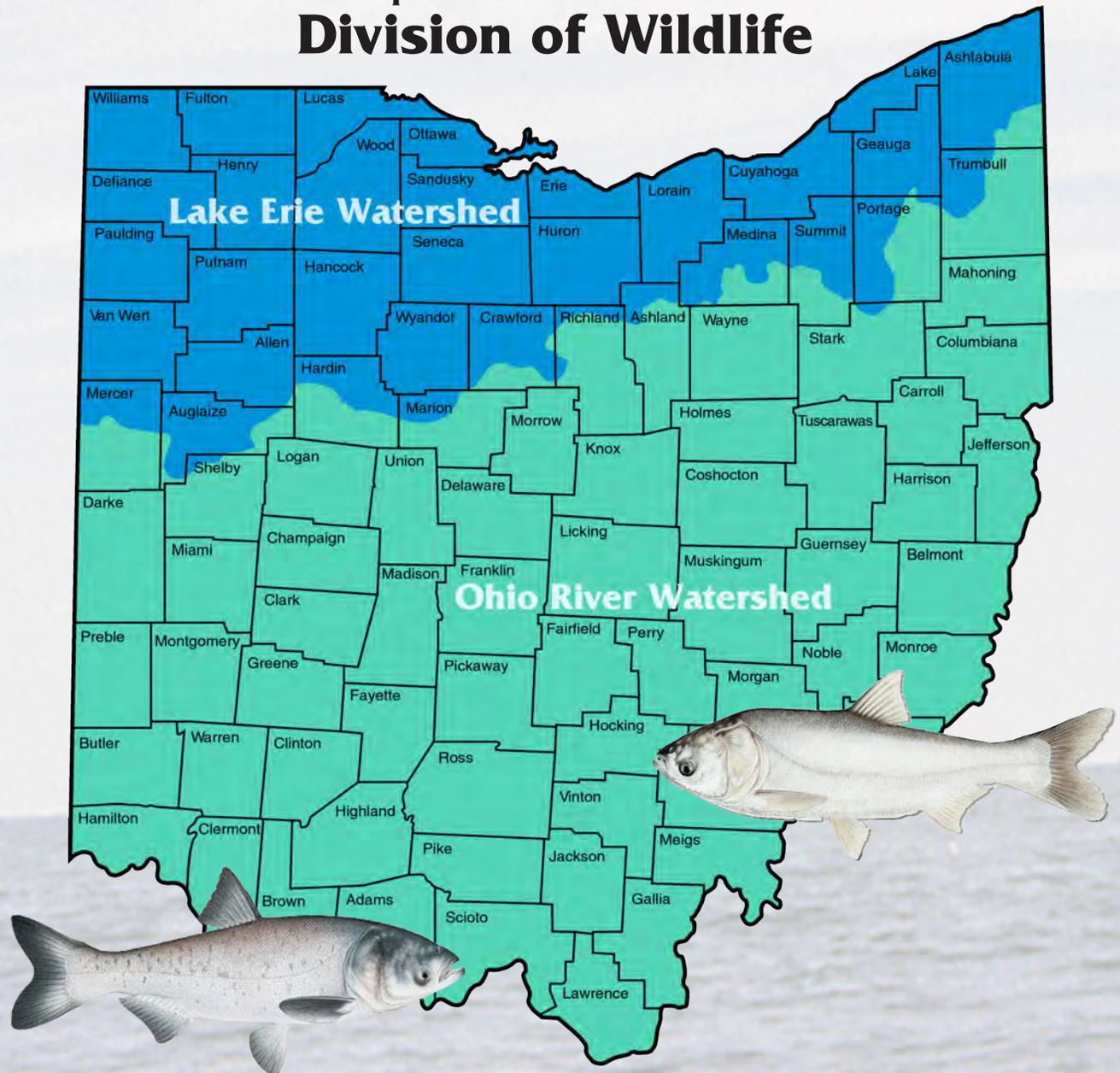




Asian Carp Tactical Plan 2014-2020

Ohio Department of Natural Resources
Division of Wildlife



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Mission

*To conserve and improve fish and wildlife resources and their habitats
for sustainable use and appreciation by all.*

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I. Executive Summary

“Asian carp” refers to a select group of cyprinid fishes (minnow family) that are native to Asia. The United States Fish and Wildlife Service (USFWS) specifically uses “Asian carp” to refer to Bighead Carp *Hypophthalmichthys nobilis*, Silver Carp *H. molitrix*, Grass Carp *Ctenopharyngodon idella*, and Black Carp *Mylopharyngodon piceus*. Each of these species was intentionally introduced into the United States for different purposes, but they all pose a threat to Ohio’s aquatic ecosystems. In Ohio, the Asian carp of greatest concern are Bighead and Silver Carp. Bighead and Silver Carp are filter feeders, feeding primarily on zooplankton and phytoplankton, and are considered a detriment to aquatic food webs in Ohio waters and potential competitors with native fishes.

Ohio is part of two major watersheds and some perspectives of the Bighead and Silver Carp threat are unique to each. The northern third of Ohio is within the Lake Erie watershed and currently does not have an established population of Bighead and Silver Carp. The southern two-thirds of Ohio are within the Ohio River watershed. Adult Bighead and Silver Carp are now found up to the Greenup Dam in the middle Ohio River and are abundant in the lower river and its major tributaries. Due to these circumstances, the Ohio Department of Natural Resources-Division of Wildlife (ODNR-DOW) approach to Asian carp management will be based on the current distribution, threat level, and our ability to manage the situation; therefore, this tactical plan has chapters to address:

- Lake Erie watershed, where Bighead and Silver Carp are not established;
- Ohio River watershed, where Bighead and Silver Carp are established;
- Grass Carp, which present a separate set of problems; and,
- communication among agencies, non-governmental organizations, universities, and the public

Black Carp are not yet considered a threat to Ohio because, to date, only one unconfirmed report of their presence has been noted in the Ohio River or an Ohio River tributary (Jason Harrala, Kentucky Department of Fish and Wildlife Resources (KDFWR), personal communication). Black Carp will be monitored through routine fish sampling and should this situation change, Black Carp would be added to the *Asian Carp Tactical Plan* rather than being addressed in the more general *Ohio Aquatic Invasive Species Plan* (ODNR 2013a). The *Asian Carp Tactical Plan* focuses on relative risks and meaningful strategies related to Bighead, Silver, and Grass Carp, including:

1. ensure that aquatic invasive species (AIS) are not transferred through likely vectors and pathways to expand their range or are introduced to new areas (i.e. live bait, live fish trade, and water diversions between watersheds);
2. monitoring current populations and locations of potential new introductions; and,

3. communication between agencies and with the public

The Ohio *Asian Carp Tactical Plan* provides a foundation for on-the-ground work during 2014-2020 and future planning. Experience gained from plan development and implementation should ensure progress and continual improvement well into the future. The core components of the plan are steps to accomplish five broad outcomes (goals) through 21 specific objectives.

Outcome 1: Bighead and Silver Carp are prevented from becoming established in Lake Erie.

- **Objective 1.1.** Create permanent hydrologic separation of Ohio's critical pathways near Little Killbuck Creek, Ohio-Erie Canal at Long Lake, and Grand Lake St. Marys by 2017 and support activities taking place to create hydrologic separation at Eagle Marsh south of Ft Wayne, Indiana in the headwater of the Maumee River.
- **Objective 1.2.** Collaborate with ACRCC, USACE, USFWS, and other partners to support permanent hydrologic separation of the Mississippi River and Great Lakes basins at the Chicago Area Waterway System (CAWS) so that a strategy for separation is identified as soon as possible and no later than 2018.
- **Objective 1.3.** Use annual inter-agency fish sampling, recreational, and commercial catch reporting to monitor for the presence of Bighead and Silver Carp in Lake Erie.
- **Objective 1.4.** Cooperate with the USFWS in environmental DNA (eDNA) sampling efforts in tributaries, bays and the main lake.
- **Objective 1.5.** Prevent accidental importation of juvenile Bighead and Silver Carp via bait dealers and fish transporters through annual notifications to bait dealers and fish haulers and monitoring of bait dealers during March and November.
- **Objective 1.6.** Prevent deliberate sales or releases of live adult Bighead and Silver Carp via fish transporters and fish markets through annual notifications to fish haulers and fish markets and inspections of each.
- **Objective 1.7.** Continue sport fishery research to promote a future understanding of the role of Bighead Carp and Silver Carp in food webs should they become established in Lake Erie.

Outcome 2: Bighead and Silver Carp are prevented from introduction into waters within the Ohio River watershed that are closed systems or have pre-existing barriers to natural immigration through tributaries.

- **Objective 2.1.** By 2016, reduce risk of accidental transfer of Bighead and Silver Carp by establishing Ohio Administrative Code (OAC) to restrict use of bait collected with a cast net, seine, fish trap, or other device to waters where bait was collected.
- **Objective 2.2.** Prevent accidental importation of juvenile Bighead and Silver Carp via bait dealers and fish transporters through annual notifications to bait dealers and fish haulers and monitoring of bait dealers and live fish transporters during March to November.
- **Objective 2.3.** Prevent deliberate sales or releases of live adult Bighead and Silver Carp via fish transporters and fish markets through annual notifications to fish haulers and fish markets and inspections of each.
- **Objective 2.4.** Use annual agency fish sampling in reservoirs, inter-agency fish sampling on the Ohio River, and angler reporting to monitor Bighead and Silver Carp presence, distribution, rates of introduction, and expansion.
- **Objective 2.5.** Cooperate with the USFWS and ORFMT in a study quantifying Bighead and Silver Carp distribution and movement in the Ohio River during 2014-2016.
- **Objective 2.6.** Support eDNA sampling efforts in the Muskingum River in cooperation with the Muskingum Watershed Conservancy District (MWCD) and The Nature Conservancy during 2014.
- **Objective 2.7.** Continue sport fishery research to promote a future understanding of the role of Bighead and Silver Carp in the Ohio River and potential effects on sport fisheries in stream, river, lake, and reservoir ecosystems.
- **Objective 2.8.** Obtain dedicated federal funding for the Ohio River sub-basin to support measures to prevent further expansion of Bighead and Silver Carp within the Ohio River watershed, study Bighead and Silver Carp effects on the Ohio River ecosystem, and explore strategies for containment or control of established populations.

Outcome 3: Populations of feral Grass Carp are prevented from becoming established in Ohio.

- **Objective 3.1.** Continue annual surveillance via testing ploidy status of Grass Carp caught outside of stocked waters in cooperation with the USFWS to determine the extent of a potential problem.
- **Objective 3.2.** Each year, verify the USFWS ploidy certification program, randomly inspect shipments of Grass Carp delivered in Ohio, and fine violators who illegally import diploid Grass Carp.

- **Objective 3.3.** Work with the Aquatic Nuisance Species Task Force, Great Lakes Basin Panel on AIS and the Mississippi River Basin Panel on AIS to urge the prohibition of diploid Grass Carp in the United States.

Outcome 4: A formal ODNR-DOW response and communication strategy is in place to address emerging Asian carp information or emerging issues.

- **Objective 4.1.** Develop protocols for an ODNR-DOW response and public communication strategy upon receiving positive findings from eDNA or ploidy testing, reports of Bighead Carp or Silver Carp, reports of Grass Carp in selected circumstances, and related information by March 1, 2014.
- **Objective 4.2.** When needed, communicate plans, findings, and responses with partner agencies through existing organizational structures (OEPA, USFWS, USGS, GLFC-LEC, GLMRIS, ACRCC, ORFMT, ORSANCO, and others).

Outcome 5: Ohioans can identify Bighead, Silver, and Grass Carp and are aware of the threat they pose to fisheries, ecosystems and public health.

- **Objective 5.1.** Annually provide outreach material via the ODNR-DOW website, signage, handouts, and presentations to increase public awareness of the risks associated with populations of Bighead and Silver Carp becoming established in Ohio.

II. Asian Carp Invasion: A Problem for Ohio Waters

“Asian carp” refers to a select group of cyprinid fishes (minnow family) that are native to Asia. The United States Fish and Wildlife Service (USFWS) specifically use “Asian carp” to refer to Bighead Carp *Hypophthalmichthys nobilis*, Silver Carp *H. molitrix*, Grass Carp *Ctenopharyngodon idella*, and Black Carp *Mylopharyngodon piceus*. A larger group of Asian carp also includes the widespread invasive Common Carp *Cyprinus carpio* and Goldfish *Carassius auratus*. Each of these species was intentionally introduced into the United States for different purposes, but they all pose a great threat to Ohio’s aquatic ecosystems (Appendix 1).

Bighead Carp, introduced in 1972, and Silver Carp, introduced in 1973, were brought to the United States as aquaculture products and to control plankton and improve water quality in aquaculture and wastewater treatment facilities. By the early 1980s, both species had escaped into the Mississippi River during floods. Additional fish escaped and began migrating to the Missouri and Illinois rivers following heavy flooding of the Mississippi River during the early 1990s. They have since spread upriver and have become among the most abundant fishes in some regions of the Mississippi, lower Ohio, and Illinois rivers (Figure 1). The USFWS listed Bighead Carp (2011), Silver Carp (2007), and Black Carp (2007) as “injurious species” and live transport of these species became illegal under the federal Lacey Act.

Grass Carp were imported into Alabama and Arkansas aquaculture facilities in 1963 to control vegetation in rearing ponds. They were widely stocked and their range was expanded by intentional and accidental releases. Many of the 45 states where Grass Carp are now found, including Ohio, have banned the stocking of fertile diploid Grass Carp but allow the sale and stocking of genetically sterile triploid Grass Carp by permitted aquaculture facilities. Ohio has allowed the stocking of triploid Grass Carp since 1988.

Black Carp were brought to the United States to control snail populations in aquaculture facilities and escaped from Missouri holding ponds during 1994. High water that flooded a private aquaculture facility near Lake of the Ozarks allowed the loss of 30 or more fish. Recent collections suggest that the Black Carp is established in the lower part of the Mississippi River basin.

In Ohio, the Asian carp of greatest concern are Bighead and Silver Carp. These fishes are large-bodied species with individual Bighead Carp approaching 100 pounds and Silver Carp approaching 60 pounds (Conover et al. 2007). Both species are capable of living 20 years. Bighead and Silver Carp are filter feeders that primarily eat zooplankton and phytoplankton, but also consume aquatic insects and detritus (Conover et al. 2007). They are potential competitors with native planktivores such as

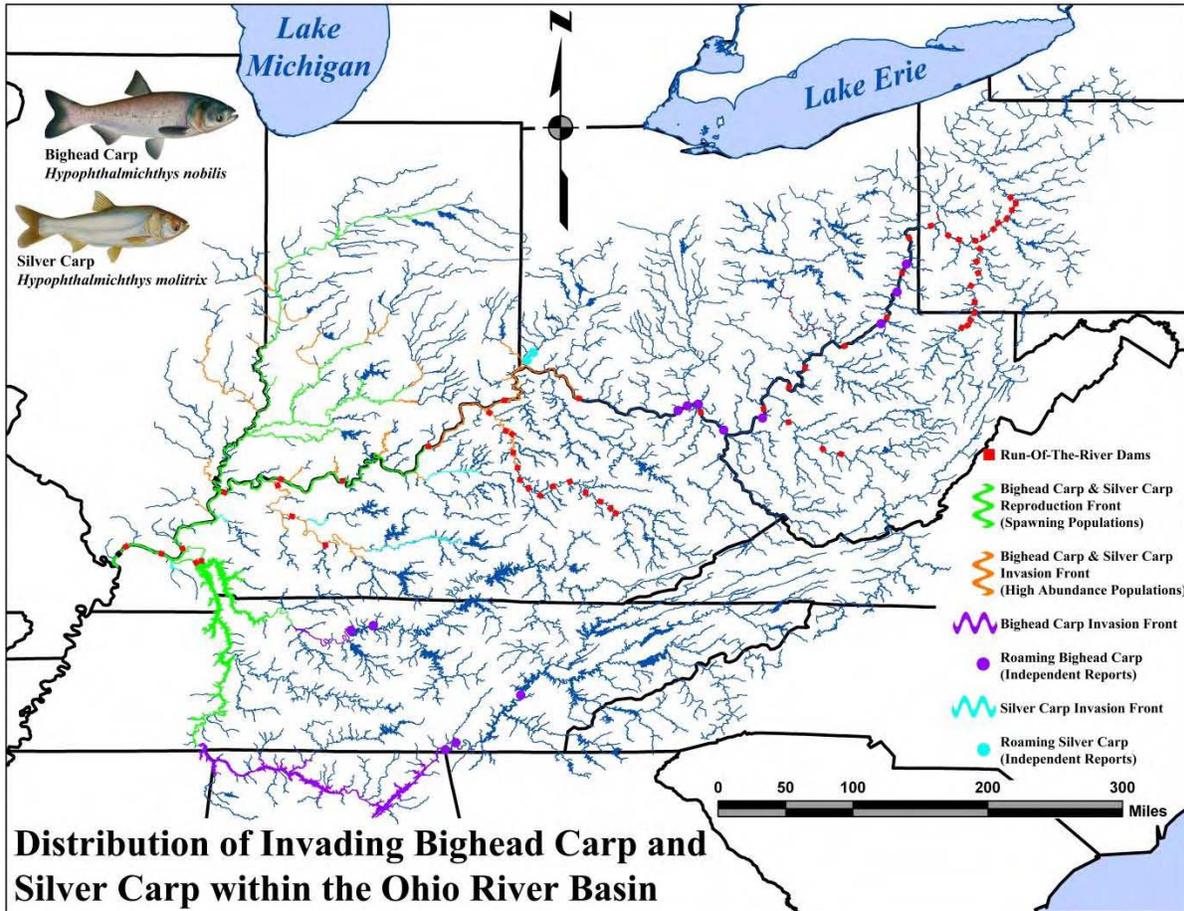


Figure 1. Status and distribution of Bighead and Silver Carp in the Ohio River and major tributaries (based on available information as of September 2012.).

Gizzard Shad, Emerald Shiners, Bigmouth Buffalo, Paddlefish, and young sport fishes and would likely effect aquatic ecosystems and native predator fishes through complex food web interactions.

The extent of the effect of established Bighead and Silver Carp in Ohio waters are unclear, but reproducing populations of these species may lead to reductions in native fishes that rely on plankton for food, including all early life stages. Potential effects of Bighead and Silver Carp on native fishes are currently being evaluated in the Mississippi and Illinois rivers where large populations have been established for several years. Results from these studies will be relevant to the Ohio River, where the first Bighead Carp was found near Smithland Dam (River Mile 919) in 1981 and Bighead and Silver Carp

are now abundant in the mainstem and major tributaries below McAlpine Dam, near Louisville, Kentucky.

Recent models of Bighead and Silver Carp diet and bioenergetics indicate that some areas of the Great Lakes, particularly western Lake Erie, have sufficient food resources to support populations of Bighead and Silver Carp (Herborg et al. 2007; Cooke and Hill 2010; Chapman, personal communication). Other locations within Lake Erie that likely have suitable food resources include harbors and bays such as Presque Isle Bay, Long Point Bay, and Rondeau Bay. Preliminary ecosystem modeling of Bighead and Silver Carp effects in Lake Erie suggest reductions in planktivore biomass and larval fish densities, but modest increases in piscivore biomass associated with predation on young Bighead and Silver Carp (Dr. Edward Rutherford, NOAA-GLERL, personal communication). A recent risk analysis (Cudmore et al. 2012) suggests a greater than 50% probability of successful Bighead or Silver Carp mating each year with 10 or fewer adult females and a similar number of adult males in close proximity within the Great Lakes basin. Additionally, a recent analysis of United States tributaries to Lake Erie indicated that there is suitable spawning habitat for Bighead and Silver Carp, with the Maumee and Sandusky rivers identified as the most likely tributaries to support successful spawning (Kolar et al. 2005; Kocovsky et al. 2012; Garcia et al. 2013).

The potential for Bighead and Silver Carp to cause significant economic effects in Lake Erie and the Great Lakes as a whole is high because of the value of commercial and recreational fisheries. The Great Lakes recreation and tourism commerce are valued at \$15 billion annually, \$1.5 billion of which is direct expenditures on recreational fishing trips (U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau 2006), and \$7.1 billion in economic impact from the region's recreational fisheries (Southwick Associates 2012 and USFWS 2012). More than 58,000 jobs are supported by Great Lakes sport fisheries (Southwick Associates 2012 and USFWS 2012) and commercial fisheries provide an additional 9,000 jobs (USFWS 1994). Rosaen et al. (2012) estimate that aquatic invasive species likely cost the Great Lakes region significantly more than \$100 million annually.

Ohio is bordered on the south by the Ohio River which is a tributary of the Mississippi River, the largest river system in North America. The Mississippi River and its many tributaries drain all or parts of 31 states and two provinces between the Rocky and Appalachian mountains. Flowing entirely within the United States, the river originates in northern Minnesota and meanders southward for 4,074 km (2,530 mi) to the Gulf of Mexico. All aquatic systems have been greatly affected by a number of invasive fish, plants, and mussels, and continue to be threatened by new AIS introductions. Placing an economic

value on biological invasions in the Mississippi River Basin is not straightforward (Windle et al. 2008); consequently, there is not a comprehensive aggregate estimate for the cost of the Bighead and Silver Carp invasion in this region or to the portion of Ohio contained within the Ohio River watershed.

Ohio is part of two major watersheds (Figure 2) and some aspects of the Bighead and Silver Carp threat are unique to each. The northern third of Ohio is within the Lake Erie watershed and currently does not have an established population of Bighead and Silver Carp. The southern two-thirds of Ohio are within the Ohio River watershed. Adult Bighead and Silver Carp are now found up to the Greenup Dam in the middle Ohio River and are abundant in the lower river and its major tributaries. Due to these circumstances, the Ohio Department of Natural Resources-Division of Wildlife (ODNR-DOW) approach to Bighead, Silver, and Grass Carp management will be based on the current distribution, threat level, and our ability to manage the situation; therefore, this tactical plan has chapters to address:

- Lake Erie watershed, where Bighead, Silver, and Grass Carp are not established;
- Ohio River watershed, where Bighead, Silver, and Grass Carp are established;
- Grass Carp, which present a separate set of problems; and,
- communication among agencies, non-governmental organizations, universities, and the public

Black carp are not yet considered a threat to Ohio because, to date, only one unconfirmed report of their presence has been noted in the Ohio River or an Ohio River tributary (Jason Harrala, Kentucky Department of Fish and Wildlife Resources (KDFWR), personal communication). Should this situation change, Black Carp would be added to the *Asian Carp Tactical Plan* rather than being addressed in the more general *Ohio Aquatic Invasive Species Plan* (ODNR 2013a). The *Asian Carp Tactical Plan* focuses on relative risks and meaningful strategies related to Bighead, Silver, and Grass Carp, including:

1. ensure that AIS are not transferred through likely vectors and pathways (i.e. live bait, live fish trade, and water diversions between watersheds) to expand their range or are introduced to new areas;
2. monitoring current populations and locations of potential new introductions; and,
3. communication between agencies and the public

The Asian Carp Regional Coordinating Committee (ACRCC) was originally formed to focus on preventing Bighead and Silver Carp movement through the Chicago Area Waterway System (CAWS) and is comprised of several agencies, stakeholders, and partners. The ACRCC now focuses on Bighead and Silver Carp over the entire Great Lakes Basin and uses the *Management and Control Plan for*

Bighead, Black, Grass, and Silver Carp in the United States (Conover et al. 2007) as the foundation of the *Asian Carp Control Strategy Framework*. Other partners engaged in the Asian carp effort include the Great Lakes Commission (GLC), Great Lakes Fishery Commission (GLFC), Lake Erie Committee of the GLFC (LEC), Great Lakes and Mississippi River basin AIS panels, and the Ohio River Fisheries Management Team (ORFMT).



Figure 2. Ohio watershed boundaries and major waterways.

Authority and responsibility for fisheries management resides within each state or province; however, cooperative inter-agency partnerships are essential in addressing regional, national, and international AIS issues.

The threat of Bighead and Silver Carp entering the Great Lakes through the CAWS has generated national interest and was the basis of the initiation of the Great Lakes Mississippi River Inter-basin Study (GLMRIS) by the U.S. Army Corps of Engineers (USACE) to determine if other direct water connections exist that could facilitate AIS movement. Four connections were identified in Ohio, two of which were identified as medium risk for the transfer of AIS, including Bighead and Silver Carp. There is also a renewed interest in controlling the movement of Bighead and Silver Carp in the Mississippi River basin. Federal legislation has been introduced to focus efforts in the Mississippi River basin and an *Ohio River Sub-Basin Asian Carp Action Plan* is being developed through the ORFMT.

III. Division of Wildlife Position Statement

Bighead, Silver, and Grass Carp pose serious threats to Ohio's sport and commercial fisheries, ecosystem integrity, and economy should reproducing populations of Bighead and Silver Carp become established. Bighead and Silver Carp are not known to have established viable populations in the Lake Erie watershed, yet positive eDNA results from the western basin of Lake Erie have raised concerns regarding their presence. Recent sampling in the Ohio River has resulted in the capture of Bighead and Silver carp upstream to Greenup Dam (both species) and R.C. Byrd Dam (Bighead Carp), but Bighead and Silver Carp have been large adults that likely migrated upstream from the lower Ohio River where both species are established and abundant. Grass Carp have been found beyond waters where sterile triploid Grass Carp have been stocked to control aquatic vegetation and some of these fish have been identified as diploids with the potential to reproduce.

The differing status and circumstance of these three species in Ohio necessitate development of strategies to address each major issue they present. The ODNR-DOW seeks to:

1. prevent establishment of invasive Bighead and Silver Carp in the Lake Erie watershed;
2. prevent further expansion of Ohio River populations of Bighead and Silver Carp to other inland waters of the Ohio River watershed; and,
3. prevent importation of diploid Grass Carp and establishment of reproducing populations in Ohio

The ODNR-DOW will use strategic and measured approaches to:

- plan and implement actions that are deliberate, realistic, and associated with desired outcomes and clear objectives;
- address sources and vectors of Bighead and Silver Carp to prevent new introductions of Bighead and Silver Carp and the importation of diploid Grass Carp;
- communicate issues and findings effectively among partner agencies, non-governmental organizations, universities, and the public;
- collaborate with state, provincial, and federal partners through existing organizations such as the LEC, ORFMT, ACRC, and others;
- support research that fills biological knowledge gaps pertaining to the distribution, habitat use, and ecological role of Bighead and Silver Carp; and,

- apply new or emerging science as tools or technologies develop to prevent introduction, minimize the effects, and prevent the spread of Bighead and Silver Carp

The ODNR-DOW response to Asian carp must also be adaptive, consistent with agency authority and responsibility, and sustainable. Adaptive approaches are essential to capitalize on new information or perspectives, whether derived from lessons learned through experimental management, collaborative insights, closing knowledge gaps, research, or discovery. Agency authority and responsibility identified in Ohio Revised Code (ORC) and Ohio Administrative Code (OAC) present legal sideboards associated with laws, regulations, and jurisdiction that must be considered. Sustainable approaches are essential because Asian carp present a long-term threat to many Ohio water bodies that the ODNR-DOW manages. As a result, tactical responses must be prudent and cannot tax agency resources to an extent that compromises the agencies mission and core responsibilities to manage fish and wildlife. Collaboration with partner agencies, federal support, and benefits from existing agency and partner work is critical to ensuring that an effective and meaningful response to Asian carp in Ohio is possible and sustainable.

IV. Overview: The Planning Environment

The ODNR-DOW operates under an organizational approach referred to as a Comprehensive Management System, or CMS (CMS Steering Committee 2011), a process for agency function that includes four key components: 1) inventory and survey; 2) strategic (long-term) and tactical (10 years or less) planning; 3) operational planning (annual); and 4) evaluation. This approach is supported by the USFWS through guidance provided by the *Comprehensive Management System Grant: Chapter 4*. The CMS is a process that allows for continual improvement of our agency and the management of fish and wildlife resources in Ohio through adaptive adjustments in mission, vision, direction, planning, and operations.

The ODNR-DOW *Strategic Plan* is the part of the CMS that provides broad, long-range direction for fish and wildlife conservation in Ohio (Appendix 3). ODNR-DOW tactical and operational plans represent additional components of the CMS that provide greater detail and are subject to routine updating as needed during the longer *Strategic Plan* time horizon (2011-2030). The *Asian Carp Tactical Plan* provides specific direction for addressing these invasive species in Ohio during 2014-2020. This plan identifies issues and desired outcomes (goals), each with specific objectives, problems, and strategies or needs to be addressed during the next seven years. Issues and desired outcomes (goals) requiring attention in each watershed directly support one or more strategic actions (termed “Our Direction” in the *Strategic Plan*) and identify specific milestones to be accomplished by implementing one or more activities conducted through the annual *Operational Plan* via operational projects.

Division of Wildlife Tactical Plans has the following elements:

Background and Situation Analysis: This section presents a brief history, overview, and current status or issues associated with each subproject or area of interest. It provides insights regarding situational strengths, weaknesses, opportunities or threats through a survey and inventory of the management, research, and conservation environment. While it may reflect on the past, it may also include current data and projections related to the future.

Issues: Issues flow from the background and situation analysis, survey and inventory, and expert knowledge of the resource. These are big picture topics that require attention for conservation actions to move forward in a particular resource area of interest. There may be one or more issues that are prioritized to address during the life of the plan.

Outcomes (Goals): Stated end points, benefits, results, or targets to be achieved, from which the quality, effectiveness, or success of work can be determined and the result or effect of having met the objectives. *In Ohio, these outcomes are essentially goals that are associated with important issues or high priority management levers and are stated as the desired future condition.* Outcomes are linked to the ODNR-DOW *Strategic Plan* via “Supporting Strategic Actions” associated with the plan cornerstones of Stewardship, Opportunities, Connections, Traditions, and Excellence.

Objectives: Concise, specific statements of what exactly will be accomplished. These accomplishments may be expressed as a quantity, a deadline, and/or the required quality of the accomplishment. *Objectives should be quantifiable and measurable to facilitate evaluation and support, and flow from outcome statements to achieve the desired condition.* Objectives are linked to the annual ODNR-DOW *Operational Plan* via “Supporting Actions”, which provide specific operational project numbers and titles when available.

Problems: A specific factor that may limit the agency’s ability to achieve goals and objectives. *These should be concise but descriptive statements about factors that may prevent or limit progress toward achieving an objective and its associated outcome.*

Strategies/Needs: Methods or approaches for achieving goals and/or objectives. *The USFWS also identifies these as “needs,” which are defined as whatever is or may be required to overcome problems. These may be viewed as actions or tools that must be applied to make significant progress toward the objective and associated outcome. These will generally be less specific and detailed than problem statements and objectives, and can be viewed as foundations for operational planning.*

The Asian Carp Tactical Plan is:

- **Available for public review and comment:** The plan is intended to keep the ODNR-DOW Fish Management and Research Group on track in addressing the highest priority issues related to Asian carp in Ohio during the next seven years. Although the plan is written as a technical document it is available for public review and comment by all stakeholders.
- **Only effective if routinely evaluated:** The plan will require routine 2-year evaluations to make necessary adjustments in plan elements or operational projects. Annual performance reports

from operational projects related to this plan should allow fine-scale adjustments in budgeting personnel and non-personnel costs of activities, and facilitate achieving tactical outcomes and objectives.

The Asian Carp Tactical Plan is not:

- **All encompassing:** The plan does not address every issue related to Asian carp in Ohio; rather, it represents the highest priority outcomes and objectives identified at this time, many of which may be accomplished during 2014-2020. During this period, additions or deletions of outcomes and objectives, or their priority among resource management may change as needs change. Some overlapping material can be found in the ODNR-DOW *Fisheries Tactical Plan, Aquatic Stewardship Chapter*.
- **Restrictive:** The plan is not intended to be restrictive. Important opportunities or issues not included in this plan are likely to arise during the next seven years and we would be remiss not to respond with revisions of tactical direction. The plan is not intended to prevent taking advantage of opportunities or restrict responses to emerging concerns.
- **An endpoint:** Completion of this plan is not considered an endpoint; rather, a guide to address the challenges outlined in this document and a continuation of the CMS cycle.

Implementation of the *Asian Carp Tactical Plan* begins February 2014. The structure of this plan is important for successful implementation of both tactical and operational activities given the CMS. Tasks and timelines should be established to address specific objectives. Many of the outcomes and objectives can be addressed through coordinating efforts within the Fish Management and Research Group. However, cooperation with anglers, other ODNR-DOW groups, ODNR Divisions, university research partners, neighboring state and provincial agencies, non-governmental organizations and other external entities will also be important.

The 2014-2020 *Asian Carp Tactical Plan* provides a foundation for not only our on-the-ground work during the next seven years, but future planning activities as well. Experience gained from plan development and implementation should ensure progress and continual improvement well into the future.

V. Lake Erie Watershed

Background and Situation Analysis

Ohio's jurisdiction of Lake Erie includes 937,000 ha (2.3 million acres) of Lake Erie proper, 502 km (312 mi) of shoreline, and all associated Ohio tributaries. However, due to the inter-jurisdictional nature of Lake Erie fisheries, they are managed cooperatively by Michigan, Ohio, New York, Pennsylvania and the Province of Ontario under auspices of the *Joint Strategic Plan for Management of Great Lakes Fisheries* (GLFC 2007) through the LEC of the GLFC. All jurisdictions manage the fishery resources and the factors affecting them cooperatively through consensus-based decision making.

Ohio's Lake Erie recreational fisheries are economically important. Each year anglers expend nearly 4 million angler hours to harvest 2.7 million kg (6 million lbs) of fish, generating over \$760 million in economic revenue for the region (Southwick Associates 2012). Whereas exact numbers of anglers using Lake Erie fisheries are unknown, information from Ohio fishing license sales, the USFWS (U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau 2012), and Southwick Associates (2012) suggests that more than 332,000 anglers fish Lake Erie each year. These anglers provide more than \$486 million in direct retail sales and support over 7,000 jobs. Included among these is the Ohio charter boat fleet, the largest in the Great Lakes, of approximately 750 licensed guides (Lucente et al. 2013). Ohio's recreational fisheries target a host of species including Walleye *Sander vitreus*, Yellow Perch *Perca flavescens*, Smallmouth Bass *Micropterus dolomieu*, Largemouth Bass *Micropterus salmoides*, White Bass *Morone chrysops*, and Steelhead *Oncorhynchus mykiss*. Walleye is the most sought after species, while Yellow Perch provide the highest catch rates.

Ohio's Lake Erie also supports a commercial fishery that annually lands over 1.8 million kg (4 million lbs) of fish, with a landed value of over \$4 million (ODNR 2013b). This fishery consists of 18 commercial trapnet licensees and 29 commercial seine licensees. Commercial trapnets primarily harvest species for the wholesale fresh and frozen fish markets. Commercial seines harvest for both the fresh and frozen markets, live fish supply markets in large metropolitan areas, and private pay lakes in Ohio and Indiana. Over 60% of the commercial harvest from Lake Erie consists of fishes that are under-utilized by the recreational fishery (e.g., White Bass, White Perch, Freshwater Drum *Aplodinotus grunniens*, and Channel Catfish *Ictalurus punctatus*); however, Yellow Perch represent over 70% of the total landed value of the commercial catch. Ohio's annual commercial harvest of Lake Erie Yellow Perch averages 680,389 kg (1.5 million lbs).

Ohio's Lake Erie also supports a number of threatened and endangered species, and species of special concern including Ciscoes *Coregonus artedi*, Lake Sturgeon *Acipenser fulvescens*, and Lake Whitefish *Coregonus clupeaformis* which were all historically important in commercial fisheries (<http://www.dnr.state.oh.us/tabid/5664/default.aspx>). Lake Whitefish currently support a limited commercial fishery in Lake Erie, while Lake Sturgeon and Ciscoes are restricted from harvest for both recreational and commercial fisheries. Other species, including Pugnose Shiner *Notropis anogenus*, Longnose Sucker *Notropis longirostris*, Burbot *Lota lota*, Lake Trout *Salvelinus namaycush*, and Channel Darter *Percina copelandi* are listed as threatened, endangered, or of special concern and contribute to the biodiversity of the Lake Erie fish community.

Lake Erie has been the unfortunate recipient of a number of aquatic invasive species over the past century (Mills et al. 1994). Most of the major introductions prior to 1980 were fishes that entered the lake through the Welland Shipping Canal, including Sea Lamprey *Petromyzon marinus*, Alewife *Alosa pseudoharengus*, and White Perch *Morone americana*. Other non-native fishes, including Rainbow Smelt *Osmerus mordax* and Common Carp, were intentionally introduced. All of these species have naturalized, reproducing populations in Lake Erie at present, and Common Carp, Smelt, and White Perch provide fishery benefits, but at a much lower value than native species. After 1980, the most important source of introductions to Lake Erie has been through ballast water discharge from commercial freighters. Species introduced through this vector include Zebra Mussels *Dreissena polymorpha* and Quagga Mussels *Dreissena rostriformis bugensis*, Round Goby *Neogobius melanostomus*, Spiny Water Flea *Bythotrephes longimanus* and Fishhook Water Flea *Cercopagis pengoi* and the Bloody Red Shrimp *Hemimysis anomala*. The long-term effects of invasive species on the native fauna of Lake Erie and its fisheries are uncertain, but are clearly not beneficial. Control programs have been implemented only for Sea Lamprey and these generally cost \$18 million per year to administer (http://www.glf.org/staff/PRCE_10.pdf). Prevention of established, reproducing populations of invasive species in Lake Erie is, by far, the only control strategy. Once established, as with most non-native invasive species, the only effective means of addressing them is to consider what compensatory actions might be necessary and available to mitigate the negative effects on the native fish community.

History of Bighead and Silver Carp in Lake Erie

There have been three documented occurrences of Bighead Carp in Lake Erie, with all occurring in the late 1990s and early 2000s (Morrison et al. 2004). The first documented occurrence was a Bighead Carp captured in a commercial trapnet in Ohio waters off Cedar Point, Sandusky Bay, Ohio

during May 1995. The fish measured 606 mm and is archived at the Ohio State University Museum of Biological Diversity. Growth chronology analysis suggested that the fish was approximately six years old and growth checks suggested that the fish may have entered the Lake Erie environment during 1993 or 1994. The second documented occurrence was a Bighead Carp captured by a commercial seine in Sandusky Bay during June 2000. This fish measured 900 mm. No growth analysis was conducted on this individual and the specimen was not archived. The third documented occurrence was a Bighead Carp captured in a commercial trapnet in Ontario waters just west of Point Pelee during October, 2000. This fish was a mature female measuring 937 mm and is archived at the Royal Ontario Museum. Growth chronology analysis on this fish suggested that it was 8 to 10 years old at capture and may have been introduced into the Lake Erie environment during the same time period as the 1995 capture (Morrison et al. 2004). There have been no other captures of Bighead Carp in Lake Erie since 2000 and no documented occurrences of Silver Carp in Lake Erie to date.

University of Notre Dame, The Nature Conservancy, and USFWS eDNA Project

As a part of a Cooperative Environmental Studies Unit (CESU), since 2011 the University of Notre Dame (UND) Center for Aquatic Conservation and The Nature Conservancy (TNC) have funded a project to explore the detection and surveillance of Bighead and Silver Carp using environmental DNA (eDNA; DNA associated with shed or sloughed microscopic tissue fragments in the water column). Environmental DNA is being developed as an early detection tool to improve monitoring of invasive species such as Bighead and Silver Carp (Jerde et al. 2011). One objective of this project is to develop the eDNA surveillance techniques and transfer this technology through the USFWS and Canadian Department of Fisheries and Oceans (DFO) to state and provincial management agencies. As a part of this project, UND and TNC have also convened a Management Transition Board, consisting of representatives from state management agencies, to guide technology transfer and to help prioritize research that addresses management needs.

In August, 2011, in conjunction with these activities, ODNR-DOW and TNC collected 417 eDNA baseline samples from Maumee and Sandusky bays and Lorain Harbor. These collections were a part of more than 3,000 eDNA samples collected from across the Great Lakes by UND, TNC, and state and federal partners and screened for Bighead and Silver Carp eDNA. At the time of collection, it was considered highly unlikely that any of the screened samples would yield positive results, except for those taken in southern Lake Michigan, within close proximity to Lake Calumet and the Chicago Area Waterways System. However, upon analysis in 2012, six of the 417 western Lake Erie samples screened

for Bighead and Silver Carp eDNA tested positive. Two positive detections for Silver Carp occurred in Michigan waters of Maumee Bay, and four positive samples for Bighead Carp occurred in Ohio waters of Sandusky Bay (Figure 3 and 4).

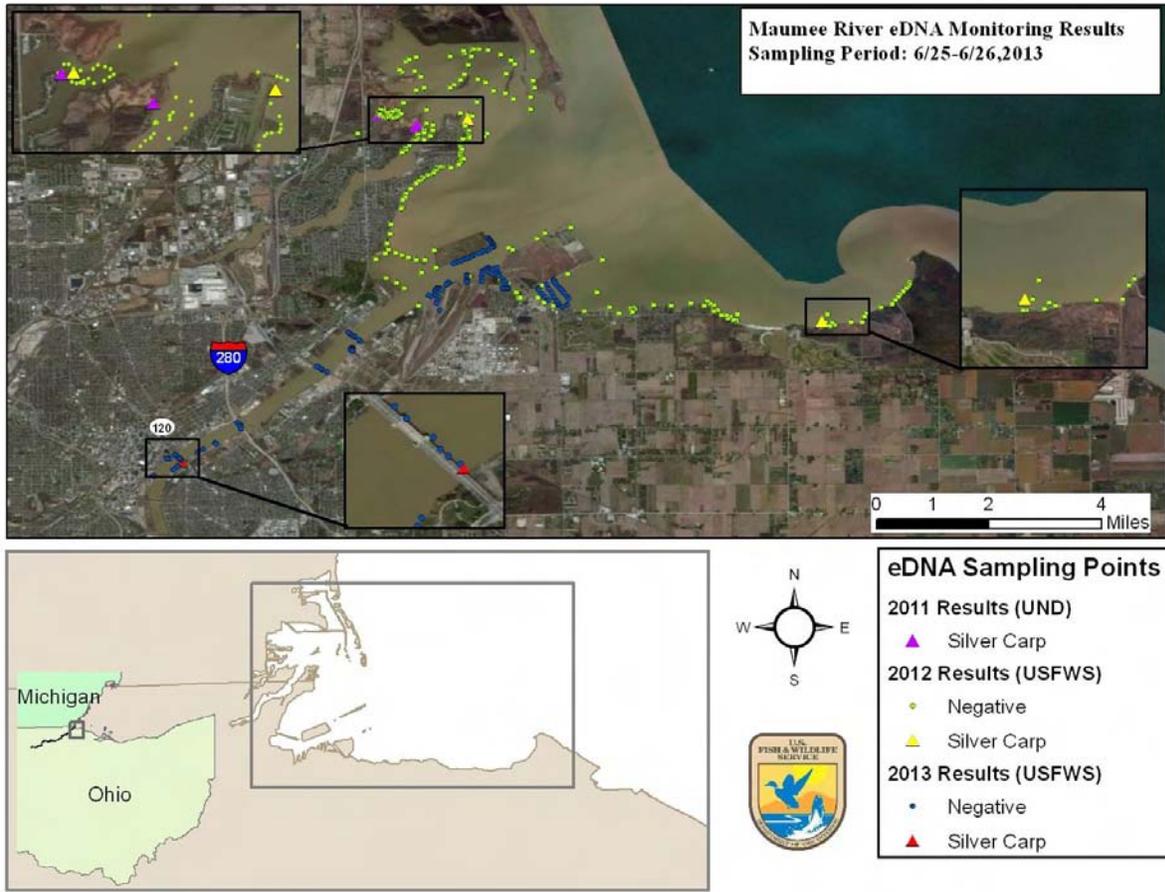


Figure 3. Positive detection of Silver Carp DNA in Maumee Bay, OH, 2011 – 2013.

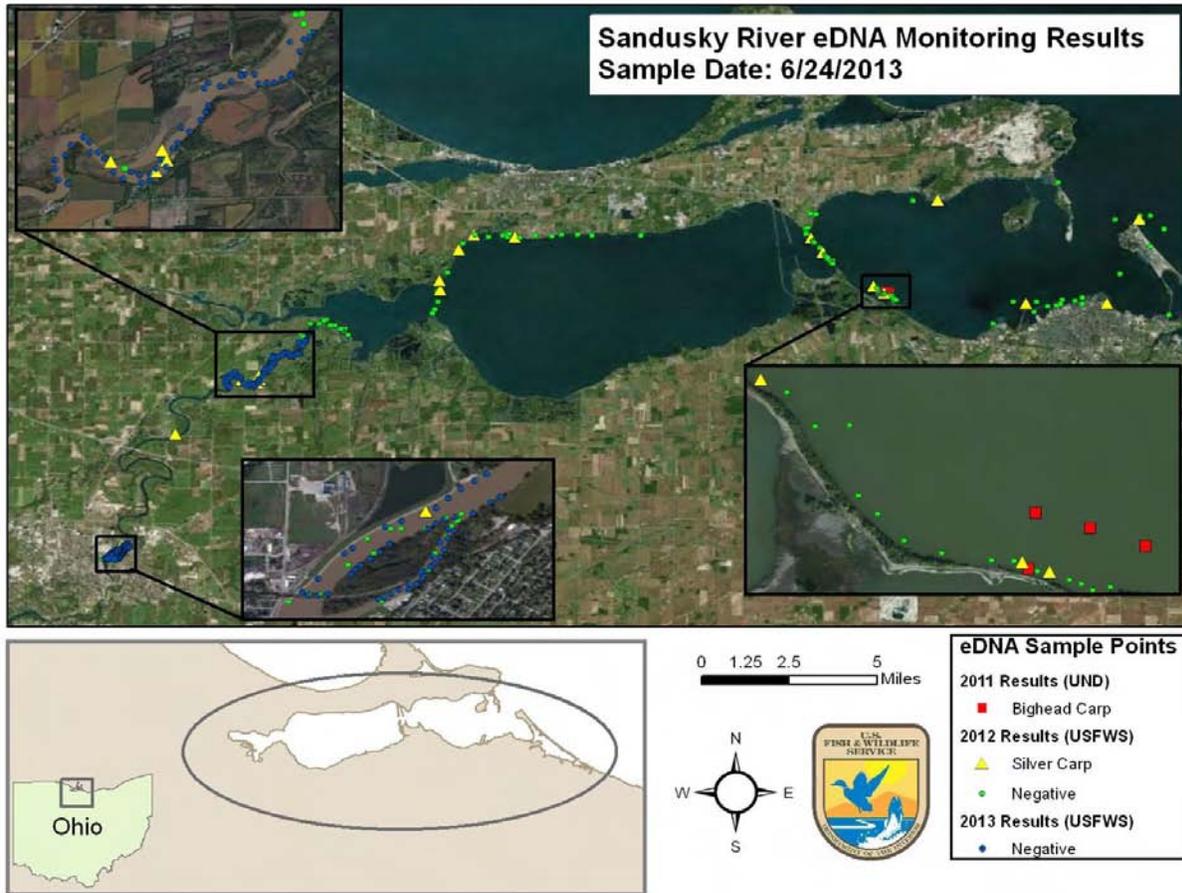


Figure 4. Positive detection of Bighead and Silver Carp DNA in Sandusky Bay, OH, 2011 – 2013.

2012 Rapid Assessment: Round 1

Survey Design: Because of the unexpected nature of these results, the ODNR-DOW, Michigan Department of Natural Resources (MDNR) and USFWS partnered to conduct a rapid assessment in an attempt to understand the extent and sources of this eDNA during mid-summer of 2012. As a part of this rapid assessment, all three agencies collaborated to develop an eDNA and traditional sampling survey in the western Lake Erie watershed that recognized specific areas that presented higher probabilities of establishment of Bighead and Silver Carp. Sampling locations and methodology were discussed jointly between ODNR-DOW, MDNR, and USFWS and selected based upon information on barriers, preferred Bighead and Silver Carp habitat, and existing nearshore fish community sampling plans. Environmental DNA samples were collected at 425 sites in the Maumee River and Bay and the Sandusky River and Bay in July of 2012 using a randomized block design, with probabilistic sampling within each block, for site selection in the bays. Additionally, an adaptive cluster design was used to

collect seventy-five samples at areas where positive eDNA samples were found in 2011. Sample site distribution included 200 eDNA samples collected in Maumee Bay, 100 eDNA samples collected in the Maumee River, 75 eDNA samples collected in Sandusky Bay and 50 eDNA samples collected in the Sandusky River using a randomized block design with probabilistic sampling. A total of 50 and 25 eDNA samples were collected in Maumee and Sandusky bays, respectively, using the adaptive cluster sampling design for a total of 500 eDNA samples collected in July of 2012. All eDNA samples were collected using established Standard Operating Procedures outlined in the *Monitoring and Rapid Response Plan for Asian Carp in the Illinois River and Chicago Area Waterways System* (ACRCC 2012) and processed at the U.S. Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC) in Vicksburg, MS.

Following the collection of eDNA samples during July of 2012, ODNR-DOW, MDNR, and USFWS conducted traditional sampling by electrofishing and gill netting at 16 sites in Maumee Bay, 12 sites in Sandusky Bay, 12 sites in the Maumee River, and 14 sites in the Sandusky River using a combination of randomized block design and adaptive cluster sampling. At each sample site, standard 10-min electrofishing transects were conducted, with only suspected Bighead and Silver Carp being targeted for capture. Additionally, large mesh gill nets were fished at seven and 10 sites in Maumee and Sandusky bay, respectively.

Results: Final results from the eDNA samples were made available to ODNR-DOW, MDNR, and USFWS during early-September. These results indicated that 20 of 150 samples from the Sandusky River and Bay and 3 of 350 samples from Maumee Bay were positive for Silver Carp eDNA. No positive detections were found in the Maumee River. In Sandusky Bay, positive Silver Carp detections occurred throughout the bay, whereas in the Sandusky River four of the positive detections were at downstream locations and one was upstream near Brady's Island, Fremont, Ohio. In Maumee Bay, two of the positive Silver Carp detections were at locations similar to those seen in 2011. The third positive detection occurred in the eastern portion of the bay near Maumee Bay State Park.

Electrofishing at 54 sampling locations in the Maumee River and Bay and the Sandusky River and Bay did not collect any Bighead or Silver Carp and produced no reportable or suspected sightings by the survey crews. The gill net collections at 17 sites in Maumee and Sandusky bays also showed no evidence of Bighead and Silver Carp.

2012 Rapid Assessment: Round 2

Survey Design: As a result of the positive eDNA detections in the Sandusky River and Bay during 2012, in early September, ODNR-DOW deployed crews in the river at the concentrated positive locations in the lower portion of the Sandusky River to conduct intensive electrofishing and larval sampling surveys. No Bighead or Silver Carp were detected in these initial surveys. Subsequent to this initial sampling, ODNR-DOW, MDNR, and USFWS conducted a second round of traditional sampling in the Sandusky River and Bay during September 2012. Sampling locations were selected based upon the randomized block design employed in the first round of sampling, with one sampling location within each of eight blocks in Sandusky Bay. Because Bighead and Silver Carp are notoriously difficult to catch with most conventional sampling gears, the second round of sampling employed unconventional methods, which included the use of electrofishing vessels to drive fish into blocking gill nets at each site. Additionally, spot or ambush electrofishing surveys were conducted at 12 sampling locations within each sampling block. Sampling locations in the Sandusky River were selected in two reaches where positive Silver Carp eDNA was detected. Within each reach, blocking gill nets were set and electrofishing boats were used to drive fish into the nets. Additionally, spot or ambush electrofishing surveys were conducted at three to four locations within each reach.

Combined electrofishing and blocking gill net sets at 10 sampling locations in the Sandusky River and Bay produced no reportable or suspected sightings of Bighead or Silver Carp.

Conclusions - 2012 Rapid Assessment: Several conclusions can be drawn from the results of the extensive eDNA and traditional sampling that occurred in the Sandusky River and Bay and Maumee River and Bay in response to the 2011 positive eDNA detections of Bighead and Silver Carp. First, if Bighead or Silver Carp are present in the Lake Erie system, they are likely in relatively low abundance. There is currently no evidence that Bighead or Silver Carp have established reproducing, self-sustaining populations in Lake Erie. They have been documented in the system; however, individuals have not been captured and reported to ODNR-DOW in more than a decade. A total of 500 eDNA samples collected across the western basin of Lake Erie revealed 23 positive detections, concentrated mostly in Maumee and Sandusky Bays and the Sandusky River. Electrofishing at more than 160 sampling locations, traditional gill netting at a total of 17 locations, and combined electrofishing and blocking gill net sampling at 10 locations failed to capture a single individual. In addition to this targeted sampling, nearly 830 commercial seine hauls were conducted in the Sandusky River and Bay during 2012. No Bighead or Silver Carp were reported in any commercial seine hauls. All commercial licensees are familiar with characteristics of Bighead and Silver Carp, some have reported Bighead Carp collections in

the past and were notified after positive eDNA collections in 2012 to report any suspected Bighead or Silver Carp.

Environmental DNA sampling techniques have been in development since 2009. The use of eDNA as an early detection tool presents enormous opportunities for AIS detection and control; however, there remain a number of uncertainties associated with interpretation of eDNA results. Positive eDNA results could be interpreted a number of ways, particularly when live specimens are not collected in conjunction with these results. Besides live specimens of Bighead and Silver Carp, other sources of eDNA in the Lake Erie environment could include commercial live haul water, bait transportation water, bird feces, or dead (market) fish (USACE 2012b). Therefore, additional research is needed on calibration of eDNA results, as well as persistence of eDNA in the environment, to assist management agencies in interpretation of eDNA results.

As a result of the findings and activities associated with the rapid assessment in 2012, the LEC established a position statement for Lake Erie fisheries management agencies that outlines strategies each agency should undertake to minimize the risk of establishment of Bighead and Silver Carp in the Lake Erie ecosystem within Michigan, Ohio, New York, Pennsylvania and Ontario (Appendix 5) (http://www.glfcc.org/lakecom/lec/LEC_docs/position_statements/LEC_Asian_Carp_Position%20Statement.pdf). Those strategies include: 1) a recognition that unified decision-making by the GLFC LEC is imperative to minimize risk of introduction; 2) state and provincial agencies should direct resources towards identification of sources and vectors for introduction of Bighead and Silver Carp into the Lake Erie ecosystem and minimize those risks; 3) state and provincial agencies should direct resources towards minimizing the risk of introductions of Bighead and Silver Carp through physical connections; 4) coordinated actions by state, provincial, and federal partners will be necessary; and 5) additional research is imperative to understand the tools available for detection, strategies for prevention, and strategies for control or mitigation of effects.

2013 Rapid Assessment

Follow-up eDNA sampling in Maumee Bay and Sandusky Bay was conducted in June 2013. In Maumee Bay, there were no detections for Bighead Carp and one detection for Silver Carp on the Maumee River (Figure 3). In Sandusky Bay, there were no detections for either Bighead or Silver Carp (Figure 4). Additional sampling will be conducted to determine the source of the Maumee River eDNA.

Issue: Established populations of Bighead and Silver Carp are not known to exist in Lake Erie, but may invade through multiple pathways and connections directly associated with the lake and hydrologic pathways connecting the Great Lakes and Mississippi River basins. ***It is imperative that every effort possible be made to prevent introduction of these fish into the Lake Erie watershed.*** If introduced into the lake, successful reproduction is considered possible in several Ohio tributaries including the Maumee and Sandusky rivers (Kocovsky et al. 2012). Once established, negative consequences are anticipated for highly valued Walleye, Yellow Perch, and Black Bass fisheries (Dr. Edward Rutherford, NOAA-GLERL, personal communications). No known controls currently exist for established populations of Bighead and Silver Carp.

Outcome 1: Bighead and Silver Carp are prevented from becoming established in Lake Erie.

Supporting Strategic Actions from the ODNR Division of Wildlife strategic plan:

- Stewardship: 1.6, 1.7
- Opportunities: 2.10

Objective 1.1: Create permanent hydrologic separation of Ohio's critical pathways near Little Killbuck Creek, Ohio-Erie Canal at Long Lake, and Grand Lake St. Marys by 2017 and support activities taking place to create hydrologic separation at Eagle Marsh south of Ft. Wayne, Indiana in the headwater of the Maumee River.

Problems:

- Four critical pathways have been identified in Ohio as potential sources of Bighead and Silver Carp introduction from the Mississippi River watershed (USACE 2012a). Two are considered medium risk, Little Killbuck Creek and Ohio-Erie Canal at Long Lake, and two are considered low risk, Grand Lake St. Marys and Mosquito Creek Lake.
- Eagle Marsh, Indiana is a pathway of medium risk for the transfer of Bighead and Silver Carp to Lake Erie.
- Creating permanent separation of critical pathways requires funding, private-public partnerships, inter-agency cooperation, and can involve extensive engineering plans, design, and construction.

Strategies:

- Leverage Great Lakes Restoration Initiative (GLRI) funds to address critical pathway closures to the greatest extent possible.

- Work with a private landowner and other state agencies to facilitate closure of the Little Killbuck Creek pathway.
- Work with the City of Akron and the USACE to close the pathway at Ohio-Erie Canal at Long Lake.
- Work with Ohio State Parks and the USACE to close the pathway at Grand Lake St. Marys.
- The Mosquito Creek Lake connection has been determined to be the lowest risk connection in Ohio. The strategy is to further evaluate this connection to determine what action is appropriate.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FCGX03: Great Lakes Restoration Initiative AIS Grant

Objective 1.2: Collaborate with ACRCC, USACE, USFWS, and other partners to support permanent hydrologic separation of the Mississippi River and Great Lakes basins at the Chicago Area Waterway System (CAWS) so that a strategy for separation is identified as soon as possible and no later than 2018.

Problems:

- The CAWS provides the single greatest risk of Bighead and Silver Carp invasion to the Great Lakes (ACRCC 2010; USACE 2012a; GLC 2012).
- A series of electric barriers are currently the only obstacle between Illinois River populations of Bighead and Silver Carp and Lake Michigan.
- Progress in planning and implementing permanent separation of the Illinois River and Lake Michigan is logistically complex and therefore, slow.
- Three solutions proposed by the GLC and the Great Lakes St. Lawrence Cities Initiative (2012) would require \$3-10 billion and 15-20 years to complete.
- USACE is currently evaluating a range of options and technologies to prevent the transfer of AIS between the Great Lakes and Mississippi River basins by aquatic pathways, with a report due to Congress by January of 2014.

Strategies:

- Participate in ACRCC meetings and communications.
- Provide department-level support for permanent separation of the basins at the CAWS.
- Work with other Great Lakes partners to support permanent separation of the basins at the CAWS.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FFDX02: Lake Erie Fisheries Management (secondary objective)
- FCGX03: Great Lakes Restoration Initiative AIS Grant

Objective 1.3: Use annual inter-agency fish sampling, recreational, and commercial catch reporting to monitor for the presence of Bighead and Silver Carp in Lake Erie.

Problems:

- Presence of Bighead and Silver Carp in Lake Erie is poorly understood.
- Three adult Bighead Carp have been caught in Lake Erie, one in 1995 and two in 2000.
- In 2011, UND found positive eDNA results for Bighead Carp in Sandusky Bay in 4 of 200 samples and for Silver Carp in 2 of 200 samples in Maumee Bay.
- In 2012, the USACE found positive eDNA results for Silver Carp in 20 of 150 samples from the Sandusky River and Sandusky Bay and 3 of 350 samples from the Maumee River and Maumee Bay.
- Sources of Bighead and Silver Carp eDNA in Lake Erie are unclear and eDNA technology is rapidly evolving.

Strategies:

- Monitor commercial catches as a means of Bighead, Silver, and Grass Carp surveillance.
- Record Bighead and Silver Carp catches during routine fish sampling with existing projects as a means of surveillance.
- Share results of sampling among agencies and jurisdictions to communicate lake-wide surveillance efforts on an annual basis through the annual LEC/STC update.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FCGX03: Great Lakes Restoration Initiative AIS Grant
- FSNS01: Lake Erie Commercial Fisheries Management (secondary objective)
- FSDS01: Lake Erie Fisheries Assessment (secondary objective)
- FFDX02: Lake Erie Fisheries Management (secondary objective)

Objective 1.4: Cooperate with the USFWS in eDNA sampling efforts in tributaries, bays, and the main lake.

Problems:

- Early invasion of Lake Erie by Bighead and Silver Carp may be difficult to detect with standard fisheries surveys and commercial catch monitoring.
- Collection of sufficient numbers of samples of eDNA is challenging in a waterbody the size of Lake Erie.
- Positive results from eDNA sampling are difficult to interpret due to multiple potential sources of DNA introduction (e.g. contaminated water, equipment, or bird feces) in a waterbody and strategies to address them are limited in open waters of the Great Lakes.

Strategies:

- Assist with collection of eDNA samples by the USFWS to the extent possible.
- Work with partner agencies and organizations to better understand and interpret results and understand potential sources of eDNA.
- Monitor current research and development of emerging eDNA technology.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FCGX03: Great Lakes Restoration Initiative AIS Grant

Objective 1.5: Prevent accidental importation of juvenile Bighead and Silver Carp via bait dealers and fish transporters through annual notifications to bait dealers and fish haulers and monitoring of bait dealers during March to November.

Problems:

- Transportation of live fishes can be a significant vector for the introduction of invasive or undesirable fishes.
- ODNR-DOW authority is not clearly outlined within existing regulations and effectiveness of required reporting is unknown.
- Positive Bighead and Silver Carp eDNA has been detected during some bait shop testing.
- Bait dealers and fish haulers may not be aware of concerns regarding Bighead and Silver Carp.
- Suppliers of bait may originate from aquaculture facilities in the southern United States that contain Bighead and Silver Carp.
- Due to the USDA-APHIS Federal Order for VHS, risks of importation of bait from waters infested with Bighead and Silver Carp may have increased.

Strategies:

- Send a letter of notification annually to bait dealers and fish haulers alerting them to concerns regarding expansion of the range of Bighead and Silver Carp and of the laws concerning their movement.
- Revise ORC and OAC to allow ODNR-DOW staff to more effectively track positive eDNA or other occurrences.
- Annually conduct random eDNA tests of bait tanks and fish haulers during months when baitfish are imported and track positive eDNA results to facilities of origin.
- Partner with other agencies (USFWS and Ohio Department of Agriculture (ODA)) to conduct inspections and track permits.
- Partner with the United States Department of Agriculture-Animal and Plant Health Inspection Service (USDA-APHIS) and ODA to address state and federal restrictions on bait movement within the Lake Erie drainage basin to minimize risks associated with VHS spread and Bighead and Silver Carp introduction.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FCGX03: Great Lakes Restoration Initiative AIS Grant
- LANX16: Wildlife Permitting
- LANX01: Rule Promulgation

Objective 1.6: Prevent deliberate sales or releases of live adult Bighead and Silver Carp via fish transporters and fish markets through annual notifications to fish haulers and fish markets and inspections of each.

Problems:

- Transportation of live fishes can be a significant vector for the introduction of invasive or undesirable fishes.
- As few as 10 released adult Bighead Carp or Silver Carp in close proximity may establish a population based on DFO risk assessment (Cudmore et al. 2012).
- Fish haulers and fish markets may not be aware of concerns regarding Bighead and Silver Carp.

Strategies:

- Send a letter of notification annually to fish haulers and fish markets alerting them to concerns regarding expansion of the range of Bighead and Silver Carp and legality of live transport of these fishes.
- Partner with other agencies (USFWS, United States Geological Survey-Lake Erie Biological Station (USGS-LEBS), ODA, Ohio Department of Transportation (ODOT), and OSP) to conduct inspections of loads from fish haulers and investigate illegal sales at fish markets.
- Revise OAC to define “dead” as “eviscerated” to prevent shipment of live fish.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FCGX03: Great Lakes Restoration Initiative AIS Grant
- LANX24: Wildlife Permitting

Objective 1.7: Continue sport fishery research to promote a future understanding of the role of Bighead and Silver Carp in food webs should they become established in Lake Erie.

Problems:

- Very little is known about the potential effects of Bighead and Silver Carp on food webs associated with important sport fish populations.
- Bighead and Silver Carp may, at some point, become part of the Lake Erie ecosystem.
- Other invasive species have had dramatic effects on nutrient dynamics, plankton communities, fish assemblages, and sport fisheries in Lake Erie (e.g., Sea Lamprey, White Perch, Round Gobies, and Zebra Mussels).

Strategies:

- Consider implications of Bighead and Silver Carp invasions and data gaps in sport fishery monitoring and the routine scoping of research projects.
- Consider, and if warranted, support additional modeling approaches to better define potential effects of Bighead and Silver Carp on sport fish populations in Lake Erie.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FCGX03: Great Lakes Restoration Initiative AIS Grant
- FSDS01: Lake Erie Fisheries Assessment (secondary objective)

VI. Ohio River Watershed

Background and Situation Analysis

The Ohio River watershed is a sub-basin within the Mississippi River basin that includes portions of 11 states and comprises 20 percent of the Mississippi River basin. Nearly 10 percent of the United States population lives in the 530,244 km² (203,940 mi²) Ohio River sub-basin. The Ohio River is formed in Pittsburgh, Pennsylvania by the confluence of the Allegheny and Monongahela rivers and flows 1,582 km (981 mi) to Cairo, Illinois where it enters the Mississippi River. Of this, 835 km (451 mi) border southern Ohio. A total of 69 tributaries with drainages greater than 2,600 km² (1,000 mi²) enter the Ohio River as it flows through Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois. The Tennessee, Wabash, and Cumberland rivers are the largest tributaries in the sub-basin, and account for approximately 20, 16 and 9 percent of the watershed, respectively (www.orsanco.org).

The Ohio River is an important source of water supply, commercial navigation, power generation, and recreation. Three million people currently use the Ohio River as a source of potable drinking water. Twenty navigational dams are operated and provide a 2.7 m (9 ft) minimum depth for commercial and recreational navigation. Over 207 metric tonnes (230 (English) tons) of cargo is transported on the river annually, composed primarily of coal and other energy products. Forty-nine power-generating facilities operate on the Ohio River and the combined capacity of these facilities exceeds 6% of the total generating capacity in the United States. Recreational fishing and boating also represents a significant portion of river use and these activities contribute to local and regional economies (Shell et al. 1996; Responsive Management 2009; Sindt in preparation; Singh and Bruskotter in preparation).

Approximately 159 fish species are found within the Ohio River and 285 are found within the basin (Wallus et al. 1990). Species composition and abundance have changed dramatically during the past century as a result of dam construction, pollution, and pollution abatement (Pearson and Krumholz 1984). The Ohio River contains 25 species of sport fishes and no fish species are federally listed as endangered, threatened, or candidate species.

Within the Ohio portion of the Ohio River watershed, the ODNR-DOW has the responsibility and authority to manage public fisheries within six major watersheds, the Great Miami, Little Miami, Scioto, Hocking, Muskingum, and Mahoning representing 13.1 million ha (32 million A) of drainage. Among these are 77 major streams that total 7,649 km (4,130 mi) and are associated with 1,856 named streams (Sanders 2002). Many of these rivers and streams provide valuable sport fisheries throughout the state.

Over two-thirds of Ohio's public fishing reservoirs are also within the Ohio River watershed. In total, Ohio is estimated to have 2,293 lakes and reservoirs ≥ 2 ha (5 acre), totaling 57,468 ha (142,006 acre) (ODNR 1980). Considering smaller waters, the U.S. Environmental Protection Agency (EPA) estimated that Ohio has 5,130 lakes, reservoirs and ponds totaling 76,267 ha (188,461 acre), whereas the ODNR estimated over 50,000 water bodies totaling 80,937 ha (200,000 acre) during this same time. Numerous small ponds counted by the ODNR were not identified by the USEPA due to differences in methods (Davic et al. 1996). The most recent estimate of all inland lentic waters, regardless of size, is over 52,000 ponds, lakes, and reservoirs statewide (Miami University 2005).

Ohio inland sport fisheries, including the Ohio River, rivers and streams, and lakes and reservoirs contribute \$2.1 billion annually to the economy (Southwick Associates 2012). These fisheries provide 14 million days of fishing for Ohio's 1.3 million anglers, and through this participation, support \$1.4 billion in retail sales and more than 18,000 jobs (Southwick Associates 2012).

Approximately 17 percent of Ohio anglers fish the Ohio River (unpublished data, Ohio State University). Results from a 2012 creel survey of waters bordering Ohio, Kentucky, and West Virginia indicated that fishing effort differed among species sought by anglers in pools and tailwaters. In pools, effort was greatest for Black Bass (45%), Catfishes (27%), "anything" (18%), Walleye and Sauger *Sander canadensis* (4%), and Morone spp. (primarily White Bass and Hybrid Striped Bass *Morone saxatilis* X *Morone chrysops* (2%). In tailwaters, effort was greatest for "anything" (42%), followed by Morone spp. (24%), Walleye and Sauger (13%), Catfishes (13%), and Black Bass (3%) (Sindt 2013 in preparation). Only 27 percent of interviewed anglers indicated that they harvested fish from the Ohio River, but they averaged 35 days fishing the river during 2011.

Although the ODNR-DOW is responsible for managing these fisheries, controlling authorities vary among lakes and reservoirs statewide, shore access can be limited along rivers and streams, and shared jurisdiction with neighboring states are among the major challenges the ODNR-DOW faces acting on its authority to manage fisheries. This is relevant in addressing all AIS, but particularly Bighead and Silver Carp. The ODNR-DOW owns very little public water and shore or bank access, thus necessitating good relationships and cooperation with controlling authorities, landowners, and inter-jurisdictional partners. Similarly, watershed health directly influences the success of sport fishes in all public waters, yet the ODNR-DOW has little influence or statutory authority to address negative effects of poor land management or use on water quality, making good inter-agency cooperation imperative and effective partnerships important. In addressing AIS, such as Bighead and Silver Carp, effective partnerships, good public communication is essential as well.

History of Bighead and Silver Carp in the Ohio River Watershed

Adult Bighead Carp have been reported by Ohio River anglers between Cincinnati, Ohio and Wheeling, West Virginia during the past several years, but in very low numbers. The first Bighead Carp found in the Ohio River was near Smithland Dam in 1981 and Bighead and Silver Carp are now abundant below McAlpine Dam (Figure 1, pg. 10, and Figure 5). Two adult Silver Carp were collected in Ohio waters during June 2012 by the Ohio River Valley Water Sanitation Commission (ORSANCO) in the Great Miami River, Markland Pool. In a follow-up sampling effort, two additional adult Silver Carp were collected in the Great Miami River and another was collected in Big Indian Creek, also in the Markland Pool section of the Ohio River. Since then, angler reports have become commonplace in the Markland and Meldahl pools, including a report of 60 dead Bighead and Silver Carp near Meldahl Dam on June 5, 2013.

During April through September 2013, commercial fishers contracted to collect Bighead and Silver Carp by the KDFWR fished 110,303 m (361,885 ft) of gillnets and collect 34 Bighead and 48 Silver Carp in Greenup, Meldahl, Markland, and McAlpine pools. All Bighead Carp exceeded 102 cm (40 in) and most Silver Carp exceeded 76 cm (30 in). The fish captured furthest upstream was one Bighead Carp below R. C. Byrd Dam (Greenup Pool) during April (KDF2013).

In other Ohio waters of the Ohio River watershed, only two Bighead Carp have been identified. During 2003, a Bighead Carp was captured in Glacier Lake near Youngstown, Ohio. During 2009, a Bighead Carp was reported at a pond on Wright Patterson Air Force Base (Dayton, OH), but follow-up surveillance did not locate additional fish. This fish, captured by an angler, was believed to be a stowaway in a shipment of fishes to the pond.

Ohio River Fisheries Management Team

The ODNR-DOW works closely on Ohio River issues with natural resource management agencies in Pennsylvania, West Virginia, Kentucky, Indiana, and Illinois through the ORFMT. This team engaged stakeholders to participate in development of the *Ohio River Sub-basin Asian Carp Action Plan* (Conover 2013) during 2012. The *Asian Carp Tactical Plan* complements the ORFMT plan, just as the ORFMT plan complements the *Management and Control Plan for Bighead, Black, Grass, and Silver Carp in the United States* (Conover et al. 2007) developed by the Asian Carp Working Group, Aquatic Nuisance Species Task Force.

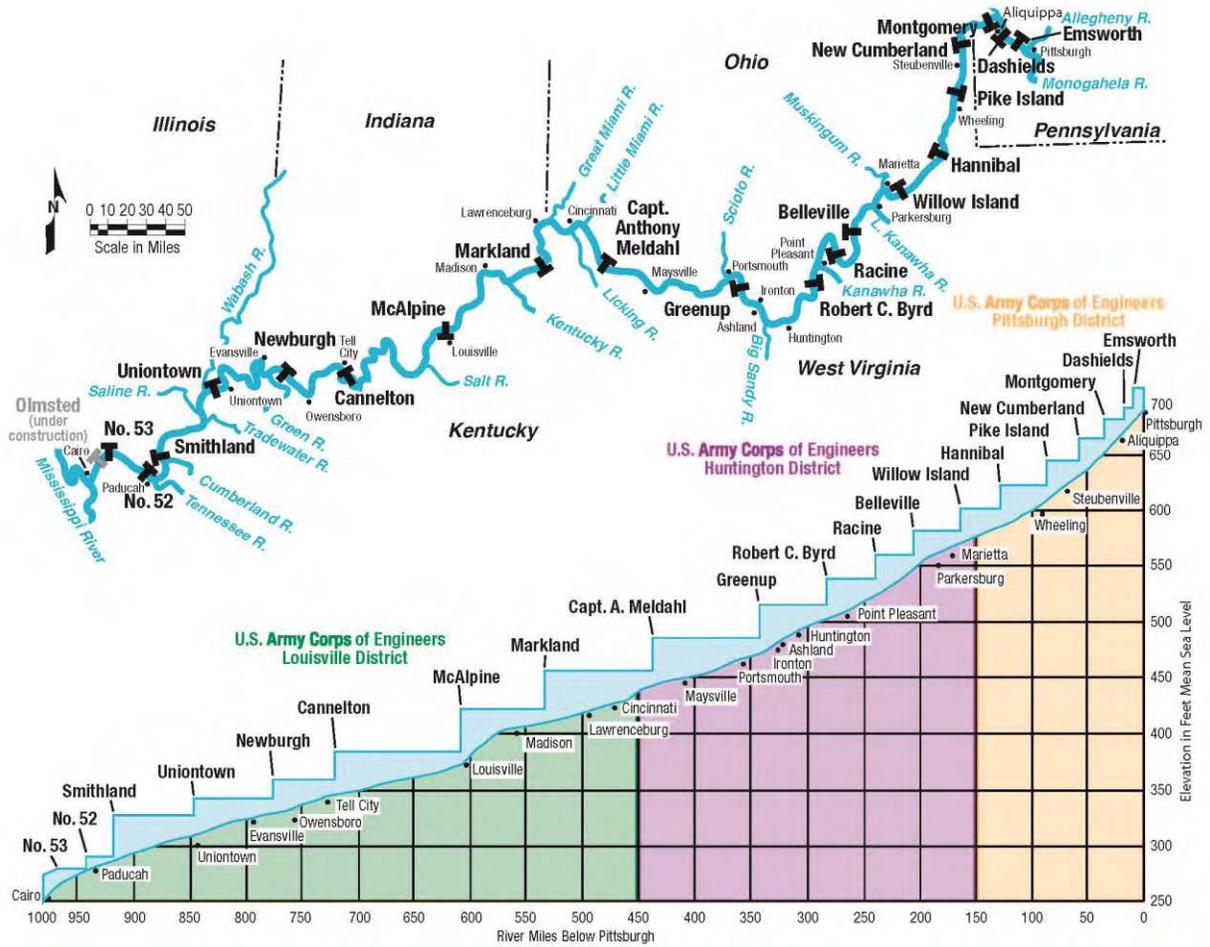


Figure 5. U.S. Army Corps of Engineers lock and dam projects on the Ohio River (courtesy of the U.S. Army Corps of Engineers).

The ORFMT was formed in 1990 to develop an inter-jurisdictional perspective to management of Ohio River fisheries. Impetus for the formation of the team was United States Supreme Court settlements that changed jurisdiction of the Ohio River from the exclusive jurisdiction of Kentucky, West Virginia, and Pennsylvania to concurrent jurisdiction along the Kentucky border with Kentucky and Ohio, Indiana, and Illinois. The Ohio Decree was entered on April 15, 1985 (Ohio v. Kentucky, 471 U.S. 153); the Indiana Decree was entered on November 4, 1985 (Indiana v. Kentucky, 474 U.S. 1); and, the Illinois opinion was decided on May 28, 1991 (Illinois v. Kentucky, 500 U.S. 380, No. 106, Orig.) (www.megalaw.com/fed/usopinions.php3). Shared jurisdiction necessitated cooperative management and led to the development of a Memorandum of Understanding (MOU) among natural resource agencies that manage fisheries in Pennsylvania, West Virginia, Ohio, Kentucky, Indiana, and Illinois.

Team objectives specified in a MOU were to: 1) develop shared fisheries management objectives; 2) coordinate regulatory responsibilities, conduct joint management programs and facilitate technical information exchange among the states with other governmental, public, and private interests; 3) designate and maintain at least one representative from each state agency to serve on an “Ohio River Fisheries Management Team”; 4) convene at least annually to discuss, plan, and report on cooperative fisheries management efforts; 5) recognize that this MOU shall neither obligate the parties to expenditure of funds nor in any way affect the legal authorities vested in the individual states; and, 6) retain this memorandum of understanding until it is modified or terminated by those who signed this agreement.

Issue: *Bighead and Silver Carp are abundant west of McAlpine Dam in the downstream reaches of the Ohio River and are progressing upstream.* Ohio River locks and dams do not prevent upstream movement of Bighead and Silver Carp and these fishes are likely to populate unobstructed rivers and tributaries connected to the Ohio River if habitat is sufficient and suitable for reproduction. Expansion of Bighead and Silver Carp distribution in the Ohio River watershed should be prevented to the greatest extent possible. Whereas eliminating expansion within open systems is not currently feasible, preventing introductions of these fishes to closed systems or those with barriers to upstream migration (tributary impoundments) is possible and important. If found in impounded waters (ponds, canal lakes, upground reservoirs, tributary reservoirs), damage to sport fisheries may be rather limited because reproduction is not anticipated due to limited spawning habitat for Bighead and Silver Carp. However, fish at large increase risk of additional transfers to rivers and streams and Lake Erie, where natural reproduction of these fishes is likely and significant negative effects are anticipated.

Outcome 2: Bighead and Silver Carp are prevented from introduction into waters within the Ohio River watershed that are closed systems or have pre-existing barriers to natural immigration through tributaries.

Supporting Strategic Actions from the ODNR Division of Wildlife strategic plan:

- Stewardship: 1.6, 1.7
- Opportunities: 2.10

Objective 2.1: By 2016, reduce risk of accidental transfer of Bighead and Silver Carp by establishing OAC to restrict use of bait collected with a cast net, seine, fish trap, or other device to waters where bait was collected.

Problems:

- Gizzard Shad and Skipjack Herring *Alosa chrysochloris* are commonly collected as bait by anglers using cast nets in major rivers and reservoirs. It is not uncommon for this bait to be used in waters other than where it was collected.
- Gizzard Shad and Skipjack Herring are similar in appearance to juvenile Bighead and Silver Carp.
- Accidentally transferred juvenile Bighead and Silver Carp could survive and populate uninfected waters.

Strategies:

- Review existing OAC and make changes necessary to reduce the risk of accidental transfer of juvenile Bighead and Silver Carp by anglers collecting their own bait.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- LANX01: Rule Promulgation

Objective 2.2: Prevent accidental importation of juvenile Bighead and Silver Carp via bait dealers and fish transporters through annual notifications to bait dealers and fish haulers and monitoring of bait dealers and live fish transporters during March to November.

Problems:

- Transportation of live fishes can be a significant vector for the introduction of invasive or undesirable fishes.
- ODNR-DOW authority is not clearly outlined with existing regulations and effectiveness of required reporting is unknown.
- Positive Bighead and Silver Carp eDNA has been detected during some bait store testing.
- Bait dealers and fish haulers may not be aware of concerns regarding Bighead and Silver Carp.
- Suppliers of bait may originate from aquaculture facilities in the southern United States that contain Bighead and Silver Carp.
- Due to a USDA-APHIS federal order for VHS, risks of importation of bait from waters infested with Bighead and Silver Carp has increased.

Strategies:

- Send a letter of notification annually to bait dealers and fish haulers alerting them to concerns regarding expansion of the range of Bighead and Silver Carp.
- Revise ORC and OAC to allow the ODNR-DOW to more effectively track positive eDNA or other occurrences.
- Annually conduct random eDNA tests of bait tanks and live fish haulers during months when baitfish are imported and track positive eDNA results to facilities of origin.
- Partner with other agencies (USFWS, USDA, and ODA) to conduct inspections and track permits.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- LANX16: Wildlife Permitting
- LANX01: Rule Promulgation

Objective 2.3: Prevent deliberate sales or releases of live adult Bighead and Silver Carp via fish transporters and fish markets through annual notifications to fish haulers and fish markets and inspections of each.

Problems:

- Transportation of live fishes can be a significant vector for the introduction of invasive or undesirable fishes.
- As few as 10 released adult Bighead and Silver Carp may establish a population based on DFO risk assessment for the Great Lakes. This result is more likely in small waters with suitable habitat.
- Fish haulers and fish markets may not be aware of concerns regarding Bighead and Silver Carp.

Strategies:

- Send a letter of notification annually to fish haulers and fish markets alerting them to concerns regarding expansion of the range of Bighead and Silver Carp and legality of live transport.
- Partner with other agencies (USFWS, ODA) to conduct inspections of loads from fish haulers and investigate illegal sales at fish markets.
- Revise OAC to define “dead” as “eviscerated” to prevent shipment of live fish.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- LANX16: Wildlife Permitting

- LANX01 Rule Promulgation
- LANX24: Commercial Fish

Objective 2.4: Use annual agency fish sampling in reservoirs, inter-agency fish sampling on the Ohio River, and angler reporting to monitor Bighead and Silver Carp presence, distribution, rates of introduction, and expansion.

Problems:

- Bighead and Silver Carp are abundant in the lower Ohio River and expanding upstream.
- The distribution and abundance of Bighead and Silver Carp is not well understood in the middle and upper reaches of the Ohio River.

Strategies:

- Conduct standard Inland Management System surveys for sport fish in lakes and reservoirs and the Ohio River and record incidence of Bighead and Silver Carp.
- Share results of fish sampling on the Ohio River with the ORFMT.
- Encourage anglers to report Bighead and Silver Carp when caught or found through 1-877-STOP-ANS.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FIDS01: Inland Fisheries Assessment (secondary objective)
- FIDS01: Ohio River Fisheries Assessment (secondary objective)

Objective 2.5: Cooperate with the USFWS and ORFMT in a study quantifying Bighead and Silver Carp distribution and movement in the Ohio River during 2014-2016.

Problems:

- Distribution, rates of movement, environmental cues to movement, and habitat use of Bighead and Silver Carp in the Ohio River are not well understood, even in lower reaches where fish are abundant.
- Movement studies of Bighead and Silver Carp in the Mississippi and Illinois rivers suggest that lock and dam structures are not significant obstacles to inter-pool movement.
- Relations between Bighead and Silver Carp densities, environmental cues to behavior, and movement are poorly understood.

- Impacts of Bighead and Silver Carp on native fish communities are poorly understood.

Strategies:

- Provide intellectual, technical, and field support to the USFWS for the Bighead and Silver carp distribution and movement study.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- USFWS (Stewart 2013): Ohio River Asian Carp Monitoring and Assessment

Objective 2.6: Support eDNA sampling efforts in the Muskingum River in cooperation with Muskingum Watershed Conservancy District (MWCD) and TNC during 2014.

Problems:

- The Muskingum River is associated with two medium risk critical pathways of Bighead and Silver Carp introduction into the Great Lakes.
- The Muskingum watershed is Ohio's largest watershed within the Ohio River drainage and has 10 on-stream impoundments that provide over 16,000 acres of high quality fishing.
- Positive results from eDNA sampling are difficult to interpret due to multiple potential sources of DNA introduction in a waterbody and limited strategies to address them in flowing, open systems.

Strategies:

- Assist with collection of eDNA samples by TNC.
- Work with partner agencies to interpret results and better understand potential sources of eDNA.
- Monitor current research and development of emerging eDNA technology.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species

Objective 2.7: Continue sport fishery research to promote a future understanding of the role of Bighead and Silver Carp in the Ohio River and potential effects on sport fisheries in stream, river, lake, and reservoir ecosystems.

Problems:

- Very little is known about the potential effects of Bighead and Silver Carp on foodwebs associated with important sport fish populations in reservoirs, rivers and streams.

- Bighead and Silver Carp are established in the Ohio River and may be introduced to other inland waters.

Strategies:

- Consider the implications of Bighead and Silver Carp invasions and data gaps in sport fishery monitoring during routine scoping of sponsored and internal research projects.
- Consider, and if warranted, support modeling approaches to better understand potential effects of Bighead and Silver Carp on sport fish populations in the Ohio River and other inland waters.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FIDS01: Inland Fisheries Assessment (secondary objective)
- FIDS01: Ohio River Fisheries Assessment (secondary objective)
- (New research projects, if necessary)

Objective 2.8: Obtain dedicated federal funding for the Ohio River sub-basin to support measures to prevent further expansion of Bighead and Silver Carp within the Ohio River watershed, study Bighead and Silver Carp effects on the Ohio River ecosystem, and explore strategies for containment or control of established populations.

Problems:

- Federal funding available to address Bighead and Silver Carp management and research is limited in the Mississippi River basin and the Ohio River sub-basin.
- State AIS grant funds are limited and must be used on a variety of AIS initiatives.
- Private grants provide meaningful, but generally short-term, funds.

Strategies:

- Provide ODNR-DOW support for a consistent federal commitment of funds to support Bighead and Silver Carp management and research initiatives in the Mississippi River basin and the Ohio River sub-basin.
- Collaborate with MICRA, ORFMT, Ohio Environmental Council, and TNC to generate federal support for funding regional and state Bighead and Silver Carp plans in the Mississippi River basin and the Ohio River sub-basin.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FIDX02: Ohio River Management

VII. Grass Carp

Background and Situation Analysis

Grass Carp were first imported into the United States in 1963 in Stuttgart, Arkansas, as a tool for biological control of vegetation (Conover et al. 2007). However, concerns regarding these fish emerged less than 10 years later as feral populations became established in the White River, Arkansas and Mississippi River, Illinois. This prompted interest in the use of non-reproducing triploid Grass Carp to reduce environmental risk. Shortly thereafter, a commercial hatchery in Arkansas developed a commercially viable process for creating triploid Grass Carp that has led to sales of over 400,000 triploid Grass Carp per year in at least 30 states (Conover et al. 2007). Importation of triploid Grass Carp is permitted by the USFWS in order to track shipments and sophisticated ploidy testing is routine at production facilities.

Ohio does not allow for importation of diploid Grass Carp (OAC 1501:31-19-01), but has allowed importation of certified triploid Grass Carp (OAC 1501:31-19-01) since 1988. Ohio Administrative Code stipulates that individuals who import or sell triploid Grass Carp can only sell Grass Carp that are certified as triploid by the USFWS. Sellers must annually report in writing to the ONDR-DOW the total number of triploid Grass Carp sold and the total number purchased during each month, and must additionally notify in writing any sale of more than 100 triploid Grass Carp. This notification must include the name and address of the purchaser, the date of the sale, and the number of Grass Carp sold. Annual estimates of the number of fish imported are based upon the triploid Grass Carp reports submitted to the ODNR-DOW. For example, in 2012, the fish delivered to Ohio represent 97 separately tested lots with 120 fish per lot tested for ploidy before certification from the USFWS.

Triploid Grass Carp are commonly used in Ohio to control vegetation in small farm ponds and small private or public lakes. A total of 44,033 triploid Grass Carp were imported in 2011 and slightly fewer (41,733 fish) in 2012, which likely represents typical annual sales in Ohio. All of these fish came from one of four aquaculture facilities in Arkansas: Keo Fish Farms; J.M. Malone and Sons; Denton and Denton Fish Farms; and Hopper-Stephens Hatcheries, Inc. Each year these vendors make approximately 150 individual sales in Ohio, often to Ohio aquaculture facilities that resell fish in small quantities. During 1988-2003, the ODNR-DOW stocked 10,654 triploid Grass Carp in 27 small public lakes or wildlife area ponds to control vegetation.

Illegal diploid Grass Carp could put Ohio rivers, streams, and Lake Erie at risk by damaging habitats and altering fish communities given the documented reproduction of Grass Carp in large rivers. Grass Carp can also decimate submersed aquatic vegetation that is critical to migrating waterfowl and

other water birds. Grass Carp have been collected in both the Ohio River and Lake Erie watersheds. In the Ohio River watershed, one Grass Carp was collected in the Muskingum River in 2007 and another in the Ohio River, Belleville Pool in 2008, but their ploidy status was unknown. The first documented occurrence of Grass Carp in Lake Erie proper occurred in 1984 (Roger Knight, personal communication). Since then the ODNR-DOW has had several confirmed and unconfirmed reports of Grass Carp in the waters of Lake Erie proper, as well as in harbors and tributaries to Lake Erie.

In 2012, the ODNR-DOW began sampling individual fish that were collected in assessment surveys, or by commercial fishermen, and testing for ploidy status. All samples collected have been tested for ploidy by Dr. Jill Jenkins, USGS National Wetlands Research Center in Lafayette, Louisiana, or Jennifer Bailey, USFWS Whitney Genetics Laboratory in La Crosse, Wisconsin. Ploidy status of individual Grass Carp was determined using flow cytometry technology as established in Jenkins and Thomas (2007). For determining ploidy of feral carp, cells from the vitreous humor (fluid taken from the eye) are used and sample collection and preparation followed the standard operating procedure supplied by Dr. Jenkins' laboratory. In 2012, a total of 10 Grass Carp were collected for ploidy testing from Lake Erie and the Sandusky River. These Grass Carp were collected in commercial fishing trapnets and seines and reported to the ODNR-DOW between March 27 and October 9, 2012. Grass Carp tested for ploidy ranged from 44-103 cm (17-41 in) in length and weighed 1.0-13.2 kg (2.2-29.1 lb). Of the 10 Grass Carp sent to be tested, eight were tested (two were not due to equipment malfunctions), five were confirmed as diploid, two were confirmed as triploid, and one was undetermined due to sample degradation.

Beginning in 2013, ODNR-DOW staff initiated a statewide ploidy testing program on Grass Carp incidentally captured during standard assessment surveys in waters where triploid fish were not stocked for vegetation control. Fisheries personnel were supplied with a Grass Carp testing kit which includes instructions for extraction of eyeballs, handling and preservation, and shipping. All samples will be tested using flow cytometry at the USFWS Whitney Genetics Laboratory. Additionally, fin clips and otoliths will be analyzed to understand origins of wild-caught Grass Carp. To further these efforts, the ODNR-DOW recently updated Lake Erie commercial fishery catch reporting software used in Lake Erie to include grid-specific reporting on Grass Carp landed and added Grass Carp to the list of species that can be commercially harvested in Lake Erie.

During March and April of 2013, eight additional Grass Carp were collected in Ohio during standard assessment surveys and submitted to the USFWS Whitney Genetics Laboratory for ploidy testing. In the Ohio River watershed, these included one fish each from the Mad River, Scioto River, and

Hoover Reservoir and two fish from Hargus Lake. The fish from the Mad and Scioto rivers and Hargus Lake were all triploid, whereas the fish from Hoover Reservoir was undetermined. Grass Carp had been previously stocked in Hargus Lake by the ODNR-DOW. In the Lake Erie watershed, three Grass Carp have been collected and tested for ploidy. One fish from the Maumee River was determined to be diploid; the other two collected from Lake Erie proper and in the Cuyahoga River were determined to be triploid.

Evidence, including ploidy testing, fish size and age, and otolith microchemistry suggest that Grass Carp collected in the Sandusky River during 2012 were the result of successful reproduction in that river (Chapman et al 2013). Although this is the first indication of natural reproduction of Grass Carp in Ohio, evaluation of reproductive potential through ploidy testing did not begin until 2012. Grass Carp have been observed in Ohio's Lake Erie since 1984; therefore, it is possible that diploid Grass Carp have been in Lake Erie for several years. An episodic flooding event, like that which occurred in the Lake Erie western basin watershed during 2011, may have established conditions suitable for reproduction. Diploid Grass Carp are not unique to the Ohio portion of Lake Erie or the Great Lakes. They have also been documented in the Michigan portion of Lake Erie near the "hot ponds" of the Detroit Edison Monroe Power Plant and several locations in Lake Calumet and tributaries of Lake Michigan (Marion Wittmann, UND, personal communication).

An issue regarding Grass Carp in Ohio is that fish transported and sold as triploids could be diploids, or mixed with diploids, and could escape waters where they were stocked and establish reproducing populations. Although there is no definitive information on the impact of Grass Carp in natural systems, the main concern is that an established population of Grass Carp will reduce aquatic vegetation and could negatively impact native fish populations. Continued monitoring of imported Grass Carp through a permit process and testing of ploidy status of wild-caught fish found beyond waters where they were originally stocked is prudent. Communicating results between neighboring states will be important in both the Lake Erie and Ohio River watersheds.

Issue: *Diploid Grass Carp have been found in Ohio.* Diploid Grass Carp must be prevented from becoming established in Ohio. If these fish successfully reproduce in Ohio, feral populations could negatively affect native habitats, ecosystem integrity, and sport fisheries.

Outcome 3: Populations of feral Grass Carp are prevented from becoming established in Ohio.

Supporting Strategic Actions from the ODNR Division of Wildlife strategic plan:

- Stewardship: 1.6, 1.7

Objective 3.1: Continue annual surveillance via testing ploidy status of Grass Carp caught outside of stocked waters in cooperation with USFWS to determine the extent of a potential problem.

Problems:

- Diploid Grass Carp have been found in private waters.
- Diploid Grass Carp have been found in un-stocked public waters (Sandusky and Maumee rivers).
- Fish haulers could potentially mix batches of triploid and diploid Grass Carp to increase profits.
- Grass Carp may escape waters where they are stocked.

Strategies:

- Test all Grass Carp collected from waters where they were not stocked using collections from the commercial fishery and fisheries assessment projects in Lake Erie and inland waters.
- Selected diploid Grass Carp collected in the Lake Erie watershed will be tested using microchemistry to determine if they were the result of natural reproduction.
- Monitor frequency of diploid and triploid Grass Carp collected from those waters where Grass Carp have not been intentionally stocked.
- Implement a “no live release” of captured Grass Carp in waters not stocked with triploid fish.
- Actively engage in discussions with the ACRCC, USFWS, USGS, Great Lakes states and Canada about next actions to address knowledge gaps about Grass Carp population status in the Great Lakes, evaluate risk from this species, and potential development of integrated pest management strategies to control impacts of feral, naturally reproducing Grass Carp.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FSNS01: Lake Erie Commercial Fisheries Management (secondary objective)
- FSDS01: Lake Erie Fisheries Assessment (secondary objective)
- FIDS01: Inland Fisheries Assessment (secondary objective)
- FIDS01: Ohio River Fisheries Assessment (secondary objective)

Objective 3.2: Each year, verify use of the USFWS ploidy certification program, randomly inspect shipments of Grass Carp delivered in Ohio, and fine violators who illegally import diploid Grass Carp.

Problems:

- Diploid Grass Carp are legal for sale in other states and potentially could be mixed with loads of triploid Grass Carp.
- Loads of imported Grass Carp are not routinely monitored.
- Risk to fish haulers of mixing diploid and triploid Grass Carp in single loads is minimal.

Strategies:

- Develop a procedure to verify use of the USFWS ploidy certification program for accuracy and compliance.
- Purchase small loads of Grass Carp for ploidy testing.
- Establish a schedule for random inspections of loads.
- Increase legal consequences for illegal importation of diploid Grass Carp.
- Work with the Great Lakes Fisheries Commission, Association of Fish and Wildlife Agencies and others to eliminate diploid Grass Carp transportation to uncontaminated waters/states.
- Change OAC to lower the reporting threshold for reporting the sale of Grass Carp.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- LANX16: Wildlife Permitting
- LANX24: Commercial Fishing

Objective 3.3: Work with the Aquatic Nuisance Species Task Force, Great Lakes Basin Panel on AIS and the Mississippi River Basin Panel on AIS to urge the prohibition of diploid Grass Carp in the United States.

Problems:

- Diploid Grass Carp are legal to stock in some states.
- Availability of diploid Grass Carp creates an opportunity for illegal sales of diploid Grass Carp in states where only triploid Grass Carp are legal.

Strategies:

- Promote a regional discussion of Grass Carp use and potential threats of diploid Grass Carp.
- Participate in a regional risk assessment for Grass Carp in North America.
- Develop specific actions to eliminate Grass Carp in Great Lakes.

- Develop rapid response plan to eliminate Bighead, Silver, and Grass Carp from becoming established in waters of the Great Lakes.

Supporting Actions:

FCGX02: Statewide Management of Aquatic Invasive Species

IX. Communication

Background and Situation Analysis

Actions of the ODNR-DOW are part of a coordinated national response to the Asian carp invasion. Issues related to AIS transcend the responsibility and authority of a single jurisdiction or agency. Therefore, the ODNR-DOW must effectively communicate internally and externally through prescribed strategies to share new information, clarify rationale for necessary actions or responses, and address emerging concerns. This may best be accomplished through existing organizations with established communication frameworks and a diversity of distribution channels for public outreach. In particular, well-coordinated inter-agency communication and public grasp of the Asian carp issue are necessary to establish and maintain support for large-scale efforts that require work across jurisdictions and federal support.

Ohio anglers view helping control the spread of exotic species as one of our most important stewardship issues (Zajac et al. 2011). However, the public, as a whole, may not be familiar with the importance of this issue to Ohio and the limited number of strategies available to minimize risk of AIS introductions. Providing accurate and current information regarding identification of Bighead and Silver Carp, risks they pose to Ohio waters, strategies for minimizing that risk, and their potential negative effects is essential to preventing further spread of these fishes. The public must also be aware that strategies to prevent AIS introduction may affect individual recreational angler behavior and experiences and the recreation industry. Businesses, in particular, may resist implementation of measures to minimize risk of AIS introductions because of cost or other effects to their operations.

Discovery of Silver Carp in the Ohio River during 2012, and reports of positive eDNA results from Lake Erie, have created a great deal of interest and concern by the public and media. During the past three years, reports of Bighead and Silver Carp by anglers fishing the Ohio River have become commonplace. However, anglers are often uncertain regarding the identification of these fish, unaware of the 1-877-STOP-ANS hotline for reporting fish that they have caught or found dead, and unfamiliar with what they can do to prevent the spread of Bighead and Silver Carp to other waters. Education and outreach are necessary to close gaps in familiarity with the Bighead and Silver Carp problem.

Finally, the public must understand that Bighead and Silver Carp, like other AIS, are undesirable and have negative consequences to sport fisheries, aquatic communities, or the economy. It must be clear that if established, AIS become a tax on the public, natural resource agencies, and the resources themselves; therefore, it is imperative that the public understand that the most effective means to manage AIS is to prevent their introduction.

Issue: Effective communication is paramount for implementing cooperative intra- and inter-agency management strategies and securing public support through understanding and appreciation of the Bighead and Silver Carp issue.

Outcome 4: A formal ODNR-DOW response and communication strategy is in place to address new or emerging Asian carp information or emerging issues.

Supporting Strategic Actions from the ODNR Division of Wildlife strategic plan:

- Connections: 3.1, 3.2, 3.7, 3.8

Objective 4.1: Develop protocols for an ODNR-DOW response and public communication strategy upon receiving positive findings from eDNA, reports of Bighead Carp or Silver Carp, and related information by March 1, 2014.

Problems:

- A formal response strategy has not been completed based on all possible scenarios and contingencies for results from sampling or reports.
- Lacking a planned response, sufficient time may not be available upon receiving positive results to develop a prudent response to the information.
- Lacking a planned and strategic response increases complexity and decreases efficiency when working with other agencies or jurisdictions and communicating with the public.

Strategies:

- Complete a formal ODNR-DOW response strategy to results from new information.
- Communicate a response strategy with the ODNR (i.e., Department), partner state and federal agencies, universities, and non-governmental organizations.
- Ensure that the ODNR-DOW communications strategy is consistent with existing USFWS Asian carp communication protocols.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species

Objective 4.2: When needed, communicate plans, findings, and responses with partner agencies through existing organizational structures (OEPA, USFWS, USGS, GLFC-LEC, GLMRIS, ACRCC, ORFMT, ORSANCO, and others).

Problems:

- An extensive network of individuals within a variety of organizations and agencies is currently working on the Asian carp issue and communication among them can be challenging due to the volume of information at large.

Strategies:

- Follow a tiered approach to communication among partners and stakeholders that facilitates cooperation and communication.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FCGX03: Great Lakes Restoration Initiative AIS Grant

Outcome 5: Ohioans can identify Bighead, Silver, and Grass Carp and are aware of the threat they pose to fisheries, ecosystems and public health.

Supporting Strategic Actions:

- Stewardship: 1.7
- Connections: 3.6, 3.7, 3.8

Objective 5.1: Annually provide outreach material via the ODNR-DOW website, signage, handouts, and presentations to increase public awareness of the risks associated with populations of Bighead and Silver Carp becoming established in Ohio.

Problems:

- The public may be unaware of the economic costs and ecological risks associated with established populations of Bighead and Silver Carp.
- The public may be unaware of how they can help prevent spread of Bighead and Silver Carp.
- The public may not be able to identify Bighead and Silver Carp and may not understand the importance of reporting these fish when seen.
- State and federal agencies do not have the capacity to monitor all waters for Bighead and Silver Carp.
- The public may not be aware of the action line for reporting Bighead and Silver Carp.
- State and federal agencies have a limited number of strategies for minimizing the risk of establishment of Bighead, Silver, and Grass Carp in Ohio.

- Strategies available for minimizing the risks of establishment of Bighead, Silver, and Grass Carp could have effects on recreational behavior and experiences and businesses.
- The public may be unaware of measures necessary to prevent introduction of Bighead and Silver Carp in waters without established populations.

Strategies:

- Maintain current Bighead and Silver Carp information on the ODNR-DOW website.
- Provide sufficient signage at boat ramps, bait and tackle stores, and other outlets to alert the public to threats from Bighead and Silver Carp.
- Create an awareness of 1-877-STOP-ANS through the ODNR-DOW website, e-newsletter, and signage used for outreach.
- Create an awareness of the strategies available for minimizing the risks of establishment of Bighead, Silver, and Grass Carp in Ohio.
- Work with recreational, aquaculture, bait, and live-haul industries to develop an understanding of consequences of no action and development of solutions that minimize effect on recreational experiences and commercial business operations, while reducing the risk of establishment of Bighead, Silver, and Grass Carp in Ohio
- Work with partners (ex. Ohio Sea Grant, ODNR Division of Watercraft, and The Ohio State University) to provide public communication.

Supporting Actions:

- FCGX02: Statewide Management of Aquatic Invasive Species
- FCGX03: Great Lakes Restoration Initiative AIS Grant

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X. Appendices

Appendix 1: Asian Carp Timeline

1963: The U.S. Fish and Wildlife Service imports Grass Carp from Eastern Asia to Arkansas for federal research on controlling aquatic vegetation in aquaculture ponds.

1966: First believed escape of Asian carp into U.S. waters, in Arkansas.

1970: State of Arkansas begins stocking Grass Carp in weed-choked waters throughout the state.

1972: Bighead Carp are first brought into the US by a fish farmer in Arkansas to improve water quality and fish production in aquaculture.

1973: Silver Carp are introduced into the US for phytoplankton control in culture ponds and as fish food.

1973: An Arkansas fish farmer who ordered Grass Carp unintentionally receives the nation's first shipment of Black Carp.

1974: The Arkansas Fish and Game Commission report extensive stocking in more than 100 public or semi-public lakes with over 50,000 acres stocked with more than 380,000 Grass Carp.

1976: Silver Carp, stocked in sewage ponds, escape into wild during flood.

1976: First wild sighting of Asian carp in Arkansas.

1980: The first report of Silver Carp swimming in the wild.

1981: The first record of a Bighead Carp caught in natural waters when an individual was caught on the Ohio River below Smithland Dam, Kentucky.

1982: Carp considered "established" in the wild in Arkansas.

Early 1990s: Heavy flooding allowed more carp to escape from fish farms into the Mississippi River and they have since migrated into the Missouri and Illinois rivers.

1990's: Three Bighead Carp were collected by commercial fisherman in the western basin of Lake Erie.

1994: The first record of escapement or release to the wild of Black Carp occurred in Missouri. Thirty or more Black Carp escaped into the Osage River in Missouri when high water flooded holding ponds at a private aquaculture facility near Lake of the Ozarks.

1996: Army Corps of Engineers directed to build demonstration electric barrier for aquatic nuisance control.

2002: Barrier I, a demonstration electric barrier in the Chicago Sanitary and Ship Canal 25 miles from Chicago, comes online. The electric barrier on the canal is designed to prevent the spread of aquatic nuisance species.

Late 2002: Biologists find Asian carp 21 miles downstream of the experimental fish barrier, about 50 miles from Lake Michigan.

2007: Congress, through the Water Resources Development Act (WRDA,) directs the Army Corps of Engineers to study factors that could reduce effectiveness of electrical barriers, including areas of potential bypass via flooded areas and to conduct a study to prevent the transfer of aquatic invasive species between the Great Lakes and the Mississippi River Basins. The US Fish and Wildlife Service added Silver, Largescale Silver, and Black Carp to the list of injurious wildlife. The importation and interstate transportation of certain listed wildlife is prohibited, with exceptions.

2008: Ohio legalizes the use of triploid grass carp for the control of aquatic vegetation.

July 2009: eDNA monitoring tested positive for the presence of Asian carp beyond the barrier, 6 miles from Lake Michigan.

December 2009: The electric barrier is shut down in order to conduct maintenance. To prevent invasive Asian carp from entering the lakes while the barrier is not turned on, fisheries managers treated a 5.7 mile portion of the canal with poison (rotenone) resulting in a large scale fish kill. One Asian carp was found among the dead fish that was collected in the canal. Michigan Attorney General filed suit in the U.S. Supreme Court on behalf of the State of Michigan against the State of Illinois for allowing Asian carp to potentially invade the Great Lakes through the Chicago Canal and other managed waterways.

January 2010: The Supreme Court refused to order emergency measures sought by the State of Michigan to stop the migration of the Asian carp toward Lake Michigan. Hours later, the Corps of Engineers announces it has found Asian carp eDNA in waters connected to Lake Michigan for the first time.

February 2010: President Obama pledges \$78 million to prevent Asian carp in the Mississippi River and Chicago Waterway System from invading the Great Lakes.

April 2010: The U.S. Supreme Court refuses to hear a request to permanently separate the Great Lakes from the Mississippi River to prevent the movement of Asian carp and other harmful aquatic invasive species between the two basins, effectively ending any hope for Michigan and the other Great Lakes states to get the Asian carp case before the Supreme Court.

May 2010: A second round of poisoning was conducted in two miles of the Little Calumet River below the O'Brien lock and dam. The purpose was to determine whether Asian carp might exist in that location where positive eDNA samples have been taken. No Asian carp were collected.

June 2010: An invasive Bighead carp was caught in Lake Calumet, 6 miles away from Lake Michigan. This is the first physical specimen that has been found in the Chicago Area Waterway System above the U.S. Army Corps of Engineer's Electric Barrier System. A stone blockage was placed in the Illinois and Michigan (I&M) Canal to prevent Asian carp being swept from the I&M Canal into the Chicago

Sanitary and Ship Canal during heavy rains.

July 2010: Asian carp are found in Indiana waters about 25 miles from where the Wabash often floods and flows into the Maumee River, a major tributary of Lake Erie. Five states - Michigan, Wisconsin, Minnesota, Ohio, and Pennsylvania – filed a lawsuit against the U.S. Army Corps of Engineers and Metropolitan Water Reclamation District of Greater Chicago (District) in federal district court.

September 2010: President Obama named John Goss as the chairman of the Asian Carp Regional Coordinating Committee to oversee the government-led effort to control the species.

October 2010: Indiana crews complete a nearly 1,200-foot-long, 8 ft high fence designed to prevent adult carp from using the northeastern Indiana marsh to swim from the Wabash River system into the Maumee River and then into Lake Erie during floods. A 13-mile concrete and steel mesh fence that splits the narrow divide between the Des Plaines River and the Chicago Sanitary and Ship Canal was also completed.

December 2010: In collaboration with other Federal and State Agencies, local governments and non-governmental organizations, the USACE launches the Great Lakes and Mississippi River Interbasin Study (GLMRIS). GLMRIS will explore options and technologies, collectively known as Aquatic Nuisance Species (ANS) controls, that could be applied to prevent ANS transfer between the basins through aquatic pathways.

2011: Silver Carp eDNA detected in Maumee Bay in the western basin of Lake Erie and Bighead Carp eDNA detected in Sandusky Bay in western Lake Erie. Results were reported in 2012.

March 2011: Bighead Carp is listed as an “injurious” species under the federal Lacey Act, making transfer of live fish illegal. The Corps of Engineers acknowledges that the Chicago Sanitary and Ship Canal's electric- dispersal barriers were only effective for large fish, defined as 5.4 inches or longer.

April 2011: Barrier IIB begins full-time operation, 100 feet away from Barrier IIA.

August 2011: The U.S. Court of Appeals for the Seventh Circuit rejected the Great Lakes states’ request for a preliminary injunction.

July 2012: Silver Carp collected for the first time in Ohio waters on the Ohio River near Cincinnati.

January 2012: A study, “Restoring the Natural Divide: Separating the Great Lakes and Mississippi River Basins in the Chicago Area Waterway System,” is released by the Great Lakes Commission and the Great Lakes and St. Lawrence Cities Initiative showing that separating the Great Lakes and Mississippi River basins to prevent the spread of Asian carp and other invasive species is not only feasible, both technically and economically, but is also a natural step toward much-needed action to improve Chicago’s water infrastructure. The study provides three options for creating a permanent hydrologic barrier between Lake Michigan and the Mississippi River basin, according to the study, building the barriers would cost between \$3 billion and \$9 billion and take at least a decade to complete.

July 2012: The Department of Fisheries and Oceans Canada released a study affirming that all five Great Lakes are hospitable to Asian carp and that once established the non-native fish will likely disrupt the

native fishery, alter the ecosystem and create another food web. The study found that it would take as few as 10 female and 10 or fewer male Asian carp of reproductive age to reproduce in the Great Lakes. Officials announced that six water samples taken from Sandusky and north Maumee bays tested positive for the presence of Asian carp eDNA. Four samples from Sandusky Bay, in Ohio waters, tested positive for Bighead Carp eDNA.

December 2012: The U.S. District Court for the Northern District of Illinois dismissed the lawsuit filed two years ago by the states of Michigan, Wisconsin, Minnesota, Ohio, and Pennsylvania, ruling that hydrologic separation of the Great Lakes and Mississippi River Basins is precluded by federal laws that require the U.S. Army Corps of Engineers to sustain through navigation between the water bodies.

February 20, 2013: An interim report for the Asian Carp Environmental DNA Calibration Study (ECALS) was released. ECALS is a three-year study to improve the understanding and interpretation of Asian carp environmental DNA (eDNA) results. ECALS will investigate alternate sources of Asian carp DNA, improve existing genetic markers and investigate the relationship between the number and distribution of positive eDNA samples with the density of Asian carp populations. The results of this study will allow project managers to better interpret eDNA results, as well as investigate ways to make the eDNA process more efficient.

May 2013: The Asian Carp Regional Coordinating Committee (ACRCC) released its [2013 Asian Carp Monitoring and Response Plan \(MRP\)](#). Outlining a revised and aggressive set of actions to track and remove Asian carp in the Upper Illinois River and the Chicago Area Waterway System (CAWS), the 2013 MRP is again designed to prevent Asian carp from establishing populations in the CAWS and Lake Michigan. The 2013 MRP details over \$6.5 million of monitoring, sampling, and response activities to be conducted by multiple members of the Asian Carp Regional Coordinating Committee. The plan outlines actions for the current (2013) field season focused on monitoring and removal of Asian carp in the Chicago Area Waterway System (CAWS) and upper Illinois Waterway; and on-going evaluations of the effectiveness of barriers and gears used in keeping Asian carp from establishing in the CAWS and Lake Michigan.

January 2013: Ohio develops the *Asian Carp Tactical Plan*.

Appendix 2. List of Abbreviations

Abbreviation	Definition
ACRCC	Asian Carp Regional Coordinating Committee
AIS	Aquatic Invasive Species
ANSTF	Aquatic Nuisance Species Task Force
CAWS	Chicago Area Waterway System
CESU	Cooperative Environmental Studies Unit
CLC	Council of Lakes Committee
CMS	Comprehensive Management System
DFO	Canadian Department of Fisheries and Oceans
EPA	US Environmental Protection Agency
GLC	Great Lakes Commission
GLFC	Great Lakes Fishery Commission
GLMRIS	Great Lakes Mississippi River Inter-basin Study
GLRI	Great Lakes Restoration Initiative
KDFRW	Kentucky Department of Fish and Wildlife Resources
LEC	Lake Erie Committee
MWCD	Muskingum Watershed Conservancy District
OAC	Ohio Administrative Code
ODA	Ohio Department of Agriculture
ODNR	Ohio Department of Natural Resources
ODNR-DOW	Ohio Department of Natural Resources, Division of Wildlife
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
ORFMT	Ohio River Fisheries Management Team
ORSANCO	Ohio River Valley Water Sanitation Commission
STC	Standing Technical Committee (Great Lakes Fisheries Commission)
TNC	The Nature Conservancy
UND	University of Notre Dame
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USDA-APHIS	United States Department of Agriculture - Animal and Plant Health Inspection Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USGS-LEBS	United States Geological Survey, Lake Erie Biological Station
VHS	Viral hemorrhagic septicemia

Appendix 3: ODNR, Division of Wildlife Strategic Plan

Strategic Plan: The Next Generation of Ohio's Conservation Journey

Building on the Past to Prepare for the Future

Ohio Department of Natural Resources

Division of Wildlife

www.wildohio.com

A Letter from the Division of Wildlife

The Division of Wildlife is pleased to present our new strategic plan. We invite all Ohioans to join us on the next generation of Ohio's conservation journey. This is the Division's fourth strategic plan, and like previous plans it builds on past successes and guides us toward future opportunities and challenges.

This strategic plan is a common, shared vision of the future of fish and wildlife conservation in Ohio. By design, it doesn't list how many fish are stocked into each lake, identify individual research projects, or determine when deer season will open from year to year. Instead, the plan steps back from detail to give a bird's-eye view of five cornerstones of Ohio conservation, our desired objective for each, and paths of direction. These include: 1) stewardship of our resources; 2) opportunities for participation in fish and wildlife recreation; 3) connections we make with all fish and wildlife enthusiasts; 4) traditions related to conservation; and, 5) a standard of excellence in the work we do for you. From this broad perspective, the division can consider where Ohio's fish and wildlife resources have been, where they are today, and how we can work together to secure their future.

Since our beginning in 1873 as the Ohio Fish Commission, our agency has been at the forefront of Ohio's fish and wildlife conservation through our commitment, passion, and statutory authority. As we consider where we stand today and look to the future, we embrace a rich history of experiences and the strong support of anglers, hunters, and trappers -- the historic foundation of our success. Yet, we also welcome all conservation enthusiasts who share an appreciation of these resources and the contributions that fish and wildlife make to the quality of life in Ohio. So, however you appreciate fish and wildlife -- with a fishing rod in hand, gun on your shoulder, traps in your packbasket, binoculars around your neck, or a camera at the ready -- we encourage all who care about Ohio's fish and wildlife to travel together on this conservation journey to promote healthy ecosystems, protect recreational opportunities, and provide promise that the values we share today will be there for the next generation.

Just as you plan your next trip outdoors, this strategic plan helps the division prepare for the years ahead. It is our hope that everyone who enjoys fish and wildlife resources will join us on this journey to conserve and improve Ohio's fish and wildlife and their habitats for sustainable use and appreciation by all.

Sincerely,

Your Ohio Division of Wildlife

The Division of Wildlife's Mission

To conserve and improve fish and wildlife resources and their habitats for sustainable use and appreciation by all

We believe that:

- Input from constituents and open lines of communication with the public are essential.
- Fish and wildlife recreation is socially and economically important to Ohio.
- Sustainable consumptive use of fish and wildlife through hunting, fishing, and trapping is at the heart of effective conservation.
- Fish and wildlife management must be based on the best available science.
- Partnerships are necessary for effective fish and wildlife conservation.
- Conservation is our priority when managing lands and waters.
- The right to own and use firearms is essential to continue our hunting and shooting sports traditions.
- A dedicated and professional workforce is key to achieving long-term success.
- Effective fish and wildlife conservation requires integration of a unified wildlife agency.
- Diverse fish and wildlife populations benefit everyone.
- Providing quality customer service is critical to achieving our mission.
- Diverse and dedicated funding is necessary for fish and wildlife conservation.
- Fiscal responsibility is crucial to the future of Ohio's fish and wildlife management.

Wildlife, Habitat, and People

Effective science-based management of Ohio's fish and wildlife resources incorporates the complex relationships among fish and wildlife, their habitats, and the interaction of people.

Wildlife

- Populations of bald eagles and peregrine falcons have rebounded, bringing these and other species back from the brink of extinction, ensuring their place among Ohio's rich diversity of wildlife.
- Native wildlife species continue to be stressed by non-native invasive species. Because of international commerce on Lake Erie and its variety of habitats, this region is particularly vulnerable to invasions.
- Ohio has generated record harvests in deer and walleye in recent years.
- Low density suburban development may increase edge habitat species like white-tailed deer, but can also increase conflict between people and wildlife.
- The Ohio Division of Wildlife produces more than 30 million fish that are stocked in Ohio's public waterways annually.

Habitat

- With nearly 45,000 square miles of land, 2.25 million acres of Lake Erie, 60,000 miles of streams, over 120,000 surface acres of inland lakes and 451 miles of the Ohio River, outdoor enthusiasts can explore a diversity of opportunities.

- More than 90 percent of Ohio's land is privately owned. The Department of Natural Resources manages two percent of Ohio's land area, of which a portion is managed for fish and wildlife recreation.
- Habitat quantity and quality is the largest factor influencing wildlife populations.
- Climate change could impact many of Ohio's valuable natural resources, including Lake Erie and wetland habitats. Warming temperatures may reduce Lake Erie and coastal wetland water levels and alter species composition. Growing season changes may increase non-native plant species competition, also impacting Ohio's wildlife.

People

- Ohio has more than five million wildlife enthusiasts who enjoy hunting, fishing and wildlife watching. Annual participant spending on wildlife recreation can exceed \$3 billion.
- Hunting and fishing generates nearly \$200 million in local and state tax dollars and supports more than 30,000 Ohio jobs. Wildlife watching generates more than \$160 million in local and state tax dollars and supports more than 22,000 Ohio jobs
- The most commonly recognized barriers for fishing and hunting participation are time, family, and work commitments, and health issues.
- The majority of anglers and hunters are males who live in rural areas. Wildlife watchers, however, tend to be females.
- Computer and online communication skills are increasing among all adults.
- Urban areas are home to four out of five Ohioans.
- Many Ohioans are moving to "ex-urban" areas, just outside core metropolitan areas, reducing farmland around cities.
- Young people are seeing their free time decreasing.

2011 – 2030 Strategic Plan; How we developed the plan

This strategic plan was created by Division of Wildlife employees with input from leaders in Ohio's conservation community, academic experts, and wildlife enthusiasts from across the state. The goal of this new plan is to provide a concise and easy-to-read document that reflects a shared vision of fish and wildlife conservation in Ohio.

We began the planning process with experience gained from our three previous strategic plans and the successes and challenges encountered during their implementation. A critical review of these plans, additional review of plans from other states, research and analysis, contributions from all division employees, and feedback from constituent leaders helped guide development of this plan.

A preliminary draft was presented for public review through the division Web site and a Web-based survey. We believe these efforts have resulted in a plan that addresses the challenges, issues, and opportunities related to fish and wildlife conservation in Ohio.

Cornerstones

Five fundamental principles will guide the division in developing the future of wildlife management in the state.

- **Stewardship:** Foster healthy ecosystems for the benefit of fish and wildlife
- **Opportunities:** Improve opportunities for fish and wildlife recreation
- **Connections:** Create, expand, and improve public awareness, understanding and appreciation of Ohio's fish and wildlife
- **Traditions:** Preserve and promote Ohio's tradition of conservation
- **Excellence:** Maintain effective and professional agency operations

1. Stewardship

Foster healthy ecosystems for the benefit of fish and wildlife

Protecting and fostering healthy ecosystems to benefit Ohio's fish and wildlife is critical to conservation in the midst of social, political, and economic changes of the 21st century. Ohio faces new and continuing challenges to maintaining healthy ecosystems. With over 11 million people living in Ohio, balancing the needs of fish and wildlife with impacts from development and economic growth will be central to these efforts. The Division of Wildlife must lead by example when managing public land and water and encourage the protection, conservation, and management of private land and water. Threats to healthy ecosystems include habitat loss, invasive and nuisance species, pollution, disease, climate change, and other challenges. The Division of Wildlife will maintain diverse fish and wildlife populations and habitats while identifying and minimizing threats to ecosystems.

Objectives

- Diverse and sustainable fish and wildlife populations and habitats representative of healthy ecosystems and sustainable use
- Minimized impacts from habitat loss, invasive and nuisance species, pollution, disease, climate change, and other challenges

Our Path (Strategies)

- 1.1 Balance the needs of fish and wildlife with the needs of people by mitigating incompatible ecosystem uses
- 1.2 Manage and evaluate fish and wildlife populations and their habitats through the best available science
- 1.3 Reintroduce and restore species and habitat where appropriate
- 1.4 Protect and sustain fish and wildlife resources through regulations, enforcement, partnerships, and education
- 1.5 Protect land and water resources through strategic acquisitions, easements, and partnerships

- 1.6 Identify ecosystem- or population-level threats through research, surveillance, monitoring and inventory
- 1.7 Strive to prevent the introduction of and control spread of harmful species through legislation, regulation, policy, management practices, education, and partnerships

2. Opportunities

Improve opportunities for fish and wildlife recreation

Ohio provides world-class opportunities for fishing, hunting, trapping, bird watching, wildlife viewing, and other forms of outdoor recreation. Diverse populations of fish and wildlife are key to providing these opportunities. However, challenges to ecosystems and fish and wildlife populations may limit recreational opportunities. In addition, a variety of barriers to recreation and participation may potentially limit the quantity, quality, and accessibility of these opportunities. Many Ohioans are passionate about fish and wildlife recreation and the Division of Wildlife supports and encourages participation of these pursuits. Opportunities may be improved in a variety of ways, such as carefully managing fish and wildlife populations and their habitats, and removing barriers to participation.

Objectives

- Sufficient fish and wildlife populations to accommodate sustainable recreational opportunities
- Minimized barriers to participation in fishing, hunting, trapping, bird watching, wildlife viewing, and other related pursuits
- Increased participation in fishing, hunting, trapping, bird watching, and other fish and wildlife pursuits

Our Path (Strategies)

- 2.1 Increase and promote “close to home” opportunities for fish and wildlife recreation
- 2.2 Increase and promote urban opportunities for fish and wildlife recreation
- 2.3 Provide timely, up-to-date and accurate information about recreational opportunities
- 2.4 Conduct research to better understand how and why people value wildlife
- 2.5 Increase access to land and water through purchases, easements, agreements, and partnerships
- 2.6 Increase, improve and maintain public access areas
- 2.7 Use special events to provide unique opportunities and improve wildlife recreation skills
- 2.8 Implement clear and concise regulations that are easily understood and effectively enforced
- 2.9 Stock fish and wildlife where appropriate to create, enhance, and diversify recreational opportunities

- 2.10 Use science-based management to maintain and enhance fish and wildlife populations for public use and recreation

3. Connections

Create, expand, and improve public awareness, understanding and appreciation of Ohio's fish and wildlife

The future of fish and wildlife resources depends on informed conservation actions by citizens. As technologies change and channels for outreach and education continue to evolve, the Division of Wildlife must stay at the forefront of these changes to deliver products and programs that connect people with fish, wildlife, and habitat. The Division of Wildlife has the responsibility to educate and inform Ohioans about fish and wildlife resources and promote the values of fishing, hunting, trapping, and fish and wildlife appreciation. Collectively, these actions can foster awareness, increase understanding, inform decisions, create a desire to participate in fish and wildlife recreation, and enhance skills and behaviors associated with these activities.

Objectives

- Increased public knowledge and understanding of the relationship between people, wildlife, and habitat
- Increased public appreciation of Ohio's fish and wildlife

Our Path (Strategies)

- 3.1 Expand the Division of Wildlife's role as the source of fish and wildlife information and education
- 3.2 Provide a variety of fish and wildlife exhibits, programs, and experiences
- 3.3 Develop and maintain partnerships to better deliver the Division of Wildlife's conservation message and promote opportunities to experience fish and wildlife
- 3.4 Maintain a corps of Division of Wildlife-trained partners and volunteers to assist, lead, and promote special programs
- 3.5 Develop and promote educational materials that address fish and wildlife management principles, outdoor skills, and other conservation concepts
- 3.6 Provide accurate fish and wildlife information using current communication technologies
- 3.7 Provide information and guidance to reduce conflicts and improve human interactions with fish and wildlife
- 3.8 Identify and address customers' evolving information needs

4. Traditions

Preserve and promote Ohio's tradition of conservation

The traditions of fishing, hunting, trapping and other recreational pursuits are an important part of our culture, both socially and economically. Social, economic, and political changes create potential barriers to participation and challenges to passing on these traditions. Young Ohioans are particularly at risk of being disconnected from the outdoors. Early and guided involvement in these recreational pursuits is critical to participation by the next generation. Likewise, continued participation is a necessary link in establishing a lasting conservation ethic. Participation in fishing, hunting, and trapping is decreasing. At the same time, more people than ever appreciate wildlife through activities like bird watching, wildlife viewing, and photography. In order to pass on Ohio's tradition of conservation to future generations we must continue to promote fishing, hunting, trapping, and fish and wildlife appreciation.

Objectives

- Consistent recruitment of fish and wildlife enthusiasts
- Devoted participants and conservation organizations that are the critical link to passing on fish and wildlife traditions

Our Path

- 4.1 Promote youth- and family-oriented events to recruit and retain participants in fish and wildlife recreation
- 4.2 Partner with fish and wildlife clubs and organizations to develop conservation recruitment programs
- 4.3 Create skill-building opportunities through mentoring, hands-on participation, and memorable outdoor experiences
- 4.4 Encourage participation in shooting sports to improve hunter recruitment

5. Excellence

Maintain an effective and professional agency

To ensure effective management of Ohio's fish and wildlife, the Division of Wildlife must maintain secure funding, workforce excellence and public accountability. Dedicated funds generated from the sale of fishing and hunting licenses, permits, and federal excise taxes on related equipment sustain agency operations. However, an ever-expanding role in conservation requires additional funding sources. A work environment that promotes employee satisfaction and productivity will attract, maintain, and retain a diverse, knowledgeable and innovative staff. Ohio's conservation journey will require creative alignment of staff and skills to meet emerging challenges. Career development and quality training will help ensure professional and dedicated employees and build leadership. Efficient business practices are critical to responsibly manage programs. The division will continually strive to improve these practices to further strengthen Ohioans' confidence that funds are appropriately spent on conservation priorities.

Objectives

- Expand sources of funding dedicated to fish and wildlife conservation
- Excellent services provided by a high-performance staff
- Business practices that are efficient, responsible, and accountable to the public

Our Path (Strategies)

- 5.1 Protect Division of Wildlife revenue generated from the sale of hunting and fishing licenses and equipment, while continually seeking new sources of revenue
- 5.2 Recruit and retain a broad range of fish and wildlife enthusiasts to enhance support for the Division of Wildlife's mission
- 5.3 Use partnerships to leverage fish and wildlife conservation funding
- 5.4 Recruit, train, and retain a highly-qualified staff
- 5.5 Continually improve our business practices to ensure the most efficient use of funds
- 5.6 Report allocation of fiscal resources annually to provide accountability to the public

Our Vision

The Division of Wildlife's ideal future includes:

- Healthy ecosystems that support thriving fish and wildlife populations for all to enjoy.
- Recognition as the authority on all fish and wildlife-related issues in Ohio through science-based management with strong support from sportsmen and women, fish and wildlife enthusiasts, and conservation partners.
- Stable funding through multiple sources representing all who value fish and wildlife conservation.
- A highly qualified, well trained, and dedicated staff that understands and respects Ohio's fish and wildlife heritage and seeks to build upon it to create a better future.

Division of Wildlife Statutory Authority

The Ohio Department of Natural Resources, Division of Wildlife is responsible for management of fish and wildlife resources as mandated by Ohio law. The specific powers and duties of the division are found in three documents: 1) the Ohio Constitution; 2) the Ohio Revised Code, Sections 1531 and 1533; and 3) the Ohio Administrative Code.

The Division of Wildlife holds ownership to all wild animals in trust for the benefit of Ohio's citizens. Fish and wildlife management practices, regulations, and enforcement are based on wildlife being a usable and renewable resource.

The chief of the Division of Wildlife has broad authority, with approval of the Wildlife Council, to adopt rules and regulations for managing lands and waters that will ensure sound management of fish and wildlife, to conduct management activities and acquire property to develop and conserve the wildlife resource, and to promote programs to educate Ohio citizens about conservation, fishing, hunting, and trapping.

Revenue from the sale of licenses, permits, products, etc. is deposited into the Wildlife Fund to be used solely for future fish and wildlife management. These funds are protected by state and federal legislation that prevents their diversion for purposes other than fish and wildlife conservation.

CONSERVATION MILESTONES

Stewardship

- 1873 Ohio legislature created the Ohio Fish Commission, now known as the Ohio Division of Wildlife
- 1904 Ohio's first non-resident hunting and trapping license required
- 1913 Ohio residents first required to purchase a hunting license
- 1918 Enactment of the Migratory Bird Treaty provided federal protection for migratory birds
- 1925 Ohio's first fishing license law enacted
- 1949 The Ohio Department of Natural Resources created
- 1973 The Ohio Endangered Species Law passed which expanded authority for the division to protect and manage non-game species
- 2000 The division adopted regulations to protect native reptiles and amphibians
- 2007 Protocol created for the division's study on impact of wind energy on wildlife species.
- 2008 Bald eagle, peregrine falcon, and osprey populations rebound from being state- endangered species to state-threatened species

Opportunities

- 1918 Ohio's first wildlife areas established as game refuges. The Theodore Roosevelt Game Preserve, now part of Shawnee State Forest, was purchased in 1920
- 1939 Jackson Lake in Jackson County was created with large-scale fish management practices implemented before filling
- 1956 Ohio's first modern statewide deer season occurred after decades of population recovery
- 1966 Ohio's first modern wild turkey season opened after decades of reintroduction and recovery efforts
- 1984 Commercial walleye fishing in Ohio's portion of Lake Erie banned; gillnets banned statewide
- 1995 Ohio's first modern mourning dove season
- 1996 Ohio recognized as world-class steelhead fishery in northeast Ohio
- 1998 Sunday hunting in Ohio legalized
- 2005 Ohio established apprentice hunting and trapping licenses through the Families Afield program

Connections

- 1930s The wildlife display at the Ohio State Fairgrounds is established as one of the division's largest annual public information efforts
- 1936 First publication of the *Ohio Conservation Bulletin*
- 1982 John A. Ruthven painted artwork for Ohio's first Wetland Habitat Stamp
- 1985 The wildlife education curriculum Project WILD introduced to Ohio
- 1990 Ohio began publishing *Wild Ohio* magazine
- 1997 The division created a Web site on the Internet
- 2009 The division hosted the 25th annual Wildlife Diversity Conference with nearly 1,000 participants
- 2010 Wildlife's Internet presence is expanded with the use of social media

Traditions

- 1956 Hunter education courses were first offered; hunter education became mandatory for first-time

hunters in 1978

- 1963 The Ohio Wildlife Council changes authority to a directory and advisory body for fish and wildlife conservation in Ohio
- 2003 Youth hunting season established to help recruit new hunters
- 2004 Ohio became the 10th state to introduce the National Archery in the Schools Program (NASP)
- 2005 Ohio's first modern river otter trapping season established
- 2010 The division launched the Ohio Wildlife Legacy Stamp to allow all Ohioans to invest in wildlife conservation

Excellence

- 1886 Ohio's first game warden appointed; in 1888 legislation was passed calling for a game warden in every county
- 1930s Game protectors, fish management agents, and game management agents begin attending specialized training
- 1937 Pittman-Robertson Legislation created a federal excise tax on hunting and shooting equipment annually generating millions of dollars for wildlife conservation across the country
- 1939 The Ohio Wildlife Fund was established to ensure that hunting and fishing license monies are used for fish and wildlife conservation
- 1950 Dingell-Johnson Legislation created a federal excise tax on fishing equipment annually generating millions of dollars for sport fish conservation across the country
- 1983 State income tax check-off program was established to allow Ohio taxpayers to donate a portion of their tax refund to the division for non-game wildlife management programs
- 1997 The first wildlife auto license plates, depicting a cardinal, went on sale with proceeds supporting fish and wildlife diversity programs
- 2007 Ohio joined 26 other states in the Interstate Wildlife Violators Compact
- 2011 The Wild Ohio Customer Relations Management System (WOCRMS) began, improving license sales transactions and record keeping

Appendix 4. ODNR, Division of Wildlife Statutory Authority

The Ohio Department of Natural Resources, Division of Wildlife is granted authority and responsibility for management of fish and wildlife resources through Ohio law established by the Ohio General Assembly. The powers and duties of the Division are found in three documents: 1) the Ohio Constitution; 2) the Ohio Revised Code, Sections 1531 and 1533; and, 3) the Ohio Administrative Code. The chief of the Division of Wildlife has been established as the executive officer who initiates and concurs on all statutory responsibilities which are either mandatory or directory in nature.

The ownership and title to all wild animals are held in trust by the Division of Wildlife. The management of these wild animals is to be for the benefit of all the people, and is based upon the premise that wildlife is a usable, renewable resource.

The chief of the Division of Wildlife has the authority to:

- 1) Acquire by gift, lease, purchase, or otherwise lands or surface rights upon lands and waters or surface rights upon waters for wild animals, fish or game management, preservation, propagation, and protection, outdoor and nature activities, public fishing and hunting grounds and flora and fauna preservation. The chief may also receive by grant, devise, bequest, or donation lands or surface rights upon lands and waters or the surface rights upon waters.
- 2) Make such rules for the protection of state owned or leased lands and waters, and property under Division control against wrongful use or occupancy as to ensure the protection of such lands, waters, and property from depredation and to preserve these lands so destruction or any improper use or occupancy does not occur.
- 3) Make and issue orders benefitting wild animals, fish or game management, preservation, propagation, and protection, outdoor and nature activities, public fishing and hunting grounds, flora and fauna preservation, and regulate the taking and possession of wild animals on any lands or waters owned or leased or under Division supervision or control.
- 4) Acquire by gift, lease, or purchase land for the purpose of establishing state fish hatcheries and game farms, and may erect thereon such buildings or structures as are necessary. The chief may also enter into agreements to improve public fishing access in all areas of the state.
- 5) Establish user fees for use of special public facilities or participation in special activities on lands and waters administered by the Division. Such special facilities and activities may include hunting or fishing on special, designated public lands and waters intensively managed or stocked with artificially propagated game birds or fish, field trial facilities, wildlife nature centers, firearm ranges, boat mooring facilities, camping sites, and other similar special facilities and activities. The chief shall set and collect the fees for concession rentals or other special projects; regulate through contracts between the Division and concessionaires the sale of tangible objects at concessions or other special projects; and keep a record of all such fee payments showing the amount received, from whom received, and for what purpose the fee was collected. All money received as user fees, concession rentals, or the other special projects shall be paid into the Wildlife Fund to be used for wildlife management projects. The chief shall also assure that all monies generated from the sale of hunting and fishing licenses and other wildlife permits shall not be directed for other uses. They shall be used solely for wildlife projects.
- 6) Sell conservation related items or items that promote wildlife conservation, including, but not limited to: pins, badges, books, bulletins, maps, publications, calendars, any other

educational article or artifact pertaining to wild animals; sell confiscated or forfeited items, sell surplus structures and equipment, and timber or crops from lands owned, administered, leased, or controlled by the Division of Wildlife.

- 7) The chief may sell, lease, transfer minerals or mineral rights, with the approval of the director, when the chief and the director determine it to be in the best interest of the state. Upon approval of the director, the chief may make, execute, and deliver contracts, including leases to mine, drill, or excavate iron ore, stone, coal, petroleum, gas, salt, and other minerals, upon and under lands owned by the state and administered by the Division to any person who complies with the terms of such a contract. Consideration for minerals and mineral rights shall be by rental or royalty basis as prescribed by the chief and payable as prescribed by contract. Moneys collected shall be paid into the state treasury to the credit of the Wildlife Habitat Fund created in section 1531.33 of the Revised Code.
- 8) The chief may barter or sell wild animals to other state, or federal agencies, and conservation or zoological organizations. Moneys received from the sale of wild animals shall be deposited into the Wild Animal Fund created in section 1531.34 of the Revised Code.

Along with these powers, the chief is mandated to plan, develop, and institute programs and policies for the general care and protection of all Division of Wildlife properties and to enforce through proper legal action all laws pertaining to the management of all wild animals in the state.

Appendix 5. Lake Erie Committee Position Statement on Asian Carp

LAKE ERIE COMMITTEE POSITION STATEMENT On *Asian Carp*

The Lake Erie Committee (LEC) of the Great Lakes Fishery Commission (commission) seeks to prevent the establishment of invasive Asian carp populations in the Lake Erie system, encompassing all waters of Lake St. Clair, the St. Clair and Detroit Rivers, and Lake Erie under provincial and state fisheries management authorities. Asian carp pose serious ecological and economic threats to Great Lakes fisheries if viable populations become established. Environmental conditions are most conducive for Asian carp reproduction and population establishment in the Lake Erie system. While Asian carp have not currently established viable populations in the Lake Erie system, data suggest the presence of Asian carp or their potential introduction vectors throughout the basin. Therefore, the LEC strongly recommends unified decision-making and timely actions among its five provincial and state member jurisdictions, in collaboration with federal fisheries agencies of both countries, to minimize the risk of Asian carp introduction and population establishment in the Lake Erie system. Decisions and management actions should be guided by effective long-term strategic vision and planning, coordination and communication, and emerging science to ensure consistent, effective, and acceptable management of risk among all jurisdictions. Specific LEC recommendations about each strategic component listed above are presented in detail below.

Long-term strategic vision and planning

Asian carp are not addressed in the LEC's fish community goals and objectives and would be a highly undesirable addition to the Lake Erie system in accordance with the committee's future vision. As in past years, individual Asian carp may be rarely observed in the lake but no viable populations should be routinely detected in agency monitoring programs if prevention efforts are successful. The LEC believes that the existing standardized, conventional-gear, monitoring programs used by provincial, state, and federal agencies to assess fisheries, the fish community, and Asian carp (USFWS), are sufficient and necessary to determine the status of detectable Asian carp populations in the Lake Erie system. Early detection tools, such as eDNA, are useful components of surveillance plans, but not for routine assessment of Asian carp population status in the system. If Asian carp can successfully enter and colonize the Lake Erie system, mitigation strategies may be needed to ensure sustainable, desired fisheries.

Asian carp will not be the last invasive threat to the Lake Erie system and such invasive species are not novel to the LEC. A myriad of established invasive species in the Lake Erie system are simply tolerated for lack of any effective management action, the sole exception thus far being sea lamprey. Prevention is the most effective strategy to address the Asian carp threat. Bighead and silver carps remain the major species of interest to the LEC, both listed as priority species during Canada/U.S. risk assessment exercises and as injurious species under the federal Lacey Act. Black carp remain in southern reaches of the Mississippi River, have not been observed in the Great Lakes, but are included as an injurious species in the Lacey Act. Grass carp are present in all Great Lakes, but are not included in the Lacey Act and are legally available for stocking as functionally sterile "triploids" in most U.S. jurisdictions.

The LEC recommends

- continued focus of resources on identifying sources and minimizing or eliminating vectors of introduction for Asian carp and other invasive species into the future,

- continued monitoring of fish communities and fisheries in standard surveys conducted by all LEC jurisdictions, as well as targeted federal invasive species sampling, to allow for timely assessment of Asian carp population status, and
- use of current early detection techniques (e.g., eDNA) solely for the identification of potential source populations, pathways of introduction, or early stages of colonization, when conventional gears are ineffective.
- priority focus on the identification of specific population sources and introduction vectors that pose the greatest risk of establishment of bighead and silver carp, including waterway connections, live-fish haulers for human food consumption or bait, and incidental direct stocking with other target species,
- priority focus on regulatory and enforcement actions to minimize the risk of bighead or silver carp entry into the Lake Erie system through identified vectors,
- secondary focus on gaps in conventional assessment programs (gears, sampling design), which should be informed by analysis of potential sources of fishes/DNA and existing monitoring efforts, and
- judicious use of monitoring efforts to provide insights on sources and vectors of carp introduction.

Coordination and Communication

The LEC recognizes and applauds the extensive efforts of federal Canadian and U.S. agencies, in collaboration with various non-federal partners, to assess the risk of Asian carp to the Great Lakes and to minimize the risk of their mass introduction into the Great Lakes through a primary pathway, the Chicago Area Waterway System (CAWS) and communication of findings and nationally elevating the importance of this issue. Efforts in the CAWS have been directed by the Asian Carp Regional Coordinating Committee (ACRCC), consisting of federal, state, and local agencies in the Great Lakes region. Formal inter-jurisdictional fisheries representation on the ACRCC is provided through the commission. Recognizing that the CAWS is a primary vector of concern for introduction of Asian carp into Lake Michigan that must be contained, the LEC duly notes that additional vectors of introduction have received much less attention, particularly within the Lake Erie system.

The Asian carp threat to the Great Lakes has received significant media attention and captured public and political interests in both nations. The LEC recognizes that these interests must be sufficiently addressed by consistent and timely communication to stakeholders, other levels of government, and media about coordinated interagency efforts that effectively minimize the risk of Asian carp establishment in Lake Erie/St Clair.

The LEC recommends

- support for ongoing collaborative efforts that effectively minimize the risk of Asian carp introduction into the Great Lakes through the CAWS and other risky pathways, as identified in peer-reviewed risk assessments,
- continued use of the commission, as a formal member of the ACRCC with bi-national representation of Lake Erie fisheries managers, to coordinate focussed actions in the CAWS that specifically address interests and concerns of Lake Erie fisheries jurisdictions,
- coordination with federal and non-federal partners in the Lake Erie system to conduct appropriate research, assessment, law enforcement, and rapid response activities that allow

member jurisdictions to effectively minimize the risk of Asian carp introduction through vectors other than the CAWS,

- committee review and coordination of all decisions/actions of Lake Erie jurisdictions relevant to Asian carp detections and potential sources or vectors, including new or existing provincial/state AIS plans, and
- reaffirmed commitments by jurisdictions to allow member attendance at LEC face-to-face meetings for full committee discussion about minimizing the risks of Asian carp introductions.
- committee review and concurrence with chain-of-custody data protocols and notification trees being used by all parties (federal, provincial, state), to ensure the integrity and transfer of information, and appropriate involvement of the committee,
- communication through the commission for current information and opportunity to comment on efforts underway in the ACRCC,
- the development of agency-specific communication strategies that explicitly include other LEC jurisdictions and make use of guiding principles herein, and
- timely updates from Asian carp researchers to the committee.

Emerging science

No feasible options currently exist for effectively managing Asian carp populations in Lake Erie, but research may provide future solutions. Basic research should enhance our understanding about how Asian carp behave, which could be useful in assessing sources, vectors, and, ultimately, the risk of introduction. Research should also reveal how Asian carp may affect the Lake Erie fish community and associated fisheries, which may be useful if prevention efforts fail and remedial fisheries management actions become necessary.

The LEC recommends

- research to inform future management decisions should include calibration and interpretation of eDNA results, and development of cost-effective, real-time eDNA (or other genetic tools) testing capability,
- research on control strategies, such as attractants/repellents, delivery of piscicides, capture efficiency of Asian carp in new and conventional sampling gears, tagging studies of Asian carp behavior, and habitat use and diet of Asian carp in North American waters, should be continued in the event that Asian carp establish populations in the Great Lakes,
- coordination and collaboration among researchers to build common knowledge and avoid duplication of efforts, and
- the addition of Asian carp research as a theme area under the commission's fishery research program.