

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

National Invasive Species Council materials

Wildlife Damage Management, Internet Center for

2006

DRAFT ENVIRONMENTAL ASSESSMENT for Listing Silver Carp (*Hypophthalmichthys molitrix*) as Injurious Wildlife under the Lacey Act

Follow this and additional works at: <http://digitalcommons.unl.edu/natlinvasive>



Part of the [Environmental Indicators and Impact Assessment Commons](#)

"DRAFT ENVIRONMENTAL ASSESSMENT for Listing Silver Carp (*Hypophthalmichthys molitrix*) as Injurious Wildlife under the Lacey Act" (2006). *National Invasive Species Council materials*. 16.

<http://digitalcommons.unl.edu/natlinvasive/16>

This Article is brought to you for free and open access by the Wildlife Damage Management, Internet Center for at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in National Invasive Species Council materials by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

DRAFT ENVIRONMENTAL ASSESSMENT

for

**Listing Silver Carp (*Hypophthalmichthys molitrix*)
as Injurious Wildlife under the Lacey Act**

Last Revised
August 2006

USFWS/DEQ/BIS
4401 North Fairfax Drive, Rm. 322
Arlington, VA 22203

Abstract

In this environmental assessment, we consider two alternatives for the proposed action to add silver carp (*Hypophthalmichthys molitrix*) to the list of injurious wildlife under the Lacey Act: 1) no action; and 2) adding all forms (diploid and triploid) of live silver carp, gametes, eggs and hybrids. Three alternatives considered, but dismissed from further analysis were 1) adding all forms of live and dead silver carp, gametes, eggs and hybrids; and 2) adding only diploid (fertile) forms of live silver carp, gametes, eggs and hybrids; and 3) require double-escape proof aquaculture ponds, transport vehicles and containers for typical use without a permit (including importation and interstate transport) instead of adding silver carp.

This action is being considered in order to protect the welfare and survival of native wildlife and wildlife resources and the health and welfare of human beings from the potential negative impacts of silver carp by adding them to the list of injurious wildlife and preventing their importation and interstate movement.

The Secretary of the Interior is authorized under the Lacey Act (18 U.S.C. § 42, as amended) to prescribe by regulation those mammals, birds, fish (including mollusks and crustaceans), amphibians, reptiles, and the offspring or eggs of any of the aforementioned, which are injurious to human beings, to the interests of agriculture, horticulture, or forestry, or to the wildlife or wildlife resources of the United States. The lists of injurious wildlife species are at 50 CFR 16.11-15.

If silver carp are determined to be injurious, then as with all listed injurious animals, their importation into, or transportation between, States, the District of Columbia, the Commonwealth of Puerto Rico, or any territory or possession of the United States by any means whatsoever is prohibited, except by permit for zoological, educational, medical, or scientific purposes (in accordance with permit regulations at 50 CFR 16.22), or by Federal agencies without a permit solely for their own use, upon filing a written declaration with the District Director of Customs and the U.S. Fish and Wildlife Service Inspector at the port of entry. The interstate transportation of any live silver carp, gametes, viable eggs or any hybrids currently held in the United States for any purposes not permitted would be prohibited.

1) Purpose of Action

The purpose of the proposed action to add all forms of live silver carp (*Hypophthalmichthys molitrix*) to the list of injurious wildlife under the Lacey Act is to prevent their further introduction and establishment into natural waters of the United States. This action is being considered in order to protect native wildlife, wildlife resources and human beings from the potential negative impacts of silver carp by listing them as injurious, thus preventing their importation and interstate movement.

2) Need for Action

The need for the proposed action to add all forms of live silver carp, gametes, eggs and hybrids to the list of injurious wildlife under the Lacey Act developed as a result of concerns over their impacts to native fishes and the recreational and commercial fisheries associated with these fish, wildlife dependent on food sources that the silver carp eat and human health due to jumping behavior exhibited by silver carp. Once disturbed, silver carp often swim rapidly near the surface creating a characteristic large wake. Silver carp regularly jump out of the water, particularly in response to outboard motors, and there are numerous reports of injuries to humans due to this behavior. The intent of this environmental assessment is to evaluate the impacts of two alternatives of the proposed action to add live silver carp, gametes, eggs and any hybrids to the list of injurious wildlife under the Lacey Act.

The Secretary of the Interior is authorized under the Lacey Act (18 U.S.C. § 42, as amended) to prescribe by regulation those mammals, birds, fish (including mollusks and crustaceans), amphibians, reptiles, and the offspring or eggs of any of the aforementioned, which are injurious to human beings, to the interests of agriculture, horticulture, or forestry, or to the wildlife or wildlife resources of the United States. The lists of injurious wildlife species are at 50 CFR 16.11-15.

If live silver carp, gametes, eggs and any hybrids are determined to be injurious, then as with all listed injurious animals, their importation into, or transportation between, States, the District of Columbia, the Commonwealth of Puerto Rico, or any territory or possession of the United States by any means whatsoever would be prohibited, except by permit for zoological, educational, medical, or scientific purposes (in accordance with permit regulations at 50 CFR 16.22), or by Federal agencies without a permit solely for their own use, upon filing a written declaration with the District Director of Customs and the U.S. Fish and Wildlife Service (Service) Inspector at the port of entry. In addition, no live silver carp, gametes, eggs and hybrids imported or transported under permit could be sold, donated, traded, loaned, or transferred to any other person or institution unless such person or institution has a permit issued by the Director of the Service. The interstate transportation of any live silver carp, gametes, eggs or hybrids currently held in the United States for any purposes not permitted would be prohibited. The proposed rule would not prohibit intrastate transport or possession of silver carp, gametes, eggs or hybrids within States, where not prohibited by the State. Any regulation pertaining to the use of silver carp, gametes, eggs or hybrids within States is the responsibility of each State.

3) Decisions that Need to be Made

The Service is the lead agency for the proposed action. The Service's Director will select one of the alternatives analyzed in detail and will determine, based on the facts and recommendations contained herein, whether this Environmental Assessment (EA) is adequate to support a Finding of No Significant Impact (FONSI) decision or whether an Environmental Impact Statement (EIS) will need to be prepared.

4) Background

In October 2002, the Service received a petition signed by 25 members of Congress representing the Great Lakes region to add bighead (*Hypophthalmichthys nobilis*), silver and black (*Mylopharyngodon piceus*) carp (referred to collectively as Asian carp) to the list of injurious wildlife under the Lacey Act. The petition was based upon concerns that Asian carp could invade the Great Lakes from the Mississippi River basin through a man-made ship and sanitary canal. The members of Congress are concerned that bighead, silver and black carp, because they are voracious eaters, may impact food supplies available to native fisheries in the Great Lakes, which are already struggling against other invasive species. The letter also noted that the Great Lakes fisheries are valued at approximately \$4 billion, and resource managers have spent decades trying to restore and protect these fisheries. A follow-up letter to the original petition from the 25 members of Congress identified seven additional Legislators that support the petition.

Silver carp were first imported into the United States in the early 1970's to control phytoplankton blooms in sewage lagoons and as a potential addition to fish production ponds. In 1974 or 1975, silver carp were collected from Bayou Meto and the White River, Arkansas. By 1981, silver carp had been collected from the White, Arkansas, and Mississippi rivers in Arkansas. Silver carp are well established throughout much of the Mississippi River Basin, and its range is still expanding.

The major pathway for introduction of silver carp in the United States was importation for biological control of plankton in sewage lagoons and culture ponds. The pathway that led to presence of this species in open waters of the United States was likely escape from facilities because of flooding. Subsequent escapes and contamination of silver carp in grass carp (*Ctenopharyngodon idella*) stocked for vegetation control may have contributed to the expansion of the species' range.

Silver carp are difficult to handle and transport because of their propensity to jump and avoid being taken by seines. These negative attributes have resulted in little silver carp culture in the United States since 1985. Silver carp are not being cultured commercially currently. If culture of silver carp resumes or increases, potential pathways for introduction into natural waters where they do not currently exist would be escapement or release from a facility or during the transport and sale of live fish.

Other more likely pathways that may aid the spread of existing populations of silver carp include connected waterways, contamination of pond-grown bait fishes, ballast water release, release or escapement from live haulers that support commercial fishers or spread by commercial fishers themselves.

Wild silver carp are at risk of being spread when juveniles are collected by cast net for use as live baitfish. Anglers sometimes catch young silver carp and use them as live bait. Release of live bait has been responsible for more than 100 introductions of fishes beyond their ranges in the United States. Although adult and market-sized silver carp are fragile and do not survive collection and transport well, fingerling silver carp are less susceptible to mortality due to handling stress.

Other potential pathways for further introductions of silver carp into the wild in the United States involve those associated with the live sale of the species in live food fish markets, regardless as to whether the fish were cultured in fish farms or were caught live in the wild. Another potential pathway is the release of silver carp through animal rights activism or prayer release.

Silver carp are known to hybridize and to produce viable offspring with both bighead and largescale silver carps. Largescale silver carp are not known to be in the United States. Hybrids of silver and bighead carps are often used in aquaculture. Both crosses (bighead carp x silver carp and the reciprocal cross) are fertile. Hybrids of bighead and silver carps often strongly resemble one or the other of the parent species. Bighead x silver carp hybrids are

common in parts of the United States. Five percent of the adult *Hypophthalmichthys* caught in the lower Missouri River in 2004 were hybrids. Bighead x silver carp hybrids were introduced to an urban lake in Arizona, and also have been collected from Alabama, Kentucky, the Missouri River and in Texas.

Silver carp naturally occur in a variety of freshwater habitats including large rivers and warm water ponds, lakes, and backwaters that receive flooding or are otherwise connected to large rivers. Silver carp occupy the upper and middle layers of the water column. Silver carp are quite tolerant of broad water temperatures: from 4 °C to 40 °C. Silver carp are known to feed at water temperatures of 10 to 19 °C; in the Missouri River, silver carp sometimes had full guts at temperatures lower than 4 °C. Silver carp can live in slightly brackish waters.

Silver carp in the Missouri River or its tributaries are rarely observed on the surface until disturbed. Once disturbed, silver carp often swim rapidly near the surface creating a characteristic large wake. Silver carp regularly jump out of the water when disturbed, particularly in response to outboard motors. This response is more pronounced with higher revolutions per minute (RPM's) and greater motor noise.

The reproductive potential of silver carp is high and increases with body size. Estimates range from 145,000-5,400,000 eggs for fish 3.18-12.1 kg. Silver carp mature anywhere from 3-8 years and male silver carp usually mature 1 year earlier than females.

Silver carp are not presently being cultured commercially in the United States and have been minimally cultured in the last 20 years. The ability of silver carp to effectively filter particles and reliance on phytoplankton for much of its diet has led to the use of silver carp as a biological control agent for phytoplankton. Silver carp are primarily phytoplanktivores, but are highly opportunistic, eating phytoplankton, zooplankton, bacteria and detritus. Silver carp have been studied as a potential tool for controlling excess nutrients in wastewater ponds, with mixed results. Silver carp have been used in some states for removal of excessive algae from wastewater.

5) Public Involvement

The Service published a Federal Register notice of inquiry on silver carp (68 FR 43482-43483, July 23, 2003) and provided a 60-day public comment period. We received 31 comments in total, but 12 of these did not address the issues raised in the notice of inquiry. We considered the information provided in the 19 relevant comments. Most of the comments supported the addition of silver carp to the list of injurious wildlife. One commenter noted that silver carp have no commercial value, but was concerned that listing would hinder control and management. One commenter asked us to delay listing until a risk assessment could be completed. Biological synopses and risk assessments were compiled for silver and largescale silver carp. The biological synopsis and risk assessment conducted for the Service by the U.S. Geological Survey is posted online in the Electronic Library of the Service's Contaminants Program at <http://www.fws.gov/contaminants/Documents/ACBSRAFinalReport2005.pdf>.

6) Alternatives, Including the Proposed Action

The following alternatives were considered in this assessment: 1) no action; 2) adding all forms (diploid and triploid) of live silver carp, gametes, eggs and hybrids. Three alternatives considered, but dismissed from further analysis were 1) adding all forms of live and dead silver carp, gametes, eggs and hybrids; and 2) adding only diploid (fertile) forms of live silver carp, gametes, eggs and hybrids; and 3) require double-escape proof aquaculture ponds, transport vehicles and containers for typical use without a permit (including importation and interstate transport) instead of adding silver carp. As a practical matter, none of the alternatives would reduce the risk of environmental impacts in states where silver carp are already found, but

Alternative 2 would prevent, or at least slow, the establishment of silver carp in watersheds where they do not currently exist.

6.1.1) Alternative 1: No Action

The No Action alternative refers to no action being taken to list live silver carp, gametes, eggs and any hybrids as an injurious species under the Lacey Act, which would allow their continued importation and interstate transport. Silver carp are established throughout much of the Mississippi River Basin. Releases and spread of silver carp into natural waters of the United States are likely to occur again and the species could become established in additional U.S. waterways, threatening native fish stocks, wildlife and wildlife resources dependent on phytoplankton, zooplankton, bacteria and detritus, and impacting human health.

If no action is taken, the Service would continue deferring to the States to regulate live silver carp, gametes, eggs and hybrids. Many States are asking the Federal government to prohibit the importation and interstate transportation of this species. They are concerned that any use of silver carp might enable the fish to be introduced to new waterways through human movement and connected waterways. They are also concerned that interstate transportation, through trucking accidents or exchange of hauling water, could result in the introduction of silver carp into State waters where they do not exist and are prohibited by State law. Several States have submitted letters of support for the addition of silver carp to the list of injurious wildlife. Silver carp that are allowed in one state may become established in interstate waterways, thus becoming established in a waterbody in a State that does not allow their possession or use. In addition, importation into the country would still be allowed; consequently silver carp could become established in new waterways where they do not currently exist through human movement such as transport accidents or unintentional releases.

6.1.2) Alternative 2: Add all Forms of Live Silver Carp, Gametes, Eggs and Hybrids

Under this alternative, the Service would add all forms of live silver carp, gametes, eggs and hybrids to the list of injurious wildlife under the Lacey Act, which would prohibit importation and interstate transport, except by permit for zoological, educational, medical, or scientific purposes. The proposed rule would not prohibit intrastate transport or possession of live silver carp, gametes, eggs or hybrids within States, where permitted by the State.

Silver carp are not currently cultured or widely used in the United States, nor do we believe that they are imported or exported at this time. There are some commercial fisheries for silver carp in the Mississippi, Missouri, and Illinois rivers. Usually, commercial fishermen catch silver carp as bycatch. Most of the catch is sold as fillets because live silver carp are difficult to handle and transport. Data for the silver carp fishery is limited, but sales and landings for silver carp are believed to be a small amount.

6.1) Summary Table of Alternative Actions

	Alternative 1: No Action	Alternative 2: List as Injurious all forms of Live Silver Carp and Hybrids
Prohibit the importation of live silver carp and hybrids	No	Yes
Prohibit the interstate transport of live silver carp and hybrids	No	Yes
Reduced risk of escapement of silver carp into U.S. waters	No	Yes
Reduced risk of establishment of silver carp into U.S. waters where they are not yet established	No	Yes
Economic Impacts	Likely reduction in native fish abundance, many of which are commercial species. Many other costs to natural resources and the economies they support.	Minimal, if any, industry costs as silver carp are not cultured in the United States. A listing would not impact the fillet market.

6.2) Alternatives Not Considered For Detailed Analysis:

6.2.1) Adding all Forms of Live and Dead Silver Carp, Gametes, Eggs and Hybrids

This alternative was dismissed from further consideration because there are no known impacts to wildlife, wildlife resources, humans, agriculture, horticulture or forestry from dead silver carp, so there is no need to prohibit dead silver carp importation or interstate transport.

6.2.2) Adding only Diploid (fertile) Forms of Live Silver Carp, Gametes, Eggs and Hybrids

This alternative was dismissed from further consideration because there is no need to distinguish between diploid (fertile) and triploid (sterile) forms of silver carp. Silver carp are not cultured or widely used in the United States, nor do we believe that they currently are imported or exported.

6.2.3) Require Double-Escape Proof Aquaculture Ponds, Transport Vehicles and Containers for Typical Use Without a Permit (Including Importation and Interstate Transport) Instead of Adding Silver Carp

This alternative was dismissed from further consideration because this alternative is not within the authorities of the injurious wildlife provisions of the Lacey Act or the Service.

7) Affected Environment

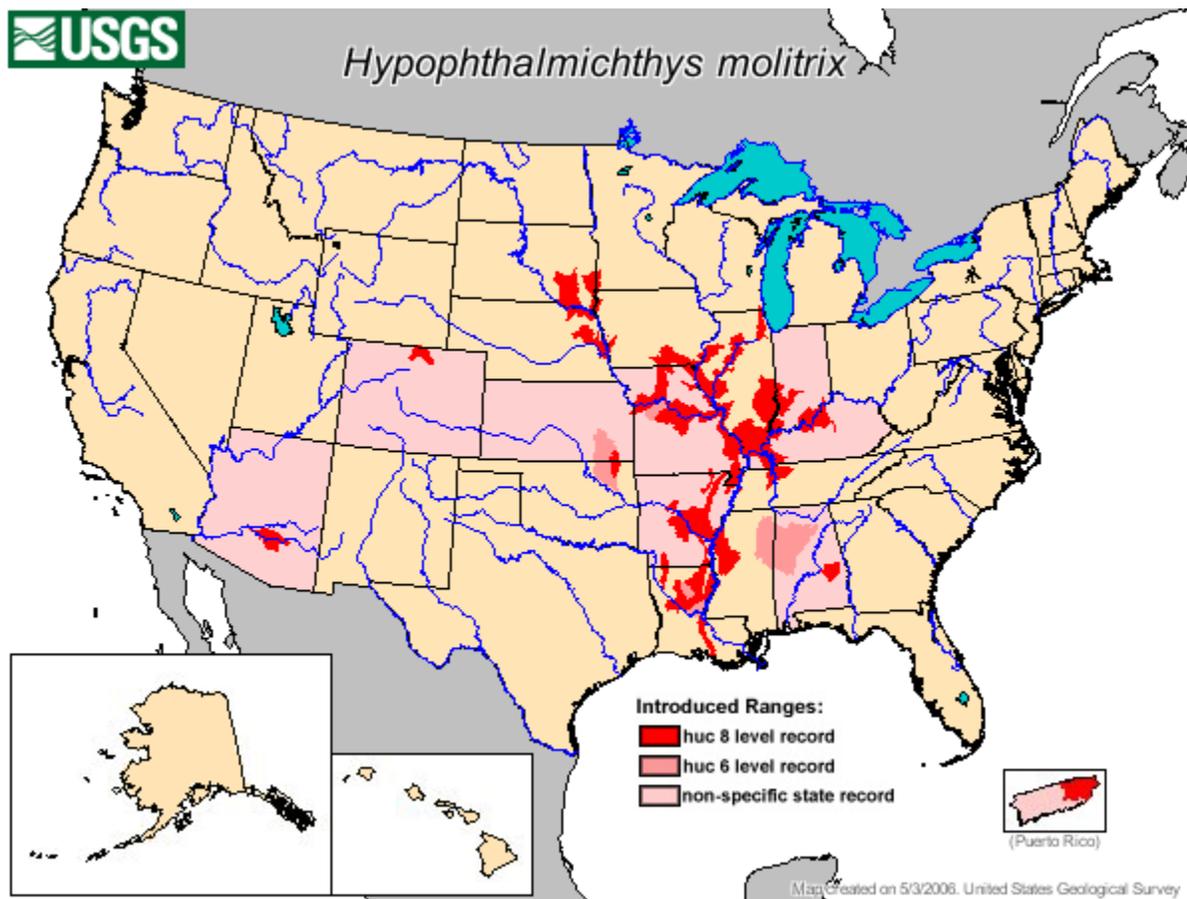
The native range of the silver carp extends from approximately 21 °N to 54 °N in eastern Asia. Most of North America, including the Great Lakes, falls within these latitudes. Silver carp could potentially become established throughout most of the United States. Modeling shows that United States distribution of silver carp could include most of the Midwest and eastern U.S. waterways, including the Chesapeake Bay, and tributaries, and Connecticut River system. Silver carp also could establish in the Columbia River, Colorado River, and Sacramento/San

Joaquin systems. This potential range includes large river systems where silver carp are not yet located.

There are 22 rivers flowing into Lakes Erie, Huron, Michigan, and Superior that could potentially serve as spawning sites for silver carp. This fact, along with the establishment of this species in countries with climates as tropical as Vietnam, as arid as Afghanistan and Pakistan, and as temperate as Kyrgyzstan and Latvia, leads to the conclusion that climate alone would not limit distribution of silver carp in the United States.

Because food availability, predation, and competition are not known to limit populations of this species elsewhere, access to habitats required for successful reproduction (i.e., substantial lengths of flowing water) will play a large role in determining potential range of silver carp in American waters. Another factor that may limit the distribution of silver carp in the United States is the requirement of incubation of eggs in waters with fairly high ionic concentrations.

In the United States, silver carp have been collected from the natural waters of 16 States and Puerto Rico. Silver carp is well established throughout much of the Mississippi River Basin, and its range is expanding.



In the United States, data from ongoing studies indicate that adult silver carp in the lower Missouri River usually used low velocity areas behind wing dikes, especially areas more than 3m deep. Silver carp in the Missouri River occupied primarily low velocity water less than 3m deep in all months of the year. Silver carp also used low velocity sections of Missouri River tributaries. Adult silver carp aggregate in pool habitats to overwinter. Ongoing studies show

indicate that silver carp in the Missouri River are active in winter, with activity slowing at $< 4\text{ }^{\circ}\text{C}$ and little movement occurring at temperatures below $2\text{ }^{\circ}\text{C}$. Silver carp used tributaries mostly in summer.

Little information exists on the ecology of wild silver carp in the fingerling stage, but large lakes connected to rivers often serve as nursery areas for silver carp in their native habitat. Juvenile silver carp typically remain in the floodplain and in backwater habitats whereas adults are typically found in main channels of rivers.

Sampling of the Upper Mississippi River System (UMRS) for the Long Term Resource Monitoring Program (LTRMP) from 1992-2004 resulted in the collection of 846 silver carp from contiguous backwaters, main channel borders, and side channel borders of Navigation Pool 26 and the Open River at Cape Girardeau, Missouri, in the Mississippi River, and La Grange Pool, Illinois, in the Illinois River. Of the 100 subadult/adult silver carp collected by the LTRMP, more were collected from side channel borders than from main channel borders and contiguous backwaters. More than 95% of silver carp were caught in water with a current $\leq 0.3\text{ m/s}$ and more than 70% were in water $\leq 1\text{ m}$ in depth.

There is limited information about juvenile silver carp in the United States because their introduction, spread and establishment is recent and ongoing. There is an abundance of young-of-year silver carp in the backwaters of the middle Mississippi River. Juvenile silver carp were collected in low velocity and off-channel habitats in the Missouri, Mississippi, Wabash, and lower Ohio rivers. Young-of-year ($< 100\text{ mm}$) and juvenile ($100\text{--}500\text{ mm}$) silver carp collected for the LTRMP were found in similar proportions between main channel borders, side channel borders, and contiguous backwaters.

8) Environmental Consequences

8.1) Ecological Impacts

8.1.1) Alternative 1: No Action

Not adding silver carp to the list of injurious wildlife would allow for an expansion of their use to watersheds and states where they are not already found, thus increasing the risk of their escape and establishment in new areas due to accidental release and, perhaps, intentional release, which would likely threaten native fish and wildlife. Releases of silver carp into natural waters of the United States are likely to occur again and the species could become established in additional U.S. waterways, threatening native fish stocks, wildlife and wildlife resources dependent on phytoplankton, zooplankton, bacteria and detritus, and impacting human health. Because all fishes forage on planktonic organisms during their early life history stages, silver carp have the potential to adversely affect every species of fish in any river system where they are introduced.

Changes in water quality are the most probable direct habitat effects on the habitat because of the introduction of silver carp, though benthic chemistry and community structure may also be impacted. Silver carp will probably have major effects on nutrient cycling and may have adverse effects on primary productivity. The effect of these fishes on nutrients, sediment re-suspension, which can stimulate plankton growth and decreasing dissolved oxygen appears to vary. Excrement from silver carp (which can equal their body weight in 10 days) has been found to organically enrich lake bottoms and alter the structure of the benthic macroinvertebrate community. Once established, silver carp could cause shifts in the food web and compete with other zooplanktivorous fishes and fish larvae for food. Silver carp will consume zooplankton, especially when phytoplankton abundance is low. They have been shown to alter the structure and abundance of the zooplankton community, shifting it to a community dominated by smaller individuals. Changes in the community towards smaller size plankton may have negative effects on fishes native to the United States that subsist on larger zooplankton.

If silver carp negatively affect important planktivorous forage fishes such as gizzard shad (*Dorosoma cepedianum*), threadfin shad (*Dorosoma petenense*) and emerald shiner (*Notropis atherinoides*), fishes and birds that prey on these species could be negatively affected. Adult silver carp are too large to be preyed on by almost any native predator. Young silver carp have likely been incorporated into the diets of piscivorous birds and fishes to some degree, but the extent of this predation is not known. It is also unknown if the quality of forage provided by is comparable to native species for piscivorous birds and fishes. Ecosystem balance could be modified if silver carp populations become large enough to dominate other planktivorous fish species. Once established, these fish could cause shifts in the food web and compete with other zooplanktivorous fishes and fish larvae for food. Changes in the community towards smaller size plankton may have negative effects on fishes native to the United States that subsist on larger zooplankton. Habitat competition would probably be low unless populations become significantly large.

8.1.2) Alternative 2: Add all Forms of Live Silver Carp, Gametes, Eggs and Hybrids

Adding silver carp to the list of injurious will help protect biota in large river systems and tributaries. No negative impacts to habitats will result from listing silver carp. Silver carp have the potential to negatively affect threatened and endangered species biodiversity, distribution and abundance by competing for phytoplankton and zooplankton. Native fishes are likely already being impacted by reduced phytoplankton available for feeding in areas where silver carp are found. This alternative would not eliminate risks to the environment in States where the silver carp is already found.

8.2) Impacts on Native Species

8.2.1) Alternative 1: No Action

Not adding silver carp the list of injurious wildlife will increase the risk of introduction into states where the carp is not yet used, which may lead to the establishment of non-reproducing and reproducing populations in new areas of the United States such as the Potomac River, Columbia River, Sacramento/San Joaquin system or others. Competition for food and habitat is likely high with other planktivorous fishes and with post-larvae and early juveniles of most native fishes. Since nearly all fishes are planktivorous as larvae and juveniles, there is potential for silver carp to adversely affect all fishes in the Mississippi River Basin including native adults such as paddlefish (*Polyodon spathula*), bigmouth buffalo (*Ictiobus cyprinellus*), gizzard shad and regionally abundant emerald shiner and threadfin shad particularly in waters where food may become limited.

Paddlefish, native to the Mississippi River Basin and Gulf of Mexico river drainages from east Texas to Alabama, is a large river fish that has declined in abundance in recent years because of overharvest and habitat alteration. Silver carp or hybrids would directly compete with paddlefish for food throughout most of the paddlefish's range. Other fish, such as the buffalos or shads, use both plankton and aquatic invertebrates as food. While these fishes are currently more common than paddlefish, they may be at risk if silver × largescale silver carp hybrids are able to establish and reduce plankton. Gizzard shad are a primary forage base for predacious fishes and important to the ecology of Midwestern rivers; thus, this is cause for concern.

If silver carp negatively affect important planktivorous forage fishes, fishes and birds that prey on these species could also be negatively affected. Adult silver carp are too large to be preyed on by almost any native predator. Young silver carp have likely been incorporated into the diets of piscivorous birds and fishes to some degree, but the extent of this predation is not known. It is also unknown if the quality of forage provided by silver carp is comparable to native species for piscivorous birds and fishes.

The potential for silver carp to transfer pathogens to other species in the United States is largely unknown. Many species of parasites and pathogens occur in silver carp collected from natural or artificial waterways in addition to culture ponds. Silver carp are susceptible to several bacterial diseases. The only viral disease agent of silver carp found in the literature is *Rhabdovirus carpio*, the causative agent for spring viraemia of carp, a systemic, acute, and highly contagious infection commonly occurring in the spring when water temperatures are below 18 °C. Silver carp are susceptible to many diseases caused by parasitic protozoans. Many trematodes have also been reported from silver carp and several crustaceans also parasitize them.

Two parasites indicate a potential threat to native North American fishes, including cyprinids: gill-damaging *Lernaea cyprinacea*, known as anchorworm (this parasite is also known to affect salmonids and eels) and *Bothriocephalus acheilognathi*, known as Asian carp tapeworm. The Asian carp tapeworm has infected native fishes of concern in five states: Arizona, Colorado, Nevada, New Mexico, and Utah. This is a damaging parasite that erodes mucus membranes and intestinal tissues, often leading to death of the host. Although silver carp are hosts of this parasite, its adverse effects on silver carp are minimal.

8.2.2) Alternative 2: Add all Forms of Live Silver Carp, Gametes, Eggs and Hybrids

Prohibiting the importation and interstate transportation of silver carp will help protect native fishes, wildlife and humans in large river systems and their tributaries. Only positive impacts to native species will result from listing silver carp. None of the alternatives will eliminate the environmental risks in those states where silver carp are currently found.

8.3) Impacts to Threatened and Endangered Species

8.3.1) Alternative 1: No Action

Adverse effects of silver carp on selected threatened and endangered freshwater mussels and fishes would be moderate to high. There are currently 114 fishes and 70 mussels on the Federal List of Endangered and Threatened Wildlife. Based on habitat requirements, it appears that 40 fishes and 25 mussels currently on the endangered or threatened species list would likely be impacted by the introduction and establishment of silver carp. Habitat requirements, springs and small streams, of the remaining listed fishes and mussels would probably preclude any detectable effects as it is highly unlikely that silver carp could survive in such small bodies of water.

Adverse effects of established populations of silver carp on endangered and threatened fishes and mussels would vary. Adverse effects to fishes would most likely come about through direct competition for food resources, particularly phytoplankton and, to a lesser extent, zooplankton, in the water column during the larval stage. Potential for direct predation and injury of drifting fertilized eggs and larvae of native fishes exist. Mussels are also filter feeders but live partly or totally buried in the substrate. Their association with the benthic environment means that they would be less likely to be affected by filter-feeding silver carp. Nevertheless, changes in the fish community structure precipitated by silver carp could easily have adverse effects on abundance and availability of host fishes required for mussel reproduction. There are other possible, but less likely, effects that will cascade through any aquatic ecosystem with an established population of silver carp. Because there is evidence of eutrophication of waters into which silver carp have been introduced, nutrients are likely to be affected.

In some habitats, silver carp can develop extremely large populations that could bring about decline of native fishes not currently on the Federal List of Endangered and Threatened Wildlife. Large populations of silver carp may alter the native fish community structure, ultimately resulting in decline of native mussels since many rely on native host fishes for reproduction. The fact that silver carp can become extremely abundant and reach a very large

size, > 1 m in length, in rivers, lakes, and reservoirs, increases probability of a negative impact on aquatic ecosystems they invade.

Fishes most likely to be affected are those species whose diet is predominantly plankton, including paddlefish, buffalos (*Ictiobus* sp.) or shads (*Dorosoma* sp.). While buffalos and shads are currently more common than paddlefish, they may be at risk because of the drastic reduction of plankton by large populations of silver carp or hybrids.

8.3.2) *Alternative 2: Add all Forms of Live Silver Carp, Gametes, Eggs and Hybrids*

Adding silver carp to the list of injurious wildlife will help protect threatened and endangered species in large river systems and tributaries. No negative impacts to threatened and endangered species will result from listing silver carp. Silver carp have the potential to negatively affect threatened and endangered mussel biodiversity, distribution and abundance. Fish, turtles and waterfowl that rely on phytoplankton, zooplankton and detritus as food may also be impacted by silver carp in natural waters. This alternative would not eliminate the risk to the environment in those states where the silver carp is already being used.

8.4) Impacts to Humans

8.4.1) *Alternative 1: No Action*

Silver carp regularly jump out of the water, particularly in response to outboard motors. There have been numerous reports of injuries to human beings and damage to boats and boating equipment because of the jumping habits of silver carp in the vicinity of moving motorized watercraft. Reported injuries include cuts from fins, black eyes, broken bones, neck and back injuries and concussions. Silver carp also cause property damage including broken radios, depth finders, fishing equipment and antennae. Some vessels have been fitted with a Plexiglas pilot's cab as protection against jumping silver carp.

Some disease-causing agents harbored by silver carp pose health risks to humans. The psychotropic pathogen *Listeria monocytogenes* has been found in market and fish farm samples of silver carp in Iran. *Clostridium botulinum* was found in 1.1% of fresh and smoked samples of silver carp from the Mazandaran Province in Iran. The toxigenic fungi *Aspergillus flavus*, *Alternaria*, *Penicillium*, and *Fusarium* were found from silver carp and from pond water in which they were raised at a fish farm in northern Iran. In addition, live *Salmonella* sp. can be found in silver carp for at least 14 days after transfer to clean water and should, therefore, be considered as a potential carrier for *Salmonella* (*S. typhimurium*). Studies on pathogenic impacts to humans have not been conducted in the United States. We must rely on studies that have been conducted elsewhere and compare those results to similar environments in the United States.

8.4.2) *Alternative 2: Add all Forms of Live Silver Carp, Gametes, Eggs and Hybrids*

Adding silver carp to the list of injurious wildlife will help protect human health by preventing the introduction and establishment of silver carp in new waterways. Silver carp have the potential to negatively affect human health. No negative impacts to humans will result from listing silver carp. Fish, turtles and waterfowl that rely on phytoplankton, zooplankton and detritus as food may also be impacted by silver carp in natural waters. This alternative would not eliminate the risk to the environment in those states where the silver carp is already being used.

8.5) Cumulative Impacts

8.5.1) *Alternative 1: No Action*

The No Action alternative refers to no action being taken to add silver carp to the list of injurious wildlife under the Lacey Act, which would allow the continued importation and

interstate transport of live silver carp, gametes, eggs and hybrids. Releases of silver carp into natural waters of the United States have occurred and are likely to occur again without any action taken to prohibit their transport. Risk of accidental releases from facilities that maintain silver carp would continue in states currently using silver carp. Under the No Action alternative, silver carp may be used in additional states and transported among or through states. The risk of floods in states where silver carp are utilized and may be utilized in the future continues to exist, as does the potential for escapement through transport accidents.

Silver and bighead carps now outnumber the catch of native species sought after commercially in several waters of the Midwest. Declines in native fishes, particularly of planktivorous species, are well documented from several other countries in which these fishes have been introduced. Given examples of declines in native fishes after the introduction of silver carp, it is reasonable to expect similar declines in native fishes in the United States, particularly those that rely heavily on plankton as a food resource. Extirpations and extinctions of native and endemic fishes have been linked to the introduction of silver carp elsewhere, although in these events, these fish were not the only nonnative species indicated, and other factors, such as water removal and habitat degradation played roles in those events.

Though many states either prohibit the possession of live silver carp or require a permit for their import, possession and/or distribution, the species could establish in additional U.S. waters, such as the Potomac/Chesapeake, Columbia or Sacramento/San Joaquin systems, thereby potentially degrading native fish stocks and impacting humans.

The ability to control spread of established populations of silver carp depends on where they are found and their access to open waterways and riverine habitat to spawn. Electric, acoustic, physical and other types of barriers may help control the spread of silver carp from the Mississippi River Basin into the Great Lakes and other waterbodies. If silver carp establish in additional large lakes or river systems as they have in the Mississippi River Basin, eradication and/or control of silver carp is likely impossible and they will be considered permanent members of the fish community by many. No effective and feasible tools are currently available to manage silver carp, should they become introduced into river systems. Chemical piscicides are the best available option, but their uses on a large scale is prohibitively expensive, can cause mortality to non-target fish and aquatic species, are not accepted by the public, and must be repeatedly used. In addition, not all life stages are equally susceptible to piscicides.

Additionally, controlling the spread of pathogens that silver carp may carry is practically impossible. There are still several pathways by which silver carp from established populations in the Mississippi River basin might be moved by people to new waterbodies and become established, including catch and release of silver carp as live baitfish.

Since effective measures to control or eradicate wild silver carp populations are not available, the ability to rehabilitate or recover ecosystems disturbed by the species is low. There are considerable impacts to native fishes, mussels and humans from silver carp. Re-establishment of impacted populations, if biologically possible, would be labor and cost intensive and would depend on eradication of silver carp within the habitat.

If no action is taken to prohibit the importation and transportation of silver carp, release or introduction of silver carp to additional waters of the United States will likely add to the cumulative impacts that have already impacted native species.

8.5.2) Alternative 2: Add all Forms of Live Silver Carp, Gametes, Eggs and any Hybrids

Listing silver carp, gametes, eggs and hybrids as an injurious species under the Lacey Act, would prohibit the importation and interstate transport of live silver carp, gametes, eggs and any hybrids. This alternative would help protect the natural resources in areas where silver carp are not yet used or have established populations in U.S. waters. This alternative would reduce the potential for silver carp to be released into additional waterbodies where they are not yet

found, through live market transportation, prayer release, baitfish movement and potential flood events.

The Service is not aware of any commercial culture of silver carp in the United States and we believe there has been minimal culture in the last 20 years. Releases or range expansion of silver carp into natural waters of the United States have occurred through flooding and human movement and are likely to occur again without any action taken to prohibit their transport. Silver carp might be moved by people to new waterbodies and become established, including catch and release of silver carp as live baitfish.

Interstate transport may still occur with the potential for accidental release even in states that do not permit their use (i.e. highway accident).

No effective and feasible tools are currently available to manage silver carp that are found in open river systems.

8.6) Summary Table of Environmental Consequences by Alternative

Impacts	Alternative 1: No Action	Alternative 2: List as Injurious all forms of Live Silver Carp and any Hybrids
Escape of live silver carp	Likely	Greatly reduced risk in states other than those States where they are already found. There may be reduced risk in States where they are already found. (Note: States may continue to allow possession and use of silver carp)
Escape of live silver carp hybrids	Likely	Greatly reduced risk in States other than those states where they are already found. There may be reduced risk in States where they are already found.
Establishment of populations of silver carp in new waterbodies	Likely	Greatly reduced risk in States other than those states where they are already found. There may be reduced risk in States where they are already found.
Ecological impacts	Likely water quality degradation where silver carp establish	Greatly reduced risk in States other than those states where they are already found. There may be reduced risk in States where they are already found.
Impacts to native fish	Likely increased negative impacts through competition for phytoplankton and zooplankton where silver carp establish	Greatly reduced risk in States other than those states where they are already found. There may be reduced risk in States where they are already found.
Impacts to threatened and endangered species	Likely increased negative impacts to listed species where silver carp establish	Greatly reduced risk of population reduction in States other than those where they are already found. There may be reduced risk in States where they are already found.
Impacts to humans	Likely additional injuries to humans by silver carps' jumping behavior	Greatly reduced risk in States other than those states where they are already found. There may be reduced risk in States where they are already found.
Cumulative impacts	Risk of additional negative impacts to native species, threatened and endangered species and humans will not be reduced	Greatly reduced risk of additional impacts to threatened and endangered mollusks in States other than those where they are already found. There may be reduced risk in States where they are already found.

9) List of Preparers

Erin Williams, United States Fish and Wildlife Service, Branch of Invasive Species, Fish and Wildlife Biologist, 4401 North Fairfax Drive, Room 322, Arlington, VA 22203

10) References

Kolar, C., Chapman, D., Courtenay, Jr. W., Housel, C., Williams, J., and D. Jennings. 2005. Asian carps of the Genus *Hypophthalmichthys* (Pisces, Cyprinidae) – A Biological Synopsis and Environmental Risk Assessment. U.S. Geological Survey deliverable to U.S. Fish and Wildlife Service under interagency agreement 94400-3-0128.

U.S. Geological Survey Nonindigenous Aquatic Species Website. <http://nas.er.usgs.gov/>. Map created on May 3, 2006.