

Upper Mississippi River Basin Asian Carp Control Strategy Framework

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Overview

Bighead, silver, black, and grass carp are the four species of Asian carp that pose a significant threat to recreation, industry, and ecology of the Upper Mississippi River Basin (UMRB). The Upper Mississippi River Basin Asian Carp Control Strategy Framework (UMRB Framework) outlines actions for prevention, containment, control, monitoring, adaptive management planning, supportive research, communication, and outreach; through the entire basin from Itasca, MN to Cairo, IL and all the tributaries and inland waters of the watershed. Implementing the UMRB Framework is intended to minimize the impact of Asian carp on the ecosystem function, recreation, and navigation in the Upper Mississippi River in a cooperative, coordinated, and efficient interagency manner. The objectives of this document are in line with the goals of the Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States (Conover et al. 2007) (National Plan) (Appendix 1), the Upper Mississippi Fisheries Plan 2010 (UMRCC Plan, Appendix 2) and directly meet the goals, as specified by the United States Congress in Section 1039 (b) of the Water Resources Reform and Development Act of 2014 (WRRDA), of controlling the spread of Asian carp in the Upper Mississippi and Ohio River basins and tributaries by carrying out activities designed to slow and eventually eliminate the threat posed by these species.

Background

The Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 (Act 16 U.S.C. 4701-4741) established the Aquatic Nuisance Species Task Force (ANSTF), an intergovernmental organization dedicated to the prevention and control of aquatic nuisance species and co-chaired by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA). The ANSTF determined that Asian carps warranted management by natural resource agencies and requested that the USFWS develop a national Asian carp plan to guide the management of Asian carps and prevent their introduction to new areas. The ANSTF and the USFWS established an Asian Carp Working Group (ACWG) consisting of a diverse representation of partners and stakeholders tasked with development of a national management and control plan for Asian carps. The ACWG completed *the Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States* in 2007 (Conover et al. 2007) (National Plan) (Appendix 1).

The Upper Mississippi Conservation Committee (UMRCC) was formed in 1943 by a group of 22 river biologists from Minnesota, Wisconsin, Iowa, Illinois and Missouri who recognized the need to work across boundaries throughout the Upper Mississippi River (UMR) to address resource issues up and down the river. The executive board of the UMRCC consists of a voting delegate from each state, and a chair for each technical committee which includes: fisheries; wildlife; water quality; freshwater mussels; law enforcement; and outreach, recreation, education, and interpretation (OREIT). The organizational framework of the UMRCC provides a forum for river

partners to discuss issues, compromise, and make management recommendations that can be applied across the jurisdictional boundaries of the UMR. The fish technical section completed an *Upper Mississippi Fisheries Plan* (UMRCC Plan) in 2010. Goal 4 of the UMRCC Plan is to slow or eliminate the spread or introduction of aquatic nuisance species, including pathogens, to the UMR. The UMRCC Plan identifies the following tasks as the greatest priorities under Goal 4:

- Prepare a list of UMR species and associated habitats which are currently at risk of becoming impaired due to aquatic nuisance species and pathogens.
- Establish a UMRCC Aquatic Nuisance Species Committee under the Fish Technical Section that will track ANS issues and programs.

After receiving requests from UMRCC membership and recognizing the magnitude of the Asian carp threat and the need for coordinated efforts to prevent the continued spread, the UMRCC coordinator proposed drafting a UMR plan specific to Asian carp. In 2013, each state's respective Chief of Fisheries, the U.S. Army Corps of Engineers (USACOE), the U.S. Geological Survey (USGS) and the academic community appointed one representative to draft this plan, with facilitation by the USFWS. The current team drafting the *UMRB Framework* consists of a representative from Missouri Department of Conservation (MDC), Illinois Department of Natural Resources (DNR), Iowa DNR, Wisconsin DNR, Minnesota DNR, U.S. Geological Survey Upper Mississippi Environmental Sciences Center (USGS-UMESC), USACOE, National Park Service (NPS) and Iowa State University (ISU), University of Minnesota (U of MN) and Southern Illinois University (SIU). All have provided comment to this document. Additionally, the fish technical committee was engaged and provided early drafts of the plan to review and comment through their representative and to seek endorsement of the final plan by the UMRCC executive board.

By 2013, populations of Silver and Bighead Carps were well established and reproducing throughout much of the mid-Mississippi and Missouri river drainages, but the extent of the invasion and population densities in the Upper Mississippi River decrease greatly as distance from Lock and Dam 19 increases (Figure 1, Baerwaldt et al. 2013). Notably, no reproduction has yet been confirmed in Minnesota or Wisconsin waters. Grass carp are distributed throughout much of the continental U.S., but again are not reproducing in Minnesota or Wisconsin waters. While black carp have been reported only as far upstream as Pool 24 in the Upper Mississippi River and from several sites in the Middle and Lower Mississippi River drainage (Figure 1, Baerwaldt et al. 2013, U.S. Geological Survey 2014.), reproduction has only been verified near Cape Girardeau, MO. Although eradication of Asian carp is likely not possible in areas where they have become established and are reproducing, there likely are ways to slow their range expansion (i.e. establishment of self-sustaining recruiting populations) and perhaps reduce or control their numbers in established areas to reduce negative impacts to river ecology and river uses.

The UMRB Framework was developed to support the UMRCC Plan goal and objectives for aquatic nuisance species (Appendix 2), specifically Asian carp. The *UMRB Framework* is also a step down plan from other existing plans. This document was drafted by drawing heavily from the National Plan (Appendix 1); UMRCC Plan (Appendix 2), and the *Minnesota Asian Carp Action Plan* - (Appendix 3).

The Water Resources Reform and Development Act of 2014 (WRRDA) was signed into law on June 10, 2014. The coordinated strategies outlined in the *UMRB Framework* meet the goals as specified in Section 1039 (b) *Aquatic Invasive Species Prevention* of the Water Resources Reform and Development Act of 2014 (WRRDA). Specifically the WRRDA language requires the Director of the USFWS in coordination with the Secretary of the Army, the Director of the National Park Service (NPS) and Director of the USGS, to lead a multiagency effort to slow the spread of Asian carp in the Upper Mississippi and Ohio River basins and tributaries by providing technical assistance, coordination, best practices, and support to State and local governments in carrying out activities designed to slow, and eventually eliminate, the threat posed by Asian carp.

Efficient use of funding will require that recommendations be strategically prioritized and properly sequenced. A basin-wide coordinated approach is needed to successfully implement an effective integrated pest prevention and management plan that involves all states, agencies and institutions while targeting multiple life stages with multiple tools. Due to differing biological and political challenges, successful strategies to prevent establishment of a recruiting population in the Upper Mississippi River may differ from those that have been applied and were successful elsewhere. Addressing such a complex issue over a geographic area that crosses many jurisdictional boundaries will require a sophisticated management structure. For this purpose, use of the existing structure of the Mississippi Interstate Cooperative Resource Association (MICRA), consisting of key representatives from the natural resource agency of each state in the basin, is expedient. To be successful in obtaining the goal, the *UMR Control Strategy Framework* must be implemented in a timely manner. With the expansion of the range of Asian carp and the present Congressional support and funding, now is the time.

Introduction

Documents and publications like the UMRCC Plan, A River that Works and a Working River (UMRCC), Ecological Status and Trends of the Upper Mississippi River System (USGS-Long Term Resource Monitoring Program), Restoring the Upper Mississippi River and Its Network of Tributaries (The Nature Conservancy), The Mississippi River in the Upper Midwest, Its Economy, Ecology and Management (McKnight Foundation) and many more provide thorough descriptions of the ecology, economy, use, and history of the great Upper Mississippi River and the natural and human communities it supports. This *UMR Control Strategy Framework* is drafted to cover, as best it can, the entire Upper Mississippi River basin, including its tributaries

and inland waters within the basin, from the headwaters at Lake Itasca in Minnesota to Cairo, IL.

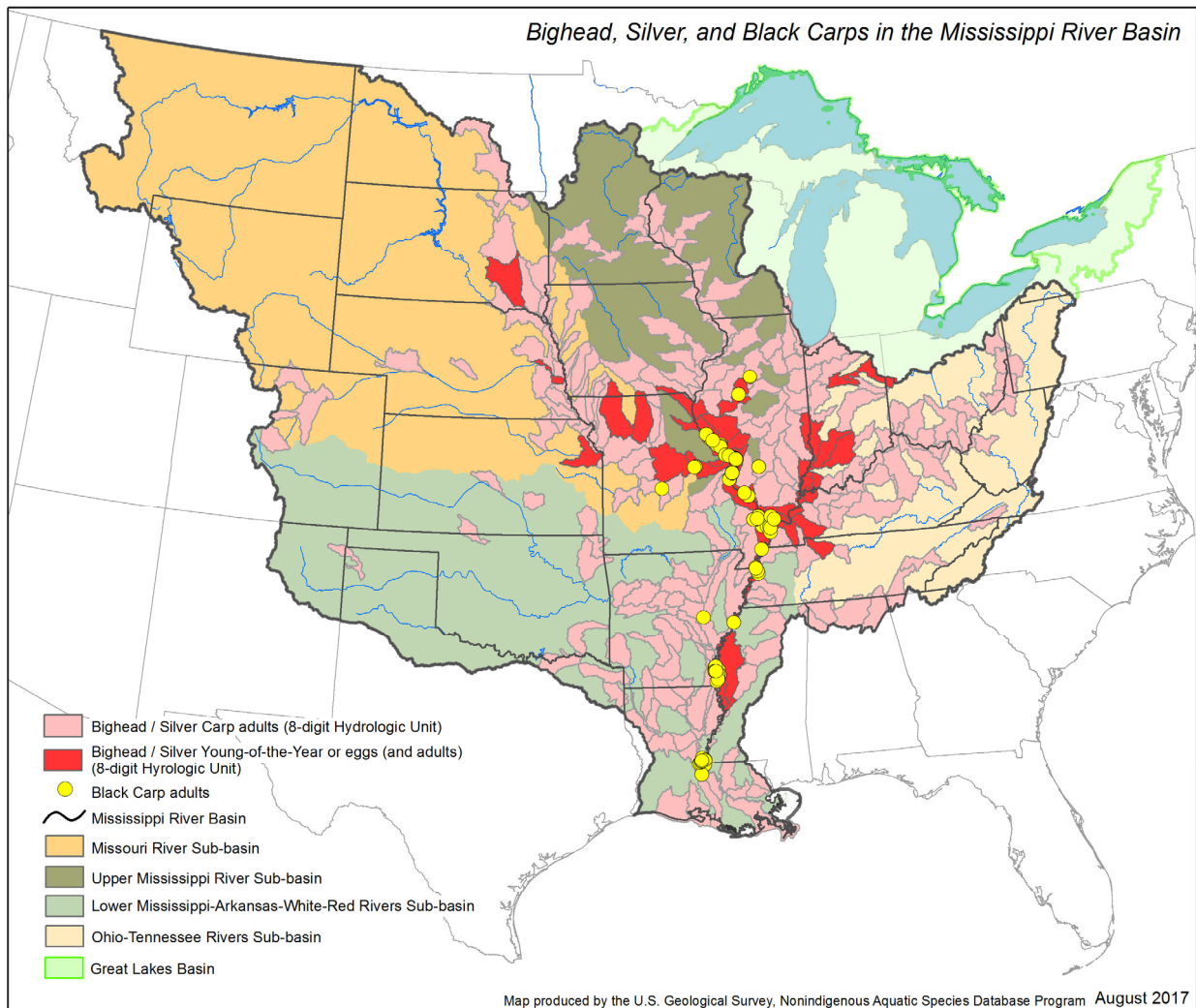


Figure 1. Distribution of Asian carps in the United States.

Terminology

The phrase “invasion front” is often used in discussion, and warrants definition. A distinction can be made for Asian carp populations at three levels of relative density and reproductive status. For the purposes of this document, the most exterior extent of confirmed capture will be referred to as the “presence front.” At the presence front, densities are low and reproduction is believed to have not yet taken place or has not been documented. The presence front will have densities including only rare fish (one or two captured at a time). Generally, the population at this front is not considered established because densities are thought to be too low to support successful reproduction. The “invasion front” is the edge

where the Asian carp population is dense enough to allow spawning and reproduction has been documented, but recruitment has not been documented. Anecdotal reports suggest spawning but failing to recruit young fish into the population is a common characteristic of Asian carp. Because of this, a third distinction can be made. The edge of the invasion where Asian carp reproduce and recruit regularly will be referred to as the “established front.” Identifying the location and break between the established, invasion, and presence fronts is crucial information for implementation of management or control efforts.

Goals:

1. **PREVENT INTRODUCTIONS:** Prevent introduction and establishment of Asian carps in the UMR.
2. **CONTAINMENT:** Contain expansion of Asian carps in the UMR while minimizing impacts to native species movement.
3. **CONTROL POPULATIONS:** Eliminate populations of Asian carps in the UMR to limit their adverse effects.
4. **PLAN:** Plan for the implementation and evaluation of prevention, containment and control efforts for Asian carps in an adaptive management process.
5. **COMMUNICATION and OUTREACH:** Conduct effective intra and inter agency communications and outreach to improve the management and control of Asian Carps in the UMR.

Goal 1: Prevent introduction and establishment of Asian carps in the UMR

Strategy 1.1: Assess risk of vectors for movement and introduction of Asian carp beyond the Upper Mississippi River and its tributaries and develop strategies to address these vectors.

The 2007 National Plan identified 22 pathways for accidental or deliberate introductions. Identification of potential vectors can begin by reviewing these 22 pathways and determining whether they all exist in the UMR basin or if there are additional vectors not previously identified. A second step would address the probability of introduction via each vector.

Strategy 1.2: Coordinate state and federal regulations and enforcement that prohibit the sale, transport, possession, production, and use of live Bighead, Silver, Black and diploid Grass Carp.

Issues regarding use of Asian carps in aquaculture and transport of live Asian carps remained unresolved by the Asian Carp Working Group that developed the National Plan. The legal culture, possession, and transport of live Asian carp species increases the risk of new introductions and makes enforcement of other Asian carp regulations more difficult. With the exception of grass carp, most states in the UMR basin have strict regulations prohibiting

possession, culture, and transport of live Asian carps. However, states within and outside of the basin with less restrictive regulations create additional avenues for accidental, if not deliberate, introductions to UMR states (Appendix A). Implementing this strategy is wrought with political challenges (Rasmussen 2010), but it should not go unaddressed.

While the individuals and agencies participating in Asian carp prevention efforts focus on management and control of the species at large, regulation changes pose sensitive challenges, particularly when it may impact an industry.

Strategy 1.3: Enhance natural and desirable properties of the Upper Mississippi River ecosystem through preservation and restoration efforts.

There is a stretch of water in the UMR above lock and dam 12 where Asian carp have been present in relatively low numbers for about 20 years with little known expansion of the population. It has been proposed that some areas of the UMR prevent Asian carp establishment because the healthy ecosystem provides biotic resistance to invasion. While Asian carp have established in nearly every ecosystem in which they were introduced, the UMR has benefited from an active and well-funded restoration program. On the other hand, many large rivers of the interior United States are engineered systems that have severely degraded ecosystem function. It is possible that degraded systems are more likely to support high densities of Asian carps than those that have been restored. Prior to developing plans to increase biotic resistance in the UMR, it will be important to gather evidence that supports what is currently only a theoretical tool for Asian carp prevention.

Goal 2: Contain expansion of Asian carps in the UMR while minimizing impacts to native species movement.

Strategy 2.1: Continue the UMR comprehensive monitoring program to maintain a current understanding of Asian carp distribution at all life stages for early detection, prevention, response, control and containment.

Monitoring programs that help delineate fronts (i.e., presence, invasion, and established) are paramount for implementation and assessment of containment actions to prevent range expansion, eradicate new introductions and control established populations. Ongoing evaluation programs should include annual review of sampling sites, strategies, and results to develop effective monitoring plans. Programs should also include developing standardized and enhanced eDNA sampling designs. Furthermore, the UMR has an established program for standardized monitoring of fish called the Long Term Resource Monitoring element of the Upper Mississippi River Restoration program. Amendments to the existing program such as expansion of the number of locations sampled and additional gears that more adequately sample Asian carp should be considered.

Strategy 2.2: Evaluate and implement deterrent measures at strategic pinch points to prevent dispersal of Asian carp recognizing other fish management goals.

Currently, the only established containment tool for Asian carp is removal. In theory, an integrated approach combining removal and deterrence can be an effective combination. Identify potential sites for deterrents or control measures and complete a feasibility analysis for measures at these sites. The feasibility study must evaluate alternatives and associated impacts. A comprehensive evaluation of ecological (including impact on native species), economic, recreational, commercial and other impacts of Asian carp spreading upstream must be part of evaluation.

Fish passage has been a concern at lock and dam sites for many years, and a suite of research has been done on the impacts of lock and dam structures to fish passage. Evaluation may include assessment of fish passage, building on research to understand the impacts of lock and dam structures, particularly at potential population pinch-points, on Asian carp and native fish (Tripp et al. 2013, Goodwin et al. 2006, Zigler et al., Knights et al., Wilcox et al.).

Strategy 2.3: Support research to improve existing or develop new containment technologies.

Deterrence technologies for Asian carp are in various states of development and application. Fisheries managers have expressed a need for an effective deterrent to help contain Asian carp, but few are currently ready for application in large scales such as that needed in the UMR. Continued effort is needed to develop and refine deterrence technologies that are effective for Asian carp and have minimal impacts to native species.

Strategy 2.4: Develop a comprehensive response plan for the UMR that identifies a clear plan of action in response to Asian carp range expansion.

Organize in a flow chart to guide responses. Response actions will be identified for positive indications of Invasive carp presence from routine or targeted fisheries sampling, eDNA sampling, commercial fishing, public sightings, or other means. Identify actions and corresponding triggers to positive invasive carp contacts. Identify high priority or sensitive ecological or recreational sites that potentially can be protected/managed with a response.

Strategy 2.5: Develop and implement new early detection and monitoring tools to supplement eDNA.

Capturing any fish when they exist in low numbers is challenging. Asian carps have a unique ability to avoid capture. As a result, there is a continued need to develop and refine techniques for early detection of Asian carps. Research should continue to improve the utility of eDNA and define ecological significance of eDNA results, especially at invasion fronts. Improved sampling

protocols that might include attractants could enhance sensitivity and reliability (sex pheromones and feeding attractants) as well as alternative tools (sex pheromone that could provide information on fish gender and would not be confounded by the risk of false positives). Improving commercial fisher reporting of Asian carp captures in the presence front and beyond through outreach or other means might be another avenue to improve detection in these low abundance areas. As well, implementing multiple tools for detection can add weight-of-evidence to these low uncertainty methods (e.g., eDNA, ichthyoplankton, and commercial catch).

Goal 3: Eliminate populations of Asian carps in the UMR to limit their adverse effects.

Strategy 3.1: Remove Asian carp from the UMR using efficient and diverse methods.

Contract fishing programs have been effective at reducing abundance of Asian carp in the Illinois River. Implementing an effective removal program in the Upper Mississippi River will require the use of diverse methods to identify best practices in a unique system. Furthermore, evaluation of the impact of removal on Asian carp populations is imperative for guiding and refining effort. Removal programs should track parameters used to evaluate success including Asian carp population parameters and native fish impacts. Diligent management of commercial efforts is critical to prevent commercial interests from fishing in areas just to gain access to more valuable species, and to prevent unacceptable negative impacts to native species. Contract fisheries may be useful in the capture and removal of Asian carp in areas where commercial fishing is not allowed to prevent the establishment of incipient populations in the basin. States should require observers with contract fishers to monitor the catch and evaluate unintentional impacts of removal on native fish populations. Diligent management is critical.

State fish and wildlife agencies will work within their authorities to increase opportunities for commercial harvest of Asian carps. States, NGOs and Friends groups can assist, where appropriate, in the development of new markets for Asian carp. States should work with emerging businesses utilizing commercially harvested Asian carp to influence business plans, strategies, and ideologies that minimize risk associated with increased commercial harvest. Make it clear that natural resource management agencies will make no effort to maintain the Asian carp populations but may assist in the development of ecologically acceptable exit strategies.

Strategy 3.2: Build harvest models to adaptively manage Asian carp in the UMR

In support of building Asian carp harvest models needed for adaptive management in the UMR, determine dynamic rate functions (i.e., recruitment, growth, mortality and immigration/emigration) for high priority areas for prevention, control and containment (Goals

1-3). Conduct population modelling of Asian carp, particularly where implementation of control and containment efforts are planned to determine the level of harvest or constraint (e.g., deterrents at pinch-point dams) needed to reduce populations to target levels. As a measure of effectiveness, monitor demographics of populations and determine if the dynamic rate functions vary in response to control and constraint measures. Lower abundances, fewer recruits, less immigration, or higher mortality are evidence of success.

Strategy 3.3: Identify and eliminate sources of Asian carp recruitment

While Asian carp reproduction in the IMZ occurs annually, successful recruitment at measurable levels seems to be only occasional (one year, 2016, during 5 years of intensive efforts in the UMR (2013 through 2017). Major recruitment events in the IMZ are a concern because they may contribute to upstream expansion of the Asian carp population by increasing propagule pressure in the presence front (i.e., they move upstream from the IMZ to the presence front). Understanding the timing and location of the sources of recruitment will contribute to the development of ways to control and contain Asian carp in the UMR.

Strategy 3.4: Support research to improve existing or develop new control technologies

The suite of tools available to managers trying to reduce the number of Asian carp and their ability to increase their range is small. Examples of existing technologies include traditional gears, targeted fishing, and non-species-specific chemicals. Examples of new technologies showing promise include Chinese Unified Method, Paupier trawler, specialized trap nets and species-specific chemicals.

Strategy 3.5: Investigate the economic and ecosystem impacts of expanding populations of Asian carps in the UMR.

Only a few studies have presented the impacts of expanding populations of Asian carp. Showing cause and effect in the field of ecology can be very difficult and quantifying the economic impacts is also challenging. Nevertheless, providing evidence that increasing populations of Asian carp have deleterious effects on the UMR ecosystem is critical for demonstrating the need for Asian carp control efforts into the future.

Goal 4: Plan for the implementation and evaluation of prevention, containment and control efforts for Asian carps in an adaptive management process.

Strategy 4.1: Create a committee composed of key partners with needed expertise to oversee the implementation of this plan.

This strategy is a critical first step to develop an effective implementation team. Because current Asian carp distributions cover a broad geographic footprint in the UMR,

implementation of this plan should be a dedicated effort led by a collaborative team from affected state and federal agencies. As a partnership of the five main stem UMR states, the Upper Mississippi River Conservation Committee (UMRCC) was identified as an organization with an interest in preserving the ecological function of the UMR and an existing structure to facilitate planning, implementation, and evaluation of Asian carp control and management in the UMR. The UMRCC Fisheries Technical Committee, which includes federal agency partners, completed a revised *Upper Mississippi River Fisheries Plan* in 2010. Goal 4 in the 2010 Fisheries Plan is to 'slow or eliminate the spread or introduction of aquatic nuisance species, including pathogens to the UMR' providing a pertinent mandate for future planning and implementation of Asian carp control efforts in the UMR.

Strategy 4.2: Develop institutional arrangements that formalize the roles and responsibilities of partner agencies and organizations in plan implementation.

The purpose of an institutional arrangement is to formalize a process for government agencies and private stakeholders to work together. In this case, the common interest is the management and control of Asian carps. Formal institutional arrangements are essential for effectively coordinated and collaborative efforts, and for establishing decision-making processes among multiple entities and programs. Effective arrangements foster integrated, science-driven, inclusive, efficient and cost effective approaches. A process for conflict resolution should be defined and agreed to during the development of institutional arrangements.

Implementation of this Control Strategy Framework will require a long-term commitment to the allocation of substantial human and financial resources. Institutional arrangements might require dedicated employees to perform assigned tasks effectively. Regardless, management and control of four species of Asian carps in large river ecosystems, and at least three species with private commercial interest, will be very complex and will require substantial investment.

Strategy 4.3: Integrate, sequence, and prioritize recommendations from among all sections of this plan.

This plan is organized into specific sections that address the primary issues of Asian carp control and management: 1) preventing introductions, 2) containment, 3) population control, 4) implementation, and 5) communication and outreach. Additional efforts are needed to integrate, prioritize, and sequence projects across all sections of this plan and should be one of the earliest tasks undertaken by the newly formed Committee (4.1). The development of a multi-year action plan should provide a clear vision for priority projects in five-year increments allowing effective implementation of projects with available funding and communication of additional needs.

Strategy 4.4: Develop criteria and/or performance measures to evaluate the effectiveness of prevention, control, and containment efforts.

For appropriate accountability of expenditures and to evaluate the effectiveness of management and control efforts, tools for assessing progress are needed. The first step will be to develop appropriate performance measures that can be tracked over time to monitor progress. Development of these performance measures should occur jointly with development of standardized sampling methodologies and a monitoring program so that methods used will provide the data needed for performance measures and so that performance measures developed are realistic given sampling/data limitations. Once developed, a monitoring program must be set in place to collect the appropriate data and to regularly develop progress reports which can be used in subsequent decision making.

Strategy 4.5: Develop an adaptive management framework that allows the flexibility to adapt strategies as knowledge is gained, techniques are refined or developed, and population status changes.

Our level of knowledge and experience in the management and control of Asian carps is somewhat limited. Ongoing and future research will answer many questions as will initial attempts at management and control. A strong adaptive management framework is needed to apply what we currently know, identify what else must be learned, and to adapt management strategies based on what is learned both through research and actions in the field. The framework must be designed for rapid incorporation of new information, particularly in the early stages of management and control, so that managers can effectively prevent new introductions, stop the spread, and reduce or eradicate existing populations of Asian carps. A basis of such an adaptive approach could be modeled after the Illinois River control program, that includes a multi-agency monitoring and response workgroup (MRWG), an annual monitoring and response plan (MRP), an interim summary report of actions taken (ISR), an annual meeting of the MRWG to present and discuss the significance of the ISR, quarterly MRWG planning meetings, and a harvest model (i.e., backbone of adaptive management framework) to continuously evaluate management options as the population status of Asian carp change as a result of natural and management influences.

Goal 5: Conduct effective intra and inter agency communications and outreach to improve the management and control of Asian Carps in the UMR.

Strategy 5.1: Develop and disseminate Asian carp information to target audiences via asiancarp.us.

Develop or use existing outlets to disseminate existing and new Asian carp information to target audiences. Information could be disseminated in the UMRCC newsletter, website, distributed by email or list serve.

Strategy 5.2: Work with other Mississippi River Basins to provide a network to distribute scientific literature on carp in the UMR.

Asian carp control and management began in the Illinois river in 2009 with efforts beginning in the Ohio, Upper Mississippi, Missouri, and Lower Mississippi following behind. Mississippi River Basin efforts are improved by an effective communication of ongoing work plans as well as findings between multiple sub basins. Sharing scientific research results will improve our understanding of Asian carp populations and control methods and improve our ability to implement the actions in this and future plans.

Strategy 5.3: Use effective communication and outreach tools to inform anglers, recreational boaters, the public, politicians, friends groups and NGOs of the importance of Asian carp control and management.

Ongoing work to control and manage Asian carp in the UMR relies on support from multiple user groups and interested parties. Communication of ongoing efforts and progress is critical to maintaining support of our programs. In areas where Asian carp are not abundant, much of the public is still unaware of the threat. An effective, basin wide coordinated educational initiative is needed to: 1) identify specific needs for information and education; 2) identify the most effective approaches to reach and affect each group; 3) gather and validate the credibility of materials; 4) become both partners and leaders in planning, implementing, and evaluating education initiatives; and 5) identify gaps in knowledge or needs that can be addressed by applied or adaptive research. For greatest effectiveness, each component of an educational program should be developed in a stakeholder participatory process, monitored, evaluated, and adaptively managed.