



Rice Lake

Eastern Marathon County Lake Study

Final Study Results 2013

University of Wisconsin-Stevens Point

and

Marathon County Staff and Citizens

Healthy lakes add value to our communities. They provide a place to relax and recreate, and can stimulate tourism. Like any infrastructure, lakes require attention and good management practices to remain healthy in developed watersheds.

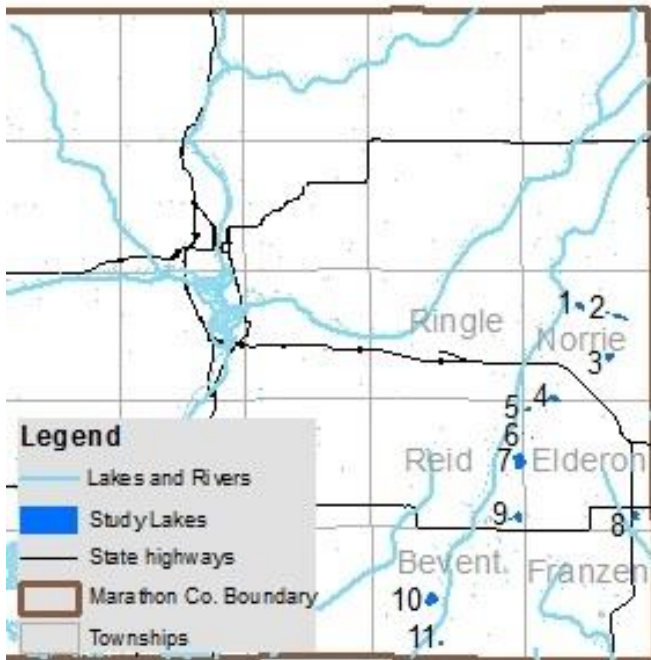
The purpose of this study is to learn about the current conditions of the fishery, habitat and aquatic ecosystems in order to help people make informed decisions to preserve what's good and correct any problems that exist.

To protect

the lake we must protect the “watershed,” the land that drains or sheds its water into the lake.



Rice Lake – Location



Rice Lake
Township of Elderon
County Highway II
Surface Area: 25.3 acres
Maximum Depth: 13.5 feet

Rice Lake, Marathon Co.

Water Flow

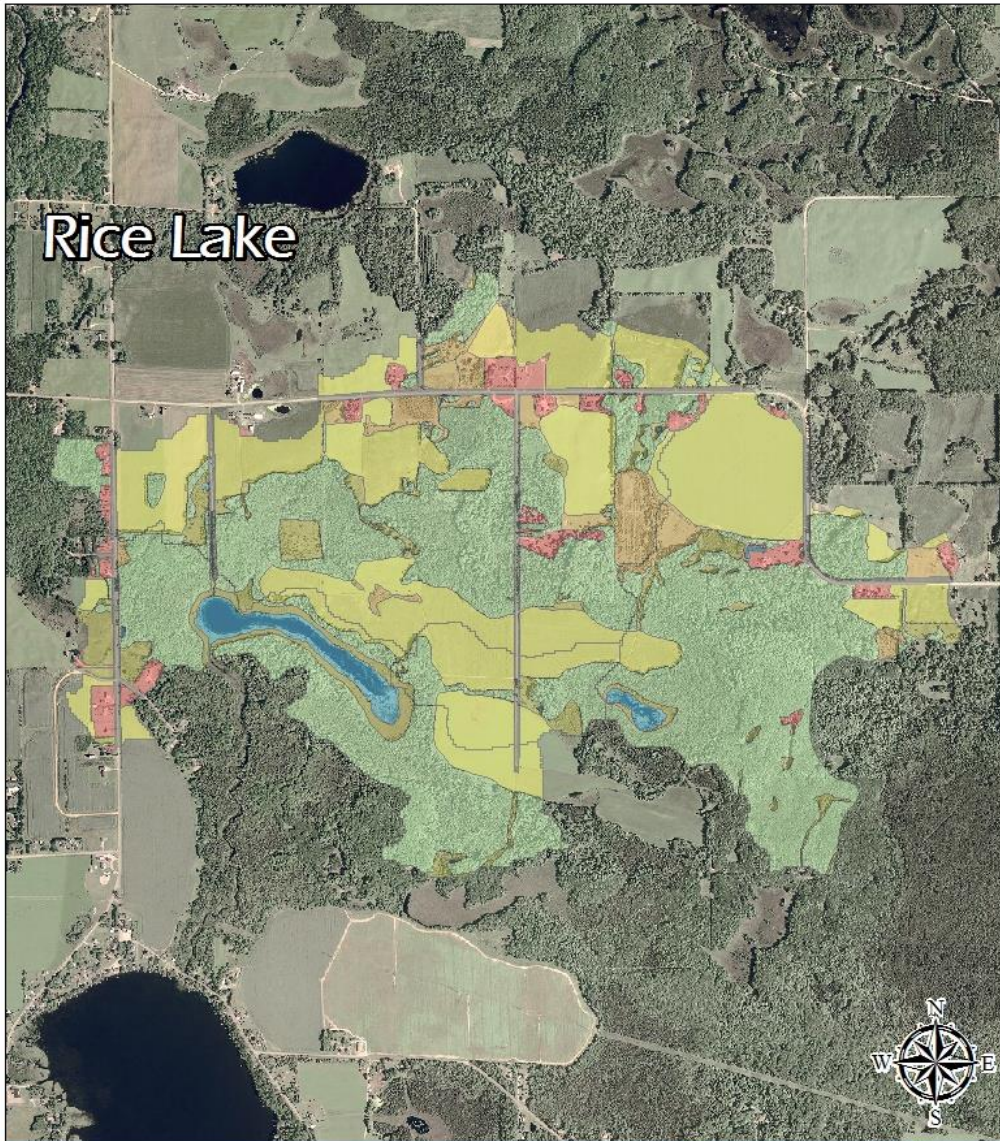
- 💧 Rice Lake is a groundwater drainage lake.
- 💧 Water enters Rice Lake through groundwater. Surface water runoff and direct precipitation also contribute water, but to lesser extents.
- 💧 Water exits Rice Lake through its outflow stream at the west end of the lake and through groundwater.



Rice Lake – Surface Watershed



Surface Watershed: The area where water runs off the surface of the land and drains toward the lake.



Land Use

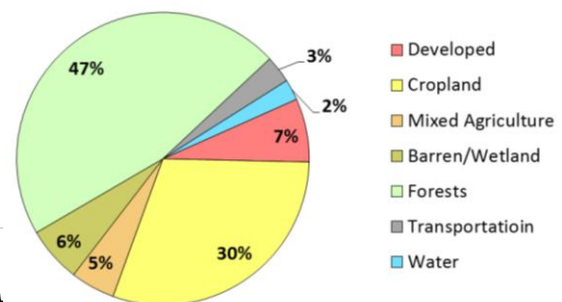
	Water		Agriculture		Transportation
	Forests		Mixed Agriculture		Developed
	Barren/Wetlands				



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- Land uses and land management practices occurring in the watershed affect the water quality in the lake.
- Land uses and land management also play major roles in how water moves across the landscape and how much water soaks into the ground (for long-term storage) or quickly runs off the land.
- The surface watershed of Rice Lake is 1,329 acres.
- The primary land uses in the Rice Lake watershed are agriculture and forests.
- In general, the land closest to the lake has the greatest immediate impact on water quality. Rice Lake has forests and wetlands around its perimeter.

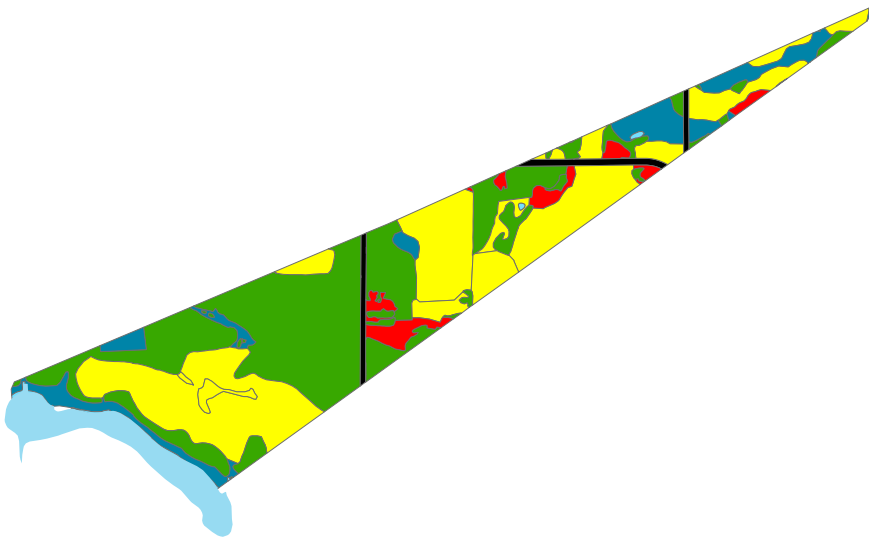
Land Use in the Rice Lake Watershed



Rice Lake – Groundwater Watershed



Groundwater Watershed: The area where water soaks into the ground and travels below ground to the lake.



Land Use	Acres
Agriculture	118
Developed	12
Forested	118
Roads	7
Water	9
Wetland	29

- ◆ **Groundwater** slowly contributes water to our lakes throughout the year. Hard surfaces on the landscape prevent water from soaking into the ground and becoming groundwater. This results in less water flowing to the lake during the winter and between rains.
- ◆ The quality of groundwater reflects what is happening on the land surface. Precipitation falling on forested land produces clean groundwater, whereas precipitation falling on lands that have chemical use can leach contaminants to groundwater. Groundwater contamination in central Wisconsin may include nitrogen, pesticides, herbicides and other soluble chemicals originating from septic systems, crops, barnyards, road maintenance, etc. Once in the groundwater, these chemicals slowly move towards a lake or river.
- ◆ The groundwater watershed for Rice Lake is 293 acres.
- ◆ The primary land uses in the Rice Lake groundwater watershed are agriculture and forests.
- ◆ In general, the lands adjacent to the lake where groundwater is flowing into the lake have the greatest immediate impact on water quality. Wetlands and forests are adjacent to Rice Lake where most of the groundwater enters.

Looking at Groundwater Up Close:

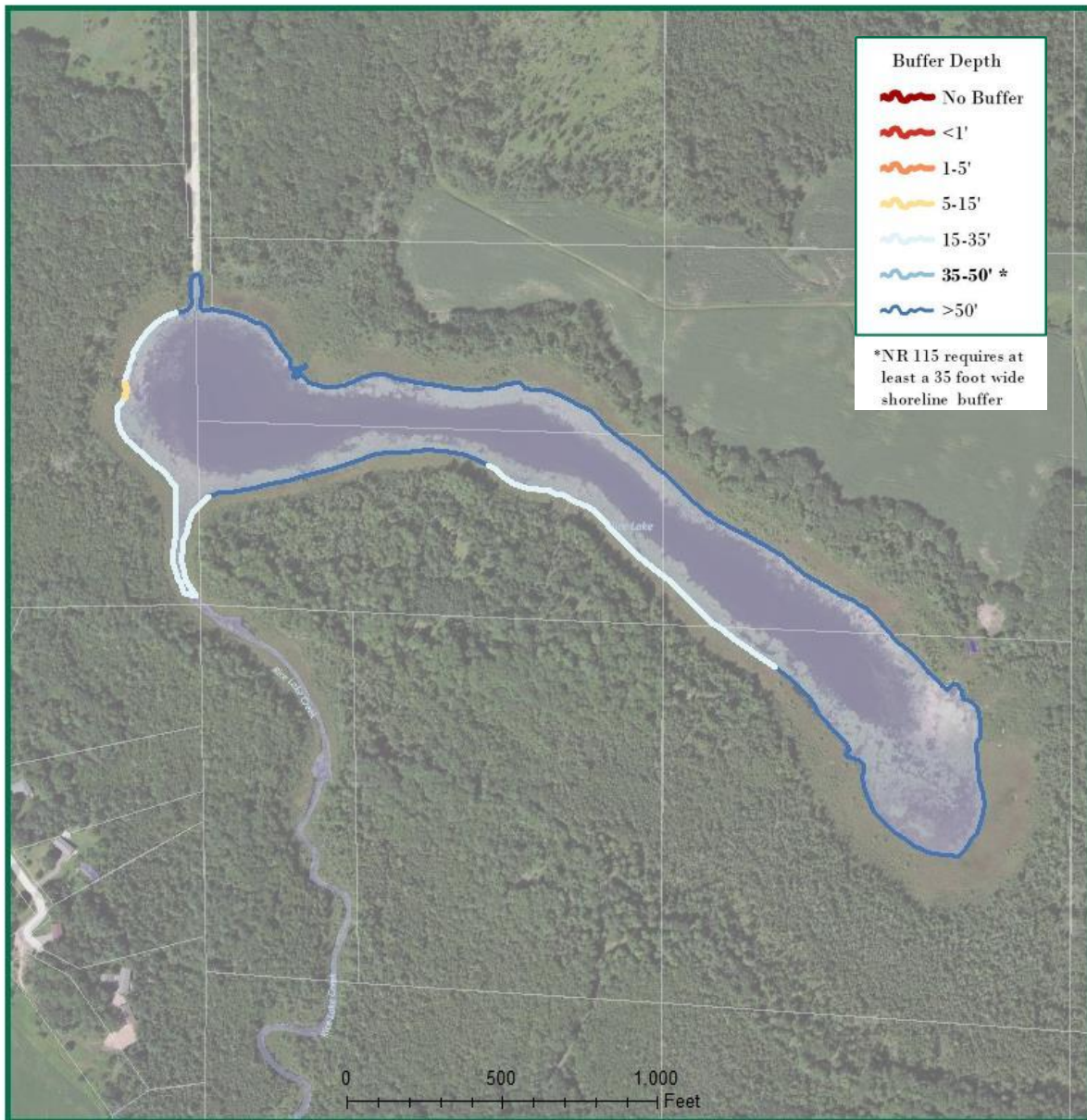
There were no groundwater connections identified at the sites sampled during the groundwater survey.



Rice Lake – Shoreland Vegetation

Shoreland vegetation is critical to a healthy lake's ecosystem. It provides habitat for aquatic and terrestrial animals including birds, frogs, turtles, and many small and large mammals. It also helps to improve the quality of the runoff that is flowing across the landscape towards the lake. Healthy shoreland vegetation includes a mix of tall grasses/flowers, shrubs and trees.

The map below shows how far the 0.5 to 3 foot tall vegetation exists landward from the edge of Rice Lake. A greater vegetative buffer provides more habitat and better water quality.



Rice Lake – Lake Map

Rice Lake’s shape and depth play major roles in determining:

- 💧 Where aquatic plants can and cannot grow
- 💧 Species of fish and where they live
- 💧 How fast water in the lake warms up and cools down
- 💧 The water quality of the lake
- 💧 Abundance of habitat for species living in the water and on the land

MARATHON COUNTY, WISCONSIN

University of Wisconsin-Stevens Point
Center for Watershed Science and Education.

Map Cartography by Christine Koeller

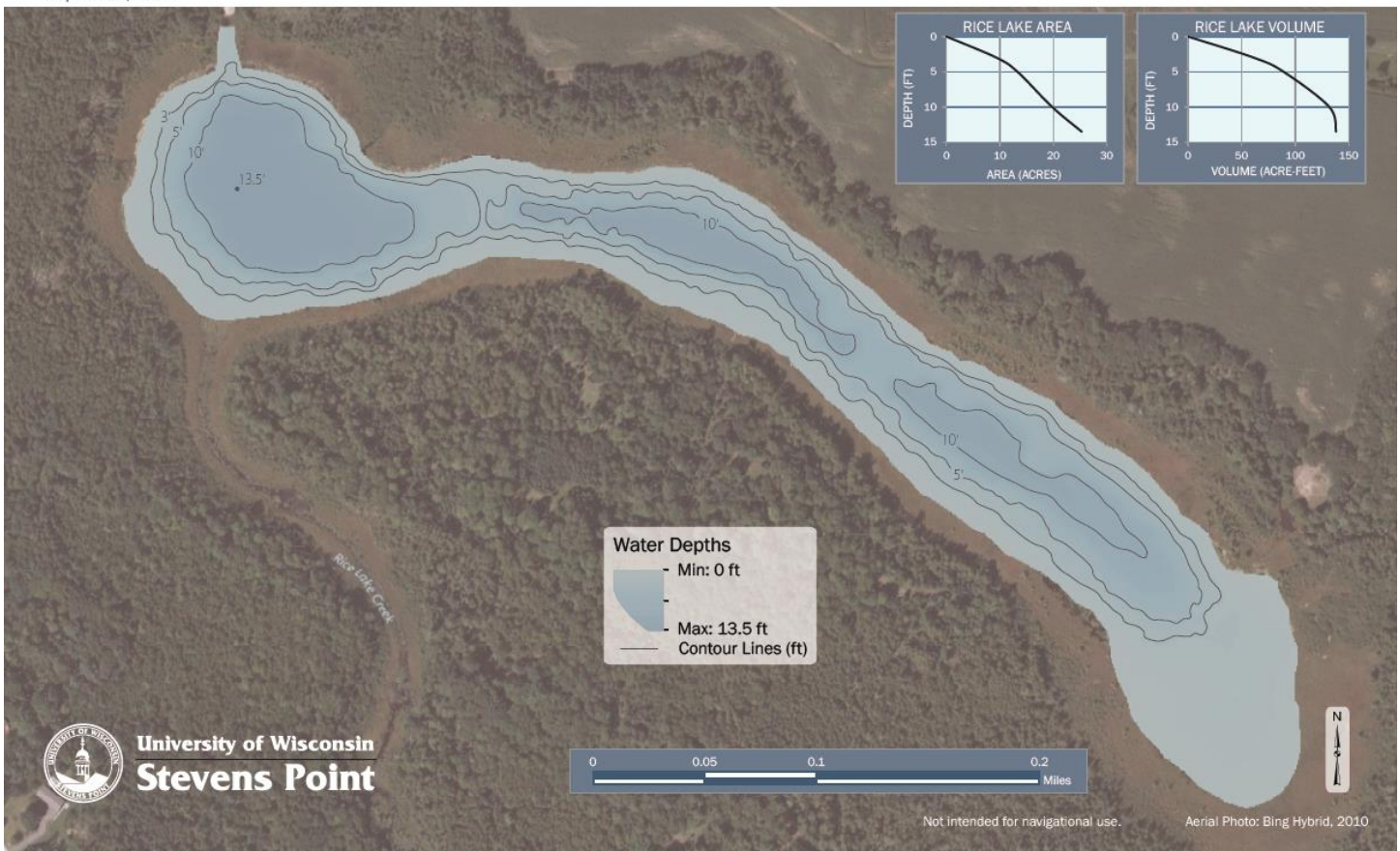
GPS and Sonar Survey
September, 2011

RICE LAKE BATHYMETRIC MAP

Map funded by the Wisconsin
Department of Natural Resources Lake
Planning Grant Program, Marathon County,
Marathon County citizens, and
lake and fishing groups.

LAKE AREA	25.3	Acres
Under 3 Feet	9.3	Acres (37%)
Over 20 Feet	0	Acres (0%)

VOLUME	138	Acre-feet
SHORELINE	1.4	Miles
MAX DEPTH	13.5	Feet



Rice Lake – Fishery

Many factors determine which fish species thrive in a lake. Physical factors include the lake's type, depth, surface area, geology and lake bed materials. Water quality in the lake also plays a role: water clouded with sediment or algae reduces the success of visual feeders, while low levels of dissolved oxygen will limit the fish population to those that can tolerate periods with low oxygen.

Total catch and length of species in Rice Lake, 2011 survey

Species	Min Length (in)	Max Length (in)	Average Length (in)	Total Catch
Bluegill	1.5	8.5	5.6	71
Yellow Bullhead	8.5	15.0	10.6	29
Golden Shiner	1.5	2.3	2.1	11
Black Crappie	7.2	11.4	8.9	7
Pumpkinseed	3.9	8.5	6.0	6
Largemouth Bass	2.7	3.1	3.0	4
Brown Bullhead	10.5	11.5	10.8	3
Northern Pike	21.9	30.8	27.1	3
Yellow Perch	5.4	6.6	6.2	3
Mudminnow	1.5	2.6	2.0	2

- ☛ Rice Lake supports a warm water fish community.
- ☛ Four species were newly identified in the 2011 survey: yellow bullhead, brown bullhead, golden shiner and central mudminnow.
- ☛ The absence of young northern pike may indicate poor reproduction, but more intense population sampling over several seasons would be required to determine this.
- ☛ The presence of young bass and abundant sunfish sampling indicates successful reproduction.

Species occurrence in Rice Lake in 2011 survey and historical Wisconsin DNR records

Species	1960	1975	2011
Black Bullhead		x	
Black Crappie	x	x	x
Bluegill	x	x	x
Brown Bullhead			x
Golden Shiner			x
Largemouth Bass	x	x	x
Central Mudminnow			x
Northern Pike	x	x	x
Pumpkinseed	x	x	x
White Sucker	x	x	
Yellow Bullhead			x
Yellow Perch	x	x	x

- ☛ In 1960, a Wisconsin DNR fisheries report indicated northern pike and largemouth bass were common in this system.
- ☛ Shortly after 1960, public access to the lake was approved and constructed.
- ☛ Fish stocking records for Rice Lake date back to 1962 and indicate stocking has consisted of adult northern pike and muskellunge fingerlings.



Rice Lake – Fishery

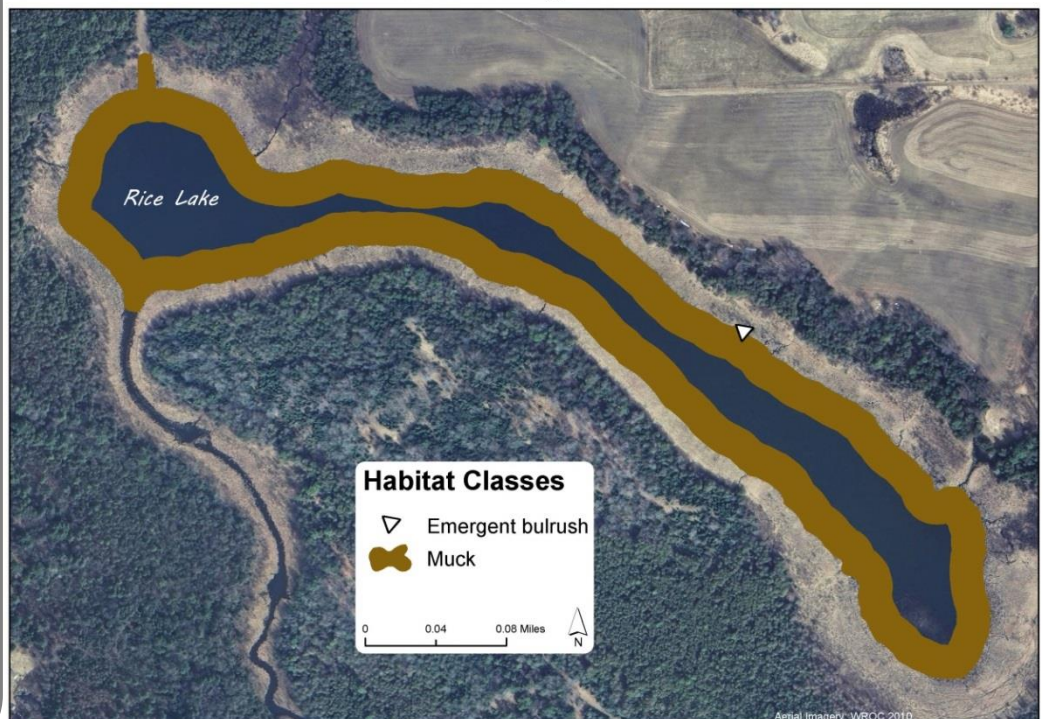
Habitat in and near the lake plays a large role in the composition of a fish community. Habitat is a combination of aquatic plants, woody structure, and lake substrate. Near the shore is found some of the most important fishery habitat.

Coarse woody habitat (CWH) is an important component of a healthy and balanced fishery, playing a key role in the life histories of many fish species. Downed trees, logs and branches along with aquatic plants offer refuge from predators, sheltered substrates for spawning, nurseries for young, and feeding grounds to forage for insects and algae. CWH is very important to other animals that live in or visit a lake, including turtles, frogs, birds and mammals.

Coarse woody habitat was not present in Rice Lake during the survey period. The soft substrate present around the lake would likely consume most logs and branches if not secured to the shoreline.

The near-shore areas of Rice Lake are densely vegetated in the summer and fall months with lily pads and coontail which provide protective cover to a variety of aquatic life. The addition of stable CWH cover would benefit the fish community.

Rice Lake Habitat
Marathon County, WI 2012

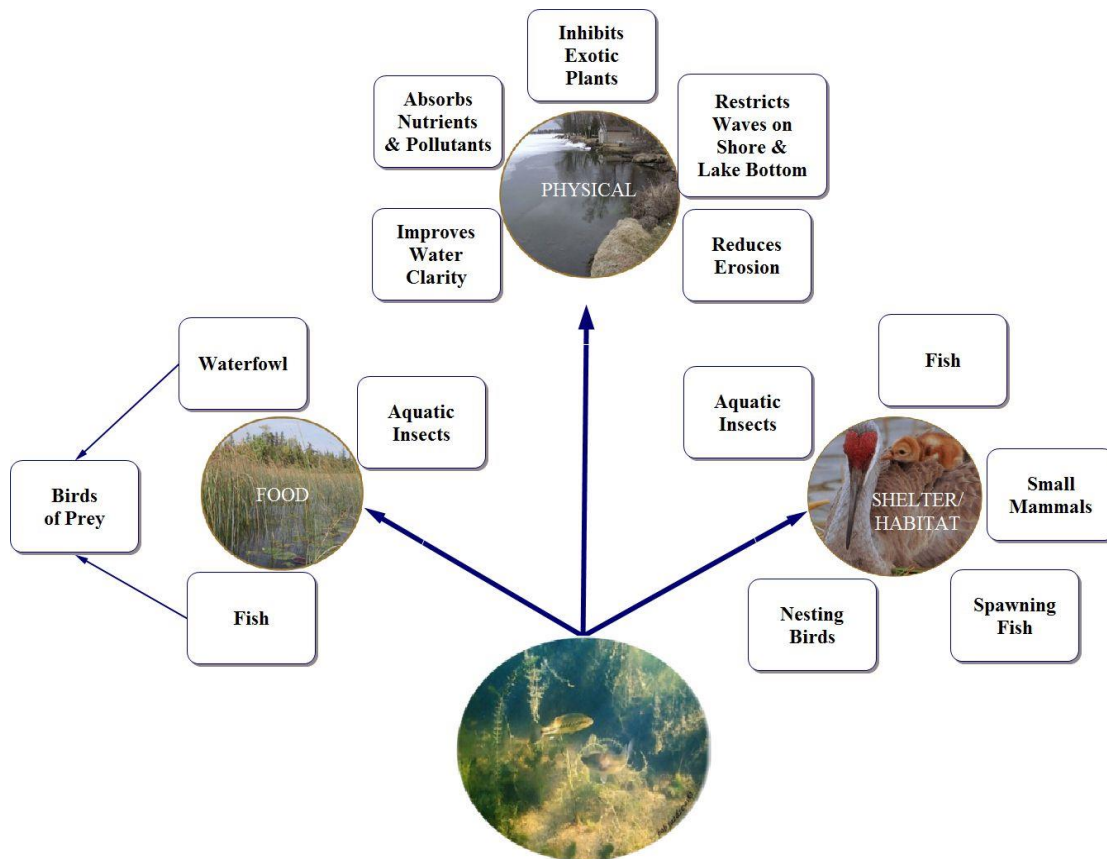


- ◆ In the absence of sand and coarser substrates such as gravel, largemouth bass and sunfish are known to build nests on soft bottoms. Depressions are deepened until some small amounts of coarser substrate accumulate in the bottom of the nests.
- ◆ Northern pike use areas with emergent and floating-leaf vegetation in shallow or flooded areas for spawning.
- ◆ Black crappie use bulrush habitat on gravel or sand substrates where they construct nests and guard young. Sparse areas of softstem bulrush are present in Rice Lake.



Rice Lake – Aquatic Plants

Aquatic plants are the forest landscape within a lake. They provide food for creatures including fish, ducks and turtles, and habitat for fish, invertebrates, and other aquatic animals. They create oxygen in the water and utilize nutrients that would otherwise be used by algae. A healthy lake typically has a variety of aquatic plant species creating diversity that can help to prevent the establishment of aquatic invasive species.



AQUATIC PLANTS Food and Refuge for Aquatic Life

- ◆ The aquatic plant community in Rice Lake is characterized by an average diversity when compared to other lakes in the Marathon County study, with a total of 22 species documented in the 2012 aquatic plant survey, with greatest species richness on the eastern end of the lake.
- ◆ The shoreline of Rice Lake is undeveloped. The lake is surrounded by stretches of bog that provide excellent habitat for a wide variety of plant species. This bog provides multiple benefits to Rice Lake.
- ◆ The water of Rice Lake is stained, most likely due to tannins from the bog around the lake. Together with algae growth and suspended sediments, the dark water impedes light penetration and is one of the primary factors limiting plant growth in Rice Lake.

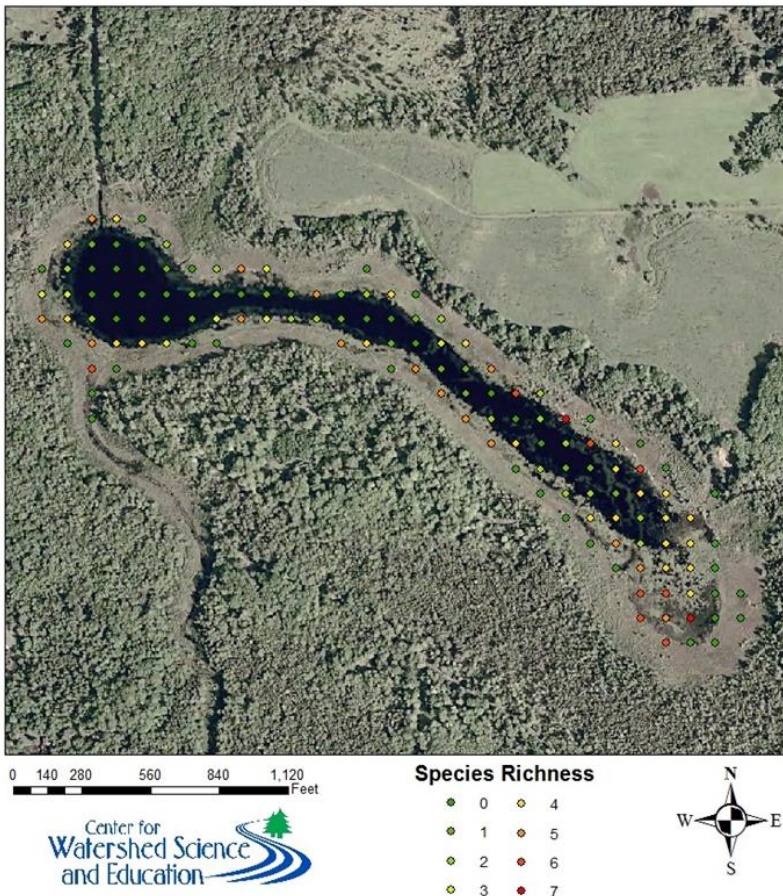


Rice Lake – Aquatic Plants

- During the 2012 aquatic plant survey of Rice Lake, 82 percent of the sites sampled had vegetation.
- The average depth of the sampled sites was 6 feet, with a maximum rooting depth of 13 feet. Most plant growth occurred between 2 and 4 feet.
- The most common plant species in the survey were coontail, flat-stem pondweed and white water lily.
- Curly-leaf pondweed (CLP) was found in a few locations during the 2012 survey. CLP can become invasive and may contribute to nuisance algae blooms throughout the summer.

Species Richness is a count of the number of plant species found at a survey point. A greater number of species in a lake helps to make the aquatic plant community more resilient to year-to-year changes and aquatic invasive species. More plant species means more diverse habitat and available food sources.

Rice Lake 2012 Aquatic Plant Survey:
Species Richness



Coontail

Coontail and **flat-stem pondweed** are food sources for waterfowl and provide excellent habitat and cover for many fish species. These aquatic plants also support insects that are food for fish and ducklings.



Rice Lake – Aquatic Invasive Species

Aquatic Invasive Species are non-native plants or animals that may cause significant harm to a lake's ecosystem. Typically, they are introduced to a lake by hitching a ride on clothing, trailers, boats and other water recreation equipment. Aquatic invasive species can be introduced to a lake accidentally or intentionally. Once in a lake, they may be impossible to completely remove and can be difficult and costly to control. Prevention and early detection are the best ways to keep aquatic invasive species from establishing in a lake.

Lakes With Aquatic Invasive Species in Marathon and Northern Portage County, 2012

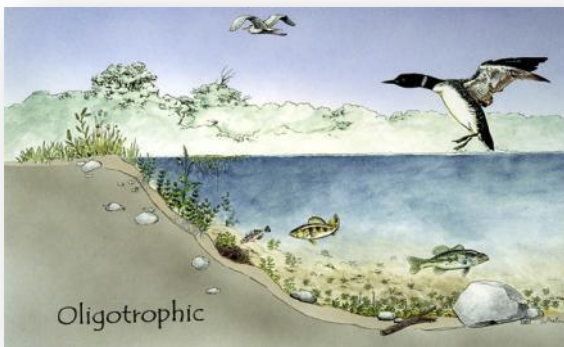
Lake Name	Banded Mystery Snail	Chinese Mystery Snail	Rusty Crayfish	Curly-Leaf Pondweed	Eurasian Water Milfoil	Purple Loosestrife
<i>Marathon County (Shaded lakes are part of Eastern Marathon Co. Lake Study)</i>						
Big Lake	✓					
Big Rib River			✓		✓	
Eau Claire Flowage		✓			✓	
Flume Creek			✓			
Johnson Creek			✓			
Lake Wausau				✓		
Little Rib River			✓			
Little Trappe River			✓			
Lost Lake		✓				
Mayflower Lake		✓		✓		
Mission Lake	✓				✓	✓
Pike Lake	✓			✓		
Rice Lake	✓	✓		✓		
South Branch Embarrass River			✓			
Spring Brook			✓			
Trappe River			✓			
Wadley Lake	✓	✓		✓	✓	
Wausau Dam Lake					✓	
Wisconsin River			✓		✓	
<i>Northern Portage County</i>						
Tree Lake	✓	✓		✓		
Plover River			✓			
Lake DuBay		✓	✓	✓	✓	

Learn to identify
invasive species &
look for them in your
lake!



Rice Lake – Water Quality

Lakes go through a natural aging process that results in increased aquatic plant growth, fish, and wildlife over time. Within a lake's watershed, human activity on the land, in a wetland, or in the lake can dramatically accelerate this process. Depending on land management practices, changes in a lake that may have normally taken centuries to occur may take place in decades or even years. The amounts of nutrients, algal growth, and water clarity measurements help to define the age of a lake. Based on these measures, lakes can be classified for comparison to one another.



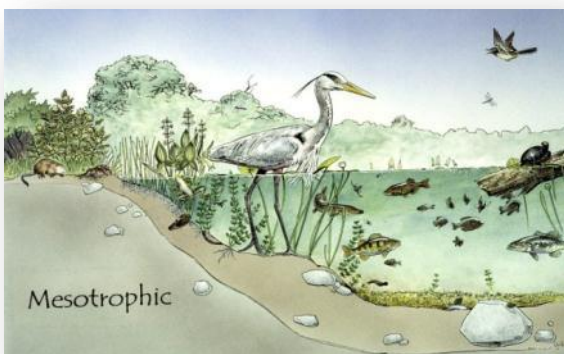
Oligotrophic Lakes

Common uses:

- ✓ Swimming
- ✓ Skiing
- ✓ Boating

Vegetation of oligotrophic lakes:

- ✓ Very little vegetation



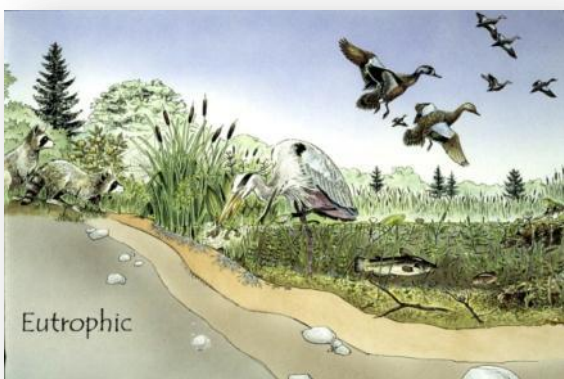
Mesotrophic Lakes

Common uses:

- ✓ Boating
- ✓ Fishing

Vegetation of mesotrophic lakes:

- ✓ Increased vegetation
- ✓ Occasional algal blooms



Eutrophic Lakes

Common uses:

- ✓ Fishing
- ✓ Wildlife watching

Vegetation of eutrophic lakes:

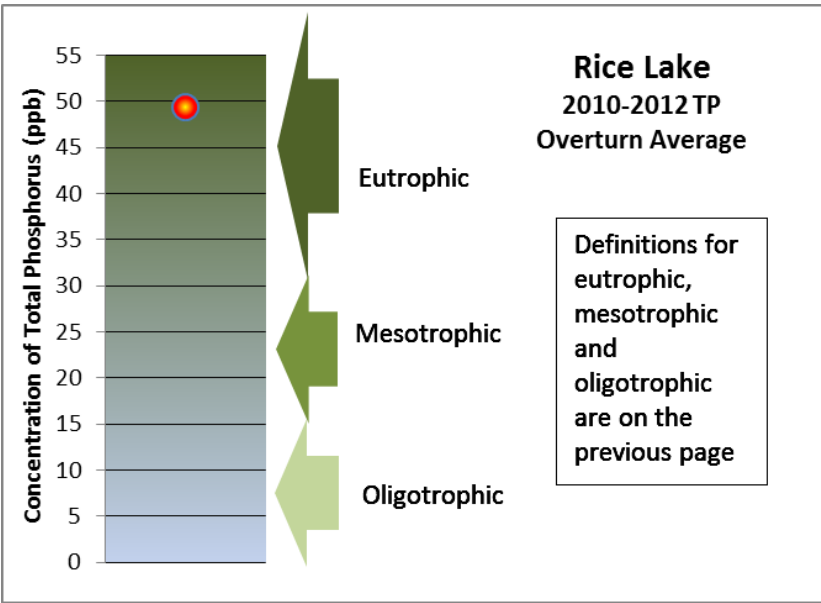
- ✓ Lots of aquatic plants
- ✓ Frequent algal blooms

Winter fish kills can occur in shallow lakes due to low oxygen levels.



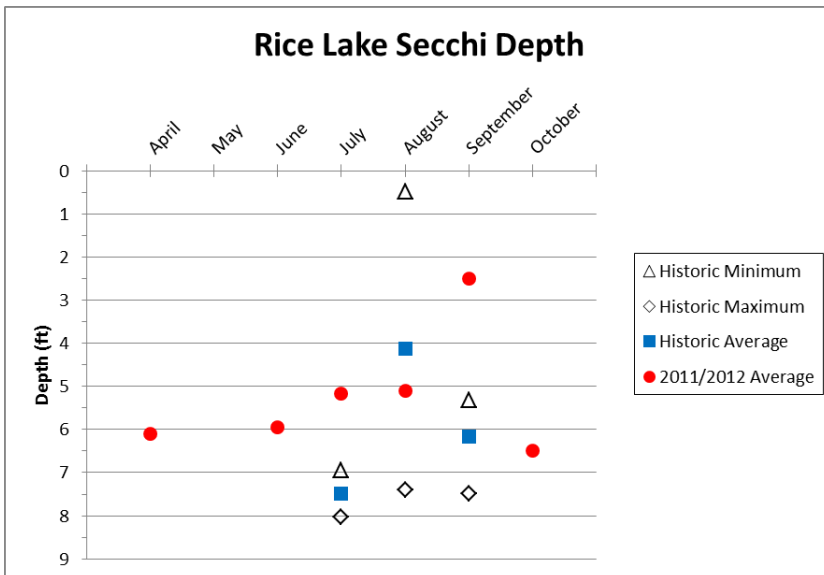
Rice Lake – Water Quality

Phosphorus is a major nutrient that can lead to excessive algae and rooted aquatic plant growth in lakes. In fact, one pound of phosphorus entering a lake can result 300 to 500 pounds of algal growth. All Marathon County lakes have either sufficient or excessive nutrients for aquatic plant growth, so these lakes will benefit from limiting the addition of more nutrients. Sources of phosphorus include septic systems, animal waste, storm water runoff, soil erosion, and fertilizers for lawns, gardens and agriculture.



- ◆ Total phosphorus levels measured when Rice Lake was well-mixed (overturn) are displayed in the graph to the left.
- ◆ Overturn sampling during the 2010-2012 monitoring period indicated that Rice Lake is a eutrophic lake with a high average total phosphorus level.

Water clarity is a measure of how deep light can penetrate (Secchi depth). Clarity is affected by water color, turbidity (suspended sediment), and algae. Water clarity helps determine where rooted aquatic plants can grow.



- ◆ The graph to the left shows water clarity data collected during the growing seasons in 2011 and 2012. It is typical for water clarity to vary throughout the year.
- ◆ On average, the 2011/2012 average Secchi depth readings were relatively consistent with historic averages.

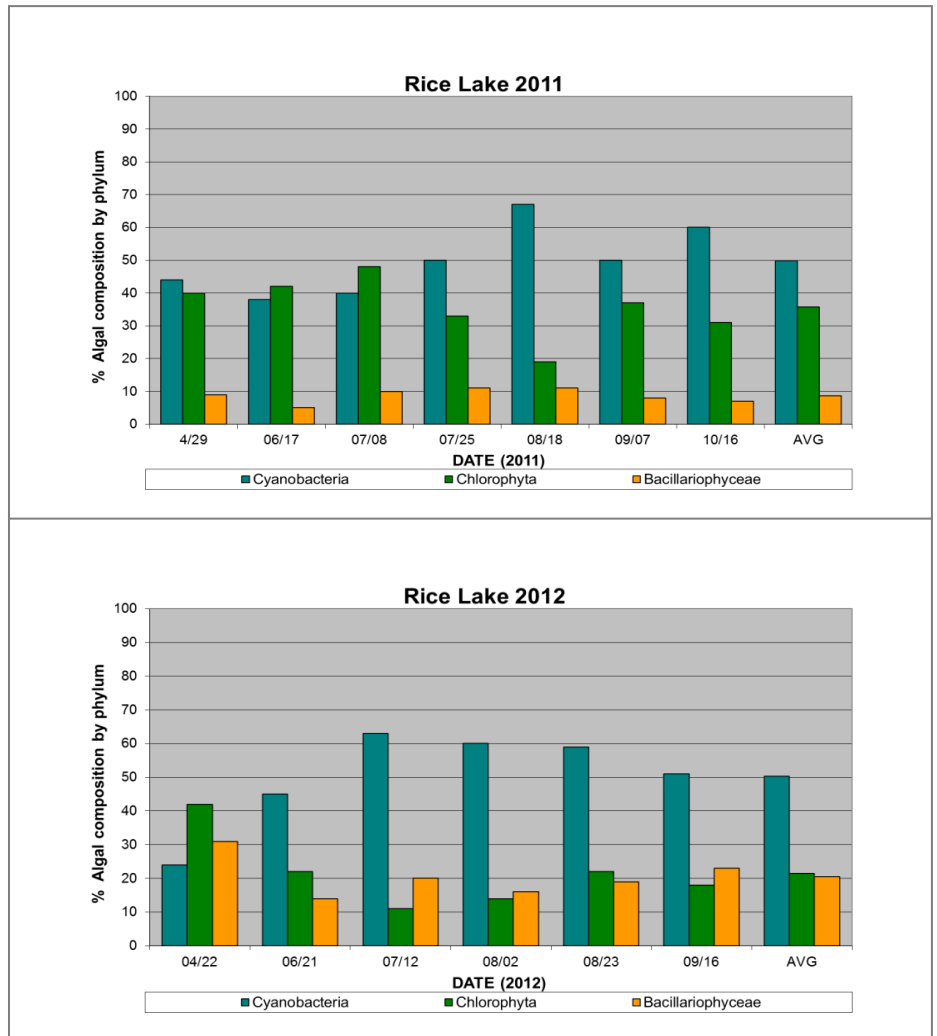


Rice Lake – Algae

Algae are microscopic, photosynthetic organisms that are important food items in all aquatic ecosystems. Different algal groups increase or decrease during the year and they can be used to analyze a lake's water quality because there are more varieties of algae than fish or aquatic plants. Conclusions can be drawn about water temperature, nutrient availability, and overall water quality of a lake using algal populations.

In Marathon County lakes, there are three dominant groups of algae: blue-green algae (Cyanobacteria), green algae (Chlorophyta), and diatoms (Bacillariophyceae).

- Blue-green algae were dominant in Rice Lake during 2011 and 2012. This pattern and the strength of the dominance are typical of a very nutrient-enriched, eutrophic lake.
- The blue-green algal species found in Rice Lake are larger forms (colonial and filamentous) that are undesirable and mostly uneaten by consumers.
- Similarly, many of the green algae present were filamentous as well, making them difficult to consume. The larger green algal filaments provide an ideal place for many of the small blue-green species to attach and colonize.
- The diatom species identified are common in eutrophic waters. These species occurred in colonies and thus are largely undesirable for eating.
- All data (total phosphorus, water clarity and algae) point to Rice Lake being a very eutrophic body of water.



PERCENT ALGAL COMPOSITION FOR RICE LAKE IN 2011 AND 2012



Blue-green algae have the widest tolerance range for temperatures and nutrient concentrations. A few varieties of blue-greens can produce toxins that are potentially harmful to livestock, pets and humans. Once well-established in a lake, blue-green algae are difficult to control and remove.

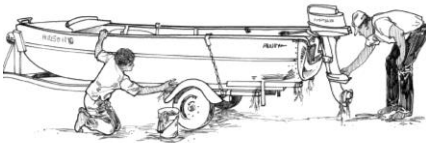


Rice Lake – What Can You Do?



Lake Users:

- ✓ Run boat engines efficiently
- ✓ Observe no/low wake zones
- ✓ Refuel away from water
- ✓ Dispose of trash properly
- ✓ Remove all aquatic plants from boats and trailers
- ✓ Respect wildlife and other lake users



Land Owners:

- ✓ Control soil erosion
- ✓ Keep livestock out of lakes and streams
- ✓ Control manure runoff
- ✓ Carefully manage nutrients and pesticides
- ✓ Leave natural shoreland vegetation in place or restore if it has been removed
- ✓ Learn to identify and look for invasive species



Home Owners:

- ✓ Leave natural shoreland vegetation in place or restore if it has been removed
- ✓ Leave woody habitat for young fish, turtles and frogs
- ✓ Eliminate the use of fertilizer or use no phosphorus fertilizer
- ✓ Eliminate or minimize use of pesticides
- ✓ Control soil erosion
- ✓ Control runoff from rooftops and hard surfaces
- ✓ Clean up after pets
- ✓ Learn to identify and look for invasive species



Stop the Spread of Aquatic Invasive Species!

Wetlands and Shorelands:

- ◆ LEARN how to identify invasive plants and animals, and who to contact if found.
- ◆ DO NOT PURCHASE prohibited and restricted species! Whenever possible purchase native plants.
- ◆ NEVER transplant water garden plants or aquarium plants into lakes, streams, wetlands, or storm water ponds. Properly dispose of unwanted plants and animals!
- ◆ REMOVE invasive exotic plants from your landscape and replace them with native plants or non-invasive exotic plants. Scout annually for new invasive plants.
- ◆ AVOID using garden plants from other regions whose invasive potential is poorly understood.

Lakes and Rivers:

- ◆ LEARN what Wisconsin invasive plants and animals look like and who to contact if seen in a lake or river.
- ◆ INSPECT your boat, trailer and equipment when traveling to different water bodies and REMOVE any attached aquatic plants or animals (before launching, after loading, and before transporting on a public highway).
- ◆ DRAIN all water from boats, motors, and all equipment after use at a lake.
- ◆ NEVER release live fish, bait or pets into a wetland or water body.
- ◆ BUY minnows from a Wisconsin bait dealer. Only use leftover minnows at that same water body.



Rice Lake – Primary Researchers



Algae

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Aquatic Plants

Jen McNelly (UW-Stevens Point)

Cultural Survey

Dr. Kristin Floress (UW-Stevens Point)

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Christine Koeller (UW-Stevens Point)

Sediment Core

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Shoreland Assessments and Build Out

Dan McFarlane (UW-Stevens Point)

Water Quality and Watersheds

Nancy Turyk (UW-Stevens Point)

Zooplankton

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UW-Stevens Point Graduate and Undergraduate Students

Project support provided by:

- Wisconsin DNR Lake Protection grants
- UW-Stevens Point and UW-Stevens Point Faculty
- Marathon County
- Marathon County Citizens

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<http://www.co.marathon.wi.us/Departments/ConservationPlanningZoning/ConservationDivision/LakePrograms.aspx>



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