

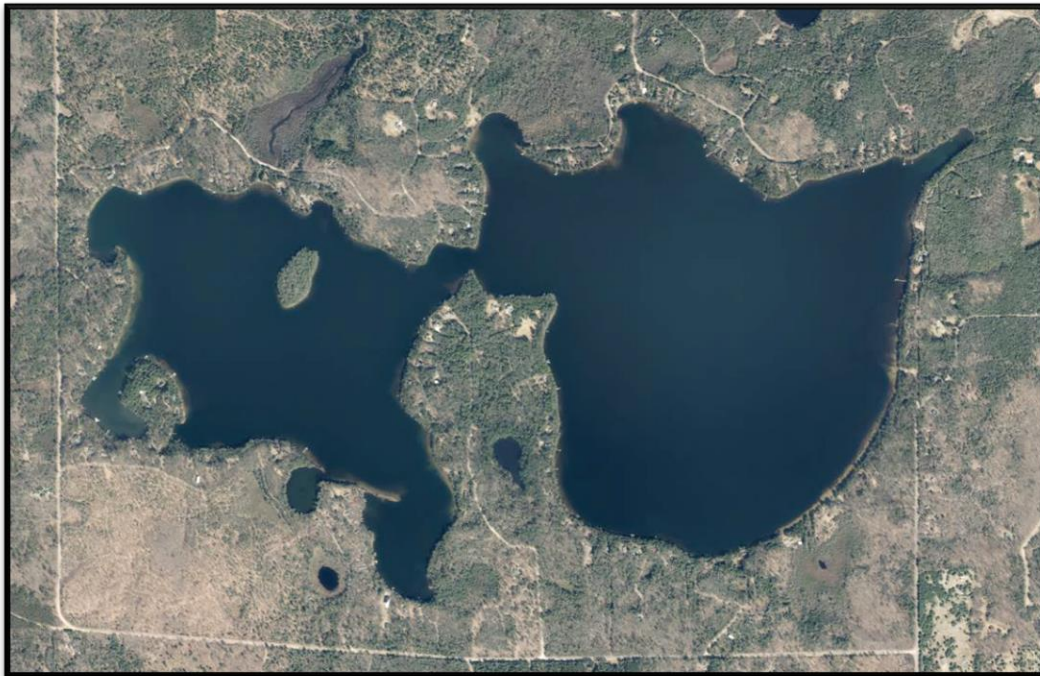
2024 Aquatic Invasive Species Early Detection Monitoring and Water Quality Monitoring Report

For

Two Sisters Lake

Oneida County, Wisconsin

Waterbody ID Code 1588200



This report provides aquatic invasive species early detection monitoring and water quality monitoring data conducted on Two Sisters Lake, August 6, 2024, by the Aquatic Invasive Species Program Staff at Oneida County Land and Water Conservation.

Prepared by Stephanie Boismenu,
Aquatic Invasive Species Coordinator & Conservation Technician
Oneida County Land & Water Conservation Department



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The Oneida County Land & Water Conservation Department's Aquatic Invasive Species Program implements an AIS Management Plan through coordination and collaboration, prevention of new AIS introductions, early detection and monitoring, control and eradication, and outreach and education. The goal of the AIS Management Plan is to minimize the harmful impacts of AIS through the prevention and management of AIS into, within, and from Oneida County.

INTRODUCTION

In Wisconsin, invasive species are defined as a non-native plant, animal or pathogen whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Humans move non-native organisms around all the time and not all non-native species become invasive. One of the reasons a non-native species can succeed as "invasive" is because of the absence of the predators and competitors from their native ecosystems that would otherwise keep them in check and balance. Without the natural checks and balances, some newly introduced species have the potential to spread uncontrollably and reproduce rapidly. As a result, these species can cause tremendous harm to water quality, the environment, wildlife, fisheries, native species, recreation opportunities, waterfront property values, the economy, and infrastructure. When this happens, we consider them invasive species.

AIS and the decline of water quality are both a major threat to our water-rich county. The Oneida County AIS Program works closely with a network of partners from around the state including DNR Lakes Biologists, UW Extension Lakes, lake groups and volunteers to conduct AIS early detection monitoring and water quality monitoring. Together, our efforts help to protect the lakes we love.

AIS early detection monitoring is the most effective and least expensive approach to locating pioneer populations of Wisconsin's Chapter NR 40 regulated AIS. Early detection of AIS will trigger statewide, regional, or local implementation of a rapid response and containment strategies and help prevent the AIS from spreading to vulnerable, uninvaded waterbodies. Rapid response efforts will also help us understand the spread of AIS within a lake, understand the health of the waterbody and watershed, and evaluate the relationship between water quality and invasive species. Both AIS early detection monitoring and rapid response efforts can make the difference between potential eradications and/or long-term management and the financial burdens involved.

Water quality monitoring consists of obtaining water clarity, dissolved oxygen and temperature. This data provides a snapshot of a lake's physical and biological characteristics, documents water quality changes over time, and is a crucial record for long-range planning. Monitoring aims at assessing the environmental state, detecting trends, and identifying potential problems in the water or watershed. The state of water quality is the result of complex natural and manmade conditions and the consequence of those interactions over time. Evaluating trends determine whether water quality is changing relative to land use, natural conditions, and relationship with AIS. Water quality data provides important and useful information to lake groups, local and regional resource managers, community stakeholders, and provides data to help protect and enhance our waters and watersheds.

This report provides AIS early detection monitoring and water quality monitoring data conducted by the AIS Program staff at Oneida County Land and Water Conservation.

BACKGROUND

Two Sisters Lake is a 719 acre lake located in the Town of Newbold, Oneida County, Wisconsin (Figure 1.1). The lake sits within the Tom Doyle Creek-Wisconsin River watershed (Figure 1.2). The lake is divided by two basins: a west basin and east basin. The maximum depth in the west basin is 53 feet, the maximum depth in the east basin is 63 feet, and the means depth throughout the lake is 30 feet. The lake is designated as a headwater drainage lake. Two Sisters Creek flows out of the lake at the outlet located in the north end of the west basin and drains into the Wisconsin River. A state owned island, totaling 4.23 acres, is located in the west basin. There is one public boat landing located on the east shore of the east basin off of Black Lake Road.

Two Sisters Lake is a soft water, two-story, spring-fed, drainage lake with clear water of very high transparency. The substrate consists of 65% sand, 25% gravel, 10% muck. Fish species in this lake include muskellunge, Northern pike, walleye, largemouth bass, smallmouth bass, perch, bluegill, crappie, rock bass, pumpkinseed, sucker and cisco.

Wisconsin has designated many of the state's highest quality waters as Outstanding Resources Waters (ORW) or Exceptional Resource Waters (ERW). Two Sisters Lake is designated as one of six ORW lakes in Oneida County and one of 97 ORW lakes in Wisconsin. Waters identified as ORW or ERW have surface waters that provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality and are not significantly impacted by human activities. Additionally, ORW and ERW status identifies waters that the State of Wisconsin has determined warrant the highest protection from the effects of pollution and a decline of water quality.

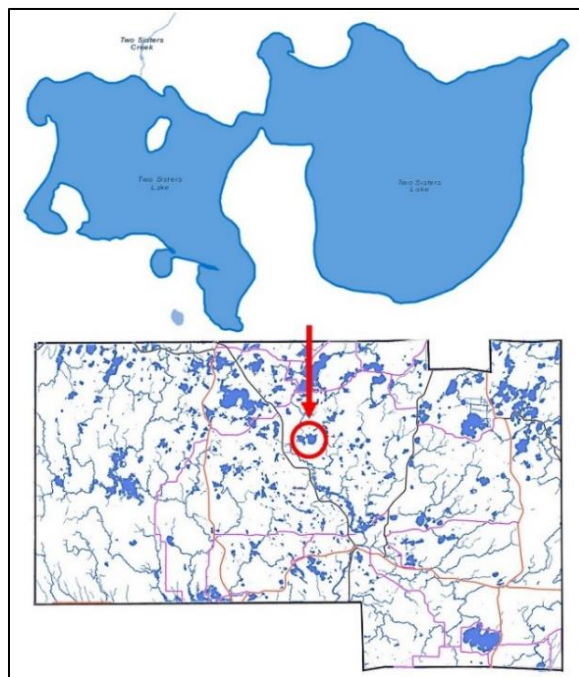


Figure 1.1 Location of Two Sisters Lake in Oneida County, Wisconsin.

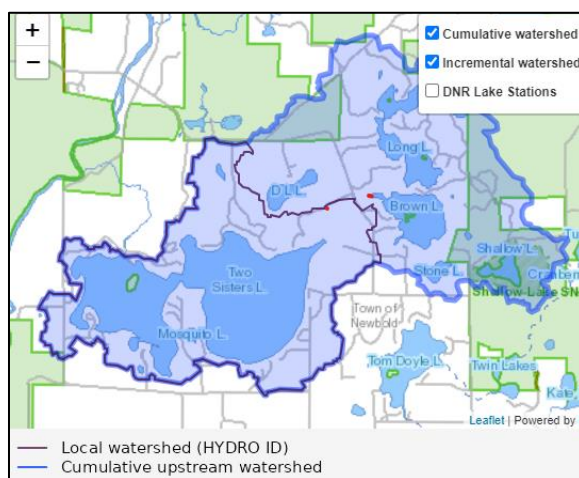


Figure 1.2 Location of Two Sisters Lake within the Tom Doyle Creek-WI River Watershed.

Source WI Water Explorer WDNR.

The Two Sisters Lake Property Owners Association was formed in 1975 and members have been dedicated, active stewards of the lake ever since. As noted from the twosisterslake.com, their purpose is to “Foster in the area the conservation of natural resources, the preservation of environmental qualities, zoning compatible with such conservation and preservation, water safety, outdoor recreation and fairness in taxes and otherwise to promote the social welfare of the inhabitants of the area.”

Volunteers from Two Sisters Lake have been involved with several statewide stewardship and citizen science programs aimed to help monitor the health of the lake and protect the lakes precious water resources (Figure 1.3). These programs include the Citizen Lake Monitoring Network (CLMN) and Clean Boats Clean Waters (CBCW) programs. Both programs are run through the Wisconsin Department of Natural Resources (WDNR), coordinated statewide by the University of Wisconsin - Extension Lakes, and coordinated locally by Oneida County Land & Water Conservation Department’s AIS Program.

- **CLMN Volunteer Water Quality Monitors:** From 1986 to 2024, volunteers from Two Sisters Lake have collected valuable water quality and water chemistry data from both deep holes of the lake, at least four times a year during the open water season. Volunteers measure water clarity, dissolved oxygen, and temperature and collect phosphorus & chlorophyll samples. The information collected is used by the WDNR, fisheries biologist, researchers, UW-Extension, and other interested individuals to monitor long-term trends and assist in projects that work to improve the lake.
- **CLMN Volunteer AIS Early Detection Monitors:** The Two Sisters Lake Property Owners Association’s AIS Program is comprised of a dedicated team of volunteers who provide AIS education, outreach, strategic planning, and monitoring activities. The volunteers have received AIS identification and monitoring training through the Oneida County AIS Program and are prepared to respond to suspected AIS threats to the lake. They are also well prepared to implement AIS proactive measures - at least once a year, they coordinated a “Shoreline Monitoring Day” to search the lake for AIS.
- **CBCW Volunteer Watercraft Inspectors:** In 2006, the Two Sisters Lake Property Owners Association began conducting CBCW watercraft inspections at the boat landing. From 2006 to 2023, their dedicated team of both volunteer and paid inspectors conducted 12,535.75 hours of inspections, inspected 12,324 watercrafts, and discussed AIS prevention steps with 26,219 people (Appendix C). Their amazing efforts have shielded the lake from the introduction of the most devastating AIS that enter vulnerable, uninfested lakes at the boat landing.



Figure 1.3: Volunteers from Two Sisters Lake attended AIS early detection monitoring and CBCW trainings on 7-13-19 and 6-3-23. *Photos courtesy Stephanie Boismenue*

What is the Purpose of the CBCW Program? The key pathway to the spread of AIS is the accidental transport of organisms on recreational boats as they are moved among waterbodies. Organisms may be carried in bilge water, live wells, bait buckets, or attached to anchors, boat hulls, trailers, and equipment. Thus, every time a boat is transported overland after use in an invaded waterbody, it has the potential to transfer AIS to uninvaded waterbodies. In response, Wisconsin developed the CBCW program in 2004, as a means for individuals, lake groups and agencies to invest their time in boat inspections and education to slow the spread of AIS. Inspecting a watercraft before entering and leaving a waterbody allows discovery and disposal of AIS, opportunity to educate boaters about AIS, assist boaters in taking prevention steps, and collect data during inspections. Since 2004, the CBCW program has been Wisconsin's most successful and least expensive proactive effort to prevent the spread of AIS at the boat landings.

Watercraft Inspectors Collect Boater Movement Data: During inspections, survey data is collected about the location of boating activities within 5 days prior to arriving at a waterbody. CBCW inspectors ask boaters "Was this boat used during the past five days on a different waterbody?" If yes, the inspector records the name, county, and state of all waterbodies visited within the 5 day timeframe. The CBCW inspector may have knowledge and/or the ability to look-up the AIS in the previously visited waterbodies. Depending on the AIS, that information could prompt additional watercraft inspection efforts. This data also allows state and local groups to compile information on boater movement and the documented AIS in the previously visited waterbodies.

2023 Boater Movement Data for Two Sisters Lake: Figure 1.5 shows the number of times (events) a boat arrived at Two Sisters Lake boat landing that had been on a different waterbody within 5 days prior to arriving at Two Sisters Lake, and the documented AIS in that waterbody. The complete data set that includes names of those waterbodies can be found in Appendix D. The complete data set includes the name and county of the waterbodies reported visited within 5 days, the documented AIS in each of those waterbodies, and the number of times (events) a boat arrived at Two Sisters Lake that had been on a waterbody with an AIS of greatest concern.

**Figure 1.5 Snapshot of
2023 Boater Movement
Data for Two Sisters Lake.**

Events	Documented AIS in Prior Waterbody
1	Asiatic Clam
27	Banded Mystery Snail
42	Chinese Mystery Snail
16	Curly-leaf Pondweed
21	Eurasian Water-Milfoil
1	Faucet Snail
3	Hybrid Eurasian / Northern Water-Milfoil
2	Phragmites (non-native)
19	Purple Loosestrife
1	Rainbow Smelt
27	Rusty Crayfish
3	Spiny Waterflea
2	Starry Stonewort
9	Yellow Iris
3	Zebra Mussel

What Can You Do to Help Protect Two Sisters Lake?

1. Become a member of the Two Sisters Lake Property Owners Association.
2. Volunteer as a Clean Boats Clean Waters watercraft inspector at the Two Sisters Lake boat landing. Any amount of time will help – a few hours a week, once a month, or even once a summer.
3. Learn to identify AIS and who to contact if found.
4. If you are purchasing used shore stations and/or a used dock from a different lake, please make sure the equipment is thoroughly cleaned and free of AIS hitchhikers before arriving at Two Sisters Lake.
5. If the invasive Aquatic-forget-me-not is growing along the shoreline, please remove it, dispose of in a trash bag, and plant natives in its place.
6. Preserve, enhance and/or restore shoreline habitat and buffer areas. Plant native wildfowlers, grasses, sedges, sub canopy and canopy trees along the shoreland, instead of mowed lawns to the water's edge. Native plants require little to no maintenance, attracts birds and pollinators, will repel nuisance geese, and provides more free time to enjoy the lake.
7. Engage in stewardship efforts and assist with ongoing efforts to help protect your lake.
8. Recognize and appreciate volunteer involvement.
9. You already know what's on the surface of Two Sisters Lake, but there is so much more to learn about your lake! Explore life below the surface and get to know the underwater gardens.

2024 AQUATIC INVASIVE SPECIES EARLY DETECTION MONITORING AND WATER QUALITY MONITORING REPORT FOR TWO SISTERS LAKE

Field Date: August 6, 2024
Field Crew: Jody Partin and John Heusinkveld, AIS Program Staff, Oneida County Land & Water Conservation Department
Volunteers: Mary Jung and Joe Steinhage, Two Sisters Lake Association members
Previous AIS Findings: Aquatic Forget-me-not, Banded Mystery Snail, Chinese Mystery Snail, and Snail and Rusty Crayfish
New AIS Findings: None

On August 6, 2024, John and Jody visited Two Sisters Lake to conduct AIS early detection monitoring along with water clarity and quality monitoring using the county canoe. Mary Jung and Joe Steinhage, members of the Two Sisters Lake Property Owners Association, volunteered to join them in their kayaks. John and Jody assisted them in learning how to identify aquatic plants and demonstrated how to conduct AIS monitoring, while they shared their expertise and knowledge of Two Sisters Lake. AIS monitoring and water quality sampling are conducted following the procedures and protocols outlined by the WDNR and the Citizen Lake Monitoring Network.

AIS EARLY DETECTION MONITORING

A visual meander survey was conducted around the entire perimeter of the lake's littoral zone, meandering between shallow and maximum rooting depth, or 100 feet from shore (whichever comes first). They observed the shoreline, the water surface, and used polarized sunglasses to see in the water. The weather while monitoring on Two Sisters Lake was very good. The air temperature was 72 degrees Fahrenheit, the sky was sunny, and winds fluctuated between 5-15mph.

Additional AIS survey efforts were implemented at the public boat landing and at four sites around the lake as shown on the map in Figure 2.1. These targeted survey sites are chosen based on vegetation density, sites suspected of a new AIS, or considered high risk of AIS introductions such as boat landings. Several methods and tools can be utilized as deemed necessary during the target survey: wade through shallow water to sift through weed beds and around structures, analyze plant rake samples, use aqua view scopes, deploy underwater camera, and snorkel to examine underwater solid surfaces.

AIS Monitoring Results

No new AIS were observed. AIS previously verified in Two Sisters Lake include Aquatic Forget-me-not (*Myosotis scorpioides*), Banded Mystery Snail (*Viviparus georgianus*), Chinese Mystery Snail (*Cipangopaludina chinensis*), and Rusty Crayfish (*Faxonius rusticus*). Identification field guides for these species can be found in Appendix A.

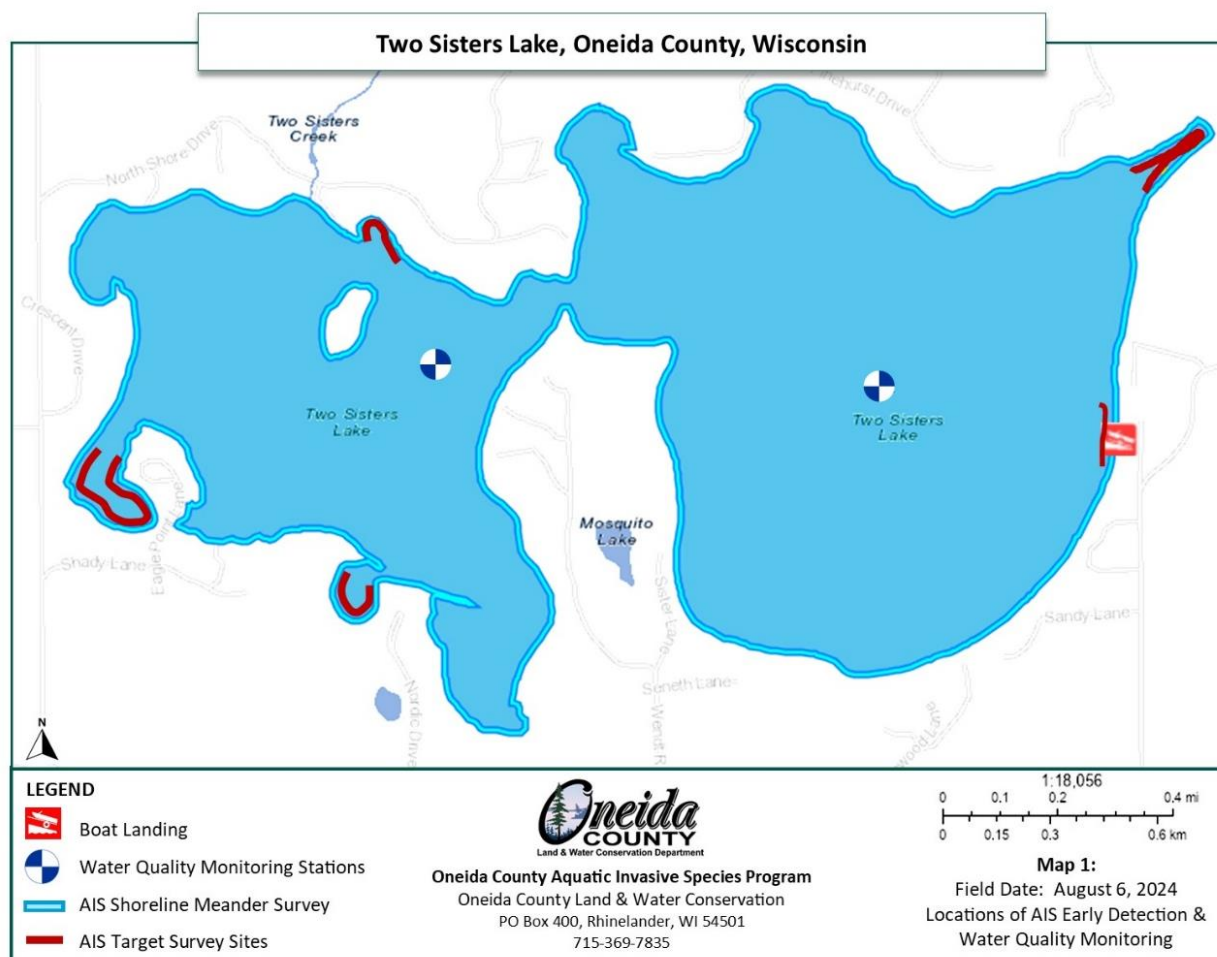


Figure 2.1 Locations of AIS and water quality monitoring activities.

Native Aquatic Plant Observations

While monitoring for AIS, Jody and John noted the common native aquatic plants observed within the lake and were impressed by the great diversity of species - a total of 20 species were documented. A description and photo of the 20 species is shown in Appendix B.

Native aquatic plants and plant communities are crucial for stabilizing an aquatic ecosystem and they are good indicators of lake health. Aquatic plants provide food, habitat and breeding areas for various organisms, including fish, insects, amphibians and wildlife. They absorb excess nutrients from the water column, preventing algal blooms and maintaining water quality. Through photosynthesis, aquatic plants release oxygen into the water. Their root systems anchor the sediment on the lakebed, preventing erosion, and improving water clarity. Over time, the diversity of species and size of plant beds may fluctuate in response to changes in water quality, AIS, and human activity.

WATER QUALITY MONITORING

Water quality monitoring includes obtaining water clarity, dissolved oxygen and temperature data at the deep hole in the eastern basin of the lake. After John, Jody, Mary and Joe navigated to the deep hole, they confirmed the depth of 63 feet with a depth finder. A Secchi disk was used to measure water clarity and an YSI ProSolo Dissolved Oxygen Meter was used to obtain dissolved oxygen and temperature readings at two foot increments.

For consistency, water quality sampling is carried out at the “deep hole” of each lake at established coordinates designated by the WDNR. Sampling at the deep hole is considered to be representative of whole-lake conditions and over time will provide trends in the health of the lake. Consistent, long-term water quality sampling data from the deep hole is critical not only for understanding lake-wide water quality status and trends, but for effective management of water resources in response to current and future changes in status and trends.

Water Clarity

One indicator of lake health is water clarity. Obtaining water clarity data provides a visual indication of the condition of the water quality related to chemical and physical properties. Water clarity has two main components: true color (materials dissolved in the water) and turbidity (particles suspended in the water such as algae and soil). It is affected by a number of physical, chemical and biological factors that are connected to the natural geology and human use of the surrounding watershed.

Water clarity can vary naturally due to storm events, wind patterns, and changes in sunlight. Clear water is characterized by low concentrations of suspended particles and the algae population is usually the largest and most variable component. Cloudy, turbid waters results when sediment and other materials are stirred up in the water and high levels of suspended particles scatter and absorb light. However, lakes with low water clarity are not necessarily “unhealthy” or polluted.

Human-driven environmental changes can reduce water clarity beyond natural conditions. For example, excessive inputs of nutrients (such as from leaking septic tanks and fertilizer runoff), soil erosion (from disturbing the shoreline and removing vegetation) and sediments (such as from construction runoff and boat traffic) can significantly reduce water clarity. Nutrient pollution can cause overgrowth of algae, both on the surface and in the water column. In addition to limiting the aesthetic value and appeal for swimming, reduced water clarity can negatively affect aquatic ecosystems and the success of fish reproduction. Controlling these changes can greatly improve water quality.

Water clarity data determines how far light penetrates into the water column and how much light is available for growth in the lakes ecosystem. Though some turbidity is essential for the diversity and productivity of aquatic life; in general, clearer water allows more sunlight to reach submerged aquatic vegetation. The vegetation, in turn, produces oxygen, provides habitat for fish and shellfish and provides food for waterfowl, fish and mammals.

What is a Secchi Disk?

A Secchi disk is used to measure water clarity and to set a numerical value to water quality. The Secchi disk is a black and white 8 inch diameter disk attached to a rope with measurements marked at one foot increments. It is lowered into the water until it can no longer be **seen (Figure 2.2)**. This depth of disappearance, called Secchi depth, is then measured and provides a value of the transparency of the water. A high Secchi depth value indicates clear water, meaning the disk was visible at a greater depth, while a lower value signifies a more turbid water where the disk disappeared closer to the surface. Low values indicate low water clarity, which can be caused by a variety of factors such as seasonal variations, plankton blooms, nutrients fueling the growth of algae, suspended sediments and organic matter, weather events, and human activity (Figure 2.3).

One Secchi reading will not tell you a great deal about the lake, but Secchi readings taken over a period of time will provide water clarity long-term trend data that can tell a story about a lake – is the water clarity improving, declining, or remaining the same? In addition, when analyzing long-term trend data, it's crucial to consider seasonal variations and potential data biases by analyzing data from similar times of year, as Secchi depth can significantly fluctuate throughout the seasons, making a simple yearly average less telling.

Water Clarity Results

The Secchi depth measurement in the eastern basin was excellent – at **16 feet**, and the appearance of the water level was normal, water column was clear, and the water color was green, which is normal for Two Sisters Lake. Secchi depths sampled in the east basin during the 2024 open water season is displayed in Figure 2.4. From 1986 to 2024, a total of 228 Secchi depths have been sampled from the Eastern Basin as shown in Figure 2.5, and provides an excellent snapshot of the trends over time. The 2024 Secchi depth data is consistent with the average early August long-term trend data sampled in the Eastern Basin and shows that even with seasonal variables, the water clarity in Two Sisters Lake is excellent (Figures 2.6 and 2.7)!

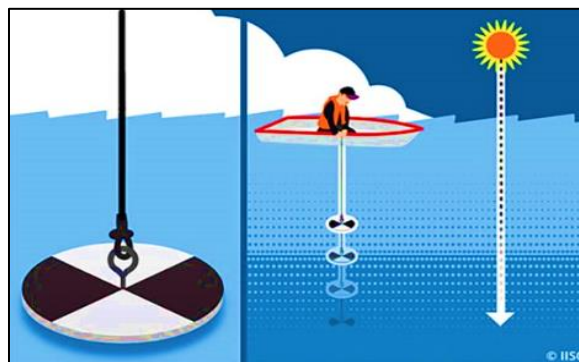


Figure 2.2. Graphic illustrates how a Secchi depth measurement is sampled.

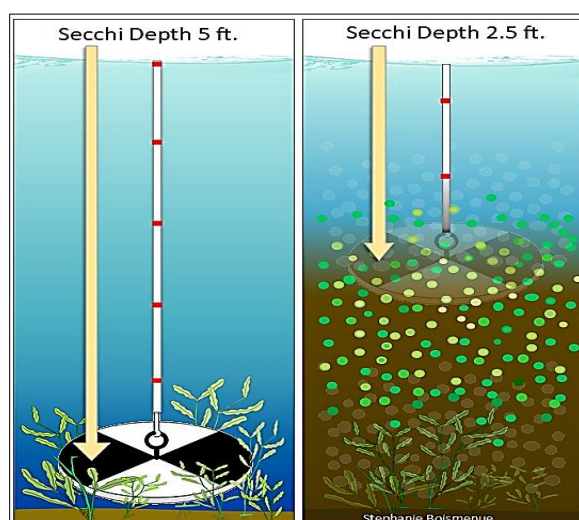


Figure 2.3. Graphic illustrates how Secchi depth measurements on a single lake are influenced by light penetration. The Secchi depth of 5 feet indicates low algae and suspended sediments at the time the lake was sampled. The Secchi depth of 2.5 feet indicates turbid water at the time the lake was sampled. Graphic credit: Stephanie Boismenu

Date	Secchi Depth (ft)	Water Column	Water Color	Collectors Perception	Collector
4-24-24	11.70	Clear	Green	1	Kent Bradshaw, CLMN Volunteer, TSL
6-27-24	19.50	Clear	Green	1	Kent Bradshaw, CLMN Volunteer, TSL
7-22-24	24.20	Clear	Green	1	Kent Bradshaw, CLMN Volunteer, TSL
8-06-24	16.00	Clear	Green	1	Oneida County AIS Team
8-20-24	21.80	Clear	Green	1	Kent Bradshaw, CLMN Volunteer, TSL
Data collectors perception of the water appearance: 1= Beautiful, could not be nicer; 2 = Very minor aesthetic problems; 3 = Enjoyment somewhat impaired (algae); 4 = Would not swim but boating OK (algae); 5 = Enjoyment substantially impaired (algae)					

Figure 2.4. Secchi depths sampled during the 2024 open water season in the Eastern Basin of Two Sisters Lake.

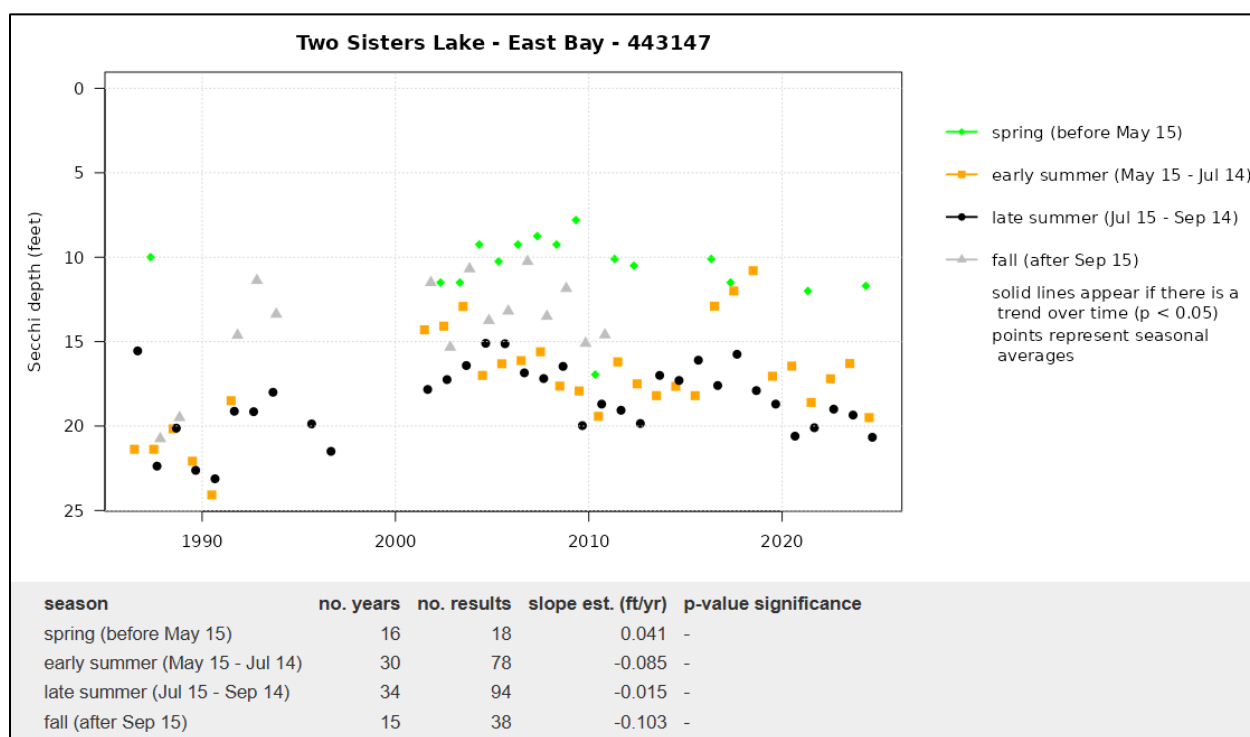


Figure 2.5. Secchi depths sampled from 1986 to 2024 in the Eastern Basin of Two Sisters Lake.
Source WI Water Explorer WDNR

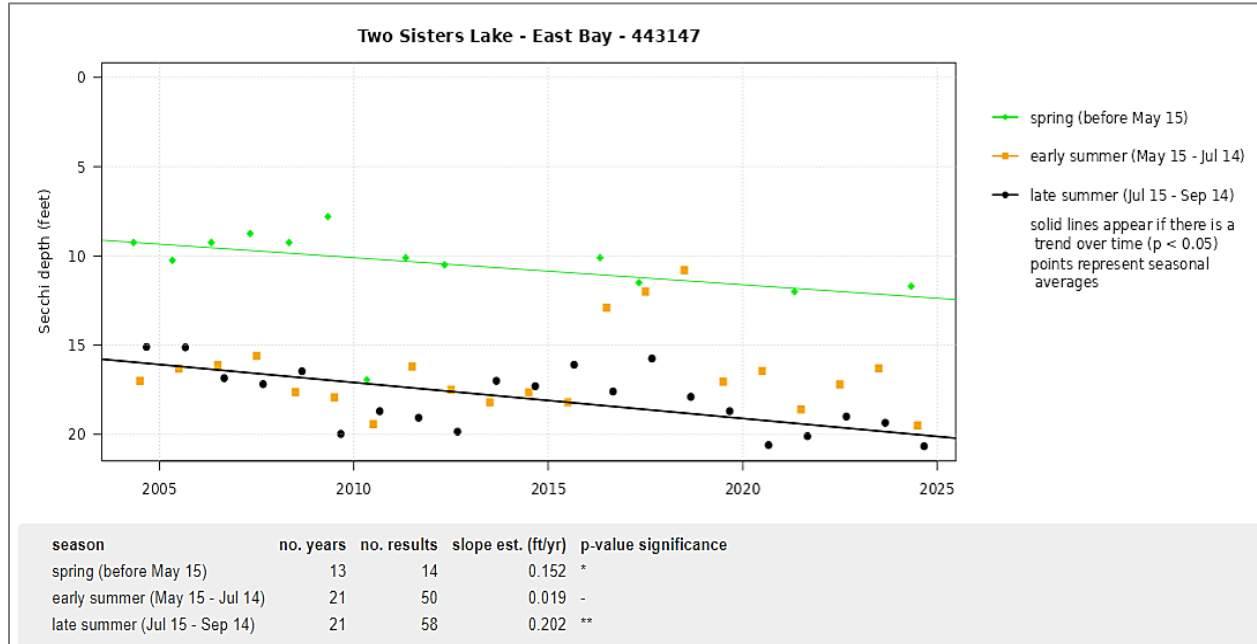


Figure 2.6. Secchi depths sampled from 1986 to 2024 in the Eastern Basin of Two Sisters Lake and shows the seasonal variation trends over time. Source WI Water Explorer WDNR

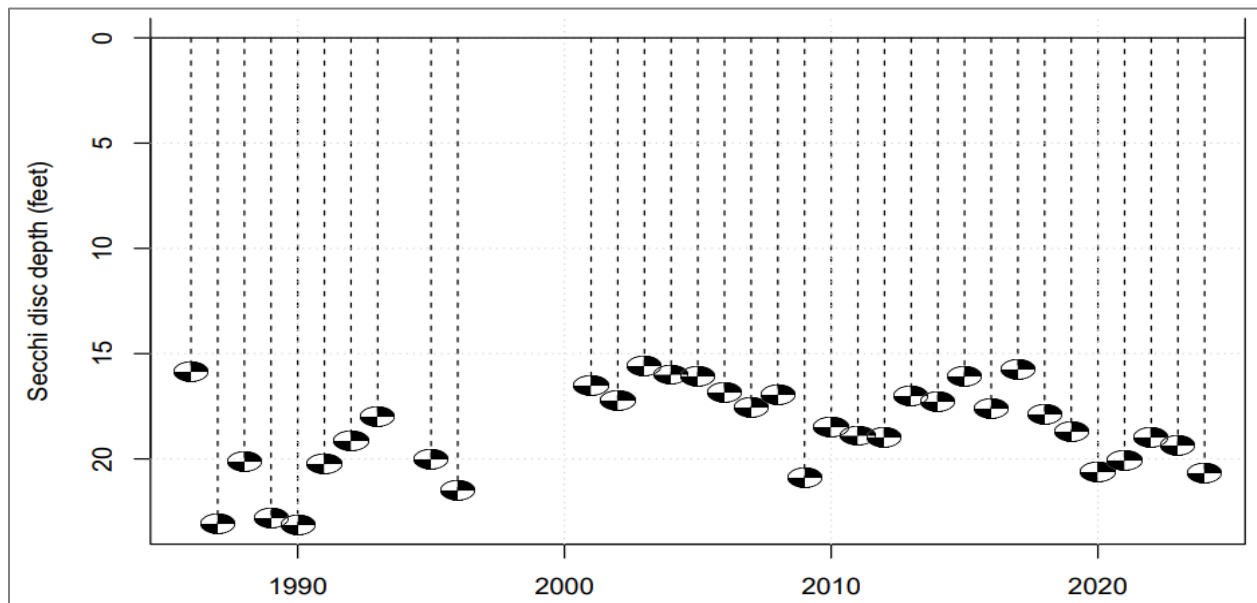


Figure 2.7. Average Secchi depth data from July and August of each year sampled in the Eastern Basin of Two Sisters Lake. Source WI Water Explorer WDNR

Dissolved Oxygen and Water Temperature

Dissolved Oxygen is a measurement of the amount of oxygen gas dissolved in water and available for use by microorganisms and fish. Dissolved oxygen is produced by aquatic plants and algae as part of photosynthesis. Sufficient dissolved oxygen in lake water is essential to the survival of aquatic organisms. The amount of dissolved oxygen present within the lake varies by season, depth, activity that consumes and produces oxygen, by water mixing through wind and sediment stir, changes in temperature, and inputs of surface and groundwater. Generally, at least 5mg/l oxygen is required for fish.

Water temperature impacts many organisms living in the lake. Reproduction, metabolic rate, and survival of fish and other aquatic animals; plant and algal growth and biomass; and nutrient cycling are all driven by water temperature. Long term data is needed to understand temperature trends.

Water Quality Results

The weather while monitoring on Two Sisters Lake was very good. The air temperature was 72 degrees Fahrenheit, the sky was sunny, and the wind fluctuated between 5-15 mph. Dissolved oxygen and temperature readings were obtained at two foot increments, totaling 31 readings (Table 2.1). The dissolved oxygen and Secchi disk readings are within normal range for this time of year and indicate that Two Sisters Lake is in excellent health. There should be no concern for the health of Two Sisters Lake.

The plot in Figure 2.8 displays the August 6, 2024 temperature and dissolved oxygen on the x-axis and depth on the y-axis. It is important to see how temperature and dissolved oxygen change from the surface to the bottom of the lake. If temperature is constant, the lake is mixed, whereas if there is a large difference in temperature the lake is stratified, and conditions at the surface may be very different than conditions at the bottom.

The plot in Figure 2.9 compares the dissolved oxygen and temperature sampled in April, June, July and August 2024. The plot on the left shows how temperature changes from the lake surface (at the top of the plot) to the lake bottom on each sampling date. The plot on the right shows how dissolved oxygen changes from the surface to the bottom. Look for seasonal changes. In spring and fall, most lakes will have steady temperatures and oxygen concentrations throughout the water column. In summer, some lakes will warm near the top and remain cool near the bottom. Those lakes may also have low concentrations of oxygen near the lake bottom

Table 2.1 Dissolved oxygen and water temperature readings from 8-6-2024, East Basin, Two Sisters Lake

Depth (ft)	Temperature (F)	Dissolved Oxygen (mg/L)
2	74.7	8.31
4	74.8	8.50
6	74.8	8.51
8	74.7	8.52
10	74.7	8.52
12	74.7	8.57
14	74.7	8.51
16	74.6	8.51
18	74.2	8.64
20	70.3	8.95
22	66.4	9.60
24	62.5	10.35
26	59.5	10.78
28	55.6	10.70
30	53.6	9.16
32	52.3	7.91
34	50.7	5.94
36	49.4	4.82
38	48.7	3.50
40	47.9	2.36
42	47.3	1.78
44	47.1	1.26
46	46.8	0.79
48	46.7	0.58
50	46.4	0.27
52	46.0	0.17
54	45.9	0.12
56	45.8	0.08
58	45.7	0.05
60	45.6	0.03
62	45.4	0.01

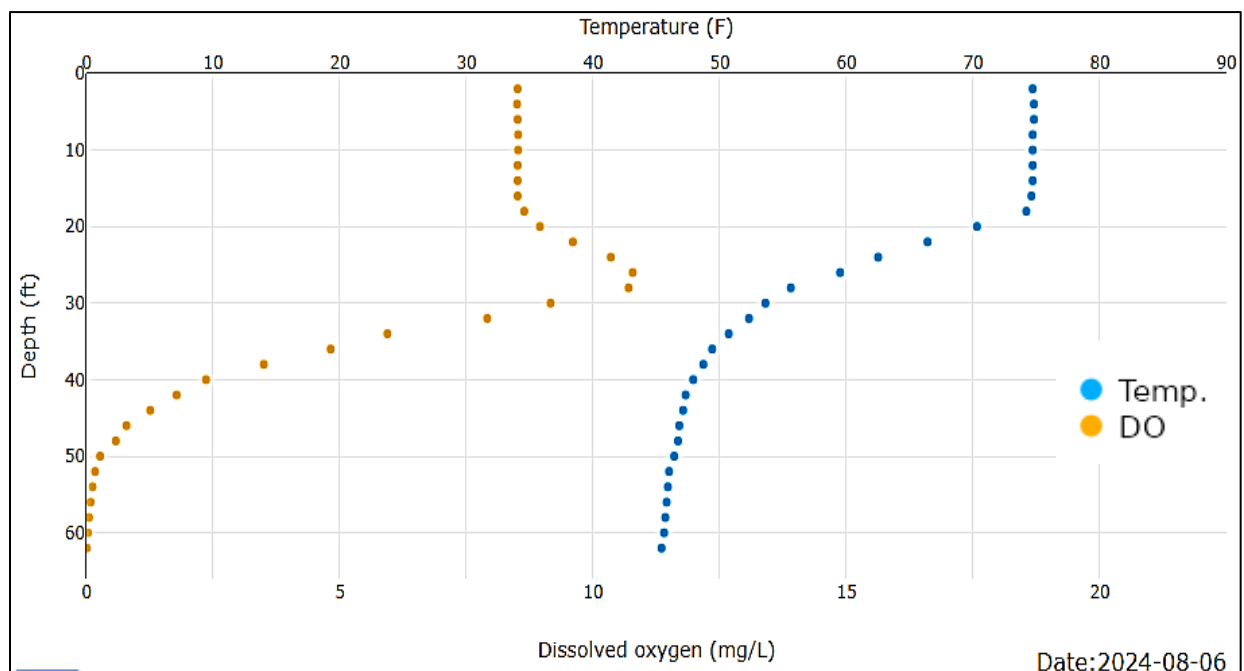


Figure 2.8 August 6, 2024 temperature and dissolved oxygen profiles sampled in the Eastern Basin of Two Sisters Lake. Source WI Water Explorer WDNR

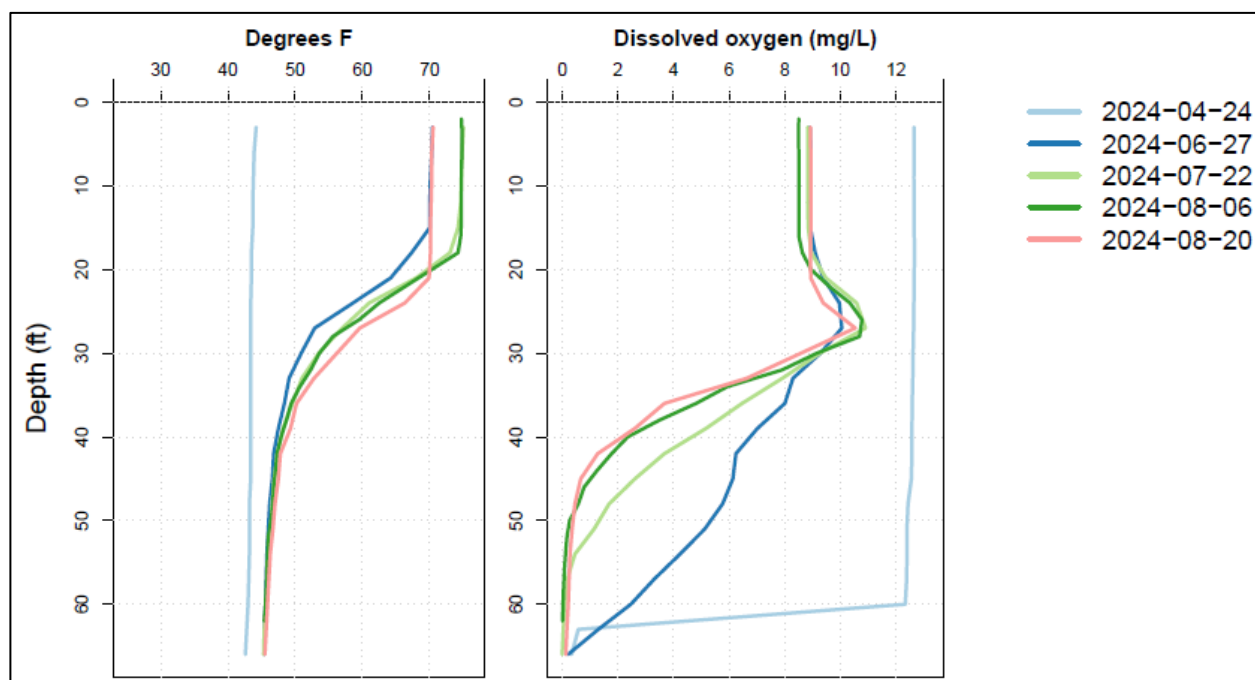


Figure 2.9. 2024 temperature and dissolved oxygen profiles sampled in the Eastern Basin of Two Sisters Lake. Source WI Water Explorer WDNR

Appendix A: AIS Field Guides for Verified AIS in Two Sisters Lake



Aquatic Invasive Species Field Guide Aquatic Forget-Me-Not (*Myosotis scorpioides*)

DO NOT PLANT THIS INVASIVE SPECIES!

Wisconsin Status: Aquatic forget-me-not is a Restricted invasive species under WI NR 40. Control is encouraged if it is on your property. This species cannot be transferred, transported, or introduced without a permit issued by the Wisconsin Department of Natural Resources.

Description: Aquatic Forget-me-not is a non-native, herbaceous perennial that escaped water gardens and ponds and spread to shorelines, wetlands, marshes, moist woodlands, and wet meadows. It is a competitive plant that grows rapidly, forms dense monocultures that crowds out native groundcover, reduces soil nutrients, and reduces wildlife habitat.



Caution: Contains pyrrolizidine alkaloids that are toxic to mammals.

Spread: Seeds, water currents, fragmentation, escapes from cultivation, and human activity.

Reproduction: It is capable of abundant reproduction through spreading stolon's (runners) and abundant seed production.

Height: From 6 inches to 24 inches tall.

Flower: Blooms May-September. Terminal, branched clusters of showy blue, 5-petaled, flat flowers with a yellow center. Flowers are 1/4 to 1/3 inch across. Sepals have flat, tight hairs.

Leaves: Alternate, oblong to lance-shaped with a rounded tip, prominent central vein, smooth edges and 1-3 inches long.

Stems: Slightly hairy, round, and angled. Multiple stems branch from the base of the plant, and further branch as the stem elongates.

Aquatic Forget-me-not (*Myosotis scorpioides*)

Wisconsin Status: Aquatic forget-me-not is Restricted under Wisconsin's Invasive Species Rule NR 40, so control is encouraged if it is on your property. This species cannot be transferred, transported, sold, or introduced without a permit.

Native to: Europe, Asia

Ecological Impacts: Aquatic forget-me-not is a fast-growing and fast-spreading non-native semi-aquatic plant that forms dense colonies. It invades shorelines and shallow water areas of lakes, rivers, streams, wetlands, bogs, swamps, ponds, and forest, ditches, and flood plains.

The dense, almost impenetrable, monotypic mats crowd out native plants, reduce habitat for wildlife and fish, reduce bird nesting and rearing sites, compact soil, and alter hydrology by trapping sediment.

Spread: Spreads quickly by seeds that float and by underground rhizomes that send out new shoots above the ground and roots below. Develops thick mats of rhizomes that can connect several hundred plants.

Similar Species: Aquatic forget-me-not can be confused with the native Small forget-me-not (*Myosotis laxa*) and non-native Woodland forget-me-not (*Myosotis sylvatic*).



Large cluster of aquatic forget-me-not growing in shallow water.

Photo credit: First Nature.

Control: Efforts are most likely to succeed when plants are small and manageable. Removing flowers and seed capsules can prevent the spread and removing the root system will prevent re-growth. Use an integrated approach of monitoring for seedlings and re-growth and control efforts.

Manual: Hand removal is effective for removing small plants and plant populations. The plants removes easily when the soil is moist. Hand pull or dig the entire plant, including the roots, before the seeds set. **Caution:** The disturbance associated with digging can result in shoreline and sediment erosion

Mowing: Mowing is not advised. Mowed plants will regenerate from the rhizomes.

Chemical: Dicamba or glyphosate may affect *Myosotis* species. Permits may be needed. Always check DNR regulations for the most up-to-date information regarding permits for control methods.

Handling During Control Efforts: Keep all parts of the plant contained in a bag or bucket.

Disposal: Dispose of in landfill or by burning. The DNR's and Waste Management programs are asking property owners to separate and bag AIS in clear bags and label the bags "Invasive plants – approved by DNR for landfiling."

Site Restoration: Plant natives in its place.

Report AIS: Visit <https://dnr.wisconsin.gov/topic/Invasives/report>

Developed by the Aquatic Invasive Species Program at Oneida County Land & Water Conservation Department (Stephanie Boismenue R 3/2024)

Reference: Wisconsin Department of Natural Resources: *Aquatic Forget-me-not* www.dnr.wi.gov/topic/Invasives/

Oneida County Aquatic Invasive Species Program
Oneida County Land & Water Conservation Department
PO Box 400 | Rhinelander, WI 54501
715-369-7835 Visit us at www.oclw.org





Aquatic Invasive Species Field Guide

Mystery Snails in Oneida County

Invasive

Chinese Mystery Snail

Cipangopaludina chinensis

- Large freshwater snail native to eastern Asia.
- Can grow to nearly 3 inches tall.
- Shell is olive-green to dark brown, smooth with visible growth lines, and 6-7 whorls.
- Lowermost whorl is much wider than the rest of the shell, and is wider than the native brown mystery snail.
- Shell opening is round to oval with a black outer lip.
- Deep indent from the lowermost whorl to base of opening.
- Operculum ("trapdoor") covers the shell opening.
- Gives birth to fully developed, live crawling young.

Invasive

Banded Mystery Snail

Viviparus georgianus

- Freshwater snail native to Southeastern U.S.
- Can grow to 1.5 inches tall and 1.5 inches wide.
- Outer shell surface is tan with distinct reddish-brown horizontal bands that follow the spiral of the shell.
- Shell opening (aperture) is on the right and oval to circular shaped.
- Distinct indent from lowermost whorl to base of opening.
- Operculum ("trapdoor") covers the shell opening.
- Gives birth to fully developed, live crawling young.

Native

Brown Mystery Snail

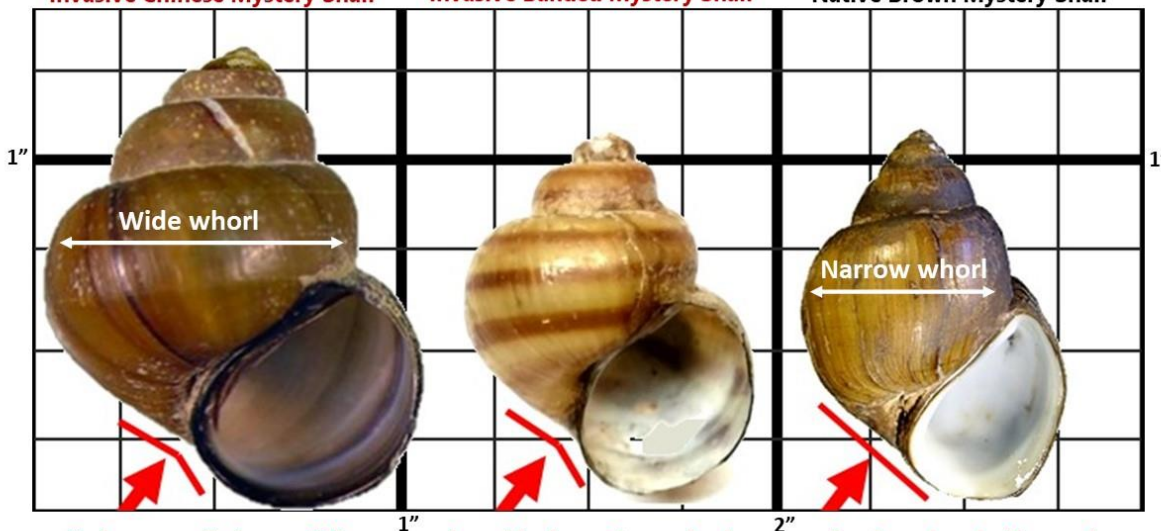
Cameloma decisum

- Native to Wisconsin.
- Rarely grows to 1.5 inches tall.
- Shell yellowish, olive green, tan or brown in color and smooth with visible growth lines.
- Lowermost whorl is rounded and the spire of the shell is elongated.
- Smooth with no sculpturing other than fine stripes.
- Diagonal shaped line from shoulders to base of operculum.
- Operculum ("trapdoor") covers the shell opening.
- Gives birth to fully developed, live crawling young. Newborn brown mystery snails have an opaque white or light translucent beige shell.

Invasive Chinese Mystery Snail

Invasive Banded Mystery Snail

Native Brown Mystery Snail



All three snails have different sculpted indents from the lowest whorl to the shell opening

Oneida County Land & Water Conservation Department's Aquatic Invasive Species Program (R5/24)



Aquatic Invasive Species Field Guide

Rusty Crayfish (*Faxonius rusticus*)

Identification

1. Rust colored stripe on top forward edge of the dorsal tail segments.
2. Rust or brown colored spot on each side of the carapace.
3. Body is gray/green to red/brown. Crayfish within the same species can vary in color.
4. Rostrum between the eyes is curved inward.
5. Large, smooth claws with an oval gap when closed.
6. Dactyl (thumb) is S-shaped.
7. Tips of claws are orange with wide black bands (Northern clearwater crayfish also has orange tips and black bands).

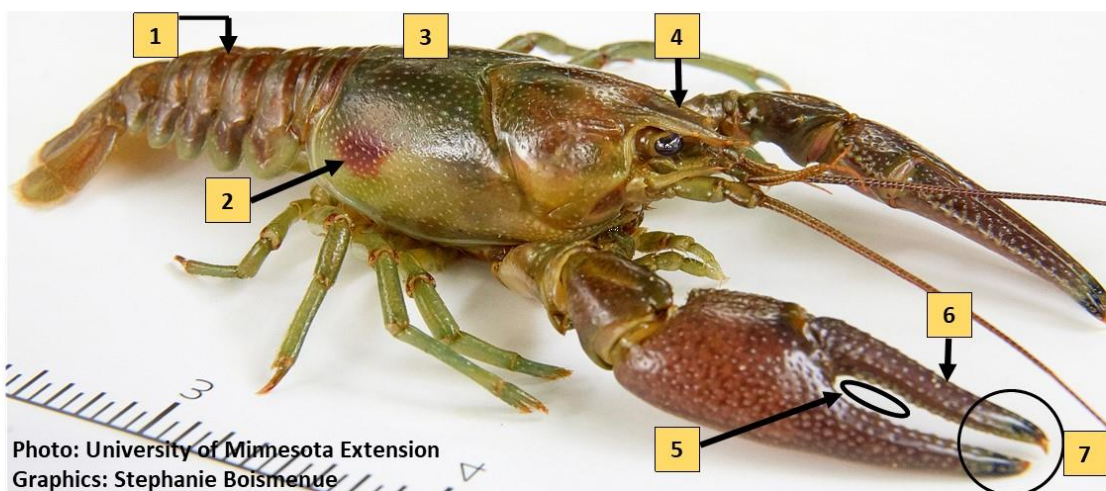


Photo: University of Minnesota Extension
Graphics: Stephanie Boismenu

Description

- Large and aggressive non-native, invasive species in WI. Found in lakes and streams. Prefers rocky substrate.
- Native to the Ohio River Basin, they were likely introduced to Wisconsin waters by the aquarium trade and anglers discarding crayfish they were using as bait.
- Adult body length up to 5 inches (not including claws). Females can carry over 200 fertilized eggs under their tails. Once they reach maturity, males molt twice a year while females molt once after releasing their young. Can live for three or four years.
- Opportunistic feeders and will eat almost anything! They are notorious for reducing aquatic plant abundance and diversity, outcompeting native species for food and space, displacing native crayfish populations, and causing significant ecological damage.

Crayfish in Wisconsin

- Calico crayfish (*Faxonius immunis*) - Native to WI
- Devil crayfish (*Cambarus diogenes*) - Native to WI
- Northern Clearwater crayfish (*Faxonius propinquus*) - Native to WI. Common in Oneida County
- Prairie crayfish (*Procambarus gracilis*) - Native to southeastern WI
- Virile crayfish (*Faxonius virilis*) - Native to WI
- White River crayfish (*Procambarus acutus*) - Native to central and southern WI
- **Red Swamp crayfish (*Procambarus clarkii*) - Non-native, invasive in WI. Found in southeastern WI**
- **Rusty crayfish (*Faxonius rusticus*) - Non-native, invasive in WI. Common in Oneida County**



Rusty Crayfish

Wisconsin Status: The rusty crayfish is a Restricted invasive species under the Wisconsin NR40 Invasive Species Rule. Restricted species cannot be transported, transferred or introduced without a permit issued by the Wisconsin Department of Natural Resources.

Control:

- **Manual:** Intensive harvest will not eradicate crayfish but may help reduce adult populations and minimize some impacts. The best method of control, however, is to prevent their introduction. Educating anglers, crayfish trappers, bait dealers and teachers about the threats of rusty crayfish will help reduce the risk of spreading rusty crayfish to new areas.
- **Chemical:** Although there are chemicals that will kill crayfish, no chemicals are available to eradicate only rusty crayfish.

Prevention Steps

Inspect and remove aquatic plants, animals and mud from the boat and equipment before leaving the boat launch.

Drain water from your boat and equipment before leaving the boat launch.

Throw away unwanted bait in the trash.

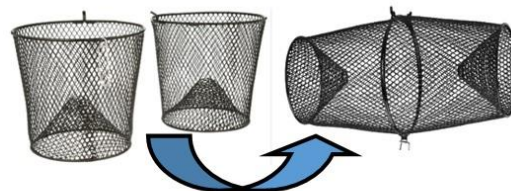
Spray or rinse your boat and equipment with high-pressure and hot tap water, especially if moored for over a day. Or dry your boat and equipment entirely for at least five days.

Do NOT use crayfish as bait. It is against the law in Wisconsin.

How to Effectively Trap Crayfish

Step 1: Setting up your trap

Connect two of the crayfish traps together via zip-ties or fishing line. The largest part of the traps should be touching each other while the smaller holes are pointing outside on each side. This ensures that the crayfish can enter the trap but cannot leave the trap.



Step 2: Baiting your trap

The Rusty Crayfish is a heavy eater and will luckily almost eat anything you throw its way. However, most common crayfish bait is unwanted fish parts, hotdogs, or fish-based cat food. You can feed this bait in through the little holes on either side of the trap or put the bait in the trap before connecting the two traps together.



This image depicts a few crayfish eating a fish head

Step 3: Placing your trap

Now that you have your trap baited and ready to go. You must find a place to place it. If you are in an area of running stream water. Place the trap vertical to the flow so that one of the small holes is in line with the fastest flow of water. If you are in still water (I.E a lake) place the trap vertical to the water's edge. You will want to mark where your trap is with weather with brightly colored cord or with a makeshift buoy made out of a plastic jug.



Produced by Oneida County Land & Water Conservation Department's Aquatic Invasive Species Program (2023)

Appendix B: Two Sisters Lake: Native Aquatic Plants Observed on 08/06/2024

- Bullhead Pond Lily, Spatterdock (*Nuphar variegata*)
- Claspingleaf Pondweed (*Potamogeton richardsonii*)
- Common Bladderwort (*Utricularia macrorhiza*)
- Common Waterweed (*Elodea Canadensis*)
- Fern Pondweed (*Potamogeton robbinsii*)
- Floating Bur-reed (*Sparganium fluctuans*)
- Floating-leaf Pondweed (*Potamogeton natans*)
- Lake Quillwort (*Isoetes lacustris*)
- Large-leaf Pondweed (*Potamogeton amplifolius*)
- Pickerelweed (*Pontederia cordata*)
- Pipewort (*Eriocaulon aquaticum*)
- Slender Naiad (*Najas flexilis*)
- Small Pondweed (*Potamogeton pusillus* ssp. *Pusillus*)
- Softstem Bulrush (*Schoenoplectus tabernaemontani*)
- Spike Rush (*Eleocharis montevidensis*)
- Water Celery (*Vallisneria Americana*)
- Water Marigold (*Bidens beckii*)
- Watershield (*Brasenia schreberi*)
- White-stem Pondweed (*Potamogeton praelongus*)
- White Water Lily (*Nymphaea odorata*)

Description of Each Species Observed in Two Sisters Lake on 8/6/2024

Bullhead Pond Lily, Spatterdock (<i>Nuphar variegata</i>) Status: Native Description: Emergent aquatic plant. Heart-shaped leaves that can grow to be 15 inches long. This plant also has a yellow, cup-shaped flower. <i>Photo Credit: Jomegat's Weblog</i>	
Claspingleaf Pondweed (<i>Potamogeton richardsonii</i>) Status: Native Description: Submerged aquatic plant. Leaves are wavy and smooth leaf edges and pointed tips. <i>Photo Credit: Paul Skawinski</i>	

Common Bladderwort (<i>Utricularia macrorhiza</i>) Status: Native Description: A submerged aquatic plant. Leaves contain small sacks (bladders) that trap small invertebrates. This plant usually has unrooted stems and tends to look cloudy underwater. <i>Photo Credit: frenchhill.org</i>	
Common Waterweed (<i>Elodea canadensis</i>) Status: Native Description: Submerged aquatic plant. Elongate, often branched stems and simple linear or lanceolate leaves in whorls of 3 (at the base of a plant the leaves may be opposite on the lowest nodes). <i>Photo Credit: UW Madison Plant Collection</i>	
Fern Pondweed (<i>Potamogeton robbinsii</i>) Status: Native Description: Submerged aquatic plant. Leaves are alternate, entire, with prominent midvein; strongly 2-ranked, feather-like, firm, linear, wrapping stem; closely spaced, finely serrated edges. <i>Photo Credit: UWSP</i>	
Floating Bur-reed (<i>Sparganium fluctuans</i>) Status: Native Description: Emergent aquatic plant. Stem is usually submerged can be up to 5 feet long. Leaves are flat, spear-like, and can grow 40 inches long. Flowers are small and are in globular clusters. <i>Photo Credit: Peter M. Dziuk</i>	
Floating-leaf Pondweed (<i>Potamogeton natans</i>) Status: Native Description: Submerged aquatic plant with both floating and submersed leaves. Submersed leaves are long and narrow. Floating leaves are oblong and slightly heart-shaped at base. <i>Photo credit: Gary Fewless</i>	

Lake Quillwort (<i>Isoetes lacustris</i>) Status: Native Description: Submerged aquatic plant. Forms a wide rosette of stiff leaves; dark green taper from the pale green-brown base. <i>Photo Credit: Shannon Sharp</i>	
Large-leaf Pondweed (<i>Potamogeton amplifolius</i>) Status: Native Description: Submerged aquatic plant. Leaves are very broad (4-7 cm wide and 8-20 cm long), arched and slightly folded. Floating leaves are 2-23cm long, with a petiole longer than the leaf blade. <i>Photo Credit: Paul Skawinski</i>	
Pickerelweed (<i>Pontederia cordata</i>) Status: Native Description: Emergent aquatic plant. Emergent heart-shaped leaves are bright green, glossy, firm, on tall air filled stalks. Flower is purplish blue and clustered on a single spike. <i>Photo Credit: asapaquatics.com</i>	
Pipewort (<i>Eriocaulon aquaticum</i>) Status: Native Description: Emergent aquatic plant. Grasslike leaves sprout from the base and taper to a point. Round, white flower grows on the tip of a long stalk that emerges above the water level. <i>Photo Credit: Stephanie Boismenue</i>	
Slender Naiad (<i>Najas flexilis</i>) Status: Native Description: Submersed aquatic plant. Stems grow from a thin rootstalk and are finely branching. Leaves are 1 - 4 cm long, slender, taper to a point, and have very finely toothed edges. <i>Photo Credit: Paul Skawinski</i>	

Small Pondweed (<i>Potamogeton pusillus</i> ssp. <i>Pusillus</i>) Status: Native Description: Submerged aquatic plant. Leafy, slender stems branch repeatedly; cylindrical to slightly flattened, up to 3' long. Alternate leaves spaced ½-2 ¾" apart and becoming more crowded toward the tip. Flowers in a spike with 1-4 distinct whorls. <i>Photo Credit: Clayton Antieau</i>	
Softstem Bulrush (<i>Schoenoplectus tabernaemontani</i>) Status: Native Description: Emergent aquatic plant. Grows 5-10 feet above the water; triangular to round shaped stems; slender green leaves appear to be a continuation of the stem. Brownish flowers and seeds located near the tip of the stem. Plants form colonies from rhizomes. <i>Photo Credit: Steve Eggers</i>	
Spike Rush (<i>Eleocharis montevidensis</i>) Status: Native Description: Emergent aquatic plant. A sedge that grows quickly to heights ranging from 6-18 inches in clumps. The leaves are thin and hair-like and the flower spikes resemble small cones. <i>Photo Credit: minnesotawildflowers.info</i>	
Water Celery (<i>Vallisneria americana</i>) Status: Native Description: An aquatic plant with ribbon-like leaves that are dark-green. This plant grows below the water surface and then blankets the surface. This plant produces small, whitish-yellow flowers. <i>Photo Credit: Jacqueline Donnelly</i>	
Water Marigold (<i>Bidens beckii</i>) Status: Native Description: Submerged aquatic plant. Stem usually unbranched, up to 2m tall. Leaves whorled or opposite, heavily divided. Usually two emergent leaves under the flower, simple with heavily serrated/lobed edges. Flowers solitary, yellow, held above the surface. <i>Photo Credit: Glen Lee</i>	

Watershield (*Brasenia schreberi*)

Status: Native

Description: An aquatic plant with stems up to 2 meters long. This plant has small floating leaves and reddish purple flowers that have 6-8 petals.

Photo Credit: Shannon Sharp



White-stem Pondweed (*Potamogeton praelongus*)

Status: Native

Description: A submersed plant with a prominent midvein. The tip of each leaf typically splits when pressed between fingers, and the stipules are white and close to the stem.

Photo Credit: Paul Skawinski



White Water Lily (*Nymphaea odorata*)

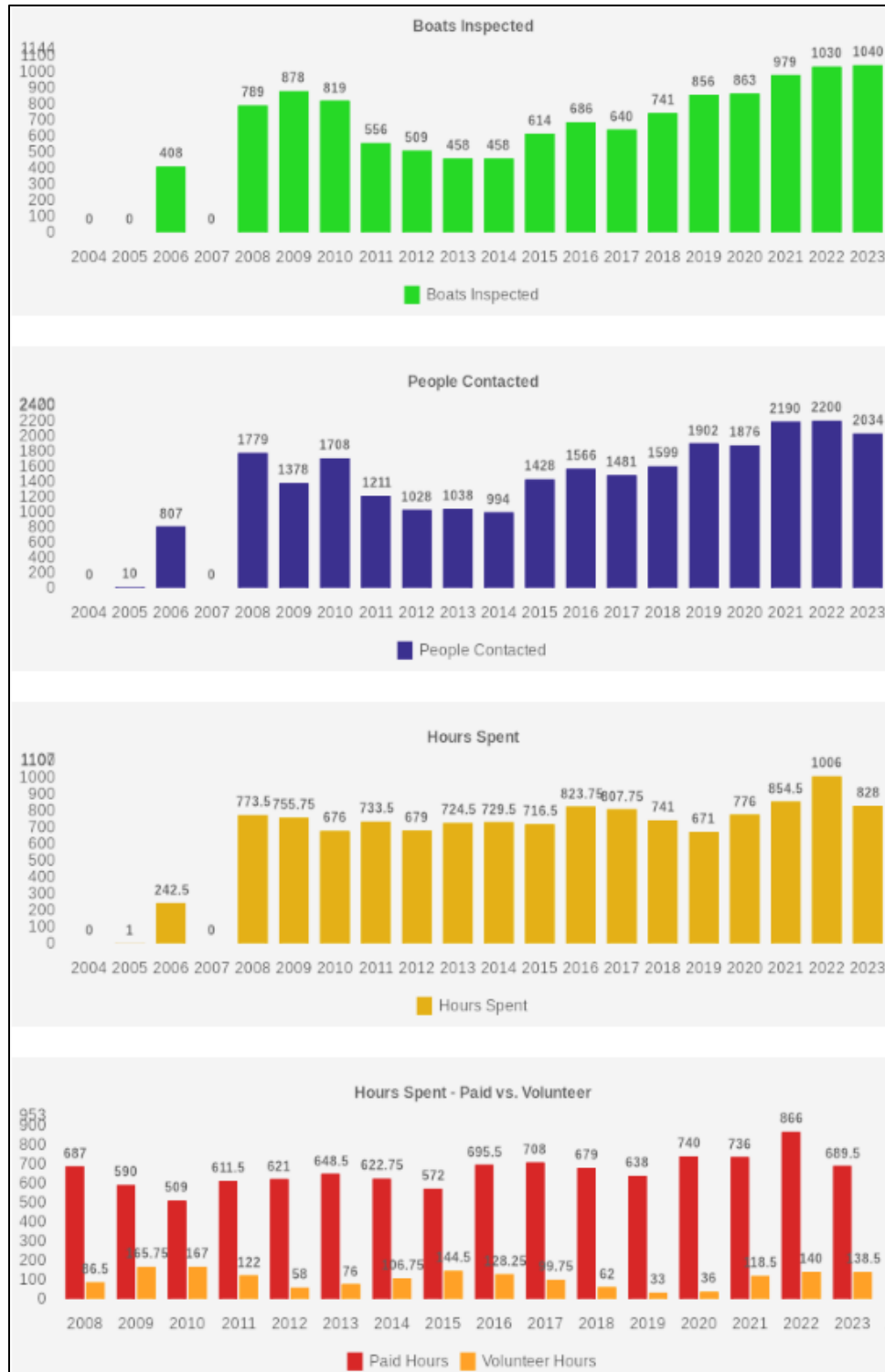
Status: Native

Description: An aquatic plant that has large, round leaves that can grow to be 12 inches in diameter. White water lilies also have large, white flowers with many petals.

Photo Credit: Stephanie Boismenue



Appendix C: Two Sisters Lake: Clean Boats, Clean Waters 2006-2023 Inspection Data



Source: <https://apps.dnr.wi.gov/lakes/invasives/WatercraftSummary.aspx?show=stats&landing=10018898>

Appendix D: Two Sisters Lake: Clean Boats, Clean Waters 2023 Boater Movement Data

Waterbodies Visited Within 5 Days Prior to Arriving at Two Sisters Lake.

Question to boaters: Was this boat used during the past 5 days on a different waterbody?			
Results: Below is a list of waterbodies boaters reported the boat had been in within 5 days prior to arriving at Two Sisters Lake.			
Prior Waterbody	County	Event Count	Documented AIS in Prior Waterbody
Big Arbor Vitae	Vilas Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Purple Loosestrife, Rusty Crayfish
Big Carr	Oneida Co.	2	Chinese Mystery Snail, Purple Loosestrife, Rusty Crayfish
Big St. Germain	Vilas Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Rusty Crayfish
Bird	Oneida Co.	1	Chinese Mystery Snail
Boom	Oneida Co.	3	Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Yellow Iris
Crescent	Oneida Co.	2	Chinese Mystery Snail, Eurasian Water-Milfoil, Rusty Crayfish
East Horsehead	Oneida Co.	1	Chinese Mystery Snail, Rusty Crayfish
Fence	Vilas Co.	1	Banded Mystery Snail, Rainbow Smelt
Grindstone	Sawyer Co.	1	Banded Mystery Snail, Curly-Leaf Pondweed, Rusty Crayfish
Hasbrook	Oneida Co.	2	Chinese Mystery Snail, Eurasian Water-Milfoil, Purple Loosestrife, Rusty Crayfish, Yellow Iris
Hodstradt	Oneida Co.	1	Chinese Mystery Snail
Horsehead	Oneida Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil
Julia	Oneida Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Rusty Crayfish
Katherine	Oneida Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Purple Loosestrife
Little Arbor Vitae	Vilas Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Rusty Crayfish
Little Muskego	Waukesha Co.	1	Asiatic Clam (Corbicula), Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Hybrid Eurasian / Northern Water-Milfoil, Starry Stonewort, Zebra Mussel
Long	Lincoln Co.	3	Chinese Mystery Snail
Manitowish	Vilas Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Purple Loosestrife, Rusty Crayfish
Manson	Oneida Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Purple Loosestrife
McNaughton	Oneida Co.	1	Purple Loosestrife
Mildred Lake	Oneida Co.	1	Chinese Mystery Snail
Minocqua Lake	Oneida Co.	6	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Flowering Rush, Hybrid Eurasian/Northern Water-Milfoil, Purple Loosestrife, Rusty Crayfish, Yellow Iris
Muskellunge	Oneida Co.	4	Chinese Mystery Snail, Yellow Iris

Muskellunge	Vilas Co.	1	Chinese Mystery Snail, Eurasian Water-Milfoil
Nokomis	Oneida Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Purple Loosestrife, Rusty Crayfish
North Twin	Vilas Co.	1	Chinese Mystery Snail, Eurasian Water-Milfoil, Rusty Crayfish
Pelican	Oneida Co.	3	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Ornamental water lilies (non-native <i>Nymphaea</i> sp.), Purple Loosestrife, Rusty Crayfish
Pewaukee	Waukesha Co.		Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Purple Loosestrife, Starry Stonewort, Zebra Mussel
Pickerel	Oneida Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed
Pine	Lincoln Co.	1	Rusty Crayfish
Plum	Vilas Co.	2	Banded Mystery Snail, Chinese Mystery Snail, Rusty Crayfish, Spiny Waterflea
Rainbow Flowage	Oneida Co.	5	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Rusty Crayfish
Razorback	Vilas Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Non-native Phragmites
Shawano	Shawano Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Faucet Snail, Hybrid Eurasian / Northern Water-Milfoil, non-native Phragmites, Purple Loosestrife, Rusty Crayfish, Zebra Mussel
Squash	Oneida Co.	5	Banded Mystery Snail, Chinese Mystery Snail, Eurasian Water-Milfoil, Rusty Crayfish
Squirrel	Oneida Co.	2	Banded Mystery Snail, Chinese Mystery Snail, Purple Loosestrife, Rusty Crayfish, Yellow Iris
Star	Vilas Co.	2	Banded Mystery Snail, Chinese Mystery Snail, Purple Loosestrife, Rusty Crayfish, Spiny Waterflea
Stone	Oneida Co.	1	Chinese Mystery Snail, Rusty Crayfish
Sweeny	Oneida Co.	1	Chinese Mystery Snail, Curly-Leaf Pondweed, Purple Loosestrife
Three Lakes Chain	Oneida Co.	1	Banded Mystery Snail, Chinese Mystery Snail, Eurasian Water-Milfoil, Purple Loosestrife, Rusty Crayfish, Yellow Iris
Tom Doyle	Oneida Co.	2	Chinese Mystery Snail
Tomahawk Lake	Oneida Co.	6	Banded Mystery Snail, Chinese Mystery Snail, Curly-Leaf Pondweed, Eurasian Water-Milfoil, Purple Loosestrife, Rusty Crayfish, Yellow Iris
Trout	Vilas Co.	2	Banded Mystery Snail, Rusty Crayfish, Spiny Waterflea
Washburn	Oneida Co.	1	Chinese Mystery Snail
West Horsehead	Oneida Co.	1	None
Willow Flowage	Oneida Co.	5	Banded Mystery Snail, Chinese Mystery Snail, Eurasian Water-Milfoil, Rusty Crayfish
Wisconsin River	Marathon Co.	2	Banded Mystery Snail, Chinese Mystery Snail, Eurasian Water-Milfoil, Japanese knotweed, Purple Loosestrife, Rusty Crayfish, Yellow Iris
Wisconsin river	Oneida Co.	3	Banded Mystery Snail, Chinese Mystery Snail, Eurasian Water-Milfoil, Purple Loosestrife, Yellow Iris

