Mazina'igan Supplement

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What's lurking in our waters?

Rising numbers of aquatic invasive species jeopardize aquatic habitats

You can help!

Preventing the spread of aquatic invasive species (AIS) is a responsibility that must be shared across the board in order to stem the flow of exotic species and to keep those that have already established residence from further spreading in our valued water bodies. As the numbers of invasive species grow, so does the impact on lakes, streams and wetlands and the native species who live in those habitats. The impacts on humans vary from a nuisance status to potentially life-threatening status, and most certainly present a significant economic impact in terms of spoiled lakes and the dollars needed to keep the invaders in check. Because the problem continues to grow and requires the cooperation of all individuals, GLIFWC is providing this supplement in an effort to inform people of the problem and what they personally can do to help stem the tide of aquatic invasive species. For further information on AIS, please visit GLIFWC's website at *www.glifwc.org*.

Cover photo credits: top left, Leslie Mehrhoff, University of Connecticut; top right, Charlie Otto Rasmussen, GLIFWC; bottom left, Miles Falck, GLIFWC; bottom right, Doug Jensen, MN Sea Grant.

Aquatic Invasive Species

By Miles Falck, GLIFWC Wildlife Biologist

What is the problem?

Plants, animals and other organisms that find their way into new areas where they do not occur naturally are considered *introduced*, *exotic* or *non-native*. Not all exotic introductions cause long-term problems. Many exotic species are valued for their agricultural and aesthetic qualities, while others persist with little or no ecological impact.

Occasionally when an exotic organism is introduced into an area where it did not previously exist, it is able to flourish and quickly dominate its new surroundings. The term *invasive* is used to describe such species. This insert will focus on *aquatic invasive species* (AIS), organisms that infest and disrupt aquatic ecosystems and adjacent wetlands.

When an organism is introduced into a new area, it often leaves its natural enemies behind. Non-native organisms are prone to become invasive when their populations are no longer controlled by predation, disease or competition. As the population grows, the invasive species uses up more than its fair share of food, space and other limited resources.

Purple loosestrife, Eurasian watermilfoil and curlyleaf pondweed displace native plants, reducing important food and habitat resources for fish, waterfowl and other native species. Zebra mussels, quagga mussels and spiny waterfleas feed on food resources that would otherwise be available for the fry of native fish. The round goby, ruffe and tubenose goby eat substantial quantities of native fish eggs, limiting their reproductive success, and displace native prey species that native fish depend on. The common result of these and other impacts caused by AIS is a reduction in the diversity and abundance of native species.

The impacts of AIS are not isolated to the ecological health of our waters. The economic impacts of AIS are substantial. Sea lamprey contributed substantially to the crash of the Great Lakes commercial fishery in the mid 50's. As these fisheries rebound after years of expensive lamprey control efforts, new threats posed by more recent invaders continue to threaten sport and commercial fishing industries.

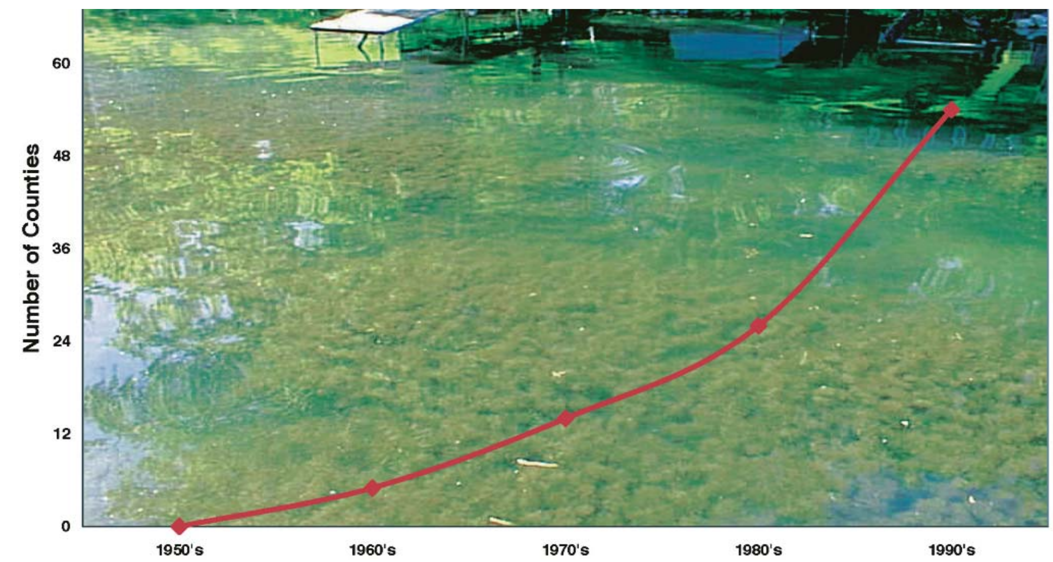
Intake pipes of water and power utilities around the Great Lakes are routinely clogged by zebra mussels and must be cleaned on a regular basis. These costs are passed on to consumers. A 1999 study by Cornell University tallied $138 billion in annual expenses in the United States due to exotic species on land and water.

Whether it is reduced harvest for hunters and fishermen, restricted access to a favorite lake, or the increased costs related to control and management efforts, aquatic invasive species impact all of us. Consequently, we all share the responsibility of preventing their spread.

Unlike terrestrial habitats, aquatic ecosystems present unique challenges for managing invasive species. Mechanical and chemical controls are easier to apply and target on land, while these same methods will often make an aquatic environment more susceptible to re-invasion because their application cannot be targeted on the invasive species as easily. Consequently, native species are often impacted by control efforts along with the non-native species. This could set the stage for a re-invasion with little or no competition from native species. Once established, aquatic invasive species are difficult to manage and practically impossible to eradicate.

The challenges of managing AIS are daunting, the list of known exotics is long and continues to grow. Faced with these facts, some may ask "why bother?" But when viewed from the opposite perspective, the good news is that the vast majority of our lakes and streams are free of invasive species, and preventing their spread is relatively easy. But it requires vigilance and cooperation from an informed public.

Eurasian Watermilfoil in Wisconsin Counties



Eurasian watermilfoil is an underwater plant that grows rapidly and can reach up to 20 feet long. Originally from Europe and Asia, the prolific milfoil now dominates many midwestern waters, its dense stands choking out native plants. (Graph by Miles Falck, photo by WI DNR)

How do AIS get here?

Historically, natural boundaries such as oceans and mountain ranges limited the movement of species around the globe. Human activities are primarily responsible for breaking down these barriers to dispersal. The creation of the Welland canal in 1829 between Lakes Ontario and Erie allowed ocean going ships access to upper Great Lakes ports. Unfortunately, it also opened up Lakes Erie, Huron, Michigan, and Superior to invasion by the sea lamprey and other exotics.

Many exotic organisms, such as the zebra mussel and round goby, found their way into the Great Lakes accidentally by stowing away in the ballast water of ocean-going ships. These ships pump large amounts of water into their ballast tanks in distant ports to make travel on the open sea safer. The ballast water is discharged when they take on cargo in Great Lakes ports, along with any stowaways.

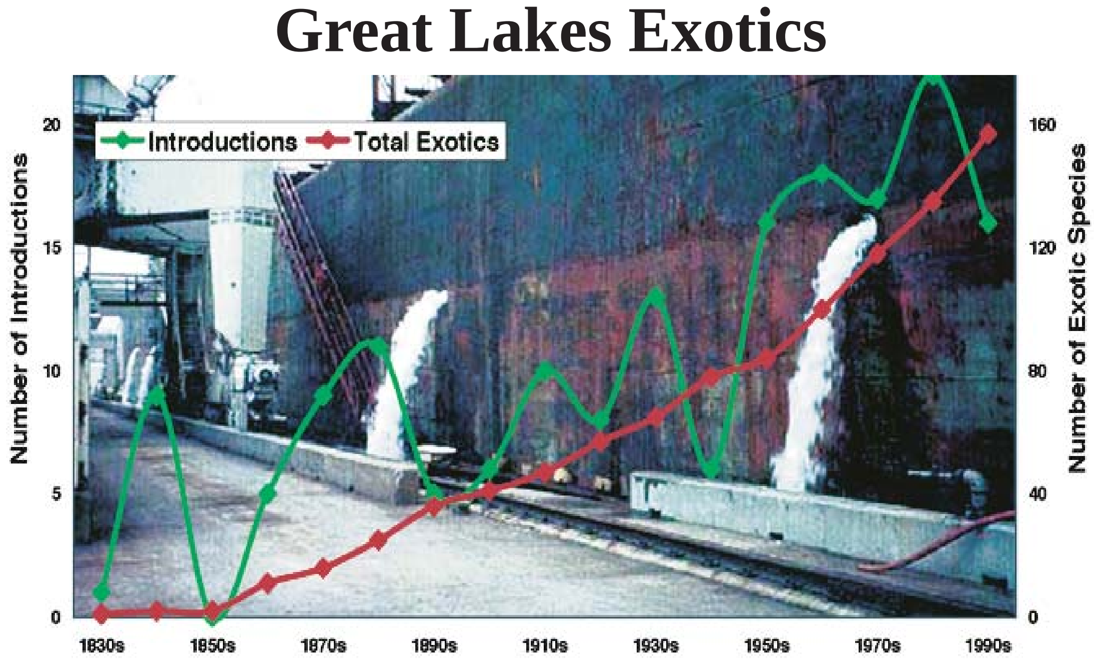
Barge traffic can also bring exotic species from the southern US and Gulf of Mexico north along the Mississippi River. As global trade has expanded in recent decades, the rate of exotic introductions has increased as well. Fish stocking, bait, aquaculture, the aquarium trade, and ornamental plantings are other common routes for aquatic invasive species to be introduced.

How do AIS spread?

Once established in the Great Lakes or another water body, AIS spread to other inland lakes by hitchhiking on recreational boats, trailers, and equipment. Small plant fragments, seeds, spores, and the larval stages of zebra mussels are a few examples of material that can be transported by boats and recreational equipment. Much of this material is difficult, if not impossible, to detect with the naked eye and distribution data is incomplete. The safest practice is to take preventive measures to reduce the chance of transporting AIS, even if the landing is not posted as infested and hitchhikers are not readily visible:

- ☒ Remove any visible mud, plants, fish or animals before transporting equipment.
- ☒ Eliminate water from equipment before transporting.
- ☒ Clean and dry anything that came in contact with water (boats, trailers, equipment, clothing, dogs, etc.)
- ☒ Never release plants, fish or animals into a body of water unless they came out of that body of water.

Great Lakes Exotics



Many exotic organisms, such as the zebra mussel and round goby, found their way into the Great Lakes accidentally by stowing away in the ballast water of ocean-going ships. The ballast water is discharged when they take on cargo in Great Lakes ports, along with any stowaways from the ship's port of origin. (Graph by Miles Falck, photo by L. David Smith, http://massbay.mit.edu.exoticspecies/ballast)

Great Lakes exotic species list

The list of Great Lakes exotic species on page three could continue for several more pages if run in total. Obviously, the list of non-native species in the Great Lakes is frighteningly long and growing. The list itself serves as an exclamation mark to the urgency of claims that prevention and control need to be effective now.

The list was published on the NOAA website (glerl.noaa.gov/res/Programs/invasive/) as an analysis of the 162 exotic species documented in the Great Lakes. NOAA notes that this number of documented exotic species is best thought of as a minimum number. Identification of new non-native species relies on the ability to find, identify and verify them.

Ship ballast has long been one of the most common pathways for exotic species to enter the Great Lakes. Other avenues include canals connecting the lakes to inland waterways and deliberate release, such as stocking, or accidental release, such as dumping bait buckets or aquariums. It is thought that one of the Great Lakes first invaders, the sea lamprey, traversed the canals from the Atlantic Ocean and entered the Great Lakes in the 1830's.

A partial list of exotic species in the Great Lakes

Decade Found	Common Name	Species	Description	Origin	Release Mechanism
1830s	sea lamprey	*Petromyzon marinus*	fish	Atlantic	Shipping and/or other
1840s	bitter dock	*Rumex obtusifolius*	plant—vascular	Europe, Asia or both	Unknown
1840s	bittersweet nightshade	*Solanum dulcamara*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1840s	poison hemlock	*Conium maculatum*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1840s	spearmint	*Mentha spicata*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1840s	water cress	*Rorippa nasturtium aquaticum*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1860s	black-grass rush	*Juncus gerardii*	plant—vascular	Atlantic	Shipping
1860s	oak leaved goose foot	*Chenopodium glaucum*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1860s	purple loosestrife	*Lythrum salicaria*	plant—vascular	Europe, Asia or both	Shipping and/or other
1860s	snail	*Elimia virginica*	invertebrate—benthic	Atlantic	Canal construction
1860s	spiny naiad	*Najas marina*	plant—vascular	Europe, Asia or both	Shipping
1870s	alewife	*Alosa pseudoharengus*	fish	Atlantic	Canal construction
1870s	chinook salmon	*Oncorhynchus tshawytscha*	fish	Pacific	Stocking or other deliberate release
1870s	common carp	*Cyprinus carpio*	fish	Europe, Asia or both	Stocking or other deliberate release
1870s	curlyleaf pondweed	*Potamogeton crispus*	plant—vascular	Europe, Asia or both	Stocking or other deliberate release
1870s	faucet snail	*Bithynia tentaculata*	invertebrate—benthic	Europe, Asia or both	Shipping
1870s	goldfish	*Carassius auratus*	fish	Europe, Asia or both	Stocking or other deliberate release
1870s	rainbow trout	*Oncorhynchus mykiss*	fish	Pacific	Stocking or other deliberate release
1880s	brown trout	*Salmo trutta*	fish	Europe, Asia or both	Stocking or other deliberate release
1880s	crack willow	*Salix fragilis*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1880s	narrow leaved cattail	*Typha angustifolia*	plant—vascular	Europe, Asia or both	Canal construction
1880s	white willow	*Salix alba*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1880s	yellow flag	*Iris pseudacorus*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1890s	European valve snail	*Valvata piscinalis*	invertebrate—benthic	Europe, Asia or both	Shipping
1890s	giant chickweed	*Stellaria aquatica*	plant—vascular	Europe, Asia or both	Unknown
1890s	greater European pea clam	*Pisidium amnicum*	invertebrate—benthic	Europe, Asia or both	Shipping
1890s	weeping alkali grass	*Puccinellia distans*	plant—vascular	Europe, Asia or both	Shipping
1890s	western water horehound	*Lycopus asper*	plant—vascular	North America	Release, apparently accidental
1900s	banded mystery snail	*Viviparus georgianus*	invertebrate—benthic	North America	Release, apparently accidental
1900s	European ear snail	*Radix auricularia*	invertebrate—benthic	Europe, Asia or both	Shipping
1900s	European water horehound	*Lycopus europaeus*	plant—vascular	Europe, Asia or both	Shipping
1900s	smooth field sow thistle	*Sonchus arvensis var. glabrescens*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1910s	garden loostrife	*Lysimachia vulgaris*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1910s	glossy buckthorn	*Rhamnus frangula*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1910s	henslow's pea clam	*Pisidium henslowanum*	invertebrate—benthic	Europe, Asia or both	Shipping
1910s	indian balsam	*Impatiens glandulifera*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1910s	rainbow smelt	*Osmerus mordax*	fish	Atlantic	Stocking or other deliberate release
1920s	European water clover	*Marsilea quadrifolia*	plant—vascular	Europe, Asia or both	Shipping
1920s	flowering rush	*Butomus umbellatus*	plant—vascular	Europe, Asia or both	Shipping
1920s	green alga	*Enteromorpha intestinalis*	phytoplankton	Atlantic	Release, apparently accidental
1920s	margined madtom	*Noturus insignis*	fish	Atlantic	Canal construction
1920s	western mosquitofish	*Gambusia affinis*	fish	North America	Stocking or other deliberate release
1930s	coho salmon	*Oncorhynchus kisutch*	fish	Pacific	Stocking or other deliberate release
1930s	fanwort	*Cabomba caroliniana*	plant—vascular	North America	Release, apparently accidental
1930s	freshwater jellyfish	*Craspedacusta sowerbyi*	invertebrate—planktonic	Europe, Asia or both	Release, apparently accidental
1930s	minor naiad	*Najas minor*	plant—vascular	Europe, Asia or both	Stocking or other deliberate release
1930s	Oriental mystery snail	*Cipangopaludina chinensis malleata*	invertebrate—benthic	Europe, Asia or both	Release, apparently accidental
1930s	Oriental weatherfish	*Misgurnus anguillicaudatus*	fish	Europe, Asia or both	Release, apparently accidental
1930s	yellow floating heart	*Nymphoides peltata*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1940s	aquatic weevil	*Tanysphyrus lemnae*	insect	Europe, Asia or both	Unknown
1940s	diatom	*Chaetoceros hohnii*	phytoplankton	Widespread	Shipping
1940s	Oriental mystery snail	*Cipangopaludina japonica*	invertebrate—benthic	Europe, Asia or both	Stocking or other deliberate release
1950s	Eurasian watermilfoil	*Myriophyllum spicatum*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1950s	European fingernail snail	*Sphaerium corneum*	invertebrate—benthic	Europe, Asia or both	Unknown
1950s	humpback pea clam	*Pisidium supinum*	invertebrate—benthic	Europe, Asia or both	Shipping
1950s	kokanee	*Oncorhynchus nerka*	fish	Pacific	Stocking or other deliberate release
1950s	marsh thistle	*Cirsium palustre*	plant—vascular	Europe, Asia or both	Unknown
1950s	pink salmon	*Oncorhynchus gorbuscha*	fish	Pacific	Release, apparently accidental
1950s	suckermouth minnow	*Phenacobius mirabilis*	fish	North America	Canal construction
1950s	water chestnut	*Trapa natans*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1950s	white perch	*Morone americana*	fish	Atlantic	Canal construction
1960s	calanoid copepod	*Skistodiaptomus pallidus*	invertebrate—planktonic	North America	Release, apparently accidental
1960s	micro-sporidian parasite	*Glugea hertwigi*	invertebrate-parasite	Europe, Asia or both	Stocking or other deliberate release
1960s	red alga	*Chroodactylon ramosum*	phytoplankton	Atlantic	Shipping
1960s	salmonid whirling disease	*Myxobolus cerebralis*	invertebrate-parasite	Unknown	Release, apparently accidental
1960s	waterflea	*Eubosmina coregoni*	invertebrate—planktonic	Europe, Asia or both	Shipping
1970s	birdsfoot trefoil	*Lotus corniculatus*	plant—vascular	Europe, Asia or both	Release, apparently accidental
1970s	brown alga	*Sphacelaria fluviatilis*	phytoplankton	Europe, Asia or both	Shipping and/or other
1970s	cladoceran	*Bosmina maritima*	invertebrate—planktonic	Europe, Asia or both	Shipping
1970s	European frogbit	*Hydrocharis morsus-ranae*	plant—vascular	Europe, Asia or both	Shipping and/or other
1970s	harpacticoid copepod	*Nitocra hibernica*	invertebrate—benthic	Europe, Asia or both	Shipping
1980s	Asian clam	*Corbicula fluminea*	invertebrate—benthic	Europe, Asia or both	Release, apparently accidental
1980s	Eurasian ruffe	*Gymnocephalus cernuus*	fish	Europe, Asia or both	Shipping
1980s	Quagga mussel	*Dreissena bugensis*	invertebrate—benthic	Europe, Asia or both	Shipping
1980s	spiny waterflea	*Bythotrephes longimanus*	invertebrate—planktonic	Europe, Asia or both	Shipping
1980s	threespine stickleback	*Gasterosteus aculeatus*	fish	Atlantic	Shipping and/or other
1980s	zebra mussel	*Dreissena polymorpha*	invertebrate—benthic	Europe, Asia or both	Shipping
1990s	fish-hook waterflea	*Cercopagis pengoi*	invertebrate—planktonic	Europe, Asia or both	Shipping
1990s	New Zealand mud snail	*Potamopyrgus antipodarum*	invertebrate—benthic	Other	Shipping
1990s	round goby	*Neogobius melanostomus*	fish	Europe, Asia or both	Shipping
1990s	tubenose goby	*Proterorhinus marmoratus*	fish	Europe, Asia or both	Shipping
1990s	waterflea	*Daphnia lumholtzi*	invertebrate—planktonic	Other	Release, apparently accidental
2000s	fingernail clam	*Pisidium moitessierianum*	invertebrate-benthic	Europe, Asia or both	Shipping
2000s	oligochaete	*Vejdovskyella intermedia*	invertebrate—benthic	Widespread	Shipping

Sources: Holsinger 1976; Hartviksen and Momot 1989; May, B. and J.E. Marsden. 1992; Mills et al. 1993; Hoagman 1994; Anderson 1996; Pronin et al. 1998; Bell Museum 2000; Muzinic 2000; Ricciardi et al. 2000; Ricciardi 2001; Duggan et al. 2003; Grigorovich et al. 2003

For a complete list: www.glerl.noaa. gov/res/Programs/invasive/

Surveys to monitor zebra mussels in Lake Metonga

Crandon, Wis.—Preliminary results from an interagency effort to study zebra mussels on Lake Metonga in northeast Wisconsin indicate that populations of the exotic species continue to expand.

"High reproduction and survival in 2003 resulted in a substantial increase in adult densities in 2004," said Michael Preul, Sokaogon Chippewa Community fisheries biologist. A project leader for the long-term study, Pruel said that juvenile zebra mussels were much smaller in 2004 than the previous year, however, a possible result of cool summer temperatures or a decline in the forage base.

Zebra mussels were identified in Lake Metonga in July of 2001. In spring 2002, the Sokaogon Chippewa Community initiated a long-term study in partnership with the Lake Metonga Association, U.S. Fish and Wildlife Service and Wisconsin Department of Natural Resources. The study was designed to address possible ecological impacts to Lake Metonga and the potential spread of zebra mussels downstream to the Wolf River.

Underwater photo of zebra mussels colonizing native mussel. (Photo submitted by Michael Preul)

"This cooperation documents the importance of Lake Metonga and seriousness of the zebra mussel threat in the region," Pruel said.

The study includes chemical, physical, and biological surveys. Biological surveys include adult and juvenile zebra mussel surveys and surveys of other biological communities most likely to be impacted by zebra mussels, including phytoplankton, zooplankton (microscopic plants and animals) and fish.

Zebra mussels look like small clams with a yellowish or brown "D" shaped shell, usually with dark and light colored stripes. They can reach two inches in length and generally live 2-3 years. Zebra mussels are native to the Caspian Sea region of Asia. They were discovered in Lake St. Clair near Detroit in 1988 and currently are found in all of the Great Lakes, many rivers and some inland lakes. Zebra mussels were first found in Wisconsin waters of Lake Michigan at Racine Harbor in 1991.

Study results indicate that zebra mussels have been reproducing in Lake Metonga for a number of years. They are found in suitable habitat throughout the lake but have not been found on samplers in Outlet and Swamp Creeks downstream of Lake Metonga. Adult zebra mussel densities are low throughout most of the lake. Densities average seven per square meter, however there are a few hotspots.

"We collected an alarming 1000 zebra mussels from one fish crib and found adult densities on a rocky point approaching 400 per square meter," said Preul.

Lake Metonga contains habitat similar to other lakes that have high zebra mussel densities. There is suitable substrate, ample food, and sufficient calcium levels for growth and reproduction. Water temperature, pH, salinity and dissolved oxygen levels are within tolerable ranges. Zebra mussels have been found in Lake Metonga in depths of up to 30 feet on gravel, cobble, boulders, sticks and logs, native mussels, crayfish, and man-made substrates such as docks, boats and motors. Furthermore, they have been found on submerged aquatic plants. It's not uncommon to find aquatic plants with attached zebra mussels washed up on shore. A combination of quality habitat and prolific reproduction (one mature female can produce up to 200,000 eggs per year) may lead to high densities in Lake Metonga. Adult densities in some areas of the Great Lakes average 3,000 per square meter with highs of 70,000 per square meter.

Zebra mussels are filter feeders. Each adult zebra mussel can filter one quart of water per day. Nearly all particulate matter, including phytoplankton and some small zooplankton, are removed. These microscopic plants and animals form the base of the food chain. Biologists speculate that reduction of phytoplankton and zooplankton may have impacts on fish species such as perch, walleye, and other species that feed on plankton during part of their development.

Other potential impacts are a reduction in native mussel abundance and an increase in water clarity, which could increase aquatic plant coverage. Zebra mussels don't pose a health risk to divers or swimmers, but their sharp shells can make walking on them hazardous. Zebra mussels are transported to lakes primarily by boat traffic. Boaters should be alert that they might be spreading either the larval form—known as veligers—or adults if they transport water or aquatic plants from one lake to another. There are thousands of lakes within a couple hours driving distance of Lake Metonga that contain suitable habitat for zebra mussels.

"Lake Metonga also contains the exotic plant Eurasian watermilfoil that can be colonized by zebra mussels," Preul said. "By not removing this plant from boats, two exotics could be spread to other lakes at the same time."

The study continues in 2005. Results will be used to help manage the Lake Metonga ecosystem and may be used to help predict the impacts of zebra mussels on other inland lakes.

For further information contact Michael Preul at (715) 478-7621.

Toxic algae blooming in area lakes Scientists blame zebra mussels

By Jeff Alexander, Muskegon Chronicle Staff Writer

Muskegon, Mich.—For years, scientists have pondered the worst-case scenario that could result from zebra mussels infesting the Great Lakes and scores of inland waters. That picture is becoming increasingly, and alarmingly, clear.

A potent group of toxic compounds has been discovered in a common algae found in Muskegon Lake and the poisons may be present in other Michigan lakes. What makes this environmental horror story so unusual and troubling is that the toxins, called microcystins, were not dumped into Muskegon Lake by a renegade industry.

The culprits in this case: Zebra mussels. What's worse, the only obvious solution would be killing all the zebra mussels in lakes, which isn't possible at this point.

Imported to the Great Lakes in the 1980s by trans-oceanic freighters, the mollusks have increased water clarity in lakes by eating algae as they filter huge volumes of water through their tiny bodies. The down side is that zebra mussels eat only nutritious algae—they spit out algae containing toxic compounds.

The result: Blue-green algal blooms, which can contain microcystins, are proliferating in relatively clean lakes across Michigan and other states, including Muskegon and White lakes, Lake Leelanau in northern Michigan and Lake Champlain in Vermont. The blooms create a blue-green layer of scum on the water's surface that looks like floating paint.

Scientists who recently tested algae scum on Muskegon Lake found elevated concentrations of microcystins. When ingested via drinking tainted water, the naturally occurring poisons can cause vomiting, diarrhea, fever, rashes, throat irritation and, in extreme cases, liver damage and cancer.

"I don't want to scare people, but the levels of microcystins we found are significant. These are very high concentrations and are on the same order of magnitude as the highest concentrations of microcystins ever reported," said Gary Fahnenstiel, director of the National Oceanic and Atmospheric Administration's (NOAA) Lake Michigan Field Station in Muskegon.

Fahnenstiel, one of the world's leading experts on algae, said people should avoid swimming, wading, windsurfing, canoeing or water-skiing in areas of lakes with blue-green algal blooms. Dogs also should avoid those waters.

Close up view of bottom of zebra mussel sampler. (Photo submitted)

Although full-blown algal blooms are easy to spot on the water's surface, those blooms are hard to spot while forming or after being dispersed by waves. Here's a hint for next summer: In its diffuse stage, blue-green algae resembles a cloud of pollen in the water.

Blue-green algal blooms have long been common in lakes with high levels of phosphorous, such as Spring Lake. Zebra mussels are now causing the blooms in lakes with low phosphorous levels, according to scientific studies.

Although blue-green algae has poisoned drinking water supplies in other countries, Fahnenstiel said it is unlikely microcystins will foul Lake Michigan, a source of drinking water for much of Muskegon, Ottawa and Kent counties. Wave action in the lake is usually too intense to allow blue-green algal blooms to form, and the local drinking water intakes are deep enough to avoid the harmful algae, which floats to the water's surface.

The Muskegon Lake samples represented the "worst-case scenario," Fahnenstiel said, because they were taken from algae scum floating on the lake. But

(See Toxic algae blooming, page 10)

Researchers find sale of invasives continue to thwart prevention measures

By Kristine Maki, Lac Courte Oreilles Plant Ecologist

Plants and animals have long been moved by humans beyond ranges achieved through natural means. Most often this causes no problems, but when invasive plants or animals are moved to new areas, either by accident or intentionally, problems occur to native plants and animals. Today's interest in water gardening and lake and shoreline restorations increases the risk that aquatic invasive plants are moved throughout the country.

In a study sponsored by Minnesota Sea Grant and the Minnesota Department of Natural Resources, researchers at the University of Minnesota surveyed aquatic plant vendors to determine unintentional shipment of invasive plants, intentional sale of illegal plants, and any unintentional shipment of other organisms. The researchers, Susan Galatowitsch and the author, placed 40 orders for aquatic plants, totaling 123 taxa and 681 individual plants, from 34 vendors across the United States.

Hydrilla clogs drainage and irrigation canals, prevents boating access for fishing and other water recreation, impedes commercial navigation, shades out beneficial native plants, degrades water quality, restricts water movement, and interferes with hydroelectric plants and urban water supplies. (Photo by Leslie Mehrhoff, University of Connecticut)

Federal noxious weeds and Minnesota prohibited exotic species were ordered to determine whether current regulations are effective in stopping the sale of these species.

Upon the arrival of plant purchases, the contents were examined for unintentional receipts of plants and other organisms, receipt of federal noxious weeds and Minnesota prohibited exotic species.

Many more organisms were received than what the researchers ordered! Upon close examination of the orders, additional plants, animals, fungi, and algae were discovered in 93 percent of the orders. Ten percent of the orders included plants considered to be invasive: hydrilla (*Hydrilla verticillata*), giant salvinia (*Salvinia molesta*), purple loosestrife (*Lythrum salicaria*), and curlyleaf pondweed (*Potamogeton crispus*). These four plants are causing problems all around the country and are some of the worst weeds in the world.

Noxious weed laws are written to slow the spread of invasive species. Minnesota prohibited exotic species and Federal noxious weeds, in part to determine if communication between sellers and regulators was working well enough to stop the sale of prohibited species. Of the 14 attempts made at ordering prohibited species or noxious weeds, the researchers received the outlawed species 13 times (93%).

If improper disposal of aquarium or water garden plants occur, or lake or shoreline restorations occur with plants that have organisms attached to them, the possibility of an invasive plant being introduced to an area is great.

Sales in the aquatic gardening industry are now reaching approximately $1 billion/year. If one assumes there are approximately one million individual purchases, and 10% of these include an unintentional invasive, there would be 100,000 opportunities annually for an invasive aquatic plant to be introduced to an environment where it could naturalize.

In addition, plants are being sold that have been found to be highly invasive and are banned from certain areas.

Riparian land owners, water gardeners, resource mangers, and policy makers need to be aware of the risks associated with the sale and use of aquatic plants and be prepared to properly clean and dispose of plants, be knowledgeable on the best plants to use, and watch for new populations that may be related to introductions from this pathway.

For more information, contact Kristine Maki, Lac Courte Oreilles plant ecologist, (715) 634-0102.

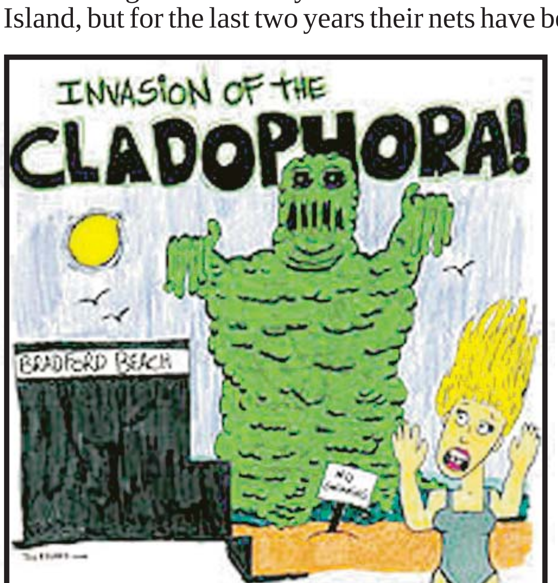
Zebra mussels promote green algae which fouls commercial fishing gear

By Mark Ebener, CORA Biologist

Sault Ste. Marie, Mich.—Beginning in about 1997 Chippewa Ottawa Resource Authority (CORA) commercial fishermen began reporting that their fishing gear set in northern Lake Huron near Cedarville, Michigan to capture whitefish was becoming fouled with a green slime. The slime was so thick that it would essentially render 40 foot tall trapnets inoperable and ruin 20-30 boxes of gillnets.

In response, the fishermen basically abandoned fishing those areas for several years in favor of areas east of Cedarville such as Drummond Island where the slime did not appear to be abundant. Now, the slime problem has rendered fishing impossible near Drummond Island, but Cedarville is now fishable because the slime problem seems to have disappeared there.

Biologists have always been able to successfully fish survey gear at Drummond Island, but for the last two years their nets have become covered with the slime and their ability to catch fish has declined dramatically.



(Illustration by Tea Krulos www.riverwest currents.org/2004/October/002214.html)

The same situation began developing in Lake Michigan in 2003-2004.

In June 2003 fishermen from the Naubinway areas of northern Lake Michigan reported that the same green slime nearly wiped out their commercial trapnets.

In 2004 in Green Bay, Lake Michigan the slime was terrible and basically stopped the commercial fishery from catching whitefish for June, July, and part of August.

The slime has been identified as the filamentous green algae *Chladophora*.

Green slime fouls tribal commercial fishermen's gear in some areas of northern Lake Huron. The slime encountered has rendered 40-foot tall trap nets inoperable and ruined boxes of gillnets. (Net photo submitted by Mark Ebener; Chladophora photo: Chester County Water Resources Authority. http://arwin.wcupa.edu:16080/ponds/Aquatic%20Plants.htm#metaphyton)

Chladophora is the green algae most people see attached to rocks in a body of water that seems to dance with the waves and currents.

Biologists believe that zebra and quagga mussel's excretions have provided nutrients for expanded growth of *Chladophora*. At the same time, zebra and quagga mussels have increased water clarity of the Great Lakes, except Superior, making it possible for *Chladophora* to grow at greater depths in the lakes. Thus, *Chladophora* is now more abundant because it has more nutrients available to it and can occupy a greater area of the lakes. It appears that *Chladophora* dies overwinter and then floats around in big mats in the water column, where it fouls commercial fishing gear after a storm or even a strong wind.

Adhered to the filamentous algae or living in the huge mats of *Chladophor*a are also other organisms such as diatoms, protozoans, nematodes, water bear, copepods, mites, and volvox.

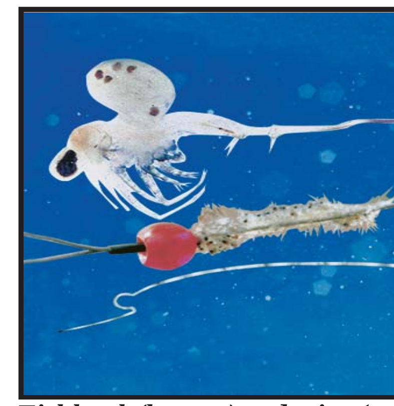
Researchers from Environment Canada will be sampling more of the slime this year to try and understand what is occurring and why.

Leslie J. Mehrhoff, University of Connecticut

Eurasian watermilfoil is an underwater plant that grows rapidly and can reach up to 20 feet long. Originally from Europe and Asia, the prolific milfoil now dominates many midwestern waters, its dense stands choking out native plants and damaging fish habitat.

Doug Jensen

Zebra mussels look like small clams with "D" shaped shells, usually with light and dark stripes. Although they can be up to two inches long, most are under an inch. They usually grow in clusters and are found in shallow, algae-rich water. They attach themselves to boat hulls, and their tiny larvae can live for weeks in water left onboard.



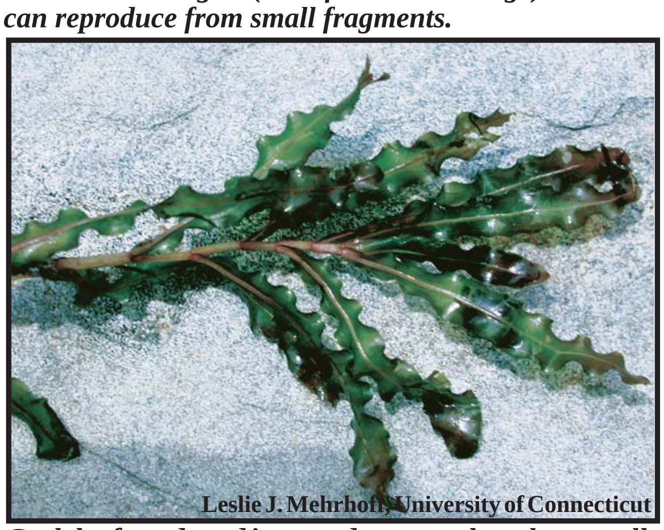
Fishhook (bottom) and spiny (top
crustaceans that threaten aqu
competing with native fish fo
waterfleas were discovered in
spread to all of the Great Lak
discovered in Lake Ontario in 1
spread to lakes in Michigan, L
New York. Both waterfleas coll
downrigger cables and can clog
a reel's drag system and preven

Leslie J. Mehrhoff, University of Connecticut

Fanwort is a beautiful looking aquarium plant with fan-shaped underwater leaves. Native to the southeastern United States, it is considered to be very weedy even where it is native. Fanwort grows very densely where it has been introduced, and because it has tightly-spaced leaves, it has a tubular appearance in the water. Fanwort is a serious aquatic weed as far north as upstate New York and Michigan (out of its native range). Fanwort can reproduce from small fragments.

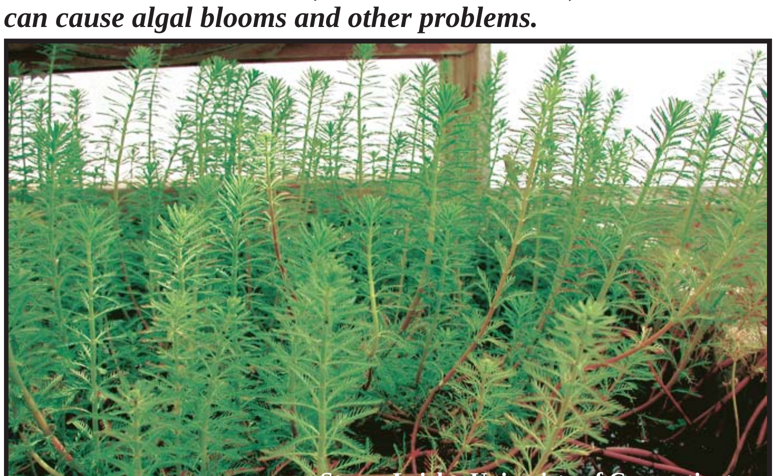
www.denniskalma.com/purloostf.html

Purple loosestrife is a perennial plant native to Europe. It arrived in eastern North America in the early 1800's via plants brought by settlers and seeds carried within livestock and the ballast holds of ships. In North America, purple loosestrife quickly spread westward displacing native wetland plant communities. It's current distribution covers much of the United States and Canada.



Leslie J. Mehrhoff, University of Connecticut

Curlyleaf pondweed is an underwater plant that usually grows in lake water about three to ten feet deep. It has wavy leaves with fine-toothed edges and grows well in cold temperatures, even under ice. Because it begins early, it shades out native plants, forming dense mats that make it difficult to boat or swim through. During the mid-summer die-back, it releases nutrients, which can cause algal blooms and other problems.



Stacey Leicht, Univeristy of Connecticut

Parrot feather gets its name from its feather-like leaves. It has been introduced worldwide for use in indoor and outdoor aquaria. However, it has escaped cultivation and spread via plant fragments and intentional plantings. Infestations can alter aquatic ecosystems by shading out the algae in the water column.

Leslie J. Mehrhoff, University of Connecticut

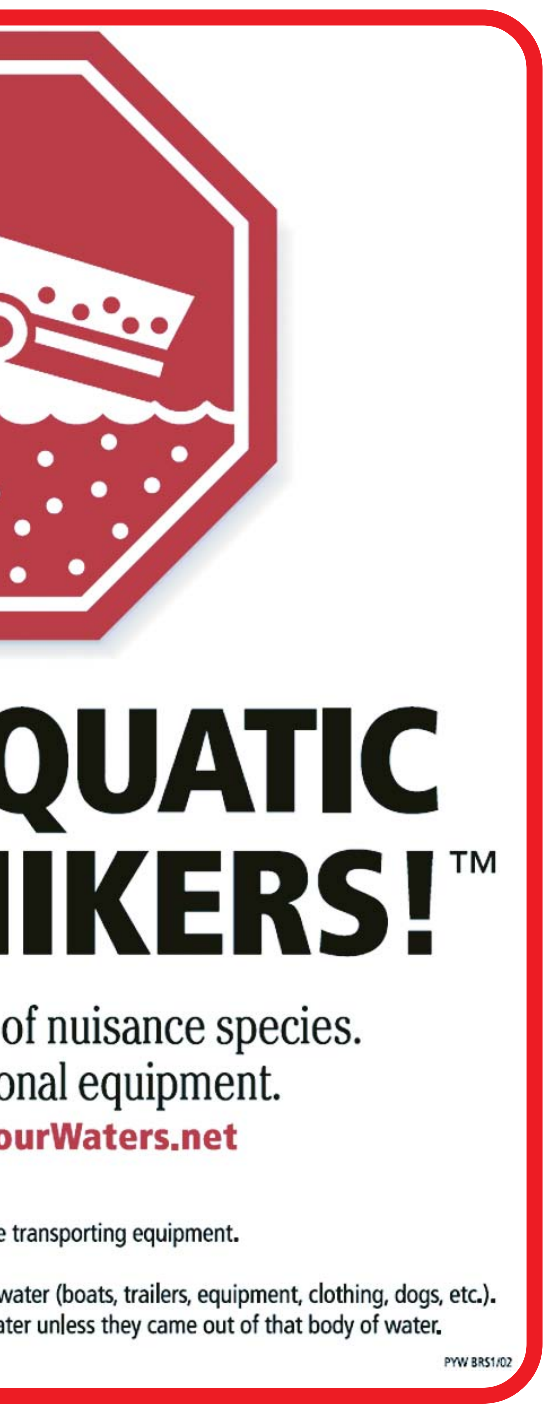
Water chestnut can grow in any freshwater setting, although it prefers nutrient-rich lakes and rivers. Water chestnut can form dense floating mats, severely limiting light—a critical element of aquatic ecosystems. It can also reduce oxygen levels, which may increase the potential for fish kills. It competes with native vegetation.

Flowering rush is a perennia
introduced in the Midwest as
primarily from rhizomes in shal
and as a submersed form in w
stands crowd out native species

p) waterfleas are small predacious atic ecosystems and fishing by r food and fouling gear. Spiny Lake Ontario in 1982 and have es and some inland lakes. First 998, the fishhook waterfleas have ake Erie and the Finger Lakes of ect in masses on fishing lines and the first eyelet of rods, damaging t landing a fish.

Bighead (left) and silver carp are invasive fish spreading to lakes, rivers and streams in several areas of North America, particularly the Mississippi River and the Great Lakes regions. Because they feed on plankton, these fish compete for food directly with native organisms, including mussels, all larval fishes and some adult fishes. They are both Asian carp brought to North America in the 1970s to remove algae from aquaculture ponds. The silver carp is know for its flying leaps out of the water.

(AIS information reprinted from: Sea Grant's WATCH cards, Wisconsin DNR Wildcards, www.invasivespecies.org; Wisconsin DNR AIS website; URL: ecy.wa.gov/program/wq/plants/weeds)



Common reed grass is most often found in large colonies, ranging in height from six to thirteen feet. It is a perennial reed grass with gray-green leaves and bares a large light-brown to purple flower spike that appears between July and September. Normally found in and near marshes, swamps, fens, shorelines and roadside ditches, it blocks out native species.

Sea lamprey is an eel-like fish that invaded the Great Lakes from the Atlantic Ocean through the Welland Canal. They are parasites that attach themselves to the sides of fish and suck out their blood and body fluids. They can cause the fish to die and are responsible for the death of thousands of lake trout annually. It costs taxpayers about $15 million a year to control lampreys.

European frogbit is a free-floating aquatic plant that can quickly choke shallow ponds, open marshes, ditches, and edges of lakes. Dense layers of interlocking plants and dangling roots can interfere with swimming, boating, fishing and waterfowl hunting. European frogbit can displace native aquatic plants.

l plant from Europe and Asia an ornamental plant. It grows low areas of lakes as an emergent ater up to 10 feet deep. Its dense like bulrush.

Hydrilla has become a severe problem in several areas of the United States. Hydrilla clogs drainage and irrigation canals, prevents boating access for fishing and other water recreation, impedes commercial navigation, shades out beneficial native plants, degrades water quality, and restricts water movement.

Yellow floating heart is a perennial, waterlily-like plant that carpets the water surface with long-stalked, heart-shaped leaves. Like other floating-leaved plants, yellow floating heart grows in dense patches, excluding native species and even creating stagnant areas with low oxygen levels underneath the floating mats.

How can you help prevent the spread of aquatic invasive species in ceded territory waters?

By Jim Thannum, GLIFWC
Natural Resource Development Specialist

Determine if the water body you intend to fish or rice in is reported to have aquatic invasive species.

This can be done by watching for Exotic Species Advisory warning signs posted at boat landings, using the internet to access maps at GLIFWC's web site www.glifwc.org, and examining maps at tribal registration stations that highlight known Aquatic Invasive Species (AIS) in tribal walleye and wild rice harvest lakes

Note: Some lakes may be infested with invasive species but have yet to be reported or have a warning sign installed. As a precaution, please take the preventative steps listed below and protect ceded territory waters for future generations.

Inspect and remove aquatic plants, animals, and mud from your boat, trailer and equipment.

Curlyleaf pondweed

Curlyleaf pondweed begins to grow rapidly with the warming water temperatures of early spring, forming large, dense patches which can clog waterways. By mid-summer the pondweed canopy begins to die back, and the resulting high oxygen demand caused by this decaying vegetation can adversely affect fish populations. Curlyleaf pondweed has been found in many popular fishing lakes throughout Minnesota, including Mille Lacs Lake. Curlyleaf pondweed has also been found in popular Wisconsin fishing waters, including Pelican Lake, Lake Minocqua, Tomahawk Lake Chain, Kentuck, Little Saint Germaine, and Lake Wissota among others.

Eurasian watermilfoil

Eurasian watermilfoil often reproduces by fragmentation, with 4-8 inch pieces breaking off, rooting and forming new plants. This trait enables the plant to be easily transferred from lake to lake by outboard motors and trailers. Dense stands of Eurasian watermilfoil can alter predator-prey relationships, leading to increases in forage fish and decreases in larger fish (i.e. walleye and musky). Researchers have found that during daytime feeding periods, 3-4 times as many fish feed in areas with native plant communities as in the milfoil patches. Furthermore, when milfoil dies in the fall it decays, reducing oxygen levels otherwise available for fish. Eurasian watermilfoil has been found throughout the Twin Cities area and has spread northward in Minnesota to many lakes including Mille Lacs Lake.

Eurasian watermilfoil has also been found in popular Wisconsin fishing waters including the Chippewa Flowage, Round Lake and Little Round Lake (Sawyer County), Lake Metonga, Rainbow Flowage, Lake Minocqua, Minong Flowage, Eagle Chain and others.

Never release live bait into a water body, or transfer aquatic animals or water from one water body to another. Dispose of unwanted bait in the trash away from water. (Photo ©State of Minnesota, Department of Natural Resources)

Drain all water from your motor, live well, bilge, transom wells, etc.

Spiny water fleas and zebra mussels can accidently be transferred from lake to lake through water left in motors, livewells, bilges, and transom wells. The spiny water flea reproduces rapidly and competes with young perch and other small fish for food.

Spiny waterfleas

Spiny waterfleas have spread from Lake Superior to inland ceded territory waters including:

- St. Louis River, Island Lake Reservoir & Fish Lake Flowage in Minnesota,
- Gile Flowage in Wisconsin,
- Lake Gogebic and Michigamme Lake in Michigan.

Zebra mussels

Zebra mussels have spread throughout the Great Lakes and up the Mississippi River system to the Twin Cities. Zebra mussels are now found in over 43 inland lakes in Wisconsin and 200 waterways in Michigan, posing a serious threat to inland ceded territory waters. In recent years zebra mussels have spread to two 1842 ceded territory waters:

- Second Lake (Fortune Pond) near Crystal Falls, Michigan, and
- Lake Metonga near Crandon, Wisconsin.

Zebra mussels have been found to clog the intakes of water systems, damage boat motors, and injure people with their sharp shells. Zebra mussels can also spread from lake to lake by attaching themselves to aquatic vegetation.

Dispose of unwanted bait in the trash away from water.

Never release live bait into a waterbody, or transfer aquatic animals or water from one waterbody to another. Rusty crayfish and smelt provide good examples of the danger posed by exotic species that were used for bait. Exotic earthworms have also been implicated in impacts to terrestrial woodlands.

Rusty crayfish

Rusty crayfish were brought into Wisconsin for bait in the 1960s and are now found in over 100 lakes and streams in northern Wisconsin. They have also spread throughout 1854 ceded territory waters in Minnesota. As rusty crayfish spread, they uproot vegetation, depriving native fish of cover and food, making waters murky, and eating fish eggs.

(See Help prevent the spread of AIS, page 10)

What is GLIFWC doing to prevent the spread of AIS?

By Sue Erickson, Staff Writer

Public education

GLIFWC believes that having an informed public is the first step in stemming the tide of AIS. This involves raising public awareness of the problem, helping people identify AIS and letting them know how their actions can help prevent further spread of invasive aquatic plants and animals.

In order to better inform the public, GLIFWC has included information in *Mazina'igan*, GLIFWC's quarterly newspaper, which has featured one aquatic or terrestrial invasive plant in each edition over the past year. GLIFWC has also acquired and produced several brochures on various invasive species.

Several educational displays developed by GLIFWC feature AIS and are taken to various conferences, sport shows and fairs as part of the public outreach program. The displays identify the problem and illustrate how to prevent the spread of AIS. Information, including AIS brochures and identification cards for several species, are distributed at informational booths.

Materials available through the GLIFWC Public Information Office (pio@glifwc.org) include the following informative brochures produced by GLIFWC or other agencies:

Plants Out of Place (GLIFWC)
Purple Loosestrife: What You Should Know, What You Can Do (OFAH)
Help Stop Aquatic Hitchhikers (MN DNR)
The Facts on Eurasian Water-Milfoil (WI DNR/UW-Extension)
Zebra Mussel Boater's Guide (WI DNR/SeaGrant)

GLIFWC also has individual species identification cards for numerous AIS as well as terrestrial invasives that were published by the Wisconsin Department of Natural Resources or Sea Grant.

Additional species-specific information including photos, life history, ecological impacts, control methods, and educational resources are available at GLIFWC's web site (www.glifwc.org—click on "invasive species").

In addition, GLIFWC has collected field data and compiled existing data from several cooperating agencies and organizations to develop a regional database for invasive species throughout Wisconsin, Minnesota and Michigan. This data can be accessed via GLIFWC's Internet Map site (see related story on page 11). The information and maps are updated annually (www.glifwc.org—click on "maps").

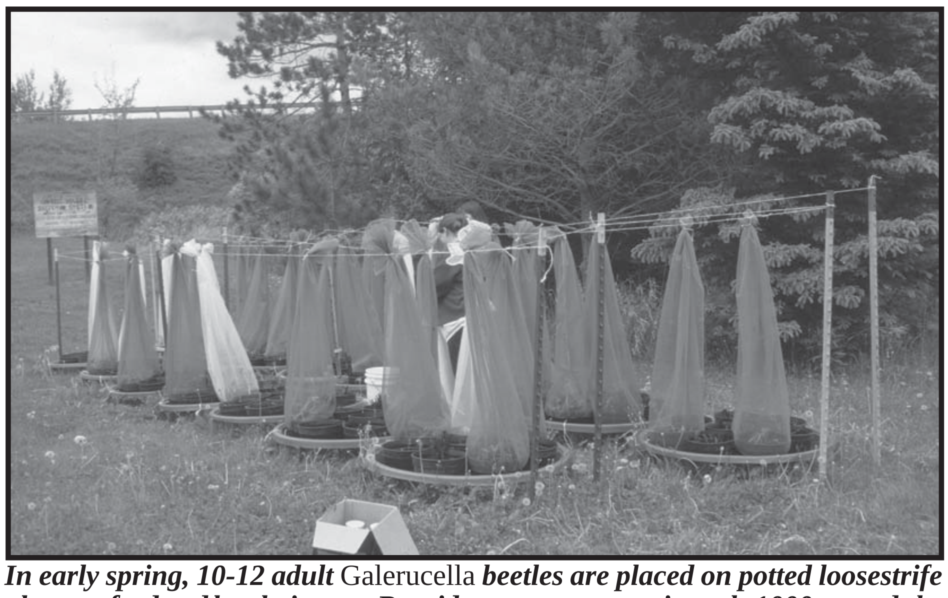
Monitoring and inventory

Key to understanding and confronting the problems of AIS is knowing where they are and in what quantity. Gathering this information is a time-consuming and labor-intensive process because there are so many waterbodies to survey. GLIFWC is developing a regional AIS database by collecting field data and compiling existing data from other agencies.

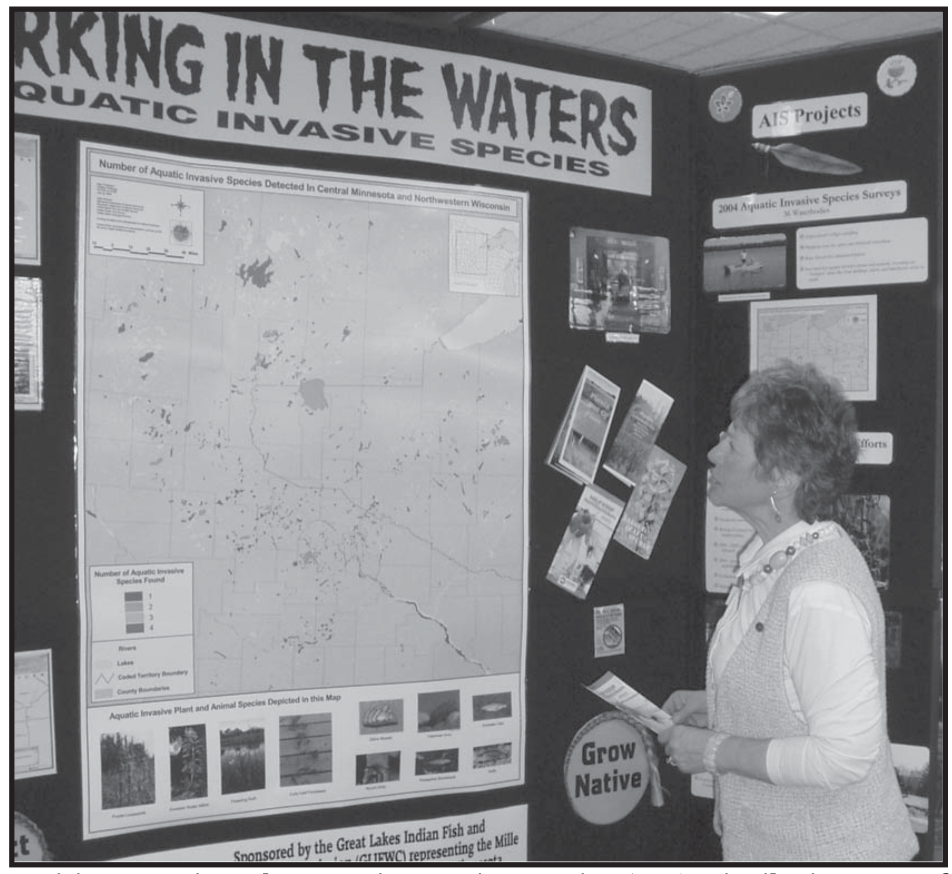
Since 1986 GLIFWC has worked with the U.S. Fish & Wildlife Service's (USFWS) Sea Lamprey Control Program. Each spring GLIFWC sets lamprey traps in a number of rivers that are tributaries of Lake Superior for mark and recapture population studies. The lamprey are trapped, marked and released. Those that are trapped in the recapture effort are destroyed. Data recorded are provided to the USFWS in order to calculate sea lamprey population estimates.

GLIFWC has also assisted the USFWS with annual surveys for zebra mussels in the upper St. Croix River. In 2003 GLIFWC staff surveyed fourteen St. Croix headwater lakes for zebra mussels. While no zebra mussels were found, they did identify rusty crayfish and purple loosestrife in some of the lakes and found curlyleaf pondweed in one lake where it was not previously documented. Staff also noted the presence of the Georgia mysterysnail and the Chinese mystery snail in some lakes. The Georgia mystery snail is from the Southeastern United States but is making its way north. The Chinese mystery snail is a large snail imported for escargot and use in aquariums. The ecological impacts of these snails are not yet fully understood.

In 2004, GLIFWC staff initiated monitoring efforts on 36 lakes within the ceded territories to inventory aquatic invasive species on waters that contribute substantially to tribal wild rice and walleye harvests. Looking for invasive plants and animals from mid-June through mid-September, staff documented infestations and published the results in a report now available on the GLIFWC website.



In early spring, 10-12 adult** Galerucella **beetles are placed on potted loosestrife plants to feed and lay their eggs. By mid-summer, approximately 1000 new adults will emerge from each pot for release at loosestrife infested wetlands. (Photo by Miles Falck)



A visitor examines the Aquatic Invasive Species (AIS) Distribution map of Minnesota lakes produced by GLIFWC, part of an informational display on AIS. GLIFWC's display was up during a conference on AIS in Northwest Wisconsin held at Lakewoods Resort, Cable, Wisconsin in April. The display highlights the problems presented by a variety of aquatic invasive species and provides information on preventing their spread. (Photo by Dara Olson)

In 2005, efforts will be made to select waters where *new* infestations are likely to occur in order to improve the chances of successful management and/or prevent their spread.

Control and prevention efforts

GLIFWC has been treating purple loosestrife within the Bad River–Chequamegon Bay watershed since 1988. Purple loosestrife threatens the integrity of wetland habitats by out-competing native vegetation. Diverse wetland plant communities can quickly be displaced by dense stands of purple loosestrife.

GLIFWC staff have used a variety of methods to control loosestrife, including hand pulling, chemical control and biological control through the introduction of *Galerucella* beetles. The latter method, which has proven effective, involves raising the beetles and distributing them in loosestrife-infested wetlands.

GLIFWC biological and enforcement staff who use boats in various ceded territory waters have all attended the WDNR's Clean Boats, Clean Waters workshops, which stress proper cleaning of boats and equipment after use. GLIFWC has passed on the training to temporary, seasonal staff who work on the lakes and made power-washers available to all staff that use boats, including enforcement satellite offices located on member reservations. In addition, each GLIFWC boat now has a log book providing recent information on regional AIS distribution, identification information, reporting forms, and a checklist that is filled out after properly inspecting and cleaning boats.

Coordination with other agencies and organizations

Because aquatic invasive plants disperse widely across the landscape and administrative boundaries, it is advantageous to work cooperatively towards management and control objectives. In addition, the number of new invasives being introduced into regional waters continues to exceed control activities and is too much for any one agency to manage alone. The vastness of the problem requires effective networking among all concerned and coordination so that information can be shared and labor is not duplicated.

GLIFWC continues to work with a variety of agencies and organizations, including state and federal agencies as well as private organizations, lake associations and concerned individuals. The regular sharing of data, educational resources and management strategies with other agencies and organizations promotes regional cooperation and reduces duplication of effort and expenses. Examples include:

- ✗ Coordinate monitoring efforts
- ✗ Provide brochures
- ✗ Provide educational displays
- ✗ Compile and provide regional distribution data
- ✗ Network via professional conferences
- ✗ Maintain AIS information on website

Help prevent the spread of AIS

(Continued from page 8)

Smelt

Smelt have been found in 21 northern Wisconsin lakes. They pose the greatest risk to walleye in smaller, deep, clear lakes lacking a diverse fishery. The impact of smelt on walleye populations can be seen in Sparkling Lake (Vilas County, WI) where they were first discovered in 1981.

Historically this lake had good natural reproduction, but as smelt numbers increased, fishery surveys started showing that young walleye weren't surviving into the fall of their first year. This problem continued with fall fisheries surveys documenting no significant natural reproduction since 1988. It is believed that smelt compete directly with juvenile walleye for food, limiting walleye recruitment.

GLIFWC Inland Fisheries Aid Chuck Smart, power-washes the hull of a GLIFWC electrofishing boat to prevent the unintentional spread of aquatic invasive species. All GLIFWC staff using boats have power-washers available to them. (Photo by Charlie Otto Rasmussen)

Wash your boat and equipment with hot water (>104°F) or a vinegar/salt water solution, and then rinse with a high pressure hose.

If you have hard-to-treat equipment that cannot be exposed to hot water you can:

- dip equipment into vinegar for 20 minutes to kill harmful aquatic species such as spiny water fleas and zebra mussels; or
- use a 1% table salt solution for 24 hours can replace the vinegar dip. This table provides correct mixtures for the 1% salt solution in water:

Gallons of Water	Cups of Salt
5	2/3
10	1 1/4
25	3
50	6 1/4
100	12 2/3

- **If hot water is not available, spray equipment with high-pressure water.**
- This step is particularly important to take after boats have been used in ceded territory waters known to possess:
  spiny waterfleas (St. Louis River, Island Lake Reservoir, and Fish Lake Flowage in Minnesota, Gile Flowage in Wisconsin, and Lake Gogebic and Michigamme Lake in Michigan),
  zebra mussels (Second Lake (Fortune Pond) in Michigan, and Lake Metonga in Wisconsin), or
  heterosporis parasites (Vilas County lakes, including Lac Vieux Desert, Big Arbor Vitae, Scattering Rice, Eagle, Carpenter, Cranberry, Catfish, and Yellow Birch lakes or Oneida County lakes, Dam, Sand and Columbus).

DRY Equipment.

If possible, allow five (5) days of drying time before entering new waters.

Toxic algae blooming in area lakes

(Continued from page 4)

the Bear Lake sample was taken in an area with no scum on the water—the blue-green algae looked more like pollen in the water.

Although few people are out on area lakes now, Fahnenstiel said it would be wise in the future to avoid going in water where blue-green algae is present. Wind and waves will disperse the surface scum, but the algae usually slips below the surface and returns when the water is calm.

"As a scientist and boater who spends time on Muskegon Lake—my kids swim and tube in the lake—I would not go in the water when these blooms are present," Fahnenstiel said.

Rick Rediske, a professor of water resources at Grand Valley State University and chairman of the Muskegon Lake Public Advisory Council, said he would limit activities in any lake with a blue-green algal bloom: "I would boat in it but I wouldn't swim in it," he said.

A Michigan State University study published earlier this year concluded that blue-green algal blooms could occur in any lake where zebra mussels are present. More than 100 Michigan lakes are infested with zebra mussels, according to state data.

"These algae blooms are not likely to go away," Fahnenstiel said. "Our experience in the Great Lakes has been that once these blooms appear, they occur every year. If you have zebra mussels in your lake, you'd better be looking out for these algal blooms."

Sarah Holden, a Michigan Department of Environmental Quality aquatic biologist, said the state has not been monitoring for microcystins in lakes. "I think it is a relatively uncommon thing that is starting to become more frequent," Holden said. "We're trying to get a handle on it, figure out the best way to find lakes with problems, figure out what the health concerns are for people and how to get the word out."

A 2000 study performed by NOAA scientists in Saginaw Bay and Lake Erie warned that microcystins, which don't break down quickly in the environment, could move up the food chain, from invertebrates to fish and, ultimately, to people who eat the tainted fish.

The levels of microcystins in Muskegon Lake are four times higher than those found in Lake Erie in 2000.

There is no evidence that microcystins have affected fish or humans here, but no studies have been conducted.

Bloom of the cyanobacteria Anabaena ***and*** Microcystis ***in Lake Sallie, Minnesota. (Photo from ASLO slide collection taken by D.F. Brakke, scanned by K.L. Schulz.)***

Microcystin contamination has never been documented in area lakes until now because no one ever tested for the toxins. Although blue-green algae has been a problem in other parts of the world for more than a century, it has only emerged as an issue in the United States in recent years, according to several scientists.

"There could be lakes out there, such as Spring Lake, that could be very high (for microcystins). We just haven't sampled them," Fahnenstiel said.

Spring Lake, one of West Michigan's most popular and intensely studied lakes, is notorious for massive blue-green algal blooms. Scientists from Grand Valley State University (GVSU) have thoroughly studied those blooms and phosphorous pollution in Spring Lake, but did not test for toxic microcystins in the algae, said Alan Steinman, director of GVSU's Annis Water Resources Institute. He said the test is difficult and costly to perform.

"I've always been told that blue-green algae is not a harmful thing," said John Nash, chairman of the Spring Lake Lake Board.

When informed that some blue-green algae contains toxins, Nash said, "That concerns me."

Rediske said he has seen people swim, water ski and ride tubes in blue-green algal blooms on Spring Lake. "People seem to go out in Spring Lake in all conditions. This is something that really needs to be looked at," Rediske said.

Microcystin contamination has been a problem for more than 100 years in other countries. There have been numerous cases of people, dogs and livestock becoming ill after drinking or wading in water laced with microcystins.

In Brazil, more than 60 kidney patients died after drinking water laced with microcystins passed through their dialysis machines.

People have become ill and some dogs have died recently in Vermont after falling into blue-green algae on picturesque Lake Champlain. Soldiers in Great Britain were sickened after canoeing through a blue-green algal bloom, and a Wisconsin boy died last year after falling into an agricultural pond contaminated with microcystins, Fahnenstiel said.

The problem is a relatively new one in the Great Lakes region. That's because zebra mussels are increasing the number of lakes experiencing blue-green algal blooms.

*(Reprinted with permission from the Muskegon **Chronicle**, Sunday, October 17, 2004 edition.)*

Tracking the spread of AIS

By Miles Falck, GLIFWC Wildlife Biologist

One of the most important aspects of managing any invasive species is to determine its distribution and abundance. This information can be used to prioritize management, justify funding requests, target educational outreach, and to direct and evaluate control efforts.

Realizing the importance of this data, many federal, state, and tribal agencies, as well as universities and non-government organizations collect and compile this important information. Unfortunately, not all of this data is accessible in one place, and it varies in quality and completeness.

GLIFWC has compiled much of this data and made it available in a common format that can be accessed over the Internet. The goal of this project is to provide tools that enable regional coordination of invasive species management. Data contributors include:

- Great Lakes Indian Fish & Wildlife Commission
- Lac Courte Oreilles Natural Resource Department
- Michigan Department of Natural Resources
- Minnesota Department of Natural Resources
- National Park Service
- Sea Grant
- The Nature Conservancy
- U.S. Forest Service
- U.S. Geological Survey
- Wisconsin Department of Natural Resources

GLIFWC's Map Viewer (click on "maps" at www.glifwc.org) provides access to known AIS locations in an interactive online mapping environment. Users can zoom-in on the area of interest and display only the information they need. Customized maps can be printed for developing grant applications, educational materials, presentations, or field use.

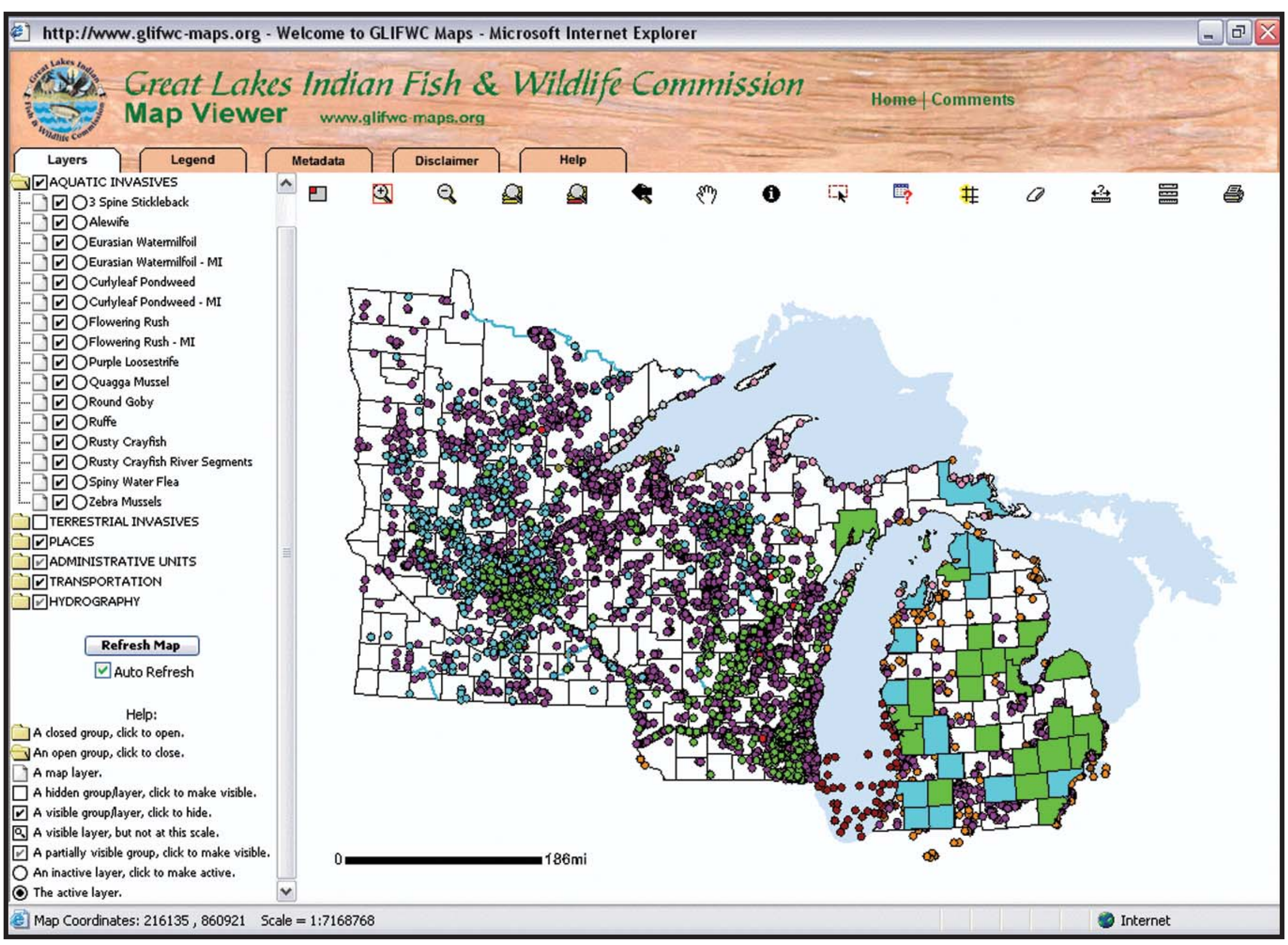
In addition, the data for each location can be queried, viewed and printed using a suite of interactive tools. The information provided includes information source, date of documentation, contact person, estimates of abundance, acreage, and accuracy of location.

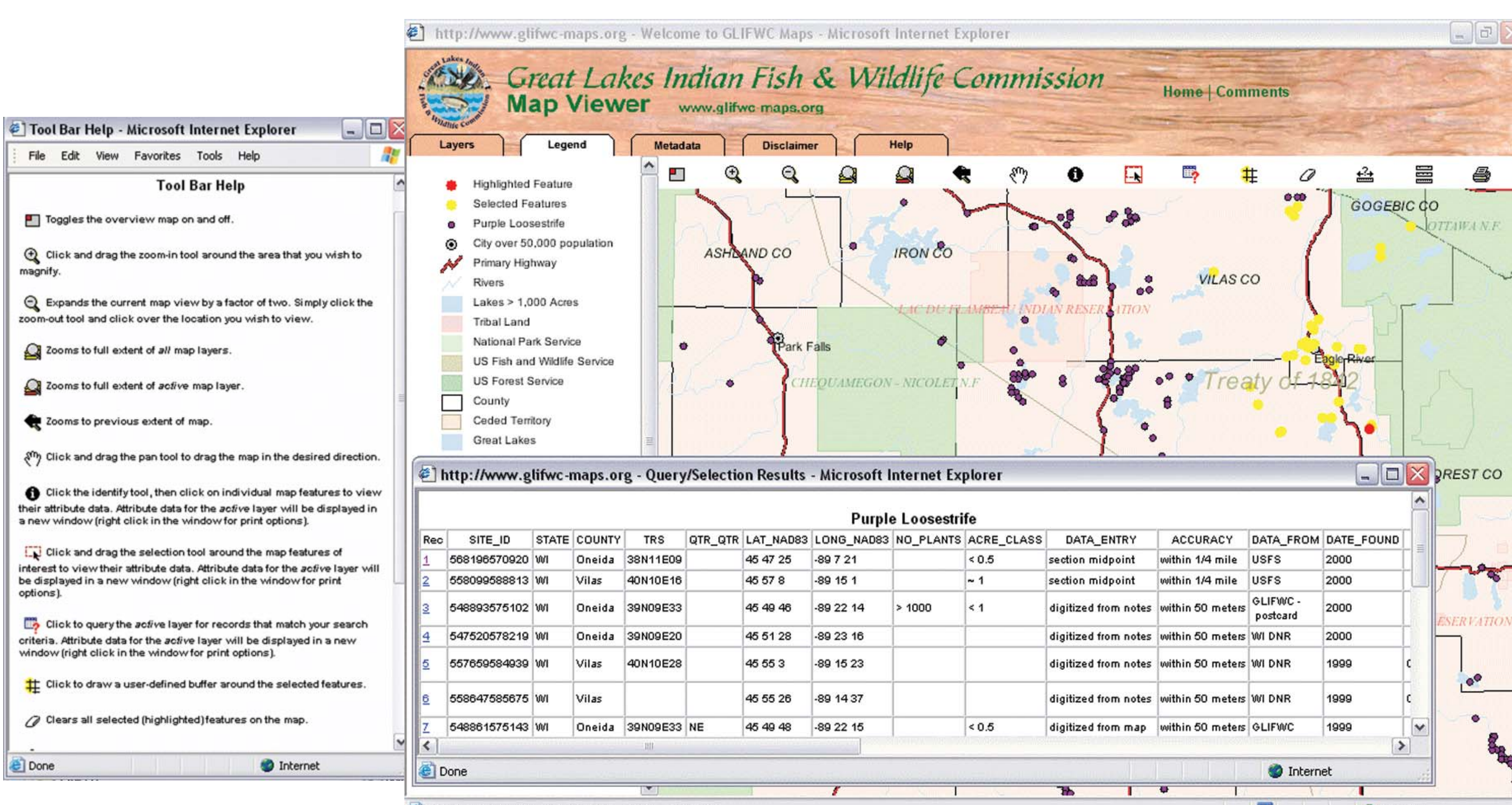
The left panel of the web site is used to control the visibility of the various layers, display map legends, and provide access to help files for using the site. The toolbar located directly above the map is used to zoom in or out, display data, run queries, and print maps.

The site continues to evolve as data are updated and new applications are added. One promising new technology is the use of "open GIS." GLIFWC is currently incorporating this into the web site so that users will have the added benefit of displaying topographic maps, aerial and satellite imagery, and digital elevation models.

This data is not housed on GLIFWC servers, nor is it maintained by GLIFWC staff. Instead it is stored on servers at USGS, NASA, and Terraserver and is provided as an "open GIS" map service that can be accessed by other map viewers.

Similarly, GLIFWC intends to make some of its data available in an open GIS format in the future so that other web sites can make use of the data for similar applications. The advantage is that no one organization has to compile and store the various databases, yet they can be effectively combined over the Internet and made available to those who need access in one seamless package. This method will avoid duplication of efforts while facilitating coordination among agencies, organizations, and individuals that utilize the data.





Funding, cooperation & coordination

By Miles Falck, GLIFWC Wildlife Biologist

Funding

Much of GLIFWC's work on aquatic invasive species education and outreach as well as prevention and control efforts is a result of funding from cooperating agencies. GLIFWC is grateful for the opportunities provided through funds from the following cooperators:

Bureau of Indian Affairs (BIA)—Noxious Weed Program

Annual funding from the BIA's Noxious Weed Program provides a foundation for GLIFWC to develop new partnerships and bring additional resources to bear on noxious weed management within the treaty ceded territories.

Natural Resources Conservation Service (NRCS)—Environmental Qualities Incentive Program (EQIP)

Funding from the NRCS EQIP program has provided resources to control purple loosestrife on private lands within the Bad River-Chequamegon Bay watershed. Due to the prolific nature of purple loosestrife, its ability to disperse long distances, and the diversity of public and private land owners involved, effective long-term control requires a coordinated and cooperative effort among landowners.

Use of NRCS EQIP funds has increased the effectiveness of GLIFWC's watershed control strategy by providing funds to work cooperatively with The Nature Conservancy and private landowners to control purple loosestrife on privately-owned lands. EQIP funds have also been used to develop educational materials (*Plants Out of Place* and *Target: Leafy Spurge* brochures) to raise awareness about the ecological impact of exotic plants and to prevent new introductions within the ceded territories.

Environmental Protection Agency (EPA)—Great Lakes National Program Office (GLNPO)

GLNPO has provided funding to: 1) evaluate the effectiveness of purple loosestrife controls within the Bad River watershed, and 2) prioritize and guide management efforts for other invasive non-native plants in the ceded territories.

Gillnet covered with spiny waterfleas. (http://gleams.altarum.org/glwatershed/photos/glnpo/image/viz_iss4.html)

Administration for Native Americans (ANA)

Funding from ANA has enabled GLIFWC to build its capacity to inventory and track the distribution and abundance of AIS in the treaty ceded territories and implement educational outreach activities.

Wisconsin's Comprehensive Management Plan

In cooperation with the Wisconsin DNR and the UW–Extension, GLIFWC contributed to *Wisconsin's Comprehensive Management Plan To Prevent Further Introductions and Control Existing Populations of Aquatic Invasive Species*. As a signatory to this management plan, GLIFWC is eligible for funding from the US Fish & Wildlife Service to implement activities identified in the management plan. GLIFWC has been using these funds to inventory waters for AIS, implement educational outreach and manage purple loosestrife.

Cooperating agencies and organizations

Because invasive species disperse widely across the landscape and administrative boundaries, it is advantageous to work cooperatively towards management and control objectives. In addition, the number of new exotics being introduced into local ecosystems continues to out-pace control activities and is too much for any one agency to manage alone. GLIFWC routinely shares information and coordinates management activities with several cooperating agencies and organizations.

- ☑ Great Lakes Indian Fish & Wildlife Commission member tribes
- ☑ Invasive Plant Association of Wisconsin
- ☑ Local schools & volunteers
- ☑ Michigan Department of Natural Resources
- ☑ Minnesota Department of Agriculture
- ☑ Minnesota Department of Natural Resources
- ☑ Northern Great Lakes Visitor Center
- ☑ Northwoods Weed Initiative
- ☑ Private landowners
- ☑ Sea Grant
- ☑ The Nature Conservancy
- ☑ USDA–Natural Resources Conservation Service
- ☑ USDA–Forest Service
- ☑ UW–Extension
- ☑ Wisconsin Wetlands Association
- ☑ Wisconsin Department of Natural Resources

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