Monterey Bay Aquarium

# Seafood Watch®

## Asian Carp

*Hypophthalmichthys molitrix*
*Cyprinus carpio*
*Ctenopharyngodon idella*
*Hypophthalmichthys nobilis*



## Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Missouri, Tennessee

## Combined gillnets - trammel nets, Seine nets (unspecified), Fyke nets

*September 4, 2019*

*Seafood Watch Consulting Researcher*

**Disclaimer**

Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report.

Seafood Watch Standard used in this assessment: Standard for Fisheries vF3

# Table of Contents

# About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Watch Assessment. Each assessment synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." This ethic is operationalized in the Seafood Watch standards, available on our website here. In producing the assessments, Seafood Watch seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying assessments will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Watch assessments in any way they find useful.

# Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] or farmed that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard. Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and rating

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guide and online guide:

**Best Choice/Green:** Are well managed and caught in ways that cause little harm to habitats or other wildlife.

**Good Alternative/Yellow:** Buy, but be aware there are concerns with how they're caught.

**Avoid/Red** Take a pass on these for now. These items are overfished or caught in ways that harm other marine life or the environment.

[1] "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

# Summary

This report reviews US domestic commercial fisheries targeting common carp and three Asian carp species: bighead carp, silver carp, and grass carp using gill/trammel nets, fyke nets and/or seine nets. Nine states (with documented Asian carp commercial fisheries) along the Mississippi River basin are reviewed: Illinois, Iowa, Missouri, Indiana, Kentucky, Tennessee, Arkansas, Louisiana, and Mississippi. Common carp and Asian carp are non-native, invasive species. The continued range expansion of Asian carp threatens regional waterway sustainability via competition and predation on native species and by disrupting aquatic plant ecology.

Due to the invasive nature of bighead carp, silver carp, grass carp, and common carp, all species reviewed received "very low concern" and "low concern" scores for abundance/stock status and fishing mortality, respectively. The management goal for these commercial fisheries is to maximize harvest and minimize the spread of nuisance carp species.

Bycatch data are limited for most carp fisheries in states reviewed; however, all gear types targeting Asian carp and common carp fisheries have the potential to interact with endangered or threatened sturgeons. Although bycatch rates of endangered pallid sturgeon and threatened lake sturgeon are reportedly low in targeted carp fisheries, these species were included due to their high vulnerability and conservation status, and they limited the C2 score for the reviewed fisheries.

Management effectiveness varied by state, and higher scores were largely driven by state policies prohibiting the stocking of Asian carp, the establishment of carp Harvest Incentive Programs to bolster carp industry infrastructure regionally, and record-keeping/catch accounting requirements. Asian carp and common carp are typically targeted over mud, sand, or gravel substrates (some mussel beds occur regionally), and all gear types do occasionally come into contact with the bottom; however, these impacts are moderate.

Asian carp and common carp commercial fisheries and efforts to control the spread of invasive carp generally enhance Ecosystem Based Fisheries Management in the Mississippi River basin by supporting local ecology and native species. In summary, all states and gear types reviewed receive a "good alternative" rating overall.

# Final Seafood Recommendations

| SPECIES/FISHERY | CRITERION 1: IMPACTS ON THE SPECIES | CRITERION 2: IMPACTS ON OTHER SPECIES | CRITERION 3: MANAGEMENT EFFECTIVENESS | CRITERION 4: HABITAT AND ECOSYSTEM | OVERALL RECOMMENDATION |
|---|---|---|---|---|---|
| Common carp Kentucky Mississippi River Basin, Combined gillnets - trammel nets, United States of America | Green (5.000) | Red (1.732) | Green (4.000) | Green (3.873) | **Good Alternative (3.403)** |
| Grass carp Kentucky Mississippi River Basin, Combined gillnets - trammel nets, United States of America | Green (5.000) | Red (1.732) | Green (4.000) | Green (3.873) | **Good Alternative (3.403)** |
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## Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, and no Red Criteria, and no Critical scores
- **Good Alternative/Yellow** = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern2, and no more than one Red Criterion, and no Critical scores
- **Avoid/Red** = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

[2] Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

# Introduction

## Scope of the analysis and ensuing recommendation

This report reviews US domestic commercial fisheries targeting common carp and three Asian carp species: bighead carp, silver carp, and grass carp. A fourth species of Asian carp, black carp, is not reviewed here since there are no developed commercial fisheries targeting black carp to date in the US (despite recent range expansion). Common carp and Asian carp are non-native, invasive species. More recently introduced to the US, Asian carp in particular pose a significant conservation threat to the Mississippi River basin and the connected Great Lakes. Asian and common carp life history and foraging ecology threaten regional waterway sustainability via competition and predation on native species and by disrupting aquatic plant ecology (ACRCC 2019) (ACRCC Action Plan 2019) (DNR Minn 2019).

Nine states with documented Asian carp commercial fisheries along the Mississippi River basin are reviewed: Illinois, Iowa, Missouri, Indiana, Kentucky, Tennessee, Arkansas, Louisiana, and Mississippi (states with only common carp commercial fisheries are not reviewed here). Although gear types vary by waterway and state, the gear types used to target Asian carp and common carp fall into three primary categories: 1) gill/trammel nets, 2) fyke nets (generally hoop nets or buffalo nets), and 3) seine nets (see below for more detail on gears).

**History and geographic coverage:** Bighead and silver carp were imported from eastern China and Asia to Arkansas in the 1970s to improve water quality in aquaculture ponds and sewage treatment lagoons and as a potential addition to fish production ponds. Bighead carp, which can grow to 80 pounds (lb) or more, have spread through the Mississippi River basin and have been collected as far north as Lake Pepin in Minnesota. Silver carp are now established throughout much of the Mississippi River basin and are expanding in the Ohio River and other basins (ACRCC Action Plan 2019).

Grass Carp were historically used by resource managers as a means of combating nuisance aquatic vegetation in ponds and lakes in the US. Records indicate that by the mid-1970s grass carp had been stocked in at least 45 states. Although not considered widely established outside of the Mississippi River basin, grass carp are now the most widespread species of Asian carp in North America (see Overview of Species section below for distribution maps) (ACRCC Action Plan 2019).

Common carp have a more longstanding history in the US and were originally introduced in the early 1800s to support aquaculture and to feed increasing immigrant populations. Common carp attained sizable numbers in California by 1879. High reproductive rates coupled with a wide thermal tolerance facilitated the stocking and spread of common carp throughout much of the US (Fishbio 2016) (Figure A).

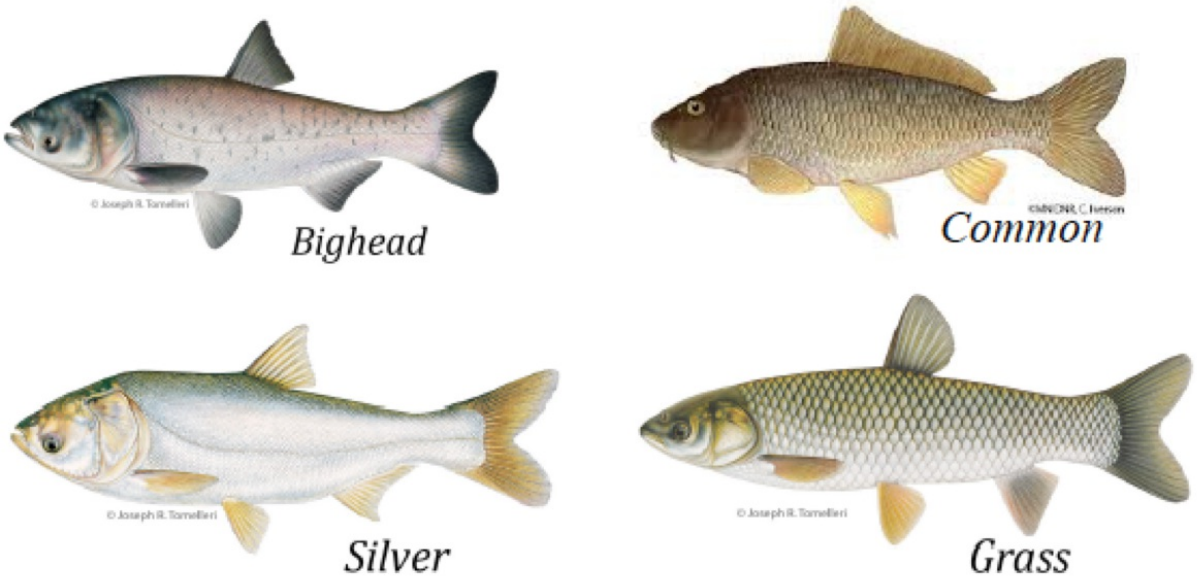


Figure 1 Asian and common carp species reviewed.

**Gear types:** There are three primary gear types used to capture Asian and common carp: gill/trammel nets, fyke nets (hoop nets, buffalo nets, pound nets), and seine gear. Gear types vary by inland and river waterway and state. Gill nets/trammel nets predominate in the Mississippi River basin; however, fyke nets are used frequently, and seine gear is gaining traction in some areas with larger commercial fisheries, such as Illinois. Gill nets/trammel nets and fyke nets are examples of passive capture techniques that involve the capture of fishes or other aquatic animals by entanglement, entrapment, or angling devices that are not actively moved by humans or machines while the organisms are being captured (Hubert et al., 2012) (Figure B; Figure C). It is important to note that although gill nets are often fished passively, some fishers in the region are fishing them more actively by driving the carp into the gill nets with loud noises or other disturbances in the water (Morris, KDFWR, personal communication 2019). Seine gear is an example of an active form of capture.

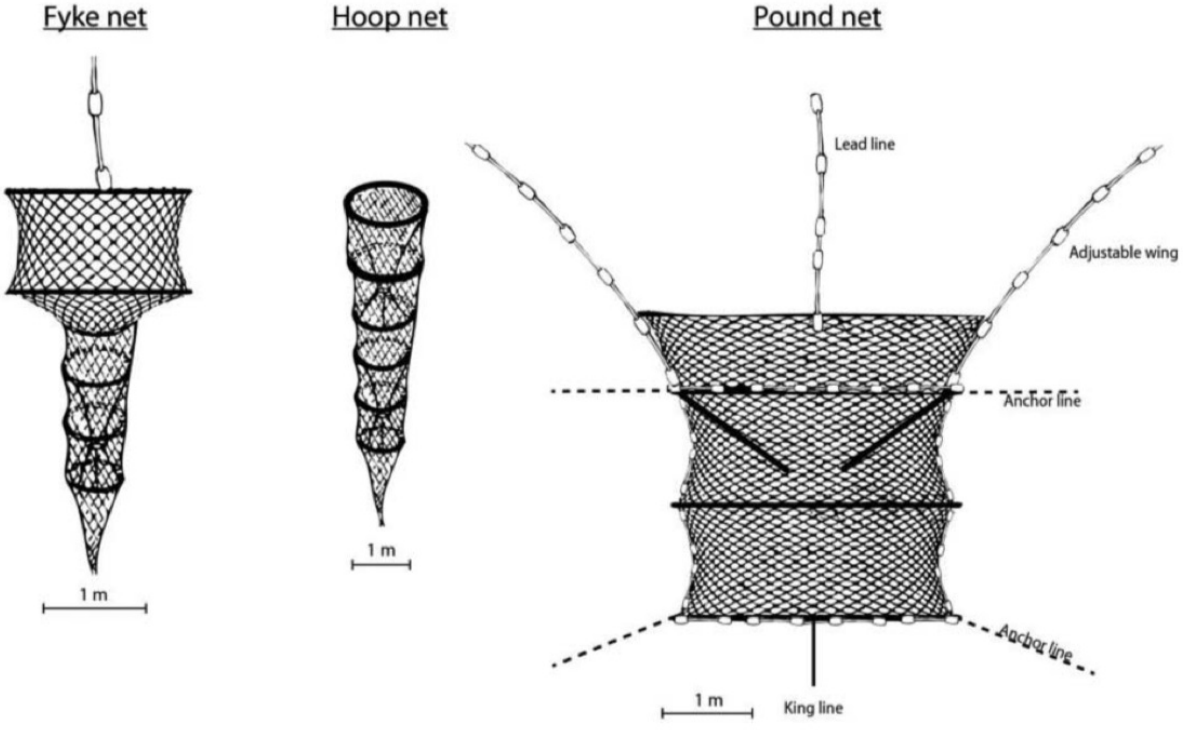

Figure 2 Fyke net schematic examples (Collins et al. 2015).

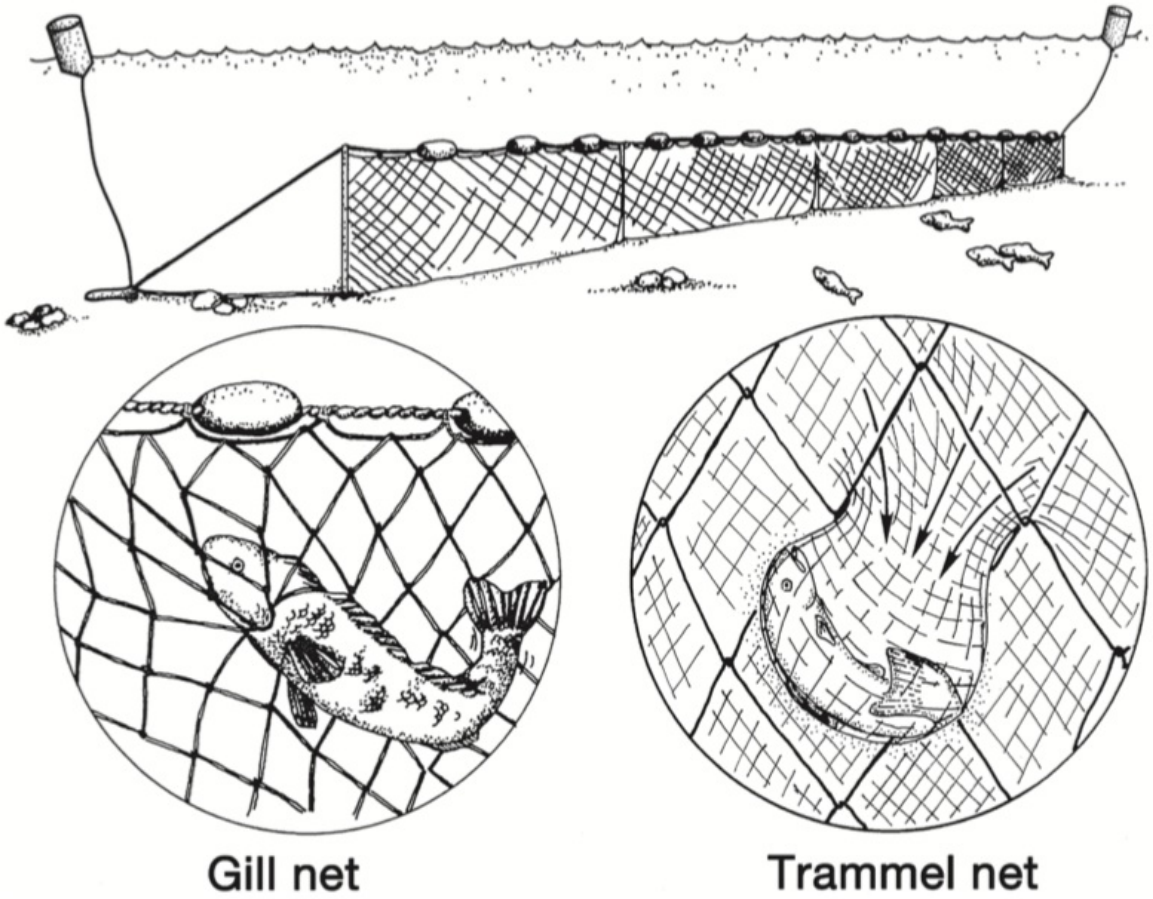


Figure 3 Schematic of gill net and trammel net gear (Hubert et al. 2012).

## Species Overview

Four species are reviewed as part of this report: common carp and three species of Asian carp including bighead carp, silver carp, grass carp. Asian carp are distributed across the Mississippi River Basin. Common carp are distributed throughout most of the United States, with the exception of Alaska and Puerto Rico. Asian and common carp commercial fisheries are managed by state; however, regional partnerships and committees have been established to support efforts to control the spread of Asian carp in the Mississippi River basin and Great Lakes areas. Major players in these efforts include but are not limited to the Asian Carp Regional Coordinating Committee (ACRCC), United States Geological Service (USGS), US Fish and Wildlife Service (USFWS) and the US Army Corps of Engineers.

**Common carp *(Cyprinus carpio)*:** Common carp have large scales, a long dorsal fin base, and two pairs of long barbels in its upper jaw. Common carp are omnivorous; they eat an herbivorous diet of aquatic plants but prefer to scavenge the bottom for insects, crustaceans (including zooplankton), crawfish, and benthic worms. The size and weight of common carp increases with age, and individuals have been recorded to live 47 years or longer. Common carp are one of the most damaging aquatic invasive species due to their wide distribution and

severe impacts in shallow lakes and wetlands (DNR Minn 2019) (Figure A).

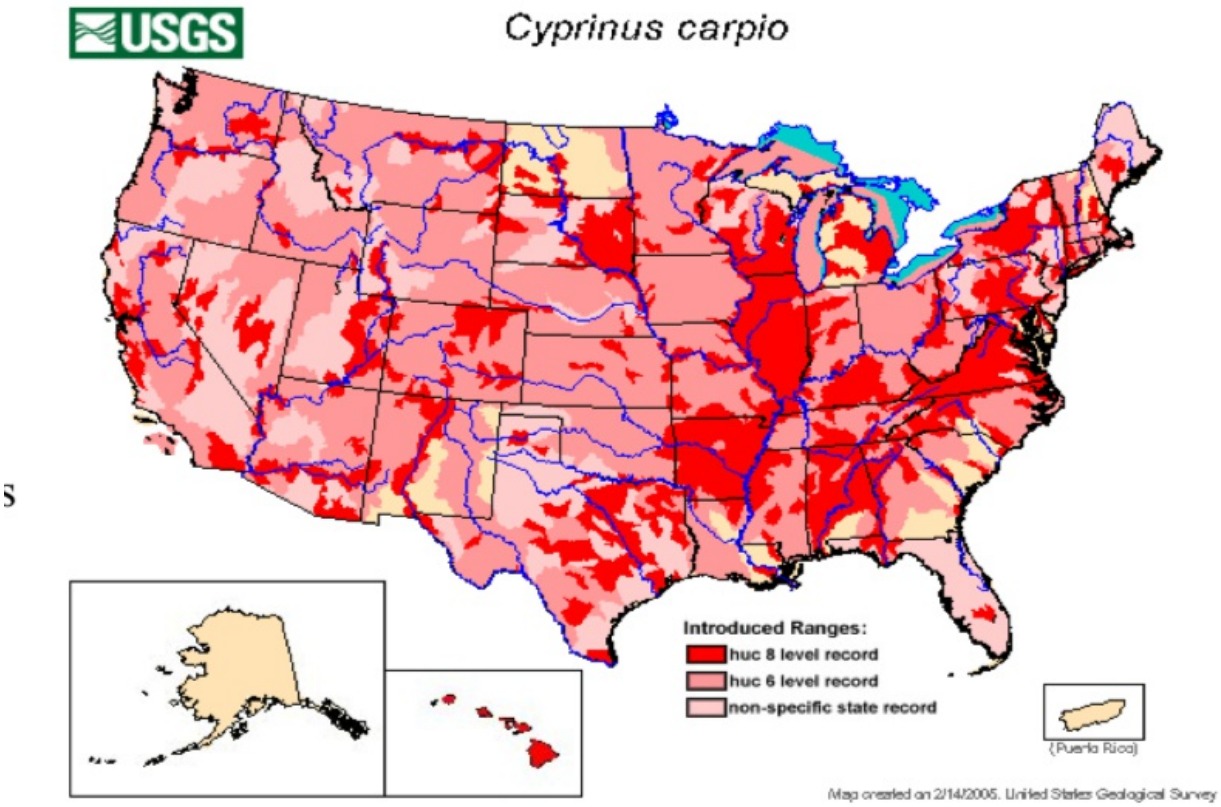


Figure 4 Common carp distribution in the United States (USGS 2019).

**Bighead carp *(Hypophthalmichthys nobilis)***: A bighead carp is a deep-bodied, or wide, fish with a large toothless mouth and very large head. Bighead carp have been known to hybridize (cross-breed) with silver carp and produce viable, reproductive offspring. Bighead carp are an R-selected species and can mature in 2 to 3 years, commonly weighing up to 40 lb. However, under the right conditions they can grow to more than 80 lb (ACRCC 2019). Bighead carp are extremely hardy and can adapt to many temperate freshwater environments. Bighead carp are voracious eaters and consume a wide range of zooplankton, detritus, and small invertebrates, outcompeting native species for food. The bighead carp lacks a true stomach which requires it to feed almost continuously (ACCRC 2019).

**Silver carp *(Hypophthalmichthys molitrix)***: Silver carp are deep-bodied, or wide, with a moderately large and broad head encompassing just under one third of their body size. Silver carp feed primarily on phytoplankton and can outcompete many native fish juveniles. Like the bighead carp, silver carp lack a true stomach, which requires them to feed almost continuously. Silver carp mature in 2 to 4 years and commonly weigh 20 lb. When older, they can reach a maximum size of more than 80 lb (Figure B) (ACRCC 2019).

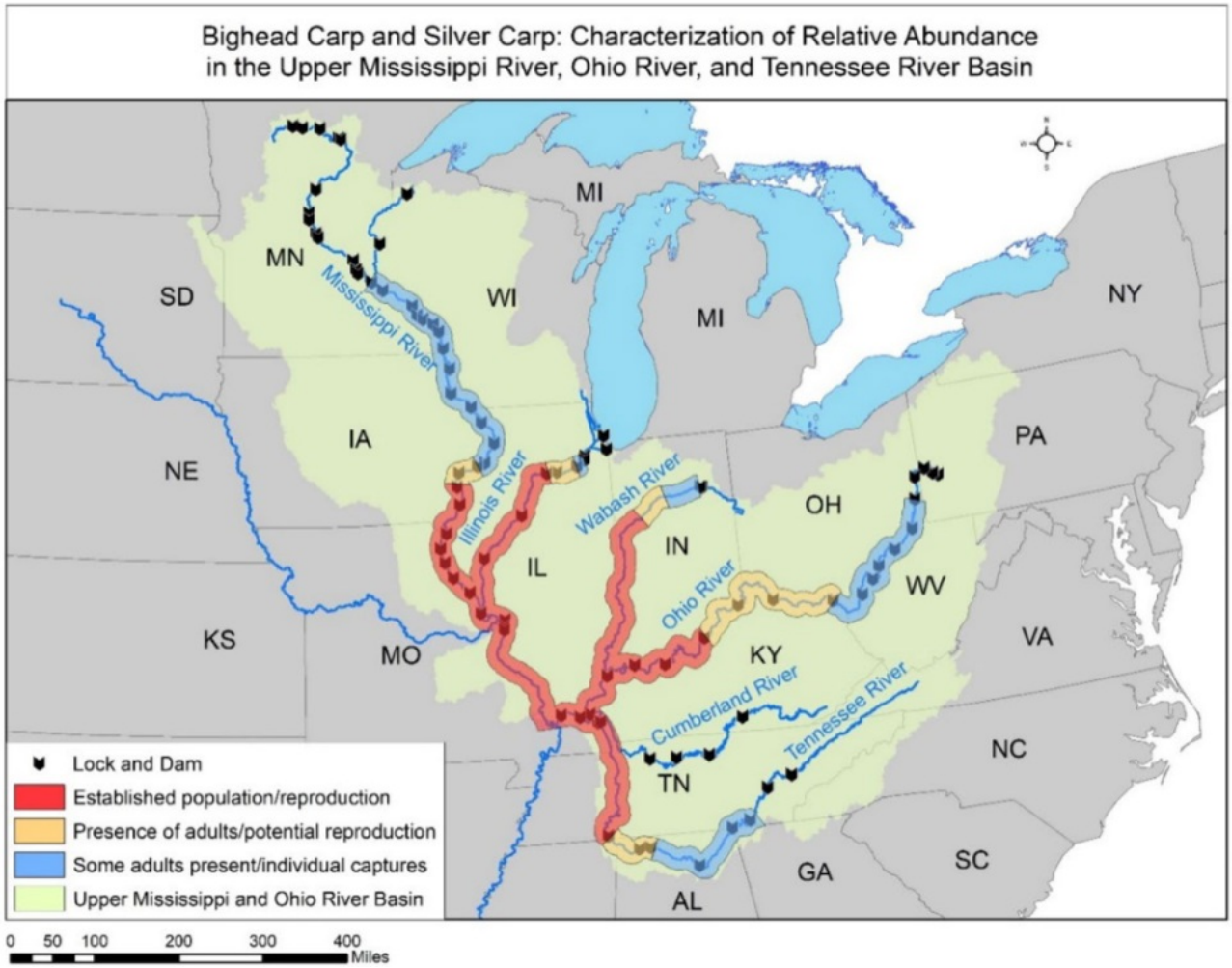


Figure 5 Characterization of current (2017) relative abundance of Bighead Carp and Silver Carp in the Upper Mississippi River Basin, Ohio River Basin, and IWW/CAWS (ACCRCC Action Plan 2019).

**Grass carp *(Ctenopharyngodon idella)*:** Grass carp prefer large, slow flowing water bodies and spawn in large rivers with moderate currents; however, adult grass carp can tolerate water temperatures ranging from 32 to 100° F. Grass carp feed on aquatic plants but can also consume detritus, insects, small fish, earthworms and other invertebrates in the absence of aquatic vegetation. Grass carp can consume up to 40 percent of their body weight per day. Grass carp mature in 2 years, but it can take them more than a decade to grow to a maximum size of more than 80 lb (Figure C) (ACRCC 2019).

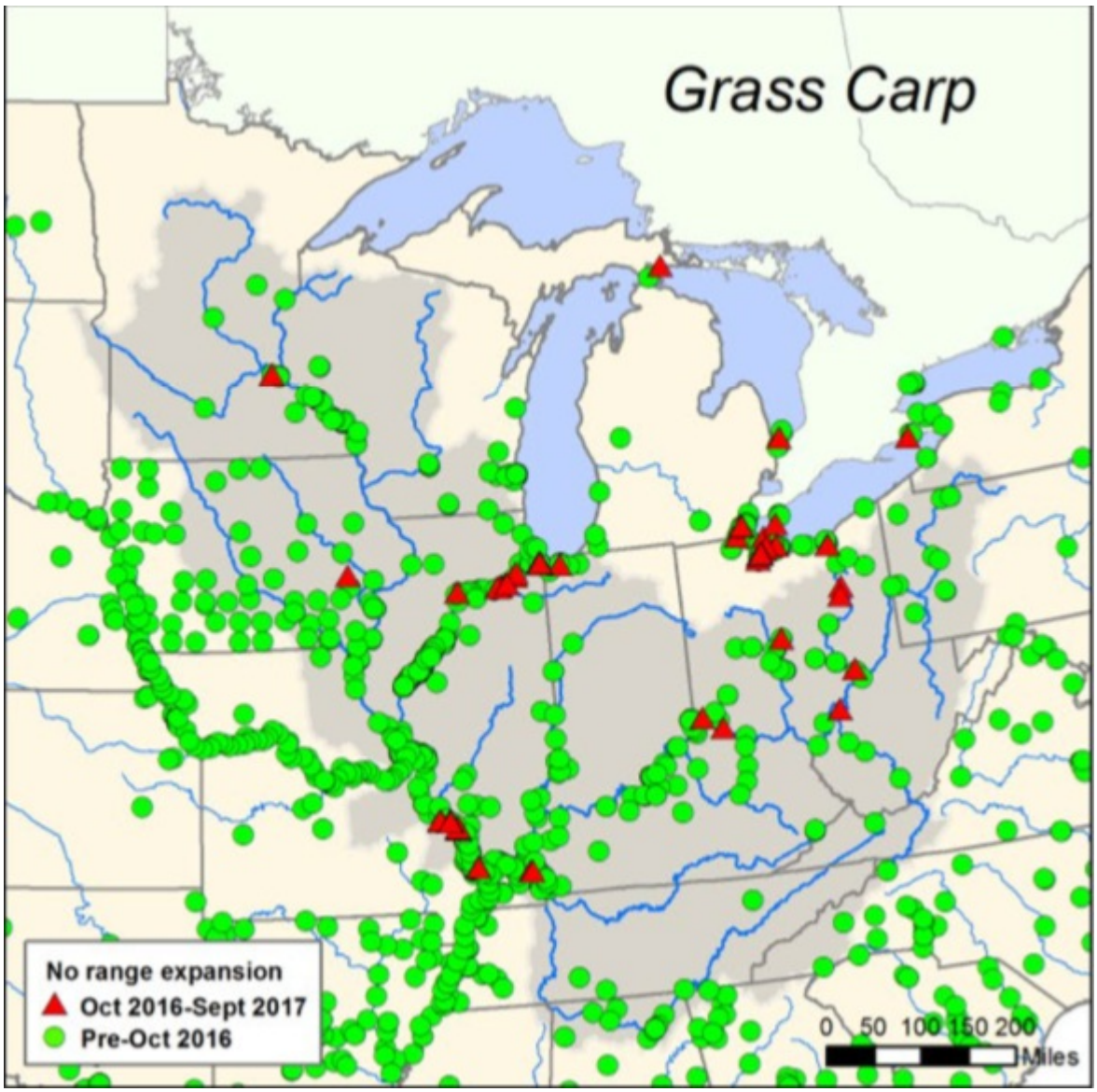

Figure 6 Range expansion maps of all grass carp carp: Green circles represent the data points of occurrences before the reporting period (before October 2016); red triangles identify the new data points collected in from October 2016-September 2017; yellow triangles indicate occurrences that expanded the range of that species. Source: USGS NAS Database (ACCRCC Action Plan 2019).

## Production Statistics

Common carp commercial fisheries have a longstanding history in the domestic US, with landings data dating back to the early 1900s. In the Upper Mississippi River Basin, common carp landings peaked in the early 1970s at nearly 7 million lb and have declined significantly since that time. Landings of silver and bighead carp in the Mississippi River Basin have increased dramatically since 2001 and peaked in 2017 at over 10 million lb. Grass carp landings have been steady since 2009, averaging roughly 390,000 lb 2009 to 2017 (UMRCC 2019) (KDFWR, IDNR) (LDFW). As states along the Mississippi and Ohio River basins continue to work to develop markets and harvest incentive programs, it is expected that commercial landings of Asian carp will continue to increase (Figure A) (ACRCC Action Plan 2019).

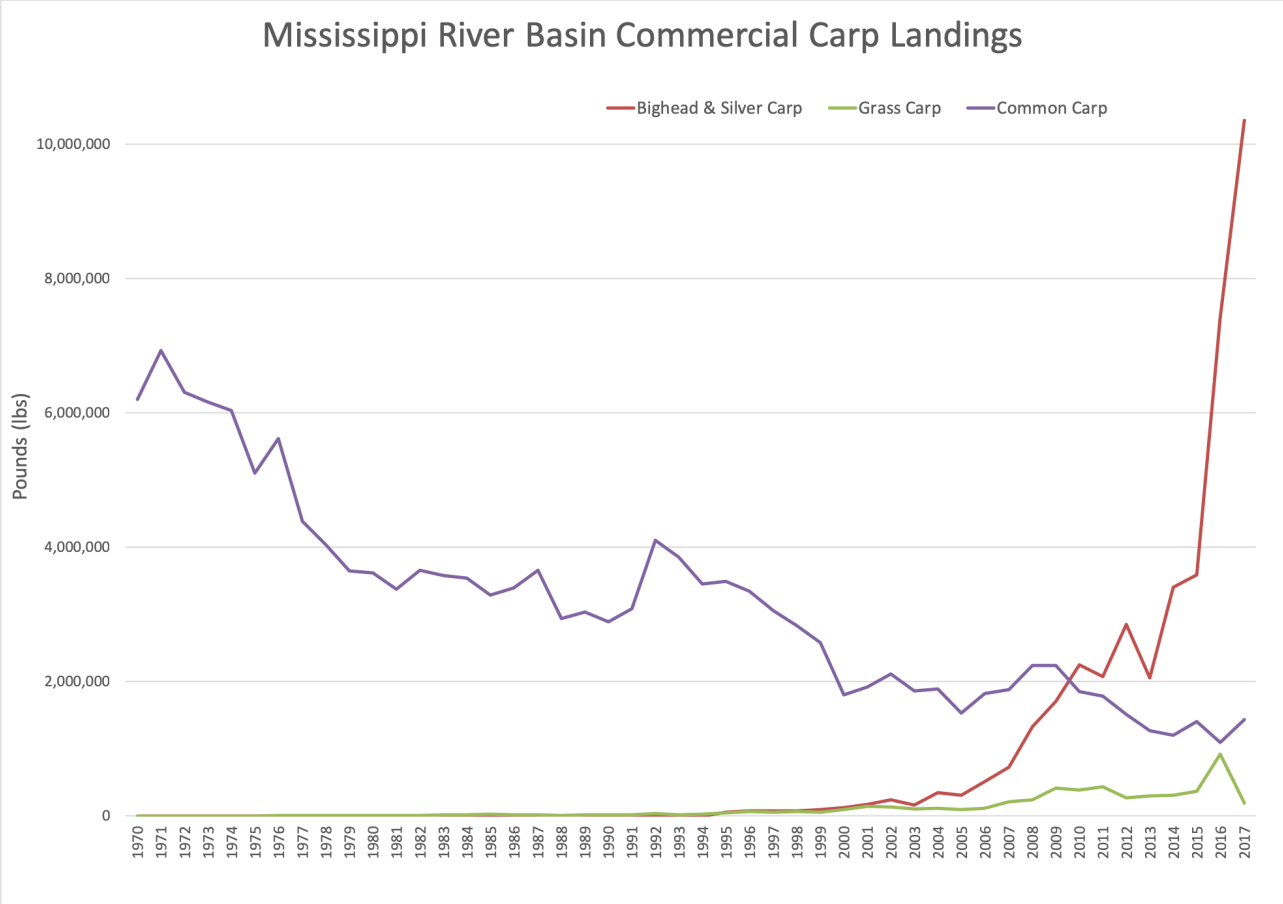


Figure 7 Commercial landings of Asian and common carp species. *Note: Data from Upper Mississippi River Conservation Committee (UMRCC) and from individual states were aggregated to generate figure, and this should be considered an estimate.

Harvests of Asian and common carp vary by state. Illinois, Kentucky, and Louisiana harvest the highest levels of Asian carp in the basin; whereas, Iowa carp catches are lower and primarily dominated by common carp. Low market demand and production capacity of Asian and common carp have limited the development of large-scale markets for these species. States like Kentucky, Tennessee, and Illinois support harvest incentive programs to foster retention and utilization of carp species. For example, substantial harvests of Asian carp in Kentucky support three processors in the western part of the state that process Asian carp for human consumption. Conversely, some states with less infrastructure have struggled to find processing facilities willing to pay competitive market-value prices for Asian and common carp. The price of Asian carp varies by state and is also influenced by its intended use (human consumption or fish meal/ fertilizer). The price per pound Asian carp receives (USD 0.11 to 0.22; Kentucky subsidizes an additional $0.05/lb for certain bodies of water) (KDFWR 2019) (KDFWR 2018) (Maher 2017) (Morris, KDFWR, personal communication 2019) is relatively low compared to other commercial catfish and buffalofish harvested in the region.

Data on production and market value are limited by state. In Illinois, Asian carp (bighead and silver) accounted for the highest proportion (58%) of the total reported harvest in the state in 2017, worth an estimated USD 829,657. This represented a 43% increase from 2016 to 2017 (Maher 2017). This value represents the upper- to mid-range of estimated market values of Asian carp by state (based on relative landings information). Production and market share of Asian carp is expected to increase in states with developed research and harvest incentive programs. For instance, the ACRCC and Illinois Department of Natural Resources (DNR) are supporting a Monitoring and Response Plan (MRP) towards increasing the harvest value of adult Asian carp in the lower Illinois River. The goal of this MRP is removal of 8 million lb per year by 2019 and working toward a 5-year goal of 15 million lb removed annually by 2022 (ACRCC Action Plan 2019).

## Importance to the US/North American market.

Common carp and Asian carp species are not standard imports to the US due to limited domestic demand. Beginning in 2012, small amounts of carp species products were imported from Asia (primarily China, Vietnam, and South Korea), ranging from 6 million lb to 10 million lb with values ranging from USD 3 to 20 million, 2012 to 2018 (NOAA 2019). Imports decreased from 2017 to 2019. The National Oceanic and Atmospheric Association (NOAA) tracks these imports; however, it is important to note that "carp" is lumped in with other more commonly traded species like catfish and tilapia. Therefore, carp likely represents a small proportion of these imports.

Similarly, carp exports are not tracked by species, and they are reportedly lumped in with other more common species. Exports ranged from 1.2 million lb to 2.2 million lb from 2010 to 2018, with estimated values ranging from USD 1.9 million to USD 3.6 million (NOAA 2019). Primary countries exported to include: Canada, Mexico and China. Carp likely comprises a small percentage of these export estimates.

## Common and market names.

Table 1. Names for Asian carp and common carp (FDA 2019) (ACRCC 2019).

| Common name | Market name | Vernacular name |
|---|---|---|
| common carp | carp | European Carp, German carp, mirror carp, carfu |
| bighead | bighead carp, silverfin | |
| silver carp | silver carp, silverfin | Amur carp, Asiatic Carp, Israel Carp |
| grass carp | Carp, silverfin | |

## Primary product forms

Products include a variety of filets, fish cakes, burgers, smoked fish, fish paste, and fish powder; pet foods; fish meal; fertilizer; medical applications; nutritional supplements, and others (ACRCC 2019).

# Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

# Criterion 1: Impacts on the Species Under Assessment

*This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:*

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤3.2=Yellow or Moderate Concern*
- *Score ≤2.2=Red or High Concern*

*Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical*

### Guiding Principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*

### Criterion 1 Summary

| BIGHEAD CARP | | | |
|---|---|---|---|
| **Region \| Method** | **Abundance** | **Fishing Mortality** | **Score** |
| Kentucky/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Tennessee/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Missouri/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Missouri/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Arkansas/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Indiana/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Indiana/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Iowa/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Mississippi/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Mississippi/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| COMMON CARP | | | |
|---|---|---|---|
| **Region \| Method** | **Abundance** | **Fishing Mortality** | **Score** |
| Kentucky/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Tennessee/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Missouri/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Missouri/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Arkansas/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Indiana/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Indiana/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Mississippi/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Mississippi/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| GRASS CARP | | | |
|---|---|---|---|
| **Region \| Method** | **Abundance** | **Fishing Mortality** | **Score** |
| Kentucky/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Tennessee/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Missouri/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Missouri/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Arkansas/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Indiana/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Louisiana/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Indiana/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Mississippi/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Mississippi/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| SILVER CARP | | | |
|---|---|---|---|
| **Region \| Method** | **Abundance** | **Fishing Mortality** | **Score** |
| Kentucky/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Tennessee/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Missouri/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Missouri/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Arkansas/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Indiana/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Louisiana/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Indiana/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Illinois/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Illinois/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Seine nets (unspecified) \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Iowa/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Mississippi/Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |
| Mississippi/Mississippi River Basin \| Fyke nets \| United States of America | 5.00: Very Low Concern | 5.00: Low Concern | Green (5.000) |

## Criterion 1 Assessment

SCORING GUIDELINES

### Factor 1.1 - Abundance

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- *5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.*
- *2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance level, OR abundance is unknown and the species is not highly vulnerable.*
- *1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.*

### Factor 1.2 - Fishing Mortality

Goal: Fishing mortality is appropriate for current state of the stock.

- *5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable*

*level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.*

- *3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.*
- *1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.*

BIGHEAD CARP

## Factor 1.1 - Abundance

KENTUCKY/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Very Low Concern**

The three Asian carp species (grass, bighead, silver) and common carp are non-native, and therefore receive a score of "very low" concern for abundance based on Seafood Watch Criteria.

**Justification:**

Common carp originated in Europe and Asia and were introduced in the United States during the mid 1830s. They were established in a number of regions by the 1870s. Common carp are now considered established in all mainland states across the United States. Over 100 years later in the 1960s and 1970s, the USFWS imported Asian carp (bighead, silver, grass) species from Southeast Asia to the southern United States, specifically Arkansas, to help aquaculture and wastewater treatment facilities keep retention ponds clean (Watershedcouncil.org 2019) (ACRCC 2019).

Intentional stocking of bighead and silver carp by state and federal agencies, followed by flooding events and/or accidental releases, facilitated Asian carp expansion into the Mississippi River system and migration into the Missouri and Illinois rivers from the 1980s to the present time. Asian carp species are at risk of spreading into the Great Lakes and other important waterways in the United States and Canada (Kelly et al. 2011). The migration of bighead and silver carp through the Illinois River via the Chicago Area Waterway System, Wabash River, Grand Calumet River, and possibly other pathways that connect the Mississippi River and Great Lakes basins is the most acute aquatic-invasive-species threat currently facing the region (ACRCC

2019).

Abundance estimates and stock assessments are limited for most carp species; however, one study from the Upper Mississippi River System in Illinois found that silver carp catches increased exponentially from 1998 to 2008, with an intrinsic rate of increase approaching 84% (Sass et al. 2010). Although this value may be high compared to other regions, commercial catches and regional surveys suggest Asian carp populations are increasing in most impacted areas.

## Factor 1.2 - Fishing Mortality

KENTUCKY/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Standard target reference points (MSY, etc.) do not apply to this fishery because Asian carp and common carp are non-native, and Kentucky's harvest programs are designed to maximize harvests and minimize any adverse impacts to the ecosystem associated with Asian and common carp invasion. Therefore, all carp species reviewed in Kentucky receive a score of "low" concern for fishing mortality.

**Justification:**

Asian carp are caught with gill nets in Kentucky. Since 2013, silver carp have dominated overall carp landings in Kentucky, averaging 1.4 million lb from 2013 to 2017. Bighead landings averaged 110,000 lb, and common carp landings averaged 55,000 lb during the same time period. Commercial grass carp landings were first reported in 2017 at approximately 26,000 lb (Figure A).

Kentucky currently manages a comprehensive Asian carp tracking and harvest incentive program. A formal Asian Carp Control Strategy Framework and an Asian Carp Harvest Program were established in 2014 (KDFWR 2019). The Harvest Incentive Program supports Asian carp harvests in a number of ways including: opening access to more waters during longer seasons for commercial fishers, subsidizing fishers' revenue per pound of Asian carp landed, and providing free ice to carp fishers. Catches of Asian carp have increased steadily since the inception of the programs in 2013 and 2014 (Morris, KDFWR, personal communication 2019).

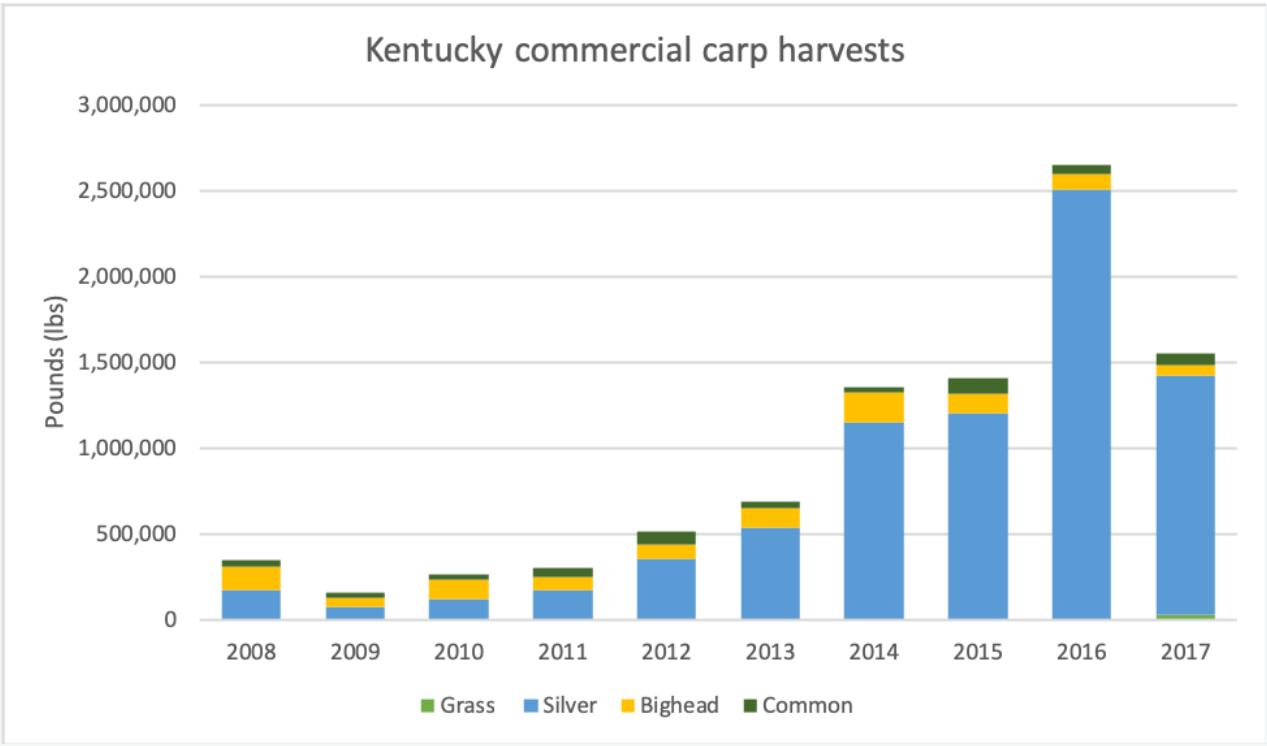


Figure 8 Kentucky commercial carp harvests 2008-2017 (KDFWR 2019).

TENNESSEE/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Standard target reference points (MSY, etc.) do not apply to this fishery because common carp and Asian carp are non-native, and Tennessee's harvest programs are designed to maximize harvests to minimize any adverse impacts to the ecosystem associated with carp invasions. Therefore, all common carp and Asian carp species reviewed in Tennessee receive a score of "low" concern for fishing mortality.

**Justification:**

Data on carp harvests prior to 2016 are unavailable due to limited reporting requirements in Tennessee in previous years. In 2018, approximately 105,852 lb of common carp, 990,000 lb of silver carp, 25,000 lb of bighead carp and 38,320 lb of grass carp were harvested. Fishery managers believe that these values are reflective of catch levels from the last 5 years (Ganus, TWRA, personal communication 2019). Due to the nature of Tennessee's waterways, gill nets are the primary gear used to target common carp and Asian carp species.

MISSOURI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

The Missouri commercial fisheries for common and Asian carp were relatively small-scale until 2015, and catches increased significantly in 2017 and 2018, with roughly 600,000 lb of bighead and silver carp (reported together due to morphological similarities), and much smaller amounts of common carp and grass carp (Figure A). Asian and common carp were caught primarily with seine and gill nets on the Mississippi River in

Missouri in 2017 and primarily with gill nets for the remainder of the waterways. Asian and common carp are non-native, and Missouri's' commercial carp fisheries are designed to maximize harvests. Therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed receive a score of "low" concern for fishing mortality in Missouri.

**Justification:**

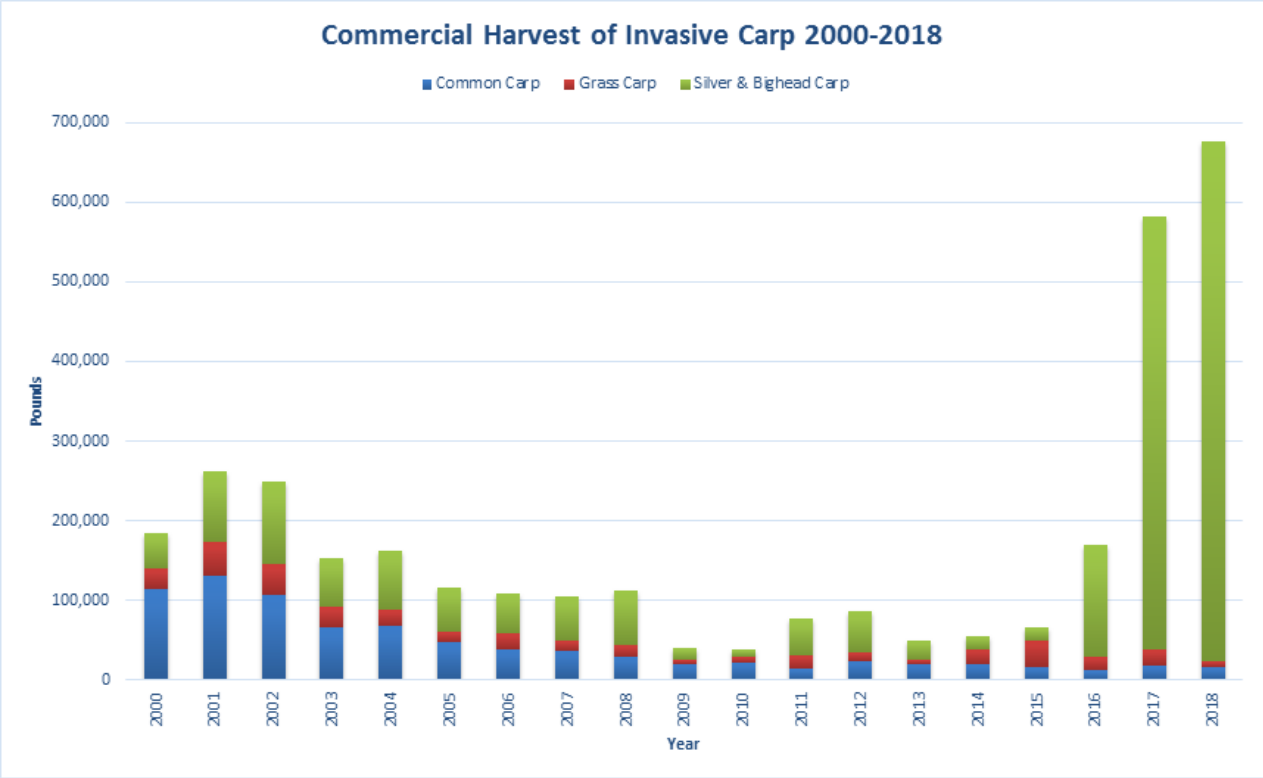


Figure 9 Missouri commercial carp harvests, 2000-2018 (MDC 2019).

ARKANSAS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Although there are commercial catches of Asian and common carp in Arkansas, landings are not tracked formally. Anecdotal information suggests that common and silver carp are the most commonly caught species, followed by bighead and grass (Moles, AGFC, personal communication 2019). Gill nets are the only gear permitted to target carp in Arkansas. Because Asian carp and common carp are non-native, all common carp and Asian carp species (silver, bighead, grass) reviewed in Arkansas receive a score of "low concern" for fishing mortality.

ILLINOIS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

Total catches of Asian carp and common carp are relatively high in the state of Illinois, averaging over 6 million lb total from 2013 to 2017. Asian and common carp are non-native, and Illinois' carp harvest programs are designed to maximize harvests. Therefore, all common carp and Asian carp species (silver, bighead,

grass) reviewed in Illinois receive a score of "low" concern for fishing mortality.

**Justification:**

Due to identification challenges and similar morphology between species, bighead and silver landings are reported together in Illinois and averaged approximately 5 million lb from 2013 to 2017; both grass carp and common carp averaged roughly 775,000 lb during that same time and peaked at over 1 million lb in 2017. There are three primary gear types used in Illinois: gill/trammel comprised roughly 80% of carp catches in 2017 with hoop nets and seine nets at about 10% respectively (Figure A) (Maher 2017).

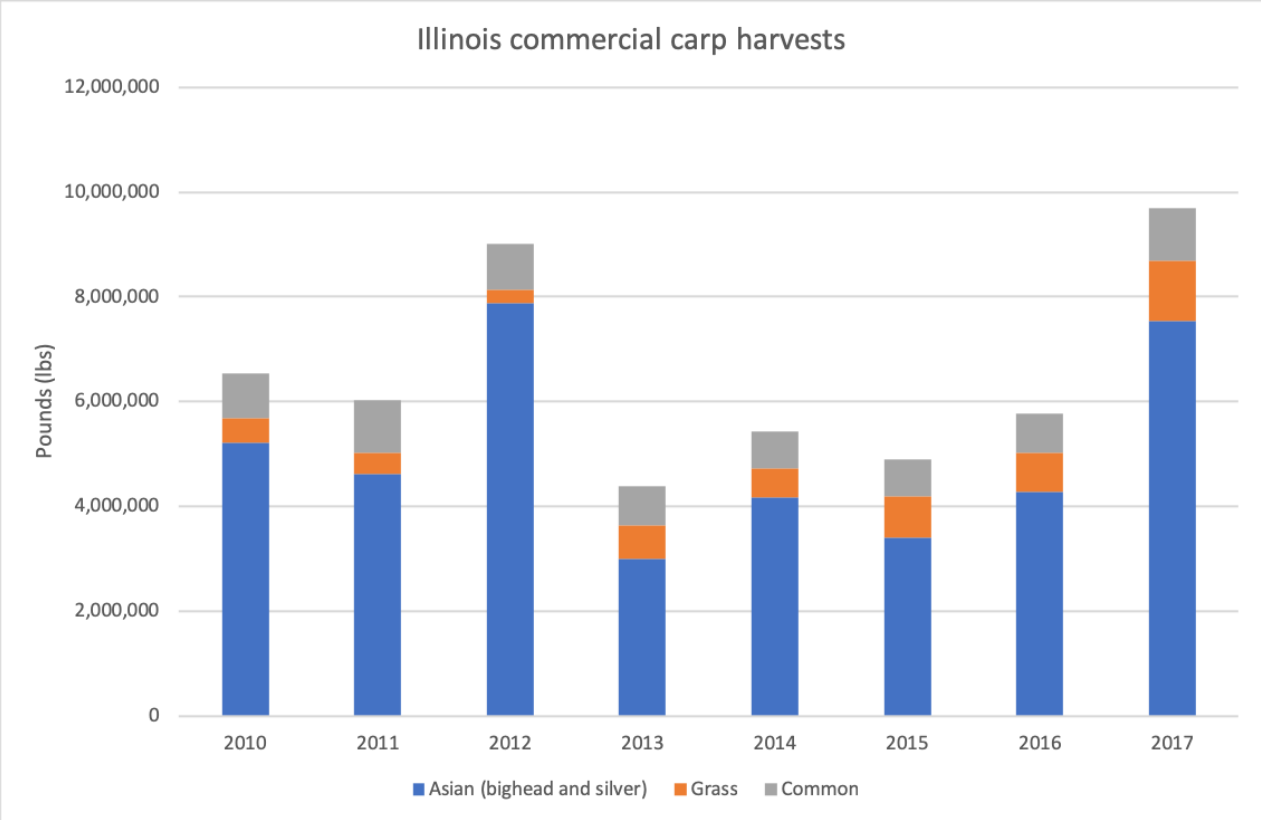


Figure 10 Illinois commercial carp landings 2010-2017 (Maher 2017).

INDIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Low Concern**

Harvest of Asian and common carp in Indiana are relatively low and occur in inland waters using hoop nets, and on the Ohio river using gill nets. Common carp and Asian carp (grass, bighead and silver) are non-native, and therefore receive a score of "low" concern for abundance in Indiana.

**Justification:**

Asian carp harvest (bighead and silver) predominate in Indiana on the Ohio river using gill nets (which peaked at 32,500 lb in 2015), whereas moderate common carp removals have been reported in inland waterways such as the Wabash and White riverways (typically well below 1000 lb). All Asian carp landings reported as one unit due to similar morphology (Figure A).

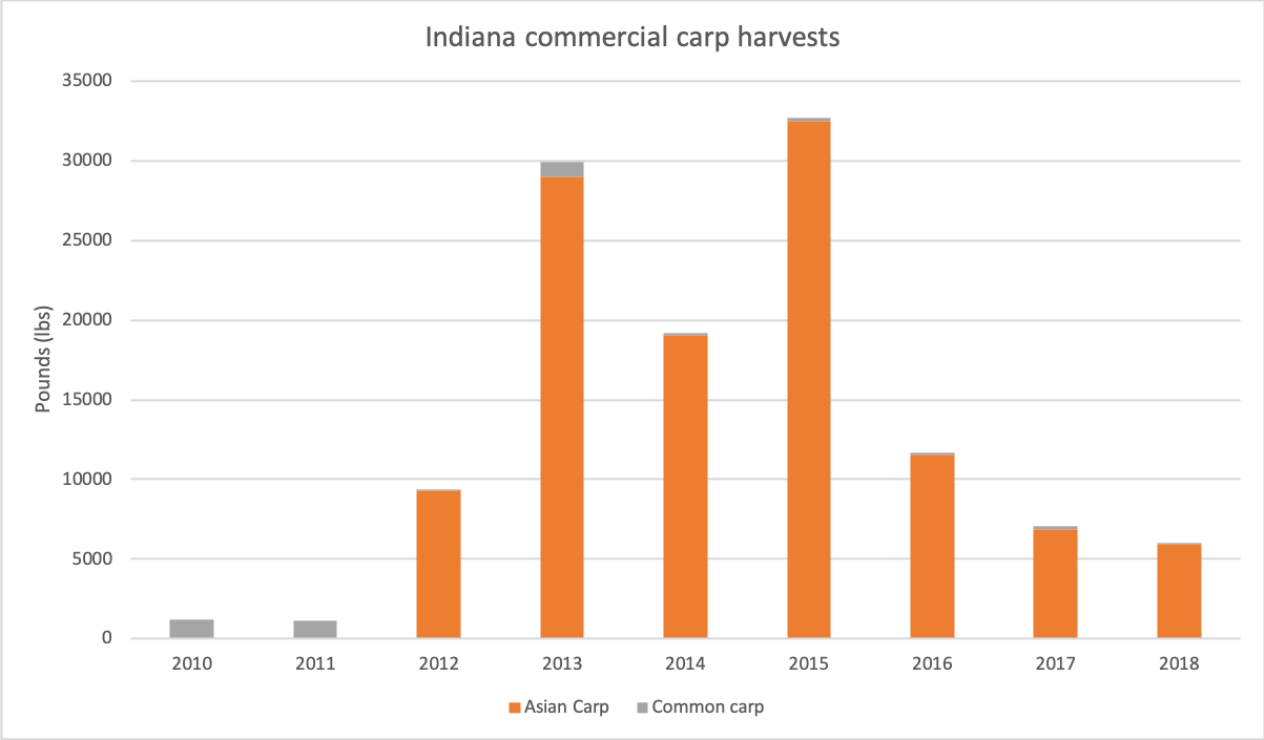


Figure 11 Indiana commercial carp harvests, 2010-2018.

LOUISIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

Asian and common carp are non-native and receive a score of "low" concern for fishing mortality in Louisiana.

**Justification:**

Harvests of Asian and common carp in Louisiana occur as bycatch-only fisheries; however, landings of Asian carp (especially bighead and silver) have been increasing since 2006. Bighead carp represent the largest proportion of overall landings in Louisiana and averaged 392,000 lb from 2014 to 2018, followed by silver carp, averaging 117,000 lb during the same period (Figure A). It's important to note that due to confidentiality reasons at least half of Asian and common carp landings are not reported in this review, so this should be considered an underestimate. Primary gear types used include hoop nets, seine, and gill nets (Reed, LDFW, personal communication 2019).

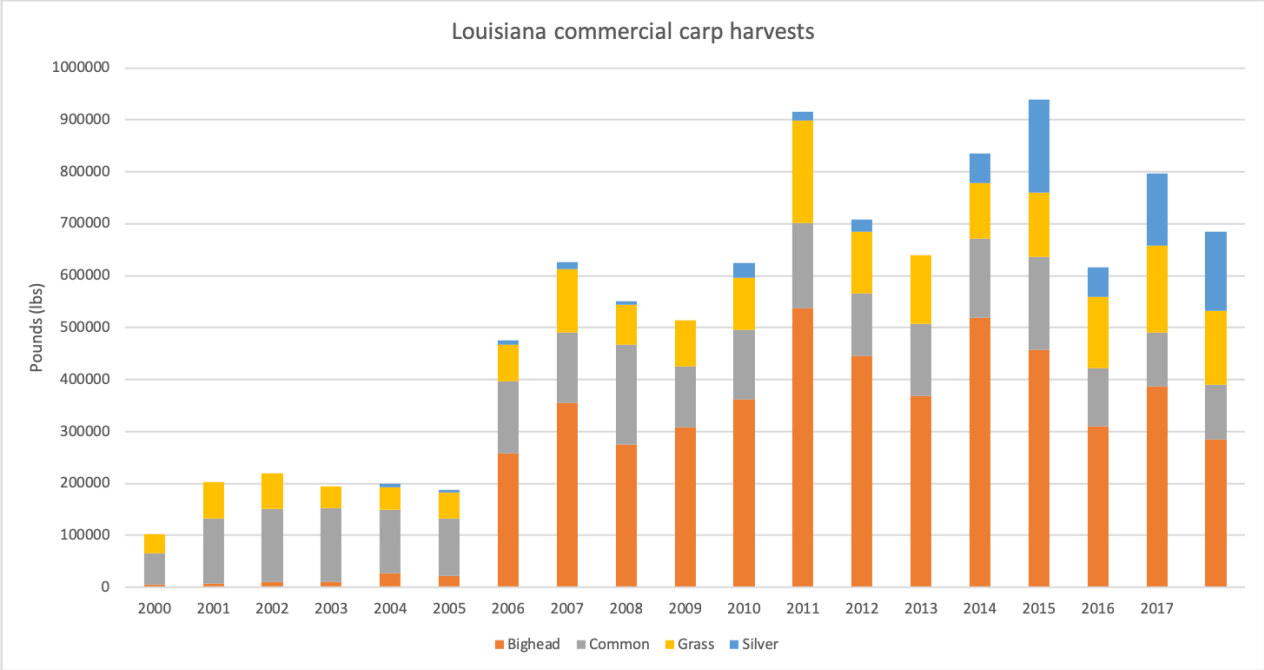


Figure 12 Louisiana commercial carp landings, 2000-2018.

IOWA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Asian and common carp are non-native; therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed in Iowa receive a score of "low" concern for fishing mortality.

**Justification:**

Common carp dominate carp harvests in the state of Iowa and averaged roughly 170,000 lb annually from 2014 to 2018 (Figure A). Although common carp harvests have declined moderately since the mid 1990s, Asian carp species harvests have increased moderately since 2009 (but still comprise a relatively small proportion of overall carp harvests). Annual averages from 2014 to 2018 are as follows: grass 17,215 lb, bighead 5,808 lb, silver 19,414 lb.

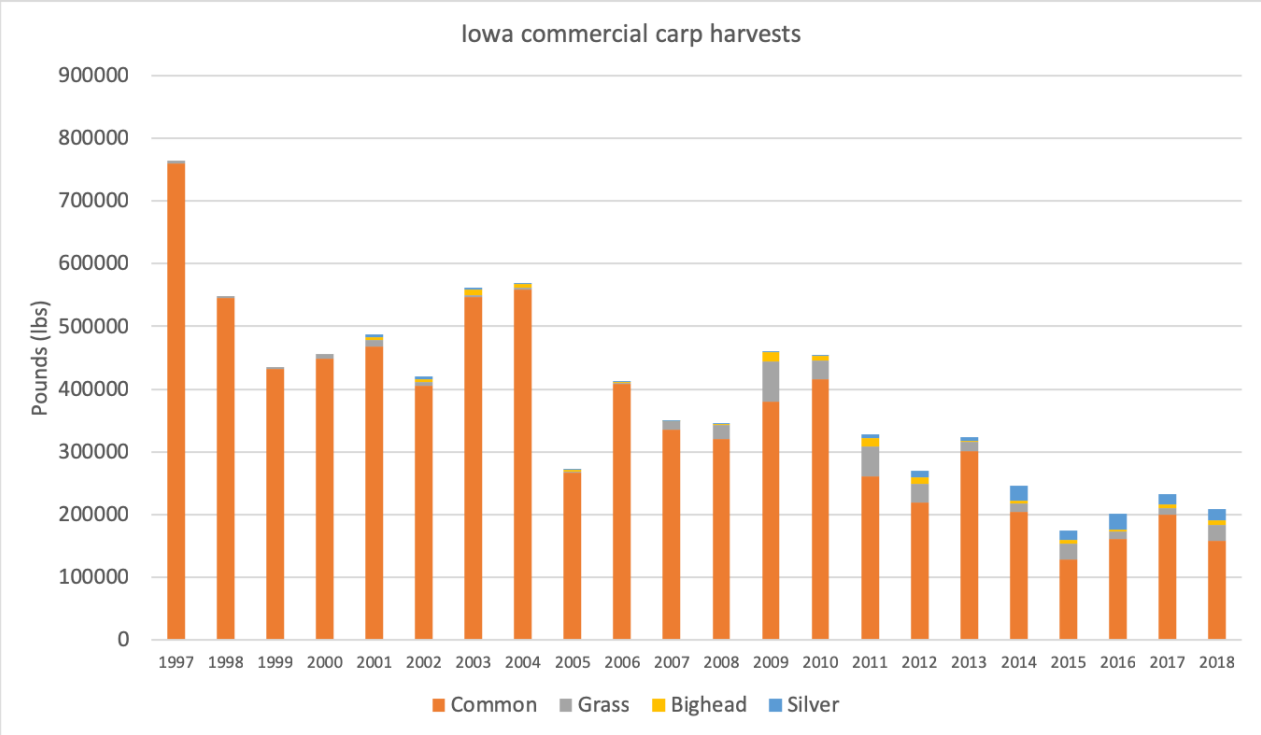


Figure 13 Iowa commercial carp harvests, 1987 - 2018 (IDNR 2019).

Multiple gear types are used in Iowa including buffalo or fyke nets, gill (including trammel) nets and seine nets. Common carp are primarily caught with gill and trammel nets (~61% of total Iowa common carp harvests) followed by seine gear. Asian carp (grass, silver, bighead) are primarily harvested with gill/trammel nets (~80% of total Asian carp harvest in Iowa) followed by buffalo/fyke nets (~8%) (Fowler, IDNR, personal communication 2019).

MISSISSIPPI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Low Concern**

Commercial landings from all waterways are not tracked formally for the state of Mississippi; however, processing information and partial-landings data are reviewed by state managers. Gill/trammel nets, followed by fyke nets, are the primary gear types used in Mississippi. In 2015 and 2016, approximately 377,000 and 980,000 lb, respectively, of Asian carp were processed (this represents a minimum estimate of landings) (Riecke, MDWFP, personal communication 2019). Silver carp dominates reported landings. Because Asian and common carp are non-native, all common carp and Asian carp species (silver, bighead, grass) reviewed in Mississippi receive a score of "low" concern for fishing mortality.

COMMON CARP

## Factor 1.1 - Abundance

KENTUCKY/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Very Low Concern**

The three Asian carp species (grass, bighead, silver) and common carp are non-native, and therefore receive a score of "very low" concern for abundance based on Seafood Watch Criteria.

**Justification:**

Common carp originated in Europe and Asia and were introduced in the United States during the mid 1830s. They were established in a number of regions by the 1870s. Common carp are now considered established in all mainland states across the United States. Over 100 years later in the 1960s and 1970s, the USFWS imported Asian carp (bighead, silver, grass) species from Southeast Asia to the southern United States, specifically Arkansas, to help aquaculture and wastewater treatment facilities keep retention ponds clean (Watershedcouncil.org 2019) (ACRCC 2019).

Intentional stocking of bighead and silver carp by state and federal agencies, followed by flooding events and/or accidental releases, facilitated Asian carp expansion into the Mississippi River system and migration into the Missouri and Illinois rivers from the 1980s to the present time. Asian carp species are at risk of spreading into the Great Lakes and other important waterways in the United States and Canada (Kelly et al. 2011). The migration of bighead and silver carp through the Illinois River via the Chicago Area Waterway System, Wabash River, Grand Calumet River, and possibly other pathways that connect the Mississippi River and Great Lakes basins is the most acute aquatic-invasive-species threat currently facing the region (ACRCC 2019).

Abundance estimates and stock assessments are limited for most carp species; however, one study from the Upper Mississippi River System in Illinois found that silver carp catches increased exponentially from 1998 to 2008, with an intrinsic rate of increase approaching 84% (Sass et al. 2010). Although this value may be high compared to other regions, commercial catches and regional surveys suggest Asian carp populations are increasing in most impacted areas.

## Factor 1.2 - Fishing Mortality

KENTUCKY/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Standard target reference points (MSY, etc.) do not apply to this fishery because Asian carp and common carp are non-native, and Kentucky's harvest programs are designed to maximize harvests and minimize any adverse impacts to the ecosystem associated with Asian and common carp invasion. Therefore, all carp species reviewed in Kentucky receive a score of "low" concern for fishing mortality.

**Justification:**

Asian carp are caught with gill nets in Kentucky. Since 2013, silver carp have dominated overall carp landings in Kentucky, averaging 1.4 million lb from 2013 to 2017. Bighead landings averaged 110,000 lb, and common carp landings averaged 55,000 lb during the same time period. Commercial grass carp landings were first reported in 2017 at approximately 26,000 lb (Figure A).

Kentucky currently manages a comprehensive Asian carp tracking and harvest incentive program. A formal Asian Carp Control Strategy Framework and an Asian Carp Harvest Program were established in 2014 (KDFWR 2019). The Harvest Incentive Program supports Asian carp harvests in a number of ways including: opening access to more waters during longer seasons for commercial fishers, subsidizing fishers' revenue per pound of Asian carp landed, and providing free ice to carp fishers. Catches of Asian carp have increased steadily since the inception of the programs in 2013 and 2014 (Morris, KDFWR, personal communication 2019).

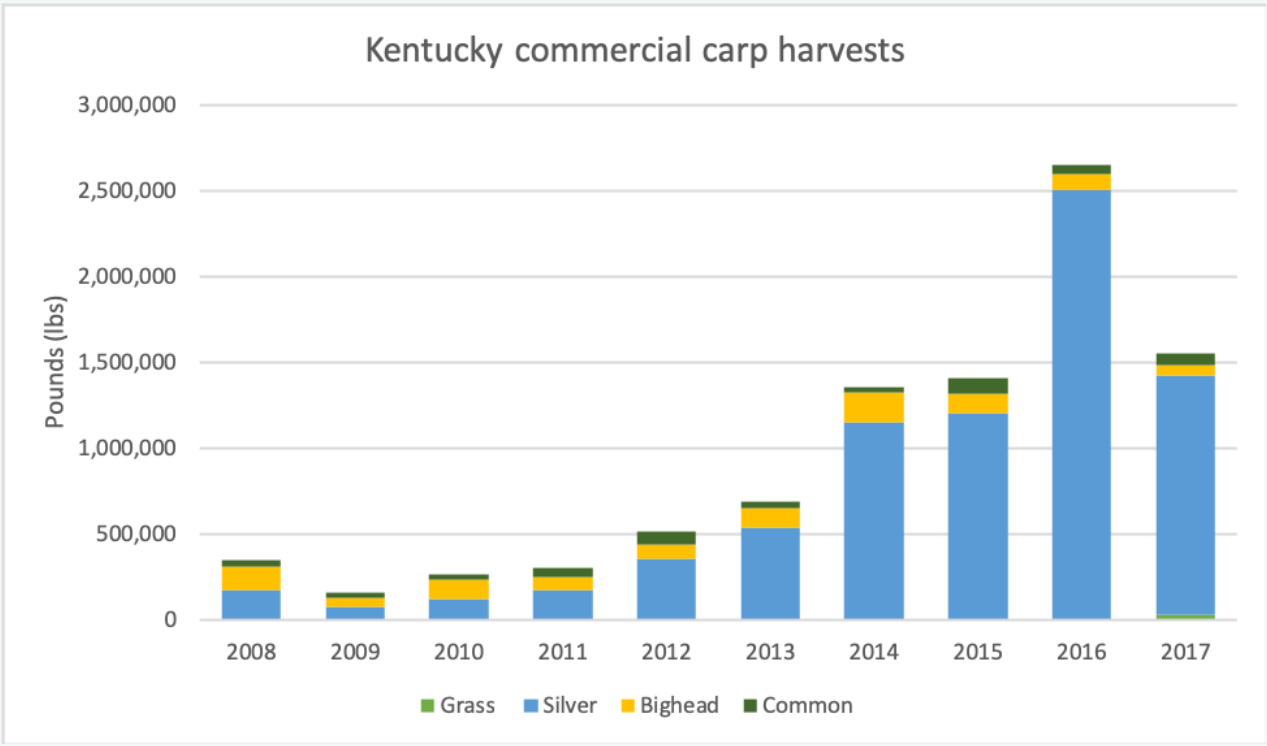


Figure 14 Kentucky commercial carp harvests 2008-2017 (KDFWR 2019).

TENNESSEE/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Standard target reference points (MSY, etc.) do not apply to this fishery because common carp and Asian carp are non-native, and Tennessee's harvest programs are designed to maximize harvests to minimize any adverse impacts to the ecosystem associated with carp invasions. Therefore, all common carp and Asian carp species reviewed in Tennessee receive a score of "low" concern for fishing mortality.

**Justification:**

Data on carp harvests prior to 2016 are unavailable due to limited reporting requirements in Tennessee in previous years. In 2018, approximately 105,852 lb of common carp, 990,000 lb of silver carp, 25,000 lb of bighead carp and 38,320 lb of grass carp were harvested. Fishery managers believe that these values are reflective of catch levels from the last 5 years (Ganus, TWRA, personal communication 2019). Due to the nature of Tennessee's waterways, gill nets are the primary gear used to target common carp and Asian carp species.

MISSOURI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

The Missouri commercial fisheries for common and Asian carp were relatively small-scale until 2015, and catches increased significantly in 2017 and 2018, with roughly 600,000 lb of bighead and silver carp (reported together due to morphological similarities), and much smaller amounts of common carp and grass carp (Figure A). Asian and common carp were caught primarily with seine and gill nets on the Mississippi River in Missouri in 2017 and primarily with gill nets for the remainder of the waterways. Asian and common carp are non-native, and Missouri's' commercial carp fisheries are designed to maximize harvests. Therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed  receive a score of "low" concern for fishing mortality in Missouri.

**Justification:**

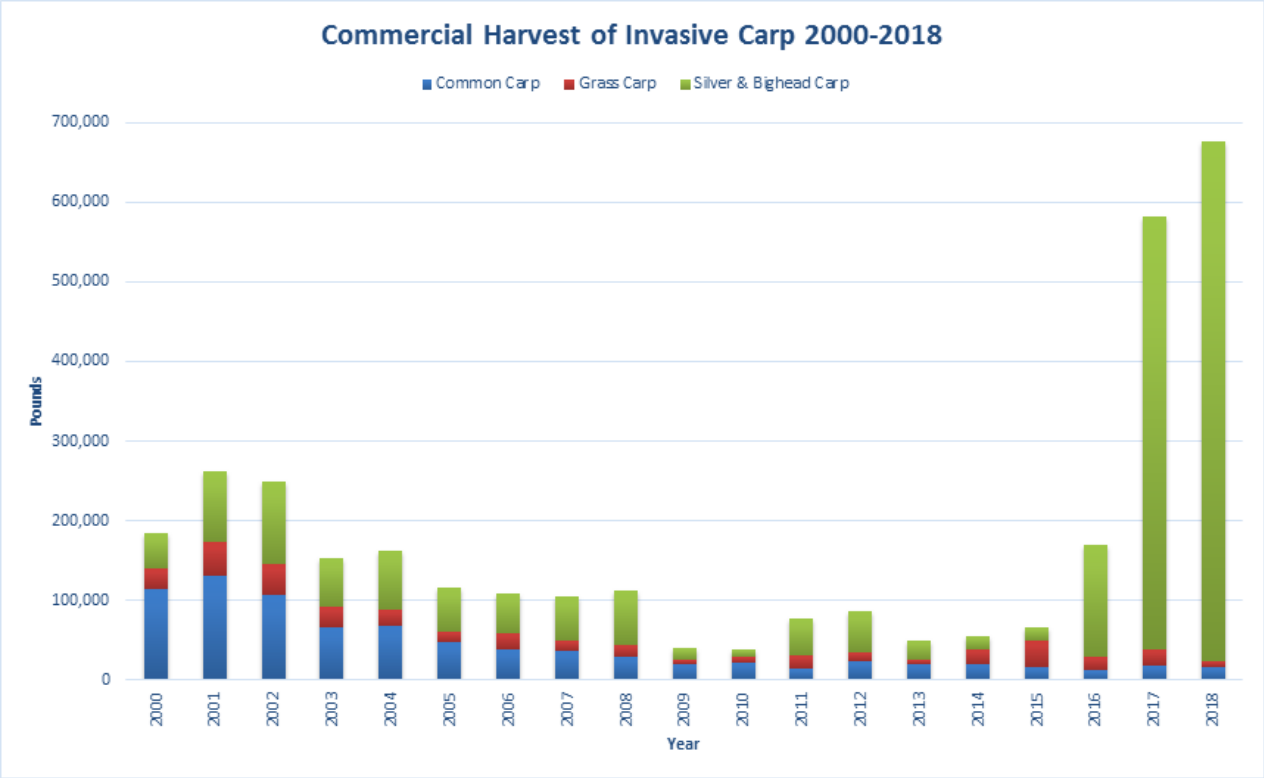


Figure 15 Missouri commercial carp harvests, 2000-2018 (MDC 2019).

ARKANSAS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Although there are commercial catches of Asian and common carp in Arkansas, landings are not tracked formally. Anecdotal information suggests that common and silver carp are the most commonly caught species, followed by bighead and grass (Moles, AGFC, personal communication 2019). Gill nets are the only gear permitted to target carp in Arkansas. Because Asian carp and common carp are non-native, all common carp and Asian carp species (silver, bighead, grass) reviewed in Arkansas receive a score of "low concern" for fishing mortality.

ILLINOIS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

Total catches of Asian carp and common carp are relatively high in the state of Illinois, averaging over 6 million lb total from 2013 to 2017. Asian and common carp are non-native, and Illinois' carp harvest programs are designed to maximize harvests. Therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed in Illinois receive a score of "low" concern for fishing mortality.

**Justification:**

Due to identification challenges and similar morphology between species, bighead and silver landings are reported together in Illinois and averaged approximately 5 million lb from 2013 to 2017; both grass carp and common carp averaged roughly 775,000 lb during that same time and peaked at over 1 million lb in 2017. There are three primary gear types used in Illinois: gill/trammel comprised roughly 80% of carp catches in 2017 with hoop nets and seine nets at about 10% respectively (Figure A) (Maher 2017).

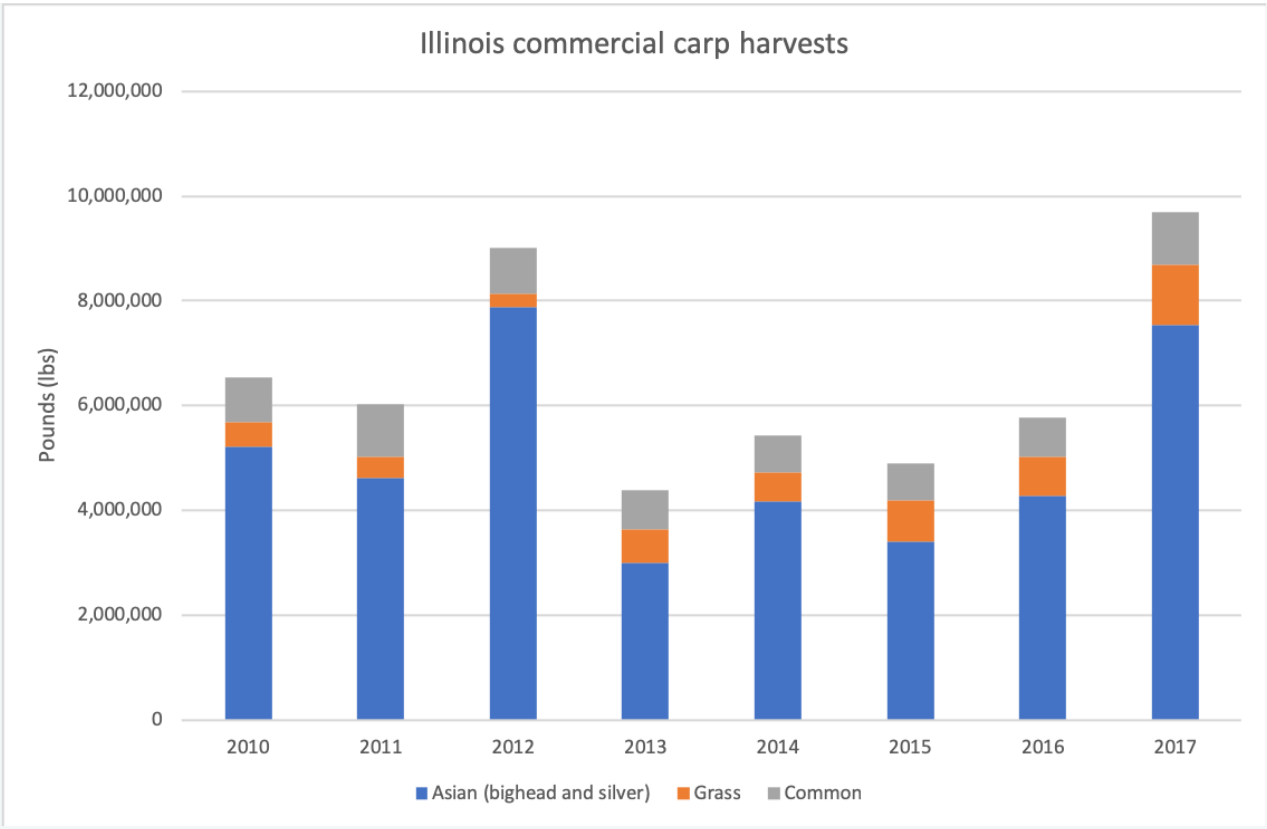


Figure 16 Illinois commercial carp landings 2010-2017 (Maher 2017).

INDIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Low Concern**

Harvest of Asian and common carp in Indiana are relatively low and occur in inland waters using hoop nets, and on the Ohio river using gill nets. Common carp and Asian carp (grass, bighead and silver) are non-native, and therefore receive a score of "low" concern for abundance in Indiana.

**Justification:**

Asian carp harvest (bighead and silver) predominate in Indiana on the Ohio river using gill nets (which peaked at 32,500 lb in 2015), whereas moderate common carp removals have been reported in inland waterways such as the Wabash and White riverways (typically well below 1000 lb). All Asian carp landings reported as one unit due to similar morphology (Figure A).

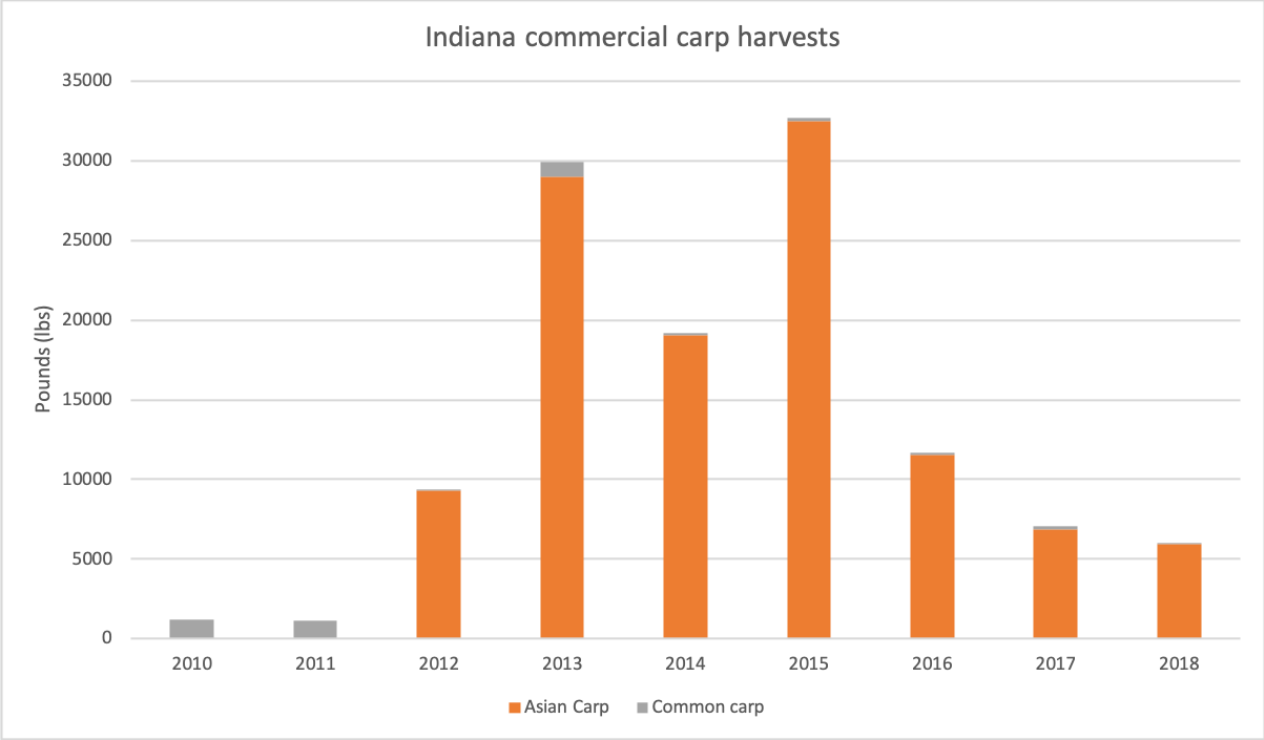


Figure 17 Indiana commercial carp harvests, 2010-2018.

LOUISIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

Asian and common carp are non-native and receive a score of "low" concern for fishing mortality in Louisiana.

**Justification:**

Harvests of Asian and common carp in Louisiana occur as bycatch-only fisheries; however, landings of Asian carp (especially bighead and silver) have been increasing since 2006. Bighead carp represent the largest proportion of overall landings in Louisiana and averaged 392,000 lb from 2014 to 2018, followed by silver carp, averaging 117,000 lb during the same period (Figure A). It's important to note that due to confidentiality reasons at least half of Asian and common carp landings are not reported in this review, so this should be considered an underestimate. Primary gear types used include hoop nets, seine, and gill nets (Reed, LDFW, personal communication 2019).

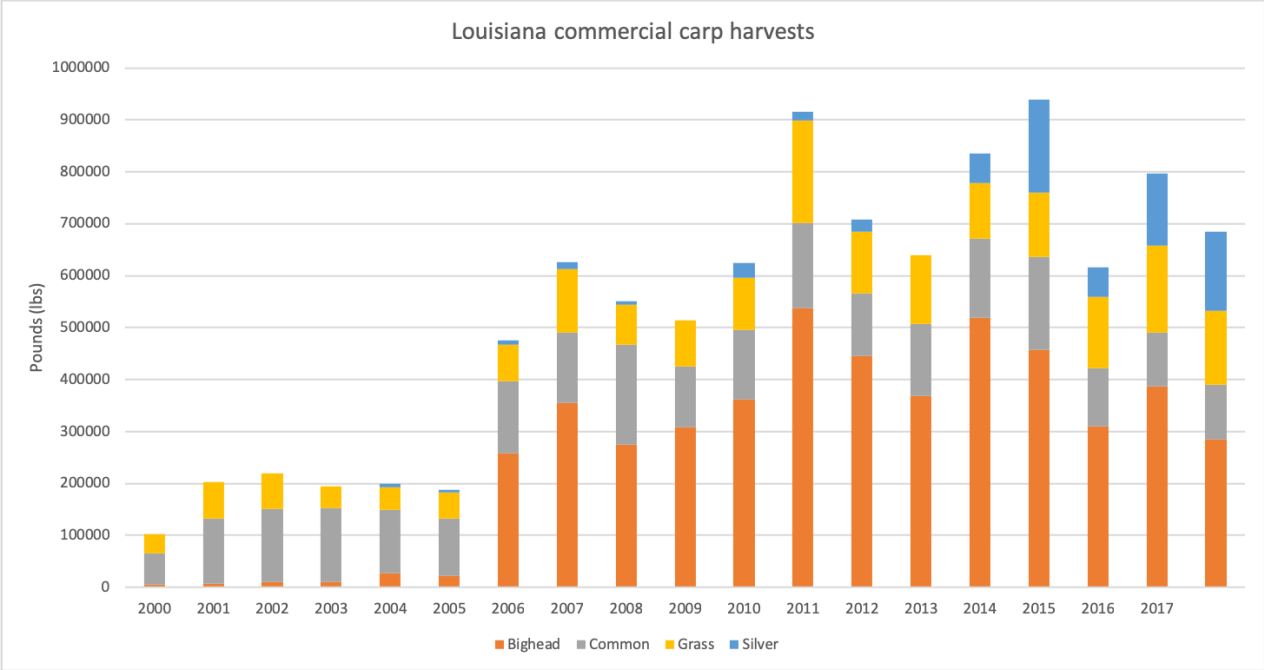


Figure 18 Louisiana commercial carp landings, 2000-2018.

IOWA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Asian and common carp are non-native; therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed in Iowa receive a score of "low" concern for fishing mortality.

**Justification:**

Common carp dominate carp harvests in the state of Iowa and averaged roughly 170,000 lb annually from 2014 to 2018 (Figure A). Although common carp harvests have declined moderately since the mid 1990s, Asian carp species harvests have increased moderately since 2009 (but still comprise a relatively small proportion of overall carp harvests). Annual averages from 2014 to 2018 are as follows: grass 17,215 lb, bighead 5,808 lb, silver 19,414 lb.

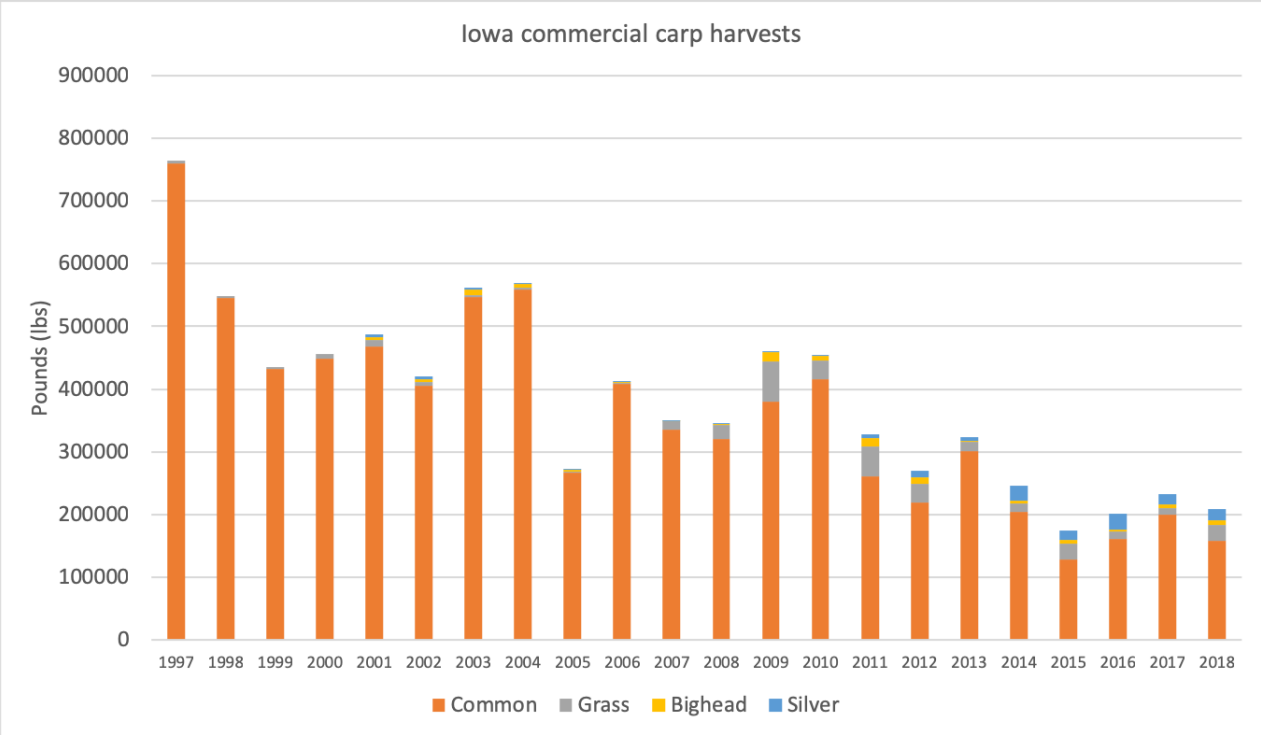


Figure 19 Iowa commercial carp harvests, 1987 - 2018 (IDNR 2019).

Multiple gear types are used in Iowa including buffalo or fyke nets, gill (including trammel) nets and seine nets. Common carp are primarily caught with gill and trammel nets (~61% of total Iowa common carp harvests) followed by seine gear. Asian carp (grass, silver, bighead) are primarily harvested with gill/trammel nets (~80% of total Asian carp harvest in Iowa) followed by buffalo/fyke nets (~8%) (Fowler, IDNR, personal communication 2019).

MISSISSIPPI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Low Concern**

Commercial landings from all waterways are not tracked formally for the state of Mississippi; however, processing information and partial-landings data are reviewed by state managers. Gill/trammel nets, followed by fyke nets, are the primary gear types used in Mississippi. In 2015 and 2016, approximately 377,000 and 980,000 lb, respectively, of Asian carp were processed (this represents a minimum estimate of landings) (Riecke, MDWFP, personal communication 2019). Silver carp dominates reported landings. Because Asian and common carp are non-native, all common carp and Asian carp species (silver, bighead, grass) reviewed in Mississippi receive a score of "low" concern for fishing mortality.

## Factor 1.1 - Abundance

KENTUCKY/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Very Low Concern**

The three Asian carp species (grass, bighead, silver) and common carp are non-native, and therefore receive a score of "very low" concern for abundance based on Seafood Watch Criteria.

**Justification:**

Common carp originated in Europe and Asia and were introduced in the United States during the mid 1830s. They were established in a number of regions by the 1870s. Common carp are now considered established in all mainland states across the United States. Over 100 years later in the 1960s and 1970s, the USFWS imported Asian carp (bighead, silver, grass) species from Southeast Asia to the southern United States, specifically Arkansas, to help aquaculture and wastewater treatment facilities keep retention ponds clean (Watershedcouncil.org 2019) (ACRCC 2019).

Intentional stocking of bighead and silver carp by state and federal agencies, followed by flooding events and/or accidental releases, facilitated Asian carp expansion into the Mississippi River system and migration into the Missouri and Illinois rivers from the 1980s to the present time. Asian carp species are at risk of spreading into the Great Lakes and other important waterways in the United States and Canada (Kelly et al. 2011). The migration of bighead and silver carp through the Illinois River via the Chicago Area Waterway System, Wabash River, Grand Calumet River, and possibly other pathways that connect the Mississippi River and Great Lakes basins is the most acute aquatic-invasive-species threat currently facing the region (ACRCC 2019).

Abundance estimates and stock assessments are limited for most carp species; however, one study from the Upper Mississippi River System in Illinois found that silver carp catches increased exponentially from 1998 to 2008, with an intrinsic rate of increase approaching 84% (Sass et al. 2010). Although this value may be high compared to other regions, commercial catches and regional surveys suggest Asian carp populations are increasing in most impacted areas.

## Factor 1.2 - Fishing Mortality

KENTUCKY/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Standard target reference points (MSY, etc.) do not apply to this fishery because Asian carp and common carp are non-native, and Kentucky's harvest programs are designed to maximize harvests and minimize any adverse impacts to the ecosystem associated with Asian and common carp invasion. Therefore, all carp species reviewed in Kentucky receive a score of "low" concern for fishing mortality.

**Justification:**

Asian carp are caught with gill nets in Kentucky. Since 2013, silver carp have dominated overall carp landings in Kentucky, averaging 1.4 million lb from 2013 to 2017. Bighead landings averaged 110,000 lb, and common carp landings averaged 55,000 lb during the same time period. Commercial grass carp landings were first reported in 2017 at approximately 26,000 lb (Figure A).

Kentucky currently manages a comprehensive Asian carp tracking and harvest incentive program. A formal Asian Carp Control Strategy Framework and an Asian Carp Harvest Program were established in 2014 (KDFWR 2019). The Harvest Incentive Program supports Asian carp harvests in a number of ways including: opening access to more waters during longer seasons for commercial fishers, subsidizing fishers' revenue per pound of Asian carp landed, and providing free ice to carp fishers. Catches of Asian carp have increased steadily since the inception of the programs in 2013 and 2014 (Morris, KDFWR, personal communication 2019).

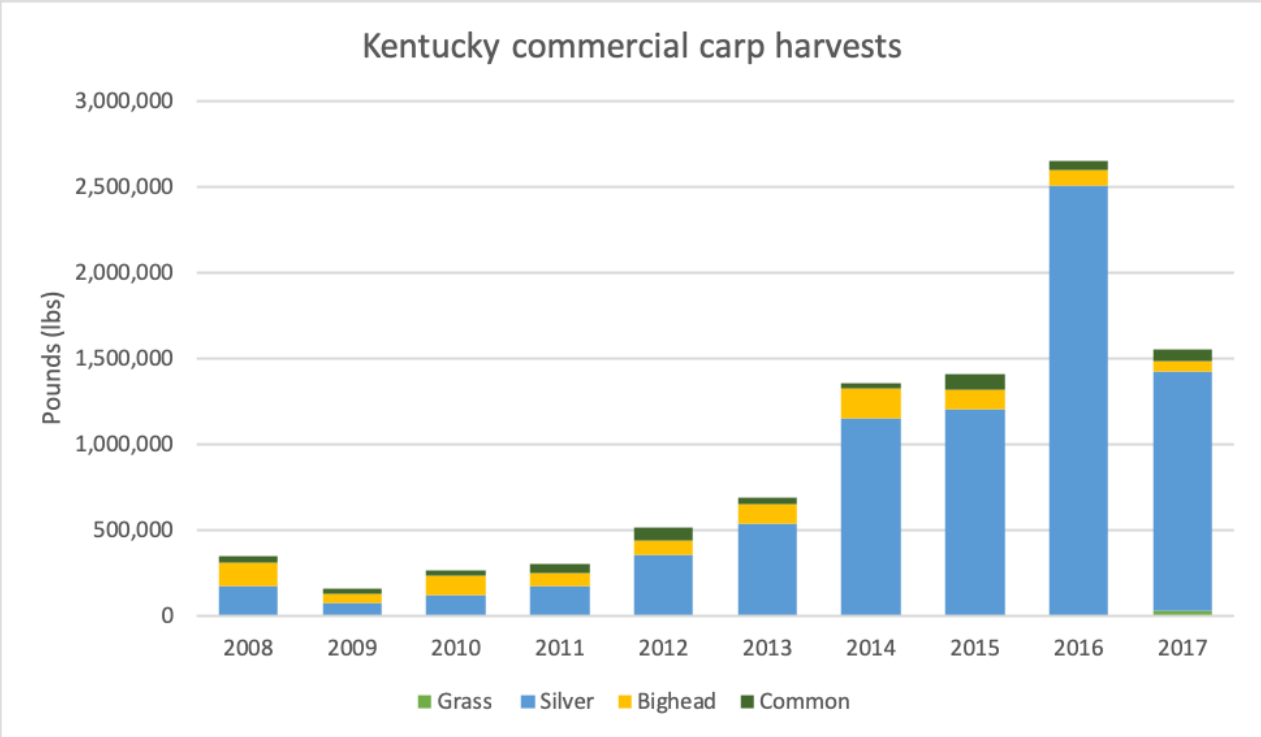


Figure 20 Kentucky commercial carp harvests 2008-2017 (KDFWR 2019).

TENNESSEE/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Standard target reference points (MSY, etc.) do not apply to this fishery because common carp and Asian carp are non-native, and Tennessee's harvest programs are designed to maximize harvests to minimize any adverse impacts to the ecosystem associated with carp invasions. Therefore, all common carp and Asian carp species reviewed in Tennessee receive a score of "low" concern for fishing mortality.

**Justification:**

Data on carp harvests prior to 2016 are unavailable due to limited reporting requirements in Tennessee in previous years. In 2018, approximately 105,852 lb of common carp, 990,000 lb of silver carp, 25,000 lb of bighead carp and 38,320 lb of grass carp were harvested. Fishery managers believe that these values are reflective of catch levels from the last 5 years (Ganus, TWRA, personal communication 2019). Due to the nature of Tennessee's waterways, gill nets are the primary gear used to target common carp and Asian carp species.

MISSOURI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

The Missouri commercial fisheries for common and Asian carp were relatively small-scale until 2015, and catches increased significantly in 2017 and 2018, with roughly 600,000 lb of bighead and silver carp (reported together due to morphological similarities), and much smaller amounts of common carp and grass carp (Figure A). Asian and common carp were caught primarily with seine and gill nets on the Mississippi River in Missouri in 2017 and primarily with gill nets for the remainder of the waterways. Asian and common carp are non-native, and Missouri's' commercial carp fisheries are designed to maximize harvests. Therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed receive a score of "low" concern for fishing mortality in Missouri.

**Justification:**

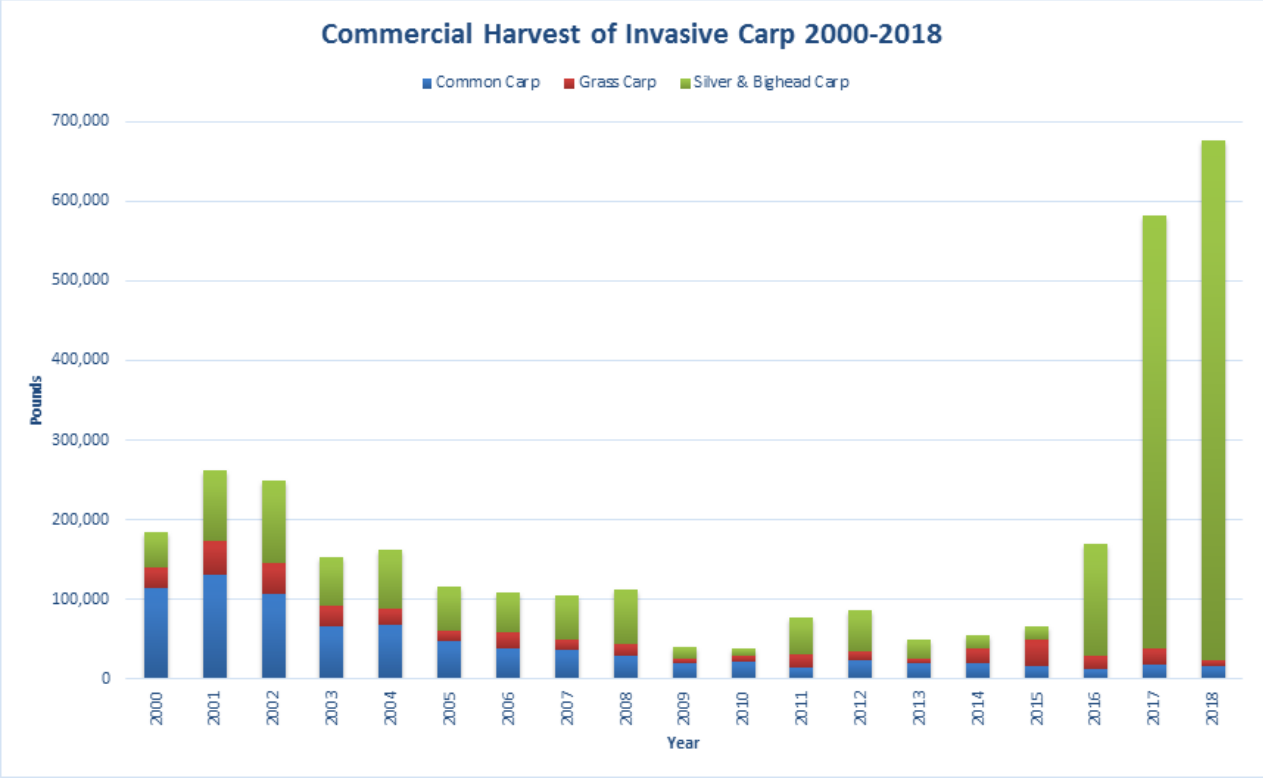


Figure 21 Missouri commercial carp harvests, 2000-2018 (MDC 2019).

ARKANSAS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Although there are commercial catches of Asian and common carp in Arkansas, landings are not tracked formally. Anecdotal information suggests that common and silver carp are the most commonly caught species, followed by bighead and grass (Moles, AGFC, personal communication 2019). Gill nets are the only gear permitted to target carp in Arkansas. Because Asian carp and common carp are non-native, all common carp and Asian carp species (silver, bighead, grass) reviewed in Arkansas receive a score of "low concern" for fishing mortality.

ILLINOIS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Total catches of Asian carp and common carp are relatively high in the state of Illinois, averaging over 6 million lb total from 2013 to 2017. Asian and common carp are non-native, and Illinois' carp harvest programs are designed to maximize harvests. Therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed in Illinois receive a score of "low" concern for fishing mortality.

**Justification:**

Due to identification challenges and similar morphology between species, bighead and silver landings are reported together in Illinois and averaged approximately 5 million lb from 2013 to 2017; both grass carp and common carp averaged roughly 775,000 lb during that same time and peaked at over 1 million lb in 2017. There are three primary gear types used in Illinois: gill/trammel comprised roughly 80% of carp catches in 2017 with hoop nets and seine nets at about 10% respectively (Figure A) (Maher 2017).

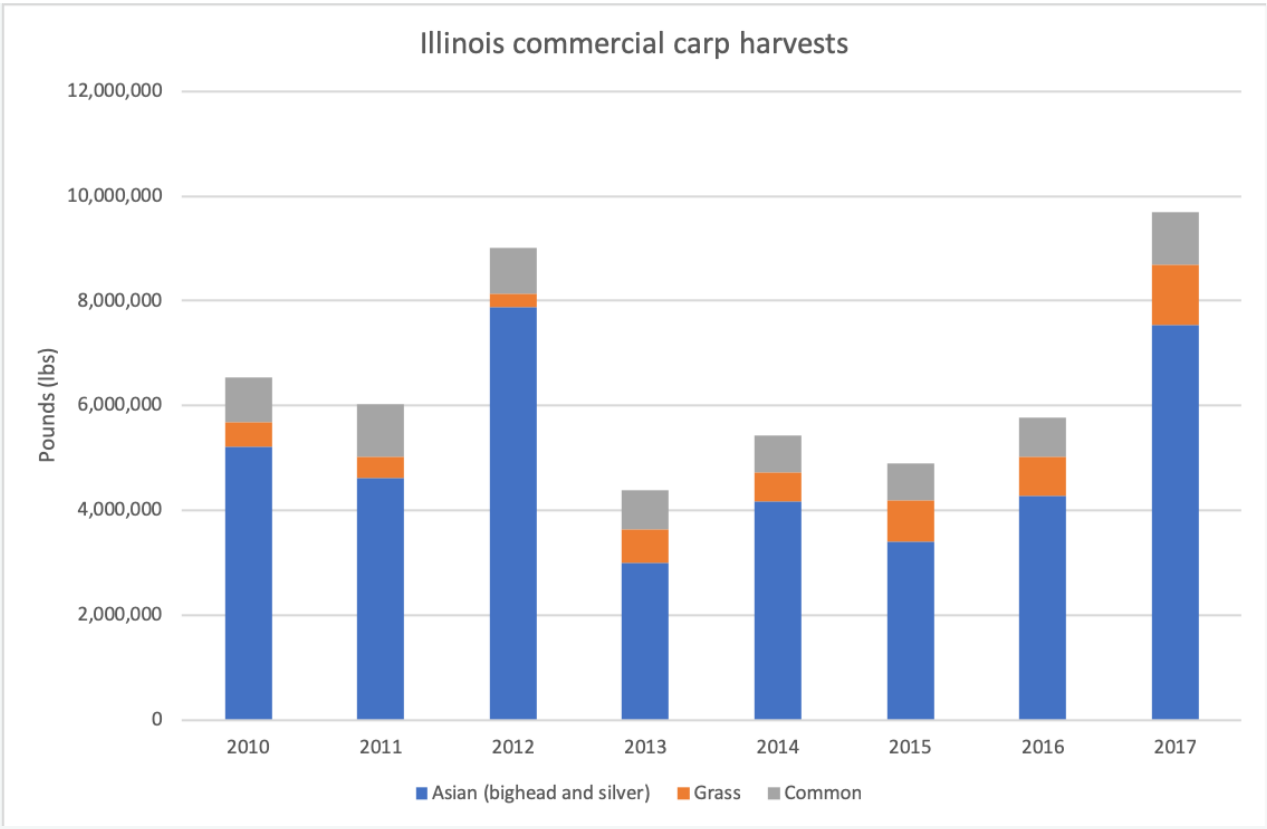


Figure 22 Illinois commercial carp landings 2010-2017 (Maher 2017).

INDIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Low Concern**

Harvest of Asian and common carp in Indiana are relatively low and occur in inland waters using hoop nets, and on the Ohio river using gill nets. Common carp and Asian carp (grass, bighead and silver) are non-native, and therefore receive a score of "low" concern for abundance in Indiana.

**Justification:**

Asian carp harvest (bighead and silver) predominate in Indiana on the Ohio river using gill nets (which peaked at 32,500 lb in 2015), whereas moderate common carp removals have been reported in inland waterways such as the Wabash and White riverways (typically well below 1000 lb). All Asian carp landings reported as one unit due to similar morphology (Figure A).

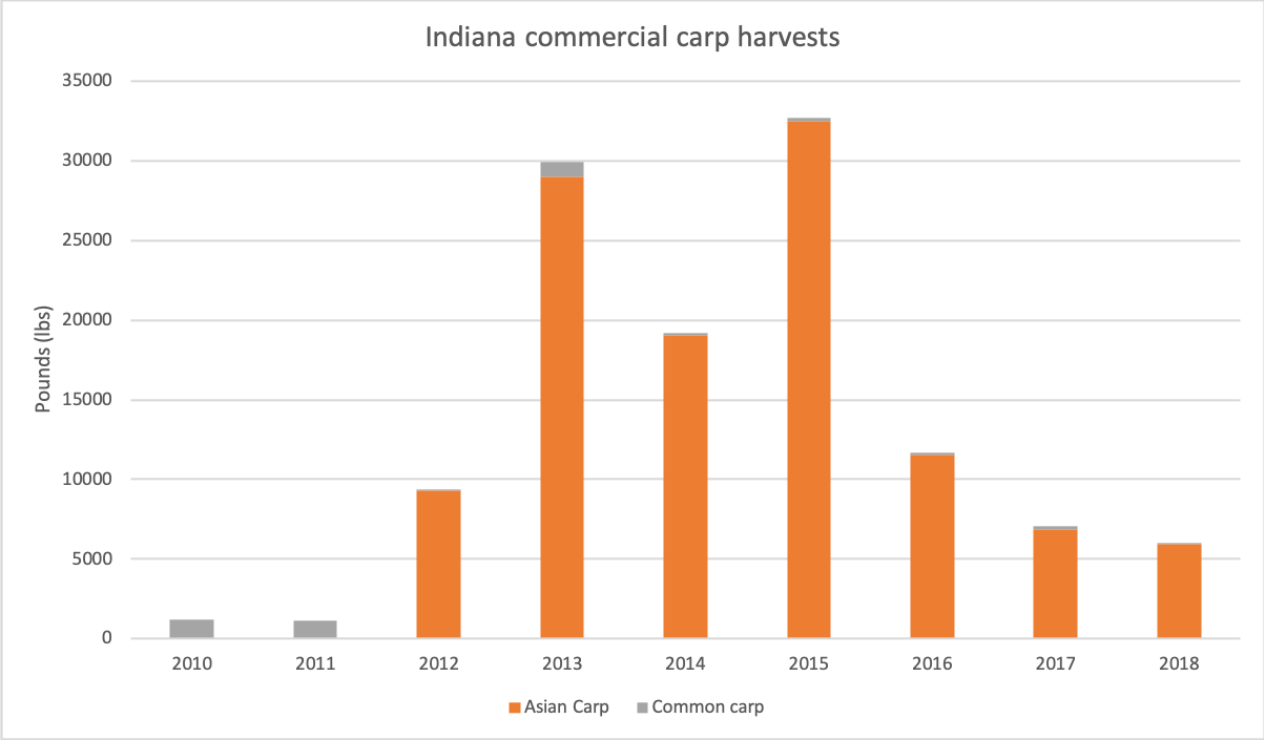


Figure 23 Indiana commercial carp harvests, 2010-2018.

LOUISIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

Asian and common carp are non-native and receive a score of "low" concern for fishing mortality in Louisiana.

**Justification:**

Harvests of Asian and common carp in Louisiana occur as bycatch-only fisheries; however, landings of Asian carp (especially bighead and silver) have been increasing since 2006. Bighead carp represent the largest proportion of overall landings in Louisiana and averaged 392,000 lb from 2014 to 2018, followed by silver carp, averaging 117,000 lb during the same period (Figure A). It's important to note that due to confidentiality reasons at least half of Asian and common carp landings are not reported in this review, so this should be considered an underestimate. Primary gear types used include hoop nets, seine, and gill nets (Reed, LDFW, personal communication 2019).

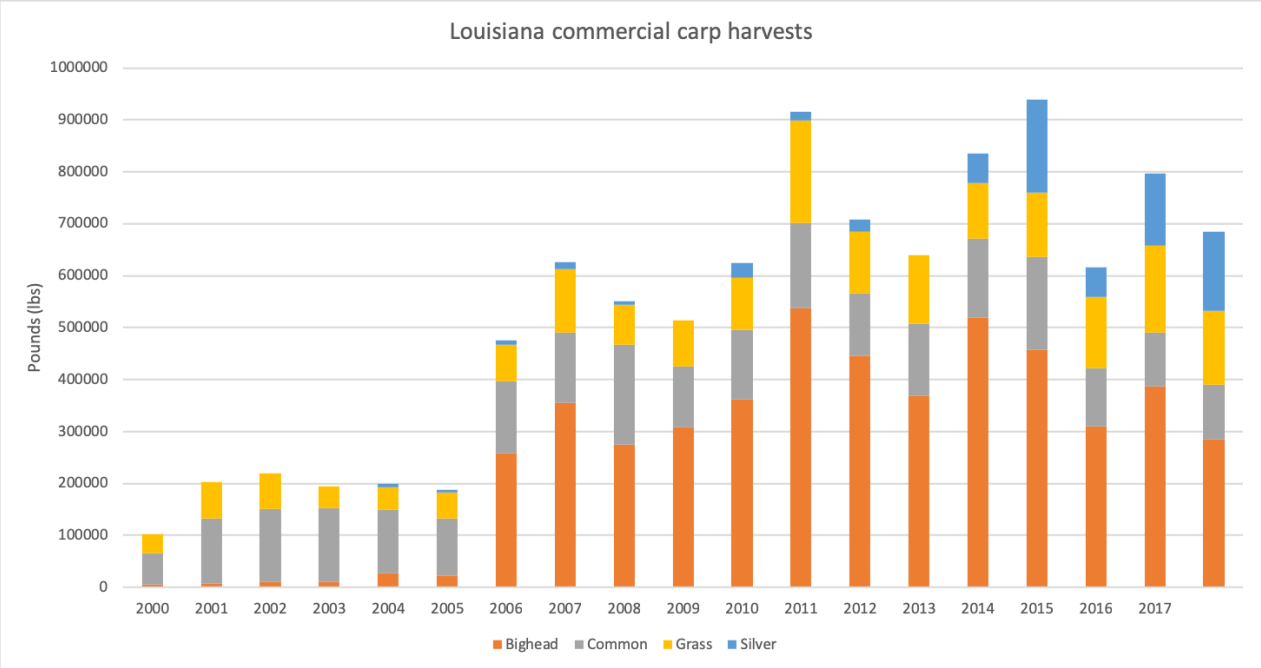


Figure 24 Louisiana commercial carp landings, 2000-2018.

IOWA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Asian and common carp are non-native; therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed in Iowa receive a score of "low" concern for fishing mortality.

**Justification:**

Common carp dominate carp harvests in the state of Iowa and averaged roughly 170,000 lb annually from 2014 to 2018 (Figure A). Although common carp harvests have declined moderately since the mid 1990s, Asian carp species harvests have increased moderately since 2009 (but still comprise a relatively small proportion of overall carp harvests). Annual averages from 2014 to 2018 are as follows: grass 17,215 lb, bighead 5,808 lb, silver 19,414 lb.

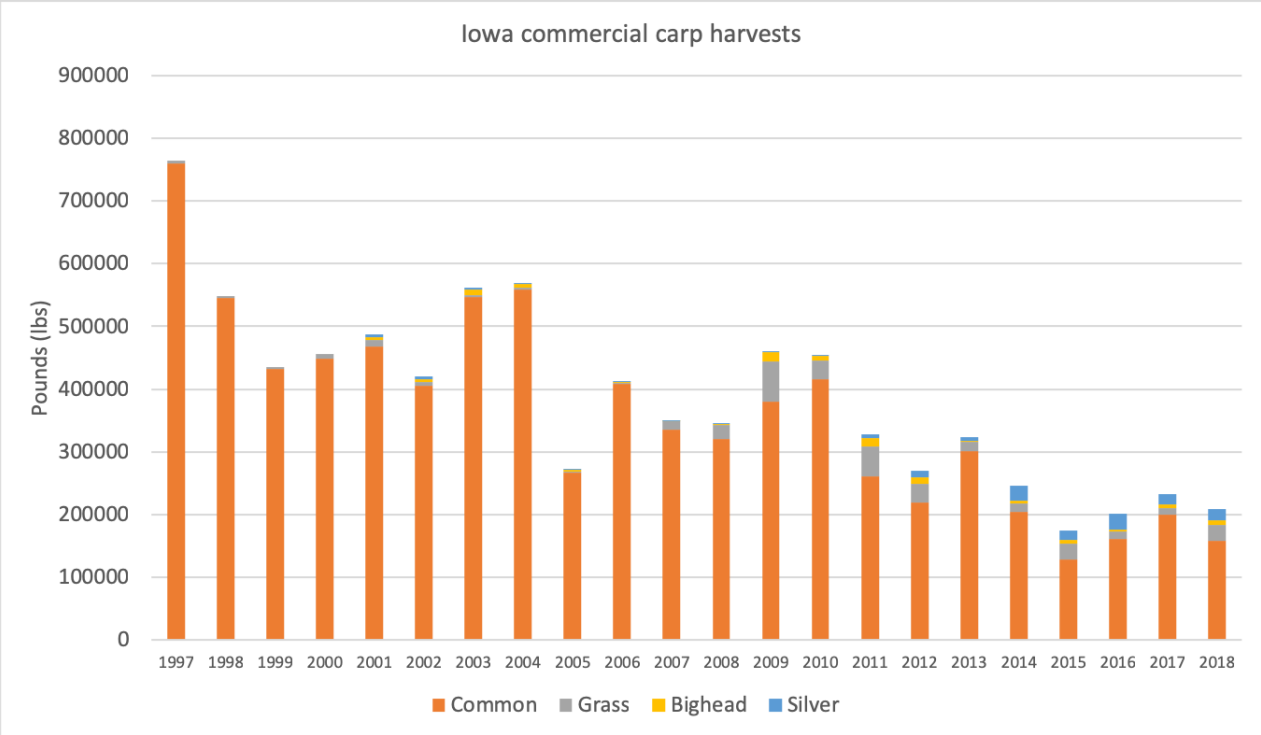


Figure 25 Iowa commercial carp harvests, 1987 - 2018 (IDNR 2019).

Multiple gear types are used in Iowa including buffalo or fyke nets, gill (including trammel) nets and seine nets. Common carp are primarily caught with gill and trammel nets (~61% of total Iowa common carp harvests) followed by seine gear. Asian carp (grass, silver, bighead) are primarily harvested with gill/trammel nets (~80% of total Asian carp harvest in Iowa) followed by buffalo/fyke nets (~8%) (Fowler, IDNR, personal communication 2019).

MISSISSIPPI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Low Concern**

Commercial landings from all waterways are not tracked formally for the state of Mississippi; however, processing information and partial-landings data are reviewed by state managers. Gill/trammel nets, followed by fyke nets, are the primary gear types used in Mississippi. In 2015 and 2016, approximately 377,000 and 980,000 lb, respectively, of Asian carp were processed (this represents a minimum estimate of landings) (Riecke, MDWFP, personal communication 2019). Silver carp dominates reported landings. Because Asian and common carp are non-native, all common carp and Asian carp species (silver, bighead, grass) reviewed in Mississippi receive a score of "low" concern for fishing mortality.

SILVER CARP

## Factor 1.1 - Abundance

KENTUCKY/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Very Low Concern**

The three Asian carp species (grass, bighead, silver) and common carp are non-native, and therefore receive a score of "very low" concern for abundance based on Seafood Watch Criteria.

**Justification:**

Common carp originated in Europe and Asia and were introduced in the United States during the mid 1830s. They were established in a number of regions by the 1870s. Common carp are now considered established in all mainland states across the United States. Over 100 years later in the 1960s and 1970s, the USFWS imported Asian carp (bighead, silver, grass) species from Southeast Asia to the southern United States, specifically Arkansas, to help aquaculture and wastewater treatment facilities keep retention ponds clean (Watershedcouncil.org 2019) (ACRCC 2019).

Intentional stocking of bighead and silver carp by state and federal agencies, followed by flooding events and/or accidental releases, facilitated Asian carp expansion into the Mississippi River system and migration into the Missouri and Illinois rivers from the 1980s to the present time. Asian carp species are at risk of spreading into the Great Lakes and other important waterways in the United States and Canada (Kelly et al. 2011). The migration of bighead and silver carp through the Illinois River via the Chicago Area Waterway System, Wabash River, Grand Calumet River, and possibly other pathways that connect the Mississippi River and Great Lakes basins is the most acute aquatic-invasive-species threat currently facing the region (ACRCC 2019).

Abundance estimates and stock assessments are limited for most carp species; however, one study from the Upper Mississippi River System in Illinois found that silver carp catches increased exponentially from 1998 to 2008, with an intrinsic rate of increase approaching 84% (Sass et al. 2010). Although this value may be high compared to other regions, commercial catches and regional surveys suggest Asian carp populations are increasing in most impacted areas.

IOWA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Very Low Concern**

Asian and common carp are non-native; therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed in Iowa receive a "very low concern" score for fishing mortality.

**Justification:**

Common carp dominate carp harvests in the state of Iowa and averaged roughly 170,000 lbs annually 2014-2018 (Figure A). While common carp harvests have declined moderately since the mid-1990s, Asian carp species harvests have increased moderately since 2009 (but still comprise a relatively small proportion of overall carp harvests). Annual averages 2014-2018 are as follows: grass 17,215 lbs, bighead 5,808 lbs, silver 19,414 lbs.

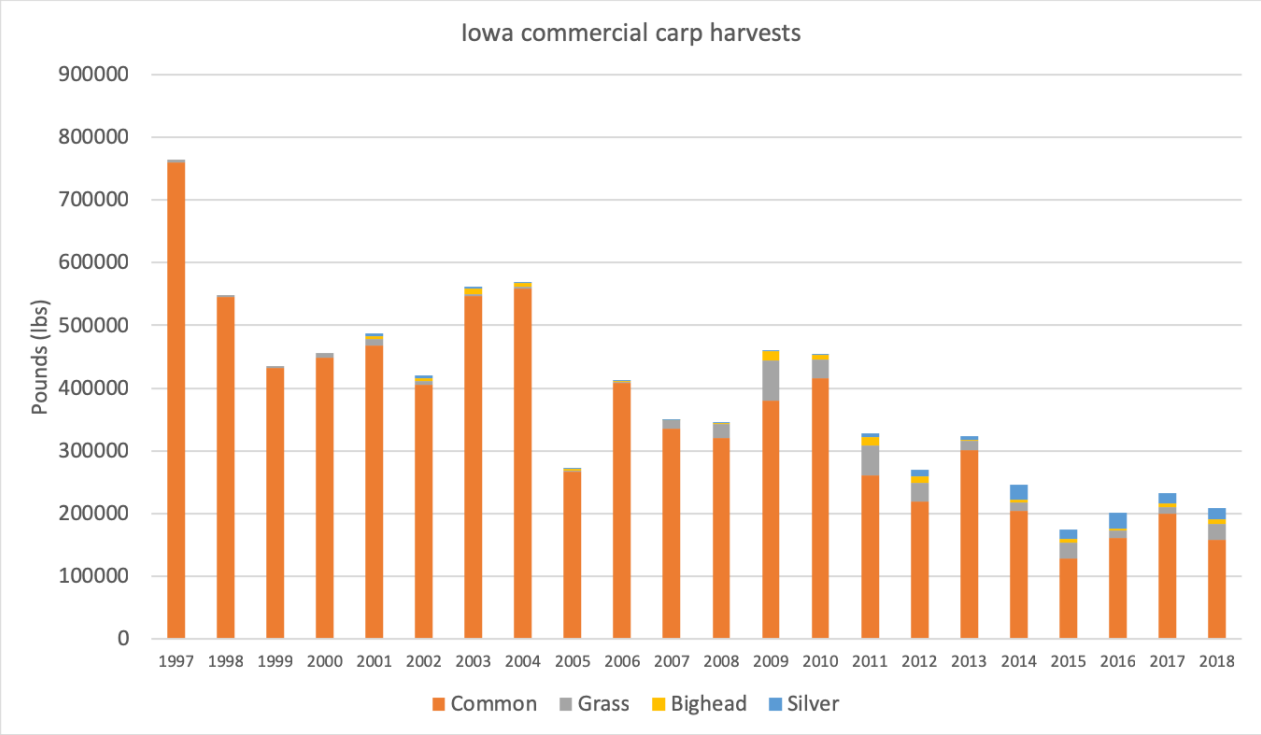


Figure 26 Iowa commercial carp harvests, 1987 - 2018 (IDNR 2019).

Multiple gear types are used in Iowa including buffalo nets, gill (including trammel) nets and seine nets. Common carp are primarily caught with gill and trammel nets (~61% of total Iowa common carp harvests) followed by seine gear. Asian carp (grass, silver, bighead) are primarily harvested with gill/trammel nets (~80% of total Asian carp harvest in Iowa) followed by buffalo/fyke nets (~8%).

## Factor 1.2 - Fishing Mortality

KENTUCKY/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Standard target reference points (MSY, etc.) do not apply to this fishery because Asian carp and common carp are non-native, and Kentucky's harvest programs are designed to maximize harvests and minimize any

adverse impacts to the ecosystem associated with Asian and common carp invasion. Therefore, all carp species reviewed in Kentucky receive a score of "low" concern for fishing mortality.

**Justification:**

Asian carp are caught with gill nets in Kentucky. Since 2013, silver carp have dominated overall carp landings in Kentucky, averaging 1.4 million lb from 2013 to 2017. Bighead landings averaged 110,000 lb, and common carp landings averaged 55,000 lb during the same time period. Commercial grass carp landings were first reported in 2017 at approximately 26,000 lb (Figure A).

Kentucky currently manages a comprehensive Asian carp tracking and harvest incentive program. A formal Asian Carp Control Strategy Framework and an Asian Carp Harvest Program were established in 2014 (KDFWR 2019). The Harvest Incentive Program supports Asian carp harvests in a number of ways including: opening access to more waters during longer seasons for commercial fishers, subsidizing fishers' revenue per pound of Asian carp landed, and providing free ice to carp fishers. Catches of Asian carp have increased steadily since the inception of the programs in 2013 and 2014 (Morris, KDFWR, personal communication 2019).

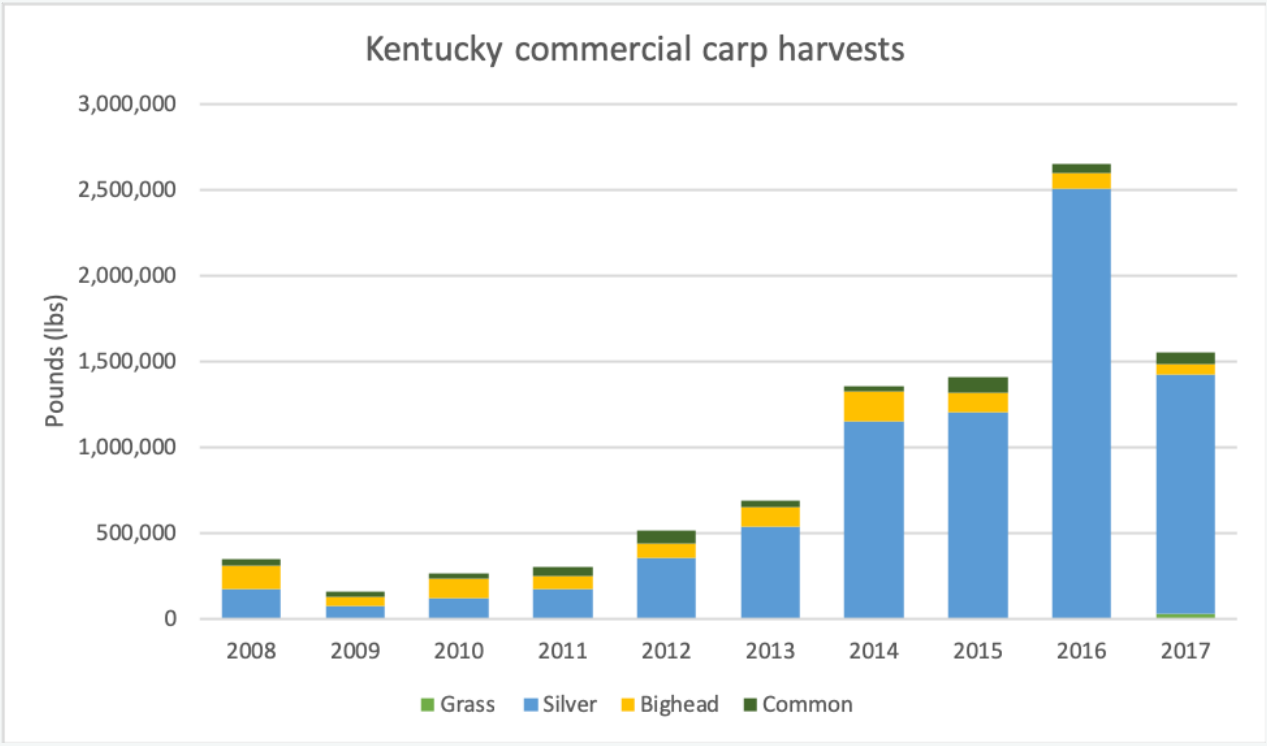


Figure 27 Kentucky commercial carp harvests 2008-2017 (KDFWR 2019).

TENNESSEE/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Standard target reference points (MSY, etc.) do not apply to this fishery because common carp and Asian carp are non-native, and Tennessee's harvest programs are designed to maximize harvests to minimize any adverse impacts to the ecosystem associated with carp invasions. Therefore, all common carp and Asian carp species reviewed in Tennessee receive a score of "low" concern for fishing mortality.

**Justification:**

Data on carp harvests prior to 2016 are unavailable due to limited reporting requirements in Tennessee in previous years. In 2018, approximately 105,852 lb of common carp, 990,000 lb of silver carp, 25,000 lb of bighead carp and 38,320 lb of grass carp were harvested. Fishery managers believe that these values are reflective of catch levels from the last 5 years (Ganus, TWRA, personal communication 2019). Due to the nature of Tennessee's waterways, gill nets are the primary gear used to target common carp and Asian carp species.

MISSOURI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

The Missouri commercial fisheries for common and Asian carp were relatively small-scale until 2015, and catches increased significantly in 2017 and 2018, with roughly 600,000 lb of bighead and silver carp (reported together due to morphological similarities), and much smaller amounts of common carp and grass carp (Figure A). Asian and common carp were caught primarily with seine and gill nets on the Mississippi River in Missouri in 2017 and primarily with gill nets for the remainder of the waterways. Asian and common carp are non-native, and Missouri's' commercial carp fisheries are designed to maximize harvests. Therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed receive a score of "low" concern for fishing mortality in Missouri.

**Justification:**

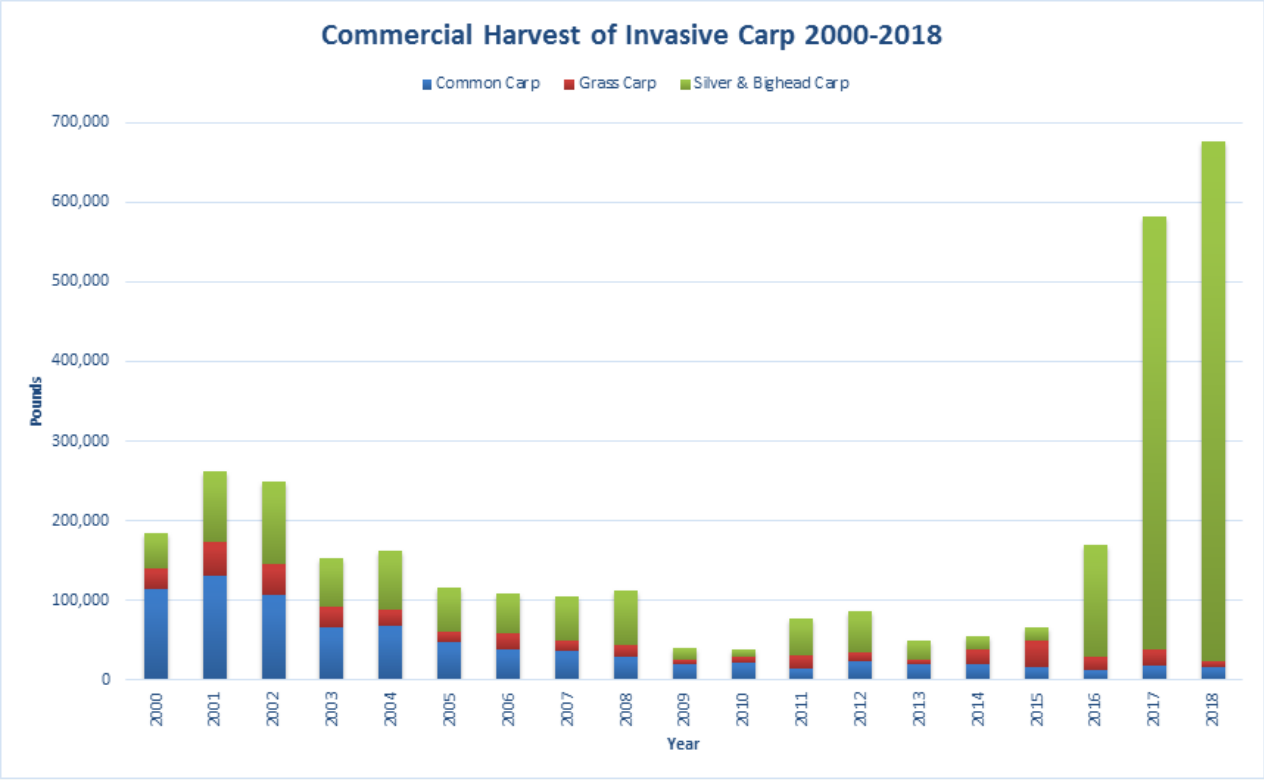


Figure 28 Missouri commercial carp harvests, 2000-2018 (MDC 2019).

ARKANSAS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Although there are commercial catches of Asian and common carp in Arkansas, landings are not tracked formally. Anecdotal information suggests that common and silver carp are the most commonly caught species, followed by bighead and grass (Moles, AGFC, personal communication 2019). Gill nets are the only gear permitted to target carp in Arkansas. Because Asian carp and common carp are non-native, all common carp and Asian carp species (silver, bighead, grass) reviewed in Arkansas receive a score of "low concern" for fishing mortality.

ILLINOIS/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

Total catches of Asian carp and common carp are relatively high in the state of Illinois, averaging over 6 million lb total from 2013 to 2017. Asian and common carp are non-native, and Illinois' carp harvest programs are designed to maximize harvests. Therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed in Illinois receive a score of "low" concern for fishing mortality.

**Justification:**

Due to identification challenges and similar morphology between species, bighead and silver landings are reported together in Illinois and averaged approximately 5 million lb from 2013 to 2017; both grass carp and common carp averaged roughly 775,000 lb during that same time and peaked at over 1 million lb in 2017. There are three primary gear types used in Illinois: gill/trammel comprised roughly 80% of carp catches in 2017 with hoop nets and seine nets at about 10% respectively (Figure A) (Maher 2017).

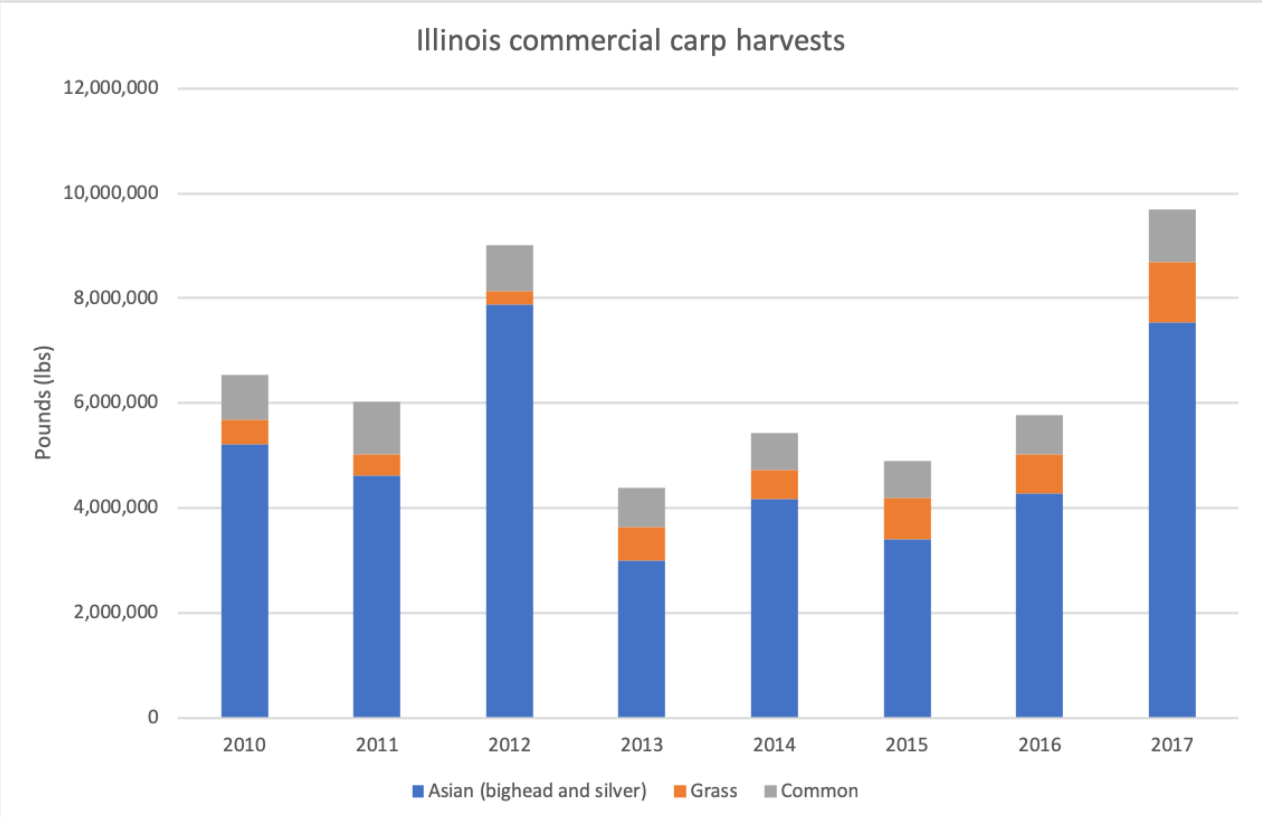


Figure 29 Illinois commercial carp landings 2010-2017 (Maher 2017).

INDIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Low Concern**

Harvest of Asian and common carp in Indiana are relatively low and occur in inland waters using hoop nets, and on the Ohio river using gill nets. Common carp and Asian carp (grass, bighead and silver) are non-native, and therefore receive a score of "low" concern for abundance in Indiana.

**Justification:**

Asian carp harvest (bighead and silver) predominate in Indiana on the Ohio river using gill nets (which peaked at 32,500 lb in 2015), whereas moderate common carp removals have been reported in inland waterways such as the Wabash and White riverways (typically well below 1000 lb). All Asian carp landings reported as one unit due to similar morphology (Figure A).

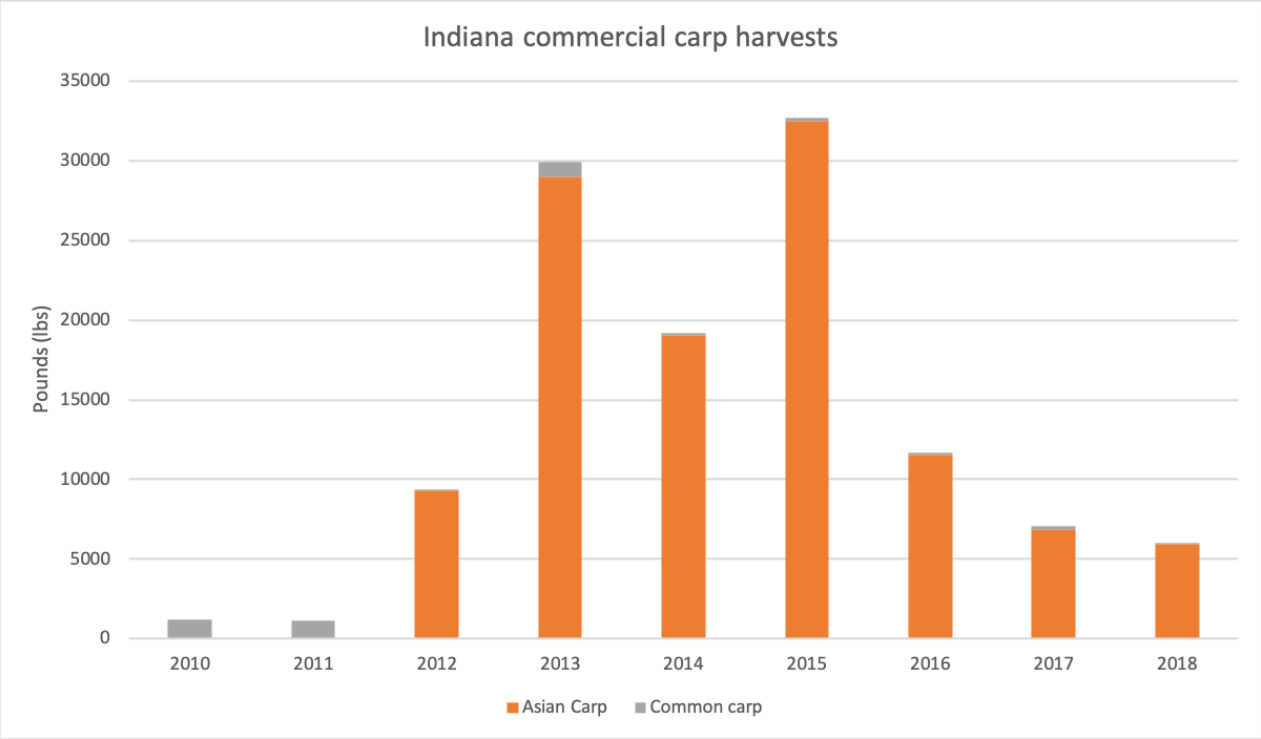


Figure 30 Indiana commercial carp harvests, 2010-2018.

LOUISIANA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Low Concern**

Asian and common carp are non-native and receive a score of "low" concern for fishing mortality in Louisiana.

**Justification:**

Harvests of Asian and common carp in Louisiana occur as bycatch-only fisheries; however, landings of Asian carp (especially bighead and silver) have been increasing since 2006. Bighead carp represent the largest proportion of overall landings in Louisiana and averaged 392,000 lb from 2014 to 2018, followed by silver

carp, averaging 117,000 lb during the same period (Figure A). It's important to note that due to confidentiality reasons at least half of Asian and common carp landings are not reported in this review, so this should be considered an underestimate. Primary gear types used include hoop nets, seine, and gill nets (Reed, LDFW, personal communication 2019).

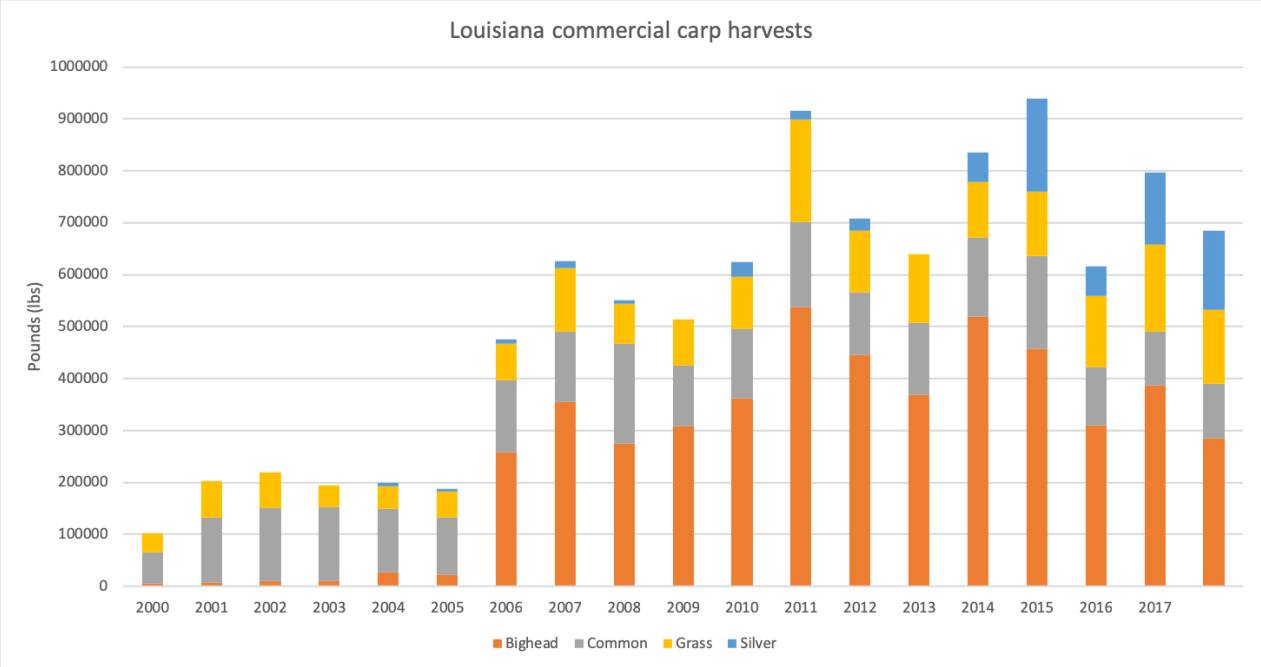


Figure 31 Louisiana commercial carp landings, 2000-2018.

IOWA/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Low Concern**

Asian and common carp are non-native; therefore, all common carp and Asian carp species (silver, bighead, grass) reviewed in Iowa receive a score of "low" concern for fishing mortality.

**Justification:**

Common carp dominate carp harvests in the state of Iowa and averaged roughly 170,000 lb annually from 2014 to 2018 (Figure A). Although common carp harvests have declined moderately since the mid 1990s, Asian carp species harvests have increased moderately since 2009 (but still comprise a relatively small proportion of overall carp harvests). Annual averages from 2014 to 2018 are as follows: grass 17,215 lb, bighead 5,808 lb, silver 19,414 lb.

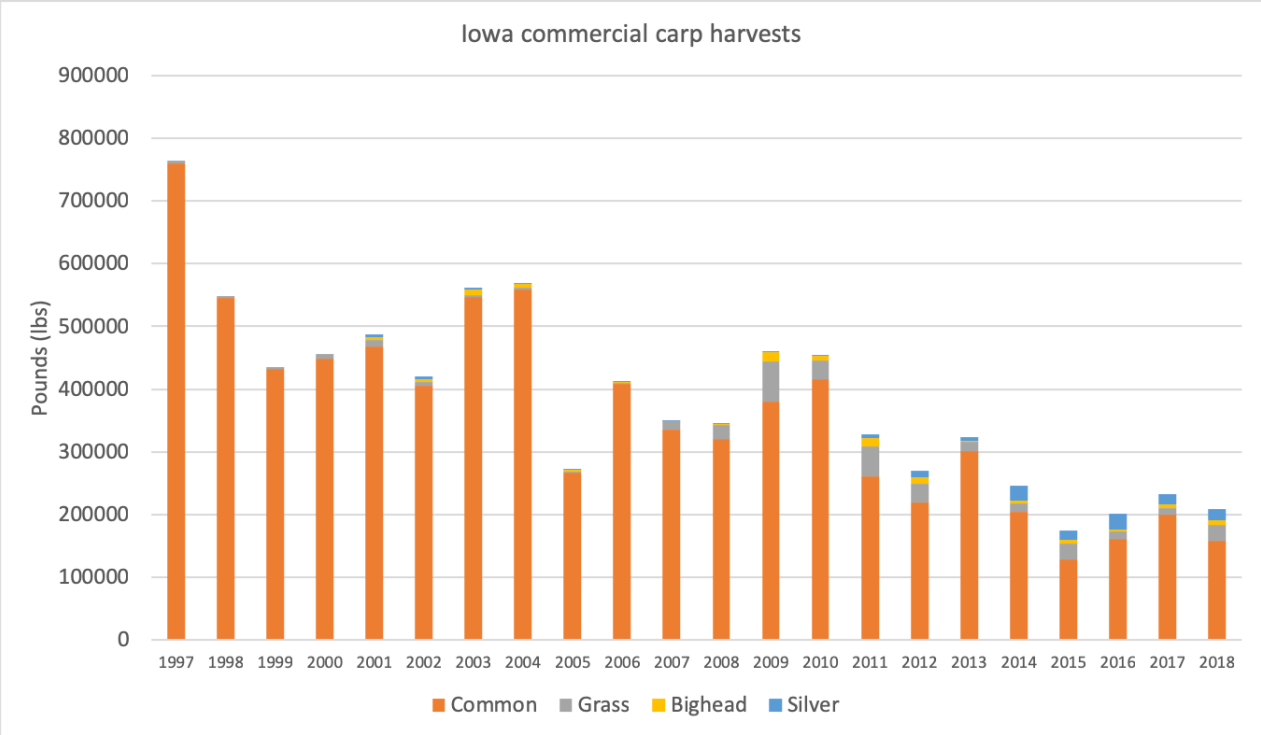


Figure 32 Iowa commercial carp harvests, 1987 - 2018 (IDNR 2019).

Multiple gear types are used in Iowa including buffalo or fyke nets, gill (including trammel) nets and seine nets. Common carp are primarily caught with gill and trammel nets (~61% of total Iowa common carp harvests) followed by seine gear. Asian carp (grass, silver, bighead) are primarily harvested with gill/trammel nets (~80% of total Asian carp harvest in Iowa) followed by buffalo/fyke nets (~8%) (Fowler, IDNR, personal communication 2019).

MISSISSIPPI/MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI/MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Low Concern**

Commercial landings from all waterways are not tracked formally for the state of Mississippi; however, processing information and partial-landings data are reviewed by state managers. Gill/trammel nets, followed by fyke nets, are the primary gear types used in Mississippi. In 2015 and 2016, approximately 377,000 and 980,000 lb, respectively, of Asian carp were processed (this represents a minimum estimate of landings) (Riecke, MDWFP, personal communication 2019). Silver carp dominates reported landings. Because Asian and common carp are non-native, all common carp and Asian carp species (silver, bighead, grass) reviewed in Mississippi receive a score of "low" concern for fishing mortality.

# Criterion 2: Impacts on Other Species

*All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:*

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤=3.2=Yellow or Moderate Concern*
- *Score ≤=2.2=Red or High Concern*

*Rating is Critical if Factor 2.3 (Fishing Mortality) is Crtitical*

### Guiding Principles

- *Ensure all affected stocks are healthy and abundant.*
- *Fish all affected stocks at sustainable level.*
- *Minimize bycatch.*

### Criterion 2 Summary

Only the lowest scoring main species is/are listed in the table and text in this Criterion 2 section; a full list and assessment of the main species can be found in Appendix A.

| BIGHEAD CARP - ARKANSAS/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | | **Fishing Mortality** | | **Subscore** |
| Sturgeons (unspecified) | 1.00:High Concern | | 3.00:Moderate Concern | | Red (1.732) |
| Finfish | 2.33:Moderate Concern | | 3.00:Moderate Concern | | Yellow (2.644) |
| Silver carp | 5.00:Very Low Concern | | 5.00:Low Concern | | Green (5.000) |
| Common carp | 5.00:Very Low Concern | | 5.00:Low Concern | | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | | 5.00:Low Concern | | Green (5.000) |

| BIGHEAD CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | | **Fishing Mortality** | | **Subscore** |
| Sturgeons (unspecified) | 1.00:High Concern | | 3.00:Moderate Concern | | Red (1.732) |

| | | | |
|---|---|---|---|
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

BIGHEAD CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

BIGHEAD CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

BIGHEAD CARP - INDIANA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| BIGHEAD CARP - INDIANA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| BIGHEAD CARP - IOWA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| BIGHEAD CARP - IOWA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| BIGHEAD CARP - IOWA/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

BIGHEAD CARP - KENTUCKY/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

BIGHEAD CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

BIGHEAD CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| BIGHEAD CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| BIGHEAD CARP - MISSISSIPPI/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| BIGHEAD CARP - MISSISSIPPI/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| BIGHEAD CARP - MISSOURI/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |

| | | | |
|---|---|---|---|
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

BIGHEAD CARP - MISSOURI/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

BIGHEAD CARP - TENNESSEE/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

COMMON CARP - ARKANSAS/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| COMMON CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| COMMON CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| COMMON CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| COMMON CARP - INDIANA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |

| | | | |
|---|---|---|---|
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| COMMON CARP - INDIANA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - IOWA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - IOWA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - IOWA/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - KENTUCKY/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |

| | | | |
|---|---|---|---|
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| COMMON CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - MISSISSIPPI/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - MISSISSIPPI/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - MISSOURI/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - MISSOURI/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| COMMON CARP - TENNESSEE/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| GRASS CARP - ARKANSAS/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |

| | | | |
|---|---|---|---|
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| GRASS CARP - INDIANA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| GRASS CARP - INDIANA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| GRASS CARP - IOWA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| GRASS CARP - IOWA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| GRASS CARP - IOWA/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| GRASS CARP - KENTUCKY/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| GRASS CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| GRASS CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - MISSISSIPPI/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - MISSISSIPPI/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - MISSOURI/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - MISSOURI/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

GRASS CARP - TENNESSEE/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Silver carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

SILVER CARP - ARKANSAS/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

SILVER CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

SILVER CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

SILVER CARP - ILLINOIS/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |

| | | | |
|---|---|---|---|
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| SILVER CARP - INDIANA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| SILVER CARP - INDIANA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| SILVER CARP - IOWA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| SILVER CARP - IOWA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| SILVER CARP - IOWA/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| SILVER CARP - KENTUCKY/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| SILVER CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| SILVER CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| SILVER CARP - LOUISIANA/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| SILVER CARP - MISSISSIPPI/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |
| **Species** | **Abundance** | **Fishing Mortality** | **Subscore** | | |
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) | | |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) | | |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) | | |

| SILVER CARP - MISSISSIPPI/MISSISSIPPI RIVER BASIN - FYKE NETS - UNITED STATES OF AMERICA | | | | | |
|---|---|---|---|---|---|
| **Subscore:** | **1.732** | **Discard Rate:** | **1.00** | **C2 Rate:** | **1.732** |

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

SILVER CARP - MISSOURI/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

SILVER CARP - MISSOURI/MISSISSIPPI RIVER BASIN - SEINE NETS (UNSPECIFIED) - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

SILVER CARP - TENNESSEE/MISSISSIPPI RIVER BASIN - COMBINED GILLNETS - TRAMMEL NETS - UNITED STATES OF AMERICA

| Subscore: | 1.732 | Discard Rate: | 1.00 | C2 Rate: | 1.732 |
|---|---|---|---|---|---|

| Species | Abundance | Fishing Mortality | Subscore |
|---|---|---|---|
| Sturgeons (unspecified) | 1.00:High Concern | 3.00:Moderate Concern | Red (1.732) |
| Finfish | 2.33:Moderate Concern | 3.00:Moderate Concern | Yellow (2.644) |
| Bighead carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |
| Common carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

| | | | |
|---|---|---|---|
| Grass carp | 5.00:Very Low Concern | 5.00:Low Concern | Green (5.000) |

Main species for Asian carp and common carp target fisheries were determined based on three fishery dependent and fishery independent data sources: Kentucky commercial fishery, Kentucky Asian Carp Harvest Program, and an Illinois harvest program. Main species were identified for relevant gear types if they comprised >5% of the catch by weight and/or number. This information was then corroborated by fishery managers from all states, who had the opportunity to add additional species that may have been more reflective of the bycatch composition in their region (McMullen, Maher, Kinney, Irons, Fowler, Moles, Jansen, Riecke, personal communication 2019). Therefore, all main species identified in this review are based on regional bycatch data and/or anecdotal reports from fishermen and local fishery managers.

Although bycatch rates of endangered pallid sturgeon and threatened lake sturgeon are reportedly low in targeted carp fisheries, these species were included due to their high vulnerability and conservation status. Sturgeons (spp.) and paddlefish limited the C2 score for all states and gear types due to their threatened conservation status and/or vulnerable life history traits.

### Criterion 2 Assessment

SCORING GUIDELINES

### Factor 2.1 - Abundance

*(same as Factor 1.1 above)*

### Factor 2.2 - Fishing Mortality

*(same as Factor 1.2 above)*

STURGEONS (UNSPECIFIED)

### Factor 2.1 - Abundance

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**High Concern**

The three sturgeon species that may interact with targeted Asian carp and common carp fisheries include pallid, lake, and shovelnose sturgeon. American paddlefish also have the potential to be bycatch in carp fisheries regionally. Pallid sturgeon are listed as "Endangered" under the federal Endangered Species Act, and lake sturgeon are listed as "Threatened" in all states reviewed. Due to the endangered and threatened status of a number of species in this group, sturgeon and paddlefish receive a score of "high" concern for abundance.

**Justification:**

American paddlefish move long distances through the Mississippi basin and historically through 26 state jurisdictions. A range-wide, coordinated management effort is not in place, but state-specific surveys have been conducted to track trends, and understanding of paddlefish migratory behavior has improved over time (Pracheil et al. 2012). State agency biologists completed questionnaires in 1983, 1994, and 2006 (Bettoli et al. 2009). In each of the surveys, the population status was qualitatively documented as extirpated, stable, increasing, decreasing, or unknown. In the most recent survey (2006), 16 biologists reported the status of the population in their states as stable, stable/increasing, or increasing, while three states reported the status as stable/decreasing or decreasing (Bettoli et al. 2009).

The shovelnose sturgeon is unique among sturgeons in that the species seems to be relatively stable within its historic habitat range despite facing the same threats that have severely depleted other sturgeon species. Smaller size and earlier maturation of shovelnose may account for greater resilience to habitat and fishing impacts (Phelps et al. 2016). Shovelnose sturgeon migrate throughout the Mississippi River and its tributaries, crossing multiple state jurisdictions. As with paddlefish, assessments of the population status in each of 26 states where shovelnose sturgeon were historically distributed were conducted using questionnaires in 1983, 1994, and 2006. Of those states, nine reported that the population was stable; in two states the population had increased, and in one it had decreased. Research by Phelps et al. (2016) suggests a stable stock status in

the upper Missouri and upper Mississippi Rivers. Concerns about how habitat fragmentation impacts stock status in the middle and lower Missouri River and middle and lower Mississippi River, and absence of data in some areas of the Ohio River (Indiana, Ohio, and Kentucky) are also listed as concerns (Phelps et al. 2016).

Pallid sturgeon populations have declined dramatically over the last century. The Upper Missouri River subpopulation continues to decline from the status described in the 2000 Biological Opinion. Predictive models indicate that the heritage wild adult pallid sturgeon in the Upper Missouri River likely will be extirpated by 2018. Pallid sturgeon in the Lower Missouri River and Middle Mississippi River also are in decline for a number of reasons. Lack of reproduction and recruitment are associated with a highly altered hydrogragh and are resulting in reduced spawning cues, habitat fragmentation and loss, and reduction in prey productivity (USFWS 2003). A recent mark recapture study (with no recaptures and very high uncertainty) found roughly 2.6 to 15 fish per river kilometer, with major variations between river segments (Friedenberg et al. 2018).

Lake sturgeon are widely distributed in North America, being found in three major drainages: the Mississippi River, the Great Lakes, and Hudson Bay. Although they occur in the greatest abundance in the large lakes and rivers of the Great Lakes region of the US and Canada, most of the lake sturgeon natural range in the US is in the Mississippi River Basin from the upper Mississippi River and its major tributaries to the southern border of Arkansas. Formerly abundant throughout much of this southern area, the lake sturgeon has been drastically reduced or eliminated throughout most of its southern range. Culling throughout the late 1800s followed by over-harvesting in the early 1900s caused this slow growing, long-lived species to decline in abundance (USFWS 2001).

## Factor 2.2 - Fishing Mortality

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderate Concern**

Harvests of endangered pallid sturgeon and threatened lake sturgeon are prohibited in all states; however,

fisheries do exist in most states for paddlefish and shovelnose sturgeon. Challenges associated with limited data and/potentially exceeded reference points for paddlefish and shovelnose sturgeon yield a rating of "moderate" concern for sturgeon and paddlefish fishing mortality in Asian and common carp fisheries.

**Justification:**

It's important to note that harvests of paddlefish and shovelnose sturgeon vary by state, and shovelnose harvests are prohibited in Tennessee and Louisiana. There are limited target reference points for shovelnose fishing mortality. Research suggests that shovelnose mortality was increasing and recruitment declining in the Mississippi River where harvests are occurring (Tripp et al. 2009) (Phelps et al. 2016). One primary conservation concern with the shovelnose fishery, however, is the bycatch of morphologically similar endangered pallid sturgeon. One study from Tennessee found that the incidental take of pallid sturgeon in a shovelnose fishery was roughly 2% of all sturgeon harvests. This information is generally not reported due to misidentification. The study also demonstrated the possible effects of gill net ghost fishing (which included an additional pallid sturgeon take) (Bettoli et al. 2009) (Kock and Quist 2010). While carp fisheries are not targeting sturgeon, it is possible that both pallid and shovelnose sturgeon can interact with the gear types, although true rates of bycatch are unknown.

Although data is limited, paddlefish distribution is likely to overlap with Asian carp fishery operations in some regions (Jansen, IDNR, personal communication 2019). Paddlefish are susceptible to overharvest, and a recent study found annual mortality rates in different portions of the Mississippi Basin ranged from 26 to 34%, with exploitation rates of roughly 15% (Hupfield et al. 2016). Research suggests that these exploitation rates may result in growth and recruitment overfishing and that fishing mortality rates exceeding F in some Mississippi basin systems depend on harvest rates and environmental conditions (Scholten and Bettoli 2005).

## Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

*Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.*

| RATIO OF BAIT + DISCARDS/LANDINGS | FACTOR 2.3 SCORE |
|---|---|
| <100% | 1 |
| >=100 | 0.75 |

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**< 100%**

There is a paucity of information on bycatch rates and discard mortality in inland fisheries along the Mississippi River basin (Raby et al. 2011). Although the proportion of discards to total landings is unknown in all states, a number of factors yield a <100% score: including the invasive nature of Asian carp species (both juveniles and adults must be retained and killed in all state commercial fisheries); Asian carp (especially silver carp) tend to school and fishers target these large schools using fish finders; and a few studies suggest varying levels of discard mortality rates among common bycatch species such as catfish and paddlefish.

**Justification:**

Fishery managers report that fishing methods for Asian carp species tend to rely on the use of fish finders to locate large schools. This method yields low bycatch relative to overall landings. Most states have gear tending requirements to limit bycatch mortality associated with long soak times. Additionally, non-target species are mandated to be returned to the water, and managers report they are typically in good condition, especially with commonly used fyke nets (Kinney, LDWF, personal communication 2019).

There are limited studies on discard mortality rates of common bycatch species; however, one study found relatively low discard mortality rates of blue catfish caught by hooks, suggesting a resilient physiology for the species group (Schmitt and Shoup 2013). Another tagging study estimated low discard mortality rates of sublegal paddlefish (4% post-release mortality rate) in gillnets, suggesting some degree of physiological resilience in this species. Survival of bycatch is often temperature-dependent in the Mississippi river basin, where cooler water is linked to lower discard mortality rates (Bettoli et al. 2009) (Schmitt and Shoup 2013).

# Criterion 3: Management Effectiveness

*Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective,' 'moderately effective,' 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:*

- *5 (Very Low Concern) — Meets the standards of 'highly effective' for all five factors considered.*
- *4 (Low Concern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.*
- *3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.*
- *2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'*
- *1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'*
- *0 (Critical) — Management Strategy and Implementation is 'critical'.*

The Criterion 3 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤3.2=Yellow or Moderate Concern*
- *Score ≤2.2 = Red or High Concern*

*Rating is Critical if Management Strategy and Implementation is Critical.*

GUIDING PRINCIPLE

- The fishery is managed to sustain the long-term productivity of all impacted species.

### Criterion 3 Summary

| Fishery | Management Strategy | Bycatch Strategy | Research and Monitoring | Enforcement | Stakeholder Inclusion | Score |
|---|---|---|---|---|---|---|
| Fishery 1: Arkansas / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly Effective | Yellow (3.000) |
| Fishery 2: Illinois / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |
| Fishery 3: Illinois / Mississippi River Basin \| Fyke nets \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Fishery 4: Illinois / Mississippi River Basin \| Seine nets (unspecified) \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |
| Fishery 5: Indiana / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |
| Fishery 6: Indiana / Mississippi River Basin \| Fyke nets \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |
| Fishery 7: Iowa / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Moderately Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Yellow (3.000) |
| Fishery 8: Iowa / Mississippi River Basin \| Fyke nets \| United States of America | Moderately Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Yellow (3.000) |
| Fishery 9: Iowa / Mississippi River Basin \| Seine nets (unspecified) \| United States of America | Moderately Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Yellow (3.000) |
| Fishery 10: Kentucky / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |
| Fishery 11: Louisiana / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |
| Fishery 12: Louisiana / Mississippi River Basin \| Fyke nets \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |
| Fishery 13: Louisiana / Mississippi River Basin \| Seine nets (unspecified) \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Fishery 14: Mississippi / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly Effective | Yellow (3.000) |
| Fishery 15: Mississippi / Mississippi River Basin \| Fyke nets \| United States of America | Moderately Effective | Moderately Effective | Moderately Effective | Moderately Effective | Highly Effective | Yellow (3.000) |
| Fishery 16: Missouri / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Moderately Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Yellow (3.000) |
| Fishery 17: Missouri / Mississippi River Basin \| Seine nets (unspecified) \| United States of America | Moderately Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Yellow (3.000) |
| Fishery 18: Tennessee / Mississippi River Basin \| Combined gillnets - trammel nets \| United States of America | Highly Effective | Moderately Effective | Moderately Effective | Highly Effective | Highly Effective | Green (4.000) |

## Criterion 3 Assessment

### Factor 3.1 - Management Strategy and Implementation

*Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do manages follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.*

ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Moderately Effective**

There are strategies to prevent the further spread of common and Asian carp, including prohibitions on transporting and stocking Asian carp. There are currently no processing incentive programs to reduce Asian and common carp biomass, and Arkansas receives a score of "moderately effective" for management.

**Justification:**

Asian carp species were stocked in Arkansas in the mid- to late-1970s to help aquaculture and wastewater treatment facilities keep retention ponds clean (Watershedcouncil.org 2019) (ACRCC 2019). Since that time,

both common and Asian carp have continued to spread throughout the Mississippi River basin. The Arkansas Game and Fish Commission (AGFC) currently prohibits any stocking or live fish transport of any Asian carp species in order to prevent the further spread of carp regionally. And in 2017, Arkansas opened up a special commercial fishing season on Lake Chicot to target Asian carp from 1 Nov. to 31 Dec. (AGFC 2019). Arkansas does not at this time have a processing incentive program in place to bolster or subsidize Asian and common carp harvests to reduce biomass.

Some mechanisms are in place to allow for the recovery for species potentially impacted by the carp invasion, such as the endangered pallid sturgeon. In 1993, the USFWS published the Pallid Sturgeon Recovery Plan, which established partnerships between federal, state, and local organizations formed to support pallid sturgeon recovery (pallidsturgeon.org 2019). The USFWS is now raising and stocking pallid sturgeon across the Basin (USFWS 2019b). Seasonal fishery timing restrictions are in place to minimize any adverse impacts of fishing or invasive species to another potentially impacted species, such as the buffalo fish species.

ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Illinois receives a score of "highly effective" for management strategy and implementation because management measures are in place to prevent further spread of invasive carp, to reduce biomass, and to minimize adverse impacts to other resident species.

**Justification:**

A number of strategies are in place to prevent the spread of Asian and common carp in the state of Illinois. Bighead and silver carp are listed as injurious in Illinois, and possession of them alive is prohibited. It is also illegal to stock any Asian or common carp species in the state of Illinois (Maher, IDNR, personal communication 2019). Additional measures are aimed at reducing carp biomass including a targeted fishing project in the upper Illinois River (2018 catches exceed 1.3 mllion lb), and the Middle Mississippi River (~180,000 lb) to reduce population levels.

Illinois also supports a number of harvest incentive programs, and a processing support program was established in 2017. As part of the Asian Carp Market Value Program (MVP), Illinois Department of Natural Resources offers grant funding for current Asian carp processors and product-makers to support development of new markets and sales opportunities for Asian carp products (IDNR 2018). Illinois also contracts directly with the commercial fishermen to support Asian carp harvests {Maher, IDNR, personal communication 2019). Harvest limitations and/or protections for species adversely impacted by Asian carp exist for a number of species including pallid and shovelnose sturgeon and buffalo fish species

INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Highly Effective**

Indiana receives a score of "highly effective" for management strategy and implementation because measures exist to prevent the spread and reduce biomass of Asian carp and common carp species; recovery programs are in place for threatened species.

**Justification:**

Stocking of Asian carp is prohibited in Indiana (with the exception of sterile triploid grass carp), as is transport

of live Asian carp within the state. Additionally, cast nets are prohibited within 300 years of dams to avoid transplant of Asian carp juvenile fish to new waterways (Jansen, IDNR, personal communication 2019). A permanent physical barrier was also established in Indiana in conjunction with the Army Corps of Engineers, to prevent inter-basin transfer of aquatic nuisance species, with specific emphasis on preventing Asian Carp movement to the Great Lakes (US Army Corps Engineers 2015).

IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Iowa prohibits stocking of Asian carp species in public waters and uses a number of a management measures to prevent further increases in Asian carp populations. However, Iowa still allows stocking of reproductively viable grass carp in private ponds, which poses some risk to public rivers; therefore, Iowa receives a score of "moderately effective" for management strategy and implementation.

**Justification:**

Although Iowa does not have an official harvest incentive program, it does allow commercial harvests of Asian carp and common carp on some lake waters (typically commercial harvests are not allowed on lakes) and Iowa periodically contracts commercial fishers to incentivize additional carp harvests. Also, Iowa has an educational program in place with seasonal staff hired to conduct surveys at boat ramps across the state during the summer. The goal of this program is to educate the public about aquatic invasive species and ways to prevent their movement  Ghost fishing is mitigated by commercial fishing regulations with gear tending and set check requirements (Fowler, IDNR, personal communication 2019).

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Highly Effective**

Kentucky receives a score of "highly effective" for management strategy and implementation due to stocking prohibitions to reduce the further spread of Asian carp species and some measures to support the recovery of threatened species that may be impacted by Asian and common carp.

**Justification:**

Kentucky has banned stocking of all Asian carp species, except for triploid grass carp (which cannot reproduce). It is also illegal to transport Asian carp alive in order to prevent accidental release into other waterways (Morris, KDFWR, personal communication 2019).

The Kentucky Department of Fish and Wildlife Resources (KDFWR) is currently partnering with the USFWS and several other entities to test an Asian carp deterrent system called a Bio-Acoustic Fish Fence, at Lake Barkley Lock. This system will be tested for 3 years, and if effective at deterring Asian carp from moving through the lock chamber, this technology may be implemented at additional locks in Kentucky's river systems. KDFWR has also coordinated with neighboring states and other agencies to create a strategic plan for deployment of Asian carp barrier systems in the Tennessee, Cumberland, and Ohio Rivers once funding is available (Morris, KDFWR, personal communication 2019).

Similar to many other states, Kentucky supports a recovery program for threatened Lake Sturgeon. In 2007, KDFWR initiated a long-term project to restore a self-sustaining population of Lake Sturgeon to the upper Cumberland River drainage, where the species once occurred. Also, the KDFWR enacted a regulation (301

KAR 1:201) that makes it illegal to keep (possess) any Lake Sturgeon caught while fishing (KDFWR 2019).

Kentucky also supports a large-scale Asian Carp Harvest Program, which involves linking directly with processors and commercial fishers in Kentucky. "The goal is to bring in 5 million pounds of Asian carp this year, 8 million pounds in 2020, 10 million pounds in 2021, 15 million pounds in 2022, and 20 million pounds each in 2023 and 2024" (Yu 2019).

LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Louisiana receives a score of "highly effective" for management strategy and implementation due to regulations in place to prevent the spread of Asian carp species, and recovery programs in place to support vulnerable species impacted by non-native species.

**Justification:**

Louisiana state law mandates that "exotic species of Asian carp" (silver, bighead, black, and grass) taken from state waters must not be returned to the water and may not be possessed alive." Also, the Louisiana Watershed Initiative, established in 2016, recently identified mitigation of invasive species as an important item in their framework (Kinney, LDWF, personal communication 2019). Louisiana is involved in the USFWS aquatic invasive species program, Hazard Analysis and Critical Control Point (HACCP), to identify pathways for invasive spread and improve pathway management to reduce invasive spread (USFWS 2019). In order to support sturgeon recovery regionally, no targeted fisheries for sturgeon are allowed in Louisiana.

MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Mississippi permits commercial harvests of Asian and common carp to prevent increases in stock size. And in 2018, a private entity established a program in Moon Lake to subsidize commercial fishers targeting Asian carp in the area (Riecke, MDWFP, personal communication 2019). Stocking of Asian and common carp is not permitted in public Mississippi waterways and lakes without a MDWFP permit (state managers confirm permits are no longer issued); however, grass carp stocking is still permitted in private ponds (Pugh, MDWFP, personal communication 2019) (Miss. University 2016). Because there are risks of grass carp spread associated with private pond stocking, Mississippi receives a score of "moderately effective" for management strategy and implementation.

MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Some management measures are in place in Missouri to prevent increases in Asian and common carp stock size; however, the Missouri Department of Conservation (MDC) does not prohibit the stocking of grass carp or common carp in private ponds, and Missouri receives a score of "moderately effective" for management strategy and implementation.

TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Highly Effective**

Tennessee receives a score of "highly effective" for management of invasive Asian carp and common carp species. Management measures are in place to prevent further spread of invasive carp, reduce biomass, and minimize adverse impacts to other resident species.

**Justification:**

A number of strategies are in place to prevent the spread of Asian and common carp in the state of Tennessee. Transporting live fish is prohibited for Asian carp, and stocking Asian carp is prohibited (with the exception of sterile/triploid grass carp; TN Rule 1660-1-26). Stocking and transport of common carp by licensed dealers is not prohibited at this time. Tennessee also works to rebuild species that could be negatively impacted by Asian and common carp invasions, such as the threatened lake sturgeon. A Recovery Plan is in place to conserve habitat and restock lake sturgeon in the Tennessee River area (USFWS 2019b).

A Harvest Incentive Program (ACHIP) is in place in Tennessee, funded by state government subsidies, which allow wholesale fish dealers to buy carp at higher values per pound (TWRA 2019).

Tennessee supports an ongoing research project in conjunction with the The Nashville District of the U.S. Army Corps of Engineers, USGS, University of Minnesota, Fish Guidance Systems and the Kentucky Department of Fish and Wildlife Resources to construct and test an acoustic bubbler system or Bio-Acoustic Fish Fence (BAFF) below the Barkley dam, beginning in the fall of 2018 (The Lake News 2018).

## Factor 3.2 - Bycatch Strategy

*Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.*

ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Asian carp and common carp gill net fisheries are not highly selective. Some management measures are in place (e.g., seasonal timing restrictions to minimize interactions with paddlefish); however, the efficacy of these measures are unknown (Moles, AGFC, personal communication 2019). There are limited data on commercial carp landings, bycatch, or ghost fishing, and Arkansas receives a score of "moderately effective" for bycatch strategy.

ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Seine, gill net, and hoop net fishing gear are not highly selective gear, and though bycatch rates state-wide are unknown, the carp fisheries can impact species of concern, such as sturgeon. Illinois uses bycatch reduction techniques; however, the efficacy of these measures in many cases is unknown due to limited data.

Ghost fishing is mitigated by regulations mandating gear be tended at all times to minimize gear loss. Therefore, Illinois receives a score of "moderately effective" for bycatch strategy.

**Justification:**

Seine and gill net gear is not highly selective; however, fisher testimony and some research suggests that bycatch rates in Illinois across all gear types targeting carp are relatively low (Maher, IDNR, personal communication 2019). Data on bycatch in targeted carp fisheries are limited.

Fishers are required in legislation to release all non-targeted species immediately to the water, and mortality is presumed to be fairly low (Maher, IDNR, personal communication 2019). However, the efficacy of these measures is unknown due to limited abundance and mortality data for a number of species. Pallid and lake sturgeon are prohibited from harvest by both commercial and recreational fishers, and they must be released immediately if caught. Commercial fishers are required to be in attendance of their entanglement gear seasonally, which may reduce the mortality of bycatch and the likelihood of ghost fishing.

INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderately Effective**

The main gear types used in Indiana are not highly selective, and the efficacy of bycatch reduction techniques are unknown. There are attempts to minimize ghost fishing through gear-tending requirements; however, there are no requirements to report lost gear. Therefore, Indiana receives a score of "moderately effective" for bycatch strategy.

**Justification:**

Indiana limits the use of gill and seine nets to the Ohio river (not permitted in inland waters), while hoop nets/fyke nets are used primarily in inland waters (Jansen, IDNR, personal communication 2019). Gear tending requirements are intended to limit lost gear and the effects of ghost fishing, including the requirement to run gill nets every 24 hours and hoop nets every 48 hours. All gear must be labeled with identification tags.

IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Gill nets, fyke nets, and seine gear are not highly selective, and the efficacy of measures to reduce bycatch and mitigate ghost fishing are unknown; therefore, Iowa receives a score of "moderately effective" for bycatch strategy.

**Justification:**

Pallid sturgeon are typically not found as far north as Iowa, and lake sturgeon are rare, so they are unlikely to interact with carp fishing activities (Fowler, IDNR, personal communication 2019). There are not legal gear restrictions in place; however, fishers will self-select mesh size and seasons that minimize catch of non-target species (Fowler, IDNR, personal communication 2019). Bycatch data are not required to be included on submitted commercial fisheries landings reports.

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Kentucky receives a score of "moderately effective" for bycatch strategy because, although gear regulations do minimize the potential for bycatch in the common and Asian carp fisheries, the efficacy of these measures is generally unknown at this time.

**Justification:**

Kentucky requires commercial fishers using gill nets to use mesh that is 3” bar mesh or larger in order to limit bycatch of most sport fish species. All bycatch not being harvested are to be returned to the water immediately after being freed from the nets. KDFWR requires commercial fishers to tend floating gill nets at all times. Fishers are also required to tend sinking gill nets (which must be at least 3 feet under the surface) every 6 hours in the summer and every 8 hours in the winter. Any gear that is lost must be reported immediately to KDFWR (Morris, KDFWR, personal communication 2019).

LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Louisiana regulations require that gill net fishers remain in the area of their gear, and all non-target species are required to be released (Kinney, LDWF, personal communication 2019). Each year, Louisiana runs a ghost fishing gear round-up to remove lost fishing gear (primarily traps) from waterways (LDWF 2019). Louisiana receives a score of "moderately effective" for bycatch strategy because, while there are some gear tending requirements (with unknown efficacy) in place to minimize bycatch, there are no lost gear reporting requirements.

MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Asian carp and common carp gill and fyke net fisheries are not highly selective. Some management measures are in place, such as commercial fishery restrictions prohibiting sport fish and sturgeon retention (Riecke, MDWFP, personal communication 2019). There are limited data on bycatch or ghost fishing, and Mississippi receives a score of "moderately effective" for bycatch strategy.

MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Gill nets and seine nets used to target Asian and common carp in Missouri are not highly selective, and bycatch data are unavailable. In order to mitigate gear loss and bycatch mortality, the Wildlife Code of Missouri requires that gill nets be attended at all times (MDC 2019). The efficacy of this measure at reducing bycatch is unknown, however, and Missouri receives a score of "moderately effective" for bycatch strategy.

TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Tennessee primarily takes Asian and common carp with gill net gear, which is not highly selective. State statute requires that non-target species be returned to the water, and the number of permits issued to sensitive target species, such as paddlefish is restricted to limit effort (TN Rule 1660-01-30) (TWRA 2017). However, the efficacy of these bycatch reduction techniques is unknown due to limited data, and Tennessee receives a score of "moderately effective" for bycatch management.

**Justification:**

Bycatch data are limited for Asian and common carp target fisheries. Fishery managers report that bycatch rates are likely low due to the nature of the fishery (gill nets set higher in the water column avoid more benthic species like sturgeon and catfish, and gear is set on schools of silver carp as identified with fish finders (Ganus, TWRA, personal communication 2019). Tennessee commercial fishers are allowed to leave their gill nets unattended overnight. The impacts of ghost fishing are unknown in Tennessee, and there are no gear reporting requirements. Managers report it is unlikely that lost gill nets in the Tennessee waterways would continue to fish effectively as ghost gear due to water movement (Ganus, TWRA, personal communication 2019).

## Factor 3.3 - Scientific Research and Monitoring

*Considerations: How much and what types of data are collected to evaluate the fishery's impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.*

ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Arkansas does not currently track commercial landings or associated bycatch in Asian or common carp fisheries. However, legislation may be proposed that would require tracking of commercial landings in the future, and the AGFC just completed a comprehensive commercial fisher survey to assess the scope of the carp fishery (Moles, AGFC, personal communication 2019). While there is insufficient monitoring at this stage, Arkansas receives a score of "moderately effective" for scientific research and monitoring in light of work ongoing to improve catch accounting in the state.

ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Some data related to Asian and common carp stock abundance are collected in Illinois, and management in Illinois relies on an appropriate strategy for carp invasive species. Therefore, Illinois receives a score of "moderately effective" for scientific research and monitoring.

**Justification:**

A mark-recapture study was conducted in the La Grange Reach of the Illinois River, and data indicated an

exponential increase in silver carp catches since 1998, with an intrinsic rate of increase approaching 84%, suggesting this area may have some of the highest densities of wild silver carp in the world (Sass et al. 2010). Additional monitoring of Asian carp and common carp are conducted via reported fishery landings data.

INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Although Indiana does not have an explicit stock assessment program for Asian and common carp, landings data and regional sampling are used to track the distribution of the invasive species. Additionally, Indiana is collaborating with neighbor state, Kentucky, to develop a CPUE based relative abundance of some carp species on the Ohio in the future (Jansen, IDNR, personal communication 2019). Management relies on an appropriate strategy to track the spread and removals of invasive Asian carp and common carp in Indiana and receives a score of "moderately effective" for scientific research and monitoring.

IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

A recent study in Iowa explored Asian carp relative abundance, size structure, and condition along the Des Moines River in southeastern Iowa, and the role of climatic variability in inducing fluctuations in silver carp recruitment in the Missouri, Des Moines, Mississippi, Illinois, and Wabash rivers. Silver carp dominated landings and constituted roughly 60% of fish captured in trammel nets, and CPUEs were highest in late-spring and mid-fall (Sullivan 2016). Commercial landings data is tracked and also provides insight into carp abundance and distribution. In summary, Iowa collects some data on carp abundance and health and receives a score of "moderately effective" for scientific research and monitoring.

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Fisheries-dependent and fisheries-independent data sources provide information regarding Asian and common carp stock abundance in Kentucky. Management in Kentucky relies on an appropriate strategy with sufficient monitoring; therefore, Kentucky receives a score of "moderately effective" for scientific research and monitoring.

**Justification:**

Kentucky conducts a number of research and monitoring projects for Asian and common carp in western and central Kentucky management areas. Example projects include: monitoring sport-fish bycatch in the Asian Carp Harvest Program through review of commercial fishing harvest reports and ride**l**alongs with commercial fishermen, regional silver carp demographic and movement studies, and new gear development studies (KDFWR 2018). Although lost fishing gear information is tracked in Kentucky, there are limited data on ghost fishing related to target and non-target species. Commercial fishers targeting Asian carp species for harvest are required to submit daily harvest reports to KDFWR. These reports include bycatch species, and condition upon release (alive or moribund). This information is compiled in the ACHP annual project report mentioned above (Morris, KDFWR, personal communication 2019).

LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Stock assessments for Asian and common carp do not exist regionally; however, Louisiana relies on commercial landings information as one data-limited assessment method. Additionally, Louisiana fisheries managers have conducted larval fish tows to look at larval carp occurrence in some state waterways. Specifically, Asian carp were assessed in the Atchafalaya, Mississippi, Ouachita, and Red rivers, and larval carp comprised 14% of all larval fishes captured (Kinney, LDWF, personal communication 2019) (LDWF 2017). In light of the management objective (to reduce Asian carp biomass), Louisiana relies on an appropriate and limited monitoring strategy and receives a score of "moderately effective" for scientific research and monitoring.

MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Mississippi informally tracks commercial landings, primarily using production data, and does not currently track associated bycatch in targeted Asian or common carp fisheries (Riecke, MDWFP, personal communication 2019). Because some landings data are tracked, and the strategy is appropriate for the invasive carp species reviewed, Mississippi receives a score of "moderately effective" for scientific research and monitoring of Asian and common carp.

MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Moderately Effective**

Data are not collected on Asian and common carp abundance regionally; however, the state relies on commercial landings as one data-limited assessment method (McMullon, MDC, personal communication 2019). In light of the management objective (to reduce common and Asian carp biomass), Missouri uses an appropriate, limited monitoring strategy and receives a score of "moderately effective."

TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Regional abundance estimates of common and Asian carp have not been conducted in Tennessee, and commercial landings data before 2016 are uncertain (Ganus, TWRA, personal communication 2019). Improvements in management and monitoring from 2017 to the current time, in addition to a scheduled 2019 bycatch assessment for the fishery, yield a score of "moderately effective" for Tennessee scientific research and monitoring.

## Factor 3.4 - Enforcement of Management Regulations

*Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.*

ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Fishing licenses are requisite to commercially fish in Arkansas; however, commercial anglers are not required to report landings currently, and the effectiveness of enforcement measures is unknown. Arkansas, therefore, receives a score of "moderately effective" for enforcement of management regulations.

ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Permits are required to commercially fish in the state of Illinois, and commercial harvesters are required to report their catch annually as determined by the Illinois statute governing commercial fishing. Illinois fishery managers will not issue a license for the current year until a report from the previous year has been submitted. Additionally, the state of Illinois has the authority to audit the records of wholesale aquatic life dealers to verify the accuracy of reports submitted by commercial fishermen (Maher, IDNR, personal communication 2019). Appropriate permitting and reporting requirements accompanied by the capacity to ensure compliance yield a score of "highly effective" for Illinois in enforcement of management regulations.

INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Highly Effective**

Asian carp commercial fishing licenses are subject to gear restrictions. Each month, fishers are required to submit a monthly harvest report that tracks gear type and species landed. County officers patrol inland and river waterways as needed (Jansen, IDNR, personal communication 2019). In summary, appropriate permitting and reporting requirements accompanied by the capacity to ensure compliance yield a score of "highly effective" for Indiana in enforcement of management regulations.

IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

All commercial fishing harvesters are required to submit a monthly report of their harvested catch with no record of bycatch. Failure to submit commercial landings data is enforced by follow-up emails, letters, denial of future licenses, and eventual legal action. Local law officials are available to ensure compliance on waterways (Fowler, IDNR, personal communication 2019), and Iowa receives a score of "highly effective" for enforcement of management regulations.

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Highly Effective**

Appropriate permitting and reporting requirements accompanied by the capacity to ensure compliance yield a score of "highly effective" for Kentucky in enforcement of management regulations.

**Justification:**

Permits are required to commercially fish in the state of Kentucky, and KDFWR requires commercial fishers who are fishing on the Asian Carp Harvest Program to call in to the area KDFWR biologist to request a fishing location and time. Fishers are also required to record their daily catch and bycatch and condition of bycatch upon release. KDFWR staff conduct ride alongs with commercial fishers on a regular basis to record additional information. All daily harvest logs must be submitted at the end of each month. If reports are not submitted then the fishers could face a suspended or revoked license (Morris, KDFWR, personal communication 2019).

LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Louisiana commercial fishers are required to have commercial fishing licenses and are either required to report their catch or sell to a dealer that will report (Kinney, LDWF, personal communication 2019). All trip ticket data comes to LDWF and is compiled by watershed and basin. Law Enforcement does compliance checks for licenses, correct species, and correct minimum size requirements. Appropriate permitting and reporting requirements accompanied by the capacity to ensure compliance yield a score of "highly effective" for Louisiana in enforcement of management regulations.

MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderately Effective**

Appropriate commercial fishery permitting requirements are in place in Mississippi, and capacity is sufficient to ensure compliance of the fishery in this aspect. Law enforcement and conservation officers are present on waterways as well. However, landings data reporting requirements are not enforced strictly in the state of Mississippi at this stage (Riecke, MDWFP, personal communication 2019), and Mississippi receives a score of "moderately effective" for enforcement.

MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Appropriate permitting and reporting requirements are in place, and capacity is sufficient to ensure compliance of the fishery. Therefore, Missouri receives a score of "highly effective" for enforcement.

**Justification:**

The Wildlife Code of Missouri requires that commercial fishers keep a dated receipt that includes the weight and species of fish and the weight of extracted fish eggs (raw or processed) of each species landed for three years for inspection purposes, and that commercial fishers submit a monthly landings report (MDC 2019a Wildlife Code of Missouri). Monthly reports must be received by the department within thirty days of the end of each month. "Failure to submit a monthly report shall be sufficient cause for the department to revoke the current year's commercial fishing permit and deny renewal of the permit for the following year." Additionally, MDC Protection Division staff conduct annual inspections with all commercial permittees (McMullon, MDC, personal communication 2019).

TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Highly Effective**

Tennessee commercial fishers are required to report their catch monthly (and roe removals daily) as determined by the Tennessee statute governing commercial fishing. Wholesale fish dealers are also required to submit reports monthly to ensure appropriate processing (TN Rule 1660-1-30) (TWRA 2017). Site visits are conducted by state fishery managers as part of the Tennessee Asian Carp Harvest Program. County officers also monitor waterways as needed (Ganus, TWRA, personal communication 2019). Appropriate permitting and reporting requirements accompanied by the capacity to ensure compliance yield a score of "highly effective" for enforcement of management regulations in Tennessee.

## Factor 3.5 - Stakeholder Inclusion

*Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.*

ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Highly Effective**

For stakeholder inclusion, Arkansas receives a score of "highly effective" for involving major user groups in management discussions and providing transparent mechanisms for addressing user conflicts. Arkansas Fisheries Commission meetings are open to the public, and additional public meetings are held when substantive fishery regulation changes are proposed (AGFC 2019).

ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Illinois receives a score of "highly effective" for stakeholder inclusion for involving major user groups in management discussions, providing transparent mechanisms for addressing user conflicts, and for encouraging participation in the commercial carp fishery, a program designed to reduce biomass of the invasive species.

**Justification:**

Public meetings are utilized to solicit input prior to any substantive changes occurring in common and Asian carp fisheries. The formulation of an Illinois commercial fishing association further bolsters communication between fishers and managers in the region (Maher, IDNR, personal communication 2019). Managers suggest that the harvest incentive programs for Asian carp also provide important avenues for communication between stakeholders (Irons, Illinois DNR, personal communication 2019).

INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Highly Effective**

For stakeholder inclusion, Indiana receives a score of "highly effective" for involving major user groups in management discussions and providing transparent mechanisms to address user conflicts. If any major regulation changes are proposed, public meetings are held to solicit input from stakeholders (Jansen, IDNR, personal communication 2019).

IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Iowa receives a "highly effective" score for stakeholder inclusion for involving major user groups in management discussions and providing transparent mechanisms for addressing user conflicts. If there are any regulation changes in Iowa, changes are communicated to stakeholders, and public meetings are held to solicit input (Fowler, IDNR, personal communication 2019).

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Highly Effective**

Kentucky receives a score of "highly effective" for stakeholder inclusion for involving major user groups, encouraging public participation via the Asian Carp Harvest Program and public meetings, and providing an effective mechanism for addressing user conflicts. KDFWR staff are in regular contact with commercial fishers and other stakeholders through phone, email, Facebook, and in person meetings. KDFWR also facilitates public meetings for recreational fishers, commercial fishers, processing facilities managers, and other stakeholders as needed. Additionally, KDFWR has literature and educational programs for the public regarding identification and prevention measures for Asian carp (Morris, KDFWR, 2019 pers. comm.).

LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Louisiana  receives a score of "highly effective" for stakeholder inclusion involving major user groups in management discussions and providing transparent mechanisms to address user conflicts. Monthly Fisheries

Commission meetings are open to the public, and additional public meetings are held when substantive fishery regulation changes are proposed (Kinney, LDWF, personal communication 2019).

MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Highly Effective**

Mississippi involves major user groups in management discussions and provides transparent mechanisms for addressing user conflicts. If any major regulation changes are proposed, public meetings are held to solicit input from stakeholders. Also, stakeholder involvement and financial support has been used in Mississippi to bolster Asian carp harvests in the Moon River Area (Riecke, MDWFP, personal communication 2019), and Mississippi receives a score of "highly effective" for stakeholder inclusion.

MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA

**Highly Effective**

Monthly commercial landings reports include a comments/questions box, and permittees are regularly invited to comment or submit questions via the Commercial biannual Fisheries newsletter. Public meetings throughout the state are utilized to solicit input prior to any substantive changes occurring in the common and Asian carp fisheries (McMullen, MDC, personal communication 2019). In summary, Missouri receives a score of "highly effective" for stakeholder inclusion that involves major user groups in management discussions and provides transparent mechanisms for addressing user conflicts.

TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Highly Effective**

Tennessee receives a score of "highly effective" for stakeholder inclusion that involves major user groups in management discussions, and for encouraging participation in the commercial carp fishery, a program designed to reduce biomass of the invasive species.

**Justification:**

The Tennessee Commercial Fishing Advising Committee and Tennessee Fishing Commission meet annually as part of the state's fishery regulation cycle. Commission meetings are open to the public, and public comment periods provide the opportunity for various stakeholders to comment on management changes and legislation (Ganus, TWRA, personal communication 2019).

# Criterion 4: Impacts on the Habitat and Ecosystem

*This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:*

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤3.2=Yellow or Moderate Concern*
- *Score ≤2.2=Red or High Concern*

GUIDING PRINCIPLES

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

*Rating cannot be Critical for Criterion 4.*

### Criterion 4 Summary

| Region / Method | Gear Type and Substrate | Mitigation of Gear Impacts | EBFM | Score |
|---|---|---|---|---|
| Arkansas / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Illinois / Mississippi River Basin / Fyke nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Illinois / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Illinois / Mississippi River Basin / Seine nets (unspecified) / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Indiana / Mississippi River Basin / Fyke nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Indiana / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Iowa / Mississippi River Basin / Fyke nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |

| | | | | |
|---|---|---|---|---|
| Iowa / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Iowa / Mississippi River Basin / Seine nets (unspecified) / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Kentucky / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Louisiana / Mississippi River Basin / Fyke nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Louisiana / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Louisiana / Mississippi River Basin / Seine nets (unspecified) / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Mississippi / Mississippi River Basin / Fyke nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Mississippi / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Missouri / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Missouri / Mississippi River Basin / Seine nets (unspecified) / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |
| Tennessee / Mississippi River Basin / Combined gillnets - trammel nets / United States of America | 3 | 0 | Very Low Concern | Green (3.873) |

## Criterion 4 Assessment

SCORING GUIDELINES

### Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap) and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.*
- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
- *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*

- *0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
  *Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.*

## Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

## Factor 4.3 - Ecosystem-Based Fisheries Management

Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

## Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**3**

Asian carp and common carp are typically targeted over mud, sand, or gravel substrates (some mussel beds occur regionally). Gill/trammel nets, fyke nets, and seine gear are typically set mid-water column to target carp, but do occasionally come into contact with the bottom and receive a score of "3" based on Seafood Watch Criteria (Ganus, TWRA, personal communication 2019) (Hubert et al. 2012).

## Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**0**

Gill, seine, and fyke nets come into contact with the river bed; however, depending on the waterway flow and target species, the actual amount of contact the gear has with the floor will vary. All states reviewed do not allow dredging or bottom trawling in the Mississippi River basin to protect the river floor and/or mussel beds from negative impacts. The ban on trawling and dredging commercial fishing gear reduces the negative impacts of commercial fishing gear on a portion of river floor; however, gill, seine, and fyke nets do contact the bottom occasionally, and the Asian carp and common carp target fisheries receive a "0" based on Seafood Watch standards for gear mitigation.

## Factor 4.3 - Ecosystem-Based Fisheries Management

ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA

**Very Low Concern**

Policies are in place to manage the fishery and/or control the spread of invasive Asian and common carp that do not have long-term, adverse effects on native species. Ecosystem assessments are ongoing and demonstrate that the removal of Asian carp and common carp will enhance the natural ecology of the Mississippi River basin (ACRCC Action Plan 2019) (USGS 2019). Therefore, the Asian carp and common carp commercial fisheries receive a score of "very low" concern for Ecosystem Based Fisheries Management (EBFM).

**Justification:**

The threat of Asian carp invasion and continued range expansion poses significant conservation concerns throughout the Mississippi River Basin and into the Great Lakes area. The acute threat posed by Asian carp has received national attention and funding. Thus, targeted fishing and conservation efforts have been developed to minimize the spread of Asian carp, which will in turn protect native species and enhance EBFM.

The most recent ACRCC Action Plan (April 2019) describes priority projects aimed at carp detection, prevention, and control. The ACRCC partnership represents a collaboration of 27 US states and Canadian federal, state, provincial, and local agencies and organizations with the primary goal of preventing the introduction and establishment of Asian carp in the Great Lakes, and controlling them where they already occur. One primary component of the ACCRC strategy is the Electrical Dispersal Barrier System (EDBS) in the Chicago Area Waterway System. The EDBS is intended to stop the movement of juvenile and adult Asian carp towards the Great Lakes. Other ACRCC projects focus on increased monitoring of the distribution and abundance of Asian carp across the Mississippi River Basin, contract fishing, and market development.

USGS also supports a number of projects throughout the Mississippi River basin. USGS has focused in part on conducting risk assessments and life history research to enhance the ability of agencies to manage Asian carp and minimize their influence and spread. For example, "FluEgg" is a numerical model that can be used to

assess Asian carp reproduction risk in rivers.

In addition to larger regional partnerships, state fishery management agencies also support efforts more locally to minimize the spread of Asian carp and restore native species ecology. Kentucky, Tennessee, and Illinois manage harvest incentive programs to support sustainable commercial fisheries and enhance the profitability of Asian carp production.

One outstanding gap in EBFM in the Mississippi River basin is the limited tracking of bycatch in Asian and common carp fisheries.

# Acknowledgements

*Scientific review does not constitute an endorsement of the Seafood Watch® program, or its seafood recommendations, on the part of the reviewing scientists. Seafood Watch® is solely responsible for the conclusions reached in this report.*

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# Appendix A: Extra By Catch Species

FINFISH

### Factor 2.1 - Abundance

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERIC
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderate Concern**

Bycatch data are limited in most states, with the exception of Kentucky and Illinois. Based on extant state-specifi information and phone interviews, the following list of finfish species represents a proxy list for species most lik to be bycatch in targeted common carp or Asian carp gill net, fyke net, and seine fisheries across the Mississipp basin: smallmouth buffalo, bigmouth buffalo, black buffalo, blue catfish, channel catfish, flathead catfish, freshwater drum, river carpsucker (Moles, AGFC, personal communication 2019) (Morris, KDFWR, personal communication 2019) (Ganus, TWRA, personal communication 2019) (Maher, IDNR, personal communication 20 (McMullen, MDC, personal communication 2019) (Fowler, IDNR, personal communication 2019) (Jansen, IDNR, personal communication 2019) (Kinney, LDWF, personal communication 2019) (Riecke, MDWFP, personal communication 2019).

Due to data limitations, reporting uncertainty, and variation between states, black buffalo from the sucker family was used to score the finfish bycatch and ranked the most vulnerable. Black buffalo, therefore, limits the C2 scc for all potential finfish bycatch species caught in carp fisheries. Black buffalo exhibit "moderate vulnerability" (Ta 2), so finfish as a group receive a score of "moderate" concern for fishing mortality.

**Justification:**

Despite its wide range in the Mississippi basin, black buffalo are listed as of special concern or vulnerable in Kentucky, Iowa, Mississippi, South Dakota, and West Virginia (Iowa DNR 2019) (KDWFR 2019a). Concerns over black buffalo status center on habitat destruction and competition from invasive bighead carp.

Table 2. Black buffalo, Mississippi basin/Gill nets, fyke nets, seine

| **Black buffalo, Mississippi basin/Gill nets, fyke nets, seine** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Productivity Attributes** | **Value** | **Score (1 = low risk; 2 = medium risk; 4 = high risk)** | **Reference** | **Susceptibility Attribute** | **Information** | **Score (1 = low risk; 2 = medium risk; 4 = high risk)** | **Referer** |
| **Average age at maturity (years)** | 2 | 1 | Fishbase 2019 | **Areal overlap** | | 3 | |
| **Average maximum age (years)** | 24 | 2 | Fishbase 2019 | **Vertical overlap** | | 3 | |
| **Fecundity (eggs/yr)** | 1,000 | 2 | Michigan University 2019 | **Selectivity of fishery** | | 2 | |
| **Average maximum size (cm) (not to be used when scoring invertebrate species)** | 123 | 2 | Fishbase 2019 | **Post-capture mortality** | | 2 | Asian Ca Harvest Program data 201 |
| **Average size at maturity (cm) (not to be used when scoring invertebrate species)** | NA | 3 | Fishbase 2019 | **Susceptibility Subscore** | | 1.875 | |
| **Reproductive strategy** | Demersal egg layer or brooder | 2 | Fishbase 2019 | | | | |
| **Trophic level** | 3.4 | 3 | Fishbase 2019 | **Productivity-Susceptibility Score** | 2.93 | | |

| | | | | | |
|---|---|---|---|---|---|
| **Density dependence (invertebrates only)** | NA | | | **Vulnerability Rating (high, medium or low)** | Medium |
| **Quality of Habitat** | Substantially compromised | 3 | USFWS 2019 | | |
| **Productivity Subscore** | | **2.25** | | | |

(Fishbase 2019) (Michigan University 2019) (USFWS 2019)

## Factor 2.2 - Fishing Mortality

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**Moderate Concern**

There is a lack of information on the bycatch composition of targeted Asian and common carp fisheries in the Mississippi basin. The gear types used in carp fisheries reviewed here include: gill nets, seine nets, and fyke nets. All of these gear types render finfish susceptible to capture based on the Seafood Watch Unknown Bycatch Matrix (UBM). However, a number of factors suggest that fishing mortality is not adversely affecting impacted finfish populations and/or is unknown (see justification below). Therefore, finfish receives a score of "moderate" concern for fishing mortality in Asian and common carp fisheries.

**Justification:**

Commercial fishery landings data suggests that catfish and buffalo species harvests have been stable to increasing in most states (Iowa DNR 2019) (KDFWR 2019) (IDFW 2015) (Ganus 2018).

Anecdotal information from a number of states across the Mississippi basin indicates that a number of fishing regulations and/or fishing behavioral choices may reduce fishing mortality of unwanted finfish bycatch species. For instance, target Asian and common carp fisheries are often limited to cooler seasons in order to reduce temperature- dependent fishing mortality rates for a number of species (Moles, AGFC, personal communication 2019) (Phelps et al. 2010). Large mesh size used to target Asian and common carp species is likely to release smaller and juvenile finfish (Fowler, IDNR, personal communication 2019). Also, gill nets and seine nets are typically fished in the middle or surface of the water column in the Mississippi basin rivers and inland lakes, which enables higher tropic level benthic species such as catfish and sturgeon to evade nets based on their depth profiles (Kinney, LDWF, personal communication 2019).

## Factor 2.3 - Discard Rate

KENTUCKY / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
TENNESSEE / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSOURI / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
ARKANSAS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
LOUISIANA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
INDIANA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
ILLINOIS / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, SEINE NETS (UNSPECIFIED), UNITED STATES OF AMERICA
IOWA / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, COMBINED GILLNETS - TRAMMEL NETS, UNITED STATES OF AMERICA
MISSISSIPPI / MISSISSIPPI RIVER BASIN, FYKE NETS, UNITED STATES OF AMERICA

**< 100%**

There is a paucity of information on bycatch rates and discard mortality in inland fisheries along the Mississippi River basin (Raby et al. 2011). Although the proportion of discards to total landings is unknown in all states, a number of factors yield a <100% score: including the invasive nature of Asian carp species (both juveniles and adults must be retained and killed in all state commercial fisheries); Asian carp (especially silver carp) tend to school and fishers target these large schools using fish finders; and a few studies suggest varying levels of discard mortality rates among common bycatch species such as catfish and paddlefish.

**Justification:**

Fishery managers report that fishing methods for Asian carp species tend to rely on the use of fish finders to locate large schools. This method yields low bycatch relative to overall landings. Most states have gear tending requirements to limit bycatch mortality associated with long soak times. Additionally, non-target species are mandated to be returned to the water, and managers report they are typically in good condition, especially with commonly used fyke nets (Kinney, LDWF, personal communication 2019).

There are limited studies on discard mortality rates of common bycatch species; however, one study found relatively low discard mortality rates of blue catfish caught by hooks, suggesting a resilient physiology for the species group (Schmitt and Shoup 2013). Another tagging study estimated low discard mortality rates of sublegal paddlefish (4% post-release mortality rate) in gillnets, suggesting some degree of physiological resilience in this species. Survival of bycatch is often temperature-dependent in the Mississippi river basin, where cooler water is linked to lower discard mortality rates (Bettoli et al. 2009) (Schmitt and Shoup 2013).