



# Asian Carp and the Great Lakes Region

**Eugene H. Buck**

Specialist in Natural Resources Policy

**Harold F. Upton**

Analyst in Natural Resources Policy

**Charles V. Stern**

Analyst in Natural Resources Policy

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## Summary

Four species of non-indigenous Asian carp are invading U.S. waterways, resulting in a variety of concerns and problems. Two species—bighead and silver carp—are of particular concern, based on the perceived degree of potential danger. 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. Bills have been introduced in the 111<sup>th</sup> Congress to improve control of these species.

According to the Great Lakes Fishery Commission, Asian carp are 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 has constructed and is currently operating electrical barriers to prevent fish passage. However, in light of recent tests indicating the potential presence of Asian carp in the Great Lakes, increased federal funding to prevent fish encroachment has been announced by the Obama Administration, and calls to permanently separate the two basins have grown. The potential closure of existing navigation structures in the CAWS and the permanent separation of the basins remains the most contentious issue related to Asian carp control, and a long-term solution has yet to be decided.

On December 21, 2009, the State of Michigan filed suit against the State of Illinois, the U.S. Army Corps of Engineers, and the Metropolitan Water Reclamation District of Greater Chicago. Michigan has asked the U.S. Supreme Court to order closure of shipping locks near Chicago to prevent Asian carp from invading the Great Lakes. On January 19, 2010, the Supreme Court refused to order emergency measures sought by the State of Michigan to stop the migration of invasive Asian carp toward Lake Michigan from rivers and a sanitary canal in Illinois. Without comment, the Court refused to issue a preliminary injunction that would have closed waterway locks and required other temporary measures in reaction to the discovery of Asian carp upstream in Illinois rivers.

In the 111<sup>th</sup> Congress, Section 126 in Title I of P.L. 111-85 directed the U.S. Army Corps of Engineers to implement additional measures to prevent aquatic invasive species from bypassing the Chicago Sanitary and Ship Canal Dispersal Barrier Project and dispersing into the Great Lakes. Other bills have been introduced to list Asian carp species as injurious under the Lacey Act (H.R. 48, H.R. 3173, S. 237, S. 1421), and to direct various federal agencies to take specific actions to increase control over and restrict the spread of Asian carp (H.R. 51, H.R. 4472, S. 237, S. 2946).

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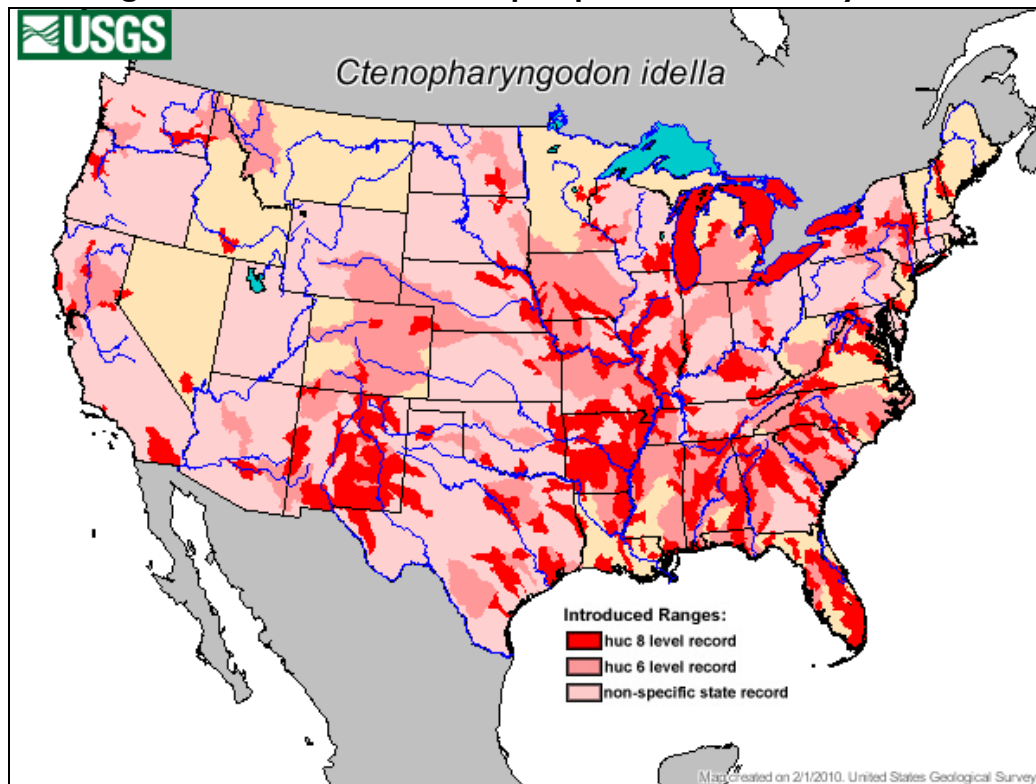
## Background

Four species of non-indigenous Asian carp are invading U.S. waterways, resulting in a variety of concerns and problems. Two species—bighead and silver carp—are of particular concern, based on the perceived degree of potential danger. 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. Bills have been introduced in the 111<sup>th</sup> Congress to improve control of these species.

### Grass Carp<sup>1</sup>

The grass carp or white amur, *Ctenopharyngodon idella*, was first imported to the United States in 1963 for biological control of vegetation in aquaculture operations. Grass carp have also been stocked to biologically control invasive aquatic plants in other settings. Shallow, quiet waters are the grass carp's typical habitat, and this species easily tolerates waters near freezing. Its maximum size is about 100 pounds. The species initially escaped a fish farming experiment station in Arkansas, and was subsequently stocked in Arkansas lakes and reservoirs open to stream systems. It has since spread widely across the country, including to four of the Great Lakes (**Figure 1**).

**Figure 1. Records of Grass Carp Capture, as of February 1, 2010**



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

**Notes:** HUC is an abbreviation for “Hydrologic Unit Code,” used to indicate to how much of a drainage basin the data apply. HUC 6 indicates that one or more grass carp have been captured in the drainage basin. HUC 8

<sup>1</sup> Information from U.S. Geological Survey Fact Sheet, at <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=514>.

indicates that one or more grass carp have been captured in the drainage subbasin. These records should not be interpreted as indicating the current presence of grass carp in all of these areas.

## Black Carp<sup>2</sup>

The black carp or black amur, *Mylopharyngodon piceus*, arrived in the United States in the early 1970s unintentionally among imported grass carp. Subsequently, this species was imported as a food fish and as a biological control agent to combat a pest in aquaculture ponds. Of the four species of carp in U.S. waterways, black carp has the most limited 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 can pose a significant threat to native mollusks, many of which are listed as threatened or endangered under the Endangered Species Act. The maximum size of this species is about 150 pounds.

**Figure 2. Records of Black Carp Capture, as of February 2, 2010**



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

**Notes:** HUC is an abbreviation for “Hydrologic Unit Code,” used to indicate to how much of a drainage basin the data apply. HUC 8 indicates that one or more black carp have been captured in the drainage subbasin. These records should not be interpreted as indicating the current presence of black carp in all of these areas.

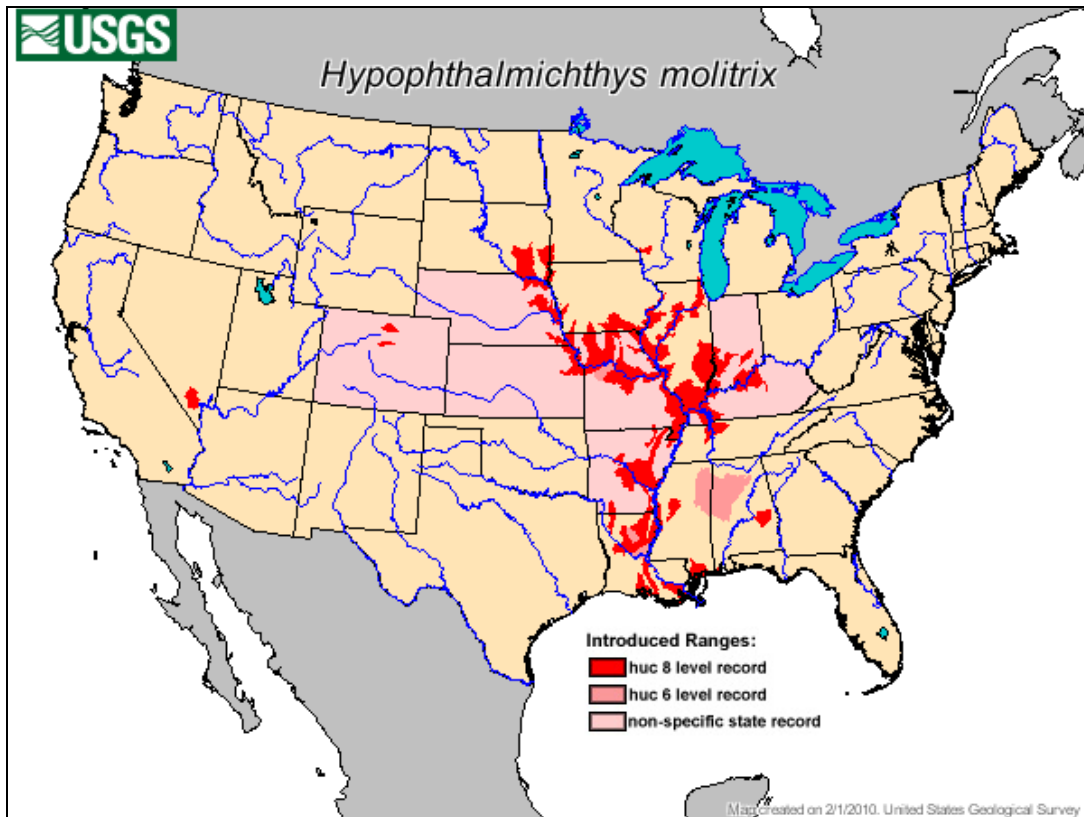
<sup>2</sup> Information from U.S. Geological Survey Fact Sheet, at <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=573>.

## Silver Carp<sup>3</sup>

Silver carp, *Hypophthalmichthys molitrix*, were first imported to the United States in 1973 by a private fish farmer in Arkansas. This species has been used to control phytoplankton (microscopic drifting algae) in nutrient-rich water bodies and is also a food fish. Escapes from aquaculture facilities and unintended inclusion of silver carp among shipments of grass carp stocks have contributed to the spread of this species. The U.S. distribution of silver carp is confined primarily to the Mississippi River drainage, with no proven occurrence in the Great Lakes (Figure 3).

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. The maximum size of this species is about 60 pounds.

**Figure 3. Records of Silver Carp Capture, as of February 1, 2010**



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

**Notes:** HUC is an abbreviation for “Hydrologic Unit Code,” used to indicate to how much of a drainage basin the data apply. HUC 6 indicates that one or more silver carp have been captured in the drainage basin. HUC 8 indicates that one or more silver carp have been captured in the drainage subbasin. These records should not be interpreted as indicating the current presence of silver carp in all of these areas.

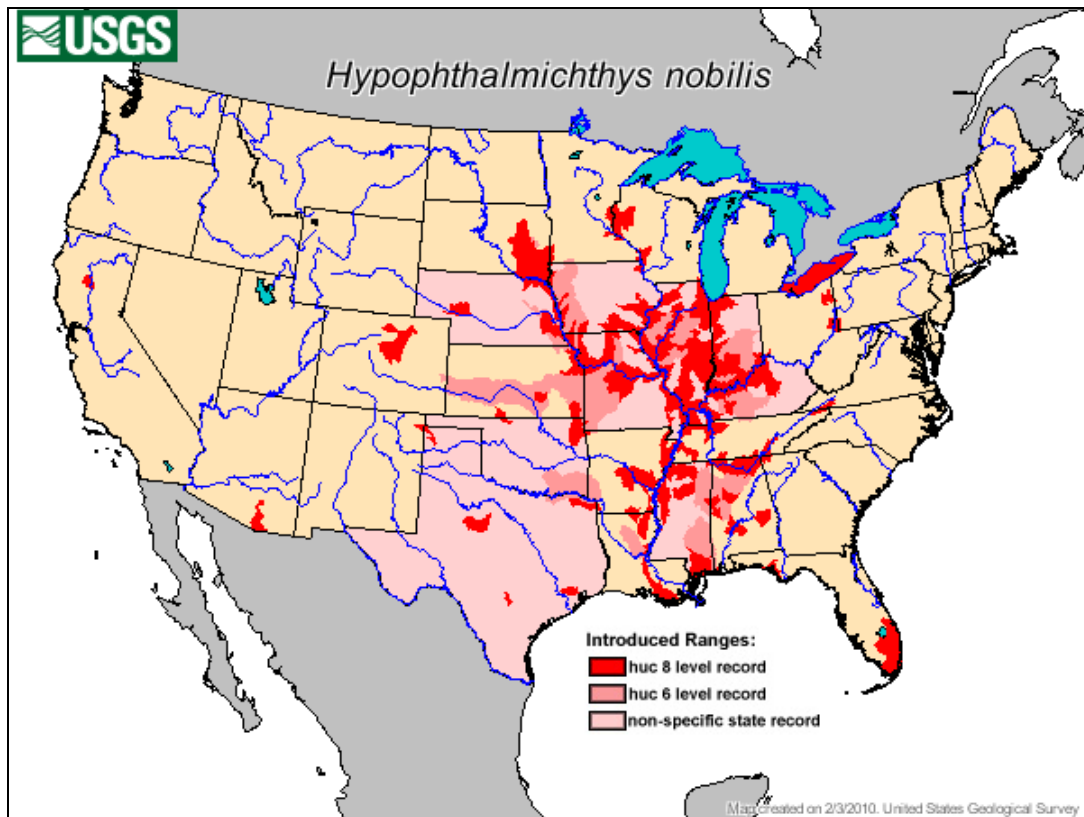
<sup>3</sup> Information from U.S. Geological Survey Fact Sheet, at <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=549>.

## Bighead Carp<sup>4</sup>

The bighead carp, *Hypophthalmichthys nobilis*, was first imported to the United States in 1972 for use in a private aquaculture operation in Arkansas. This species was discovered in open waters of the Ohio and Mississippi Rivers in the 1980s, probably after escaping aquaculture facilities. In the United States, bighead carp are found primarily in the Mississippi River drainage, but they have been reported in Lake Erie (Figure 4).

Bighead carp inhabit large rivers. They are filter-feeders, consuming primarily phytoplankton and zooplankton. The maximum size of this species is about 90 pounds.

**Figure 4. Records of Bighead Carp Capture, as of February 3, 2010**



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

**Notes:** HUC is an abbreviation for “Hydrologic Unit Code,” used to indicate to how much of a drainage basin the data apply. HUC 6 indicates that one or more bighead carp have been captured in the drainage basin. HUC 8 indicates that one or more bighead carp have been captured in the drainage subbasin. These records should not be interpreted as indicating the current presence of bighead carp in all of these areas.

<sup>4</sup> Information from U.S. Geological Survey Fact Sheet, at <http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=551>.

## **Economy at Risk**

### **Threat**

According to the Great Lakes Fishery Commission,<sup>5</sup> Asian carp are a significant threat to fisheries of the Great Lakes.<sup>6</sup> 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. Native 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.<sup>7</sup> 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.<sup>8</sup> 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 additional concerns have also been raised because of potential effects on recreational boating and hunting.<sup>9</sup> Although undetermined at this point, it is also possible that there could be positive consequences to the Great Lakes ecosystem from the introduction of these fish.

### **Economy**

It has been widely reported that Great Lakes fisheries generate economic activity of approximately \$7 billion annually, and these fisheries are threatened by the introduction of Asian carp. Potential economic effects of Asian carp movement into the Great Lakes should be put in the proper context for several reasons. The entire Great Lakes fishery and its associated value are not likely to be at risk. Although Asian carp introduction is likely to harm many Great Lakes fisheries, potential changes to the ecosystem and associated economy are not fully understood. Additional biological and economic data and analyses would be required to estimate the magnitude of potential changes to these fisheries. This information is not available for predicting biological and economic changes by lake, species, or fishery. Measures of economic activity such as 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,<sup>10</sup> to make comparisons of the economic efficiency of 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.

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<sup>5</sup> Established in 1954 under the bilateral U.S./Canada Convention on Great Lakes Fisheries.

<sup>6</sup> See <http://www.glfsc.org/fishmgmt/carp.php>.

<sup>7</sup> See <http://www.asiancarp.org/rapidresponse/documents/AsianCarp.pdf>.

<sup>8</sup> See <http://www.glfsc.org/fishmgmt/carp.php>.

<sup>9</sup> 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.

<sup>10</sup> 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.



The economic impacts 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 valuing 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 2006, approximately 1.5 million anglers fished 17.9 million recreational days on the Great Lakes.<sup>11</sup> These anglers spent an estimated \$1.2 billion during Great Lakes fishing trips and \$1.3 billion on equipment for activities related to Great Lakes fishing.<sup>12</sup> Economic impacts resulting from these expenditures included more than 58,000 jobs, salaries of \$2.1 billion, and total impacts<sup>13</sup> throughout the U.S. economy of slightly more than \$7 billion.<sup>14</sup> 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.<sup>15</sup> **Table 1** provides a breakdown of angling activity and economic impacts of recreational fishing by state.

In 2008, commercial fishing in the Great Lakes produced 18.3 million pounds of fish with a landed value<sup>16</sup> of nearly \$17 million (**Table 2**).<sup>17</sup> Commercial fisheries are important to many coastal communities, and except for Lake Erie, each lake supports tribal fisheries. The top species are lake whitefish, yellow perch, walleye, chubs, smelt, and lake trout. Specific lakes contribute the bulk of commercial landings of certain species—for example, Lake Huron (60% of whitefish), Lake Erie (97% of walleye, 84% of yellow perch, and 94% of smelt), and Lake Michigan (80% of chubs and 42% of lake trout).<sup>18</sup> Record harvests occurred in 1899, when 147 million pounds were landed.<sup>19</sup> Landings and value of commercial fisheries in the Great Lakes have declined dramatically because of many factors such as invasive species, pollution, habitat degradation, overfishing, competition with imports, personal tastes and preferences, and regulatory changes.

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<sup>11</sup> U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Census Bureau, 2006 *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*, Washington, DC, 2007.

<sup>12</sup> Southwick Associates, *Sportfishing in America: An Economic Engine and Conservation Powerhouse*, American Sportfishing Association, Multistate Conservation Grant Program, 2007. Hereinafter cited as "Southwick Associates 2007."

<sup>13</sup> 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.

<sup>14</sup> Southwick Associates 2007.

<sup>15</sup> See <http://www.glerl.noaa.gov/seagrant/FEE/05-504-Economics.pdf>.

<sup>16</sup> In this case, landed value is the amount paid to fishermen at the dock.

<sup>17</sup> U.S. Department of Commerce, National Marine Fisheries Service, *Fisheries of the United States 2008*, Silver Spring, MD, July 2009.

<sup>18</sup> Ronald E. Kinnunen, *Great Lakes Commercial Fisheries*, Michigan Sea Grant Extension, Marquette, MI, August 2003.

<sup>19</sup> See [http://www.great-lakes.net/teach/envt/fish/fish\\_1.html](http://www.great-lakes.net/teach/envt/fish/fish_1.html).

**Table 1. Great Lakes Recreational Fishing Activity and Economic Impacts in 2006**

States	Anglers	Days Fished	Retail Sales (000s)	Salaries (000s)	Jobs	Total Impact (000s)
Illinois	56,000	728,000	\$93,589	\$55,158	1,511	\$175,074
Indiana	46,000	759,000	\$224,588	\$117,321	4,170	\$394,866
Michigan	461,000	6,981,000	\$562,654	\$312,197	8,283	\$1,001,641
Minnesota	48,000	272,000	NR	NR	NR	NR
New York	247,000	2,060,000	\$213,174	\$122,147	3,288	\$369,194
Ohio	328,000	2,807,000	\$480,482	\$248,301	9,915	\$801,817
Pennsylvania	85,000	598,000	\$399,342	\$213,921	5,200	\$725,705
Wisconsin	235,000	3,705,000	\$315,336	\$159,420	6,153	\$528,274
<b>Totals (Great Lakes States)</b>	<b>1,506,000</b>	<b>17,910,000</b>	<b>\$2,289,165</b>	<b>\$1,228,465</b>	<b>38,520</b>	<b>\$3,996,571</b>
<b>Totals (United States)</b>			<b>\$2,524,266</b>	<b>\$2,189,490</b>	<b>58,291</b>	<b>\$7,089,230</b>

**Source:** U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Census Bureau, *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*, Washington, DC, 2007. Southwick Associates, *Sportfishing in America: An Economic Engine and Conservation Powerhouse*, American Sportfishing Association, Multistate Conservation Grant Program, 2007.

**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.

Minnesota economic impacts were not reported (NR) because of small sample size. Illinois (<10), Indiana, and Pennsylvania estimates should also 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 2008**

State	Landings (pounds)	Revenue
Michigan	9,998,000	\$7,448,000
Minnesota	318,000	\$158,000
New York	44,000	\$65,000
Ohio	4,493,000	\$5,315,000
Pennsylvania	50,000	\$140,000
Wisconsin	3,376,000	\$3,641,000
<b>Total</b>	<b>18,279,000</b>	<b>\$16,767,000</b>

**Source:** U.S. Department of Commerce, National Marine Fisheries Service, *Fisheries of the United States 2008*, Silver Spring, MD, July 2009. p.6.

There are 4.3 million boats registered in the Great Lakes states, and it has been estimated that 911,000 operate on the Great Lakes.<sup>20</sup> 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 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.<sup>21</sup> Economic results from these expenditures included more than 246,000 jobs and salaries of \$6.5 billion.

**Table 3** provides economic measures of boating on Great Lakes states. The study found that a significant share of boating expenditures took place at Great Lakes marinas. It is also likely that a significant portion of boating expenditures are related to fishing activity.

**Table 3. Annual Economic Impact of Boating on Great Lakes States in 2003**

(includes all registered boats and boating in Great Lakes states)

State	Boats (000s)	Sales (000s)	Jobs	Salaries (000s)
Illinois	360,252	\$1,958,000	22,407	\$678,000
Indiana	216,145	\$2,203,000	30,437	\$710,000
Michigan	953,554	\$3,905,000	51,329	\$1,342,000
Minnesota	845,094	\$3,709,000	49,060	\$1,247,000
New York	528,094	\$2,749,000	28,901	\$987,000
Ohio	413,048	\$1,959,000	26,148	\$656,000
Pennsylvania	355,235	\$71,000	1,195	\$24,000
Wisconsin	610,800	\$2,493,000	36,640	\$825,000
<b>Total</b>	<b>4,282,222</b>	<b>\$19,047,000</b>	<b>246,117</b>	<b>\$6,479,000</b>

**Source:** Great Lakes Commission, *Great Lakes Recreational Boating's Economic Punch*, Ann Arbor, MI, 2004.

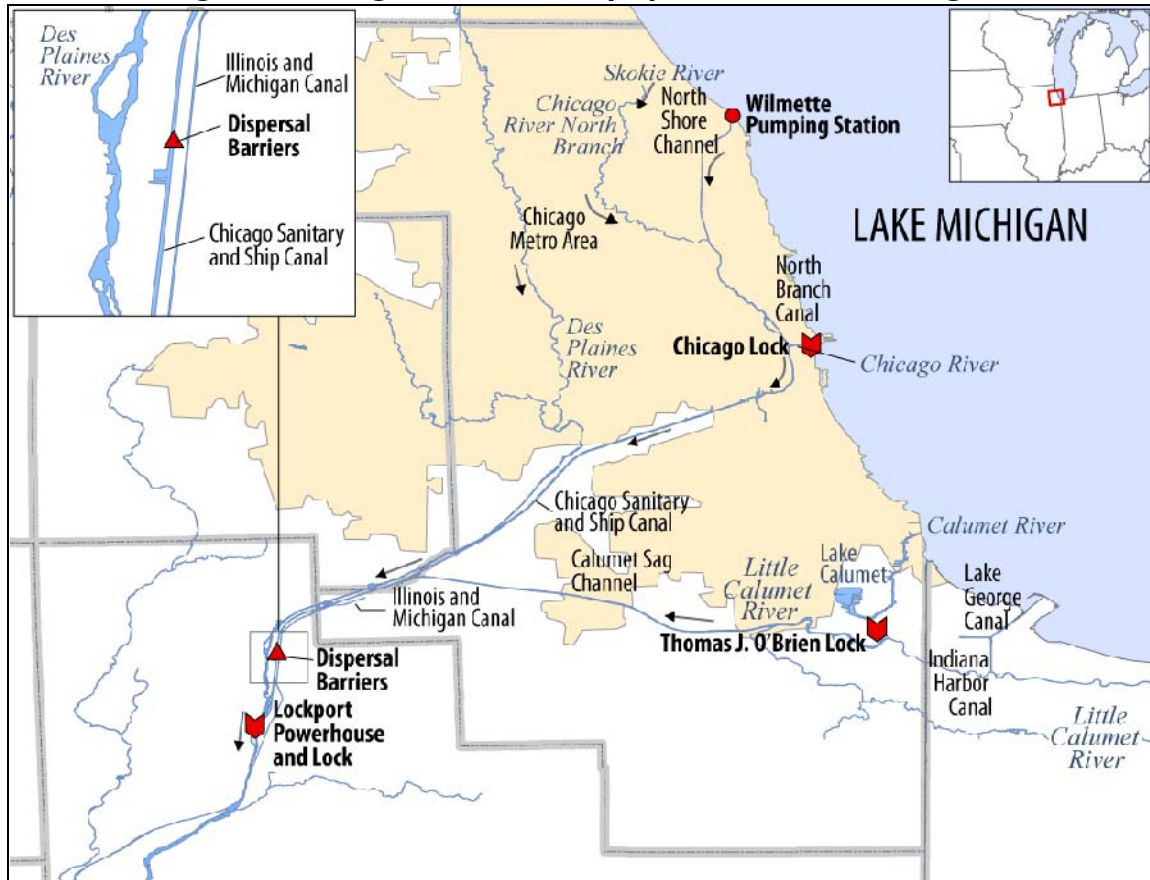
## The Chicago Area Waterway System (CAWS)

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 maintained at a minimum depth of 9 feet by the U.S. Army Corps of Engineers (hereinafter referred to as the Corps). 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, 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 full system of projects comprising the CAWS is shown in **Figure 5**.

<sup>20</sup> Great Lakes Commission, *Great Lakes Recreational Boating's Economic Punch*, Ann Arbor, MI, 2004. Hereinafter cited as "Great Lakes Commission 2004."

<sup>21</sup> Great Lakes Commission 2004.

Figure 5. Chicago Area Waterway System and Lake Michigan



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

An important geologic feature in the Chicago area's watershed is the Chicago Portage. The Chicago Portage separates the drainage basins of the Mississippi River and the Great Lakes. The Corps first connected these bodies of water for navigation in 1848 by constructing a 97-mile canal connecting the Chicago River and the Illinois River known as the Illinois and Michigan (I&M) Canal.<sup>22</sup> The I&M Canal was maintained for commercial use from 1848 to 1933, and was eventually replaced by the network of canals and locks that comprises the CAWS.<sup>23</sup> Canals within the CAWS currently 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. The altered flow of the rivers prevented sewage discharge into the canals from contaminating Chicago's drinking water supply intakes on Lake Michigan. Currently, pumping continues to alter the natural flow of the CAWS.

<sup>22</sup> Both before and after anthropogenic intervention, this divide has also been breached on occasion through flooding events on the Des Plaines and Chicago Rivers that connect the two drainage basins. However, the I&M Canal was the first permanent connection between the drainage basins.

<sup>23</sup> Today the I&M Canal remains open as a state park site. The I&M Canal's own potential to convey Asian carp into other CAWS canals has been an additional item of discussion in recent invasive species debates.

The locks of the CAWS have been a focal point for those debating how to prevent Asian carp encroachment on the Great Lakes. The Corps operates multiple lock sites that connect the CAWS to the Great Lakes, including the O'Brien Lock (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 (MWD) that could provide flood control in severe rainstorms.<sup>24</sup> The MWD independently owns and operates a third site (the Wilmette pumping station) on the North Shore Channel that directly connects to the Great Lakes. The Corps also operates Lockport Lock and Dam (completed in 1933) southwest of Chicago on the CSSC in Lockport. (See **Figure 5**.) Due to its distance from the Great Lakes, this lock has not been as prominent in recent invasive species debates.

The CAWS plays a significant role in commercial and recreational navigation, although no analysis of its cumulative economic impact on the region has been completed. Statistics from the Corps indicate that 22.3 million tons of commodities moved through the waterways that comprise the Chicago Harbor in 2008,<sup>25</sup> including bulk quantities of sand and gravel, coal, and steel.<sup>26</sup> The Chicago Lock is one of the country's busiest locks for traffic, and handled 36,256 vessels and conducted 11,599 lockages in 2008.<sup>27</sup> The O'Brien Lock handled 17,532 vessels and conducted 6,310 lockages in 2008.<sup>28</sup> Much of the traffic on both locks was recreational traffic, accounting for approximately 70% of total traffic through the locks in 2008.<sup>29</sup> Lockage statistics show that the transit of commodity-laden commercial barges is much higher at O'Brien Lock, which allows for shippers to offload onto deepwater vessels.<sup>30</sup> Recently, the Corps has estimated that shippers saved an estimated \$192 million in 2008 by using the O'Brien and Chicago locks instead of overland shipping.<sup>31</sup> However, calculations underpinning this figure have not been released publicly.

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<sup>24</sup> The Corps and the MWD coordinate action during severe rainstorms, and may open both the locks and the sluice gates to discharge floodwaters into Lake Michigan and prevent flooding of downtown Chicago. This last occurred in 2008.

<sup>25</sup> The Waterborne Commerce Statistics Center includes the following waterways in the Port of Chicago: Chicago River (both north and south branches), the CSSC, the Cal-Sag Channel, and Calumet Harbor and River in Illinois and Indiana. Since each segment's movements are counted individually, total tonnage double-counts tonnage carried on multiple segments within the Chicago Harbor. For data on individual segments, see <http://www.iwr.usace.army.mil/ndc/wcsc/pdf/wcusgl08.pdf>, pp. 3-7.

<sup>26</sup> U.S. Army Corps of Engineers, *Waterborne Commerce of the United States, Calendar Year 2008, Part 3—Waterways and Harbors, Great Lakes*, IWR-WCUS-08-03, Alexandria, VA, 2008, p. 7. Available at <http://www.iwr.usace.army.mil/ndc/wcsc/pdf/wcusgl08.pdf>.

<sup>27</sup> The Corps defines a "lockage" as the movement of either vessel(s) or extraneous matter through a lock. Since a movement of a group of vessels (such as a group of recreational vessels) is counted as one lockage, the total number of vessels transported through a lock typically exceeds the combined number of commercial, recreational, and other lockages at a chamber. For additional information, see [http://www.ndc.iwr.usace.army.mil/lpms/pdf/lpmsstat\\_v3.pdf](http://www.ndc.iwr.usace.army.mil/lpms/pdf/lpmsstat_v3.pdf).

<sup>28</sup> U.S. Army Corps of Engineers, *Waterborne Commerce Statistics Center*, 2008. See <http://www.ndc.iwr.usace.army.mil/lpms/lock2008web.htm>.

<sup>29</sup> *Ibid.*

<sup>30</sup> *Ibid.* According to Corps statistics, approximately 6.8 million tons in bulk commodities transported through the O'Brien Lock in 2008, while 105,000 tons of commodities transported through the Chicago Lock in 2008. 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*, Great Lakes Fishery Commission, 2008 Project Completion Report, Chicago, IL, November 2008, pp. 50-55.

<sup>31</sup> Asian Carp Workgroup, *Draft Asian Carp Control Strategy Framework*, Washington, DC, February 2010, p. 8. Available at <http://www.asiancarp.org/rapidresponse/documents/AsianCarpControlStrategyFramework.pdf>.

## Federal Efforts to Control Asian Carp

Federal efforts to control the introduction of Asian carp in U.S. waters can generally be divided into two categories. First, beginning in 1996, Congress directed the Corps and other agencies to undertake a limited number of studies, engineering projects, rapid response actions, and monitoring activities that focus on the immediate need to keep Asian carp out of the CAWS and Great Lakes. In most cases, these activities have been conducted by the Corps, with planning coordination with other agencies. Second, the federal government is engaged in long-term, nationwide planning and management of Asian carp under authorities codified in the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (P.L. 101-646, as amended), as well as in other statutes.<sup>32</sup> These actions have usually been conducted by the Aquatic Nuisance Species (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.

### Short-Term Efforts in the CAWS

In 1996, Congress directed the Assistant Secretary of the Army and the ANS Task Force to investigate environmentally sound methods to prevent the dispersal of Asian carp and other aquatic nuisance species from the CSSC into the Great Lakes.<sup>33</sup> In response, an advisory panel of agency representatives recommended an electronic dispersal barrier demonstration project operated by the Corps at the southwestern end of the CSSC north of Lockport Lock and Dam (see **Figure 5**) as the preferred short-term method to stop the movement of Asian carp. 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 because it was determined to be a non-lethal deterrent that would not impede navigation or water flow in the canal.<sup>34</sup>

After construction and testing to ensure the safety of vessels on the CSSC, the demonstration barrier became operational in 2002. It has subsequently been tested and verified as effective in blocking the attempted upstream passage of tagged common carp. However, independent review suggested that deterrence of some smaller fish may require minor modifications to voltage and other operating parameters, and the barrier itself was not built for operation beyond a few years. As a result, in 2004 Congress authorized construction of a larger, more permanent barrier (Barrier II) with enhanced capabilities.<sup>35</sup> Barrier II is located approximately 800 feet downstream (toward the Mississippi River) from the demonstration barrier and has two sets of electrical arrays (known as Barriers IIA and IIB) that provide redundancy.<sup>36</sup> Barrier IIA was constructed at a total cost of approximately \$10 million and became permanently operational in April 2009. Barrier IIB is

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<sup>32</sup> 16 U.S.C. § 4701.

<sup>33</sup> 16 U.S.C. § 4722(i)(3).

<sup>34</sup> U.S. Army Corps of Engineers, *Chicago Sanitary and Ship Canal Dispersal Barrier System*, Fact Sheet, November 13, 2009. Available at [http://www.lrc.usace.army.mil/pao/fish\\_barrier\\_fact\\_sheet.pdf](http://www.lrc.usace.army.mil/pao/fish_barrier_fact_sheet.pdf).

<sup>35</sup> P.L. 108-335, § 345.

<sup>36</sup> In addition to providing increased protection, redundancy in the barrier system eliminates the need for major chemical treatments and fish kills during routine maintenance of a single barrier.

scheduled to be operating no later than October 2010, at an expected cost of approximately \$13 million.<sup>37</sup>

Federal agencies have also coordinated rapid response activities to supplement the demonstration barrier's protection through the Asian Carp Regional Coordinating Committee. This committee is led by EPA's Great Lakes Program, and includes representatives from federal, state, and local governments, as well as nongovernmental organizations. One example of a recent successful rapid response action by the committee was the chemical treatment of the CSSC on December 1-7, 2009. More than 400 federal and nonfederal partners combined resources to conduct a mass rotenone poisoning on a 5.7-mile stretch of the CSSC while Barrier IIA was taken down for scheduled maintenance. This effort located a single bighead carp, 500 feet above the Lockport Lock and Dam and downstream from the electric barriers.<sup>38</sup>

In the Water Resources Development Act of 2007 (WRDA 2007, P.L. 110-114), Congress consolidated the multiple authorities for electrical barrier construction and operations by the Corps, and directed the Corps to study other means to prevent the spread of Asian carp through the CAWS, including the range of options for technologies that could potentially mitigate various means of ANS passage beyond the dispersal barriers.<sup>39</sup> In response to this directive, the Corps produced an interim study in January 2010 that 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.<sup>40</sup> This project is expected to be built with approximately \$13.2 million in funding from the EPA's Great Lakes Restoration Initiative (GLRI), and is scheduled for completion by October 2010. The Corps is also exploring how existing structures, such as locks, can be operated to minimize the likelihood of Asian carp infestation, and has convened meetings with navigation interests on potential changes. An Interim III study exploring options for these operational changes is expected in March 2010.

Also in WRDA 2007, Congress authorized a long-term study on the feasibility of approaches to permanently eliminate the risk of interbasin transfer of ANS, including permanent ecological separation of the basins.<sup>41</sup> This study, known as the Interbasin Feasibility Study, is ongoing. According to the Corps' FY2011 budget justifications for Civil Works, it has a remaining cost of \$8.5 million and no projected completion date. In 2008, the Great Lakes Fishery Commission conducted its own preliminary study on ecological separation that highlighted major issues pointing out specific research needs in this area, and recommended that the Corps give priority to studying this issue.<sup>42</sup> The potential closure of existing navigation structures in the CAWS and the permanent separation of the basins remains the most contentious issue related to Asian carp control, and a permanent solution has yet to be decided. For more information on lock closure, see the "Litigation" and "Congressional Interest" sections of this report.

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<sup>37</sup> Personal Communication with Chuck Shea, Dispersal Barrier Project Director, Army Corps of Engineers, Chicago District, February 24, 2010.

<sup>38</sup> Illinois Department of Natural Resources, *Bighead Asian Carp Found in Chicago Sanitary and Ship Canal*, December 3, 2009. Available at <http://dnr.state.il.us/pubaffairs/2009/December/asianCarp3Dec2009.htm>.

<sup>39</sup> 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.

<sup>40</sup> 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/pao/ANS\\_DispersalBarrierEfficacyStudy\\_Interim\\_I\\_FINAL.pdf](http://www.lrc.usace.army.mil/pao/ANS_DispersalBarrierEfficacyStudy_Interim_I_FINAL.pdf).

<sup>41</sup> P.L. 110-114, § 345.

<sup>42</sup> Brammeier et al., p. 99.

The Corps and other agencies, including the FWS, EPA, and USGS, are also contributing resources toward monitoring efforts to evaluate the movement of Asian carp in the CAWS. In addition to conventional sampling methods, such as electrofishing and netting, the Corps is working 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. The method has yet to complete independent peer review, but a preliminary scientific audit of the methodology by EPA in February 2010 indicated that the technique is likely to be uncontroversial and that management decisions can be based on the results of eDNA testing.<sup>43</sup> To date, no fish have been located upstream of the barriers using conventional methods, but positive eDNA test results for Asian carp found further upstream suggest it is very likely that Asian carp are currently present at multiple locations on the lake side of the barriers, including Calumet Harbor, the O'Brien Locke, and the North Branch of the Chicago River.<sup>44</sup>

## Nationwide Asian Carp Control and Long-Term Actions

Separate from the efforts focusing on short-term engineering 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 in the mid-1990s, the working group requested and co-funded USGS risk assessments of multiple Asian carp species that determined a high potential that black, silver, and bighead carp could become established in the United States.<sup>45</sup> In response to these concerns, in 2007 FWS listed black and silver carp as injurious under the Lacey Act.<sup>46</sup>

Also in 2007, FWS authored *Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States*, produced in collaboration with federal and non-federal stakeholders. The final plan outlines seven broad goals (divided into 133 short- and long-term recommendations) that would contribute to a long-term goal of extirpation of wild Asian carp. Recommendations in that report include a wide array of methods, including those intended to stop Asian carp encroachment (such as electric barriers, bubble curtains, and sonic barriers to control carp movement) as well as those that would eliminate wild Asian carp populations outright (including concentrated fishing operations, genetic manipulation, and pheromone baiting).<sup>47</sup>

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<sup>43</sup> U.S. Congress, House Committee on Transportation and Infrastructure, Subcommittee on Water Resources and Environment, *Statement of Cameron Davis, Senior Advisor to the Administrator, Environmental Protection Agency*, hearing on Asian Carp and the Great Lakes, 111<sup>th</sup> Cong., 2<sup>nd</sup> sess., February 8, 2010.

<sup>44</sup> U.S. Army Corps of Engineers, "Agencies Accelerate Action in Response to New Test Results Suggesting Asian Carp Presence in Calumet Harbor," press release, January 19, 2010. Available at [http://www.lrc.usace.army.mil/pao/Release\\_eDNA\\_19Jan2010.pdf](http://www.lrc.usace.army.mil/pao/Release_eDNA_19Jan2010.pdf).

<sup>45</sup> 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.fisheries.org/html/publications/catbooks/x51032C.shtml>; 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 <http://www.fws.gov/contaminants/OtherDocuments/ACBSRAFinalReport2005.pdf>.

<sup>46</sup> 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](http://www.anstaskforce.gov/Documents/Injurious_Wildlife_Fact_Sheet_2007.pdf).

<sup>47</sup> Greg Conover, Rob Simmonds, and Michelle Whalen, *Management and Control Plan for Bighead, Black, Grass*, (continued...)



Through its Midwest regional office, FWS is in the process of implementing some of these recommendations, although full implementation of the plan would require additional resources; FWS estimated that full implementation of all of the measures would cost approximately \$286 million over 20 years.<sup>48</sup> As outlined in the plan, other federal agencies, including the Corps, USGS, EPA, and the U.S. Coast Guard, would also contribute resources under their respective authorities.

## **Recent Developments: Asian Carp Control Strategy Framework**

Recent positive eDNA test results in the Great Lakes and the December 2009 rapid response chemical treatment of the CSSC have raised the profile of efforts to control Asian carp. On February 8, 2010, the White House convened a Summit for Great Lakes governors on the threat of Asian carp to the Great Lakes. 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 this summit, the Obama Administration unveiled a Draft Asian Carp Control Strategy Framework. The framework outlines future actions and funding sources to eliminate the threat of Asian carp in the Great Lakes. It builds on both the existing Corps barrier and monitoring projects and the 2007 FWS national management plan. The draft plan identifies 25 short- and long-term actions and \$78.5 million in new funding (\$58 million from the President's GLRI) to implement these recommendations.<sup>49</sup> (See **Table 4.**)

Short-term recommendations in the framework are expected to be implemented by May 15, 2010. They include (1) ensuring proper supplies for future rapid response operations, including rotenone, netting, and personnel; (2) intensifying fish collection and other monitoring efforts (including eDNA); (3) modifying structural operations for locks, dams, sluice gates, and pumping stations; (4) expediting construction of the 13-mile barrier and sustained operations of Barrier IIA; and (5) researching applications of targeted biological controls (such as pheromone attractants). Long-term actions that are to be undertaken between now and 2020 include (1) feasibility studies of additional structural enhancements (electric and other barriers); (2) future rotenone applications; (3) implementation of biological controls; (4) sustained operations of barriers and continued exploration of monitoring techniques; and (5) various other items, including controlled lock operations and development of a market for Asian carp.

A preliminary review of the framework's recommendations indicates sustained or increased funding for most of the major ongoing federal efforts mentioned earlier in this report. Significantly, the framework highlights funding for the Interbasin Feasibility Study. This study would investigate the feasibility of permanent ecological separation and will likely attract significant attention in the future. It is expected that an interim study focusing on ecological separation for the CAWS will be completed by 2012. A more comprehensive study focusing on all Great Lakes waterways is to be completed subsequently.

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(...continued)

*and Silver Carps in the United States*, Aquatic Nuisance Species Task Force, Asian Carp Working Group, Washington, DC, November 2007.

<sup>48</sup> Asian Carp Workgroup, *Draft Asian Carp Control Strategy Framework*, Washington, DC, February 8, 2010, p. vi. Available at <http://www.asiancarp.org/RegionalCoordination/documents/AsianCarpControlStrategyFramework.pdf>.

<sup>49</sup> For a complete summary of each recommendation, including funding sources, see *Draft Asian Carp Control Strategy Framework*, *ibid.*, pages 13-33, or Table 1 in that report.

**Table 4. Asian Carp Control Strategy Matrix**

Action Item	Agency	Funding	Source	Start Date
Ongoing Barrier Operation	Corps	\$3,750,000	Corps	FY2010
Increase eDNA, Other Monitoring Capacity	Corps, IL DNR, FWS	\$3,540,000	GLRI, Corps, FWS, ILDNR	Ongoing
Barrier IIB Construction	Corps	\$13,000,000	Corps	2009
Implement Interim Study I/ Construct Other Barriers	Corps	\$13,200,000	Corps	FY2010 Q-2
Final Report on Additional Barriers	Corps	\$1,100,000	Corps	2009
Inter-basin Feasibility Study	Corps	\$1,000,000	Corps	FY2010
Commercial Market Enhancement	IL DNR	\$3,000,000	GLRI	FY2010
Additional Rotenone Actions	IL DNR, FWS, USCG	\$5,000,000	Not currently funded	FY2010 Q-4
Interbasin Transfer Assessment	USGS	\$500,000	GLRI	FY2010 Q-2
Targeted Removal	RR Team	\$2,000,000	GLRI	FY2010 Q-2
Commercial Fishing Removal	IL DNR, USCG	\$300,000	GLRI	FY2010
Lacey Act Enforcement	FWS	\$400,000	GLRI	FY2010
Integrated Pest Management	FWS	\$4,223,000	GLRI	FY2010
State Aquatic Nuisance Management Plans	FWS	\$11,000,000	GLRI	FY2010
Activities to Support ANS Priorities	FWS	\$8,500,000	GLRI & FWS	FY2010
Competitive Funding	EPA/FWS	\$8,800,000	GLRI	FY2010
Research Projects, Other Science	USGS, multiple agencies	\$4,203,000		Multiple start dates

**Source:** Environmental Protection Agency, Draft Asian Carp Control Strategy Framework Matrix.

**Notes:** Some items from the framework and matrix documents have been combined. This table omits actions without funding (but that were identified in the framework).

## Litigation

On December 21, 2009, the State of Michigan filed suit against the State of Illinois, the U.S. Army Corps of Engineers, and the Metropolitan Water Reclamation District of Greater Chicago, asking the U.S. Supreme Court to order closure of shipping locks near Chicago to prevent Asian carp from invading the Great Lakes.<sup>50</sup> Michigan was subsequently joined by several other Great Lakes states in this action.

<sup>50</sup> For detailed filings, see (1) <http://www.supremecourtus.gov/SpecMastRpt/Orig%201,%202%20&%203%20Motion%20to%20Reopen.pdf>; (2) [http://www.illinoisattorneygeneral.gov/pressroom/2010\\_01/ILLINOIS\\_RESPONSE\\_01-05-2010\\_15-04-18.pdf](http://www.illinoisattorneygeneral.gov/pressroom/2010_01/ILLINOIS_RESPONSE_01-05-2010_15-04-18.pdf); and (3) [http://www.supremecourtus.gov/SpecMastRpt/US\\_Memorandum\\_in\\_Opposition.pdf](http://www.supremecourtus.gov/SpecMastRpt/US_Memorandum_in_Opposition.pdf).

On January 19, 2010, the Supreme Court refused to order emergency measures sought by the State of Michigan to stop the migration of invasive Asian carp toward Lake Michigan from rivers and a sanitary canal in Illinois. Without comment, the Court refused to issue a preliminary injunction that would have closed waterway locks and required other temporary measures in reaction to the discovery of the Asian carp upstream in Illinois rivers.

The Court's action did not dispose of Michigan's plea to reopen a decades-old decree to address the Asian carp migration issue on its merits. That will come later in cases 1, 2, and 3 Original, *Wisconsin, Michigan and New York v. Illinois*. On February 4, 2010, Michigan's Attorney General Mike Cox filed a new motion, asking the Supreme Court to reconsider issuing a preliminary injunction for the closure of Chicago-area locks.

## Congressional Interest

Section 126, Title I, of P.L. 111-85 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. 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. In addition, several bills have been introduced in the 111<sup>th</sup> Congress to address multiple concerns about Asian carp.

- Several bills propose to amend the Lacey Act to add bighead carp (S. 1421/H.R. 3173 and Section 171 of S. 237) or both bighead and silver carp (H.R. 48) to the list of injurious species that are prohibited from being imported or shipped interstate. The Senate Environment and Public Works Subcommittee on Water and Wildlife held a hearing on S. 1421 on December 3, 2009, and the full committee ordered this bill reported on December 10, 2009.
- H.R. 51 would direct the U.S. Fish and Wildlife Service to study the feasibility of various approaches to eradicating Asian carp from the Great Lakes watershed.
- H.R. 4472 and S. 2946 would direct the Secretary of the Army to take action with respect to the Chicago waterway system to prevent the migration of bighead and silver carp into Lake Michigan, including closing O'Brien and Chicago Locks.
- Section 172 of S. 237 would direct the Secretary of the Interior to establish an interbasin and intrabasin monitoring program to monitor the movement of aquatic invasive species in interbasin waterways, assess the efficacy of dispersal barriers and other options for preventing the spread of invasive species, and identify potential sites for dispersal barrier demonstration projects.

## **Author Contact Information**

Eugene H. Buck  
Specialist in Natural Resources Policy  
gbuck@crs.loc.gov, 7-7262

Harold F. Upton  
Analyst in Natural Resources Policy  
hupton@crs.loc.gov, 7-2264

Charles V. Stern  
Analyst in Natural Resources Policy  
cstern@crs.loc.gov, 7-7786