

Ohio Comprehensive Management Plan

EXECUTIVE SUMMARY

Aquatic nuisance species (ANS) have been recognized as a serious problem in Ohio. This document is an important step in the coordinated response to the problem and serves as an efficient means of communicating the scope of activities necessary to effectively deal with the issue. With regard to the major goals of prevention, control, and abatement, there are corresponding discussions of existing problems, necessary strategic actions, and specific tasks. Also included are the concepts of monitoring and evaluation related to the major goals and the strategic actions.

This outline provides the framework for the development of a comprehensive program to address the aquatic nuisance species problem. The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, Public Law 101-646) provides guidance for the development of such state program documents and, upon approval by the national ANS Task Force, may provide funding for elements of the program. This document is designed to meet the specific requirements of Section 1204 (A) of the NANPCA. That section relates to the development of a "comprehensive management plan ...which identifies those areas or activities within the state, other than those related to public facilities..." Therefore, this plan deals with the issue from a broad natural resources perspective rather than the more limited perspective of the users of raw water who might be affected by infestations of zebra mussels. More important than simply meeting the requirements of the act, however, is the expected value of having a general roadmap for Ohio agencies to use in developing projects within their respective authorities.

The template for this document was developed during a workshop in 1995 hosted by the Great Lakes Commission in cooperation with the Coastal Zone Management Program. The resulting model plan provided valuable guidance to the multi-agency Ohio effort. This effort was led by Department of Natural Resources, Division of Wildlife personnel and included representatives of the Division of Natural Areas and Preserves, the Division of Real Estate and Land Management, the Ohio Lake Erie Office, Ohio Sea Grant, the Ohio Environmental Protection Agency, and the Ohio Cooperative Fish and Wildlife Research Unit (U.S. National Biological Service). Public comments are being solicited from local governments and regional entities, and public and private organizations that have expertise in the control of aquatic nuisance species. Comments will be considered and revisions made to the plan, as appropriate. A responsiveness summary will be included so that commentors may understand how their comments were addressed.

While this plan provides guidance, it does not stand alone as an instrument to deal with the problem. For funding requests under the NANPCA, an Annual Workplan will be developed which will specify annual budgets for Ohio projects and activities linked to the plan. This Annual Workplan will serve as the overall proposal to the national ANS Task Force. Although the Department of Natural Resources would act as

the grants coordinator, we expect broad participation in the program by various state and local entities. With this coordinated effort, we anticipate success in qualifying for the federal funds as well as a more efficient approach for implementing Ohio ANS strategies. Beyond the federal funding incentive, we believe that Ohio entities will find the document essential for designing projects, preparing proposals, and prioritizing activities related to the ANS issue.

NONINDIGENOUS ANS BACKGROUND

The Regional Situation

The introduction of nonindigenous aquatic nuisance species (ANS) into the Great Lakes and inland state 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 water resources of the Great Lakes region are an integral part of activities such as recreation and tourism valued at \$15 billion annually, \$6.89 billion of which is related to the fishing industry. Approximately 75,000 jobs are supported by sport fisheries; and commercial fisheries provide an additional 9,000 jobs (U.S. Fish & Wildlife Service 1994).

The Great Lakes region has been subject to the invasion of ANS since the settlement of the region by Europeans. Since the 1800's, at least 139 nonindigenous aquatic organisms have colonized habitats of the Great Lakes ecosystem. The bulk of these species include: plants (59), fish (25), algae (24), mollusks (14) and oligochaetes (7). About 55 percent of these species are native to Eurasia; 13 percent are native to the Atlantic Coast. Although the obvious impacts of some of the most abundant species are being determined, most of the ANS and their direct and indirect impacts are not known.

As the use of the Great Lakes for commercial transportation intensified, the rate of introduction of ANS also increased. More than one-third of the organisms have been introduced in the past 30 years, a surge that closely followed the opening of the St. Lawrence Seaway in 1960. Human activities contributing to the transport and dispersal of ANS in the Great Lakes and inland state waters include release of organisms from the ballast water of ships, transport and release from the bottom 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, water transport and ornamental and landscape practices. Activities such as the flushing of raw water through gas utility lines from one water body to another should be monitored as a possible means of introduction.

A newly introduced species, if it becomes established through reproduction, can disrupt the natural ecosystem balance by altering the composition, density and interactions of native species. This disruption can cause significant changes to the ecosystem, such as alterations to foodwebs, nutrient dynamics and biodiversity. The new introductions can also cause costly socioeconomic impacts even if effective prevention and control mechanisms are established. Eventually, each newly introduced species will become integrated into an ecosystem that is in a constant state of flux; or the population will not survive and become extinct (New York State Department of Environmental Conservation 1993).

Approximately 10 percent of the Great Lakes' nonindigenous aquatic species have resulted in significant negative ecological and economic impacts. The following examples portray the extensive ecological and economic impacts caused by ANS that have been introduced into the Great Lakes region.

The invasion of the sea lamprey in the 1940's 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 1940's and 1950's, the sea lamprey, a top predator which kills fish by attaching to its prey and feeding on body fluids, devastated populations of whitefish and lake trout. The predation of the sea lamprey on this valuable commercial fishery permitted populations of commercially less valuable fish to proliferate. In 1992, the cost of sea lamprey control and research to reduce its predation was approximately \$10 million annually. The total value of the lost fishing opportunities plus indirect economic impacts could exceed \$500 million annually (Office of Technology Assessment 1993).

The nonindigenous populations of alewife increased rapidly in the Great Lakes during the 1940's and 1950's because of the suitability of the habitat and the fact that predators were not sufficiently abundant to check their growth. Consequently, periodic die-offs fouled recreational beaches and blocked municipal and industrial water intakes. While the alewife out-competed and suppressed whitefish, yellow perch, emerald shiners and rainbow smelt, it subsequently became a prey fish for introduced trout and salmon. The alewife has permanently altered the existing predator-prey relationships in the Great Lakes ecosystem.

The ruffe, a Eurasian fish of the perch family, was introduced to North America in the 1980's, most likely through the ballast water of a seagoing vessel. This ANS has few predators, no commercial or recreational value and may be displacing valuable native fishes. Since its introduction, the ruffe has become established in the nearshore waters of western Lake Superior with an estimated average rate of range expansion of 18 shoreline miles per year. By the fall of 1994, ruffe populations were found in Michigan waters of Lake Superior, and in August of 1995, three ruffe were discovered in a commercial harbor in northern Lake Huron, more than 300 miles east of the previously known range. The ruffe has become very abundant in Duluth Harbor. Based on observations of present ruffe migration rates and life history aspects of the ruffe in Europe, it appears there may be a negative impact on valuable native fish populations.

The round goby and the tubenose goby were introduced via ballast water into the Great Lakes (in the St. Clair River, near Detroit) in 1990. The tubenose goby has not thrived, but the round goby has spread into Lakes Erie and Michigan where the largest populations are found. The round goby was observed in the St. Louis River Estuary in Lake Superior during the summer of 1995. The primary concern with the round goby is the tremendous range expansion exhibited since its introduction in 1990. It is a very aggressive fish, and feeds voraciously upon bottom-feeding fishes (e.g., sculpin, darters and logperch), snails, mussels and aquatic insects. The Great Lakes fisheries, particularly those in Lake Michigan and Lake Erie, may be impacted by this ANS due to its robust

characteristics and potential to displace native species from prime habitat and spawning areas.

The spiny water flea, a likely ballast water introduction, is a tiny crustacean with a sharply barbed tail spine. The northern Europe native was first found in Lake Huron in 1984. The spiny water flea is now found throughout the Great Lakes and in some inland lakes. Although researchers do not know what effect the invader will have on the ecosystem, resource managers suspect that the water flea competes for food (e.g., zooplankton) with small fish such as perch.

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. This ANS has caused serious economic and ecosystem impacts. The zebra mussel, a highly opportunistic mollusk, reproduces rapidly and consumes microscopic aquatic plants and animals 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. Great Lakes municipalities, utilities and industries - due to the infestation of zebra mussels in their intake/discharge pipes - have significant costs associated with monitoring, cleaning and controlling infestations. By the end of this century, water users across the country are expected to spend between \$2 billion and \$3 billion cleaning clogged water intakes (Ruiz et al. 1995). Commercial and recreational vessels and beach areas are also vulnerable to the negative impacts of the zebra mussel.

Nonindigenous plants also have been introduced to the Great Lakes region and inland waters. Purple loosestrife is a wetland plant from Europe and Asia that was introduced to the east coast of North America in the 1800's. Purple loosestrife invades marshes and lakeshores, replacing valuable native wetland plants. The invading plants are unsuitable as cover, food or nesting sites for a wide range of native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads and turtles.

Eurasian water milfoil, unintentionally introduced to North America from Europe, has spread into inland lakes primarily by boats. Milfoil can proliferate in high densities in lakes producing habitat conditions that cause serious impairments to commercial fishing and water recreation such as boating, fishing and swimming. The plant's surface canopy can also out-compete and eliminate native aquatic vegetation as well as threaten native fish and wildlife populations.

The Ohio Situation

The introduction of nonindigenous species is not a new phenomenon in Ohio. All the species mentioned above are causing or have potential to cause significant problems throughout the state--from Lake Erie on the north to the Ohio River on the south. Furthermore, it is likely that nonindigenous species will cause more problems and damage in Ohio than in any of the other Great Lakes states. The reason for this is quite simple. Lake Erie is very different from the other Great Lakes. It is the southernmost of

the Great Lakes, the shallowest, the warmest, the most nutrient enriched and biologically the most productive. Frequently Lake Erie produces more fish for human consumption than the other four Great Lakes combined. These environmental attributes are ideal for many invading species, and, unfortunately mean Lake Erie will frequently be the most adversely affected by invading species.

Currently at least two species of Dreissenid mussels are present in Lake Erie with densities exceeding one million/square meter at water intakes. Each large water intake (over 300 million gallons/day) spends in excess of \$350,000 annually to remove and/or prevent infestations of zebra mussels. Furthermore, they are now expanding and covering soft sediments.

Major changes have occurred in Lake Erie including a disappearance of native clams, greatly reduced planktonic diatom and rotifer densities, vastly increased water clarity and a reduction in the annual economic value of the sport fishery. These events occurred coincidentally with the exponential increase in numbers of zebra mussels and the reduction of phosphorous levels. Furthermore, zebra mussels have been shown to accumulate contaminants and can pass those contaminants up the food chain. During the summer of 1995, they were implicated as the probable cause of a large bloom of toxic algae in the western basin. They have spread to a number of inland lakes and reservoirs and the waters of the Ohio River along our entire border. In the Ohio River, they pose a serious threat to the mussel industry.

The round goby has proliferated in the benthic areas of the central basin adjacent to Lake and Ashtabula Counties. This raises concern because of potential negative impacts on native organisms and possible bioaccumulation of contaminants. That is, gobies may feed on zebra mussels, thereby providing a potential pathway for contaminants to higher organisms.

The plant species mentioned in the regional discussion are also of concern--particularly purple loosestrife, *Lythrum salicaria*, which is a serious problem in many Lake Erie marshes. Other invasive plant species such as Eurasian water milfoil, *Myriophyllum spicatum*, and the bushy pondweed, *Najas minor*, have caused problems in Ohio's inland waters as well.

Numerous ANS have been introduced and dispersed in the Great Lakes and inland waters of Ohio by various pathways. The environmental and socioeconomic costs resulting from ANS infestations will only continue to rise with further successful ANS introductions. Although an awareness of the problems caused by ANS is emerging, the solutions to these problems are not readily apparent. This comprehensive state management plan for nonindigenous ANS provides guidance on management actions to prevent, control and limit the impacts of ANS that have invaded or may invade the Great Lakes region and inland state waters.

POLICY BACKGROUND

The complex environmental and economic impacts posed by the intrusion of ANS require policies and programs to address prevention and control at various levels of government. In addition, improved coordination of new and existing policies could more effectively focus attention on the problems and achieve more positive results. The following overview describes the basic role of federal, regional and state government in implementation of the federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA, Public Law 101-646). It also includes a brief assessment of Ohio's existing laws and programs that address prevention and control of aquatic nuisance species.

Federal Role

The federal NANPCA calls upon states to develop and implement comprehensive state management plans to prevent introduction and control the spread of ANS. Section 1002 of NANPCA outlines five objectives of the law, as follows:

- to prevent further unintentional introductions of nonindigenous aquatic 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.

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

Section 1201 of the Act established the national ANS Task Force, co-chaired by the U. S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA). The Task Force is charged with coordinating governmental efforts related to ANS with the efforts of the private sector and other North American interests.

The group also facilitates national policy direction in support of the Act. The ANS Task Force (consisting of seven federal agency representatives and eight ex officio members representing nonfederal governmental agencies) has adopted the ANS Program under Section 1202 of NANPCA. That program recommends the following essential elements:

Prevention: Establish a systematic risk identification, assessment and management process to identify and modify pathways by which nonindigenous ANS spread.

Detection and Monitoring: Create a National Nonindigenous Aquatic Nuisance Species Information Center to coordinate efforts to detect the presence and monitor the distributional changes of all nonindigenous ANS, identify and monitor native species and other effects, and serve as a repository for that information.

Control: The Task Force or any other potentially affected entity may recommend initiation of a nonindigenous ANS control program. If the Task Force determines, using a decision process outlined in the control program, that the species is a nuisance and control is feasible, cost effective and environmentally sound, a control program may be approved.

The ANS Task Force recommends research, education and technical assistance as strategies to support the elements listed above. The ANS Task Force also provides national policy direction as a result of protocols and guidance that have been developed through the efforts of the following working committees: Research Protocol/Coordination Committee, Intentional Introduction Policy Review Committee, Great Lakes Panel on Aquatic Nuisance Species, Ruffe Control Committee, Risk Assessment and Management Committee, Detection and Monitoring Committee, Zebra Mussel Coordination Committee, Brown Tree Snake Control Committee.

One specific charge of the federal government under Section 1101 of NANPCA was the establishment of ballast water management regulations to limit introductions through transoceanic shipping. Regulations adopted by the Coast Guard in 1993 apply to all vessels that have been operating outside the Exclusive Economic Zone (EEZ) of the U. S. or Canada and enter the Snell Lock in New York carrying ballast water. Vessel masters have three options under these regulations: (1) demonstrate that a ballast exchange was done at sea beyond the EEZ in a depth exceeding 2000 meters, (2) retain the ballast during the vessel's entire Great Lakes voyage, in which case tanks may be sealed, or (3) have an alternative environmentally-sound method of ballast water management approved by the Coast Guard. All vessels are checked, and ports being visited are notified of the ballast water conditions in place. Seaway authorities and the Canadian Coast Guard assist in enforcement of the regulations.

The Coast Guard is currently working to address the fact that vessels reporting No Ballast on Board (NOBOB) (77% of vessels entering the lakes) do carry some residue that eventually can enter the system when water is exchanged within the Great Lakes. In addition, a federal research program is examining alternative methods of ballast water management.

Regional Role

Great Lakes regional coordination is addressed under Section 1203 of NANPCA which calls upon the Great Lakes Commission to convene the Great Lakes Panel on Aquatic Nuisance Species. 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) assist the ANS Task Force in coordinating federal programs within the region, (4) advise the public and private individuals on control efforts; and (5) submit annually a report to the Task Force describing prevention, research and control activities in the Great Lakes Basin.

State Role

The comprehensive state management plans for ANS are addressed in Section 1204 of NANPCA. Section 1204 requires that the management plan identify "those areas or activities within the state, other than those related to public facilities, for which technical and financial assistance is needed to eliminate or reduce the environmental, public health, and safety risks associated with ANS." The content of each state plan is to focus on the identification of 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. 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 ANS 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. Plans may be implemented with other funds supplied by state and cooperative agencies.

Ohio's Authorities and Programs

The State of Ohio currently has a number of statutory and regulatory authorities with which it addresses or potentially can address the issue of prevention and control of nonindigenous ANS. All have been developed over time in response to individual target species and a variety of concerns as they arose. Therefore, there is not currently a comprehensive, coordinated and vigorously-enforced policy framework to deal with problem species and their impacts. Clearly, one task must be to identify gaps within the state's policies and statutes and to develop recommendations for improvements. Such improvements may entail developing new legislation and regulations, revising existing authorities, and developing methods for improving enforcement, coordination, and information dissemination regarding new or existing authorities.

The following existing authorities and policies have been identified relative to Ohio's management of nonindigenous ANS. Some of these deal more broadly with all species that may invade terrestrial or transitional ecosystems, as well as aquatic ecosystems. -

SALE AND PROPAGATION OF PURPLE LOOSESTRIFE (O.R.C. ' 927.682).

The Director of the Department of Agriculture (DOA) prohibits the sale and propagation of purple loosestrife pursuant to O.R.C. ' 927.682. No person or governmental entity may sell, offer for sale or plant *Lythrum salicaria* without a permit issued by the Director. The Director may issue a permit only for controlled experiments and may exempt from the permit requirement any variety demonstrated not to be a threat to the environment (O.R.C. ' 927.682).

IMPORTATION, SALE AND POSSESSION FOR PURPOSES OF INTRODUCTION INTO WATERWAYS OF EXOTIC SPECIES OF FISH OR HYBRIDS THERE-OF (O.A.C. ' 1501:31-19-01).

The State of Ohio's fishing regulations provide that exotic species of fish, i.e., any fish not naturally found in Ohio waters, or hybrids thereof may not be imported, sold or possessed for the purposes of introduction into any body of water that is connected to or drains into a flowing stream or other body of water that would allow egress of fish into public waters in the state. In addition, the possession, sale and importation of grass carp capable of reproducing is prohibited. Importers and sellers of grass carp are required to certify that all grass carp handled are of the sterile triploid variety and must have prior written authorization from the chief of the Division of Wildlife (DOW) to import and sell this variety. It is also illegal to import, sell or possess for any purpose any of the following: walking catfish, diploid white amur, silver carp/white bream, black amur/black carp, bighead carp/bighead amur or any hybrid thereof, or Australian crayfish of the genus *Cherax*. (O.A.C. ' 1501:31-19-01).

AQUACULTURAL ENTERPRISES (O.R.C. ' 1533.632, O.A.C. 1501:31-39-01).

O.R.C. 1533.632 mandates that the Division of Wildlife regulate the aquaculture industry, and allows for the issuance of permits for Class B species, which can include nonindigenous species. Class B species refer to those that are more ecologically sensitive and Class A species are those that are more common. Permits for the culture of Class A and B species are to be issued on a case-by-case basis, and the chief shall take into account " . . . the species for which the Class B permit is requested, the location of the aquaculture production facility, and any other information determined by the chief to be necessary to protect the wildlife and natural resources of this state." According to rules promulgated by the Division of Wildlife, a permit will not be granted until a division representative determines the classification of the aquaculture facility, based upon level of potential risk of escapement. Aquatic species or hybrids not native to a watershed or not established through division stocking will not be considered for approval unless the facility has no risk of escapement at any time (O.A.C. 1501:31-39-01).

BAIT FISH (O.A.C. ' 1501:31-13-04).

Rules promulgated by the Division of Wildlife prohibit such sale in accordance with the division's statutory authority to protect and preserve the wild animals of the state.

CONTROL MEASURES FOR NON-NATIVE FLORA AS PART OF MANAGEMENT PLANS FOR ODNR-MANAGED PRESERVES AND WILDLIFE AREAS.

Each preserve and wildlife area managed by ODNR, DOW and Division of Natural Areas and Preserves (DNAP), is governed by a management plan specific to that area. Each plan incorporates a statement of policy regarding treatment of nonnative flora identified as problems within the preserve or wildlife area. Generally speaking, guidelines call for manual removal, burning and treatment with herbicides. Management plans include provision for monitoring and assessment to determine the extent of growth and nature of the disturbance, if any. Management plans are tailored to the specific preserve or wildlife area and prescribe the treatment appropriate for each species depending upon the habitat type, extent of invasion and management goals for the area.

The first four policies are considered enforceable while the last is considered nonenforceable in that a citizen may not be able to force compliance and enforcement by the state if an instance of noncompliance exists. Within the Lake Erie watershed, enforceable authorities incorporated into the Ohio Coastal Management Program (OCMP), can be enforced against federal agencies through application of the federal consistency provision (Section 307) of the federal Coastal Zone Management Act (16 U.S.C. 1541 et seq.). The consistency provision applies to all federally conducted, funded and permitted activities that may affect land or water uses of the coastal area, as defined by the OCMP, whether or not they occur directly within the OCMP management boundary. This will not take effect until the implementation of the OCMP begins, following federal approval by NOAA.

Several authorities in addition to those cited above currently exist and could be used to more effectively control the introduction and spread of nonindigenous species.

The Chief of ODNR's Division of Wildlife has general statutory authority and control . . . in all matters pertaining to the protection, preservation, propagation, possession, and management of wild animals and may adopt rules under section 1531.10 of the Revised Code for the management of wild animals" (O.R.C. 1531.08). Therefore, in instances where it is determined that the introduction and/or spread of nonindigenous aquatic species is potentially detrimental to the management of the wild animals of the state, the Division may adopt additional rules to avert adverse impacts.

The Ohio Department of Agriculture has statutory authority to adopt rules necessary to carry out its responsibilities regarding plant pests under O.R.C. 927.70 (O.R.C. 927.52). No person may harbor any plant pest which has been determined by the director of agriculture to be destructive or dangerously harmful. "Pest" is defined broadly as any organism that causes or may cause injury, disease, or damage to any plant part, or plant product. This apparently could be broadly applicable if economic or noneconomic plants, or natural systems, were to be judged to be threatened by a pest species. Thus, the broad rule-making authority exists, but an assessment of the need for additional rules may be required.

ODNR's Division of Natural Areas and Preserves has statutory authority to create and manage state nature preserves, and wild, scenic, and recreational rivers along with their corridors up to one thousand feet from the normal waterlines. While the division has rule-making authority with respect to management of lands within the preserves and wild, scenic and recreational rivers, it does not have authority to regulate activities with respect to species that may be disruptive to the ecosystems thus being preserved. The Ohio Revised Code specifically prevents land use restrictions imposed by the division upon private lands along wild, scenic, or recreational river corridors; however the division works actively with local governments to ensure that local zoning, flood plain and other river overlay districts and forest buffers provide appropriate protection. O.R.C. ' 1517.14 states that the chief of the division "may participate in watershed-wide planning with federal, state and local agencies in order to protect the values of wild, scenic and recreational river areas."

In addition to exercising its statutory and regulatory authorities, the state currently fosters extensive research and education/outreach programs through the Ohio Department of Natural Resources (ODNR), the Ohio Environmental Protection Agency (OEPA), Ohio Sea Grant College Program, the Great Lakes Aquatic Ecosystems Research Consortium, the Lake Erie Protection Fund, state universities and others. Informational efforts focus upon educating recreational water users and commercial enterprises regarding methods to reduce impacts of human activity upon the introduction and spread of ANS. Research efforts have focussed upon pollutant uptake mechanisms, potential control methods, effects of increased water clarity, predator\prey relationships and other trophic level interactions. Implementation of this state management plan is intended to assist the state in enhancing and better coordinating these programs and activities.

MANAGEMENT ACTIONS

The goals of Ohio's State Management Plan for ANS are designed to address different stages of ANS invasion: 1) the introduction of the nonindigenous species transported from water bodies from other parts of the continent or world; 2) the spread of an established, reproducing ANS population to other water bodies and 3) the colonization of ANS populations within water bodies, including the harmful impacts resulting from colonization.

The three goals on which Ohio's State Management Plan for ANS is based are as follows:

Goal I:

Preventing new introductions of nonindigenous ANS into the Great Lakes and inland waters of the state.

Goal II:

Limiting the spread of established populations of nonindigenous ANS into uninfested waters of the state.

Goal III:

Abating harmful ecological, economic, social and public health impacts resulting from infestation of nonindigenous ANS.

The State of Ohio recognizes that, to facilitate accomplishment of these goals, it must coordinate with jurisdictions outside the state and build its tasks upon sound science. Therefore, mechanisms will be established to ensure that all prevention, control and abatement tasks developed and implemented by the state under this plan are (1) done so in cooperation with federal agencies, local governments, interjurisdictional organizations and other entities, as appropriate (NANPCA, Section 1202), (2) based upon the best scientific information available, and (3) conducted in an environmentally-sound and conscientious manner.

Goal I: Preventing new introductions of nonindigenous ANS into Lake Erie, the Ohio River, and inland waters of Ohio.

Problem: The introduction of nonindigenous ANS into the Great Lakes region, including inland state waters, frequently causes environmental, socioeconomic, and public health impacts. The severity of these impacts is not known or recognized on a wide-scale basis, impeding the investment of resources needed to prevent new ANS introductions. Although 139 nonindigenous aquatic species have already been introduced into the Great Lakes ecosystem, new introductions are still highly likely. The prevention of new introductions is critical in ameliorating ANS problems in the Great Lakes region and in individual states.

Multiple mechanisms transport ANS into the Great Lakes and inland State waters; some such mechanisms transcend the authority of a single state to control. A prime example is ballast water discharge from transoceanic shipping, the largest source of nonindigenous aquatic species invasions worldwide (Carlton 1985). The absence of interjurisdictional authority is problematic in regulating the transoceanic vectors transporting ANS to the Great Lakes. Cooperative efforts are necessary between state, federal, and international agencies to promulgate and enforce regulations to ensure that ballast management practices and other related transport mechanisms are employed to prevent ANS introductions. Seventy-seven percent of vessels that entered the Great Lakes in 1995 reported No Ballast on Board (Weathers and Reeves 1996) compared to 51.8% in 1990 (Locke, et. al. 1991). These figures are based on vessels giving voluntary reports. The ratio between vessels retaining ballast water and vessels exchanging was .933 in 1993 and down to .125 in 1995. Problem cases have gone from 7.4% in 1993 to 3.9% in 1995. Current regulatory policy ensures that at least an 85% exchange of ballast water takes place although a 100% exchange is the goal (Weathers and Reeves 1996.)

Current technology is frequently inadequate to prevent new introductions of ANS into the Great Lakes and inland state waters. Research on prevention strategies to minimize ANS transport, such as innovative ballast water management technology, is critical in the effective prevention of ANS introduction. Ongoing studies by the U.S. and Canadian Coast Guards indicate that it is especially important to deal with the difficult problem posed by vessels entering the Great Lakes with residual unpumpable ballast water and sediment in their tanks. This medium, potentially harboring a variety of ANS, is often mixed with Great Lakes fresh water and discharged at another Great Lakes port during cross transfers. A sample during the 1995 navigation season suggests 40% of vessels entering with No Ballast on Board (NOBOB) engaged in a cross transfer with unpumpable ballast water (Weathers and Reeves 1996). A 1991 Canadian study found vessels with only unpumpable ballast were carrying on average 157.7 metric tons of water. In order to achieve more effective emptying or flushing of these tanks, the feasibility of altering the current design of ballast tanks needs to be examined.

Other significant transport mechanisms increasing the potential for new introduction of ANS into the Great Lakes and inland state waters included the aquaculture business, commercial barge traffic, recreational boating, the bait industry, the pet shop trade, plant nurseries, and fish stocking activities- all of which have the potential to introduce ANS as well as associated parasites and other disease organisms. A new concern is the flushing of natural gas and petroleum pipelines with raw water which could potentially carry organisms from one body of water to another. The pet shop trade has become more problematic, offering increasing numbers of easily introduced aquatics like crayfish and minnows. In some cases, such activities are subject to little or no regulation. In cases where laws/regulations do exist, they are frequently not well publicized and/or enforced. As mentioned in the policy statement, there are often gaps in the current laws. User groups that could potentially introduce ANS into the Great Lakes region/state are generally not adequately informed of ANS prevention practices.

Strategic Action IA: In partnership with other states and federal agencies, develop state

The State of Ohio recognizes that, to facilitate accomplishment of these goals, it must coordinate with jurisdictions outside the state and build its tasks upon sound science. Therefore, mechanisms will be established to ensure that all prevention, control and abatement tasks developed and implemented by the state under this plan are (1) done so in cooperation with federal agencies, local governments, interjurisdictional organizations and other entities, as appropriate (NANPCA, Section 1202), (2) based upon the best scientific information available, and (3) conducted in an environmentally-sound and conscientious manner.

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Problem: The introduction of nonindigenous ANS into the Great Lakes region, including inland state waters, frequently causes environmental, socioeconomic, and public health impacts. The severity of these impacts is not known or recognized on a wide-scale basis, impeding the investment of resources needed to prevent new ANS introductions. Although 139 nonindigenous aquatic species have already been introduced into the Great Lakes ecosystem, new introductions are still highly likely. The prevention of new introductions is critical in ameliorating ANS problems in the Great Lakes region and in individual states.

specific and regional listings of ANS that have the potential to infest the Great Lakes and Ohio waters. As part of this cooperative effort, identify existing and potential transport mechanisms that facilitate new ANS introductions.

such mechanisms transcend the authority of a single state to control. A prime example is ballast water discharge from transoceanic shipping, the largest source of nonindigenous aquatic species invasions worldwide (Carlton 1985). The absence of interjurisdictional authority is problematic in regulating the transoceanic vectors transporting ANS to the Great Lakes. Cooperative efforts are necessary between state, federal, and international agencies to promulgate and enforce regulations to ensure that ballast management practices and other related transport mechanisms are employed to prevent ANS introductions. Seventy-seven percent of vessels that entered the Great Lakes in 1995 reported No Ballast on Board (Weathers and Reeves 1996) compared to 51.8% in 1990 (Locke, et. al. 1991). These figures are based on vessels giving voluntary reports. The ratio between vessels retaining ballast water and vessels exchanging was .933 in 1993 and down to .125 in 1995. Problem cases have gone from 7.4% in 1993 to 3.9% in 1995. Current regulatory policy ensures that at least an 85% exchange of ballast water takes place although a 100% exchange is the goal (Weathers and Reeves 1996.)

Current technology is frequently inadequate to prevent new introductions of ANS into the Great Lakes and inland state waters. Research on prevention strategies to minimize ANS transport, such as innovative ballast water management technology, is critical in the effective prevention of ANS introduction. Ongoing studies by the U.S. and Canadian Coast Guards indicate that it is especially important to deal with the difficult problem posed by vessels entering the Great Lakes with residual unpumpable ballast water and sediment in their tanks. This medium, potentially harboring a variety of ANS, is often mixed with Great Lakes fresh water and discharged at another Great Lakes port during cross transfers. A sample during the 1995 navigation season suggests 40% of vessels entering with No Ballast on Board (NOBOB) engaged in a cross transfer with unpumpable ballast water (Weathers and Reeves 1996). A 1991 Canadian study found vessels with only unpumpable ballast were carrying on average 157.7 metric tons of water. In order to achieve more effective emptying or flushing of these tanks, the feasibility of altering the current design of ballast tanks needs to be examined.

Other significant transport mechanisms increasing the potential for new introduction of ANS into the Great Lakes and inland state waters included the aquaculture business, commercial barge traffic, recreational boating, the bait industry, the pet shop trade, plant nurseries, and fish stocking activities- all of which have the potential to introduce ANS as well as associated parasites and other disease organisms. A new concern is the flushing of natural gas and petroleum pipelines with raw water which could potentially carry organisms from one body of water to another. The pet shop trade has become more problematic, offering increasing numbers of easily introduced aquatics like crayfish and minnows. In some cases, such activities are subject to little or no regulation. In cases where laws/regulations do exist, they are frequently not well publicized and/or enforced. As mentioned in the policy statement, there are often gaps in the current laws. User groups that could potentially introduce ANS into the Great Lakes region/state are generally not adequately informed of ANS prevention practices.

Strategic Action IA: In partnership with other states and federal agencies, develop state specific and regional listings of ANS that have the potential to infest the Great Lakes and Ohio waters. As part of this cooperative effort, identify existing and potential transport mechanisms that facilitate new ANS introductions.

Task IA1: Research and/or support research on the movement and transport of ANS on a global-scale and use findings to help predict potential viable ANS invasions in the Great Lakes and inland state waters.

Strategic Action IB: Cooperate with/support interjurisdictional approaches to facilitate legislative, regulatory, and other actions needed for the prevention of new ANS introductions into the Great Lakes and inland state waters.

Task IB1: Cooperate with/support coalitions among the Great Lakes states to promote federal legislation/programs for the prevention of new ANS introductions in the region/state.

Task IB2: Cooperate with/support an interjurisdictional process to ensure compatibility and consistency between Great Lakes states and between states and federal agencies.

Task IB3: Participate and cooperate in the development of a Great Lakes regional approach through the Great Lakes Panel on ANS to prevent new introductions of ANS into the Great Lakes and inland state waters.

Strategic Action IC: Utilize effective state legislation and regulations to prevent new ANS introductions into state waters, including Lake Erie, the Ohio River, and inland waters.

Task IC1: Establish an interagency task force (with input from the public and private sectors) to review and recommend statutory and regulatory changes for state legislative consideration.

Task IC2: Develop and implement an outreach program that informs relevant groups of the regulations, their rationale, and compliance procedure.

Task IC3: Review, recommend, and implement effective enforcement programs.

Strategic Action ID: Develop/maintain monitoring programs in Lake Erie, the Ohio River, and inland waters of Ohio to provide for the early detection of infestations of ANS.

Task ID1: Inventory and coordinate information from existing monitoring programs.

Task ID2: Recommend implementation of additional monitoring techniques if needed.

Strategic Action IE: Conduct or support research and actions for prevention of new introductions of ANS into Lake Erie, the Ohio River, and inland waters of Ohio.

Task IE1: Determine the transport mechanisms potentially responsible for new ANS introductions into Lake Erie, the Ohio River, and inland waters of Ohio. Develop preventative action plans to interrupt pathways of introduction.

Task IE2: Examine trophic changes and habitat alterations in the Great Lakes region to predict the potential effect on new ANS introductions into Lake Erie, the Ohio River, and inland waters of Ohio.

Strategic Action IF: Develop and conduct an effective information/education program on the prevention of new ANS introductions in Lake Erie, the Ohio River, and inland waters of Ohio.

Task IF1: Develop an advisory team from relevant Great Lakes regional state user groups (e.g., shipping industry, aquaculture business, recreational boating/angler groups, bait and tackle establishments) to assess existing ANS information/education programs and build on the strengths and weaknesses of these programs.

Task IF2: Establish monitoring/tracking programs to evaluate the effectiveness of information/education efforts.

Goal II: Limiting the spread of established populations of nonindigenous ANS into uninfested waters of the state.

Problem: The spread of established populations of nonindigenous ANS into uninfested state waters is often via human activity, such as boat transfers, ballast exchange, bait handling, water transport, and ornamental and landscape practices. Limiting the spread of such populations is problematic due to the numerous pathways of dispersal, the complex ecological characteristics associated with ANS populations, and the lack of feasible technology that is needed to limit the spread.

Many public and private resource user groups are not aware of existing infestations of ANS in Lake Erie, the Ohio River, and inland waters of Ohio, and why they cause priority problems locally, regionally and beyond. The probability of ANS spread to other waters can increase when resource user groups are not aware of how their routine activities can cause the dispersal of ANS into uninfested water bodies. An information/education program is needed to provide information on why the spread of ANS populations needs to be limited, how the ANS populations can be reduced, and also the value of a healthy aquatic ecosystem that supports a diverse native aquatic community. Information/education programming is also critical to strengthening public/private support for and statewide participation in ANS management strategies.

It is also difficult to manage the spread of ANS since infestation frequently occurs in watersheds that occupy more than one state. Cooperation among Great Lakes states sharing ANS infested watersheds is needed to implement consistent management strategies that will effectively limit the spread of ANS populations.

Strategic Action IIA: Identify and prioritize ANS whose spread should be limited.

Task IIA1: Utilize our interagency task force (IC1) with input from user groups to select and prioritize those ANS that merit management.

Strategic Action IIB: Monitor the spread of those ANS determined to be a state priority.

Task IIB1: Coordinate a monitoring program in Lake Erie, the Ohio River, and inland waters of Ohio that will indicate or document the spread of ANS.

Task IIB2: Develop identification materials for each ANS that is being monitored to facilitate participation of all stakeholders.

Strategic Action IIC: Develop and implement control strategies to limit the spread of each ANS determined to be a state priority.

Task IIC1: Develop voluntary and regulatory control strategies to limit the spread of ANS into state waters, including Lake Erie, the Ohio River, and inland waters of Ohio.

Task IIC2: Implement a watershed approach to limit the spread of ANS in the state and

establish cooperative policies with states sharing watersheds to limit the spread of ANS populations.

Strategic Action IID: Inform and educate the appropriate resource user groups on the management strategies needed to limit the spread of targeted ANS populations. To support this effort, the target groups should be informed on how the spread of ANS threatens the health of a diverse native aquatic community, and other harmful ANS impacts.

Task IID1: Assess existing ANS information/education programs (ODNR, Sea Grant, and Cooperative Extension) on the spread of ANS populations. Build on the strengths and address the weaknesses of these programs. Utilize the advisory team created in IF1 to accomplish this task. (Note that this task is not intended to duplicate efforts but will be done simultaneously with the IF1.)

Task IID2: Identify pathways that disperse ANS and inform these groups on practices to help limit the spread. This outreach program should focus on changing the behavior of user groups to limit the spread of targeted ANS populations in Lake Erie, the Ohio River, and inland waters of Ohio.

Task IID3: In cooperation with other Great Lakes states, establish a voluntary intra-lake ballast water management program that will inform ship owners, captains, engineers, and other commercial shipping personnel on how to improve ballast management practices to impede the transfer of ANS from one Great Lake to another.

Task IID4: Coordinate with Ohio's coastal management programs to ensure, where appropriate, that public access projects and interpretive displays include information about ANS.

Task IID5: Establish monitoring/tracking programs to evaluate the effectiveness of information/education efforts.

Strategic Action IIE: Utilize effective state regulations to limit the spread of ANS within the state.

Task IIE1: Utilize the interagency task force (1C1) to review and recommend statutory and regulatory changes for state legislative consideration.

Task IIE2: Develop and implement an outreach program that informs relevant groups of the regulations, their rationale, and compliance programs.

Task IIE3: Review, recommend, and implement effective enforcement programs.

Strategic Action IIF: Support/coordinate scientific research between state and federal agencies and academic institutions that investigate potential management strategies to limit the spread of ANS populations and associated environmental impacts.

Task IIF1: Prioritize research needs to help in establishing program structure.

Task IIF2: Conduct priority research, or promote the conduct of such research via federal research initiatives, academia, or the private sector.

Task IIF3: Develop a technology transfer program to be used in distributing research findings such as the Great Lakes Information Network (GLIN.)

Goal III: Abating harmful ecological, economic, social and public health impacts resulting from infestations of nonindigenous ANS.

Problem: The infestation of nonindigenous ANS in the Great Lakes and inland state waters can cause, to varying degrees, ecological, economic, social and public health impacts. Strategies to control ANS in infested water bodies, in efforts to abate their impacts, are not always known or technically and/or economically feasible. Control strategies must also be designed so as not to cause significant environmental impacts.

The infestation of ANS in the Great Lakes and inland state waters can alter or disrupt existing relationships and ecological processes. Without co-evolved parasites and predators, some nonindigenous aquatic species out-compete and even displace aquatic native plant or animal populations. As part of this process, the invading species can also influence to some extent the foodwebs, nutrient dynamics, and biodiversity of the ecosystems. To abate the ecological impacts of the invading organism, it is necessary to understand the mechanisms by which the species disrupts the natural balance of the ecosystem.

Lake Erie, the Ohio River, and inland waters of Ohio provide valuable economic benefits for Ohio, some of which include commercial and sport fisheries, recreational use, and water usage by manufacturers, industry and electric power companies. Some introduced ANS to the Great Lakes region/state have provided economic benefits, such as those supporting the aquaculture business and sport fishing industry. However, several ANS have been found to cause adverse economic impacts. For instance, the zebra mussel infests the intake/discharge pipes of hundreds of facilities that use raw water from the Great Lakes, incurring extensive monitoring and control costs. The Eurasian water milfoil forms thick mats on the surface of water which can interfere with many types of water recreational activities, such as swimming, water skiing and sailing. The invasion of the ruffe in Duluth-Superior appear to be displacing the perch and whitefish populations, which could pose a serious threat to the commercial and support fishing industry if the ruffe invasion spreads throughout the Great Lakes and inland state waters.

Organisms invading the Great Lakes and inland state waters can threaten public health through the introduction of disease, concentration of pollutants, contamination of drinking water, and other harmful human health effects (Ohio Sea Grant College Program 1995). An extensive abatement system for these ANS needs to be established to prevent human health problems from occurring in Lake Erie, the Ohio River and inland waters of Ohio.

Strategic Action IIIA: Assess the ecological, socioeconomic, and public health impacts of ANS in Lake Erie, the Ohio River and inland waters of Ohio. Use this assessment as guidance to develop action levels that warrant implementation of control strategies.

Task IIIA1: Identify and assess economic value and resource implications for each ANS.

Task IIIA2: Identify the ANS that should be targeted for abatement strategies because they threaten the public safety, human health, and ecological integrity of Lake Erie, the Ohio River and the inland waters of Ohio.

Strategic Action IIIB: Based on the above impact assessments, encourage the development and implementation of abatement strategies, including physical, chemical and biological mechanisms with a reasonable potential to eradicate or reduce populations of targeted ANS in Lake Erie, the Ohio River, and inland waters of Ohio.

Task IIIB1: Establish protocols that will provide guidance in designing and implementing abatement strategies, the following principles should be incorporated.

*The abatement strategy must not create problems greater than those related to the ANS itself.

*An abatement strategy must be well focused and not have serious, long term impacts to the environment or non-target organisms (e.g., production of persistent toxics.)

*The abatement strategy must not reduce the long term human utilization of the water body (with the exception of those waters with special resource designation) or threaten human health.

Task IIIB2: Support/coordinate scientific research between state and federal agencies and academic institutions that investigate potential abatement strategies and associated environmental impacts. Develop a technology transfer program to be used in distributing research findings.

Strategic Action IIIC: Develop and implement means of adapting human activities to coexist with infestations of ANS where effective control and eradication are not feasible.

Task IIIC1: Support/coordinate scientific research between state and federal agencies and academic institutions that investigate potential means to coexist with infestations of ANS. Develop a technology transfer program to be used in distributing research findings.

Task IIIC2: Actively seek potential beneficial and alternative uses for these ANS and disseminate this information through a technology transfer program.

Strategic Action IIID: Conduct an information/education program providing information on ANS impacts and related abatement strategies. Utilize existing groups/programs responsible for information dissemination when appropriate with the advisory team set up in IF1 taking an active role.

Task IIID1: Design programs targeting public agencies needed in promoting management action to abate impacts; user groups needed for effective control of targeted species; and communities that need to learn how to live with ANS problems.

Task IIID2: Establish monitoring/tracking programs to evaluate the effectiveness of information/education efforts.

PROGRAM MONITORING AND EVALUATION

The evaluation process of Ohio's State Management Plan will enable us to monitor our progress toward prevention, limitation, and abatement of ANS. We will be able to ensure appropriate implementation of our management actions as well as make the necessary "mid-course" corrections. In essence, by incorporating the best scientific and management knowledge with periodic public evaluation, we will be implementing an adaptive management program (sensu Lee, 1993). The process will involve three components: oversight, evaluation, and ultimately, dissemination of information. Each component will be discussed below.

Oversight: An oversight committee will be composed of external publics (identified as interested parties during the review process), other state entities (e.g., ODNR, OEPA, Ohio Geological Survey, etc.), a representative from the governor's office, and members from the original task force who authored this document. The role of this interagency committee will be to examine progress on management actions focused on the three goals of the state management plan. The committee can evaluate the success of each strategic action by examining the level of achievement of the tasks clearly defined within each action.

Evaluation: The evaluation effort should not only examine progress, but place a special emphasis on identifying funding needs to successfully accomplish goals and associated tasks. This information will prove useful in future program planning processes. Evaluation should also incorporate information from those groups affected by plan implementation. These include organizations (or people) involved with the responsibility of implementing management actions and resource user groups.

Dissemination: An annual report will be produced highlighting the progress of our management actions. This report will include information on the successes in achieving the goals (prevention, limitation, and abatement) of the ANS Plan as well as future plans and directions. Successes, failures, and new directions within Ohio will be evaluated in comparison with other regional plans. The annual report will be available to members of the general public and local, state, and federal decision-makers.

GLOSSARY

aquatic nuisance species (ANS): an organism that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquaculture or recreational activities dependent on such waters.

baitfish: fish species commonly sold for use as bait for recreational fishing such as emerald shiners.

ballast water: any water and associated sediments used to manipulate the trim and stability of a vessel.

cross transfer: when a vessel enters the Great Lakes with no ballast on board (NOBOB) but takes on and discharges ballast water while still present in the lakes thus releasing some of the unpumpable ballast residue into the Great Lakes.

environmentally sound: methods, efforts, actions or programs to prevent introductions or control infestations of ANS that minimize adverse impacts to the structure and function of an ecosystem and adverse effects on non-target organisms and ecosystems and emphasize integrated pest management techniques and nonchemical measures.

exclusive economic zone (EEZ): area within 200 miles of the baseline, in this case from the mouth of the St. Lawrence Seaway.

exotic: see nonindigenous.

federal consistency: The requirement under the Coastal Zone Management Act that stipulates that federal actions that are reasonably likely to affect land or water use or natural resources of the coastal zone be consistent with the enforceable policies of a coastal state's federally approved coastal management program (CMP). A coastal state reviews the federal action to determine if the proposed action will be consistent with the CMP.

Great Lakes: Lake Ontario, Lake Erie, Lake Huron (including Lake St. Clair), Lake Michigan, Lake Superior, and the connecting channels (Saint Mary's River, Saint Clair River, Detroit River, Niagara River), and Saint Lawrence River to the Canadian Border, and includes all other bodies of water within the drainage basin of such lakes and connecting channels.

no ballast on board (NBOB): when a vessel entering the Great Lakes declares NBOB, it means that they have pumped out their ballast tanks of water before entering the exclusive economic zone.

nonindigenous species: any species or other viable biological material that enters an ecosystem beyond its historic range, including any such organism transferred from one country to another.

persistent toxics: a toxic pollutant that remains in the environment for a substantial period of time, potentially causing injury to ecosystem health.

unintentional introduction: an introduction of nonindigenous aquatic species that occurs as the result of activities other than the purposeful or intentional introduction of the species involved, such as the transport of nonindigenous species in ballast or in water used to transport fish, mollusks or crustaceans for aquaculture or other purposes.

unpumpable ballast: residue left behind in a vessels ballast tanks after ballast water has been pumped out, usually 4-5" in the bottom of the tank. **waters of the United States:** the navigable waters and the territorial sea of the United States.

watershed: an entire drainage basin including all living and nonliving components.

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