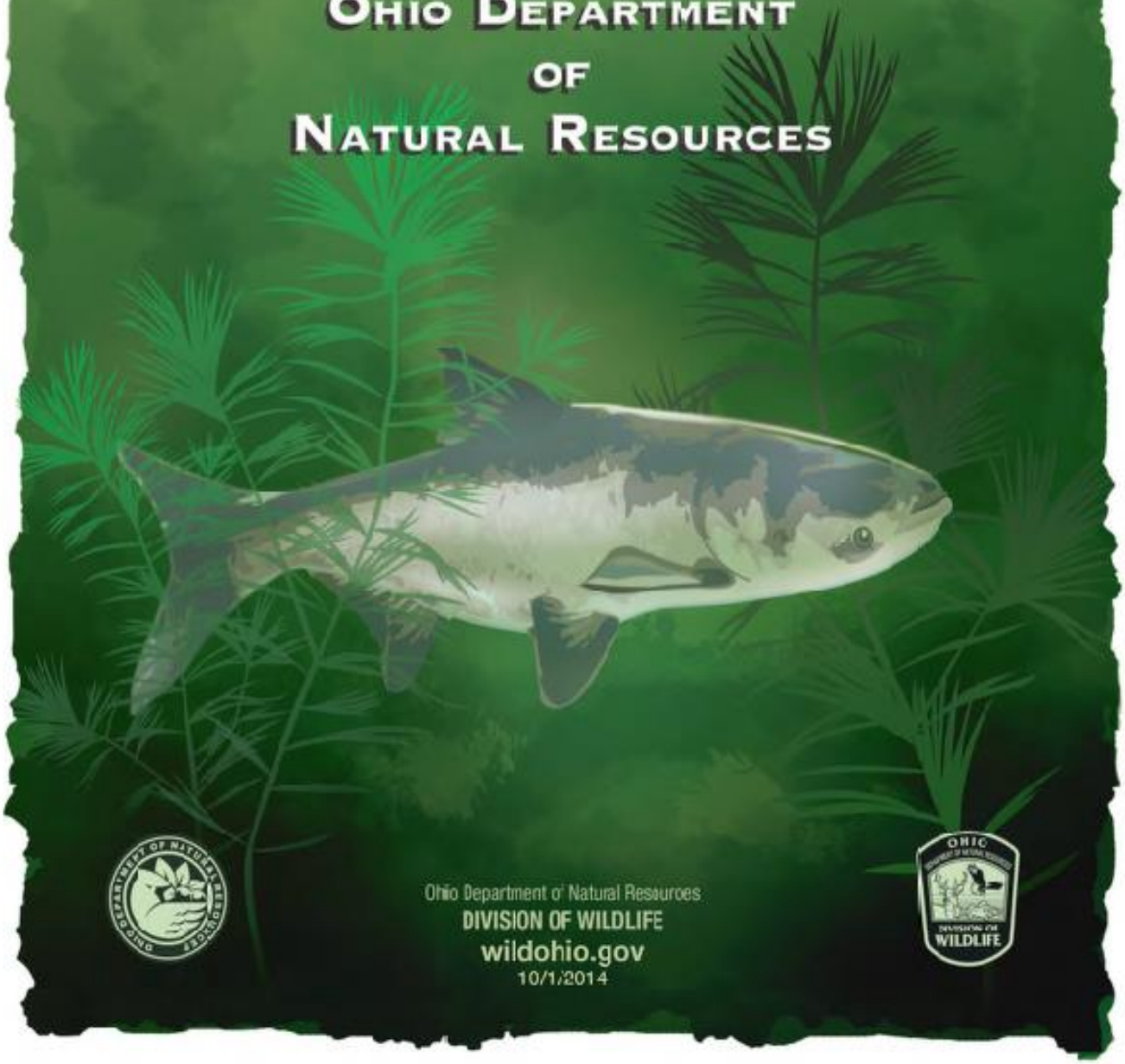
State Management Plan for Aquatic Invasive Species

Ohio Department of Natural Resources



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EXECUTIVE SUMMARY

Introduction

The actions recommended in this State Management Plan (SMP) are designed to be effective in preventing both the entry of new organisms into Ohio waters and the transfer and spread of organisms among and within water bodies in the state. This SMP also aims to minimize the impacts of invasive species on the environment, economy, and society and to protect and maintain biodiversity, industry, and recreational opportunities.

The state of Ohio straddles two major North American watersheds. The northern third of Ohio lies within the Great Lakes basin, and the southern two-thirds of the state lies within the Mississippi River basin. Both of these basins have been significantly impacted by aquatic invasive species (AIS), with the most significant invasions occurring in the last 30 years.

A number of animal and plant AIS have adversely affected the productivity and biodiversity of Ohio's native species and aquatic ecosystems. Most of these AIS introductions have been the result of human activities. There are many vectors and pathways for the introduction and spread of AIS including, but not limited to commercial shipping, aquaculture, live organism trade or release, commercial fishing, recreational equipment and activities, research activities, and water delivery and diversions. Potential threats may be prioritized by the degree of negative impact these species can have upon the environment, society, and economy. Negative impacts can include changes in river, lake, or wetland ecology including loss of biodiversity; changes in nutrient cycling; reduced habitat and water quality; reduced recreational opportunities; increased costs for industry; decreased property values; and threats to public safety.

The Great Lakes region has been impacted by both intentional and unintentional introductions of AIS since the settlement of the region. Since the 1800s, at least 182 non-native aquatic organisms have colonized habitats within the Great Lakes ecosystem. Potential for AIS to cause significant economic impacts in the Lake Erie region is because of the value of commercial and recreational industries.

Many partners share responsibility for protecting Ohio waters from the introduction of new AIS. Commitment and coordination between partners at federal, state, and local government levels; along with universities, non-government organizations (NGOs), businesses, and private landowners are needed to effectively combat AIS. Strategies used to prevent and abate AIS to date have included a number of regulatory and voluntary efforts by both public and private entities. Examples include voluntary Best Management Practices (BMPs) for the exchange of ballast water, as well as recently enacted ballast water regulations. Additionally, a variety of educational programs have increased awareness of introduction pathways and ways to prevent new AIS introductions. Government agencies and nongovernment partner's will work together to monitor existing AIS, search for new AIS, and provide assessments of AIS management efforts. However, much work remains to control established invasive species and to protect Ohio waters from new introductions of AIS.

Defining the Problem

A number of animal and plant AIS have adversely impacted the environment, industry, economy, and human health and they have arrived through many different pathways. AIS risk can be prioritized by the degree of negative impact (risk level). High risk species are those that currently cause or could potentially cause significant harm while medium risk species are those that have a lesser impact but are still a cause for concern.

Goals, Objectives, and Strategies

The primary focus of this SMP is the prevention of new AIS introductions to Ohio waters through interruption of the most significant pathways and vectors. This SMP contains background information on both environmental and economic impacts. It describes current priority species based upon these impacts, and vectors of AIS entry into the state. This plan describes new strategies in addition to existing efforts to prevent the introduction of new AIS, prevent the dispersal of established AIS, detect and respond to new invaders, and abate the harmful effects of AIS in Ohio waters.

Beyond this background information, the core of the plan lies in 26 different management strategies organized within ten objectives under the following five goals:

1. **Leadership:** Provide leadership for AIS issues in Ohio among local, state, and federal agencies as well as other organizations in order to effectively address AIS.
2. **Prevention:** Identify AIS vectors and focus efforts on preventing the introduction and spread of AIS into Ohio.
3. **Early Detection and Rapid Response:** Implement early detection and rapid response actions so that newly introduced AIS can be located quickly and eliminated.
4. **Control:** When feasible, control or manage AIS that have or may have significant impacts in Ohio.
5. **Research and Education:** Increase research efforts on AIS, and educate the general public and individuals involved in related business, trade, research, recreation and government sectors about AIS issues.

Existing Authorities and Programs

Addressing prevention and control of AIS requires coordination of policies and programs at many levels of government. Federal, regional, and state government all play a role in implementation of the federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, Public Law 101-646) and the National Invasive Species Act of 1996 (NISA, Public Law 104-332). In addition to the above, the state of Ohio currently has a number of statutory and regulatory authorities detailed in both the Ohio Administrative Code (OAC) and Ohio Revised Code (ORC) with which it addresses issues of prevention and control of AIS. The majority of this authority lies within the Ohio Department of Natural Resources (ODNR), Ohio Department of Agriculture (ODA), and the Ohio Environmental Protection Agency (OEPA). Even though there are statutes dealing with AIS in Ohio, many gaps exist that prevent effective management. More comprehensive regulations are needed to address the movement of AIS through: live bait, live food market, private/pay lakes, pet trade, plant trade, and recreational activities.

Priorities for Action

All of the strategies listed under the five goals of this plan are important, but when it comes to implementation there is a need to prioritize strategies based upon the severity of the problem, the programmatic authority, capability and feasibility to resolve it, and the cost of the proposed solution. The following five priority actions are listed in order of importance:

1. **Coordinate the Ohio Aquatic Invasive Species Committee to address AIS issues in Ohio.**

2. **Evaluate the effectiveness of existing management and regulatory tools for preventing the introduction of priority AIS**.

3. **Target outreach efforts and prioritize key audiences to promote understanding of invasive species dispersal pathways and risks.**

4. **Implement control and rapid response strategies that are based on the best available scientific information and conducted in an environmentally sound manner.**

Program Monitoring and Evaluation

The implementation of Ohio's SMP will enable us to monitor progress toward the five goals in the plan. We will be able to select appropriate management actions as well as make necessary "mid-course" corrections. This process will involve three components: (1) oversight, (2) evaluation, and (3) dissemination of information.

I. INTRODUCTION

Ohio is the 34th largest state in the U.S but ranks 7th in number of people making it a highly populace state; consequently Ohio is very susceptible to the movement of AIS by humans. Ohio also has over 60,000 miles of streams which can act as super highways for AIS movement within Ohio. From a regional standpoint, Ohio is part of two major North American watersheds (Figure 1). The northern third of Ohio lies within the Great Lakes basin, and the southern two-thirds of the state lie within the Mississippi River Basin. Both basins have been significantly impacted by AIS. The Great Lakes basin is the largest freshwater system in the world and represents a top natural resource management priority. It is likely that AIS impacts will be the most significant in Lake Erie because it is shallow, warm, nutrient enriched, and biologically productive. The Mississippi River is one of the largest and most ecologically diverse river systems in the world and because AIS use rivers to spread, Ohio is susceptible to invasions from anywhere within the basin through the Ohio River.

Figure 1: Ohio watershed boundaries and major waterways.

Aquatic ecosystems throughout Ohio are experiencing significant negative effects from established AIS, and Ohio waters are continually threatened by new invasions. AIS are non-native aquatic organisms that may cause economic and/or environmental harm. Newly introduced species can disrupt the balance of a natural ecosystem, often in its food web, leading to changes in the abundance and species composition of native plants and animals. This disruption can cause permanent, irreversible ecological damage and may increase the likelihood of additional AIS introductions because of the system's instability. The introduction of AIS is a source of biological pollution that threatens not only the ecology, but also causes economic, social, and public health impacts to the region. AIS can have significant economic effects on waterfront property values, tourism, utilities, fisheries, and other industries (Lovell and Stone 2005).

The Great Lakes region has been impacted by both intentional and unintentional introductions of AIS since the settlement of the region by Europeans (Mills et al. 1993, Ricciardi 2001). Since the 1800s, at least 182 non-native aquatic organisms have colonized habitats within the Great Lakes ecosystem. These species include: 27 algae, 55 vascular plants, 66 invertebrates, 28 fish, and six bacteria and viruses (National Oceanic and Atmospheric Administration 2011). About 55 percent of these species are native to Eurasia, with an additional 13 percent native to the United States (US) Atlantic Coast.

Potential for AIS to cause significant economic impacts in the Great Lakes region is high because of the value of commercial and recreational industries. Ohio's nine ports on Lake Erie typically handle 55–60 million tons of cargo each year and support vital industries such as steelmaking, construction, salt mining, and power generation. The region's recreation and tourism industries are valued at $15 billion annually, $1.5 billion of which is direct expenditures on recreational fishing trips (U.S. Fish & Wildlife Service and U.S. Census Bureau 2006) with an estimated total impact related to the region's recreational fishing industry of nearly $7.1 billion (Southwick Associates 2007). More than 58,000 jobs are supported by Great Lakes sport fisheries (Southwick Associates 2007), and commercial fisheries provide an additional 9,000 jobs (U.S. Fish & Wildlife Service 1994). Rosaen et al. (2012) estimate that aquatic invasive species likely costs the Great Lakes region significantly more in aggregate than $100 million annually.

The Mississippi River basin is the largest river system in North America and its many tributaries drains all or parts of 31 US states and two Canadian provinces between the Rocky and Appalachian Mountains. Flowing entirely within the United States, the river itself originates in northern Minnesota and meanders southward for 2,530 miles to the Mississippi River Delta at the Gulf of Mexico. The Mississippi River Basin has been greatly impacted by a number of invasive fish, plants, and mussels, and continues to be threatened by new AIS introductions. There are a reported 149 AIS established within the Mississippi River Basin, including 56 plants, 16 invertebrates, 75 fish, one amphibian, and one mammal (U.S. Geologic Survey 2012). Placing an economic value on biological invasions in the Mississippi River Basin is not straightforward and is extremely complex (Windle et al. 2008), consequently, there is not a current and comprehensive aggregate estimate for the cost of AIS in this region or to the portion of the state of Ohio contained within the Ohio River watershed.

There are many vectors and pathways for the introduction and spread of AIS including, but not limited to commercial shipping, aquaculture, live organism trade or release, commercial fishing, recreational equipment and activities, research activities, and water

delivery and diversions. A changing climate is likely to increase opportunities for additional non-native species to successfully invade Ohio waters as warmer temperatures increase the likelihood of non-native species becoming established.

Actions taken to date to prevent the introduction of new AIS include regulatory and voluntary efforts by both public and private entities. Some of these activities serve as models using innovative, strategic approaches. These include voluntary BMPs for the exchange of ballast water as well as recently enacted ballast water regulations. A wide variety of educational programs (such as those aimed at recreational boating and aquatic species trade industries) have increased awareness of introduction pathways and ways to prevent new AIS introductions. Government agencies and nongovernment partners need to work together to monitor existing AIS, search for new AIS, and provide assessments of AIS management efforts. However, much work remains to control established invasive species and to protect Ohio waters from new introductions of AIS.

This comprehensive AIS SMP describes new strategies in addition to existing efforts to prevent the introduction of new AIS, prevent the dispersal of established AIS, detect and respond to new invaders, and abate the harmful effects of AIS in Ohio waters. This SMP identifies a goal related to each of five conceptual areas: (1) leadership, (2) prevention, (3) early detection and rapid response, (4) control and management, and (5) research and education.

Recent research has demonstrated that preventing the spread of invasive organisms from already colonized areas (i.e., containment) is the most effective way to reduce the likelihood of new invasions at the landscape scale (Drury and Rothlisberger 2008). Therefore, the focus of this SMP is on the prevention of new AIS to Ohio waters through interruption of the most significant pathways and vectors for new introductions. The preventative actions recommended in this SMP are designed to be effective with both the entry of new organisms into Ohio waters, and the transfer and spread of organisms among and within water bodies in the state. This SMP also aims to minimize the impacts of invasive species on the environment, economy, society, human health and to protect and maintain biodiversity and recreational sustainability.

While prevention of new invasions is a focus of this SMP, some new invasions are inevitable even with the best prevention programs. Therefore, early detection and further development of a response capacity for new invasions are also important components of the plan. Additionally, this SMP addresses management and control efforts to minimize impacts from established AIS populations using a coordinated, science-based approach. Many partners share responsibility for protecting Ohio waters from the introduction of new AIS. Commitment and coordination between partners are needed to effectively implement the provisions of this SMP and ensure organized commensurate actions.

Ohio's first SMP was approved in 1999 under the auspices of NISA. At the time it was among the first SMPs in the nation approved by the Aquatic Nuisance Species Task Force (ANSTF). In 2008, the ODNR Division of Wildlife (DOW) formed the Ohio Aquatic Invasive Species Committee (OAISC) to address AIS issues in Ohio, including the revision of Ohio's AIS SMP. The OAISC is made up of government, industry, university, and private groups (Section XI). The revised SMP incorporated elements from the plans in Michigan and Pennsylvania and the ODNR DOW and Ohio Sea Grant prepared a draft SMP for review by the OAISC which identified gaps and strengthened the overall SMP.

II. DEFINING THE PROBLEM

A number of animal and plant AIS have adversely affected the productivity and biodiversity of Ohio's native species and aquatic ecosystems. Most of these AIS introductions have been the result of human activities and a changing climate is likely to increase opportunities for additional non-native species to successfully invade Ohio waters due to warmer temperatures and enhanced reproductive cycles. There are many pathways for the introduction and spread of AIS. Some pathways, such as the aquaculture industry, are currently regulated to minimize the risk of new AIS introductions, while other pathways have traditionally gone unchecked. AIS risk can be prioritized by the degree of negative impact (risk level). High risk species are those that currently cause or could potentially cause significant harm to the environment, industry, economy, and human health. Medium risk species are those that have a lesser impact but are still a cause for concern. The following two sections describe the history of introduction, distribution, and current or potential impacts for high and medium risk animal and plant invasive species.

Animals

High Risk Species:

Asian carps refer to a group of fishes that are native to Asia. The U.S. Fish and Wildlife Service (USFWS) specifically uses "Asian carp" to refer to bighead carp *Hypophthalmichthys nobilis*, silver carp *H. molitrix*, black carp *Mylopharyngodon piceus*, and grass carp *Ctenopharyngodon idella*. The larger group of Asian carps 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. Bighead and silver carp were introduced into aquaculture and wastewater treatment facilities to control algae and escaped into the Mississippi River during floods in the early 1980s. They have since spread upriver and have become the most abundant fish in some regions of the Mississippi, lower Ohio, and Illinois rivers. Black carp were brought to the United States to control snail populations in aquaculture facilities and escaped from holding ponds in Missouri in 1994. Recent collections suggest that the black carp are established in the lower part of the Mississippi River basin. Grass carp were imported into aquaculture facilities in Alabama and Arkansas in 1963 to control vegetation in rearing ponds. They were widely stocked and their range was expanded by intentional and non-intentional releases. Many of the 45 states where grass carp are now found, including Ohio, have banned the stocking of diploid grass carp, but allow the stocking of triploid (genetically sterile) grass carp by permitted aquaculture facilities.

Asian carps are a threat because of their reproductive success, long life spans, and feeding habits, thereby damaging habitat and disrupting food webs. Bighead and silver carp feed on plankton and are in direct competition with native organisms. Silver carp can also be hazardous to boaters and water-sport enthusiasts because, when startled by the sound of passing boat motor, they can jump six to ten feet out of the water into the path of moving boats, causing damage and injuring passengers. Grass carp are known to eradicate aquatic vegetation in lakes, altering habitat and interfering with the reproduction of native fish. Black carp feed primarily on mussels and snails which threaten native mollusk and snail populations (some of the most imperiled/endangered organisms in North America) as well as mollusk-feeding fish and birds. Common carp

and goldfish feed on the bottom and are notorious (especially common carp) for altering their environments by destroying and uprooting submerged vegetation, negatively impacting other fish and waterfowl.

The **northern snakehead** *Channa argus* prefers stagnant shallow ponds, swamps, and slow streams with mud or vegetated substrate, with temperatures ranging from 0° to over 30° C. This fish is popular in Asian cuisines, and most introductions were likely released fish procured for food. Northern snakeheads are established in Virginia, Maryland, Pennsylvania, New York, and Arkansas. The species is well established in the Potomac River and several of its tributaries in Virginia and Maryland (Starnes et al. 2011). These predatory fish compete with native species for food and habitat. Juveniles eat zooplankton, insect larvae, small crustaceans, and the fry of other fish. As adults they feed mostly on other fishes with the remainder of their diet comprised of crustaceans, frogs, small reptiles, and sometimes small birds and mammals.

The invasion of the **sea lamprey** *Petromyzon marinus*, a parasitic fish which kills other fish by attaching to its prey and feeding on body fluids, in the 1920s resulted in substantial economic losses to recreational and commercial fisheries, and has required annual expenditures of millions of dollars to finance control programs. Sea lamprey used the shipping canal system that circumnavigated Niagara Falls to move from Lake Ontario to the upper Great Lakes. During the 1940s and 1950s, the sea lamprey devastated populations of commercially and recreationally valuable whitefish and lake trout. The reduction in populations of these fishes permitted populations of less valuable fish to increase and proliferate. Of all AIS invasions into the Great Lakes, only the sea lamprey has been successfully managed at a level where their populations are low enough to minimize impacts. In 2012, the cost of sea lamprey control and research was approximately $18 million annually (Rosaen et al. 2012). The total value of lost fishing opportunities plus indirect economic impacts from lamprey predation probably exceeds $500 million annually (U.S. Office of Technology Assessment 1993).

The **round goby** *Neogobius melanostomus* and **tubenose goby** *Proterorhinus semilunaris* were introduced into the Great Lakes via ballast water from ocean-going vessels. Tubenose goby is a smaller fish that has recently been substantially increasing in numbers around the Bass Island Chain in Lake Erie. Round goby were first detected in the St. Clair River near Detroit in 1990 and appeared in Cleveland harbor shortly thereafter. By 1998, they were widespread throughout all of Lake Erie. There has been at least one introduction to an inland Ohio water body, and other streams and lakes are potentially at risk. The primary concern with round goby is the tremendous population growth and range expansion it exhibited since its introduction in 1990, facilitated by its ability to spawn repeatedly within a given year and its efficient method of early juvenile dispersal.

It is an aggressive fish and a strong competitor with small bottom-feeding native fishes like mottled sculpin *Cottus bairdi*, darter species, and even juvenile game fishes like smallmouth bass *Micropterus dolomieu*. Gobies are voracious predators on snails, mussels, aquatic insects, and the eggs and fry of native fish species. Great Lakes fisheries have been profoundly impacted by round goby because of its robust characteristics and potential to displace native species from prime habitat and spawning areas (e.g., Winslow 2010, Steinhart et al. 2004). As an efficient nest predator, their potential to impact recruitment of native sport fishes led the State of Ohio to close Lake Erie's smallmouth bass fishery to harvest during the spawning season so that the male

can stay on the nest to guard against predators. Round goby have also been implicated in reintroducing historically bioaccumulated contaminants back into food webs (Kwon et al. 2006). After years of declining levels, PCB concentrations in Lake Erie smallmouth bass tissue tripled on average following the establishment of round goby (Ohio Environmental Protection Agency, unpublished data).

The **zebra mussel** *Dreissenia polymorpha* and **quagga mussel** *Dreissena bugensis*, both ballast water introductions, are two of the best known invaders of the Great Lakes region and other areas of the country where they have spread. These AIS have caused serious economic and ecosystem impacts (e.g., Windle et al. 2008). Dreissenid mussels are highly opportunistic, reproduce rapidly, and consume plankton from the water column in large quantities. Major changes have occurred in Lake Erie after the dreissenid invasion, including the disappearance of native clams from many areas, greatly reduced planktonic diatom and rotifer densities, a substantial resurgence in blooms of potentially toxic cyanobacteria/blue-green algae, vastly increased water clarity, and reduction in the annual economic value of the sport fishery. The initial invasion and exponential increase in numbers of dreissenid mussels occurred coincidentally with the reduction of phosphorus levels induced by the Clean Water Act and Great Lakes Water Quality Agreement. Dressenid mussels have been shown to accumulate contaminants and can pass those contaminants up the food web. Dreissenid mussels have spread to a number of inland lakes and reservoirs as well as the waters of the Ohio River along our entire border where they pose a serious threat to native mussels.

Potential impacts on fisheries can be profound because of changes in food availability and spawning areas. Economic impacts are as common as the ecosystem impacts. Great Lakes municipalities, utilities, and industries, because of the infestation of dreissenid mussels in their intake/discharge pipes, have incurred significant costs from monitoring, cleaning, and controlling infestations. For example, by 2008 the Cleveland Plain Dealer estimated dreissenid mussels had cost the region approximately $1.5 billion in efforts to prevent such clogging/fowling. Commercial and recreational vessels and beach areas are also vulnerable to the negative impacts of dreissenids.

Medium Risk Species:

Alewife A*losa pseudoharengus* are perhaps best known for their invasion of the Great Lakes by using the Welland Canal to bypass Niagara Falls. Alewife colonized the Great Lakes and increased rapidly during the 1940s and 1950s because of the suitability of the habitat and the fact that predators were not sufficiently abundant to check their population growth. Declining water quality prior to the Clean Water Act, and the loss of large native planktivores like the lake herring or cisco *Coregonus artedii* from Lake Erie contributed to the establishment of alewife by creating an open niche. Like many herring species, alewives are prone to massive die-offs because of seasonal changes in water temperature. Periodic kills have fouled recreational beaches and blocked municipal and industrial water intakes. At the same time alewife out-competed and suppressed native whitefishes, yellow perch, and emerald shiners, and became a key prey species for salmonids. Unfortunately, alewives produce an enzyme (thiaminase) that breaks down thiamin or vitamin B1, and as a result, predatory fish with diets high in alewife are more susceptible to mortality. The alewife has permanently altered existing predator-prey relationships in the Great Lakes ecosystem, and caused instability in the forage base because of their population variability.

The **river ruffe** *Gymnocephalus cernuus*, a Eurasian fish of the perch family, was introduced to North America in the 1980s most likely through the ballast water of ocean-going vessels. Ruffe have few predators, no commercial or recreational value, and may be displacing native fishes. Since its introduction, the ruffe became established in the nearshore waters of western Lake Superior, with an estimated average rate of range expansion of 18 shoreline miles per year. By the fall of 1994, ruffe populations were found in Michigan waters of Lake Superior. Based on observations of present ruffe expansion rates, and life history aspects of the ruffe in Europe, there is high potential for future negative impacts to valuable native fish such as yellow perch in situations where the two are forced to compete for food resources. While this species has never been collected in Ohio's Lake Erie waters, its potential impacts warrant continued vigilance.

The **spiny water flea** *Bythotrephes longimanus* and **fishhook water flea** *Cercopagis pengoi*, likely ballast water introductions, are tiny crustaceans with sharply barbed tail spines. The spiny water flea is a native of northern Europe and was first found in Lake Huron in 1984, and Lake Erie in 1986 (Bur et al. 1986). The fishhook water flea was first collected in Lake Erie's central basin in 2002. Both species are now found throughout the Great Lakes, and the spiny water flea has been found in some inland lakes. They can form dense blooms and clump on fishing line, making retrieval of gear difficult. Resource managers suspect that these invaders compete with native zooplankton and fish for food but may also be used by native fish as a food source.

Plants

High Risk Species:

Giant reed grass *Phragmites australis* has become a tremendous problem in Lake Erie coastal marshes and other wetlands throughout northern Ohio. This non-native grass forms extensive colonies with individual stalks often reaching 10–15 feet in height. It spreads primarily by rhizomes that run above or below the surface.

European or glossy buckthorn *Rhamnus frangula* is a wetland shrub that has become a serious problem in wetlands such as bogs, fens, wet prairies, and sedge meadows, particularly in northern Ohio. It can completely displace native vegetation over large areas of a wetland and is difficult to control as it spreads aggressively by seed and rhizomes.

Reed canary grass *Phalaris arundinacea* is a non-native grass that forms dense populations that can virtually eliminate all other plants. It has become a serious problem in several native wetland communities in Ohio including marshes, fens, and wet prairies.

Flowering-rush *Butomus umbellatus* has narrow, sword-like leaves beneath multiple long-stalked pink flowers on tall stems. The species spreads by seed, rhizomes, and bulbets that break off from the rhizomes. It has recently spread rapidly in the western Lake Erie marshes where it is now the dominant species, replacing purple loosestrife in many cases.

Hydrilla was release in the 1960s from aquariums into waterways in Florida and is now established in the southeast from Connecticut to Texas. *Hydrilla* is an aggressive plant that can form large dense mats that impact aquatic fish and wildlife along with recreationalists. By the 1990s, control and management were costing millions of dollars

each year. *Hydrilla* can be controlled by aquatic herbicides, grass carp (itself an invasive species), and insects. Tubers pose a problem to control as they can lay dormant for a number of years. This has made it even more difficult to remove from waterways and estuaries. *Hydrilla* is established in the Ohio River and was recently identified in ponds in the Lake Erie watershed.

Medium Risk Species:

Purple loosestrife *Lythrum salicaria* is an invasive wetland plant from Europe and Asia that was introduced to the east coast of North America in the 1800s. Since then, it has spread to the Great Lakes region and inland waters in Ohio. It produces a brilliant spike of lavender flowers making it a popular garden plant, although only the variety *Lythrum virgatum* is allowed to be sold in Ohio (*L. salicaria* is listed as a noxious weed by the Ohio Department of Agriculture). Purple loosestrife invades marshes and lakeshores, displacing valuable native wetland plants. It can develop a monoculture which is unsuitable as cover, food, or nesting sites for a wide range of native wetland fish and wildlife species.

Eurasian watermilfoil *Myriophyllum spicatum* was unintentionally introduced to North America from Europe and has spread into inland lakes and ponds primarily by recreational boaters. Eurasian watermilfoil can reach high densities in lakes and cause serious problems for commercial fishing as well as recreational activities such as boating, fishing, and swimming. The plant's floating surface canopy can out-compete and eliminate native aquatic vegetation, thereby threatening native fish and wildlife populations.

Bushy pondweed/lesser naiad *Najas minor* and **Curly pondweed** *Potamogeton crispus* are two other non-native aquatic plants impacting inland lakes and ponds in Ohio. These submersed aquatic plants are especially abundant in eutrophic water where an overabundance of nutrients, often from fertilizer runoff or sewage waste, has altered the natural ecology. They can reduce native aquatic plant and fish diversity as well as impact recreational activities. When a large biomass of curly pondweed begins to die late in the growing season, its decomposition can lead to oxygen depletion and fish kills in smaller inland waters.

Narrow-leaved cattail *Typha angustifolia* and **Hybrid cattail** *Typha X glauca* (its hybrid with the native broad-leaved cattail *Typha latifolia*) are aggressively spreading plants which tend to form dense colonies that displace native emergent plant species. Both plants can be distinguished from the native species by a narrow gap that separates the male and female flowers of the inflorescence as well as by narrower leaves. They both spread by rhizomes and airborne seeds.

Japanese knotweed *Fallopia japonica* (syn. *Polygonum cuspidatum*) is a large, herbaceous perennial plant, native to eastern Asia. In North America and Europe the species is very successful and has been classified as an invasive species in several countries. It is a frequent colonizer of temperate riparian ecosystems, roadsides and waste places. It forms thick, dense colonies that completely crowd out any other herbaceous species and is now considered one of the worst invasive exotics in parts of the eastern United States.

III. GOALS, OBJECTIVES, AND STRATEGIES

Continuous effort is required to block the pathways that AIS use to enter and disperse in Ohio waters, as well as to detect and respond to new invaders, and to manage and control established populations. The goals of this SMP are designed to address different stages of AIS invasion: the introduction of AIS transported from water bodies outside of Ohio; the dispersal of established, reproducing AIS populations in Ohio to other water bodies within the state; and the colonization of AIS populations within water bodies.

The State of Ohio recognizes that to accomplish these goals, it must coordinate with jurisdictions inside and outside the state and build its strategies upon sound science. Therefore, mechanisms will be established to ensure that all strategies developed and implemented by the State under this plan are (1) done in cooperation with federal agencies, local governments, interjurisdictional organizations and other entities; (2) based upon the best scientific information available; and (3) conducted in an environmentally-sound manner.

The five goals of the SMP address:

- **Goal - 1 Leadership**
- **Goal - 2 Prevention**
- **Goal - 3 Early Detection and Rapid Response**
- **Goal - 4 Control and Management**
- **Goal - 5 Research and Education**

Goal 1 - Leadership: Provide leadership for AIS issues in Ohio among local, state, and federal agencies as well as other organizations in order to effectively address AIS.

Objective 1.1: Coordinate all AIS management programs and activities within Ohio and establish multi-state cooperation and coordination within the Great Lakes and Mississippi River regions as well as nationally.

- **Strategy 1.1a:** Coordinate the OAISC to address AIS issues in Ohio. The Committee will be comprised of government, industry, university, and private groups and will meet annually to address relevant AIS issues.
- **Strategy 1.1b:** Partner with AIS management programs in nearby states through regional organizations (e.g., Great Lakes and Mississippi River Basin Panels) and national organizations (e.g., Aquatic Nuisance Species Task Force and Association of Fish and Wildlife Agencies) to ensure that AIS efforts in Ohio remain relevant and current; are based in the most recent science; and coordinated with regional, national, and local programs.
- **Strategy 1.1c:** Identify all sources of funding available and evaluate their utility for addressing Ohio's priority AIS issues. Identify the current funding capacity and identify priority resource needs and new funding opportunities. In cooperation with other partners, work with the Governor's Office and Legislature to establish a permanent funding mechanism for AIS management activities. Identify funding gaps and identify currently funded programs that are lower priority or not meeting their goals so that resources can be reallocated.

Goal 2 - Prevention: Identify AIS vectors and focus efforts on preventing the introduction and spread of AIS into Ohio.

Objective 2.1: Establish a comprehensive process to identify AIS of greatest concern that are not yet present in Ohio waters and prioritize highest-risk introduction pathways.

- **Strategy 2.1a:** Identify and rank, by short- and long-term risk assessment, the species or groups of species of greatest concern and conduct an analysis to determine the level of risk associated with their introduction. The species list will include species in the U.S. but not established in Ohio as well as species not yet in the U.S.
- **Strategy 2.1b:** Using the prioritized list of AIS with the greatest potential to invade Ohio waters, identify existing and potential pathways that would facilitate introductions of these species. Prioritize highest-risk pathways for future legislation, rules, research, and control efforts.
- **Strategy 2.1c:** Work with government and non-government stakeholders to develop a science-based, comprehensive screening system for evaluating risks associated with the introduction of all non-native aquatic species.

Objective 2.2: Identify potential prevention strategies for addressing AIS of greatest risk and high-risk introduction pathways.

- **Strategy 2.2a:**, Evaluate the effectiveness of existing management and regulatory tools (incorporating pathway analysis) for preventing the introduction of priority AIS into Ohio by identifying potential gaps and improve existing tools. Develop and implement specific strategies and plans to reduce the likelihood of both intentional and unintentional introduction of harmful AIS through high-risk pathways.
- **Strategy 2.2b:** Identify "ecologically sensitive" aquatic resource areas that are free of AIS, and enhance protection through the (1) identification of potential introduction pathways and (2) establishment of additional precautionary measures including educational outreach and enforcement.
- **Strategy 2.2c:** Identify BMPs, codes-of-conduct, and potential certification options for key industry and user groups (e.g., pet and aquarium trades, water gardens, aquaculture industry, research community, commercial shipping, recreational boating, transportation industry, and bait retailers and suppliers) to help keep the priority AIS out of Ohio.

Goal 3 - Early Detection and Rapid Response: Implement early detection and rapid response actions so that newly introduced AIS can be located quickly and eliminated.

Objective 3.1: Enhance coordination within Ohio to detect new invasions, as well as range expansions of AIS within Ohio. Prioritize early-detection efforts and increase knowledge and expertise to enhance these efforts.

- **Strategy 3.1a:** Assemble a focused committee of agency, municipal, NGO, and academic professionals who survey aquatic organisms as part of their monitoring and research activities and have them evaluate current early-detection programs, identify gaps, and make recommendations for improved monitoring of priority AIS.

- **Strategy 3.1b:** Develop a list of experts within agencies, academia, NGO, and contractors that can help identify AIS and develop contract arrangements if necessary.
- **Strategy 3.1c:** Create a regional "watch" list for species that have potential to enter Ohio.
- **Strategy 3.1d:** Identify high "invasion likelihood" areas for targeted early detection surveying.
- **Strategy 3.1e:** Establish cooperative policies with states sharing watersheds for coordinated early detection efforts.

Objective 3.2: Create a master inventory of Ohio AIS that is regularly maintained, updated, and accessible.

- **Strategy 3.2a:** Create a compilation of AIS in Ohio held by various groups (local, county, state, federal, and private organizations). Identify inventory gaps, and develop strategies to address deficiencies.
- **Strategy 3.2b:** Integrate Ohio AIS location information into the United States Geologic Surveys Nonindigenous Aquatic Species Database.

Objective 3.3: Implement Ohio's Rapid Response Plan (Appendix A) for the eradication of newly detected AIS under predetermined conditions.

- **Strategy 3.3a:** Implement Ohio's RRP in high risk systems where there is a high likelihood that eradication efforts will be effective.

Goal 4 - Control: When feasible, control or manage AIS that have or may have significant impacts in Ohio.

Objective 4.1: Prioritize AIS on which to focus control efforts and explore and utilize the various methods available to control these populations.

- **Strategy 4.1a:** Implement scientific analyses to prioritize control efforts for both species and sites and consider the long-term, cost-effectiveness of all proposed strategies against the "no-action" alternative.
- **Strategy 4.1b:** Implement control strategies that are based on the best available scientific information and conducted in an environmentally sound manner. Coordinate control strategies with federal agencies, local governments, interjurisdictional organizations, and other appropriate entities. Establish protocols that will provide guidance in designing and implementing control and eradication strategies.
- **Strategy 4.1c:** Evaluate potential incentive programs or assistance for private landowners for the control of invasive species and restoration of impacted ecosystems.
- **Strategy 4.1d:** Develop means of modifying human activities in areas of AIS infestations to help prevent their spread.

Goal 5 - Research and Education: Increase research efforts on AIS, and educate the general public and individuals involved in related business, trade, research, recreation and government sectors about AIS issues.

Objective 5.1: Establish and coordinate an Ohio AIS research network by building on existing state, federal, and university programs.

- **Strategy 5.1a:** Identify all current AIS research needs and potential network members and prioritize the research specific to Ohio's freshwater habitats.

Objective 5.2: Increase public awareness of AIS impacts and strategies that can be implemented to reduce the establishment and spread of AIS in Ohio.

- **Strategy 5.2a:** Target outreach efforts and prioritize key audiences (e.g., live organism trades and aquatic user groups) to promote understanding of invasive species dispersal pathways and risks.
- **Strategy 5.2b:** Maintain a comprehensive and current AIS website and work to develop other types of media to inform the public of AIS issues.

Objective 5.3: Target policy makers and legislative staff for outreach efforts.

- **Strategy 5.3a:** Provide educational briefings on the threats, economic and ecological impacts, and solutions to AIS invasions in Ohio for decision makers and legislators. Keep legislators and decision makers informed and updated on the progress of Ohio AIS management efforts.

IV. EXISTING AUTHORITIES AND PROGRAMS

Addressing prevention and control of AIS requires coordination of policies and programs at many levels of government. The following overview describes the basic role of federal, regional, and state government in implementation of the federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, Public Law 101-646) and the National Invasive Species Act of 1996 (NISA, Public Law 104-332). It also includes an assessment of Ohio's existing laws and programs that address prevention and control of AIS.

Federal Role

Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA): NANPCA calls upon states to develop and implement a comprehensive SMP to prevent introduction and control the spread of AIS. Section 1002 of NANPCA outlines five objectives of the law, as follows:

1. Prevent unintentional introduction and dispersal of nonindigenous species into waters of the United States through ballast water management and other requirements;
2. Coordinate federally conducted, funded or authorized research, prevention control, information dissemination and other activities regarding the zebra mussel and other aquatic nuisance species;
3. Develop and carry out environmentally sound control methods to prevent, monitor and control unintentional introductions of nonindigenous species from pathways other than ballast water exchange;
4. Understand and minimize economic and ecological impacts of nonindigenous aquatic nuisance species that become established, including the zebra mussel;
5. Establish a program of research and technology development and assistance to States in the management and removal of zebra mussels.

NANPCA was primarily a response to the Great Lakes invasion of the zebra mussel, which has caused extensive ecological and socioeconomic impacts. Although the zebra mussel issue played a key role in prompting passage of the legislation, NANPCA was established to prevent occurrence of new unintentional introductions of AIS, and to limit dispersal and adverse impacts of invasive species currently inhabiting United States waters.

Section 1201 of the Act established the national Aquatic Nuisance Species ask Force (ANSTF), co-chaired by the US Fish and Wildlife Service and the National Oceanic and Atmospheric Administration (NOAA). The Act charges the ANSTF with developing and implementing a program for waters of the United States to prevent introduction and dispersal of aquatic nuisance species; to monitor, control and study such species; and to disseminate related information. The ANSTF is composed of 13 Federal and 13 ex-officio members. It is supported by six regional panel and numerous committees. The ANSTF also provides national policy direction as a result of protocols and guidance that have been developed through its standing and ad-hoc committees.

National Invasive Species Act: NISA (1996) amended and expanded NANPCA, mandating regulations to prevent the introduction and spread of AIS into the Great Lakes through ballast water. Initially in response to round goby, it also authorized the dispersal

barrier demonstration on the upper Mississippi watershed that is the current centerpiece of efforts to prevent silver and bighead carps from invading the Great Lakes. NISA authorized additional funding for AIS research, and required ballast water management programs to demonstrate technologies and practices to prevent nonindigenous species from being introduced.

U.S. Fish and Wildlife Service: The USFWS's Aquatic Invasive Species Program is housed within the Fisheries and Habitat Conservation Program's Division of Fisheries and Aquatic Resource Conservation. The Branch of Aquatic Invasive Species essentially houses three functions:

1. The FWS Aquatic Invasive Species Program – The AIS Program seeks to prevent the introduction and spread of AIS, rapidly respond to new invasions, monitor the distribution of and control established invaders, and foster responsible conservation behaviors through its national public awareness campaigns (Stop Aquatic Hitchhikers and Habitattitude).
2. Administration of Aquatic Nuisance Species Task Force – The Branch of AIS builds capacity, coordinates, and implements AIS prevention and control activities authorized under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, as amended by the National Invasive Species Act (NISA) of 1996), including: co-chairing and administering the ANSTF, supporting Regional Panels, providing grants for State/Interstate ANS Management Plans, and implementing a National AIS program.
3. Injurious Wildlife Evaluations and Listings – The AIS Program supports the Injurious Wildlife Provisions of the Lacey Act through an ongoing process of evaluating species and possibly listing them as injurious through the rulemaking process.

The AIS Program has worked to prevent populations of invasive species like Asian carp and zebra quagga mussels from entering or spreading into the United States. Priority containment (boat inspection and decontamination), early detection and rapid response (snakehead eradication and Chicago Sanitary Shipping Canal), interjurisdictional coordination and planning (Quagga/Zebra Mussel Action Plan and 100th Meridian), and regulatory (injurious wildlife listing of black and silver Asian carp) and non-regulatory actions (Stop Aquatic Hitchhikers!) have occurred across many jurisdictions. Through the actions of the AIS program, a national AIS network has been built – including 39 states, 6 Regional panels, over 1,000 participants in two national public awareness campaigns and many other partners – that has planned, directed and accomplished significant regional and landscape level invasive species prevention and management resource outcomes. The AIS Program serves as the nation's front line for prevention of new aquatic invasive species by regulating imports of injurious wildlife, facilitating behavioral change and managing pathways to limit the introduction and spread of invasives (awareness campaigns and ballast water), and developing monitoring programs for invasion hotspots to facilitate early detection and rapid response.

U.S. Forest Service (USFS): The mission of the USFS is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. The USFS strives nationally, regionally, and locally to reduce, minimize, or eliminate the potential for introduction, establishment, spread, and impact of aquatic and terrestrial invasive species (including plants, pathogens, vertebrates, invertebrates, fungi, algae, etc.) across all landscapes and ownerships. The Forest

Service plays an important national and regional role with the Aquatic Nuisance Species Task Force, including serving on several Regional ANS Panels. USFS invasive species management specialists are stationed at national, regional, and local offices throughout the country.

The USFS National Invasive Species Management Policy (Forest Service Manual – FSM 2900) provides direction to all National Forests and Grasslands to work with local, State, Tribal, and other partners to address aquatic and terrestrial invasive species threats. This national policy emphasizes importance of integrating USFS invasive species activities to expand prevention, early detection and rapid response, control, restoration, cooperation, education and awareness, and mitigation activities across all National Forest System programs areas. Among other requirements, the policy directs all National Forests and Grasslands to cooperate with State governments and Tribes to implement and enforce applicable regulations, plans, and guidance on invasive species management on National Forests and Grasslands, including but not limited to:

1. State regulations related to prevention and control of aquatic and terrestrial invasive species (including noxious weeds);
2. State regulations associated with utilizing, storing, transporting, or certifying invasive species-free (and/or noxious weed-free) straw, hay, mulch, gravel, forage, seed, or other materials; or
3. Statewide aquatic nuisance species management plans, fish and wildlife management plans, early detection and rapid response plans, or other statewide or region-wide invasive species management plans.

In southeastern Ohio, the Wayne National Forest covers over a quarter million acres of Appalachian foothills extending over a variety of aquatic and terrestrial habitats, and land ownerships. The Wayne NF is a working forest that provides multiple uses and multiple products to communities. The Ohio AIS Management Plan has included the USFS as a key federal partner in addressing priority invasive species management activities within Ohio, particularly in the areas associated with the Wayne National Forest. Under direction provided in FSM 2900 and other Forest Service requirements, all aquatic and terrestrial invasive species management activities conducted on the Wayne NF are integrated to restore and improve watershed condition, protect fish and wildlife populations and habitat, maintain forest productivity, improve recreational opportunities, and sustain critical ecosystem services.

There are a few additional pieces of federal legislation that can be used in the prevention and management of AIS.

Lacey Act: The Lacey Act (1900) largely falls to the USFWS for enforcement. Under its 18USC42 Lacey Act authority the USFWS can list wild animals as “injurious” and thus illegal for live (for the most part) interstate transport, but the process is lengthy and the species list is resultantly short, especially regarding fishes. As of 2012, potential AIS listed as injurious by the Lacey Act (and the date of their listing) are walking catfishes of the family Clariidae (1970), mitten crabs *Eriocheir* spp. (1989), zebra mussel (1991), snakehead fishes of the family Channidae (2002), silver carp (2007), largescale silver carp *Hypophthalmicthys harmandi* (2007), black carp (2007), and bighead carp (2010).

Plant Protection Act: The Plant Protection Act (2000) amounts to a comprehensive consolidation of earlier statutes and is coupled with several related statutes expanding

jurisdiction to non-plant invasive species. Implementation largely falls to the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) to prohibit, inspect, treat, quarantine, or require mitigation measures prior to allowing entry or interstate transport. APHIS can impose a relatively rapid response via proclamation, but that authority is usually invoked in response to pests or threats related to commercially valuable cultured organisms. For example, in October 2006 in response to viral outbreaks on the Great Lakes, APHIS imposed a federal order restricting international and interstate transport of fish species known to be susceptible to the invasive viral hemorrhagic septicemia (VHS) virus within or out of the at-risk region (i.e., states and provinces bordering the Great Lakes and St. Lawrence River). The stated purpose of this order was "to prevent the spread of VHS into aquaculture facilities."

Asian Carp Prevention and Control Act: Concern over the potential for ecological and economic damage to the Great Lakes region if Asian carps successfully invade has prompted several recent pieces of federal legislation. The Asian Carp Prevention and Control Act (2010) added bighead carp to the Lacey Act's injurious list and prohibited the importation and shipment of some other select carp species.

Water Resources Development Act: The Water Resources Development Act (2007) authorized the Secretary of the Army to construct various projects for improvements to rivers and harbors of the United States to provide for the conservation and development of water and related resources. This Act includes maintaining the AIS dispersal barrier on the upper Mississippi system.

Stop Invasive Species Act: The Stop Invasive Species Act (S. 2317, H.R. 4406) was introduced in April 2012 to stop Asian carps from destroying the Great Lakes ecosystem. It would require the expedited creation of a plan to block Asian carp from entering the Great Lakes through a number of surface water connections across the Great Lakes region. The act would require the Army Corps of Engineers to accelerate the release of their final action plan and develop a definitive plan to permanently prevent Asian carp from entering the Great Lakes. The bill remains in committee.

Asian Carp Regional Coordinating Committee: In 2007 under the direction of USFWS, the "Asian Carp Working Group," comprised of several agencies, stakeholders and partners, submitted the Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States to the ANSTF for approval (Conover et al. 2007). The Plan was used as the foundation of the Asian Carp Control Strategy Framework, which was developed by the Asian Carp Regional Coordinating Committee (ACRCC). .

Ballast water: The potential for ballast water introductions of AIS is of international concern. Policies must be implemented at some jurisdictional level, ideally federally, because of the interjurisdictional/interstate nature of the shipping industry. NANPCA initiated ballast water management regulations to limit introductions through transoceanic shipping. Regulations adopted by the USCG in 1993 apply to all vessels that have been operating outside the Exclusive Economic Zone (EEZ) of the U.S. or Canada, and enter the Snell Lock in New York carrying ballast water. Vessel masters have three options under these regulations: (1) demonstrate that a ballast exchange was done at sea beyond the EEZ in a depth exceeding 2,000 meters; (2) retain the ballast during the vessel's entire Great Lakes voyage, in which case tanks may be sealed; or (3) have an alternative environmentally-sound method of ballast water management approved by the USCG.

The USEPA has issued two draft vessel general permits that would regulate discharges from commercial vessels, excluding military and recreational vessels. The proposed permits would help protect the nation's waters from ship-borne pollutants and reduce the risk of introduction of invasive species from ballast water discharges.

The draft Vessel General Permit (VGP), which covers commercial vessels greater than 79 feet in length, would replace the current 2008 VGP, when it expires in December 2013. Under the Clean Water Act, permits are issued for a five-year period after which time USEPA generally issues revised permits based on updated information and requirements. The new draft Small VGP would cover vessels smaller than 79 feet in length and would provide such vessels with the Clean Water Act permit coverage they will be required to have as of December 2013.

A key new provision of the permit is a proposed numeric standard to control the release of non-indigenous invasive species in ballast water discharges. The new ballast water discharge standard addressing invasive species is based upon results from independent USEPA Science Advisory Board and National Research Council National Academy of Sciences studies. These limits are generally consistent with those contained in the International Maritime Organization's (IMO) 2004 Ballast Water Convention.
The new standard is expected to substantially reduce the risk of introduction and establishment of non-indigenous invasive species in U.S. waters.

Prompted by AIS concerns worldwide, the United Nations' IMO held its Ballast Water Convention in 2004. Its requirements will enter into force 12 months after ratification by 30 nations representing 35 percent of world shipping tonnage. Thirty-three member nations (including Canada but still excluding the United States) representing nearly 25 percent of world shipping tonnage had ratified the convention as of January 2012.

Ultimately, the Convention intends to implement international Ballast Water Performance Standards in two phases. In Phase I (until January 2016), ballast of qualifying vessels must discharge fewer than 10 organisms that are greater than 50 µm in length (half the diameter of an average human hair) per cubic meter of ballast water. This would allow the discharge of up to 5,000 – 200,000 organisms depending on vessel size. Phase II (after January 2016) will require less than one organism per 100 cubic meters of ballast water, which would still allow discharge of up to 50 – 2,000 organisms depending on vessel size.

The IMO's interim measure calls for Ballast Water Exchange (BWE). The USCG and Joint Ballast Water Working Group began implementation of BWE on Great Lakes waters in 2004. In 2008, the St Lawrence Seaway and USCG required ocean-going vessels to exchange ballast water prior to entering the upper Great Lakes. The USCG issued its Final Rule on ballast water in March 2012 and it will require oceangoing vessels to meet the IMO standard, some as soon as 1 December 2013.

Regional Role

Regional AIS Panels: The activities of NANPCA, NISA, and (by extension) the ANSTF are coordinated through six regional panels; the state of Ohio is represented on two of those six panels. Section 1203 of NANPCA calls upon the Great Lakes Commission to convene the Great Lakes Panel on Aquatic Nuisance Species. Similarly, the Mississippi

River Basin Panel of the ANSTF was first convened in 2003 and is hosted by the Mississippi Interstate Cooperative Resource Association. Official state representatives must be employees of state management agencies, but broader panel membership is drawn from diverse federal, state, provincial, and regional agencies. Input from private sector user groups, Sea Grant programs, academic faculty and staff, and environmental organizations are also used to ensure that the positions of the panels provide a balanced and regional perspective on AIS issues. Panel responsibilities for the Great Lakes region and Mississippi River basin are fivefold: (1) identify priorities for activities within each relevant basin, (2) develop and submit recommendations to the ANSTF (established via Public Law 101-646), (3) coordinate aquatic nuisance species program activities within each basin, (4) advise public and private interests on control efforts, and (5) report to the ANSTF describing prevention, research, and control activities within each basin.

State Role

State Management Plan for AIS: The comprehensive SMPs for AIS are addressed in Section 1204 of NANPCA. Section 1204 requires that management plans identify "those areas or activities within the state, other than those related to public facilities, for which technical and financial assistance is needed to eliminate or reduce the environmental, public health, and safety risks associated with AIS." The content of each state plan is to focus on the identification of feasible, cost-effective management practices and measures to be used by state and local entities to prevent and control AIS infestations in a manner that is environmentally sound. As part of the plan, federal activities are to be identified for prevention and control measures, including direction on how these activities should be coordinated with state and local efforts. Section 1204 also states that in the development and implementation of the management plan, the state needs to involve appropriate local, state, and regional entities, as well as public and private organizations that have expertise in AIS prevention and control. The SMPs are to be submitted to the national ANSTF for approval. If the plan meets the requirements of the ANSTF, the plan becomes eligible for federal cost-share support. Plans may be implemented with other funds supplied by state and cooperative agencies.

The State of Ohio currently has a number of statutory and regulatory authorities detailed in both the Ohio Administrative Code (OAC) and Ohio Revised Code (ORC) with which it can address issues of prevention and control of AIS. These have been developed over time, generally in response to individual species and concerns as they arose. Consequently, there is not currently a comprehensive, coordinated, and vigorously enforced policy framework to deal with invasive species and their impacts. One task must be to identify gaps in Ohio's policies and statutes, and develop recommendations for improvements. Such improvements may entail developing new legislation and regulations; revising existing authorities; and developing methods for improving enforcement, coordination, and information dissemination regarding new or existing authorities.

The following existing authorities and policies have been identified relative to Ohio's management of AIS. Some sections of code are species-specific while others are more general with respect to species that may invade terrestrial, transitional, or aquatic ecosystems.

Purple loosestrife: The director of the ODA prohibits the sale and propagation of purple loosestrife pursuant to ORC 927.682. No person or governmental entity may sell, offer

for sale or plant *Lythrum salicaria* without a permit issued by the director. The director may issue a permit only for controlled experiments, but may exempt from the permit requirement any variety demonstrated not to be a threat to the environment (ORC 927.682).

Wild animal importing, exporting, selling and possession regulation: The state of Ohio's fishing regulations provide that exotic species of fish —i.e., any fish not naturally found in Ohio waters—or hybrids thereof may not be imported, sold or possessed for the purposes of introduction into any body of water that is connected to or drains into a flowing stream or other body of water that would allow egress of fish into public waters in the state. In addition, the possession, sale, and importation of grass carp capable of reproducing is prohibited. Importers and sellers of grass carp are required to certify that all grass carp handled are of the sterile triploid variety and must have prior written authorization from the chief of the DOW to import and sell this variety. It is also illegal to possess, import, or sell for any purpose at any time live individuals of any of the following species or their hybrids: walking catfish *Clarias batrachus*, diploid white amur/grass carp, silver carp/white bream, bighead carp/bighead amur, black amur/black carp, round goby, tubenose goby, snakeheads *Channa* or *Parachanna* spp., white perch *Morone americana*, three-spined stickleback *Gasterosteus aculeatus*, sea lamprey, or the subspecific eastern banded killifish *Fundulus diaphanus diaphanus*. Exceptions for such species may be made only for research, by zoos, public aquariums, and public displays and only after permission is obtained from the wildlife chief. In addition, it is illegal for any person to possess, import, or sell marron *Cherax tenuimanus*, yabby *C. destructor*, zebra mussel, quagga mussel, or rudd *Scardinius erythrophthalmus* (OAC 1501:31-19-01).

Aquaculture: ORC 1533.632 mandates that the DOW regulate the aquaculture industry, and allows for the issuance of permits for species which can include nonindigenous species. Class B species refer to species that are more ecologically sensitive and Class A species to those that are more common or do not pose a threat. Class B permits are to be issued on a case-by-case basis, and the chief shall take into account “the species for which the Class B permit is requested, the location of the aquaculture production facility, and any other information determined by the chief to be necessary to protect the wildlife and natural resources of this state." According to rules promulgated by the DOW, a permit will not be granted until a Division representative determines the classification of the aquaculture facility based upon level of potential risk of escapement. Aquatic species or hybrids not native to a watershed or not established through stocking by the Division will not be considered for approval unless the facility has no risk of escapement at any time. Two levels of escapement prevention are required for Class B species and some named hybrids cultured outside their naturally occurring watersheds as detailed by OAC 1501:31-39-01.D.2.b (ORC 1533.632, OAC 1501:31-39-01).

Bait and bait dealers: Rules promulgated by the DOW regulate such sale in accordance with the Division’s statutory authority to protect and preserve the wild animals of the state, mostly related to the management of native stocks through regulation. Specifically related to potential AIS, it is illegal to sell or use as bait “any fish or minnow not already established in waters of Ohio over which the wildlife chief has control” (OAC 1501:31-13-04).

Other ODNR Division of Wildlife Authorities: The chief of ODNR’s DOW has general statutory authority and control over AIS in all matters pertaining to the protection,

preservation, propagation, possession, and management of wild animals and may adopt rules for the management of wild animals (ORC 1531.08). Specifically, as deemed necessary, the chief "shall adopt, and may amend and rescind, rules that are necessary for the administration and enforcement" of the ORC (ORC 1531.10). The Chief also has the authority to restrict the stocking of aquatic organisms in public waters through OAC 1501:31-13-01-7 which requires individuals stocking any species of fish into waters of the State to obtain permission from the Chief of the DOW. Waters of the state are defined as all waters except those private waters that are not connected with other natural surface waters. In addition, the chief "may adopt, amend, and rescind such rules as necessary to control or eradicate parasites and diseases of game birds, game quadrupeds other than captive white-tailed deer, fur-bearing animals, or nonnative wildlife" on "wholly enclosed preserves" as described in ORC 1533.71 (ORC 1533.79). Therefore, in instances where it is determined that the introduction and/or spread of nonindigenous aquatic species is potentially detrimental to the management of the wild animals of the state, the Division may adopt additional rules to check adverse impacts.

Other Ohio Department of Agriculture Authorities: The ODA has statutory authority to adopt rules necessary to carry out its responsibilities regarding plant pests (ORC 927.70). No person may harbor any plant pest which has been determined by the director of agriculture to be destructive or dangerously harmful. "Pest" is defined broadly as any organism that causes or may cause injury, disease, or damage to any plant part, or plant product. This apparently could be broadly applied if plants or natural systems were to be judged to be threatened by a pest species. Thus, broad rule-making authority exists, but an assessment of the need for additional rules may be required.

In addition, the director of the ODA has authority to label "dangerously contagious or infectious disease[s]" of animals as those diseases determined "to be of harmful effect on the animal or poultry industry or the public health and to be capable of transmission by any means from a carrier animal to a human or to another animal" (ORC 941.01). This includes diseases of cultured aquatic organisms (including potentially invasive diseases or diseases of potentially invasive host organisms used in aquaculture) that may also infect wild populations. The chief of the ODA's Division of Animal Health is charged with preventing the spread of "dangerously contagious or infectious disease, providing for the control and eradication of such disease, and cooperating with the United States Department of Agriculture in such work" (ORC 940.02).If such a disease is detected, the director has authority to impose quarantine, including an individual animal or as by "geographic area" if the director determines such broad quarantine to be necessary (ORC 941.07). This authority was invoked in 2007 to issue quarantine on Ohio's Lake Erie region in response to an outbreak of the invasive fish disease viral hemorrhagic septicemia among several wild populations of fishes within Lake Erie. The order prohibited the human transportation of susceptible fishes from the Lake Erie region as defined by the order.

ODNR Division of Watercraft Authorities: The director of the ODNR has statutory authority to create state wild, scenic, or recreational river areas along with their corridors up to one thousand feet from normal waterlines. Beginning in 2009, the chief of ODNR's Division of Watercraft was given responsibility to develop "rules governing the use, visitation, protection, and administration" of such areas. The Division is further charged with providing conservation education and to "provide for corridor protection, restoration, habitat enhancement, and clean-up projects" within these areas. While the Division of Watercraft has rule-making authority with respect to management of lands within wild,

scenic, and recreational river areas, it does not have authority to regulate activities with respect to species that may be disruptive to the ecosystems being preserved. The ORC specifically prevents land use restrictions to be imposed by the Division upon private lands along wild, scenic, or recreational river corridors; however, the Division works with local governments to ensure that local zoning, flood plain, and forest buffers provide appropriate protection. The ORC states that the chief or chief's representative "may participate in watershed-wide planning with federal, state and local agencies in order to protect the values of wild, scenic, and recreational river areas" (ORC 1547.81).

Local Governments: Chapter 164 of the ORC details state disbursement of aid to local government for improvements. Natural resources assistance councils appointed by public works integrating committees are charged with reviewing various open space acquisition project proposals, including "acquisition of land or rights in land for parks, forests, wetlands, natural areas that protect an endangered plant or animal population, other natural areas, and connecting corridors for natural areas" as well as development of such land acquisitions to enhance their accessibility by the public. Such projects can emphasize "the reduction or elimination of nonnative, invasive species of plants or animals" and "shall not… encourage invasive nonnative species" (ORC 164.22).

Ohio Coastal Management Program: Within the Lake Erie watershed, enforceable authorities incorporated into the Ohio Coastal Management Program (OCMP: duties and definitions detailed in ORC 1506) can be enforced against federal agencies through application of the federal consistency provision (Section 307) of the federal Coastal Zone Management Act (16 U.S.C. 1541 et.seq.). The consistency provision applies to all federally conducted, funded, and permitted activities that may affect land or water uses of the coastal area, as defined by the OCMP, whether or not they occur directly within the OCMP management boundary. This took effect with implementation of the OCMP following federal approval by NOAA in 1997.

The Great Lakes-St. Lawrence River Basin Water Resources Compact: The Great Lakes-St. Lawrence River Basin Water Resources Compact (ORC 1522), while originally drafted through region-wide collaboration, is implemented at the state level. Passed by the states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, and Wisconsin in 2008, and amended within Ohio in 2012, the Compact facilitates the interjurisdictional management of the use of the water resources of the Great Lakes. The compact makes little mention of AIS. However, communities that have corporate boundaries falling partly within the basin or partly within two Great Lakes watersheds do create some risk of AIS transfer. These communities are permitted some exception to the prohibition on water diversions given that the volume of water diverted from the Great Lakes basin is returned less an allowance for consumptive use. If some portion of the volume used to fulfill the replacement criterion originates outside the Great Lakes basin, it must be treated to meet water quality discharge standards and "to prevent the introduction of invasive species into the basin" (ORC 1522.4.9).

Research and Education: In addition to exercising its statutory and regulatory authorities, the state currently fosters extensive research and education/outreach programs through the ODNR, the OEPA, the Ohio Lake Erie Commission's Lake Erie Protection Fund, the Ohio Sea Grant College Program, the Great Lakes Aquatic Ecosystem Research Consortium, the Great Lakes Regional Research Information Network, the International Joint Commission's Council of Great Lakes Research Managers, the ACRCC, regional panels of the ANSTF, state universities, and others.

Informational efforts focus upon educating recreational water users and commercial enterprises regarding methods to reduce impacts of human activity related to the introduction and spread of AIS. Research efforts have focused upon pollutant uptake mechanisms, potential control methods, and effects of increased water clarity, predator-prey relationships, and other trophic level interactions. Some research effort has been made to quantify the economic impacts of AIS on the state or region (e.g., Rosaen et al. 2012, Windle et al. 2008). However, those efforts have been too few to date and have not been comprehensive simply because the data required to compile a comprehensive and defensible economic statement are not currently collected.

Control measures for non-native flora as a part of management plans for state-managed nature preserves and wildlife areas. Each nature preserve and wildlife area managed by the ODNR, DOW and the Division of Parks & Recreation's Natural Areas and Preserves program is governed by a management plan specific to that area. Each plan incorporates a statement of policy regarding control of invasive plants identified as problems within the nature preserve or wildlife area. Generally speaking, guidelines call for manual removal, burning, and treatment with herbicides. Management plans include provisions for monitoring and assessment to determine the extent of growth and nature of the disturbance, if any. Management plans and control efforts are tailored to the specific nature preserve or wildlife area and prescribe the treatment appropriate for each species depending upon the habitat type, extent of invasion, and management goals for the area.

Ohio Invasive Plants Council: The Ohio Invasive Plants Council (OIPC) was formed in 2005, this Council represents a broad partnership of agencies, organizations, and individuals concerned about the threats of invasive plants in Ohio. The mission of OIPC is to "participate in statewide efforts to address the threats of invasive species to Ohio's ecosystems and economy by providing leadership and promoting stewardship, education, research, and information exchange." OIPC holds annual meetings, research conferences, and regional workshops to improve awareness of invasive species. OIPC has developed a scientifically-based protocol for assessing invasiveness of plant species.

Gaps in Authorities in Ohio: Event though there are statutes dealing with AIS in Ohio, many gaps exist that prevent effective management. More comprehensive regulations are urgently needed to address the movement of live fish for: bait, live food market, and for stocking private/pay lakes. Ohio will also focus on the movement of AIS through the pet trade, plant trade, and recreational activities.

V. PRIORITIES FOR ACTION

All of the strategies listed under the five goals of this plan are important, but when it comes to implementation there is a need to prioritize strategies based upon the severity of the problem, the programmatic authority, capability and feasibility to resolve it, and the cost of the proposed solution. Priority actions in this plan target species and pathways that cause the most significant economic and/or ecological impacts. The following five priority actions are listed in order of importance:

1. **Coordinate the Ohio Aquatic Invasive Species Committee** to address AIS issues in Ohio. The Committee will be comprised of government, industry, university, and private groups and will meet annually to address relevant AIS issues (Goal 1; Objective 1.1; Strategy 1.1a).

2. **Evaluate the effectiveness of existing management and regulatory tools** (incorporating pathway analysis) for preventing the introduction of priority AIS into Ohio by identifying potential gaps and improve existing tools. Develop and implement specific strategies and plans to reduce the likelihood of both intentional and unintentional introduction of harmful AIS through high-risk pathways (Goal 2; Objective 2.2; Strategy 2.2a).

3. **Target outreach efforts and prioritize key audiences** (e.g., live organism trades and aquatic user groups) to promote understanding of invasive species dispersal pathways and risks (Goal 5; Objective 5.2; Strategy 5.2a).

4. **Implement control and rapid response strategies that are based on the best available scientific information and conducted in an environmentally sound manner.** Coordinate control and rapid response strategies with federal agencies, local governments, interjurisdictional organizations, and other appropriate entities. Establish protocols that will provide guidance in designing and implementing control and eradication strategies (Goal 3; Objective 3.3; Strategy 3.3a and Goal 4; Objective 4.1; Strategy 4.1b).

VI. PROGRAM MONITORING AND EVALUATION

The implementation of Ohio's SMP will enable us to monitor progress toward the five goals in the plan. We will be able to select appropriate management actions as well as make necessary "mid-course" corrections. By incorporating the best scientific and management knowledge with periodic public evaluation, we will be implementing an adaptive AIS management program. This process will involve three components: (1) oversight, (2) evaluation, and (3) dissemination of information.

Oversight

The OAISC will act as the advisory committee and will examine progress on the plans goals, objectives and strategies and recommend future plan revisions.

Evaluation

The evaluation effort should not only examine progress toward stated goals, objectives, and strategies but place a special emphasis on success at identifying funding needs to accomplish goals and associated tasks. This information will prove useful in future program planning processes. Evaluation should also incorporate information from those groups affected by plan implementation through the OAISC.

Dissemination

A report will be produced annually highlighting the progress of our management activities. This report will include information on the successes in achieving objectives towards the goals of the AIS Plan, as well as future plans and directions. Successes, failures, and new directions within Ohio will be evaluated in comparison with other state and regional plans. Reports will be made available to members of the general public and local, state, and federal agencies.

VII. IMPLEMENTATION TABLE FOR PLAN GOALS (See Section III)

Goal 1: Leadership: Provide leadership for AIS issues in Ohio among local, state, and federal agencies as well as other organizations in order effectively address AIS.

Objective	Strategic Action	Measure of Success	Target Date	Lead State Agency	Cooperating Agency or Organization	Estimated State Cost	Status
Objective 1.1: Coordinate all AIS management programs and activities within Ohio and establish multi-state cooperation and coordination within the Great Lakes and Mississippi River regions as well as nationally.	**Strategy 1.1a:** Coordinate the OAISC to address AIS issues in Ohio. The Committee will be comprised of government, industry, university, and private groups and will meet annually to address relevant AIS issues.	Meet annually to address relevant AIS issues.	Annual	DOW	OAISC	$5,000	Ongoing
	Strategy 1.1b: Partner with AIS management programs in nearby states through regional organizations (e.g., Great Lakes and Mississippi River Basin Panels) and national organizations (e.g., Aquatic Nuisance Species Task Force and Association of Fish and Wildlife Agencies) to ensure that AIS efforts in Ohio remain relevant and current; are based in the most recent science; and coordinated with regional, national, and local programs.	Maintain membership on regional panels and national organizations. Attend meetings when possible and assume leadership roles when possible.	Ongoing	DOW	NA	$5,000	Ongoing
	Strategy 1.1c: Identify all sources of funding available and evaluate their utility for addressing Ohio's priority AIS issues. Identify the current funding capacity and identify priority resource needs and new funding opportunities. In cooperation with other partners, work with the Governor's Office and Legislature to establish a permanent funding mechanism for AIS management activities. Identify funding gaps and identify currently funded programs that are lower priority or not meeting their goals so that resources can be reallocated.	Identify funding requirements to secure funding source for AIS.	2014	DOW	OAISC	$5,000	Pending

Goal 2: Prevention: Identify AIS vectors and focus efforts on preventing the introduction and spread of AIS into Ohio.

Objective	Strategic Action	Measure of Success	Due	Lead State Agency	Cooperating Agency or Organization	Estimated State Cost	Status
Objective 2.1: Establish a comprehensive process to identify AIS of greatest concern that are not yet present in Ohio waters and prioritize highest-risk introduction pathways.	**Strategy 2.1a:** Identify and rank, by short- and long-term risk assessment, the species or groups of species of greatest concern and conduct an analysis to determine the level of risk associated with their introduction. The species list will include species in the U.S. but not established in Ohio as well as species not yet in the U.S.	List of AIS of greatest concern for Ohio	2014	DOW	OAISC	$20,000	Pending
	Strategy 2.1b: Using the prioritized list of AIS with the greatest potential to invade Ohio waters, identify existing and potential pathways that would facilitate introductions of these species. Prioritize highest-risk pathways for future legislation, rules, research, and control efforts.	List of high risk pathways	2015	DOW	OAISC	$20,000	Pending
	Strategy 2.1c: Work with government and non-government stakeholders to develop a science-based, comprehensive screening system for evaluating risks associated with the introduction of all non-native aquatic species.	AIS screening system	2016	DOW	OAISC	$40,000	Pending

Goal 2: Prevention: Identify AIS vectors and focus efforts on preventing the introduction and spread of AIS into Ohio (continued).

Objective	Strategic Action	Measure of Success	Due	Lead State Agency	Cooperating Agency or Organization	Estimated State Cost	Status
Objective 2.2: Identify potential prevention strategies for addressing AIS of greatest risk and high-risk introduction pathways.	**Strategy 2.2a:**, Evaluate the effectiveness of existing management and regulatory tools (incorporating pathway analysis) for preventing the introduction of priority AIS into Ohio by identifying potential gaps and improve existing tools. Develop and implement specific strategies and plans to reduce the likelihood of both intentional and unintentional introduction of harmful AIS through high-risk pathways.	Close high risk pathways	2016	DOW	OAISC	$20,000	Pending
	Strategy 2.2b: Identify "ecologically sensitive" aquatic resource areas that are free of AIS, and enhance protection through the (1) identification of potential introduction pathways and (2) establishment of additional precautionary measures including educational outreach and enforcement.	List of ecologically sensitive areas and preventative measures.	2017	DOW	TNC	$5,000	Pending
	Strategy 2.2c: Identify BMPs, codes-of-conduct, and potential certification options for key industry and user groups (e.g., pet and aquarium trades, water gardens, aquaculture industry, research community, commercial shipping, recreational boating, transportation industry, and bait retailers and suppliers) to help keep the priority AIS out of Ohio.	Offer Hazard analysis and critical control points (HACCP) training for selected user groups.	2015	DOW	OAISC	$40,000	Pending

Goal 3: Early Detection and Rapid Response: Implement early detection and rapid response actions so that newly introduced AIS can be located quickly and eliminated.

Objective	Strategic Action	Measure of Success	Due	Lead State Agency	Cooperating Agency or Organization	Estimated State Cost	Status
Objective 3.1: Enhance coordination within Ohio to detect new invasions, as well as range expansions of AIS within Ohio. Prioritize early-detection efforts and increase knowledge and expertise to enhance these efforts.	**Strategy 3.1a:** Assemble a focused committee of agency, municipal, NGO, and academic professionals who survey aquatic organisms as part of their monitoring and research activities and have them evaluate current early-detection programs, identify gaps, and make recommendations for improved monitoring of priority AIS.	Comprehensive AIS monitoring program.	2014	DOW	OAISC	$25,000	Pending
	Strategy 3.1b: Develop a list of experts within agencies, academia, NGO, and contractors that can help identify AIS and develop contract arrangements if necessary.	Expert AIS list	2013	DOW	OAISC	$5,000	Pending
	Strategy 3.1c: Create a regional "watch" list for species that have potential to enter Ohio.	AIS watch list.	2014	DOW	OAISC	$10,000	Pending
	Strategy 3.1d: Identify high "invasion likelihood" areas for targeted early detection surveying.	List of high risk areas for AIS invasions.	2015	DOW	OAISC	$10,000	Pending
	Strategy 3.1e: Establish cooperative policies with states sharing watersheds for coordinated early detection efforts.	Cooperative agreements with adjacent states.	2015	DOW	Michigan, Indiana, Kentucky, West Virginia, Pennsylvania	$5,000	Pending

Goal 3: Early Detection and Rapid Response: Implement early detection and rapid response actions so that newly introduced AIS can be located quickly and eliminated (Continued).

Objective	Strategic Action	Measure of Success	Due	Lead State Agency	Cooperating Agency or Organization	Estimated State Cost	Status
Objective 3.2: Create a master inventory of Ohio AIS that is regularly maintained, updated, and accessible.	**Strategy 3.2a:** Create a compilation of AIS in Ohio held by various groups (local, county, state, federal, and private organizations). Identify inventory gaps, and develop strategies to address deficiencies.	List of AIS location information.	2014	DOW	OAISC	$20,000	Pending
	Strategy 3.2b: Integrate Ohio AIS location information into the United States Geologic Surveys Nonindigenous Aquatic Species Database.	Ohio information integrated into NAS database.	2014	DOW	OAISC	$10,000	Pending
Objective 3.3: Implement Ohio's Rapid Response Plan for the eradication of newly detected AIS under predetermined conditions.	**Strategy 3.3a:** Implement Ohio's RRP in high risk systems where there is a high likelihood that eradication efforts will be effective.	Successful implementation of Ohio RRP.	Case-by-case basis	DOW	OAISC	Unknown	Pending

Goal 4: Control: When feasible, control or manage AIS that have or may have significant impacts in Ohio.

Objective	Strategic Action	Measure of Success	Due	Lead State Agency	Cooperating Agency or Organization	Estimated State Cost	Status
Objective 4.1: Prioritize AIS on which to focus control efforts and explore and utilize the various methods available to control these populations.	**Strategy 4.1a:** Implement scientific analyses to prioritize control efforts for both species and sites and consider the long-term, cost-effectiveness of all proposed strategies against the "no-action" alternative.	Prioritized list of control efforts.	Ongoing	DOW	OAICS	$20,000	Pending
	Strategy 4.1b: Implement control strategies that are based on the best available scientific information and conducted in an environmentally sound manner. Coordinate control strategies with federal agencies, local governments, interjurisdictional organizations, and other appropriate entities. Establish protocols that will provide guidance in designing and implementing control and eradication strategies.	Successful control program.	Ongoing	DOW	OAISC	Unknown	Pending
	Strategy 4.1c: Evaluate potential incentive programs or assistance for private landowners for the control of invasive species and restoration of impacted ecosystems.	Private lands AIS control program.	Ongoing	DOW	OAISC	Unknown	Pending
	Strategy 4.1d: Develop means of modifying human activities in areas of AIS infestations to help prevent their spread.	Abatement strategies	Ongoing	DOW	OAISC	Unknown	Pending

Goal 5: Research and Education: Increase research efforts on AIS, and educate the general public and individuals involved in related business, trade, research, recreation and government sectors about AIS issues.

Objective	Strategic Action	Measure of Success	Due	Lead State Agency	Cooperating Agency or Organization	Estimated State Cost	Status
Objective 5.1: Establish and coordinate an Ohio AIS research network by building on existing state, federal, and university programs.	**Strategy 5.1a:** Identify all current AIS research needs and potential network members and prioritize the research specific to Ohio's freshwater habitats.	Prioritized list of research efforts.	Ongoing	DOW	OAICS	$20,000	Pending
Objective 5.2: Increase public awareness of AIS impacts and strategies that can be implemented to reduce the establishment and spread of AIS in Ohio.	**Strategy 5.2a:** Target outreach efforts and prioritize key audiences (e.g., live organism trades and aquatic user groups) to promote understanding of invasive species dispersal pathways and risks.	Successful outreach program.	Ongoing	Ohio Sea Grant	OAISC	$30,000	Pending
	Strategy 5.2b: Maintain a comprehensive and current AIS website and work to develop other types of media to inform the public of AIS issues.	Updated web site	Ongoing	DOW	OAISC	$5,000	Ongoing
Objective 5.3: Target policy makers and legislative staff for outreach efforts.	**Strategy 5.3a:** Provide educational briefings on the threats, economic and ecological impacts, and solutions to AIS invasions in Ohio for decision makers and legislators. Keep legislators and decision makers informed and updated on the progress of Ohio AIS management efforts.	Knowledgeable decision makers	Ongoing	DOW	OAISC	$5,000	Pending

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IX. GLOSSARY

Aquatic Invasive Species (or Aquatic Nuisance Species) – Animals, plants, or other organisms that adversely affect the habitats they invade economically, environmentally, and/or ecologically. Such invasive species may disrupt recreation, economy, and/or ecology by dominating a region.

Ballast water – Any water used to manipulate the trim and stability of a ship or boat.

Best management practices – A method or technique that has consistently shown results superior to those achieved with other means, and that is used as a benchmark.

Diploid – The natural state of having paired sets of chromosomes in a cell or cell nucleus allowing an animal to reproduce sexually.

Exotic – See “nonindigenous.”

Exclusive Economic Zone – The sea zone prescribed by the United Nations Convention on the Law of the Sea over which a state has special rights. It stretches from the seaward edge of the state's territorial sea out to 200 nautical miles from its coast.

Nonindigenous – A plant, animal, or other organism that is not native to a region.

Plankton – Small organisms that drift with water currents. Phytoplankton (including algae) and zooplankton (very small animals, like water fleas) form the basis of aquatic food webs.

Triploid – The state of having three sets of chromosomes in the cell or cell nucleus that prevents reproduction. Triploidy is induced in some managed, stocked animals.

Vector/Pathway – The path by which an organism can travel.

Watershed – The entire drainage basin of a water body or region including all living and nonliving components.

X. ACRONYMS

ACRCC - Asian Carp Regional Coordinating Committee
AIS - Aquatic invasive species
ANSTF - Aquatic Nuisance Species Task Force
BMPs - Best Management Practices
BWE - Ballast Water Exchange
DOW - Division of Wildlife
EEZ - Exclusive Economic Zone
IMO - International Maritime Organization's
NANPCA - Nonindigenous Aquatic Nuisance Prevention and Control Act
NGO - Non-government organizations
NISA – National Invasive Species Act
NOAA - National Oceanic and Atmospheric Administration
OAC - Ohio Administrative Code
OAISC - Ohio Aquatic Invasive Species Committee
OCMP - Ohio Coastal Management Program
ODA - Ohio Department of Agriculture
ODNR - Ohio Department of Natural Resources
OEPA - Ohio Environmental Protection Agency
OIPC - Ohio Invasive Plants Council
ORC - Ohio Revised Code
RRP – Rapid Response Plan
SMP - State Management Plan
US – United States
USACE - U.S. Army Corps of Engineers
USCG - U.S. Coast Guard
USEPA - U.S. Environmental Protection Agency
USFWS – United States Fish & Wildlife Service
USGS – United States Geologic Survey
VGP - Vessel General Permit
VHS - Viral Hemorrhagic Septicemia

XI. OHIO AQUATIC INVASIVE SPECIES COMMITTEE

Pete Mohan	Akron Zoological Park
Jennifer Hillmer	Cleveland Metroparks
Mike Durkalec	Cleveland Metroparks
Linda Sekura	Cleveland Museum of Natural History
Doug Warmolts	Columbus Zoo and Aquarium
Dave Smith	Freshwater Farms of Ohio
Don Arcuri	Great Lakes Fish Commission
Mike Matta	Great Lakes Fish Commission
Stephen Blessing	Green Vista Water Gardens (and ONLA)
Rick Graham	Izaak Walton League
Glen Nekvasil	Lake Carriers Association
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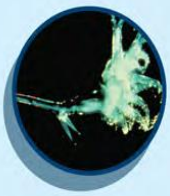
APPENDIX A – RAPID RESPONSE PLAN FOR AQUATIC INVASIVE SPECIES

Rapid Response Plan for Aquatic Invasive Species

Ohio Department of Natural Resources
Division of Wildlife



October 1, 2014

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EXECUTIVE SUMMARY

Introduction

Preventing introductions is the foremost aim of aquatic invasive species (AIS) management, and is crucial to avoid irreversible consequences of introductions. Early detection and effective rapid response are crucial to prevent establishment and minimize the ecological and economic impacts of an AIS introduction. Rapid response measures are implemented to confirm presence of reported AIS, evaluate efficacies of new approaches for control, and/or reduce or eliminate AIS populations within a given area.

Considerable preparation is necessary and can be initiated in advance of the need to implement a rapid AIS response effort. To the extent possible, managers will need partner agreements, funding, ability to comply with regulatory requirements, protocols and procedures, and response training. The Ohio Department of Natural Resources (ODNR) Division of Wildlife (DOW) has developed this Rapid Response Plan (RRP) to guide internal response actions and coordinate response actions with partner agencies during AIS response.

Authority

Addressing prevention and control of AIS requires coordination of policies and programs at many levels of government. Federal, regional, and state governments all have roles in implementation of this plan. The State of Ohio also details a number of statutory and regulatory authorities in both the Ohio Administrative Code and Ohio Revised Code to address issues of prevention and control of AIS. Most of this authority lies within the ODNR, Ohio Department of Agriculture, and the Ohio Environmental Protection Agency.

Scope and Applicability

The State of Ohio straddles two major watersheds. The northern third of Ohio lies within the Great Lakes basin, and the southern two-thirds of the State is part of the Mississippi River basin. Both of these basins have been significantly impacted by AIS, with many of the most significant invasions occurring within the last 30 years. Coordinating rapid AIS response operations will involve numerous response agencies and jurisdictions. A synchronized effort across the jurisdictions within the State of Ohio will be crucial.

Applicable Plans

To the extent practicable, AIS response operations shall be consistent with federal, state, and local plans, including this RRP that represents the ODNR's response plan. Implementation of this RRP will proceed in conjunction with the *Ohio AIS State Management Plan* and the *Ohio Asian Carp Tactical Plan*.

Geographic Limitations

The geographic scope of this AIS Plan encompasses the land and waters governed by the State of Ohio. Generally, ODNR DOW has responsibility to control AIS. AIS issues that have the potential to expand beyond Ohio boundaries will necessitate the involvement of other agencies including adjacent states, the Provinces of Ontario and Quebec, the US Fish and Wildlife Service, and U.S. Environmental Protection Agency Region V.

Procedures

The rapid response action steps given below should be followed chronologically, but the process may end at varying points depending upon the details of each specific situation. Action 1 commences upon receiving a report of an AIS.

Action 1: *Report find to appropriate personnel.*
Action 2: *Is the report an unknown or high-threat species?*
Action 3: *Identify/verify the species.*
Action 4: *Conduct risk assessment to determine if the species is a candidate for rapid response.*
Action 5: *Assess rapid response options.*
Action 6: *Decide whether to use Incident Command System (ICS).*
Action 7a: *Plan and implement the response (Not using ICS).*
Action 7b: *Plan and implement the response (using ICS).*
Action 8: *Create an after-action report and begin adaptive management.*

I. INTRODUCTION

Purpose

The discovery of a new non-native species, or a new population of an established non-native species that has moved outside of its known distribution, is considered an introduction. Preventing introductions is the foremost aim of aquatic invasive species (AIS) management, and is crucial to avoid irreversible consequences of introductions. Eradication of an established, widespread AIS is costly and unlikely (Lodge et. al 2006). If AIS are not eradicated, efforts to limit their distribution and abundance can become perpetual and costly (e.g., Sea Lamprey control in the Great Lakes). Unfortunately, prevention measures are not foolproof, and even the best efforts will not stop all introductions.

Early detection and effective rapid response are crucial to prevent establishment (National Invasive Species Council (NISC 2008) and minimize the ecological and economic impacts of an AIS introduction (California Department of Fish and Game 2008). The sooner a new introduction is detected, the greater the probability of a successful systematic response effort while the population is still localized (NISC 2003). In many cases, actions must occur quickly to be effective, possibly within only a few days of the introduction. Successful rapid response therefore depends on effective early detection, monitoring, and AIS reporting programs for alerting managers to new introductions. Government officials and natural resource managers must be prepared and committed to take rapid and effective action following a report of an AIS introduction (Smits and Moser 2009). The purposes of rapid response measures may vary depending on the AIS, but generally these measures are implemented to confirm presence of reported AIS, evaluate efficacies of new approaches for control, and/or reduce or eliminate AIS populations within a given area.

Considerable preparation is necessary and can be initiated in advance of need to implement a rapid AIS response effort. To the extent possible, managers will need partner agreements, funding, ability to comply with regulatory requirements, protocols and procedures, and response training.

The Ohio Department of Natural Resources (ODNR) Division of Wildlife (DOW) has developed this Rapid Response Plan (RRP) for AIS to guide internal response actions and coordinate response actions with partner agencies during AIS response. The RRP provides a flexible framework for response and operational guidance to protect Ohio aquatic ecosystems and ensure the health and safety of all involved parties.

This RRP does not address issues of prevention, early-detection monitoring, post-response monitoring, or reporting systems. It focuses on actions following a report of possible introduction of AIS and provides general information regarding the major components of any rapid response effort.

II. AUTHORITY

The authority to address prevention and control of AIS requires coordination of policies and programs at many levels of government. Federal, regional, and state governments all have roles in implementation of the federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, Public Law 101-646) and the National Invasive Species Act of 1996 (NISA, Public Law 104-332). The State of Ohio also details a number of statutory and regulatory authorities in both the Ohio Administrative Code (OAC) and Ohio Revised Code (ORC) to address issues of prevention and control of AIS. Most of this authority lies within the ODNR, Ohio Department of Agriculture (ODA), and the Ohio Environmental Protection Agency (OEPA).

The authority has developed over time, generally in response to individual species and concerns as these arose. Consequently, no comprehensive, coordinated, and vigorously enforced policy framework is in place to deal with invasive species and their impacts. The following existing authorities and policies have been identified regarding Ohio's management of AIS. Some sections of code are species-specific while others are more general with respect to species that may invade aquatic ecosystems. The following provisions in OAC and ORC are pertinent:

- OAC 1501:31-19-01 (ODNR): Wild animal importing, exporting, selling, and possession regulation. Ohio's fishing regulations specify that exotic species of fish or hybrids thereof may not be imported, sold, or possessed for the purposes of introduction into any body of water connected with or draining into a flowing stream or other body of water that would allow egress of fish into public waters in the State. The statute also addresses possession, sale, and importation of certain species.
- ORC 1533.632, OAC 1501:31-39-01 (ODNR): The code mandates that the ODNR DOW regulate the aquaculture industry with respect to issuance of permits for nonindigenous species.
- OAC 1501:31-13-04 (ODNR): Bait and bait dealers. Rules promulgated by DOW regulate such sales in accordance with the DOW's statutory authority to protect and preserve the wild animals of the State, mostly related to management of native stocks through regulation. Specifically related to potential AIS is illegal selling or using as bait "any fish or minnow not already established in waters of Ohio over which the wildlife chief has control."

Control measures for non-native flora constitute part of management plans for state-managed preserves and wildlife areas. Each preserve and wildlife area managed by the ODNR DOW, and the ODNR Division of Parks and Recreation Natural Areas and Preserves is under a management plan specific to that area. Each plan incorporates a statement of policy regarding treatment of nonnative flora identified as problems within the preserve or wildlife area. Generally speaking, guidelines call for manual removal, burning, and treatment with herbicides. Management plans include provisions for monitoring and assessment to determine the extent of growth and nature of the disturbance, if any. Management plans are tailored to the specific preserve or wildlife area, and prescribe treatment appropriate for each species depending upon the habitat type, extent of invasion, and management goals for the area.

Several authorities in addition to those cited above could be used to help control introduction and spread of nonindigenous species. ODNR DOW's Chief has general statutory authority and control over AIS in all matters pertaining to protection, preservation, propagation, possession, and management of wild animals, and may adopt rules for management of wild animals (ORC 1531.08). Specifically, as deemed necessary, the Chief "shall adopt, and may amend and rescind, rules that are necessary for the administration and enforcement" of the ORC (ORC 1531.10). The Chief has the authority to restrict stocking of aquatic organisms in public waters per OAC 1501:31-13-01-7, which requires that individuals

stocking any species of fish into Ohio waters obtain permission from the Chief. Waters of the state are defined as all waters except those private waters that are not connected with other natural surface waters. In addition, the Chief "may adopt, amend, and rescind such rules as necessary to control or eradicate parasites and diseases of game birds, game quadrupeds other than captive white-tailed deer, fur-bearing animals, or nonnative wildlife" on "wholly enclosed preserves" as described in ORC 1533.71 (ORC 1533.79). Therefore, where introduction and/or spread of nonindigenous aquatic species have been determined potentially detrimental to management of wild animals of the State, the DOW may adopt additional rules to prevent or minimize adverse impacts.

The ODA has statutory authority to adopt rules necessary to carry out its responsibilities regarding plant pests (ORC 927.70). No person may harbor any plant pest determined by the Director of ODA to be destructive or dangerously harmful. "Pest" is defined broadly as any organism that causes or may cause injury, disease, or damage to any plant part or plant product. This authority could possibly be broadly applied if plants or natural systems are judged threatened by a pest species.

In addition, the ODA Director has authority to label as "dangerously contagious or infectious diseases" of animals those diseases determined "to be of harmful effect on the animal or poultry industry or the public health and to be capable of transmission by any means from a carrier animal to a human or to another animal" (ORC 941.01). This includes diseases of cultured aquatic organisms (including potentially invasive diseases or diseases of potentially invasive host organisms used in aquaculture) that may also infect wild populations. The ODA's Division of Animal Health Chief is charged with preventing the spread of "dangerously contagious or infectious disease, providing for the control and eradication of such disease, and cooperating with the United States Department of Agriculture (USDA) in such work" (ORC 940.02). If such a disease is detected, the director has authority to impose quarantine, including of an individual animal or of a "geographic area" if the director determines such broad quarantine necessary (ORC 941.07). This authority was invoked in 2007 to issue quarantine on Ohio's Lake Erie region in response to an outbreak of the invasive fish disease viral hemorrhagic septicemia (VHS) among several wild populations of fishes, both native and AIS, within Lake Erie. The order prohibited transport of susceptible fishes by humans from the Lake Erie region as defined by the order.

The ODNR Director has statutory authority to create state wild, scenic, or recreational river areas along with their corridors up to 1,000 feet from normal waterlines. Beginning in 2009, ODNR's Division of Watercraft Chief was given responsibility to develop "rules governing the use, visitation, protection, and administration" of such areas. The Division is further charged to provide conservation education and to "provide for corridor protection, restoration, habitat enhancement, and clean-up projects" within these areas. While they have rule-making authority with respect to management of lands within wild, scenic, and recreational river areas, it does not have authority to regulate activities with respect to species that may disrupt the ecosystems being preserved. The ORC specifically prevents imposition of land use restrictions by the Division upon private lands along wild, scenic, or recreational river corridors; however, the Division works with local governments to ensure that local zoning, flood plain, and forest buffers provide appropriate protection. The ORC states that the Chief or Chief's representative "may participate in watershed-wide planning with federal, state, and local agencies in order to protect the values of wild, scenic, and recreational river areas" (ORC 1547.81).

Chapter 164 of the ORC details state disbursement of aid to local government for improvements. Natural resources assistance councils appointed by public works integrating committees are charged with reviewing various open space acquisition project proposals, including "acquisition of land or rights in land for parks, forests, wetlands, natural areas that protect an endangered plant or animal population, other natural areas, and connecting corridors for natural areas," as well as development of such land acquisitions to enhance public accessibility to these. Such projects can emphasize "the

reduction or elimination of nonnative, invasive species of plants or animals" and "shall not… encourage invasive nonnative species" (ORC 164.22).

Within the Lake Erie watershed, enforceable authorities incorporated into the Ohio Coastal Management Program (OCMP) (duties and definitions detailed in ORC 1506) can be invoked against federal agencies through application of the federal consistency provision (Section 307) of the federal Coastal Zone Management Act (16 United States Code [U.S.C.] 1541 et.seq.). The consistency provision applies to all federally conducted, funded, and permitted activities that may affect land or water uses of the coastal area, as defined by the OCMP, whether or not they occur directly within the OCMP management boundary. This took effect with implementation of the OCMP following federal approval by the National Oceanic and Atmospheric Administration in 1997.

The Great Lakes-St. Lawrence River Basin Water Resources Compact (ORC 1522), while originally drafted through region-wide collaboration, is implemented at the state level. Passed by the States of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, and Wisconsin in 2008, and amended within Ohio in 2012, the Compact facilitates inter-jurisdictional management of the use of the water resources of the Great Lakes. The compact makes little mention of AIS. However, communities with corporate boundaries falling partly within the basin or partly within two Great Lakes watersheds do pose some risk of AIS transfer. These communities are permitted some exception to the prohibition on water diversions given that the volume of water diverted from the Great Lakes basin is returned, less an allowance for consumptive use. If some portion of the volume used to fulfill the replacement criterion originates outside the Great Lakes basin, it must be treated to meet water quality discharge standards and "to prevent the introduction of invasive species into the basin" (ORC 1522.4.9).

In addition to exercising its statutory and regulatory authorities, the State currently fosters extensive research and education/outreach programs through ODNR, OEPA, the Ohio Lake Erie Commission's Lake Erie Protection Fund, the Ohio Sea Grant College Program, the Great Lakes Aquatic Ecosystem Research Consortium, the Great Lakes Regional Research Information Network, occasional programs of the International Joint Commission's Council of Great Lakes Research Managers, the Asian Carp Regional Coordinating Committee , regional panels of the Aquatic Nuisance Species Task Force, state universities, and others. Informational efforts focus upon educating recreational water users and commercial enterprises regarding methods to reduce impacts of human activity related to introduction and spread of AIS. Research efforts have focused upon pollutant uptake mechanisms, potential control methods, and effects of increased water clarity, predator-prey relationships, and other trophic-level interactions. Some research effort has been expended to quantify economic impacts of AIS on the State or region (e.g., Rosaen et al. 2012, Windle et al. 2008).

III. SCOPE AND APPLICABILITY

The State of Ohio straddles two major watersheds. The northern third of Ohio lies within the Great Lakes basin, and the southern two-thirds of the State is part of the Mississippi River basin. Both of these basins have been significantly impacted by AIS, with many of the most significant invasions occurring within the last 30 years. The Great Lakes have a long history of AIS introductions—both intentional and unintentional. As of 2014, more than 190 introduced species have been reported in the Great Lakes basin (i.e., Lakes Superior, Michigan, Huron, St. Clair, Erie, Ontario, and their connecting channels and water bodies within their respective drainages) (Mills et al. 1993, Ricciardi 2001, Ricciardi 2006).

Specific to Ohio, the United States Geological Survey listing of nonindigenous aquatic species (http://nas.er.usgs.gov/queries/SpeciesList.aspx?group=&state=OH&Sortby=1) currently lists 113 AIS within the following taxonomic Groups: bryozoans, coelenterate, crustaceans, fishes, mammals, mollusks, and reptiles. High-profile AIS include the zebra and quagga mussels, Sea Lampreys, Round Goby, and Asian carps.

Coordinating rapid AIS response operations will involve numerous response agencies and jurisdictions. A synchronized effort across the jurisdictions within the State of Ohio will be crucial. This AIS Plan applies to and is in effect for the following cases:

- A new non-native species is discovered in aquatic areas under the exclusive management authority of the State of Ohio.
- A new population of an established non-native species is discovered in aquatic areas outside of its known distribution area.

Of particular note are AIS which may present an imminent and substantial danger to public health or welfare. The ODNR is committed to joint operations with the federal agencies and adjoining state jurisdictions having authority to conduct AIS response activities. This concept is consistent with and expands upon existing emergency preparedness and response systems and doctrine such as the National Response Framework and National Incident Management System.

IV. APPLICABLE PLANS

To the extent practicable, AIS response operations shall be consistent with federal, state, and local plans, including this AIS RRP that represents the ODNR's response plan. Additionally, compliance with incident-specific Environmental Assessments (EA) and Environmental Impact Statements (EIS) may also be required.

Implementation of this RRP will proceed in conjunction with the *Ohio AIS State Management Plan and* the *Ohio Asian Carp Tactical Plan* within the State of Ohio prior to or following a rapid response operation.

The Midwest Region of the US Fish and Wildlife Service (USFWS) has developed a draft Categorical Exclusion that, if approved, would cover AIS rapid response actions. A categorical exclusion, if approved, would expedite compliance with National Environmental Policy Act. However, until that approval occurs, programmatic EAs or EISs are needed, minimally, to justify actions supported by use of USFWS funds. Even after development and approval of a programmatic EA or EIS, development and approval of a short addendum may be necessary (along with release of it to the public for comment, prior to a decision to act, in the case of a Programmatic EIS).

The Endangered Species Act (ESA) directs all federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the ESA. Section 7 of the ESA, called "Interagency Cooperation," is the mechanism by which federal agencies or other entities funded by a federal agency (action agency) ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species.

V. GEOGRAPHIC LIMITATIONS

This RRP encompasses the land and waters governed by the State of Ohio (Figure 1). Generally, ODNR DOW has responsibility to control AIS. Issues that have the potential to expand beyond Ohio boundaries will necessitate the involvement of other agencies including adjacent states, the Provence of Quebec, the US Fish and Wildlife Service, and U.S. Environmental Protection Agency (USEPA) Region V.

Figure 1. Ohio watershed boundaries and major waterways.

VI. PROCEDURE

The rapid response action steps given below and diagramed in Figure 2 should be followed chronologically, but the process may end at varying points depending upon the details of each specific situation. In addition, this plan is designed to complement and be used in conjunction with other existing plans (e.g., Ohio's *State Management Plan*, Ohio's *Asian Carp Tactical Plan*, and the DOW *Fisheries Tactical Plan*). The RRP flowchart in Figure 2 is intended to accompany the narrative section of the RRP below but can also be used as a summary/overview of the RRP actions. Action 1 commences upon receiving a report of an AIS.

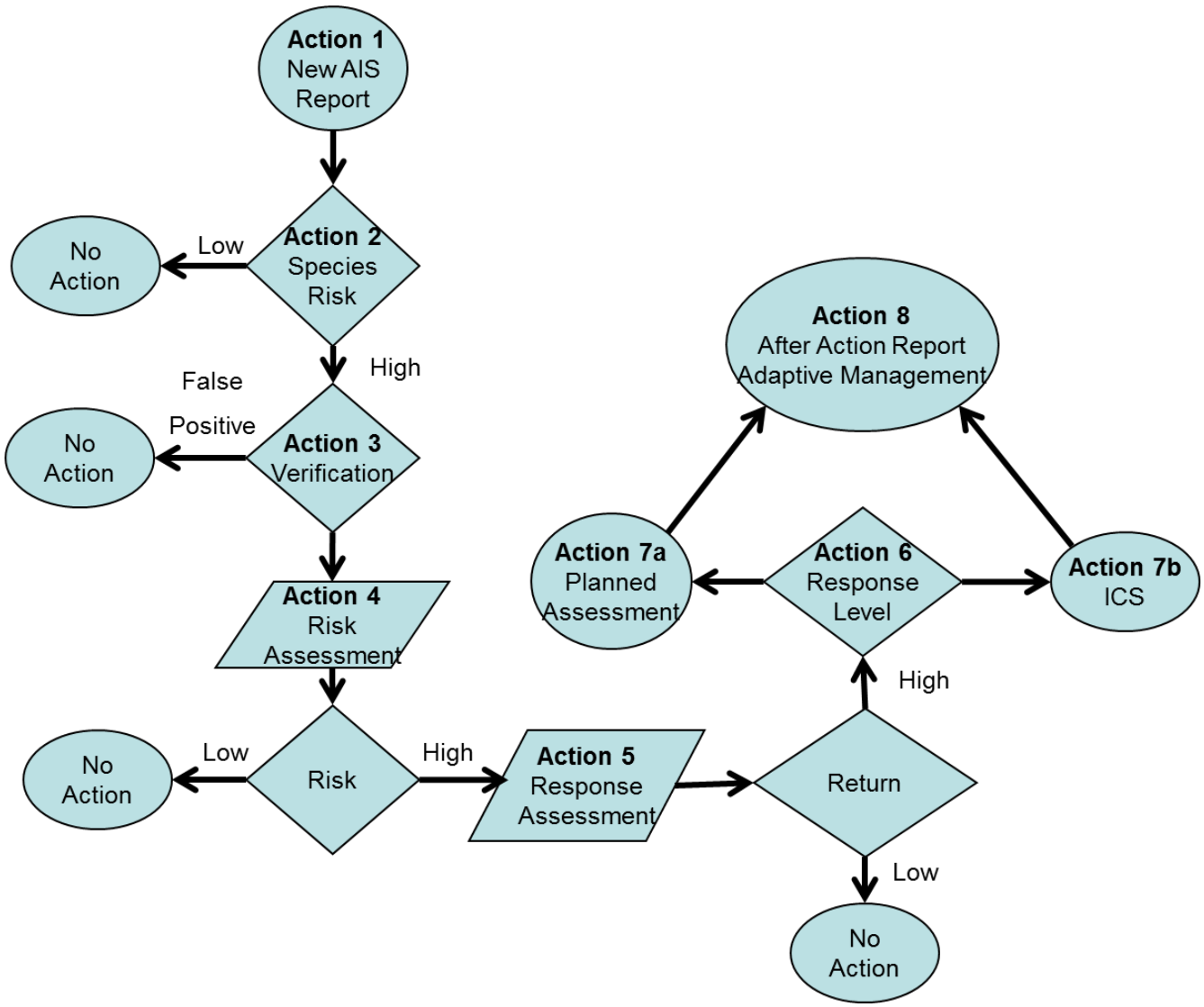

Figure 2. Aquatic Invasive Species Rapid Response Action Steps.

Action 1: Report find to appropriate personnel

Reports of invasive species come from a wide variety of sources, including the general public, partner organizations, and state agencies. The agency receiving the report will record the information listed below on the *AIS Reporting Worksheet* (Appendix A) and, if necessary, use Appendix B: *Contacts for Invasive Species Information in Ohio*, to direct the report to the proper state agency staff. Reports of high-priority species from the *Aquatic Invasive Species Watch List* (Appendix C) should be confirmed as having been received by appropriate staff to ensure timely response and so that the information is not inadvertently lost. Information should be recorded on the *Aquatic Invasive Species Reporting Worksheet* (Appendix D) by/from the person submitting a report of a new invasive species.

Action 2: Is the report an unknown or high-risk species

When an AIS report is received, the appropriate staff (as determined from Action 1 above) uses their best professional judgment to determine threat level and priority. When high-threat priority species (Appendix C) are reported from a credible source with an appropriate level of documentation (photos, detailed description, etc.) then species identification and verification (Action 3) is initiated:

High-threat/priority reports may include invasive species that represent previously known invasive species from Ohio but are also:

- Outlier populations/occurrences – invasive species that may already be present in Ohio, but are being reported in a unique, new regional location (i.e., first occurrence for the Lake Erie watershed, etc.);
- Threats to rare and endangered native species and/or habitat; or
- A leading edge of an expanding invasive species.

If the reported species does not meet the above criteria, no further rapid response action is taken using this procedure. The outcome of this action should be reported back to the original person or entity that submitted the report. The report may be noted, recorded, or shared with other entities, as appropriate.

Action 3: Identify/verification of the species

Once it has been determined that a report is for a high-threat priority species, the appropriate personnel, as identified in Appendix B, will facilitate verification of the report and/or specimen. In some cases, Action 3 can occur in collaboration with the risk assessment in Action 4.

Newly reported AIS must be verified by an expert who is recognized by the responding agency. When possible and deemed necessary, specimens should be verified by a second expert and voucher specimens should be retained and stored properly for future analysis. A site visit may also be necessary for species identification/verification if a specimen or sufficient evidence was not provided. In some instances, the information provided from the initial report in Action 1 may be enough to properly identify a species and verify its existence. This is particularly true if a voucher specimen is provided by the original reporter. Proper permitting should be obtained for federal or state restricted and prohibited invasive species during this action.

If the reported species is confirmed to be a native species (*false-positive* report) or a known occurrence of AIS, then no further rapid response action is taken. Similarly, if the species is unable to be found or

located as reported, the responding agency may use best professional judgment to end the response action or conduct a more thorough search. The report may be noted in a log to track common misidentifications and other reporting trends. Results from this action may be communicated to relevant partners and stakeholders, as appropriate.

Initial communication with key partners, stakeholders, and other appropriate entities should be considered during this action. For example, if the reported AIS have been verified to be an invasive plant species regulated under the federal noxious weeds list or an injurious wildlife species regulated under the Lacey Act, the USDA and/or the USFWS should be notified. Entities with jurisdictional and/or management authority for the location of the infestation should also be considered for contact during this action. In some cases, property owners may need to be contacted for permission so that verification can occur. A press release or other public notification should also be considered after positive verification has occurred to facilitate additional detections, aid in containment and limiting the spread of the invasion, and raising awareness about the issue.

Action 4: Risk Assessment - Conduct risk assessment to determine if the species is a candidate for rapid response

Confirmation of a new occurrence of a high-threat priority AIS in the state or watershed will result in a risk assessment of the invasion and specific situation. In some cases, this process can occur in collaboration with Action 3 above. AIS reports being considered as part of this action are deemed to represent high-threat priority AIS (Appendix C). The specific details of a particular occurrence or invasion (magnitude, location, etc.), will inform the decision about whether a rapid response is feasible and necessary. The risk assessment conducted as part of Action 4 is intended as an information gathering process to determine the potential environmental, economic, or human health threat, and evaluate if the AIS and the particular details of the occurrence make it a candidate for a rapid response. There are some quantitative and concrete criteria that can be used for the assessment; however, best professional judgment of the circumstances will be used to determine if a response is appropriate and can realistically minimize the AIS threat.

The appropriate personnel, with the assistance from other sources if needed, will conduct the risk assessment and record related details on the *Aquatic Invasive Species Risk Assessment Worksheet* (Appendix D). The following factors may be used:

- Is the species a new invasion to the state or to a geographic location within the state?
- Is the species known to cause significant impacts in its native range and/or is the species known to be invasive outside of its native range?
- Is there knowledge of the source of introduction and risk of reintroduction or further spread?
- Was the invasion detected early?
- Is the infestation small and localized?
- Can the species be quarantined/contained while control measures are planned and implemented?
- Is there acceptance that not responding will have serious impacts?
- Is the location public or directly connected to public resources (i.e., public land or water)?

Following the risk assessment, the invasion should be classified as either low risk or high/unknown risk. If the outcome is low risk, the occurrence is noted but no further rapid response action is taken using this plan. If the outcome is high or unknown risk, proceed to Action 5.

Results from this action may be communicated to relevant partners and stakeholders, per the discretion of the responding agency. Nearby property owners (individual and/or associations), municipalities (city,

township, county), and other relevant parties should be considered. Many of these entities may be valuable resources for conducting the risk assessment and may be able to provide information that might otherwise not be available to the responding agency.

The lead agency should also consider a press release during this action to raise awareness for the issue and stay in front of misinformation, rumors, and general questions. The press release should include mention of the initial report, confirmation of species identification, biological information, and appropriate results from the risk assessment in Action 4. Lastly, the press release should also give a general description of the next steps ("assess response options," etc.), and provide a point of contact for questions and additional information.

Action 5: Assess rapid response options

To determine the appropriate response options, previously obtained scientific information on the species and the infestation will be used to evaluate response availability and feasibility. The agency with jurisdictional authority and/or the appropriate personnel, with the assistance from other sources as appropriate, will assess the response options using best professional judgment. This assessment may include (but is not limited to) answering additional questions such as:

- Are known successful treatment/response options available?
- Are there serious environmental issues or regulatory hurdles that will lead to delays or greatly increase the cost of the response?
- Are there threatened or endangered species present?
- Are the AIS in a high priority natural community?
- Are there social or economic reasons to treat?
- Are there concerns with infrastructure or human safety?
- If permits are needed, can they be obtained in a timely manner?
- Is there a need for law enforcement or investigation associated with the infestation?
- What are the unintended or non-target impacts of the response options?
- Does the response require multiple uses or long-term control?
- Is there adequate physical access to the site?
- Will permission be necessary and available from local landowners?
- What are the current funding conditions for response efforts?
- Can response efforts be conducted by agency staff, or will response efforts require contract assistance (or both)?
- Are there opportunities for collaboration with stakeholders and partner agencies?

While some response options are focused on eradication, it is important to also consider options such as biological control, monitoring, and education and outreach efforts. If eradication is not feasible or desirable, alternate options may be useful for preventing further spread of the AIS or raising awareness in other locations that could potentially become invaded. In some instances, no rapid response may be feasible or available and, therefore, no further rapid response action may be taken. The results of Action 5 should be shared with appropriate partners, federal agencies, local municipalities, property owners, and other relevant entities to ensure consistent and accurate sharing of information. Once the assessment of response options is complete, proceed to Action 6.

Action 6: Response level - Decide whether to use ICS

The first step in planning a response is to determine if an Incident Command System (ICS) is appropriate. Certain response scenarios can benefit from a highly coordinated and structured format, such as an ICS.

An ICS is a systematic tool used for the command, control, and coordination of emergency responses and is commonly used by federal and state agencies to respond to emergency events such as floods, fires, and other high-threat situations. See Appendix E for more details on an ICS and how to implement the system for AIS rapid response.

As with many of the above actions, determining whether or not to use an ICS in a response to AIS is ultimately decided using best professional judgment. Specific factors to consider include:

- Are federal resources or federal agencies involved?
- Is the response jurisdictionally or operationally complex? (Multiple agencies involved several levels of authorities, AIS invasion and response crosses state/federal borders, etc.)?
- Is the response action outside of the "routine operations" of the responding agency?
- Is chemical control part of the response action?
- What is the scale of the response action (local, regional, statewide, etc.)?
- Is there a significant threat to public health and safety?

AIS rapid response that does NOT involve an ICS typically includes a response that is within routine operations of the lead responding agency and is jurisdictionally simple (only one agency has clear authority).

If an ICS will NOT be used for response planning and implementation, proceed to Action 7a. If an ICS will be used, proceed to Action 7b.

Action 7a: Planned Assessment - Plan and implement the response (Not using ICS)

This action involves the logistical and operational planning and implementation for the chosen response and is performed by an AIS core team that includes fish management program administrators and other key staff within the agency with jurisdictional authority and with assistance from other sources as appropriate. While Action 7a does not involve ICS protocols, some elements of an ICS may be used where applicable. For example, it may be beneficial to appoint an incident commander and a command team for decision making.

In general, planning and implementing AIS rapid response without using an ICS should:

- Follow standard decision support and chain of command protocols of the lead responding agency and
- Follow standard lead responding agency policies for communication, safety, operations, logistics, equipment, personnel, and finance/spending.

The AIS core team should be notified of rapid response planning and implementation. Additionally, communication should continue with any of the entities contacted during the previous actions to keep everyone updated and informed of progress. A second press release may be issued during this action to notify constituents and the general public of the rapid response process and progress.

Once rapid response has been implemented, proceed to Action 8.

Action 7b: ICS - Plan and implement the response using ICS

This action uses the ICS to plan and ultimately implement a rapid response. For more details about AIS rapid response involving an ICS, refer to Appendix E. The following are general steps/guidelines for AIS rapid response that involve ICS:

Planning Phase:

- Appoint Incident Commander (IC)/Unified Command (UC).
- IC/UC review of all previous information obtained during Actions 1–5.
- IC/UC refers to ICS flowchart to determine current status within "Planning P."
- Proceed as directed by IC/UC following the "Planning P" (appoint appropriate officers, etc.).
- Develop an Incident Action Plan (see Appendix E).

Implementation Phase:

- Carry out the Incident Action Plan following the "Planning P" (see Appendix E).
- Follow policies developed by IC/UC and appropriate ICS officers.
- Follow protocols and procedures developed by, and under the direction of, IC/UC and appropriate ICS officers.

Once ICS rapid response planning and implementation is complete, proceed to Action 8.

Action 8: Create an after-action report and begin adaptive management

An after-action report will be produced after each response to summarize and document the process from the initial report of the invasion through the conclusion of the response implementation. While a full after-action report is only needed for responses that continue beyond Action 4, other reports of AIS that end prior to Action 4 should still be documented for future reference and decision support.

Adaptive management is a process for continually improving management policies and practices by learning from the outcomes of operational programs. Adaptive management is crucially important to the implementation of a rapid response to AIS. Ideally, adaptive management will include an evaluation of response effectiveness, mitigation and/or restoration of treatment areas, an assessment of reintroduction risks, and post-procedure monitoring. Additionally, education and outreach efforts should continue during the adaptive management phase of the RRP to help articulate/communicate outcomes of the response.

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VIII. LIST OF ACRONYMS AND ABBREVIATIONS

AIS: Aquatic Invasive Species
DOW: Division of Wildlife
EA: Environmental Assessment
EIS: Environmental Impact Statement
ESA: Endangered Species Act
IC: Incident Commander
ICS: Incident Command System
OAC: Ohio Administrative Code
OCMP: Ohio Coastal Management Program
ODA: Ohio Department of Agriculture
ODNR: Ohio Department of Natural Resources
OEPA: Ohio Environmental Protection Agency
ORC: Ohio Revised Code
NANPCA: Nonindigenous Aquatic Nuisance Prevention and Control Act
NISC: National Invasive Species Council
RRP: Rapid Response Plan
US: Unified command
USDA: United States Department of Agriculture
USEPA: United States Environmental Protection Agency
USFWS: United States Fish and Wildlife Service
VHS: Viral hemorrhagic septicemia

Appendix A: Aquatic Invasive Species Reporting Worksheet

Aquatic Invasive Species Reporting Worksheet

Reporters contact information
• Name:
• Phone:
• E-mail:
Type of invasive species being reported (circle one):
• Fish
• Invertebrate
• Aquatic Plant
• Other
Common name:
Scientific name:
Physical description (approximate size, color, density, etc.):
Was specimen obtained (Yes/No):
Was photograph taken (Yes/No):
Date of observation:
Location of observation (county, township, water body):
Coordinates (latitude/longitude):
Additional location details (habitat, environmental conditions, etc.):

Appendix B: Contacts for Invasive Species Information in Ohio

Contacts for Invasive Species Information in Ohio

Aquatic Invasive Species	*Contact*	*Email and Phone*
Aquatic Invasive Species Program Questions on overall Aquatic Invasive Species Program and Ohio's Aquatic Invasive Species State Management Plan.	John Navarro ODNR DOW	614-265-6346 John.navarro@dnr.state.oh.us
Aquatic Invasive Plants General questions about aquatic plant identification and early detection, rapid response, and monitoring *Chemical Control* - Questions on the chemical control of aquatic species, permitting, and submerged plant identification. *Mechanical Removal* - Questions about mowing and other forms of mechanical control, permitting, and Great Lakes Shoreline management. *Phragmites* – Questions about identification and the control of invasive phragmites.	Bob Ford ODNR DOW	419-424-5000 bob.ford@dnr.state.oh.us
Aquatic Invasive Animals Questions about Asian carp identification, status in Ohio, Ohio's Asian Carp Management Plan, other fish (e.g. snakehead) and aquatic animals (e.g. crayfish).	John Navarro ODNR DOW	614-265-6346 John.navarro@dnr.state.oh.us
Great Lakes Regional Coordination Questions on Great Lakes coordination, restoration, and management.	Jeff Tyson ODNR DOW	419-625-8062 jeff.tyson@dnr.state.oh.us
Ballast Water General questions on Ohio's ballast water program and Ohio's Section 401 certification.	Paul Novak ODNR DOW	614-644-2035 paul.novak@epa.state.oh.us

Appendix C: Aquatic Invasive Species “Watch List”

Aquatic Invasive Species "Watch List"

Fish and other Aquatic Animals
• Asian carps
○ Silver Carp (*Hypophthalmicthys molitrix*)
○ Bighead Carp (*Hypophthalmichthys noblis*)
○ Black Carp (*Mylopharyngodon piceus*)
○ Grass Carp (*Ctenopharyngodon idella*)
• Northern Snakehead (*Channa argus*)
• Red swamp crayfish (*Procambarus clarkia*)
• Any *unknown fish or aquatic animal* (e.g., other crayfish or mussel)
Aquatic Plants
• Parrot feather (*Myriophylumm aqauticum*)
• European frog-bit (*Hydrocharis morsus-ranae*)
• Flowering rush (*Butomus umbellatus*)
• Brazilian elodea (*Egeria densa*)
• Hydrilla (*Hyrdrilla verticillata*)
• Water chestnut (*Trapa natans*)
• Water hyacinth (*Eichhornia crassipes*)
• Water lettuce (*Pistia stratiotes*)
• Any other *unidentified invasive plant*

Appendix D: Aquatic Invasive Species Risk Assessment Worksheet

Aquatic Invasive Species Risk Assessment Worksheet

1) Is the species a new invasion to the state or to a geographic location with the state (Yes/No)?
2) Is the species known to cause significant impacts in its native range and/or is the species known to be invasive outside of its native range (Yes/No)?
3) Is there knowledge of the source of introduction and risk of reintroduction or further spread (Yes/No)?
4) Was the invasion detected early (Yes/No)?
5) Is the infestation small and localized (Yes/No)?
6) Can the species be quarantined or contained while control measures are planned and implemented (Yes/No)?
7) Is there acceptance that not responding will have serious impacts (Yes/No)?
8) Is the location public or directly connected to public resources (i.e., public land or water) (Yes/No)?

Appendix E: Incident Command System for Aquatic Invasive Species Rapid Response

The Incident Command System (ICS) is a standardized, on-scene, all-hazards incident management approach that:

- Allows for the integration of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure.
- Enables a coordinated response among various jurisdictions and functional agencies, both public and private.
- Establishes common processes for planning and managing resources.

The ICS is flexible and can be used for incidents of any type, scope, and complexity because it allows users to adopt an integrated organizational structure to match the complexities and demands of single or multiple incidents at varying scales. In AIS rapid response situations, an ICS provides a systematic approach to guide departments and agencies at all levels of government, non-government organizations and the private sector to work together seamlessly.

In Ohio, if a rapid response to newly reported AIS is determined to be appropriate for ICS (see **Action 6** in *Rapid Response Plan for Aquatic Invasive Specie*), the ICS organizational structure, planning, and implementation details below will be used.

The ICS organizational structure has five major functional elements (Figure 1) - command, operations, planning, logistics, and finance/administration - and develops in a modular fashion, as needed, based on the size and complexity of the incident. As deemed necessary, the Incident Commander (IC) may appoint a Safety Officer, Liaison Officer, and Public Information Officer (PIO) collectively known as the "Command Staff." The "General Staff" may consist of an Operations Chief, a Planning Chief, a Logistic Chief, and a Finance\Administrative Chief, or any necessary combination of these positions. The IC is ultimately responsible for establishment and expansion of the ICS organization, based on needs and requirements of the response.

The organizational structure of the AIS RRP personnel can impact the efficiency and effectiveness of overall AIS response operations, including staffing and resource decisions. Using an ICS as the core organizational framework, the IC can establish Sections, Branches, Groups, Units, and Strike Teams based on incident demands. Each of these functional divisions should be managed by a Chief, Director, Supervisor, or Leader. The management span of control for any one individual should not be less than three or exceed seven direct reports.

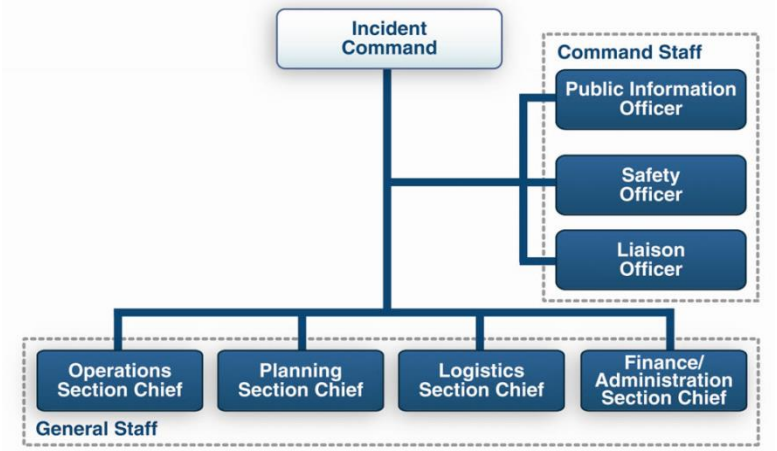

Figure 1: Basic ICS Organizational Structure

Incident command is accomplished using one of two approaches. When an incident (priority AIS invasion), occurs within a single jurisdiction, and without jurisdictional or functional agency overlap, a single IC is designated with overall incident management responsibility by the appropriate jurisdictional authority. However, when a rapid response involves multiple jurisdictions, a single jurisdiction with multiagency involvement, or multiple jurisdictions with multiagency involvement, establishment of a UC allows agencies with different legal, geographic, and functional authorities and responsibilities to work together effectively without affecting individual agency authority, responsibility, or accountability.

A UC is essentially the shared responsibility of command among several Incident Commanders. Attributes and responsibilities of a UC Unified Command are identical to an Incident Commander. Indicators that the response should be managed by a UC include when an incident:

- Crosses geographic boundaries (e.g., two states)
- Involves various governmental levels (e.g., federal, state, local)
- Impacts different functional responsibilities
- Includes different statutory responsibilities
- Has some combination of the above

If you can answer “yes” to all four of the following questions for the particular type of incident that you are responding to, then a UC is appropriate:

- Does my organization have jurisdictional authority or functional responsibility under a law or ordinance for this type of incident?
- Is my organization specifically charged with commanding, coordinating, or managing a major aspect of the response?
- Does my organization have the resources to support participation in the response or organization?
- Does the incident or response operation impact my organization’s area of responsibility?

An AIS rapid response can span multiple geographic or functional authorities and require use of UC. By working together as a team under UC, all agencies with jurisdictional authority or functional responsibility for the incident jointly provide management direction through a common set of incident objectives and a single planning process. Under UC, a single agency may still be designated as the overall lead, and that agency's official or pre-established representative is identified as the IC for incident management.

Centralized, coordinated incident action planning is used to guide all response activities and specify communications management objectives throughout the entire ICS organization. Management by objectives is accomplished through a systematic planning process that:

1. Sets overall priorities within assigned geographical area
2. Determines appropriate strategies for use in achieving priorities
3. Develops and issues assignments, plans, procedures, and protocols
4. Establishes specific, measurable tactics or tasks in support of defined strategies
5. Allocates critical resources based on priorities
6. Ensures objectives are met and strategies are followed
7. Documents results to measure performance and facilitates corrective actions.

The systematic operation of AIS rapid response actions may require a repetitive schedule to promote internal and external continuity during and following staffing transitions. During each operational period, situation reports help staff understand the incident situation and responders' efforts. The Incident Action Plan (IAP) establishes goals for future operational periods. Figure 2 illustrates the initial typical ICS initial operational cycle ("Planning P"). Subsequent cycles skip the initiation procedures and resources are continuously identified and distributed based on guidance from the IC, Operations Section Chief, and the IAP.

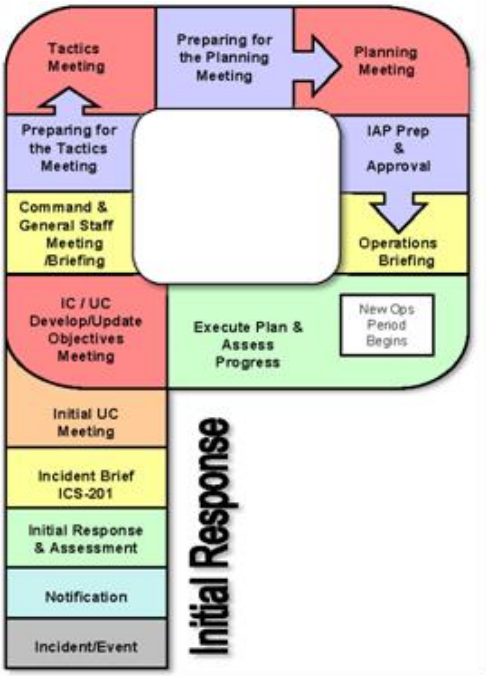

Figure 2: ICS "Planning P"

An IAP is the central tool for conveying planning and operational instructions for all response participants and should provide a clear statement of objectives and actions, a basis for measuring work effectiveness and progress, and a record of accountability. The level of detail required in an IAP varies according to the size and complexity of the response. Regardless of the number of response partners, a single IAP should be generated by the IC/UC. The following explains the planning process required to develop an IAP.

The IAP is prepared by the Planning Section with direction from the Command Staff and input from the appropriate Sections, Branches, and Units of the General Staff. It should be written at the outset of response and revised continually. The goals and objectives are laid out and reviewed by each section, based on its objectives. Each section is responsible for the following items to produce the IAP:

- Incident Command/UC
  - Incident objectives and strategy
  - Overall management and strategy

- Planning Section
  - Leadership of planning meeting and operation shift briefing
  - Preparation of the IAP

- Operations Section
  - Determination of resource requirements
  - Determination of division boundaries
  - Determination of tactics
  - Determination of Division/Group work assignments for Operations personnel

- Logistics Section
  - Determination of logistical objectives
  - Determination of logistical staging areas and facilities
  - Determination of logistical assignments and progress
  - Determination of re-deployable resources accountability
  - Determination of in-transit resources status
  - Assurance that Logistics Section can support the IAP

- Finance Section
  - Determination of cost implications of incident objectives
  - Assurance that IAP is within the financial limits established by the IC

The contents of the IAP include all of the following:

- Event name – The name of the response event, typically based on location of the most heavily impacted area and the type of event (example: “Operation Grand Haven Goby”)
- Date/time prepared – The day/time the IAP was prepared
- Operational period – The timeframe the IAP covers

- General control objectives - A prioritized list of measureable tasks to be accomplished in the specified operational period
- Status updates – Objectives completed during past operational periods, resource status/availability
- Organization and chain of command – Written description of the organizational/command structure
- Safety/hazard information
- Demobilization instructions/plans

The following job descriptions may serve as guidelines for selecting individuals to fill each Command and General Staff position. While not an exhaustive list, the "desired attributes" highlight important skills and personality characteristics that should be considered when appointing individuals to positions. Once the IC chooses his/her staff, the list of primary responsibilities may help the staff to understand their role in the ICS rapid response process.

Incident Commander
Desired Attributes: Proven leader, experienced in risk management, strong communicator
Primary Responsibilities:

- Determine incident priorities
- Establish incident objectives
- Manage tactical operations
- Assure safety of responders and public
- Identify and order the necessary resources to accomplish objectives
- Keep organization briefed
- Evaluating contingencies

Operations Section Chief
Desired Attributes: Leader, gives clear direction, conscientious
Primary Responsibilities:

- Manage tactical operations
- Ensure tactical operations are conducted safely
- Maintain close communications with the IC/UC
- Identify required tactical resources to accomplish response objectives

Planning Section Chief
Desired Attributes: Strong facilitator and communicator
Primary Responsibilities:

- Keep everyone working together
- Provide current, accurate situation status and concise briefings in support of the ICS process meeting schedule
- Accurately track all resources
- Facilitate the planning process by conducting timely meetings and working closely with the Operation Section Chief, Logistics Section Chief, and Command Staff
- Ensure thorough documentation of all key decisions
- Establish and maintain a complete list of things that must be accomplished, ensuring that each item on the list is assigned to the appropriate ICS element (e.g., Operations, Logistics, etc.)

Logistics Section Chief
Desired Attributes: Experienced in logistical support, detail-oriented, propensity for customer service and teamwork
Primary Responsibilities:

- Anticipate incident's potential for growth and plan resource and personnel requirements accordingly
- Develop and implement a resource ordering and tracking process
- Ensure an effective communication network is in place to support incident operations
- Support development of the IAP
- Ensure that Command and General Staff are aware of excessive costs
- Ensure appropriate demobilization (e.g., account for property and services, properly dispose of hazardous materials)

Finance/Administration Section Chief
Desired Attributes: Experienced in finance/administration, detail-oriented, organized
Primary Responsibilities:

- Ensure the proper completion of response cost-accounting documentation
- Coordinate and manage response budgets and cost estimates
- Provide financial support for contracting services, purchases, and payments
- Project the "burn rate" of funding and advise the IC/UC when a ceiling must be increased
- Maintain a daily inventory of all purchases
- Forward all invoices to the appropriate agency processing center for payment

Liaison Officer
Desired Attributes: Interpersonal skills, highly organized, knowledge of local stakeholders, communications skills via phone, in person, and by electronic means
Primary Responsibilities:

- Provide agencies and organizations with a schedule for incident and determining their information needs
- Keep the IC/UC informed on issues dealing with assisting agencies, cooperating agencies, stakeholders
- Coordinate with the Public Information Officer
- Coordinate VIP visits
- Coordinate outreach efforts (e.g., community meetings)
- Oversee external messages to stakeholders
- Serve as contact point for stakeholders, politicians and their staff, government agencies, nongovernmental agencies, industry partners
- Identify public and private concerns related to the incident
- Maintain master list of contact numbers

Public Information Officer
Desired Attributes: Experienced in public affairs, communications savvy
Primary Responsibilities:

- Support the public communications needs of the IC/UC
- Gather and disseminate incident information (e.g., number of responders)
- Work closely with the Liaison Officer to inform public and stakeholders

- Assist in establishing and implementing communications requirements such as holding press conferences, disseminating press releases, answering media queries
- Attend command meetings to exchange information with the IC/UC and to get approval of information to be released
- Ensure that the response organization is kept informed on the overall response efforts
- Coordinate media activities with the Command and General Staff (especially the Operations Section Chief)
- Determine need to develop an Outreach Plan

Safety Officer
Desired Attributes: Understands regulations, risk management skills, technical expertise
Primary Responsibilities:

- Work with the Operations Section Chief to identify and mitigate safety hazards associated with planned strategies and tactics
- Participate in the planning process
- Identify hazardous situations associated with the incident
- Participate in the development of the IAP
- Exercise authority to stop or prevent unsafe tactics
- Investigate accidents and injuries that have occurred in the incident areas
- Develop appropriate safety plans for the response
- Monitor compliance with safety requirements

For more information on the ICS please go to: http://www.fema.gov/incident-command-system