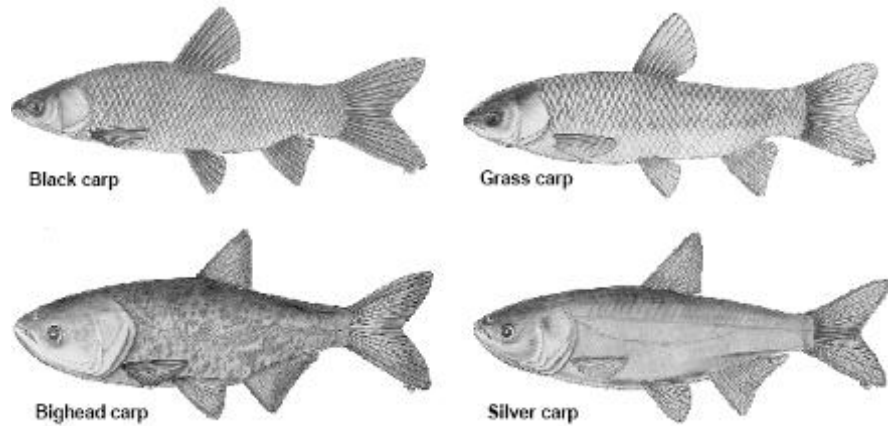


ASIAN CARP

Overview

Several species of carp native to Asia have been introduced into the United States. Species of particular concern include the black (*Mylopharyngodon piceus*), bighead (*Hypophthalmichthys nobilis*), grass (*Ctenopharyngodon idella*), and silver (*Hypophthalmichthys molitrix*) carp, collectively known as “Asian carp.” These nonnative fish species were imported into the United States and can cause significant ecological and economic impacts when introduced into natural water bodies, as demonstrated in the Mississippi River system. While self-sustaining populations of Asian carp have yet to be established in the Great Lakes ecosystem, many consider the threat of their invasion imminent.



Graphic: Matthew Thomas, Kentucky Department of Fish and Wildlife Resources

The introduction and spread of Asian carp into the United States have occurred through a variety of pathways, including use by and unintentional escapes from commercial activities and university research facilities, regulated stocking by government agencies, and unauthorized stocking by individuals. In the early 1990s, severe flooding allowed the escape of thousands of Asian carp into the Mississippi River system from aquaculture facilities. Upon introduction, Asian carp populations have thrived in the Mississippi River and connected waterways causing extensive impacts. The establishment of self-sustaining populations of Asian carp in the Mississippi River has led to their migration toward Lake Michigan through the Illinois River and the Chicago Sanitary and Ship Canal (CSSC). To prevent Asian carp from entering Lake Michigan and the rest of the Great Lakes, an aquatic invasive species (AIS) electrical dispersal barrier system has been constructed in the CSSC, operating approximately 25 miles southwest of Lake Michigan. To determine the leading edge of Asian carp populations in the Chicago Area Waterways System (CAWS), intensive monitoring is being conducted, including screening for the genetic material, or environmental DNA (eDNA), of the bighead and silver carp as well as conventional sampling for actual specimens. The eDNA of bighead and silver carp has been detected in water samples taken throughout the CSSC and from Calumet Harbor in Lake Michigan. In addition, a live, adult bighead carp was collected in Lake Calumet in June 2010. Overall, these results suggest that Asian carp are approaching Lake Michigan.

Asian carp pose a threat to the Great Lakes given their potential for rapid growth, consumption of vast quantities of food, and prolific reproduction. These fish can weigh up to 100 pounds, depending on the species, and can grow to a length of more than four feet. They have a broad climate tolerance and are particularly well-adapted to that of the Great Lakes region. Asian carp are voracious, nonselective feeders, adapting their diets to their environment, consuming a wide range of zooplankton, phytoplankton, algae, and detritus at a daily rate of two to three times their body weight. Since the Asian carp’s diet overlaps with that of certain native species, they may be strong ecological competitors with the potential to displace and/or consume native populations of fishes, plants mollusks, and other invertebrates, causing devastating ecological and economic impacts to the valuable Great Lakes fisheries.

Identification

Black carp exhibit a body shape that is large, elongated, and slender. The coloration of the black carp is brown to black along the spine, fading to white along its belly with a gold sheen. The body is covered with large, circular scales. The head is pointed with a flattened front and a small, toothless mouth. The black carp has large throat teeth, resembling human molars, which are adapted to crushing mollusk shells. Black carp adults can exceed 5.9 feet in length and 150 pounds in weight.

Grass carp have a body shape similar to black carp that is large, elongated, and slender. Coloration of the body varies from black to olive brown, grading to brassy or silvery white on the sides and belly. The scales are large, circular in shape, and outlined with a dark pigment, giving a cross-hatched effect. The head is slightly flattened with moderately small eyes centered on the side of the head and a toothless mouth. Grass carp have small, comb-like teeth that are best suited for consuming vegetation. In the United States, this species is often used as a biological control for aquatic vegetation. Grass carp can grow up to 5.2 feet in length and 80 pounds in weight.

Bighead carp are large and deep-bodied, with a very large head. Coloration of the body is dark gray, fading to white toward the underside, and with dark blotches on the sides. Its head has no scales, a large mouth with no teeth, and a protruding lower jaw. Its eyes are located far forward and low on its head. It is very similar to the silver carp, and can be distinguished by the dark coloration on its sides. Bighead carp can grow to lengths of 5 feet and weigh up to 88 pounds.

Silver carp, similar in body shape to the bighead carp, are also large and deep-bodied. Coloration of the body is silver when young, developing into a green color along the spine with age. The silver carp has a moderately large and broad head with a large mouth, toothless, upturned lower jaw, and low-set eyes. The species is known for leaping out of the water when startled (e.g., by noises such as a boat motor). Silver carp grow to about 3.3 feet in length and 60 pounds in weight.

Nonindigenous Occurrences

The escape of bighead, grass, and silver carp from confined structures (e.g., wastewater treatment lagoons, aquaculture facilities, and private fish farms) located primarily in southern waters of the United States has led to establishment of self-sustaining populations in the Mississippi River basin. Northward migration in the Mississippi and Ohio Rivers also has led to established populations of bighead and silver carp in the Illinois River system. This has created considerable concern due to the river's connection to Lake Michigan through the CSSC. Black carp also have been reported in the lower part of the Mississippi River basin, but an established population has not been documented to date.

Means of introduction: Black carp were initially introduced into the United States along with a shipment of grass carp delivered to a private fish farm in Arkansas in the 1970s. Black carp were then intentionally introduced into the country in the early 1980s for use as both a food fish and a biological control agent in cultured catfish ponds infested with snail-borne parasites. The first and only known record of escape or release of black carp was in 1994 when high flood waters caused thirty or more individuals to be released into the Osage River in Missouri from a private aquaculture facility near Lake of the Ozarks.

Grass carp were first brought into the United States in 1963 to evaluate their application for biological control for aquatic nuisance vegetation in aquaculture facilities. This was a joint action of the United Nations Food and Agriculture Organization, the U.S. Fish and Wildlife Service (USFWS), and Auburn University in Alabama. Grass carp were raised and spawned at a USFWS Fish Farming Experiment Station in Stuttgart, Arkansas and Auburn University. The first documented release from a facility is believed to have occurred in 1984 in Arkansas, though reports of captured grass carp in open waters occurred in the early 1970s. Grass carp have been widely stocked for biological control against aquatic plants, resulting in range expansion by intentional and non-intentional releases. Reproducing populations have spread throughout U.S. river systems with reports of grass carp in all but five states. Consequently, some states have established a ban for the stocking of grass carp unless they are genetically sterile with a triploid number of chromosomes, which may, depending on the state, require a certification process or permit.

Bighead carp were imported into the United States in 1973 by a private fish farmer in Arkansas to investigate their use in improving water quality to increase fish production in culture ponds. Universities and state agencies conducted research on bighead carp for a number of years to evaluate their effects on the water quality of wastewater treatment lagoons. Bighead carp were also acquired for propagation as food fish, specifically targeting ethnic live fish markets. In the early 1980s, the species began appearing in the Ohio and Mississippi rivers. It is believed that these occurrences resulted from their escape from aquaculture facilities located in proximity to the Mississippi River system.

Silver carp were imported to the United States in 1973 as a food fish and as an agent of biological control of phytoplankton in aquaculture facilities located in Arkansas. Given their ability to efficiently filter suspended material from water, silver carp were stocked intentionally in some states to improve water quality in lakes, aquaculture ponds, and wastewater systems. By 1980, specimens were found in natural waters and were believed to have escaped from fish hatcheries or other aquaculture facilities.

Status in the Great Lakes Region: As of October 2011, there are no confirmed reports of established, self-sustaining Asian carp populations in the Great Lakes. Bighead carp have been collected in Lake Erie and grass carp have been collected from lakes Michigan, Ontario, Erie, and Huron; however, there has been no documentation of either species reproducing in the Great Lakes. Bighead carp, reported in at least 18 states, have been found in the Illinois River and in Lake Calumet near Lake Michigan. The presence of a live bighead carp in Lake Calumet which is upstream (north) of the electric dispersal barrier system, and the positive identification of Asian carp eDNA in the Calumet Harbor on Lake Michigan, suggests that small numbers of carp are approaching the Great Lakes via the CAWS. Asian carp also have been collected from several other water bodies in Illinois, in Bryant Creek and Oxendine Bayou, Indiana, as well as in Lake Pepin in Minnesota. In the fall of 2011, water samples taken from the Mississippi, Minnesota, and St. Croix rivers, flowing through Minnesota, tested positive for silver carp eDNA. Grass carp have been reported in 45 U.S. states, including all eight Great Lakes states. Grass carp species are prohibited in 12 states, including Michigan, Minnesota, and Wisconsin. The silver carp is spreading rapidly through the Mississippi River basin, including parts of Wisconsin, Illinois, and Indiana. In May 2010, silver carp spawning was documented in Indiana's Wabash River, about 100 miles downstream of a floodplain connection with the Maumee River, an Ohio tributary of Lake Erie. Only one black carp specimen has been collected in the Great Lakes region in Illinois. Black carp have also been reported in Arkansas, Mississippi, Louisiana and Missouri.

Distribution Maps: Geographic information on the location of aquatic invasive species sightings in the United States is made available through the U.S. Geological Survey, Nonindigenous Aquatic Species (NAS) program (<http://nas.er.usgs.gov>). The NAS distribution maps for the following Asian carp species can be found at:

Black Carp: <http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=573>

Grass Carp: <http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=514>

Bighead Carp: <http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=551>

Silver Carp: <http://nas2.er.usgs.gov/viewer/omap.aspx?SpeciesID=549>

Management

Electric Dispersal Barrier System: The construction and operation of an electric dispersal barrier system in the southern end of the Chicago Sanitary and Ship Canal (<http://www.lrc.usace.army.mil/AsianCarp/barrier.htm>) serves as the cornerstone of management to impede the movement of Asian carp into the Great Lakes. The barrier system is located approximately 25 miles southwest of Lake Michigan. Under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA), the U.S. Army Corps of Engineers

(Corps) was given the responsibility to identify an environmentally sound method for preventing the exchange of AIS between the Mississippi River and Great Lakes watersheds. NANPCA, amended as the National Invasive Species Act of 1996 (NISA), authorized the Corps to construct a test electric dispersal barrier to prevent the movement of AIS between the Great Lakes and Mississippi River watersheds through the CSSC. This demonstration barrier, or Barrier I, became operational in April 2002. The Corps began construction in 2004 on a permanent barrier consisting of two separate barriers, Barriers IIA and IIB. The Water Resources Development Act (WRDA) of 2007 provided authorization for the Corps to complete Barrier II and to operate and maintain the barrier system at full federal cost. Barrier IIA was activated for long-term operation in April 2009; Barrier IIB was activated in April 2011. The resulting electric dispersal barrier system consists of three separate barriers designed to emit a low-voltage, pulsing electric current through steel cables secured to the bottom of the canal. The current creates an electric field to deter both the upstream and downstream movement of fish in efforts to prevent interbasin exchange of AIS.

In targeting larger fish, it is recognized that the dispersal barrier may not effectively prevent interbasin exchanges of every life stage of invasive fish or other genera of AIS (e.g., plants and invertebrates). There is, however, general agreement among public officials and researchers that the barrier system has played a key role in impeding the establishment of self-sustaining populations of Asian carp upstream (north) of the barrier.

Asian Carp Management Plans and Monitoring Activities: In addition to the electric dispersal barrier system, federal and state agencies have been engaged in a number of other management activities to stop the introduction and spread of Asian carp. Nationwide management of established populations of Asian carp is guided by the *Management and Control Plan for Bighead, Black, Grass, and Silver Carp in the United States*. The management plan was developed by an Asian carp working group of the federal interagency Aquatic Nuisance Species Task Force; the workgroup is comprised of private and public sector fisheries professionals, aquaculturists, and aquatic ecologists. The goals and strategies of the plan are to prevent, control, and mitigate adverse effects of Asian carp using public outreach, research, and evaluation methods for Asian carp management and control. Although the ANS Task Force approved the Asian carp management and control plan in 2007, implementation of the plan's strategies and recommendations, estimated at \$286 million over a 20-year period, has yet to be comprehensively financed (as of November 2011).

Asian carp management efforts intensified in the Chicago area when genetic (eDNA) monitoring results matching the DNA of the silver and bighead carp were confirmed in water samples taken from various locations in the CAWS in the fall of 2009 and spring of 2010. In response to eDNA evidence indicating the presence of Asian carp in proximity to the Great Lakes, the Asian Carp Control Strategy Framework (Framework) was developed in 2010 as a collaborative effort of the Asian Carp Regional Coordinating Committee (ACRCC). Established as a multijurisdictional entity, the ARCC is comprised of representatives from a variety of federal, state and local agencies. The Framework, released in draft form in February 2010 and updated in May 2010 and again in December of 2010, provides a blueprint for managers from different agencies to work together to advance Asian carp monitoring, control, and removal efforts. Also included in the Framework are short-term and long-term strategies for combating the invasion of Asian carp; a clarification of the roles and responsibilities of the federal, state, municipal, and other agencies involved; and identification of funding sources to pay for immediate action.

One of the management priorities of the Framework is to establish a comprehensive monitoring system for Asian carp in the CAWS. The monitoring plan is focused in the following areas: systematically determining the distribution and abundance of Asian carp in the waterway system; removing any Asian carp found in the CAWS; defining the location of the leading edge and reproduction of Asian carp populations; and identifying where there is a need for specific response actions in portions of the CAWS. Monitoring techniques being used include water sampling for eDNA and conventional sampling (e.g., electrofishing, netting and trapping) for actual specimens. Also completed as management priorities under the Framework is the construction of physical barriers to prevent transfer of carp via floodplain connections between the CSSC and Des Plaines River in Illinois, and between the Wabash and Maumee rivers near Fort Wayne, Indiana.

Future Directions in Asian Carp Management: Researchers and government officials are continuing to investigate the efficacy of several new management techniques to impede the migration of Asian carp toward Lake Michigan. These include, but are not limited to, building and operating an acoustic sound barrier, encouraging commercial and recreational harvesting, and developing selective biological control agents.

Mandated by Congress in 2007, the Corps is conducting the Great Lakes and Mississippi River Interbasin Study (GLMRIS) that examines the range of options and technologies available to prevent the exchange of AIS between the Great Lakes and Mississippi River basins. The focus of GLMRIS is to assess prevention options targeting the CAWS as well as all hydrologic connections between the two watersheds. The anticipated completion date for the project is 2015 (www.glmris.anl.gov). In addition, there has been a call by the Great Lakes states and provinces for ecological separation of the Mississippi River and Great Lakes basin as a permanent solution to preventing the exchange of AIS. A study conducted jointly by the Great Lakes Commission and the Great Lakes and St. Lawrence Cities Initiative is developing options for ecological separation in the CAWS. The range of options involves construction of physical barriers in different locations in the CAWS to prevent the exchange of water while maintaining the system's benefits of commercial shipping, recreational boating, wastewater treatment, and flood control (<http://www.glc.org/ans/chicagowaterway.html>).

Relevant Policy and Regulatory Issues: Under the Lacey Act of 1900, the black carp, silver carp, and bighead carp are listed as injurious fish species, prohibiting their import and transport. The grass carp is not listed under the Lacey Act. A triploid (sterile) grass carp inspection service is offered by the U.S. Fish and Wildlife Service to help states, as well as other countries, protect their aquatic habitats from the establishment of reproducing (diploid) grass carp populations. The program is designed to provide assurance that shipments of alleged triploid grass carp do not contain diploid grass carp. Fishery regulations in Ontario have prohibited the possession of live invasive fish since 2005.

Significant Contributions Provided by:

U.S. Geological Survey, Nonindigenous Aquatic Species Program. <http://nas.er.usgs.gov>

References:

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- Asian Carp Control. Asian Carp Regional Coordinating Committee. <http://www.asiancarp.org>
- Asian Carp Portal. USACE Chicago District. <http://www.lrc.usace.army.mil/AsianCarp/>
- Asian Carp and the Great Lakes. U.S. Environmental Protection Agency <http://www.epa.gov/glnpo/invasive/asiancarp/>
- Asian Carp brochure. U.S. Fish and Wildlife Service. <http://www.fws.gov/midwest/greatlakes/library/broch-AsianCarp.pdf>
- Asian Carp: An Overview. Michigan Sea Grant. <http://www.miseagrant.umich.edu/downloads/ais/10-750-fs-asian-carp.pdf>
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- U.S. Army Corps of Engineers. Great Lakes and Mississippi River Interbasin Study (GLMRIS). <http://glmr.is.anl.gov/>
- Great Lakes Commission and Great Lakes St. Lawrence Cities Initiative. Envisioning a 21st Century Chicago Area Waterways Systems. <http://www.glc.org/ans/chicagowaterway.html>

Studies, Assessments and Management Plans

2011 Asian Carp Control Strategy Framework

Asian Carp Regional Coordinating Committee (ACRCC)

<http://www.asiancarp.org/Documents/FrameworkDec15-2010.pdf>

The Asian Carp RCC is comprised of federal, state, and local agencies tasked with the prevention of the invasion of Asian carp into the Great Lakes. This document, updated in December 2010, describes control and prevention actions currently being undertaken by the ACRCC and planned short-term and long-term actions. The framework identifies lead agencies and funding sources for each action.

Proposed Plan for the Prevention, Detection, Assessment, and Management of Asian Carps in Michigan Waters (2010)

Michigan Department of Natural Resources, Fisheries Division

http://michigan.gov/documents/dnr/AsianCarpManagementPlan_334348_7.pdf

The Michigan Department of Natural Resources (DNR) Fisheries Division Management Team charged its Asian Carps Working Group to "develop a draft plan for Michigan to address potential monitoring and assessment needs for Asian carps." Strategies in this plan are organized into five goals: prevention, communication, detection, assessment, and management. Of these goals, prevention and communication are named as immediate priorities. The focus of the plan is on "strategies and actions that could be directly implemented by DNR and other Michigan agency staff."

A Risk Analysis Pertaining to the Use of Triploid Grass Carp for the Biological Control of Aquatic Plants (2008)

Florida Department of Agriculture and Consumer Services

http://www.floridaaquaculture.com/publications/P-01537_Report-TGC%20final.pdf

An important outcome of a hydrilla management workshop organized by Florida LAKEWATCH (January 2008) was recommended use of triploid grass carp as a biocontrol tool for this invasive plant. The purpose of the workshop was to summarize management, control, and research options and recommendations for hydrilla infestations in water bodies throughout Central Florida in response to increasing chemical resistance to fluridone.

Management and Control Plan for Bighead, Black, Grass, and Silver Carp in the United States (2007)

Aquatic Nuisance Species Task Force Asian Carp Working Group

http://www.anstaskforce.gov/Documents/Carps_Management_Plan.pdf

The document presents a comprehensive overview of those species of Asian carp identified as a priority concern, including the bighead, black, grass, and silver carp. The overall purpose of the plan is extirpation of Asian carp in the wild, except for non-reproducing grass carp within predetermined locations in the United States. The plan outlines management goals for the targeted species of Asian carp, allowing for a viable aquaculture industry through a framework for the responsible use of domestic stocks of Asian carp.

Preventing the Introduction of Asian Carp into Minnesota (2007)

Minnesota Department of Natural Resources

http://files.dnr.state.mn.us/natural_resources/invasives/aquaticanimals/asiancarp/110107_plan.pdf

Minnesota state legislation directed the Minnesota Department of Natural Resources to develop a plan to prevent the introduction of Asian carp into Minnesota by November 1, 2007. The implementation of this plan has focused efforts on the potential to delay the introduction of Asian carp into the state and limit the spread within the state. Effectiveness of the plan is dependent upon implementation in a comprehensive manner, focusing on all priority pathways of introduction and spread.

Asian Carp of the Genus *Hypophthalmichthys* (Pisces, Cyprinidae) - A Biological Synopsis and Environmental Risk Assessment (2005)

U.S. Fish and Wildlife Service and U.S. Geological Survey

<http://www.fws.gov/contaminants/OtherDocuments/ACBSRAFinalReport2005.pdf>

The purpose of this document is to present a summary of the biology and distribution of the three species of *Hypophthalmichthys*. Also included is an evaluation of the organism risk potential of each species of *Hypophthalmichthys* in the U.S. using the Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process.

Risk Assessment for Asian Carp in Canada (2004)

Fisheries and Oceans Canada

http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2004/RES2004_103_E.pdf

This assessment evaluates the risk of survival, reproduction, and spread of Asian carp, as well as their pathogens, parasites, or fellow travelers if introduction into Canada were to occur. These risks were assessed as part of an expert workshop using best available information on their biology, potential vectors of introduction, and impacts in both native and introduced ranges.

Environmental DNA Research

University of Notre Dame

http://edna.nd.edu/Environmental_DNA_at_ND/Home.html

The University of Notre Dame conducts cutting-edge research on the use of environmental DNA (eDNA) in monitoring for Asian carp. Under contract with the U.S. Army Corps of Engineers in 2009-10, Notre Dame performed eDNA monitoring in the Chicago Area Waterway System and in southern Lake Michigan. This website provides a description of eDNA methods and current research initiatives, along with Asian carp monitoring results.

U.S. and Canadian Federal Resources

Asian Carp Control – The official website of the Asian Carp Regional Coordinating Committee

U.S. Fish & Wildlife Service and University of Texas - Arlington

<http://www.asiancarp.org/>

Electric Dispersal Barrier Project

U.S. Army Corps of Engineers

<http://www.lrc.usace.army.mil/AsianCarp/barrier.htm>

Asian Carp Portal

U.S. Army Corps of Engineers – Chicago District

<http://www.lrc.usace.army.mil/AsianCarp/>

Asian Carp Species Profile

U.S. Department of Agriculture-National Invasive Species Information Center

<http://www.invasivespeciesinfo.gov/aquatics/asiancarp.shtml>

Asian Carp Tri-fold Brochure

U.S. Fish and Wildlife Service

<http://www.fws.gov/midwest/greatlakes/library/broch-AsianCarp.pdf>

Preventing Movements of Invasive Fish Between the Mississippi River and Great Lakes Basins

U.S. Fish and Wildlife Service

<http://www.fws.gov/midwest/Fisheries/library/post-laxfro.pdf>

Asian Carp: Huge Fish with Huge Impacts

U.S. Fish and Wildlife Service

<http://www.asiancarp.org/Documents/AsianCarp.pdf>

Asian Carp Monitoring in Western Lake Erie

U.S. Fish and Wildlife Service

<http://www.fws.gov/northeast/lowergreatlakes/Programs/ans/Projects/AsianCarpMon.html>

Asian Carp and the Great Lakes

U.S. Environmental Protection Agency-Great Lakes Invasive Species

<http://www.epa.gov/glnpo/invasive/asiancarp/>

Asian Carp Status Report

Fisheries and Oceans Canada

http://www.dfo-mpo.gc.ca/csas/Csas/status/2005/SAR-AS2005_001_E.pdf

Asian Carp

Sea Grant Nab the Aquatic Invaders (Clyde the big smack™ silver carp)

http://www.iiseagrant.org/NabInvader/Lakes/suspects/suspect_clyde.html

Black Carp

U.S. Fish and Wildlife Service

<http://www.fws.gov/midwest/Fisheries/library/fact-blackcarp.pdf>

Black Carp - Questions and Answers

U.S. Fish and Wildlife Service

http://www.fws.gov/southeast/hotissues/Black_Carp_Q_A.html

Black Carp Fact Sheet

U.S. Geological Survey-Nonindigenous Aquatic Species

<http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=573>

Black Carp - *Mylopharyngodon piceus*

U.S. Army Corps of Engineers-Aquatic Nuisance Species Research Program

http://el.erdc.usace.army.mil/ansrp/mylopharyngodon_piceus.pdf

Reproductive Potential of Triploid Grass Carp

U.S. Geological Survey

http://www.cerc.usgs.gov/pubs/center/pdfDocs/black_carp.pdf

Biological Synopsis of Grass Carp

Fisheries and Oceans Canada

<http://www.dfo-mpo.gc.ca/Library/286222.pdf>

Facts about Bighead and Silver Carp

U.S. Geological Survey-Columbia Environmental Research Center

http://walrus.wr.usgs.gov/infobank/programs/html/factsheets/pdfs/2004_X021_CF.pdf

State and Provincial Resources

Exotic Species – Asian Carp

Great Lakes Fishery Commission

<http://www.glfsc.org/fishmgmt/carp.php>

Asian Carp

Illinois Department of Natural Resources

<http://dnr.state.il.us/fish/asianCarp.htm>

Asian Carp: An Overview

Michigan Sea Grant-Aquatic Invasive Species

<http://www.miseagrant.umich.edu/downloads/ais/10-750-fs-asian-carp.pdf>

Great Lakes Photography: Asian Carp

Michigan Sea Grant

<http://www.miseagrant.umich.edu/photos/ais/asian-carp.html>

Invasive Carp

Ontario Federation of Anglers Hunters-Invasive Species Awareness Program

<http://www.invadingspecies.com/Invaders.cfm?A=Page&PID=20>

Asian Carp Fact Sheet

Pennsylvania Sea Grant

<http://seagrant.psu.edu/publications/fs/asiancarp2007.pdf>

Black Carp Fact Sheet

Indiana Department of Natural Resources

http://www.in.gov/dnr/files/BLACK_CARP.pdf

Bighead and Silver Carp WATCH

Illinois-Indiana Sea Grant

<http://www.iisgcp.org/images/Bghead&Silver07.jpg>

Bighead Carp Fact Sheet

Indiana Department of Natural Resources

http://www.in.gov/dnr/files/BIGHEAD_CARP.pdf

Bighead and silver carp (*Hypophthalmichthys nobilis* & *H. molitrix*)

Minnesota Department of Natural Resources

<http://www.dnr.state.mn.us/invasives/aquaticanimals/asiancarp/index.html>

Bighead Carp Classification Table

Wisconsin Department of Natural Resources

http://www.dnr.state.wi.us/invasives/classification/pdfs/LR_Hypophthalmichthys_nobilis.pdf

Bighead and Silver Carp (*Hypophthalmichthys nobilis* and *H. molitrix*)

Wisconsin Department of Natural Resources

http://www.dnr.state.wi.us/invasives/fact/asian_carp.htm

Grass Carp Fact Sheet

Indiana Department of Natural Resources

http://www.in.gov/dnr/files/GRASS_CARP.pdf

Grass Carp

Minnesota Department of Natural Resources

<http://www.dnr.state.mn.us/invasives/aquaticanimals/grasscarp/index.html>

Triploid Grass Carp in New York Ponds

New York Department of Environmental Conservation

<http://www.dec.ny.gov/outdoor/7973.html>

Pond Owner's Guide to the Use of Grass Carp in Pennsylvania

Pennsylvania Fish and Boat Commission

<http://resources.cas.psu.edu/WaterResources/pdfs/GrassCarp.pdf>

Silver Carp Fact Sheet

Indiana Department of Natural Resources

http://www.in.gov/dnr/files/SILVER_CARP.pdf

Silver Carp Classification Table

Wisconsin Department of Natural Resources

http://www.dnr.state.wi.us/invasives/classification/pdfs/LR_Hypophthalmichthys_molitrix.pdf