difficult to distinguish from some species of native baitfish (e.g., gizzard shad). These species have been documented in high abundances in some locations throughout the Mississippi River Basin (e.g., tailwaters and backwaters). Because of their abundance and natural behavior, juvenile bighead and silver carps may be collected with, or in place of, native bait fish. Although less likely to be collected than bighead and silver carps, juvenile grass carp may be collected with wild-harvested native baitfish. Dumping or releasing unwanted, unused live baitfish is a pathway of concern for any aquatic nuisance species. Effective information programs, regulations, and enforcement are all essential components for controlling this pathway."*

Current Minnesota strategies

Several state actions have been taken or are ongoing to support the following strategies related to this issue:

In place:

9. Prohibit import of live baitfish (M.S. 97C.515).
10. Prohibit release of live bait into state waters (M.S. 97C.205, 17.4985, 17.4986).
11. Prohibit import, possession, sale, purchase, and introduction of Asian carp (M.S. 84D and M.R. 6216).

Ongoing:

12. Provide information to anglers about state laws related to prohibited invasive species and live bait, and the precautions to take... (e.g., Bighead and Silver Carp Watch Card, Help Stop Aquatic Hitchhikers! signs, Section in the fishing regulation booklet).

Credit: Minnesota Sea Grant

Additional recommendations to address this issue:

13. Develop and provide information to commercial and recreational baitfish harvesters that will help prevent accidental and deliberate unauthorized introductions of Asian carp.

Discussion

This issue is important to address because of the similarity in appearance between young Asian carp and some native baitfish species. Minnesota does not allow commercial or noncommercial import of baitfish except by permit, although there is an exception in state regulations for minnows to be imported for aquarium use. This exception could be a potential pathway.

IMPORTATION

Importation from outside the US into Minnesota is possible, but is not one of the more likely means of introduction to state waters. Since there are fertile stocks of bighead, grass, and silver carps available from the wild and bighead, black, and grass carp broodstock are available from a few commercial hatcheries, it is more likely that illegal import into the state may occur from within the US. Nonetheless, the Internet and mail service makes it easy to buy, sell, and even import live fish, including Asian carps. Interstate or international shipments of Asian carps would be difficult to detect and regulations that prohibit them in Minnesota are difficult to enforce.

Current Minnesota Strategies

State and federal actions have been taken or are ongoing to support the following strategies:

In place:

14. Prohibit import, possession, sale, purchase, and introduction of Asian carp (M.S. 84D and M.R. 6216; Federal injurious wildlife designation by USFWS for silver, large-scale silver, and black carp).

Ongoing:

15. Inform conservation officers about laws that apply to the import of live Asian carps, the importance of preventing the illegal import of Asian carps, and Asian carp identification.
16. State and non-governmental entities pursue and support passage of more comprehensive federal regulations to limit importation and interstate movement of Asian carp species through Congressional acts or additional designations of Asian carp as injurious wildlife by the USFWS.
17. Monitor markets for prohibited products and when found, conduct investigation to determine source.

Additional recommendations to address this issue:

18. Inform potential importers of applicable state and federal laws and associated risks with international shipments of live Asian carps.

Discussion

Training of conservation officers has occurred in 2007. An ongoing information campaign is needed to notify state conservation officers that Asian carps are prohibited invasive species in Minnesota and both state and federal regulations apply to their importation. Further, state officers should establish regular dialogue and work in partnerships with federal agents to prevent illegal imports of Asian carps. It will be necessary to develop and maintain current information that lists which Asian carps are legal or illegal to import into individual states, and applicable federal laws.

INCIDENTAL INCLUSION OF ASIAN CARPS IN SHIPMENTS OF FARM-RAISED FISH INTO THE STATE

One potential activity that could introduce Asian carp to the state's waters would be import of other fish species, such as catfish, to the state for stocking. The national plan states,

> *"Catfish and other species are sold live for use in non-aquaculture waters. If Asian carps are present in the aquaculture ponds from which the catfish and other species are harvested, it is possible to transport them to fishing ponds and lakes. Erdman (1984) reported that two silver carp were apparently stocked into golf course ponds as fingerlings mixed with grass carp. Other species have been accidentally introduced into new waters via public and private stockings (Simpson and Wallace 1982; Zuckerman and Behnke 1986). However, any Asian carps that might be present tend to be much larger than the other fish and are removed from the net prior to loading out fish. Size differences make the Asian carps relatively easy to detect, and removing them is a standard practice. In-pond grading technology is also available to replace hand sorting on farms."*
>
> *"Some black and grass carps may be stocked into catfish fingerling ponds. Bighead carp are stocked in catfish foodfish grow-out ponds, not stocker or fingerling ponds. It is possible for black or grass carps to be loaded unintentionally onto a truck for delivery to another catfish farm. Black carp are very susceptible to catfish harvesting operations and seine crews must be diligent in returning black carp to the pond (Avery et al. 2004). The grower has an incentive to retain the black and grass carps in their ponds because if they are loaded out, the grower would lose the aquatic vegetation and snail control provided by these species and would incur additional expense for replacement. The much larger size of the Asian carps makes it relatively easy to remove them from a net of catfish stockers during the loading process. However, additional labor is required to remove black carp when harvesting catfish, which results in extra labor and additional costs to the farm (Venable et al. 2000; personal communication, Anita Kelly, Southern Illinois University)."*

Current Minnesota Strategies

State actions have been taken or are ongoing to support the following strategies.

<u>In place:</u>

19. Include requirements in DNR Fisheries contracts for the purchase of fish for stocking and also conditions in importation permits for commercial import of farm-raised fish. The requirements specify that the imported fish must come from fish farms that do

not contain aquatic invasive species. These requirements should address both DNR and non-DNR importation of farm-raised fish.

Additional Recommendations to address this issue:

20. Review Standard Operating Procedures [for fish farming] and recommend Best Management Practices that include requirements for suppliers and purchasers to conduct inspections of fish prior to shipment and release.
21. Conduct random inspections of live fish shipments into and within the state.

Discussion

Import of farm-raised fish is a relatively small-scale activity in Minnesota, but it is relatively high risk and one event could lead to introduction of Asian carp if precautions are not taken. DNR Fisheries imports catfish into the state from fish farms in other states that may allow use of Asian carp in fish farms. Aquaculture businesses in the state may request permits to import fish from fish farms in other states. Both DNR and commercial import of fish should address the risk of incidental contamination of shipments from fish farms in other states.

UNAUTHORIZED RELEASES BY INDIVIDUALS

There is potential for accidental and deliberate unauthorized release of Asian carps into Minnesota's waters. The national plan describes the issue as follows:

> *"One pathway is cultural, ceremonial, or symbolic releases related to special events. It has been a long tradition in some Southeast Asian cultures to release fish as a way to recognize very special events (e.g., birth of child, funerals, or New Year celebrations; personal communication, Josee Cung, Minnesota Department of Natural Resources). There are most likely two levels of this practice in the United States. One is the release of small, easy to obtain fish, from pet or bait stores, into small ponds at temples for ceremonial reasons. This does not appear to be a likely pathway for Asian carp introductions. A second pathway is catching and subsequently releasing wild-caught fish. It is a cultural practice among some religious groups to release fish as a symbolic token. This generally occurs with wild-caught fish and not with fish purchased live at a fish market. However, fish markets could provide a source for live Asian carps in locations where they are not present in the wild. While releases are usually done infrequently by an individual or individual family (every 5-15 years; personal communication, Josee Cung, Minnesota Department of Natural Resources), the cumulative effect of many individual actions over time elevates the risks associated with this pathway."*

It was reported that members of a Twin Cities area Korean Methodist Church conducted "at least two fish releases" (goldfish, maybe others) into the Mississippi River. (Personal communication Douglas A. Jensen, January 2007).

Another potential pathway in many parts of the country is the retail sale of live Asian carps as food fish. Many retail grocers within ethnic communities have specialized market sales of live Asian carps. Consumers within these markets prefer to purchase live Asian carps rather than dead or even freshly killed fish (Kerr et al. 2005). The sale of live fish within these markets has created considerable concern over potential unauthorized introduction enough so that some large cities have promulgated local laws that require Asian carps sold live by a retail grocer to be slaughtered upon sale. It is not known if this is occurring in Minnesota. A survey of Asian markets in the past did not reveal the sale of Asian carp in the Twin Cities area for food fish. More information is needed to fully assess this potential pathway of introduction in Minnesota.

Current Minnesota Strategies

State actions have been taken to support the following strategies related to this issue.

In place:

22. Prohibit import, possession, sale, purchase, and introduction of Asian carp (M.S. 84D and M.R. 6216).

Additional recommendations to address this issue:

23. Use educational campaigns such as Habitattitude™ to convey messages to the public that they should not release live fish including Asian carps.
24. Develop an information module and provide materials to producers, growers, marketers, and food fish consumers of live Asian carps that will help prevent accidental and deliberate unauthorized introductions.

Discussion

Identifying effective outreach methods to change behaviors to reduce the risks of accidental and deliberate unauthorized introductions of Asian carps will be challenging. DNR has recognized in the past that language differences may require the need for both verbal and written translations. Sea Grant Programs in the east coast states have developed foreign language materials that address the release of fish intended for human consumption.

CONCLUSION / SUMMARY

For many years, DNR has been very concerned about the threat Asian carp pose to the state's aquatic resources. Our conclusions, based on past state efforts, involvement at regional and national levels, and discussion within the state, are that preventing the introduction of Asian carp into Minnesota waters is daunting challenge. Asian carp are currently in the Mississippi river as far north as Iowa and are also poised to enter Lake Michigan through the Chicago Sanitary and Ship Canal. There are also four other types of high-priority potential pathways of introduction to state waters that we have described.

While the State desires to interrupt these pathways to Minnesota waters, preventative actions depend in part upon efforts of other states, federal agencies and Congress. Some of the strategies considered in this plan have limited potential or may not be implemented in time to be effective due to issues beyond the state's control. Others that are implemented may only provide temporary benefits and are unlikely to be successful over the long-term.

Prevention efforts, however, have the potential to delay the introduction or limit the spread of Asian carp, providing immediate environmental, economical and social benefits. Delaying the introduction of Asian carp would allow the State to consider alternative management strategies such as habitat improvement for native species. Recognizing the scale of challenge and these obstacles, this plans lays out the best options to attempt to curb the introduction of Asian Carp into Minnesota.

In the future, the state may need to focus on how to best address Asian carp that are in Minnesota waters. As with prevention, much thought and discussion have gone into developing strategies in the national plan for management and control of Asian carp. That plan is a resource for addressing management and other states that have populations of Asian carp in their waters are gaining experience that will be valuable to Minnesota if and when we face the issue of how to manage Asian carp. To prepare for the future, it will be important to keep Minnesota's aquatic resources in the best shape possible, so that native species and ecosystems have the best chance to compete with Asian carp.

IMPLEMENTATION TABLE

Action Number	Action Description	Status	Lead (potential lead)	Cooperators	Range of Cost	Funding Source (potential)	Scale/ Location	Timeline
Spread of Wild Populations via Interstate Waters								
1	Pursue development and installation of behavioral fish barriers in Mississippi River	Ongoing	USACE & DNR / MN Congressional Delegation	WIDNR, IADNR, USFWS	High	WRDA – Authorization of $4M if enacted; No appropriation yet	Minnesota Iowa Wisconsin	ASAP
2	Support use of behavioral and/or physical fish barriers to prevent introduction into the Great Lakes	Ongoing	USACE – Chicago District	DNR	Moderate (DNR Invested $67,000 as state match)	DNR - Invasive Species Program	Great Lakes States	Ongoing
3	Anticipate and address consequences of specific containment actions on native biological communities.	Ongoing	DNR	USFWS, USACE	Low		Interstate and state waters	Prior to initiating contain-ment
4	Pursue restoration of a physical fish barrier to prevent Asian carp from migrating upstream past St. Anthony Falls in the Mississippi River.	New	(USACE)	DNR	High	Undetermined	Statewide	Undeter-mined
5	Encourage the ACOE to keep downstream locks closed when vessels have exited downstream.	New	DNR	USACE	Low	USACE operations	Corps District	ASAP
6	Evaluate the effectiveness afforded by alternative technical containment measures (i.e., physical and behavioral barriers).	New	Undetermined	DNR, USFWS, USACE	Undetermined	Undetermined (possibly WRDA appropriation)	Waterway	During operation of barriers
7	Develop effective physical and behavioral barriers for controlling the movement of Asian carps	New	Undetermined (U of M)	Undetermined	Moderate	Undetermined (LCCMR, Congress, USFWS)	Waterway	ASAP

Action Number	Action Description	Status	Lead (potential lead)	Cooperators	Range of Cost	Funding Source (potential)	Scale/ Location	Timeline
8	Promote, support, and provide technical analysis and comment for the field testing of novel containment methods.	New	Undetermined (U of M)	Undetermined	Moderate	Undetermined (LCCMR, Congress, USFWS)	-	ASAP
Spread via Wild-caught Baitfish								
9	Prohibit import of live baitfish and enforce the prohibition	In place (M.S. 97C.515)	DNR	-	Low	Program funds	Statewide	Ongoing
10	Prohibit release of live bait into state waters	In place (M.S. 97C.205, 17.4985, 17.4986).	DNR	-	None	-	Statewide	Ongoing
11	Prohibit import, possession, sale, purchase, and introduction of Asian carp	In place (M.S. 84D and M.R. 6216).	DNR	USFWS	None	-	Statewide	Ongoing
12	Provide information to anglers about state laws related to prohibited invasive species and live bait, and the precautions to take	Ongoing	DNR	Minnesota Sea Grant, USFWS	Low	Program funds	Statewide	Ongoing
13	Develop and provide information to commercial and recreational baitfish harvesters	New	DNR	Minnesota Sea Grant	Low	Program funds	Statewide	
Importation								
14	Prohibit import, possession, sale, purchase, introduction of Asian carp	In place (M.S. 84D and M.R. 6216)	DNR	USFWS – injurious wildlife	None	-	Statewide	Ongoing

Action Number	Action Description	Status	Lead (potential lead)	Cooperators	Range of Cost	Funding Source (potential)	Scale/ Location	Timeline
15	Inform conservation officers about import laws, the importance of preventing import, and Asian carp identification.	Ongoing	DNR	USFWS	Low	Program funds	Statewide	Ongoing
16	Pursue and support passage of more comprehensive federal regulations to limit importation and interstate movement	Ongoing	State	NGOs	None	-	National	ASAP
17	Monitor markets for prohibited products and when found, conduct investigation to determine source and address.							
18	Inform potential importers of applicable state and federal laws and associated risks with international shipments of live Asian carps.	New	DNR	Undetermined	Low	Program funds	Statewide	ASAP
Incidental Inclusion of Asian Carps in Shipments of Farm-raised Fish into the State								
19	Include requirements in DNR Fisheries contracts for the purchase of farm-raised fish and also conditions in commercial importation permits	Ongoing	DNR		Low	DNR staff time		Ongoing
20	Review Standard Operating Procedures [for fish farming] and recommend Best Management Practices that include requirements for suppliers and purchasers to conduct inspections of fish prior to shipment and release.	New	USFWS	DNR	Low	-		Undeter-mined

Action Number	Action Description	Status	Lead (potential lead)	Cooperators	Range of Cost	Funding Source (potential)	Scale/ Location	Timeline
21	Conduct random inspections of live fish shipments into and within the state.	Ongoing	DNR	USFWS for international shipments	Low	Program funds	Statewide	Ongoing
Unauthorized Releases by Individuals								
22	Prohibit import, possession, sale, purchase, and introduction of Asian carp	In place (M.S. 84D and M.R. 6216).	DNR	USFWS	None	-	Statewide	Done
23	Use educational campaigns such as Habitattitude™ to convey messages to the public that they should not release live fish including Asian carps.	Ongoing	DNR	Minnesota Sea Grant	Low	Program funds	Statewide	Ongoing
24	Develop an information module and provide materials to producers, growers, marketers, and food fish consumers that will help prevent accidental and deliberate unauthorized introductions.	New	DNR	Undetermined	Low	Program funds	Statewide	ASAP

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Appendix A. Summary of the prevention related strategies and recommendations, by Goal, included in the national plan (Connover, Simmonds, and Whalen 2007) for managing and controlling Asian carp in the United States.

Note: In the column titled Applicability to Minnesota, several of the recommendations in the national plan are listed as "not applicable" because Minnesota already prohibits the import, possession, sale, purchase, transport, and propagation of grass carp.

Goal 1: Prevent accidental and deliberate unauthorized introductions of bighead, black, grass, and silver carps in the United States.	
National Strategies and Recommendations	**Applicability to Minnesota**
Strategy 3.1.1. Take actions to prevent the collection, transport, release, and improper disposal of Asian carps that may be intermixed with live wild-harvested baitfish.	
3.1.1.1. Assist states to develop, promulgate, and enforce regulations that manage the harvest, transport, import, trade, and release of live wild-harvested aquatic bait.	• Import banned in MN • Harvest banned from infested waters in MN
3.1.1.2. Explore the use of baitfish grown in monoculture, and certified to be disease-free and uncontaminated by other aquatic species.	• Import into Minnesota is prohibited • Only one minnow dealer is conducting trials with monoculture of baitfish
3.1.1.3. Develop and provide information to commercial and recreational baitfish harvesters that will help prevent accidental and deliberate unauthorized introductions of Asian carps.	• Signs, brochures, and fish regulations booklet, contain the message to dispose of bait in trash
Strategy 3.1.2. Take actions to prevent the stocking of diploid Asian carps into non-aquaculture waters for biological control.	
3.1.2.1. Encourage states to develop regulations that prohibit the stocking of any diploid Asian carps into non-aquaculture waters for biological control.	• Import and stocking is prohibited in MN
3.1.2.2. Remove or contain diploid Asian carps that have been previously stocked into non-aquaculture waters for biological control.	• Not applicable – no known populations in MN
Strategy 3.1.3. Take actions to prevent illegal sale, shipping, and stocking of diploid grass carp as triploid grass carp.	
3.1.3.1. Encourage states that allow the legal importation of grass carp to adopt consistent, uniform regulations that allow only certified triploid grass carp to be shipped or stocked.	• Not applicable; all grass carp are already prohibited in MN (M.R. 6216)
3.1.3.2. Encourage states to conduct routine and random inspections of all live grass carp shipments within the state.	• Not applicable in MN
3.1.3.3. Encourage the USFWS to provide ploidy determination for states conducting inspections of grass carp shipments.	• Not applicable in MN

Strategy 3.1.4. Take actions to prevent the shipment of live black carp in grass carp shipments.	• Not applicable; grass and black carp are prohibited in MN (M.R. 6216)
Strategy 3.1.5. Take actions to address stocking triploid Asian carps into non-aquaculture waters for biological control.	
3.1.5.1. Encourage states to prohibit stocking triploid bighead, black, and silver carps for biological control in non-aquaculture waters.	• Not applicable; these carp are already prohibited in MN (M.R. 6216)
3.1.5.2. Encourage states to allow stocking triploid grass carp for biological control in non-aquaculture waters only within watersheds where grass carp are already present in the wild.	• Not applicable; all grass carp are already prohibited in MN (M.R. 6216)
3.1.5.3. Remove or contain triploid Asian carps that have been previously stocked in non-aquaculture waters within watersheds where the fish are not currently self-sustaining in the wild.	• Not applicable in MN; no populations are known to exist in MN
Strategy 3.1.6. Take actions to ensure that stocking triploid grass carp for biological control does not result in accidental or deliberate unauthorized introductions of diploid grass carp.	
3.1.6.1. The USFWS should seek an independent scientific review and evaluation of the Triploid Grass Carp Inspection and Certification Program.	• Not applicable in MN
3.1.6.2. Develop and provide information on the USFWS Triploid Grass Carp Inspection and Certification Program.	• Not applicable in MN
Strategy 3.1.7. Take actions to prevent the transport and release of Asian carps by commercial vessels and recreational watercraft.	
3.1.7.1. Investigate fully the risks associated with ballast water transfers or other means of water transfer by commercial vessels and recreational watercraft.	• Low probability and priority for MN
3.1.7.2. Inform boaters, barge operators, and others of the risks of moving infested water and encourage voluntary actions to reduce this risk.	• Low priority for MN
Strategy 3.1.8. Take actions to prevent the unintentional transport, release, or disposal of Asian carps by natural resources managers during management activities.	
3.1.8.1. Natural resources managers should employ pathway management tools, such as Hazard Analysis and Critical Control Point planning in the review of Standard Operating Procedures, to prevent introductions of Asian carps through natural resources management related pathways.	• DNR Operational Order is on invasive species in process
3.1.8.2. Develop and provide information to natural resources managers and field staff that will help prevent unintentional introductions and spread of feral Asian carps.	• Not applicable; no feral populations in MN
Strategy 3.1.9. Take actions to prevent the illegal importation and prohibit the legal importation of live bighead, black, grass, and silver carps into the United States.	

3.1.9.1. Prohibit international importation of Asian carps under federal and state regulations, except for research purposes under a controlled permit.	• Black, silver and large-scale silver carp are designated as federal injurious wildlife • All bighead, black, grass, and silver are prohibited invasive species in MN (M.R. 6216)
3.1.9.2. Inform USFWS Law Enforcement Officers, other federal inspectors, and state conservation law enforcement officers about laws that apply to the import of live Asian carps, the importance of preventing the illegal import of Asian carps, and Asian carp identification.	• DNR Conservation Officers received training in 2007 • More DNR enforcement capacity will be added in 2008
3.1.9.3. Inform potential importers of applicable state and federal laws and associated risks with international shipments of live Asian carps.	• Applicable; include in new recommendations
3.1.9.4. Increase the numbers of trained USFWS Law Enforcement Officers and increase physical inspections of international shipments of live fish and eggs at designated or non-designated ports of entry.	• Not applicable to states
Strategy 3.1.10. Take action to prevent the incidental inclusion of live Asian carps in international imports with other fishes.	• Low probability and priority for MN
Strategy 3.1.11. Take actions to prevent the unintentional escape, release, or improper disposal of Asian carps from aquaculture facilities at poorly sited locations.	
3.1.11.1. Urge the development and enforcement of state regulations that prohibit the production of Asian carps at poorly sited facilities.	• Not applicable in MN, Asian carp are not allowed in the state
3.1.11.2. Develop and provide information to Asian carp producers and growers that will help upgrade poorly sited facilities such that they are no longer high-risk to contain farm-raised carps and prevent accidental introductions.	• Not applicable in MN; all species are prohibited
Strategy 3.1.12. Develop an active research initiative to identify alternatives to the use of Asian carps.	
3.1.12.1. Form a coordinating research group that includes representatives from the aquaculture industry, the ethnic retail grocer industry, marketing scientists and developers, and aquaculture scientists to focus research efforts on the highest priority alternatives to the use of Asian carps.	• Not applicable in MN; they are not used here
3.1.12.2. Develop an information module on economic and effective alternatives to replace the use of bighead and black carps on aquaculture facilities.	• Not applicable in MN; they are not used here
Strategy 3.1.13. Take actions to prevent the incidental inclusion of Asian carps in aquaculture shipments of other farm-raised species to non-aquaculture waters.	
3.1.13.1. Review Standard Operating Procedures and recommend Best Management Practices that include requirements for suppliers and purchasers to conduct inspections of fish prior to shipment and release.	• Applicable; include in MN prevention plan

3.1.13.2. Encourage states to develop regulations that allow for random inspections of live fish shipments into and within the state.	• In place for shipments to or within the state; not in place for interstate shipments through the state.
3.1.13.3. Encourage states to develop, coordinate, and make available on-line databases of aquaculture facilities that culture bighead, black, grass, or silver carps.	• Not applicable in MN
3.1.13.4. Prohibit the use of surface waters containing Asian carps from being used in aquaculture facilities unless effective treatment is in place with a monitoring program.	• Not applicable in MN
Strategy 3.1.14. Reduce potential risks of continued use of Asian carps on properly sited aquaculture facilities to the environment.	
3.1.14.1. Review Standard Operating Procedures and develop Best Management Practices for properly sited aquaculture facilities.	• Not applicable in MN
3.1.14.2. Encourage states to prohibit the use of grass carp on aquaculture facilities within watersheds where grass carp are not present in the wild.	• Not applicable in MN, grass carp are prohibited
3.1.14.3. Encourage states to restrict the use of grass carp to certified triploids only on aquaculture facilities within watersheds where grass carp are present but not reproducing.	• Not applicable in MN, all grass carp are prohibited
3.1.14.4. States should encourage the use of only certified triploid grass carp on aquaculture facilities within watersheds where grass carp are self-sustaining in the wild.	• Not applicable in MN
3.1.14.5. Verify functional sterility of triploid bighead carp and develop a triploid certification program for bighead carp.	• Not applicable in MN
3.1.14.6. Encourage states to prohibit the use of bighead carp on aquaculture facilities within watersheds where bighead carp are not self-sustaining in the wild.	• Not applicable in MN
3.1.14.7. Encourage states to restrict the use of bighead carp on aquaculture facilities within watersheds with self-sustaining populations to certified triploids only.	• Not applicable in MN
3.1.14.8. Encourage states to prohibit the use and production of silver carp on aquaculture facilities.	• Not applicable in MN
3.1.14.9. Encourage states to prohibit the use and production of diploid black carp on aquaculture facilities.	• Not applicable in MN, black carp are prohibited
Strategy 3.1.15. Take actions to prevent the live transport of wild-caught Asian carps and potential introduction through release, improper disposal, or escape.	
3.1.15.1. Where legal for commercial or recreational fishers to possess Asian carps, encourage states to prohibit the possession of live wild-caught Asian carps.	• Not applicable in MN
3.1.15.2. Review Standard Operating Procedures and actions of commercial fishers to identify Best Management Practices that reduce risks of live transport and introduction.	• Not applicable in MN

3.1.15.3. Develop an information module and provide materials to commercial and recreational fishers and commercial live haulers that will help prevent accidental and deliberate unauthorized introductions of Asian carps.	• Not applicable in MN
Strategy 3.1.16. Take actions to prevent the release, escape, or improper disposal of domestic commercial shipments of live Asian carps.	
3.1.16.1. Require informational labeling of truck and invoice for shipments of Asian carps to avoid improper handling and potential introduction of fish that may be involved in an accident (e.g., "Nonnative fish: Unauthorized release prohibited").	• A national issue
3.1.16.2. Review Standard Operating Procedures and develop Best Management Practices for fish haulers regarding containment and water transfer.	• Not applicable in MN
3.1.16.3. Prohibit the use of water from natural water bodies for water exchange during transport.	• Important, but difficult to implement with intrastate shipments
3.1.16.4. Investigate improvements for containment methods on trucks carrying Asian carps.	• Not applicable in MN
3.1.16.5. Encourage states to require the approval of pre-planned routes for commercial shipments of live Asian carps.	• Somewhat applicable; unclear how to implement
3.1.16.6. Develop an information module and provide materials to commercial transporters of live farm-raised Asian carps that will help prevent accidental and deliberate unauthorized introductions.	• Not applicable in MN
Strategy 3.1.17. Reduce the potential risk to the environment from continued commercial, domestic transport of live farm-raised Asian carps.	• Not applicable in MN
Strategy 3.1.18. Take actions to prevent the accidental and deliberate unauthorized release of Asian carps by individuals.	
3.1.18.1. Encourage states to prohibit the sale, live transport, and unauthorized release of live Asian carps for non-commercial uses.	• Applicable; already prohibited invasive species in MN
3.1.18.2. Encourage states that allow sales of live Asian carps for human consumption to require retail grocers to kill the fish using prescribed humane methods, immediately upon sale.	• Not applicable in MN
3.1.18.3. Use educational campaigns such as Habitattitude™ to convey messages to the public that they should not release live Asian carps.	• Applicable; Minnesota DNR and Sea Grant have become Habitattitude partners and are spreading its message in Minnesota, but a comprehensive campaign is needed
3.1.18.4. Develop an information module and provide materials to producers, growers, marketers, and foodfish consumers of live Asian carps that will help prevent accidental and deliberate unauthorized introductions.	• Applicable; include in MN prevention plan
3.1.18.5. Promote the national Aquatic Nuisance Species Hotline and encourage the general public to report illegal possession or stocking of Asian carps and other activity that could effect an introduction or rapid response.	• DNR will look into this recommendation

Strategy 3.1.19. Take actions to prevent the release, escape, or improper disposal of Asian carps by aquarium/hobby industry importers, wholesalers, and retailers.	
3.1.19.1. Encourage states to prohibit the trade of Asian carps for aquaria and hobby purposes.	• Already prohibited invasive species in MN
Strategy 3.1.20. Prevent the release, escape, or improper disposal of live Asian carps via education facilities and projects, including schools, public aquaria, and research facilities.	
3.1.20.1. Urge states to develop and enforce regulations to reduce risks associated with the possession and disposal of Asian carps for research and exhibition purposes**.**	• Already prohibited invasive species in MN; permits are required for research and education
3.1.20.2. Develop an information module and provide materials to the academic and research communities that will help prevent accidental and deliberate unauthorized introductions of Asian carps.	• DNR permits are required and would include conditions that address this.
3.1.20.3. Encourage states to prohibit the trade of live Asian carps by commercial biological supply companies.	• Already prohibited invasive species in MN
Strategy 3.1.21. Take action to prevent the transport and release of adult sized (non-baitfish) Asian carps by boaters, anglers, and bowfishers.	
3.1.21.1. Develop an information module and provide materials to recreational fishers and boaters that will help prevent accidental and deliberate unauthorized introductions of Asian carps.	• Applicable; ongoing effort can be expanded
Goal 2: Contain and control the expansion of feral populations of bighead, black, grass, and silver carps in the United States.	
Strategy 3.2.1. Develop a national strategy and guidelines for science-based decision making concerning the need for continued and additional containment measures.	
3.2.1.2. Evaluate the effectiveness afforded by alternative technical containment measures (i.e., physical and behavioral barriers).	• Applicable; include in MN prevention plan
3.2.1.3. Promote, support, and provide technical analysis and comment for the field testing of novel containment methods.	• Applicable; include in MN prevention plan
3.2.1.4. Anticipate and address consequences of specific containment actions on native biological communities.	• Applicable; ongoing need to include in MN prevention plan
Strategy 3.2.2. Take immediate actions to prevent interbasin transfers and limit intrabasin movements of feral Asian carp populations.	
3.2.2.1. Develop and implement redundant barrier systems within the Chicago Sanitary and Ship Canal to limit the unrestricted access of Asian carps to Lake Michigan.	• Applicable; MN has supported this and provided some funds; include in MN prevention plan
3.2.2.2. Develop and implement reasonable and effective measures that prevent the spread of Asian carps via canals, waterways, or other water diversions between basins.	• Applicable; include in Minnesota prevention plan

3.2.2.3. Construct and operate a Sound Projector Array-based acoustic bubble curtain fish deterrent at two locks and dams on the Upper Mississippi River to prevent the spread of Asian carps throughout the basin.	• Applicable; MN Governor's office, MN Congressional members, and DNR have sought federal funding for this; include in Minnesota prevention plan
3.2.2.4. Identify additional containment measures needed to limit intrabasin movements of feral populations of Asian carps within the Mississippi River and other basins where established.	• Applicable; include in MN prevention plan
Strategy 3.2.3. Minimize the range expansion and ecological effects of feral populations of Asian carps in conjunction with management actions to enhance aquatic environments for the sustainability of native biological communities.	
3.2.3.1. The USFWS and other natural resources management agencies should provide technical assistance and biological information to the USACE and participate in collaborative planning of fish passage and habitat restoration projects.	• Applicable; MN supports this; include in MN prevention plan
3.2.3.2. Require federal and state agencies to consider the potential range expansion and ecological effects of Asian carps when designing or reviewing water control structure projects and permits.	• Applicable
Goal 6: Conduct research to provide accurate and scientifically valid information necessary for the effective management and control of bighead, black, grass, and silver carps in the United States.	
Strategy 3.6.3. Develop effective methods to contain feral Asian carp populations and prevent their further spread.	
3.6.3.1. Develop effective physical and behavioral barriers for controlling the movement of Asian carps.	• Applicable; include in MN prevention plan

Appendix B – Review of applicable strategies and actions from draft Minnesota Invasive Species Plan being prepared by the Minnesota Invasive Species Advisory Council.

Strategies and Recommendations from State Invasive Species Plan	Status
Strategy I-1. Improve understanding of the potential risks associated with *nonnative species* and *pathways*.	
Action I1a. Identify known and additional nonnative species of concern, evaluate their level of risk, and ***rank***/***classify*** the **species**.	• Asian carp have been evaluated, ranked as severe threats and classified as prohibited invasive species
Action I1c. Identify known and additional **pathways** of introduction, evaluate their level of risk, and rank the relative level of risk of pathways on a continuing basis.	• This was done in the national Asian carp plan. It has been reviewed from the MN perspective for the MN prevention plan.
Strategy I-3. State Regulations - Review state regulations to optimize legal authority for prevention of the import and introduction of invasive species, while recognizing that regulations reflect unique agency approaches and needs.	
Action I3b. Review existing state regulations to identify gaps and needs.	• Applicable; state prevention regulations in place
Action I3c. Explore the need for new approaches or change in legal approach.	• New approaches could be considered, but are not apparent
Action I3d. Adopt effective rules or approaches as appropriate within each responsible agency to augment statutory approach.	• Applicable; Asian carp have been designated as prohibited invasive species in MN (M.R. 6216).
Strategy I-4. Federal Regulations - Seek and support more comprehensive and improved federal / international regulations regarding invasive species.	
Action I4a. State and non-governmental entities pursue and support passage of more comprehensive federal regulations through congressional members.	• Applicable; DNR has encouraged Congressional members and the USFWS to list black, bighead and silver as Injurious Wildlife Species; include in MN prevention plan
Strategy I-5. Federal and State Inspections and Enforcement - Continue inspections and enforcement of invasive species regulations and quarantines by state and federal agencies.	

Action 5b. Monitor markets for prohibited products and when found, conduct investigation to determine and close source	• Applicable; DNR has done some monitoring; more could be done; include in MN prevention plan
Action 5d. Investigate incidents when invasive species are found related to interstate shipments with trace back and trace forward actions to follow distribution chain and take appropriate safeguarding measures.	• Applicable; DNR and USFWS responsibility
Action 5e. Use DNR Conservation Officers to enforce M.S. 84D and M.R. 6216 and other applicable regulations according to an annual statewide Invasive Species Enforcement Plan.	• Ongoing
Strategy I-7. Research and Technologies - Improve technological options and strategic approaches, and work to implement appropriate standards that will help prevent introductions of invasive species into the state or connected watersheds (e.g., innovative ballast water management technology and technology for barriers in waterways, or alternatives to linking watersheds)	
Action a. Conduct, fund, or support research to develop new technologies to prevent/reduce the risks of new introductions of invasive species.	• Applicable; include in Minnesota prevention plan
Action b. Support the evaluation of available technology to prevent/reduce the risks of new introductions of invasive species.	• Applicable; include in MN prevention plan
Action c. Support use of best available technologies that could prevent the introduction of invasive species into the state. (e.g., development of technological standards)	• Applicable; include in MN prevention plan
Action d. Use methods such as Hazard Analysis and Critical Control Points (HACCP) to reduce risk of invasive species introduction through business and government operations.	• DNR is using similar approach; USFWS is using HACCP
Strategy I-8. Public Awareness - **Conduct effective outreach programs targeting people who could potentially introduce invasive species into the state**.	
Action a. Develop specific messages and actions for priority audiences (e.g., commercial horticultural trade, recreational boaters, commercial barge industry, biological supply houses, the pet trade especially. in aquatic organisms)**.**	• Applicable; Bighead and Silver Carp Watch cards have been developed and distributed; more messages for selected audiences should be developed and dispersed; include in MN prevention plan
Action c. Use enforcement according to the MN DNR statewide invasive species enforcement plan and watercraft inspectors to inform boaters entering state waters about invasive species, state regulations, and precautions for boaters.	• Ongoing
Strategy I-9. Regional Approaches - Seek interjurisdictional and watershed-wide cooperation and approaches to prevent introductions of potentially invasive species into watersheds that include Minnesota (e.g., Asian carp in other states, barriers in Illinois waterways).	• Ongoing; some interstate cooperative efforts have occurred