ILLINOIS STATE COMPREHENSIVE MANAGEMENT PLAN

FOR AQUATIC NUISANCE SPECIES

25 OCTOBER 99

The Zebra Mussel (*Dreissena polymorpha*)

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EXECUTIVE SUMMARY

The Illinois State Comprehensive Management Plan for Aquatic Nuisance Species approaches the

subject of nuisance nonindigenous aquatic species from the natural resources management perspective. This plan was written by Rodney Horner, Richard Sparks (IL/DNR) and Pat Charlebois (IL-IN Sea Grant), closely following the Model Plan provided by the Great Lakes Panel and borrowing from the plans of New York, Ohio and Michigan. It has been more than a year in development to date. A separate plan for protecting public facilities in Illinois should be prepared. That plan should address nonindigenous aquatic nuisance species (ANS) from the perspective of industrial and municipal water users. Its development requires technical and engineering capability beyond the scope of a natural resources agency.

This plan is primarily directed at addressing the impacts of unintentional, unsanctioned introductions of nuisance nonindigenous aquatic species into Illinois waters. Nonindigenous species are plants and animals found beyond their natural ranges. Many are highly beneficial. Most U.S. crops and domesticated animals, many sport fish and aquaculture species, numerous horticultural plants and most biological control organisms have origins outside Illinois (Michigan DNR draft plan). In this plan, we are focusing on nuisance aquatic species, and therefore do not address beneficial species or those species that are semi-aquatic or terrestrial. We recognize, however, that nonindigenous semi-aquatic and terrestrial nuisance species may become public health threats or threaten the integrity of Illinois ecosystems, and provide illustrative examples; strategies developed in this plan may be applicable to those types of species and systems at a later date. The geographic scope of the plan is that of the State of Illinois and the boundary waters under its jurisdiction, including the Mississippi, Ohio and Wabash Rivers, and the Illinois portion of Lake Michigan. (See Attachment 4, Illinois and its waterways.)

Aquatic nuisance species are recognized as serious problems in Illinois. This document is an important step in providing guidance on management actions to address the prevention, control and impacts of nuisance nonindigenous aquatic species that have invaded or may invade the waters of Illinois. The development of a state plan is called for in Section 1204 (A) of the **Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (P.L. 101-646)** (**NANPCA**). **NANPCA** was re-authorized and amended by the **National Invasive Species Act of 1996 (NISA) (P.L. 104-332)**. These laws provide an opportunity for federal cost-share support for implementation of the plan. Approval of the management plan by the national Aquatic Nuisance Species Task Force is also required for a state to be eligible for federal cost-share support. Section 1204 (B) authorizes development of a separate state plan for protecting public facilities. The facilities protection plan should be submitted to the Assistant Secretary of the Army (for civil works).

This plan provides a framework of goals and objectives, and a program of tasks to be accomplished in the management of ANS. **The implementation of this plan will require the commitment of staff and resources to accomplish its goals and objectives.** (see Table 3).

When considering implementing the plan, it is important to weigh the program costs against the costs of **not** having a program. The overall cost to industrial and municipal water users of the zebra mussel introduction alone was $120 million between 1989 and 1995 (Hushak et al, 1995). This yields an average cost per year to date of $1.5 million for each of the 8 Great Lakes States. Dollars spent in **remediating** the impacts of just the zebra mussel introduction would fund a nuisance nonindigenous species prevention and control program for many years.

As mentioned, the model for this document was developed by the Great Lakes Commission and approved by the Great Lakes Panel on Aquatic Nuisance Species. Other state management plans (Michigan, New York and Ohio) provided a great deal of valuable information for its development. Section 1204 requires that the management plan Aidentifies 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 nuisance

species.@ The three goals on which this plan are based are as follows:

> Goal I: Preventing new introductions of nonindigenous aquatic nuisance species into the Great Lakes and Mississippi Basin waters of Illinois.
>
> Goal II: Limiting the spread of established populations of nonindigenous aquatic nuisance species into uninfested waters of the state.
>
> Goal III: Abating harmful ecological, economic, social and public health impacts resulting from infestations of nonindigenous aquatic nuisance species.

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 work plan will be developed, which will specify annual budgets for Illinois projects and activities linked to the plan. This annual work plan will serve as an overall proposal to the national ANS Task Force. We expect broad interest in the program by various state and local entities as they seek support in taking action against ANS. With this coordinated effort, we anticipate success in qualifying for the federal funds as well as a more efficient approach for implementing Illinois ANS strategies. Beyond the federal funding incentive, we believe that Illinois entities will find the document essential for designing projects, preparing proposals and prioritizing activities related to the ANS issue (Ohio DNR, 1996)**.**

INTRODUCTION

Aquatic nuisance species (ANS) are a significant threat to the integrity of marine and freshwater ecosystems of the United States. They affect foodwebs, nutrient dynamics and biodiversity of the aquatic ecosystems that they invade. Recognizing the magnitude of the threat, the federal government passed the Nonindigenous Aquatic Nuisance Prevention and Control Act in 1990, reauthorized and updated as the National Invasive Species Act in 1996. Among the provisions of these acts is the opportunity for federal cost-share support for implementation of an ANS state plan.

This document is the ANS plan for the state of Illinois. It is designed to address the prevention, control, and impacts of ANS through management, research and outreach. It focuses primarily on unintentional, unsanctioned introductions of *nuisance* nonindigenous aquatic species into Illinois waters. It does not address *beneficial* nonindigenous species such as those used in aquaculture, horticulture, or as biological control agents. This plan also does not address those species that are semi-aquatic or terrestrial. We recognize, however, that nonindigenous semi-aquatic and terrestrial nuisance species may become public health threats or threaten not only the integrity of Illinois ecosystems, but also the economic, societal and public health conditions in Illinois. An example of a societal impact is that of the Asian longhorned beetle, whose invasion is currently forcing the removal of all the trees in several suburban Chicago neighborhoods in an attempt to bring the invasion under control. A potential public health impact is that of the Oriental liver fluke, whose intermediate host, the Chinese mitten crab, has been imported into the Great Lakes. Another threat is the potential that a virulent form of cholera might be imported as it was into South America. The severity of these impacts is not widely recognized, impeding the commitment needed to prevent future introductions. Also, a Acrisis response@ mentality often limits the vision and opportunity for the prevention of future introductions, leaving the state with control problems that are economically costly, technically challenging and often impossible to solve.

Strategies developed in this plan may be applicable to semi-aquatic or terrestrial species and systems at a later date. The geographic scope of the plan is that of the State of Illinois and the boundary waters under its jurisdiction, including the Mississippi, Ohio and Wabash rivers, and the Illinois portion of Lake

Michigan. (See Attachment 4, Illinois and its waterways.)

NONINDIGENOUS AQUATIC NUISANCE SPECIES BACKGROUND

The Regional Situation

The Great Lakes Basin

The introduction of nuisance nonindigenous aquatic species into the Great Lakes and inland state waters is a potential biological threat not only to the ecology of the region, and the states= water resources, but also to the economic, societal and public health conditions of the region. 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. Sport fisheries support approximately 60,000 jobs; and commercial fisheries provide an additional 9,000 jobs (U.S. Fish and Wildlife Service, 1995; American Sport Fishing Association, 1996).

The Great Lakes Region has been subject to the invasion of aquatic nuisance species since the settlement of the region by Europeans. Since the 1800s, at least 139 nuisance 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 aquatic nuisance species and their direct and indirect impacts are not known.

As use of the Great Lakes intensified as a transport route for commerce, the rate of introduction of aquatic nuisance species also increased. More than one-third of the organisms have been introduced in the last 30 years, a surge coinciding with the opening of the St. Lawrence Seaway. Other human activities contributing to the transport and dispersal of aquatic nuisance species in the Great Lakes and inland state waters include the release of organisms from the ballast water of ships, transport and release from the bottoms of ships, movement or intentional release of aquaculture and sport 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.

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 the food webs, nutrient dynamics and biodiversity. These species have the potential to cause significant ecological problems because they have been introduced into a habitat in which there may be no natural controls such as pathogens, parasites or predators. Lack of natural controls may allow a species= numbers to grow at its maximum potential (Michigan DNR). New introductions also can 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 will become extinct (New York State Department of Environmental Conservation, 1993).

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

Great Lakes region.

The sea lamprey (*Petromyzon marinus*) invasion in the 1940s 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 which kills a fish by attaching to it and feeding on its 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 and likely permitted the explosion of alewife (see below) by reducing lake trout predators. In 1992, sea lamprey control costs and research to reduce its predation were approximated at $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 alewife (*Alosa pseudoharengus*) populations increased rapidly in the Great Lakes in the 1940s and the 1950s 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 alewife out-competed and suppressed whitefish, yellow perch, emerald shiners and rainbow smelt, it subsequently became a fish preyed upon by introduced trout and salmon. The alewife has permanently altered the predator-prey relationships in the Great Lakes ecosystem.

The ruffe (*Gymnocephalus cernuus*), a Eurasian fish of the perch family, was introduced to North America in the 1980s, most likely through the ballast water of a seagoing vessel. This aquatic nuisance species has few predators, no commercial or recreational value, and is replacing 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 (Thunder Bay River, MI). This sighting was more than 300 miles east of the previously known range. During 1996, there was no range expansion, but two significant developments were observed. 1), 6 YOY and 2 yearling ruffe were caught at Thunder Bay, ON, the first time ruffe had been collected there since 1994, indicating possible reproduction occurring; 2) the numbers of ruffe discovered in Lake Huron at Thunder Bay River, MI expanded from 3 in 1995 to 34 (mostly YOY) by 1996 (Czypinski, et al., 1997). The ruffe is now the most abundant species in Duluth Harbor where it was first introduced. Based on observations of present ruffe migration rates, native fish population displacements in Lake Superior, and past experience of ruffe in European waters, it appears that ruffe may be in competition with yellow perch and whitefish populations. Ongoing research is attempting to verify this conjecture (Tom Busiahn, USFWS, pers. comm.). Walleye populations are affected indirectly through a change in the food chain composition brought on by the proliferation of the ruffe. Based on moderate estimates of expected declines of yellow perch, whitefish and walleye, the annual economic loss to the U.S. sport and commercial fisheries is estimated at approximately $119 million if the ruffe expands its range to all lake regions (Leigh, 1994).

The round goby (*Neogobius melanostomus*) **and the tubenose goby** (*Proterorhinus marmoratus*) were introduced via ballast water into the St. Clair River, near Detroit in 1990. The tubenose goby has not thrived, but the round goby has spread into all five of the Great Lakes. 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 the eggs of bottom dwelling fishes (e.g., sculpin, darters and log perch), as well as on snails, mussels and aquatic insects. The Great Lakes fisheries, particularly those in lakes Michigan and Erie, are threatened by this aquatic nuisance species due to its robust characteristics and ability to displace native species from prime habitat and spawning areas. Recent research indicates that 85% of round gobies tested survived the winter under the ice in a pond 2 feet

deep and a similar number survived the summer in the same pond at temperatures in excess of 86^0F. The round goby also tolerates very low dissolved oxygen levels in the laboratory (D. Soluk, IL DNR-NHS pers. comm.). The round goby has left the confines of Lake Michigan, has been found 12 miles downstream of Lake Michigan in the Calumet River (U.S. Fish and Wildlife Service, 1996) and is poised to enter the Illinois River system and the interior of the United States . For reasons not readily apparent, it has spread no further to date, but given its broad range of environmental tolerances, it is likely merely awaiting its opportunity.

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

Another spiny water flea (*Daphnia lumholtzi*), a native of southern Asia, Africa and parts of Australia, was first discovered in the state of Texas in 1991. Since its discovery, it has spread to 5 states including Illinois, where it was first found in Lake Springfield. By 1994, it had spread to 4 new lakes. By 1996, it was found in 10 lakes in Illinois (Kolar et al., 1997). *Daphnia lumholtzi* was thought to be primarily a lake species, but is now established in the Illinois River and was found in 1996 by INHS researchers only 30 river miles south of Lake Michigan in the Cal-Sag channel (Stoeckel, unpublished, 1997). The potential for invasion of the Great Lakes by *D. lumholtzi* is high, and may already have occurred. Pump-back mitigation of Lake Michigan water leakage from locks and sluice gates from the Chicago River back to the lake is due to be as much as 85 cfs. This has the obvious potential to introduce *D. lumholtzi* and other plankton from downstream. Also, water can be transported upstream from the Mississippi drainage basin into Lake Michigan via the bilge water of commercial and recreational watercraft or in the bait buckets and live wells used by anglers. Approximately 60,000 boats lock in or out of Lake Michigan at the Chicago Harbor Lock each year; about 70% are recreational craft (Richard Pickett USACE, pers. comm.). Another 21,000 pass through the Thomas J. O=Brien Lock, of which 80% are recreational boats (LaVeta Bear USACE, pers. comm.). Adult *D. lumholtzi* or their eggs (which are resistant to drying) can be transported in drops of water or mud attached to water birds, boats, or trailers. Its effects on the ecosystem are unknown, but its length of 3-5 mm and its spike helmet and tail presumably deter predation, and may impact the zooplankton community structure and the diets of zooplankton eating fish.

The zebra mussel (*Dreissena polymorpha*), 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 aquatic nuisance species 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. Municipalities, utilities and industries in the Great Lakes as well as elsewhere, due to the infestation of the zebra mussel in their intake/discharge pipes have significant costs associated with monitoring, cleaning and controlling infestations. According to a recent economic impact study, zebra mussels have cost water users $120 million between 1989 and 1995. Commercial and recreational vessels and beach areas are also vulnerable to the negative impacts of the zebra mussel (Hushak et al., 1995).

The white perch (*Morone americana)* is native to Lake Ontario and the Atlantic Slope drainages of northern North America. In recent years it has invaded the upper Great Lakes reaching the Chicago area in 1988. It currently is found in extreme southern Illinois (Laird and Page, 1996). Its effects on the

ecosystem of the Mississippi Basin are unknown. To date, it is found in increasing numbers in the Illinois River at Peoria (Wayne Herndon, IL DNR pers. comm.).

Purple loosestrife (*Lythrum salicaria*) is a wetland plant from Europe and Asia that was introduced to the east coast of North America in the 1800s. Purple loosestrife invades marshes and lake shores replacing cattails and other wetland plants. This nuisance nonindigenous plant is unsuitable to meet habitat needs - such 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 milfoil (*Myriophyllum spicatum)*, unintentionally introduced to North America from Europe, has spread into inland lakes, primarily by boat traffic. 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 out-compete and eliminate native aquatic vegetation, and threaten native fish and wildlife populations. In Illinois, this plant has been involved in a substantial fish kill when the dense plant population collapsed during a period of hot weather, thus reducing the oxygen level in the lake to zero.

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

The Upper Mississippi River Basin

To our knowledge, there are no comprehensive surveys of the cost of monitoring and controlling nuisance nonindigenous aquatic pests in the Mississippi and its major tributaries such as the Ohio River. Estimates are that the zebra mussel will cost water users in the Great Lakes several billion dollars over the next ten years for capital investments in zebra mussel control systems and in added operating costs. The economic effects on water users in the Mississippi Basin will probably be on the same order. One fairly small fossil fuel power plant (450 megawatts) on the Illinois River spent $1 million to install a system to control zebra mussels and currently spends $40,000 per year to operate the system.

Invasive species may have detrimental impacts on waste discharges, as well as water users. In the lower Illinois River, zebra mussels at densities of 90,000 per square meter (about 1 square yard) of river bottom consumed enough oxygen to lower oxygen levels well below the state standard of 5 parts per million. In order to maintain oxygen standards in rivers with dense zebra mussel populations, it might become necessary to reduce organic loading from farming operations, industries and municipal sewage treatment plants, at considerable cost for the additional waste treatment.

Zebra mussels overgrow and smother native mussels including species harvested commercially for the cultured pearl industry. A few species of native mussels have thick, pearl-white shells that can be used as Astarter@ nuclei in cultured pearls; the zebra mussels are not suitable substitutes because they have thin, non-lustrous shells. Commercial shelling in the Illinois River was halted in part because the native mussel populations were under stress from the zebra mussels. The 19.8 million pounds of native mussel shell (the raw material for producing cultured pearls) exported from the U.S. in 1991 were worth $40 million. Cultured pearl sales amount to $700 to $800 million in the U.S. and $3 billion worldwide (D. Blodgett, INHS pers. comm.). The efforts of at least one company in the U.S. that has had some success

in producing pearls in native mussels may be disrupted by the zebra mussel invasion.

Current studies of the dynamics of the zebra mussels of the Illinois and Mississippi river system indicate that zebra mussel populations are patchily distributed. Upstream concentrations serve as reproductive centers. Most larvae must travel, borne by the flowing water, a minimum of 304.6 km (190.4 miles) before being mature enough to settle to the substrate. This suggests that colonization and population growth in the upper 70% of the Illinois waterway is strongly dependent on larvae produced in Lake Michigan and the Chicago area waterways. Control of this population might be achieved with an upstream dispersal barrier (Stoeckel et al., 1997).

Schneider et al. (1998) have modeled the risk of zebra mussel spread using 120 boat landings in Illinois, the number of boat trips from infested waters, the distance from infested waters, boat use at the site and the position of a lake within the river system. The model predicts inland invasion will occur first at high use areas close to infested waters followed by central Illinois reservoirs acting as stepping-stones (upstream reservoirs of infection). In this fashion, zebra mussels will seriously threaten critical native mussel habitats. The model predicts that efforts to prevent the initial invasion of stepping-stone lakes should focus on education efforts rather than quarantine. Boaters leaving infested lakes would be directed to washing stations for their boats and trailers. Another technique might be to use signs, educational pamphlets, spot inspections and washing stations at the uninfested stepping-stone lakes, before boaters launch. The spot inspections would have an educational function similar to the courtesy safety inspections of boats.

Invasive species threaten other native species, including sport fish that are important to local and regional economies along the major inland rivers. River-based recreation in a sample of 76 counties along the upper Mississippi River is conservatively estimated to generate 18,000 jobs and $1.2 billion annually (Carlson, 1993). From 1993 to 1995, national B.A.S.S. Superstar tournaments on the Illinois River at Peoria brought $3-8 million per year into the local economy according to the Peoria Convention and Visitors= Bureau. Recovery of native fish and wildlife populations, and of the economies that depend upon them, are two of the long-term successes of the Clean Water Act. It would be ironic if these successes were undone by biological contaminants-the ANS and their associated parasites and diseases.

The Illinois Situation

As is the case with all states, the introduction of nuisance nonindigenous species is not a new occurrence in Illinois. It should be noted that not all nonindigenous species could be classified as nuisance species, since many such species form the basis of our sport fishery in the Great Lakes and in inland waters. Illinois waters have been invaded by ANS from the Mississippi Basin as well as from elsewhere in the Great Lakes. Invasions from the Great Lakes are possible because of the artificial connections between Lake Michigan and the Illinois River as depicted in Plates 1 and 2. Plate 1 depicts the Chicago waterways as they were in 1830. In the first decade of the Twentieth Century, the process of diverting the Chicago waterways from their historic flow **into** Lake Michigan (with a portage required to enter the Mississippi River basin) began. By 1930, the system had been re-plumbed (Plate 2) diverting water **from** Lake Michigan and sending it downstate into the Mississippi River drainage (Ryder, 1995).

For the past 30 years or so, there has been a concerted effort to clean up pollution. At one time, the pollution in the Chicago waterways constituted an impenetrable barrier through which very few organisms of any type, native or non-native, deliberately or unintentionally introduced, could pass (principally because of lack of dissolved oxygen). This is no longer the case. The zebra mussel, in one or two years after it invaded Lake Michigan, invaded the interior of Illinois, reached the Mississippi River and went upstream to the Minneapolis/St. Paul area. Striped bass (*Morone saxatilis*) and hybrid striped

bass were reported by anglers in southern Lake Michigan last year, possibly from the Illinois River system. Grass carp (*Ctenopharyngodon idella*) are already present in the Great Lakes (Mills, et. al., 1991). A rainbow trout (*Oncorhynchus mykiss),* tagged in Lake Michigan, was caught two years ago in Louisiana. The Great Lakes Basin, practically speaking, now includes some 31 states in the Mississippi River basin plus the Province of Ontario. It is an open system with organisms free to travel in either direction.

From the south, as escapees from aquaculture, grass carp (*C. idella*) and bighead carp *(Hypophthalmichthys nobilis)* have become established in our big rivers and silver carp (*H. molitrix*) are commonly caught by our commercial fishery. Black carp (*Mylopharyngodon piceus*) also escaped from Arkansas aquaculture in 1993 into the Mississippi Basin. These threaten the Mississippi Basin as well as Lake Michigan with unknown ecological consequences. *Daphnia lumholtzi* seems poised to enter the Great Lakes through southern Lake Michigan if it has not already done so.

Lake Michigan has been invaded by most of the species mentioned above and it is only a matter of time before others, such as ruffe, make their appearance.

The Mississippi basin has been invaded in the other direction (from Lake Michigan) by white perch, the zebra mussel, and the round goby, which has penetrated some 12 miles inland through the Cal-Sag channel. The white perch reached the Illinois waters of Lake Michigan by 1988 and recently have been captured in the Calumet River, the Illinois River and the Mississippi River in extreme southern Illinois (Laird and Page, 1996) (See Table 1).

Dispersal Barriers for Invasive Nuisance Species. Several proposals have been submitted to develop and test dispersal barriers that would reduce the exchange of nuisance aquatic species between the Mississippi and Great Lakes-St. Lawrence drainage basins. The efforts have been coordinated by an executive committee with representation from the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Illinois Environmental Protection Agency, the Illinois Department of Natural Resources, Illinois-Indiana Sea Grant, and the Metropolitan Water Reclamation District of Greater Chicago. The executive committee is advised by a panel with broad representation from governmental organizations, waterway and lake user groups, and other non-governmental organizations.

Phased Development and Deployment: Phases I and II. The development of the dispersal barrier will proceed in three phases. Phase one will be an electrical barrier to deter the passage of bottom-dwelling fishes such as the round goby. Phase two would raise the height of the electrical barrier to cover the entire water column and deter all fish large enough to swim away from the electrical field (larval fish are incapable of swimming upstream against even moderate currents). The first two phases would not prevent eggs, larvae and zooplankton from drifting through the electrical field, a problem that Phase III would address.

Phase III. The third phase would require that the nuisance species be killed. Field and lab testing of physical and chemical control techniques are underway, but will require some additional funding.

Cost. The total cost of the Phase I dispersal barrier is estimated at $839,000, including some small scale field trials and lab tests already completed in 1998, and assessments of effectiveness to be completed following construction of the barriers (Philip Moy USACE, pers. comm.). The current cost estimate for construction of the first demonstration barriers in the Chicago Sanitary and Ship Canal at Illinois Waterway Mile 302.2 is $420,000. The total funds available (Congressional appropriations to the USACE) are approximately $570,000, so the design and engineering work is proceeding. It is encouraging that the barrier project is proceeding, but it is difficult to estimate the costs of projects that

include experimental elements, so supplemental funding may be necessary. Costs of the Phase II and III barriers have not been estimated, but costs generally increase with greater effectiveness (reliable blockage of a broad spectrum of invasive nuisance species).

Native species

Any number of native Lake Michigan species could enter Illinois= river systems and vice-versa. The potential ecological impacts of such transfers are difficult to predict. Species that already exist in both drainages could present problems if they change drainages, problems such as competition between different strains and hybridization. Hybridization can cause problems because the offspring are less capable of surviving. For example, river fish that are adapted to warm water could hybridize with Lake Michigan fish which are cold water adapted, resulting in young that survive less well in either temperature regime.

Table 1. ANS in or poised to enter Mississippi Drainage via Chicago waterways and Illinois River

High risk of rapid invasion	**Origin and possible effects**
round goby *Neogobius melanostomus*	Already in the Calumet River, may prefer rivers. Origin: Europe. **Likely to displace sculpins, darters, log perch, steal bait, interfere with lake trout restoration and reproduction of river fishes by egg predation**.
rusty crayfish *Orconectes rusticus*	Abundant in near shore areas of southern Lake Michigan. Origin: Native to southern Indiana. **Displaces native crayfish, consumes native plants and fish eggs, can alter food chains.**
spiny water flea *Bythotrephes cederstroemi*	Abundant in open waters of southern Lake Michigan. Origin: Europe. **Aggressive predator, may displace native predatory cladocerans, reduce food supply for juvenile native fishes.**
white perch	Spreading westward in the Great Lakes, it

Morone americana	has invaded the Mississippi River basin. Origin: Quebec and the Atlantic Slope drainages. It may have invaded Lake Ontario following the construction of the Erie Canal (Page and Burr, 1991). Common in the Illinois River, found in the Mississippi River to its junction with the Ohio River. It could have spread south from Lake Michigan and northward from the Gulf of Mexico. **Effects on the river ecosystems unknown.**
hydrozoan *Cordylophora caspia*	Already common in the Illinois River main channel and backwater lakes, also in the Des Plaines River and in southern Lake Michigan. It is already widespread in European and North American coastal rivers. Apparently introduced to U.S. in the 1800's. Origin: Caspian and Black Seas. **Effects largely unknown. Could foul native mussels and clams, intakes, and pipes.**
Medium risk - later invasion	
ruffe *Gymnocephalus cernuus*	In western Lake Superior, recently moved to Lake Huron, probably will spread through Great Lakes. Origin: Europe. **Competes with yellow perch, other planktivorous fish; predicted to devastate sport/commercial fisheries.**
European rudd *Scardinius erythrophthalmus*	Confined to Lake Ontario and its tributaries. Origin: Europe **Could compete with native minnows.**
tubenose goby	In St. Clair River--no sign of spreading so

Proterorhinus marmoratus	far. Origin: Black Sea area **Unknown effects.**
Unknown risk	**Abundant in L. Michigan for decades; may eventually invade the Mississippi basin.**
alewife *Alosa pseudoharengus*	**Competes with other planktivorous >forage= fish. Massive, sporadic die-offs can create public nuisance on beaches.**
rainbow smelt *Osmerus mordax*	**Competes with other planktivorous >forage= fish.**
sea lamprey *Petromyzon marinus*	**Parasite/predator of salmonids and other valuable fishes, extremely costly to control.**

Table 2: ANS poised to enter or that have entered the Great Lakes-St. Lawrence Drainage via the Chicago waterways and Illinois River.

High risk of rapid invasion	**Origin and possible effects**
grass carp, white amur *Ctenopharyngodon idella* (already reported in Great Lakes)	Origin: NE Asia (Amur River), stockings. **May compete with herbivorous waterfowl for submersed aquatic vegetation; may limit efforts to re-vegetate barren shallows.**
striped bass *Morone saxatilis* (already reported in Lake Michigan)	Origin: coastal Atlantic, Pacific, and Gulf of Mexico, stockings. **May compete with other top level predators already introduced to the Great Lakes and deplete forage base.**

white bass x striped bass hybrids *Morone chrysops x Morone saxatilis* (already reported in Lake Michigan)	Origin: fish hatcheries, stockings. **May compete with other top level predators. May increase the population of striped bass by backcrossing with pure striped bass.**
a spiny zooplankter (no common name) *Daphnia lumholtzi* (reported in Chicago waterways)	Origin: SE Asia, Africa. **May displace native zooplankters. May not replace native zooplankters as food for larval fish because of its large, defensive spines.**
Medium risk - later invasion	
bighead carp *Hypophthalmichthys nobilis*	Origin: south and central China, aquaculture. **May compete with native fishes (larvae and adults) that consume zooplankton.**
silver carp *Hypophthalmichthys molitrix*	Origin: China, aquaculture. **May compete with native fishes (larvae and adults) that consume zooplankton.**
Unknown risk	
black carp, black amur, snail carp, Chinese roach *Mylopharyngodon piceus*	Origin: east Asia (Amur River to Vietnam), aquaculture. **Will consume native mussels, clams, and snails, as well as zebra mussels, possibly endangering several native mollusk species.**
dark falsemussel *Mytilopsis leucophaeata*	Origin: Atlantic coast. **A fouling organism, like the zebra mussel. Requires brackish water to spawn, so appears unlikely to spread.**

POLICY BACKGROUND

The prevention and control of aquatic nuisance species have global implications that require policies and programs at various levels of government. The following overview of the federal *Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990* (P.L. 101-646) (NANPCA); re-authorized and amended by the *National Invasive Species Act of 1996* (P.L. 104-332) (NISA), delineates the basic role of federal, regional and state government in the act=s implementation. NANPCA has served as an important resource in the development of Illinois= State ANS Management Plan. The following also

includes a brief overview of Illinois= laws and regulations that address the prevention and control of ANS species.

Federal Role

NANPCA is the federal legislation that calls upon each state to develop and implement a comprehensive state management plan for the prevention and control of aquatic nuisance species. The act, established for the prevention and control of the unintentional introduction of nuisance nonindigenous aquatic species, is based on the following five objectives as listed in section 1002 of NANPCA:

> to prevent further unintentional introductions of nuisance 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 created in response to the zebra mussel invasion of the Great Lakes, where this ballast water introduction has caused serious ecological and socioeconomic impacts. Although the zebra mussel invasion of the Great Lakes has played a central role in prompting passage of federal legislation, NANPCA has been established to prevent new ANS introductions and to limit the dispersal of aquatic nuisance species already in U.S. waters.

The national ANS Task Force, co-chaired by the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration, was established under Section 1201 of NANPCA to coordinate governmental efforts related to nuisance nonindigenous aquatic species in the United States with those of the private sector and other North American interests. An important role of this federal group in the implementation of NANPCA is to facilitate 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 entities) has adopted the Aquatic Nuisance Species Program under Section 1202 of the act, which recommends the following essential elements:

> **Prevention**: Establish a systematic risk identification, assessment and management process to identify and modify pathways by which nuisance nonindigenous aquatic species spread.
>
> **Detection and Monitoring**: Create a National Nuisance Nonindigenous Aquatic Species Information Center to coordinate efforts to detect the presence and monitor the distributional changes of all nuisance nonindigenous aquatic species, to identify and monitor native species and other effects, and to serve as a repository for that information.
>
> **Control**: The task force or any other potentially affected entity may

> recommend initiation of a nuisance nonindigenous aquatic species 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 and the Brown Tree Snake Control Committee.

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. U.S. regulations control the discharge of ballast from all vessels entering Great Lakes waters, thus far the only region in the United States to be regulated. The U.S. Coast Guard has enforced the regulations since May, 1993, with active assistance from the Canadian Coast Guard and Seaway authorities. As of November, 1997, the Canadian federal government has yet to enact federal ballast water management regulations; voluntary guidelines are in place. The Coast Guard is currently working to address the fact that vessels reporting Ano ballast on board@ or NOBOB (77% of the vessels entering the Great Lakes) do carry some residue that eventually can enter the system when water is exchanged with the Great Lakes. A federal research program is examining innovative technology for 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 six fold: 1) identify Great Lakes ANS priorities; 2) make recommendations to the national ANS Task Force; 3) assist the ANS Task Force in coordinating federal programs within the Great Lakes region; 4) coordinate, where possible, aquatic nuisance species program activities in the Great Lakes region that are not conducted pursuant to NANPCA; 5) advise public and private individuals and entities on ANS control efforts; and 6) submit annually, a report to the ANS Task Force describing prevention, research and control activities in the Great Lakes Basin.

State Role

Two state management plans for aquatic nuisance species are addressed in Section 1204 of NANPCA. Section 1204 (A) requires that the comprehensive management plan Aidentifies 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 associate with aquatic nuisance species.@ Section 1204 (B) addresses the public facilities plan. 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 nuisance 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 comprehensive 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 plan is 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.

Illinois= Authorities and Programs

Illinois currently has a number of statutes and administrative rules with which it addresses or potentially can address the issue of prevention and control of nuisance nonindigenous aquatic species. These were developed ten years ago, in response to introductions or potential introductions of ANS species by the bait industry and/or aquaculture. It was clear that our response time to ANS species introductions or potential introductions was slow. It was also clear that many of the unintentional ANS introductions were beyond a single state=s power to control. However, a comprehensive and coordinated approach was needed for introductions that were controllable. This prompted the development of legislation, amendments to the Fish Code of Illinois, and the promulgation of 17 Ill.ADM.Code 870 (Administrative Rule 870).

The Aquaculture Development Act was passed by the legislature and signed into law by Governor Thompson in September, 1987. By the end of 1988, Administrative Rule 870 was fully developed, and the first aquaculture licenses were issued. These laws and rules addressed those aspects of potential ANS introduction that could be brought under our control with regulations, available resources and manpower. These regulations have been well received by the aquaculture, bait industry, and others who see them as useful, and reasonable. ANS introductions that have occurred since that time have been those which are beyond the reach of a single state to control. These regulations do not address the aquarium industry. The most reasonable control on this industry is at the point of entry into the country, which in Illinois is U.S. Customs at Chicago=s O=Hare International Airport.

The Aquaculture Development Act defined aquaculture as agriculture. The Department of Agriculture became the lead agency for the promotion of aquaculture and the Department of Conservation (now the Dept. of Natural Resources) the regulatory agency. As a result of this act, the Dept. of Conservation developed Administrative Rule 870, whose title is AAquaculture, Transportation, Stocking, Importation And/Or Possession of Aquatic Life@. This rule was developed under the authority of the **Fish and Aquatic Life Code, [515 ILCS 5].**

Part 870 establishes the aquaculture permit and the Aquatic Life Approved Species List. This is a comprehensive list of species, developed with input from all the stakeholders, which will be considered approved for aquaculture, transportation, stocking, importation and/or possession in the State of Illinois. An aquaculture permit is automatically granted to persons wishing to raise species on the list. This list includes amphibians, reptiles, crustaceans, mollusks, gastropods, fish and plants. If a species does not appear on this list, it is illegal to import/possess, unless the person has an aquaculture permit granted by the DNR and a separate letter of authorization to import/possess for each species not on the list.

The letter of authorization is granted on a case by case basis, by the DNR Chief of Fisheries after

receiving advice of the Aquaculture Advisory Committee (AAC). The AAC is established by administrative rule 870. It consists of representatives of the DNR Divisions of Fisheries (Chair), Wildlife Resources, Natural Heritage, Natural History Survey, Law Enforcement, the President of the Illinois Aquaculture Industry Association, the Aquaculture Coordinator of the Department of Agriculture, the Director of Southern Illinois University=s Fisheries Research Laboratory, and the Chief of the Division of Food, Drugs and Dairies of the Department of Public Health. The committee finds by majority vote, advising the Chief of Fisheries on the acceptability of the risk of a given species for aquaculture. The committee establishes criteria for siting of aquaculture facilities, operational rules and their water management in the case of species not on the list.

Administrative Rule 870 also establishes a restricted species transportation permit for the movement of grass, bighead, and silver carp, and a salmonid import permit requiring disease certification before the permit may be issued to the importing hatchery.

To reinforce Administrative Rule 870, (because of a recent interpretation from the DNR legal department), additional prohibitions of the use of ANS species **as bait** appear in 17 Ill.ADM.Code 810 (Administrative Rule 810), which governs sport fishing.

Under these regulations, we in Illinois feel that we have very good control of aquaculture introductions and have experienced no problems since their adoption in 1988.

The Illinois Exotic Weed Act, designated 525 ILCS Sec. 10/1-5 defines purple loosestrife *Lythrum salicaria* to be an exotic weed and makes its sale or propagation illegal except by permit from the IL DNR. Said permit will only be issued for the purpose of experiments into controlling or eradicating plants declared as exotic weeds.

MANAGEMENT ACTIONS

The goals of Illinois= State Management Plan are designed to address different stages of ANS invasion: 1) the introduction of the nuisance 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 Illinois water bodies; and 3) the colonization of ANS populations within water bodies, including the harmful impacts resulting from colonization.

The three goals of Illinois= State Management Plan for ANS are:

> **Goal I:** Preventing new introductions of nuisance nonindigenous aquatic species into the Great Lakes and the Mississippi Basin waters of Illinois.
>
> **Goal II:** Limiting the spread of established populations of nuisance nonindigenous aquatic species into uninfested waters of the state.
>
> **Goal III:** Abating harmful ecological, economic, social and public health impacts resulting from infestation of nuisance nonindigenous aquatic species.

Goal I: Preventing new introductions of nuisance nonindigenous aquatic species into Lake Michigan and the Mississippi Basin of Illinois.

Problem: The introduction of nuisance nonindigenous aquatic species into the Great Lakes region, including inland state waters, can cause environmental, socioeconomic and public health impacts.

Potential public health impacts include the introduction of disease organisms such as cholera, or intermediate hosts that serve as vectors for the parasites and diseases of humans and of domesticated and native species. For example, the Asian tiger mosquito (*Aedes albopictus*) can serve as the intermediate host for the virus disease, dengue hemorrhagic fever (Burrows, et.al., 1973). Medical entomologists believe the tiger mosquito was introduced to the Chicago region in shiploads of used tires from Malaysia that were brought to a recycling plant. Eggs, the aquatic larvae and adults of the tiger mosquito were hiding in the used tires, some of which contained rainwater.

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. Also, a delayed Acrisis-response@ approach often limits the vision and opportunity for the prevention of new introductions, leaving the region with ANS management problems that are economically costly, technically challenging and frequently irreversible. Although 139 known nonindigenous aquatic species already have been introduced into the Great Lakes and Mississippi Basin ecosystems, new introductions are highly likely. The prevention of new introductions is critical in ameliorating ANS problems in the Great Lakes region, the Mississippi Basin and individual states. **Overall cost effectiveness dictates that the emphasis should be placed on prevention of new introductions rather than that of attempting after-the-fact control of harmful organisms.**

Multiple mechanisms transport aquatic nuisance species into the Great Lakes and Mississippi Basin waters; some mechanisms transcend the authority of a single state to control. A prime example is ballast water discharge from transoceanic shipping, the largest source of nuisance nonindigenous aquatic species invasions worldwide (Carlton, 1985). The lack of any binding international authority creates a problem regulating transoceanic shipping. This shipping is the vector of many of the aquatic nuisance species to the Great Lakes and the Mississippi Basin. Cooperative efforts are necessary between state, federal (i.e., Coast Guard) 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 NOBOB (Weathers and Reeves, 1996) compared to 51.8 % in 1990 (Locke, et al., 1991). These figures are based on vessels giving voluntary reports. Over time (1993-1996), an increasing number of vessels entering the Great Lakes in ballast had made the required mid-ocean exchange with salt water, helping to alleviate, but not eliminate ANS. Problem cases (i.e., vessels which have made no attempt at compliance) have gone from 7.4% in 1993 to 4.9% in 1996. Current regulatory policy ensures that at least 85% exchange of ballast water takes place, although 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 Mississippi Basin waters. Research on prevention strategies to minimize ANS transport, such as innovative ballast water management technology, is critical in the effective prevention of ANS introductions. **Ongoing studies by the U.S. and Canadian Coast Guards indicate that it is especially important to deal with the residual, unpumpable ballast water and sediment in the tanks of vessels entering the Great Lakes. This medium, potentially harboring a variety of ANS, is often mixed with Great Lakes fresh water and discharged at another Great Lakes port.** A sample during the 1995 navigation season suggests that 40% of the vessels entering with NOBOB engaged in a cross transfer with unpumpable ballast water (Weathers and Reeves, 1996). **A 1991 Canadian Study found vessels with only unpumpable ballast water were carrying on average 157.7 metric tons (41,600 gal.) of water.** To achieve more effective emptying or flushing of these tanks, the feasibility of altering current ballast tank design needs to be examined (OHIO DNR, 1996).

Other significant transport mechanisms increasing the potential for new introductions of ANS into the Great Lakes and the Mississippi Basin waters include the aquaculture business, commercial barge

traffic, recreational boating, the bait industry, the pet shop trade, plant nurseries and fish stocking activities. In Illinois, steps have been taken to bring those ANS transport mechanisms that are within the authority of the State to control, under our control. These include DNR regulation of the aquaculture business and fish stocking, the Aquatic Life Approved Species List (all aquatic life not listed requires special permission to import/possess), and an active information and education program (I&E) supported by IL-IN Sea Grant funding, to inform and enlist the aid of recreational boaters in preventing the spread of ANS. We do not have a wild bait industry.

Strategic Action 1-1: In partnership with other states, develop state-specific and regional listings of aquatic nuisance species that have the potential to infest the Great Lakes and Illinois waters. As part of this cooperative effort, identify existing and potential transport mechanisms that facilitate new ANS introductions.

Task 1-1a: Research and support research on the movement and transport of ANS on a global scale and use the findings to help predict potential viable ANS invasions of the Great Lakes and Mississippi Basin waters.

Strategic Action 1-2: Cooperate with and support interjurisdictional approaches to facilitate legislative, regulatory and other actions needed for the prevention of new ANS introductions into the Great Lakes and Mississippi Basin waters of Illinois.

Task 1-2a: Continue participation in interjurisdictional coalitions (Great Lakes Panel, Great Lakes Fishery Commission, International Joint Commission & others) among the Great Lakes states to promote federal legislation and programs for the prevention of new ANS introductions into the region and state.

Task 1-2b: Support the interjurisdictional process to ensure compatibility between Great Lakes states, Mississippi Basin states, and between states and federal agencies.

Task 1-2c: Participate and cooperate in the development of a Great Lakes regional approach (Great Lakes Action Plan for ANS Prevention and Control) through the Great Lakes Panel on ANS and a Mississippi River Basin approach through MICRA and UMRCC to prevent new introductions of ANS into the Great Lakes and Mississippi Basin waters of Illinois.

Strategic Action 1-3: Illinois has enacted effective state legislation and regulations to prevent new ANS introductions into Illinois waters, including Lake Michigan, inland waters and the Illinois, Mississippi and Ohio rivers.

Task 1-3a: Illinois has established an interagency task force (with input from public and private sectors) to review and recommend statutory and regulatory changes for legislative consideration (**Aquaculture Advisory Committee** [AAC]).

Task 1-3b: The Illinois AAC should develop and implement an Information and Education outreach program that informs relevant groups of the regulations, their rationale and compliance procedure.

Task 1-3c: The Illinois AAC should review, recommend and implement effective enforcement

programs.

Strategic Action 1-4: Develop and maintain monitoring programs in Lake Michigan and the Illinois, Mississippi and Ohio rivers to provide for the early detection of infestations of ANS.

Task 1-4a: Inventory and coordinate information from existing monitoring programs.

Task 1-4b: Recommend implementation and work to develop additional monitoring techniques if needed.

Strategic Action 1-5: Conduct or support research and actions for prevention of new introductions of ANS into the waters of Illinois.

Task 1-5a: Determine the transport mechanisms potentially responsible for new ANS introductions into the waters of Illinois. Develop preventive action plans.

Task 1-5b: Examine trophic changes and habitat alterations in the Great Lakes region to predict the potential effect of new ANS introductions.

Strategic Action 1-6: Develop and conduct an effective information and education program on the prevention of new ANS introductions into the waters of the state.

Task 1-6a: Participate in the activities of the Great Lakes Panel=s Education Committee.

Task 1-6b: Evaluate effectiveness of the information/education program.

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

Problem: A successfully established nuisance nonindigenous organism in any large ecosystem should be regarded as **impossible to eradicate**. The spread of established populations of ANS into uninfested waters of the state is often via human activity, such as boat transfers, ballast exchange, bait handling, water transport, and ornamental and landscape practices. Limiting the spread is problematic due to 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 many of the existing infestations of ANS in Lake Michigan, the inland waters of Illinois and the Illinois, Mississippi and Ohio rivers and why they cause 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 and education program is needed to explain 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. Information and education programming is also critical to

strengthening public and private support for statewide participation in ANS management strategies.

It is also difficult to manage the spread of ANS since infestation frequently occurs in drainage basins that include more than one state. Cooperation among the Great Lakes states and the Province of Ontario, which share ANS infested basins, is needed to implement management strategies that may more effectively limit the spread of ANS populations.

Strategic Action 2-1: Identify and prioritize ANS whose spread should be limited.

Task 2-1a: Present this task to the Aquaculture Advisory Committee in Illinois to guide in the selection of ANS that merit management.

Strategic Action 2-2: Monitor the spread of those ANS determined to be of high priority.

Task 2-2a: Coordinate a monitoring program in Lake Michigan, the Illinois, Mississippi and Ohio Rivers and the inland waters of Illinois that will indicate or document the spread of ANS.

Task 2-2b: Develop identification materials for each ANS that is being monitored to facilitate participation of all stakeholders.

Strategic Action 2-3: Develop and implement control strategies to limit the spread of each ANS determined to be a state priority.

Task 2-3a: Develop control strategies to limit the spread of ANS into state waters, based on current Illinois law.

Task 2-3b: Implement the strategies developed to limit the spread of ANS in the state and establish cooperative policies with states sharing basins to limit the spread of ANS populations.

Task 2-3c: Establish dispersal barriers at the Chicago waterways, a gateway to ANS introductions from the Great Lakes into the Mississippi Basin and from the Mississippi Basin into the Great Lakes.

Strategic Action 2-4: 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, targeted groups should be informed on how the spread of ANS threatens the health of a diverse native aquatic community and other harmful ANS impacts. Volunteer groups such as lake management associations and outdoor recreation groups should be actively involved in these outreach efforts.

Task 2-4a: The Great Lakes Panel on ANS Education Committee is currently assessing existing ANS information and education programs (DNR, Sea Grant, and Cooperative Extension) on the spread of ANS populations. Build on the strengths and address the weaknesses of these programs.

Task 2-4b: Identify pathways that disperse ANS and inform these groups on practices that limit the spread. This outreach program should focus on changing the behavior of user groups to limit the spread of targeted ANS populations in the waters of Illinois.

Task 2-4c: 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 how to improve ballast management practices to impede the transfer of ANS from one Great Lake to another.

Task 2-4d: Ensure that where appropriate, public access points such as harbors, boat ramps and marinas have interpretive displays that include information about ANS.

Task 2-4e: Establish monitoring/tracking programs to evaluate the effectiveness of information/education efforts.

Strategic Action 2-5: Utilize effective state regulations to limit the spread of ANS within the state.

Task 2-5a: This task was completed with the establishment of the Aquaculture Advisory Committee, which is already in place and functioning.

Task 2-5b: Develop and implement an outreach program.

Task 2-5c: Review, recommend and implement effective enforcement programs.

Strategic Action 2-6: Support and 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 2-6a: Prioritize research needs to help in establishing program structure.

Task 2-6b: Conduct priority research, or promote the conduct of such research via federal research initiatives, academia, or the private sector.

Task 2-6c: Develop a technology transfer program to be used in distributing research findings such as the Great Lakes Information Network (GLIN)

Task 2-6d: Research, develop and test an advanced dispersal barrier in the Chicago waterways that will reduce transfer of ANS between the Great Lakes and Mississippi Basins.

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

Problem: The infestation of ANS in the Great Lakes and the Mississippi Basin 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 to limit 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 nuisance 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 Michigan, the inland waters of Illinois and the Illinois, Mississippi and Ohio rivers provide valuable economic benefits for Illinois, including commercial and sport fisheries, recreational use, and water usage by manufacturers, industry and electric power companies. Some introduced nonindigenous species to the Great Lakes/state have provided **enormous** 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 and the Illinois and Mississippi rivers, incurring extensive monitoring and control costs.

The Eurasian water milfoil forms thick mats on the surface of water and can interfere with many types of water recreational activities, such as fishing, swimming, water skiing and sailing. A weevil, *Euhrychiopsis lecontei,* native to Illinois, has shown some promise as a biological control agent, reducing the populations of this invader (Sheldon, 1996). The invasion of the ruffe in Duluth/Superior Harbor appears to be following the same pattern that it has followed in England, Scotland and Germany. Within a few years, they increase exponentially to become the most abundant fish. There is still no verified evidence that ruffe are in direct competition with other fish species (Tom Busiahn USFWS, pers. comm.). The door is open at the southern end of Lake Michigan. The consequences of the ruffe spreading into the Mississippi River system are unknown and unpredictable.

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 such as cholera, shistosomiasis (Bilharzia), Asian liver fluke and others from occurring in Lake Michigan, the inland waters of Illinois and the Illinois, Mississippi and Ohio rivers. The Chinese mitten crab, recently found in the Great Lakes, is an intermediate host for the Asian (human) liver fluke. The fluke has shown up in mitten crabs in some locations on the west coast. Fortunately for the residents of the Great Lakes region, the crab is unlikely to maintain populations in the Great Lakes, unless there are continued introductions in ballast water, because the adults must migrate to brackish water in order to spawn.

Strategic Action 3-1: Assess the ecological, socioeconomic and public health impacts of ANS in Lake Michigan, the inland waters of Illinois and the Illinois, Mississippi and Ohio rivers . Use this assessment as guidance to develop action levels that warrant implementation of control strategies.

Task 3-1a: Identify and assess economic value and resource implications for each ANS.

Task 3-1b: Identify the ANS that should be targeted for abatement strategies because they threaten the public safety, human health and ecological integrity of the waters of Illinois.

Strategic Action 3-2: 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.

Task 3-2a: Establish protocols that will provide guidance in designing and implementing control strategies. The following principles should be incorporated:

> **The control strategy must not create greater problems than those related to the ANS themselves.**
>
> **A control strategy must be well focused and not have serious, long term impacts to the environment or non-target organisms.**
>
> **There must be a need to control the ANS due to causing, or the potential of causing adverse impacts.**
>
> **The control strategy must not threaten human health or reduce the long term human utilization of the water body. The proposed dispersal barrier in the canal system at Chicago is a special case. The barrier might use warm water or a carefully selected toxicant, such as chlorine or glutaraldehyde (which degrades rapidly to harmless carbon dioxide) to kill aquatic organisms in a very restricted (a few hundred yards) section of the waterway, to prevent the exchange of invasive, nuisance species between the Great Lakes and Mississippi basins. Chemicals or warm water would be used in combination with a non-lethal electric barrier designed to deter fish from entering the treated area. The barrier system would have to be designed so that it would be harmless to humans who accidentally fall into the treated area (e.g., if chlorine were used, it would be no more concentrated than in a swimming pool).**
>
> **Control efforts should be directed against the areas significantly impacted and not be broad or general in nature.**
>
> **The control strategy must have a reasonable likelihood of succeeding.**

Task 3-2b: Support/coordinate scientific research between state and federal agencies and academic institutions that investigate potential control strategies and associated environmental impacts. Develop a technology transfer program to be used in distributing research findings. Specifically, develop and test dispersal barriers in the Chicago waterways and assess applicability in reservoirs and other locations where nuisance species threaten to expand their ranges.

Strategic Action 3-3: Develop and implement means of learning to live with infestations of ANS where effective control and eradication are not feasible.

Task 3-3a: Support/coordinate scientific research between state and federal agencies and academic institutions that investigate the potential means to coexist with infestations of ANS. Develop a technology transfer program to be used in distributing research findings.

Task 3-3b: Actively seek potential beneficial and alternative uses for these ANS and disseminate this information through a technology transfer program (GLIN).

Strategic Action 3-4: Conduct an information/education program providing information on ANS impacts and related control strategies. Utilize existing groups/programs responsible for information dissemination when appropriate.

Task 3-4a: 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 aquatic nuisance species problems.

Task 3-4b: Establish monitoring/tracking programs to evaluate the effectiveness of information/education efforts.

Strategic Action 4-1: Illinois ANS program monitoring, evaluation, oversight, and distribution.

Task 4-1a: The coordinator (to be named) is to prepare an annual report to the DNR Director and distribute to the Task Force and the constituencies.

Task 4-1b: The coordinator (to be named) is to coordinate the dissemination of the annual report through the DNR Information Services, IL-IN Sea Grant and the Natural History Survey.

Task 4-2: The annual report will be disseminated to the constituencies.

TABLE 3: ILLINOIS INVASIVE SPECIES MANAGEMENT PLAN AND TIMETABLE FOR YEARS 1-5

Tasks	Name, Agency	Year 1	Year 2	Year 3	Year 4	Year 5
0-0: Hire full time coordinator to oversee implementation	*Conlin - F Thomas - INHS	Write job specs, advertise, interview and hire. See Appendix I for suggested job specs. $36.9K / annum.	Coordinator takes over development and revision of the management plan and timetable, subject to appropriate public and technical review. Prepares and disseminates annual report. $38.4K /	Coordinator takes over development and revision of the management plan and timetable, subject to appropriate public and technical review. Prepares and disseminates annual report. $39.9K / annum	Coordinator takes over development and revision of the management plan and timetable, subject to appropriate public and technical review. Prepares and disseminates annual report. $41.5K / annum	Coordinator takes over development and revision of the management plan and timetable, subject to appropriate public and technical review. Prepares and disseminates annual report. $43.2K / annum

			annum			
1-1a: Predict invasions **In general, Goal I tasks are considered as first priority.**	Schneider - NHS * Sparks	Review historical data on invasions $15K	Develop invasive species profile $22K	Assess risk $20K		
1-2a: Cooperate to prevent new introductions	*Conlin - F GLC GLFC MICRA - Bertrand UMRCC - Bertrand UMRBA	Solicit political support for ANS dispersal barrier development to protect Mississippi R. basin. **See 3-2b.**	Solicit financial assistance to aid in operation of dispersal barrier. **See 3-2b.**	Lobby congress for funding to develop Phase II of the dispersal barrier. **See 3-2b.**	Begin construction Phase II. **See 3-2b.**	Evaluate effectiveness of Phases I and II, finalize plans for Phase III. **See 3-2b.**
1-2b: Support interjurisdictional compatibility	Conlin - F	Distribute IL ANS plan to MICRA, UMRCC, Great Lakes Panel on ANS, UMRBA	Encourage other jurisdictions to help us close the door to ANS invasion.			
1-2c: Participate in Great Lakes and Mississippi Basin regional approach	*Conlin - F *Bertrand - F GLFC rep *Trudeau - F UMRCC - Bertrand Pescitelli - F	Present need for ANS action to UMRCC, MICRA ANS Committee. Cost, $0.8K for 2 people for 2 ad hoc committee meetings.	Present ad hoc ANS comm. suggestions to MICRA. Request they consider those measures for their states. Offer travel to other UMR personnel to view Illinois ANS measures. $1.2K travel.	Annual meeting MICRA ANS ad hoc committee to coordinate and assess progress. $0.4K travel expense for two people annually.	Annual meeting MICRA ANS ad hoc committee to coordinate and assess progress. $0.4K travel expense for two people annually.	Annual meeting MICRA ANS ad hoc committee to coordinate and assess progress. $0.4K travel expense for two people annually.
1-3a: Interagency task force to recommend statutory and regulatory changes	*Conlin - F DNR - Aquaculture Advisory Committee Horner - F	Aquaculture Advisory Committee to review current statues and regulations regarding ANS.	Complete review, recommend changes as deemed necessary.	Promulgate new or edit existing rules as deemed necessary by committee deliberations.	Meet annually for review.	Meet annually for review.
1-3b: Develop		Youth educ. in	Youth educ.	Develop new	Use new	Use new

information/education outreach program	Charlebois - NHS -IL-IN Sea Grant	informal settings and formal classes, id cards, signs, guides, PSAs $17.3K	in informal settings and formal classes, id cards, signs, guides, PSAs $37.9K	curricula. Youth ed. in informal settings and formal classes, id cards, signs, guides, PSAs $74.2K	curricula. Youth ed. in informal settings and formal classes, id cards, signs, guides, PSAs $76.4K	curricula. Youth ed. in informal settings and formal classes, id cards, signs, guides, PSAs $78.7K
1-3c: Implement effective enforcement programs	*DNR - Law DNR - F Horner	Includes regulatory and educational ($2K) road and boat ramp checks $60K	Includes regulatory and educational ($2K) road and boat ramp checks $62K	Includes regulatory and educational ($2K) road and boat ramp checks $64K	Includes regulatory and educational ($2K) road and boat ramp checks $66K	Includes regulatory and educational ($2K) road and boat ramp checks $68K
1-4a: Inventory and coordinate existing monitoring programs	*Dettmers - NHS Pescitelli - F	Inventory. Intern 3 man mo. $2.5K	Coordinate. Annual sampling, report, web page. $1K	Coordinate. Annual sampling, report, web page. $1.2K	Coordinate. Annual sampling, report, web page. $1.4K	Coordinate. Annual sampling, report, web page. $1.6K
1-4b: Recommend additional monitoring if needed	*Dettmers - NHS	Part of 1-4a	Part of 1-4a	Part of 1-4a	Part of 1-4a	Part of 1-4a
1-5a: Plans to interrupt pathways of introduction	Injerd - OWR * Sparks	Planner and intern, 3 man months each. $11.25K			Planner and intern, 3 man months each. $12K	
1-5b: Predict potential effects of new ANS introductions	Kruse - NH *Schneider - NHS Sparks			Ecologist and modeler, 3 man mo. ea. $20K		
1-6a: Assess and improve ANS information/education programs. **See 1-3b:**	Charlebois - NHS -IL-IN Sea Grant		Great Lakes users= advisory committee assesses program. $3K		Great Lakes users = advisory committee assesses program. $3.2K	
1-6b: Evaluate effectiveness of the information/ education. **See 1-3b:**	Charlebois - NHS -IL-IN Sea Grant	Survey boater knowledge and attitudes. $3K				Survey boater knowledge and attitudes. $3.2K

2-1a: Select ANS that merit management **In general, Goal II tasks are considered second priority.**	Horner - F Stuewe - F *Trudeau - F	Convene Aquaculture Advisory Committee to establish species of concern.	Select those species for which effective action is possible, if any.	Determine actions to be taken and the cost/benefit ratio. Seek funding. $10K.	Implement action program upon funding approval. $12K.	Implement action program upon funding approval. $12K.
2-2a: Coordinate a monitoring program	*Dettmers-NHS Pescitelli - F Trudeau - F	Add on to existing fish sampling & add species-specific sampling. $80K	Continue $82K	Continue $84K	Continue $86K	Continue $88K
2-2b: Develop identification materials for each ANS **See 1-3b:**	*Charlebois-NHS-IL-IN Sea Grant Jeffords - NHS	New id cards and brochures. $3K		Updated id cards and brochures. $3.2K		Updated id cards and brochures. $3.4K
2-3a: Develop **voluntary** control strategies for ANS species of concern.	Conlin, Lynnette Mick Chief Staff DNR - Law	Determine current law; identify beneficial voluntary actions which can be taken by anglers and boaters. Survey agencies and universities for input.	Determine species for which regulatory control is needed (other than that which is already in place). Would these controls be efficacious?	Actions to be determined.	Actions to be determined.	Actions to be determined.
2-3b: Implement an approach to limit the spread of ANS and **cooperate with states sharing basins**.	*Conlin - F *Schneider - NHS *Stuewe	Regional (RA) Administrators to determine whether or not their respective regions have been invaded, by which ANS species and to what extent.	RAs determine the potential for spread and recommend measures which might be taken to limit that spread. Determine best locations for signage at Ahot spots@.	RAs implement ANS monitoring program within their regions, coordinate their programs with each other and other states.	RAs implement ANS monitoring program within their regions, coordinate their programs with each other and other states.	RAs implement ANS monitoring program within their regions, coordinate their programs with each other and other states.
2-3c: Establish dispersal barriers at the Chicago waterways.	*Sparks *USACOE *Thomas Conlin	Study the effectiveness of a Phase I bottom electrical barrier v.s. the round goby.	Select, prepare the site, and install Phase I electrical barrier.	Evaluate Phase I barrier, study the effectiveness of Phase II whole water column barrier v.s.	Initiate installation and operation of Phase II barrier.	Evaluate effectiveness of Phase II barrier.

	USFWS			fish.		
2-4a: Assess and improve existing ANS information/ education programs **See 1-3b**	Charlebois - NHS -IL-IN Sea Grant		Great Lakes Panel=s Ed. Comm., 1.6a conducts assessment		Great Lakes Panel =s Ed. Comm., 1.6a conducts assessment	
2-4b: Outreach program to change behavior of user groups to limit the spread **See 1-3b**	Charlebois - NHS -IL-IN Sea Grant	Covered by 1-3b and 1-5a	Covered by 1-3b and 1-5a	Covered by 1-3b and 1-5a	Covered by 1-3b and 1-5a	Covered by 1-3b and 1-5a
2-4c: Establish a voluntary intra Great-Lake ballast water management program	*OWR, Mike Conlin (Great Lakes Panel) Navigation industry Port authorities					
2-4d: Harbors, boat ramps and marinas for interpretive displays **See 1-3b**	Charlebois - NHS -IL-IN Sea Grant	Covered by 1-3b	Covered by 1-3b	Covered by 1-3b	Covered by 1-3b	Covered by 1-3b
2-4e: Evaluate effectiveness of information/education efforts	Charlebois - NHS -IL-IN Sea Grant	Covered by 1-6a and 1-6b	Covered by 1-6a and 1-6b	Covered by 1-6a and 1-6b	Covered by 1-6a and 1-6b	Covered by 1-6a and 1-6b
2-5a: Aquaculture Advisory Committee reviews and recommends statutory and regulatory changes	*Conlin - F DNR - Law Horner - F	Review	Recommend	Promulgate and implement any changes deemed necessary	Promulgate and implement any changes deemed necessary	Promulgate and implement any changes deemed necessary
2-5b: Develop and implement an outreach program	Charlebois - NHS -IL-IN Sea Grant	Covered by 1-3b	Covered by 1-3b	Covered by 1-3b	Covered by 1-3b	Covered by 1-3b

See 1-3b						
2-5c: Review, recommend and implement effective enforcement programs	*Conlin - F DNR - Law Horner - F	Determine necessity and effectiveness of enforcement programs.	Promulgate and implement any changes deemed necessary	Promulgate and implement any changes deemed necessary	Promulgate and implement any changes deemed necessary	Promulgate and implement any changes deemed necessary
2-6a: Prioritize research needs	Conlin - F Kruse - NH * Sparks Thomas - INHS - OSRA	Review and prioritize research, 2 man mo. $6K				
2-6b: Conduct priority research	* Sparks Thomas - INHS		Assess Species interactions, assess impacts. $60K	Lab and field investigations. $75K	Lab and field investigations, assess 2-6a. $100K	Lab and field investigations, assess 2-6a, 3-3a. $120K
2-6c: Develop a technology transfer program patterned after GLIN.	*Charlebois - NHS-IL-IN Sea Grant	Partner with MICRA, UMRCC. $2K	Partner with MICRA, UMRCC, develop website, tech. transfer $7K	Partner with MICRA, UMRCC, maintain website, tech. transfer $7K	Partner with MICRA, UMRCC, maintain website, tech. transfer $7.2K	Partner with MICRA, UMRCC, maintain website, tech. transfer $7.4K
2-6d: Research, develop and test an advanced (Phase III) dispersal barrier in the Chicago waterways that will reduce the transfer of ANS between the Great Lakes and the Mississippi river basins.	*Sparks Moy USACOE *Thomas Dettmers Injerd	R&D potential chemical agents, ultrasonics, etc. for feasibility of use, efficacy, and environmental impacts. Seek funding.	Assess alternate methods for potential use as Phase III barriers.	Field test promising alternatives to access their use as potential barriers.	Choose the method R&D has shown to be economical and effective, and install the pilot project.	Evaluate effectiveness.
3-1a: Identify and assess economic value and resource implications for each ANS. **In general, Goal III tasks are considered third priority.**	*Schneider - NHS Sparks - NHS Trudeau - F	Assess economic and environmental impacts. $15K	E and e assessment; retarget and adjust plan. $17K			
		$3.2K				

3-1b: Identify the ANS that should be targeted for abatement strategies	*Schneider - NHS Sparks Trudeau - F Horner - F			$3.4K		$3.6K
3-2a: Establish protocols for designing and implementing control strategies	Horner - F Pescitelli - F * Sparks	$2K				
3-2b: Support/coordinate scientific research on control strategies and environmental impacts. Develop technology transfer program	Charlebois - NHS -IL-IN Sea Grant Sparks *Thomas - INHS	Develop and test dispersal barriers, integrated pest management techniques. $168K	Develop and test dispersal barriers, integrated pest management techniques. $173.2K	Develop and test dispersal barriers, integrated pest management techniques. $178.4K	Evaluate and improve dispersal barriers, integrated pest management techniques. $180K	Evaluate and improve dispersal barriers, integrated pest management techniques. $180K
3-3a: Research means to live with infestations of ANS. Develop a technology transfer program	Charlebois - NHS -IL-IN Sea Grant * Sparks	In-plant prevention and control technology. Partner with EPRI, AWWA, etc. $2K	In-plant prevention and control technology. Partner with EPRI, AWWA, etc. $2.2K	In-plant prevention and control technology. Partner with EPRI, AWWA, etc. $2.4K	In-plant prevention and control technology. Partner with EPRI, AWWA, etc. $2.6K	In-plant prevention and control technology. Partner with EPRI, AWWA, etc. $2.8K
3-3b: Seek potential beneficial and alternative uses for ANS. Disseminate this information similar to GLIN.	*Horner - F Charlebois - NHS -IL-IN Sea Grant SIU -C	Assemble Aquaculture Advisory Committee to address this opportunity.	Determine from which ANS lemons lemonade can be made.	Disseminate via GLIN like network.	Inquire from other jurisdictions any successes they may have had along these lines.	Disseminate via GLIN
3-4a: Design programs targeting public agencies; user groups; and communities	*Charlebois - NHS-IL-IN Sea Grant	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2K	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2.2K	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2.4K	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2.6K	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2.8K
3-4b: Evaluate the effectiveness of information/ education efforts	*Charlebois - NHS-IL-IN Sea Grant	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2K	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2.2K	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2.4K	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2.6K	Partner with AWWA, EPRI, IEPA, USACE, IDPH. $2.8K
4-1a: Program monitoring, evaluation, oversight & distribution	Coordinator - Name to be announced	Prepare annual report to DNR Director & distribute to constituency. $1.6K	Prepare annual report to DNR Director & distribute to constituency. 1.7K	Prepare annual report to DNR Director & distribute to constituency. 1.7K	Prepare annual report to DNR Director & distribute to constituency. 1.8K	Prepare annual report to DNR Director & distribute to constituency. !.8K

4-1b: Coordinate dissemination of the annual report	Coordinator - Name to be announced	Disseminate annual report through DNR Information Services, IL-IN Sea Grant and the Natural History Survey	Disseminate annual report through DNR Information Services, IL-IN Sea Grant and the Natural History Survey	Disseminate annual report through DNR Information Services, IL-IN Sea Grant and the Natural History Survey	Disseminate annual report through DNR Information Services, IL-IN Sea Grant and the Natural History Survey	Disseminate annual report through DNR Information Services, IL-IN Sea Grant and the Natural History Survey
4-2: Dissemination	*Coordinator DNR Inform. Services IL-IN Sea Grant Jeffords - NHS	Covered by 4-1	Covered by 4-1	Covered by 4-1	Covered by 4-1	Covered by 4-1
Estimated Annual Cost		$431.95K	$511.3K	$587.9K	$593.5K	$617.9K

*Lead NHS - Natural History Survey

DNR-LAW-Conservation Law Enforcement OSRA-Office of Scientific Research & Analysis

F- Fisheries OWR-Office of Water Resources

GLFC - Great Lakes Fishery Commission UMRBA-Upper Mississippi River Basin Assoc.

NH - Natural Heritage UMRCC-Upper Mississippi River Cons. Comm.

MICRA-Mississippi Interstate Cooperative Resource Association

PROGRAM MONITORING AND EVALUATION

The evaluation process of Illinois= Management Plan will provide a means of monitoring progress, evaluate implementation needs and problems and make necessary Amid-course@ corrections in our progression toward prevention, limitation, utilization and control of ANS. The process involves three main components: oversight, evaluation and reporting.

OVERSIGHT

An oversight committee will be established, consisting of interested parties identified during the review process, various IL/DNR Divisions (Fisheries, INHS, Natural Heritage, OSRA, and OWR), and ILEPA, including members from the original steering committee who authorized 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 also place special emphasis on funding needs to successfully accomplish the goals and associated tasks. This information will prove useful for future program planning purposes. Evaluation should also incorporate information from those groups affected by plan implementation. These include people (organizations) involved with the responsibility of implementing management actions and resource user groups.

REPORTING

An annual report will be prepared and disseminated, highlighting the progress of our management actions. This report will include information on the successes in achieving the goals of prevention, limitation and control of the Illinois Management Plan, as well as future plans and directions. Successes, failures and new directions within Illinois will be evaluated in comparison to other regional plans. This annual report will be made available to the general public, as well as 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 the commercial, agricultural, aquaculture or recreational activities dependent on such waters.

Assistant Secretary: The Assistant Secretary of the Army (Civil Works).

ballast water: any water and associated sediments used to adjust 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.

DNR: Department of Natural Resources.

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.

exotic: see nonindigenous.

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

Mississippi Basin: The 31 states in the Mississippi River drainage.

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

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.

Task Force: The Aquatic Nuisance Species Task Force established under section 1201 of NANPCA (1990).

unintentional introduction: an introduction of nuisance 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 nuisance nonindigenous species in ballast or in water used to transport fish, mollusks or crustaceans for aquaculture or other purposes.

unpumpable ballast: the residue left behind in a vessel=s ballast tanks after ballast water has been pumped out, usually 4-5" in the bottom of the tank.

USACE: United States Army Corps of Engineers.

USFWS: United States Fish and Wildlife Service.

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

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APPENDICES

A. Plate 1, Chicago Area Waterways in 1830 (Ryder, 1995).

A. Plate 2, Chicago Area Waterways in 1930 (Ryder, 1995).

B. MANAGEMENT PLAN STEERING COMMITTEE MEMBERS

UNIT e-mail

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C. Job Description, ANS Coordinator

Classification: Program Administrator

Salary: $36,899/ annum

Job duties: 60%

Manages, plans, coordinates and monitors implementation of statewide Aquatic Nuisance Species prevention, control and abatement strategies; Manages, plans, coordinates and monitors implementation of statewide aquatic life diversity programs; develops and recommends plans for implementation of statewide stream fisheries and watershed habitat management programs; coordinates input from other government agencies and publics; Reviews project performance and technical reports, makes recommendations regarding annual budget development; Manages contracts for watershed ANS projects; Prepares annual report for distribution.

Job duties: 30%

Assists natural resources administrators in implementation of statewide ANS programs; coordinates programs with other state, federal, city and county agencies and other interested organizations; evaluates program goals, objectives, problems and strategies and makes recommendations for their modification; organizes and provides in service training to DNR employees regarding ANS species identification and methods to prevent their spread.

Job duties: 10%

Communicates about fisheries, aquatic life diversity, aquatic nuisance species and watershed management programs to the public, other agencies and DNR employees by writing letters, memos, technical reports and magazine articles; gives public talks, makes slide presentations and participates in radio and TV interviews; attends conferences and gives speeches to interest groups and organizations; maintains contacts with universities, colleges and other educational institutions; Represents the Division on teams/committees with other state, federal and Great Lakes agencies on issues related to Aquatic

Nuisance Species.

Minimum Qualifications: Completion of graduate core program in wildlife or fisheries management, wildlife or fisheries biology or zoology or other related field of study.

D. Nonindigenous Aquatic Nuisance Prevention and Control Act (P.L. 101-646)

E. Public Input Summary