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Asian Carp and the Great Lakes Region

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Summary

Four species of nonindigenous Asian carp are expanding their range in U.S. waterways, resulting in a variety of concerns and problems. Three species—bighead, silver, and black carp—are of particular note, based on the perceived degree of environmental concern. Current controversy relates to what measures might be necessary and sufficient to prevent movement of Asian carp from the Mississippi River drainage into the Great Lakes through the Chicago Area Waterway System. Recent federal response and coordination measures direct actions to avoid the possibility of carp becoming established in the Great Lakes. These include ongoing studies of efforts to separate the two drainage basins.

According to the Great Lakes Fishery Commission, Asian carp pose a significant threat to commercial and recreational fisheries of the Great Lakes. Asian carp populations could expand rapidly and change the composition of Great Lakes ecosystems. Native species could be harmed because Asian carp are likely to compete with them for food and modify their habitat. It has been widely reported that Great Lakes fisheries generate economic activity of approximately $7 billion annually. Although Asian carp introduction is likely to modify Great Lakes ecosystems and cause harm to fisheries, studies forecasting the extent of potential harm are not available. Therefore, it is not possible to provide estimates of potential changes in the regional economy or economic value (social welfare) by lake, species, or fishery.

The locks and waterways of the Chicago Area Waterway System (CAWS) have been a focal point for those debating how to prevent Asian carp encroachment on the Great Lakes. The CAWS is the only navigable link between the Great Lakes and the Mississippi River, and many note the potential of these waterways to facilitate invasive species transfers from one basin to the other. The U.S. Army Corps of Engineers (Corps) constructed and is operating electrical barriers to prevent fish passage through these waterways. In light of indications that Asian carp may be present near the Great Lakes, beginning in FY2010 the Obama Administration increased federal funding to prevent fish encroachment and related damage. Part of this funding was spent by the Corps to explore options that would achieve “hydrologic separation” of the Great Lakes and Mississippi River drainage basins. In January 2014, the Corps released a study (known as the “GLMRIS” study) which outlined a number of potential options ranging from no action to more than $18 billion for complete hydrologic separation and related mitigation. After pressure from Congress, the Corps in August 2017 released a draft of the Brandon Road Lock and Dam study (i.e., a follow-up study to GLMRIS focusing on a specific project) and recommended a tentatively selected plan. The selected alternative involves nonstructural control, complex noise, an electric barrier, and other measures, which would cost over $275 million and take four years to complete.

Since December 2010, Michigan and other Great Lakes states have filed a number of requests for court-ordered measures to stop the migration of invasive Asian carp toward Lake Michigan from the Mississippi River basin via the CAWS. The U.S. Supreme Court denied several motions for injunctions to force Illinois, the Corps, and the Metropolitan Water Reclamation District of Greater Chicago to take necessary measures to prevent the carp from entering Lake Michigan. Michigan, Minnesota, Ohio, Pennsylvania, and Wisconsin sought a separate order in federal district court seeking similar relief, which was also denied.

Bills introduced in the 115th Congress, H.R. 2983 and S. 1398, would have required the Corps to release a draft version of the GLMRIS Brandon Road Study (which was subsequently released in August 2017). With the release of the study, some in Congress may wish to authorize its draft contents, or direct other actions by the Corps and other agencies to stem the further spread of Asian carp.

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Background

Four species of nonindigenous Asian carp are expanding their range in U.S. waterways, resulting in a variety of concerns and problems. Three species—bighead, silver, and black carp—are of particular note, based on the perceived degree of environmental concern. Current controversy relates to what measures might be necessary and sufficient to prevent movement of Asian carp from the Mississippi River drainage into the Great Lakes through the Chicago Area Waterway System. Movement of Asian carp into the Great Lakes is of concern because increased numbers of carp in the Great Lakes increase the risk that Asian carp will establish reproducing populations in these waters. Congressional interest in the 115th Congress has focused on a draft feasibility study including proposed actions at the Brandon Road Lock and Dam to avoid the possibility of carp becoming established in the Great Lakes, as well as other actions to stem the further spread of Asian carp upstream in the Mississippi River Basin.

Grass Carp[1]

The grass carp or white amur, *Ctenopharyngodon idella*, was first imported to the United States in 1963 by the U.S. Fish and Wildlife Service for biological control of vegetation in aquatic environments. Grass carp are stocked to biologically control invasive aquatic plants, such as *Hydrilla* and Eurasian water milfoil. Shallow, quiet waters are their typical habitat, and this species easily tolerates waters near freezing. Grass carp initially escaped from the U.S. Fish and Wildlife Service Fish Farming Experimental Station in Stuttgart, AR. By 1970, grass carp had been stocked in lakes and reservoirs throughout the southeast United States and in Arizona, including some that were open to stream systems.[2] It has since spread widely across the country (**Figure 1**), including to four of the Great Lakes. Most grass carp now are stocked as sterile triploids,[3] and grass carp have not established breeding populations in the Great Lakes basin.

Black Carp[4]

The black carp, *Mylopharyngodon piceus*, arrived in the United States in 1973 with silver and bighead carp. Subsequently, this species was imported as a food fish, as the only cost-effective biological control agent to control non-native snails in catfish aquaculture ponds in Arkansas and Mississippi, and as a potential sterile biological control agent for zebra mussels. Of the four species of carp in U.S. waterways, black carp has the most limited known distribution (**Figure 2**).

The preferred habitat of black carp is along the bottom in deep water of large rivers. Owing to this habitat preference for deeper waters, sampling to determine black carp distribution is considered incomplete, since sampling is more difficult in deeper waters. Black carp feed primarily on mussels and snails, and there are concerns that black carp may harm native

[1] Information from U.S. Geological Survey Fact Sheet, at http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=514; and A.J. Mitchell and A.M. Kelly, "The Public Sector Role in the Establishment of Grass Carp in the United States," Fisheries, Vol. 31, no. 3 (March 2006):113-121.

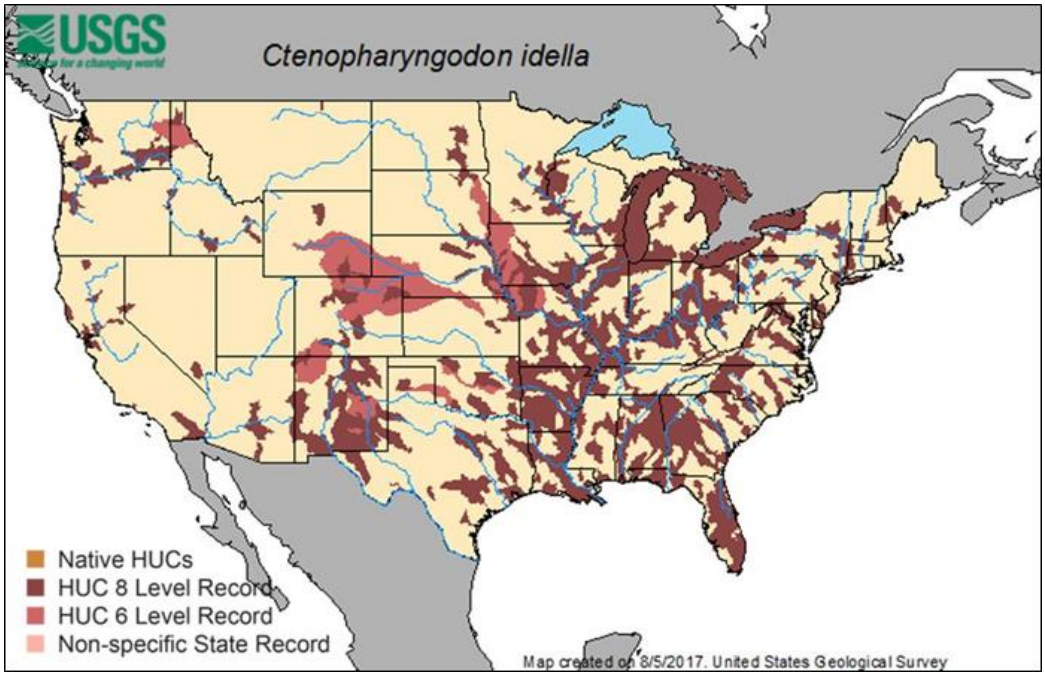
[2] F.J. Guscio and E.O. Gangstad, *Research and Planning Conference on the Biological Control of Aquatic Weeds with the White Amur*, prepared for the interagency Research Advisory Committee, Aquatic Plant Control Program, Office of the Chief of Engineers, Department of Army, 1970.

[3] The U.S. Fish and Wildlife Service Triploid Grass Carp Inspection and Certification Program was authorized in 1995 (P.L. 104-40) to certify that only genetically triploid (i.e., sterile) grass carp are shipped among 32 states restricting the import of any nonsterile grass carp. For more information on this program, see https://www.fws.gov/warmsprings/FishHealth/frgrscrp.html.

[4] Information from U.S. Geological Survey Fact Sheet, at http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=573.

mollusks, many of which are listed as threatened or endangered under the Endangered Species Act.

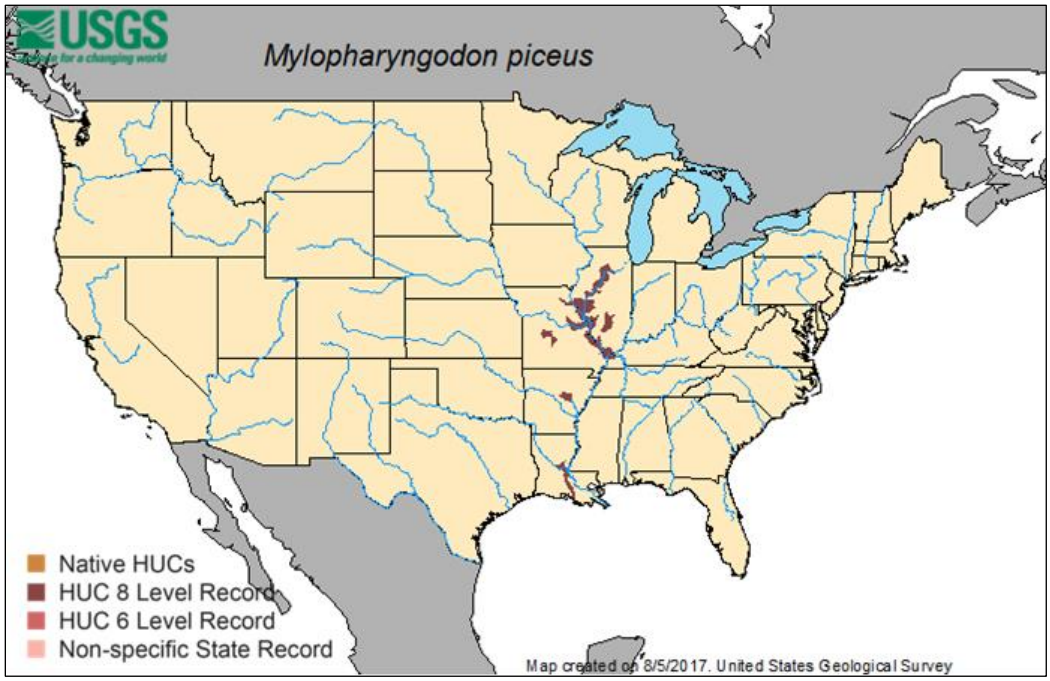
Figure 1. Records of Grass Carp Capture, as of January 26, 2017



Source: U.S. Geological Survey, Nonindigenous Aquatic Species Fact Sheet on grass carp.

Notes: HUC (Hydrologic Unit Code) indicates to how much of a drainage basin the data apply. HUC 8 = one or more grass carp captured in the drainage subbasin. Records should not be interpreted as indicating the current presence of grass carp in all these areas. Alaska and Hawaii are not shown.

Figure 2. Records of Black Carp Capture, as of January 26, 2017



Source: U.S. Geological Survey, Nonindigenous Aquatic Species Fact Sheet on black carp.

Notes: HUC 8 = one or more black carp captured in the drainage subbasin. Records should not be interpreted as indicating the current presence of black carp in all these areas. Alaska and Hawaii are not shown.

Silver Carp[5]

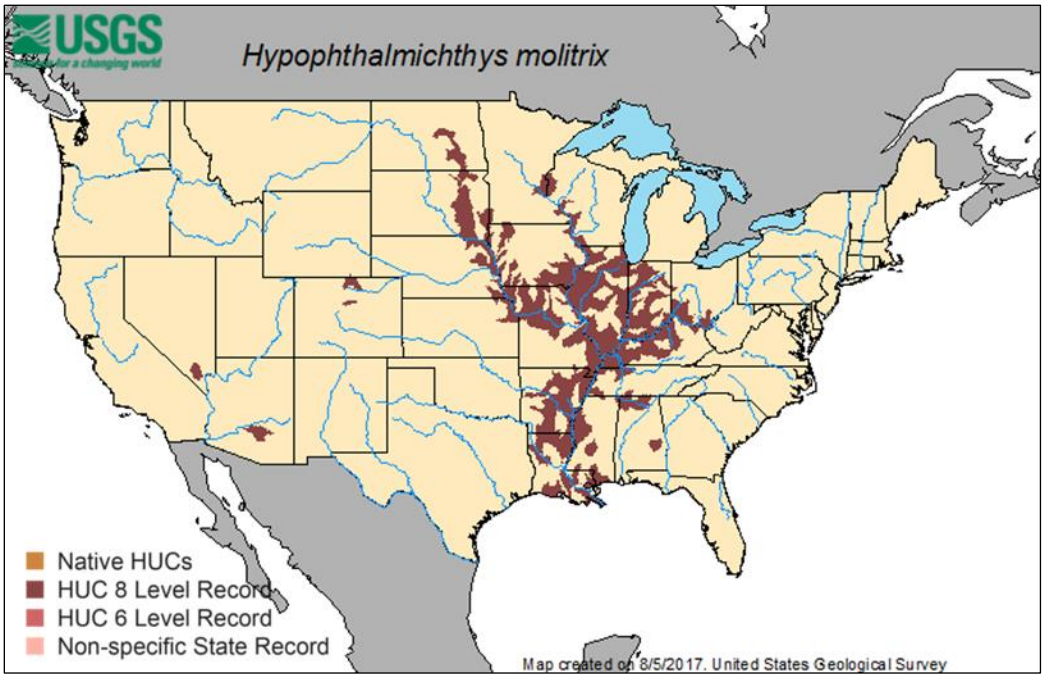
Silver carp, *Hypophthalmichthys molitrix*, were brought into the United States in 1973 under an agreement of maintenance between a private fish farmer and the Arkansas Game and Fish Commission.[6] This species has been used to control phytoplankton (microscopic drifting algae) in nutrient-rich water bodies and is also a food fish. Escapes from a state fish hatchery and from research projects involving use of these fish in municipal sewage systems,[7] as well as possible inclusion of silver carp among other fish shipments, contributed to the spread of this species. Silver carp proved unsuitable for U.S. aquaculture, and were never widely used. The U.S. distribution of silver carp is confined primarily to the Mississippi River drainage, with no record of capture in the Great Lakes (**Figure 3**).

[5] Information from U.S. Geological Survey Fact Sheet, at http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=549.

[6] W.L. Shelton and R. O. Smitherman, "Exotic Fishes in Warm-Water Aquaculture," *Distribution, Biology, and Management of Exotic Fishes*, W.R. Courtenay, Jr. and J.R. Stauffer, eds., Baltimore, MD: The Johns Hopkins University Press, 1984, p. 262-301.

[7] Scott Henderson, *An Evaluation of Filter Feeding Fishes for Removing Excessive Nutrients and Algae from Wastewater*, U.S. Environmental Protection Agency, Project Summary, EPA-600/S2-83-019, May 1983.

Figure 3. Records of Silver Carp Capture, as of January 26, 2017



Source: U.S. Geological Survey, Nonindigenous Aquatic Species Fact Sheet on silver carp.

Notes: HUC (Hydrologic Unit Code) indicates to how much of a drainage basin the data apply. HUC 8 = one or more silver carp captured in the drainage subbasin. Records should not be interpreted as indicating the current presence of silver carp in all these areas.

The silver carp is a filter-feeder, capable of consuming large amounts of phytoplankton, zooplankton (small drifting and/or swimming invertebrates), and detritus. Silver carp are easily startled by outboard motors, causing them to jump several feet out of the water.

There are no population estimates of silver carp in U.S. waters. However, the population of silver carp in the La Grange Reach of the Illinois River during 2007-2008 was estimated to be about 4,000 fish per river mile, with a biomass of about 19,000 pounds per river mile.[8]

Bighead Carp[9]

Bighead carp, *Hypophthalmichthys nobilis*, were brought into the United States in 1973 under an agreement of maintenance between the Arkansas Game and Fish Commission and a private fish farmer.[10] They proved suitable for U.S. aquaculture[11] and continue to be economically important

[8] Greg G. Sass, et al., "A Mark-Recapture Population Estimate for Invasive Silver Carp (*Hypophthalmichthys molitrix* in the La Grange Reach, Illinois River," *Biological Invasions*, v. 12, no. 3 (2010): 433-436.

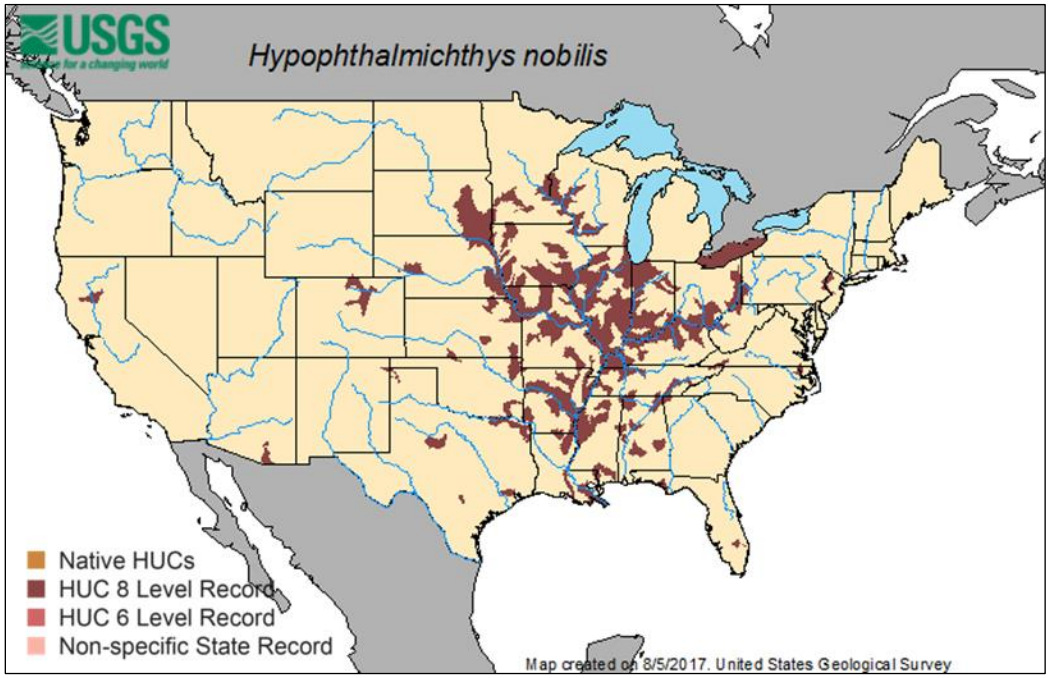
[9] Information from U.S. Geological Survey Fact Sheet, at http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=551.

[10] W.L. Shelton and R. O. Smitherman, "Exotic Fishes in Warm-Water Aquaculture," *Distribution, Biology, and Management of Exotic Fishes*, W.R. Courtenay, Jr. and J.R. Stauffer, eds., Baltimore, MD: The Johns Hopkins University Press, 1984, p. 262-301.

[11] At one time, the market for this species produced by aquaculture was primarily the ethnic live-fish trade in large cities. However, live sale of this species is now prohibited in many cities. For California markets, these fish were killed before entering the state to keep them as fresh as possible. An exception is New York City, where it is still legal to sell live bighead carp, but they must be killed before they leave the store.

in Arkansas, Mississippi, and Alabama.[12] This species was discovered in open waters of the Ohio and Mississippi Rivers in the 1980s, probably after escaping from fish hatcheries and/or research projects involving use of these fish in municipal sewage systems.[13] In the United States, bighead carp are found primarily in the Mississippi River drainage. However, a limited number of bighead carp were captured by commercial fishermen in Lake Erie between 1995 and 2003 (**Figure 4**).

Figure 4. Records of Bighead Carp Capture, as of January 26, 2017



Source: U.S. Geological Survey, Nonindigenous Aquatic Species Fact Sheet on bighead carp.
Notes: HUC (Hydrologic Unit Code) indicates to how much of a drainage basin the data apply. HUC 8 = one or more bighead carp captured in the drainage subbasin. Records should not be interpreted as indicating the current presence of bighead carp in all these areas.

Like silver carp, bighead carp typically require large rivers for spawning, but inhabit lakes, backwaters, reservoirs, and other low-current areas during most of their life cycle. They are filter-feeders, consuming primarily phytoplankton and zooplankton.

Managing Non-Native Species

Non-native species that do become established commonly exist at low populations for several generations, after which some begin a period of rapid population growth and range expansion. Although initial captures of wild silver carp were reported in the early 1970s, silver carp only rarely were captured in U.S. rivers until about 1999, after which their population began to grow at an exponential rate. Some suggest that floods in the early 1990s may have provided excellent spawning and recruitment opportunities for silver carp, and stimulated their later exponential

[12] This species also was raised previously by aquaculture operations in Kansas and Illinois.

[13] Scott Henderson, *An Evaluation of Filter Feeding Fishes for Removing Excessive Nutrients and Algae from Wastewater*, U.S. Environmental Protection Agency, Project Summary, EPA-600/S2-83-019, May 1983.

growth phase.[14] Field experience in the United States has shown that silver carp generally follow a few years after bighead carp in colonizing new habitat.[15]

Many factors may contribute to the introduction and spread of non-native species. For example, juvenile silver and bighead carp are easily mistaken for native baitfish. Thus, the dumping of unused bait by sport fishermen may contribute to the introduction and spread of these species. In addition, bighead carp (as well as a number of other potentially invasive non-native fish species) have been reared, transported, and traded in large numbers as live fish for human food, especially in large metropolitan areas. Such commerce in bighead carp occurred with relatively limited state and local regulation until recently.

Eradication of non-native species in aquatic environments is difficult and rare, having only occasionally been successful when efforts were focused on small-scale and closed systems like reservoirs, ponds, small locks, and marinas. Since eradication of a non-native species, once it has become established, is unlikely, difficult, and therefore expensive, management more often focuses on preventing troublesome species from entering new habitats, through regulating imports of certain nuisance species, preventing or slowing the spread of already introduced species, and monitoring to detect new invaders when their populations may be localized and at low densities such that eradication might still be possible.[16] While efforts to prevent introduction may be costly, it almost always will be less expensive than continued attempts to eradicate or control non-native species that become established.

Potential Impacts

Ecological Concerns

Scientists disagree on the ability of Asian carp to thrive in the Great Lakes and the potential damage these fish might cause to Great Lakes ecosystems.[17] According to the Great Lakes Fishery Commission,[18] Asian carp pose a significant threat to fisheries of the Great Lakes.[19] Asian carp populations could expand rapidly and change the composition of Great Lakes ecosystems. Direct ecological effects are likely to result from their various diets: silver carp eat phytoplankton, bighead carp eat zooplankton, black carp eat invertebrates such as snails and mussels, and grass carp eat aquatic plants. Resident Great Lakes fish species could be harmed, because Asian carp are likely to compete with them for food and modify their habitat. Species at greatest risk include native mussels, other aquatic invertebrates, and fishes.[20] As bighead and silver carp have dispersed and migrated within the Mississippi River drainage, these species have out-competed native fish to become the most abundant fish in certain areas.[21] In the Lake Erie basin, the Maumee, Sandusky, and Grand Rivers were determined to be the most likely to be able

[14] Duane Chapman, research fisheries biologist, U.S. Geological Survey, Columbia Environmental Research Center, Columbia MO, personal communication, February 26, 2010.

[15] Greg Conover, "The Asian Carp Working Group Update," *ANS Task Force Spring Meeting Minutes*, May 26-27, 2004, p. 35-37; Available at http://www.anstaskforce.gov/Minutes/Spring04_Minutes.pdf.

[16] For more background on prevention and control methods, see CRS Report R43258, *Invasive Species: Major Laws and the Role of Selected Federal Agencies*, by Renée Johnson, R. Eliot Crafton, and Harold F. Upton.

[17] See Adam Hinterthuer, "The Explosive Spread of Asian Carp." *BioScience*, v. 62, no. 3 (March 2012): 220-224.

[18] Established in 1954 under the bilateral U.S./Canada Convention on Great Lakes Fisheries.

[19] See http://www.glfc.org/fishmgmt/carp.php.

[20] Seehttps://www.fws.gov/midwest/fisheries/library/fact-asiancarp.pdf.

[21] See http://www.glfc.org/fishmgmt/carp.php.

to support spawning of Asian carp.[22] In July 2012, a Bi-national U.S.-Canadian Asian Carp Risk Assessment concluded that bighead and silver carp pose a substantial environmental risk to the Great Lakes within 20 years, with the risk increasing over time, especially for Lakes Michigan, Huron, and Erie.[23] This assessment further concluded that should bighead and silver carp become established in the Great Lakes, their spread would not likely be limited. Ecological consequences might include competition for planktonic food, leading to reduced growth rates, and recruitment and abundance of fish dependent upon this plankton, as well as reduced abundance of fishes with pelagic, early life stages. A January 2016 Risk Assessment for Grass carp found that the invasion process of Grass carp to Lakes Michigan and Erie had begun, and these fish were likely to become established within 10 years.[24]

On the other hand, others have predicted that black carp are not likely to become established in the Great Lakes if introduced, while silver carp are predicted neither to spread quickly nor to be perceived as a nuisance in the Great Lakes.[25] Bighead carp were not considered in this analysis. A 2015 study used a food model to find that, while Asian carp could eventually account for one-third of the fish weight in Lake Erie, a complete fishery collapse is unlikely.[26] Models used in the study forecasted that Asian carp would not become as abundant in Lake Erie as they are in the Mississippi and Illinois rivers due to various ecosystem differences.

Furthermore, the Great Lakes today are hardly pristine habitat, with the intentional human introduction of non-native species (e.g., brown and rainbow trout, coho and Chinook salmon) characterizing fishery management of the waters for many years. The intentional and accidental introduction of non-native species has changed this historic ecosystem in many ways, including depletion of previously dominant lake trout and whitefish species. In addition, the ecological changes wrought by non-native species arriving in ship ballast water (e.g., zebra mussels, round goby) and by other means (e.g., lamprey and alewife) have been substantial.

Economic Concerns

Recreational and commercial fisheries of the Great Lakes depend on fish populations that could be affected by Asian carp. The primary economic impacts of Asian carp are likely to be related to these fisheries, although concerns have also been raised about potential effects on recreational boating and hunting.[27] Although the net effects are likely to be negative, it is also possible that the introduction of Asian carp to the Great Lakes may provide some utility, such as the development of new commercial and recreational fisheries.[28]

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[22] Patrick M. Kocovsky, et al., "Thermal and Hydrologic Suitability of Lake Erie and Its Major Tributaries for Spawning of Asian Carps," *Journal of Great Lakes Research,* v. 38, no. 1 (March 2012): 159-166.

[23] Available at http://waves-vagues.dfo-mpo.gc.ca/Library/346546.pdf.

[24] Available at http://waves-vagues.dfo-mpo.gc.ca/Library/40596679.pdf.

[25] Cynthia S. Kolar and David M. Lodge, "Ecological Predictions and Risk Assessment for Alien Fishes in North America," *Science,* vol. 298 (November 8, 2002), pp. 1233-1236.

[26] Hongyan Zhang, Edward S. Rutherford, and Doran M. Mason, et al., "Forecasting the Impacts of Silver and Bighead Carp on the Lake Erie Food Web," *Transactions of the American Fisheries Society,* vol. 145, no. 1 (2016).

[27] According to the U.S. Fish and Wildlife Service, Asian carp degrade waterfowl habitat and put waterfowl production areas at risk. Reductions of waterfowl populations could decrease hunting opportunities and associated economic impacts from hunting expenditures.

[28] Mississippi Development Authority Press Release, "Moon River Foods to Create 100 New Jobs," July 22, 2014.

It has been widely reported that Great Lakes fisheries generate U.S. economic activity of approximately $7 billion annually.[29] One should exercise caution in using this figure for assessing public policy alternatives or to make comparisons with the value of other economic sectors. The Great Lakes is composed of many fisheries, each specific to different water bodies, species, and groups of users. Asian carp are likely to affect each lake and areas within lakes to varying degrees because of different biological, chemical, and physical conditions. Anglers will be affected to different degrees depending on local ecological interactions and substitute angling opportunities.

Measures of economic activity such as the $7 billion of economic impacts are only one dimension of economic analysis. The economic input-output studies of the recreational and boating sectors provided below cannot be used to estimate changes in social welfare,[30] to assess trade-offs among public policy alternatives, or to conduct benefit-cost analysis. To more fully understand how society would be affected, valuation studies would be required to estimate the potential changes in social welfare resulting from Asian carp introduction.

Although Asian carp introduction is likely to harm many Great Lakes fisheries, potential changes to ecosystems and the associated economy are not well understood. It is questionable whether accurate predictions of changes by lake, species, and associated fishery are possible. Potential changes resulting from species invasions are difficult to assess because of the underlying complexity of ecological and economic systems. Data and models required to make these assessments are not available and complete assessments would be costly and likely require years of research. The lack of definitive predictions does not mean that the effects of Asian carp introduction would not be significant or that managers should wait to assess the actual effects as Asian carp become established in the Great Lakes. Existing information related to Asian carp movement and population increases in the Mississippi Basin and the magnitude of recreational activities in the Great Lakes indicate that a major threat exists and the effects are likely to be significant.

The economic contributions of recreational and commercial activities on state and regional economies of the Great Lakes region are significant. The economic input-output data cited below measure financial activities associated with the money people spend to buy goods and services on their fishing trips. Expenditures at businesses that provide goods and services have direct, indirect, and induced effects on business revenues, jobs, and personal income in the local area and at the state level. This approach to assessing recreational fishing is the expenditure and economic impact approach. The following descriptions provide recent economic information, but do not consider the effects of Asian carp introduction.

The Great Lakes' recreational fisheries target perch, black bass, walleye, lake trout, salmon, pike, steelhead, and others. In 2011, approximately 1.7 million anglers fished 19.7 million recreational days on the Great Lakes.[31] Economic impacts resulting from these expenditures included approximately 50,000 jobs, salaries of $2.2 billion, and total impacts[32] throughout the U.S.

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[29] This discussion only considers the U.S. economy; Canadian fisheries and recreation might also be affected. See the later section "
Canadian Concern."

[30] Social welfare is a measure of the well-being of society or of a community. Estimates of changes in social welfare determine whether society loses or gains from a given action.

[31] U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Census Bureau, *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*, Washington, DC, 2012.

[32] Total impacts include direct, indirect, and induced impacts as money is cycled through the economy, in this case as a result of expenditures on recreational fishing equipment and trips.

economy of slightly more than $7 billion.[33] Great Lakes fisheries also support charter boat fishing businesses that provide recreational fishing services to anglers. In 2002, an estimated 1,746 charter firms made more than 93,000 charter trips in the Great Lakes region.[34] **Table 1** provides a breakdown of angling activity and economic impacts of recreational fishing by state.

In 2015, Great Lakes commercial fishing produced 14.9 million pounds of fish with a landed value[35] of over $22 million (**Table 2**).[36] Commercial fisheries are important to many coastal communities, and except for Lake Erie, each lake supports tribal fisheries. Top species are lake whitefish, yellow perch, walleye, chubs, and smelt. For certain species, specific lakes contribute the bulk of commercial landings—including Lake Huron (60% of whitefish), Lake Erie (84% of yellow perch, and 94% of smelt), and Lake Michigan (80% of chubs).[37] Record harvests occurred in 1899, when 120 million pounds were landed in the United States.[38] Landings were dominated by lake herring and chubs (64 million pounds), lake trout (10 million pounds), and yellow perch (10 million pounds).[39] Landings and value of commercial fisheries in the Great Lakes have declined dramatically because of factors such as invasive species, pollution, habitat degradation, overfishing, competition with imports, personal tastes and preferences, and regulatory changes.

Table 1. Great Lakes Recreational Fishing Activity and Economic Impacts in 2011

States	Anglers	Days Fished	Retail Sales (000s)	Salaries (000s)	Jobs	Total Impact (000s)
Illinois	69,000	148,000	$58,496	$34,389	786	$105,389
Indiana	27,000	114,000	$18,919	$7,115	213	$27,872
Michigan	650,000	10,987,000	$1,272,353	$774,939	19,805	$2,231,549
Minnesota	46,000	207,000	85,159	51,378	1,494	154,284
New York	332,000	4,485,000	$612,789	$340,811	6,787	$1,029,998
Ohio	343,000	2,161,000	$486,483	$207,718	7,048	$759,943
Pennsylvania	120,000	387,000	$55,208	$31,862	891	$95,433
Wisconsin	178,000	1,246,000	$114,345	$56,867	1,883	$185,460
Totals (Great Lakes States)	**1,665,000**	**19,661,000**	**$2,703,752**	**$1,505,079**	**38,907**	**$4,589,928**
Totals (United States)	**33,112,000**	**553,841,000**	**$2,971,195**	**$2,205,174**	**49,298**	**$7,227,425**

[33] Southwick Associates, *Sportfishing in America: An Economic Force for Conservation*, American Sportfishing Association, Multistate Conservation Grant Program, 2011. Hereinafter cited as "Southwick Associates 2011."

[34] See http://nsgl.gso.uri.edu/michu/michui05006.pdf. More recent data can be found from state reporting programs; for example Michigan Department of Natural Resources maintains annual charter fishing reports at http://www.michigan.gov/dnr/0,4570,7-153-10364_52259_47568-91504—,00.html.

[35] In this case, landed value is the amount paid to fishermen at the dock.

[36] U.S. Department of Commerce, National Marine Fisheries Service, *Fisheries of the United States 2015*, Silver Spring, MD, September 2016.

[37] Ronald E. Kinnunen, *Great Lakes Commercial Fisheries*, Michigan Sea Grant Extension, Marquette, MI, August 2003.

[38] Norman S. Baldwin, Robert W. Saafeld, and Margaret A. Ross, et al., *Commercial Fish Production in the Great Lakes 1867-1977*, Great Lakes Fishery Commission, Technical Report No. 3, Ann Arbor, MI, September 1979. Hereinafter cited as Great Lakes Fishery Commission 1979.

[39] Great Lakes Fishery Commission 1979.

Sources: U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Census Bureau, *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*, Washington, DC, 20012. Southwick Associates, *Sportfishing in America: An Economic Engine and Conservation Powerhouse*, American Sportfishing Association, Multistate Conservation Grant Program, 2011.

Notes: Great Lakes fishing includes lakes Superior, Michigan, Huron, Ontario, Erie, and St. Clair, connecting waters, and fishing in tributaries for smelt, steelhead, and salmon. Illinois, Indiana, Minnesota, and Pennsylvania estimates should be used with caution because of small sample sizes (10 to 30). Retail sales include trip and equipment expenditures. Equipment expenditures were prorated according to how and where equipment such as boats were used. United States totals include economic impacts outside Great Lakes states that resulted from trip and equipment expenditures for Great Lakes fishing.

Table 2. Great Lakes Commercial Fishing Landings and Revenue in 2015

State	Landings (pounds)	Revenue
Michigan	7,460,000	$12,148,000
Minnesota	217,000	$156,000
New York	58,000	$108,000
Ohio	4,503,000	$4,885,000
Pennsylvania	35,000	$117,000
Wisconsin	2,676,000	$4,931,000
Total	**14,949,000**	**$22,345,000**

Source: U.S. Department of Commerce, National Marine Fisheries Service, *Fisheries of the United States 2015*, Silver Spring, MD, September 2016, p. 8.

There are almost 4.3 million boats registered in the Great Lakes states, and it has been estimated that 911,000 operate on the Great Lakes.[40] When disturbed by a boat motor, silver carp may jump as high as 10 feet out of the water. In parts of the Mississippi River drainage, silver carp have caused injuries and damaged equipment when large fish have jumped into moving boats. Silver carp also could injure boaters and water-skiers and detract from boating in the Great Lakes. As in the case of fisheries, predictions of the potential magnitude of economic effects on Great Lakes boating are not available.

In 2004, the U.S. Army Corps of Engineers in partnership with the Great Lakes Commission undertook a study of recreational boating in the Great Lakes states. Recreational boaters spent approximately $9.8 billion during trips and $5.7 billion on craft in Great Lakes states.[41] Economic results from these expenditures included more than 246,000 jobs and salaries of $6.5 billion.

Social Concerns

The introduction of Asian carp to the Great Lakes, potentially changing lake ecosystems from "salmon and trout dominated" to "carp dominated," has the potential to damage the public image of these lakes and to lower the feeling of "well-being" and pride of area residents.[42] As such, the introduction of these species could reduce the social value of lake-related activities.

[40] Great Lakes Commission, *Great Lakes Recreational Boating's Economic Punch*, Ann Arbor, MI, 2004. Hereinafter cited as "Great Lakes Commission 2004." See also http://www.lre.usace.army.mil/Portals/69/docs/PPPM/PlanningandStudies/JohnGlenn/boating.pdf.

[41] Great Lakes Commission 2004.

[42] For example, see John Schneider, "Asian Carp's Threat Goes Far Beyond Economics," *Lansing State Journal*, June 3, 2010.

The popularity of live Asian carp in some ethnic markets continues to stimulate illegal transport of these fish across state and international borders. In February 2012, Canadian border enforcement personnel intercepted the third illegal shipment of live Asian carp in two months and the fifth in a year. These fish allegedly originated from fish farms in the southern United States and were bound for Toronto.[43]

The Chicago Area Waterway System (CAWS)

The Chicago Area Waterway System (CAWS) is a segment of the Illinois Waterway in northeastern Illinois and northwestern Indiana. The Illinois Waterway is a 327-mile channel running from Chicago to St. Louis. It is maintained at a minimum depth of 9 feet by the U.S. Army Corps of Engineers (hereinafter referred to as the Corps).[44] It is the only navigable link between two of the largest freshwater drainage basins in the world, the Great Lakes and the Mississippi River. The CAWS portion of the Illinois Waterway includes modified rivers, locks, canals and other structures that control the flow of water through the Chicago metropolitan area. It has recently received attention for its potential to provide a pathway for Asian carp to migrate from the Mississippi River and its tributaries into the Great Lakes. The system of projects comprising the CAWS is shown in **Figure 5**.

Historically, an important geologic feature in the Chicago area's watershed was the Chicago Portage. The Chicago Portage separated the drainage basins of the Mississippi River and the Great Lakes prior to modification of these waterways. These bodies of water were first artificially connected for navigation in 1848 through a privately constructed 97-mile canal connecting the Chicago River to the Illinois River. This canal, known as the Illinois and Michigan (I&M) Canal, was maintained for commercial use from 1848 to 1933. It was eventually replaced by the network of canals and locks that comprises the CAWS.[45] Canals within the CAWS today include the Chicago Sanitary and Ship Canal (or CSSC, completed in 1900), the North Shore Channel (completed in 1910) and the Cal-Sag Channel (completed in 1922). During construction of these canals, the flows of the Chicago River and the Calumet River were also permanently reversed away from Lake Michigan and toward the Mississippi River drainage basin through structural modifications and pumping.[46] The altered flow of the rivers prevented sewage discharge into the canals from contaminating Chicago's drinking water supply intakes on Lake Michigan.

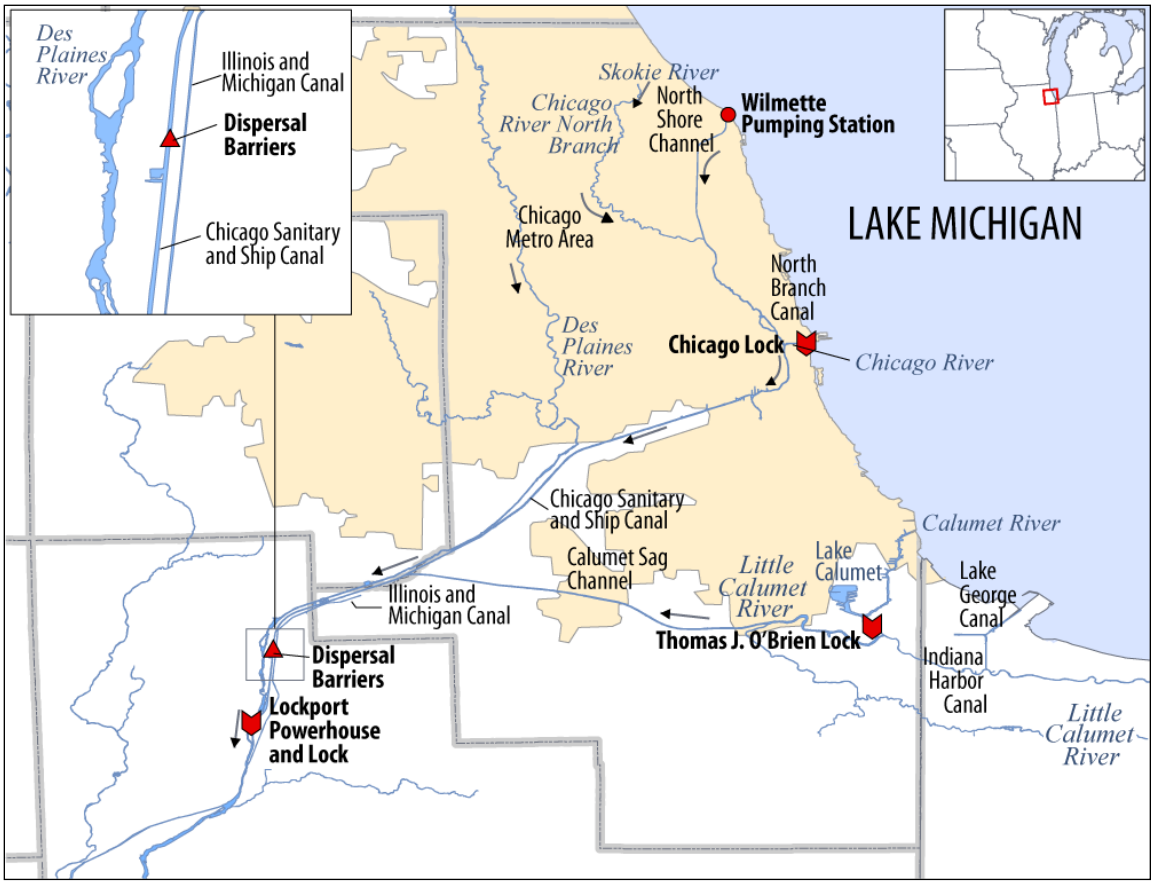
[43] See https://www.eenews.net/greenwire/2012/03/27/stories/1059962054.

[44] Although the Corps has the primary authority to maintain the CAWS for navigation, multiple federal, state, and local entities also possess authorities that must be considered in the context of management actions in the CAWS. Some of these entities include the state of Illinois, the Metropolitan Water and Reclamation District of Greater Chicago, the City of Chicago, the Fish and Wildlife Service, the Environmental Protection Agency, and the U.S. Coast Guard.

[45] Today the I&M Canal remains open as a state park site. The I&M Canal's potential to move Asian carp into other CAWS canals has been an additional item of discussion in recent invasive species debates.

[46] The canal was designed to run southwest from Lake Michigan toward the Mississippi at a small gradient.

Figure 5. Chicago Area Waterway System and Lake Michigan



Source: Adapted by the Congressional Research Service, February 2010.

In recent years, the locks of the CAWS have become a focal point for those debating how to prevent invasive species (and specifically, Asian carp) encroachment between the Great Lakes and the Mississippi River. The Corps operates multiple lock sites that connect the CAWS to the Great Lakes, including the O'Brien Lock and Dam (on the Cal-Sag Channel) and the Chicago Lock (on the Chicago River; see **Figure 5**). Both of these locks include sluice gates operated by the Metropolitan Water Reclamation District of Greater Chicago (MWRD) that can provide flood control in severe rainstorms.[47] The MWRD independently owns and operates a third site (the Wilmette pumping station) on the North Shore Channel that directly connects the CAWS to the Great Lakes. The Corps also owns and operates the lock at Lockport Powerhouse and Lock, which is southwest of Chicago on the CSSC. Due to its distance from the Great Lakes and the fact that the Corp's electric fish barriers (see below section "Electric Barriers") operate upstream on the CSSC, this third lock has not been as prominent in recent invasive species debates.

The CAWS plays a significant role in the region's commercial and recreational navigation, although estimates of the full economic value of the locks within the CAWS (in particular, O'Brien Lock) vary widely. The Chicago Lock, one of the country's busiest locks for traffic,

[47] The Corps and the MWRD coordinate during severe rainstorms, and may open both the locks themselves and the sluice gates to allow for discharge of floodwaters into Lake Michigan to prevent flooding of downtown Chicago. This last occurred in 2014.

handled 39,575 vessels and conducted 11,218 lockages in 2016.[48] The O'Brien Lock handled 10,337 vessels and conducted 4,637 lockages in 2016.[49] While most of the traffic on the Chicago Lock is recreational, the transit of commodity-laden commercial barges is higher at O'Brien Lock, which allows for shippers to offload onto deepwater vessels.[50] Statistics from the Corps indicate that approximately 4 million tons worth of commodities move through O'Brien lock annually, including bulk quantities of sand and gravel, coal, and steel.[51]

Additional analysis, including a comparison of alternative means of freight transit, is necessary to fully understand the value of the locks to the region. In response to an estimate by the Corps that shippers saved approximately $192 million by using the O'Brien and Chicago locks in 2008 (or an addition of approximately $27 per ton of freight shipped), the state of Michigan commissioned a study which concluded that the locks are of considerably less value (thus any closure of locks would have a minimal impact). The 2010 Michigan study estimated that a shift from barge to overland shipping would result in additional costs of approximately $64 million-$69 million annually, or approximately $10 per ton.[52] This study was criticized by the Illinois Chamber of Commerce, which published several academic critiques of the Michigan study, as well as a separate study estimating much higher costs associated with lock closure.[53] The Illinois study estimated a total cost of $530 million-$580 million annually over the next eight years for lock closure, and a net cost to the Chicago economy of $4.7 billion over a 20-year horizon.[54] The studies differ considerably due to the treatment of several important assumptions, including those related to indirect costs for the transition to overland shipping. Both studies have ramifications for proposals to close or alter the CAWS to prevent the spread of Asian carp.

Federal Response to Asian Carp

Congress has directed the Corps and other agencies to undertake specific actions to block the upstream passage of Asian carp in the CAWS. This work was largely conducted by the Corps (due to its role in maintaining the CAWS), with planning coordination and funding from other agencies. The federal government has also been engaged in long-term, nationwide planning and management of Asian carp under authorities codified in the Nonindigenous Aquatic Nuisance

[48] U.S. Army Corps of Engineers, *Lock Performance Monitoring System: Lock Use, Performance, and Characteristics*, 2017. http://www.navigationdatacenter.us/lpms/lpms.htm.

[49] U.S. Army Corps of Engineers, *Summary of Lock Statistics by River*, 2016. Available at http://www.navigationdatacenter.us/lpms/pdf/2016-river_basin.pdf. Hereinafter cited as "Summary of Lock Statistics by River, 2016."

[50] Ibid. According to Corps statistics, approximately 4.3 million tons in bulk commodities transported through the O'Brien Lock in 2016, while 94,000 tons of commodities were transported through the Chicago Lock in 2016. For additional analysis of vessel movement and lockages based on Corps data, see Joel Brammeier, Irwin Polls, and Scudder Mackey, *Preliminary Feasibility of Ecological Separation of the Mississippi River and the Great Lakes to Prevent the Transfer of Aquatic Invasive Species*, Alliance for the Great Lakes, 2008 Project Completion Report, Chicago, IL, November 2008, pp. 50-55.

[51] Summary of Lock Statistics by River, 2016.

[52] The study was included as an appendix to Michigan's recent Supreme Court filing, and is available at http://www.michigan.gov/documents/ag/1-Appendix-Renewed_Motion_310133_7.pdf. For more information on this litigation, see the "Litigation" section of this report.

[53] Documents available at http://www.ilchamber.org/lockclosingstudy.html.

[54] Joseph P. Schwieterman, An Analysis of the Economic Effects of Terminating Operations at the Chicago River Controlling Works and the O'Brien Locks On the Chicago Area Waterway System, DePaul University, Chicago, IL, April 7, 2010, at http://www.ilchamber.org/documents/lockstudy/DePaul%20University%20Study%20on%20Terminating%20Lock%20Operations.pdf.

Prevention and Control Act of 1990 (P.L. 101-646, as amended) and other statutes.[55] These actions were conducted by the Aquatic Nuisance Species Task Force (ANS Task Force), chaired by the Fish and Wildlife Service (FWS) and the National Oceanic and Atmospheric Administration (NOAA), with support provided by various other agencies, including the U.S. Environmental Protection Agency (EPA), the U.S. Geological Survey (USGS), and the Corps.

Due to the increasing profile of Asian carp and its potential establishment in the Great Lakes, efforts to impede the spread of Asian carp have intensified over time. The White House prioritized the issue in early 2010 with the White House Commission on Environmental Quality (CEQ) announcement of a forum of Great Lakes governors and a suite of new actions to control Asian carp. Total federal funding for Asian carp activities since the announcement of the framework has been approximately $463 million (see **Table 3**), with almost half of this funding derived from the EPA Great Lakes Restoration Initiative.

Response Efforts in the CAWS

Electric Barriers

In the National Invasive Species Act of 1996 (P.L. 104-332), Congress directed the Corps and the ANS Task Force to investigate environmentally sound methods to prevent the dispersal of aquatic nuisance species from the Great Lakes into the Mississippi River drainage.[56] In response, an advisory panel of federal, state, local, and international representatives (known as the Dispersal Barrier Panel) recommended an electronic dispersal barrier demonstration project at the southwestern end of the CSSC north of Lockport Powerhouse and Lock (see **Figure 5**) as the preferred short-term method to stop the movement of invasive species through the CAWS.[57] This type of barrier uses steel cables secured to the bottom of the canal to create a pulsating field of electricity that discourages fish from passing. It was selected based on projected cost, likelihood of success, environmental impacts, commercial availability, permit requirements, and effect on existing canal uses. The barrier was completed in 2001 and became operational in 2002.[58] Early experiences with power outages at the barrier led to concerns that Asian carp might use these opportunities to migrate through the area.

Based on subsequent experience and testing, the Dispersal Barrier Panel determined that the demonstration barrier should be upgraded into a stronger, more permanent barrier (Barrier I), and that construction of a second large barrier (Barrier II) would provide additional protection through redundancy in the barrier system. These recommendations were subsequently authorized by Congress in 2005 and consolidated in 2007.[59] Barrier II, located approximately 800 feet

[55] 16 U.S.C. §4701.

[56] The waters of the CAWS were widely noted to be polluted and oxygen-deprived through the early 1980s. These conditions likely prevented the spread of aquatic species through the area over the earlier history of the CAWS. Recent efforts to clean up the waterway have also made possible the survival of many species in the area, including invasive species.

[57] 16 U.S.C. §4722(i)(3). Although the barrier was authorized and designed to repel multiple aquatic invasive species, the primary goal of the original barrier was to impede the downstream movement of round goby from the Great Lakes to the Mississippi River basin. Because of funding and construction delays, the demonstration barrier was not operational in time to prevent this movement, and round goby were found downstream of the barrier site in 1999.

[58] A full history of the demonstration barrier, including the rationale for the preferred barrier technology, is available at University of Wisconsin Sea Grant Institute (UWSG), *Aquatic Invasive Species: Dispersal Barrier History*, 2006.

[59] The demonstration barrier was originally authorized in the National Invasive Species Act of 1996 (P.L. 104-332) and its funding level was increased in Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 (P.L. 109-234). Funding for Barrier II was first provided as an environmental restoration

downstream from Barrier I, has two sets of electrical arrays (known as Barriers IIA and IIB). Construction of Barrier IIA began in 2004, and became operational in 2009 at a total cost of approximately $10 million. Barrier IIB was completed in 2010, at a cost of approximately $13 million.[60] Recent budget requests by the Corps have estimated the operational costs of these barriers at approximately $16.7 million per year.[61]

Federal agencies have also coordinated rapid response activities to supplement the barrier protection system through the Asian Carp Regional Coordinating Committee (ACRCC), formed in 2009.[62] The ACRCC, led by Council on Environmental Quality, includes representatives from federal agencies, as well as some state and local government organizations. To date, the most visible actions by the committee have been chemical treatments on the CAWS to temporarily eliminate and evaluate the presence of aquatic species, including Asian carp.

Other Prevention in the CAWS

In addition to building the electrical barriers, in Section 3061(b)(D) of WRDA 2007, Congress directed the Corps to study other means to prevent the spread of Asian carp through the CAWS, including the range of options for technologies to prevent passage beyond the electrical barriers.[63] In recent appropriations acts, Congress has generally extended the authority for the Corps to implement these emergency actions, which relate to a number of studies by the Corps that are completed or in progress:[64]

- Interim Report I recommended a network of concrete and chain link barricades to deter fish passage over the Des Plaines River during flooding or through culverts connecting the CSSC to the I&M canal.[65] This project was built with approximately $13 million in funding and was completed in 2010.
- Interim Report II includes two phases: Report IIA studied optimal operating parameters for the electrical barriers and was completed in 2011, and Report IIB, which is in progress and will be used to improve barrier operations along with Report IIA.[66]

project under WRDA 1986 (P.L. 99-662, §1135) in 2002 and required a local cost-sharing partner. The project was subsequently authorized at a level of $9 million in the District of Columbia Appropriations Act, 2005 (P.L. 108-335, §345). In WRDA 2007 (P.L. 110-114, §3061), Congress consolidated the multiple authorizations for barrier construction and authorized the Corps to permanently operate both barriers at a 100% federal cost.

[60] Personal Communication with Charles Shea, Dispersal Barrier Project Director, Army Corps of Engineers, Chicago District, February 24, 2010.

[61] Office of the Assistant Secretary of the Army, *FY2018 Civil Works Budget for the U.S. Army Corps of Engineers.*, Washington, DC, May 2017, p. 220.

[62] See http://www.asiancarp.us/.

[63] See 121 Stat. 1121. The Corps is studying four areas in this regard: optimal operating parameters for the barriers, ANS barrier bypass, ANS human transfer, and ANS abundance reduction.

[64] Most recently, Congress extended the Corps emergency authorities in §1039 of the Water Resources Reform and Development Act (WRRDA) of 2014 (P.L. 113-121).

[65] U.S. Army Corps of Engineers—Chicago District, *Interim I Dispersal Barrier Bypass Risk Reduction Study & Integrated Environmental Assessment*, Final Report, Chicago, IL, January 2010. Available at http://www.lrc.usace.army.mil/Portals/36/docs/projects/ans/docs/ANS_DispersalBarrierEfficacyStudy_Interim_I_FINAL.pdf.

[66] U.S. Army Corps of Engineers—Chicago District, Interim IIA ChicagoSanitary and Ship Canal Dispersal Barriers: Optimal Operating Parameter Laboratory Research and Safety Tests, Final Report, Chicago, IL, September 2011. Available at http://www.lrc.usace.army.mil/Portals/36/docs/projects/ans/docs/Interim%20IIA%20with%20app%20090811.pdf.

- Interim Report III explored how locks and other structures could be operated to minimize the likelihood of Asian carp infestation. This study concluded that partial changes in operating parameters would not be beneficial in slowing Asian carp migration; however, the Corps installed fish screens on certain sluice gates and modified operations to provide lock closure during chemical and other control efforts in response to this study.[67]
- Interim Report IIIa focused on other deterrent measures to prevent Asian carp migration into the Great Lakes.[68] The study was completed in July 2010, but the Corps has stated that it currently lacks authority to implement its recommendations (which include an acoustic bubble curtain demonstration project).
- Interim Report IV is in progress and will document the results of ongoing testing and analysis, including a systematic risk assessment of barrier failure modes and a comprehensive environmental assessment.[69] While the study was projected to be released in 2016, recent research efforts related to barrier efficacy have resulted in an extended release date.[70]

Monitoring

The Corps and other agencies, including the FWS, EPA, and USGS, have contributed resources toward monitoring efforts to evaluate the presence and movements of Asian carp in the CAWS. In addition to conventional sampling methods such as electrofishing and netting, the Corps worked with the University of Notre Dame to conduct an experimental fish sampling method known as environmental DNA (eDNA) testing. This method filters water samples, then extracts fragments of shed DNA to search for genetic markers unique to Asian carp.[71] While few Asian carp have been located upstream of the barriers using conventional sampling methods, positive eDNA test results for silver carp from multiple locations upstream suggest that the fish could be present on the lake side of the barriers.[72] A 2013 study by the Corps, FWS, and the USGS analyzed potential

[67] U.S. Army Corps of Engineers—Chicago District, *Interim III Dispersal Barrier Efficacy Study: Modified Structures and Operations, Illinois and Chicago Area Waterways, Risk Reduction Study and Integrated Environmental Assessment*, Final Report, Chicago, IL, June 2, 2010. p iii. Notably, the Corps did not consider extended lock closure (i.e., more than two months) under this study.

[68] U.S. Army Corps of Engineers—Chicago District, Interim IIIA Dispersal Barrier Efficacy Study: Modified Fish Dispersal Deterrents, Illinois and Chicago Waterways Risk Reduction Study and Integrated Environmental Assessment, Chicago, IL, April 2010. Available athttp://www.lrc.usace.army.mil/Portals/36/docs/projects/ans/docs/02June2010_InterimIIIA.pdf.

[69] Email communication with Corps, September 27, 2017.

[70] A study published in August 2017 by FWS, USGS, and the Corps observed fish passages through the electric barriers in the opposite direction of downstream bound tows, citing concern for the efficacy of the barriers to prevent the spread of invasive species from moving toward the Great Lakes Basin. For more information, see http://www.asiancarp.us/news/bargetrafficstudy.htm.

[71] An audit of eDNA methodology by EPA in February 2010 concluded that the technique is sufficiently reliable and robust in reporting a pattern of detection that should be considered actionable in a management context. See U.S. Congress, House Committee on Transportation and Infrastructure, Subcommittee on Water Resources and Environment, *Statement of Professor David Lodge, Director, Center for Aquatic Conservation,* hearing on Asian Carp and the Great Lakes, 111th Cong., 2nd sess., February 8, 2010. Appendix: Laboratory Audit Report, Lodge Laboratory, Department of Biological Sciences, University of Notre Dame. See also Christopher L. Jerde, et al., "Sight-Unseen Detection of Rare Aquatic Species Using Environmental DNA," *Conservation Letters*, v. 4, no. 2 (April/May 2011): 150-157.

[72] In addition, recent reports indicate positive DNA test results for both silver and bighead carp from Lake Erie. See

alternative sources for these positive eDNA samples (other than live fish) and concluded that a number of sources could potentially lead to positive samples.[73] The Asian Carp Regional Coordinating Committee also released a 2014 study working to resolve issues of ambiguity in eDNA interpretation.[74]

Coordination, Other Pathways

Nationwide Asian Carp Management

Separate from efforts focusing on short-term prevention and other actions in the CAWS, the ANS task force has studied and initiated a number of nationwide management actions through its Asian Carp Working Group. Beginning around 2001, the working group requested and co-funded USGS risk assessments of multiple Asian carp species that found a high potential for black, silver, and bighead carp to become established in the United States.[75] In response to these findings, FWS listed black and silver carp as injurious under the Lacey Act in 2007.[76] On December 7, 2010, the President signed P.L. 111-307, which listed bighead carp as injurious under the Lacey Act.

Also in 2007, FWS authored a study, *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States*, produced in collaboration with federal and nonfederal stakeholders. The final plan outlines seven broad goals (divided into 133 short- and long-term recommendations) that would contribute to a goal of extermination of wild Asian carp. Recommendations in that report included a wide array of methods, including methods to stop Asian carp encroachment such as electric barriers, bubble curtains, and sonic barriers.

Asian Carp Action Plan (Formerly Asian Carp Control Strategy Framework)

Several developments raised the profile of the Asian carp issue and led to White House involvement in control efforts. As previously mentioned, eDNA testing in 2009 and 2010 indicated that Asian carp are potentially present at multiple locations upstream of the electric barriers. Additionally, in June 2010 the Asian Carp Regional Coordinating Committee (ACRCC) announced the capture of a live bighead carp at Lake Calumet (upstream of the electric barriers, between O'Brien Lock and Lake Michigan) by a fisherman under contract with the Illinois

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http://www.cbc.ca/news/canada/asian-carp-dna-found-in-year-old-lake-erie-samples-1.1166536.

[73] The study, known as "ECALS," mentioned runoff from fish markets, fertilizers, fisheries gear, and bird droppings, among other things, as potential alternative sources for positive eDNA samples. See Dr. Richard Fischer et al., *Environmental DNA Calibration Study, Interim Technical Review Report, February 2013.* Available athttp://www.asiancarp.us/documents/ECALS_INTERIM.pdf.

[74] Baewaldt, Kelly et al., *Environmental DNA Calibration Study, Interim Technical Review Report, December 2014. Available at* See http://www.asiancarp.us/documents/IP-057663_ECALS_Interim_Report_FINAL.pdf.

[75] See Leo G. Nico and J. D. Williams, *Black Carp: A Biological Synopsis and Updated Risk Assessment*, U.S. Geological Survey, Final Report to the Risk Assessment and Management Committee of the ANSTF, Gainesville, FL, 2001, available at http://www.jstor.org/stable/10.1899/27.3.BR.800.1; and C. S. Kolar, D. C. Chapman, and W. R. Courtenay et al., *Asian Carps of the Genus Hypophthalmichthys (Pisces, Cyprinidae):A Biological Synopsis and Environmental Risk Assessment*, U.S. Geological Survey, Report to the Fish and Wildlife Service, LaCrosse, WI, 2005, available at https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2010106904.xhtml.

[76] The Lacey Act, 16 U.S.C. §§3371-3378, makes it unlawful to import, export, sell, acquire, or purchase fish, wildlife or plants taken, possessed, transported, or sold (1) in violation of U.S. or Indian law or (2) in interstate or foreign commerce involving any fish, wildlife, or plants taken, possessed or sold in violation of state or foreign law. Under this law, designated injurious species are identified at 50 C.F.R. §16. See also http://www.anstaskforce.gov/Documents/Injurious_Wildlife_Fact_Sheet_2007.pdf.

Department of Natural Resources.[77] The finding was significant, as it represented the first live Asian carp located upstream of the barriers. A second live silver carp was found in June 2017 in the Little Calumet River (above the electric barriers, below the T.J. O'Brien Lock and Dam, nine miles from Lake Michigan) by a fisherman under contract as part of the ACRCC Monitoring Response Work Group's seasonal monitoring event.[78]

In 2010 the White House convened a Summit for Great Lakes governors on the threat of Asian carp. This meeting focused on defining strategies to combat the spread of Asian carp and improving coordination and effective response across all levels of government. At the summit, the Obama Administration unveiled a framework, known as the Asian Carp Control Strategy Framework (referred to here as the framework).[79] The framework has been updated annually to report on new actions and funding for Asian carp.

The original FY2010 framework built on the existing work by federal agencies (including barrier operations and monitoring) and outlined future actions and new funding sources to eliminate the threat of Asian carp in the Great Lakes. Many of the new expenditures at that time were funded by the Environmental Protection Agency's Great Lakes Restoration Initiative (GLRI), which provided for interagency transfers to fund federal actions, as well as grants for state and local actions.[80] Subsequent frameworks have included less funding from the GLRI and more funding from agency "base" budgets (i.e., actions not funded from the GLRI). Major actions that have been funded in these frameworks include targeted monitoring and assessment above and below the electric barrier system, commercial harvesting and removal actions below the barrier system, waterway separation and control measures, research and technology development, eDNA analysis and refinement, enforcement of illegal transfer, outreach communication and training, and carrying out the Great Lakes Mississippi River Interbasin Study and other pathway closures (see below section, "GLMRIS Study"), among other things. In 2016 the title of the framework was changed to Asian Carp Action Plan (referred to here as action plan) in order to highlight interagency planning and coordination.[81] The 2016 and 2017 action plans include a long-term planning document, identifying future actions to continue preventing the introduction, establishment, and spread of Asian cap in the Great Lakes. Reported funding levels in the frameworks are shown below in **Table 3**.

Table 3. Asian Carp Control Strategy Framework: GLRI and Base Funding
(dollars rounded to the nearest million)

	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018 (Request)
Agency "Base" Funding	$21	$20	$32	$35	$45	$58	$40	$26	$19
GLRI Funding	$58	$26	$19	$16	$16	$16	$17.5	$23	$0

[77] See http://www.asiancarp.us/news/bigheadchicago.htm.

[78] See http://www.asiancarp.us/documents/SilverCarpCapturePressRelease6-23-17.pdf.

[79] See Asian Carp Regional Coordinating Committee, *FY2012 Asian Carp Control Strategy Framework*, February 2012. Available at http://www.asiancarp.us/documents/2012Framework.pdf.

[80] For more information on the GLRI, see CRS Report R43249, *The Great Lakes Restoration Initiative: Background and Issues*, by Pervaze A. Sheikh.

[81] See Asian Carp Regional Coordinating Committee, *FY2016 Asian Carp Action Plan*, April 2016. Available at http://www.asiancarp.us/documents/2016AsianCarpActionPlan.pdf.

	FY2010	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018 (Request)
Total Funding	$79	$46	$52	$51	$61	$74	$57.5	$42	$19

Source: Asian Carp Regional Control Frameworks/Action Plans for FY2010-FY2017 and FY2017 Consolidated Appropriations Act Joint Explanatory Statement.

Note: FY2017 funding assumed constant funding from FY2016 enacted budget (Asian Carp Action Plan 2017). The Trump Administration proposed to eliminate funding for GLRI for FY2018, stating that "this change returns the responsibility for funding local environmental efforts and programs to state and local entities." For its part, the House Committee on Appropriations for Interior and Environment's appropriations bill for FY2018 recommended maintaining GLRI at FY2017 enacted level. See committee report at https://appropriations.house.gov/uploadedfiles/23918.pdf.

GLMRIS Study

The most prominent long-term Asian carp prevention option is the potential separation of the Great Lakes and Mississippi River basins (in Chicago and in other areas), so as to prevent all interbasin movement of aquatic nuisance species.[82] A return to physical hydrologic separation of the basins in the Chicago area would make further encroachment of Asian carp in that area unlikely, but would involve significant changes to existing navigation and water control structures in the CAWS. Efforts to separate other areas of potential encroachment between the two basins would be similarly costly and could require modifications and construction throughout the region.

Beginning in 2010, the Corps undertook a study, the Great Lakes and Mississippi River Interbasin Study, or GLMRIS, to evaluate potential options to prevent or reduce the spread of aquatic invasive species between the Great Lakes and Mississippi River basins. Authority for the study was provided in Section 3061(d) of WRDA 2007 (P.L. 110-114), and directed that "hydrologic separation" be among the options considered by the Corps. Congress provided subsequent guidance for GLMRIS in P.L. 112-141, the Moving Ahead for Progress in the 21st Century Act (also known as MAP-21), enacted on July 6, 2012.[83] That authorization directed the Corps to expedite completion of the GLMRIS study.

The Corps released its GLMRIS study on January 6, 2013.[84] It differed from a "traditional" Corps feasibility study in several ways. Most important, it analyzed an array of potential alternatives but did not recommend a specific plan. In contrast to most Corps feasibility studies, it did not include an environmental impact statement as required for federal construction projects under the National Environmental Policy Act, nor did it include a breakdown of expected cost-share responsibilities between the federal government and local sponsors. Thus, some in Congress have expressed concerns that the report is not actionable in a legislative context. In explaining its approach, the Corps pointed to the original WRDA 2007 authority for the study, noting that in contrast to traditional Corps authorizations, this legislation directed the Corps to identify and

[82] See also Jerry L. Rasmussen, et al., "Dividing the Waters: The Case for Hydrologic Separation of the North American Great Lakes and Mississippi River Basins," *Journal of Great Lakes Research*, v. 37, no. 3 (Sept 2011): 588-592.

[83] See P.L. 110-114, §345, and P.L. 112-141, §1538. The latter authorization, which was enacted on July 6, 2012, directed the Corps to complete the portion of the study focusing on the CAWS within 18 months of enactment.

[84] U.S. Army Corps of Engineers, *Great Lakes and Mississippi River Interbasin Study*, January 6, 2013. http://glmris.anl.gov/glmris-report/. Hereinafter, GLMRIS.

study a range of alternatives.[85] The Corps also pointed to the MAP-21 requirement for expedited study completion, and noted that a full study process would have been impossible to complete under the required time frame.

The GLMRIS study describes eight alternatives, including a "no action" alternative, to prevent the interbasin transfer (i.e., upstream or downstream movements) of multiple aquatic nuisance species, or ANS (i.e., Asian carp, as well as other species). It focuses on the CAWS, with future phases of the study expected to focus on other areas of connection outside of Chicago. The options outlined in GLMRIS range from no or minimal changes to the current approach (such as nonstructural methods of prevention, which are included in seven of the eight options), to major structural changes to water control structures (six of the eight options) and complete hydrologic separation (four of the eight options). The cost for the options analyzed ranges from no cost to more than $18 billion for complete lakefront hydrologic separation. The eight alternatives analyzed in GLMRIS and their costs are shown below in **Table 4**. Several of the alternatives include one or more of a new and previously untested structure, referred to by the Corps as a "GLMRIS lock." The lock would be built and operated to specifications meant to negate the potential for the spread of ANS. The lock is shown below in **Figure 6**.

Table 4. Summary of GLMRIS Alternatives

($ in billions)

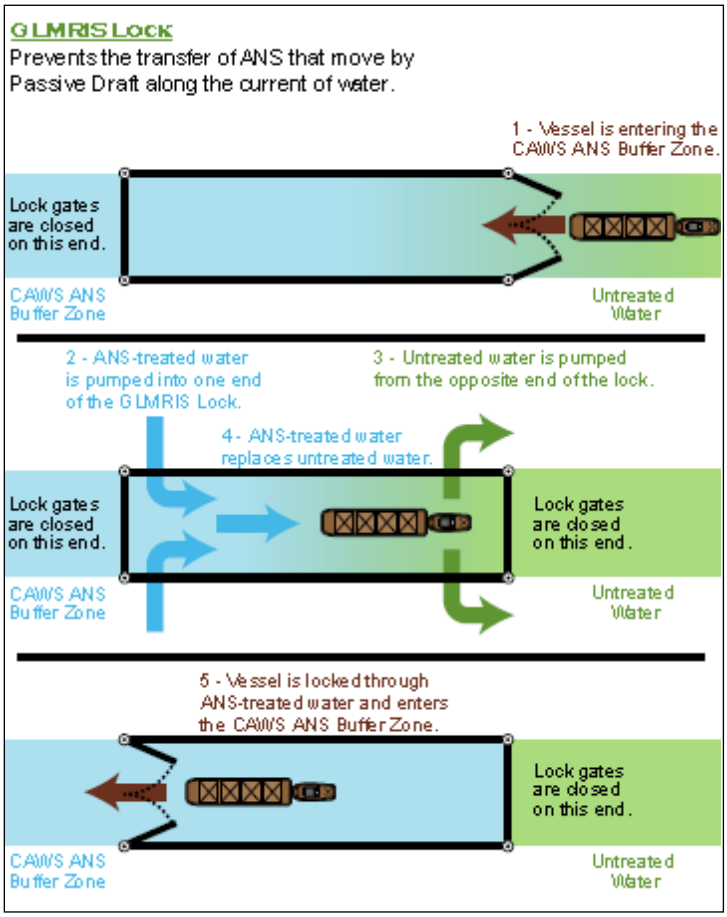
Alternative	Name/Description	Cost ($-b)	Time to Complete
1	No New Action	—	—-
2	Nonstructural Control Technologies	$0.068	Immediate
3	Mid-System Control Technology with No Buffer Zone	$15.543	25 years
4	Control Technology with a Buffer Zone	$7.806	10 years
5	Lakefront Hydrologic Separation	$18.389	25 years
6	Mid-System Hydrologic Separation	$15.512	25 years
7	Mid-System Separation, Cal-Sag Open, Control Technologies with a Buffer Zone	$15.097	25 years
8	Mid-System Separation, CSSC Open, Control Technologies with a Buffer Zone	$8.333	25 years

Source: Great Lakes and Mississippi River Interbasin Study, 2013.

Notes: All of the alternatives except the no action alternative include nonstructural actions.

[85] The Corps explanation is generally provided in GLMRIS, pp ES-1 to ES-3. Some disagree with this interpretation, pointing out that the Corps typically includes a recommended alternative in its studies without explicit direction to do so from Congress.

Figure 6. GLMRIS Lock Operations



Source: Great Lakes and Mississippi River Interbasin Study, 2013

Brandon Road Lock and Dam Study

The GLMRIS report describes the Brandon Road Lock and Dam (BRLD) as a promising location to control the movement of carp upstream into the Great Lakes basin, where all five aquatic pathways between the Great Lakes and Mississippi River basins share a connection point, as seen in **Figure 7**.[86] The height of the Brandon Road dam prevents fish from potentially swimming or jumping upstream; and therefore the only aquatic connection is through the adjacent lock. The BRLD was highlighted for implementation of proposed control technologies in three out of the six structural alternatives presented in the GLMRIS.

In May 2014, the Corps released a summary of public comments received on the alternatives outlined in the GLMRIS report. The summary report found a split in public opinion, noting 40% of commenters favored an alternative that involved physical separation, while 35% preferred an alternative that allowed navigation within the CAWS.[87] Based on this public input, the Corps concluded that a formal evaluation of options and technologies near the BRLD was an

[86] GLMRIS, p. 21.

[87] U.S. Army Corps of Engineers, *GLMRIS Report Public Comment Summary*, May 2014. http://glmris.anl.gov/documents/docs/glmris_report_public_input.pdf.

appropriate next step to prevent or reduce the spread of aquatic invasive species.[88] Authority for the study was provided in Section 1039 of the Water Resources Reform and Development Act (WRRDA) of 2014 (P.L. 113-121), which directed the Corps to establish formal emergency procedures to prevent the passing of Asian carp beyond the BRLD. Congress provided guidance for the Brandon Road Study in the explanatory statement for P.L. 114-113, the Consolidated Appropriations Act of 2016, directing the Corps to expedite completion of the Brandon Road Study.[89]

Figure 7. Brandon Road Study Area

Source: Brandon Road Draft Integrated Feasibility and Environmental Impact Statement, 2017.

[88] U.S. Army Corps of Engineers, "Corps Announces Plans to Evaluate Options at Brandon Road Site as Continuance of Great Lakes and Mississippi River Interbasin Study (GLMRIS), Initiates Public Comment Period," news release, Chicago, IL, November 18, 2014.

[89] *Congressional Record*, December 17, 2015, p. H10056.

After receiving pressure from Congress, the Trump Administration released a draft plan for the BRLD in August 2017.[90] Those pushing for a delay of the release of the report proposed further planning and coordination until a new Assistant Secretary of the Army for Civil Works was appointed. On the other hand, two bills (H.R. 2983 and S. 1398) were introduced in June 2017 that would have mandated the Corps to release the draft report.[91] The study is a follow-up to the broader GLMRIS, which surveyed potential options to separate the Great Lakes and Mississippi River drainage basins so as to prevent encroachment of Asian carp and other invasive species. After public comment closes (October 2017), the Corps expects that a final feasibility study will take roughly two years to complete.[92]

The Draft Brandon Road Study evaluated six alternatives and includes a tentative recommendation. Alternatives were evaluated based on probability of establishment in Great Lakes, safety risk, system performance, construction and National Economic Development (NED) costs, and anticipated implementation date, among other things.[93] Alternatives are further described in **Table 5**. The study selected the technology alternative, including both complex noise and an electric barrier, as the tentatively selected plan, which involves using nonstructural control, complex noise, water jets, an engineered channel, an electric barrier, and other measures to prevent Asian carp from traveling further upstream. The Corps report says this alternative was selected because it both reduces risk of invasive establishment as well as allows for continued navigation. These measures would cost over $275 million and could be complete by 2025 at the earliest.[94] While the lock closure alternative was ranked as the most effective alternative, the Corps calculated that the closure of navigation would cost the shipping industry more than $300 million annually.

Some express concern for how the plan could affect commercial navigation, citing the effectiveness of control strategies to date at keeping Asian carp out of Lake Michigan.[95] On the other hand, proponents for the plan in the recreational fishing and boating industry emphasize the risk invasive species pose to the aquatic ecosystem.

[90] U.S. Army Corps of Engineers, *Great Lakes and Mississippi River Interbasin Study—Brandon Road Draft Integrated Feasibility Study and Environmental Impact Statement,* August 2017, http://glmris.anl.gov/documents/docs/brandon-rd/GLMRIS-BR_Draft_Report.pdf. Hereinafter, Brandon Road Draft Study.

[91] The bills were announced on June 21, 2017, the same day a live carp was caught nine miles from Lake Michigan (see "Asian Carp Action Plan (Formerly Asian Carp Control Strategy Framework)").

[92] Brandon Road Draft Study, p. 396.

[93] Typically, Corps ecosystem restoration projects and involves a number of potential benefits that are nonmonetized, thus alternatives are evaluated based on National Ecosystem Restoration (NER) outputs (i.e., net change in ecosystem values). However, multipurpose plans such as the Brandon Road Study must contribute to both NER and National Economic Development (NED) benefits, which in this case include the project's potential effects on navigation and Great Lakes Fisheries. Thus for this project, the tentative recommendation is that which maximizes the sum of net contributions to NED and NER. For a complete list of evaluation criteria and a comparison among alternatives, see Brandon Road Draft Study, p. ES-13, Figure ES-6.

[94] The nonfederal cost share of implementation costs for Corps ecosystem restoration/protection project is 35%, unless the project authorization details otherwise (33 U.S.C. §2213(c)(7)).

[95] See http://www.chicagotribune.com/news/opinion/commentary/ct-asian-carp-lake-michigan-army-corps-engineers-perspec-0226-jm-20170224-story.html.

Table 5. Summary of Draft Brandon Road Study Alternatives

($ in millions)

Alternative	Name/Description	First Costs ($-m)	Time to Complete
1	No New Action	—	—
2	Nonstructural Alternative	$0.6	2 years
3	Technology Alternative, Electric Barrier	$266.8	4 years
4	Technology Alternative, Complex Noise	$113.9	4 years
5	**Technology Alternative, Complex Noise with Electric Barrier**	**$275.4**	**4 years**
6	Lock Closure	$5.9	2 years

Source: Brandon Road Draft Integrated Feasibility and Environmental Impact Statement, 2017.

Notes: All of the alternatives except the no action alternative include nonstructural actions. Time to complete assumes the alternative is authorized for construction.

Upper Mississippi and Ohio River Basins Prevention

Apart from efforts in the Great Lake region, some have expressed concern that Asian carp could continue north on the Mississippi River and its tributaries and damage ecosystems in the Upper Mississippi. Section 5016 of WRDA 2007 authorized the Corps to study and construct a project to prevent dispersal of aquatic nuisance species into the northern reaches of the Upper Mississippi River system. Section 1039 of WRRDA 2014 (P.L. 113-121) authorized FWS, in collaboration with the National Park Service (NPS) and USGS, to provide technical assistance, best practices, and support to state and local governments working to slow the spread of Asian carp in the Upper Mississippi and Ohio River Basins. In FY2015, federal agencies spent approximately $2.3 million on activities in the Upper Mississippi and Ohio River Basins (excluding the CAWS).[96]

Litigation

The apparent ecological and economic threat posed by the migration of Asian carp into the Great Lakes via the CAWS has prompted litigation to prevent such risks. Several Great Lakes states, particularly Michigan, have pursued a number of legal options, seeking court orders to restrict the entry of Asian carp into Lake Michigan and the Great Lakes generally.

In December 2009, Michigan petitioned the U.S. Supreme Court to amend its 1967 decree regarding diversion of water between Lake Michigan and the Illinois Waterway, including the Chicago Sanitary and Ship Canal.[97] With the support of other Great Lakes state and regional governments, Michigan sought an order from the Court that would declare the operation of

[96] U.S. Fish and Wildlife Service, 2015 Annual Report to Congress: Second Annual Summary of Activities and Expenditures to Manage the Threat of Asian Carp in the Upper Mississippi and Ohio River Basins, September 2015, https://www.fws.gov/midwest/fisheries/asian-carp/WRRDA2015.pdf.

[97] Motion to Reopen and For a Supplemental Decree, Petition, and Brief and Appendix in Support of Motion, *Wisconsin v. Illinois*, 388 U.S. 426 (1967), *available at* http://www.supremecourt.gov/SpecMastRpt/Orig%201,%202%20&%203%20Motion%20to%20Reopen.pdf. The Court's 1967 decree controls the diversion of water from Lake Michigan into the Chicago Sanitary and Ship Canal and provides that any of the parties to the disputes resolved by the decree may petition the Court to modify the decree or issue a supplemental decree for issues that would affect the operation of the waterway. *Wisconsin*, 388 U.S. at 430.

diversion facilities within the CAWS to be a public nuisance that threatened natural resources and allowed the introduction of invasive species into Lake Michigan.[98] Michigan also requested that the Court order Illinois, the U.S. Army Corps of Engineers, and the Metropolitan Water Reclamation District of Greater Chicago to prevent the spread of Asian carp into the lake by closing shipping locks and taking other necessary measures to prevent the carp from entering Lake Michigan.[99] Without comment, the Court denied Michigan's requests.[100] In February 2010, Michigan renewed its motion and requested that the Court reconsider an order to close the Chicago-area locks based on new evidence showing Asian carp to be present in Lake Michigan.[101] The Court again denied Michigan's motion without comment.[102]

After a live Asian carp was found beyond the electric barrier in the summer of 2010, Michigan, Minnesota, Ohio, Pennsylvania, and Wisconsin sued the U.S. Army Corps of Engineers and the Metropolitan Water Reclamation District of Greater Chicago (MWRD) in federal district court, seeking similar remedial measures as they requested in their attempt to amend the Supreme Court's 1967 decree. The states sought an order compelling the Corps and MWRD to abate the public nuisance created by the migration of Asian carp into the Great Lakes, to minimize the risk of migration from the CAWS to Lake Michigan, and to implement permanent measures to separate Illinois waters from Lake Michigan.[103] The court rejected each of the proposed remedial measures, noting a lack of consensus on the extent of the threat and the efficacy of the proposed solutions.[104] It held that the discovery of a live fish above the barrier did not prove that the barrier had failed and noted that the cause of the introduction of the fish to that particular section of the waterway was not known.[105] The court emphasized "its recognition that the potential harm in a worst case scenario is great" but concluded that "the level of certainty of harm is low based on the evidence adduced to date."[106] In July 2014, a federal appeals court again denied unanimously the states' motion.[107]

Canadian Concern

For many decades, the United States and Canada have conducted a major cooperative program to deal with the consequences arising from the introduction of the non-native sea lamprey,

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[98] *Mot. to Reopen* at 1-2. Minnesota, New York, Ohio, Wisconsin, and the Canadian Province of Ontario filed briefs in support of Michigan's request.

[99] Motion for Preliminary Injunction at 29-30, *Wisconsin v. Illinois*, 388 U.S. 426.

[100] Wisconsin v. Illinois, Nos. 1, 2, and 3, Orig., 130 S.Ct. 1166 (Jan. 19, 2010) (order denying Michigan's motion for preliminary injunction); Wisconsin v. Illinois, Nos. 1, 2, and 3, Orig., 130 S.Ct. 2397 (Apr. 26, 2010) (order denying Michigan's motion to reopen and for supplemental decree).

[101] Renewed Motion for Preliminary Injunction, *Wisconsin v. Illinois*, 388 U.S. 426, *available at* http://www.supremecourt.gov/SpecMastRpt/1-Renewed%20Motion%20for%20PI.pdf.

[102] Wisconsin v. Illinois, Nos. 1, 2, and 3, Orig., 130 S.Ct. 1934 (Mar. 22, 2010) (order denying Michigan's renewed motion for preliminary injunction).

[103] Complaint for Injunctive and Declaratory Relief at 2, Michigan v. U.S. Army Corps of Engineers, No. 1:10-cv-04457 (N.D. Ill. July 19, 2010).

[104] Michigan v. U.S. Army Corps of Engineers, No. 1:10-cv-04457, 11-21 (filed Dec. 2, 2010), *available at* http://www.greatlakeslaw.org/files/dist_ct_pi_opinion_order.pdf.

[105] *Id*. at 49-50 ("the presence of a single live fish (or a small number of individual live fish) above the barrier is far too thin a basis from which to infer that the barrier is not effective").

[106] *Id*. at 54, 61.

[107] Michigan v. U.S. Army Corps of Engineers, No. 12-3800, July 14, 2014, http://media.ca7.uscourts.gov/cgi-bin/rssExec.pl?Submit=Display&Path=Y2014/D07-14/C:12-3800:J:Wood:aut:T:fnOp:N:1380188:S:0.

Petromyzon marinus, to the Great Lakes. Through the Great Lakes Fishery Commission, the governments of the United States and Canada, together with neighboring states and provinces, spend millions of dollars annually to control this invasive parasite and limit its damage to sport and commercial fisheries.

Canada has assessed the risks posed by the introduction of Asian carp,[108] concluding that the risk of impact would be high in some parts of Canada, including the southern Great Lakes basin, by the four species of Asian carp. Canada is currently addressing these concerns through its participation in the bilateral Great Lakes Fishery Commission and the ACRCC. In 2015, nine Grass carp were found on the Canadian side of the Great Lakes.[109]

The Great Lakes Water Quality Agreement (Agreement) between the United States and Canada, coordinated by EPA, was renewed in 2012, stating that the Great Lakes should be "free from the introduction and spread of aquatic invasive species" which negatively impact water quality, among other things.[110] The Agreement commits to a triennial review of the state of the Great Lakes to analyze basin-wide environmental trends and ecosystem conditions.[111] The 2017 State of the Great Lakes report ranks the status of invasive species in the Great Lakes as poor with a deteriorating trend.[112] The report notes that, while the number of new invasive species to the ecosystem has slowed, at least 30% of the aquatic invasive species in the Great Lakes have significant environmental impact.[113]

Congressional Interest

As previously mentioned, Section 1039 of P.L. 113-121 directed the Corps to implement additional measures to prevent aquatic nuisance species from bypassing the Chicago Sanitary and Ship Canal Dispersal Barrier Project and to prevent aquatic nuisance species from dispersing into the Great Lakes. Congress has previously held several hearings on Asian carp. On February 9, 2010, the House Transportation and Infrastructure Subcommittee on Water Resources and Environment held a hearing on Asian carp in the Great Lakes. On February 25, 2010, the Senate Energy and Natural Resources Subcommittee on Water and Power held a hearing to examine the science and policy behind efforts to prevent the introduction of Asian carp into the Great Lakes. On July 14, 2010, the Senate Energy and Natural Resources Subcommittee on Water and Power held an oversight hearing to examine the federal response to the discovery of Asian carp in Lake Calumet, Illinois.

While no hearings have been held to date in the 115th Congress, appropriations concerns relating to Asian carp have been discussed. House and Senate committee reports for the Energy and Water Development appropriations bill for FY2018 provide guidance for use of Corps funding related to Asian carp prevention. The Senate report would direct the Corps to provide quarterly updates to

[108] Available at http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2004/RES2004_103_E.pdf.

[109] See Asian Carp Regional Coordinating Committee, *FY2017 Asian Carp Action Plan*, December 2016. Available at http://www.asiancarp.us/documents/2017ActionPlan.pdf.

[110] Great Lakes Water Quality Protocol of 2012, Protocol Amending the Agreement Between Canada and the United States of America on Great Lakes Water Quality, 1978, as Amended on October 16,1983, and on November 18, 1987, February 12, 2013. Available at https://binational.net//wp-content/uploads/2014/05/1094_Canada-USA-GLWQA-_e.pdf.

[111] Ibid, p.54.

[112] See The Governments of Canada and the United States, *State of the Great Lakes 2017 Highlights Report*, June 2017. Available at https://binational.net/wp-content/uploads/2017/06/SOGL_17-EN.pdf.

[113] Ibid, p.14.

Congress on federal efforts to prevent the spread of Asian carp.[114] The House report would provide funds for existing electric barriers in the CAWS and provide semiannual progress updates to Congress.[115] Both reports also directed the Corps to release the Brandon Road Study in draft form.

One ongoing question for Congress is whether to authorize the Brandon Road Study's findings, and if so when this should occur. In recent years, a finalized feasibility study by the Corps and a Report by the Chief of Engineers (or "Chief's Report") recommending a project for construction have typically formed the basis for Corps project construction authorizations in Water Resources Development Acts.[116] Thus, formal authorization of the Brandon Road study's findings could encounter procedural hurdles in pursuing congressional authorization as long as the study remains in draft form.

Legislation

Bills introduced in the 115th Congress, H.R. 2983 and S. 1398, would have required the Corps to release a draft version of the GLMRIS Brandon Road Study, which was subsequently released in August 2017. Other authorities have been enacted in prior congresses. In the 112th Congress, Division B, Section 105, of P.L. 112-74 authorized the Corps of Engineers to implement emergency measures to exclude Asian carp from the Great Lakes, and Section 1538 of P.L. 112-141 authorized expedited completion of parts of the GLMRIS study (see above section, "GLMRIS Study"). In the 113th Congress, Section 1039 of P.L. 113-121 directed the Corps to establish formal emergency procedures to prevent the passing of Asian carp beyond the Brandon Road Lock and Dam. Congress provided guidance for the Brandon Road Study in the explanatory statement for P.L. 114-113, directing the Corps to expedite completion of the Brandon Road Study.[117]

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[114] U.S. Congress, Senate Committee on Appropriations, *Energy and Water Development Appropriations Bill*, report to accompany S. 1609, 115th Cong., 1st sess., July 20, 2017, S.Rept. 115-132 (Washington: GPO, 2017).

[115] U.S. Congress, House Committee on Appropriations, *Energy and Water Development Appropriations*, report to accompany H.R. 3266, 115th Cong., 1st sess., July 17, 2017, H.Rept. 115-230 (Washington: GPO, 2017).

[116] For more information see CRS Report R41243, *Army Corps of Engineers: Water Resource Authorizations, Appropriations, and Activities*, by Nicole T. Carter and Charles V. Stern.

[117] *Congressional Record*, December 17, 2015, p. H10056.

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