Pike Lake

Eastern Marathon County Lake Study

Final Study Results 2013

University of Wisconsin-Stevens Point
and
Marathon County Staff and Citizens

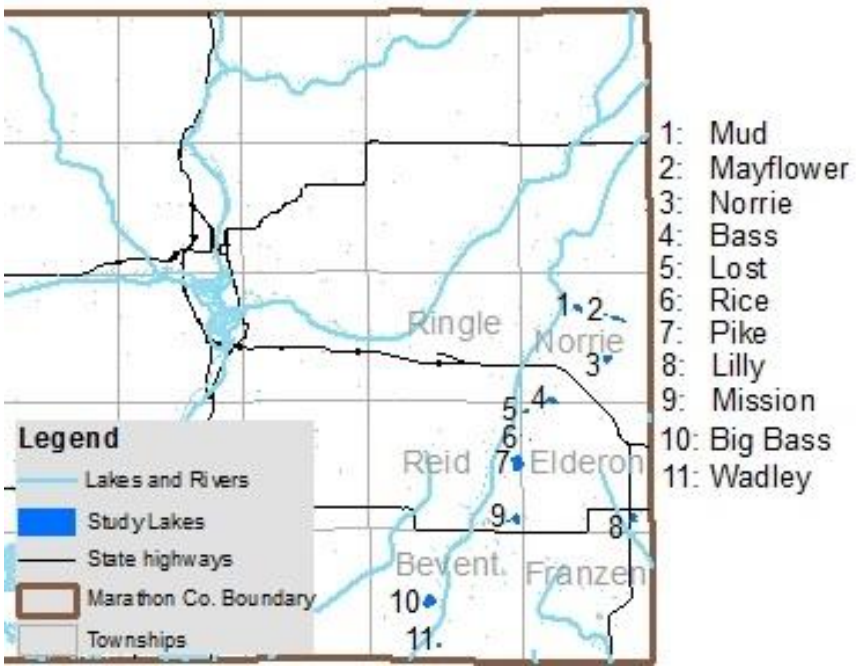
Healthy lakes add value to our communities. They provide a place to relax and recreate, and can stimulate tourism. Like any infrastructure, lakes require attention and good management practices to remain healthy in developed watersheds.

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.

Pike Lake – Location



Pike Lake

Townships of Reid and Elderon

East of County Road Y

North of Bevent

South of Hatley

Surface Area: 207 acres

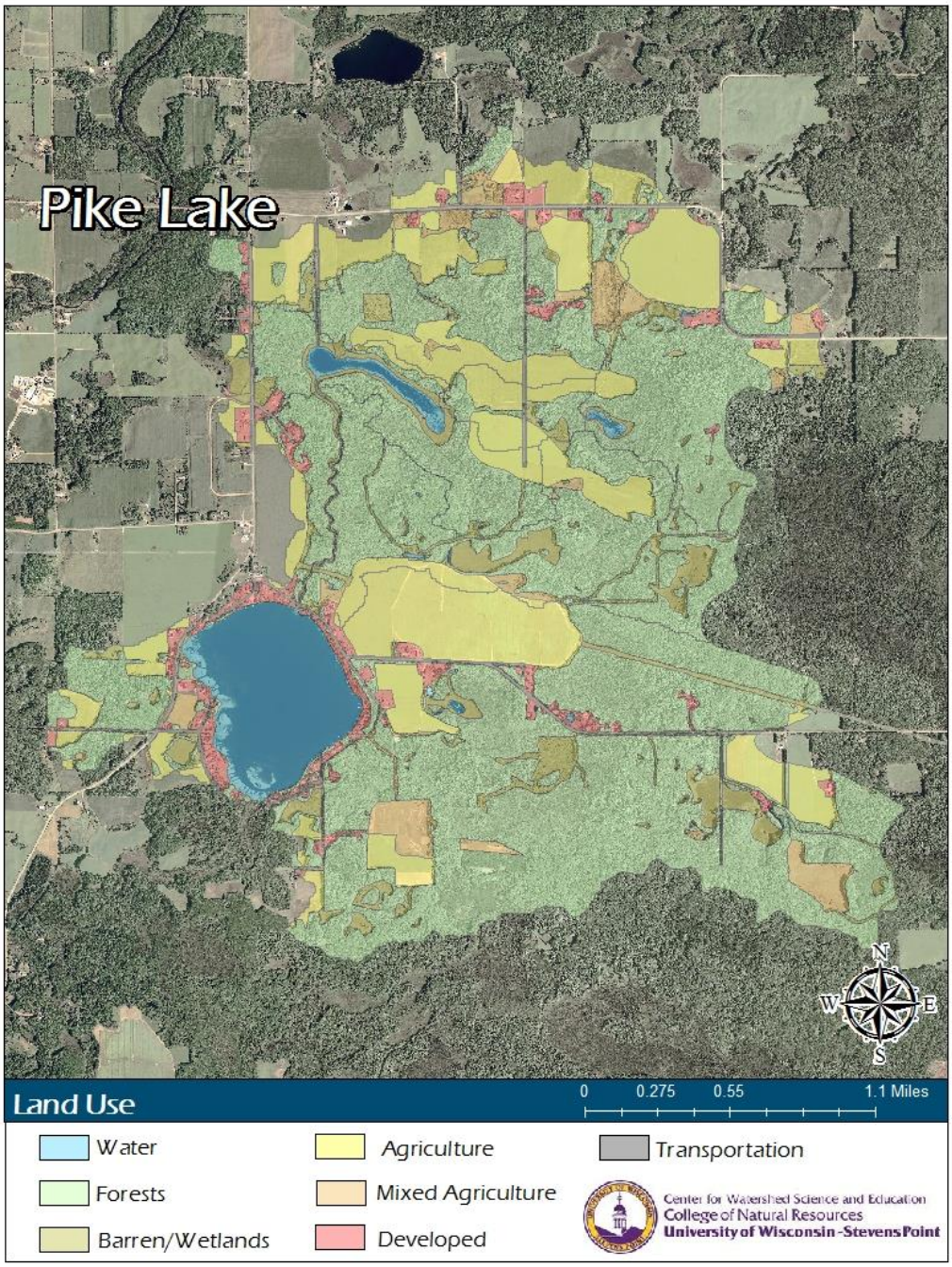
Maximum Depth: 31 feet

Water Flow

- Pike Lake is a drainage lake.
- Water enters Pike Lake primarily from an inlet stream on the northern side of the lake.
- Groundwater, surface water runoff and direct precipitation also contribute water, but to lesser extents.
- Water exits Pike Lake through its outlet stream at the south end and through groundwater.

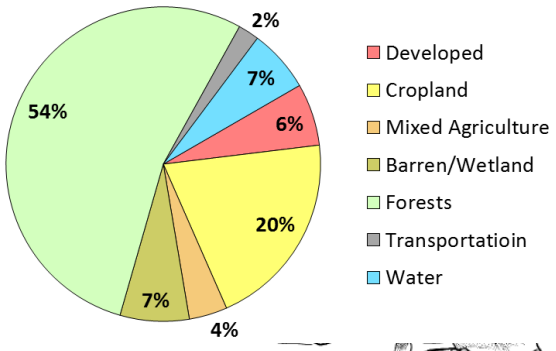
Pike Lake – Surface Watershed

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



- **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 Pike Lake is 2,359 acres.
- The primary land uses in the Pike Lake watershed are agriculture and forests.
- In general, the lands closest to the lake have the greatest immediate impact on water quality. The lake has development around much of its perimeter.
- Land use that affects Rice Lake and the stream that drains it also have a direct impact on the quality of water in Pike Lake.

Land Use in the Pike Lake Watershed

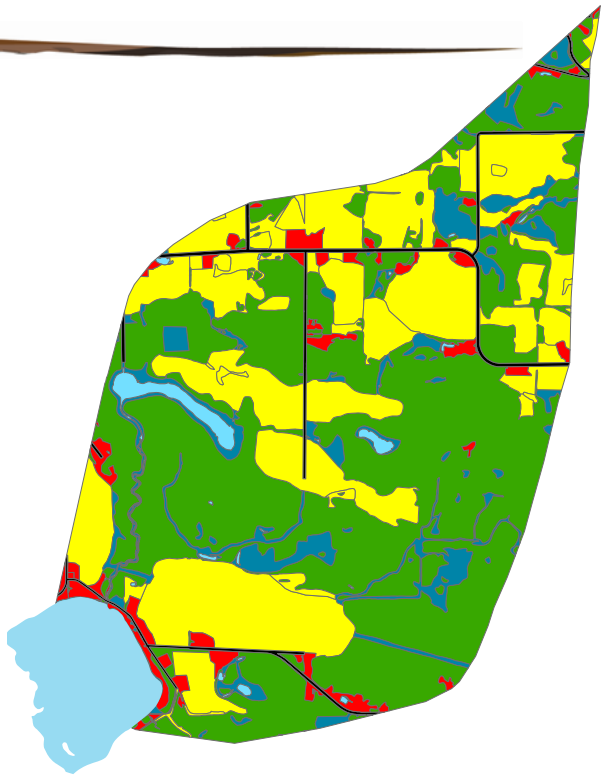


Pike Lake – Land Use in the Surface Watershed

Pike Lake – Lake Map

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

- **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 Pike Lake is 2,929 acres.
- The primary land uses in the Pike Lake groundwater watershed are agriculture and forests. In general, the lands adjacent to the lake where groundwater enters the lake have the greatest immediate impact on water quality. Residential development and agriculture are nearest the lake in the areas of groundwater inflow.
- Land adjacent to the inflow stream also contributes to the water quality in Pike Lake.
- Pike Lake has residential development around some of its perimeter.



Land Use	Acres
Agriculture	936
Developed	111
Forested	1447
Roads	61
Water	147
Wetland	227

Looking at Groundwater Up Close:

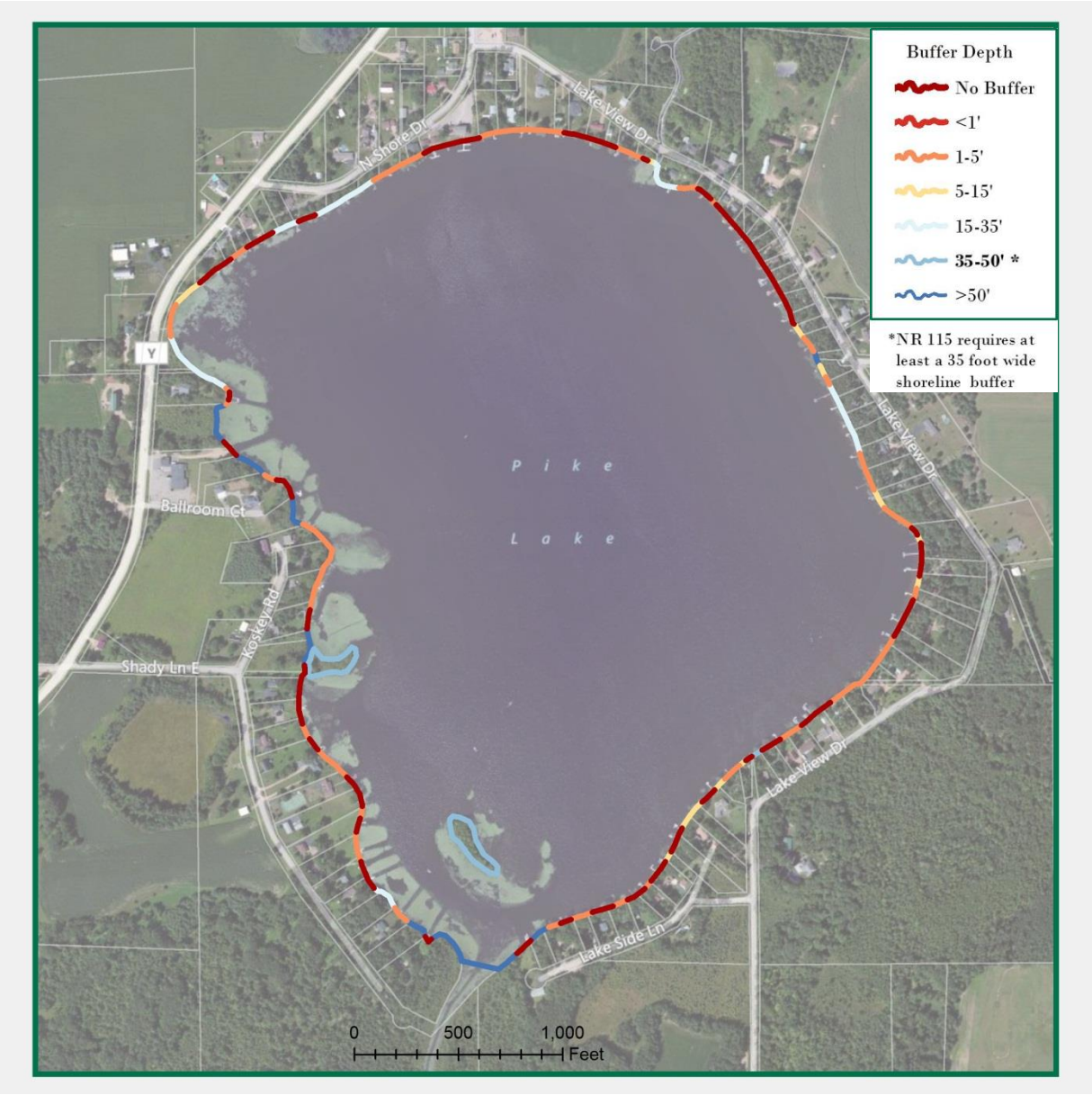
Groundwater enters Pike Lake primarily from the north with some groundwater entering in the southeast.

No groundwater outflow sites were identified during the groundwater survey.

Pike Lake – Groundwater Watershed

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.

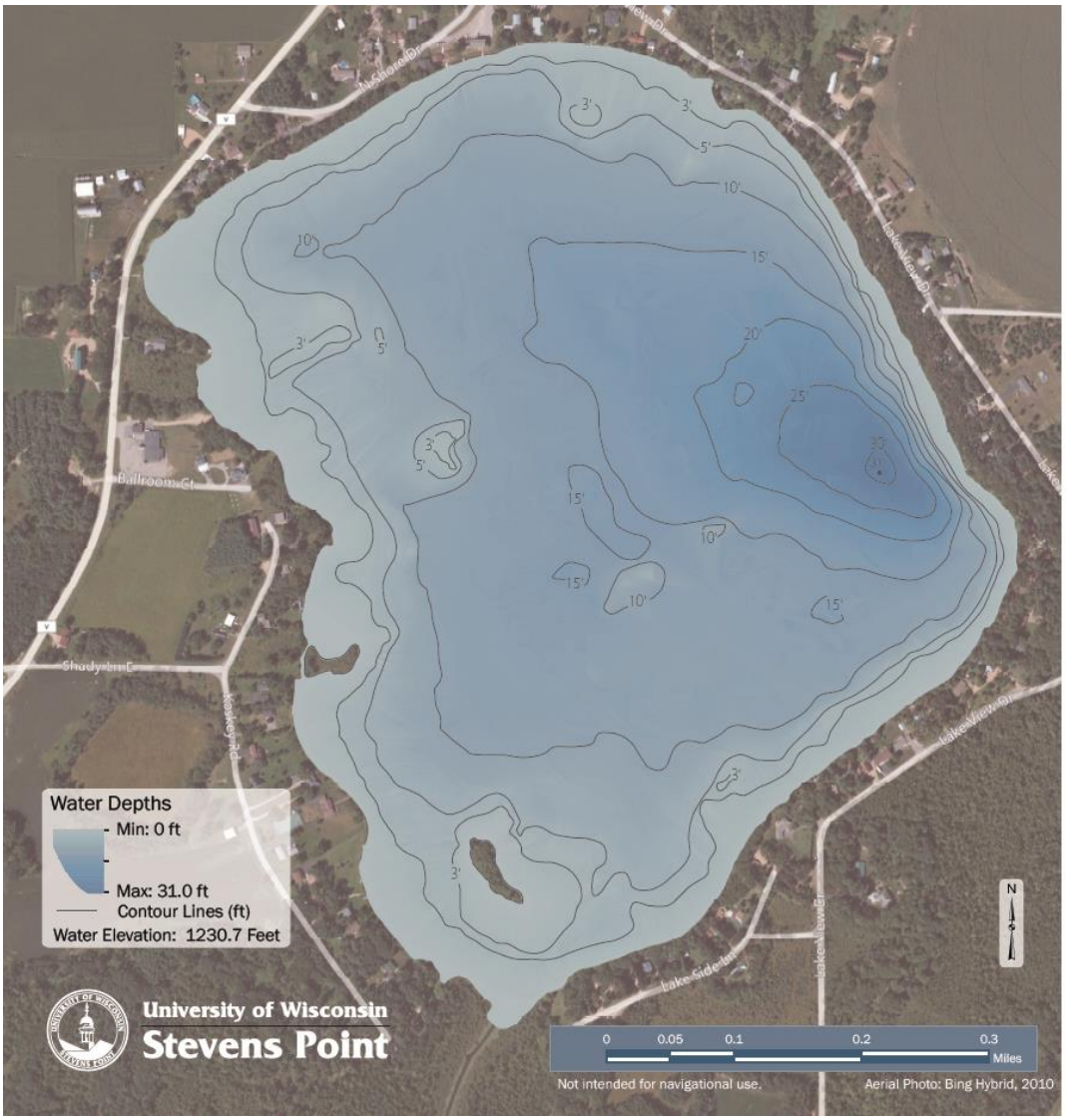
The map below shows how far the 0.5 to 3 foot tall vegetation exists landward from the edge of Pike Lake. A greater vegetative buffer provides more habitat and better water quality.



Pike Lake – Shoreland Vegetation

Pike 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



PIKE 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.

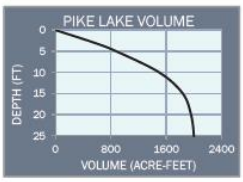
MARATHON COUNTY, WISCONSIN

GPS and Sonar Survey
October, 2012

University of Wisconsin-Stevens Point Center for Watershed Science and Education, College of Natural Resources and the GIS Center, College of Letters and Science.

Cartography by Christine Koeller

LAKE AREA	207	Acres
Under 3 Feet	38.6	Acres (18.7%)
Over 20 Feet	12.7	Acres (6.1%)
VOLUME	2009	Acre-feet
SHORELINE	2.6	Miles
MAX DEPTH	31.0	Feet



Pike 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.

- The Pike Lake fish species assemblage is more diverse than surrounding lakes in eastern Marathon County.
- Being a drainage lake, fish have an opportunity to enter from upstream and downstream systems.
- Two rusty crayfish (exotic/invasive) were captured during the sampling period.
- The presence of young bass and abundant sunfish sampling indicates successful reproduction is occurring in Pike Lake.
- Reproductive success of northern pike could not be determined since no young pike were sampled. More intense population sampling over several seasons would be required to determine reproductive success.
- Walleye reproduction has been variable in Pike Lake, and no young walleyes were observed during the sampling period.

Total catch and length of species in Pike Lake during 2012 fyke netting and seining efforts

Species	Min Length (in)	Max Length (in)	Average Length (in)	Total Catch
Bluegill	0.8	10.9	3.8	177
Yellow Bullhead	7.8	13.2	9.7	138
Yellow Perch	3.2	8.1	4.8	107
Bluntnose Minnow	1.3	2.2	1.8	100
Black Crappie	4.9	15.3	9.6	37
Northern Pike	17.3	28.7	22.4	29
Pumpkinseed	4.5	7.2	5.9	17
Walleye	14.8	24.6	21.7	10
Johnny Darter	2.0	2.4	2.1	7
Largemouth Bass	11.0	15.6	13.8	5
Black Bullhead	7.0	12.6	9.8	2
Golden Shiner	1.7	7.2	4.4	2
Brown Bullhead	12.6	12.6	12.6	1
Iowa Darter	1.9	1.9	1.9	1
Spottail Shiner	2.6	2.6	2.6	1
White Sucker	7.2	7.2	7.2	1
Bluegill x Pumpkinseed hybrid	3.9	3.9	3.9	1

Total catch and length of species in Pike Lake during 2012 boom shocking survey

Species	Min Length (in)	Max Length (in)	Average Length (in)	Total Catch
Bluegill	1.4	7.9	4.2	51
Pumpkinseed	2.2	7.3	4.7	38
Yellow Bullhead	7.6	10.8	9.6	14
Black Crappie	3.2	9	6.1	10
Black Bullhead	5.2	13	10.7	7
Yellow Perch	3.1	6.7	5.1	7
Largemouth Bass	4.5	17.9	12.2	6
Northern Pike	15.7	20.3	18.4	5
Common shiner	3	3.3	3.1	3
Bluntnose Minnow	1.7	2.7	2.6	2
White sucker	8.1	9.2	8.7	2
Brown Bullhead	11	11	11.0	1

Pike Lake – Fishery

Species occurrence in Pike Lake in 2012 surveys and historical Wisconsin DNR

Species	1956	1969	1973	1975	1976	1977	1990	1996	2002	2005	2008	2012
Black Bullhead		x		x			x	x	x			x
Black Crappie	x	x	x	x	x	x	x	x	x		x	x
Bluegill	x	x	x	x	x	x	x	x	x	x	x	x
Bluegill x Pumpkinseed hybrid												x
Brown Bullhead												x
Bluntnose Minnow												x
Channel Catfish								x				
Common Shiner										x		x
Golden Shiner	x	x					x	x	x			x
Iowa Darter												x
Johnny Darter					x							x
Largemouth bass	x	x	x	x	x	x	x	x	x	x	x	x
Northern pike	x	x	x	x	x	x	x	x	x	x	x	x
Pumpkinseed		x			x		x	x	x	x	x	x
Rock Bass									x			
Slender Madtom										x		
Spotfin Shiner									x			
Spottail shiner										x		x
Walleye		x	x	x		x	x	x	x		x	x
White sucker	x	x		x	x			x	x			x
Yellow bullhead									x			x
Yellow Perch	x	x	x	x	x	x	x	x	x	x	x	x

According to records from the Wisconsin DNR, extensive management efforts have been conducted on Pike Lake related to fish and fish habitat since the 1930s.

- From 1940-1970, Pike Lake was treated with sodium arsenite and copper compounds to control weed growth, manual cutting of aquatic plants, and spraying of shoreline vegetation with other approved herbicides. More environmentally-friendly mechanical control methods began in 1984.
- Fish kills of walleye, yellow perch and northern pike, believed to be related to the occurrence of toxic algae, were first noted in 1962. Mortality in bullhead species believed to be related to bacterial infections was reported up until the 1970s.
- In 1971, eutrophication of Pike Lake was occurring more rapidly than expected due to algae blooms and occasional winter fish kills from low dissolved oxygen. Sporadic reports of winter kills indicate continuing eutrophication issues.
- Walleye stocking has been prevalent since 1938, although pike was also stocked with some frequency until 1965. In 1981, with approval from the Wisconsin DNR, a walleye spawning reef was installed by the Pike Lake Sportsmen Club along the eastern shore, but natural reproduction of walleye was not improved from this effort. Walleyes For Tomorrow installed a second artificial walleye spawning reef after 2006 adjacent to the southern inlet, with better contouring and a larger surface area for the same purpose.
- Yellow perch have also been stocked in recent years, and an abundant population of perch was present during 2012 sampling. It is not possible to evaluate the effectiveness of these stocking efforts with the limited sampling conducted during this study.
- In 2006, boy scouts installed three fish cribs constructed of wooden pallets anchored to the bottom.

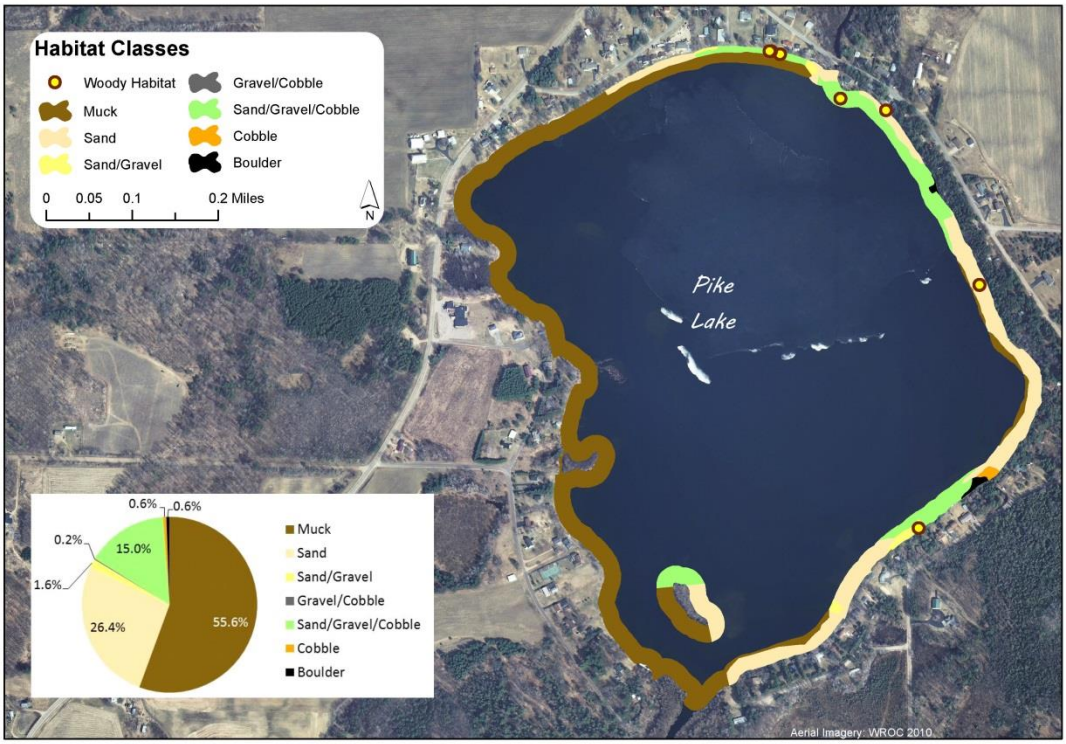
Pike Lake – Fishery

Habitat in and near the lake plays a major 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 (CWH) is sparse in Pike Lake. The addition of CWH cover into Pike Lake would benefit the fish community.

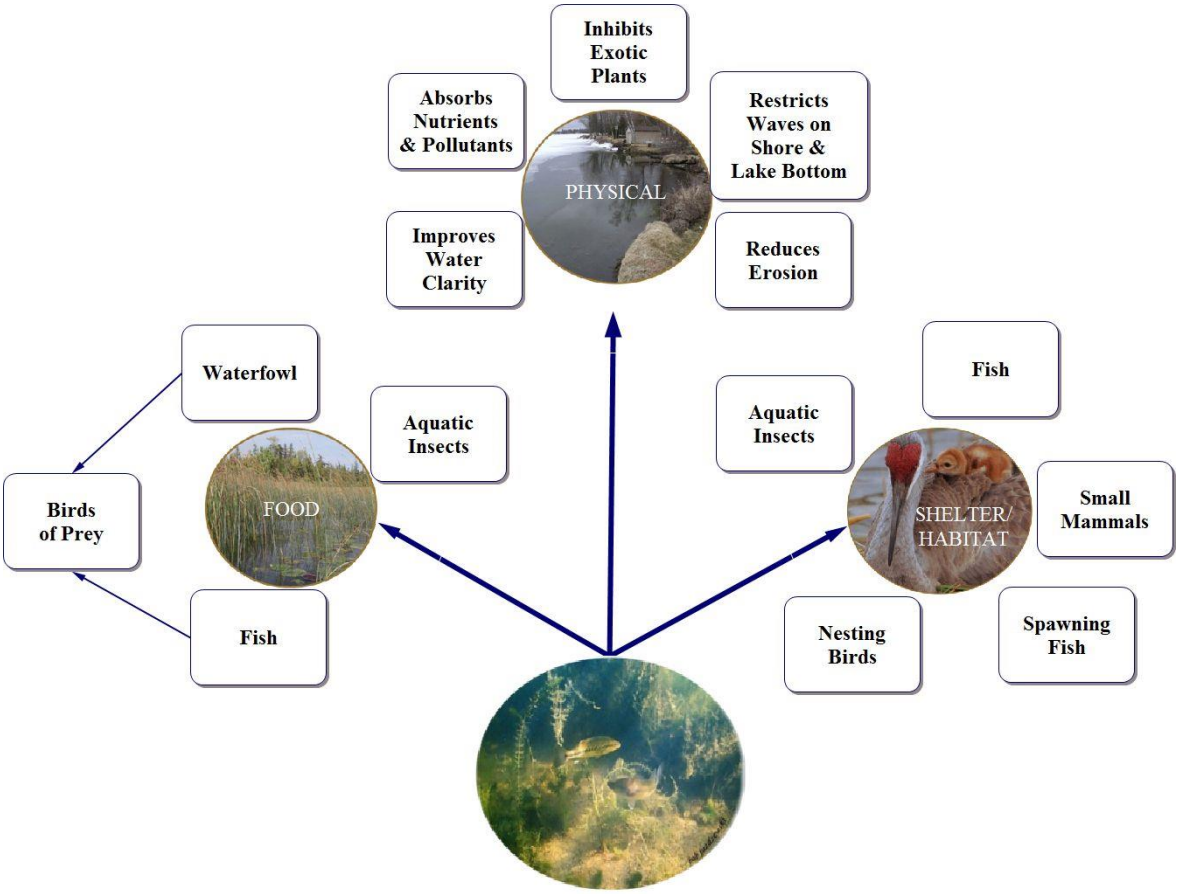
Substrate and Coarse Woody Habitat - Pike Lake
Marathon County, WI 2012



- Gravel areas are used by many fish for spawning habitat, including sunfish (bluegill, pumpkinseed and black bass), where males will construct nests and guard their young. Northern pike spawn in shallow or flooded areas with emergent and floating-leaf vegetation.
- Black crappie use bulrush habitat on gravel or sand substrates where they construct nests and guard young. Bulrush is present along areas of the western shoreline in Pike Lake.
- Yellow perch and walleye use near-shore cobble in oxygen-rich environments for spawning.
- Sand can be important habitat for non-game minnow reproduction.

Pike 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

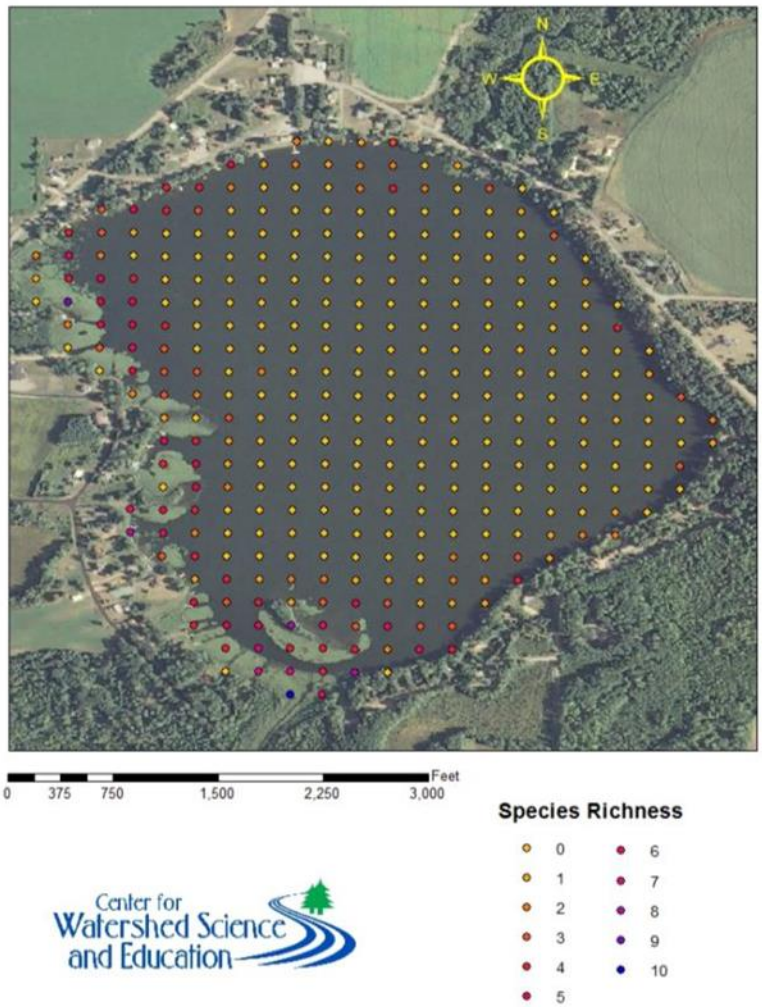
- Overall, the plant community in Pike Lake is characterized by an above average diversity when compared to other lakes in the Marathon County study, with a total of twenty-one species documented in the 2011 survey. Much of the diversity observed in Pike Lake was limited to bays and undeveloped shores on the western side of the lake.
- The number of plant species and percent of littoral zone that is vegetated have decreased somewhat since the 2006 aquatic plant survey. Dominant species have changed as well.

Pike Lake – Aquatic Plants

- During a 2011 aquatic plant survey of Pike Lake, 36 percent of the sites sampled had vegetation. The average depth of the sampled sites was 6 feet, with a maximum rooting depth of 11 feet.
- The three most frequently encountered aquatic species are native to Wisconsin: flat-stem pondweed, coontail and muskgrass.
- Prior to the survey, Pike Lake had been identified by the Wisconsin DNR as having curly-leaf pondweed (CLP) populations. A separate June 2012 survey documented the presence of curly-leaf pondweed along the entire length of the lake's western shore.

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.

Pike Lake Aquatic Plant Survey: Species Richness 2011



Center for Watershed Science and Education

Coontail

Coontail and f**lat-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.

Flat-stem pondweed

Pike 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, boats, trailers 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.

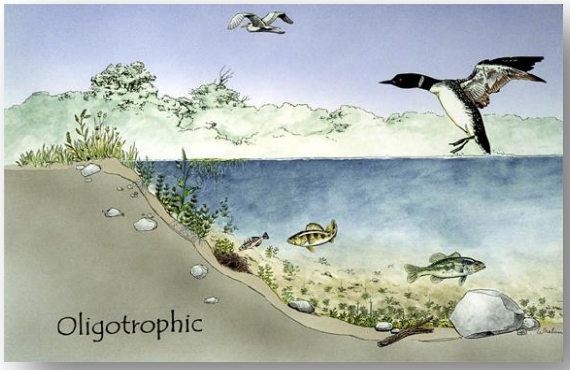
Lakes With Aquatic Invasive Species in Marathon and Northern Portage County, 2012

Lake Name	Banded Mystery Snail	Chinese Mystery Snail	Rusty Crayfish	Curly-Leaf Pondweed	Eurasian Water Milfoil	Purple Loosestrife
Marathon County (Shaded lakes are part of Eastern Marathon Co. Lake Study)						
Big Bass 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			✓	✓	✓	
Northern Portage County						
Tree Lake	✓	✓	✓			
Plover River			✓			
Lake DuBay		✓	✓	✓	✓	

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

Pike 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.



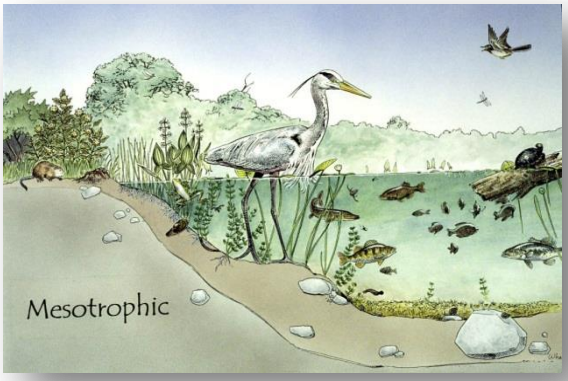
Oligotrophic Lakes

Common uses:

- ✓ Swimming
- ✓ Skiing
- ✓ Boating

Vegetation of oligotrophic lakes:

- ✓ Very little vegetation



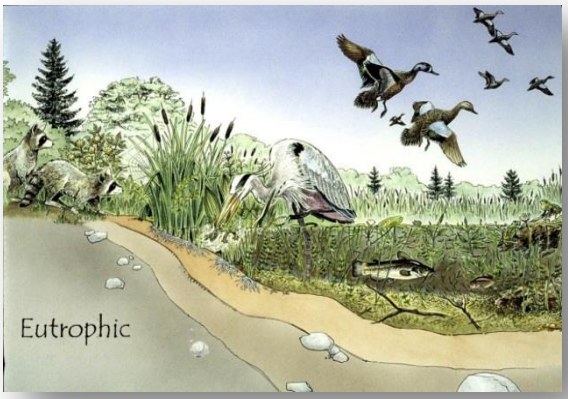
Mesotrophic Lakes

Common uses:

- ✓ Boating
- ✓ Fishing

Vegetation of mesotrophic lakes:

- ✓ Increased vegetation
- ✓ Occasional algal blooms



Eutrophic Lakes

Common uses:

- ✓ Fishing
- ✓ Wildlife watching

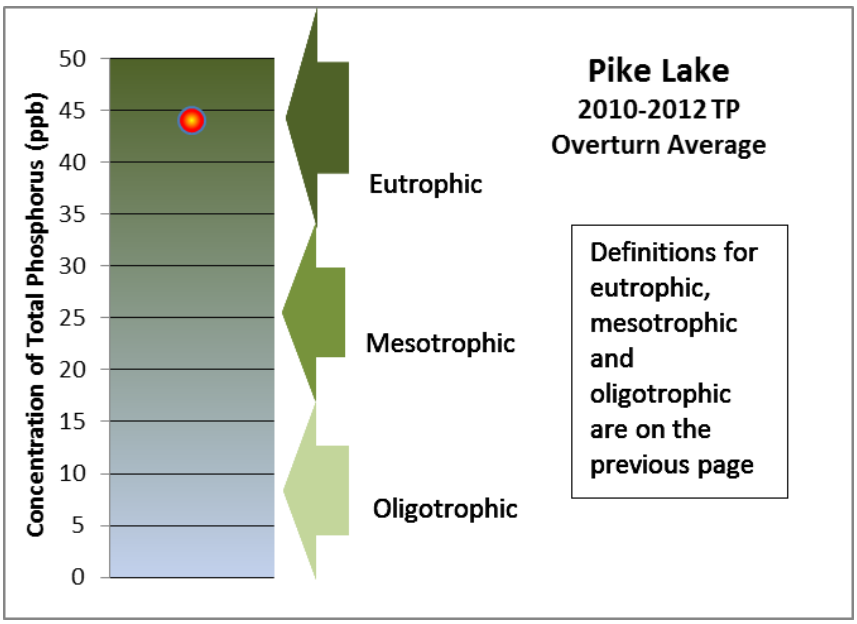
Vegetation of eutrophic lakes:

- ✓ Lots of aquatic plants
- ✓ Frequent algal blooms

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

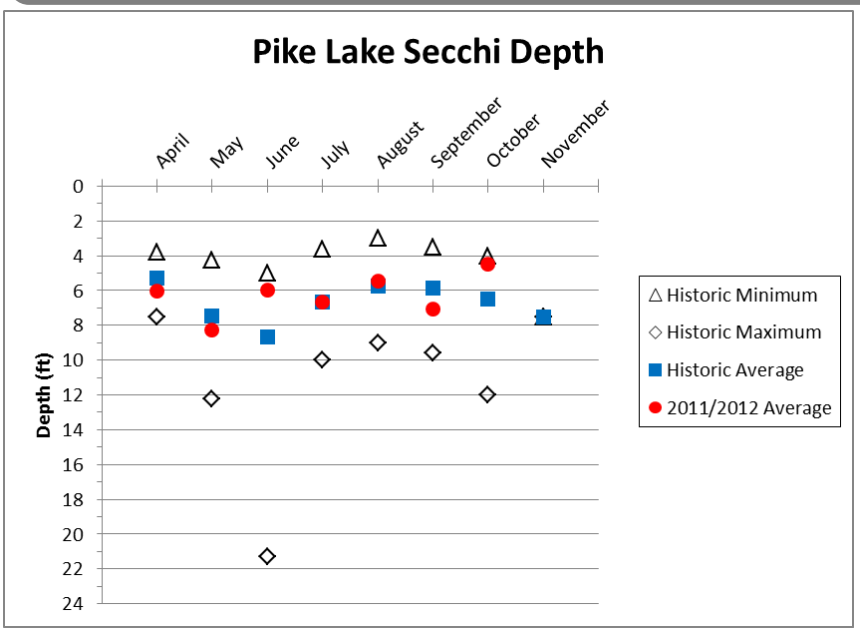
Pike Lake – Water Quality

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. 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 Pike Lake was well-mixed (overturn) are displayed in the graph to the left.
- Overturn sampling during the 2010-2012 monitoring period indicated that Pike 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.



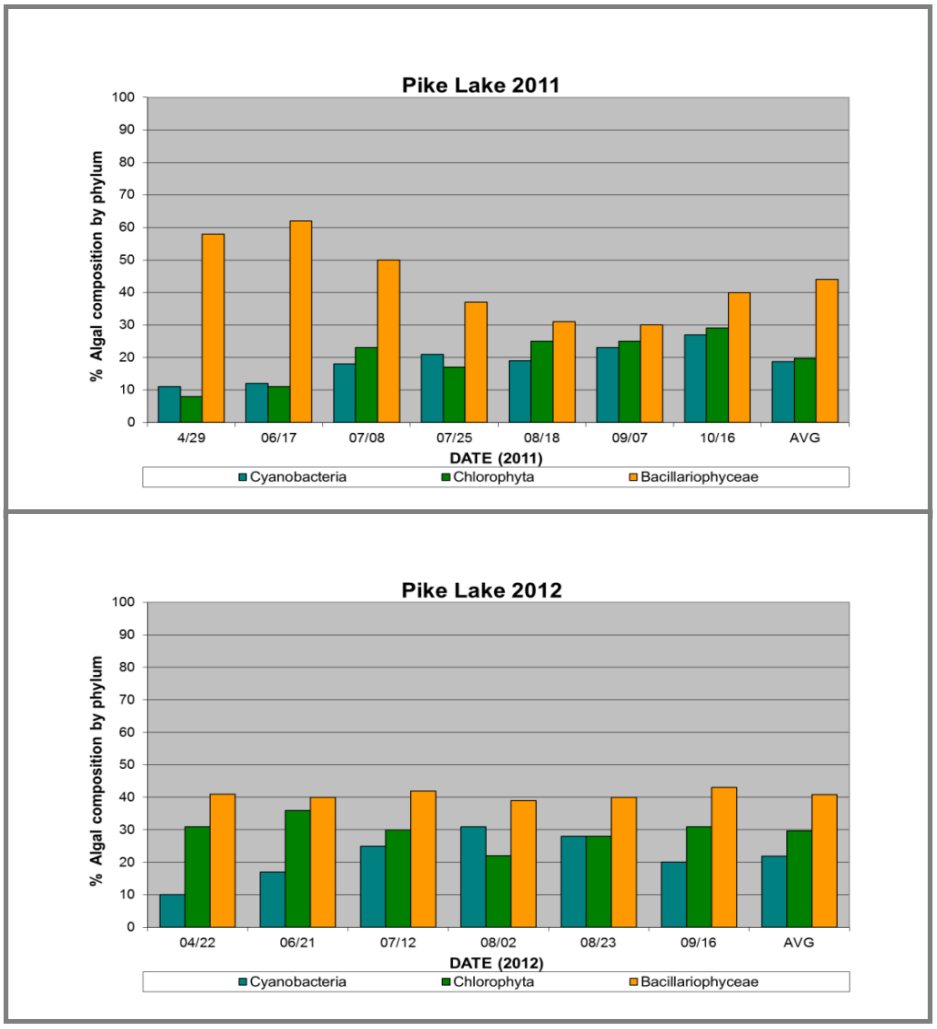
- The graph to the left shows water clarity data collected during the growing season in 2011 and 2012. It is typical for water clarity to vary throughout the year.
- The 2011/2012 average Secchi depth readings were relatively consistent with historic averages.

Pike Lake – Water Quality

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).

- Despite some variation in the seasonal patterns of the algal community, diatoms were the dominant algal group in Pike Lake during both 2011 and 2012.
- The diatoms were represented by a rich species mixture; most are associated with eutrophic waters. These plankton species grow quite densely in colonies and likely contributed to the very low water clarity observed in 2011 and 2012.
- The remaining components of the algal community, green algae and blue-green algae, were minor and like the diatoms are typical of eutrophic lakes.
- The high total phosphorus value, the low water clarity, and the dense and dominating diatom community found in Pike Lake are typical of a stable eutrophic lake.



PERCENT ALGAL COMPOSITION FOR PIKE LAKE IN 2011 AND 2012

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

Pike Lake – Algae

Lake sediment can help to tell the history of a lake and changes that may have affected the lake related to water quality, the abundance of aquatic plants, and sedimentation or land use changes in the watershed. These changes are assessed by evaluating the content of the upper layer of the sediment versus lower layers. This information can help to guide management decisions for a lake.

- Analysis of Pike Lake's sediment core suggests increased disturbance in the lake basin since the time of European land clearing.
- Over this time period, there have been increases in nutrients to the lake, including phosphorus, and substantial habitat changes.
- Ragweed generally increases with logging and land clearing but does not peak until the land is prepared for agriculture, which became widespread around the turn of the century. High levels of ragweed pollen between 10 and 12 inches deep probably represent this period. A high ragweed index deeper in the sediment suggests earlier disturbance due to logging or agricultural clearing by Native Americans.

This is an example of a sediment core collected from the bottom of a Wisconsin lake. The darker layers indicate organic-rich sediments often due to increased growth of aquatic plants and/or soil erosion. Additional analysis of these layers can help to confirm the source(s).

Diatom species found in lake sediments in Marathon County.

Diatoms are a type of algae sediment. They are well-preserved in sediments due to silica-based cell walls which resist degradation.

Different species of diatoms are sensitive to water quality; thus, changes in the diatom community from the bottom to the top of the sediment core can reveal how water quality in the lake has changed over time.

Pike Lake – Primary Researchers

Lake Users:

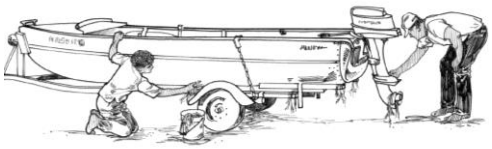
- ✓ Run boat engines efficiently
- ✓ Observe no/low wake zones
- ✓ Refuel away from water
- ✓ Dispose of trash properly
- ✓ Remove all aquatic plants from boats and trailers
- ✓ Respect wildlife and other lake users

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.

Pike Lake – Primary Researchers

Algae

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Cultural Survey

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Shoreland Assessments and Build Out

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Water Quality and Watersheds

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- *Marathon County*
- *Marathon County Citizens*

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

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