

Plan for Aquatic Plant Management in Pike Lake Marathon County, Wisconsin



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Pike Lake Aquatic Plant Management Plan

Background and Goals

The Pike Lake Sportsman Club and other interested citizens were interested in developing an aquatic plant management plan (APM) for Pike Lake to provide thoughtful guidance to balance aquatic plant management, fishery and wildlife needs, and recreational desires.

The development of an aquatic plant management plan for Pike Lake provided an opportunity for local citizens to learn about the lake and its ecosystem, the role that aquatic plants play in the lake ecosystem, and potential for balancing these needs with recreational interests. The Pike Lake APM committee was comprised of representatives from the Pike Lake Sportsman Club, the Pike Lake fishing club, Towns of Reid and Elderon, and the Marathon County Land Conservation Department. The committee worked on the development of the plan with UWSP Center for Watershed Science and Education (CWSE) and UW-Extension Lakes Program. Wisconsin DNR provided technical expertise and funding for this process.

The Pike Lake APM committee met four times between May and August 2006. During these sessions they observed presentations by Deborah Konkel (Aquatic Plant Specialist, WDNR) author of *Pike Lake Aquatic Plant Community Changes between 1989 and 2002*, Nancy Turyk (Water Resource Scientist, UWSP CWSE), and Tom Meronek (Fishery Manager, WDNR) on the aquatic plant management and the fisheries of Pike Lake. These presentations provided background information about aquatic plants, the roles they play in the lake's ecosystem, and aquatic plant management opportunities.

The Committee was interested in obtaining feedback from the community, so a survey was developed to acquire opinions of local residents and lake users. Surveys were made available to members of the Pike Lake Sportsman Club and the Pike Lake fishing club. In an effort to include lake users not associated with the clubs, surveys were gathered from the local taverns and solicited through local newspapers. Seventy-two surveys were returned.

Options for aquatic plant management in Pike Lake were presented to the public on Sept. 30, 2002 at a meeting at the Reid Town Hall. All members of the Pike Lake Sportsman Club that were not in attendance were provided copies of the management plan options and encouraged to respond with their preference.

Goals

The Pike Lake APM committee identified seven goals for this process/plan:

- 1) promote a healthy aquatic plant community
- 2) reduce algae blooms
- 3) reduce negative (invasive) aquatic plants (ie curly leaf pondweed) if possible
- 4) better understand the lake ecology
- 5) improve water quality
- 6) enhance the panfish population
- 7) support a core group who will learn to identify aquatic plants and monitor for aquatic invasive plant species and changes in the aquatic plant community

History of Aquatic Plant Management in Pike Lake

People have been attempting to control aquatic plants and algae in Pike Lake since at least the 1940s. Aquatic plants have been harvested in Pike Lake on and off for decades. In the early years of harvesting locals created a home made harvester that cut the plants, but for the most part the cut plants were left in the lake. There is also a long history of chemical use in Pike Lake. Deborah Konkell, WDNR compiled the aquatic plant treatment records in the document *Changes in the Aquatic Plant Community of Pike Lake 1999-2002*. Following is a summary of chemical use extracted from this report.

Treatments for algae growth have been carried out since 1940, but records of actual chemical usage have been regularly recorded only since 1949 (Table 1). There were probably unrecorded treatments carried out during the 1940's, so the total amount of chemicals used is likely higher than reported.

Two elements, copper and arsenic were major components of compounds utilized in Pike Lake. Between 1942 and 2002, 14,765 pounds of copper sulfate and 304 gallons of Cutrine had been applied for algae control in Pike Lake. This means that 3,748 pounds of pure elemental copper had gone into the lake. Copper does not degrade and remains in the lake sediments, toxic to aquatic life. During 1949-64, 3560 pounds of Arsenic had been added to Pike Lake. Arsenic is highly toxic and does not degrade. If dredging or sediment removal from the lake is necessary, the arsenic contaminated sediments must be handled as hazardous waste. These toxins may be affecting aquatic organisms including mollusks, which would otherwise filter algae from the water thus improving water clarity.

Organic compounds were also used in Pike Lake for aquatic plant control. Silvex (2,4,5-TP) was applied to Pike Lake during 1968-1969 in the amount of 139.5 pounds. Silvex is no longer approved for aquatic use due to its toxicity. Endothall Acid was added to Pike Lake in several forms: as granular Aquathol (6345 pounds), liquid Aquathol (697 gallons) and as Hydrothol (4560 pounds). Hydrothol is the monoamine salt formulation and is more detrimental to young fish. (Konkell, 2003)

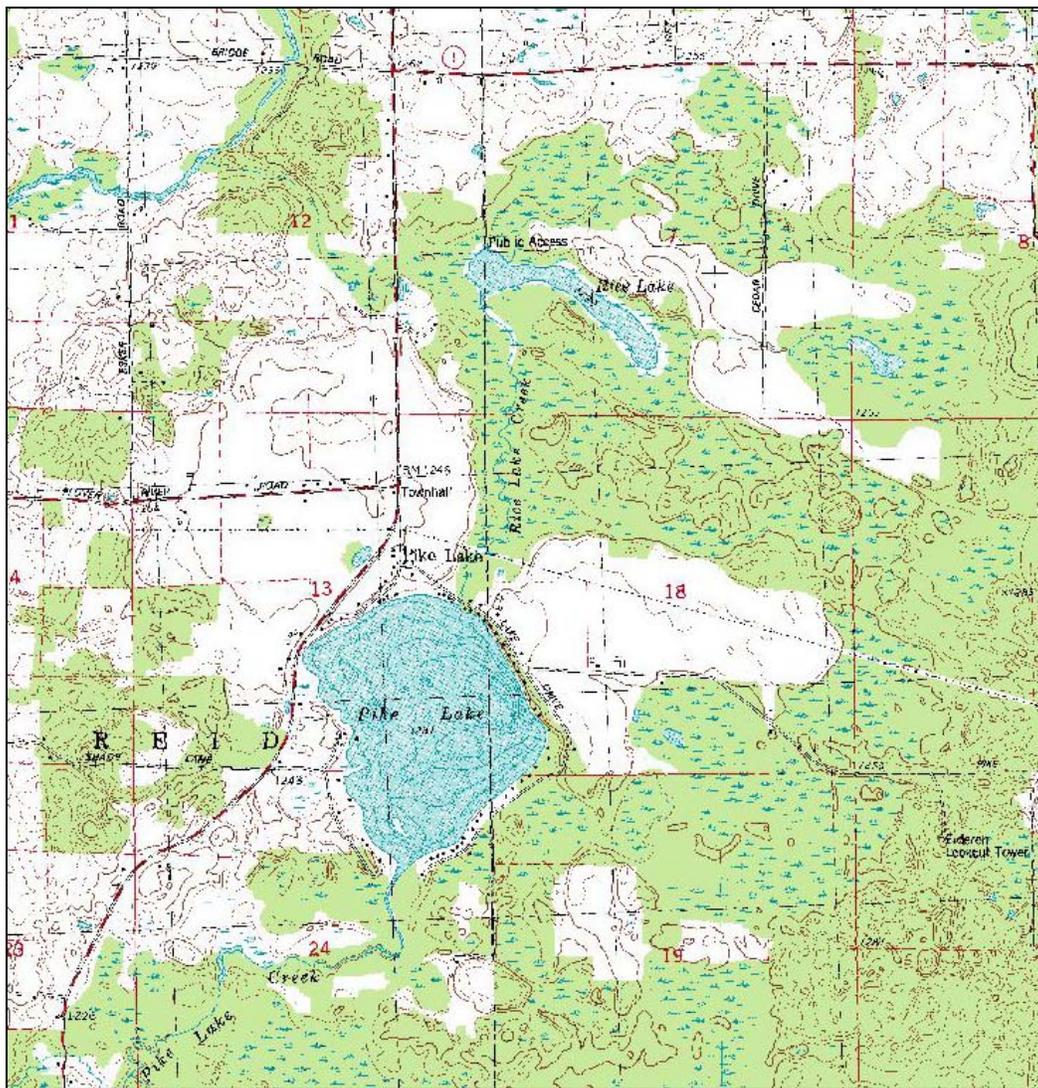
Table 1: Aquatic herbicides applied to Pike Lake, 1942-2002

	Copper Sulfate pounds	Cutrine gallons	Arsenic pounds	Silvex 2,4,5-TP	Aquathol pounds	Aquathol gallons	Hydrothol pounds	2, 4-D pounds	Rodeo ounces	Diquat gallons
1942	1100									
1944	440									
1949	1000		110							
1950	1000		150							
1951	850									
1952	1000									
1960			600							
1963	850		1260							
1964	1600		1440							
1965	800									
1966	800									
1967	1900							440		
1968	750			67.5	1350					
1969	1125			72		51				
1970	750				1125					
1971					150					
1973					1010					
1974	300				1060					
1975					350					
1976							870			
1977							415			
1978							300	30		
1979							750	30		
1980					500		1500	10		
1981								10		
1982					550		650	20		
1983	500					24		5		8
1984								10		
1990		50				102	40		15	19
1991		38.75				68.5			3	11.5
1992		14.5				88.5			6	5
1993		39.75				38.5				14.75
1994		20.5			250	36.5	35		3	17
1995		36.5				52.5				12.75
1996		11.5				8.75				4.5
1997		21				42.25				10
1998		18.75				45.5			1	9.5
1999		17.5				37			3	11.25
2000		12.5				30.75			5	17
2001		10				33.5				11.5
2002		13.25				37.5			6	11.75
Totals	14765	305	3560	140	6345	697	4560	555	42	164

A Brief Description of Pike Lake and Its Watershed

Pike Lake is a 205 acre hardwater lake located in the Towns of Elderon and Reid in Marathon County. It is an impounded drainage lake that receives water from Rice Lake, the 25-acre lake to the north, and drains to the south to the Plover River (**Figure 1**). An impoundment is located on the outflowing creek. This was put in place to raise the level of the lake for recreation. The maximum water depth is 35 feet and it has a mean depth of about 13 feet. The depth that aquatic plants can grow is approximately 12 feet, which comprises about 1/3 of the lake. Residential development near Pike Lake began in the 1920s and today there are approximately 75 riparian homes and several businesses. There is a boat landing on the south eastern side of the lake, right on the town border of Elderon and Reid, resulting in a high human use area. Much of the lake is used for recreation and fishing.

Figure 1: Map of Pike Lake and the surrounding areas



The Pike Lake watershed has many land uses with no one type dominating (Figure 2

Figure 2). Using the WISCLAND 1992 land cover, forested land covers 29% of the watershed, agriculture 23%, grassland 22%, and wetland 20%. About 6% of the watershed is comprised of streams and lakes (Figure 3).

Some types of bottom sediment (substrate) provide better conditions for aquatic plant growth than others. Hard sandy soils are often nutrient poor and do not tend to be the best substrate for aquatic plant growth. Muck sediments have plentiful organic materials and tend to be rich in nutrients; these traits are ideal for aquatic plant growth. Sediment types were identified at each sampling site during the aquatic plant surveys conducted by the WDNR in 1989, 1993, 1999, and 2002. There has been a substantial increase of muck (and concurrently a decrease in sandy substrate) between 1989 and 2002 (Figure 4). Some of this increase can be attributed to the use of chemical herbicides which kill the aquatic plants in place. The plant drops to the bottom of the lake and decomposes, creating muck. Using an aquatic plant harvester, the plant tissue and the nutrients in the tissue are removed resulting in less muck formation in the lake bottom.

Figure 2: Land use in the Pike Lake Watershed.

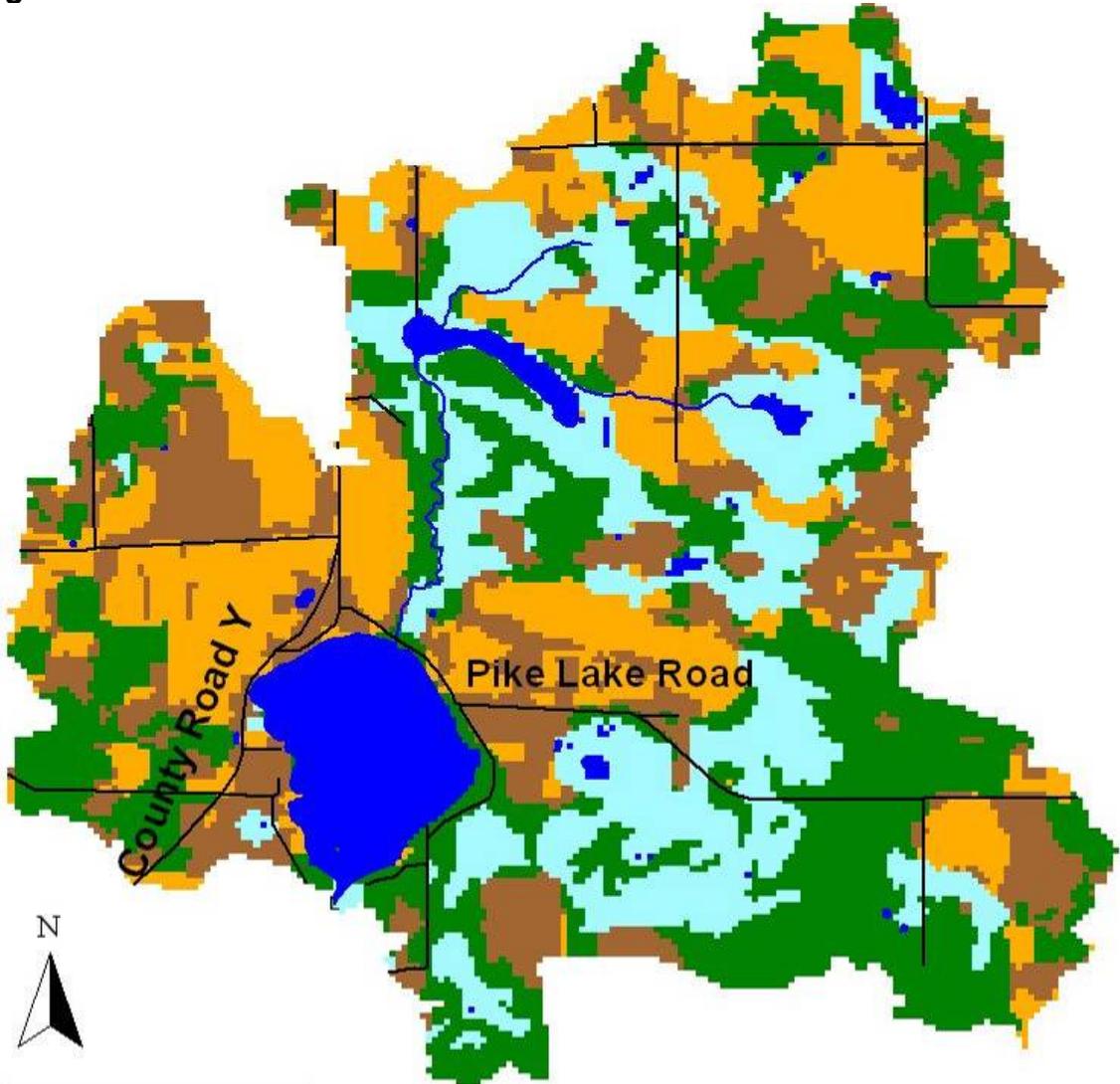


Figure 3: Percent land cover in the Pike Lake Watershed

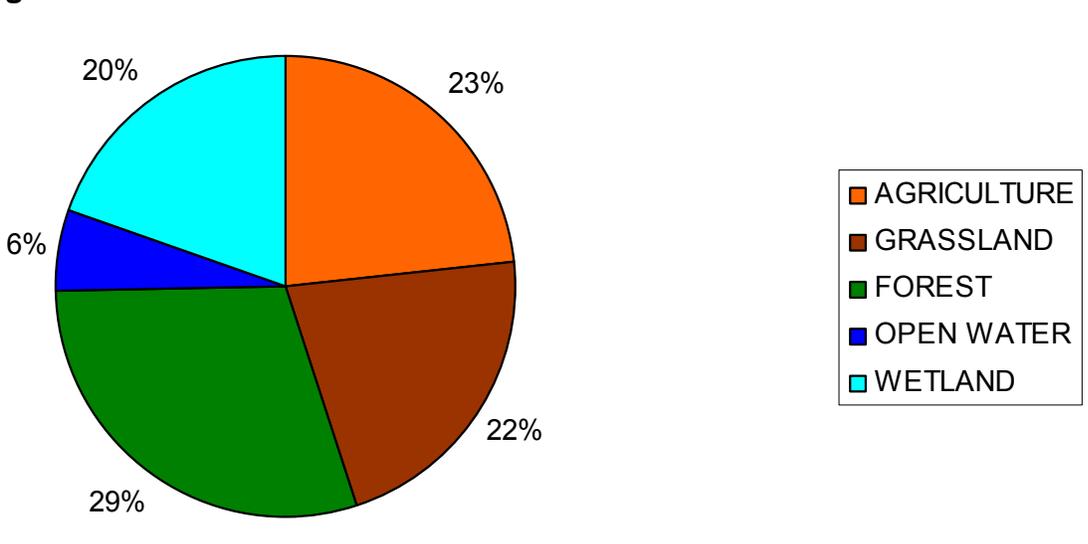
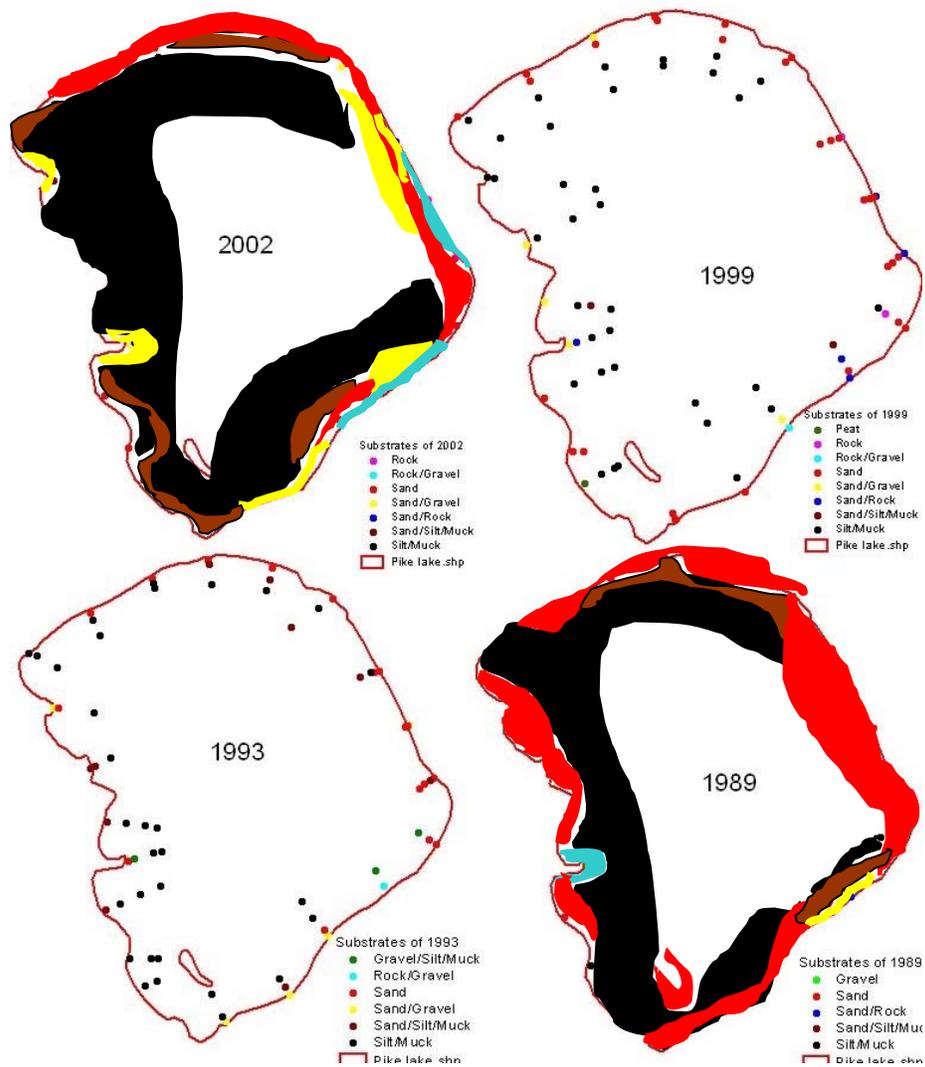


Figure 4: Substrates in Pike Lake from 1989 to 2002 (D. Konkel, WDNR).



The Aquatic Plant Community

The type and amount of aquatic plants are tied to the water quality, fishery, and wildlife in a lake; a change in one affects the others. If a system is in balance, care must be taken to avoid upsetting the balance. If a system is out of balance strategically selected actions taken to balance one of the parts of the system (such as aquatic plant management) should help to bring balance to other parts of the system (such as the fishery).

Another relationship that exists in a lake is between algae and aquatic plants. A balance between the two can result in relatively clear water and a healthy aquatic plant community. The removal of too many aquatic plants can result in larger or more frequent algae blooms

(e.g. the dog days of August, familiar to Pike Lake residents that knew the lake back in the 1960s).

Invasive non-native species of aquatic plants are an increasing problem in Wisconsin lakes. They are rapidly spreading from lake to lake by being transported on boats, fishing equipment, boat trailers, etc. In general these species grow wherever they can get a footing and take advantage of areas with open lakebed from raking, chemical application, low water levels, etc. Invasive species can dramatically upset the aquatic plant community in a lake and can be difficult or often impossible to eradicate. Prevention and early detection are the best ways to keep these nuisance plants out of the lake. Based on the Pike Lake 2002 aquatic plant survey results, the only invasive aquatic plant that was identified was Curly leaf pondweed (*Potamogeton crispus*).

In May 2006 Deborah Konkell presented a summary of the history of aquatic plants in Pike Lake between 1989 and 2002 to the APM Committee. The information presented came from her report *Changes in the Aquatic Plant Community of Pike Lake 1999-2002 Marathon County, Wisconsin*. According to her summary, the maximum rooting depth for aquatic plants in Pike Lake is 13 feet, but most of the plant growth in Pike Lake takes place in the 5 to 10 foot depth zone. Coontail (*Ceratophyllum demersum* L.) is the dominant plant species in this zone. Sensitive areas in the lake include vegetation in the 1 to 3 foot depth, behind (south of) the island, and the southwest/west shoreline.

Muskgrass (*Chara* sp.) is currently the dominant species in the lake and is an indicator of disturbance. Disturbance can be from a variety of sources; biological (i.e. carp), raking, boat motors, changes in water quality (reduced light penetration), and/or chemical treatment. These plants show that disturbance occurred, but do not indicate source. Muskgrass is a type of macrophytic algae that does not have true roots, therefore, it absorbs nutrients directly from water. It is considered good for water quality because it uses phosphorus that could otherwise be used by "nuisance" algae. It also provides habitat for aquatic insects and small fish. The 2002 survey showed more muskgrass (chara) than in past years.

A more diverse aquatic plant community generally supports a more diverse fish community. Between 1989 and 2002 diversity and floristic quality were both on a downward trend in Pike Lake (Figure 5). In 2002 the plant community was only 56% similar to the 1989 aquatic plant community, presumably due to the use of herbicides. Muskgrass became the dominant plant species (it is not affected by the herbicides that were used). All species of Pondweed (*Potamogeton* sp.) have declined since 1989 (Figure 6). Pondweeds provide good habitat, but are sensitive to harvesting. Curly leaf pondweed (*Potamogeton crispus* L.) is an invasive species that is present and is becoming overly abundant in Pike Lake. It grows under the ice and once the ice cover is gone it grows rapidly very early in the year. It dies off in June and releases phosphorus into the water which can result in algae blooms that can be problematic if curly leaf pondweed becomes too abundant.

The plant densities in Pike Lake are about average, with muskgrass, white water lily (*Nymphaea odorata*), arrowhead (*sagitaria* sp.), and softstem bulrush (*Scirpus validus*) all slightly higher than average. Aquatic plant growth is expected to be abundant in Pike Lake because of the large areas of shallow depth, gradual bottom slope, hard water, fertile silt

sediment, and abundant nutrients (rising over time). Nutrients and algae are both highest in August.

The undesirable changes in the plant community (above) are disturbing and continuing. The chemical treatments are not providing a solution and may be the root cause of these changes. Management recommendations from Konkel's report include 1) Establish buffer zones of natural vegetation around the lakeshore, 2) Plant emergent aquatic plants to replace rip-rap, 3) Cooperate with efforts in the watershed to reduce erosion and fertilizer run off into Pike Lake, 4) Eliminate fertilization of shoreline properties, 5) Sediment analysis must be conducted in Pike Lake before any project involving the sediments, 6) Explore alternatives to the use of broad-spectrum chemicals for native aquatic plant control. Additional recommendations from Konkel included maintaining invasive species signs at the boat landing and having volunteers trained through the DNR Clean boats/clean waters program. Some DNR boat inspectors will come through in the summer but they have a number of counties to cover so they will only visit landings once or twice over the summer.

Figure 5. Diversity and floristic quality indices in Pike Lake for four aquatic plant surveys between 1989 and 2002.

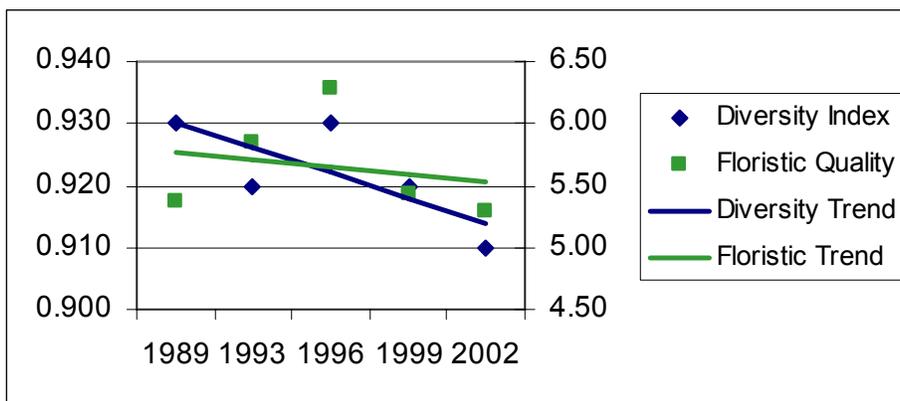
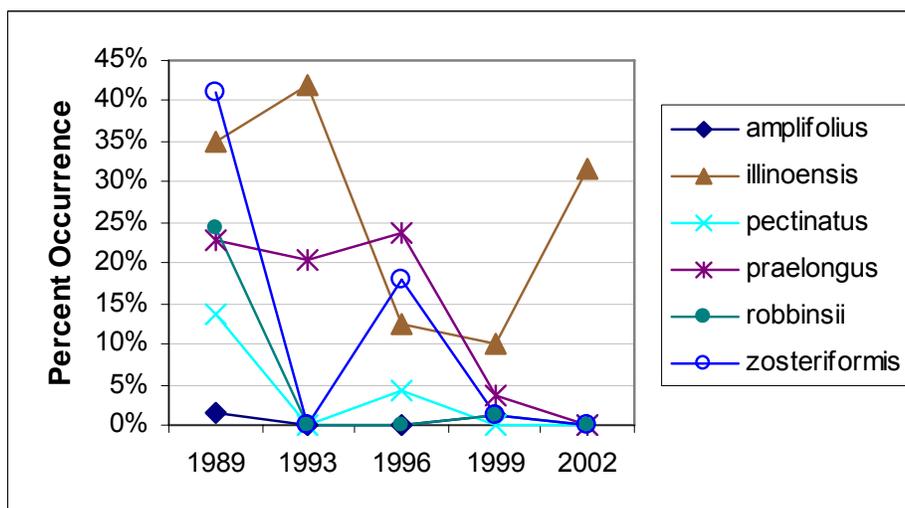


Figure 6. Pondweed species in Pike Lake aquatic plant surveys 1989, 1993, 1999 and 2002.



Fisheries and Wildlife Habitat

According to Tom Meronek, WDNR Fisheries Biologist, the fish community in Pike Lake is average for this type of lake. During a presentation to the Pike Lake APM Committee he compared fish populations from surveys conducted in 1996 and 2002. The fishery is comprised of black crappies, bluegills, yellow perch, large-mouth bass, northern pike, and walleye. Since 1996 the black crappie and bluegill, and northern pike populations have increased, and there has been a significant increase in the walleyes greater than 15 inches (Figure 7 and Figure 8). The large mouth bass population has decreased, but there are still some greater than 19 inches. The yellow perch population has nearly disappeared.

Submerged vegetation is very important to the fishery in Pike Lake and proper management of the vegetation can enhance the fishery. According to Meronek, studies have shown that bass have switched to a fish diet sooner under proper vegetation management. This results in larger, healthier bass. A radial pattern of plant removal can be beneficial to the quality of the bluegill population. In addition, deadfalls and woody habitat can also help to balance the fishery in the lake.

Recommendations by Meronek for improvement of the fishery in Pike Lake included 1) re-establish beds of emergent vegetation, 2) cut or treat in radials, 3) eliminate non-native plants (curl pondweed) as recommended by Konkel, 4) allow more vegetation within the 1.5 to 5 foot littoral zone, 5) leave dead timber in the water, 6) balance the predator/prey relationship.

Wildlife is dependant upon aquatic plants in Pike Lake for food, habitat, and oxygen production. Some species of aquatic plants provide better food than others. The wildlife that were observed in the lake and on the island by survey respondents included waterfowl (ducks, geese, loons, blue herons), birds (including eagles), turtles, snails, muskrats, and beaver

Figure 7. Number and length of black crappies, bluegills, and yellow perch collected in surveys of the Pike Lake fishery in 1994 and 2002.

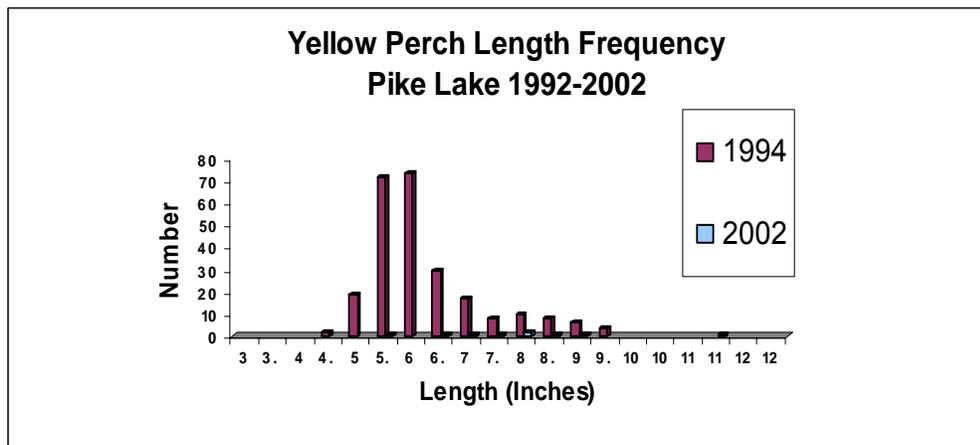
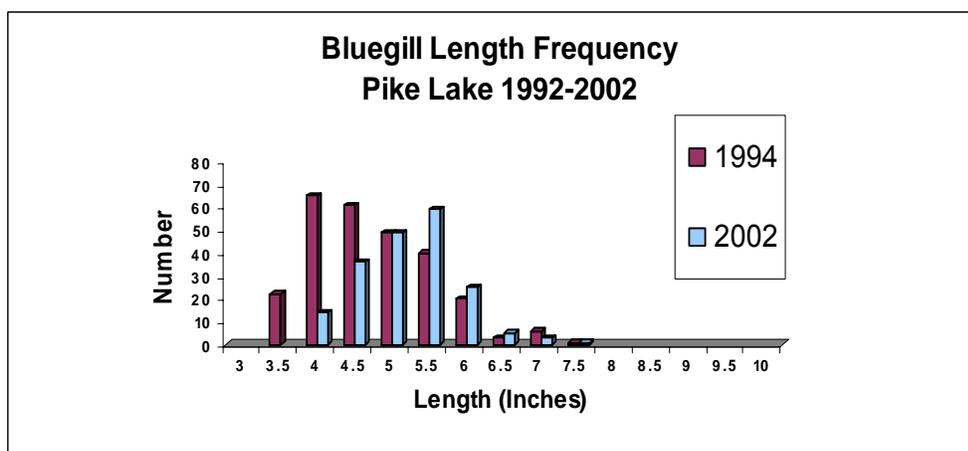
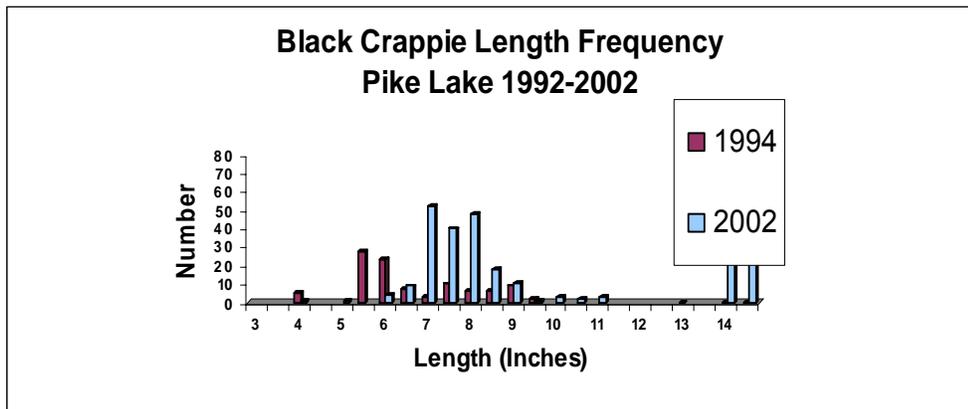
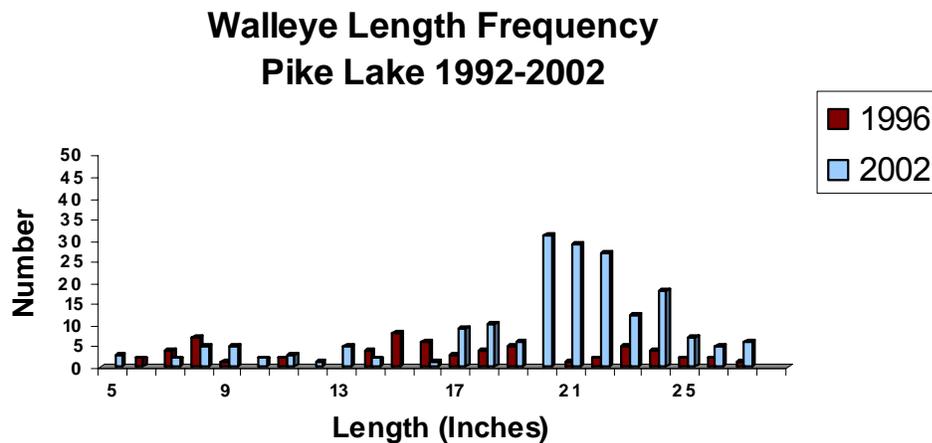
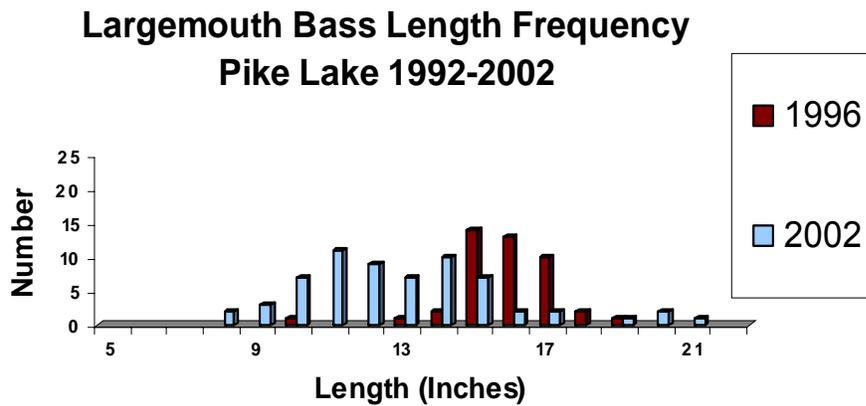
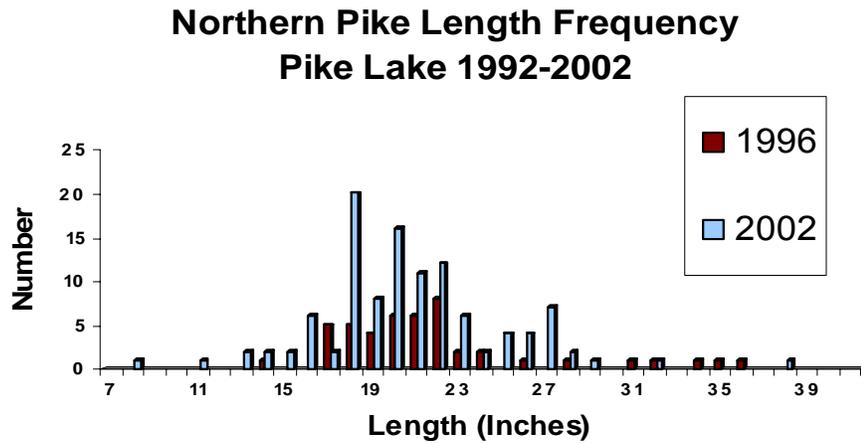


Figure 8. Number and length of northern pike, largemouth bass, and walleye collected in surveys of the Pike Lake fishery in 1994 and 2002.

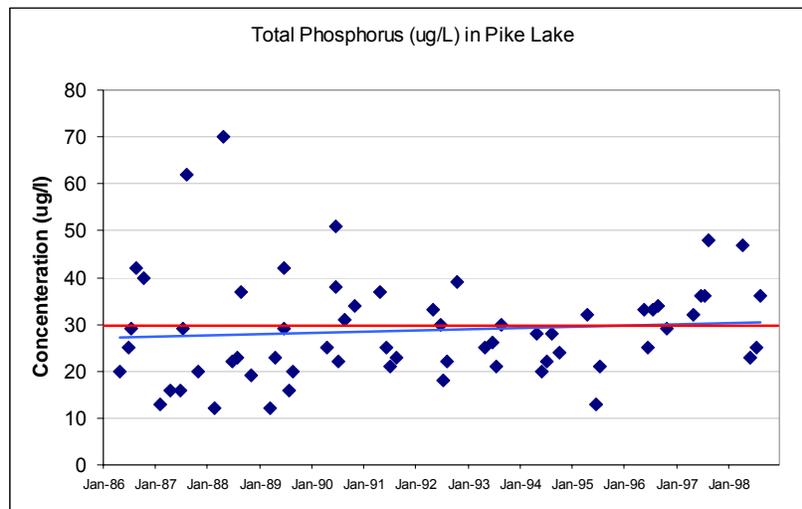


Water Quality

Nutrients are the primary fuel for algae and aquatic plants in lakes. Higher phosphorus concentrations can lead to increased aquatic plant and algal production, reduced water clarity, and oxygen depletion from decomposition of plants and algae. Lakes with more than 30 µg/L total phosphorus (TP) generally experience more algae blooms and aquatic plant growth (Shaw et al., 2002).

In Pike Lake, concentrations of phosphorus have been measured periodically since 1986. Variability in the year-to-year data can be due to differences in the climate (precipitation, temperature, etc), the time of year that samples were collected, and differences in aquatic plant management techniques (application of herbicides versus harvesting). Changes in land use practices within the watershed can also effect concentrations of phosphorous in the lake. Although the concentrations have not changed significantly over the years, it appears that the phosphorus has slowly been increasing in Pike Lake (blue line in Figure 9) and is nearing a mean of 30 ug/L, a threshold that generally results in increased algae blooms and aquatic plant growth (red line in Figure 9).

Figure 9. Total Phosphorus concentrations in Pike Lake from 1986-1998. (WDNR STORET data)



The mean summer phosphorus and chlorophyll *a* (a measure of algae) in Pike Lake has varied between eutrophic and mesotrophic status (Figure 10). Quality of eutrophic lakes can include less enjoyable swimming, difficulty boating, frequent and prolonged algae blooms, and abundant aquatic plants.

Water clarity is a measure of how deep light can penetrate. It is an aesthetic measure and is related to how deep rooted aquatic plants can grow. Water clarity is affected by water color, turbidity (suspended sediment), and algae (chlorophyll *a*). Water clarity (measured with a Secchi Disc) has remained in the mesotrophic range during the study period and has not varied noticeably (Figure 11).

The combination of phosphorus, chlorophyll a and water clarity data indicate that Pike Lake is a eutrophic/mesotrophic lake with fair to poor water quality. This trophic state would support abundant plant and algae growth (Konkel, 2003).

Figure 10: Summer mean phosphorus and chlorophyll a concentrations in Pike Lake. (WDNR STORET data).

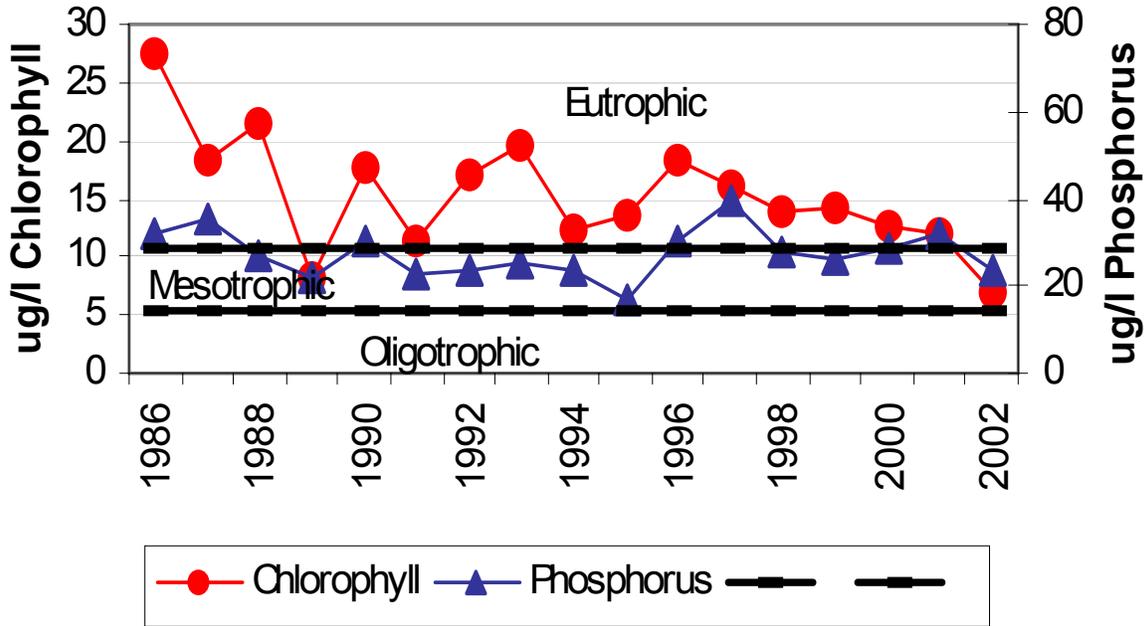
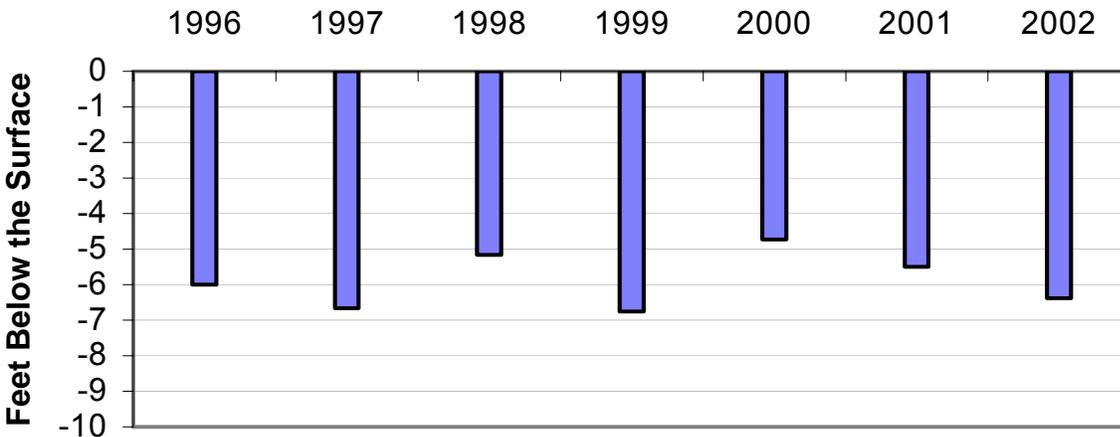


Figure 11: Summer mean water clarity in Pike Lake. (WDNR STORET data)



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Citizen Survey

The committee determined that one of the best ways to assess the public's views on Pike Lake was to query them through a survey. The survey of lake users was conducted during the summer of 2006. Surveys were distributed to all members of the Pike Lake Sportsman Club and the Pike Lake fishing club. They were also available at two local taverns and solicited in two newspapers. A total of 65 responses were received.

The survey included 41 questions broken into eight topic sections: *about you, water quality, recreation/boating, fishing, wildlife, aquatic plants, shoreline/lakeshore residents, and your opinion*. Select responses that relate most directly to aquatic plant management are presented in this section. The survey and graphed responses to all questions can be found in Appendix B.

The length of time that respondents were familiar with Pike Lake ranged from 3 to 70 years. There appears to be two primary groups of population duration in the group surveyed, one that includes people that have been there twenty years or less and another group greater than 30 years. Sixty-nine percent of respondents owned or rented property on the lake and fifty-three percent of respondents were year-round Pike Lake residents.

Water Quality

When asked about the current lake quality, most indicated it was fair to good. The response to whether the water quality in the lake had improved, decreased, or remained the same varied by sub-groups of 0-10 years, 11-20 years and greater than 20 years. In all three sub-groups less than half felt that the lake quality declined. The majority in the 0-10 year group indicated that the water quality had declined while the 11-20 year group was split almost evenly between declined and stayed the same and the greater than 20 year group was split between declined and improved. Most of the respondents mildly to strongly agreed that the presence of aquatic plants is essential to maintaining water quality and water clarity in Pike Lake, however, the primary water quality problems facing the lake were identified as algae/scum and aquatic plants.

Fishing

Fifty-one percent of respondents mildly agreed that native aquatic plants improve fishing quality and 23% strongly agreed. Eighteen percent were not sure of the relationship between aquatic plants and fishing. Fifty-five percent of the respondents rated the fishing in Pike Lake as average ("I catch fish sometimes and some of them are big enough to keep"). The majority of the people felt that the fishing quality has declined or stayed the same over the years. This question was also split into the three categories based on how long respondents had been on the lake, from 0-10, 11-20, and greater than 20. In all three groups there was more than half that thought the fishing declined. The greater than 20 year group had the fewest that felt the fishing has improved and the 11-20 years group had the highest number of responses that indicated fishing improved.

Wildlife

To the majority of the lake users wildlife was very important (62%) and rated the wildlife quality as very good (40%). The results for the question related to changes in wildlife were split into the three groups based on the duration of time on the lake, 0-10 years, 11-20 years, and greater than 20 years. Overall, most responses indicated that the quality of wildlife habitat had remained the same. The only responses that indicated the quality of wildlife habitat had improved were in the greater than 20 year group. Thirty-four percent of respondents believed native aquatic plants improved the quality of hunting for waterfowl and other wildlife.

Aquatic Plants

The majority of respondents felt they were slightly (49%) or moderately (30%) familiar with issues related to native aquatic plants and lake ecology. Fifty-two percent mildly agreed and 33% strongly agreed that native aquatic plants serve important functions that maintain the health of Pike Lake. Responses were nearly balanced in the perception of native aquatic plants adding to the scenic beauty of the lake with 19% strongly disagreeing, 28% mildly disagreeing, 21% neutral, 29% mildly agreeing, and 3% strongly agreed.

Most indicated that floating and emergent vegetation were signs of an unhealthy lake. When asked if they believe that the removal of native aquatic vegetation is harmful to the lake's health (water quality, biotic balance) 41% felt it probably was true and 20% felt this probably was false. Eleven percent each indicated this was definitely true and definitely false and the balance of responses didn't feel they knew. The statement that native aquatic plants are weeds and should be removed was posed; 11% felt this was definitely false, 20% indicated probably false, 41% indicated probably true, and 11% definitely true. A little more than half of the respondents described the level of aquatic plant growth in Pike Lake as heavy ("the plants limit my use of some parts of the lake and diminish attractiveness").

The question "native plants reduce the economic values of the lake in the long-term" was asked. Thirty-nine percent of respondents were unsure and 31% felt this probably was true. Seventy-eight percent of respondents indicate that they clean their boat, trailer and fishing equipment all of the time before using Pike Lake, 15% most of the time, and 7% never clean these items to prevent the spread of exotic plants into Pike Lake.

Shoreland and Land Use Management Practices

Perception of the beauty of lake shorelines with turf grass mowed to the edge was varied and responses were fairly well distributed. Thirty-five percent felt turf grass mowed to the edge of the lake is beautiful, 22% were neutral, and 43% did not prefer turf grass. When asked if lake shorelines are more attractive with an abundance of native plant, the majority (44%) agreed with this perception, 27% were neutral, and 29% disagreed.

The survey asked to select a description that best fit where the respondent's property meets the lake. Twenty-five percent identified undeveloped natural landscape, 25% lawn, 25% landscaped trees and shrubs, 39% rock rip-rap, and 9% retaining wall. Only 24

surveys indicated that they had natural shoreline vegetation. The reported distance that natural vegetation extended inland from lakeside ranged from 1 to 100 feet, with an average of 30 feet. State shoreline regulations require at least 35 feet (with a 30 foot view corridor); only 9 were reported to meet these standards. When asked how much of their lakeside property was mowed, responses ranged from 0 to 100% with an average of 60%. Only twenty-five percent (14 out of 56) of the responses indicated that they use fertilizer on lawn (13) and/or garden (4), however when asked the nearest distance to the lake that fertilizer was applied, 19 surveys had a response. Reported distances ranged from 0 to 100 feet with an average of 77 feet. Thirty-one percent use fertilizer within the 35 foot buffer zone nearest the lake.

Issues and Decisions

The major problems with the lake were identified as weeds (58 responses), followed by algae/scum (45), smell/odors (8), water clarity (14), and litter (12) responses.

When asked who should be involved in Pike Lake's management decisions, lake association members was identified by most with 55 responses, lake shore residents (49), fishing club (39), university personnel and watershed residents (18 each), state government (13), local government (8) and county government (6).

Aquatic Plant Management Plan for Pike Lake

The Pike Lake Committee presented the following information to lake association members and the public for review and input. Overwhelming majority supported the options recommended by the committee. All of the options that were discussed are included in the appendix for reference.

Pike Lake is a complex ecosystem that has extraordinary features in some parts of the lake and areas that provide challenges to recreation in other parts of the lake. The APM Committee reviewed surveys and maps provided by lake users to help construct the aquatic plant management plan for Pike Lake.

The Pike Lake Aquatic Management Plan has 7 major areas of focus. The map shown in Figure 12 indicates regions of the lake to be treated in different ways and should be used along with the descriptions below.

Lily Pads

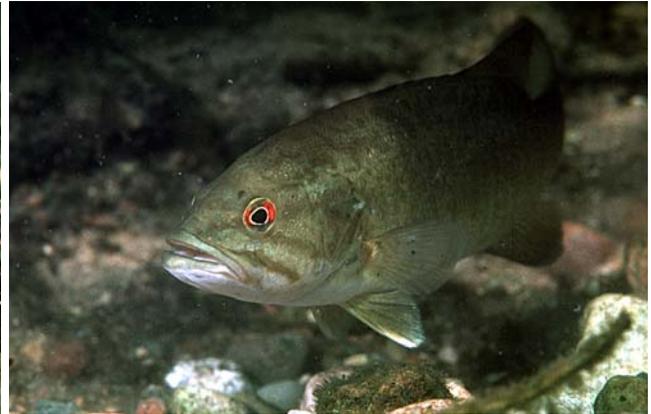
Lily pads are a type of aquatic plant that plays an important role in the aquatic ecosystem. They provide shelter and cool water for fish and aquatic biota and food for muskrats, beaver, and waterfowl. Because they float on top of the water they break waves which reduces shoreline erosion. Their dense stands help to prevent the establishment of invasive aquatic plant species. Lily pad beds can be as old as 100 years. Some “thinning” can be done without harming the entire bed.



Plan: Leave lily pad beds alone but provide access lanes from docks for boating (width approx. 30 feet). Upon request by dock owners, removal will only occur when large obstructive amounts are present.

Conservancy Areas

Several areas around the lake have been identified by the citizen survey and Committee as having significant value to the lake's ecosystem because they provide food and habitat for fish and wildlife. The area around the island was identified in the citizen survey as the area with the majority of wildlife observations. These animals included turtles, ducks, eagles, loons, geese, muskrats, fish, snails, and birds. Recognizing that healthy habitat on land and in the adjacent water is necessary to support the wildlife that is enjoyed by so many lake users, the Committee designated the area around the island as a conservancy zone. These areas are shown in dark green in Figure 12. This area comprises 25 acres.



Photos courtesy of Wisconsin Lakes Partnership

Plan: This designation will not limit access but restricts harvesting and chemical application for aquatic plant control. Access between the island and shoreland could be provided by harvesting (if needed), however aquatic plant harvesting is limited to areas of greater than 5 feet of water depth. The exception to this limitation is the harvesting of an access path to the private boat docks (if desired by adjacent land owners).

Chara

Chara is a type of algae that is often mistaken for an aquatic plant. It can become abundant in areas of a lakebed that have been disturbed by raking, boating activity, or chemical treatment. Chemical treatment kills many aquatic plants, but does not affect chara, leaving it behind to dominate the plant community.

Chara provides habitat for aquatic invertebrates (fish, turtle, and waterfowl food) and small fish. In addition, it “ties up” phosphorus which reduces algal blooms and growth of filamentous algae. Like aquatic plants, chara produces oxygen into the lake system, but does not have a lot of biomass to decompose and use up oxygen when it dies back in the winter.

Chara is generally low growing and therefore does not interfere with lake use. Removal of large areas of chara could open the exposed lake bed up to opportunistic plants including aquatic invasive species. Oftentimes aquatic invasive species are difficult if not impossible to remove once they are established.



Plan: Leave chara in place to avoid the potential establishment of invasive species.

Curly Leaf Pondweed (*potomageton crispus*)

Curly leaf pondweed can be an invasive non-native species of aquatic plant. It grows early in the year so it out-competes native species of plants. It dies back in June and as the tissue decomposes it releases phosphorus into the water. This frequently leads to enhanced growth of algae/filamentous algae.



Plan: Harvest in late April or early May (as soon as harvester can remove the top 15 nodes) to prevent the formation of turions. Harvesting in this fashion should result in the reduction of new plants. Plant material will be removed rather than left to decay and release nutrients to the lake, eventually reducing algae blooms.

“Nuisance” Aquatic Plant Areas

These areas of the lake (shown in brown in Figure 12) were identified as regions with heavy aquatic plant growth that restricts boating and may limit the success of predator fish predation of pan fish. The latter can have an effect on the health of the fishery.



Plan: Provide access lanes between docks and naturally occurring open water plus reduction of aquatic beds in some areas of the lake. Harvesting would occur in three to five feet depth of water.

Strategically placed radial cuts will be done to balance the fish community by enhancing the ability of predatory species of fish to feed – shown in red in Figure 12.

Considerations:

- Harvesting may negatively affect potamogeton (pondweeds) which are native aquatic plants that provide good habitat.
- Chemicals will not remove dead vegetation adding, to the build-up of muck and keeping nutrients in the lake system. This may lead to additional aquatic plant and algae growth.
- Some chemicals may remain in the sediment and the lake’s ecosystem.

Inlet Vegetation

Lake residents are concerned about the quality of water and possibility that filamentous algae may be entering Pike Lake via the inlet. Reducing nutrient inputs in the watershed may help to reduce/eliminate this issue.

Plan: Leave aquatic plants in place to act as a filter to remove filamentous algae and utilize nutrients from the water.

The Pike Lake Sportsman Club may investigate the use of an additional man-made filter.

Hand Pulled Plants

Individuals can hand harvest aquatic plants at their shoreline; a channel (thirty feet or less) out as far as needed for access without a permit. The channel must be adjacent to their dock. Any hand harvested aquatic plants should be removed from Pike Lake and composted away from the lake.

Plan: Provide a pick up service for hand pulled plants from docks by the harvester after the first cutting of each year.

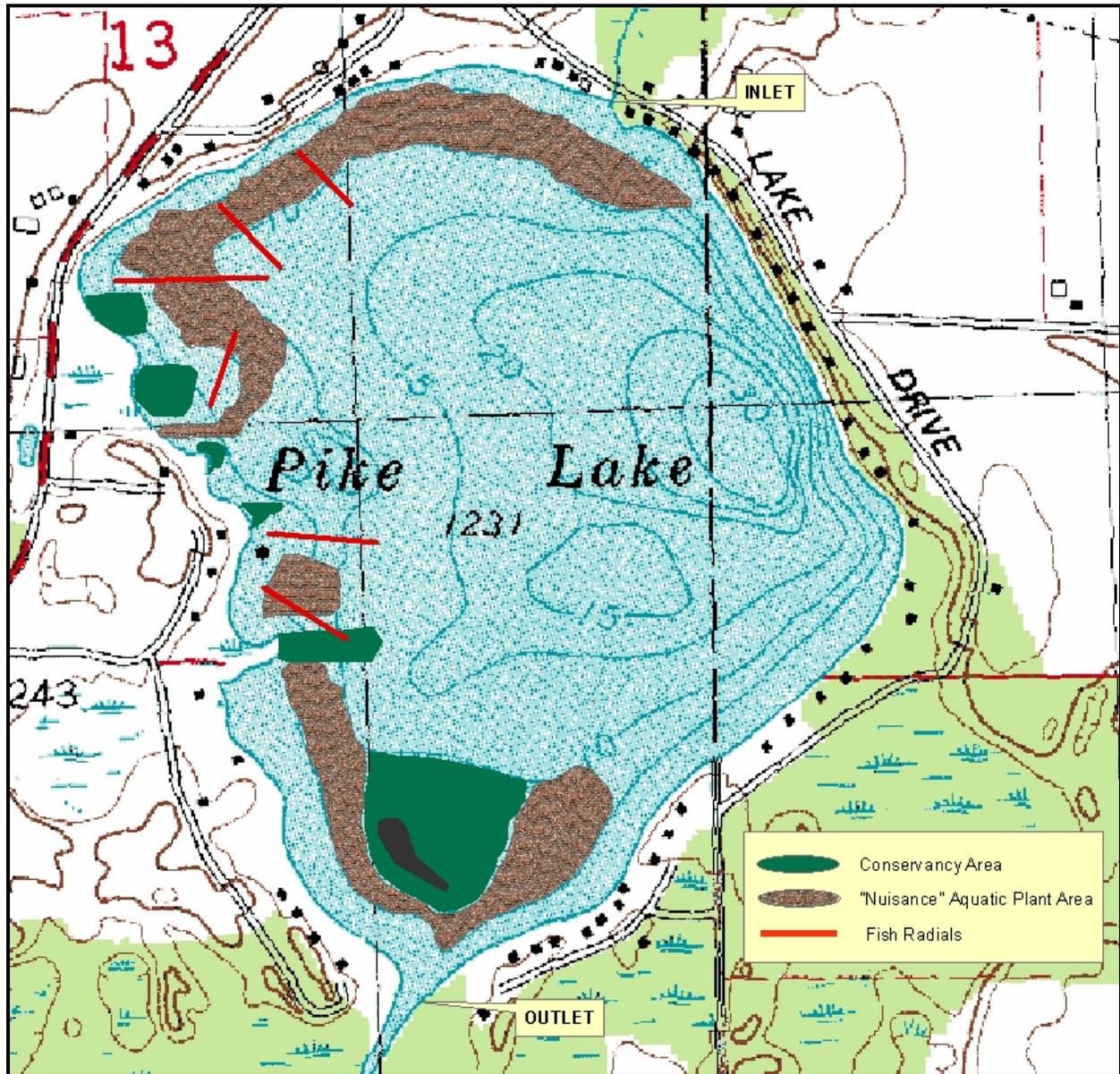
Additional Activities

1. Keep existing shoreland buffers intact and encourage landowners to restore vegetative buffers for better water quality and habitat.
2. Eliminate the use of fertilizer on shoreland properties and/or encourage annual soil tests prior to application of fertilizer.
3. Conduct a lake management study for a better understanding of internal and external nutrient loading.
4. Provide opportunities for residents and lake users to learn about shoreland land use practices, phosphorus, aquatic invasive plants (residents and boat landing), etc. The survey results indicate many topics that should be addressed.
5. Develop a corps of knowledgeable people to identify aquatic invasive species and monitor the lake routinely.
6. Continue to conduct citizen based water quality monitoring.
7. Improve the fishery by re-establishing emergent vegetation (such as bulrush) and allowing more vegetation in the 1.5 – 5 foot littoral zone.

APM Plan Review

On an annual basis the Pike Lake APM committee will review the APM plan and discuss any potential adjustments with the WDNR. Harvesting records (dates and estimated volume of harvesting) and maps should be included in the review. A monitoring strategy should be developed to provide data to the review process.

Figure 12. Map of Pike Lake showing aquatic plant management/protection areas.



APPENDIX A – Aquatic Plant Management Options Presented at Public Meeting

Pike Lake is a complex ecosystem that has extraordinary features in some parts of the lake and areas that provide challenges to recreation in other parts of the lake. The APM Committee has reviewed surveys and maps provided by lake users to help construct the aquatic plant management plan for Pike Lake.

The Pike Lake Aquatic Management Plan has 7 major areas of focus. The map shown in Figure 1 indicates regions of the lake that are recommended to be treated in different ways and should be used along with the descriptions below.

Conservancy Areas

Several areas around the lake have been identified by the citizen survey and Committee as having significant value to the lake's ecosystem because they provide food and habitat for fish and wildlife. These areas are shown in dark green in Figure 1. This designation will not limit access but restricts harvesting and chemical application for aquatic plant control. The exception to this limitation is the harvesting of an access path to the private boat docks if desired by adjacent land owners.

The area around the island was identified by many as the area with the majority of wildlife observations identified in the citizen survey. Animals identified include turtles, ducks, eagles, loons, geese, muskrats, fish, snails, birds. Recognizing that healthy habitat on land and in the adjacent water is necessary to support the wildlife that is enjoyed by so many lake users, the Committee proposes to designate the area around the island as a conservancy zone (dark green on map). Access between the island and shoreland would be provided by harvesting (if needed), however aquatic plant harvesting would be limited to areas of greater than 5 feet of water depth.

Inlet Vegetation

Lake residents are concerned about the quality of water and possibility that filamentous algae may be entering Pike Lake via the inlet. Reducing nutrient inputs in the watershed may help to reduce/eliminate this issue.

Recommendation: Leave aquatic plants in place to act as a filter to remove filamentous algae and utilize nutrients from the water.

Note: The Pike Lake Sportsman Club may investigate the use of an additional man-made filter.

Lily Pads

Lily pads are a type of aquatic plant that plays an important role in the aquatic ecosystem. They provide shelter and cool water for fish and aquatic biota and food for muskrats, beaver, and waterfowl. Because they float on top of the water they break waves which reduces shoreline erosion. Their dense stands help to prevent the establishment of invasive aquatic plant species. Lily pad beds can be as old as 100 years. Some “thinning” can be done without harming the entire bed.

Recommendation: Leave lily pad beds alone but provide access lanes for boating (width approx. 30 feet). Removal will only occur when large obstructive amount are present.

Chara

Chara is a type of algae that is often mistaken for an aquatic plant. It can become abundant in areas of a lakebed that have been disturbed by raking, boating activity, or chemical treatment. Chemical treatment kills many aquatic plants, but does not affect chara, leaving it behind to dominate the plant community.

Chara provides habitat for aquatic invertebrates (fish, turtle, and waterfowl food) and small fish. In addition, it “ties up” phosphorus which reduces algae blooms and growth of filamentous algae. Like aquatic plants, chara produces oxygen into the lake system, but does not have a lot of biomass to decompose and use up oxygen when it dies back in the winter.

Removal of large areas of chara could open the exposed lake bed up to opportunistic plants including aquatic invasive species. Oftentimes aquatic invasive species are difficult if not impossible to remove once they are established.

Recommendation: Leave chara in place to avoid the potential establishment of invasive species.

Curly Leaf Pondweed (*p. crispus*)

Curly leaf pondweed can be an invasive non-native species of aquatic plant. It grows early in the year so it out-competes native species of plants. It dies back in June and as the tissue decomposes it releases phosphorus into the water. This frequently leads to enhanced growth of algae/filamentous algae.

Option 1 (Recommendation): Harvest in late April or early May (as soon as harvester can remove the top 15 nodes) to prevent the formation of turions. Harvesting in this fashion should result in the

reduction of new plants. Plant material will be removed rather than left to decay and release nutrients to the lake, eventually reducing algae blooms.

Option 2: Chemical treatment would need to be conducted early in the year, prior to the formation of turions.

Caution:

Plant material will remain in the lake. Decomposition of this material will release nutrients into the system which can be readily used by other aquatic plant species and/or algae. Residue of chemicals can remain in the sediment for decades.

“Nuisance” Aquatic Plant Areas

These areas of the lake (shown in red in Figure 1) are identified as regions with heavy aquatic plant growth that restricts boating and may limit the success of predator fish predation of pan fish. The latter can have an effect on the health of the fishery.

Considerations:

- Harvesting may negatively affect potamogeton (pondweeds) which are native aquatic plants that provide good habitat.
- Chemicals will not remove dead vegetation adding, to the build-up of muck and keeping nutrients in the lake system. This may lead to additional aquatic plant and algae growth.
- Some chemicals may remain in the sediment and the lake’s ecosystem.

Option 1: Do nothing

Option 2: Provide access lanes between docks and naturally occurring open water. Harvesting would occur in three to five feet depth of water.

Option 3: Option 2 plus the reduction of aquatic beds in some areas of the lake. Harvesting would occur in three to five feet depth of water.

Option 4 (Recommendation): Provide access lanes between docks and naturally occurring open water plus reduction of aquatic beds in some areas of the lake. Harvesting would occur in three to five feet depth of water. Strategically placed radial cuts will be done to balance the fish community by enhancing the ability of predatory species of fish to feed – shown in red in Figure 1)

Option 5: Aggressive plant removal – remove all plants in 3 – 10 feet of water

Caution:

The removal of large areas of plants can result in the risk of creating opportunities for the establishment of nuisance and/or invasive aquatic plant species and/or increased growth of algae. It may also result in reduction of habitat necessary for fish in warm weather.

Hand Pulled Plants

Provide a pick up service from docks for hand pulled plants after the first cutting of each year.

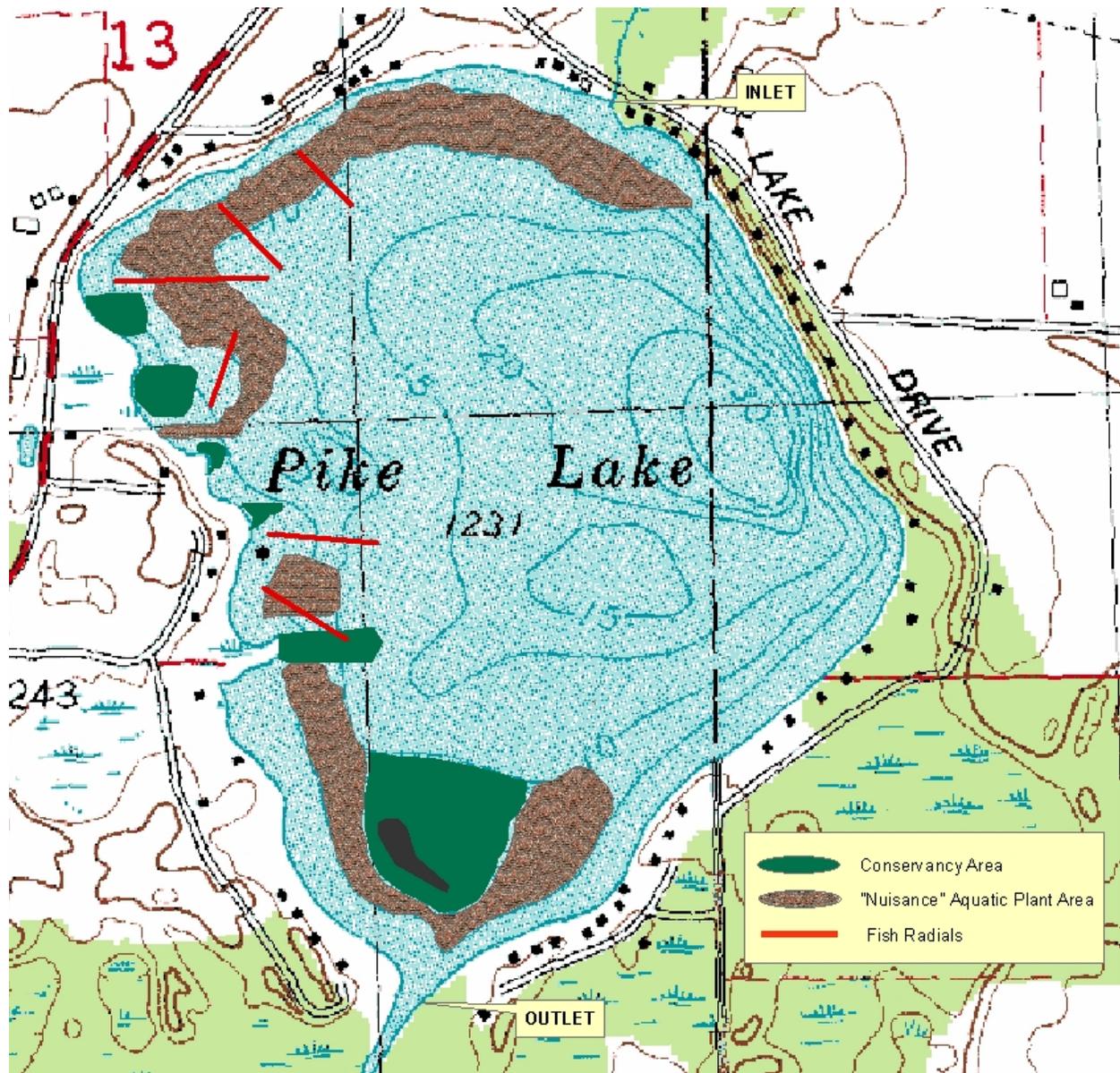
Additional Committee Recommendations

1. Keep existing shoreland buffers intact and encourage landowners to restore vegetative buffers for better water quality and habitat.
2. Eliminate the use of fertilizer on shoreland properties and/or encourage annual soil tests prior to application of fertilizer.
3. Conduct a lake management study for a better understanding of internal and external nutrient loading.
4. Provide opportunities for residents and lake users to learn about shoreland land use practices, phosphorus, aquatic invasive plants (residents and boat landing), etc.
5. Develop a corps of knowledgeable people to identify aquatic invasive species and monitor the lake routinely.
6. Continue to conduct citizen based water quality monitoring.
7. Improve the fishery by re-establishing emergent vegetation (such as bulrush) and allowing more vegetation in the 1.5 – 5 foot littoral zone.

APM Plan Review

On an annual basis the APM committee will review the APM plan and discuss any potential adjustments with the DNR.

Figure 1. Map of Pike Lake showing aquatic plant management areas.

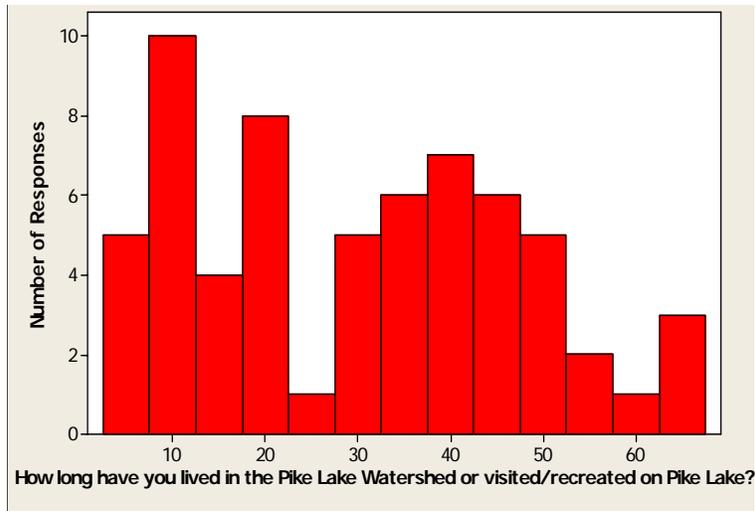


APPENDIX B – Pike Lake Survey Questions and Responses

Pike Lake Survey 2006

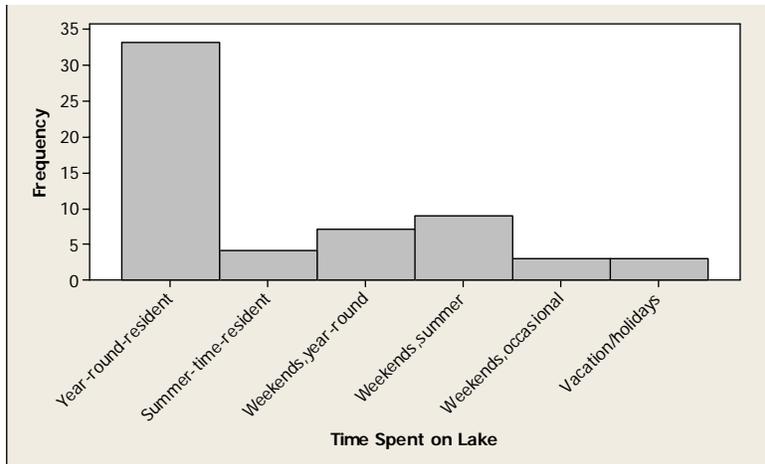
About You

1. How long have you lived in the Pike Lake Watershed? _____ years



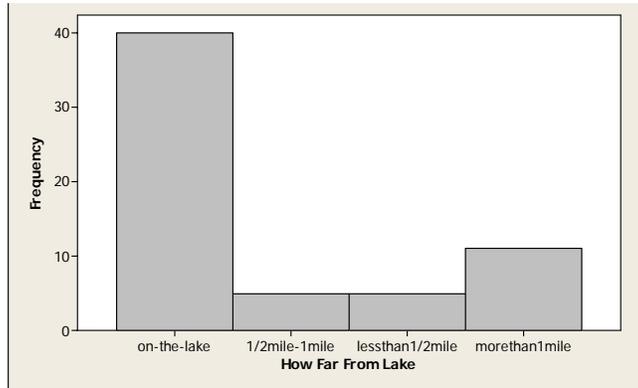
2. What best describes the time you spend on Pike Lake?

- Year-round resident
- Summer-time resident
- Weekends, year-round
- Weekends, summer
- Weekends, occasional
- Vacations/holidays



3. Do you own or rent property

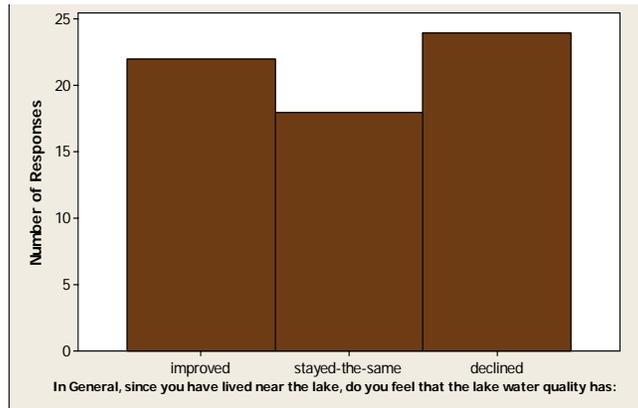
- On the lake
- Within 1/2 mile of the lake
- 1/2 mile to 1 mile of the lake
- more than 1 mile from the lake



Water Quality

4. In general, since you have lived near the lake, do you feel that the lake water quality has:

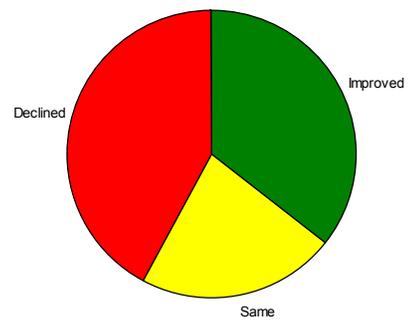
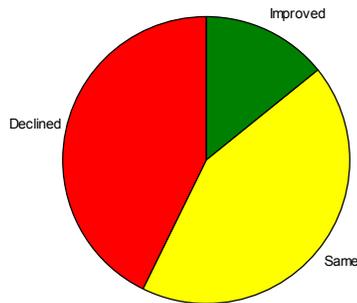
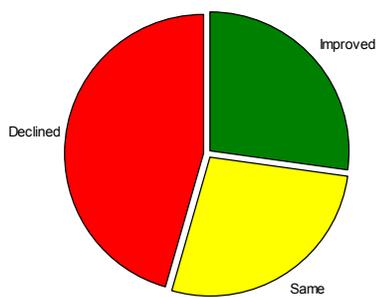
- Improved
- Stayed the same
- Declined



Has water quality changed?
(People living on the lake 0-10 years)

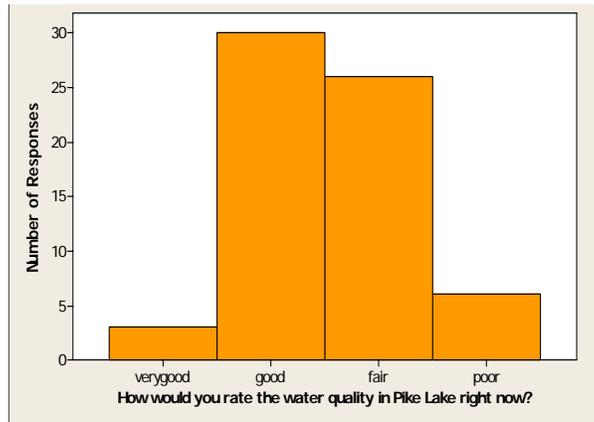
Has water quality changed?
(People living on the lake 11-20 Years)

Has water quality changed?
(People living on the lake more Than 20 Years)



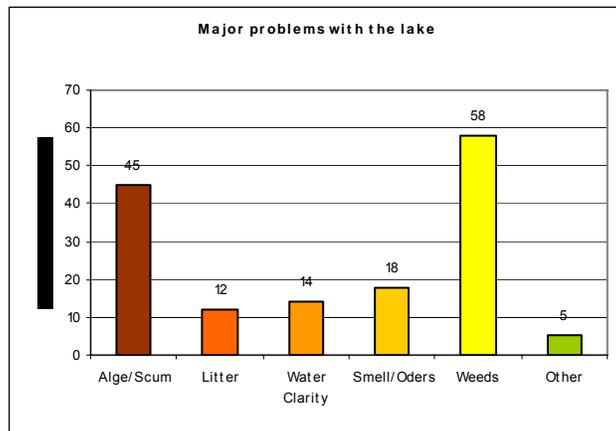
5. How would you rate the water quality of Pike Lake right now?

- Excellent
 Very Good
 Good
 Fair
 Poor



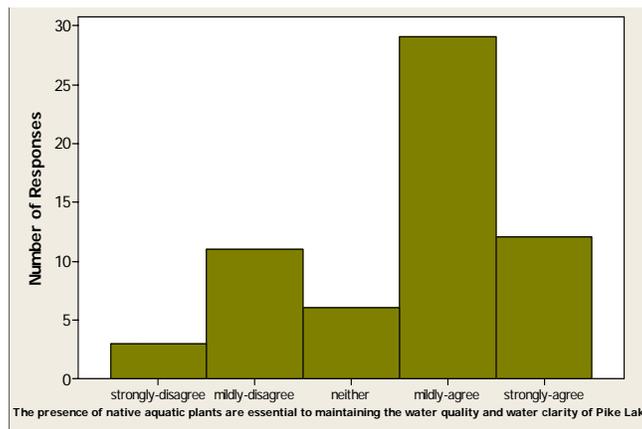
6. Which of the following do you think are the major water quality problem(s) facing the lake? (check all that apply)

- Algae/Scum
 Litter
 Water Clarity
 Smell/Odors
 Weeds
 Other _____



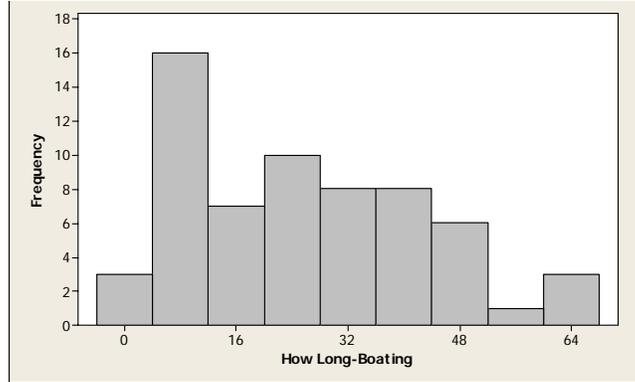
7. The presence of native aquatic plants are essential to maintaining the water quality and water clarity of Pike Lake.

- Strongly disagree
 Mildly disagree
 Neither
 Mildly agree
 Strongly agree



Recreation/Boating

8. How long have you been boating on the lake? _____ years



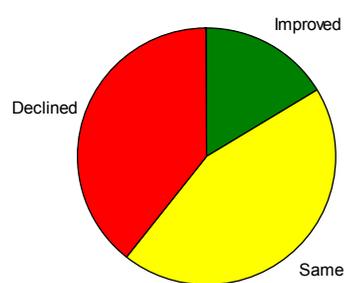
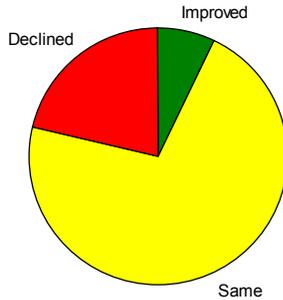
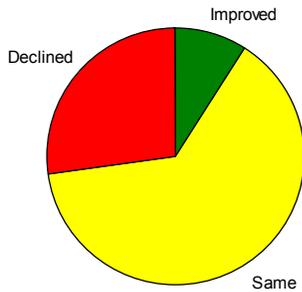
9. In general, how has the quality of boating on Pike Lake changed:

- Improved
 Stayed the same
 Declined

Has the boating quality changed?
(People living on the lake 0-10 years)

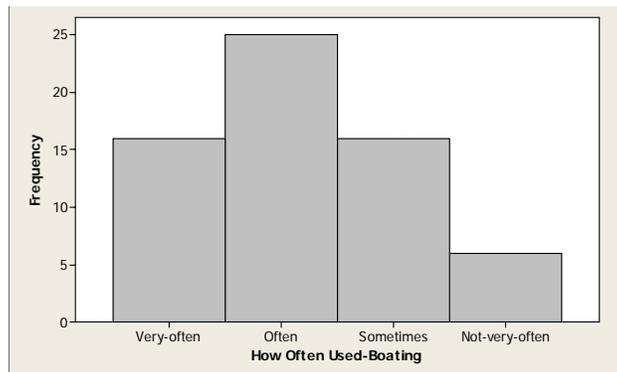
Has the boating quality changed?
(People living on the lake 11-20 years)

Has the boating quality changed?
(People living on the lake more than 20 years)



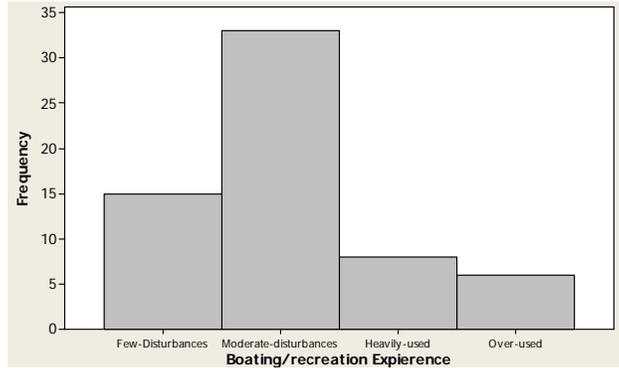
10. How often do you use Pike Lake?

- Very often
 Often
 Sometimes
 Not very often
 Never



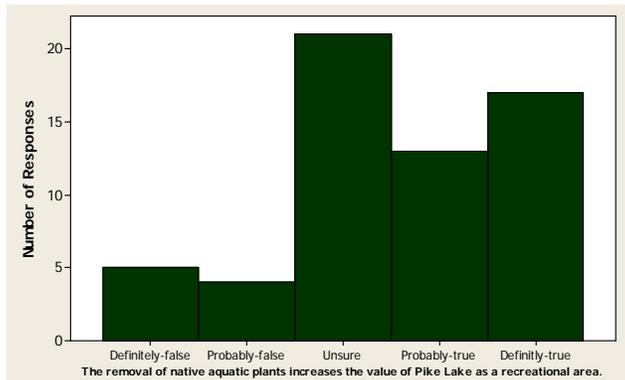
11. Which statement best describes your recreation/boating experience at the lake?

- Few disturbances (Rarely see and hear another person)
- Moderate disturbances (Sometimes the noise and activities of other disturb me)
- Heavily used (Often the noise and activities of other disturb me)
- Over used (I have to regularly plan around the noise and activities of others)
- Unusable (There is so much noise and activity that I normally can't enjoy the lake)



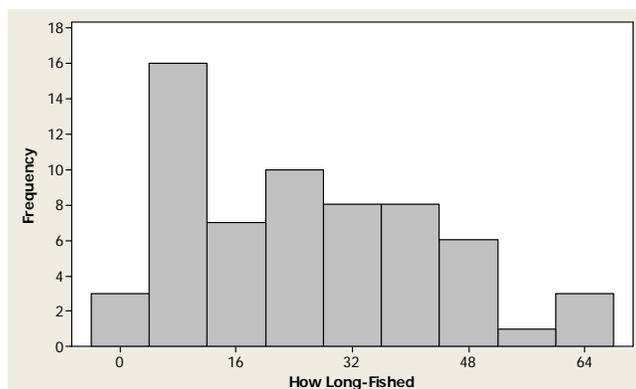
12. Removal of native aquatic plants increases the value of Pike Lake as a recreational area.

- Definitely false
- Probably false
- Unsure
- Probably true
- Definitely true



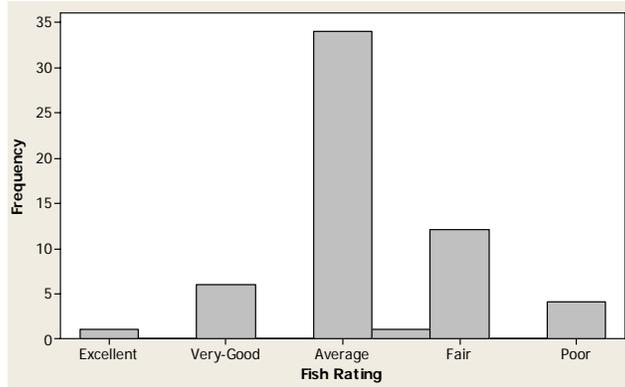
Fishing

13. How long have you fished on the lake? _____ years



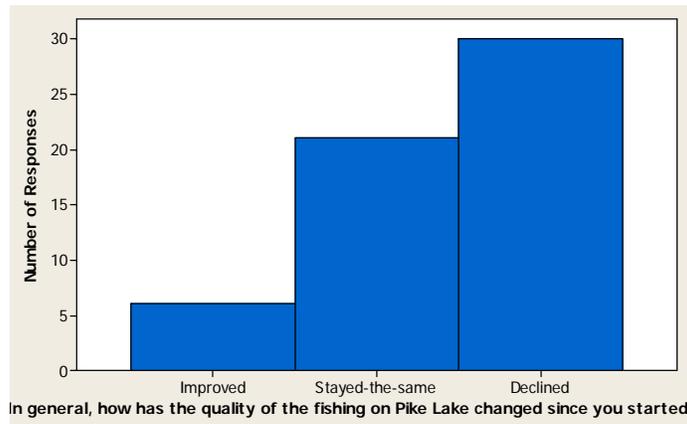
14. How would you rate the fishing on the lake?

- Excellent (I catch fish every time I go out and are often big enough to keep)
- Very Good (I catch fish almost every time I go out and most are big enough to keep)
- Average (I catch fish sometimes and some of them are big enough to keep)
- Fair (I sometimes catch fish and most are too small to keep)
- Poor (I rarely catch fish and when I do they are often too small to keep)

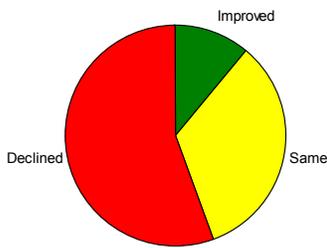


15. In general, how has the quality of the fishing on Pike Lake changed since you started:

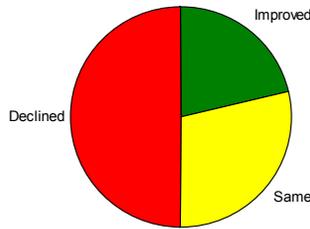
- Improved
- Stayed the same
- Declined



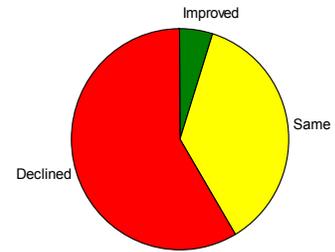
Has fishing quality changed?
(People living on the lake 0-10 years)



Has fishing quality changed?
(People living on the lake 11-20 years)

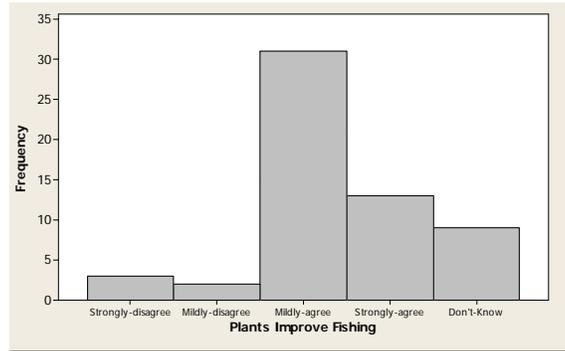


Has fishing quality changed?
(People living on the lake more than 20 years)



16. Native aquatic plants improve the quality of fishing.

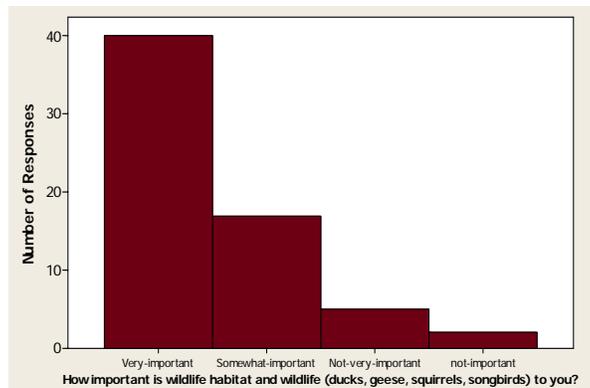
- Strongly disagree Mildly disagree Neither Mildly agree Strongly agree



Wildlife

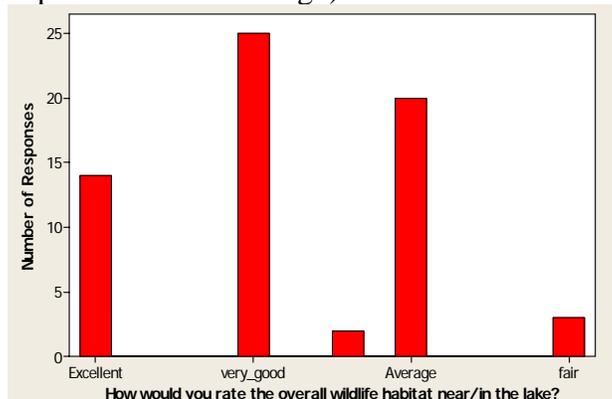
17. How important is wildlife habitat and wildlife (ducks, geese, squirrels, songbirds) to you?

- Very important Somewhat important Not very important Not important I dislike wildlife



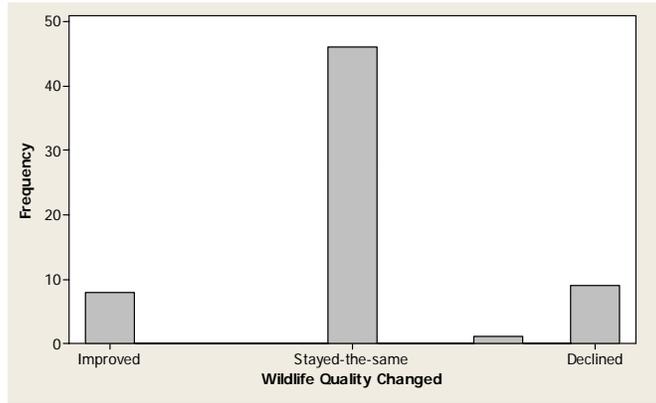
18. How would you rate the overall wildlife habitat near/in the lake?

- Excellent (Wildlife can go anywhere to find food and shelter)
 Very Good (There are a few places that wildlife can't go, but most places provide food and shelter)
 Average (There are parts of the area where wildlife can't find food and shelter)
 Fair (most areas are not fit to provide food and shelter for wildlife)
 Poor (There is no place for wildlife to go)

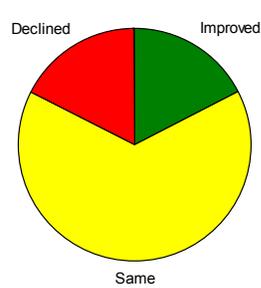
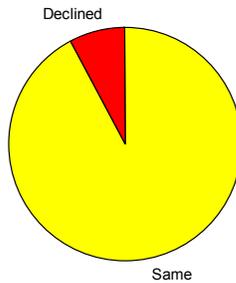
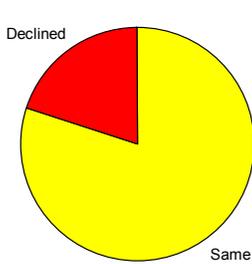


19. How has the quality of wildlife habitat in Pike Lake changed since you have been around:

- Improved Stayed the same Declined

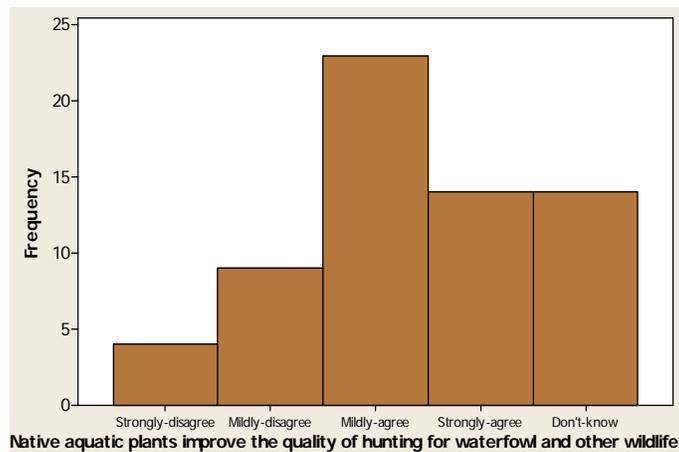


Has wildlife quality changed? (People living on the lake 0-10 years) Has wildlife quality changed? (People living on the lake 11-20 years) Has wildlife quality changed? (People living on the lake more than 20 years)



20. Native aquatic plants improve the quality of hunting for waterfowl and other wildlife.

- Strongly disagree Mildly disagree Neither Mildly agree Strongly agree



21. Skip to the next question info you did not identify a boating, fishing, water quality or wildlife decline.

If you indicated that the boating, fishing, water quality or wildlife quality has declined, please indicate which of the following issues, in your opinion, may have contributed to this decline.

Using the list below, provide the letter of your top three choices of issues that are causing decline.

Boating Quality: 1st___ 2nd___ 3rd___
 Fishing Quality: 1st___ 2nd___ 3rd___
 Water Quality: 1st___ 2nd___ 3rd___
 Wildlife Quality: 1st___ 2nd___ 3rd___

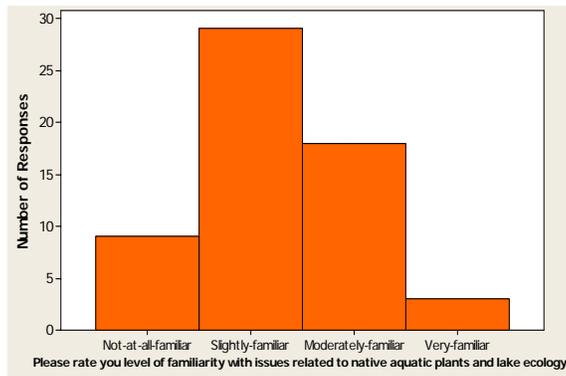
Issues Causing Decline

- | | | |
|------------------------------------|---------------------------|--------------------------|
| a. Air Pollution | b. Fertilizer Used | c. Soil Erosion |
| d. Development Pressures | e. Heavy Recreational Use | f. Septic System Seepage |
| g. Herbicide/Pesticide use | h. Vegetable Agriculture | i. Livestock Agriculture |
| j. Overabundance of aquatic plants | k. Other_____ | |

Aquatic Plants

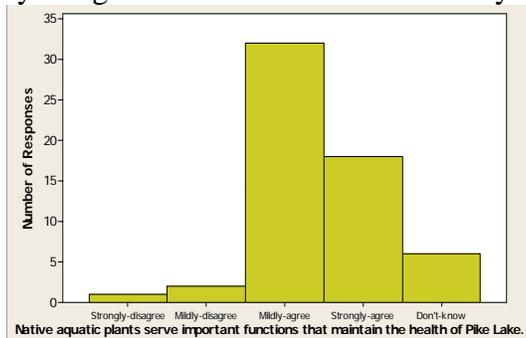
22. Please rate your level of familiarity with issues related to native aquatic plants and lake ecology.

- Not at all familiar Slightly familiar Moderately familiar Very familiar



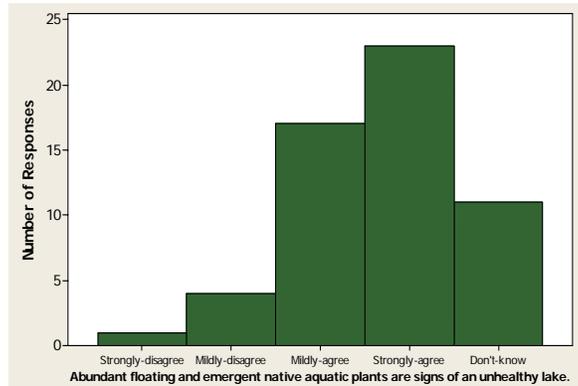
23. Native aquatic plants serve important functions that maintain the health of Pike Lake.

- Strongly disagree Mildly disagree Neither Mildly agree Strongly agree



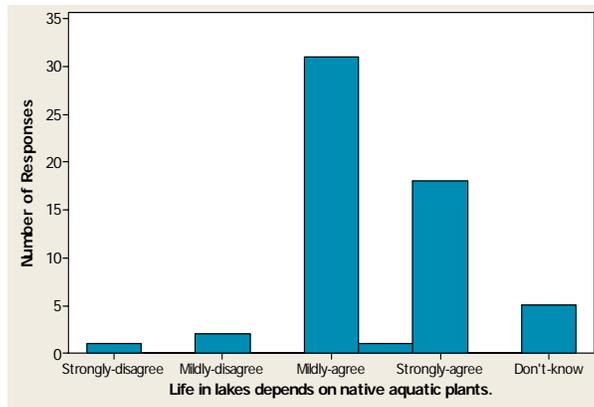
24. Abundant floating and emergent native aquatic plants are signs of an unhealthy lake.

Strongly disagree Mildly disagree Neither Mildly agree Strongly agree



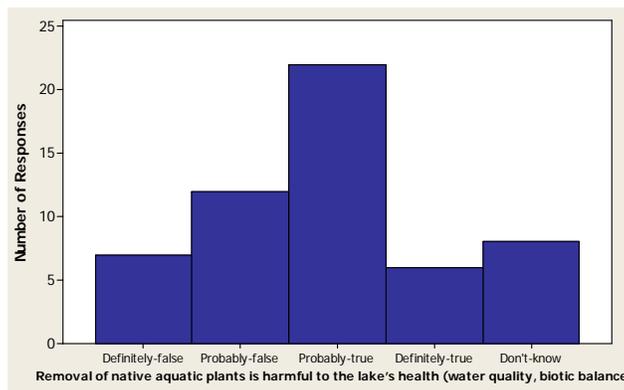
25. Life in lakes depends on native aquatic plants.

Strongly disagree Mildly disagree Neither Mildly agree Strongly agree



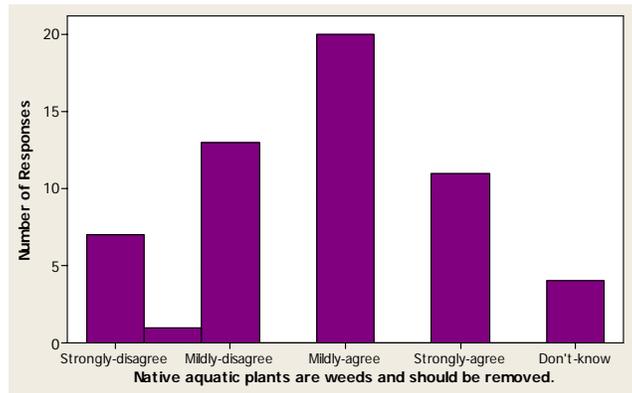
26. Removal of native aquatic plants is harmful to the lake's health (water quality, biotic balance)

Definitely false Probably false Unsure Probably true Definitely true



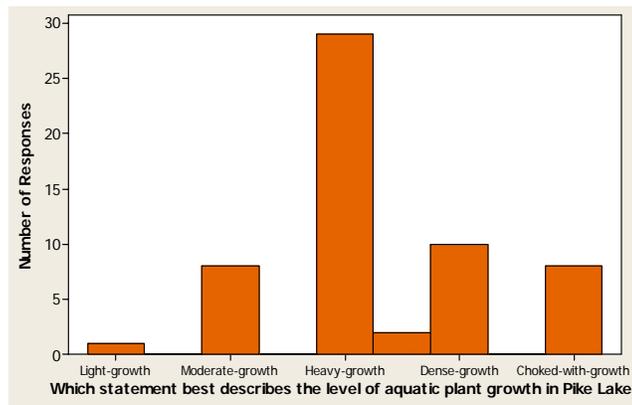
27. Native aquatic plants are weeds and should be removed.

- Strongly disagree Mildly disagree Neither Mildly agree Strongly agree



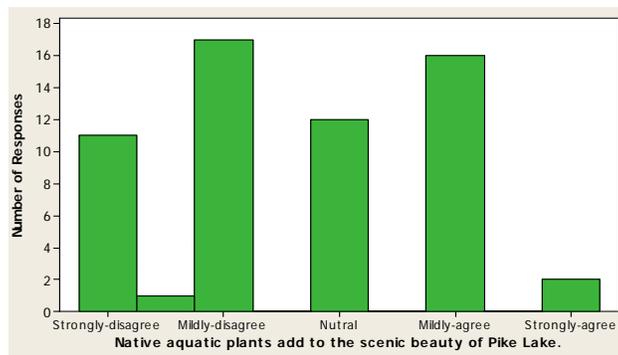
28. Which statement best describes the level of aquatic plant growth in Pike Lake?

- Light growth (Very little, less than optimum for fish and wildlife)
- Moderate growth (Just the right amount for fish and wildlife)
- Heavy growth (the plants limit my use of some parts of the lake and diminish attractiveness)
- Dense growth (the plants limit my use of much of the lake and are unattractive)
- Choked with growth (the plants ruin my ability to enjoy the lake)



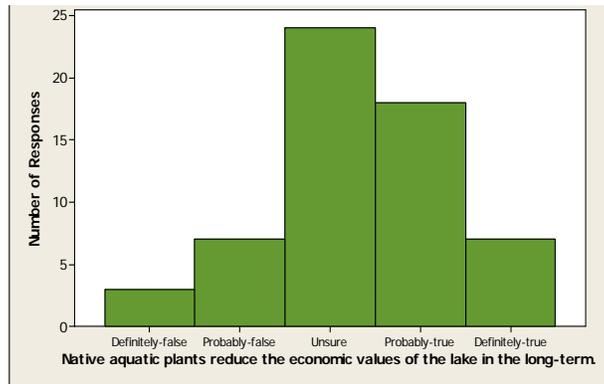
29. Native aquatic plants add to the scenic beauty of Pike Lake.

- Strongly disagree Mildly disagree Neutral Mildly agree Strongly agree



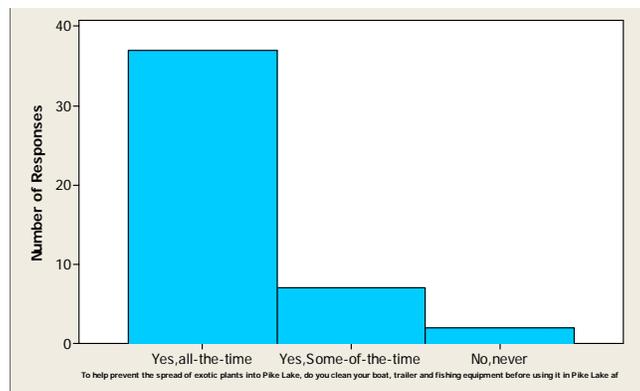
30. Native aquatic plants reduce the economic values of the lake in the long-term.

- Definitely false
 Probably false
 Unsure
 Probably true
 Definitely true



31. To help prevent the spread of exotic plants into Pike Lake, do you clean your boat, trailer and fishing equipment before using it in Pike Lake after it has been used in another lake?

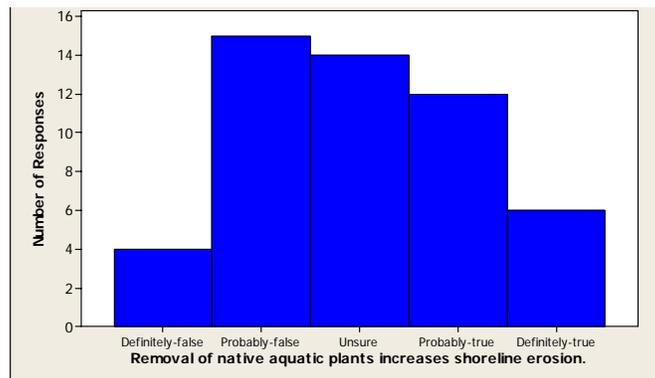
- Yes, all the time
 Yes, some of the time
 No, never



Shoreline/Lakeshore Residents

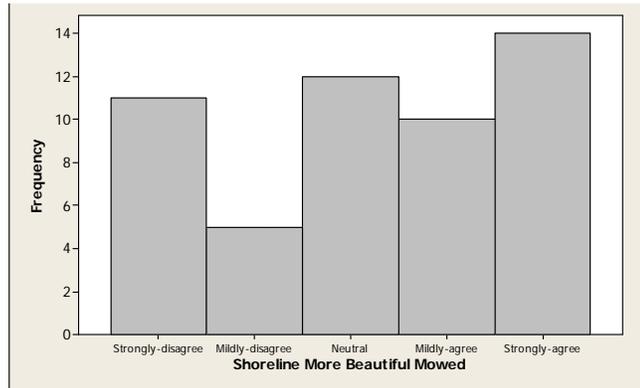
32. Removal of native aquatic plants increases shoreline erosion.

- Definitely false
 Probably false
 Unsure
 Probably true
 Definitely true



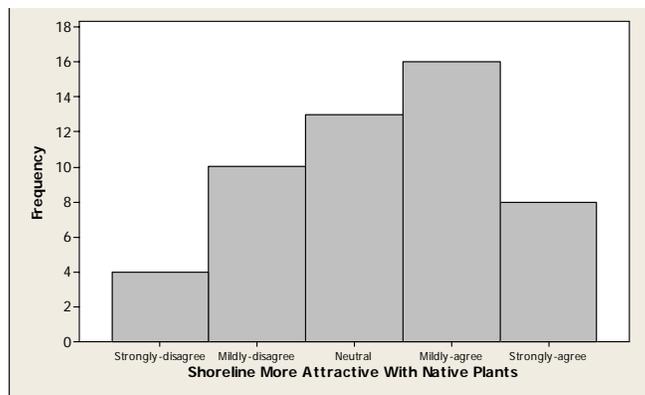
33. Lake shorelines are more beautiful when lawns are turf grass and mowed to the edge.

- Strongly disagree Mildly disagree Neither Mildly agree Strongly agree



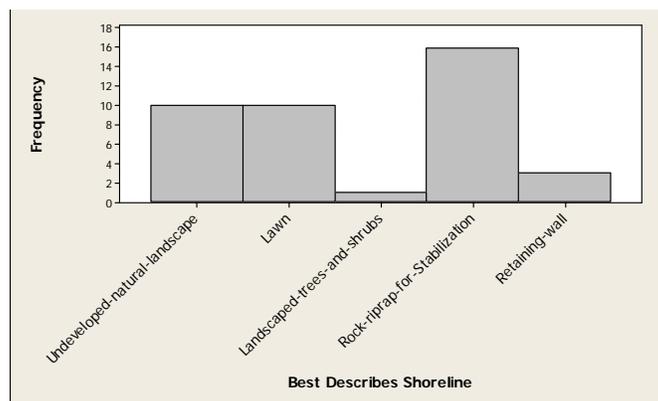
34. Lake shorelines are more attractive when they have an abundance of native plants.

- Strongly disagree Mildly disagree Neither Mildly agree Strongly agree

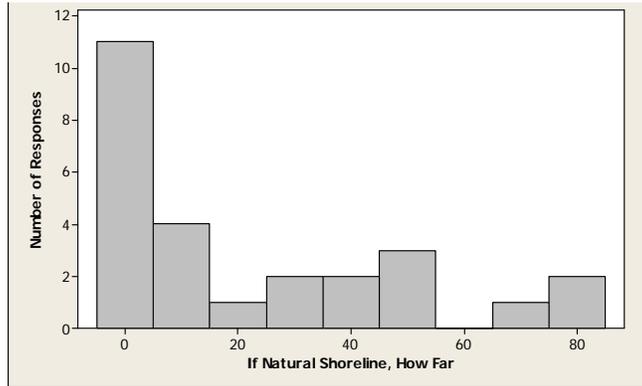


35. What best describes the location where your property meets the lake?

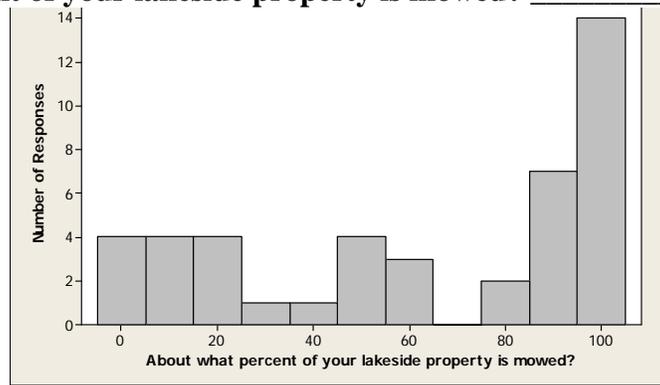
- Undeveloped Natural Landscape Lawn Landscaped Trees and Shrubs
 Rock Riprap for Stabilization Retaining Wall



36. If you have undeveloped natural landscape or a combination of un-mowed vegetation with trees and shrubs, how far from the lakeshore on to the property does it extend? _____ Feet

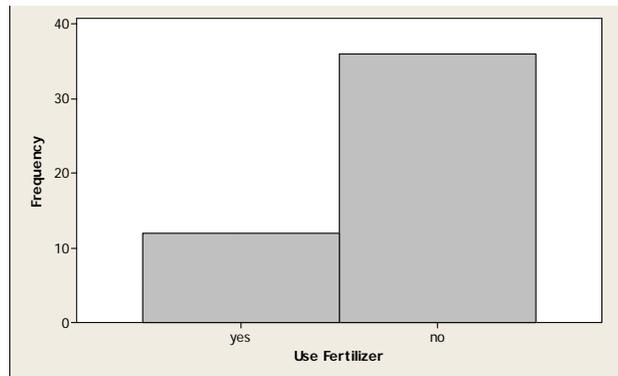


37. About what percent of your lakeside property is mowed? _____ %



38. Do you use fertilizer?

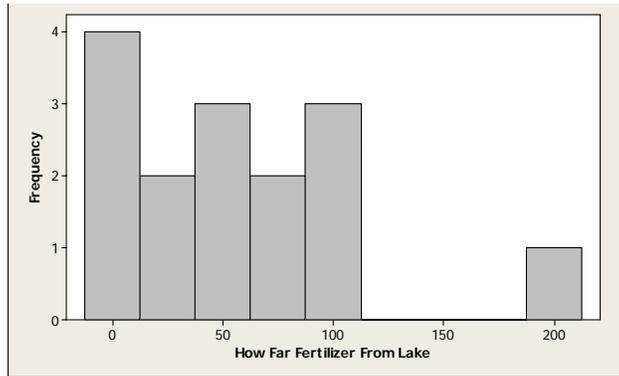
Yes No



If so, where?

Lawn (13) Garden (4) Agricultural Fields (0) Other _____ (0)_____

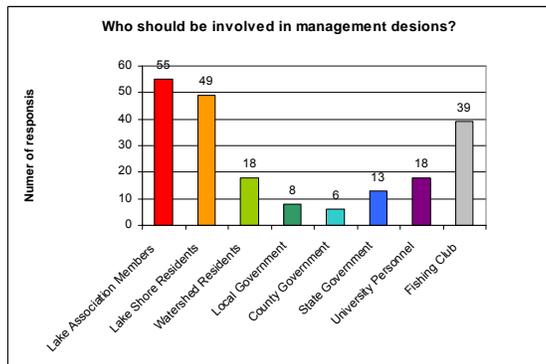
39. What is the closest distance from the lake to the areas (lawn or garden) that is fertilized?
 _____ feet



Your Opinion

40. Who should be involved in making management decisions for Pike Lake?
 (check all that apply)

- Lake Association Members
- Lake Shore Residents
- Watershed Residents
- Local Government
- County Government
- State Government
- University Personnel

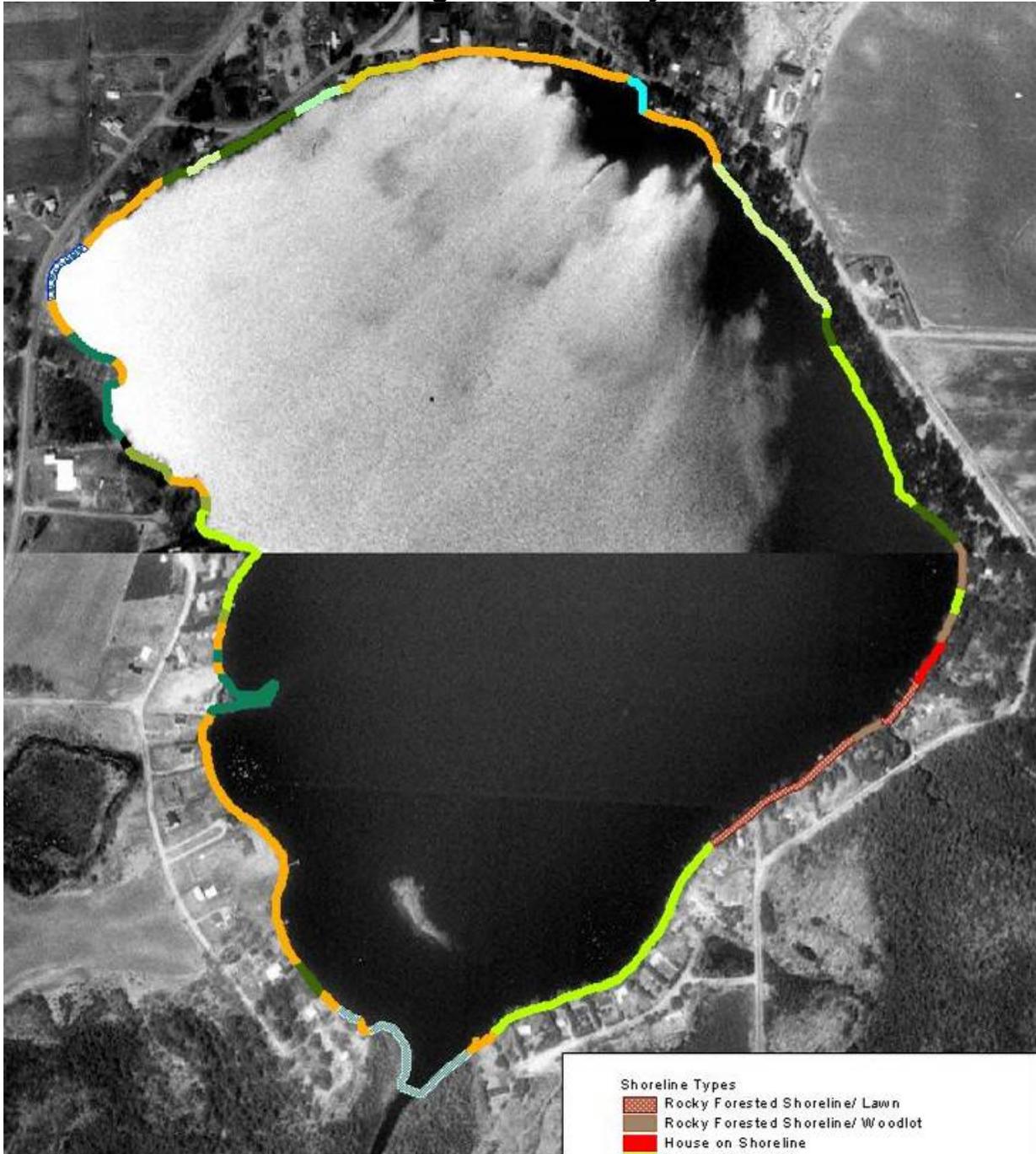


41. In your opinion, what should be done to restore, maintain, or improve the lake?

- Keep up the good work!
- Continue Cutting weeds & Looking To The Futuice
- Probally through scientific and local & state government
- Maintain Weed Control!!!
- Timing of weed cutting for best benefit
- I believe we are creating an awareness of the lake's health & taking appropriate steps to maintain the health of the lake
- CUT SOME WEEDS
- Take advice of informed groups to improve lake
- SRAY WEEDS
- research-what are the problems, what can be solved-prioritize! Educate all of us!!
- Complete APM plan, do another grant project for entire watershed, etc. Learn more as a group, & spread that information

Cut & remove weeds, reduce nutrients from lake
 Clean out weeds & muck also lily pads
 It needs serious help. The creeks from Rice lake and the outlet by the dam need to be opened up to keep water flowing
 Some where to swim by Pike Lake Lodge.
 Suck Silt from bottom and dead weeds open creeks to get lake filtered out
 Swimming for kids - get rid of weeds
 Control the weeds, make a place for kids to swim at pike lake resort
 Spray the weeds
 control aquatic growth in lake algae, water clarity
 Stop run offs and leaky septic systems
 1. Eliminate individual watercraft; 2. extend the no-wake hours - up to 24 hours per day; 3. Continue to cut weeds. 4. of great importance is to control the sources of fertilization of the overly-abundant weeds. 5. Eliminate noise pollution. The lake (200a.) is much too small for all of the speed boats & individual water craft.
 make sure all septic systems are inspected and brought up to date. Restrict large boat (100 house p) access.
 1. ban personal watercraft (jetski's) 2. Post addition signs at landings regarding quiet hours or state the public landing will be permanently closed. 3. close public landing and let lakeside resort charge a fee to unload boat.
 Clean out muck and remove bio mass
 First, you need to decide if you want naturally beautiful lake for wildlife & fish/or a recreational playground for residents and vacationers. For fishing, and wildlife benefit, the inlet and outlet (spillway) need to be remodeled. For recreation, you need to remove 85% of all aquatic plants.
 DREDGE THE WEST BAY!
 Need to start worrying about garbage, plastic firecracker casings, water flow & boat traffic-too many weeds limit areas boats can function so everyone uses only a small area- Have the DNR set a ice shack fee to help with lake clean ups.
 Weed removal, Pesticide spraying, ect... is critical to lake restoration.
 open up the creek from Rice Lake
 EVERYTHING WE ARE DOING. CUTTING-CHEM. AIRATE IN WINTER KEEP-INLETS & OUTLETS OPEN
 remove public landings
 Keep harvesting weeds not spraying
 Reduce the amount of weeds in the lake to a healthy level clear natural water ways for a more natural flow to restore oxygen levels
 Keep on harvesting weeds especially the water lilies.
 Close the public landing, Get rid of the large rocks in the lake.
 150 HP limit on boats get weeds under control
 Listen to local people
 Decrease or eliminate exotic-invasive weed population maintain higher water levels. Keep inlets/outlets free-flowing for flushing system
 Control Weed Growth
 *control of agriculture runoff, seepage into watershed of lake mainly from vegetable agriculture
 *Maintaining proper usage of septic systems on lakefront properties. *Removal of some emergent and submergent vegetation plus removal of bottom sediment (mud) in areas of lake (shorelines)
 Recommendations from the study group and continual monitoring thereafter
 Sportsmen's Club Members have kept this lake alive & clean for many years -- it takes much work, time & cooperation but also a lot of money. We need to keep the club but also need funding from the state of Wisconsin.
 I think the Lake should be drained and dredged out.

APPENDIX C – Shoreland Vegetation Survey Results



Shoreline Types	
	Rocky Forested Shoreline/ Lawn
	Rocky Forested Shoreline/ Woodlot
	House on Shoreline
	Managed Woodlot
	Coniferous/ Deciduous Forest
	Forested Shoreline/ Managed Woodlot
	Lawn Shoreline
	Natural Inlet
	Lawn Mowed From Bar/Houses to Shoreline
	Tall Grassy Buffer
	Wetland Vegetation
	Wetland Deciduous
	Boat Landing
	Deciduous Forest
	Wetland Conifers



**Wetland Vegetation
and Lawn Shoreline**



**Lawn Shoreline
And Wetland Conifers**



**Lawn Shoreline and
Conifer Deciduous Forest**



**Rocky Forested
Shoreline/ Woodlot**



Lawn Shoreline



**Lawn Shoreline and
Deciduous Forest**