Indiana Aquatic Invasive Species (AIS) Management Plan

2020

Indiana Department of Natural Resources, Division of Fish & Wildlife

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1. Executive Summary

Invasive species are any species or other viable biological material (including its seeds, eggs, spores) that are transported into an ecosystem beyond its historic range, either intentionally or accidentally, and reproduce and spread rapidly into new locations, causing economic or environmental harm or harm to human health. Invasive species can be plants, animals, and other organisms, such as bacteria and viruses. This plan addresses invasive species that can live in the aquatic habitats of Indiana.

Invasive species problems are both a consequence of, and an impact on the economic welfare of our nation (Evans, 2003). Most introductions of invasive species can be linked to the intended or unintended consequences of economic activities, such as trade and shipping (Perrings et al., 2002). The introduction of aquatic invasive species (AIS) into Indiana waters is a source of biological pollution that threatens not only the ecology of our water resources, but also the economic, societal, and public health conditions of the region and states. In Indiana, expenditures have reached upwards of $3 million annually for the prevention and control of AIS (Rosaen et al., 2012), and more could be done.

The development of a state management plan, as called for in Section 1204 of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (P.L. 101-646) (NANPCA), provides an opportunity for federal cost-share support for implementation of the plan. The original Indiana AIS Management Plan completed in 2004 identified feasible, cost-effective management practices and measures to be taken by state and local programs to prevent and control AIS infestations in a manner that is environmentally sound. Indiana has successfully eliminated several high priority aquatic plants from Indiana waters through aggressive and sustained actions. In addition, Indiana severed a natural watershed connection between the Great Lakes and Mississippi River basins that eliminated a potential route for Asian carp to enter Lake Erie.

Aquatic invasive species can enter Indiana waterways via numerous pathways, including ballast, fish transfer, bait buckets, boats and trailers, aquaculture, water garden hobby, and aquarium trade. A number of national and state regulatory efforts have been implemented to address pathways or species of concern; however, more can be done. To be most successful in implementing AIS prevention and control, Indiana is actively involved with several federal agencies, state agencies, and national, regional, and state AIS groups.

Three key stages of invasion, **introduction, spread** and **establishment,** lead to three critical points of intervention:

1. Preventing the **introduction** of new nonindigenous species transported from water bodies in other parts of the continent or world;

2. Limiting the **spread** of established, reproducing AIS populations to other water bodies in Indiana and other states; and

3. Mitigating the harmful ecological, economic, social, and public health impacts of **established** AIS populations.

The purpose of this update to the AIS management plan is to continue to guide the implementation of current and future actions to minimize the harmful effects of AIS in Indiana. A total of 7 goals, 28 strategies, and 89 actions are identified. The goals of the plan include:

Goal I: Coordination with Other Agencies
Goal II: Prevention of AIS Introductions and Spread
Goal III: Enhancement of Early Detection
Goal IV: Institution of Rapid response Objectives
Goal V: Control and Management of Established AIS
Goal VI: Mitigating the Harmful Impacts of AIS
Goal VII: Evaluation and Adaptation of AIS Management Plan

The approaches used to accomplish each of these goals are described in detail as an implementation table. The implementation table describes primary agencies, cooperating agencies, and the anticipated annual cost for each strategy.

There are numerous invasive species in the United States, many of which are not well understood by the scientific community. Despite the desire to address each existing and potential invasive species in Indiana individually, the resources and scientific capability to do so limits management actions. Therefore, the Indiana AIS Program has identified priority aquatic invasive species that can feasibly be addressed through the goals described in this plan. Under the umbrella of management options to address these priorities for action, common pathways between priority species and other aquatic invasive species will be addressed.

For more information on Indiana's aquatic invasive species contact the Indiana Department of Natural Resources AIS coordinator at AIS@dnr.IN.gov.

1. Introduction

1.1 Aquatic Invasive Species Management Plan Purpose

An “invasive species” is any species or other viable biological material (including its seeds, eggs, spores) that is transported into an ecosystem beyond its historic range, either intentionally or accidentally, and reproduces and spreads rapidly into new locations, causing economic or environmental harm or harm to human health. Often the term “nuisance species” is used in literature and publications to describe many of the species described in this document, although sometimes the term refers to native species that that occur in destructively high numbers. For the purposes of this document the term aquatic invasive species (AIS) will be used to describe a species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic, environmental harm or harm to human health. This aligns with the terminology used by the Indiana Aquatic Invasive Species Program.

The purpose of the original comprehensive AIS state management plan and this revision is to guide the implementation of current and future actions in maintaining and enhancing the state of Indiana’s efforts to prevent the introduction of new AIS, prevent the dispersal of established AIS, detect and respond to new invaders, and manage and control AIS to minimize the harmful effects of AIS in Indiana waters, including Lake Michigan, connecting channels, rivers, streams, inland lakes, and wetlands. This AIS management plan identifies actions and goals covering coordination, prevention, early detection, rapid response, and limiting the spread of invasive species while mitigating their impacts.

The introduction of AIS into Indiana waters is a source of biological pollution that threatens not only the ecology of the region and states' water resources, but also the economic, societal, and public health conditions of the region and states. The Great Lakes and connecting channels and rivers form the largest surface freshwater system in the world. The aquatic resources of the Great Lakes region are an integral part of activities such as recreation and tourism. A recent report said that approximately 1.5 million jobs in the United States are directly connected to the Great Lakes, producing $62 billion in wages (Vaccaro and Read, 2011). According to the U.S. Fish and Wildlife Service, 1.7 million anglers fished in the Great Lakes in 2011, spending $1.9 million on fishing-related expenditures (USFWS, 2011). The introduction of more than 180 exotic species has irreversibly altered the Great Lakes ecosystem, causing dramatic changes in biological relationships and natural resource availability. Several species listed as threatened or endangered under the Endangered Species Act are at risk because of predation by or competition with AIS (Nature Conservancy, 2017; Wilcove et al., 1998).

These valuable resources and associated Hoosier investments are at risk if AIS invade and degrade these ecosystems. In Indiana, state and federal expenditures have reached upwards of $3 million annually for the prevention and control of invasive species (Rosaen et al., 2012), and significantly more could be done.

The following guiding principles describe the precepts by which the Indiana AIS Management Plan has been used over the last decade and a half and by which we have developed this update to reflect the implementation into the future. The Indiana AIS Management Plan process will:

- Ensure strong leadership, and a commitment to follow, implement, and evaluate the plan as an integrated and coordinated long-term process.
- Show the economic impact of AIS to the people of Indiana by producing effective educational outreach materials and programs.
- Create a usable plan for all levels of government and grassroots organizations.
- Prioritize issues that need to be addressed immediately. Allow for flexibility, recognizing that priorities will vary across agencies and organizations and that all ideas should be retained. Use public input to assure that prioritization recognizes differing viewpoints.
- Use frequent and effective communication tools.
- Use education efforts to develop leadership support from the local to state level.
- Involve the public in education and implementation. Create a plan that is clear, uncluttered, accessible, and avoids unnecessary complexity in messages to the general public as an introduction to AIS issues.
- Provide guidance for directing limited resources where they will be most effective. Make sure the plan is not driven by politics but by the best available science-based risk assessment and management strategies.

1.2 Aquatic Invasive Species Management Plan Background

Hoosiers support recreational, commercial, and protective uses of aquatic habitats in Indiana, which range widely from the Lake Michigan shoreline to the banks of the Ohio River. Records of the U.S. Fish and Wildlife Service and Indiana Department of Natural Resources show that more than 800,000 anglers and 11,000 waterfowl hunters depend on intact aquatic wildlife and ecosystems in Indiana (USFWS, 2011; IN DNR, 2012). An additional 1.7 million wildlife watchers enjoy the benefits of wildlife diversity in the state (USFWS, 2011). According to the 2011 National Survey of Fishing, Hunting and Wildlife-Associated Recreation, anglers, hunters, and wildlife watchers spend $1.6 billion annually to participate in these activities in Indiana. Invasive species are a great threat to outdoor recreational opportunities.

More than 60 rare and endangered species rely on wetland and aquatic habitats in the state. The recently revised State Wildlife Action Plan (SWAP) states its mission is “to manage, conserve, and enhance habitats’ and populations’ stability for diverse fish and wildlife resources (IN DNR 2015). By 2025, SWAP will be fully integrated throughout Indiana’s conservation community. SWAP will serve to bridge the efforts of dedicated natural resources professionals and stewards, which will ultimately enrich the quality of life for all Hoosiers. Among the concerns addressed within the plan, invasive species continues to rank as a significant concern for native species and habitat throughout the state.

Increasing global trade and travel have brought hundreds of foreign species to our doorsteps in a period of hours or days, and a number of them have turned out to be invasive in our environment.

As use of the Great Lakes intensified as a transportation route for commerce, the rate of introduction of AIS also increased. Human activities contributing to the transport and dispersal of AIS into the Great Lakes and inland state waters include release of organisms from the ballast water and hull fouling of ships, movement or intentional release of aquaculture and fishery species along with their associated (free-living and parasitic) organisms, release of organisms associated with pet industries or pest management practices, recreational boating, bait handling, artificial waterway connections between watersheds, and ornamental and landscape practices.

The development of a state management plan, as called for in Section 1204 of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (P.L. 101-646) (NANPCA) provides an opportunity for federal cost-share support for implementation of the plan. The original Indiana Aquatic Nuisance Species (ANS) Management Plan identified feasible, cost-effective management practices and measures to be taken on by state and local programs to prevent and control ANS infestations in a manner that is environmentally sound. Information for the original management plan was derived from several agency meetings, interviews with more than 40 stakeholders, and public meetings on April 15, July 29, and Sept. 18, 2003. The list of project reviewers, including work group members, totaled more than 120 individuals who represent industries, agencies, and organizations with an interest in impacts and management of AIS. Drafts of the management plan were available for public review and comment during the summer. A professional facilitation team from D.J. Case & Associates, Mishawaka, Indiana, guided all meetings and plan development under contract to the Indiana DNR Division of Fish & Wildlife. Indiana's first state management plan was approved by the Aquatic Nuisance Species Task Force (ANSTF) in 2004.

After Indiana's first state management plan was approved by the ANSTF, Indiana started receiving state management plan funding and was able to hire a full-time AIS coordinator. Implementation of the plan and project goals has been dependent on resources available through federal grants, including an infusion of new money from the Great Lakes Restoration Initiative starting in 2010. With increased funding and more than a decade of having an active AIS program, the Indiana DNR Division of Fish & Wildlife decided to undertake a comprehensive review and proceed with this revision of the original ANS management plan. The AIS staff and division staff evaluated the original plan and decided to proceed with plan revision, focusing on getting a contract in place for major edits. DNR contracted with Cardno Inc., a private environmental consulting group, to strengthen the plan by reviewing outdated materials, identifying gaps, and reformatting the aging state management plan so that it could be better used by our partners and the public. The process to obtain feedback and updates through the scoping process by Cardno Inc. included calls with major stakeholders and two meetings with division AIS staff before the wider review and edits that were used to prepare the first draft of the plan.

Revisions started by working with DNR staff from the Division of Fish & Wildlife, other DNR divisions, as well as engaging the Indiana Invasive Species Council (IISC), which represents a broad and diverse invasive species background. These staff and partners provided input on how to make the plan better. The IISC was provided the opportunity to review and provide input on

the state management plan revision and was given updates at quarterly public meetings in 2019 and 2020. Input received from partners and stakeholders was an important part of the plan development process, weighing heavily on the original work group and partner organizations who helped draft the original plan. Comments received during the review and editing of a draft version of this plan revision were incorporated into this final product. In addition to the edits and review of the state management plan, Indiana has developed and approved a framework for structured decision-making and rapid-response planning titled "Indiana's Rapid response Planning for Aquatic Invasive Species".

Several of the most noteworthy reviewer comments and how they were or will be addressed include:

- The need for consistent and recognizable communication, education, and outreach efforts were highlighted as a concern. These efforts are in keeping with the goals and strategies clarified within the revised management plan.
- When revising the plan, the need to use consistent terminology regarding defining invasive species was identified, because the use of other words like nonindigenous, exotic, nuisance, etc. can confuse the plan's audience.
- The original state management plan needed to have a clearer description of goals and to eliminate the redundancy within the strategies and actions found under those goals. In the original plan there were 55 strategies and 125 actions, many of which were redundant, so we revised the plan to 28 strategies and 89 actions.
- Reviewers wanted us to highlight the major accomplishments achieved over the last decade-plus of implementing the original state management plan.
- The need for the plan to reflect the variety of aquatic invasive species pathways, including current and future education, prevention, and control activities, and how they tie into addressing invasive species pathways.
- Revision of the plan should focus on reformatting the aging state management plan, which was text heavy and hard to navigate, so that it could be better used by our partners and the public.
- Incorporate and reference the recently revised State Wildlife Action Plan (SWAP). Among the concerns addressed within the SWAP, invasive species continues to rank as a significant concern for native species and habitats throughout the state.

To develop this plan revision, Indiana's AIS program coordinator, various department staff, and our contractor reviewed existing AIS prevention and control plans. Some plans reviewed included recently approved revised AIS management plans from neighboring Great Lakes states as well as work done as part of interstate coordination of efforts like the regional mutual aid agreement. This revised plan builds upon the idea that regional actions, communication and coordination are the keys to achieving the goals of Indiana's state management plan.

Key staff and contributors to the revision of the Indiana AIS management plan can be reviewed in Appendix A.

1.3 Past Accomplishments

Indiana AIS Program

Goal I of the Indiana AIS Management Plan describes the need to coordinate all efforts among agencies and organizations within Indiana and in other states and nations to manage AIS. As part of accomplishing this goal, Indiana DNR hired a full-time coordinator to implement the AIS Plan beginning in 2005. Through this position the Indiana DNR has implemented many of the action items described in the AIS Plan including the development of a Rapid Response Plan in 2012 (Goal IV). The Rapid Response Plan provides guidance for responding to an aquatic invasive species incidents quickly and effectively.

Lake Manitou – Hydrilla Eradication

In accordance with Goal V of the Indiana AIS Management Plan, Indiana DNR aggressively controlled hydrilla (*Hydrilla verticillata*) in Lake Manitou. Hydrilla was detected in Lake Manitou by Indiana DNR in August of 2006. Lake Manitou is a 735-acre natural lake in Rochester. Shortly after the detection of hydrilla in Lake Manitou, access restrictions were imposed to prevent the movement of hydrilla away from the lake. In addition to access restrictions, the Indiana DNR initiated an aggressive eradication plan using aquatic herbicides. The combination of access restrictions, 10 years of herbicide applications, and 3 years of intensive surveys after herbicide treatments resulted in a total of 5 consecutive years of no detection and complete eradication of hydrilla from Lake Manitou. In addition, these efforts appear to have prevented the spread to other water bodies.

Meserve Lake – Parrotfeather Eradication

In accordance with Goal V of the Indiana AIS Management Plan, Indiana DNR actively controlled parrotfeather (*Myriophyllum aquaticum*) in Meserve Lake. Parrotfeather was first detected in Meserve Lake in 2006. Management plans were quickly implemented to eradicate and prevent the spread. Intensive chemical application treatments and hand plant removal were conducted from 2008 through 2010. Since those activities, parrotfeather has not been detected in Meserve Lake and is believed to be eradicated from the lake.

Griffy Lake – Brazilian Elodea

In accordance with Goal V of the Indiana AIS Management Plan, Indiana DNR actively controlled Brazilian elodea (*Egeria densa*) in Griffy Lake. To prevent the spread of Brazilian elodea from Griffy Lake, the public boat ramp was closed in 2005. In 2006 and 2007 chemical application treatments were conducted to eradicate the invasive plant. Brazilian elodea has not been detected in Griffy Lake since April of 2007 and is currently believed to be eradicated from the lake due to the management actions implemented immediately after detection.

Eagle Marsh Watershed Separation Project – Asian Carp

Goal II of the Indiana AIS Management Plan is based on the desire to prevent new introductions of AIS. Since 2010, Indiana DNR has been instrumental in the prevention of AIS transfer at the Eagle Marsh natural watershed connection. Eagle Marsh is a 716-acre wetland located near Fort Wayne that was identified as a possible pathway for Asian carp and other invasive species to transfer between the Wabash River drainage (Mississippi River basin) into the Maumee River (Great Lakes basin) watershed during flood conditions. Extensive efforts have been made to separate the natural aquatic pathway connecting these two watersheds. In 2015, the multi-year project culminated in the completion of a 1.7-mile-long berm at Eagle Marsh that serves as a barrier between the Great Lakes and Mississippi River drainages, effectively eliminating the potential pathway for adult Asian carp entering Lake Erie via Eagle Marsh.

2. Problem and Prioritization

The Great Lakes region has been subject to the invasion of non-native species since the settlement of the region by Europeans. By 2006, at least 182 nonindigenous aquatic organisms had colonized habitats of the Great Lakes ecosystem (Ricciardi, 2006). Among these were 26 algae, 28 fish, 6 bacteria and viruses, 59 plants, 18 mollusks, 22 crustaceans, and various other types of organisms (NOAA, 2012). Foreign organisms have entered the Great Lakes basin by major mechanisms or routes, including shipping, unintentional releases, ship or barge canals, along railroads or highways, and by deliberate releases. About 55% of the exotic species in the Great Lakes basin are native to Eurasia, and 13% are native to the U.S. Atlantic coast. Although the obvious impacts of some of the most abundant invasive species are being determined, most of the nonindigenous species and their direct and indirect impacts are still unknown.

Aquatic invasive species can enter Indiana waterways via numerous pathways; however, the primary pathways for the introduction of aquatic invasive species are ballast, fish transfer, bait buckets, boats and trailers, aquaculture, water garden hobby, and aquarium trade. Appendices B and C describe in detail the federal, regional, and state programs and regulations that are currently in place to prevent the introduction of invasive species via these primary pathways.

Ballast water has been identified as a major pathway for the introduction of aquatic invasive species in the Great Lakes. Since the completion of the St. Lawrence Seaway in 1959 there have been a significant number of nonindigenous species introductions to the Great Lakes linked to the discharge of ballast water. Presently, approximately, 190 non-native species occur in the Great Lakes system, and most were suspected to have been introduced via ballast water discharge from ships. Ballast water from commercial vessels contributed to the invasion of several highly impactful species including Zebra Mussel (*Dreissena polymorpha*), Quagga Mussel (*Dreissena r. bugensis*) and Round Goby (*Neogobius melanostomus*) (Grigorovich et al., 2003).

Indiana contains an extensive network of lakes, ponds, drainage ditches, streams, and rivers. These water bodies provide a variety of popular recreational opportunities including boating, fishing, and swimming; however, these recreational activities provide opportunities for the

unintentional introduction of invasive species, including the two-way transfer between the Great Lakes basin and Mississippi River basin. Indiana is the 38th largest state in the U.S but ranks 17th in population, indicating a similar population density to many of the neighboring Midwestern states. Indiana has more than 21,000 miles of perennial rivers and streams. Streams in the northern 1/4 of Indiana lie within the Great Lakes basin with drainage into both Lake Michigan and Lake Erie (Figure 1). The Great Lakes basin is the largest freshwater system in the world and represents a top natural resource management priority. The remainder of the streams in the state are within the Mississippi River basin. The Mississippi River is one of the largest and most ecologically diverse river systems in the world. Both basins have been significantly impacted by AIS. Approximately 450 naturally formed glacial lakes are present in the northern tier of the state with 16 of these lakes ranging from 500 to 3,060 acres. Man-made reservoirs are scattered through the rest of the state. There are nearly 600 impoundments totaling more than 71,000 acres that contain state-owned fish in Indiana with the largest being 10,750 acre Monroe Lake.

Invasive plants and invertebrates can be easily transferred from one waterway to another when they are attached to boats, boat trailers, or other recreational equipment. Anglers often inadvertently transfer invasive species via bait buckets; however, intentional fish transfer and unauthorized stocking efforts have been known to occur and introduce invasive species to new water bodies.

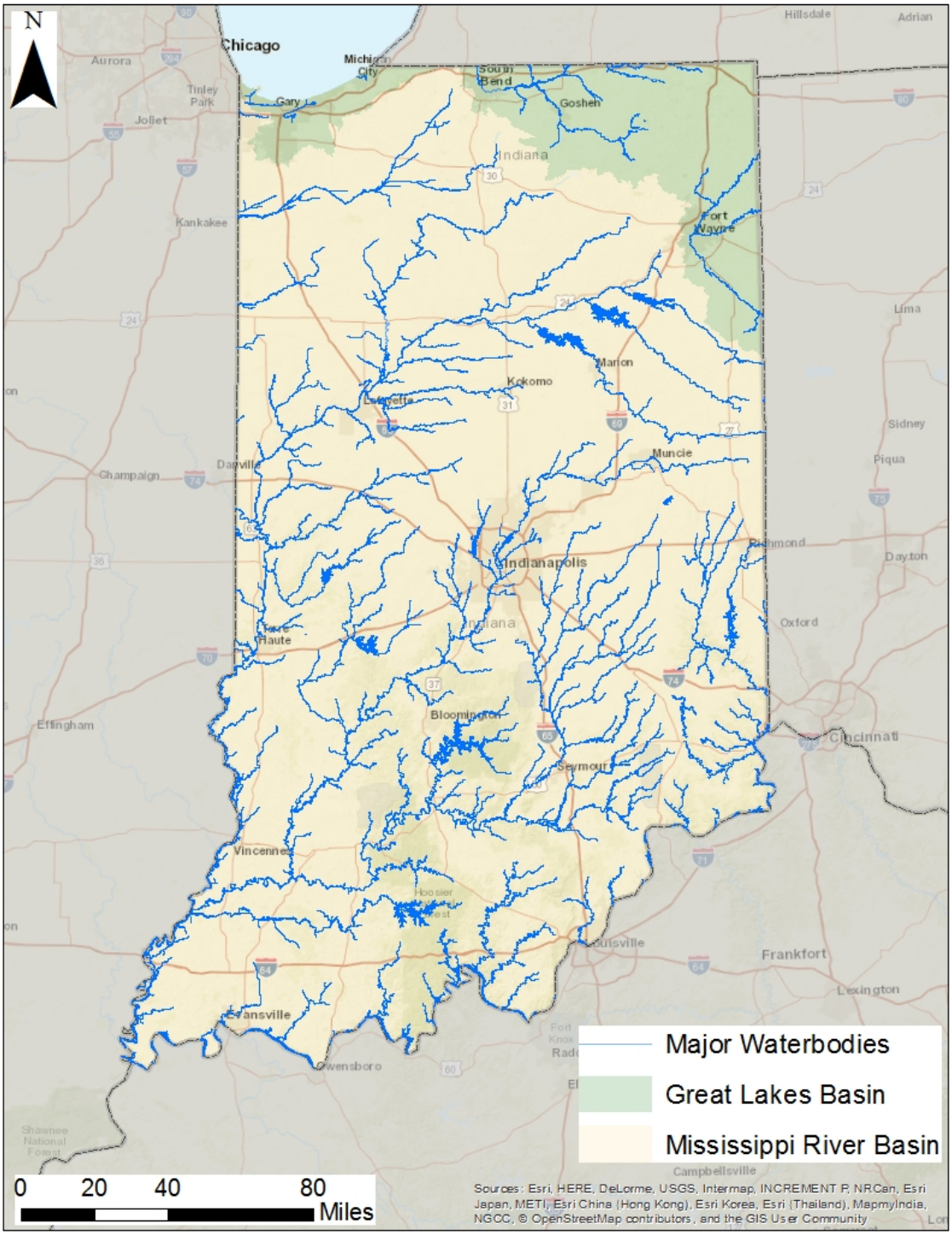

Figure 1. Indiana's major water bodies & watershed boundary

As compared to other pathways, the release of unwanted plants and animals from aquariums, water gardens, and backyard ponds is a lesser known but important pathway for the introduction of aquatic invasive species. A number of plants and animals popular for sale online and in stores

are hardy and can become highly invasive in Indiana. While many aquarium and water garden species being sold are of tropical origins and cannot tolerate Indiana's specific climate, these species can carry pathogens and parasites that may severely impact our native species.

The aquarium trade is responsible for a third of the world's aquatic invasive species (Padilla and Williams, 2004). The aquarium trade industry has grown significantly, with 11 million aquarium hobbyists currently participating in the activity in the United States. Several decades ago, the only aquarium species available were the few species carried by the local stores, usually goldfish or guppies. With the advent of global commerce and the internet, it is now possible for a home aquarist to order one of hundreds of species of fish and have it shipped from nearly anywhere in the world. Fish not specifically prohibited by the "Prohibited Exotic Fish" rule (312 IAC 9-6-7) and shipped for aquarium purposes are generally exempt from state importation laws. As a result, the state has no way of tracking most aquarium trade species that are coming into Indiana and which might be problematic if released into the wild. Release of large aquarium fish may be primarily related to buying species that grow to unmanageable sizes.

The introduction of AIS via aquaculture is an emerging pathway of growing concern. Aquaculture is defined as the controlled cultivation and harvest of aquatic organisms, including finfish, shellfish, and aquatic plants (Goldburg et al., 2001, 2003). There are approximately 100 different species of plants and animals raised in aquaculture across the United States (Naylor et al., 2001). While the aquaculture industry is currently small in Indiana, steady growth has been observed for many years; therefore, the potential for the introduction of aquatic invasive species from aquaculture facilities in Indiana could increase as the industry continues to expand. Presently, the most important aquaculture regulation in Indiana is the "Aquaculture Permit" (312 IAC 9-10-17). This rule is primarily used for regulation of grass carp and for research use of fish species that would otherwise be illegal for live possession under 312 IAC 9-6-7. The aquaculture permit also allows the state to review and evaluate species that are not part of the traditional approved species list, allowing for special review and additional permit conditions to oversee aquaculture operations.

No comprehensive survey of aquatic invasive species has been conducted in Indiana; however, several researchers, district biologists, and aquatic plant management companies have contributed to invasive species occurrence lists provided in Table 1 below and Appendix D. Species of concern but not yet detected in the state are shown in Table 2. Several of the fish species on the Indiana watch list are from a set of 56 fish species predicted as being potential invaders that could be transported in the ballast water of ships from the Ponto-Caspian region of Eurasia (Kolar and Lodge, 2002). Ecological risk assessments including plant risk assessments and coordination with regional aquatic invasive experts and managers have been used for other groups of plants or animals. Greater detail and ecological information on several of the species of concern are given in the following subsection by taxon (animals, plants, diseases, pathogens, and parasites).

Table 1. Aquatic invasive species detected in Indiana and reported through USGS NAS, EDDMapS, and state biologists. The common and scientific names are given, along with the primary paths of introduction and level of concern.

Fish			
Common Name	**Scientific Name**	**Pathway(s)**	**Priority/Concern**
Alewife	*Alosa pseudoharengus*	Ballast, fish transfer	Concern
Goldfish	*Carassius auratus*	Fish transfer, bait bucket	Concern
Grass Carp	*Ctenopharyngodon idella*	Fish transfer	Concern
Common Carp	*Cyprinus carpio*	Fish transfer, bait bucket	Concern
Threespine Stickleback	*Gasterosteus aculeatus*	Bait, fish transfer	Concern
Silver Carp	*Hypophthalmichthys molitrix*	Fish transfer	Priority
Bighead Carp	*Hypophthalmichthys nobilis*	Fish transfer	Priority
White Perch	*Morone americana*	Fish transfer, bait bucket	Priority
Black Carp	*Mylopharyngodon piceus*	Aquaculture, Fish transfer	Priority
Round Goby	*Neogobius melanostomus*	Ballast, bait bucket	Concern
Sea Lamprey	*Petromyzon marinus*	Ballast	Priority
Rudd	*Scardinius erythrophthalmus*	Fish transfer, bait bucket	Concern
Invertebrates			
Common Name	**Scientific Name**	**Pathway(s)**	**Priority/Concern**
Spiny Water Flea	*Bythotrephes cederstroemi*	Ballast, bait bucket, trailer	Concern
Fishhook Water Flea	*Cercopagis pengoi*	Ballast, bait bucket, trailer	Concern
Chinese Mystery Snail	*Cipangopaludina chinensis*	Aquarium, bait bucket	Concern
Asiatic Clam	*Corbicula fluminea*	Bait bucket, trailer	Concern
Zebra Mussel	*Dreissena polymorpha*	Bait bucket, trailer, ballast	Concern
Quagga Mussel	*Dreissena r. bugensis*	Bait bucket, trailer, ballast	Concern
Rusty Crayfish	*Orconectes rusticus*	Bait	Concern
Red Swamp Crayfish	*Procambarus clarkii*	Bait bucket	Concern
Plants			
Common Name	**Scientific Name**	**Pathway(s)**	**Priority/Concern**
flowering rush	*Butomus umbellatus*	Wetland plant transfer	Priority
Brazilian elodea	*Egeria densa*	Aquarium, bait bucket, trailer	Priority
floating water hyacinth	*Eichhornia crassipes*	Trailer, private ponds	Priority
hydrilla	*Hydrilla verticillata*	Aquarium, bait bucket	Priority
yellow flag iris	*Iris pseudacorus*	Wetland plant transfer	Concern
purple loosestrife	*Lythrum salicaria*	Wetland plant transfer	Concern
parrot feather	*Myriophyllum aquaticum*	Trailer, bait bucket	Priority
Eurasian watermilfoil	*Myriophyllum spicatum*	Trailer, bait bucket	Priority
brittle waternymph	*Najas minor*	Aquarium, bait bucket, trailer	Concern
starry stonewort	*Nitellopsis obtusa*	Trailer, bait bucket	Priority
yellow floating heart	*Nymphoides peltata*	Wetland, private pond	Concern
reed canarygrass	*Phalaris arundinacea*	Wetland plant transfer	Concern
common reed	*Phragmites australis*	Wetland plant transfer	Concern
water lettuce	*Pistia stratiotes*	Trailer, private ponds	Concern
curlyleaf pondweed	*Potamogeton crispus*	Aquarium, bait bucket, trailer	Concern
narrow-leaved cattail	*Typha angustifolia*	Wetland plant transfer	Concern
Diseases/parasites			
Common Name	**Scientific Name**	**Pathway(s)**	**Priority/Concern**
Largemouth bass virus	Family Iridoviridae	Fish transfer, bait bucket, live well	Concern

Table 2. Aquatic invasive species on the watch list (not yet detected in Indiana waters). The common and scientific names are given, along with the primary paths of introduction. For watch list species, the standard abbreviation for the nearest state, province, or region known to have the species is provided. (ONT = Lake Ontario; EA = Eurasia; SA = South America).

Fish				
Common Name	**Scientific Name**	**Pathway(s)**	**Occurrences**	**Priority/Concern**
Black Sea Silverside	*Atherina boyeri*	Ballast	EA	Concern
Fourspine Stickleback	*Apeltes quadracus*	Bait bucket, fish transfer	PA	Concern
Black Sea Sprat	*Clupeonella cultriventris*	Ballast	EA	Concern
Snakehead fish	Family Channidae	Fish transfer, food	VA, AR	Priority
Walking catfish	Family Clariidae	Fish transfer	CT, FL, GA, MA	Concern
Eurasian Ruffe	*Gymnocephalus cernuus*	Ballast, fish transfer	MI, WI	Priority
Monkey Goby	*Neogobius fluviatilis*	Ballast	EA	Concern
European Perch	*Perca fluviatilis*	Ballast, aquaculture	EA	Concern
Eurasian Minnow	*Phoxinus phoxinus*	Ballast	EA	Concern
Stone Moroko	*Pseudorasbora parva*	Fish transfer, aquarium	EA	Concern
Roach	*Rutilus rutilus*	Ballast	EA	Concern
Wels Catfish	*Silurus glanis*	Intentional release, escape	EA	Concern
Zander	*Stizostedion lucioperca*	Ballast, aquaculture	NY, ND	Concern
Tench	*Tinca tinca*	Fish transfer, bait	IL, OH, KY	Concern
Invertebrates				
Common Name	**Scientific Name**	**Pathway(s)**	**Occurrences**	**Priority/Concern**
Yabby	*Cherax destructor*	Intentional release	EA	Concern
Giant Cladoceran	*Daphnia lumholtzi*	Ballast, bait bucket	IL, KY, OH, MI	Concern
Killer Shrimp	*Dikerogammarus villosus*	Ballast	EA	Concern
Golden Mussel	*Limnopera fortune*	Ballast	SA	Concern
New Zealand Mudsnail	*Potamopyrgus antipodarum*	Bait bucket, trailer	IL, WI, MI	Concern
Plants				
Common Name	**Scientific Name**	**Pathway(s)**	**Occurrences**	**Priority/Concern**
Anchored water hyacinth	*Eichhornea azuria*	Trailer, water garden	AR	Concern
European frogbit	*Hydrocharis morsus-ranae*	Bait bucket, trailer	MI	Priority
giant salvinia	*Salvinia auriculata* complex	Aquarium, bait bucket	MS, AR, AL	Concern
water soldier	*Stratiotes aloides*	Watergarden plantings, trailer	ONT	Concern
European water chestnut	*Trapa natans*	Watergarden plantings	KY, PA	Priority
Diseases/parasites				
Common Name	**Scientific Name**	**Pathway(s)**	**Occurrences**	**Priority/Concern**
Heterosporis parasite	*Heterosporis* sp.	Fish transfer, bait bucket	WI, MI	Concern
Whirling disease in salmon	*Myxobolus cerebralis*	Trailer, fish transfer	MI	Concern
Viral hemorrhagic septicemia	*Novirhabdovirus* sp.	Ballast, fish transfer, bait bucket	WI, MI, OH	Priority
Spring viremia of carp	*Rhabdovirus carpio*	Fish transfer, bait bucket	WI, IL	Concern

2.1 Animals

Black Carp (*Mylopharyngodon piceus*): The Black Carp is a bottom-dwelling molluscivore that has been used by U.S. fish farmers to prey on and control parasite-carrying snails in their production ponds. Black Carp are superficially very similar in appearance to Grass Carp (*Ctenopharyngodon idella*). Grass Carp may be used legally by licensed dealers for aquatic plant control in private ponds in Indiana as a genetically modified fish that cannot reproduce. As such, Nico and Williams (1996) expressed concern that if Black Carp become more common in U.S. aquaculture, there will be an increased risk that the species could be misidentified as Grass Carp and unintentionally introduced to some areas. It is highly probable that Black Carp would feed on and reduce populations of native mussels and snails (Nico and Williams, 1996). There are 20 species of mussels listed as state endangered or of special concern in Indiana, including 10 federally endangered species, and one federal candidate species, which would likely be further affected by Black Carp introductions. Black Carp are regulated by the Indiana DNR to prevent their movement and live possession. Their importation is also regulated by the federal Lacey Act, under which they are listed as an Injurious Wildlife Species. Canada also prohibits their importation, possession, transportation, and release. Sterilization of Black Carp for aquaculture use does not eliminate the ecological risk posed by these fish (USFWS, 2002). A sterile adult Black Carp can eat 3 to 4 pounds of mollusks a day and can live up to 15 years. The methods used to produce sterile fish do not guarantee 100% sterility, meaning that a small percentage of fertile fish may be found among groups of sterile fish. To date, there have been four confirmed reports of Black Carp found in Indiana waters. All have been collected by commercial anglers. Three were captured in the Ohio River just downstream of the Newburgh lock and dam near Evansville, and there was a 2020 capture in the Wabash River just north of the confluence with the Ohio River. The species has also been documented to be increasing in numbers within the Mississippi River and some of its tributaries in the southern half of Illinois (Figure 2).

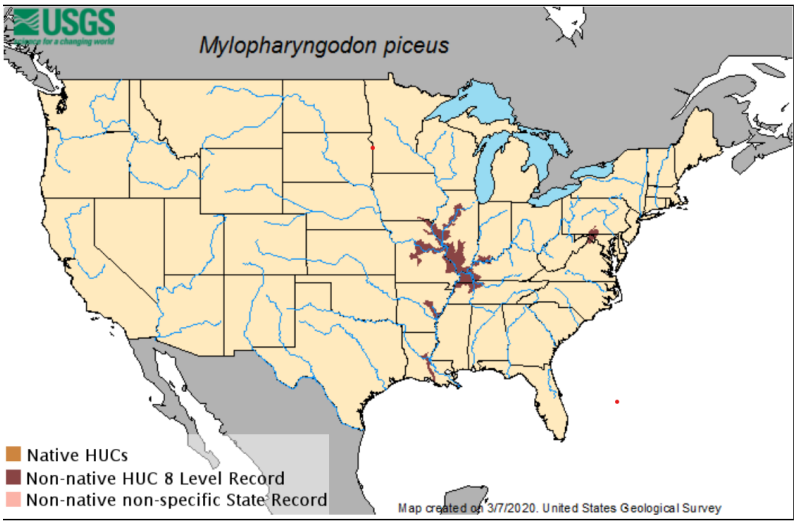

Figure 2. Distribution of Black Carp (*Mylopharyngodon piceus*) in the United States as of 2020 (Nico and Neilson, 2020).

Chinese Mystery Snail (*Cipangopaludina chinensis*): The Chinese Mystery Snail is native to Burma, Thailand, South Vietnam, China, Korea, Russia in the Amur region, Japan, the Philippines, and Java. This snail has been reported from an increasing number of sites in Indiana

in both the Lake Michigan and Mississippi River watersheds (Kipp et al., 2017a). Chinese Mystery Snails live partially buried in the mud or silt of lakes, ponds, rice paddies, irrigation canals, roadside ditches, or slower portions of streams. They prefer quiet water where there is some vegetation and a mud substrate. This species was probably introduced through accidental or intentional releases from the aquarium industry and continues to be a popular aquarium species in the region. This species of invasive snail, by evidence of its spread and growth, has shown it can survive in Indiana, although its effects on the waters of the state and ecology are less understood. It can serve as a vector for various parasites and diseases, some of which may infect humans. Shells of this large snail have been clogging intake screens at the IPALCO Stout and Perry K power-generating plants in Marion County (Terry Hogan, pers. comm. Cinergy Corporation, 2 October 2000). The large conically shaped shell creates a troublesome problem for the maintenance of the power plant, as the shells clog the cooling water condenser tubes. The snails are an operculated species, having a "trap door" over their entrance and thus can simply close up and wait for an intermittent biocide to pass by without effectively controlling them.

Eurasian Ruffe (*Gymnocephalus cernuus*): The Eurasian Ruffe was first reported in a tributary of Lake Superior and has since entered Lake Michigan, Lake Huron, and many of their tributaries. At this time, the Eurasian Ruffe has not been detected in Indiana waters; however, in 2013 genetic material was detected using environmental DNA (eDNA) sampling in the waters of Calumet Harbor, which is located along the Lake Michigan shoreline at the Indiana-Illinois state line (Tucker et al., 2016). After this discovery, multiple state and federal agencies collaborated in a rapid response effort to survey for the presence of live Eurasian Ruffe in Calumet Harbor and other areas along the Lake Michigan shoreline near Chicago. These efforts resulted in no detections of the species. The Eurasian Ruffe can tolerate a wide range of habitat conditions. It can outcompete other species and dominate an ecosystem quickly. The species can tolerate a wide range of ecological and environmental conditions, as evidenced by its discovery in lakes, rivers, estuaries, and ponds throughout its native and invasive range. It is currently unclear how the species entered the Great Lakes; however, it was likely introduced through ballast water. Prevention strategies for the control of the Eurasian Ruffe include increased predation, ballast water management, pesticides, and baitfish management.

Giant Cladoceran (*Daphnia lumholtzi*): This exotic zooplankton species is native to Africa, Asia, and Australia, and was most likely brought to North America with African fish imported for the aquarium trade or to stock reservoirs. Since 1995, it has been found in the Illinois River and a connecting channel to Lake Michigan through Chicago and now appears close to invading Lake Michigan. Multiple records for this species now occur in the adjacent states of Illinois, Ohio, and Kentucky, including a record for the Ohio River at Louisville and at Grand Lake, which outflows into a tributary of the Wabash River in Ohio (Benson et al., 2017c), but to date it has not been found in Indiana waters outside the shared waters of the Ohio River. Cladocerans, also known as water fleas, are small zooplankton that are an important food source for larval and early juvenile stages of nearly every species of North American fish. *Daphnia lumholtzi* is much larger and has more numerous spines than similar native species. The large spines make it difficult for young fish to eat this exotic plankton. Protection from predation could give it a

competitive advantage over the more edible native species. This could result in reduction of food available in lakes, streams, and fish hatcheries where this zooplankton invades. Sportfish susceptible to impacts would be late-spawning species such as bass and other sunfish.

New Zealand Mudsnail (*Potamopyrgus antipodarum*): The New Zealand Mudsnail is a small aquatic snail, about one-eighth of an inch long. As its name states, this species is native to freshwater lakes and streams of New Zealand. Like many organisms today, it is being incidentally carried to many locations around the world such as Europe, Asia, and North America. In the U.S. this snail was first detected in the mid-1980s in the Snake River region of Idaho. Since then, it has spread to waters of Montana, Wyoming, California, Arizona, Oregon, and Utah. In the eastern U.S. the species has been identified in all the Great Lakes except Lake Huron, and it now occurs at inland sites in some of the Great Lakes states. It was discovered in Lake Michigan near Waukegan, Illinois in 2006, but it has not yet been detected in Indiana (Benson et al., 2017a). Mudsnail densities of more than one-half million per meter square in western streams are a cause for concern. Because the West is known for abundant trout and productive fishing spots, there is concern that this mudsnail will impact the food chain for native trout as well as the physical characteristics of the streams themselves. Research is needed to determine the impacts of large populations of the species on the native fauna such as aquatic insects and native snails, and on any changes in the physical environment.

Sea Lamprey (*Petromyzon marinus*): Sea Lamprey have been found in Indiana's portion of Lake Michigan and the tributaries that feed into Lake Michigan. The invasion of the Sea Lamprey in the 1940s has resulted in substantial economic losses to recreational and commercial fisheries and has required annual expenditures of millions of dollars to finance control programs. During the 1940s and 1950s, the Sea Lamprey, a top predator that kills fish by attaching to its prey and feeding on body fluids, devastated populations of Whitefish and Lake Trout. Their aggressive feeding behavior contributed significantly to the collapse of fish species that were the economic mainstay of a vibrant Great Lakes fishery (Great Lakes Fishery Commission, undated). Indiana shares in the changes that have resulted in the commercial fishing and recreational economy of the Great Lakes. For example, before Sea Lampreys entered the Great Lakes, Canada and the United States harvested about 15 million pounds of Lake Trout in lakes Huron and Superior annually. By the early 1960s, the catch was only about 300,000 pounds. In 1992, annual Sea Lamprey control costs and research to reduce its predation were approximated at $10 million. Ongoing control efforts have resulted in a 90% reduction of Sea Lamprey populations in most areas, creating a more amenable environment for fish survival and spawning.

Silver Carp (*Hypophthalmichthys molitrix*) and Bighead Carp (*Hypophthalmichthys nobilis*): These so-called Asian carps have been used in many parts of the world as a food fish and sometimes introduced into sewage lagoons and aquaculture ponds (Jennings, 1988). In 2009 and 2010 the Great Lakes states spent nearly $3.7 million to address issues related to Asian carp invasions (Rosaen et al., 2012), with the Environmental Protection Agency directing an additional $13 million for emergency actions (Great Lakes Commission, 2009). Extensive efforts continue to prevent their invasion into the Great Lakes. Silver and Bighead Carp are regulated by the Indiana DNR to prevent their movement and live possession. The importation of these two species is also regulated by the federal Lacey Act, under which they are listed as Injurious Wildlife Species. Canada also prohibits their importation, possession, transportation, and release. The impact of these two species in the United States is not adequately understood. The largest Bighead Carp reported from Indiana waters was 53.5 pounds, but they are known to reach 90 pounds elsewhere in the United States. Silver Carp reach lengths of three feet and weights of 60 pounds. Because Bighead Carp and Silver Carp are planktivorous and can attain a large size, Laird and Page (1996) suggested these carp have the potential to deplete zooplankton populations. As Laird and Page pointed out, a decline in the availability of plankton can lead to reductions in populations of native species that rely on plankton for food, including all larval fishes, some adult fishes, and native mussels. In some of the big pools along the Mississippi River, Asian carp multiplied so quickly that in less than a decade they made up 90% or more of the fish community. Several species of fish with high recreational and commercial value are most at risk from such competition in large rivers and the Great Lakes, including Paddlefish, Bigmouth Buffalo, salmon, Walleye, and Yellow Perch. To date, populations of Bighead Carp have been reported in the Mississippi drainage in Indiana in every large river system, including the Wabash River drainage upstream to the J.E. Roush Lake Dam on the Tippecanoe River up to Oakdale Dam (which forms Lake Freeman), the White River to Indianapolis, the East Fork of the White River, and in embayments along the Ohio River. Silver Carp currently have a similar distribution in Indiana (Figure 3) but have become even more abundant and successful than the Bighead Carp (Nico et al., 2020a; Nico et al., 2017).

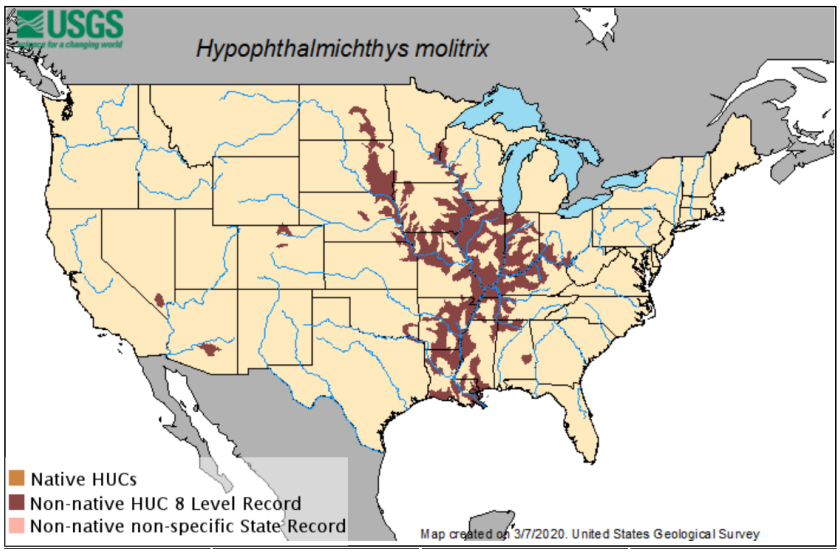

Figure 3. Distribution of Silver Carp (*Hypophthalmichthys moltrix*) in the United States as of 2020 (Nico et al., 2020a)

Snakehead (Channidae): The snakehead is a family of fishes that originates in Asia and Africa. Most snakehead species live in freshwater swamps, ditches, ponds, and rice paddies. The Bullseye Snakehead (*Channa marulius*) is established in Florida (Fuller et al., 2017), and the Northern Snakehead (*Channa argus*) has been found in several states, most of which are along the Atlantic Coast. Some Northern Snakehead collection sites may represent isolated individuals that do not contain viable populations; however, the species does appear to be established in some Eastern states, particularly in areas associated with the Potomac River and Chesapeake Bay. In the Mississippi Valley it occurs in parts of eastern Arkansas. In 2004 a single specimen of the Northern Snakehead was collected in Lake Michigan near downtown Chicago; however, there does not appear to be an established population there or anywhere else in the Great Lakes (Fuller et al., 2017b). Currently there have been no reports of snakeheads in Indiana waters. Snakeheads have been transported to the United States primarily as pets in the aquarium trade and as food. It is believed that many of the snakeheads found in the wild were illegally stocked to establish a local food source or released from the aquarium trade. When snakeheads become established, they have the capability to disrupt ecosystems by competing with native species. In many situations the use of piscicides to eradicate snakeheads is not feasible, therefore, taking measures to prevent the initial introduction of the species is essential.

Spiny Water Flea (*Bythotrephes longimanus*) and Fishhook Water Flea (*Cercopagis pengoi*): The Spiny Water Flea, a likely ballast water introduction, is a tiny crustacean (related to shrimp and crabs) with a sharply barbed tail spine. This northern European native was first found in Lake Huron in 1984. The Spiny Water Flea is now found throughout the Great Lakes, including Lake Michigan, and in some inland lakes in nearby states (Liebig et al., 2017). Another invasive zooplankton called the Fishhook Water Flea was first found in Lake Ontario in 1998. It has since been reported from all the Great Lakes (Benson et al., 2017b) and was most likely transported in the ballast water of ships. Many predatory fish avoid them as prey, and most smaller fish cannot effectively consume them because they cannot ingest the hooked tail spine. These large zooplankton are nearly a half-inch long and may compete for food with young fish such as Yellow Perch that also eat small zooplankton. The long tail spine of these two water fleas is irritating to anglers whose lines become entangled with "globs" of the invertebrates. Anglers and other recreational water users can avoid transferring these species by emptying water from live wells, bait buckets, and other equipment and completely drying them before using them in inland waters of the state.

White Perch (*Morone americana*): White Perch are naturally found in brackish waters of the Atlantic coast but invaded the lower Great Lakes during the late 1980s. White Perch is a food fish and provides angling opportunities but may stunt when overpopulation occurs in freshwater lakes (Pflieger, 1997; Smith, 2002). Through competition with native species, predation on fish eggs, preying on young fish, and hybridization with White Bass, White Perch can quickly become the dominant species in freshwater lakes. White Perch are thought to cause declines in walleye (Schaeffer and Margraf, 1987), Yellow Perch (Parrish and Margraf, 1990), and White Bass (Todd, 1986) in the Great Lakes region. White Perch have been collected in northwest Indiana from Lake Michigan, Wolf Lake, Cedar Lake, Koontz Lake, Fancher Lake, and the Grand Calumet River. Although White Perch may have migrated from Lake Michigan to Wolf Lake and the Grand Calumet River, this fish was probably illegally stocked in Cedar Lake, Fancher Lake, and Koontz Lake since these waters are outside of the Great Lakes drainage. The invasion by White Perch can degrade fishing quality. A 2001 fisheries survey showed that White Perch had rapidly overwhelmed the fish community in Cedar Lake, constituting 88% by number and 67% by weight of the fish caught. Just as in Cedar Lake, White Perch was the most abundant fish by number (49%) and weight (25%) in a 1999 survey of Wolf Lake. This species should not be confused with the native Freshwater Drum, which may commonly be referred to as a "white perch" in parts of southern Indiana.

Zebra Mussel (*Dreissena polymorpha*) and Quagga Mussel (*Dreissena rostriformis bugensis*): The Zebra Mussel, another ballast water introduction, is one of the best-known invaders of the Great Lakes region and other areas of the country where it has spread (Figure 4). This aquatic invasive species has caused serious economic and ecosystem impacts. The Zebra Mussel, a highly opportunistic mollusk, reproduces rapidly and consumes plankton from the water column in large quantities. The potential impact on the fishery can be profound due to changes in food availability and spawning areas, to name a few. Economic impacts are as pervasive as the ecosystem impacts. Due to the infestation of Zebra Mussels in their intake and discharge pipes, Great Lakes municipalities, utilities, and industries have significant costs associated with monitoring, cleaning, and controlling infestations.

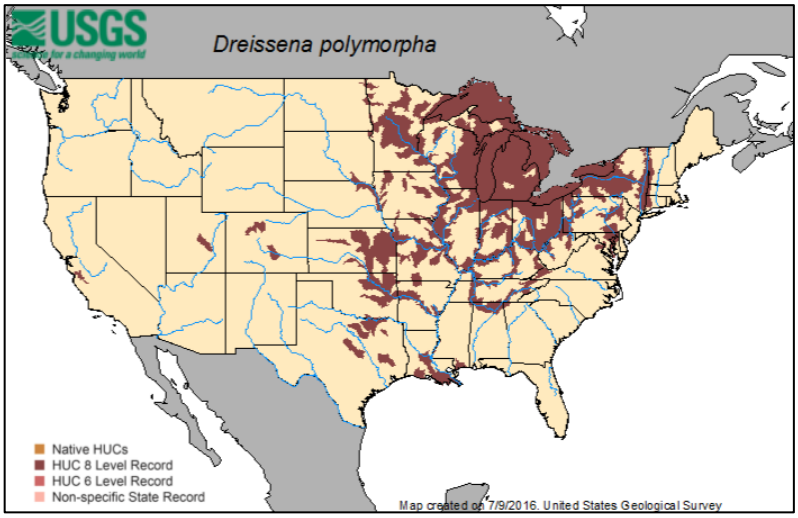

Figure 4. Distribution of Zebra Mussel (*Dreissena polymorpha*) in the United States as of 2020 (Benson et al., 2020e).

More recently the Quagga Mussel has become an increasing threat to waters of the American Southwest and Midwest, and it has gained a notable stronghold in the Great Lakes (Figure 5). These mussels have expanded their range in recent years and may be replacing the Zebra Mussel in the lower Great Lakes (Mills et al., 1996; Benson et al., 2017d). Quagga Mussels seem to prefer deeper, cooler waters like those of the Great Lakes; as such, they may pose a greater threat in the Great Lakes while Zebra Mussels have remained an ongoing threat to inland waters (Mills et al., 1996; Benson et al., 2017d).

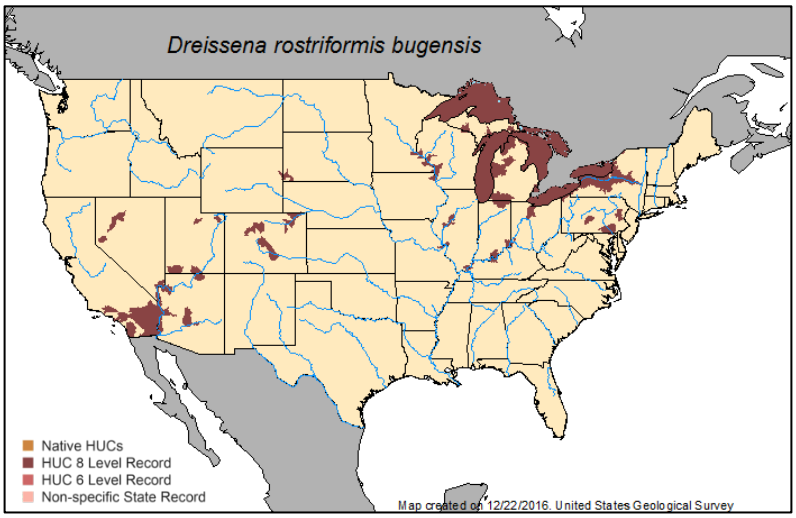

Figure 5. Distribution of Quagga Mussel (*Dreissena rostriformis bugensis*) in the United States as of 2020 (Benson et al., 2020d).

2.2 Plants

Brazilian elodea (*Egeria densa*): Brazilian elodea has been found in Indiana waters, including what was a thriving population in Griffy Lake in Bloomington. An intensive herbicide treatment plan orchestrated by Indiana DNR at Griffy Lake led to the eradication of the species in 2007 when the last fragment of Egeria was observed. Brazilian elodea looks much like a larger, more robust version of its commonly found native relative, *Elodea canadensis* (waterweed). Stems are erect, cylindrical, simple, or branched and grow until they reach the surface of the water where they form dense mats. This plant has been common in the aquarium and water garden trade for decades but has been prohibited in Indiana.

Common reed (*Phragmites australis*): Common reed is a widely distributed wetland plant found on five continents. It can grow up to 20 feet high in dense stands in wetlands and is long-lived. This plant is capable of reproduction by seeds, but primarily does so asexually by means of rhizomes. Research has shown that native and introduced varieties of this species currently exist in North America. The species is invasive in eastern states along the Atlantic coast and increasingly across much of the Midwest and in parts of the Pacific Northwest. The plant has been common along roadside ditches in northwest Indiana and has spread throughout the state. Where it occurs in abundance, it can change a diverse wetland community to a monoculture, decreasing the wildlife habitat value of the area.

Eurasian watermilfoil (*Myriophyllum spicatum*): Eurasian watermilfoil can rapidly invade shoreline areas by forming dense mats across the surface of the water and can grow in fairly deep water. The plants initial establishment is suspected to have been an accidental release from an aquarium and was first detected in Washington, D.C. in 1942. By 1950, it was found in Arizona, California, and Ohio. Eurasian watermilfoil now occurs throughout Indiana but is especially prevalent in the northern natural lakes region. This non-native milfoil species crowds out desirable native vegetation, provides no desirable food for waterfowl or wildlife, and makes waterways unsuitable for boating, fishing, and swimming. Strategically timed herbicide applications can be effective for managing Eurasian watermilfoil, although herbicides effective against the plant can be very expensive and may have secondary effects on other plants or animals in the water. Mechanically harvesting Eurasian watermilfoil can spread the plant because it reproduces through fragmentation and re-rooting.

European frogbit (*Hydrocharis morsus-ranae*): In the 1930s European frogbit was being cultivated in Canada and later escaped into Canadian water bodies. The species is believed to have been transported to the United States via boats and boat trailers. New York was the first state to document European frogbit in 1974; however, the species has since spread to Vermont, Michigan, and Washington. European frogbit reproduces by turions, which are buds that break off from the plant and sink to the bottom to over-winter. These turions rise to the surface in the spring and begin to grow. Establishment is often rapid because one plant can produce upwards of 100 turions. The plant has a dense mass of roots that rarely anchor to the sediment, thereby allowing the species to be easily transported by currents. Herbicides and even shading (Zhu, 2014) have been used for treatment; however, mechanical harvesting appears the most viable method of removal. There have been no reports of European frogbit in Indiana to date, therefore prevention is critical.

Flowering rush (*Butomus umbellatus*): Flowering rush is native to Eurasia and was intentionally brought to North America as an ornamental species. The species has been found in several states, including the nearby states of Wisconsin, Michigan, Ohio, and Illinois. The only Indiana records date back to 1963 in an area along the Elkhart River at Goshen (Cao et al., 2017). Flowering rush occurs in lakes, riparian zones, water courses, wetlands, and marshes. Flowering rush can be identified by its flowers that have three pink to white petals that are approximately one inch across. In many situations flowering rush can compete with native plant species for limited resources. Herbicide applications and cutting have historically been unsuccessful, therefore preventing the spread of flowering rush is critical to its management.

Hydrilla (*Hydrilla verticillata*): Hydrilla is a European species that is thought to have been introduced to Florida sometime during the 1950s. It is an aggressive invasive species that spread throughout Florida and most other southern states before being transferred through various pathways over the course of its spread. Hydrilla is broken down geographically in its spread by being monecious or dioecious. The dioecious form is dominate in the South and the monecious form being more successful on the East coast and Midwest (Figure 6). Hydrilla is one of the most aggressive aquatic invasive plants and is certainly among the most notorious of submerged aquatic plant species. It may be found in all types of water bodies. Hydrilla is a submersed plant that can grow to the surface and form dense mats. The plant stems are slender, branched and as long as 25 feet. Infestations of hydrilla are extremely severe and can completely choke entire lakes and public water supplies. The plant can disperse from fragments, and the tubers can remain dormant for many years, which makes eradication of the species difficult.

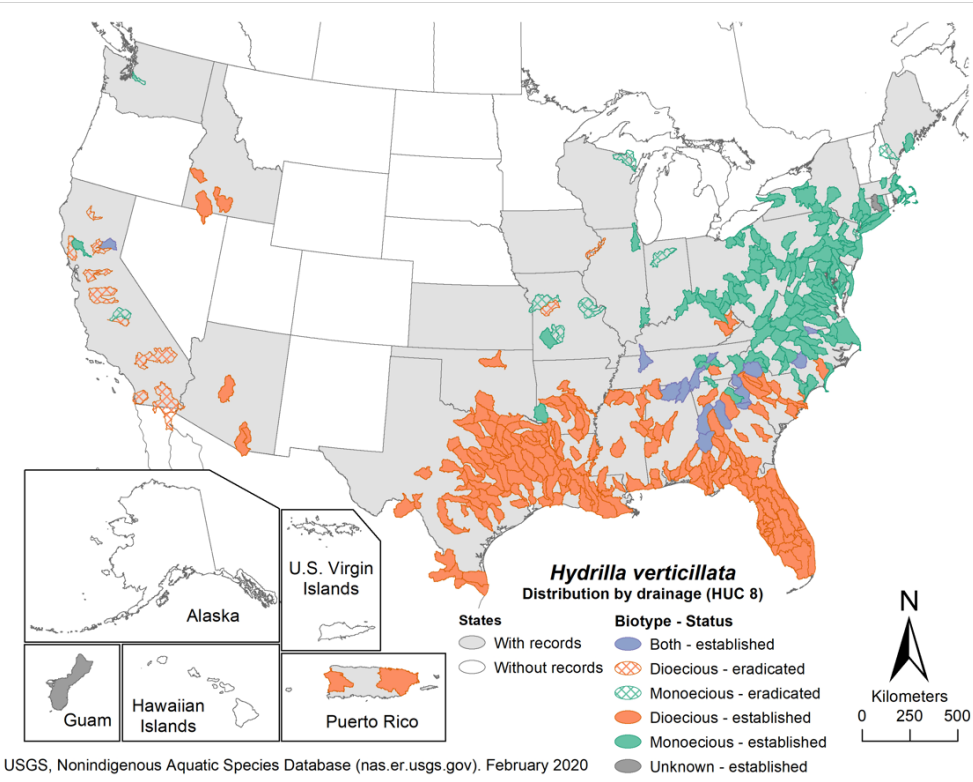

Figure 6. Distribution of hydrilla (*Hydrilla verticillata*) in the United States as of 2020 (Pfingsten, I.A., 2020).

Hydrilla was first detected in Indiana in 2006 at Lake Manitou near Rochester. Immediately after the detection of hydrilla in Lake Manitou, steps were taken to prevent the spread of the species to other lakes in the region. To prevent the spread of hydrilla from recreational vessels, access restrictions were imposed at Lake Manitou. To eradicate hydrilla from Lake Manitou, a decade long chemical control program began in 2007. This aggressive strategy resulted in eradication of

hydrilla from the lake but with a high financial treatment cost. Due to the length of a hydrilla eradication program, high cost, and environmental problems the plant causes when it establishes, prevention of new introductions is of extreme high priority.

Parrotfeather (*Myriophyllum aquaticum*): Parrotfeather is a plant species that is adapted to high nutrient environments such as lakes, ponds, sloughs, streams, ditches, and canals. This plant has been widely used in the water garden industry. It grows best when rooted in shallow water but has the capability to persist as a floating plant in deeper water. Outside of its native range parrotfeather reproduces exclusively by plant fragmentation. Dense colonies of parrotfeather can form that replace native species. Herbicide applications to treat parrotfeather have been successful, but it is often difficult to achieve complete control. The mechanical harvesting of parrotfeather is seldom a reasonable option due to the plant's ability to reproduce from fragments. Meserve Lake is the only public Indiana water body where parrotfeather has been reported. The completion of an extensive herbicide application program from 2008 to 2010 is believed to have eradicated parrotfeather.

Purple loosestrife (*Lythrum salicaria*): Purple loosestrife, known for its beautiful purple flowers and landscape value, is a wetland plant from Europe and Asia that was introduced to the east coast of North America in the 1800s. It has become a serious pest to native wetland communities where it outcompetes native plants. Purple loosestrife invades marshes and lakeshores, replacing cattails and other wetland plants. This invasive plant is unsuitable to meet habitat needs such as cover, food, or nesting sites for a wide range of wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads, and turtles. To control the spread of purple loosestrife, a state law was enacted on July 1, 1996, that prohibits the sale of all forms of purple loosestrife (any variety, species, horticultural variety, cultivar), or other members of the genus *Lythrum*, whether reportedly sterile or not. In small infestations, purple loosestrife may be controlled by hand pulling and physical removal, especially when the plants are young. Herbicide applications can also be effective at reducing densities. Biological control of larger colonies has been achieved with the use of certain insects that feed on the plant. Since the 1990s, the Indiana DNR has been releasing the beetles *Galerucella calmariensis* and *Galerucella pusilla* to control purple loosestrife where it has invaded wetlands. Purple loosestrife has been reduced at many of the sites where the beetles have been introduced, and it appears that this form of biological control may be viable in helping to manage the intensity of purple loosestrife invasions.

Reed canarygrass (*Phalaris arundinacea*): Reed canarygrass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America (Wisconsin DNR, undated). The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800s for forage and erosion control. It has become naturalized in much of the northern half of the U.S. including a large number of locations throughout Indiana and was occasionally planted on steep slopes and banks of ponds and created wetlands. Invasion is associated with disturbances including ditching of wetlands, stream channelization, disturbance of forested wetlands, sedimentation, and intentional planting. Over

time, it forms large, monotypic stands that harbor few other plant species and are therefore of little use to wildlife. Once established, reed canarygrass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites. Reed canarygrass is difficult to eradicate without removing other beneficial plants.

Starry stonewort (*Nitellopsis obtusa*): Starry stonewort is an exotic charoid species and therefore closely resembles chara (muskgrass); however, starry stonewort can be distinguished from chara by the presence of star-shaped rhizoids, which chara does not possess. Starry stonewort may spread rapidly between water bodies via oocytes or plant fragments transported on boats and trailers (Pullman and Crawford, 2010). The species has spread rapidly among lakes in Michigan and is now present in multiple Indiana lakes. This invasive fast-growing macro-algae was first discovered in Lake Wawasee in 2008, and even with aggressive plant control starry stonewort has continued to spread mostly through northeast Indiana lakes (Kipp et al., 2017b). Starry stonewort is managed primarily using copper- and endothall-based algaecides (Pullman and Crawford, 2010). The lake associations in Indiana that currently have starry stonewort are working closely with the DNR and chemical applicators to determine the best chemical management strategies to manage the species.

2.3 Diseases, Pathogens, and Parasites

Amphibian chytridiomycosis: Chytridiomycosis is a disease caused by the pathogenic funguses *Batrachochytrium dendrotobatidis* ("chytrid" or "*Bd*") and *B. salamandivorans* ("salamander chytrid" or *Bsal*) that has been linked to global amphibian declines and extinctions (Skerratt et al., 2007; Voyles et al., 2009). *Bd* has been the subject of much research during the past decade and has been identified at localities throughout the U.S. including Indiana (Brodman and Briggler, 2008; Kinney et al., 2011; Lannoo et al., 2011). *Bsal* is an emerging fungus that has not been documented in the U.S., but that has decimated salamander populations in Europe, and has the potential to be detrimental to both terrestrial and aquatic salamanders in North America. In an effort to prevent the spread of *Bsal* into the U.S., the U.S. Fish and Wildlife Service has enacted a law (50 CRF 16.14) prohibiting the import or interstate transport of 201 salamander species thought to be vulnerable to *Bsal*. The list contains both native and non-native species and includes aquatic and semi-aquatic salamander species native to Indiana.

Heterosporis: The fish parasite, *Heterosporis* sp., was found in fish muscle tissue from yellow perch in Wisconsin, Minnesota, and Ontario in 2000 (Wisconsin DNR, 2005). Previously, this genus of parasites was unknown from North America and had only been reported from aquarium species such as angelfish, bettas and cichlids, and the Japanese Eel. In 2015, a new species of Heterosporis, *Heterosporis sutherlandae*, was described from fish originating from inland lakes in Minnesota and Wisconsin, and it appears to be widespread in the Great Lakes region (Phelps et al., 2015). Heterosporis infection does not seem to cause direct mortality, but when an infected fish dies, other fish may eat infected muscle or the infected muscle may break down, releasing

spores into the water that are then acquired by other fish. In severely infected fish, almost 90% or more of the fillet is made up of the parasite's spores rather than muscle tissue. There is no evidence that Heterosporis can infect people; however, many people discard infected fish because changes in texture and quality of the flesh make the fish appear to be freezer burned, even as a fresh fillet. The disease is seen in Walleye, Yellow Perch, sculpin, and Northern Pike. In the laboratory, Rainbow Trout, Channel Catfish, and Fathead Minnow also readily hosted the parasite. Largemouth Bass and Bluegill could be infected, but the degree of infection was less severe. Fisheries biologists in Indiana are interested in any similar reports in fish from state waters.

Largemouth Bass virus (LMBV): Largemouth Bass virus ceased being a "southern phenomenon" when it caused a kill at 565-acre Lake George, along the border between Indiana and Michigan, in August 2000. Previously, LMBV had only been documented from kills during the heat of the summer at southern U.S. reservoirs. LMBV first gained attention in 1995, when it was implicated in a fish kill on Santee-Cooper Reservoir in South Carolina. To date, LMBV has been detected in bass from Lake George, Hamilton Lake, Little Long Lake, Dewart Lake, Chapman Lake, Dogwood Lake, and Starve Hollow Lake. Scientists do not know how the virus is transmitted between fish or how it is activated into a fatal disease. Along with hot weather, stress factors might include poor water quality caused by pollution and frequent handling by anglers. Most bass infected with LMBV appear completely normal. The LMBV appears to attack the swim bladder, so diseased fish will be near the surface, have trouble swimming in an upright position, and may appear bloated. Adult bass of two pounds and more seem to be the most susceptible to disease, or at least the most visible. Although Largemouth Bass die-offs have received considerable attention, LMBV-related kills have been minor in comparison to kills prompted by other causes, such as pollution. Fisheries biologists in Indiana continue to monitor populations where Largemouth Bass die-offs occur. Scientists know of no cure, as is commonly the case with viruses. Transmission may be prevented by avoiding transfer of water or fish between waters and reducing stress on fish where possible.

Spring viremia of carp (SVC): An exotic fish virus, spring viremia of carp, was suspected of killing more than 10 tons of Common Carp in a lake in northwestern Wisconsin (Wisconsin DNR, 2002). The diagnosis was the first documented occurrence in wild fish in the United States, although SVC was previously diagnosed in a North Carolina fish farm that raises an ornamental carp variety called koi. SVC has since become established in Lake Michigan (Illinois-Indiana Sea Grant, 2017b), and in 2015 was detected in a shipment of Chinese firebelly newts (*Cynops orientalis*) imported to the United States (Ip et al., 2016). The virus, which is widespread in Europe and found in Russia, Asia, and the Middle East, cannot infect humans. The disease remains an international animal health concern, however, and is covered under an international treaty that requires confirmation of the virus by a designated laboratory, reporting to international animal health authorities, and other measures. Only members of the minnow family, which includes carp, are naturally susceptible to the virus, but Northern Pike fry also have been infected in laboratory studies. Effects on other species can create problems for fisheries and aquaculture production, potentially affecting large areas, if the virus reaches

downstream waters in the Mississippi River Basin. SVC strikes primarily in the spring or fall, when fish immune systems are suppressed due to very cold water temperatures. Signs of the fish disease include a fluid buildup in the body cavity, small hemorrhages on the skin and the belly, and hemorrhages on the swim bladder. Infected fish become diseased and can die within 10 to 17 days. Fisheries management agencies and the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) program are monitoring wild carp and aquaculture facilities to determine any distribution of the disease in other areas.

Viral hemorrhagic septicemia (VHS): VHS has been present in the Great Lakes since at least 2003. VHS is caused by a virus that infects fish in both marine and freshwater environments. Indiana DNR works closely with its interagency partners including the Indiana Board of Animal Health (BOAH) that are tasked with monitoring for known and unknown foreign animal diseases, including VHS. Surveillance continues within Indiana but to date VHS has not yet been discovered. Symptoms of VHS are highly variable and include twisting of the body, erratic swimming, fish becoming lethargic, bulging eyes, liver abnormalities, and kidney abnormalities. Visible symptoms of VHS include bleeding of the eyes, skin, gills, fin bases, skeletal muscles, and internal organs. VHS is often lethal, however survivors carry and spread the disease to other individuals (Illinois-Indiana Sea Grant, 2017c). Multiple fish species are affected by VHS, including species of ecological and recreational importance to the Great Lakes (USDA, 2006). VHS has been in the Great Lakes since 2003 and has been detected in inland lakes of Ohio, New York, Michigan, and Wisconsin. To date, the prevention of the spread of VHS is the primary method of management by restricting the interstate movement of live VHS-susceptible fish (Illinois-Indiana Sea Grant, 2017c).

Whirling disease: Whirling disease is caused by *Myxobolus cerebralis*, which is a myxosporidean fish parasite in trout and salmon species from Europe. The parasite penetrates the head and spinal cartilage of fingerling trout, where it reproduces rapidly, causing the fish to swim erratically, negatively affecting feeding ability and predator avoidance behavior. Severe infections can result in high rates of mortality and skeletal deformities that persist in adult fish. Spores released when the fish dies are nearly indestructible and can survive in sediments for 20 to 30 years. Whirling disease was unintentionally introduced to the eastern United States in the late 1950s in shipments of frozen trout that harbored spores of this fish parasite (Markiw, 1992). The parasite devastated Rainbow Trout populations in Colorado, Montana, and other Western states in the 1990s (USGS, 2017). The life cycle of the parasite can only be completed in areas where sediments are inhabited by *Tubifex* worms, the second host of the parasite. Fish transfers probably spread the disease to other states. Whirling disease has not been detected in Indiana, although it is known from over 20 states and occurs in all the Great Lakes and many of their tributaries (Illinois-Indiana Sea Grant, 2017a; USGS, 2017).

3. Existing Authorities and Programs

3.1 Federal Role

Nonindigenous Aquatic Nuisance Prevention and Control Act

The 1990 Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA), reauthorized as the National Invasive Species Act (NISA) in 1996, was primarily created in response to the Zebra Mussel invasion of the Great Lakes where ballast water introduction had caused serious ecological and socio-economic impacts. Although the Zebra Mussel invasion of the Great Lakes has played a central role in prompting passage of the federal legislation, NANPCA has been established to prevent the occurrence of all new ANS introductions and to limit the dispersal of all ANS already in U.S. waters.

The act, established for the prevention and control of the unintentional introduction of nonindigenous aquatic nuisance species, is based on the following five objectives as listed in Section 1002 of NANPCA:

- To prevent further unintentional introductions of nonindigenous aquatic nuisance species;
- To coordinate federally funded research, control efforts and information dissemination;
- To develop and carry out environmentally sound control methods to prevent, monitor and control unintentional introductions;
- To understand and minimize economic and ecological damage; and
- To establish a program of research and technology development to assist state governments.

The primary components of NANPCA:

- Required vessels entering ports on the Great Lakes to exchange ballast water and meet other requirements, with voluntary guidelines for similar actions on other waters of the U.S.
- Authorized studies and monitoring programs to assess the spread of AIS and develop methods for controlling them.
- Required the development of Armed Services ballast water programs as well as the establishment of the Ballast Water Management Demonstration Program.
- Authorized the establishment of the Aquatic Nuisance Species Task Force.
- Established a mechanism for regional collaboration and coordination through the establishment of the ANSTF Regional Panels.
- Authorized the development of an AIS Program to be housed within the U.S. Fish and Wildlife Service; and
- Established the State\Interstate ANS Management Plan Grant program managed by the U.S. Fish and Wildlife Service, through which States can develop and implement a

comprehensive state management plan for the prevention and control of aquatic nuisance species.

NISA amended NANPCA "To provide for ballast water management to prevent the introduction and spread of nonindigenous species into the waters of the United States, and for other purposes." NISA authorized:

- The production of guidelines for how to guard against the introduction and dispersal of invasive species
- Regulations for vessel operations and crew safety, and education and training programs to promote compliance.
- Funding for research on environmentally sound methods to control the spread of invasive species,
- Ecological surveys for certain environmentally sensitive regions of the country; and
- The establishment of the National Ballast Information Clearinghouse to provide data about ballasting practices and compliance with guidelines. One role of the federal government in the prevention of unintentional introductions of aquatic nuisance species is defined under Section 1101 of NANPCA, which mandates the establishment of regulations for ballast water management aimed at limiting introductions through transoceanic shipping. In recent years, a number of state, federal, and Canadian laws have been established to regulate ballast water discharge the Great Lakes waters.

Great Lakes waters regulations have been enforced by the U.S. Coast Guard (USCG) since May 1993 (and expanded nationwide in 2004), with active assistance from the Canadian Government. Current Coast Guard regulations require that oceangoing vessels meet ballast water discharge standards relating to the concentration and size of organisms released into the environment. These standards have also been adopted by the EPA and are based on similar standards used by the International Maritime Organization Convention. Options for meeting these requirements include obtaining ballast water from a U.S. Public Water System, discharging water into a reception facility or other vessel for treatment, and implementing approved technology for treating ballast water (Great Lakes Commission, 2016).

Additional federal programs that regulate potential pathways to the introduction of AIS are the National Pollutant Discharge Elimination System (NPDES) Program and the Clean Water Act (CWA). The introduction of AIS via ballast water discharges is regulated by the EPA through the NPDES program under Vessel General Permits (VGP). The VGP covers incidental discharges into waters of the United States from commercial vessels greater than 79 feet in length and for ballast water for commercial vessels of all sizes. The Clean Boating Act (CBA) of the CWA regulates discharges incidental to the normal operation of recreational vessels. This amendment to the CWA regulates owners or operators of all recreational vessels in all "waters of the United

States" as defined by the Clean Water Act. The CBA is enforced by both the USCG and appropriate state agencies. Differing ballast water regulations between nations and states and the considerable number of agencies with some ballast water authority continues to create confusion leading to difficulty in preventing all AIS introductions through this pathway.

The continuing mission of the U.S. Forest Service (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 within Indiana 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 and more specifically within Indiana. With DNR being a major land manager in Indiana, engagement with USFS needs to be strengthened to better manage all taxa of invasive species, not just terrestrial invasive species.

The U.S. Fish and Wildlife Service (FWS) administers the Lacey Act. The Lacey Act regulates the import of any species protected by international or domestic law. It also prevents the spread of invasive, or non-native, species through the Injurious Wildlife Provision. In 2010 the Asian Carp Prevention and Control Act was enacted to prohibit the importation and shipment of certain species of carp. This amendment to the Lacey Act also added the Bighead Carp (*Hypophthalmichthys nobilis*) to the list of injurious species. Additional species were added to the list in 2016 as a result of a risk assessment process undertaken by FWS. This proactive process identified species of concern as a result of climate match, history of invasiveness, and other characteristics, and should be continued to identify other potentially invasive species.

The list of injurious fish, mollusks, crustaceans, or their eggs (50 CFR 16.13) includes the following aquatic invasive species:

- walking catfish (family *Clariidae*)
- mitten crabs (genus *Eriocheir*)
- Zebra Mussel (*Dreissena polymorpha*)
- snakeheads (genus *Channa* and *Parachanna*)
- Silver Carp (*Hypophthalmichthys molitrix*)
- Largescale Silver Carp (*Hypophthalmichthys harmandi*)
- Black Carp (*Mylopharyngodon piceus*)
- Bighead Carp (*Hypophthalmichthys nobilis*)
- live or dead uneviscerated salmonid fish, live fertilized eggs, or gametes of salmonids are prohibited unless accompanied by a certification that the ensures they are free of *Oncorhynchus masou* virus and the viruses causing viral hemorrhagic septicemia and infectious hematopoietic necrosis, and meet the conditions in 50 CFR 16.13
- Crucian Carp (*Carassius carassius*)

- Prussian Carp (*Carassius gibelio*)
- Eurasian Minnow (*Phoxinus phoxinus*)
- Stone Moroko (*Pseudorasbora parva*)
- Roach (*Rutilus rutilus*)
- Nile Perch (*Lates niloticus*)
- Amur Sleeper (*Perccottus glenii*)
- European Perch (*Perca fluviatilis*)
- Zander (*Sander lucioperca*)
- Wels Catfish (*Silurus glanis*)
- Common Yabby (*Cherax destructor*)

In 2013 the Injurious Wildlife Provision was challenged by the U.S. Association of Reptile Keepers, arguing that the act as written lacks authority to prohibit "interstate transportation" of the listed species between the 49 continental United States. After that there were several motions filed and appeals made, ultimately resulting in the final 2017 ruling that the Injurious Wildlife Provision does not prohibit transport of injurious wildlife between states within the continental United States. It does however prohibit movement of injurious wildlife into the United States. In addition, injurious wildlife cannot be moved between the continental United States and the District of Columbia, Hawaii, Puerto Rico, and any possessions of the United States. This decision has resulted in a significant gap in the ability of the federal government to combat the introduction and spread of invasive species.

The U.S. Department of Agriculture also regulates the importation and interstate transport of aquatic pests and pathogens that can have a negative impact on crop production, horticulture, silviculture, and aquaculture. The Federal Noxious Weed List has authority through the Plant Protection Act (Title IV) of the P.L. 106-224 (2000). Included in the list are 19 aquatic or wetland species as of April 13, 2020. These species include:

- mosquito fern (*Azolla pinnata*)
- killer algae (*Caulerpa taxifolia*) (Mediterranean strain)
- anchored water hyacinth (*Eichhornia azurea*)
- hydrilla (*Hydrilla verticillata*)
- miramar weed (*Hygrophila polysperma*)
- water spinach (*Ipomoea aquatic*)
- African elodea (*Lagarosiphon major*)
- ambulia (*Limnophila sessiliflora*)
- broadleaf paper bark tree (*Melaleuca quinquenervia*)
- arrowleaf false pickerelweed (*Monochoria hastata*)
- heartshape false pickerelweed (*Monochoria vaginalis*)
- duck lettuce (*Ottelia alismoides*)
- arrowhead (*Sagittaria sagittifolia*)
- giant salvinia (*Salvinia auriculata*)

- giant salvinia (*Salvinia biloba*)
- giant salvinia (*Salvinia herzogii*)
- giant salvinia (*Salvinia molesta*)
- wetland nightshade (*Solanum tampicense*)
- exotic bur-reed (*Sparganium erectum*)

Most Federal Noxious Weeds became well established in the United States before being listed. This reactionary listing therefore does not have the impact that proactive prohibitions would have before potentially problematic plant species are allowed into the country. A rigorous risk assessment process and resulting prohibitions before importation would provide greater protections to the United States.

The U.S. Army Corps of Engineers (USACE) is very active on many fronts of invasive species issues. They led the Great Lakes and Mississippi River Interbasin Study (GLMRIS), which identified natural and man-made aquatic connections between the Great Lakes and Mississippi basins, which pose a risk of the transfer of invasive species. The effort goes on to identify a range of options and technologies to prevent AIS movement between the basins at the locations that pose the greatest risk. It was through this effort that the Eagle Marsh connection in Fort Wayne was identified as a high risk, and a solution was developed to separate the watersheds at this location. The separation project was completed in 2015.

USACE has been a leader in the development of in-water barriers to prevent the movement of AIS. The most well-known barrier system is the electric barrier in the Chicago Sanitary and Ship Canal that began operation in 2002. Since then, the system has grown to a system of three electric barriers operating in combination to ensure the most effective deterrence possible. USACE also researches other types of barriers using sound, bubbles, lights, and even pheromones as a means of controlling the movement of AIS fish.

Finally, USACE is heavily involved in aquatic plant research. The Aquatic Plant Control Research Program (APCRP) is the nation's only federally authorized research program directed to develop technology for the management of invasive aquatic plant species. The program provides effective, economical, and environmentally compatible methods for assessing and managing problem aquatic plants.

3.2 Regional Role

Two major basins incorporate waters of the state of Indiana, the Mississippi River, including the Ohio and Wabash River drainages, and the Great Lakes, including the St. Joseph and other rivers draining to Lake Michigan from the northern tier of the state and with a smaller portion of the northeastern part of the state draining to Lake Erie (Figure 1). Fisheries-related activities in the Ohio and Mississippi river basins are coordinated in part by the Mississippi Interstate Cooperative Resource Association (MICRA) and the Ohio River Fish Management Team (ORFMT). MICRA is an organization of 28 state natural resources management agencies with fisheries management jurisdiction in the Mississippi River Basin. Organized in 1991, MICRA is

a partnership to improve management of interjurisdictional fish and other aquatic resources within the basin. Federal agencies and federally chartered entities that manage and regulate Mississippi River Basin resources across states also participate in the MICRA partnership. ORFMT is composed of six states' natural resources management agencies that collaborate on research and regulations along the length of the Ohio River system. The Great Lakes ANS Panel provided early leadership for developing state ANS management plans, including model guidance on invasive species regulations. The second regional AIS panel to which Indiana has a connection is the Mississippi River Basin Panel, which covers a much larger number of states and varying invasive concerns. Although none of these organizations has direct regulatory authority within Indiana, they all have been instrumental in generating discussion between states in the respective regions regarding common regulatory interests and concerns. Indiana has had one or more state agency representatives participating in activities of these two regional panels for nearly two decades.

Additional examples of regional initiatives that have brought about substantive cooperation on AIS include the Great Lakes St. Lawrence Governors and Premiers AIS Task Force. The Governors and Premiers in 2013 released the first list of 16 "least wanted" AIS that present a serious threat to the Great Lakes St. Lawrence Basin. Since then, the region's eight states and two provinces have taken more than 40 actions to prohibit or restrict these high-risk species, including a signed mutual aid agreement and regional AIS law enforcement. With most existing AIS regulations throughout the region created as a reaction to new infestations or existing pathways of introduction, this regional approach was designed to have select species prohibited in all states and provinces, although establishing identical listings can be a challenge. An annotated listing of all Indiana regulations pertaining to prevention and control of aquatic invasive species is provided in Appendix C.

3.3 State Role

The comprehensive state management plans for aquatic invasive species are addressed in Section 1204 of NANPCA. Section 1204 requires that the management plan "identifies 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 aquatic invasive species." The content of each state plan is to focus on the identification of feasible, cost-effective management practices and measures to be pursued by state and local programs to prevent and control aquatic invasive species 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 state management plans are to be submitted to the national ANS Task Force for approval. If the plan meets the requirements of the ANS Task Force, the plan becomes eligible for federal cost-share support. If not, the plan is returned to the state with recommended modifications. Plans may be implemented with other funds supplied by state and cooperative agencies. Further details on the state management plans can be found in Section 1204 of the act. The state management plan section 1204 does not lay out details regarding the editing and revision process, although ANSTF guidance documents lay out the requirements and timeline for minor/major technical revisions of approved plans.

Indiana Department of Natural Resources Division of Fish & Wildlife (DFW) is the agency responsible for the conservation of the state's fish and wildlife resources. DFW uses its existing authority to regulate invasive fish, aquatic invertebrates, and some terrestrial animals. Along with DFW rule-making authority, the Aquatic Invasive Species Program uses the authorities of the Division of Entomology & Plant Pathology (DEPP) to prohibit the sale of AIS plants. DEPP has the authority to regulate plants, insects and some other invertebrates, and plant pathogens of concern. DEPP also regulates the approval and release of beneficial biocontrol organisms, pests, or pathogens. The agency performs pest inspections of nursery products, beekeeping, and export of agricultural materials, monitoring for populations of pests, and control programs for certain high-priority invasive species. There is a regulatory authority gap when it comes to worms, crustaceans, and gastropods (snails). A list of State of Indiana authorities and rules can be found in Appendix C.

4. Goals

The purpose of this AIS management plan is to guide the implementation of current and future actions to minimize the harmful effects of AIS in Indiana. The goals of the plan that were agreed up by DFW staff, partners, and reviewers include:

Goal I: Coordination with Other Agencies
Goal II: Prevention of AIS Introductions and Spread
Goal III: Enhancement of Early Detection
Goal IV: Institution of Rapid Response Objectives
Goal V: Control and Management of Established AIS
Goal VI: Mitigating the Harmful Impacts of AIS
Goal VII: Evaluation and Adaptation of AIS Management Plan

The goals are expanded upon below to identify the problems to overcome to be successful. In addition, 28 strategies and 89 actions have been identified that can help Indiana meet its goals.

4.1 Goal I: Coordination with Other Agencies

Problem Description: Because aquatic invasive species issues cross the gamut of nearly all natural resource, commercial, recreational, and human health programs, it can be difficult to coordinate efforts. Fragmentation of programs can result in duplication of effort and lack of efficiencies or even conflicting policies in controlling invasive species. Pathways of entry cross state and other jurisdictional lines. Many problem species are in boundary waters. Coordination of efforts among state agencies and across the region are essential to effectively prevent and control problems associated with invasive species. Actions that control species in Indiana also prevent the export of problems to other states in the region.

Goal I: Coordinate all efforts among agencies and organizations both within Indiana and with other states and nations to manage aquatic invasive species efficiently.

Strategy I.A. Support and build upon the institutional capacity to implement the plan.

Action I.A.1. Maintain a full-time statewide coordinator and hire new staff as needed for effective implementation of the AIS Plan.

Action I.A.2. Work with the Indiana Invasive Species Council to guide efforts on aquatic species and as a model for efforts to address terrestrial species.

Strategy I.B. Consistently fund the plan, covering the necessary aspects of statewide and regional prevention, control, monitoring, early detection, rapid response, and evaluation practices.

Action I.B.1. Utilize current state funding and apply for federal grant opportunities, including state management plan funding, Great Lakes Restoration Initiative grants, and Asian Carp Regional Coordinating Committee (ACRCC) funds to implement the state plan.

Action I.B.2. Support and develop dedicated sources of funding for implementation of invasive species activities.

Action I.B.3. Support regional increases in funding for conservation law enforcement to include more focused efforts on AIS issues and prevention awareness.

Strategy I.C. Integrate the state plan with national and regional initiatives by supporting federal and interjurisdictional regulatory and educational approaches that prevent AIS from entering Indiana.

Action I.C.1. Influence regional and national policies by informing decision-makers of ways in which Indiana's ability to prevent and control

AIS are affected by regional, federal, and international jurisdiction, policies, and regulations.

Action I.C.2. Maintain coordination and engagement with state, regional, and national invasive species organizations and agencies and invasive species collaboratives.

Action I.C.3. Engagement and support of the Great Lakes Aquatic Nuisance Species (ANS) Panel, International Joint Commission, Council of Great Lakes Governors, and Great Lakes Fishery Commission and their AIS-related subcommittees, such as the Lake Michigan Committee and Fish Health Committee.

Action I.C.4. Engagement and support of the Mississippi Interstate Cooperative Resource Association (MICRA) and its subcommittees, including the Mississippi River Basin Panel (MRBP) on ANS and the Ohio River Fish Management Team (ORFMT).

Strategy I.D. Build capacity to implement better coordination within state and local professional and citizen organizations to address the various constituents' information needs (e.g., Indiana Lake Management Society, lake associations).

Action I.D.1. Hold or support public meetings, conferences, and/or workshops to get updates from state agencies and ensure that all stakeholders understand the issues, participate in prioritization, and know where they can get information.

Action I.D.2. Provide training for local level citizen leaders, including technical information and communication training.

Action I.D.3. Involve citizens in education, prevention, reporting, and control processes by distributing educational information geared toward the introduction to aquatic invasive species management.

4.2 Goal II: Prevention of AIS Introductions and Spread

Problem Description: Aquatic invasive species may be difficult or impossible to eradicate after they have become established; therefore, prevention of new introductions is the most cost-effective, and sometimes the only means to avoid damaging results. Often the costs associated with managing a new species are not known, making it difficult to raise support for prevention actions, especially if they limit commercial or recreational activities. A delayed "crisis-response" approach may limit the vision and opportunity for avoiding problems that could be economically costly, technically challenging, and frequently irreversible. Established AIS are unnecessarily

spread simply by routine activities of uninformed water resource users. The public must understand how species are spread and why it is important to prevent the movement and spread.

Goal II: Prevent new introductions and spread of established invasive aquatic species in Indiana.

Strategy II.A. Examine the risk of pathways by which AIS are introduced into Indiana to limit transmission or establishment of invasive species.

Action II.A.1. Through coordination with regional panels and experts evaluate the risk to Indiana associated with ballast water in Lake Michigan and explore the transport of materials in bilge water on the Ohio River.

Action II.A.2. Determine the risk associated with commercial sales of exotic species through pathways such as aquaculture, water garden industry, and aquarium hobby.

Action II.A.3. Examine risks associated with removal and replacement of recreational structures (e.g., boat lifts, piers, buoys, diving equipment).

Action II.A.4. Examine the types and severity of risks associated with the recreational boating pathway.

Strategy II.B. Utilize risk assessments to identify priority AIS not yet established in Indiana using criteria such as invasive potential, prospective cost, and difficulty of control.

Action II.B.1. Identify the source location of invasive species, including natives introduced outside their range and transfer of natives with altered genomes.

Action II.B.2. Assess the invasive potential of the species based on other areas in the nation or world that have been colonized.

Action II.B.3. Identify trigger points or control points of invasive species introduction, release, and establishment related to the physiology, ecology or use of the species.

Action II.B.4. Consider climate change in risk assessments.

Action II.B.5. Support the development of tools to assess economic impact of invasive species, including species that are not yet known from the state, introduced but not established, and established populations.

Strategy II.C. Assess the risks of the introduction of new organisms on natural resources and water use.

Action II.C.1. Identify threats to natural resources, including biodiversity, state and federal threatened and endangered (T&E) species, and habitat quality.

Action II.C.2. Examine threats to commercial use of water, including reduced operating efficiencies and control costs, impairment of water conveyance and withdrawal, and drinking water treatment processes.

Action II.C.3. Identify threats to human health through direct or indirect introduction of new species such as toxin-producing blue green algae or animal vectors transmitting zoonotic pathogens and parasites to humans.

Action II.C.4. Assess threats of new invasive species on domestic animals and plants currently used in aquaculture and nurseries.

Action II.C.5. Identify threats to recreational use of water as a result of invasion an invasive species.

Strategy II.D. Develop effective state regulations to prevent introductions of high-risk invasive species.

Action II.D.1. Utilize results of risk assessments to prohibit potentially problematic AIS.

Action II.D.2. Regionally coordinate prohibited species lists.

Action II.D.3. Determine potential enforcement agencies and explore limitations and potential difficulties in enforcement.

Action II.D.4. Refine a permitting system that allows for prohibited species to be used for consumption or possessed for research on control methods or spread prevention under highly controlled situations.

Strategy II.E. Develop regulations to address high risk aquatic pathways.

Action II.E.1. Assess and revise where necessary the permitting system that regulates controlled use of fish in production facilities for aquaculture,

food, and stocking of beneficial exotic species in public waters for recreational and commercial use.

Action II.E.2. Address the effects of AIS colonization occurring as a result of riparian habitat modification conducted through state and local permitting programs such as aquatic plant control, lake shoreline construction, maintenance of drainage ditches, and construction in and around wetlands that result in habitat conditions favoring an invasion of AIS.

Action II.E.3. Evaluate and potentially implement the use of boat and trailer laws or rules to avoid introducing from out-of-state or spreading within the state plants, animals, and pathogens.

Action II.E.4. Support regional or national regulations aimed to prevent movement into and within the Great Lakes via ballast water.

Strategy II.F. Develop and implement non-regulatory best management practices to prevent new introductions.

Action II.F.1. Identify native species that can be substitutes for invasive species in aquaculture, the pet trade, and landscaping.

Action II.F.2. Encourage dealers and educational institutions to develop policies on selling risky species as pets or using them for educational use.

Action II.F.3. Provide informational materials and training to companies involved in invasive pest control to assist in educating the public on invasive species issues, the benefits of native species and biodiversity, and the use of native substitutes in aquaculture, the pet trade, and landscaping.

Action II.F.4. Create a safe, accessible, and free of recourse means for the disposal of unwanted pets.

Action II.F.5. Participate as a state in the Protect Your Waters, Stop Aquatic Hitchhikers campaign, and other targeted regional, national, and international programs.

Action II.F.6. Use Hazard Analysis and Critical Control Points (HACCP) prevention plans and training materials for each introduction pathway used by private entities, public agencies, and land use programs.

Strategy II.G. Educate the public on the benefits of preventing introductions of invasive species.

Action II.G.1. Provide the public with current information on the definition, distribution, and risks of invasive species.

Action II.G.2. Provide the public with information on AIS in Indiana and methods and benefits to reduce the chance of unintentionally introducing new species into or from Indiana.

Action II.G.3. Address invasive species as part of statewide conservation initiatives.

Action II.G.4. Utilize Department and Division websites and printed materials to educate the public on AIS regulations.

Action II.G.5. Maintain AIS prevention messaging at public access locations.

Strategy II.H. Provide adequate resources for the enforcement of all regulations that prevent the spread of invasive species in Indiana.

Action II.H.1. Educate conservation officers on plant and animal AIS identification and the existing laws established to prevent their spread.

Action II.H.2. Support international efforts to control movement of new species by participating in national and international education, law enforcement, and regulatory activities.

4.3 Goal III: Enhancement of Early Detection

Problem Description: Monitoring programs often get limited consideration in prioritization of agency or organizational activities due to the delay in realizing the benefits of the program; however, early cost-effective control or eradication of an invasive species or associated pathogen cannot be achieved without early detection of the offending organism. Various agencies and organizations are monitoring water bodies for their own purposes. Coordination between these efforts would maximize the use of limited resources. Because costly or controversial eradication or enforcement may result, training is essential to verify that species are properly identified in monitoring efforts.

Goal III: Conduct monitoring programs to enhance early detection of introductions or invasions.

Strategy III.A. Maximize early detection program efforts to ensure that detections of invasive species are properly detected, verified, and reported.

Action III.A.1. Use the risk assessment process to identify high priority species to be monitored for.

Action III.A.2. Maintain a current list of invasive species that occur in Indiana.

Action III.A.3. Compile basic and standardized reporting information on species found within the state and region while promoting and populating reporting databases like EDDMapS and USGS NAS database.

Action III.A.4. Develop institutional capacity or access to individuals who can verify identification of critical invasive species.

Action III.A.5. Develop a system to verify the identification of reported species and ensure vouchering of specimens in appropriate scientific institutions.

Strategy III.B. Develop official early detection mechanisms across state agencies and partners to reduce duplication of effort or gaps in coverage.

Action III.B.1. Coordinate existing agency and volunteer water quality monitoring efforts to ensure maximum coverage of high priority waters in Indiana where AIS could potentially invade.

Action III.B.2. Review and evaluate applications for Indiana DNR issued Scientific Purposes Licenses to identify efforts in or near high priority at-risk areas.

Action III.B.3. Periodic hosting of training workshops to enable identification of new AIS.

Strategy III.C. Use monitoring information to show the public the progression of species invasions and identify control points for reducing the introduction of new species.

Action III.C.1. Maintain accurate mapping and species distributions of established and newly invaded species, depicting the spread through time.

Action III.C.2. Develop clear and concise factsheets, press releases, and handouts that identify newly introduced species or watch list species, their current distribution, and the currently available information on their effects.

Action III.C.3. Engage the public at the local level regarding early detection and monitoring.

4.4 Goal IV: Institution of Rapid Response Objectives

Problem Description: Many techniques for eradicating or controlling invasive species are either very labor intensive (e.g., removing individual plants by hand) or non-selective (e.g., use of piscicides to kill invasive fish; destruction of an entire lot of infected fish and disinfection of the hatchery). Therefore, it is much more cost effective and acceptable to apply these techniques when the infested area is small; however, the nature of the treatment methods may require use of techniques that would normally involve significant education of the public to obtain their approval, may involve intrusion on private property, and could require intensive coordination between agencies with differing authorities. If the plans are not developed and approved before emergency use, the conflicts that result could severely hamper the implementation and effectiveness of the early control or eradication. Indiana has developed and approved a framework for structured decision-making and rapid response planning titled "Indiana's Rapid Response Planning for Aquatic Invasive Species". This document can be found in Appendix E.

Goal IV: Institute rapid response objectives to limit delays, confusion, and costs of controlling new introductions.

Strategy IV.A. Develop institutional capacity and agency preparedness for rapid response activities.

Action IV.A.1. Inventory staff, equipment, and regional authorities available for rapid response in each region of the state.

Action IV.A.2. Identify a lead agency and the responsibility of other cooperating agencies.

Action IV.A.3. Review response plans from other states and coordinate the plans with efforts of other regional organizations.

Action IV.A.4. Establish all regulatory and administrative authorities needed for effective and timely response to AIS on public and private property.

Strategy IV.B. Develop, implement, evaluate, and adjust rapid response plans for particular species to effectively control new invasions when necessary and feasible.

Action IV.B.1. Identify, classify, and prioritize species that under certain conditions may be amenable to eradication through rapid response actions.

Action IV.B.2. Use monitoring to evaluate the success of control measures as well as initial project success and adjust response plans to ensure success into future seasons.

Strategy IV.C. Inform and educate the public on the need for rapid response actions, and potential impacts on non-target organisms.

Action IV.C.1. Convince the public and implementing agencies that proactive early response to initial infestations will be more cost effective than waiting for severe infestation.

4.5 Goal V: Control and Management of Established AIS

Problem Description: Any aquatic invasive species that has successfully become established in a large ecosystem is unlikely to be eradicated by currently available control methods. Effectively managing established populations can benefit native aquatic species populations and diversity, benefitting the overall aquatic ecosystem. Effective management and control programs can also reduce the abundance of established species and introduction into uninfested waters. Research must continue to find the most effective control techniques that lessen impacts to native species.

Goal V: Provide effective control and management of established AIS, reducing risk of established populations of aquatic invasive species moving into uninfested waters of the state.

Strategy V.A. Research and implement control methods for priority species.

Action V.A.1. Prioritize control efforts that target invasive species that reduce the value of resources that are maintained by public funds (e.g., sport fisheries, threatened and endangered species, public properties) and accessible to the public.

Action V.A.2. Develop vegetation management plans and implement effective controls for established problematic AIS plants.

Action V.A.3. Continue the use of fisheries techniques (e.g., exclusionary devices, renovation and restocking, habitat protection and restoration) that control the spread of harmful invasive fish.

Action V.A.4. Evaluate the effectiveness of control efforts on reducing invasive species populations.

Action V.A.5. Document economic costs associated with the introduction and management of AIS especially species introduced for commercial use or sale.

Action V.A.6. Continue commercial removal efforts for Asian carp.

Strategy V.B. Evaluate, quantify, and document non-target impacts of control actions implemented.

Action V.B.1. Conduct surveys on native communities adequate to predict and track the impacts of control measures on non-target species.

Action V.B.2. Explore methods of conservation for rare aquatic plant species that are in competition with invasive plants.

Action V.B.3. Support research and development of treatment and eradication options for whole-lake invasive plant infestations to lessen unacceptable adverse impacts to the native community.

Strategy V.C. Limit the spread of AIS by incorporating control and management efforts into all landscape level management plans.

Action V.C.1. Develop watershed level criteria for use of control methods to reduce the possibility the invasive species will be eradicated from one part of the watershed and be reintroduced from another area upstream or downstream.

Action V.C.2. Include AIS control in plans for cleaning up sites that were contaminated by other pollutants.

Action V.C.3. Address AIS as part of habitat restoration plans, including the United States Fish and Wildlife Service (USFWS) Partners for Fish and Wildlife program, NRCS farm bill programs, and Indiana DNR Classified Forest & Wildlands Program.

Strategy V.D. Establish effective and responsive state permitting programs for control and management of AIS plants.

Action V.D.1. Include effective means of controlling invasive plants in review criteria for permits for aquatic vegetation control permits on public waters.

Action V.D.2. Ensure that herbicides used are registered with the Office of the State Chemist, used according to label directions, and applied by competent and licensed applicators.

4.6 Goal VI: Mitigating the Harmful Impacts of AIS

Problem Description: A number of harmful aquatic invasive species have become widely established in public waters. Few, if any, cost-effective or technologically viable means of controlling or eradicating the species are available. In recognition of the irreversible changes in these systems, the most rational approach to dealing with these species may be to develop recreational or commercial uses. Where the species are interfering with water uses, technology must be implemented or developed to allow continued use of the water.

Goal VI: Mitigate harmful ecological, economic, social, and public health impacts resulting from infestations of aquatic invasive species.

Strategy VI.A. Develop a public interest in recreational fishing for naturalized species having no viable control methods while at the same time eliminating an incentive for the public to illegally distribute the species to other waters to establish populations.

Action VI.A.1. Eliminate size and bag limits on all AIS but require all such species to be killed immediately upon taking possession of listed species.

Action VI.A.2. Encourage the commercial use of existing invasive species as food fish rather than introduction of new species.

Strategy VI.B. Support the development and implementation of technology and cost-effective treatments to allow continued use of irreversibly contaminated waters.

Action VI.B.1. Support the development and exploration of chemical or physical treatments of source water for hatcheries that remove Zebra Mussel veligers, diseases, or other pathogens without affecting fish eggs and fry.

Action VI.B.2. Support the development and exploration of methods of treating diseases of trout and salmon, such as whirling disease and bacterial kidney disease.

4.7 Goal VII: Evaluation and Adaptation of AIS Management Plan

Problem Description: Adequate evaluation processes are necessary to ensure that the management plan remains up to date and accommodates changes in the rapidly shifting field of aquatic invasive species. Funding and implementation of the plan depend upon being able to demonstrate results and fiscal responsibility.

Goal VII: Evaluate the effectiveness of the plan and use adaptive management strategies to update the plan after the 10-year period of use or when updates are needed to meet AIS management goals.

Strategy VII.A. Document on an annual basis the accomplishments and challenges faced during the implementation of the plan.

Action VII.A.1. The AIS program coordinator as part of the annual evaluation will document work performed, effectiveness of the plan on meeting goals, and on the utilization of state and federal funding, with an emphasis on the effective use of the plan.

Action VII.A.2. The coordinator will maintain an annual report that will be provided to state and federal agencies and the public upon request.

Strategy VII.B. Conduct a cost-benefit analysis for the AIS program.

Action VII.B.1. The coordinator will track the use of state general funds, dedicated funds, and return of federal funds to Indiana as they were used to implement the plan.

Action VII.B.2. The coordinator will use published literature and actual costs of abatement and control to estimate the fiscal benefits of the plan in conducting activities that resulted in avoiding costs associated with damages incurred from invasive species.

Strategy VII.C. Use information from annual evaluations to make mid-course adjustments to the plan.

Action VII.C.1. The AIS coordinator will facilitate review of the goals and strategies of the AIS management plan.

Action VII.C.2. Invasive species unit supervisor and executive leadership will provide recommendations on any changes that should be made to improve implementation of the plan.

Strategy VII.D. Produce an update to the plan every 10 years or when updates are needed to meet AIS management goals.

Action VII.D.1. The coordinator will use information from annual updates and input gathered from implementing agencies, organizations, and the general public to produce an update to the long-term plan to meet the AIS management goals.

5. Implementation Table

Based upon strategic actions and oversight from the Indiana DNR, the implementation table in Table 3 lists all goals, strategies, and actions with information identifying the primary and cooperating agencies. A total of seven goals, 28 strategies, and 89 actions are identified. The goals of the plan include coordination, prevention, early detection, rapid response, management and control, mitigating the impacts of AIS, and the evaluation and adaptation of the plan through time. Of the actions identified the top 10 highest priority actions are listed immediately below as determined by plan reviewers. All 10 are considered to be equally important and thus are not in any order of priority.

- **I.A.1.** Maintain a full-time AIS coordinator and hire staff as needed to implement the plan.
- **I.B.1.** Use current state funding and apply for federal grant opportunities to implement the state plan.
- **II.A.2.** Determine the risk associated with commercial sales of exotic species through pathways such as aquaculture, water garden industry, and aquarium hobby.
- **II.D.1.** Use results of risk assessments to prohibit potentially problematic AIS.
- **II.G.2.** Provide the public with information on AIS and methods and benefits to reduce the chance of unintentionally introducing new species into or from Indiana.
- **III.A.3**. Compile basic and standardized reporting information on species found within the state and region while promoting and populating databases like EDDMapS and USGS NAS database.
- **IV.A.4.** Establish all regulatory and administrative authorities needed for effective and timely response to AIS on public and private property.
- **IV.B.2.** Use monitoring to evaluate the success of control measures as well as initial project success, and make adjustments to response plans to ensure success into future seasons.
- **V.A.1.** Prioritize control efforts that target invasive species that reduce the value of resources that are maintained by public funds and accessible to the public.
- **VI.A.2.** Encourage the commercial use of existing invasive species as food fish rather than introduction of new species.

Table 3. Implementation Table describing the goals, strategies, and actions with information identifying the primary and cooperating agencies.

Goal	Strategy/Actions	Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
I. Coordinate all efforts among agencies and organizations both within Indiana and with other states and nations to manage AIS efficiently.	I.A. Support and build upon the institutional capacity to implement the plan.			$100,000
	I.A.1. Maintain a full-time AIS coordinator and hire staff as needed to implement the plan.	DFW		
	I.A.2. Work with the Indiana Invasive Species Council to guide efforts on aquatic species and as a model for efforts to address terrestrial species.	DFW	IISC	
	I.B. Consistently fund the plan, allowing for statewide and regional prevention, control, monitoring, early detection, rapid response, and evaluation practices.			$200,000
	I.B.1. Use current state funding and apply for federal grant opportunities to implement the state plan.	DFW	IISC	
	I.B.2. Support and develop dedicated funding for implementation of invasive species activities.	DFW	DEPP, LARE, DNP, TNC, IISC	
	I.B.3. Support regional increases in funding for conservation law enforcement to include more focused efforts on AIS.	LE	DFW	
	I.C. Integrate the state plan with national and regional initiatives by supporting federal and interjurisdictional efforts.			$15,000
	I.C.1. Influence regional and national policies by informing decision-makers on the need for regional, federal, and international jurisdiction, policies, and regulations.	DFW	GLC, MICRA	
	I.C.2. Maintain coordination and engagement with state, regional, and national invasive species organizations, agencies and collaboratives.	DFW	FWS, IISC, GLP, MRBP	
	I.C.3. Engagement and support of regional activities of the Great Lakes basin.	DFW	GLP, GLC, TNC	

Goal	Strategy/Actions		Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
		I.C.4. Engagement and support of regional activities of the Mississippi River basin.	DFW	MICRA, MRBP	
	I.D. Build capacity to implement better coordination within state and local professional and citizen organizations.				$15,000
		I.D.1. Hold or support public meetings, conferences, and/or workshops to ensure that state and local stakeholders are engaged in AIS issues.	DFW	IISC, ILMS	
		I.D.2. Provide training for local-level citizen leaders, including technical information and communication training.	ILMS	POA, LARE	
		I.D.3. Involve citizens in education, prevention, reporting, and control processes by distributing educational information geared toward the introduction to AIS management.	DFW	IISC, POA	
II: Prevent new introductions and spread of established AIS in Indiana.	II.A. Examine the risk of pathways by which AIS are introduced into Indiana.				$30,000
		II.A.1. Evaluate the risk associated with ballast water in Lake Michigan and explore the transport of materials in bilge water on the Ohio River.	DFW, GLP	FWS, MICRA	
		II.A.2. Determine the risk associated with commercial sales of exotic species through pathways such as aquaculture, water garden industry, and aquarium hobby.	DFW, DEPP	IISC	
		II.A.3. Examine risks associated with removal and replacement of recreational structures (e.g., boat lifts, piers, buoys, diving equipment).	DFW	DEPP	
		II.A.4. Examine the types and severity of risks associated with the recreational boating pathway.	DFW	IISC	
	II.B. Use risk assessments to identify priority AIS not yet established in Indiana using criteria such as invasive potential, prospective cost, and difficulty of control.				$100,000
		II.B.1. Identify the source location of AIS, including natives introduced outside their range and transfer of natives with altered genomes.	DFW, DEPP	IISC	
		II.B.2. Assess the invasive potential of species based on other areas in the nation or world that have been colonized.	DFW, DEPP	USGS, FWS, IISC	
		II.B.3. Identify trigger points or control points of AIS introduction, release, and establishment related to the physiology, ecology or use of the species.	DFW, IISC	USGS	
		II.B.4. Consider climate change in risk assessments.	DFW, IISC	USGS, FWS	

Goal	Strategy/Actions		Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
		II.B.5. Support the development of tools to assess economic impact of AIS, including species that are not yet found, introduced but not established, and established populations.	DFW, IISC	USGS, DEPP	
	II.C. Assess the risks of the introduction of new organisms on natural resources and water use.				$10,000
		II.C.1. Identify threats to natural resources, including biodiversity, state and federal T&E species, and habitat quality.	DFW, IISC	USGS	
		II.C.2. Examine threats to commercial use of water, including reduced operating efficiencies and control costs, impairment of water conveyance, and drinking water treatment.	DFW, ISDH	IDEM	
		II.C.3. Identify threats to human health through direct or indirect introduction of new species such as toxin-producing algae or animal vectors transmitting zoonotic pathogens and parasites.	DFW, ISDH	IDEM	
		II.C.4. Assess threats of new invasive species on domestic animals and plants currently used in aquaculture and nurseries.	DFW, IDEM	IAA	
		II.C.5. Identify threats to recreational use of water as a result of invasion of an invasive species.	DFW, IDEM	IISC	
	II.D. Develop effective state regulations to prevent introductions of high-risk invasive species.				$20,000
		II.D.1. Use results of risk assessments to prohibit potentially problematic AIS.	DFW, DEPP	LE, ISL	
		II.D.2. Regionally coordinate prohibited species lists.	DFW, DEPP	GLP, MICRA	
		II.D.3. Determine potential enforcement agencies and explore limitations and potential difficulties in enforcement.	DFW, DEPP	LE, FWS,	
		II.D.4. Refine a permitting system that allows for prohibited species to be used for consumption or possessed for research on control methods or spread prevention.	DFW, DEPP	LE, FWS,	
	II.E. Develop regulations to address high-risk aquatic pathways.				$20,000
		II.E.1. Assess and revise where necessary the permitting system that regulates controlled use of fish in production facilities for aquaculture, food, and stocking of exotic species.	DFW	IAA, BOAH	
		II.E.2. Address the effects of AIS colonization occurring as a result of riparian habitat modification conducted through state and local permitting programs.	DFW, FWS, IDEM	DNP, TNC	
		II.E.3. Evaluate and potentially implement the use of boat and trailer laws or rules to avoid introducing or spreading AIS plants, animals, and pathogens.	DFW	LE, BASS	
		II.E.4. Support regional or national regulations aimed to prevent movement into and within the Great Lakes via ballast water.	DFW, IDEM	GLP, GLC, ISL	

Goal	Strategy/Actions		Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
	II.F. Develop and implement non-regulatory best management practices to prevent new introductions.				$50,000
		II.F.1. Identify native species that can be substitutes for invasive species in aquaculture, the pet trade, and landscaping.	DFW, DEPP	ILMS, IAA, IISC	
		II.F.2. Encourage dealers and educational institutions to develop policies on selling risky species as pets or using them for educational use.	DFW	FWS, SG	
		II.F.3. Provide informational materials and training to companies involved in invasive pest control to assist in educating the public on invasive species issues.	DFW	LARE, IISC	
		II.F.4. Create a safe, accessible, and free of recourse means for the disposal of unwanted pets.	DFW, DEPP	IAA, ILMS, SG, FWS	
		II.F.5. Participate as a state in the Protect Your Waters, Stop Aquatic Hitchhikers campaign, and other targeted regional, national, and international programs.	DFW	ILMS, MRBP, GLP, SG	
		II.F.6. Use HACCP prevention plans and training materials for each introduction pathway used by private entities, public agencies, and land use programs.	DFW	FWS, IDEM, SG	
	II.G. Educate the public on the benefits of preventing introductions of invasive species.				$20,000
		II.G.1. Provide the public with current information on the definition, distribution, and risks of invasive species.	DFW, DEPP	DNP, IISC, ILMS, IAA, BASS	
		II.G.2. Provide the public with information on AIS and methods and benefits to reduce the chance of unintentionally introducing new species into or from Indiana.	DFW, DEPP	LE, INDOT	
		II.G.3. Address invasive species as part of statewide conservation initiatives.	DFW	DNP, NRCS	
		II.G.4. Use Department and Division websites and printed materials to educate the public on AIS regulations.	DFW, DEPP	ILMS, BASS	
		II.G.5. Maintain AIS prevention messaging at public access locations.	DFW	INDOT, BASS, SG	
	II.H. Provide adequate resources for the enforcement of all regulations that prevent the spread of invasive species in Indiana.				$30,000
		II.H.1. Educate conservation officers on plant and animal AIS identification and the existing laws established to prevent their spread.	DFW	LE	
		II.H.2. Support international efforts to control movement of new species by participating in national and international education, law enforcement, and regulatory activities.	DFW	LE, SG, MRBP, GLP	

Goal	Strategy/Actions		Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
III: Conduct monitoring programs to enhance early detection of introductions or invasions.	III.A. Maximize early detection program efforts to ensure that detections of invasive species are properly detected, verified, and reported.				$50,000
		III.A.1. Use the risk assessment process to identify high priority species to be monitored for.	DFW	IISC	
		III.A.2. Maintain a current list of invasive species that occur in Indiana.	DFW	IISC	
		III.A.3. Compile basic and standardized reporting information on species found within the state and region while promoting and populating databases like EDDMapS and USGS NAS database.	DFW	IISC, USGS, FWS, EDD	
		III.A.4. Develop institutional capacity or access to individuals who can verify identification of critical invasive species.	DFW	FWS, DEPP	
		III.A.5. Develop a system to verify the identification of reported species and ensure vouchering of specimens in appropriate scientific institutions.	DFW	FWS, DEPP	
	III.B. Develop official early detection mechanisms across state agencies and partners to reduce duplication of effort or gaps in coverage.				$50,000
		III.B.1. Coordinate existing agency and volunteer water quality monitoring efforts to ensure maximum coverage of high priority waters in Indiana where AIS could potentially invade.	IDEM, ILMS	DFW, TNC	
		III.B.2. Review and evaluate applications for Indiana DNR-issued Scientific Purposes Licenses to identify efforts in or near high priority at-risk areas.	DFW, IDEM	FWS, TNC	
		III.B.3. Periodic hosting of training workshops to enable identification of new AIS.	IISC, IDEM	DFW, ILMS, TNC	
	III.C. Use monitoring information to show the public the progression of species invasions and identify control points for reducing the introduction of new species.				$40,000
		III.C.1. Maintain accurate mapping and species distributions of established and newly invaded species, depicting the spread through time.	DFW	USGS, EDD	
		III.C.2. Develop factsheets, press releases, and handouts that identify newly introduced species or watch list species, their current distribution, and information on their effects.	DFW	USGS, EDD	

Goal	Strategy/Actions		Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
		III.C.3. Engage the public at the local level regarding early detection and monitoring.	DFW	ILMS, SG, IISC	
IV: Institute rapid-response objectives to limit delays, confusion, and costs of controlling new introductions.	IV.A. Develop institutional capacity and agency preparedness for rapid-response activities.				$20,000
		IV.A.1. Inventory staff, equipment, and regional authorities available for rapid response in each region of the state.	DFW, FWS	LE, DEPP, USGS	
		IV.A.2. Identify a lead agency and the responsibility of other cooperating agencies.	DFW, FWS	LE, DEPP, USGS, BOAH	
		IV.A.3. Review response plans from other states and coordinate the plans with efforts of other regional organizations.	DFW, FWS	LE, DEPP, USGS	
		IV.A.4. Establish all regulatory and administrative authorities needed for effective and timely response to AIS on public and private property.	DFW, FWS	LE, DEPP, IDEM, OISC	
	IV.B. Develop, implement, evaluate, and adjust rapid-response plans for particular species to effectively control new invasions when necessary and feasible.				$20,000
		IV.B.1. Identify, classify, and prioritize species that under certain conditions may be amenable to eradication through rapid response actions.	DFW	DEPP, FWS	
		IV.B.2. Use monitoring to evaluate the success of control measures as well as initial project success and adjust response plans to ensure success into future seasons.	DFW, LARE	DEPP, IDEM, ILMS, TNC	
	IV.C. Inform and educate the public on the need for rapid-response actions, and potential impacts on non-target organisms.				$10,000
		IV.C.1. Convince the public and implementing agencies that proactive early response to initial infestations will be more cost effective than waiting for severe infestation.	DFW	POA, ILMS	
V: Provide effective control and management of established AIS reducing risk of established populations of aquatic invasive species moving into uninfested waters.	V.A. Research and implement control methods for priority species.				$2,900,000
		V.A.1. Prioritize control efforts that target invasive species that reduce the value of resources that are maintained by public funds and accessible to the public.	DFW	DEPP, DNP	

Goal	Strategy/Actions		Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
		V.A.2. Develop vegetation management plans and implement effective controls for established problematic AIS plants.	POA	DFW, LARE, UR	
		V.A.3. Continue the use of fisheries techniques that control the spread of harmful invasive fish in public waters.	DFW	IDEM, ISDH, UR	
		V.A.4. Evaluate the effectiveness of control efforts on reducing invasive species populations.	DFW	IDEM, LARE	
		V.A.5. Document economic costs associated with the introduction and management of AIS, especially species introduced for commercial use or sale.	DFW		
		Action V.A.6. Continue commercial removal efforts for Asian carps.	DFW	FWS	
	V.B. Evaluate, quantify, and document non-target impacts of control actions implemented.				$30,000
		V.B.1. Conduct surveys on native communities adequate to predict and track the impacts of control measures on non-target species.	DFW, IDEM, DEPP	LARE, ILMS, TNC	
		V.B.2. Explore methods of conservation for rare aquatic plant species that are in competition with invasive plants.	DFW, DEPP	LARE, ILMS, TNC	
		V.B.3. Support research and development of treatment and eradication options for whole-lake invasive plant infestations to lessen unacceptable adverse impacts to the native community.	DFW, DEPP	LARE, ILMS, TNC, UR	
	V.C. Limit the spread of AIS by incorporating control and management efforts into all landscape level management plans.				$20,000
		V.C.1. Develop criteria for use of control methods to reduce the possibility the invasive species will be eradicated from one part of the watershed and reintroduced from another area.	DFW	LARE, POA	
		V.C.2. Include AIS control in plans for cleaning up sites that were contaminated by other pollutants.	IDEM	DFW	
		V.C.3. Address AIS as part of habitat restoration plans, including the USFWS Partners for Fish & Wildlife program, NRCS farm bill programs, and Indiana DNR Classified Forest & Wildlands.	DFW	NRCS, FWS, INDOT	
	V.D. Establish effective and responsive state permitting programs for control and management of AIS plants.				$20,000

Goal	Strategy/Actions		Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
		V.D.1. Include effective means of controlling invasive plants in review criteria for permits for aquatic vegetation control permits on public waters.	DFW	LARE	
		V.D.2. Ensure that herbicides used are registered with the Office of the State Chemist, used according to label directions, and applied by competent and licensed applicators.	DFW	OISC, IDEM	
VI: Mitigate harmful ecological, economic, social, and public health impacts resulting from infestations of AIS.	VI.A. Develop interest in recreational fishing for naturalized AIS while at the same time eliminating an incentive for the public to illegally distribute the species to other waters.				$10,000
		VI.A.1. Eliminate size and bag limits on all AIS but require all such species to be killed immediately upon taking possession of listed species.	DFW, LE	ILMS, FWS	
		VI.A.2. Encourage the commercial use of existing invasive species as food fish rather than introduction of new species.	DFW, FWS	ILMS, SG, GLP, UR	
	VI.B. Support the development and implementation of technology and cost-effective treatments to allow continued use of irreversibly contaminated waters.				$10,000
		VI.B.1. Support the development of treatments of source water for hatcheries that remove Zebra Mussel veligers, diseases, or other pathogens without affecting fish eggs and fry.	DFW, FWS	IDEM, OISC	
		VI.B.2. Support the development and exploration of methods of treating diseases of trout and salmon, such as whirling disease and bacterial kidney disease.	DFW, FWS	OISC, UR, GLP	
VII: Evaluate the effectiveness of the plan and use adaptive management strategies to update the plan after the 10-year period of use or when updates are needed to meet AIS management goals.	VII.A. Document on an annual basis the accomplishments and challenges faced during the implementation of the plan.				$10,000
		VII.A.1. AIS coordinator perform annual evaluation to document work performed, effectiveness of the plan on meeting goals, and the use of state and federal funding.	DFW	FWS	
		VII.A.2. Maintain an annual report that will be provided to state and federal agencies and the public upon request.	DFW	FWS	
	VII.B. Conduct a cost-benefit analysis for the AIS program.				$10,000
		VII.B.1. Track the use of state general funds and dedicated funds, and the return of federal funds to Indiana as they were used to implement the plan.	DFW	IISC, FWS	

Goal	Strategy/Actions		Primary Agencies	Cooperating Agencies	Anticipated Annual Cost ($)
		VII.B.2. Use published literature and actual costs of abatement and control to estimate the fiscal benefits of the plan.	DFW	IISC	
	VII.C. Use information from annual evaluations to make mid-course adjustments to the plan.				$10,000
		VII.C.1. The AIS coordinator will facilitate review of the goals and strategies of the AIS management plan.	DFW	IISC	
		VII.C.2. Invasive species unit supervisor and executive leadership will provide recommendations on any changes that should be made to improve implementation of the plan.	DFW		
	VII.D. Produce an update to the plan every 10 years or when updates are needed to meet AIS management goals.				$30,000
		VII.D.1. Use information from annual updates and input from implementing agencies, organizations, and the general public to produce an update to the plan to meet AIS goals.	DFW	IISC, FWS	
TOTAL:					**$3,850,000**

Key for Table 3:

BASS: Bass Anglers Sportsman Society
BOAH: Indiana Board of Animal Health
DEPP: DNR Division of Entomology & Plant Pathology
DFW: DNR Division of Fish & Wildlife
DNP: DNR Division of Nature Preserves
EDD: Early Detection and Distribution Mapping System ("EDDMapS")
FWS: U.S. Fish and Wildlife Service, NISA funds
GLC: Great Lakes Commission
GLP: Great Lakes ANS Panel
IAA: Indiana Aquaculture Association
IDEM: Indiana Department of Environmental Management
IISC: Indiana Invasive Species Council
ILMS: Indiana Lakes Management Society
INDOT: Indiana Department of Transportation
ISDH: Indiana State Department of Health
ISL: Indiana State Legislature
LARE: Lake and River Enhancement Program
LE: DNR Division of Law Enforcement
MICRA: Mississippi Interstate Cooperative Resource Association
MRBP: Mississippi River Basin Panel on ANS
NRCS: Natural Resources Conservation Service
OISC: Office of the Indiana State Chemist
POA: Property Owners Associations
SG: Sea Grant
TNC: The Nature Conservancy, Indiana
UR: University-organized research and projects
USGS: United States Geological Survey

6. Priorities for Action

Indiana's extensive network of streams, rivers, reservoirs, and lakes has been invaded by numerous AIS. In addition to the AIS that have been detected in Indiana, there are many species that have the potential to enter Indiana water bodies in the future. Despite the desire to address each of these species individually, the resources and scientific capability to do so limits management actions. Therefore, the Indiana AIS Program has identified priority AIS species that can feasibly be addressed. Below is the list of species the Indiana AIS Program considers priorities for action based upon the severity of the problem, ability to resolve the problem, and the cost of the proposed actions.

Table 4. The current and future priorities for action necessary to manage each priority species in relation to the goal that they accomplish.

Common & Latin Name	Current & Future Actions	Goal(s)
Flowering rush (*Butomus umbellatus*)	Flowering rush has been found only in Elkhart County. Current and future management focuses on chemical applications, cuttings, monitoring, and education.	II, III, V
Snakehead fish (*Channidae*)	To date there are no reports of snakehead fish in Indiana waters; therefore, current efforts are focused on prevention and rapid-response planning.	II, IV
Brazilian elodea (*Egeria densa*)	A series of herbicide treatments in 2006 and 2007 eradicated Brazilian elodea from Griffy Lake. Monitoring for new occurrences is a priority while continuing to remove from trade/sales.	II, IV
Floating waterhyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*)	These two plants have been found on occasion in Indiana waters, but they do not seem to be overwintering. DNR will assess the status of these species through monitoring and survey work.	II, III

Eurasian Ruffe (*Gymnocephalus cernua*)	In 2013 Eurasian ruffe DNA was detected in Lake Michigan waters near the Indiana-Illinois border. This led to a rapid-response survey by Indiana DNR and other state and federal agencies. Eurasian ruffe was not detected, and currently there are no known populations in Indiana. Continuing to work with USFWS on monitoring.	II, III, IV
Hydrilla (*Hydrilla verticillata*)	Discovered in Lake Manitou in north-central Indiana and treated for 10 years until monitoring declared the species eradicated. Hydrilla has also been located in the Ohio River system and will continue to be monitored.	II, IV
European frogbit (*Hydrocharis morsus-ranae*)	To date there are no reports of European frogbit in Indiana waters. Current efforts are focused on prevention and rapid-response planning.	II, IV
Silver Carp (*Hypophthalmichthys molitrix*)	A 1.7-mile-long berm was completed in 2015 at Eagle Marsh to sever the natural watershed boundary between the Great Lakes and Mississippi River basins. DNR will continue monitoring at Eagle Marsh and other aquatic pathways into the Great Lakes.	I, II, III, V, VI
Bighead Carp (*Hypophthalmichthys nobilis*)	A 1.7-mile-long berm was completed in 2015 at Eagle Marsh to sever the natural watershed boundary between the Great Lakes and Mississippi River basins. DNR will continue monitoring at Eagle Marsh and other aquatic pathways into the Great Lakes.	I, II, III, V, VI
White Perch (*Morone americana*)	White Perch have been found in multiple Indiana water bodies. Primary management actions include the education of anglers and monitoring spread.	II, III, V, VI
Black Carp (*Mylopharyngodon piceus*)	Ohio River basin states have been monitoring through surveys and commercial fishing. Three individuals were reported in 2019 in the Indiana-Kentucky waters of the Ohio River	I, II, III, V, VI

	including a fish that was caught in the lower Wabash River in 2020. Support continued regional incentives to report captures by recreational and commercial anglers.	
Parrotfeather (*Myriophyllum aquaticum*)	In 2006 parrotfeather was detected and treated in Meserve Lake. Eradication has been achieved. Enforce the prohibition of sale of this species while monitoring for new occurrences.	II, IV
Eurasian watermilfoil (*Myriophyllum spicatum*)	Eurasian watermilfoil now occurs throughout Indiana but is especially prevalent in the northern natural lakes region, crowding out desirable vegetation and affecting lakes. Herbicide treatments are the current management strategy for mitigating impacts.	I, II, III, V
Starry stonewort (*Nitellopsis obtusa*)	Starry stonewort is present in multiple Indiana lakes and continues to expand. Current management actions include copper and endothall applications. Research is being advanced for more optimal herbicides.	I, II, III, V
Viral hemorrhagic septicemia (*Novirhabdovirus* sp.)	To date there have been no reports of VHS in Indiana waters, therefore current efforts are focused on prevention and rapid-response planning.	II, III, IV
Sea Lamprey (*Petromyzon marinus)*	Multiple management actions have been implemented, including barriers, lampricides, and male sterilization.	I, III, V
European water chestnut *(Trapa natans)*	To date there are no reports of European water chestnut in Indiana waters, therefore, current efforts are focused on prevention and rapid-response planning.	II, IV

The control, eradication, and prevention of these species has been identified as priorities for action due the feasibility to accomplish the desired solution. By targeting the diverse actions in this plan, the Indiana AIS Program believes many other AIS of concern will be also be addressed. The pathways for the introduction of the priority species include aquaculture, ballast water management, fish transfer, wetland plant transfer, aquarium and water garden trade, bait buckets, and recreational equipment.

7. Program Guidance and Evaluation

7.1 Guidance

The Indiana Invasive Species Council (IISC) was established by the Indiana General Assembly in 2009 to enhance the ability of state agencies to detect, prevent, monitor, and manage new and long-established invasive species (Indiana Code 15-16-10). The council exists within the Purdue University College of Agriculture and consists of 11 individuals, many of whom represent various industries, organizations, and state agencies. The IISC strives to work with responsible agencies and partners to effectively and efficiently slow the spread and thwart the impact of invasive species in Indiana. The Invasive Aquatics Advisory Committee of IISC provides the greater IISC with information on issues and concerns specifically related to aquatic invasives.

7.2 Evaluation

The evaluation effort should not only examine progress, but also place a special emphasis on identifying funding needs to successfully accomplish goals and associated tasks. Performance measures will be used to assess the effectiveness of management objectives. For instance, on an annual basis this might include:

- whether objectives are achieved;
- rate of spread along a river reach or coastline;
- change in total acreage of habitat occupied by the AIS or the displaced native species;
- changes in abundance of an invader and directly or indirectly impacted species; or
- changes to federal and state T&E and extinct species lists due to AIS.

The aquatic invasive species program will strive to evaluate the effectiveness of this plan regularly and use adaptive management strategies to update the plan after a 10-year period of use or when updates are needed to meet AIS management goals. We will continue to document on an annual basis the accomplishments and challenges faced during the year, including funding needs and expenditures. By facilitating the tracking and use of state general funds, dedicated funds, and federal funds awarded to the state of Indiana for AIS projects and to implement this plan we will be able to monitor and evaluate the program's cost and benefits. Implementing social science and boater surveys to evaluate public knowledge will provide benchmarks for invasive species message efficacy and retention. The agency can also use information gathered from the annual evaluations and reports to make mid-course adjustments to the plan in order to make significant progress on the goals and strategies laid out in this plan.

It is recognized that unforeseen factors may affect the progress of remedying a problem, and this would be evident through program monitoring and evaluation. This information will prove useful in future program planning processes. Evaluation should also incorporate information from those

groups affected by plan implementation. These include organizations (or individuals) involved with the responsibility of implementing management actions and resource user groups.

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9. Acronyms

ACRCC: Asian Carp Regional Coordinating Committee

AIS: Aquatic Invasive Species

ANS: Aquatic Nuisance Species

ANSTF: Aquatic Nuisance Species Task Force

APHIS: Animal and Plant Health Inspection Service

CWA: Clean Water Act

DNR: Department of Natural Resources

DFW: Division of Fish & Wildlife

EPA: Environmental Protection Agency

FWS: U.S. Fish and Wildlife Service

GLC: Great Lakes Commission

GLRI: Great Lakes Restoration Initiative

IDEM: Indiana Department of Environmental Management

IN DNR: Indiana Department of Natural Resources

IISC: Indiana Invasive Species Council

ILMS: Indiana Lakes Management Society

LARE: Lake and River Enhancement Program

MICRA: Mississippi Interstate Cooperative Resource Association

MRBP: Mississippi River Basin Panel (on ANS)

NANPCA: Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (Public Law 101-646)

NEPA: National Environmental Policy Act

NISA: National Invasive Species Act

NOAA: National Oceanic and Atmospheric Administration

NPDES: National Pollutant Discharge Elimination System

NRCS: Natural Resources Conservation Service

ORFMT: Ohio River Fish Management Team

T&E: Threatened and Endangered

USDA: United States Department of Agriculture

USFWS: United States Fish and Wildlife Service

USGS: United States Geological Survey

Appendix A. Key contributors/reviewers of the Indiana AIS Management Plan

NAME	Affiliation
Brian Schoenung	Indiana DNR -F&W
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Tom Estrem	Cardno Inc.

Appendix B. Regional and Federal AIS Management Programs

Great Lakes Commission (GLC) and Great Lakes ANS Panel

Great Lakes regional coordination is addressed under Section 1203 of NANPCA, which first called upon the Great Lakes Commission (GLC) to convene the Great Lakes Panel on Aquatic Nuisance Species in 1991. Panel membership is drawn from a wide range of federal, state, provincial and regional agencies, private-sector user groups, Sea Grant programs, and environmental organizations to ensure that the positions of the Panel provide a balanced and regional perspective on Great Lakes issues. The Panel's responsibilities for the Great Lakes region are fivefold: 1) identify Great Lakes priorities; 2) make recommendations to the national ANS Task Force; 3) coordinate AIS programs within the region; 4) advise public and private individuals on control efforts; and 5) submit annually a report to the ANS Task Force describing prevention, research, and control activities in the Great Lakes basin.

The Great Lakes ANS Panel provided early leadership for developing state ANS management plans, including model guidance on plans and regulations. All eight Great Lakes states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin) have federally approved plans.

Mississippi Interstate Cooperative Resource Association (MICRA)

The MICRA was established in 1991 to improve the conservation, development, management and use of interjurisdictional fishery resources (both recreational and commercial) in the Mississippi River basin through improved coordination and communication among the responsible management entities. The Mississippi River basin is the largest watershed in the nation, covering 1.25 million square miles, and draining 41% of the continental United States. Ninety-three of the basin's rivers have been identified by the states as interjurisdictional waters, including the Ohio River and parts of the Wabash River in Indiana. The organization formed form a regional aquatic invasive species panel (Mississippi River Basin Panel or MRBP) under the auspices of the federal task force and began meeting in 2003. Twenty-eight states located in the Mississippi River drainage, spanning from New York in the northeast to Montana in the northwest and Louisiana in the south, participate in MICRA. Members states include AL, AR, CO, GA, IL, IN, IA, KS, KY, LA, MN, MS, MO, MT, NE, NY, NC, ND, PA, OH, OK, SD, TN, TX, VA, WV, WI, and WY.

Fish Health Committee, Great Lakes Fishery Commission (GLFC)

Established in 1973 under Article VI of the Great Lakes Fishery Commission Convention between the United States and Canada (1955), the Great Lakes Fish Health Committee serves as the instrument of the commission in coordinating regional efforts in the Great Lakes basin to prevent introduction and dissemination of communicable fish diseases. The committee consists of two representatives appointed by each agency formally cooperating with the Great Lakes Fishery Commission. Generally, the Indiana representatives include the DFW health supervisor for Indiana DNR and a DFW hatchery manager knowledgeable in technical management of fish health.

U.S. EPA Great Lakes National Program Office (GLNPO)

The U.S. Environmental Protection Agency's Great Lakes National Program Office (GLNPO) coordinates U.S. efforts with Canada under the Great Lakes Water Quality Agreement to restore and maintain the chemical, physical, and biological integrity of the Great Lakes basin ecosystem, which includes all five Great Lakes. GLNPO has brought together federal, state, tribal, local, and industry partners under the framework of the Great Lakes Restoration Initiative, which in turn fulfills the aims of the Great Lakes Water Quality Agreement. The Agreement includes 10 Annexes, each of which focuses on specific issues. Binational teams have been set up to implement the actions required by these Annexes. U.S. federal agencies have taken on a leadership role by co-chairing these binational teams. Annex 6 directly addresses Aquatic Invasive Species, specifically preventing the introduction of new aquatic invasive species and limiting the impacts of existing aquatic invasive species. GLNPO is involved with a number of environmental tasks, including the remediation of contaminated sediments, preventing pollution, identifying emerging contaminants, identifying, protecting and restoring important habitats, monitoring and reporting on environmental trends, and providing assistance for community-based Remedial Action Plans for Areas of Concern and for Lake-wide Management Plans. GLNPO also assists its Great Lakes partners though grants, interagency agreements, and contracts.

Stop Aquatic Hitchhikers Campaign, Habitattitude Campaign, and Protect Your Waters Website

The "Stop Aquatic Hitchhikers!" campaign and https://stopaquatichitchhikers.org/ website empower recreational users to become part of the solution in stopping the transport and spread of these harmful hitchhikers. The national ANS Task Force and the U.S. Fish and Wildlife Service are the primary sponsors of this campaign. The “Stop Aquatic Hitchhikers!” website includes information to introduce the public to the aquatic invasive species problem as well as providing tools or products and activities, as well as a list of federal/state/NGO partners that use the national campaign. Campaign sponsors will use a variety of means, such as public service announcements, stickers, posters, magazine and newspaper articles, television, and radio programs to make the public aware of this issue. Most material and announcements will include

this website address to direct individuals to visit and learn about how they can become part of the solution. Individuals and clubs/organizations are being called upon to spread the message. Support materials will be available to help those who want to get involved.

Department of Homeland Security

The U.S. Department of Homeland Security (DHS) is responsible for assessing the vulnerabilities of the nation's critical infrastructure and cybersecurity threats and takes the lead in evaluating these vulnerabilities and coordinating with other federal, state, local, and private entities to ensure the most effective response. These threats may include the introduction of invasive species as a means of bioterrorism. Border patrols for invasive species of plants, animals, and diseases include rules under the United States Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) and the Coast Guard, which prevent and control some of the most harmful invasive species through monitoring of pests in shipments and invasive species in ballast water of ocean-going vessels. APHIS is the primary agency responsible for responding to animal and plant disease(s) and pest emergencies. In 2003, many APHIS agricultural border inspectors were transferred to U.S. Customs and Border Protection, a unit of the newly created U.S. Department of Homeland Security.

Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW)

The FICMNEW was established through a memorandum of understanding between 16 federal agencies with invasive plant management and regulatory responsibilities. During monthly meetings the committee coordinates information on the identification and extent of invasive plants and coordinates federal agency management of the species. The committee shares scientific and technical information, fosters collaborative efforts among federal agencies, and sponsors technical and education conferences and workshops regarding invasive plants.

USDA Agricultural Research Service (ARS)

The ARS is the USDA’s chief scientific in-house research agency. It focuses on finding solutions to agricultural problems. Projects related to ANS include the development and testing of user-friendly data entry systems for importation of foreign invertebrates and microbial biological control agents of invertebrate, weed, and microbial pests. The ARS also works toward the development of cost-effective information management systems to compile connections to the federal departments and agencies responsible for the exclusion, early detection and eradication, and long-term management of invasive species and rehabilitation of affected areas. The ARS is involved in the testing of behavior-modifying chemicals and biocontrol agents used to disrupt reproduction and spread of invasive species.

United States Fish and Wildlife Service

The mission of the U.S. Fish and Wildlife Service is to work with others to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. Because of their responsibilities, the USFWS is very concerned about the impacts that invasive species are having across the nation. The USFWS addresses invasive species issues through a variety of programs and partnerships. Its invasive species efforts take proactive approaches to address intentional and unintentional introductions, combat the spread of existing invaders on and off its lands, and maintain the USFWS as a leader in invasive species prevention and control.

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

> 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).
>
> Administration of Aquatic Nuisance Species Task Force – This 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.
>
> 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 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 42 state ANS management plans, 6 regional panels, more than 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 hot spots to facilitate early detection and rapid response.

The Fish and Wildlife Service also manages more than 561 refuges through the National Wildlife Refuge System (NWRS), which encompasses more than 150 million acres of wildlife habitat. According to 2013 data, more than 2.4 million acres of the NWRS are affected by invasive plants. In addition, there are approximately 1,715 invasive animal populations residing on refuge lands. There are three national wildlife refuges in Indiana, including Big Oaks National Wildlife Refuge in Madison, Muscatatuck National Wildlife Refuge in Seymour, and Patoka River National Wildlife Refuge in Oakland City.

Finally, the Endangered Species Act (ESA - (16 U.S.C. § 1531 et seq.)) has the ultimate goal of the recovery (and long-term sustainability) of endangered and threatened species and the ecosystems on which they depend. Recovery is the process by which the decline of an endangered or threatened species is arrested or reversed and threats to it removed or reduced, so that the species' survival in the wild can be ensured. The goal of the ESA is the recovery of listed species to levels where ESA protection is no longer necessary. In many instances, these threats may be caused by invasive species. They may either directly harm the species by causing mortality or may threaten a species by modifying or destroying the habitat or food source on which that species depends. A variety of methods and procedures are used to recover listed species, such as reduction of threats (including invasive species), protective measures to prevent extinction or further decline, consultation to avoid adverse impacts of federal activities, habitat acquisition and restoration, and other on-the ground activities for managing and monitoring endangered and threatened species.

Aquatic Ecosystem Restoration Foundation (AERF)

The Aquatic Ecosystem Restoration Foundation (AERF) in Lansing, Michigan, is a nonprofit, tax-exempt corporation created to conduct and support applied research in the management of aquatic pest species, with a focus on invasive vegetation. The AERF supports research for the control of aquatic weed species and exotic plants such as Eurasian watermilfoil, hydrilla, water hyacinth, purple loosestrife, and other aquatic weeds found in lakes, ponds, reservoirs, rivers, and streams.

Aquatic Nuisance Species Research Program and Aquatic Plant Control Research Program, U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) stewards 12 million acres of public lands and waters nationwide. To manage the threats that invasive species bring to our natural resources, navigation, flood risk management, hydropower generation, and water supply, USACE implements the latest economically efficient technologies, research, and control methods. USACE is currently working to develop new pest control techniques through its Aquatic Nuisance Species Research Program and Aquatic Plant Control Research Program.

Invasive Species Program, U.S. Geological Survey (USGS)

USGS plays an important role in federal efforts to combat invasive species in natural and semi-natural areas through early detection and assessment of newly established invaders, monitoring of invading populations, improving understanding of the ecology of invaders and factors in the resistance of habitats to invasion, and development and testing of prevention, management and control methods. USGS research on invasive species includes all significant groups of invasive organisms in terrestrial and aquatic ecosystems. The Nonindigenous Plants and Animals Program tracks the status and distribution of introduced aquatic organisms and provides this information in a timely manner for research, management, and education. Two programs at the Gainesville Center complement each other: the Nonindigenous Fishes Program conducts field and laboratory studies, and the Nonindigenous Aquatic Species Program maintains a database on all nonindigenous aquatic species and maintains one of the most comprehensive websites (https://nas.er.usgs.gov/default.aspx) on invasive species distributions and descriptions.

Appendix C. Annotated List of Indiana AIS Regulations

General powers of the department (IC 14-11-1-1)

Generally authorizes the department to conduct surveys, investigate, compile, and make recommendations concerning the natural resources of Indiana.

Administration: Indiana Department of Natural Resources

Enforcement powers (IC 14-11-1-6)

The department shall recommend and secure the enforcement of laws for the conservation and development of natural resources in Indiana.

Administration: Indiana Department of Natural Resources

Definitions of private waters (IC 14-22-9-5(b))

As used in the fish and wildlife code regarding the capture and transport of baitfish outside of Indiana, "private waters" means water wholly on the land of an individual that is not connected with public waters and will not allow the ingress of fish.

Administration: Indiana DNR Division of Fish & Wildlife

Definitions of pests, pathogens, and weeds

For the purposes of IC 14-24, pest or pathogen organisms of listed taxa that may be injurious to nursery stock, agricultural crops, other vegetation, or bees are defined in IC 14-8-2-203. An exotic weed is defined in IC 14-8-2-87.5 as a weed that is not native to Indiana. Weeds are defined in IC 14-8-2-316 as any plant that is competitive, persistent, pernicious, and interferes with human activity, and as a result is undesirable.

Taxa: pests or pathogens include the arthropods, nematodes, microorganisms, fungus, parasitic plants, mollusks, plant diseases, or exotic weeds that are injurious to plants or bees

Uses: control of pests, pathogens, and weeds

Administration: Indiana DNR Division of Entomology and Plant Pathology

Powers regarding pests or pathogens (IC 14-24-2-1)

The division director may cooperate with a person in Indiana to locate, check, or eradicate a pest or pathogen.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Cooperation with federal government or other states (IC 14-24-2-2)

The division director may, on behalf of the department, enter into a cooperative agreement with the United States government, an Agency of the United States, or a state government or state agency.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Emergency action (IC 14-24-2-5)

The division director has authority to order treatment of a pest or pathogen or prevent the movement or require the destruction of pest or pathogen that may pose an environmental, health, or economic hazard to Indiana.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Rule-making authority (IC 14-24-3)

The Natural Resources Commission has authority to adopt rules to control pests or pathogens establish fees, declare species or subspecies to be pests or pathogens, and to establish quarantines.

Administration: Natural Resources Commission

Control of pests or pathogens (IC 14-24-4)

The division may inspect any site in Indiana where agricultural, horticultural, or sylvan products are grown, shipped, sold, or stored to determine if a pest or pathogen is present. The division may declare all or part of a township infested. All farms and premises located in an infested area must conform to standards of operation approved by the commission, including the destruction or treatment of infested material. The department may add costs incurred for non-compliance to the owner's tax bill.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Duties regarding imported nursery stock (IC 14-24-5-5)

A person receiving nursery stock from a foreign origin must hold the material unopened until it is inspected or released.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Control of pests or pathogens (312 IAC 18-3)

Provides specific regulatory authority over a pest or pathogen even if it is not associated with a plant. Includes survey and eradication activities, permits for movement, containment criteria, post entry requirements, honeybee issues, and various pests or pathogens.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Harmful aquatic plants (312 IAC 18-3-23**)**

Declares 28 aquatic plant species as pests or pathogens in Indiana, and prohibits their sale, distribution, and transport without a special permit.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Trade secrets (312 IAC 18-6)

Provides for the protection of trade secrets within the permitting system, particularly in reference to culture and use of genetically modified organisms or biocontrols.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Beneficial organism defined (312 IAC 18-1-4)

Defines “beneficial organism” as a parasitoid, a predator, an antagonist, a competitor, a biologically specific pathogen, or a similar living entity that is used to provide biological control of a pest or pathogen, to benefit pollination, or to benefit agriculture, horticulture, floriculture, or sylviculture.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Infested areas and quarantines (312 IAC 18-2)

Includes procedures for declaring and managing infested areas and quarantine principles.

Administration: Indiana DNR Division of Entomology & Plant Pathology

Interstate agreements on boundary waters (IC 14-22-10-9)

Provides for the State of Indiana to enter into an interstate agreement on boundary waters for the purpose of better protection of wild animals in the water.

Taxa: wild animals in boundary waters

Uses: interstate agreements for better protection

Administration: Indiana DNR Division of Fish & Wildlife

Entry onto property (IC 14-22-2-1; IC 14-22-2-5)

Allows the director of the Division of Fish & Wildlife or representative to enter into or upon private or public property for the purpose of killing or removing a wild animal that is considered a nuisance or detrimental to overall populations. The definition of public or private property does not include "barns, dwellings, or other buildings."

Administration: Indiana DNR Division of Fish & Wildlife

Search of effects; entry onto property (IC 14-22-39-3)

The director and conservation officers may:

(1) search a boat, a conveyance, a vehicle, an automobile, a fish box, a fish basket, a game bag, a game coat, or other receptacle in which game may be carried; and

(2) enter into or upon private or public property for the purposes of patrolling or investigating;

If the director or conservation officer has good reason to believe evidence of a violation of a law for the propagation or protection of fish, frogs, mussels, game, furbearing mammals, or birds will be obtained. Dwellings are not subject to this search authority and require a warrant to investigate gear or illegal possession of wild animals.

Taxa: fish, frogs, mussels, game, forbearing mammals, birds

Uses: determination of violations of fish and game laws

Exempts: dwellings

Administration: Indiana DNR Division of Law Enforcement

Sale of fish (IC 14-22-9-7)

Approval from the department is required for importation and sale of any live species of fish. It is not legal to offer, sell, barter or exchange, or purchase any fish protected by law, whether taken in Indiana, the boundary waters of Indiana, or in some other state and brought into Indiana, except as otherwise provided. Restaurants, hotels and similar facilities may prepare and serve fish to patrons and their families if the fish was lawfully taken in open season.

The provisions do not apply to the sale of fish produced in private ponds, providing that the owner has an applicable permit from the department. The sale of packaged fish and parts must be prepared subject to regulations of the Department of Natural Resources and health agencies, and be accompanied by a tag or label indicating that the fish was legally acquired as well as a dated bill of lading.

Taxa: fish

Uses: sale of live or processed fish

Exempts: properly labeled hatchery-reared fish or fish legally acquired from other states

Administration: Indiana DNR Division of Fish & Wildlife

Transportation of fish and game outside the state (IC 14-22-10-3)

A person can only legally transport a wild animal protected by state law outside of the state if the animal is legally possessed under an Indiana breeder's permit, license to fish, trap or hunt, or commercial fishing license. The wild animal shipment must be enclosed in a package on which there is clearly, legibly, and conspicuously marked information regarding the ownership, number, and kind of animals contained. Both the license and animal must be made openly available for inspection.

Taxa: all fish and game

Uses: transport of fish and game outside the state of Indiana

Administration: Indiana DNR Division of Fish & Wildlife

Transportation of wild minnows, crayfish or gamefish beyond limits of state (IC 14-22-9-5)

Unless the animals have been commercially raised in private waters, an individual may not transport more than one hundred (100) minnows or one hundred (100) crayfish to other states from Indiana in a twenty-four (24) hour period.

Taxa: minnows, crayfish, sport fish

Uses: transport outside of state of Indiana

Exempts: production of fish or crayfish in private waters

Administration: Indiana DNR Division of Fish & Wildlife

Importation statute (IC 14-22-25)

An importation permit is required to bring into Indiana, for the purpose of release or selling for release in Indiana, live fish, the fry of live fish, or any other living wild animal. Permits are granted for importation only upon satisfactory proof that the specific animals intended to be imported meet the following conditions: animals are free of a communicable disease at time of importation; that the animals will not become a nuisance; the animals will not cause damage to a native wild or domestic species. Import permits not needed for animals being imported into Indiana for the purpose of being confined and exhibited in a zoo or other public display of animals.

Taxa: live fish, fry of live fish or any other wild animal

Uses: for release or sale for release

Exempts: animals confined and exhibited in a zoo or other public display of animals, other animals that the department designates.

Administration: Indiana DNR Division of Fish & Wildlife

Wild animal importation permit (312 IAC 9-10-20)

A wild animal importation permit is required before importing a mammal, reptile, amphibian, mollusk, or crustacean for release or sale for release in Indiana. Application must be made not less than 10 days in advance of proposed importation and be accompanied by the appropriate fee for each species or release site. Proof must be shown to be able to show that species will not become a nuisance and will not damage a native wild animal, domesticated species, or animal or a species of plant. A permit is not needed to ship through Indiana, or for a zoo, carnival,

menagerie, animal dealer, pet shop, circus, or nature center licensed under 9 CFR, Chapter 1, Subchapter A, Parts I through IV or following import into Indiana for confinement and exhibit in a zoo or other public display.

Taxa: mammal, bird, reptile, amphibian, mollusk, crustacean

Uses: for release or sale for release

Exempts: during interstate shipment through Indiana. zoo, carnival, menagerie, animal dealer, pet shop, circus, or nature center licensed under 9 CFR, Chapter 1, Subchapter A, Parts I through IV. confinement and exhibit in a zoo or other public display.

Administration: Indiana DNR Division of Fish & Wildlife

Fish importation permit (312 IAC 9-10-15)

Assists in administration of the requirements relative to fish importation. Section 15(e) provides a "clean list" of fish species allowed without restriction. Genetically altered fish are not allowed under the clean list. Imported fish must be free of communicable diseases, not become a nuisance, and not damage a native wild species or domestic species of animal or plant.

Taxa: fish

Uses: importation of live fish for sale or release

Exempts: confinement and exhibit in a zoo or public display aquarium pet trade

Conditions: free of communicable disease, not become a nuisance, not damage a native wild species or domestic species of animal or plant

Administration: Indiana DNR Division of Fish & Wildlife

Fish haulers and suppliers permit (312 IAC 9-10-14)

A haulers and suppliers permit or an aquaculture permit is required to transport fish for release or sale for release. A list of automatically approved species is provided in the Haulers and Suppliers rule. The Aquaculture Permit is used for controlled species that carry a higher risk and require special conditions for use.

Taxa: includes the "clean list" in Sect 15(e) and adds five species

Uses: imports live fish from another state or country for sale, produces live fish for sale

Exempts: aquarium pet trade, holders of a bait dealers license

Conditions: fish health certification is required as a condition of the permit for trout and salmon

Administration: Indiana DNR Division of Fish & Wildlife

Aquaculture permit (312 IAC 9-10-17)

The Aquaculture Permit controls fish species not explicitly allowed under the haulers and suppliers permit as listed in 312 IAC 9-10-14(d) and 312 IAC 9-10-15(e). The permit is used for regulation of fish species that would otherwise be illegal for live possession under 312 IAC 9-6-7, and provides detailed regulations regarding the importation, production, and selling of Grass Carp. The department may require a description or investigation of the production facility prior to approval of an aquaculture permit (312 IAC 9-10-17). A definition for a closed aquaculture system in 312 IAC 9-6-1(33) as a rearing facility designed to prevent the escape of cultured organisms to the wild. All diploid Grass Carp must be held in a closed aquaculture system according to 312 IAC 9-10-17(e)(4). The requirement may be applied as needed to other cultured species. Detailed quarterly reports of the number sold and stocking location of triploid Grass Carp are required for use of this fish in private ponds. Similar information or a prohibition against release in public or private waters may be required for sales of other controlled fish species under an Aquaculture Permit.

Taxa: any species not included on the "clean list" in Sect 15(e)

Uses: imports, raises, sells or transports fish

Exempts: confinement and exhibit in a zoo or public display, aquarium pet trade

Conditions: fish health certification is required for trout and salmon, quarterly sales reports required for Grass Carp, genetic certification required for triploid Grass Carp through United States Fish and Wildlife Service (USFWS), permit holder must deliver and stock Grass Carp

Administration: Indiana DNR Division of Fish & Wildlife

Bait dealer's statute (IC 14-22-16 and IC 14-8-2-167)

Live minnows and crayfish may be sold as live bait under a bait dealers license. Minnows are defined in IC 14-8-2-167 and IAC 9-6-1(62) as including sucker, Brook Stickleback, Gizzard Shad, Threadfin Shad, and Alewife, and all of the fish of the minnow family (Cyprinidae) except exotic species identified at 312 IAC 9-6-7 and endangered species identified at 312 IAC 9-6-9.

Taxa: possession of over 500 live minnows or crayfish

Uses: taking, catching, selling, or bartering species for bait

Exempts: minnows, crayfish, or gamefish commercially raised in private waters for sale

Administration: Indiana DNR Division of Fish & Wildlife

Fish stocking permit (IC 14-22-9-8 and 312 IAC 9-10-8)

Live fish cannot be transferred between or released live into state waters without a stocking permit. The department may issue to a person a permit to stock fish in waters containing state-owned fish, waters of the state or boundary waters of the state. In instances where stocking of grass carp has been allowed in public waters, all fish were required to be reproductively sterile (i.e., triploid). Fish stocking by the Department of Natural Resources and review of private permits for stocking have been guided by a nonrule policy adopted in 1999.

Taxa: fish

Uses: release in public water

Exempts: stocking by the department

Administration: Indiana DNR Division of Fish & Wildlife

Wild animal possession permits (312 IAC 9-11)

Wild animal possession permits provide for possession of animals protected under fish and wildlife codes but not legally acquired under other permits. The animal must be free of disease, confined in a proper enclosure, and have a plan for the safe recapture or destruction of an escaped animal. Requirements for confining potential aquatic invasive species (i.e., venomous reptiles and crocodilians over five feet in length) are listed in 312 IAC 9-11-13.5.

Taxa: wildlife not covered by other permits

Uses: possession

Exempt: zoos, carnivals, menageries, circuses, pet shops, animal dealers, nature centers

Administration: Indiana DNR Division of Fish & Wildlife

Possession, sale and transport of dangerous reptiles (312 IAC 9-5-8)

Prohibits possession, sale, and transport of dangerous reptiles, including venomous reptiles and crocodilians over five feet in length unless otherwise exempted.

Taxa: dangerous reptiles

Uses: possession, sale, transport

Exempt: specimens transported through Indiana for interstate commerce to out-of-state destinations

Possession under a Class III Wild Animal Permit (312 IAC 9-11) or by a zoo

Administration: Indiana DNR Division of Fish & Wildlife

Illegal fish possession (312 IAC 9-6-7)

Importation, possession, or release into public or private waters the following exotic fish is prohibited: exotic catfish (Clariidae), Bighead Carp (*Hypophthalmichthys nobilis*), Black Carp (*Mylopharyngodon piceus*), Silver Carp (*Hypophthalmichtys molitrix*), White Perch (*Morone americana*), snakehead fish (Channidae), Rudd (*Scardinius erythrophthalmus*), Ruffe (*Gymnocephalus cernuus*), Round Goby (*Neogobius melanostomus*), Tubenose Goby (*Proterorhinus marmoratus*), Stone Moroko (*Pseudorasbora parva*), Zander (*Sander lucioperca*), Wels Catfish (*Silurus glanis*), or hybrids or genetically altered fish of any of the aforementioned species. Individuals taking possession of these fish do not violate this rule if they kill the fish immediately upon capture by removing the fish's head, removal of gill arches on at least one side, or eviscerate the fish. Exemptions are in place for individuals conducting legal, fully contained interstate transport of the fishes through the state, and those lawfully possessing an aquaculture permit or a scientific purposes license approving use of the fish for medical, educational or scientific research purposes.

Taxa: exotic catfish, Bighead Carp, Black Carp, Silver Carp, White Perch, snakehead fish, Rudd, Ruffe, Round Goby, Tubenose Goby, Stone Moroko, Zander, Wels Catfish, or a hybrid or genetically altered version of these fish.

Uses: import, possess, propagate, buy, sell, barter, trade, transfer, loan or release into public or private waters

Exempts: holders of an aquaculture permit or scientific purposes license for medical, educational, or scientific research, or a properly accredited zoological park as defined in 312 IAC 9-5-8(i) during interstate shipment

Conditions: must comply with federally listed injurious species in Lacey Act (18 USC 42) and 50 CFR 16

Administration: Indiana DNR Division of Fish & Wildlife

Mussel possession and illegal species (IC 14-22-17-3 and 312 IAC 9-9-3)

Importation, possession, or release of the following species into public or private waters is prohibited: a live Zebra Mussel, Quagga Mussel (*Dreissena* sp.), or Asiatic Clam (*Corbicula* sp.). Regulates the taking, shipping, selling, buying, or export of mussel shells taken from Indiana.

Taxa: listed exotic mussel species

Uses: import, possess, or release into public or private waters

Exempts: holder of a permit issued under 312 IAC 9-10-6.

Administration: Indiana DNR Division of Fish & Wildlife

Illegal uses of exotic fish (312 IAC 9-6-8)

Goldfish (*Carassius auratus*) can be used as live bait. Carp (*Cyprinus carpio*) cannot be used as live bait.

Taxa: carp

Uses: not permitted as live bait

Administration: Indiana DNR Division of Fish & Wildlife

Scientific purposes license (IC 14-22-22 and 312 IAC 9-10-6)

A Scientific Purposes License is required to collect fish or wildlife from public waters for purposes of medical, educational or scientific research. Annual reports of the collection methods, location, species, number, and disposition of specimens are required of license holders.

Taxa: wild birds, nests or eggs of wild birds, other wild animals

Uses: taken from public waters for scientific purposes

Conditions: annual report of the collection by species, number, and location

Administration: Indiana DNR Division of Fish & Wildlife

Nuisance wild animal control permit (312 IAC 9-10-11)

A Nuisance Wildlife Permit is required for use of any methods that would otherwise be illegal under fish and game laws to remove wildlife that are causing damage or threatening property, or health and safety of humans or domestic animals. Handling and disposition of animals is proscribed, along with annual reports. An examination is required prior to licensing.

Taxa: nuisance wildlife

Uses: control of wildlife damaging property or health and safety of humans or domestic animals

Conditions: proper handling, disposal or release

Administration: Indiana DNR Division of Fish & Wildlife

Aquatic plant control permit (IC 14-22-9-10 and 312 IAC 9-10-3)

An Aquatic Plant Control Permit is required for use of chemical, physical, biological or mechanical methods to control plants in public waters, including invasive species. Exceptions exist for privately owned lakes, farm ponds, and drainage ditches. Areas around boat landings and bathing beaches on public lakes may be treated by the adjacent property owner if the area does not exceed 625 square feet, can be no more than 25 feet along the legal shoreline, or conducted in water over six feet deep. Permit applicants must demonstrate that the treatment will provide effective relief, and that it will not unreasonably restrict use of the waterway. The treatment also must not harm non-target organisms or have significant adverse impacts to the treated waterway, on endangered or threatened species, or on other beneficial organisms at or near the treatment area.

Taxa: aquatic plants in specified state waters

Uses: control of plants, including exotics, by use of physical, mechanical, chemical, or biological means

Exempts: privately owned lake, farm pond, public or private drainage ditch, riparian owners treating less than 625 square feet

Conditions: provide information on the application to accommodate the additional regulation of physical, mechanical, and biological methods; requires information on dominant plants in proposed treatment area; requires reporting of date, location, and method of treatment

Administration: Indiana DNR Division of Fish & Wildlife

Pesticide control (IC 15-16-4 and IC 15-16-5)

Pesticides used to control invasive species must be registered with the Office of the Indiana State Chemist, used according to label directions, and legally applied by a competent and/or certified applicator.

Taxa: all organisms

Uses: pest control

Administration: Office of the Indiana State Chemist

Control of diseases (IC 15-17-3-11 and IC 15-17-3-13)

The Board of Animal Health develops, adopts, and implements programs for the prevention, detection, control and eradication of diseases and pests affecting the health of animals within and in transit through Indiana. The Board may also control the public and private sales of animals in an effort to prevent the spread of animal diseases and pests.

Taxa: animals and animal products

Uses: commercial trade

Administration: Board of Animal Health

Proclamation against importation of certain animals (IC 15-17-10-5)

Whenever the governor has good reason to believe that any disease has become an epidemic in another state and that the importation of animals or products derived from animals from that state would be injurious to the health of the citizens or the animals of this state, the governor may, on the recommendation of the board, designate such locality by proclamation and prohibit the entry or stipulate the conditions under which animals and products derived from animals of the type diseased or animals exposed to the disease may enter the state.

Taxa: animals and animal products

Uses: importation from areas with epidemic diseases

Administration: Board of Animal Health

Aquaculture (IC 15-11-7)

Aquaculture is defined as the "controlled cultivation and harvest of aquatic plants and animals" and requires the director of agriculture to encourage the development and growth of aquaculture.

Taxa: aquatic plants and animals

Uses: controlled cultivation and harvest

Administration: Director of Agriculture

Baitfish collection prohibition below dams (IC 14-22-9-3 and 312 IAC 9-7-15)

State law does not allow the taking of fish by various means including seines, nets, traps, and trotlines within 200 yards of a legal dam.

Taxa: fish

Uses: restrictions on catching minnows and bait fish species below dams

Administration: Indiana DNR Division of Fish & Wildlife

Appendix D. Invasive Fish, Invertebrates and Plants

List of invasive fish and invertebrates and plant species occurring in Indiana waters. (Sources: U.S. Geological Survey (USGS) NAS database and EDDMaps)

Fish		
Common Name	**Scientific Name**	**Distributional Notes**
Alewife	*Alosa psuedoharengus*	Lake Michigan watershed, select sites in southeast and southwest portions of state
Goldfish	*Carassius auratus*	Statewide
Grass Carp	*Ctenopharyngodon idella*	Southern and western Indiana along major rivers and Lake Michigan
Common Carp	*Cyprinus carpio*	Statewide
Threespine Stickleback	*Gasterosteus aculeatus*	Waters near Lake Michigan
Silver Carp	*Hypopthalmichthys molitrix*	Mississippi River watershed in central and southern Indiana
Bighead Carp	*Hypopthalmichthys nobilis*	Has expanded range into Mississippi River watershed in central and southern Indiana
White Perch	*Morone americana*	Northwest Indiana along Lake Michigan, in a couple of inland lakes
Black Carp	*Mylopharyngodon piceus*	Currently rare, southern most parts of Ohio and Wabash rivers in Indiana
Round Goby	*Neogobius melanostomus*	Waters near Lake Michigan
Sea Lamprey	*Petromyzon marinus*	Lake Michigan and nearby waters, two inland locations
Rudd	*Scardinius erythrophhthalmus*	Waters near Lake Michigan

Invertebrates		
Common Name	**Scientific Name**	**Distributional Notes**
Spiny Water Flea	*Bythotrephes cederstroemi*	Waters of Lake Michigan
Fishhook Water Flea	*Cercopagis pengoi*	Waters of Lake Michigan
Chinese Mystery Snail	*Cipangopaludina chinensis*	Found in several inland lakes and drainages
Asiatic Clam	*Corbicula fluminea*	Found in nearly every drainage
Zebra Mussel	*Dreissena polymorpha*	Waters of Lake Michigan and inland lakes
Quagga Mussel	*Dreissena r. bugensis*	Waters of Lake Michigan
Rusty Crayfish	*Orconectes rusticus*	Common in Indiana, native to southern and central Indiana, but considered nonnative in northern Indiana
Red Swamp Crayfish	*Procambarus clarkii*	Rare in Indiana, native to southwest Indiana, but not native to drainages in northwest portions of the state
Plants		
Common Name	**Scientific Name**	**Distributional Notes**
Flowering rush	*Butomus umbellatus*	Limited distribution in Indiana found in north-central Indiana
Brazilian elodea	*Egeria densa*	Waters include private ponds and rare occurrence in public waters
Floating water hyacinth	*Eichhornia crassipes*	Occasional occurrence under evaluation of survivability
Hydrilla	*Hydrilla verticillata*	Eradicated from Lake Manitou but found within the Ohio River
Yellow iris	*Iris pseudacorus*	Scattered locations, accidentally moved as Blue flag iris

Purple loosestrife	*Lythrum salicaria*	Scattered statewide, found especially in northern Indiana and along road corridors
Parrotfeather	*Myriophyllum aquaticum*	Eradicated from Meserve Lake, Rare
Eurasian watermilfoil	*Myriophyllum spicatum*	Statewide
Brittle waternymph	*Najas minor*	Scattered statewide
Starry stonewort	*Nitellopsis obtusa*	Northeast Indiana, mostly in glacial lakes
Yellow floating heart	*Nymphoides peltata*	Rare watch list species, limited distribution
Reed canarygrass	*Phalaris arundinacea*	Statewide
Common reed	*Phragmites australis australis*	Scattered statewide, found especially in northern Indiana and along road corridors
Water lettuce	*Pistia stratiotes*	Rare, found in single lake in Lake Count with no establishment
Curlyleaf pondweed	*Potamogeton crispus*	Statewide
Narrow-leaved cattail	*Typha angustifolia*	Statewide

Appendix E. Rapid Response Plan

2012

INDIANA'S Rapid Response Planning for Aquatic Invasive Species (AIS)

Table of Contents

Executive Summary

Aquatic invasive species pose a significant environmental and economic threat to the ecosystems and communities of the Midwest region and beyond. While avoiding invasive species introductions is key, managers must be prepared to take action when prevention measures fail. This plan provides guidelines for responding incident quickly and effectively to an aquatic invasive species. Its foundation is Incident Command System, a standardized protocol that allows for a common response framework across agencies and jurisdictions. A template version allows agencies to tailor the plan to address their specific needs. Major components of the plan include:

- **Overview of Rapid Response Effort Flowchart.** The flowchart provides a step-by-step view of the entire rapid response effort.
- **Operational Planning "P."** Developed by the United States Coast Guard, the Planning "P" is a visual representation of the Incident Command System planning process. The rapid response procedure is based upon the steps outlined in the planning "P."
- **Decision Tree for When to Take Action on Aquatic Invasive Species.** Deciding whether to take action on an invasive species is a crucial component of any rapid response plan. This tree breaks down the decision into three steps.
- **Aquatic Invasive Species Sighting Report Form.** Gathering critical information on an invasive species sighting is the first step to an effective response. This form streamlines the information-gathering process.

Indiana Rapid Response Plan for Aquatic Invasive Species

I – **Introduction**

Aquatic invasive species (AIS) are non-native organisms that may cause harm to human health, the environment, and the economy when introduced to marine, estuarine, or freshwater ecosystems (EPA 2005). Each year aquatic invasive plants and animals disrupt ecosystems across the nation, costing millions of dollars in ecological and economic damages (Pimentel 2005). Their presence threatens natural resources and affects both commercial and recreational industries, including fisheries and boating. In the Midwest and Great Lakes regions, AIS have been responsible for out-competing and preying upon native plants and animals, as well as threatening million-dollar industries (EPA 2005). Indiana's responsible action toward the prevention and rapid response of AIS concerns now and in the future will lead to the suppression and elimination of invasive species that would affect surrounding states and the country.

Taxonomic Breakdown of Rapid Response

The principal objective of a rapid response action is eradication of the introduced aquatic invasive species. When eradication is not feasible or is unsuccessful, rapid response strategies include containment, population control, and/or mitigation measures. It can be very difficult and expensive to eradicate AIS; however if rapid response actions are not initiated or do not result in eradication, ongoing control efforts are likely to prove more difficult and more expensive over the long-term. Eradication and control options need to be evaluated on the basis of the likelihood of success, cost effectiveness, and any potential detrimental impacts (Wittenberg and Cock 2001). The rapid response created for each taxonomic group and sometimes each specific species will differ dramatically. In Indiana the list of vertebrate AIS species of concern include Asian carp, goby species, ruffe, and, among others, snakehead species. While some rapid responses would have species specific control methods, others would include broad-based control measures like Rotenone or antimycin. The diversity of aquatic invasive plant species requires knowledge and fundamental understanding of chemical, mechanical, and biological control tools available to respond to the wide variety of plant species that have already been found in Indiana like hydrilla, Brazilian elodea, parrot feather, and starry stonewort. Other plant species of great concern in Indiana that would likely invoke a response would include water chestnut, yellow floating heart, and European frogbit. The discovery of an aquatic invasive pathogen might also result in a unique rapid response action. Understanding the biology, reproduction, growth, and life history can be crucial to effective and cost-effective rapid response decisions.

Definition of Rapid Response

Preventing introductions of aquatic invasive species is crucial to avoiding their establishment and spread. Prevention measures, however, are not foolproof, and government officials and natural resource managers must be prepared to take action in the event of an AIS introduction. The National Invasive Species Council defines rapid response as a systematic effort to eradicate, contain, or control a potentially invasive non-native species introduced into an ecosystem while the infestation of that ecosystem is still localized. To be most effective, a response to an

introduction should occur quickly. Yet organizing an appropriate response requires significant coordination and analysis.

The Indiana Department of Natural Resources has created this Rapid Response Plan framework with help from the Mississippi River Basin Panel (MRBP) rapid response template to foster a timely yet thorough response to either intentional or unintentional aquatic invasive species introductions.

Incident vs. Issue

This Rapid Response plan addresses an invasive species "incident," rather than an invasive species "issue." An incident is an isolated introduction of AIS that has yet to become established in the ecosystem, whereas an issue is an ongoing challenge with an established species.

Incident Command System

The Incident Command System (ICS) has earned a reputation as an "all risk, all hazard" response tool. ICS was originally developed by the Forest Service and is now recommended by the Aquatic Nuisance Species Task Force as well as agencies such as National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), and Homeland Security, which use ICS to improve response to incidents from natural disasters to oil spills. The use of unified command and common terminology allows communication and coordination across agencies and jurisdictions. This common planning process and objective-driven management scheme shifts an incident from an initial reactive response to a proactive response (Deal 2006).

By becoming familiar with ICS and using this plan as a guideline, managers will be able to respond quickly and effectively when faced with an aquatic invasive species.

II – **Planning for Rapid Response**

The following tasks are suggested for the proactive and successful preparation and implementation of a rapid response plan.

Task 1. Collaborate to complete a plan
Task 2. Enter into cooperative agreements
Task 3. Secure funding
Task 4. Finalize the rapid response plan
Task 5. Streamline the permit processes for rapid response
Task 6. Revise rapid response plan
Task 7. Develop species- or location-specific rapid response plans
Task 8. Train employees, participants, and team members
Task 9. Conduct education and outreach
Task 10. Conduct research for improved rapid response
Task 11. Develop interim rapid response protocols

Adapted with permission from the California Aquatic Invasive Species Management Plan (California Department of Fish and Game 2007).

Please refer to Appendix C for a more detailed discussion of these tasks.

III –**Rapid Response Procedure**

Overview

The following guidance is intended to direct rapid response efforts for a new aquatic invasive species **incident** in Indiana. Please see the introduction for a discussion on the difference between an aquatic invasive species (AIS) "**incident**" and an AIS "**issue**."

A flowchart (Figure 1) details the general plan of operations for responding to a possible AIS incident. The chart provides a holistic understanding of what needs to be accomplished in response to a new introduction.

In Indiana, the Indiana Department of Natural Resource's AIS coordinator is the first point of contact (please see Contact List in Appendix E). If the report is deemed credible and worthy of a response, the AIS coordinator will contact experts to confirm the identification of the specimen. If the specimen is indeed an actionable AIS incident, the AIS coordinator will send biologists to the field to confirm sighting and location. Once confirmed, the group will then notify the director of the Division of Fish & Wildlife for approval to proceed. If approved, the Indiana DNR wildlife information specialist, in cooperation with the director of the Division of Communications, will be notified to begin development of communication strategies.

Once responsible agencies are notified, the AIS coordinator becomes the Incident Commander. If multiple agencies share equal responsibility, a Unified Command may result. See description in Appendix C. Depending on the size and complexity of the incident, the Incident Commander (IC) or Unified Command (UC) may appoint a command staff to oversee operations, logistics, planning, and finance and administration for the rapid response effort. The IC/UC may also appoint a legal advisor, science advisor, liaison officer, and public information officer. The roles and responsibilities of each of these positions are described in Appendix D.

The newly appointed ICS team will then conduct a risk assessment and analyze management options. To facilitate this process, they will refer to the Operational Planning "P" Process. This process is discussed in detail in the following section.

Figure 1: Overview of Rapid Response Effort

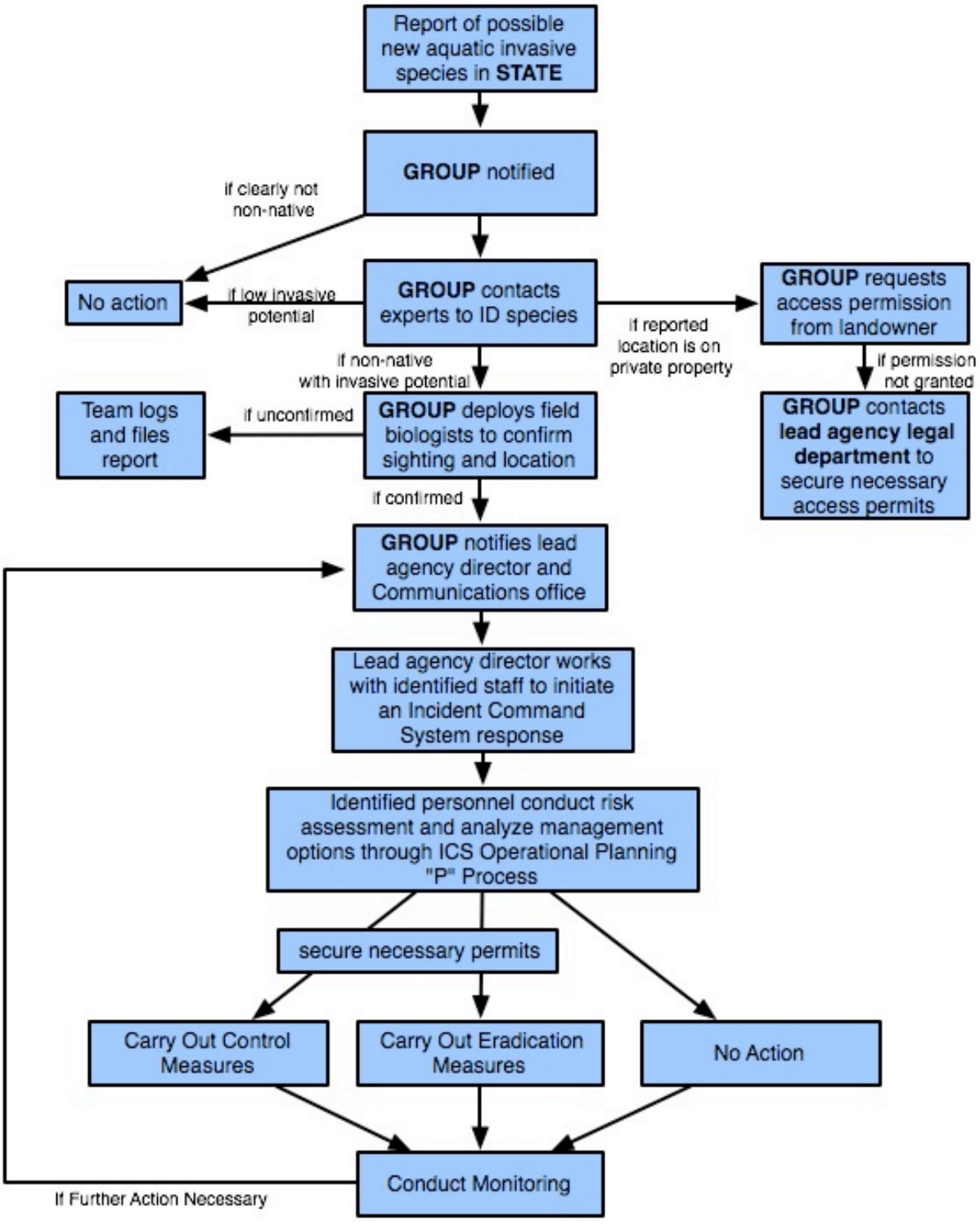


Figure 1

ICS Planning "P" Process

The crux of the rapid response plan is the Operational Planning "P" process. Developed for the U.S. Coast Guard, the Operational Planning "P" (Figure 2) is a visual representation of the ICS planning process. The "P" serves as a step-by-step guide to response from the onset of an incident to assessment and monitoring. The following discussion outlines how to use the Planning P to organize a rapid response to an aquatic invasive species incident or event. Please refer to Appendix D for an ICS organizational chart and description of job titles.

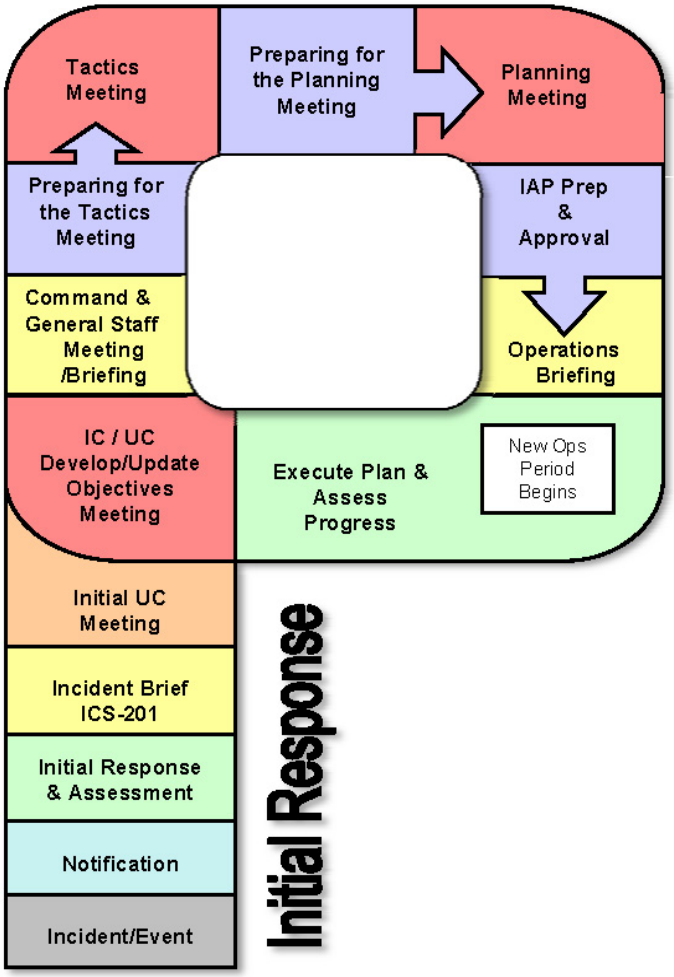
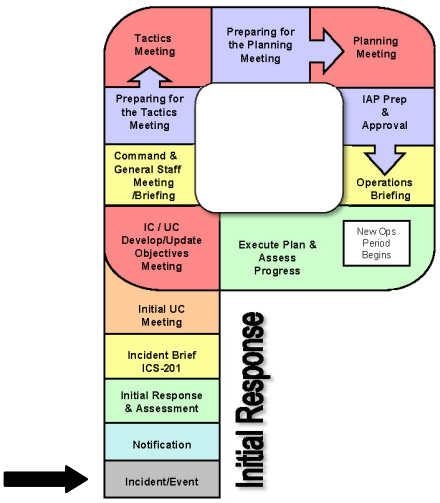
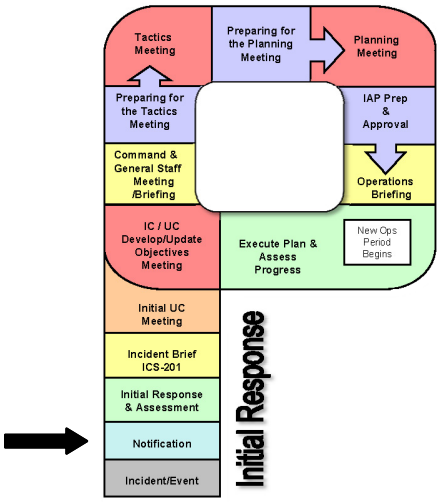


Figure 2



Incident/Event

The discovery of a possible aquatic invasive species in Indiana prompts an inquiry of whether the introduction should be managed as an incident or an issue (see discussion in introduction). Rapid response would occur for an incident.



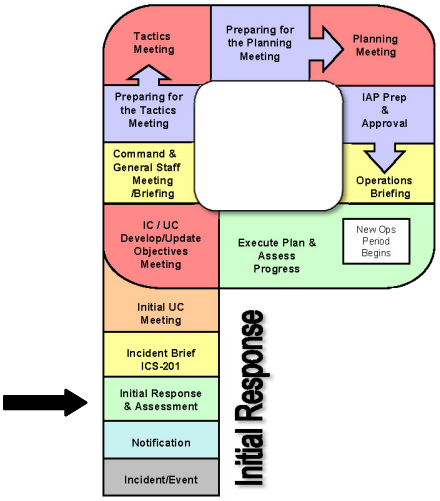
Notification

Who: Anyone who sights a potential aquatic invasive species (AIS) in Indiana (likely possibilities include nongovernmental organizations (NGOs), boat captains, anglers, field biologists, waterfront property owners, resource managers, government agency workers, recreational users, etc.).

What: Contact local authorities, state or federal agencies to report sighting of an aquatic invasive species.

How: Notification regarding a potential AIS in Indiana may happen by a variety of ways. The preferred method is direct contact with AIS coordinator by phone or email or using Indiana's online reporting form (http://www.in.gov/dnr/6385.htm). The secondary method is completion of the United States Geological Survey's online Sighting Report Form (http://nas.er.usgs.gov/SightingReport.asp) or by calling the notification hotline at 1-877-STOPANS. Upon receiving the report, USGS officials will notify Indiana DNR.

If other state and federal entities are the first to receive notification, they should gather information from the reporter as outlined on the AIS reporting form (see Appendix E). Send completed forms to the AIS coordinator by email to efischer@dnr.IN.gov.



Initial Response & Assessment

Response

Who: AIS coordinator.

What: Receives report of potential AIS in Indiana and contacts appropriate expert(s) to positively identify the AIS specimen.

How: AIS coordinator provides taxonomic experts with a specimen or photographs by mail, courier, or email. *Note:* Specimens should be handled in compliance with state/federal regulations regarding the transport of live prohibited species. An expert can be located using the Aquatic Nuisance Species Task Force's Experts database (http://www.anstaskforce.gov/experts/search.php) if necessary. A new occurrence of a non-native species in the state, or a new watershed in state, is documented in the USGS Non-indigenous Aquatic Species Alert System (http://nas.er.usgs.gov/SightingReport.aspx).

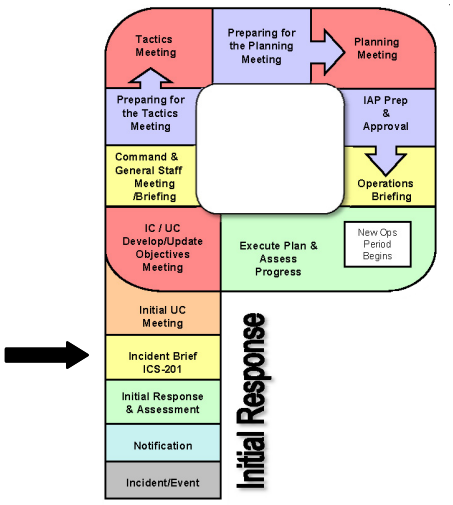
Assessment

Who: DNR fisheries biologists deployed by AIS coordinator through regional fisheries supervisor

What: Confirm AIS sighting, location, and extent of occurrence
How:

- Interview person who reported AIS
- Visit site — Approach landowner for permission if AIS will require action on private property. If landowner is non-compliant, work with Indiana DNR legal staff to secure necessary access permits.
- Conduct sampling
- Visual and taxonomic identification
- Identify life cycle stage
- Estimate extent of occurrence
- Determine if species is a potential "incident" rather than an "issue" (see introduction for distinction)
- Report situation assessment back to AIS coordinator or record information on Aquatic Invasive Species Reporting form (see Appendix E)

Incident Brief



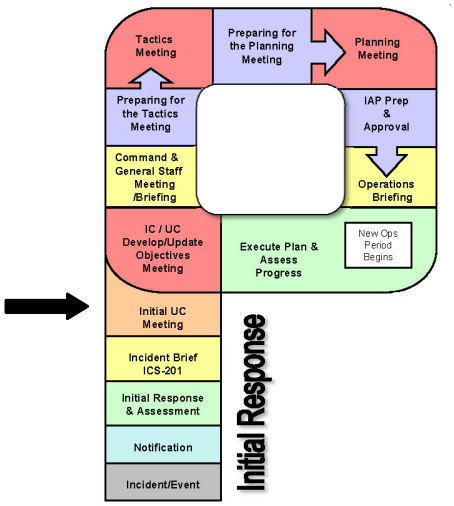
Who: AIS coordinator

What: Notifies director of Division of F&W, director of Division of Communications, and lead agency legal director of presence of AIS and likely next steps.

How: A written Incident Brief (adapted from ICS-201 form). Brief will include information such as:

- Current situation
- Initial response objectives
- Current actions
- Planned actions
- Names of involved personnel
- Resources in use
- Resources needed

Initial Unified Command Meeting



Who: Incident Commander/Unified Command. This initial meeting will likely include the AIS coordinator as Incident Commander or his/her designee and key scientific and legal support staff or advisors whom the AIS coordinator identifies.

What: Begin to establish course of action

How:

- Identify who (if anyone) should be in Unified Command (see criteria for Unified Command in Appendix D).
- Determine priorities for the incident.
  Priorities may include:
  - **Avoid ecological harm**
  - **Protect human health**
  - **Maintain economic value**
  - **Reduce risk of spread**
- Determine the incident response objectives. Objectives need to be **S**pecific in describing the objective, **M**easurable, **A**ction oriented, **R**ealistic and **T**ime sensitive. You can use the acronym **SMART** as a tool in remembering the characteristics for good objectives.

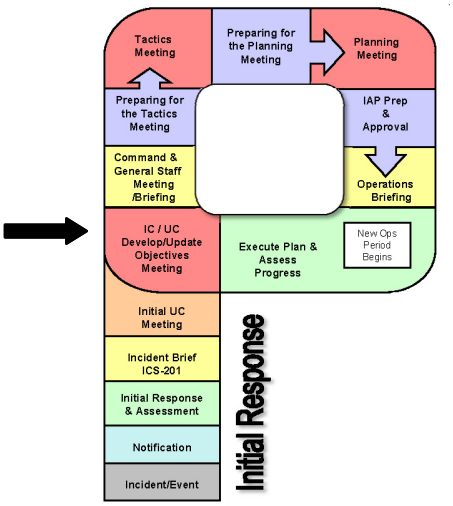
Objectives may include:

- **Determine the extent of infestation (i.e., local and regional range, sources of inputs, drainage, public access, pathways for potential spread)**
- **Determine the source of invasion**
- **Determine if a law enforcement investigation is needed**
- **Determine risk to environment, human health, economy, etc.**
- **Determine control and/or eradication methods to minimize potential environmental, health, and commercial impacts**
- **Determine appropriate use and costs of control/eradication methods**
- **Contain or eradicate invasive species in known areas of infestation**
- **Dispense timely information and a coordinated message to stakeholders, colleagues, local, state and federal agencies impacted by infestation**
- **Conduct monitoring**

- Agree on the basic organizational structure (See Figure 1 in Appendix D)
- Agree on best-qualified and acceptable individuals to fill the needed General Staff positions (i.e., Operations Section Chief, Planning Section Chief, Logistics Section Chief, Finance/Administration Section Chief — see ICS job descriptions in Appendix D)
- Agree on who fills needed Command Staff positions (i.e., Legal Advisor, Science Advisor, Public Information Officer, Liaison Officer, Safety Officer — see ICS job descriptions in Appendix D)
- Identify funding mechanisms and agree on action to secure funding
- Agree on resource-ordering procedures

Objectives Meeting

Who: Incident/Unified Command

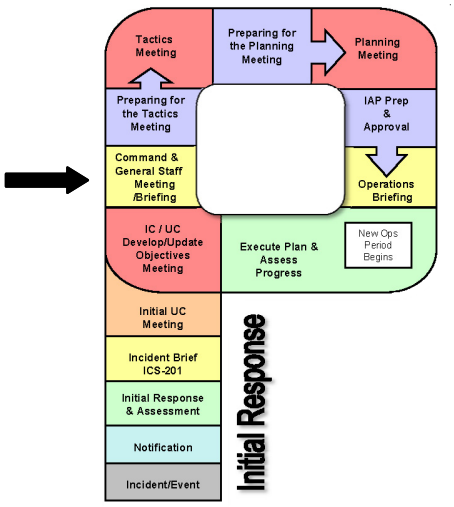


What: Evaluate the current incident status, what needs to occur next, and how it will be achieved. Refine the objectives (outlined in previous step) that will drive the AIS incident response for the next phase of the effort.

How:

- Determine time frame. Take into account pace of the operations, rate of change in incident situation, weather or other criteria, safety and well-being of responders.
- Establish an incident organization that is capable of meeting initial and long-term challenges to mitigate the incident (refer to Figure 1).
- Consider need for Deputy Incident Commander
- Identify and select incident support facilities for control and/or eradication efforts (i.e., Incident Command Post, Base, Staging Areas)
- Ensure scene integrity and evidence preservation
- Identify constraints and limitations
  Constraints and limitations may include:
  - Challenging sampling environment
  - Jurisdictional issues
  - Legislative authority
  - Funding to pay for all aspects of rapid response
  - Availability of invasion control options
  - Securing permits (time and authority)
  - Training personnel
  - Access to private property (land ownership)
  - Gaps in knowledge of species biology
  - Ecological uncertainties

Command and General Staff Meeting



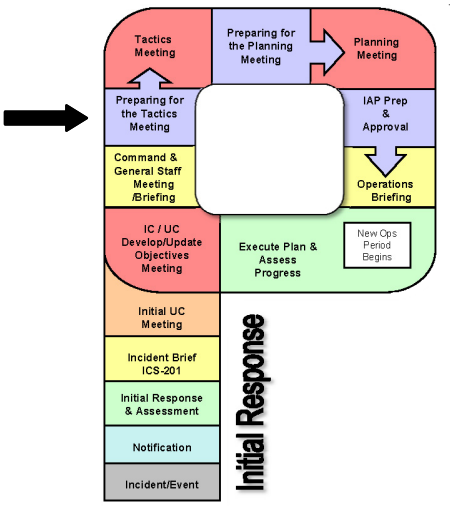
Who: Members of the IC/UC, Command, and General Staff

What: Ensure Command and General staff are apprised of situation and next steps

How: IC/UC will brief Command and General Staff on their decisions, objectives for the next operational period, priorities, limitations/constraints, and expectations.

- Review situation status
- Determine message for Liaison Officer and Public Information Officer to dispense to local, state, and federal agencies, stakeholders, and the media
- If using Unified Command, determine if Joint Information Center is required

Preparing for the Tactics Meeting

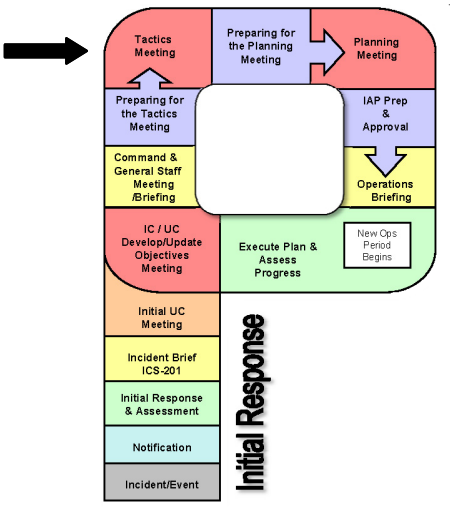


Who: Operations Section Chief, Planning Section Chief, Legal Advisor, Science Advisor

What: Prepare for the upcoming Tactics Meeting

How:

- Develop draft strategies on how to accomplish each objective
- Detail the equipment and personnel required to implement the strategies
- Confirm who has authority to procure resources
- Identify any objectives that will require legal approval



Tactics Meeting

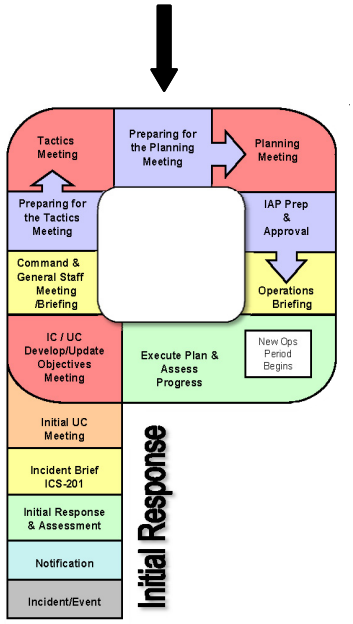
Who: Planning Section Chief, Operations Section Chief, Logistics Section Chief, Legal Advisor, Science Advisor, and the Safety Officer.

What: Organize how the operation will be conducted

How:

- Review the priorities and objectives with the Planning Section Chief and consider the incident's limitations and constraints
- Determine control or eradication measures to be performed (could include mechanical, herbicide or biocontrol treatment

- Divide the Operations Section's work into manageable units (divisions, groups, etc.)
- Assign work tasks for each identified unit
- List the resources required to accomplish the work assignment



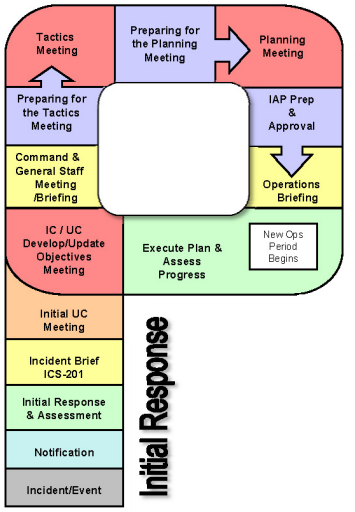
Preparing for the Planning Meeting

Who: IC/UC, Command and General Staff, technical specialists as required

What: Prepare for the Planning Meeting

How:

- Gather current incident information (including potential options for control/eradication)
- Confirm availability of resources (e.g., boats, herbicides, etc.)
- Verify that information to be presented at Planning Meeting is accurate



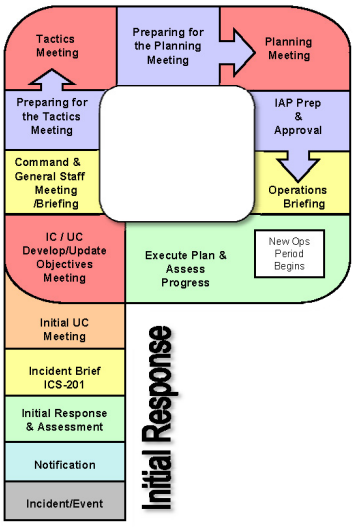
Planning Meeting

Who: Members of IC/UC, Command and General Staff, technical specialists as required

What: Bring primary players together to agree on proposed plan of action

How: Present Tactical Plan and produce a coordinated and sustainable Incident Action Plan that everyone agrees they can support

Incident Action Plan Preparation & Approval



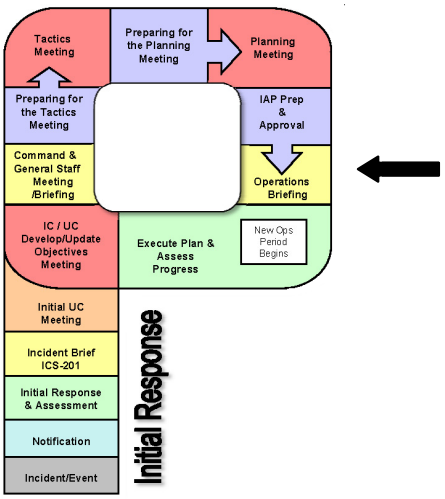
Who: Planning Section Chief, Operations Section Chief

What: Assemble Incident Action Plan for final approval by the Incident Commander/Unified Command

How:
Complete the following forms:

- ICS-202, Incident Objectives: The Planning Section Chief prepares the ICS-202, but does not establish the objectives, which are the responsibility of the IC/UC.
- ICS-203, Organization Assignment List: The Operations Section Chief prepares the ICS-203, which lists the names and positions of the management team.
- ICS-204, Assignment List: The ICS-204 contains information on the operations and the work to be accomplished. That information comes directly from the Operations Section Chief.

Forms can be found at:
http://training.fema.gov/EMIWeb/IS/ICSResource/ICSResCntr_Forms.htm



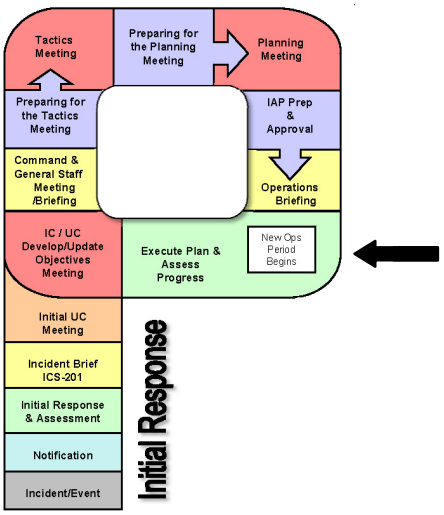
Operations Briefing

Who: IC/UC, Command Staff, General Staff, Branch Directors, Division/Group Supervisors, Staging Area Managers, Task Force/Strike Team Leaders, and Unit Leaders

What: Acknowledging that not everyone has been present at previous meetings, brief those who will carry out the plan to ensure that everyone understands his/her role in the plan

How: Cover the following areas:

- Current situation
- Overall strategy and priorities
- Short- and long-range predictions
- Safety and security issues
- Accident injuries reporting
- Expected outputs and accomplishments
- Resource-ordering and re-supply
- Resource status changes
- Assigned tasks and resources
- Chain of command
- Internal and external communication
- Transportation issues
- Reporting time and location
- Performance expectations
- Sensitive/critical information reporting
- Updating work accomplishments
- Reporting any changes in tactics
- Technical specialists assigned to Operations
- Debriefing instructions



Execute the Plan and Assess Progress

Who: Entire ICS team

What: Carry out the Incident Action Plan and monitor results

How:

- Follow steps outlined in prepared Incident Action Plan
- Adjust objectives and actions as needed
- Monitor successes and failures of prepared objectives

The timeline for aquatic invasive species control and eradication efforts will vary widely according to a number of factors including species, extent of infestation, location, weather conditions, etc. At the end of each operational period, the Incident Commander should assess progress and determine if further action is needed (refer to Figure 1). If additional action is needed, the ICS planning process should begin again. At the conclusion of the rapid response, a final report and press release detailing actions and outcomes should be prepared and delivered.

Appendix A
Decision Tree for when to take action on Aquatic Invasive Species

The following steps are meant to serve as a guideline for managers deciding whether to take action on an aquatic invasive species incident. Managers should consult experts from academia, state and federal agencies, as appropriate, to aid in this decision.

STEP 1: Is the species a new record (invasion) to the state of Indiana or geographic jurisdiction?

***If yes, go to* STEP 3. *If no go to* STEP 2.**

STEP 2: If historically present in the state/jurisdiction, is the species reported to be undergoing a noticeable shift in abundance or impact?

If yes, go to* STEP 3. *If no, record incident in appropriate Aquatic Invasive Species databases but recommend "No action" as an incident. NOTE: In this case, the situation is an issue rather than an incident (see introduction for distinction). The determination of "no action" does not preclude action as an "issue," but the conceptual framework for such evaluation is beyond the scope of this plan.

STEP 3: Is the species/incident of sufficient concern to trigger action(s) or further evaluation of potential actions?

Each species that makes it to STEP 3 results in an Incident Action Brief, with a recommendation of "Action," "No Action," or "Further Evaluation of Potential Action." All such Incident Action Briefs are advanced to the director of the lead agency, but not all trigger an "Initial Unified Command Meeting"—only those recommended for Action.

Criteria considered for Action:

- Is the new species known to cause significant impacts, either in native or non-native range? Impacts include predation, competition, habitat alteration, recreation, industry, health, etc. **If yes, this is a candidate for potential action**
- Is the species a mulluscan filter-feeder or does it create/modify structural habitat, such as vascular plants? There are sufficient examples of these (e.g., *Corbicula, Driessena, Hydrilla*) to suggest they should be considered high risk. **If yes, this is a candidate for potential action**
- Even if not considered/known to have high impacts, is the population restricted, allowing effective eradication? **If yes, this is a candidate for potential action**

Species considered for action enter the ICS process to evaluate feasibility of control/ management options (as detailed in this plan). Important criteria include:

- Geographic extent and abundance
- Priorities and objectives (such as eradication, further evaluation, etc.)
- Potential to achieve priorities and objectives, including available treatments, cost, efficacy, political will
- Has management objective been achieved elsewhere with this or a similar species?
- Timetable to achieve objectives, and whether immediate/urgent action is needed

Appendix B
Federal and State Legal Authorities for Rapid Response in Indiana

Federal:

- The National Invasive Species Act (NISA) (1996) (16 U.S.C. § 4701. et seq.) reauthorized and amended the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. NISA established an Aquatic Nuisance Species Task Force (ANSTF) to assess whether aquatic nuisance species threaten the ecological characteristics and economic uses of U.S. waters. The ANSTF is also directed to evaluate approaches for reducing risk of adverse consequences associated with unintentional introduction of aquatic species. NISA also authorized funding for state and regional management of aquatic nonindigenous species plans, and research on aquatic nuisance species prevention and control in major aquatic systems, including the Chesapeake Bay (MDNR 2003).

- Executive Order 13112 enacted February 13, 1999, by the President of the United States, directs all federal government agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause (MDNR 2003).

- The Lacey Act authorizes the Secretary of the Interior to regulate importation and interstate transport of animal species determined to be injurious. Injurious wildlife are mammals, birds, amphibians, reptiles, fish, crustaceans, mollusks and their offspring or gametes that are injurious to the interests of human beings, agriculture, horticulture, forestry, wildlife or wildlife resources of the United States. Regulation of transport or use within a state is the responsibility of each state. Possession of a species, within state boundaries, is also the responsibility of each state and is not regulated by an injurious wildlife listing (USFWS 2007).

- The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental impacts of their proposed actions and reasonable alternatives to those actions. Rapid response efforts for aquatic invasive species may require completion of the NEPA process. The process consists of an evaluation of the environmental effects of a federal undertaking, including its alternatives. There are three levels of analysis depending on whether an undertaking could significantly affect the environment. These three levels include: categorical exclusion determination; preparation of an environmental assessment/finding of no significant impact (EA/FONSI); and preparation of an environmental impact statement (EIS) (EPA 2007).

- The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) is the principal law that authorizes EPA to regulate the manufacture, distribution, sale, and use of pesticides in the United States. FIFRA Section 18 authorizes EPA to allow states to use a pesticide for an unregistered use for a limited time if EPA determines that emergency conditions exist. (For more information about FIFRA Section 18 emergency exemptions, see www.epa.gov/opprd001/section18. For the text of federal regulations regarding emergency exemptions, see 40 CFR Part 166 www.access.gpo.gov/nara/cfr/waisidx_04/40cfr166_04.html. See

http://www.epa.gov/owow/invasive_species/invasives_management/fifra18.html for more information on the FIFRA Section 18 exemption and Maryland's use of the statute in its response to snakeheads in Crofton Pond (EPA 2005 pp 13-14).

- FIFRA Section 24(c) authorizes states to register an additional use of a federally registered pesticide product or a new end-use product to meet a special local need, such as a rapid response or control action. (EPA 2005 p. 20). (For EPA guidance on FIFRA Section 24(c) registrations, see www.epa.gov/opprd001/24c)

- Clean Water Act Section 402 establishes the National Pollution Discharge Elimination System (NPDES) permit program to regulate point source discharges of pollutants into waters of the United States. It has been determined by courts that the application of pesticides within, over, and near water requires an NPDES permit even when pesticides specifically labeled for use in water are being used. In Indiana, the permitting authority is the Indiana Department of Environmental Management (IDEM). All pesticide applications to control aquatic invasive species will be required to comply with the NPDES rules established by IDEM.

- Clean Water Act Section 404 establishes programs to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Responsibility for administering and enforcing Section 404 is shared by the US. Army Corps of Engineers (USACE) and EPA. It is possible that some mechanical/physical AIS rapid response control methods, such as the mechanized clearing of riparian areas to remove AIS, or dumping of fill material to smother AIS, might require federal or state Section 404 permits. EPA and USACE regard the use of mechanized earth-moving equipment to conduct activities in waters of the United States (e.g., land clearing, ditching, channelization, and in-stream mining) as regulated discharge of dredged or fill material under Section 404 unless project-specific evidence shows otherwise. Natural resource managers should consult the appropriate USACE District office when planning AIS rapid response or control action to determine if these actions require a Federal Section 404 permit (EPA 2005 p.10).

- Federal Noxious Weed Act (7 U.S.C. §§ 2801-2814) defines a noxious weed as any living stage (including seeds and reproductive parts) of a parasitic or other plant of a kind that is of foreign origin, is new to or not widely prevalent in the U.S., and can directly or indirectly injure crops, other useful plants, livestock, poultry or other interests of agriculture, including irrigation, navigation, fish and wildlife resources, or the public health (United States Congress 1974). Under the Act, the Secretary of Agriculture has the authority to prohibit the importation and interstate transportation and sale of species that the Secretary has deemed noxious through actions such as inspection and quarantine. The Secretary is allowed to seize, treat, destroy and dispose of items that have been contaminated with a noxious weed (University of Connecticut 2004).

State:
Authority in Indiana to control invasive plants, plant pests and pathogens is given under the authority of the Division of Entomology & Plant Pathology through the creation of rules.

- In Indiana, a rule has been adopted to require a permit to move, plant, or distribute Lythrum species along with Rosa multiflora (312 IAC 18-3-13).
- Under Indiana Code 14-24-3, the power to adopt rules in regard to infested areas and the control of pests and pathogens is given to the Natural Resources Commission.
- Through this authority the state has regulated the control of hydrilla (*Hydrilla verticillata*), making it illegal to possess, sale, gift, barter, exchange, or distribute any part of life stage of hydrilla while mandating that lawful efforts be taken to eliminate the species on private property (312 IAC 18-3-21).
- The division has also created a list of 28 prohibited invasive aquatic plants, prohibiting the sale, offer for sale, gift, barter, exchange, or distribution of these species under the authority to control of pest and pathogens (312 IAC 18-3-23)

Authority in Indiana to control invasive vertebrates and invertebrates rests in the powers to regulate state activities through the Division of Fish & Wildlife.

- The Division of Fish & Wildlife regulates the importation, possession, propagation, buying, selling, bartering, trading, transfer, or release of 11 species or families of exotic fish (312 IAC 9-6-7)
- The Division of Fish & Wildlife regulates the possession and buying and selling of mussels and mussel shells. Included in the rule the state made it unlawful to import possess or release into private or public waters, a zebra mussel, quagga mussel (*Dreissena* sp.), or Asiatic clam (*Corbicula* sp.) (312 IAC 9-9-3)
- Along with rules regulating fish and mussels, the state regulates bait, crayfish, fish importation, and aquaculture through permits and licenses to further guard against the accidental transport and release of AIS.

Other agencies and organizations with expertise in aquatic invasive species control and response in Indiana include:

- United Stated Department of Agriculture (USDA) – Animal and Plant Health Inspection Service (APHIS) (Federal)
- United States Fish and Wildlife Service (USFWS) (Federal)
- Great Lakes Aquatic Nuisance Species Panel
- Mississippi River Basin Panel on Aquatic Nuisance Species
- Environmental Protection Agency (EPA) (Federal)
- National Oceanic and Atmospheric Administration (NOAA) (Federal)
- US Army Corps of Engineers (Federal)

Appendix C
Planning For Rapid Response

The following tasks are suggested for the proactive and successful preparation and implementation of a Rapid Response Plan. They are adapted with permission from the California Aquatic Invasive Species Management Plan (California Department of Fish and Game 2007.)

Task 1. Collaborate to complete plan
Representatives from Indiana's state agencies and other organizations that are currently involved in rapid response work or are likely to be involved in the foreseeable future should collaborate to finalize the Rapid Response Plan. The goal is to have a plan that can be the basis for interagency agreements.

Task 2. Enter into cooperative agreements
Indiana DNR staf,f with support from regional panels, state partnerships, and federal agencies, will work with cooperating agencies and organizations to produce a list of entities that should be invited to sign Memoranda of Understanding, Implementation Agreements, or similar instruments to facilitate cooperation on rapid response to AIS in Indiana.

Task 3. Secure funding
This Plan cannot be sufficiently implemented without adequate, stable, and dedicated funding. Agencies that sign the rapid response agreement should coordinate efforts to pursue funding options for rapid response program development, training, and implementation.

Consider the following types of funding sources:

1. Continue to use Great Lakes Restoration Initiative (GLRI) funding to protect the Great Lakes basin from new invasions.

2. Through regional panels and ANSTF request and lobby for continuation of GLRI funding renewal. There is also a need to establish funding that can be used to better address AIS outside of the Great Lakes basin. Funding is needed to implement the State ANS management statewide, not just for protection of the Great Lakes.

3. General fund revenues have been used for AIS in other states but rarely in Indiana. The invasive species fund established by the Idaho Invasive Species Act of 2008 is an example of this type of funding. In that case, the fund was established in the state treasury and "receives such appropriations as deemed necessary by the governor and the legislature to accomplish the goals" of the Act. Other examples of direct funding include the Idaho Legislature providing funding for Eurasian watermilfoil control and the Utah Legislature appropriating $2.5 million general funds, of which $1.4 million is ongoing, to allow the Utah Division of Wildlife Resources to conduct an AIS program.

4. ***Boat & Trailer Registration Fees.*** Recreational watercraft must be registered within the state of Indiana. Registration fees are collected by the Indiana Bureau of Motor Vehicles, which allocates a portion of revenues to the Lake and River Enhancement Fund. By law, this

funding can and is being used for invasive aquatic plant and animal control in lakes and rivers. The law also allows for its use for a number of other types of projects that are not related to invasive species. Increasing boat registration fees could potentially increase rapid response capabilities.

***Task 4. Finalize** the Rapid Response Plan*

Work that needs to be done to finalize the rapid response plan includes:

- Implementation Criteria: Develop the process and criteria for the State to use in determining the course of action for any new AIS introduction. Circulate for peer review.

- Likely Species & Scenarios: Identify likely species and/or early detection scenarios for AIS. Run these scenarios through the criteria developed.

- Agency Preparation: Develop information needed to help cooperating agencies designate and train, in advance, potential responders to AIS introductions.

- Alternate Staff: Develop a procedure to designate and prepare potential alternate staff. This could avoid gaps in work progress and minimize managerial time spent searching for substitutes during a response.

- Expertise Directory: Develop and maintain a directory of people who could be called upon to participate during rapid response activities, and into an ICS response. A list of taxonomic experts and protocols for requesting and using their services needs to be developed and periodically reviewed and updated. This would be a list of experts who have agreed to identify specimens for AIS Rapid Response efforts and appropriately preserve and catalogue them. In addition to scientific experts, the directory should include staff who represent the full spectrum of knowledge and skills that might be necessary during rapid response activities (e.g., ICS implementation, logistics, finance, legal, and various technical experts.) The development of this list and staff participation in Rapid Response planning and training will likely require support of executive level staff from cooperating agencies.

- Resource Directory: Develop and maintain a directory of equipment, operations centers, supply sources, and associated contact people so that resources can be mobilized as quickly as possible during a response.

- Notification List: Develop a list of who, outside of those directly involved, needs to be notified when rapid response procedures are being planned and implemented.

Task 5. Streamline permit processes for rapid response

Indiana DNR staff will coordinate with staff from relevant agencies to investigate and pursue possibilities for streamlining the regulatory permit processes that might be required for rapid

response measures. General measures or best management practices necessary to comply with streamlined permitting can be incorporated into the Rapid Response Plan.

Task 6. Revise Rapid Response Plan

- Incorporate New Information: Periodically revise the Plan and incorporate things learned by evaluating the Plan's effectiveness and consulting current scientific research and related technological developments. Revisions may also be necessary due to changes in funding, agency restructuring, and environmental regulations. The interagency agreements to cooperate on rapid response should include a procedure for making revisions to the Plan.

- Notification of Plan Changes: Indiana DNR should ensure that adopted changes to the Plan are circulated to people listed in the Rapid Response Personnel Directory and other appropriate staff among the cooperating agencies and organizations. Changes should be addressed in training activities.

- Update Directories: Indiana DNR Invasive Species staff, with assistance and input from cooperating agencies and organizations, will be responsible for the periodic update and circulation of the Rapid Response Experts Database and the Rapid Response Resource Directory.

Task 7. Develop species- or location-specific rapid response plans

Identify and prioritize certain species, groups of species or certain locations for the development of specific rapid response plans. Detailed technical information can allow this type of response plan to be implemented more efficiently than a generic response plan.

Task 8. Train employees, participants and team members

Agencies that agree to cooperate on AIS rapid response should participate in the development of a training program and train the employees likely to be involved in rapid response activities. Potential rapid response participants need to be familiar with the Rapid Response Plan, Incident Command System, and may need specialized training related to their likely duties during a response. ICS training is available online at: http://training/fema.gov/IS/

Training should also include AIS rapid response drills using a variety of scenarios and locations around the state. This will also assist in fine-tuning the Rapid Response Plan.

Task 9. Conduct education and outreach

Outreach specialists from participating agencies and organizations should develop a plan of potential methods and protocols for conducting outreach to local communities, interest groups, and the media during rapid response procedures. This could include sharing contact information for key groups such as boaters, anglers, and marine owners.

Task 10. Conduct research for improved rapid response

Academic institutions, government agencies, and other organizations that agree to cooperate on rapid response should work together through various AIS working groups, professional societies, environmental organizations, and commercial interests to promote research that can specifically improve or promote rapid response efforts.

Research the costs of rapid response, possible funding mechanisms (Task 3) and, if feasible, study the environmental and economic benefits and costs of conducting rapid response efforts versus not conducting rapid response. This may help governments decide how much to invest in rapid response measures.

Task 11. Develop interim rapid response protocols

Steps that can be taken to prepare to implement a rapid response effort while a formal plan is going through the review and approval processes:

- Memorandum of Understanding (MOU): The directors of the appropriate agencies could sign an interim MOU directing their staff to participate in rapid response planning and implementation if a new AIS introduction occurs prior to the approval of the final plan.

- Interim Funding: Management staff could identify and pursue interim funding sources for implementing a rapid response program.

- Interim Strategy: Management-level staff from cooperating agencies could informally agree upon an interim strategy regarding roles and responsibilities should an AIS introduction occur.

- Permitting: Management-level staff from cooperating agencies could discuss how, in the absence of a formal streamlined permitting process, their staff could work within the existing regulatory permit programs to facilitate a rapid response operation and direct staff to follow through on these interim measures.

- Employee Assignment: Management level staff could assign employees to an interim core rapid response team or working group. This team could participate in advanced preparation and planning. In the event of a rapid response, this team would need to be augmented by additional staff based on the location of the response and the necessary areas of expertise.

Appendix D
Incident Command System Job Descriptions

Incident Command System (ICS) position titles enable responders to speak a common language to avoid the confusion that may come when different agencies, with differences in terminology, all respond to the same aquatic invasive species incident. ICS seeks to eliminate uncertainty by using titles that are not dependent on the title of a person's daily job — a Natural Resource Planner for one agency may be a Field Biologist for another. In this way, positions are filled by the people most qualified to do the job, independent of their previous ranks or job titles.

The figure below illustrates the upper level of personnel organization for the Incident Command System. The Incident Commander oversees the entire response effort. Until the Incident Commander delegates a management function (Operations, Planning, Logistics or Finance/Administration) to another person, he/she must perform the required functions for each position.

Once the Incident Commander delegates these management functions, the chiefs of each section comprise the General Staff. The General Staff reports directly to the Incident Commander.

Command Staff help the Incident Commander and General Staff manage incident safety, communicate with the public and personnel, conduct outreach to other agencies, and advise on legal and scientific issues. Although the Command Staff positions are shown above the General Staff, they are not actually in the chain of command.

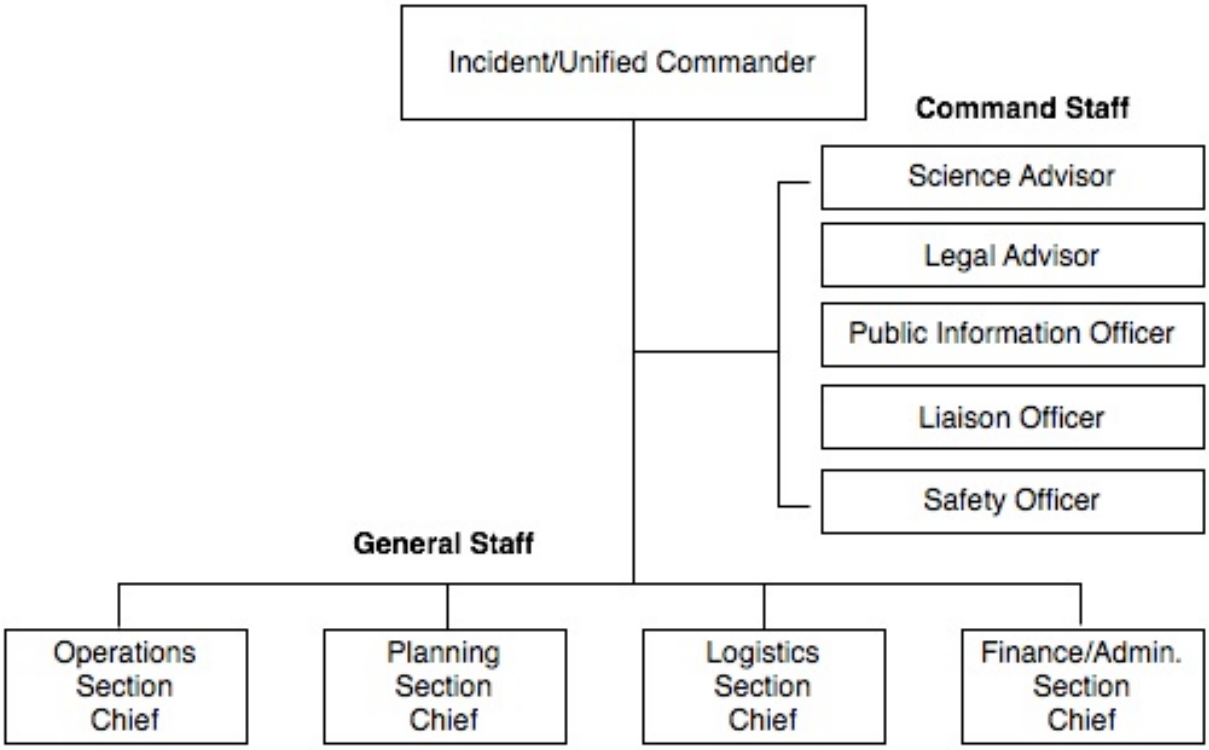


Figure 1

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 Incident Commander 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, experience 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
- Evaluate contingencies

Unified Command

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

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

If you can answer "yes" to all four questions for the particular type of incident that you are responding to, then your organization belongs in the Unified Command:

- My organization has jurisdictional authority or functional responsibility under a law or ordinance for this type of incident
- My organization is specifically charged with commanding, coordinating, or managing a major aspect of the response.
- My organization has the resources to support participation in the response or organization
- The incident or response operation impacts my organization's area of responsibility.

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 Incident Commander/Unified Command
- Identify required tactical resources to accomplish response objectives

Planning Section Chief

Desired Attributes: Strong facilitator and communicator

Primary Responsibilities:
- Keeps 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.).
- Ensure that a complete and thorough Incident Action Plan is delivered in support of the operations.

Logistics Section Chief

Desired Attributes: Experienced in logistical support, detail-oriented, propensity for customer service and teamwork

Primary Responsibilities:
- Anticipate incident 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 Incident Action Plan
- 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

Science Advisor

Desired Attributes: High scientific acumen, particularly in regard to aquatic invasive species; knowledge of environmental implications of all eradication and/or control options; ability to communicate with scientists and non-scientists alike; network of colleagues on whom to call if needed

Primary Responsibilities:

- Provide any necessary technical guidance to those preparing Incident Action Plan
- Participate in planning process
- Ensure rigorous oversight of response's scientific and environmental objectives
- Provide expert input to Incident Commander and Command Staff on scientific and environmental decisions
- Ensure Liaison and Public Information Officer are able to accurately relay scientific information to media, stakeholders, and others
- Consult with other scientific experts

Legal Advisor

Desired Attributes: High legal acumen, particularly in regard to environment laws and permitting; network of colleagues on whom to call if needed

Primary Responsibilities:

- Participate in planning process
- Provide expert input to Incident Commander and Command Staff on laws that govern aquatic invasive species response
- Provide guidance on permits required for response actions
- Oversee execution of all legal documents and contracts
- Consult with other legal experts

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 updates 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
- VIP visits
- Outreach efforts (e.g., community meetings)
- External messages to stakeholders
- 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: Experience in public affairs, communications-savvy

Primary Responsibilities:

- Support the public communications needs of the Incident Commander/Unified Command
- 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 Incident Commander/Unified Command 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 Incident Action Plan
- 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