

AQUATIC INVASIVE SPECIES

DIAMOND LAKERS

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Presented by

JOHN RICHTER

Director:

Wisconsin Lakes

Last Wilderness Alliance

Chairman:

Plum Lake Association

Wisconsin Lake leadership

Institute, Crew 11



AQUATIC INVASIVE SPECIES (AIS)



Aquatic invasive species alter habitats, leading to ecological imbalances and reducing biodiversity. AIS often thrive in new environments by outcompeting native species for essential resources such as food, light, and space. This competition can lead to the decline or extinction of native species. By monopolizing resources, invasive species can reduce the availability of food and habitat for native organisms, disrupting local ecosystems. Some

invasive species can modify the physical characteristics of their habitats. Invasive species can affect nutrient cycling within aquatic systems, which can have cascading effects on the entire ecosystem, including changes in water quality and availability of nutrients for native species. Certain plants may grow rapidly and form dense mats on water surfaces, blocking sunlight and affecting the growth of native aquatic plants. Invasive fish prey on native fish populations, leading to declines in those species and altering the dynamics of the ecosystem. Invasive mussels alter sediment structures by filtering large volumes of water, which can change nutrient dynamics and affect the organisms that rely on those sediments.

On eleven-hundred acre Plum Lake, in Vilas County, rusty crayfish arrived in the 70's in bait buckets, for catching Plums big smallmouth bass. Within a few years, Plum Lake was unrecognizable below the surface – its native crayfish were gone and rusty's voracious grazing destroyed 2/3's of our aquatic plant beds. Plums habitat was altered for the next 40 years, changing our fish populations as well as the fish habitat.

SPINY WATER FLEA



Spiny water flea had been in Mendota for years and when weather and water conditions turned just right, the population exploded. Dr. Jake VANDERZANDEN who heads UW Limnology was in a boat in September of 2009 with students, dip netting the lake for plankton. What they found was water teeming with spiny water fleas. In its 500 million CF of water, Mendota was estimated to be home to 500 billion spiny water flea. The next spring they found spiny in concentrations of 1,000 per cubic meter of water, the thickest concentrations found anywhere in the world.

They lost more than 85% of their daphnia and 3 feet of water clarity as a result. Spiny was brought to Mendota from Lake Michigan, in a boat. At last count, there were 186 invasive species in Lake Michigan, brought in by ballast water up the St. Lawrence. Here is a quick outline of the impact of spiny water flea:

SPINY WATERFLEA --THEY CAN UPSET THE ENTIRE ECOSYSTEM AND MAKE THE WATER MURKY

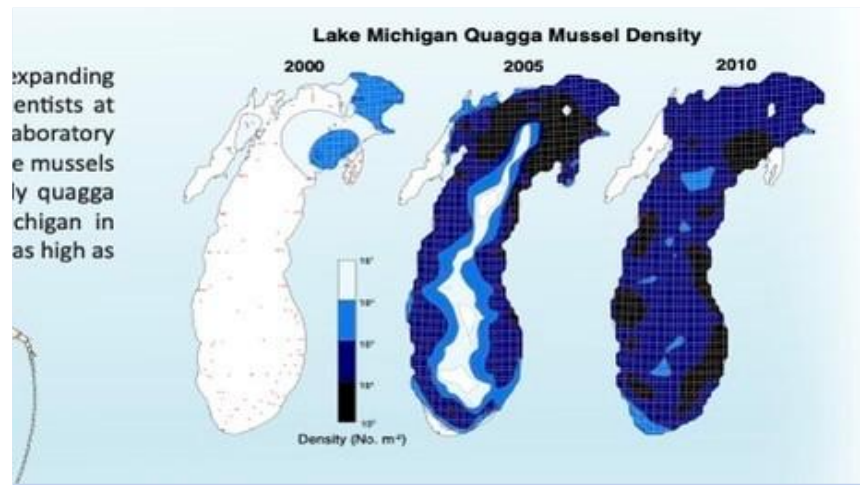
- They compete with juvenile fish since daphnia (native zooplankton) are their primary food source.
- As Spiny reduces algae-eating daphnia, phytoplankton (algae) increases and water clarity decreases.
- The long tail spines make it hard for small fish to eat spiny waterflea. They are a dead-end in the food web, lead to poor spawning results and lower game fish populations.
- **There is no way to eliminate them.**
- Spiny water flea has spread to more than 25 inland lakes in Wisconsin.

QUAGGA MUSSELS

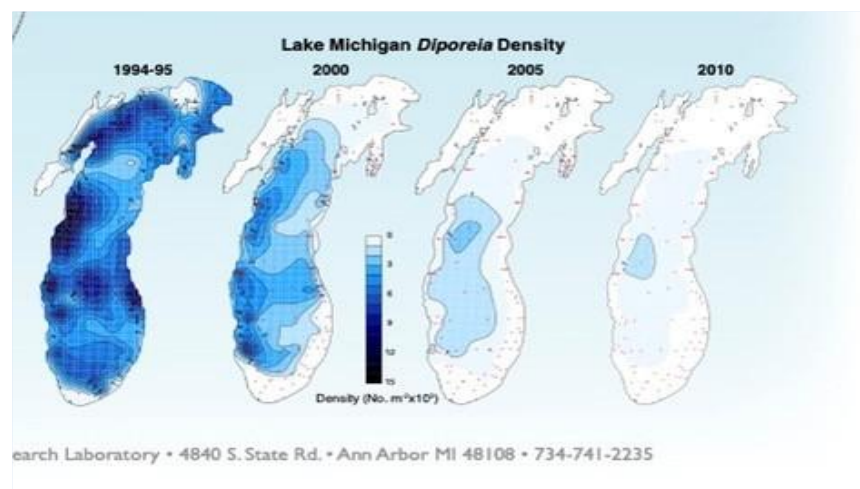


Unlike zebra mussels which require a hard surface to attach to, Quagga mussels can exist on soft bottom surfaces. Quagga mussels were discovered in Geneva Lake last summer, the long siphon enables it to filter more than a liter of water a day. It consumes both phytoplankton, and Lake Michigan's predominant zooplankton, diporeia and its cousins, our native daphnia and other zooplankton that are the main food source for young of the year fish. Numbering in the quadrillions and at densities of up to 35,000 per sq. meter,

quagga mussels filter the entire volume of Lake Michigan every 10 days. Here is a map of the expansion of quagga in Lake Michigan. year 2000 at left and how they expanded by 2010 at right. Quagga has nearly totally replaced zebra mussels in Michigan, in just 10 years.



This is a map showing the density of native zooplankton in Lake Michigan. 1994 on left and 2010 on right. the mussels have nearly erased zooplankton and phytoplankton from lake Michigan. Again, this is the primary food for young of the year fish.



Quagga at left and zebra, right. Zebra has been expanding across the state in waters that have the necessary chemical composition, primarily enough calcium which supports shell formation. It is now considered that about 12 micrograms per liter of calcium is sufficient but lakes close to that are considered potentially susceptible and recent studies on Lake Powell are casting some doubt on whether that threshold is accurate for Quagga.



Quagga mussels are among the planet's most potent invasive species. They reproduce at astonishing speed: one female quagga produces up to a million egg cells. Some are known to survive for 30 years in the deepest parts of American lakes. They can breed all year round, and spawn in temperatures as low as 5 degrees centigrade. A continent away, another Geneva struggles with Quagga. In Lake Geneva, one of the largest bodies of water in Western Europe at 224 square miles and over 1000 feet deep, It took 10 years for Quagga to completely infest this lake. To quote Ecology Professor Ibelings of the University of Geneva, "It's too late for this lake. Going back is a fairytale. We need to accept that this is a different lake now."

Quagga feces contains phosphorous and more nitrogen than any other animal. The result in lake Michigan has been an explosion of cladophora, a filamentous algae., that has exploded due to water clarity that has gone from secchi disk readings of 20 ft. to now, more than 100 ft. There are 183 species of cladophora, and some exist in many inland lakes. Another result is the production of pathogenic microbes such as *E. coli* and fecal bacteria - a potential human health hazard. We should not forget the negative effects on recreational use of impacted shorelines and nearshore areas from both the terrible smell of the rotting algae, the sharp edges of the dead mussel shells on the beach, and depressed property values of adjacent homes.

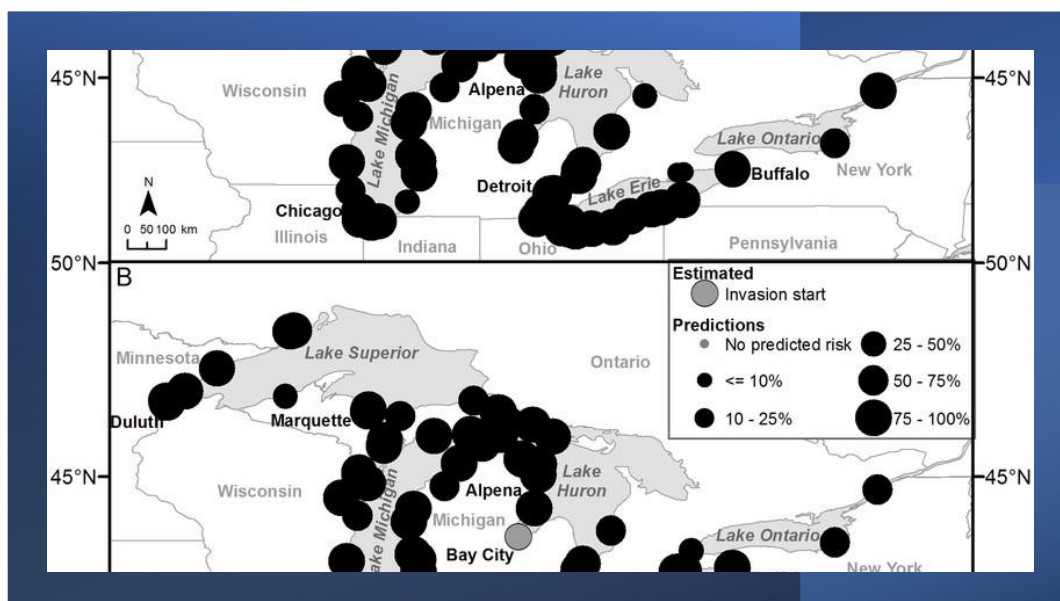
The sequence goes like this:

- cladophora blooms to new depths in the clear water
- it eventually dies, burning up oxygen as it decomposes
- anoxia results and the bacteria that produces botulism thrive
- quagga sucks up those bacteria

- gobies, also imports from the black sea, eat the poisoned mussels
- poisoned gobies become paralyzed and are easy prey for ducks, loons, eagles, grebes, gulls and herons
- the birds die, by the tens of thousands, along the Lake Michigan migration corridor.

GOLDEN MUSSEL

Golden Mussel was discovered in 2024 in the US. A native of SE Asia and China, 1 to 2 cm Golden mussels have now reached the United States, with their detection in California's Sacramento–San Joaquin Delta and they are now considered a threat for expansion. This mussel traveled 1200 miles upstream in less than ten years in South America, an incredibly rapid expansion. Due to the ease of transmission, Potential infestation is already causing scientists to gauge potential risk to the great lakes, shown in this map from Researchgate.



EUROPEAN FROG BIT



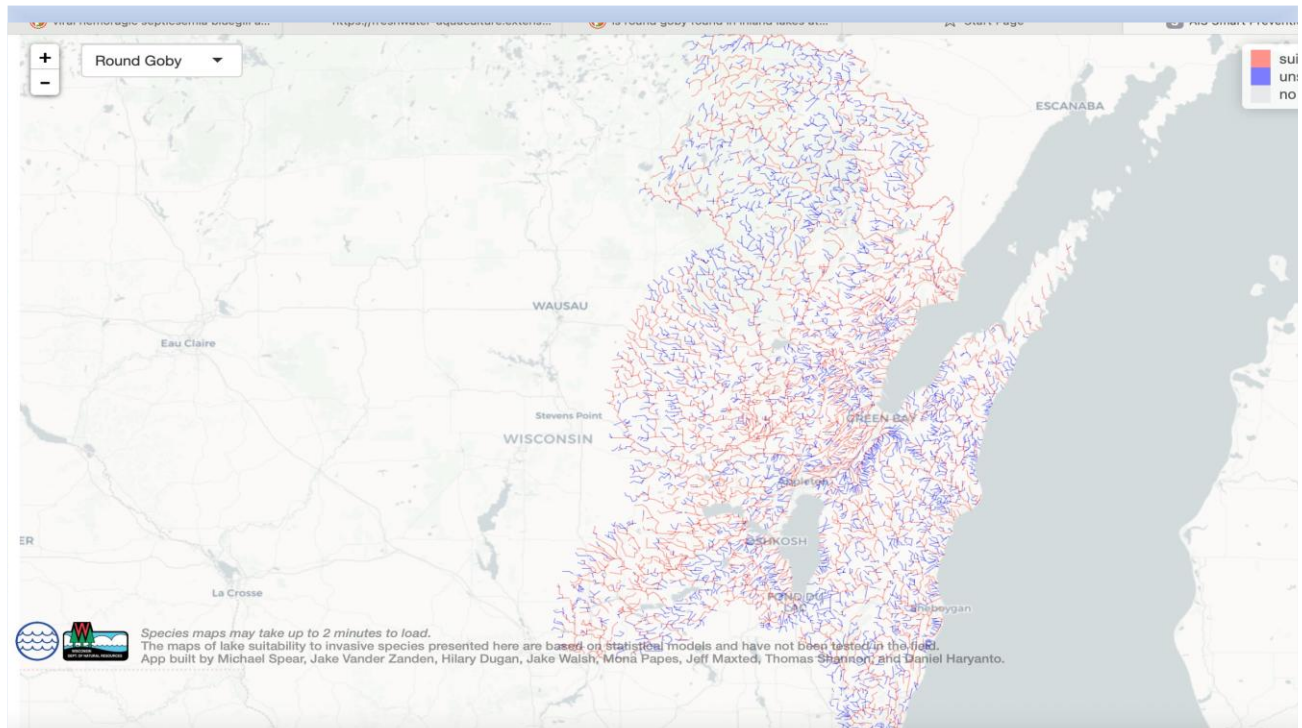
This is European Frog Bit, a floating lily pad like invasive with a leaf that is less than 2" and a very small white flower. The dense growth form of this species can get caught in boat motors, impeding navigation, affect fish and waterfowl movement, and decrease oxygen levels in water as plants decompose. European Frog Bit is extremely difficult and costly to control, and its ability to form new plants vegetatively has allowed it to spread and proliferate quickly. It is now in coastal locations in Marinette and Oconto counties. It forms very dense mats of interlocking plants that limit light penetration, and deplete oxygen levels in water, negatively affecting native aquatic plants and wildlife.

ROUND GOBY





This is a Round Goby, brought in by ballast in ocean freighters along with quagga mussels. It is expanding in rivers in states adjacent to the Great Lakes. Round Goby is a small, but aggressive bottom-dwelling fish that grows rapidly and reproduces several times in one spawning season. It is a threat to aquatic ecosystems because it can harbor contaminants such as heavy metals, PCBs, harmful bacteria, and toxins in its fatty tissues. Gobies routinely thrive at the expense of native fish populations by out-competing them for food and breeding habitat. It feeds on aquatic macroinvertebrates, small native freshwater mussels, and the eggs and young of native fish species. The Round Goby poses a particular threat to Smallmouth Bass, as it often feeds on their eggs and fry. The Round Goby has a competitive advantage because it can feed in complete darkness and aggressively defends prime spawning areas.



This map is from the Web based Ais prevention tool of UW Limnology. The red streams are considered to be suitable for Round Goby's. Jake VanderZanden at UW Limnology says Lakes are next. Round Gobies had been detained in the fox river by the last dam until 2025, when they were discovered in lake Winnebago around Oshkosh. They are now in all tributaries where all sculpin and other forage fish have been eliminated. It is considered a high probability that they made the leap in bait buckets of fishermen. They have been found as far north as the Shawano dam and south to the Princeton dam.

RED SWAMP CRAYFISH



This is Red Swamp Crayfish. This invasive is of great concern since it is a very aggressive predator on young of the year fish and carries a fungus plague to native crayfish. It also burrows and impacts shorelines and dykes.

MARbled CRAYFISH



Marbled crayfish are a current focus of Patrick Siwala, our DNR AIS Coordinator in SE Wisconsin. Patrick is a great resource and a very knowledgeable scientist and was kind enough to spend more than an hour with me as we talked about future AIS issues. These

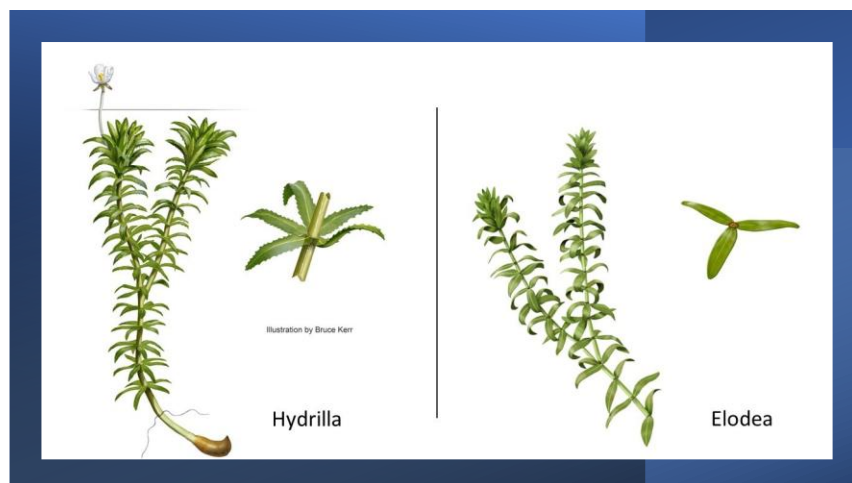
crayfish are part of his sales trade work. They are mostly a trade species, handled by pet store and aquarium sellers due to their distinctive coloring patterns. These crayfish are all female and are of concern because they reproduce through a process called apomictic parthenogenesis, allowing them to produce genetically identical offspring without the need for males. This means that a single female can rapidly create a large population on her own. They are now found in the wild in Ontario.

HYDRILLA

To quote Wisconsin DNR, Hydrilla, a submerged perennial, is the most troublesome aquatic plant in the United States. It outcompetes native vegetation, acts as a breeding ground for mosquitoes and destroys fish and wildlife.



Hydrilla has a near twin and is easily confused with one of our most common native plants and one of great habitat value. Elodea Canadensis, known as common water weed, is a relative of Hydrilla and quite similar in appearance.



SOUTHERN NAIAD



Aquatic plants don't need to be foreign to be invasive. This is Southern Naiad, a good plant offering shelter and food value, which found its way to central Vilas County last summer and has exploded in Plum and previously in High and Fishtrap, dominating the lake bottom in water less than 12ft. It is taking over and dominating in macrophyte beds that were rich, biodiverse beds. It has formed a carpet over 200 +acres in Plum last summer and bunches are breaking loose, forming dense floating mats. Trout Lake Station reports that it may last up to 3 to 4 years before receding to become a less dominant part of our ecosystem.

THE VECTOR

The vector for the spread of many of these species and the other 186 species in Lake Michigan is transfer of infested water and fragments on trailers and props. So what can we do? Decontamination capability is a goal but seems a long way off. A Utah company, Clean Wakes, has designed a new system for Western reservoirs in hopes of keeping quagga out. It's called a dip tank.

The vector is boats and the last point of intercept is boat landings. Many townships and individual lakes have added I-LIDS units like these to their boat landings. These units capture video of each boat launch, upload it to a server by modem and broadcast audio messages reminding boaters of their responsibility to drain their boats and motors and remove any plant fragments to prevent the spread of AIS. In my township in central Vilas County, we have installed 7 of these on our major lake landings. In addition to surveillance

coverage of 100% of daylight hours, we obtain a great deal of data on the use of the landings, peak times for boat launching, types of boats and common practices and mistakes of boaters. We feel this is the most comprehensive solution for landing protection available today. Videos of violations are forwarded to our DNR wardens directly and subsequently to our team for their information. Until decontamination is available in Wisconsin, AND A SYSTEM FOR COMPLIANCE IS GUARANTEED, the only option available is to outlaw the use of ballast in our inland lakes to prevent contamination and to comply with Wisconsin Law on the transfer of water.

Ballast impacts are not a lesson we should have to relearn in Wisconsin, yet our DNR and NRB are offering no response to our pleas to regulate the new ballast threat coming from ballast boats. This is a photo of my home, the Northern Highlands ecological district. The Northern Highland economy is built on the glacial lakes and pristine water in this photo. A migration of any one of these new species, particularly the mussels, into these lakes would be devastating **and unrecoverable** for this significant portion of our state.



*From the North American Invasive Species Association website
on golden mussels:*

Recreational Impacts: Infestations can lead to waterbody closures, mandatory boat inspections, increased launch and entry fees, and restrictions on fishing or shellfish harvesting due to ecosystem degradation or contamination risks.

This is from NAISMA'S WEBSITE. WHILE THIS IS ALREADY HAPPENING IN WESTERN STATES, THERE IS LITTLE EVIDENCE THAT OUR STATE legislative leaders WOULD TAKE THESE TYPES OF PROTECTIVE MEASURES, AS PROVEN BY THE FACT THAT THEY HAVE NOT DONE SO IN THE FACE OF AIS EXPANSION IN WISCONSIN SO FAR.