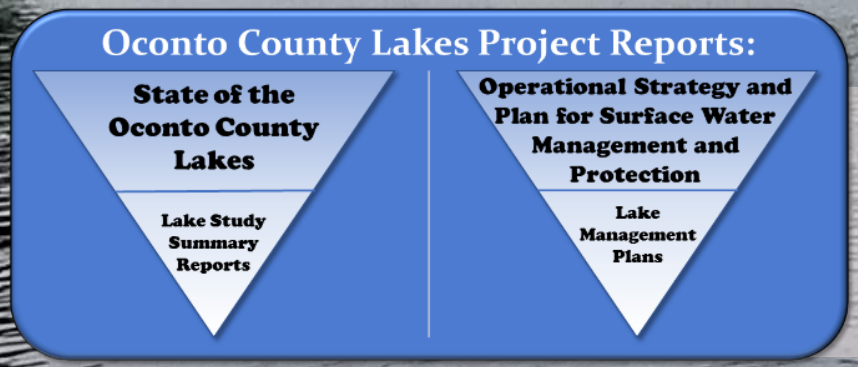
Oconto County Lakes Project

BOULDER LAKE MANAGEMENT PLAN

2025



VISION

Boulder Lake will remain a vibrant lake with exceptional water clarity, excellent fishing and boating, and a mindful lake community that works together to preserve their legacy.

Boulder Lake Management Plan

The authors would like to acknowledge the commitment and enthusiasm of Oconto County Lakes & Waterways Association, Oconto County Land and Water Conservation Department, UW Extension – Oconto County, Wisconsin Department of Natural Resources, UW-Stevens Point Water and Environmental Analysis Laboratory, the Boulder Lake Association, landowners in the Boulder Lake watershed, and participants in the Oconto County Lakes Project.

This plan was prepared by the Center for Watershed Science and Education at University of Wisconsin – Stevens Point.

Along with the Oconto County Lakes Project participants, the following individuals and organizations contributed to the content of this plan.

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Approved by Boulder Lake Association: June 7, 2025

Approved by Wisconsin Department of Natural Resources: August 20, 2025

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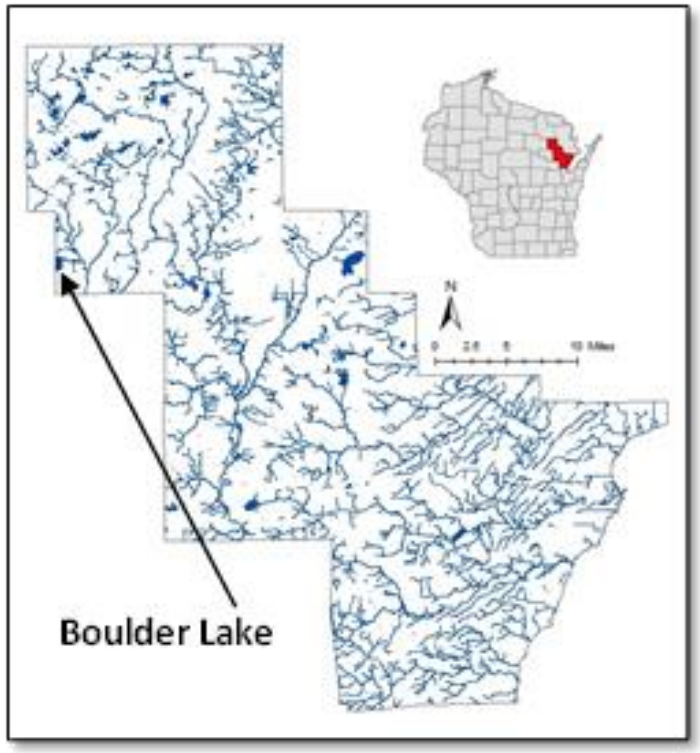
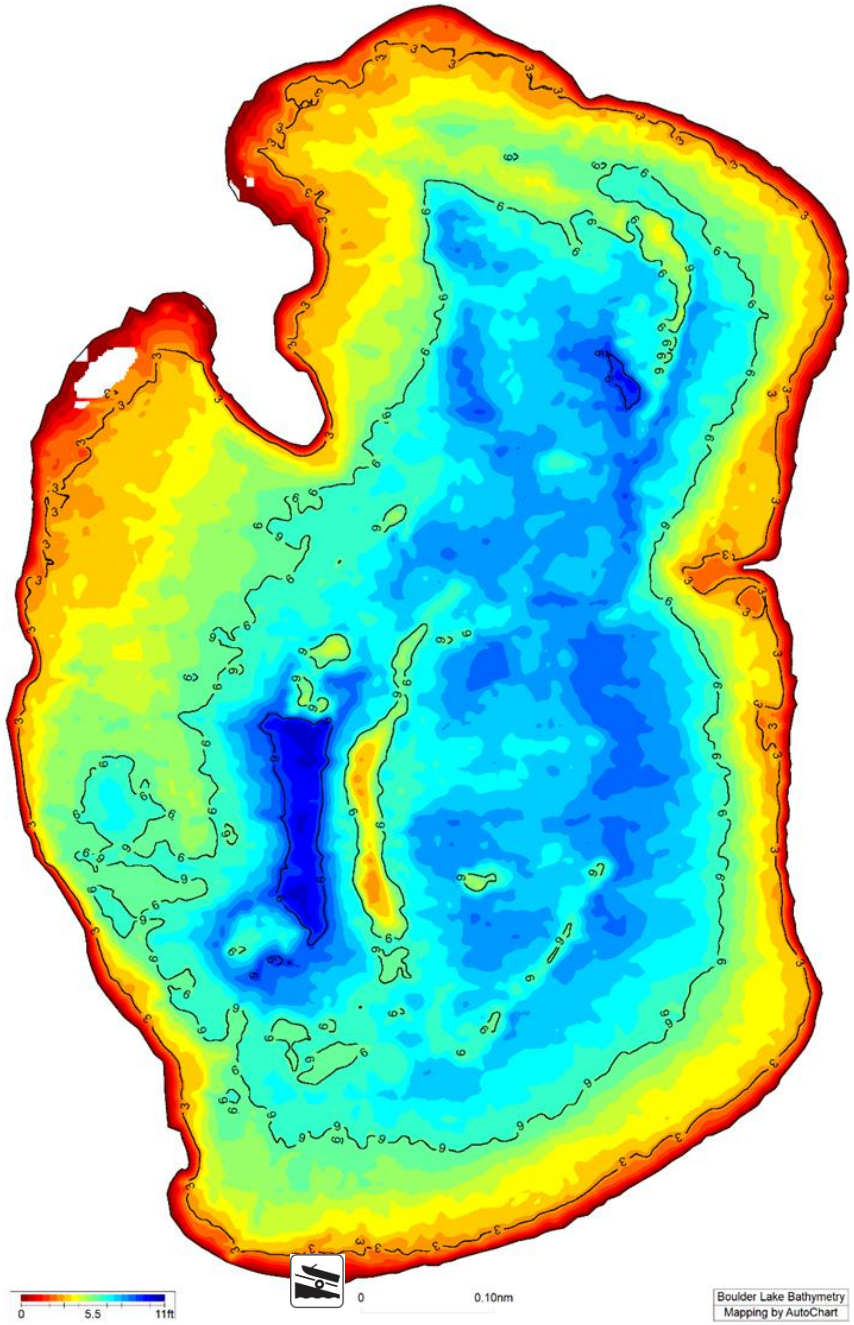
Resource	Acronym or Truncated Name
Boulder Lake Association	BLA
Citizen Lake Monitoring Network	CLMN
Clean Boats Clean Waters	CBCW
Lumberjack Resource Conservation & Development Council	LRCD
Oconto County Land & Water Conservation Dept.	OC LCD
Oconto County Board of Supervisors	OC Board
Oconto County Lakes and Waterways Association	OCLAWA
Town of Doty	TOD
University of Wisconsin - Extension	UWEX
UWSP Water & Environmental Analysis Laboratory	WEAL
UWSP Center for Watershed Science and Education	CWSE
USDA Natural Resources Conservation Service	NRCS
Wisconsin Department of Natural Resources	WDNR
Wisconsin Department of Transportation	WDOT

Background

ABOUT BOULDER LAKE

Boulder Lake is located in the Town of Doty in northeastern Wisconsin. This 370-acre spring lake has a maximum depth of 11 feet with clear water. Its bottom sediments are primarily muck and sand. Visitors have access to the lake from one public boat landing on the south side of the lake, which is owned and maintained by the US Forest Service as well as two private landings on the northeast side. Water enters Boulder Lake primarily through groundwater and surface runoff and leaves via a small tributary stream of the South Branch Oconto River.





What Is A Lake Management Plan?

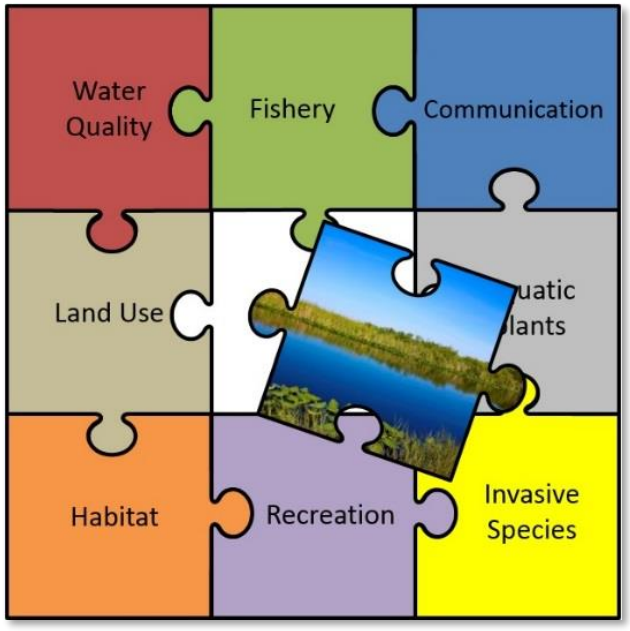
LAKE MANAGEMENT PLANS (LMP)

What is an LMP?

A management plan is a living document that changes over time to meet the current needs, challenges and desires of the lake and its community. Although each lake is different, the WDNR requires that each comprehensive lake management plan addresses a specific list of topics affecting the character of the lake, whether each topic has been identified as a priority, or as simply something to consider. In this way, every LMP considers the many aspects associated with lakes.

What is the purpose of this LMP?

This plan was created to ensure that Boulder Lake is healthy now and for future generations. It was designed to learn about Boulder Lake and identify features important to the Boulder Lake community, in order to provide a framework for the protection and improvement of the lake.



Implementing the content of this LMP will enable citizens and others to work together to achieve the vision for Boulder Lake now and in the years to come. It is a dynamic document that identifies goals and action items for the purpose of maintaining, protecting and/or creating desired conditions in the lake and identifies steps to correct past problems, improve on current conditions, and provide guidance for future boards, lake users, and technical experts.

Because many entities are involved in lake and land management, it can be challenging to navigate the roles, partnerships and resources that are available. The planning process and content of this plan have been designed to identify where some key assistance exists. The actions identified in this LMP can serve as a gateway for obtaining grant funding and other resources to help implement activities outlined in the plan.

How Was This Plan Created?

ABOUT THIS PLAN

One of the first steps in creating this plan was to gather and compile data about the lake and its ecosystem to understand past and current conditions. This was done in 2021-2022 alongside 5 other lakes as part of the Oconto County Lakes Project. The project was initiated by citizens in the Oconto County Lakes and Waterways Association who encouraged Oconto County to prioritize lake interests. This effort led to funding from the WDNR Lake Protection Grant Program. There was insufficient data available for many of the lakes to evaluate current water quality, aquatic plant communities, invasive species, and shorelands. The data that were available had been collected at differing frequencies or periods of time, making it difficult to compare lake conditions. Professionals and students from UW-Stevens Point, Oconto County Land Conservation Department, UW Extension, Oconto County citizens and WDNR staff collected the data for use in the development of lake management plans. Sources of information used in the planning process are listed at the end of this document.

Reports from the Boulder Lake Study and the materials associated with the planning process and reports can be found on the Oconto County website: **www.co.oconto.wi.us** and navigating to Departments>Land & Water Conservation>County Waterways>County-wide Lake Study.

THE PLANNING PROCESS

Who created the strategic plan?

This plan is the result of a stakeholder-driven effort which involved many partners combining insight, knowledge, and expertise throughout the process. Area residents, lake users, and representatives of local municipalities gathered at public meetings held on May 11, 2021 and March 5, 2024 via an online platform to learn from one another and make decisions about the fishery, water quality, habitat, and land management in the Boulder Lake watershed. Technical assistance during the planning process was provided by staff from OCLCD, UWEX, WDNR, and the CWSE.

How were various opinions incorporated?

Participation in the planning process was open to everyone and was encouraged by letters mailed to Boulder Lake waterfront property owners and by press releases in local newspapers. In addition, those individuals and organizations who provided their information were provided with emails about upcoming meetings, which could be forwarded to additional contact lists. To involve and collect input from as many people as possible, including those who might not be able to attend the public meetings, an online survey was conducted. Property owners and interested lake users were notified about the survey and how to access it via direct mailings to waterfront property owners and associated lake organizations and press releases in local newspapers. The surveys could be filled out anonymously online, or paper copies were available upon request. Survey questions and responses were shared at the planning sessions and can be found in the Appendix.

How Is This Management Plan Used?

Who will use this plan?

- **Individuals:** Individuals can use this plan to learn about the lake they love and their connection to it. People living near the lake can have the greatest influence on the lake by understanding and choosing lake-friendly options to manage their land and the lake.
- **Boulder Lake Association:** This plan provides an association with guidance for the whole lake and lists options that can easily be prioritized. Resources and funding opportunities for lake management activities are made more available by placement of goals into the lake management plan, and the association can identify partners to help achieve their goals for the lake.
- **Neighboring lake groups, sporting and conservation clubs:** Groups with similar goals for lake stewardship can combine their efforts and provide each other with support, improve competitiveness for funding opportunities, and make efforts more fun.
- **The Town of Doty:** Municipalities can utilize the visions, objectives, and goals documented in this lake management plan when considering town-level planning or decisions within the watershed that may affect the lake.
- **Oconto & Langlade Counties:** County professionals will better know how to identify needs, provide support, base decisions, and allocate resources to assist in lake-related efforts documented in this plan. This plan can also inform county board supervisors in decisions related to Oconto County lakes, streams, wetlands, and groundwater.
- **Wisconsin Department of Natural Resources (WDNR):** Professionals working with lakes in Oconto County can use this plan as guidance for management activities and decisions related to the management of the resource, including the fishery, and invasive species. LMPs help them to identify and prioritize needs, and where to apply resources. A well thought out lake management plan increases an application's competitiveness for funding from the State.

Who can help implement this plan?

Lead persons and resources are identified under each action in this plan. These individuals and organizations are able to provide information, suggestions, or services to achieve goals. The following table lists organization names and their common acronyms used in this plan. This list should not be considered all-inclusive – assistance may also be provided by other entities, consultants, and organizations.

Management Plan Structure

GOALS FOR BOULDER LAKE

The foundation of any effective strategic plan is clear identification of goals and the steps needed to achieve the goals. The selected goals should achieve the overall vision for Boulder Lake. This plan also identifies available resources within each objective.

The topics comprise the chapters in this plan and have been grouped as follows:

In-Lake Habitat and a Healthy Lake

Fish Community—fish species, abundance, size, important habitat and other needs

Aquatic Plant Community—habitat, food, health, native species, and invasive species

Critical Habitat—areas of special importance to the wildlife, fish, water quality, and aesthetics of the lake

Landscapes and the Lake

Water Quality—water chemistry, clarity, contaminants, lake levels

Shorelands—habitat, erosion, contaminant filtering, water quality, vegetation, access

Watershed—land use, management practices, conservation programs

People and the Lake

Recreation—access, sharing the lake, informing lake users, rules

Communication and Organization—maintaining connections for partnerships, implementation, community involvement

Updates & Revisions—plan for maintaining a living document

Boulder Lake Management Plan Goals

Goals for Boulder Lake

The following goals and actions were derived from the values and concerns of citizens interested in Boulder Lake and members of the planning committee, as well as the known science about Boulder Lake, its ecosystem and the landscape within its watershed. Implementing and regularly updating the goals and actions in this plan will ensure that the vision is supported and that changes are incorporated into the plan.

LIST OF GOALS

Goal 1	**Maintain a healthy, well-balanced fishery in Boulder Lake.**
Goal 2	**Boulder Lake will maintain a healthy and diverse aquatic plant community.**
Goal 3	**Sensitive areas in Boulder Lake, which provide essential habitat and/or water quality benefits, will be protected.**
Goal 4	**Property owners within Boulder Lake's watershed will understand their connection to the lake and will know about and utilize resources for healthy land management practices.**
Goal 5	**Boulder Lake will maintain healthy shorelands that protect water quality and provide essential habitat.**
Goal 6	**Maintain or improve water quality in Boulder Lake.**
Goal 7	**Lake users will be informed about and respectful of Boulder Lake.**
Goal 8	**Increase participation in lake stewardship.**
Goal 9	**Review plan annually and update as needed.**

Fish Community

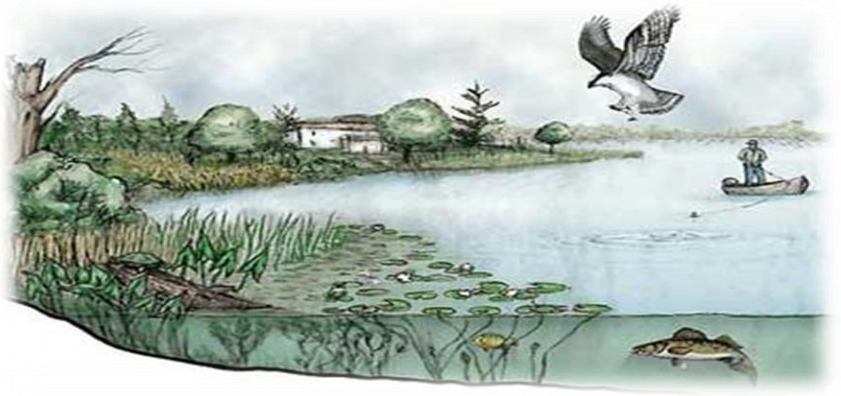
IN-LAKE HABITAT AND A HEALTHY LAKE

The health of one part of the lake system affects the health of the rest of the plant and animal community, the experiences of the people seeking pleasure at the lake, and the quality and quantity of water in the lake. Habitat is the structure for a healthy fishery and wildlife community. It can provide shelter for some animals and food for others. Many animals that live in and near the lake are only successful if their habitat needs are met.

What is lake-habitat?

Healthy lake-habitat in Boulder Lake includes native aquatic plants and shoreland vegetation, as well as tree branches/limbs above and below the water.

Habitat exists within the lake, along the shoreland, and even extends into its watershed for some wildlife species. Native vegetation (including wetlands) along the shoreline and connected to the lake provides shelter and food for waterfowl, small mammals, turtles, frogs, and fish. Native plants in and near the lake can also improve water quality and balance water quantity. Aquatic plants infuse oxygen into the water, which is essential for the fish community. Some lake visitors such as birds, frogs, and turtles use limbs from trees that are sticking out of the water for perches or to warm themselves in the sun. The types and abundance of plants and animals that comprise the lake



community also vary based on the water quality, and the health and characteristics of the shoreland and watershed.

The Fish Community

A balanced fish community has a mix of predator and prey species, each with different food, habitat, nesting substrate, and water quality needs to flourish.

What can affect the fishery?

Activities in and around a lake that can affect a fishery include:

- disturbances to the native aquatic plant community or substrate,
- excessive additions of nutrients or harmful chemicals,
- removal of woody habitat,
- shoreline alterations,
- shoreland erosion can cause sediment to settle onto the substrate, causing the degradation of spawning habitat.

What People Value about Boulder Lake

Clean, clear water
Fishing, swimming, boating
Peace and quiet
View, beach
Time with family

Habitat provides shelter and food for fish and wildlife.

Fish Community

Fish cribs are good cover for small fish, but near shore habitat is essential for reproduction of most species.

Can the fishery be improved?

Managing a lake for a balanced fishery can result in fewer expenses to lake stewards and the public. While some efforts may be required to provide a more suitable environment to meet the needs of the fish, they usually do not have to be repeated on a frequent basis. Ideally, a lake contains the habitat, water quality, and food necessary to support the fish communities present within the lake and provide fishing opportunities for people without a lot of supplemental effort and associated expenses to maintain these conditions.

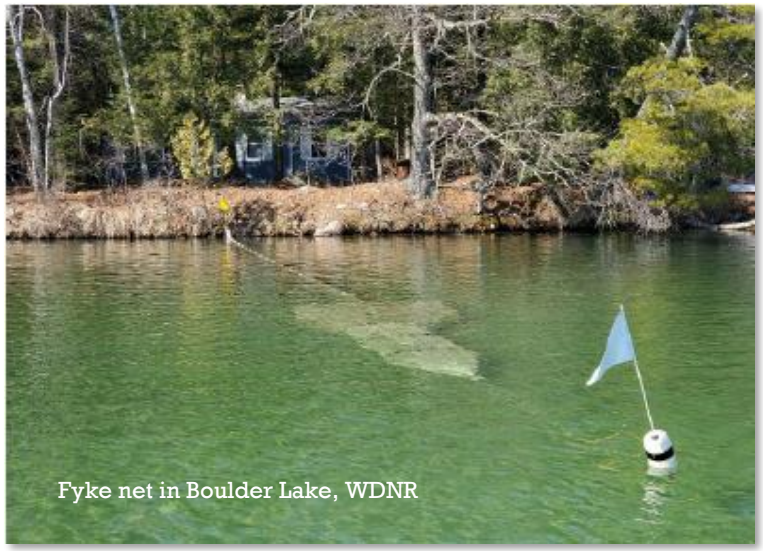
- Protecting existing habitat such as emergent, aquatic, and shoreland vegetation, and allowing trees that naturally fall into the lake to remain in the lake, are free of cost.
- Restoring habitat in and around a lake can have an up-front cost, but the effects will often continue for decades.
- Costs in time, travel, and other expenses are associated with routine efforts such as fish stocking and aeration.

Boulder Lake Fishery

- Boulder Lake was last surveyed in spring 2021. It is on a 10-year rotation for comprehensive fish surveys with the next scheduled for 2031.
- Four walleye stockings between 1973 and 2001. The population failed to thrive.
- Size structure of Largemouth Bass (LMB) is good while size structure for Smallmouth Bass is poor. Both species exhibit below average growth rates.
- Though still high, LMB abundance has declined.
- Bluegill size structure is excellent with above average growth rates.
- WDNR recommendation to continue to manage for Large and Smallmouth Bass (dominant predators) and panfish. No regulation changes proposed.

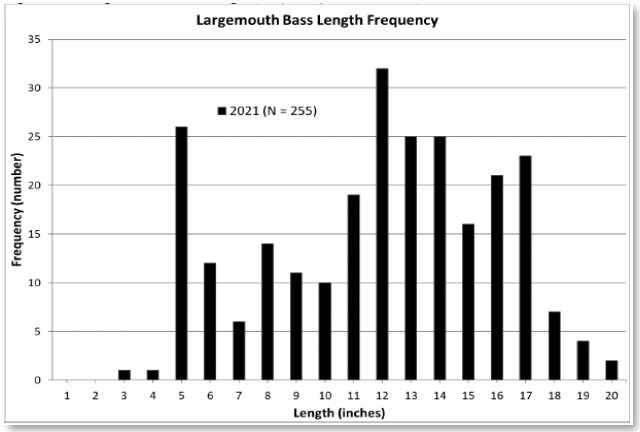
Year	Species	Strain	Age Class	Number Stocked	Avg. Length (in.)	Source
1973	Walleye	Unspecified	Fingerling	18,000	5	DNR coop ponds
1985	Walleye	Unspecified	Fry	363,000	1	DNR hatchery
1986	Walleye	Unspecified	Fry	363,000	1	DNR hatchery
2001	Walleye	Unspecified	Sm. fingerling	15,000	1.6	DNR ponds

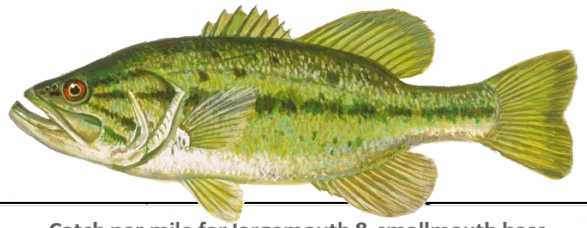
Good fishing doesn't just happen. It's the result of clean water and abundant spawning habitat found in lakes and rivers that still have plenty of natural shoreline.

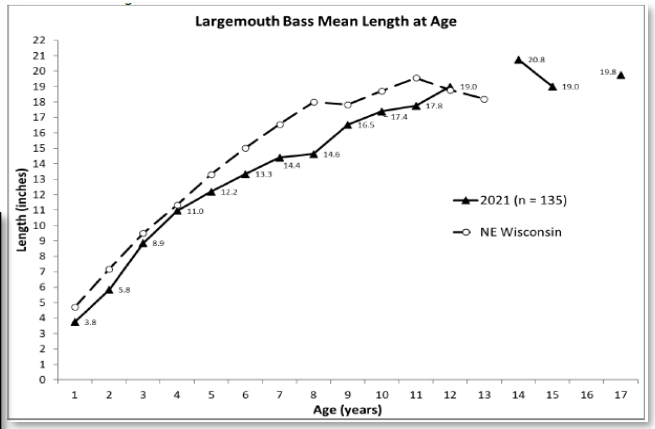


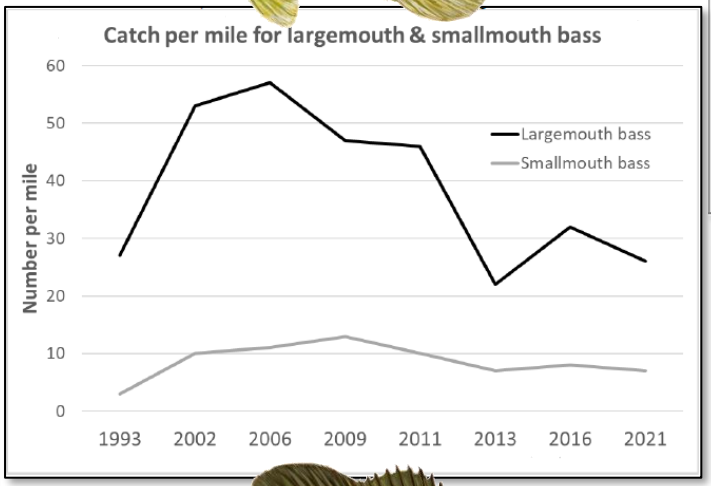
Fyke net in Boulder Lake, WDNR

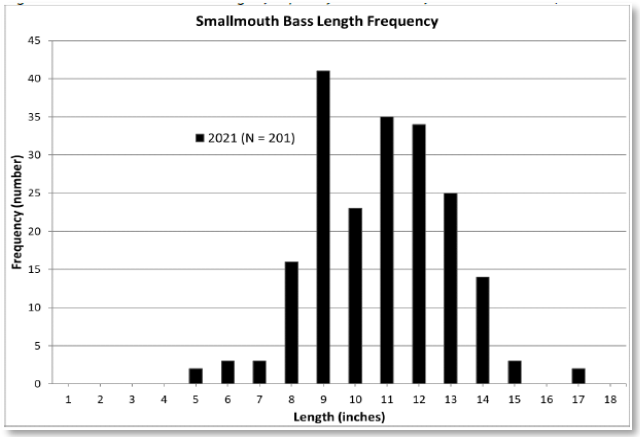
Fish Community

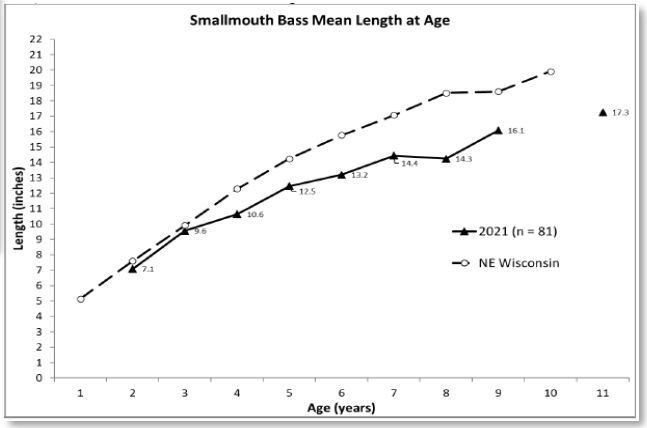


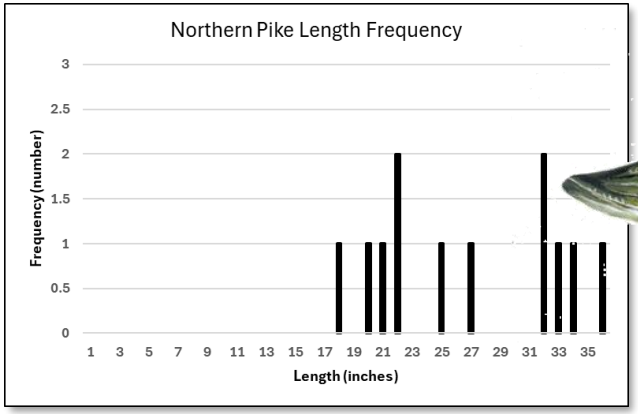


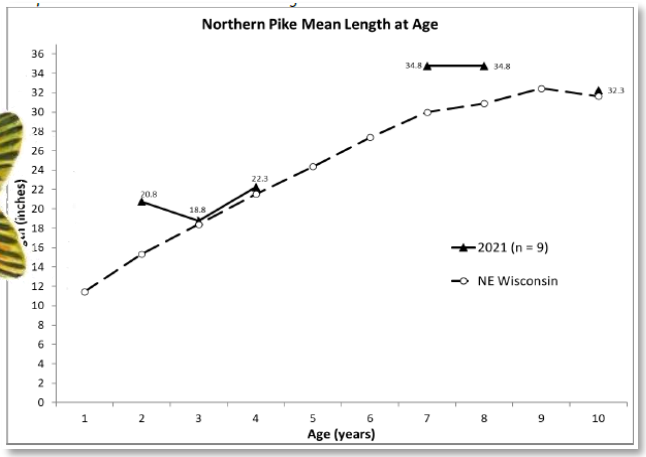




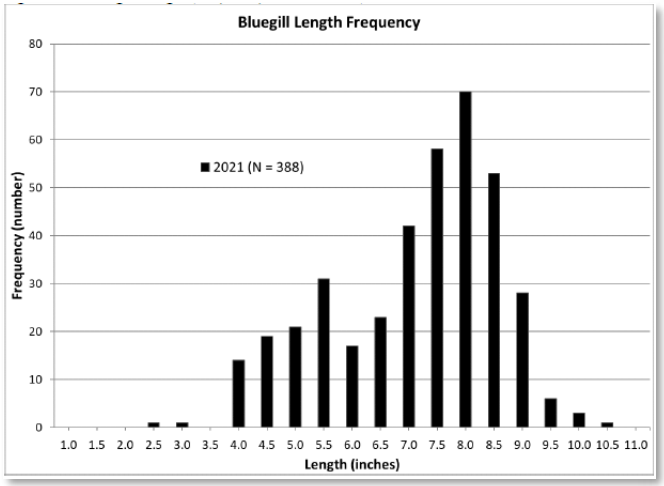


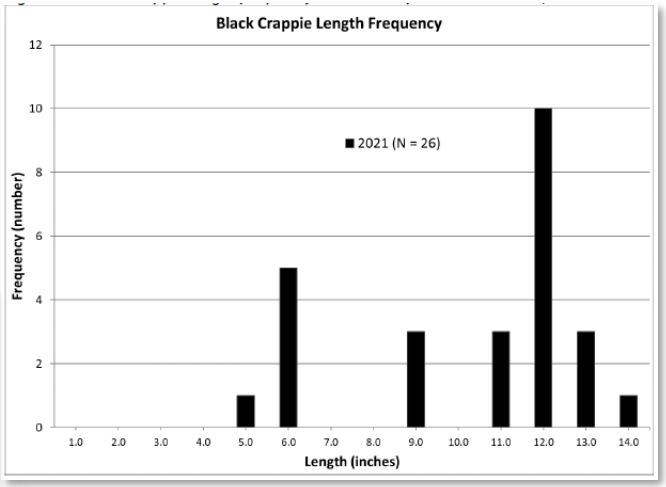


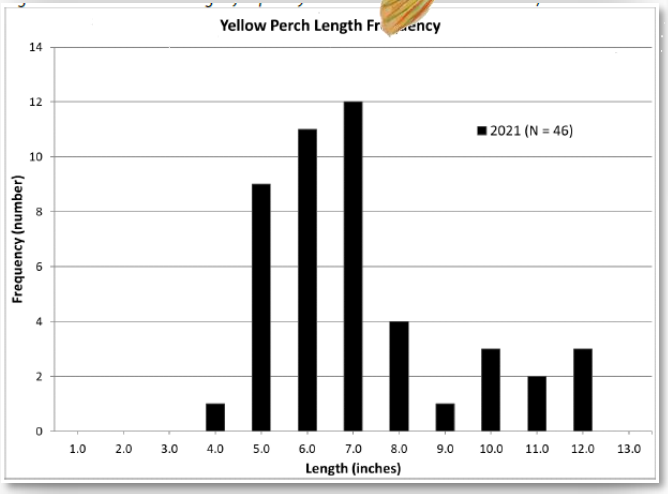


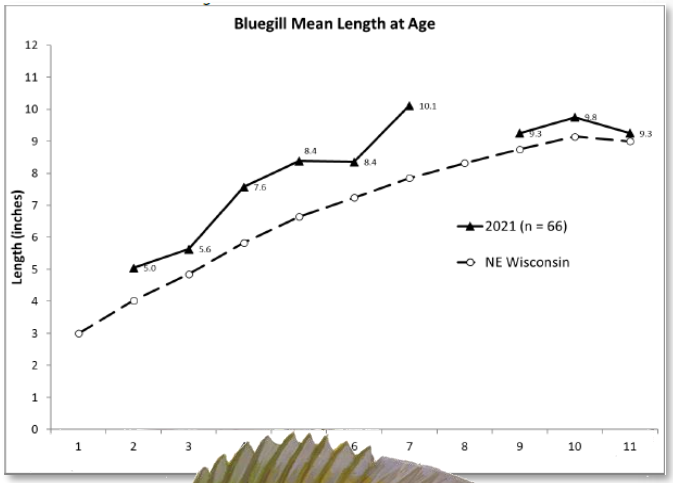


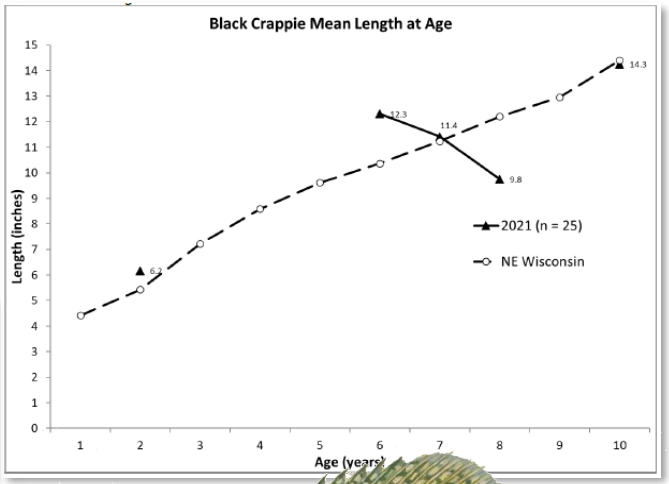
Fish Community

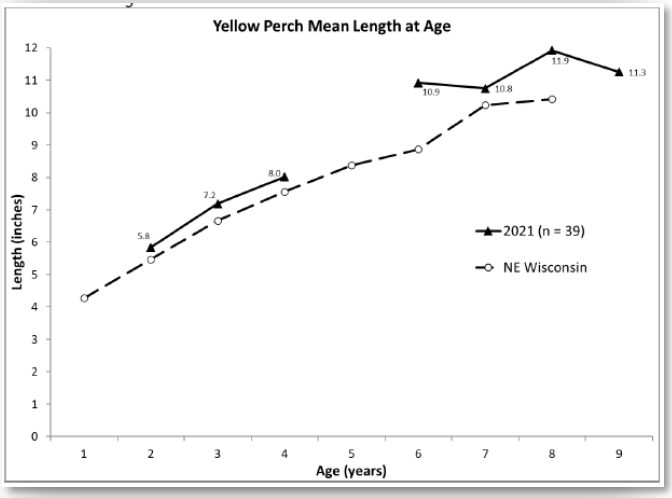


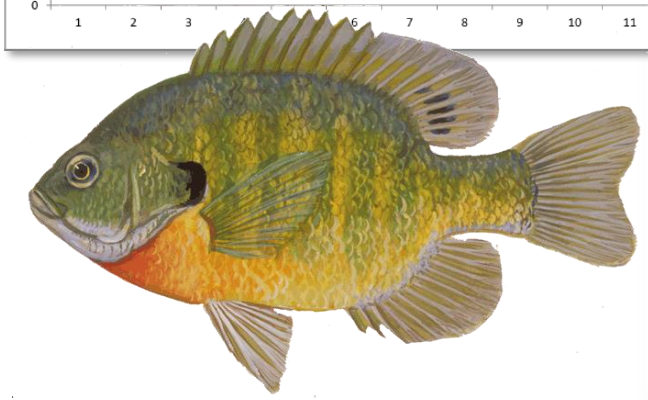


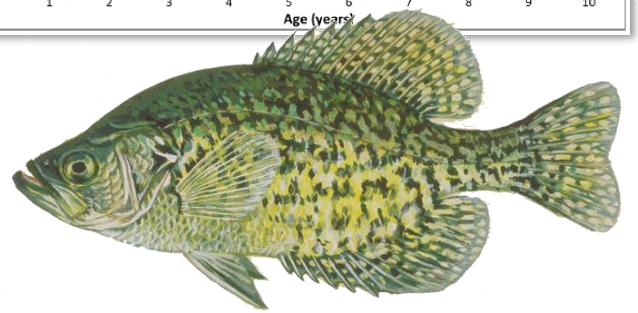












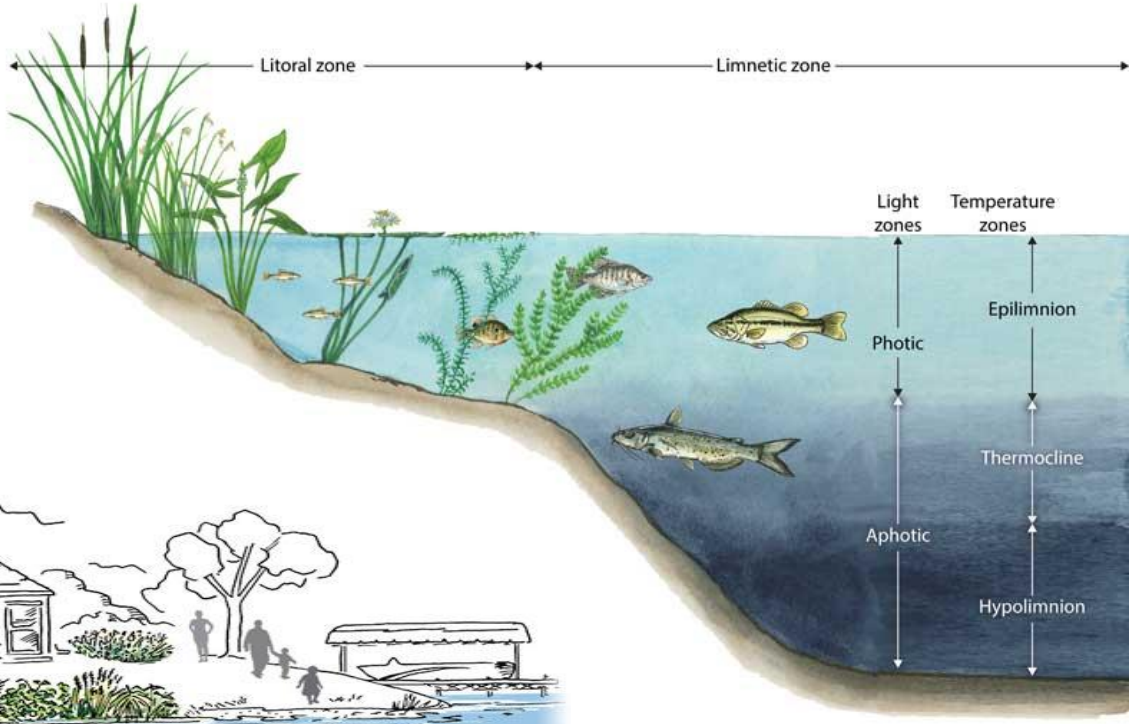
Fish Community

Goal 1. Maintain a healthy, well-balanced fishery in Boulder Lake.

Objective 1.1 Enhance fish habitat in Boulder Lake.

Actions	Lead person/group	Resources	Timeline
Identify willing property owners for fish stick installations. Track and map these installations as they occur. At least 250 logs/mile is recommended. Also identify properties seeking tree removal (>35 ft from water's edge) as a source of material.	BLA	WDNR-Tammie Paoli	
Educate property owners about healthy shoreland habitat and its importance to having a healthy fishery. See **Shorelands** section.	BLA		
Maintain loon nesting areas including protection from disturbance and possible augmentation of nesting platform.	BLA	WDNR-National Heritage Program	

Bluegill in Boulder Lake, WDNR



Aquatic Plant Community

Native plants provide essential food and habitat for fish and wildlife.

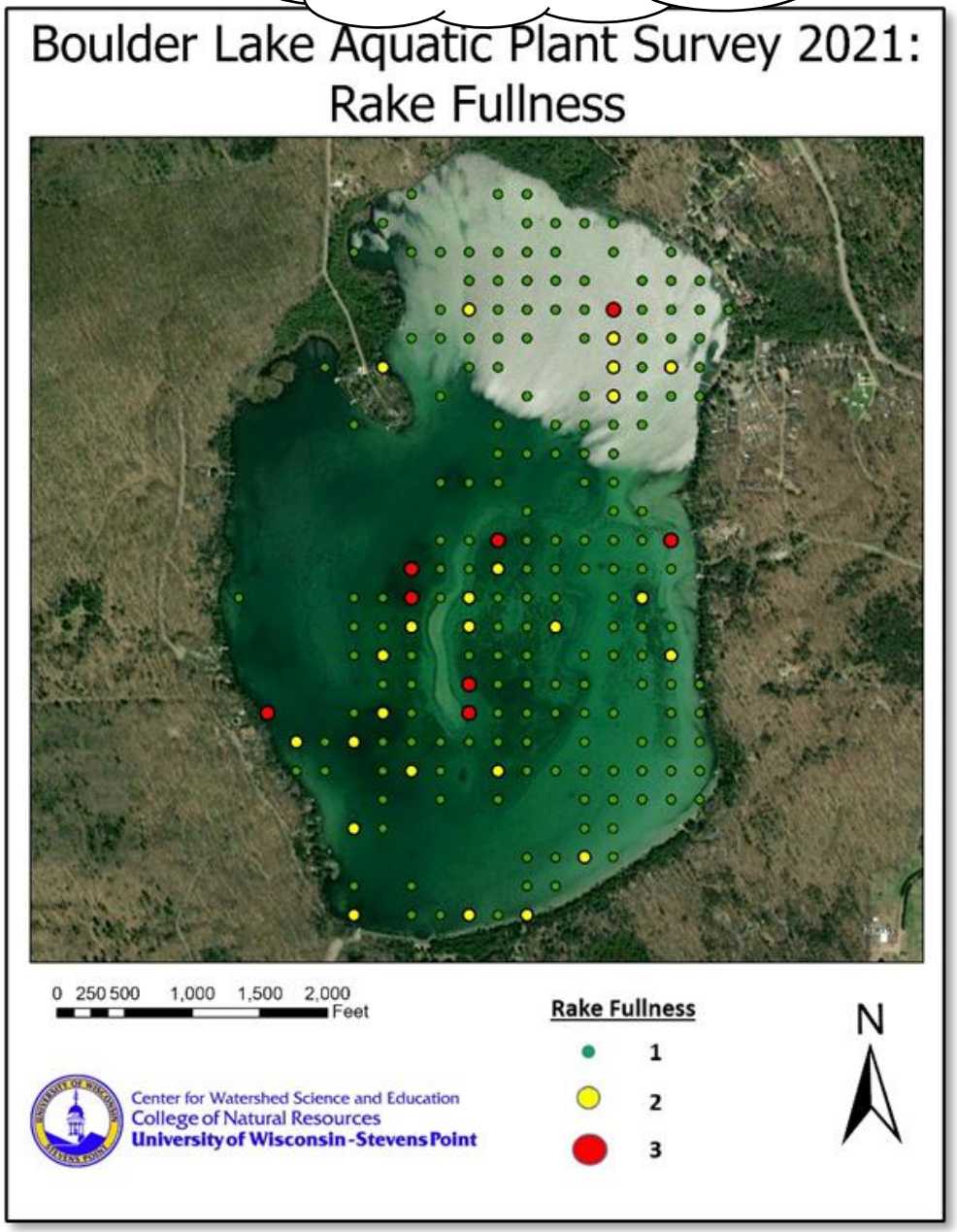
Aquatic Plants

Aquatic plants provide the forested landscape within Boulder Lake. They provide food and habitat for spawning, breeding, and survival for a wide range of inhabitants and lake visitors including fish, waterfowl, turtles, amphibians, as well as invertebrates and other animals. They improve water quality by releasing oxygen into the water and utilizing nutrients that would otherwise be used by algae. A healthy lake typically has a variety of aquatic plant species, which makes the aquatic plant community more resilient and can help to prevent the establishment of non-native aquatic species. Additionally, they stabilize the bottom sediment and help filter out the suspended sediment from the water column.

Aquatic plants near shore and in shallows provide food, shelter, and nesting material for shoreland mammals, shorebirds and waterfowl. It is not unusual for otters, beavers, muskrats, weasels, and deer to be seen along a shoreline in their search for food, water or nesting material. Aquatic plants also serve as indicator species for environmental stressors that could be occurring in a lake or river, such as a runoff event.

Boulder Lake 2021 WDNR (Brenda Nordin) Aquatic Plant Survey Highlights

- 14 species were identified in the 2021 survey, below average diversity when compared to other lakes in the study.
- 58% of visited sites had vegetative growth. The maximum depth of vegetation was 11 feet and the Floristic Quality Assessment (FQI) was 21.2.
- The most frequently encountered plant species were chara (91%), Illinois pondweed (20%) and variable pondweed (16%). All three are native to Wisconsin.
- Eurasian watermilfoil was observed at one location.

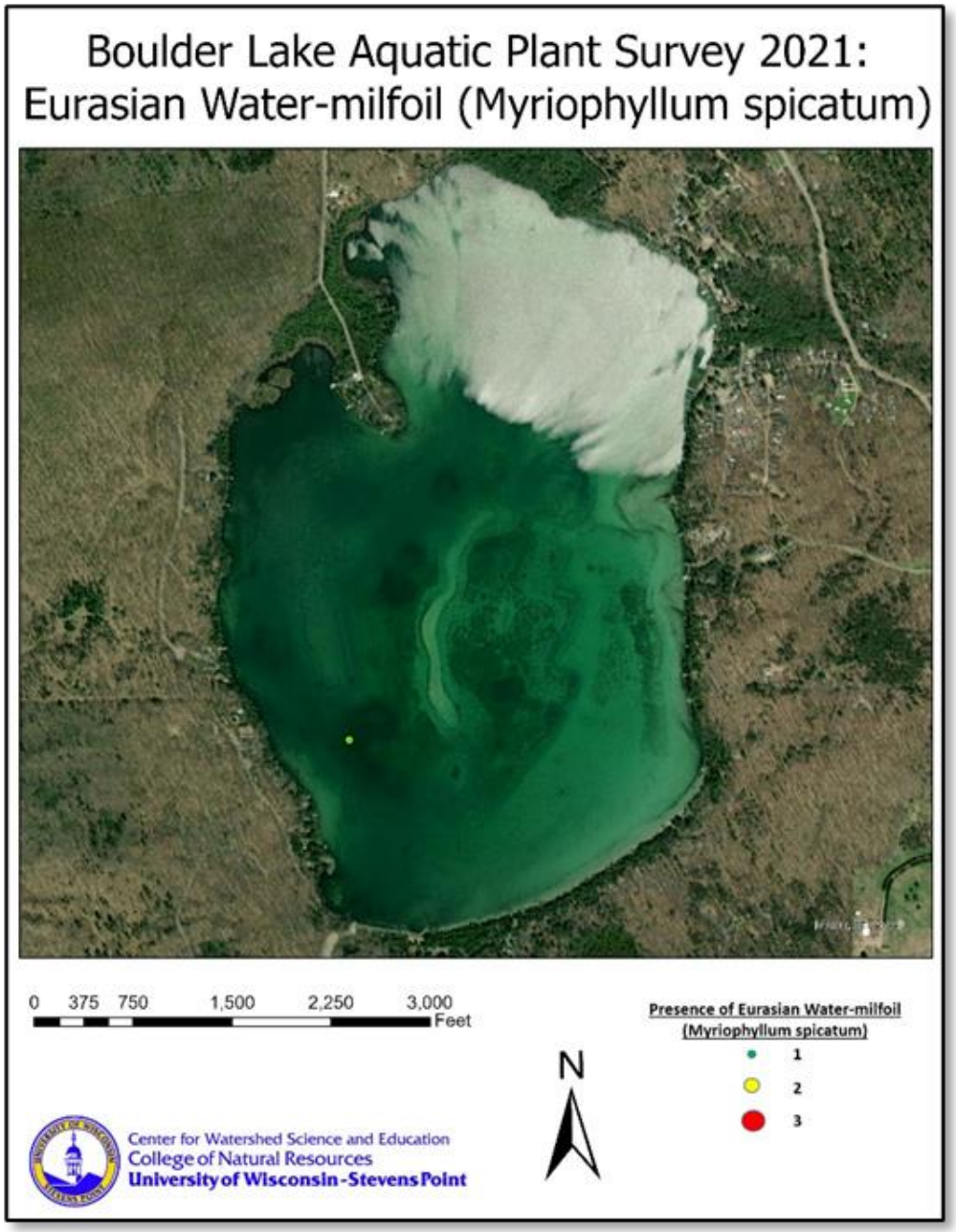


Aquatic Plant Community

Chara is a type of macro algae that grows attached to muddy lake bottoms and has a musky odor. Muskgrass, as it is known, filters the lake water and is helpful in preventing the establishment of invasive species.

Illinois pondweed is important forage and cover for aquatic animals and an important food source for waterfowl.

Variable pondweed has both floating and submersed leaves which provide food and habitat for fish.



Aquatic Invasive Species (AIS)

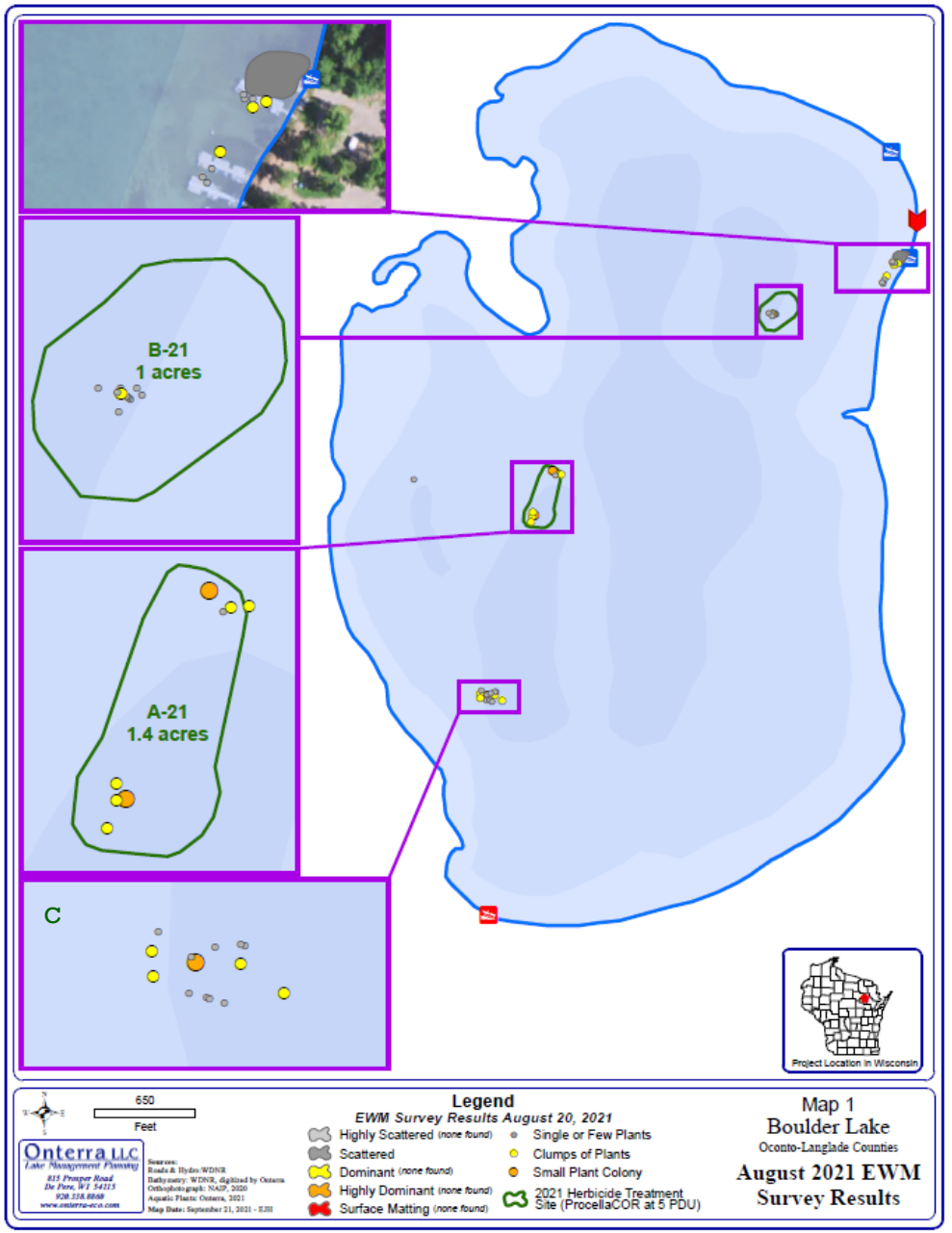
Aquatic invasive species are non-native aquatic plants and animals that are most often unintentionally introduced into lakes by lake users. This commonly occurs on trailers, boats, equipment, and from the release of bait. In some lakes, aquatic invasive plant species can exist as a part of the plant community,

Aquatic Plant Community

while in other lakes populations explode, creating dense beds that can damage boat motors, make areas non-navigable, inhibit activities like swimming and fishing, and disrupt the lakes' ecosystems.

The invasive species **Eurasian water-milfoil** (EWM) was observed at one location during the 2021 survey. EWM is one of the most common invasive aquatic plants in Wisconsin. It can form dense mats that choke out native plants and inhibit navigation. New plants can grow from stem fragments that root on contact with the substrate. EWM was first documented in Boulder Lake in 2012 and observed at one location (on the southwest side) during the 2021 survey. Following the 2012 discovery, the BLPHA secured grant funds through WDNR to initiate a monitoring and control plan. An herbicide treatment of 2.7 acres was conducted in the fall of 2012 in the northeast corner of the lake. Surveys conducted in the spring of 2013 determined that the EWM levels in the lake were too low to warrant control with herbicides and a hand-removal effort took place in 2013 and 2014. No EWM was observed during surveys conducted in 2015. Hand-removal of EWM has taken place every year since by BLPHA volunteers in a proactive effort to control EWM in Boulder Lake.

In January 2018, the BLPHA was awarded an AIS-EDR grant through WDNR to coordinate EWM hand-harvesting control efforts, both professional and volunteer, through 2022. Residual populations of EWM as of August 2021 are shown in the map. See



Aquatic Plant Community

Onterra's *2021 EWM Management and Monitoring Report* included as Appendix D.

On June 12, 2023, 2.85 acres were treated with ProcellaCOR in areas A and C at a rate of 5 prescription dose units (PDU), and in area B at 6 PDU.

DNR protocol is recommended every 5 years to detect changes in the plant community and monitor any AIS.

Banded mystery snails were first documented in Boulder Lake in 2012. Native to the southeast United States, they can compete with native snails for food and habitat, serve as a host for parasites, and are known to invade largemouth bass nests.

Aquatic Plant Management in Boulder Lake

Management strategies in Boulder Lake were designed to achieve a balance between healthy aquatic habitat, good water quality, and eradication of invasive species.

Management Options for Invasive Species or Nuisance Native Aquatic Plants

Management options that offer the most practical and effective approaches for managing invasive species or nuisance native plants, while minimizing impacts to Boulder Lake as a whole, have been identified. Depending upon conditions, the following options may be used alone or in combination with others.

Hand-pulling. No permit required.

Hand-pulling is the preferred method for removing invasive species. Additionally, lakefront property owners are allowed to manually remove native aquatic plants from an area up to 30 feet wide without a permit for swimming and boat access (this does not include the excavation or removal of any bottom sediments). Any denuded lakebed is prime real estate for invasive species, however, and close monitoring is necessary to ensure no populations are established. EWM has most often been observed in Boulder Lake typically as a few isolated plants. Vigilance is required to address these populations while they are still small. Hand -pulling in these situations is the best approach (chemicals are reserved for large beds or lake-wide infestations). The plant spreads through fragmentation, so care to remove the entire plant, roots and all, is necessary. Dispose of away from the water's edge.

Diver Assisted Suction Harvesting (DASH). Permit required.

Some populations may be in areas of a lake (deep) that are problematic for hand pulling. DASH, a method where divers guide target plants into a suction device that is filtered on the other end, is an efficient way to access these areas while still thoroughly removing all plant fragments.

Chemical Treatment: Spot Permit required.

If EWM beds exceed a certain size (typically >1 acre), hand removal may not be practical. In this case, targeting specific beds with herbicide is an option. Though less destructive to the lake ecosystem than whole-lake treatment, the herbicide will dilute into a larger area given enough time, so potential collateral damage to native and sensitive species should be considered.

Chemical Treatment: Whole-lake Permit required.

Lake-wide treatment distributes herbicide throughout the entire lake. Water volume is calculated (while considering the thermocline) to achieve a target chemical concentration in lake water. Whole-lake treatment tends to reduce populations for a

time (typically 4-6 years) resulting in less frequent applications. Because every lake responds a little differently, regular (perhaps annually) point intercept surveys are required to monitor the native plant community and measure efficacy of chemical applications.

Aquatic Plant Management Plan Review

A good aquatic plant management plan strategy should reduce the amount of management activity needed as time goes on. In Boulder Lake, a series of successful strategies (integrated plant management) should lead to a balance between healthy aquatic habitat, water quality, and recreation with minimal annual management.

Goal 2. Boulder Lake will maintain a healthy and diverse aquatic plant community.

Objective 2.1 Control/eradicate Eurasian water-milfoil to maintain good recreational access. Ensure no new populations are introduced.

Actions	Lead person/group	Resources	Timeline
Encourage/host training, develop coasters or placemats for area businesses, provide brochures for rental properties, etc. on how to identify and properly remove invasive species. Ensure adequate informational signage at boat landings (including private landings).	BLA	WDNR LRCD	Ongoing
Educate lake users on importance of native aquatic plants for preventing AIS. Bring in speaker for annual meeting, mail literature to property owners, include information in a newsletter, etc.	BLA	WDNR UWEX-Lakes LRCD	Ongoing
Support/organize volunteer crews in monitoring for and removing new populations of EWM. Map and track these observations.	BLA	WDNR	Ongoing
Hire professionals for EWM survey/removal annually (or as needed) to assess EWM population and identify new populations. Prioritize non-chemical control as much as possible.	BLA	Consultants WDNR	Annually, as needed
Hire DASH contractors (and/or volunteers) to identify deeper populations of EWM and remove these plants, as necessary. Seek cost-share and grant funding for these activities where available.	BLA	WDNR grants OCLCD cost share	Ongoing
Explore forming a lake district to fund management of invasive species and enforcement of lake rules.	BLA	UWEX-Lakes OCLCD	
Continue to pursue all options for management of AIS including hand pulling, suction harvesting and herbicides.	BLA	WDNR	As needed

Continue to explore use of 'curtain' to contain spot treatment in target areas, especially near the lake's outlet.	BLA	WDNR	
If a new AIS is suspected or observed, follow the guidance in **Appendix B**.	Lake users	WDNR	Ongoing
Consider applying for AEPP grant to obtain an Aquatic Plant Management plan (a blueprint that is more detailed and specific to aquatic plant management than the comprehensive management plan).	BLA	WDNR-Brenda Nordin	
Participate in Clean Boats Clean Waters program. Identify volunteers or consider paying someone to staff the boat launch on busy days.	BLA		

Objective 2.2 Minimize disturbance to native aquatic plants.

Actions	**Lead person/group**	**Resources**	**Timeline**
Inform property owners of the importance of native aquatic vegetation to impede the establishment of additional AIS, provide food and habitat for wildlife, and protect the shoreline via educational materials provided at the annual meeting, direct mailings and in a newsletter.	BLA	WDNR-Brenda Nordin	Ongoing
Encourage landowners to limit plant removal to invasive species or skimming off those that have become unrooted and free-floating. If plants severely impede recreation, consider hand-pulling small areas around private docks (within WDNR guidelines). Cleared lakebed is ideal habitat for AIS to become established, so be vigilant about watching for AIS in these areas.	BLA	WDNR-Brenda Nordin	Ongoing
Regularly monitor aquatic plant community to detect any changes in lake conditions and ensure stable populations. A point-intercept survey is recommended.	BLA	WDNR-Brenda Nordin Consultants	Every 5-10 years.
Reduce nutrient and sediment loading to lake by improving shoreland buffers (see **Shorelands** section) and implementing BMPs in the watershed (see **Watershed** section).		WDNR-Brenda Nordin OCLCD	Ongoing

Critical Habitat

Every waterbody has areas that are most important to the overall health of the lake.

Critical Habitat

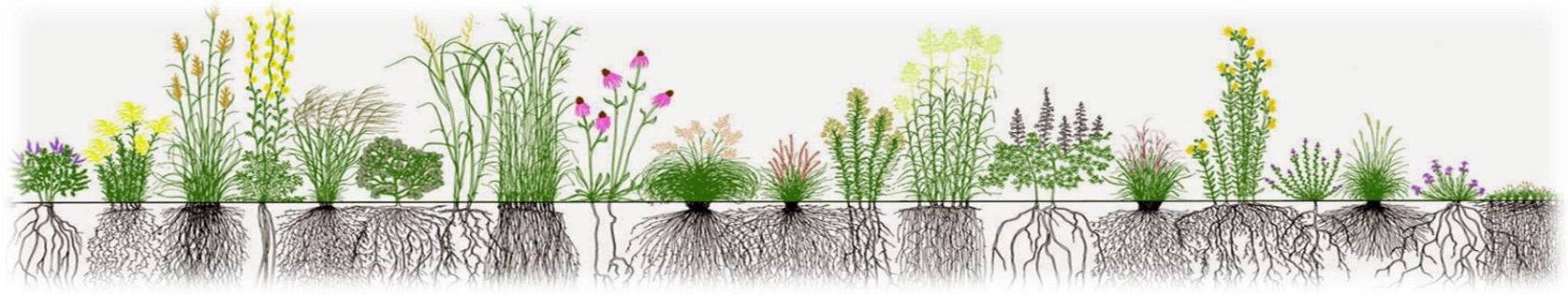
Special areas harbor habitat that is essential to the health of a lake and its inhabitants. In Wisconsin, critical habitat areas are identified by biologists and other lake professionals from the WDNR in order to protect features that are important to the overall health and integrity of the lake, including aquatic plants and animals. While every lake contains important natural features, not all lakes have official critical habitat designations. Designating areas of the lake as critical habitat enables these areas to be located on maps and information about their importance to be shared. Having a critical habitat designation on a lake can help lake groups and landowners plan waterfront projects that will minimize impact to important habitat, ultimately helping to ensure the long-term health of the lake.

Although Boulder Lake does not have an official critical habitat area designation, there are areas within Boulder Lake that are important for fish and wildlife. Natural, minimally-impacted areas with woody habitat such as logs, branches, and stumps; areas with emergent and other forms of aquatic vegetation; areas with overhanging vegetation; and wetlands are elements of good quality habitat. Identifying other important areas around the lake that are important habitat and informing lake users of their value can help raise awareness for the protection of these areas.

Goal 3. Sensitive areas in Boulder Lake, which provide essential habitat and/or water quality benefits, will be protected.

Objective 3.1 Identify and inform others of quality habitat areas in and around Boulder Lake.

Actions	Lead person/group	Resources	Timeline
Request a Critical Habitat Designation from WDNR.		WDNR-Brenda Nordin	
If critical habitat is identified, communicate to property owners, visitors, and Town Board as to why these areas are important. Look for opportunities to protect these areas.			TBD



LANDSCAPES AND THE LAKE

Boulder Lake Watershed

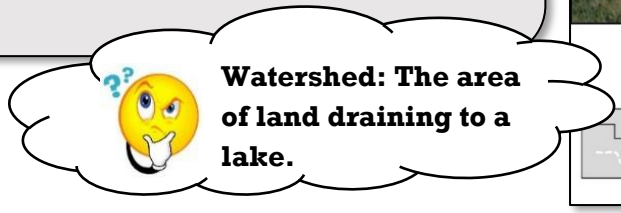
A Lake is a Reflection of its Watershed…

Understanding where Boulder Lake's water originates is important to understanding lake health. During snowmelt or rainstorms, water moves across the surface of the landscape (runoff) towards lower elevations such as lakes, streams, and wetlands. This area is called the watershed. Groundwater also feeds Boulder Lake; its land area may be slightly different than the surface watershed.

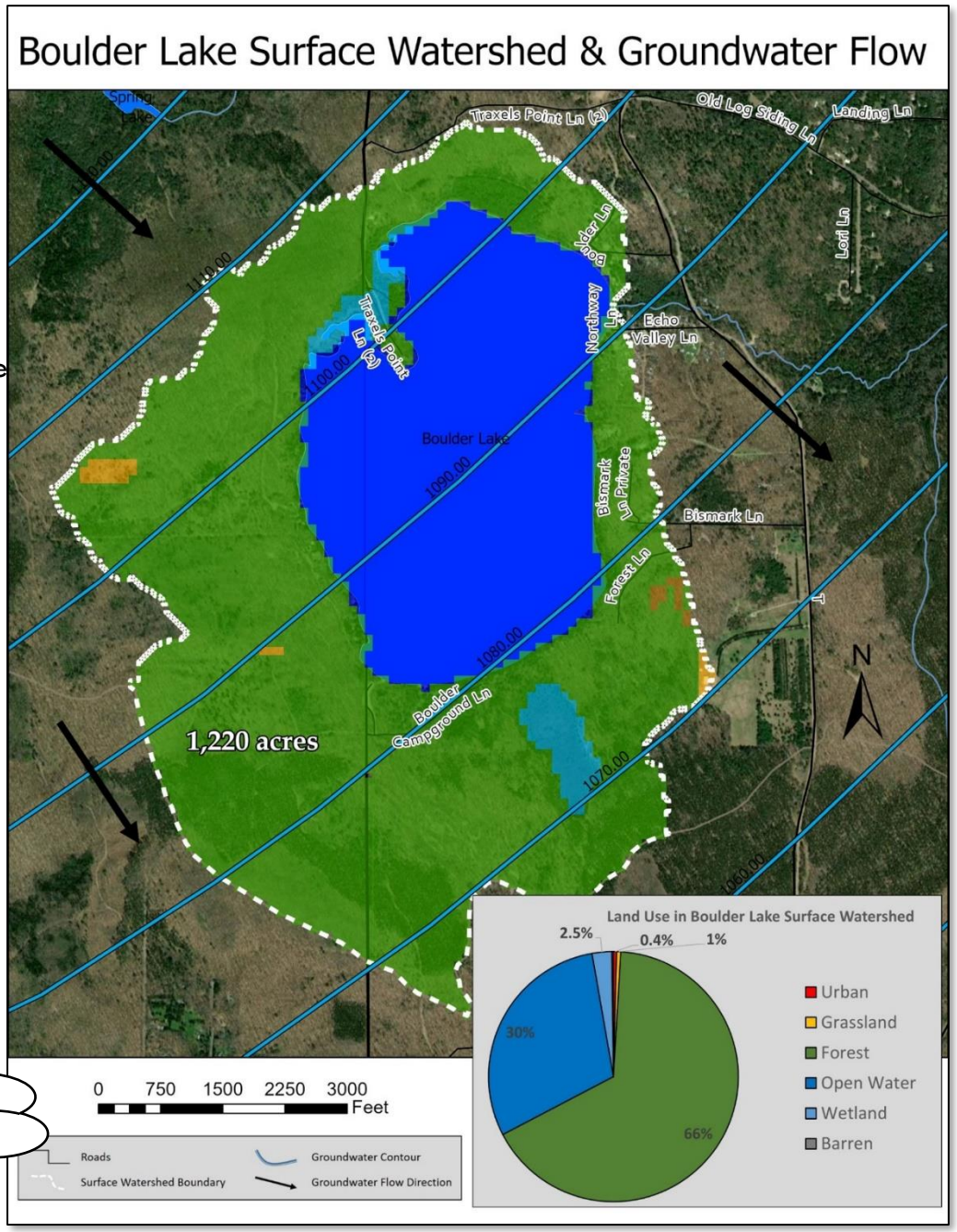
Less runoff is desirable because it allows more water to recharge the groundwater, which feeds the lake year-round - even during dry periods or when the lake is covered with ice. The capacity of the landscape to shed or hold water and contribute or filter particles determines the amount of erosion that may occur, the amount of groundwater feeding a lake, and the lake's water quality and quantity. Landscapes with greater capacities to hold water during rain events and snowmelt slow the delivery of the water to the lake.

Boulder Lake's Watershed

The Boulder Lake watershed is 1,220 acres. Primary land use is forest, open water and wetland. The lake's shoreland is surrounded primarily by forest. In general, the land closest to the lake has the greatest immediate impact on water quality.



Watershed: The area of land draining to a lake.



Watershed

Why does land matter?

Land use and land management practices within the watershed can affect both its water quantity and quality. While forests, grasslands, and wetlands allow a fair amount of precipitation to soak into the ground, resulting in more groundwater and good water quality, other types of land uses may result in increased runoff and less groundwater recharge, and may also be sources of pollutants that can impact the lake and its inhabitants.

Soil and Erosion

Areas of land with exposed soil can produce soil erosion. Soil entering the lake can make the water cloudy and cover fish spawning beds. Soil also contains nutrients that increase the growth of algae and aquatic plants.

Development

Development on the land may result in changes to natural drainage patterns, alterations to vegetation on the landscape, and may be a source of pollutants. Impervious (hard) surfaces such as roads, rooftops, and compacted soil prevent rainfall from soaking into the ground, which may result in more runoff that carries pollutants to the lake. Wastewater, animal waste, and fertilizers used on lawns, gardens and crops can contribute nutrients that enhance the growth of algae and aquatic plants in our lakes.

What can be done?

Land management practices can be put into place that mimic some of the natural processes, and reduction or elimination of nutrients added to the landscape will help prevent the nutrients from reaching the water. In general, the land nearest the lake has the greatest impact on the lake water quality and habitat and is often the easiest to manage (own property, no politics, etc.).

Be Part of the Solution!

Practices designed to reduce runoff include:

- protecting/restoring wetlands,
- installing rain gardens, swales, rain barrels, and other practices that increase infiltration
- routing drainage from pavement and roofs away from the lake
- meandering lake access paths to minimize direct flow to the lake.

Practices used to help reduce nutrients from moving across the landscape towards the lake include:

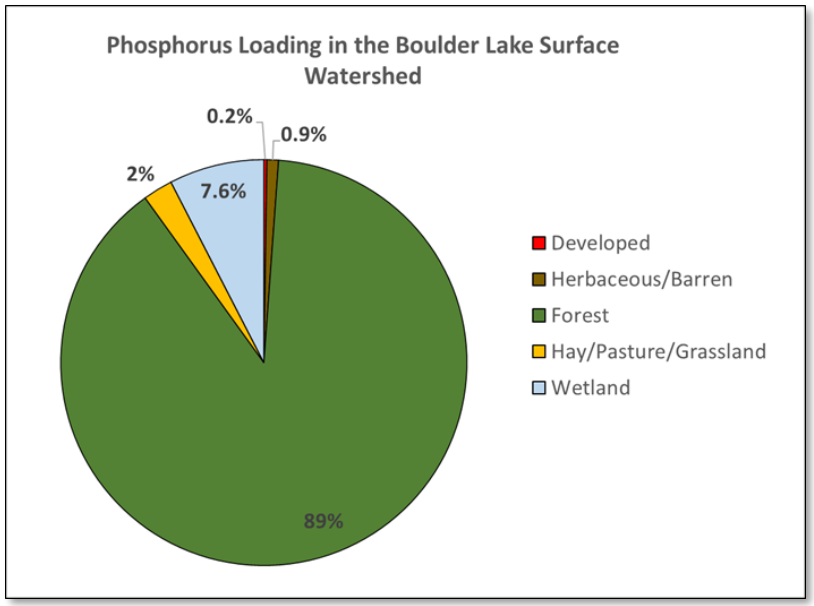
- eliminating/reducing the use of fertilizers,
- increasing the distance between the lake and a septic drainfield,
- protecting/restoring wetlands and native vegetation in the shoreland,
- controlling erosion,
- manure management and cropping practices.

Most of these activities are eligible for cost share and grant assistance!

Watershed

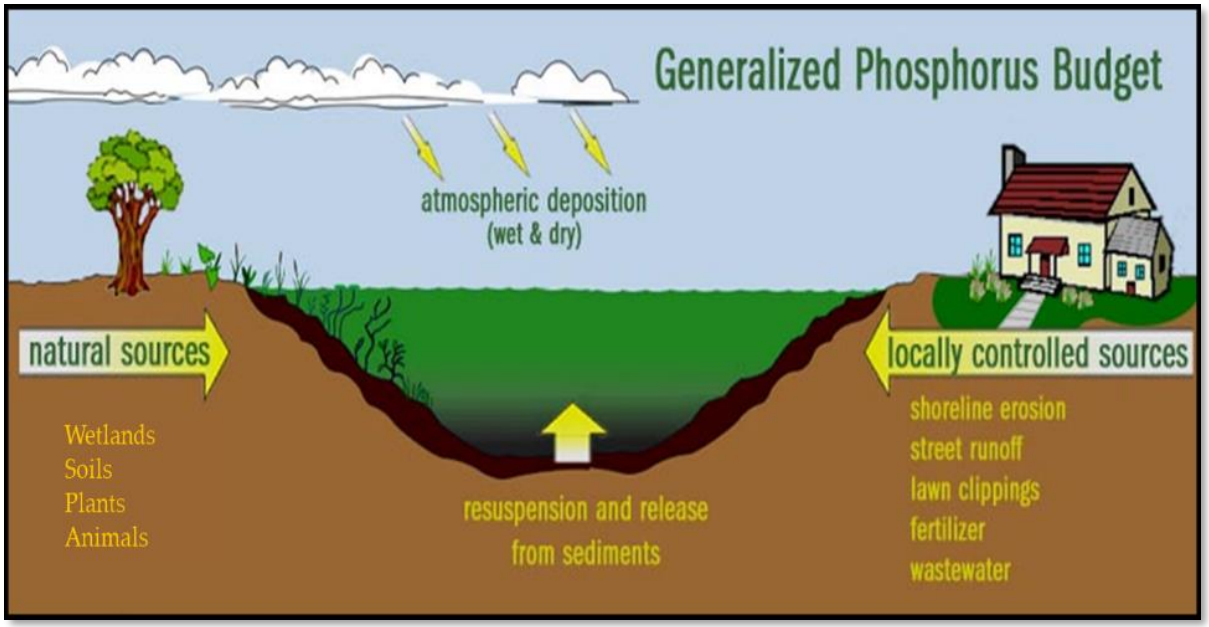
Phosphorus Modeling

Estimates of phosphorus from the landscape can help to understand the phosphorus sources to Boulder Lake. Land use in the surface watershed was evaluated and used to populate the Wisconsin Lakes Modeling Suite (WILMS) model. In general, each type of land use contributes different amounts of phosphorus in runoff and groundwater. The types of land management practices that are used and their distances from the lake also affect the contributions to the lake from a parcel of land. The phosphorus contributions by land use category, called phosphorus export coefficients, have been obtained from studies throughout Wisconsin (Panuska and Lillie, 1995). In the Boulder Lake watershed, efforts should be directed at phosphorus sources that can be controlled.



Phosphorus Loading in Boulder Lake Watershed

Based on modeling results, forest had the greatest percentage of phosphorus contributions from the watershed. Efforts to reduce nutrient inputs to the lake must be focused on land uses that we have some control over such as production and developed areas.



Goal 4. Property owners within Boulder Lake's watershed will understand their connection to the lake and will know about and utilize resources for healthy land management practices.

Objective 4.1 Support healthy land management practices in the Boulder Lake watershed to reduce sediment and nutrient loading.

Actions	Lead person/group	Resources	Timeline
Encourage the County to support and follow-up with water quality-based best management practices (BMPs) within the watershed.		OCLCD County Board Supervisors	Ongoing
Support landowners (consider financial support) interested in the protection of their land via a land conservation program (i.e. Conservation Easement, Purchase of Development Rights, or sale of land for protection).		WDNR Lake Protection Grants Knowles-Nelson Stewardship Fund Northeast WI Land Trust	As needed
Encourage any new developments to manage runoff on site and consider ways to minimize impacts from septic systems.		Town of Doty Developers/Builders	As needed
Protect wetlands to maintain the water budget of Boulder Lake. Any altered wetlands should be mitigated within the lake's watershed.	Oconto County	WDNR	As needed
Encourage design of road and construction projects that will minimize impacts to the lakes.		Town of Doty OC Highway Department/WDOT	As needed

Shorelands

90% of lake life spends all or part of their life in the near shore zone.

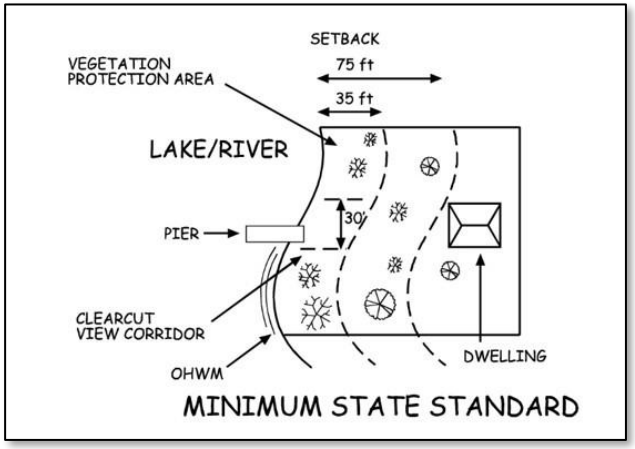
Shorelands

Shoreland vegetation is critical to a healthy lake ecosystem. It provides habitat for many aquatic and terrestrial animals including birds, frogs, turtles, and 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 unmowed grasses/flowers, shrubs, trees, and wetlands which extends at least 35 feet landward from the water's edge.

Shoreland ordinances have been in place since 1964 to improve water quality and habitat, and to protect our lakes. To protect our lakes, county and state (NR 115) shoreland ordinances state that vegetation should extend at least 35 feet inland from the water's edge, with the exception of an optional view corridor (30% of frontage, 200 foot max) for each shoreland lot. Although some properties were grandfathered in when the ordinance was initiated in 1966, following this guidance will benefit the health of the lake and its inhabitants.

Disturbed shoreland is measured as any shoreline without a shrub or herbaceous layer at the water's edge, regardless of buffer thickness. This may be a result of mowed lawn, artificial beach, etc.



Be Part of the Solution!

Follow Healthy Shoreland Practices

- Mow Less: The simplest, most affordable way to improve your shoreland is to reduce mowing near shore. Native vegetation will re-establish itself over time.
- Leave natural shoreland vegetation in place.
- Restore native shoreland vegetation where it is lacking.
- Plant attractive native species of grasses/flowers, shrubs and trees that will add interest and beauty to your property.
- Don't use fertilizers or herbicides, they may run into the lake. Test your soil to determine if fertilizer is warranted.
- Add or leave woody habitat near the shore. Turtles, birds, and fish love it!
- Never transplant water garden plants or aquarium plants into lakes, streams, or wetlands.
- Visit **www.healthylakeswi.com** for additional resources.

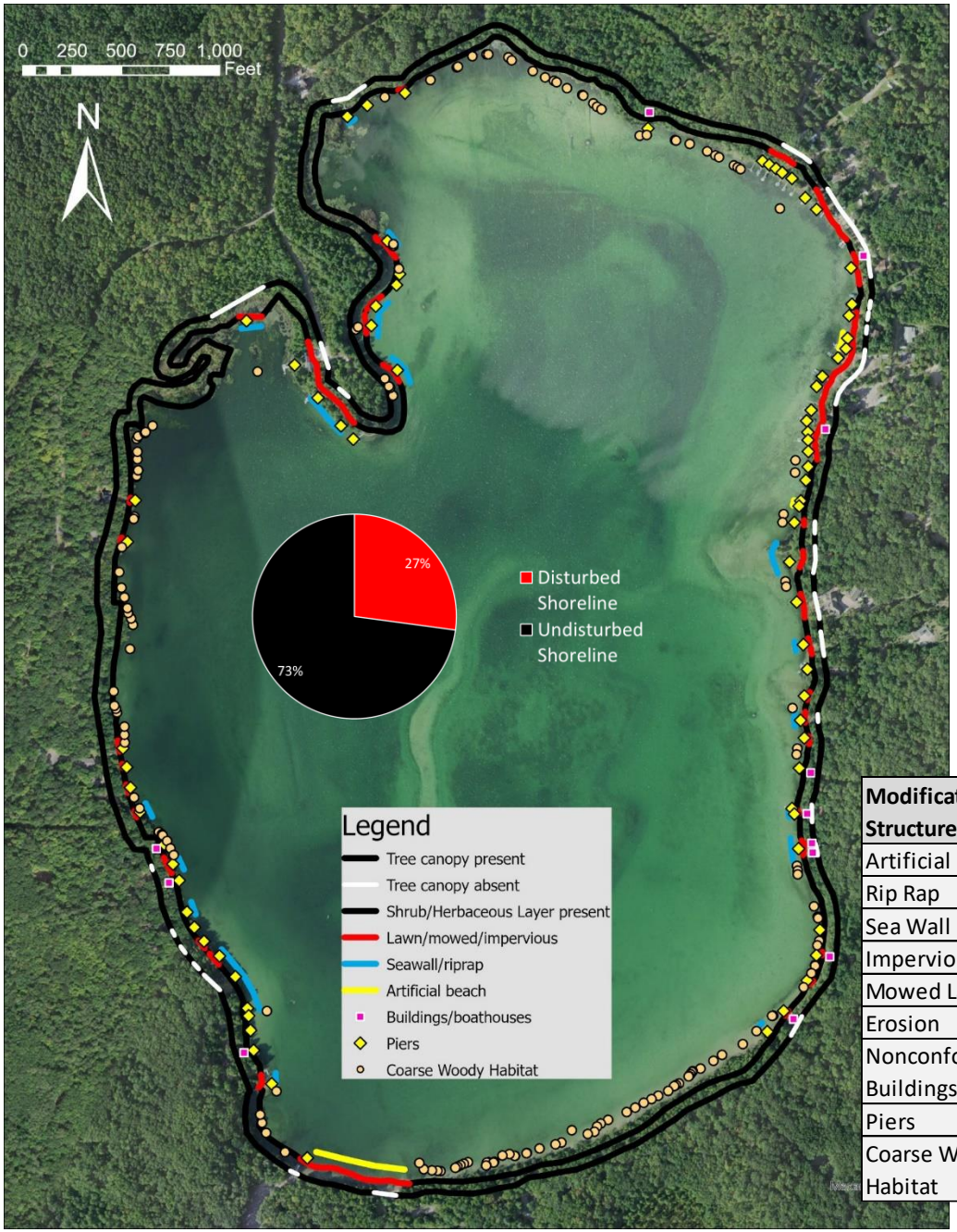
State Shoreland Zoning Ordinance

NR 115 Wisc. Adm. Code for Unincorporated Municipalities

No vegetation within 35 feet of the lake's edge shall be removed except for:

- Up to 30% (200' max) of shoreline may be removed of shrubs and trees for a view corridor
- A mowed or constructed pedestrian path up to 5 feet wide to access lake

Shorelands



Boulder Lake's Shorelands

To better understand the health of Boulder Lake, shorelands were evaluated by WDNR (Brenda Nordin) in 2021. The survey inventoried shoreland vegetation, erosion, riprap, barren ground, seawalls, structures, and docks. Nearly 1/3 of the 3.5-mile shoreline is considered disturbed. A total of 75 piers were counted during the survey (1/244 ft).

- With 73 lakefront lots, 2,190 feet (12%) of disturbed shoreland is permitted under NR115. Based on the 2021 shoreland inventory, 27% of Boulder Lake's shoreland was disturbed. Coarse woody habitat was measured at 70 logs/mile (250 logs/mile recommended.)
- Boulder Lake had average shoreland health compared to other lakes in the study. Several areas have been identified for restoration.

Modifications, Structures, Erosion	Measured Occurrence
Artificial Beach	185
Rip Rap	1625
Sea Wall	0
Impervious Surface	100
Mowed Lawn	4056
Erosion	0
Nonconforming Buildings	16
Piers	75
Coarse Woody Habitat	70 logs/mile

Coarse Woody Habitat (CWH)

Woody debris (i.e., branches, limbs, trees) that falls into the lake forms critical habitat for tiny aquatic organisms that feed bluegills, turtles, crayfish and other critters. Water insects such as mayflies graze on the algae that grow on decomposing wood. Dragonfly nymphs hunt for prey among the stems and branches. Largemouth and smallmouth bass often find food, shelter, or nesting habitat among these fallen trees.

Above water, a fallen tree is like a dock for wildlife. Ducks and turtles sun themselves on the trunk, muskrats use the tree as a feeding platform, predators such as mink and otter hunt for prey in the vicinity of fallen wood, and dead trees that remain along the shoreline are used as perches by belted kingfishers, ospreys and songbirds.

Undeveloped lakes typically contain hundreds of 'logs per mile' while they may completely disappear on developed lakes. Unless it is a hazard to navigation or swimming, consider leaving woody debris in the water.

Boulder Lake 2021 Shoreland Survey Results			
Total lakefront footage	**# Riparian lots**	**Total allowable (NR115) disturbed shoreland**	**Measured disturbed shoreland**
18,291	73	2,190 feet (12%)	4,961 feet (27%)

Goal 5. Boulder Lake will maintain healthy shorelands that protect water quality and provide essential habitat.

Objective 5.1 Shoreland property owners will be knowledgeable about and make good decisions regarding their shoreland practices that result in good water quality and habitat. At least 15 property owners will install native plantings, rain gardens, diversions, etc. in the next 3 years.

Actions	Lead person/group	Resources	Timeline
Provide informational materials to all shoreland property owners about basic lake stewardship including healthy shorelands and their composition (wildflowers, shrubs, trees, etc.). Include information on cost share programs.	BLA	OCLWA UWEX Lakes WDNR Healthy Lakes grants	Ongoing
Identify willing properties and install fish sticks to improve fish habitat (see **Fish Community** section).		OCLCD WDNR	Ongoing
Encourage and support shoreland owners interested in shoreland restoration (including rain gardens, diversion practices, infiltration practices, native plantings, no mow, or fish sticks). Include information on how and why to create healthy shorelands in a welcome packet to new property owners.		UWEX Lakes OCLCD WDNR Healthy Lakes Grants	Ongoing
Encourage those interested in shoreland restorations to contact the OCLCD for available resources.		OCLCD WDNR Healthy Lakes Grants	Ongoing
Host a speaker/demonstration: "How to restore your shoreline."		UWEX Lakes-Pat Goggin	
Explore purchase of undeveloped shoreland property.		UWEX Lakes Knowles-Nelson Stewardship Fund	As available
Consider restoring and showcasing a "demonstration site" with a sign at the water's edge about shoreland restoration (perhaps at the boat launch or on one of the commercial properties).		OCLCD UWEX Lakes – Pat Goggin WDNR Healthy Lakes Grants	

Water Quality

Water Quality

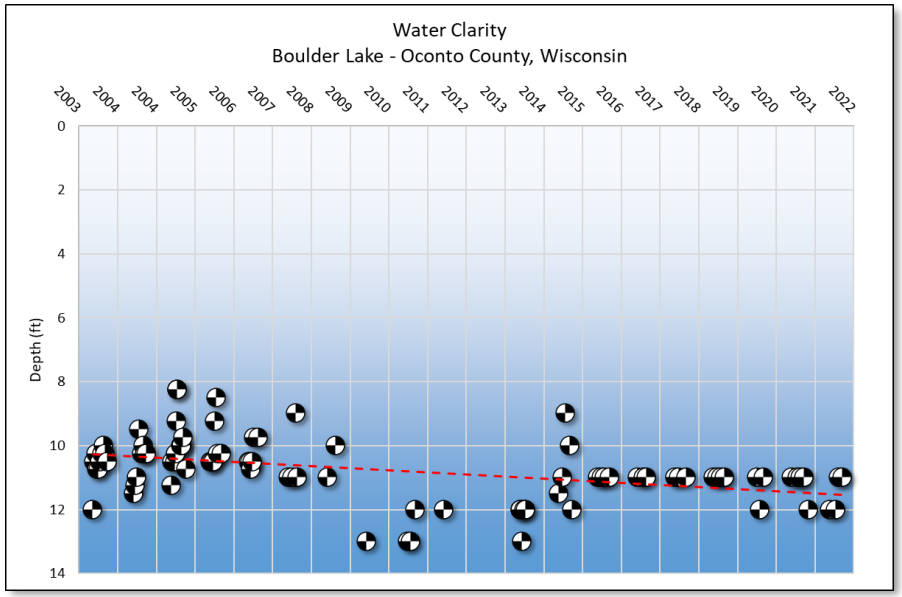
A variety of water chemistry measurements were used to characterize the water quality in Boulder Lake. Water quality was assessed during the 2021-2022 lake study and involved a number of measures including temperature, dissolved oxygen, water chemistry, and nutrients (phosphorus and nitrogen). Nutrients are important measures of water quality in lakes because they contribute to algae and aquatic plant growth. Each of these interrelated measures plays a part in the lake's overall water quality. In addition, water quality data collected in past years was also reviewed to determine trends in Boulder Lake's water quality.

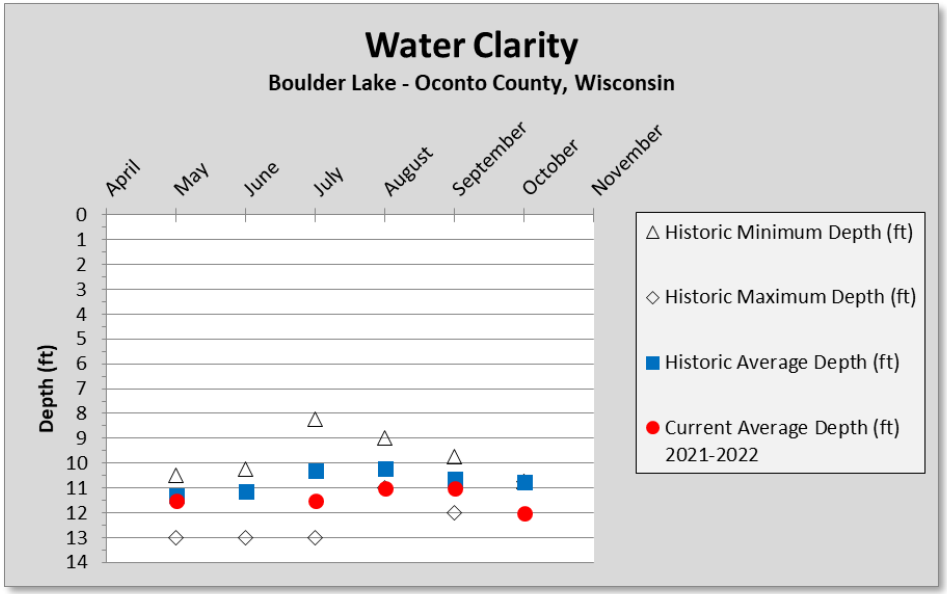
Boulder Lake's Water Quality Summary

- ✓ **Water clarity** ranged from 11-12 feet (considered good). The long-term trend suggests increasing clarity.
- ✓ **Dissolved oxygen** was in good shape with at least 3-4 feet of sufficient concentrations for fish at all times of the year.
- ✓ Concentrations of **contaminants** were 'low' during the study. Atrazine was not detected.
- ✓ **Phosphorus** concentrations were consistently below the standard of 40 ug/L during the study. **Inorganic nitrogen** remained below concentrations that spur algal blooms.

Water Clarity

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

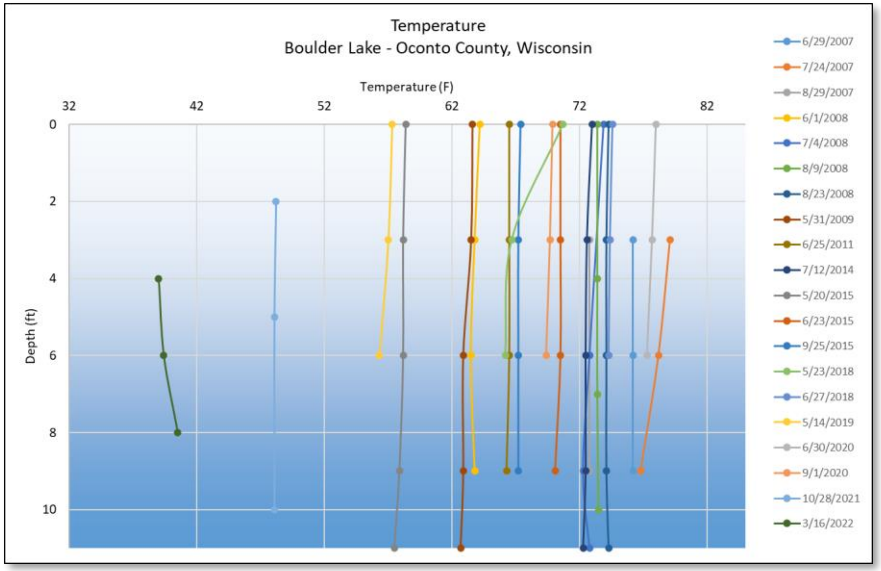




Water Quality

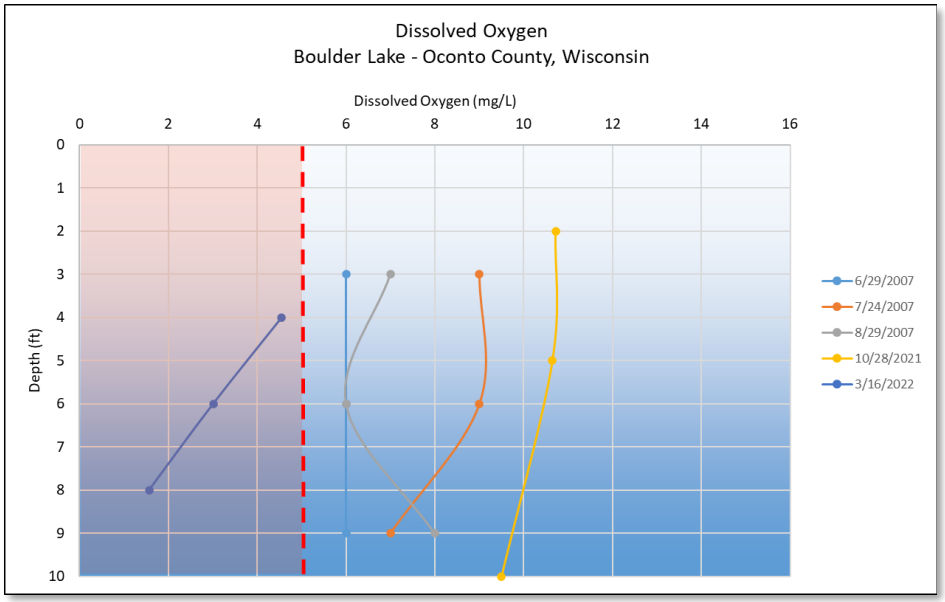
Temperature and Dissolved Oxygen

Temperature profiles for Boulder Lake illustrate a typical shallow, mixed lake with consistent temperatures with depth at each reading.



Dissolved oxygen is an important measure in Boulder Lake because a majority of organisms in the water depend on oxygen to survive. Oxygen is dissolved into the water from contact with air, which is increased by wind and wave action. Algae and aquatic plants also produce oxygen when sunlight enters the water, but the decomposition of dead plants and algae reduces oxygen in the lake.

Dissolved oxygen concentrations generally decline with depth as access to sources such as the atmosphere and growing plants is decreased. In Boulder Lake, oxygen levels stay relatively consistent with depth. At least 3-4 feet of water column retains sufficient oxygen concentrations for most fish species throughout the year.



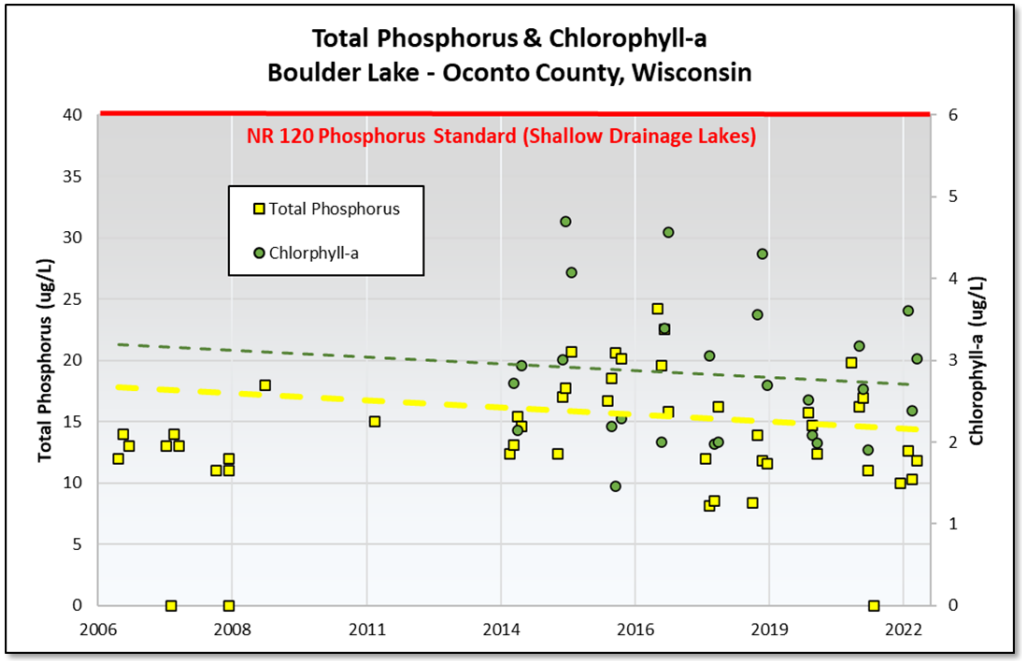
Contaminants

Chloride, sodium and potassium concentrations are commonly used as indicators of how a lake is being impacted by human activity. The presence of these compounds where they do not naturally occur indicates sources of water contaminants. Although these elements are not detrimental to the aquatic ecosystem, they indicate that sources of contaminants such as road salt, fertilizer, animal waste and/or septic system effluent may be entering the lake from either surface runoff or via groundwater. Measurements of these compounds was low.

Water Quality

Nutrients

Phosphorus is an element that is essential in trace amounts to most living organisms, including aquatic plants and algae. Naturally-occurring sources of phosphorus include soils and wetlands, and groundwater. Common sources from human activities include soil erosion, animal waste, fertilizers, and septic systems. Although a variety of compounds are important to biological growth, phosphorus receives so much attention because it is commonly the "limiting nutrient" in many Wisconsin lakes. Due to its relatively short supply compared to other substances necessary for growth, relatively small increases in phosphorus result in significant increases in aquatic plants and algae. NR 120, Wisconsin Administrative Code lists phosphorus limits for different lake types. Shallow drainage lakes such as Boulder have a standard of 40 ug/L they must stay below to remain healthy. Data from this study combined with historical data show concentrations in Boulder to be consistently below this standard with a slightly decreasing trend.



Be part of the solution!

Managing nitrogen, phosphorus and soil erosion throughout the Boulder Lake watershed is one of the keys to protecting the lake itself. Near shore activities that may increase the input of phosphorus to the lake include applying fertilizer, removing native vegetation (trees, bushes and grasses), mowing vegetation, and increasing the amount of exposed soil. Nitrogen inputs to a lake can be controlled by using lake-friendly land management decisions, such as the restoration of shoreland vegetation, elimination/reduction of fertilizers, proper management of animal waste and septic systems, and the use of water quality-based management practices.

Water Quality

Goal 6. Maintain or improve water quality in Boulder Lake.

Objective 6.1 Maintain median summer total phosphorus concentrations below 40 ug/L and fall inorganic nitrogen concentrations below 0.3 mg/L.

Actions	Lead person/group	Resources	Timeline
Inform others around the lake about the impact of nutrients and land management on water quality through the distribution of an Association newsletter and/or hosting a guest speaker at the annual meeting.		OCLWA WDNR UWEX Lakes	Ongoing
Refrain from the use of fertilizers. Encourage soil testing to determine if fertilizer is necessary.		OC UWEX	Ongoing
Encourage the restoration of unmowed vegetation to slow and absorb runoff and pollutants.		UWEX Lakes	

Objective 6.2 Continue to develop a good water quality dataset for Boulder Lake to monitor trends, declines and improvements over time.

Actions	Lead person/group	Resources	Timeline
Participate in CLMN and support volunteers collecting total phosphorus and chlorophyll-a data.	Trained volunteer	CLMN	3+ times annually-summer
Submit all collected data to WDNR for archival and use by scientists and resource managers.	Trained volunteer	WDNR	Ongoing

PEOPLE AND THE LAKE

The people who interact with the lake are a key component of the lake and its management. In essence a lake management plan is a venue by which people decide how they would like people to positively impact the lake. The plan summarizes the decisions of the people to take proactive steps to improve their lake and their community. Individual decisions by lake residents and visitors can have positive impacts on the lake and on those who enjoy this common resource. Collaborative efforts may have bigger positive impacts; therefore, communication and cooperation between the community and suite of lake users are essential to maximize the effects of plan implementation.

Boating hours, regulations, and fishing limits are examples of principles that are put into place to minimize conflicts between lake users and balance human activities with environmental considerations for the lake.

Recreation

According to survey responses, the lake is enjoyed for its scenery and fishing. There is one public boat launch located on the south side of the lake which is owned and maintained by the Town of Doty. There are also two private boat launches on the northeast side of the lake. No Wake is allowed between 5pm and 10am, or anytime in the lake's west bays (see map).

Additionally, no watercraft may operate "in an artificially bow-high manner, including wake enhancement" in waters less than 15 feet deep, which is all of Boulder Lake (Doty Ordinance 3.0507).

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Recreation

Dam

A dam at the outlet to Boulder Creek, owned by Oconto County, was installed in 1951 to raise and stabilize the water level of Boulder Lake. The 5-foot-high concrete structure has a hydraulic height of 2 feet and typically impounds about 850 acre-feet of water.

WI Dam Key Sequence No.: 1357
National Inventory of Dams No.: WI10365

Goal 7. Lake users will be informed about and respectful of Boulder Lake.

Objective 7.1 Cultivate an environment of compliance amongst lake users.

Actions	Lead person/group	Resources	Timeline
Work with other lake groups and towns to support a recreational officer and municipal court for enforcement of regulations, including 'No Wake' and safe boat operation.	BLA	TOD OCLWA OC UWEX	Ongoing
Inform residents and consider posting signage of "DNR Hotline" to report unlawful behavior. (1-800-TIP-WDNR)	BLA	WDNR	Ongoing

Communication and Organization

Working together on common values will help to achieve the goals outlined in this plan. This will involve communication between individuals, the Town of Doty, Oconto County, resource managers, and elected officials. In addition, staying informed about lake- and groundwater-related topics will be essential to achieving the goals laid out in this plan. See the Oconto County Lake Information Directory in the Appendices for contact information.

Many of the goals outlined in this plan focus on distributing information to lake and watershed residents and lake users in order to help them make informed decisions that will result in a healthy Boulder Lake ecosystem that is enjoyed by many people. Working together on common values will help to achieve the goals that are outlined in this plan.

Goal 8. Increase participation in lake stewardship.

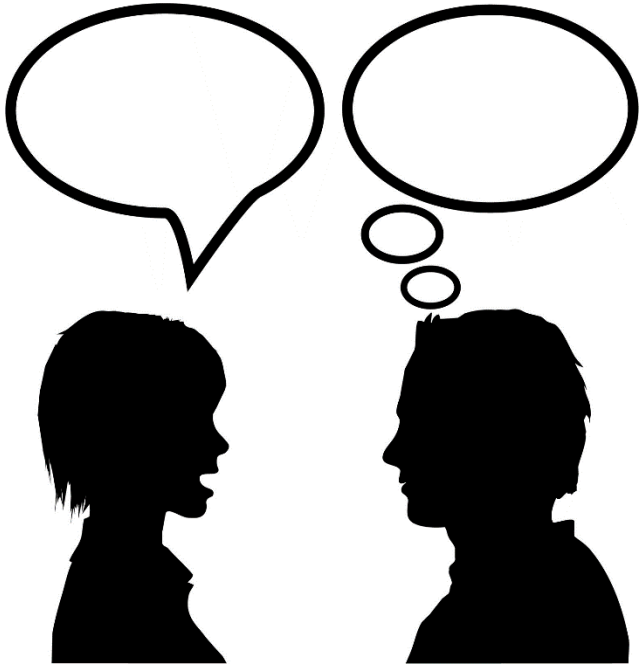
Objective 8.1 Develop opportunities and incentives for active participation in the management of Boulder Lake.

Actions	Lead person/group	Resources	Timeline
Maintain Association website and Facebook page: (https://boulderlakenews.org)	BLA		Ongoing
Maintain an email list of shoreland property owners and others interested in Boulder Lake.	BLA	OC UWEX	Ongoing
Communicate updates to lake management plan and management activities to residents and users of the lake and WDNR via meetings, email list and/or newsletter.	BLA		Ongoing
Host an annual meeting to discuss lake management and opportunities for shoreland property owners.	BLA		Annually
Host gatherings to learn about topics identified in this plan. Invite speakers or conduct demonstrations.	BLA	UWEX Lakes WDNR OCLCD	As needed
Identify ways to recruit 'next generation' of water quality monitors and AIS removers. Support interested persons in Lake Leaders Institute and/or Wisconsin Lakes Convention.	BLA	UWEX Lakes Lake Leaders	Ongoing
Distribute a welcome packet/mailing to all new shoreland property owners and rental properties with basic lake stewardship information/brochures. WDNR small-scale planning grants can pay for this.	BLA		

Communication & Organization

Objective 8.2 Maintain good, clear communication between lake association, its residents, clubs, municipalities, agency staff, elected officials and organizations interested in Boulder Lake.

Actions	Lead person/group	Resources	Timeline
Network with other lake groups in Oconto County by having Boulder Lake represented at OCLWA.	BLA	OC UWEX	Ongoing
Network with other lakes in the state to learn lake management strategies, etc. by having a representative attend the Wisconsin Lakes Convention.	BLA	UWEX Lakes	Annually in April
Consider nominating an individual from Boulder Lake for the Lake Leaders Institute.	BLA	UWEX Lakes	Ongoing



Updates and Revisions

Updates and Revisions

A management plan is a living document that changes over time to meet the current needs, challenges and desires of the lake and its community. The goals, objectives and actions listed in this plan should be reviewed annually and updated with any necessary changes. Partners listed in the plan should be contacted annually, and updated information complied. A list of changes/updates to the plan should be documented. To ensure that everyone is informed about changes, appropriate approval for changes should be acquired by all partners signing on to this plan.

Goal 9. Review plan annually and update as needed.

Objective 9.1 Communicate updates with lake community, Oconto County and WDNR.

Actions	Lead person/group	Resources	Timeline
Review plan annually and discuss accomplishments and identification of goals/objectives for coming year.	BLA		Annually
Formally update this plan every 5 years.	BLA	OC UWEX WDNR	

REFERENCES

Boat Ed, 2013. The Handbook of Wisconsin Boating Laws and Responsibilities. Approved by Wisconsin Department of Natural Resources. www.boat-ed.com

Borman, Susan, Robert Korth, and Jo Temte, 2001. Through the looking glass, a field guide to aquatic plants. Reindl Printing, Inc. Merrill, Wisconsin.

Dolata, Ken, Mohr, Dale and Turyk, Nancy, 2018. Operational Strategy and Plan for Surface Water Management and Protection in Oconto County.

Haney, Ryan, 2023. Boulder Lake Study Summary Report. Center for Watershed Science and Education-University of Wisconsin Stevens Point.

Haney, Ryan, 2023. State of the Oconto County Lakes. Center for Watershed Science and Education-University of Wisconsin-Stevens Point.

Paoli, Tammie, 2021. Boulder Lake Fisheries Survey Report, Wisconsin Department of Natural Resources.

Panuska and Lillie, 1995. Phosphorus Loadings from Wisconsin Watershed: Recommended Phosphorus Export Coefficients for Agricultural and Forested Watersheds. Bulletin Number 38, Bureau of Research, Wisconsin Department of Natural Resources.

Public Service Commission of Wisconsin, 1948. Opinions and Decisions of the Public Service Commission of Wisconsin, Volume XXXII. 410 pp.

Shaw, B., C. Mechenich, and L. Klessig, 2000. Understanding Lake Data. University of Wisconsin-Extension, Stevens Point. 20 pp.

APPENDICES

Appendix A

Appendix A. Oconto County Lake Information Directory

Algae - Blue-Green

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov
Website: http://dnr.wi.gov/lakes/bluegreenalgae

Contact: Wisconsin Department of Health Services
1 West Wilson Street, Madison, WI 53703
Phone: 608-267-3242
Website:
www.dhs.wisconsin.gov/eh/bluegreenalgae/contactus.htm

Aquatic Invasive Species/Clean Boats Clean Water

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov
Website: http://dnr.wi.gov/topic/Invasives/

Aquatic Plant Management

(Native and Invasive)

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov
Website: http://dnr.wi.gov/lakes/plants/

Aquatic Plant Identification

Contact: Dr. Emmet Judziewicz
UWSP Freckmann Herbarium
TNR 301, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-4248
E-mail: ejudziew@uwsp.edu

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov

Aquatic Plant Surveys/Management

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov
Website: http://dnr.wi.gov/lakes/plants/

Best Management Practices (rain gardens, shoreland buffers, agricultural practices, runoff controls)

Contact: Ken Dolata
Oconto County Land & Water Conservation Department
410 ½ East Main Street, Lena, WI 54139
Phone: 920-834-7152
E-mail: ken.dolata@co.oconto.wi.us
Website: http://www.co.oconto.wi.us/departments/

Boat Landings, Signage, Permissions (County)

Contact: Monty Brink
Oconto County Forestry/Park/Recreation
301 Washington Street, Oconto, WI 54153
Phone: 920-834-6995
E-mail: monty.brink@co.oconto.wi.us
Website: http://www.co.oconto.wi.us/departments/

Boat Landings (State)

Contact: Tammie Paoli
Wisconsin Department of Natural Resources
101 N. Ogden Road, Peshtigo, WI 54157
Phone: 715-582-5052
E-mail: Tammie.Paoli@wisconsin.gov
Website: http://dnr.wi.gov/org/land/facilities/boataccess/

Appendix A

Boat Landings (Town)

Contact the clerk for the specific town/village in which the boat landing is located.

Conservation Easements

Contact: Gathering Waters Conservancy
211 S. Paterson St., Suite 270, Madison, WI 53703
Phone: 608-251-9131
E-mail: info@gatheringwaters.org
Website: http://gatheringwaters.org/

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov

Contact: Northeast Wisconsin Land Trust
14 Tri-Park Way, Suite 1, Appleton, WI 54914
Phone: 920-738-7265
E-mail: newlt@newlt.org
Website: www.newlt.org

Contact: NRCS Lena Service Center
410 ½ East Main Street, Lena, WI 54139
Phone: 920-829-5406

Critical Habitat and Sensitive Areas

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov
Website: http://dnr.wi.gov/lakes/criticalhabitat/

Dams

Contact: Meg Galloway
Wisconsin Department of Natural Resources
PO Box 7921, Madison, WI 53707
Phone: 608-266-7014
E-mail: meg.galloway@wisconsin.gov
Website: http://dnr.wi.gov/org/water/wm/dsfm/dams/

Fertilizers/Soil Testing

Contact: Dale Mohr
Oconto County UW- Extension
301 Washington Street, Oconto, WI 54153
Phone: 920-835-6845
E-mail: dale.mohr@wisc.edu
Website: http://oconto.uwex.edu

Fisheries Biologist (management, habitat)

Contact: Tammie Paoli
Wisconsin Department of Natural Resources
101 N. Ogden Road, Peshtigo, WI 54157
Phone: 715-582-5052
E-mail: Tammie.Paoli@wisconsin.gov
Website: http://dnr.wi.gov/fish/

Frog Monitoring—Citizen Based

Contact: Andrew Badje
Wisconsin Department of Natural Resources
Phone: 608-785-9472
E-mail: Andrew.badje@wisconsin.gov
Website: WFTS@wisconsin.gov

Grants

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov
Website: http://dnr.wi.gov/Aid/Grants.html

Appendix A

Contact: Ken Dolata
Oconto County Land & Water Conservation Department
410 ½ East Main Street, Lena, WI 54139
Phone: 920-834-7152
E-mail: ken.dolata@co.oconto.wi.us
Website: http://www.co.oconto.wi.us/departments/

Groundwater Quality

Contact: Kevin Masarik
UWSP Center for Watershed Science & Education
TNR 224, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-4276
E-mail: kmasarik@uwsp.edu
Website: http://www.uwsp.edu/cnr/watersheds/

Groundwater Levels/Quantity

Contact: Ken Dolata
Oconto County Land & Water Conservation Department
410 ½ East Main Street, Lena, WI 54139
Phone: 920-834-7152
E-mail: ken.dolata@co.oconto.wi.us
Website: http://www.co.oconto.wi.us/departments/

Contact: George Kraft
UWSP Center for Watershed Science & Education
TNR 224, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-2984
E-mail: george.kraft@uwsp.edu

Informational Packets

Contact: UW Extension - Lakes
TNR 224, 800 Reserve St. Stevens Point, WI 54481
Phone: 715-346-2116
E-mail: uwexlakes@uwsp.edu

Lake Groups – Friends, Associations, Districts

Contact: Dale Mohr
Oconto County UW- Extension
301 Washington Street, Oconto, WI 54153
Phone: 920-835-6845
E-mail: dale.mohr@wisc.edu
Website: http://oconto.uwex.edu

Contact: Patrick Goggin
UWEX Lakes
TNR 203, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-365-8943
E-mail: pgoggin@uwsp.edu
Website: http://www.uwsp.edu/cnr/uwexlakes/organizations/

Contact: Eric Olson
UWEX Lakes
TNR 206, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-2192
E-mail: eolson@uwsp.edu
Website: http://www.uwsp.edu/cnr/uwexlakes/organizations/

Contact: Susan Tesarik
Wisconsin Lakes
4513 Vernon Blvd., Suite 101, Madison, WI 53705
Phone: 1-800-542-5253
E-mail: lakeinfo@wisconsinlakes.org
Website: http://wisconsinlakes.org/

Lake Levels

See: Groundwater

Lake-Related Law Enforcement (no-wake, transporting invasives, etc.)

Contact: Ben Mott
State Conservation Warden
Wisconsin Department of Natural Resources
427 E. Tower Drive, Suite 100, Wautoma, WI 54982
Phone: 920-896-3383
Website: http://www.wigamewarden.com/

Appendix A

Land Use Plans and Zoning Ordinances

Contact: Patrick Virtues
Oconto County Planning/Zoning/Solid Waste
301 Washington Street, Oconto, WI 54153
Phone: 920-834-6827
E-mail: Patrick.virtues@co.oconto.wi.us
Website: http://www.co.waushara.wi.us/zoning.htm

Contact: UWSP Center for Land Use Education
TNR 208, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-3783
E-mail: Center.for.Land.Use.Education@uwsp.edu
Website: http://www.uwsp.edu/cnr/landcenter/

Nutrient Management Plans

Contact: Ken Dolata
Oconto County Land & Water Conservation Department
410 ½ East Main Street, Lena, WI 54139
Phone: 920-834-7152
E-mail: ken.dolata@co.oconto.wi.us
Website: http://www.co.oconto.wi.us/departments/

Contact: NRCS Lena Service Center
410 ½ East Main Street, Lena, WI 54139
Phone: 920-829-5406

Parks (County)

Contact: Monty Brink
Oconto County Forestry/Park/Recreation
301 Washington Street, Oconto, WI 54153
Phone: 920-834-6995
E-mail: monty.brink@co.oconto.wi.us
Website: http://www.co.oconto.wi.us/departments/

Purchase of Development Rights

Contact: Northeast Wisconsin Land Trust
14 Tri-Park Way, Suite 1, Appleton, WI 54914
Phone: 920-738-7265
E-mail: newlt@newlt.org
Website: www.newlt.org

Purchase of Land

Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov
Website: http://dnr.wi.gov/topic/stewardship/

Rain Gardens and Stormwater Runoff

Contact: Ken Dolata
Oconto County Land & Water Conservation Department
410 ½ East Main Street, Lena, WI 54139
Phone: 920-834-7152
E-mail: ken.dolata@co.oconto.wi.us
Website: http://www.co.oconto.wi.us/departments/

Septic Systems/Onsite Waste

Contact: Patrick Virtues
Oconto County Planning/Zoning/Solid Waste
301 Washington Street, Oconto, WI 54153
Phone: 920-834-6827
E-mail: Patrick.virtues@co.oconto.wi.us
Website: http://www.co.waushara.wi.us/zoning.htm

Shoreland Management

Contact: Ken Dolata
Oconto County Land & Water Conservation Department
410 ½ East Main Street, Lena, WI 54139
Phone: 920-834-7152
E-mail: ken.dolata@co.oconto.wi.us
Website: http://www.co.oconto.wi.us/departments/

Shoreland Vegetation

http://dnr.wi.gov/topic/ShorelandZoning/

Shoreland Zoning Ordinances

See: Land Use Plans and Zoning Ordinances

Appendix A

Soil Fertility Testing
Contact: Dale Mohr
Oconto County UW- Extension
301 Washington Street, Oconto, WI 54153
Phone: 920-835-6845
E-mail: dale.mohr@wisc.edu
Website: http://oconto.uwex.edu

Water Quality Monitoring
Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov

Water Quality Problems
Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-360-3167
E-mail: brenda.nordin@wisconsin.gov

Wetlands
Contact: Jason Fleener
Wisconsin Department of Natural Resources
GEF2 DNR Central Office, Madison, WI 53707
Phone: 608-266-7408
E-mail: Jason.fleener@wisconsin.gov
Website: http://dnr.wi.gov/wetlands/

Contact: Wisconsin Wetlands Association
214 N. Hamilton Street, #201, Madison, WI 53703
Phone: 608-250-9971
Email: info@wisconsinwetlands.org

Wetland Inventory
Contact: Dr. Emmet Judziewicz
UWSP Freckmann Herbarium
TNR 301, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-4248
E-mail: ejudziew@uwsp.edu

Woody Habitat
Contact: Tammie Paoli
Wisconsin Department of Natural Resources
101 N. Ogden Road, Peshtigo, WI 54157
Phone: 715-582-5052
E-mail: Tammie.Paoli@wisconsin.gov
Website: http://dnr.wi.gov/fish/

Appendix B. Rapid Response Plan

REPORTING A SUSPECTED INVASIVE SPECIES

1. Collect specimens or take photos.

Regardless of the method used, provide as much information as possible. Try to include flowers, seeds or fruit, buds, full leaves, stems, roots and other distinctive features. In photos, place a coin, pencil or ruler for scale. Deliver or send specimen ASAP.

Collect, press and dry a complete sample. This method is best because a plant expert can then examine the specimen.

-OR-

Collect a fresh sample. Enclose in a plastic bag with a moist paper towel and refrigerate.

-OR-

Take detailed photos (digital or film).

2. Note the location where the specimen was found.

If possible, give the exact geographic location using a GPS (global positioning system) unit, topographic map, or the Wisconsin Gazetteer map book. If using a map, include a photocopy with a dot showing the plant's location.

Provide one or more of the following:

- Latitude & Longitude
- UTM (Universal Transverse Mercator) coordinates
- County, Township, Range, Section, Part-section
- Precise written site description, noting nearest city & road names, landmarks, local topography

3. Gather information to aid in positive species identification.

- Collection date and county
- Your name, address, phone, email
- Exact location (lat/long or UTM, Township/Range)
- Plant name
- Land ownership (if known/applicable)
- Population description (estimated # plants, area covered)
- Habitat type where found (forest, field, prairie, wetland, open water)

4. **Mail or bring specimens and information to any of the following locations (digital photos may be emailed):**

Wisconsin Dept. Natural Resources
2984 Shawano Avenue,
Green Bay, WI 54313
Phone: (920) 662-5100

UW-Stevens Point Herbarium
301 Trainer Natural Resources Building
800 Reserve Street
Stevens Point, WI 54481
Phone: 715-346-4248
E-Mail: ejudziew@uwsp.edu

Wisconsin Invasive Plants Reporting & Prevention Project
Herbarium-UW-Madison
430 Lincoln Drive
Madison, WI 53706
Phone: (608) 267-7612
E-Mail: invasiveplants@mailplus.wisc.edu

Appendix C

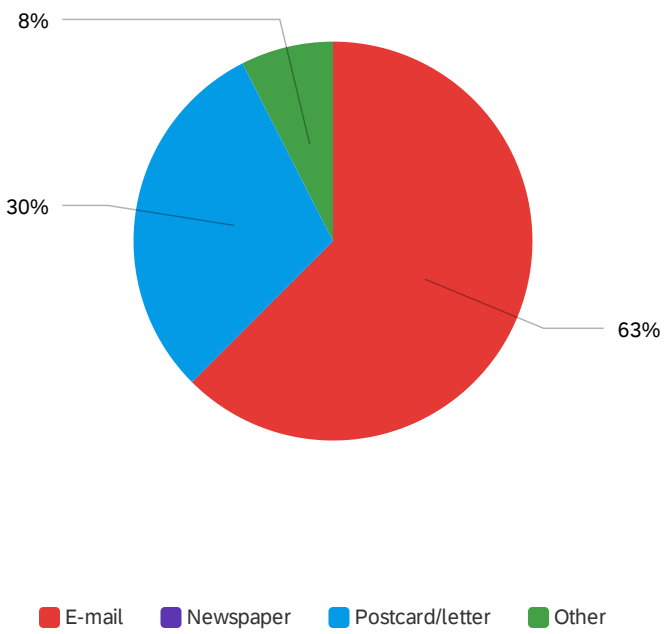
Appendix C. Lake User Survey Results

Default Report

Boulder Lake Survey - Oconto County Lakes Project

March 5, 2024 3:16 PM MST

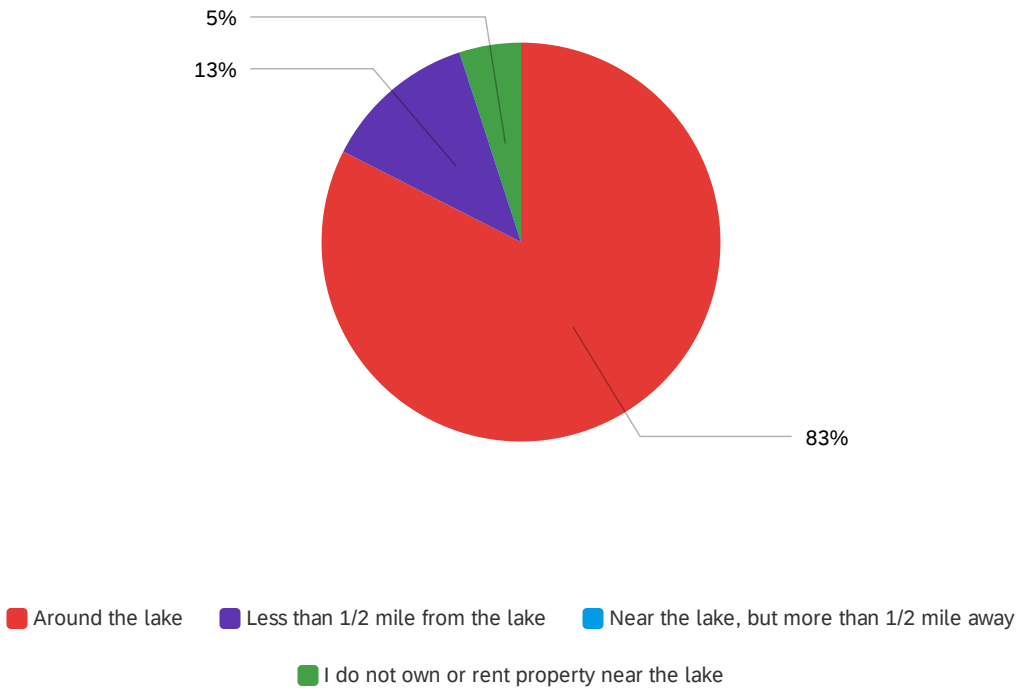
Q2 - How did you hear about this survey?



#	Field		Choice Count
1	E-mail	63%	25
2	Newspaper	0%	0
3	Postcard/letter	30%	12
4	Other	8%	3
			40

Showing rows 1 - 5 of 5

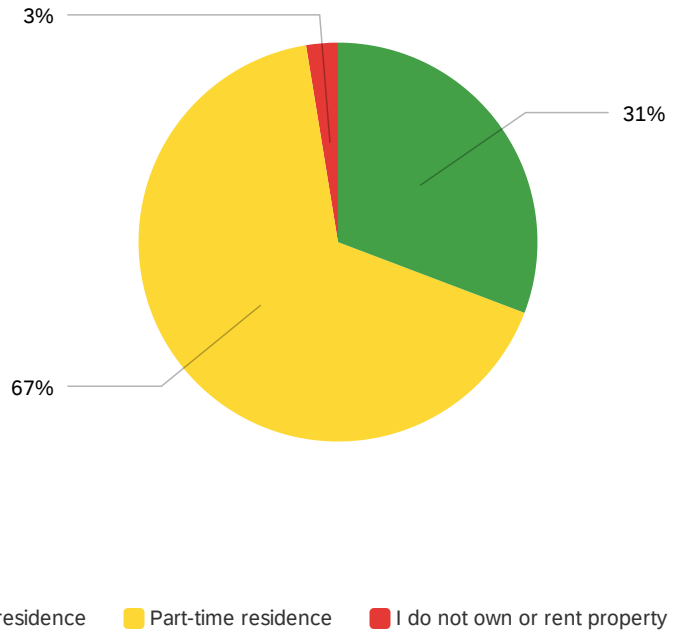
Q3 - Do you own or rent property...



#	Field		Choice Count
1	Around the lake	83%	33
2	Less than 1/2 mile from the lake	13%	5
3	Near the lake, but more than 1/2 mile away	0%	0
4	I do not own or rent property near the lake	5%	2
			40

Showing rows 1 - 5 of 5

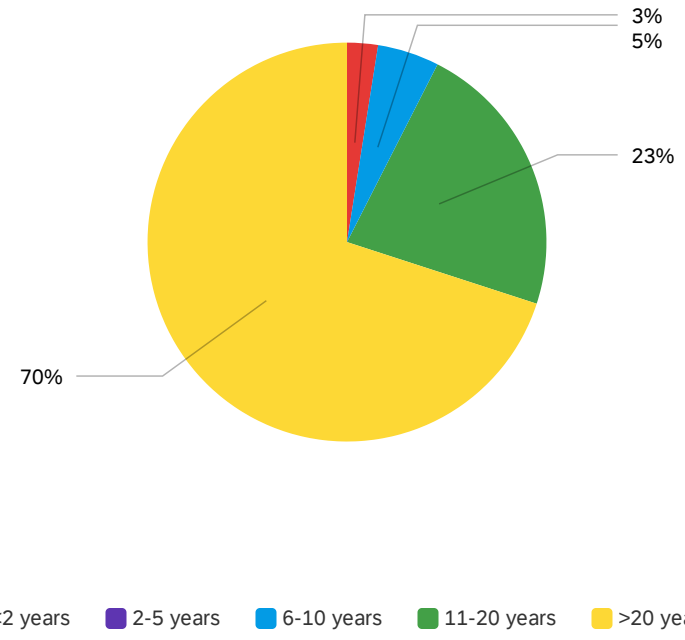
Q4 - If you own or rent property near the lake, is this property your...



#	Field		Choice Count
1	Permanent residence	31%	12
2	Part-time residence	67%	26
3	I do not own or rent property near the lake	3%	1
			39

Showing rows 1 - 4 of 4

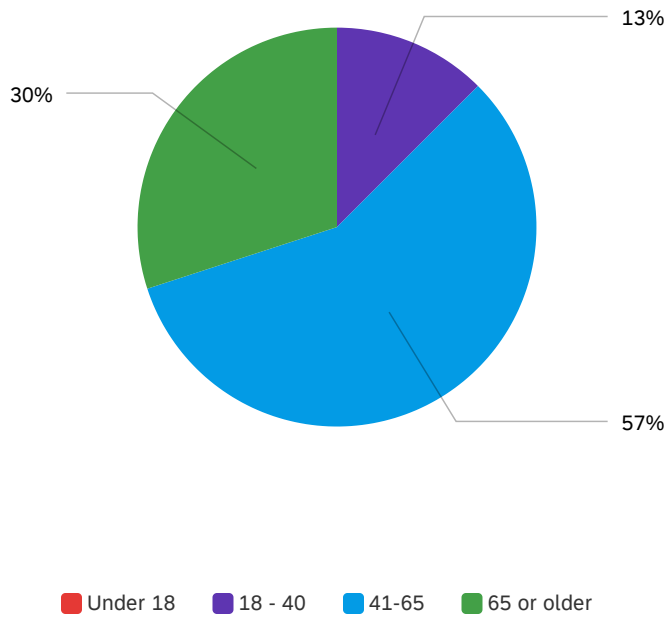
Q5 - How long have you lived on, visited or recreated on the lake?



#	Field		Choice Count
1	<2 years	3%	1
2	2-5 years	0%	0
3	6-10 years	5%	2
4	11-20 years	23%	9
5	>20 years	70%	28
			40

Showing rows 1 - 6 of 6

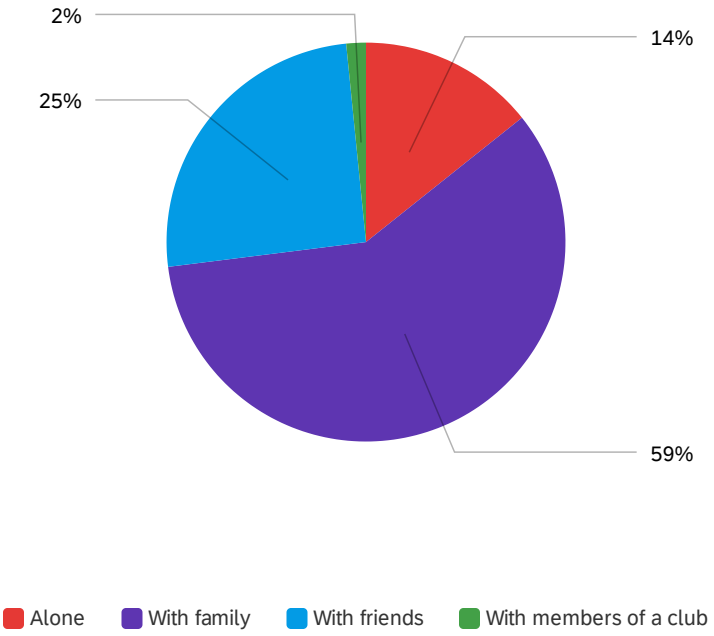
Q8 - Which category below includes your age?



#	Field		Choice Count
1	Under 18	0%	0
2	18 - 40	13%	5
3	41-65	57%	23
4	65 or older	30%	12
			40

Showing rows 1 - 5 of 5

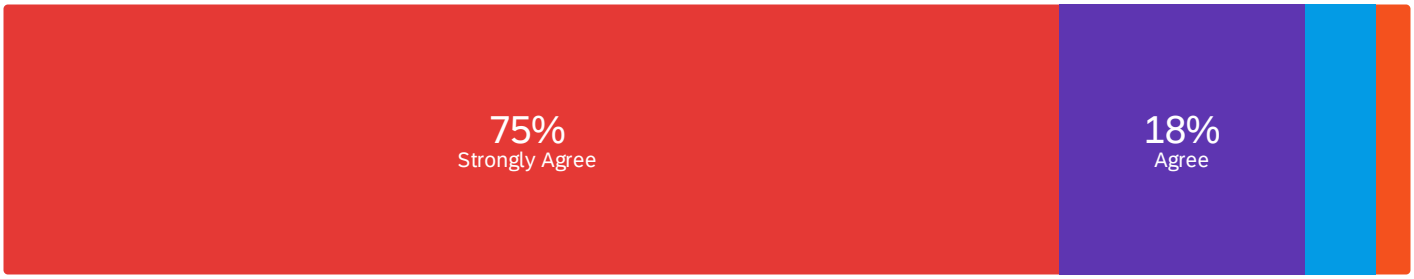
Q9 - When you visit Boulder Lake, are you typically ...(check all that apply)



#	Field		Choice Count
1	Alone	14%	9
2	With family	59%	37
3	With friends	25%	16
4	With members of a club	2%	1
			63

Showing rows 1 - 5 of 5

Q10 - I live on or near the lake...



#	Field	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	I do not live on or near the lake	Total
1	To spend time with family or friends	75% 30	18% 7	5% 2	0% 0	0% 0	3% 1	40
2	For the peace and tranquility	70% 28	25% 10	3% 1	0% 0	0% 0	3% 1	40
3	Because I enjoy the view	85% 34	13% 5	0% 0	0% 0	0% 0	3% 1	40
4	Because its a good investment	31% 12	18% 7	41% 16	0% 0	5% 2	5% 2	39

Showing rows 1 - 4 of 4

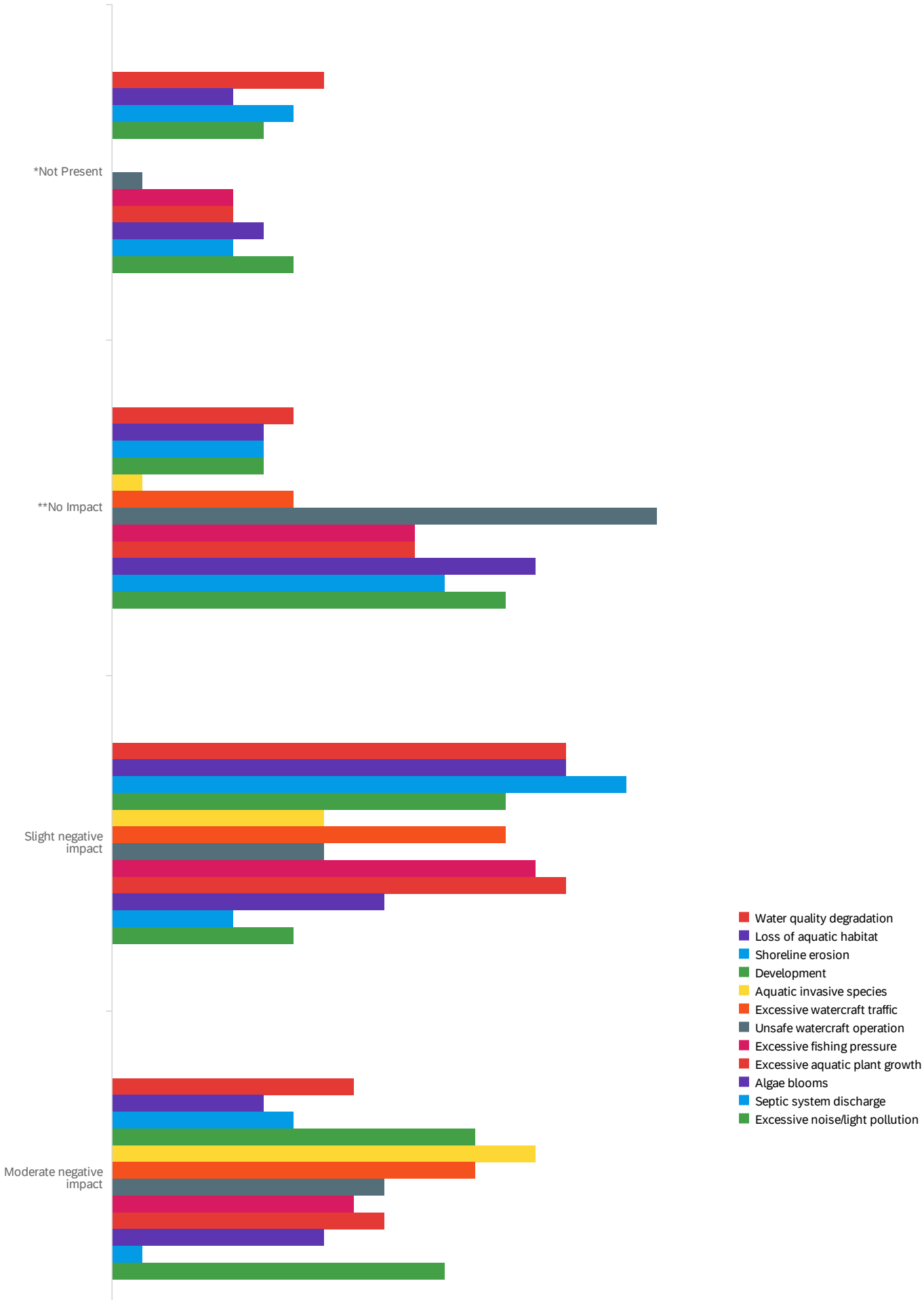
Q11 - What do you value most about Boulder Lake?

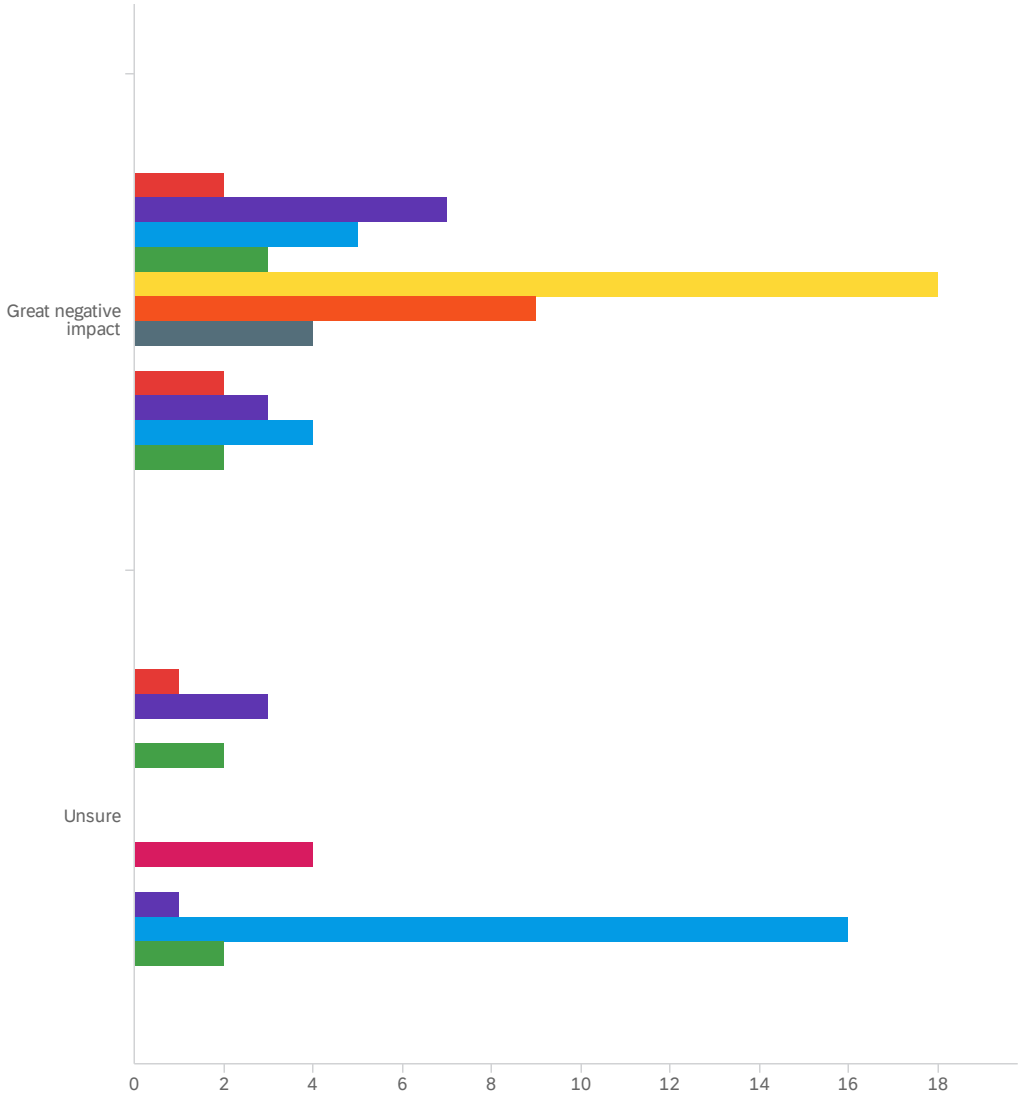
What do you value most about Boulder Lake?
The clear water
The clarity
The fishing
How clean it is
Boating
We enjoy the natural beauty, the wildlife, canoeing on the lake, memories of how Boulder Lake used to be as I grew up there. We value the peace and quiet, the sunsets and listening to the loons.
Nature
The peacefulness of the area
It’s clean clear water.
Quiet, view and water quality
It is a fun place to get away with family and be out on the water
The time spent with spouse/family. Enjoying nature. Not crazy about weekend crowds.
The lake supports fish, eagles (at least in the past although they seem to have moved), and the ability to utilize the lake even in a Kayak without being overrun with powerboats.
I value the quietness, the wildlife (loons, eagles, otters), and the use of the lake for swimming fishing and kayaking.
I most value the lake as a fishery. I have been fishing this lake annually for over 40 years.
its clear clean water and the tranquility
fishing and recreation
Wildlife, fishing, swimming with family, boating.
Sunsets and sand beach - loons, eagles and the serenity of the whole lake.
Time I spend with family and to relax.
Clear clean water limited evasive species

What do you value most about Boulder Lake?

How clean it is
Water clarity
Having loons, eagles and nature in general
The clear water
Family time spent on the lake
clean and uncrowded
Spring fed clarity
how quiet it is here
Great swimming area by our property
The clean water and beauty of the lake and forest.
Clear water and sand/gravel bottom
pristine area nestled in the National Forest. Clear water, amazing views
Clean waters, constant water levels
It's a mixed recreational and "quiet" lake depending on the time of day. Diverse use

Q42 - Below is a list of negative impacts commonly found in Wisconsin lakes. To what level do you believe each of the following factors may be impacting Boulder Lake? *Not Present means that you believe the issue does not exist on Boulder Lake**No Impact means that the issue may exist, but is not negatively impacting Boulder Lake


*Not Present
**No Impact
Slight negative impact
Moderate negative impact
Water quality degradation
Loss of aquatic habitat
Shoreline erosion
Development
Aquatic invasive species
Excessive watercraft traffic
Unsafe watercraft operation
Excessive fishing pressure
Excessive aquatic plant growth
Algae blooms
Septic system discharge
Excessive noise/light pollution



#	Field	*Not Present	**No Impact	Slight negative impact	Moderate negative impact	Great negative impact	Unsure	Total
1	Water quality degradation	18% 7	15% 6	38% 15	21% 8	5% 2	3% 1	39
2	Loss of aquatic habitat	10% 4	13% 5	38% 15	13% 5	18% 7	8% 3	39
3	Shoreline erosion	15% 6	13% 5	44% 17	15% 6	13% 5	0% 0	39
4	Development	13% 5	13% 5	33% 13	30% 12	8% 3	5% 2	40
5	Aquatic invasive species	0% 0	3% 1	18% 7	35% 14	45% 18	0% 0	40
6	Excessive watercraft traffic	0% 0	15% 6	33% 13	30% 12	23% 9	0% 0	40
7	Unsafe watercraft operation	3% 1	46% 18	18% 7	23% 9	10% 4	0% 0	39

#	Field	*Not Present	**No Impact	Slight negative impact	Moderate negative impact	Great negative impact	Unsure	Total
8	Excessive fishing pressure	10% 4	25% 10	35% 14	20% 8	0% 0	10% 4	40
9	Excessive aquatic plant growth	10% 4	25% 10	38% 15	23% 9	5% 2	0% 0	40
10	Algae blooms	13% 5	36% 14	23% 9	18% 7	8% 3	3% 1	39
11	Septic system discharge	10% 4	28% 11	10% 4	3% 1	10% 4	40% 16	40
12	Excessive noise/light pollution	15% 6	33% 13	15% 6	28% 11	5% 2	5% 2	40

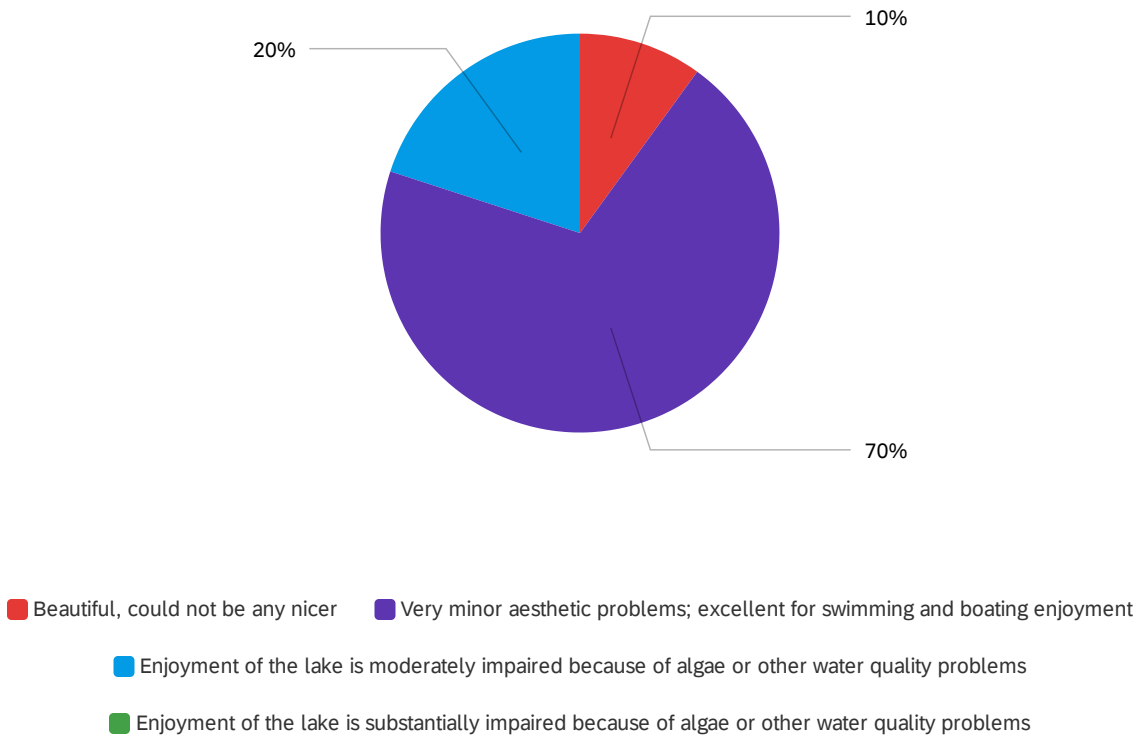
Showing rows 1 - 12 of 12

Q16 - How much impact does the water quality of Boulder Lake have on the following?

#	Field	Major impact	Some impact	No impact	Unsure	Total
1	Personal enjoyment value	70% 28	18% 7	10% 4	3% 1	40
2	Economic value	53% 21	25% 10	13% 5	10% 4	40

Showing rows 1 - 2 of 2

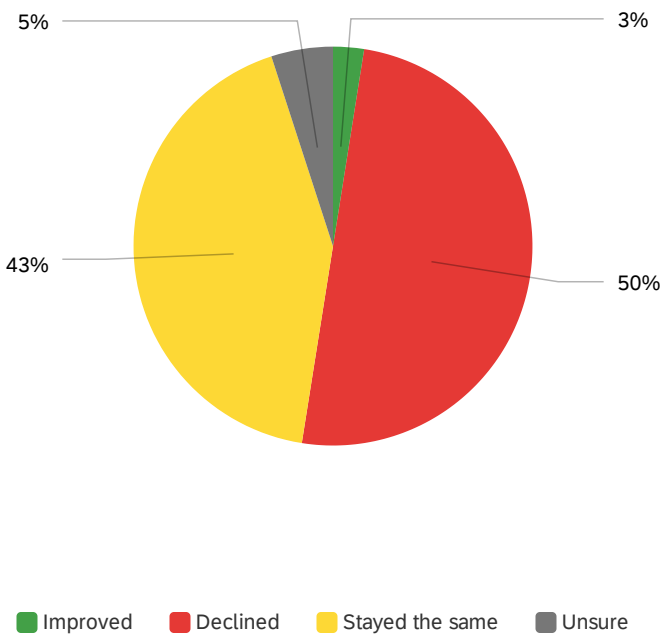
Q17 - Which statement best describes water clarity during the times you spend most on the lake?



#	Field		Choice Count
1	Beautiful, could not be any nicer	10%	4
2	Very minor aesthetic problems; excellent for swimming and boating enjoyment	70%	28
3	Enjoyment of the lake is moderately impaired because of algae or other water quality problems	20%	8
4	Enjoyment of the lake is substantially impaired because of algae or other water quality problems	0%	0
			40

Showing rows 1 - 5 of 5

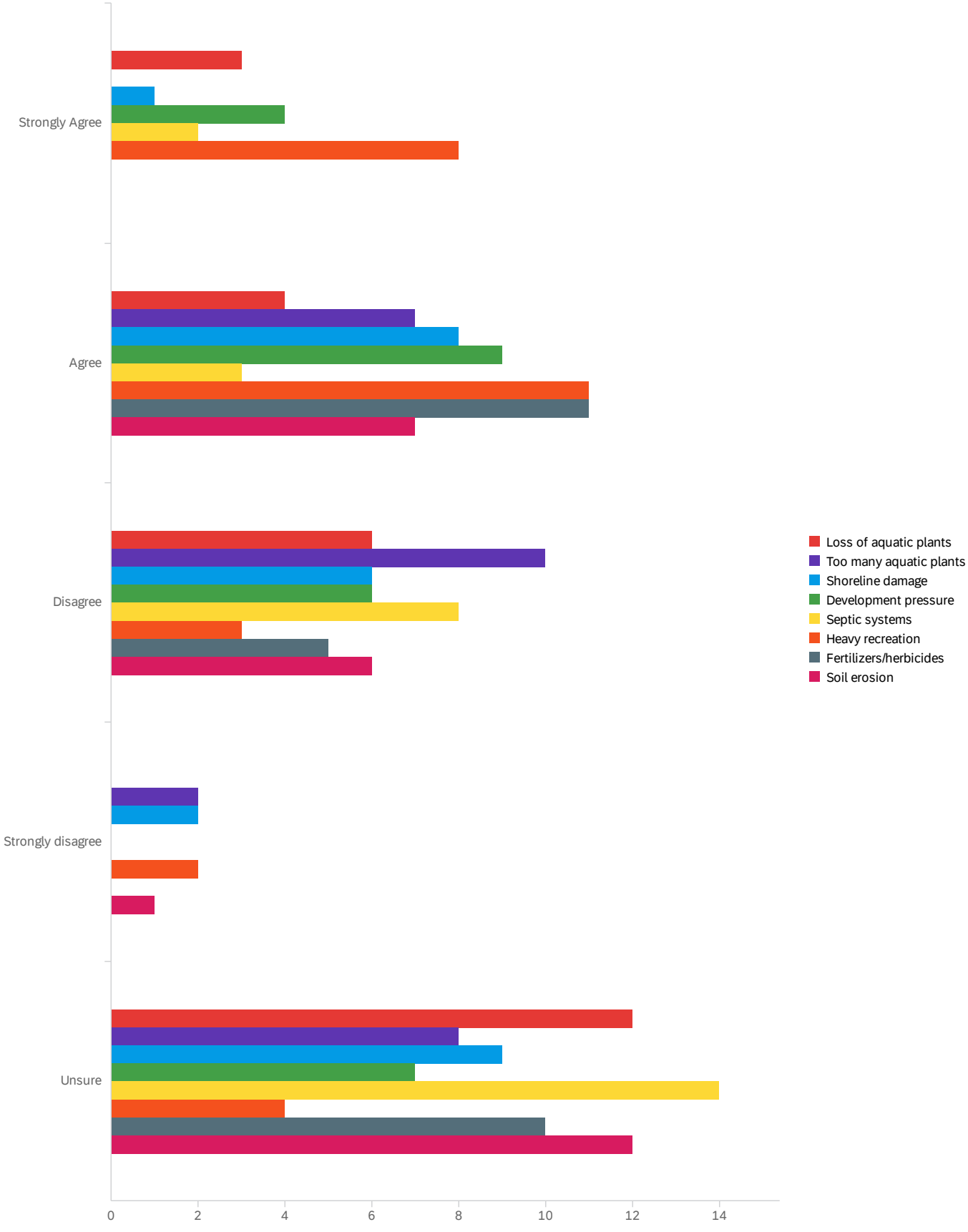
Q18 - During the time that you have lived on, visited or recreated on the lake, how would you say the water quality has changed?



#	Field		Choice Count
1	Improved	3%	1
2	Declined	50%	20
3	Stayed the same	43%	17
4	Unsure	5%	2
			40

Showing rows 1 - 5 of 5

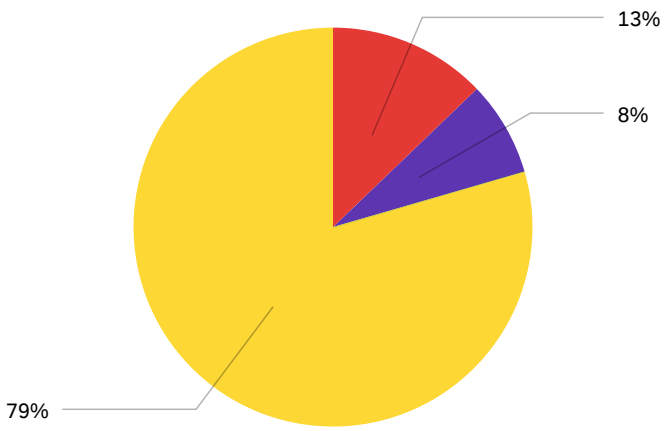
Q19 - If you think it has declined, what, in your opinion, are the primary causes?



#	Field	Strongly Agree		Agree		Disagree		Strongly disagree		Unsure		Total
1	Loss of aquatic plants	12%	3	16%	4	24%	6	0%	0	48%	12	25
2	Too many aquatic plants	0%	0	26%	7	37%	10	7%	2	30%	8	27
3	Shoreline damage	4%	1	31%	8	23%	6	8%	2	35%	9	26
4	Development pressure	15%	4	35%	9	23%	6	0%	0	27%	7	26
5	Septic systems	7%	2	11%	3	30%	8	0%	0	52%	14	27
6	Heavy recreation	29%	8	39%	11	11%	3	7%	2	14%	4	28
7	Fertilizers/herbicides	0%	0	42%	11	19%	5	0%	0	38%	10	26
8	Soil erosion	0%	0	27%	7	23%	6	4%	1	46%	12	26

Showing rows 1 - 8 of 8

Q20 - If you use fertilizers or herbicides on your land, where are they applied?

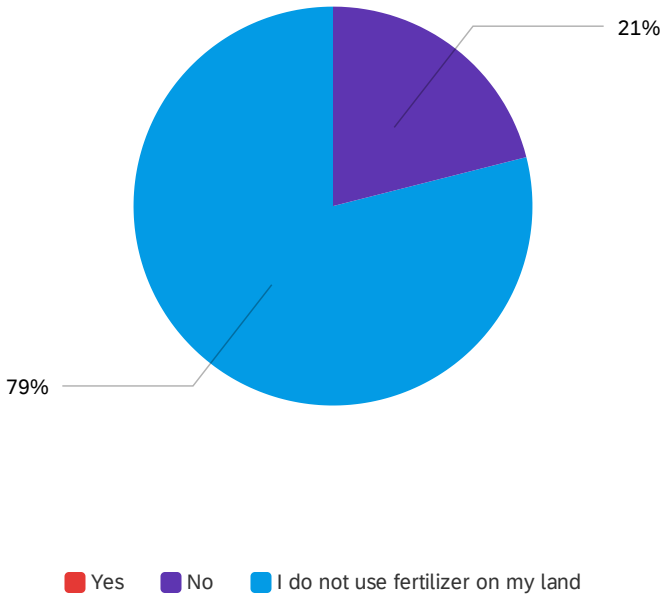


Lawn Garden Agricultural fields Other I do not use fertilizers or herbicides on my land

#	Field		Choice Count
1	Lawn	13%	5
2	Garden	8%	3
3	Agricultural fields	0%	0
4	Other	0%	0
5	I do not use fertilizers or herbicides on my land	79%	31
			39

Showing rows 1 - 6 of 6

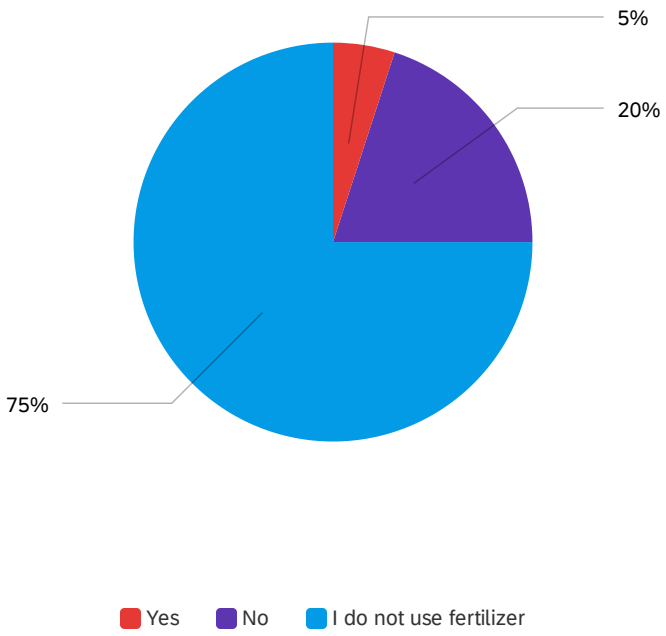
Q21 - Do you use fertilizer that contains phosphorus?



#	Field		Choice Count
1	Yes	0%	0
2	No	21%	8
4	I do not use fertilizer on my land	79%	30
			38

Showing rows 1 - 4 of 4

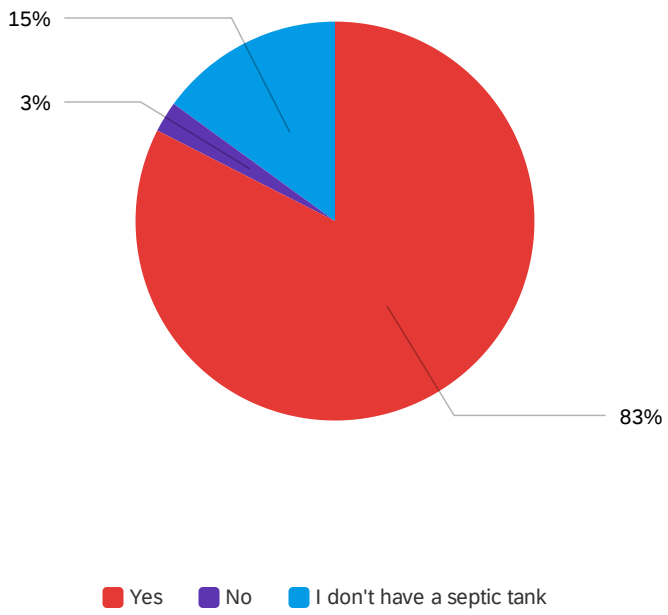
Q23 - Have you had your soil tested before using fertilizer?



#	Field		Choice Count
1	Yes	5%	2
2	No	20%	8
3	I do not use fertilizer	75%	30
			40

Showing rows 1 - 4 of 4

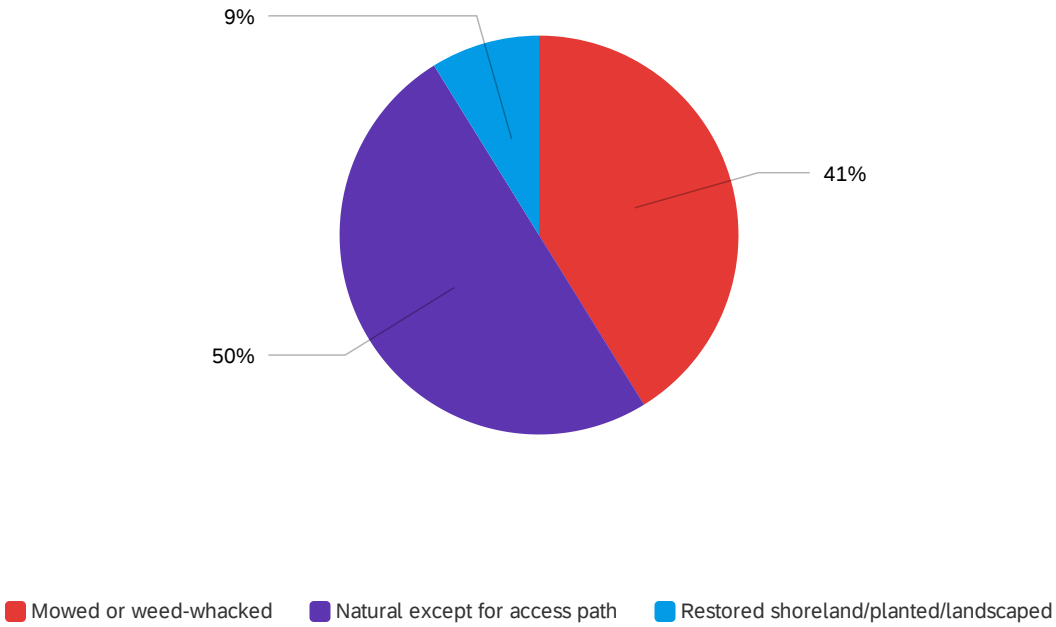
Q22 - Do you have your septic tank pumped regularly (at least every 3 years)?



#	Field		Choice Count
1	Yes	83%	33
2	No	3%	1
3	I don't have a septic tank	15%	6
			40

Showing rows 1 - 4 of 4

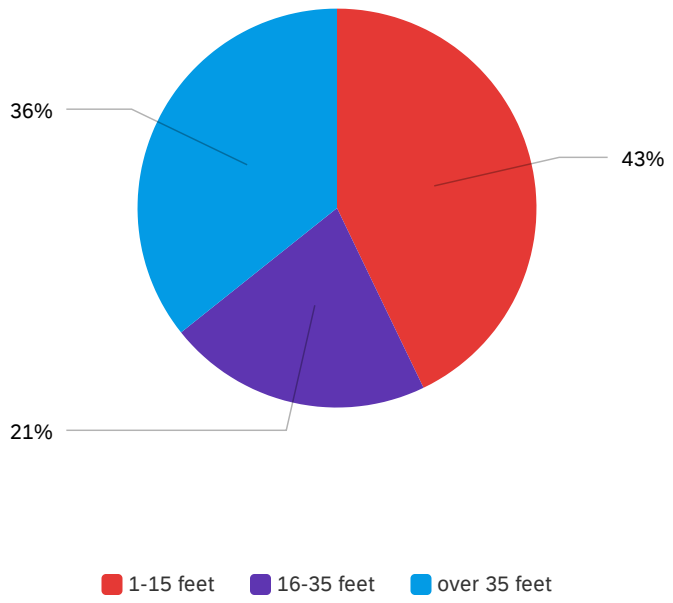
Q25 - How do you currently manage the majority of your property within 35 feet of the lake?



#	Field		Choice Count
1	Mowed or weed-whacked	41%	14
2	Natural except for access path	50%	17
3	Restored shoreland/planted/landscaped	9%	3
			34

Showing rows 1 - 4 of 4

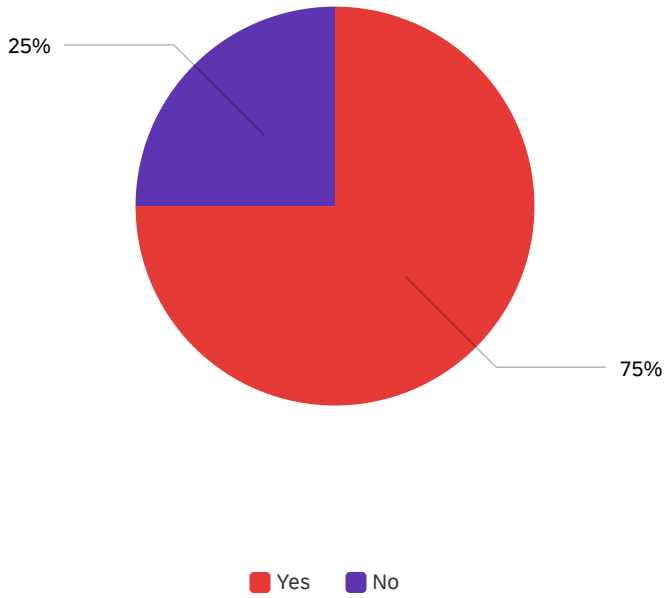
Q26 - If you have unmowed shoreland vegetation, how far inland from the water's edge does it extend?



#	Field		Choice Count
1	1-15 feet	43%	12
2	16-35 feet	21%	6
3	over 35 feet	36%	10
			28

Showing rows 1 - 4 of 4

Q31 - Do you have woody structure such as fallen trees or large branches in the shallow water along your property?



#	Field		Choice Count
1	Yes	75%	27
2	No	25%	9
			36

Showing rows 1 - 3 of 3

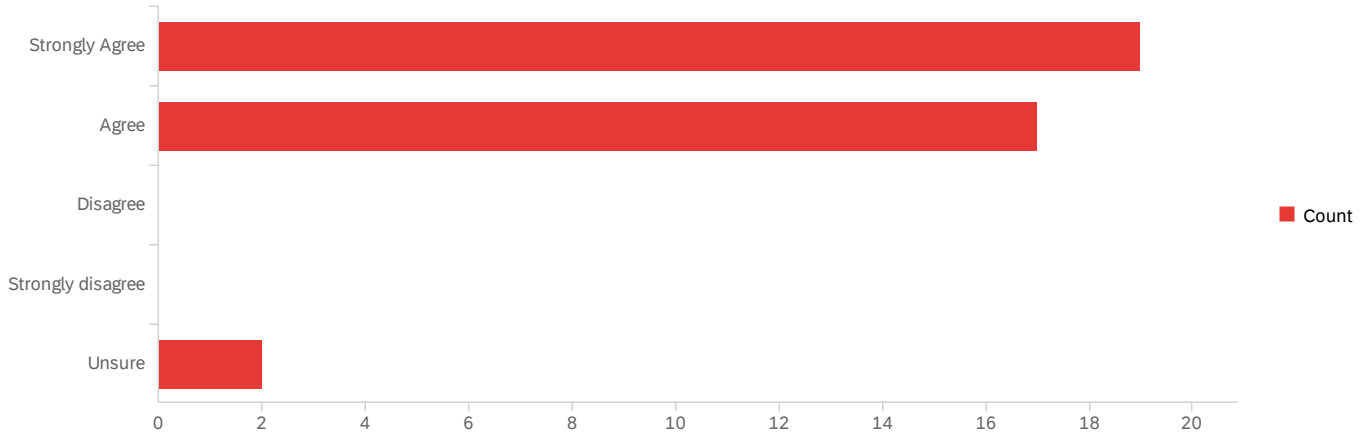
Q27 - In your opinion, does shoreland vegetation...

Strongly Agree Agree Disagree Strongly disagree Unsure

#	Field	Strongly Agree	Agree	Disagree	Strongly disagree	Unsure	Total
1	enhance the beauty of the property	38% 15	50% 20	8% 3	5% 2	0% 0	40
2	increase the economic value of the property	30% 12	30% 12	10% 4	5% 2	25% 10	40

Showing rows 1 - 2 of 2

Q28 - What might motivate you to change how you manage your shoreland?



#	Field	Strongly Agree	Agree	Disagree	Strongly disagree	Unsure	Total
1	Improving water quality	47% 18	42% 16	3% 1	0% 0	8% 3	38
2	Providing better habitat for fish and wildlife	50% 19	45% 17	0% 0	0% 0	5% 2	38
3	Available financial/technical assistance	34% 13	47% 18	3% 1	0% 0	16% 6	38
4	Savings on landscaping/maintenance costs	19% 7	35% 13	30% 11	3% 1	14% 5	37
5	Increasing my privacy	24% 9	46% 17	14% 5	0% 0	16% 6	37
6	Increasing my property value	32% 12	47% 18	13% 5	0% 0	8% 3	38

Showing rows 1 - 6 of 6

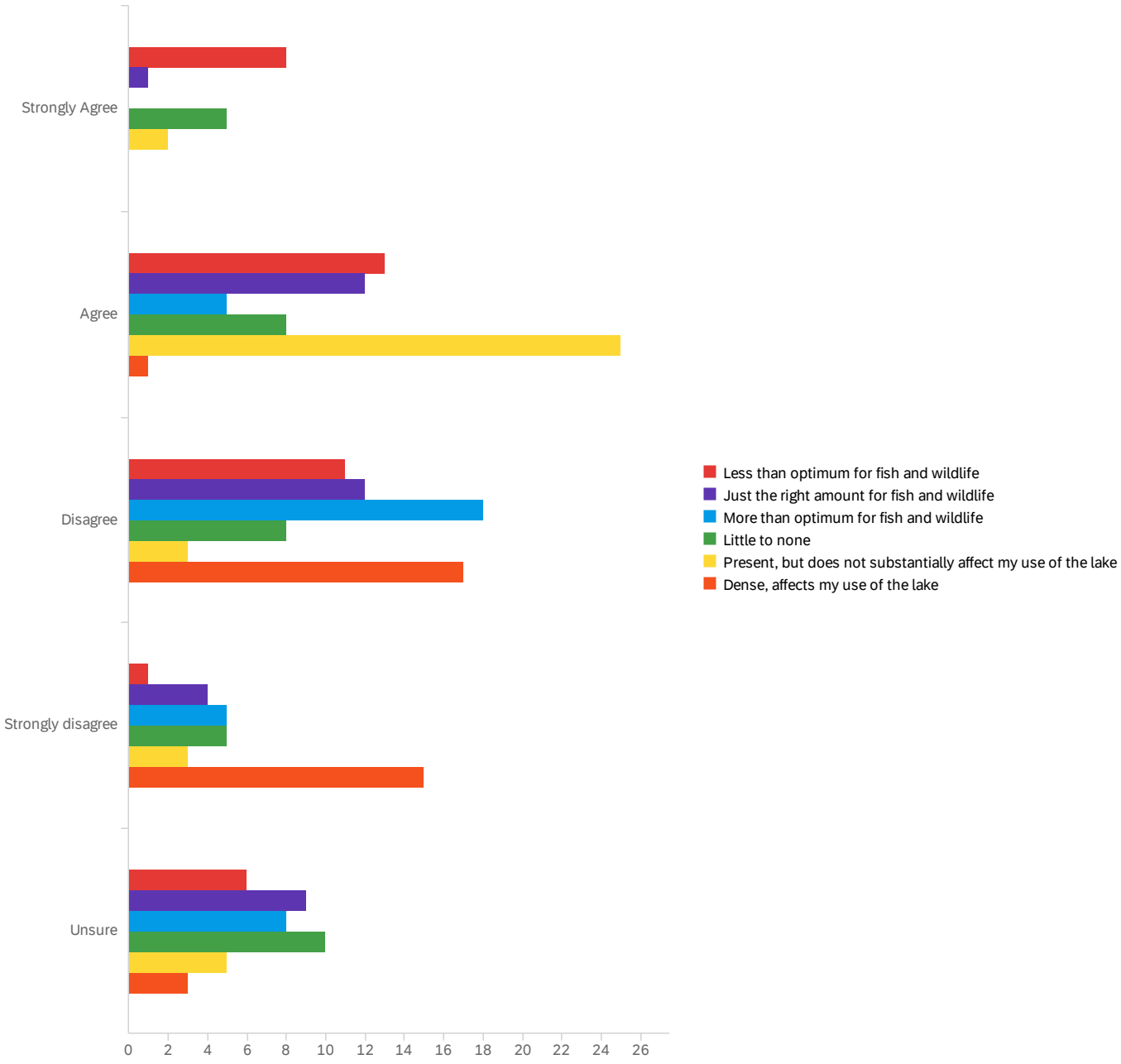
Q32 - In your opinion, which statement best describes the amount of aquatic plant growth in Boulder Lake?

#	Field	Strongly Agree		Agree		Disagree		Strongly disagree		Unsure		Total
1	Less than optimum for fish and wildlife	21%	8	33%	13	28%	11	3%	1	15%	6	39
2	Just the right amount for fish and wildlife	3%	1	32%	12	32%	12	11%	4	24%	9	38
3	More than optimum for fish and wildlife	0%	0	14%	5	50%	18	14%	5	22%	8	36
4	Little to none	14%	5	22%	8	22%	8	14%	5	28%	10	36
5	Present, but does not substantially affect my use of the lake	5%	2	66%	25	8%	3	8%	3	13%	5	38
6	Dense, affects my use of the lake	0%	0	3%	1	47%	17	42%	15	8%	3	36

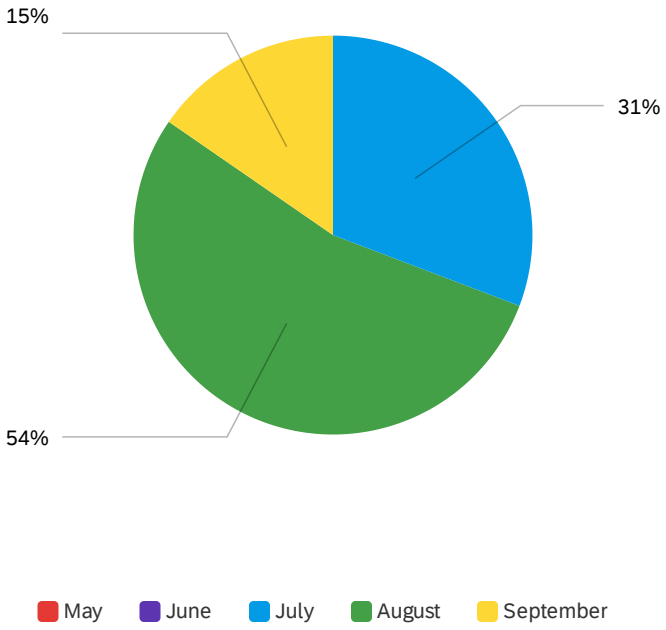
Showing rows 1 - 6 of 6

#	Field	Strongly Agree		Agree		Disagree		Strongly disagree		Unsure		Total
1	Less than optimum for fish and wildlife	21%	8	33%	13	28%	11	3%	1	15%	6	39
2	Just the right amount for fish and wildlife	3%	1	32%	12	32%	12	11%	4	24%	9	38
3	More than optimum for fish and wildlife	0%	0	14%	5	50%	18	14%	5	22%	8	36
4	Little to none	14%	5	22%	8	22%	8	14%	5	28%	10	36
5	Present, but does not substantially affect my use of the lake	5%	2	66%	25	8%	3	8%	3	13%	5	38
6	Dense, affects my use of the lake	0%	0	3%	1	47%	17	42%	15	8%	3	36

Showing rows 1 - 6 of 6


Strongly Agree
Agree
Disagree
Strongly disagree
Unsure
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Less than optimum for fish and wildlife
Just the right amount for fish and wildlife
More than optimum for fish and wildlife
Little to none
Present, but does not substantially affect my use of the lake
Dense, affects my use of the lake

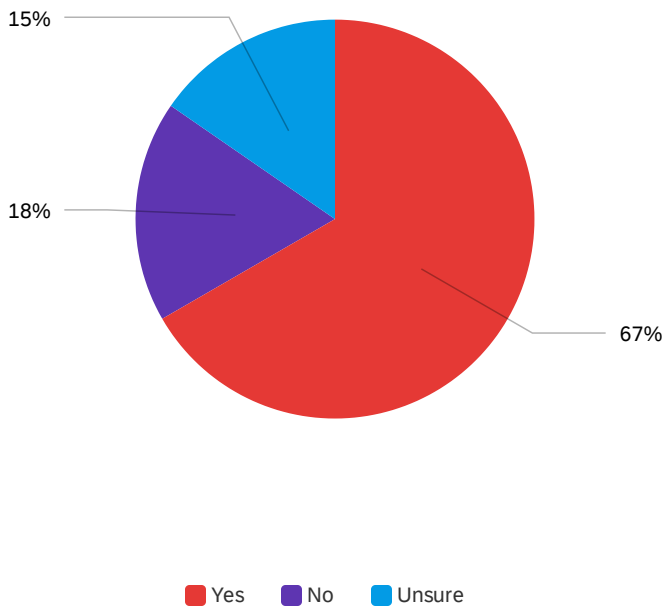
Q33 - If you think the plant growth in Boulder Lake is dense, what month(s) do the problems occur? Check all that apply.



#	Field	Choice Count	
1	May	0%	0
2	June	0%	0
3	July	31%	8
4	August	54%	14
5	September	15%	4
			26

Showing rows 1 - 6 of 6

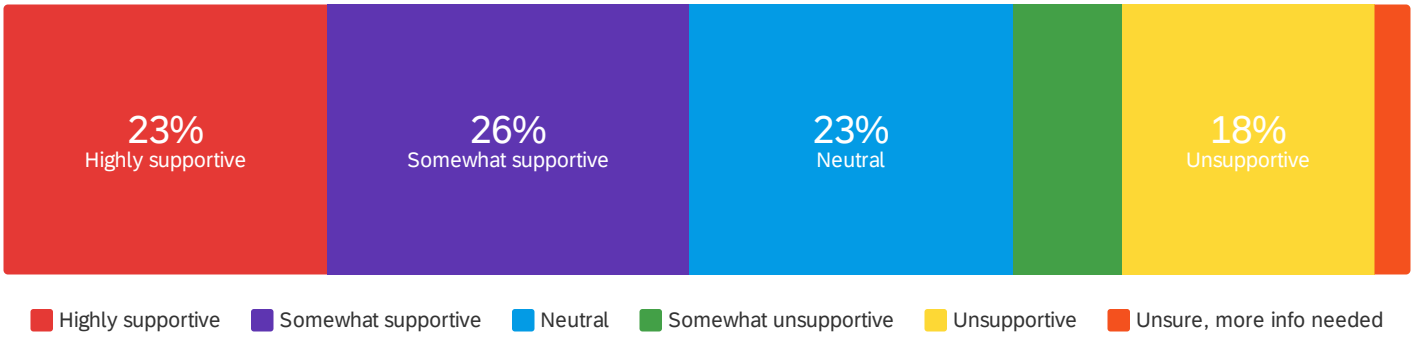
Q34 - Do you believe aquatic plant control is needed on Boulder Lake?

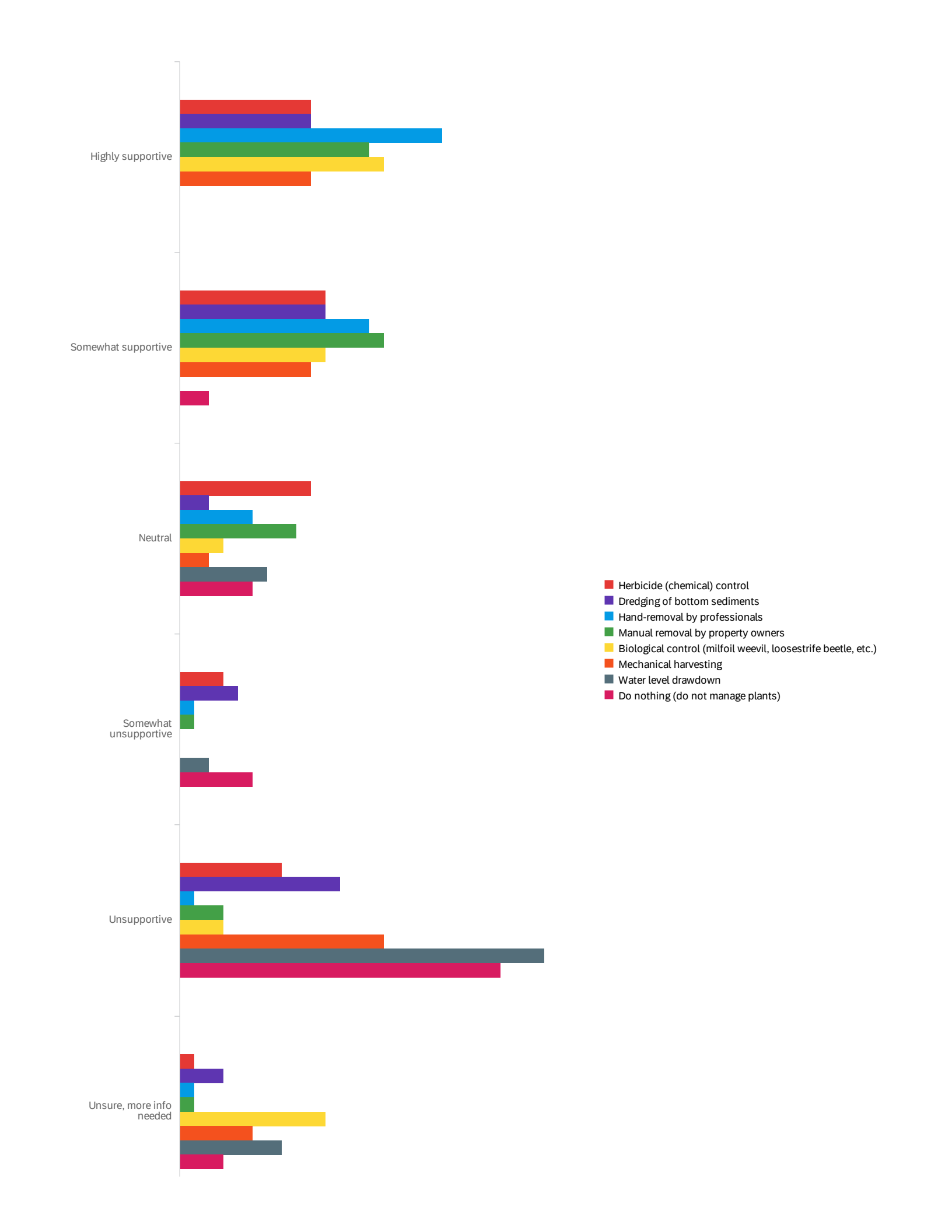


#	Field		Choice Count
1	Yes	67%	26
2	No	18%	7
3	Unsure	15%	6
			39

Showing rows 1 - 4 of 4

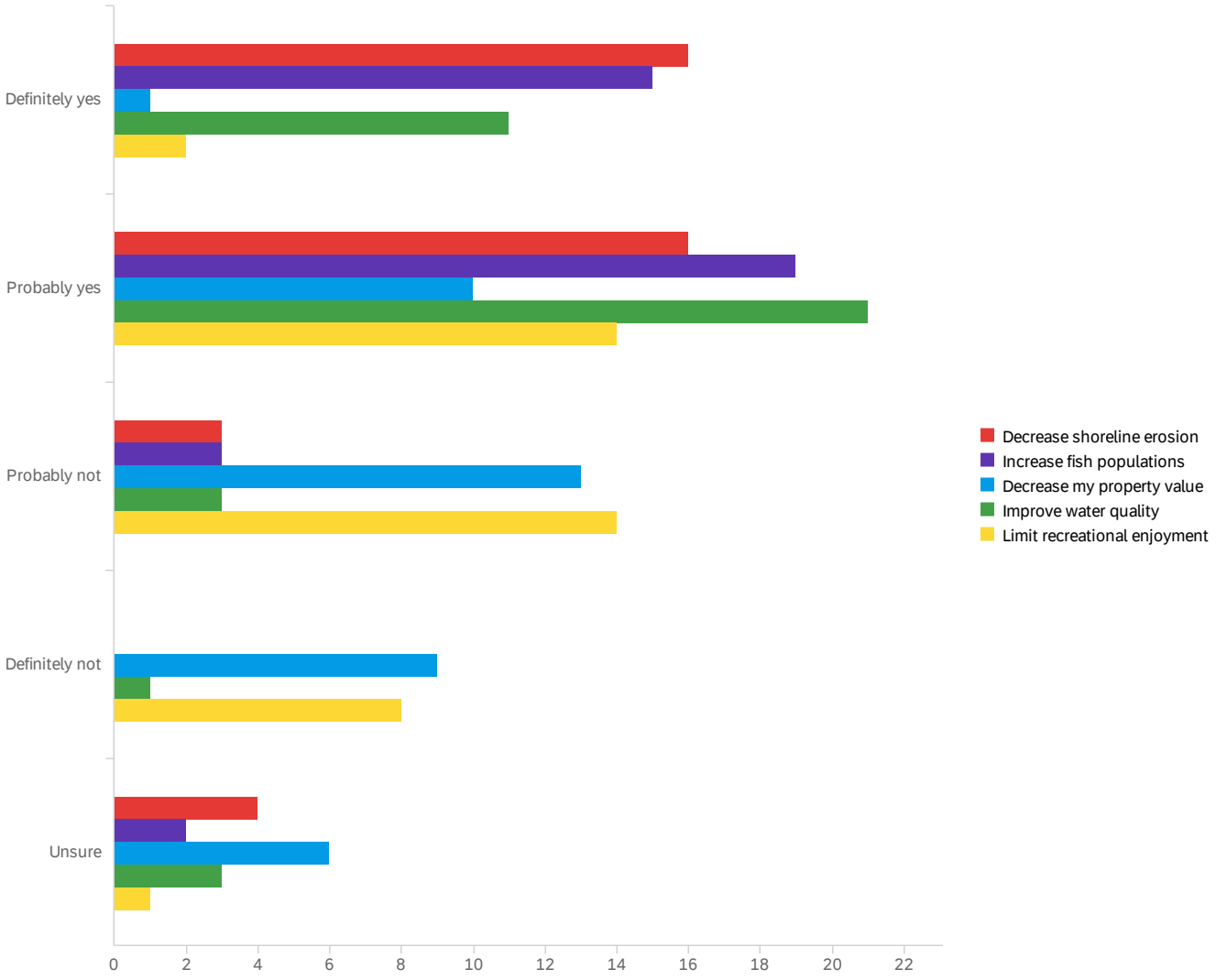
Q35 - What is your level of support for the responsible use of the following techniques to manage aquatic plants on Boulder Lake?




Highly supportive
Somewhat supportive
Neutral
Somewhat unsupportive
Unsupportive
Unsure, more info needed
Herbicide (chemical) control
Dredging of bottom sediments
Hand-removal by professionals
Manual removal by property owners
Biological control (milfoil weevil, loosestrife beetle, etc.)
Mechanical harvesting
Water level drawdown
Do nothing (do not manage plants)

0
2
4
6
8
10
12
14
16
18
20
22
24
26

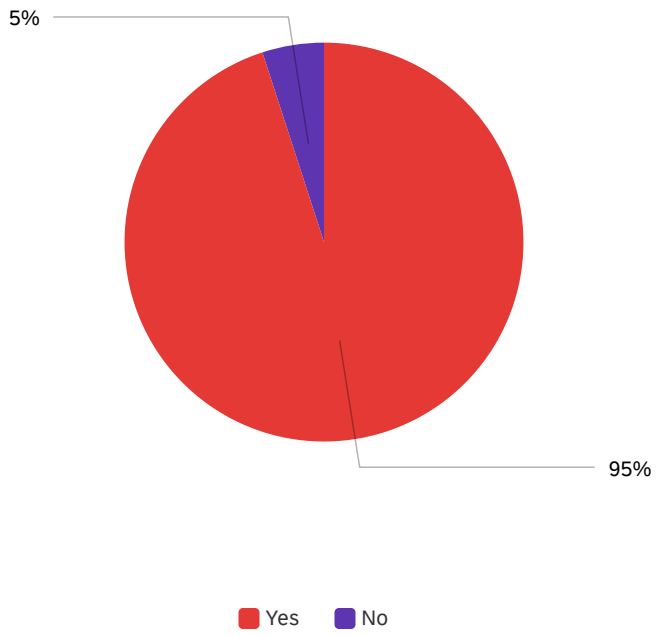
Q36 - In your opinion, does establishing or maintaining native vegetation in the water in the near-shore area...



#	Field	Definitely yes		Probably yes		Probably not		Definitely not		Unsure		Total
1	Decrease shoreline erosion	41%	16	41%	16	8%	3	0%	0	10%	4	39
2	Increase fish populations	38%	15	49%	19	8%	3	0%	0	5%	2	39
3	Decrease my property value	3%	1	26%	10	33%	13	23%	9	15%	6	39
4	Improve water quality	28%	11	54%	21	8%	3	3%	1	8%	3	39
5	Limit recreational enjoyment	5%	2	36%	14	36%	14	21%	8	3%	1	39

Showing rows 1 - 5 of 5

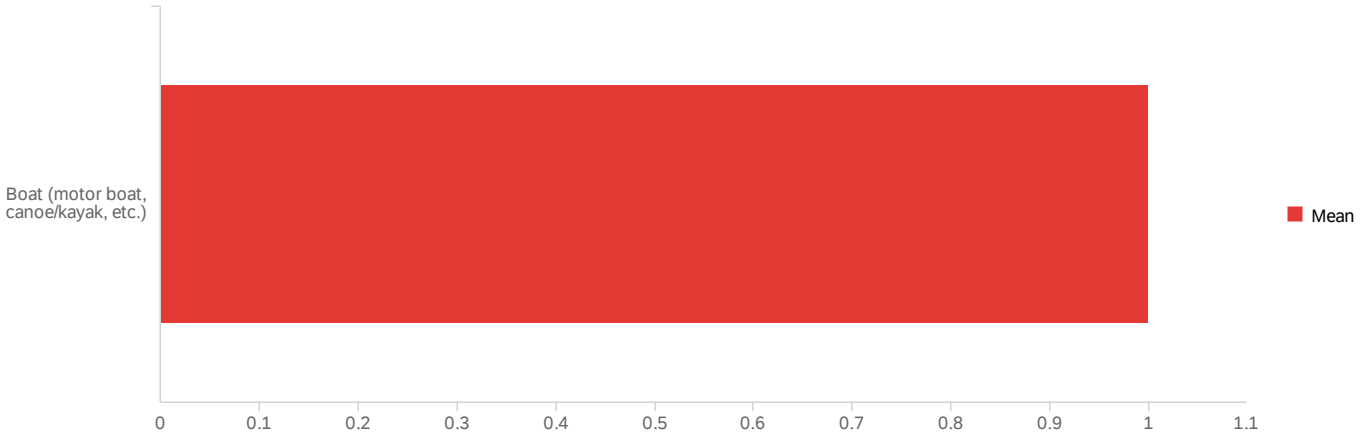
Q37 - Are you aware of invasive species (in general)?



#	Field		Choice Count
1	Yes	95%	38
2	No	5%	2
			40

Showing rows 1 - 3 of 3

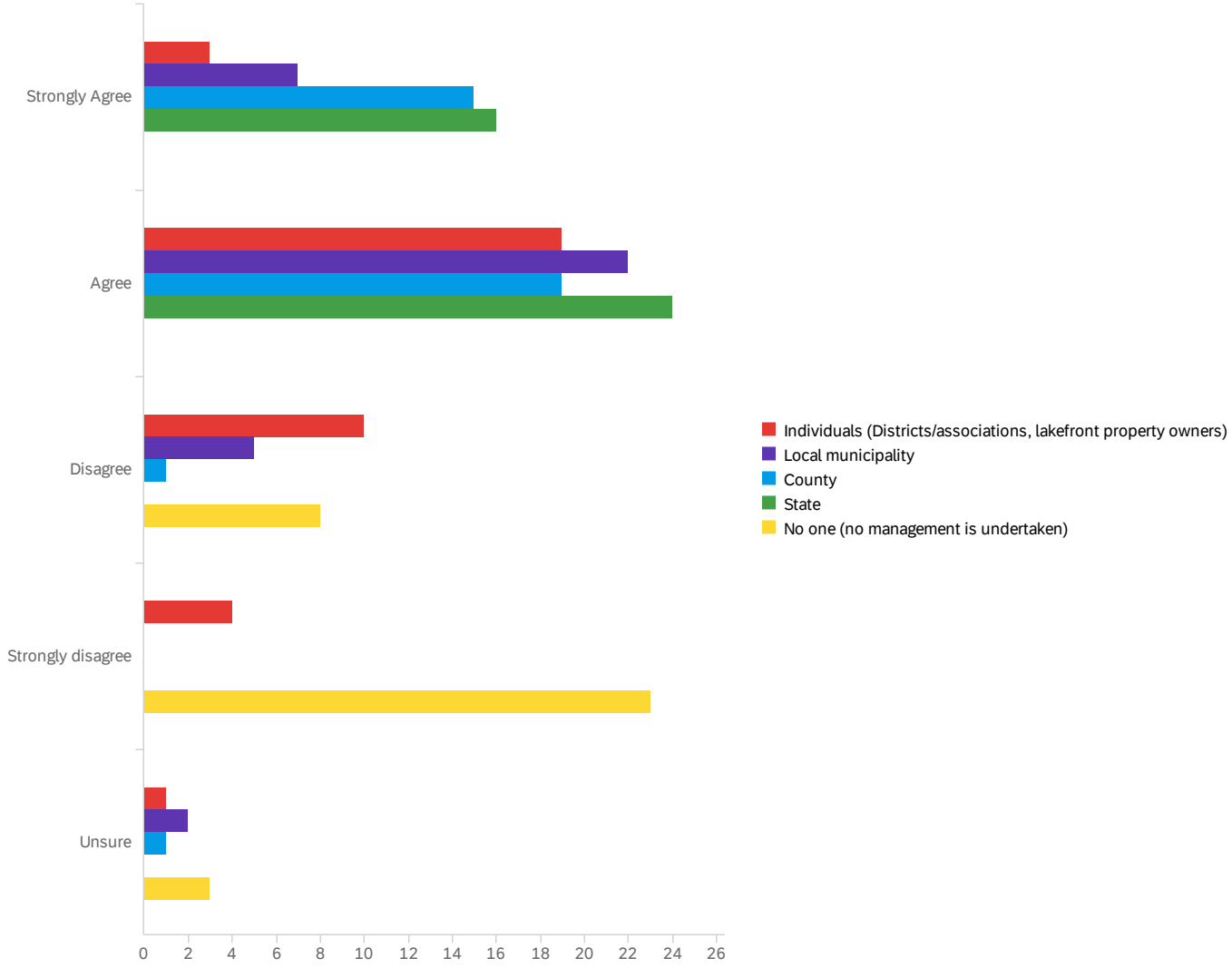
Q39 - After you have been to another lake, do you clean your.... before bringing it back to Boulder Lake?



#	Field	Yes, always		Sometimes		Rarely		No, never		Total
1	Boat (motor boat, canoe/kayak, etc.)	100%	24	0%	0	0%	0	0%	0	24
2	Trailer	100%	22	0%	0	0%	0	0%	0	22
3	Fishing equipment	86%	19	5%	1	9%	2	0%	0	22
4	Live wells	100%	17	0%	0	0%	0	0%	0	17

Showing rows 1 - 4 of 4

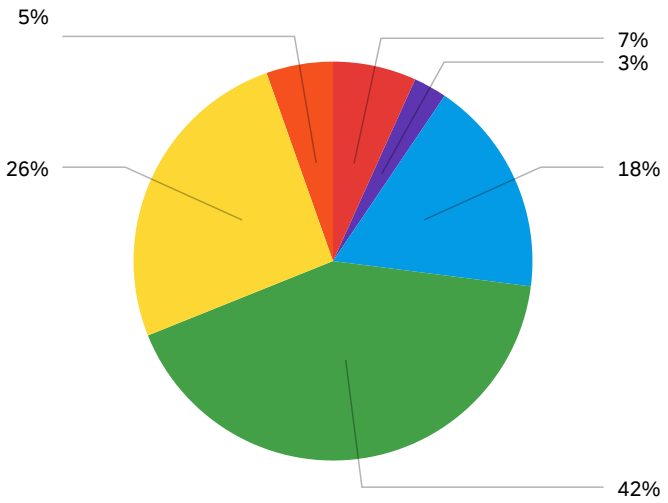
Q40 - Who should pay the cost of managing invasive aquatic plants?



#	Field	Strongly Agree		Agree		Disagree		Strongly disagree		Unsure		Total
1	Individuals (Districts/associations, lakefront property owners)	8%	3	51%	19	27%	10	11%	4	3%	1	37
2	Local municipality	19%	7	61%	22	14%	5	0%	0	6%	2	36
3	County	42%	15	53%	19	3%	1	0%	0	3%	1	36
4	State	40%	16	60%	24	0%	0	0%	0	0%	0	40
5	No one (no management is undertaken)	0%	0	0%	0	24%	8	68%	23	9%	3	34

Showing rows 1 - 5 of 5

Q41 - What is the most effective way to inform others about aquatic invasive species?



#	Field		Choice Count
1	Newspaper	7%	5
2	Billboard	3%	2
3	Info pamphlets	18%	13
4	Lakeside signs/kiosks	42%	31
5	Volunteer staff at boat launch	26%	19
6	Other	5%	4
			74

Showing rows 1 - 7 of 7

Q12 - In your opinion, what should be done to restore, maintain or improve Boulder Lake?

In your opinion, what should be done to restore, maintain or improve Boulde...
Enforce limits on the number of commercial docks/slips on the lake
Remove invasive plants
Get rid of the milfoil
Add native vegetation
None
Maintain control of Eurasian water-milfoil, reduce erosion caused by excessive motor-boat activity, maintain shoreline is as natural of condition as possible.
Having the ability to proactively respond to EWM without the roadblock of the WDNR
Explore options as a team of lake users and government agencies and impliment strategies
Destroying the invasive milfoil, helping the loon island (they need more space),& enforcing jet ski rules.
understand we have an Asian Milfoil problem that needs to be managed
Help remove the Eurasian mill foil
Educate outsiders
Enforcement of no wake zones. Many people pay no attention to them and disturb shorelines and wildlife (such as eagles nest while they were there)
I believe managing Eurasian milfoil to prevent it from becoming a major issue in the future. I think that bot traffic continues to increase on the lake and there has been an increasing disregard for no wake signs
Keep invasive species out!!!
keep up the good work that is being done
Limit use of jet propelled boats and other watercrafts!!
Watch for boats/trailers on high-use weekends.
Try to control invasive plants, enforce existing no wake areas in smaller bays to protect shoreline and water birds.
Keep up to date with all of the changes that are happening and also work with others that are knowledgable.

In your opinion, what should be done to restore, maintain or improve Boulde...

Study to see what problems exist and how it can be remedied. Everyone helps pay. Owners, county, state and federal. The campground brings all sorts of people. Some may not respect the lake life.

Manage invasive species

Limit the two private campgrounds from bringing in more trailers, implement a user lake fee at all campgrounds including the national forest campgrounds.

some dredging along shorelines is needed. 2 feet of water, 2 feet of muck, then solid bottom, on the north end.

minimize AIS

Limit boat access especially jet skis and wake boats. Keep no wake hours. Keep AIS managed in our lake and find different ways to get people motivated to help. Maybe create a lake district to raise funds. People don't want to get involved. It's only a hand full of people on our lake that really do anything to control AIS.

reduce recreational boat traffic

Get the Northern out. Some jerk put them in during the 70's and they eat too many other fish.

controle invasive plants

Continue to control the invasive species.

Remove the Milfoil invasive species and then educate us to identify and manually remove the species

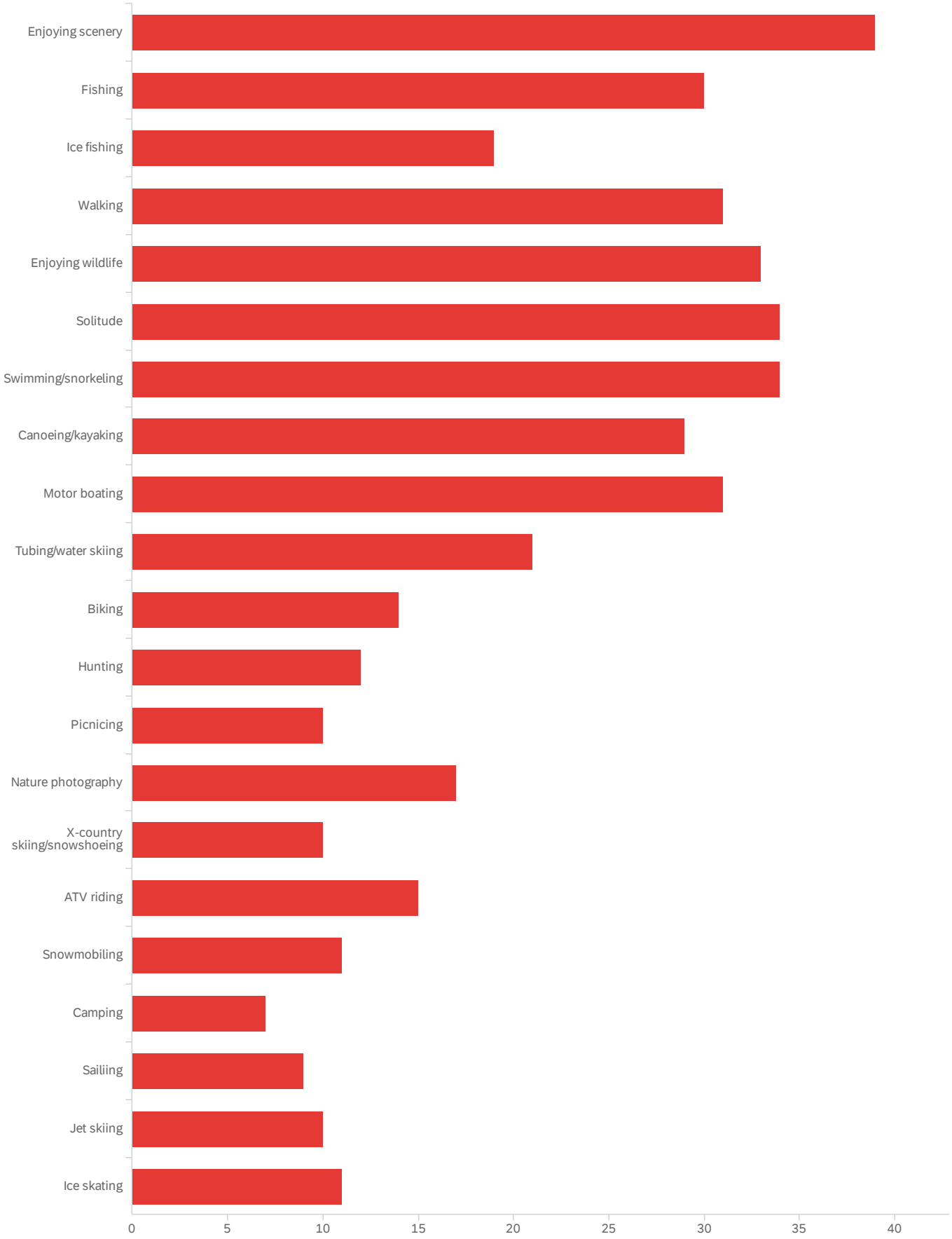
Understand and address recent increased presence of milfoil

limit use of high powered boats and jet skis. Campgrounds are primary cause of issues. USDA or Forest Service should bear some responsibility for monitoring and cleanup. Instead Lake Association bears the burden.

Eliminate private boat landings that have no control or monitoring available for AIS

I'm actually very happy with the lake right now

Q45 - What recreational activities do you partake in on Boulder Lake (check all that apply)?


Enjoying scenery
Fishing
Ice fishing
Walking
Enjoying wildlife
Solitude
Swimming/snorkeling
Canoeing/kayaking
Motor boating
Tubing/water skiing
Biking
Hunting
Picnicing
Nature photography
X-country skiing/snowshoeing
ATV riding
Snowmobiling
Camping
Sailiing
Jet skiing
Ice skating
0
5
10
15
20
25
30
35
40

#	Field	Choice Count	
1	Enjoying scenery	9%	39
2	Fishing	7%	30
3	Ice fishing	4%	19
4	Walking	7%	31
5	Enjoying wildlife	8%	33
6	Solitude	8%	34
7	Swimming/snorkeling	8%	34
8	Canoeing/kayaking	7%	29
9	Motor boating	7%	31
10	Tubing/water skiing	5%	21
11	Biking	3%	14
12	Hunting	3%	12
13	Picnicing	2%	10
14	Nature photography	4%	17
15	X-country skiing/snowshoeing	2%	10
16	ATV riding	4%	15
17	Snowmobiling	3%	11
18	Camping	2%	7
19	Sailiing	2%	9
20	Jet skiing	2%	10
21	Ice skating	3%	11
			427

Showing rows 1 - 22 of 22

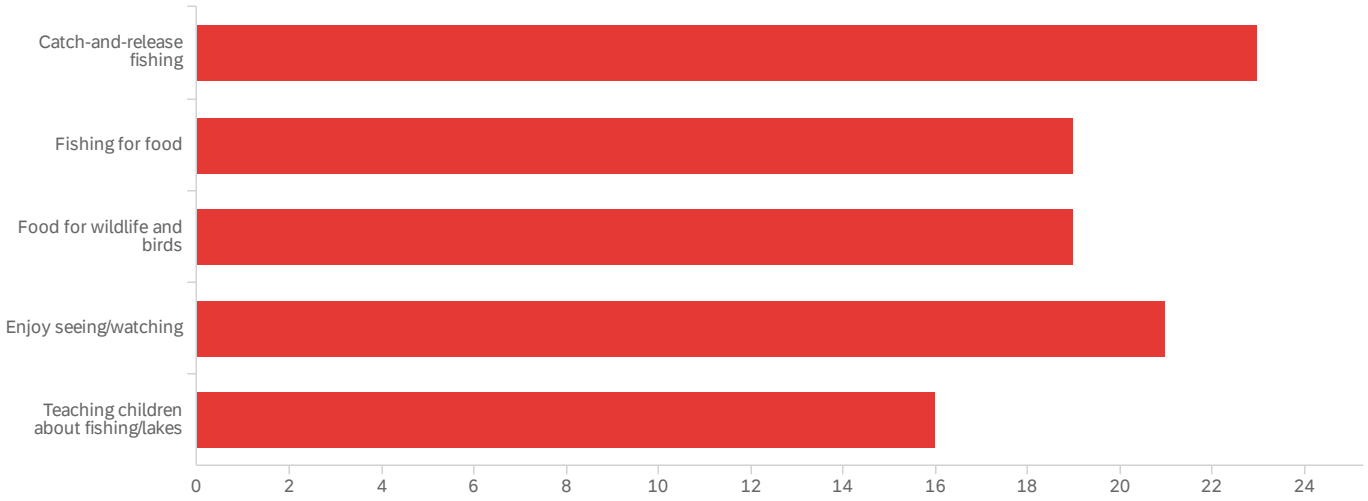
Q46 - Other recreational activities not included above:

Other recreational activities not included above:
None
Watched no loons. I am concern not enough is being done to support their habitat - “loon island”
evening cruises
Bird Watching
Snowmobiling
None
trapping
driving a car/truck while pulling a tube on the ice.

Q49 - What could be done to improve your recreation experience on Boulder Lake?

What could be done to improve your recreation experience on Boulder Lake?
Fewer boats at peak times
Removed of Invasive plants
My time
None
Stricter adherence to the no-wake regulations.
I am concerned about the cell tower that was installed on the east shore that no notice was given for. This ruins the aesthetic experience of a great natural lake in northern WI.
I think we are doing a fair job at present
Getting rid of the invasive plants.
Enforcement of no wake.
Maintain boat landings.
more policing of boating
Regularly communicating by e-mail to all property owners.
Extend the no wake time.
Stock lake with fish
We use the lake during the week and avoid it on the busy weekends which begin on Thurs - Sunday
Make it a catch and release for game fish. Don't bother with pike or walleye. Perhaps musky or smallmouth bass, totally catch and release on these, may provide sport. Again, they need a food source.
Educate people on boat etiquette and rules. Limit the types of watercraft allowed.
The lake is relatively shallow I would like to see a limit to outboard horsepower or a requirement to the type of outboard that limits the depth of impact in the water
More Fish
Monitoring of boating traffic by campgrounds. The lake owners don't abuse the no wake.
I'm very happy with the way things are. We have busy times during wake hours, and relaxing times right after. Perfect!

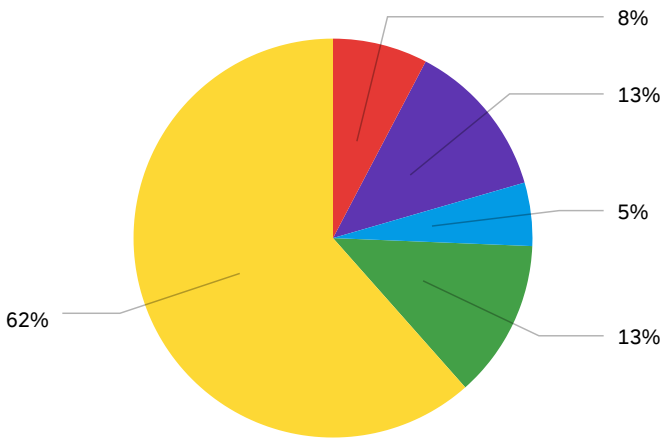
Q51 - For what purposes do you value the fishery in Boulder Lake? (Check all that apply)



#	Field		Choice Count
1	Catch-and-release fishing	23%	23
2	Fishing for food	19%	19
3	Food for wildlife and birds	19%	19
4	Enjoy seeing/watching	21%	21
5	Teaching children about fishing/lakes	16%	16
			98

Showing rows 1 - 6 of 6

Q52 - How many years experience do you have fishing Boulder Lake?

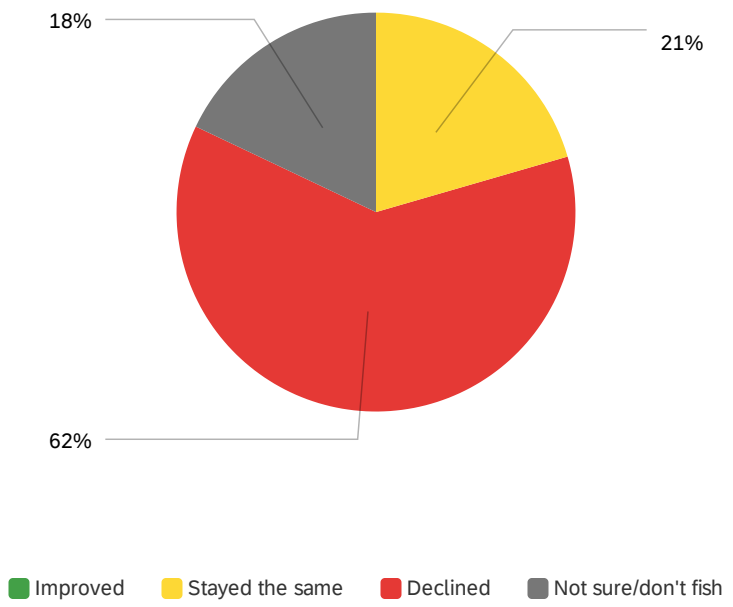


I don't fish Boulder Lake | 1-5 years | 6-10 years | 11-20 years | More than 20 years

#	Field		Choice Count
1	I don't fish Boulder Lake	8%	3
2	1-5 years	13%	5
3	6-10 years	5%	2
4	11-20 years	13%	5
5	More than 20 years	62%	24
			39

Showing rows 1 - 6 of 6

Q53 - In the time you have been fishing Boulder Lake, would you say the quality of fishing has...



#	Field		Choice Count
1	Improved	0%	0
2	Stayed the same	21%	8
3	Declined	62%	24
4	Not sure/don't fish	18%	7
			39

Showing rows 1 - 5 of 5

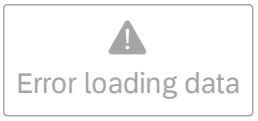
Q54 - What do you think has contributed to the change in fishing?

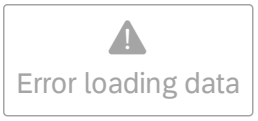
What do you think has contributed to the change in fishing?
Poor habitat, excessive motor boat traffic
Over fished
Non native fish
Lack of native plants all sand bottom
Over fished
More people using the lake.
The large mouth bass have been poorly managed by the DNR and has caused a significant impact on the Perch population.
Over fishing
fishing pressure
DNK, but really don't fish often; mostly just supervise kids/grandkids fishing off of the dock, plus a little ice fishing
Increase in people
Too many bass.
The population of Large Mouth Bass seems to dominate the lake. On certain weed beds that we could count on as a good source for perch, are now producing very little Perch, and have a higher population of Bass
fishing pressure and no planting
Recreational activity.
Not sure the perch population has decreased considerably
Bass need to be reduced, drop the size limit!
Not sure
Boulder is a clear, shallow lake, very little weeds. Fish species needs to be warm water related and most likely be catch and release for game fish. It cannot support northern pike, just too warm in summer for that. Panfish are almost non-existent.
Not sure
overfishing of some species i.e. perch and bluegills

What do you think has contributed to the change in fishing?

Northern Pike introduction.
Bass population eating the pan fish.
Not sure, I might just not be good at fishing!

Q55 - When and how often do you fish Boulder Lake?





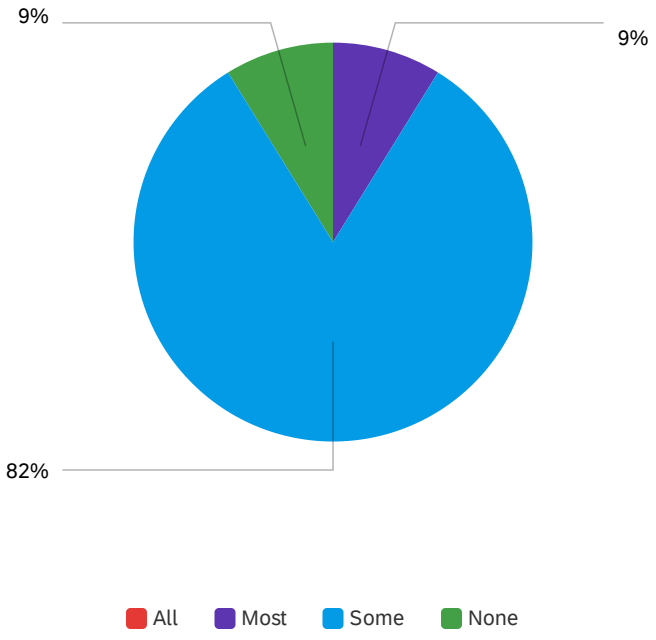
Q56 - What type of fish do you catch on Boulder Lake?

What type of fish do you catch on Boulder Lake?
Panfish
Bass
All
Bass
Blue gills, small amount of perch, bass
Largemouth and smallmouth bass
Northern Pike, Bass and Blue Gill. Perch have been stunted in growth and population
bluegill and a few perch
pan
Perch, bass, sunfish
Bass. Small northern
Bass, bluegill, crappie.
Northern Pike, Large Mouth Bass, Small Mouth Bass, Yellow Perch, Bluegill, Sunfish, and Rockbass
pan fish, bass and northern
Pan fish and bass.
Bass, perch,bluegill.
Bass, blue gill and perch
Smallies largemouth blue gills
Small/ large mouth bass
N/A
Largemouth bass, some perch, a rare small northern pike. Often wonder how small mouth bass would do here, but they need baitfish to feed on.
Blue Gill

What type of fish do you catch on Boulder Lake?

northern pike, bass & pan fish
pan fish, small mouth, large mouth and some northerns
Bass (release) Bluegill and some perch
bluegill, perch, bass and crappie
Bass and Pan Fish
Largemouth bass
blue gill bass
Northern Pike/Large Mouth Bass/Blue Gill
Perch, Bluegill,

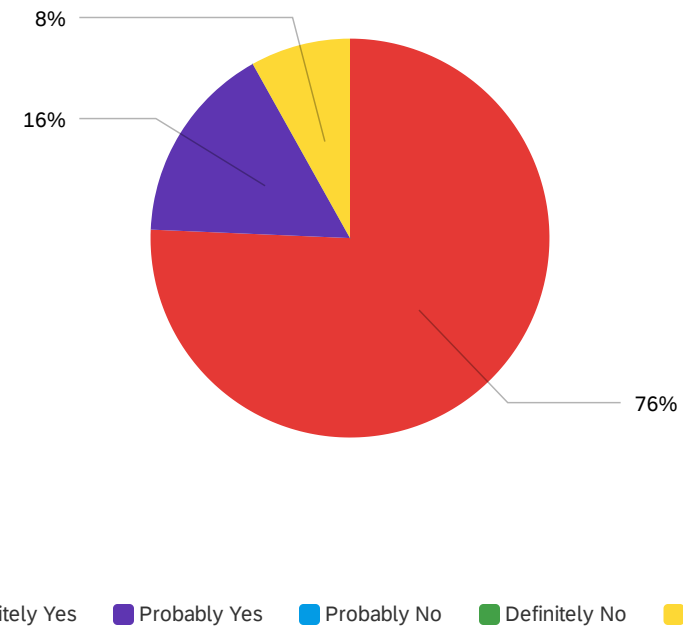
Q57 - In general, how many of the fish you catch are big enough to keep?



#	Field	Choice Count	
1	All	0%	0
2	Most	9%	3
3	Some	82%	28
4	None	9%	3
			34

Showing rows 1 - 5 of 5

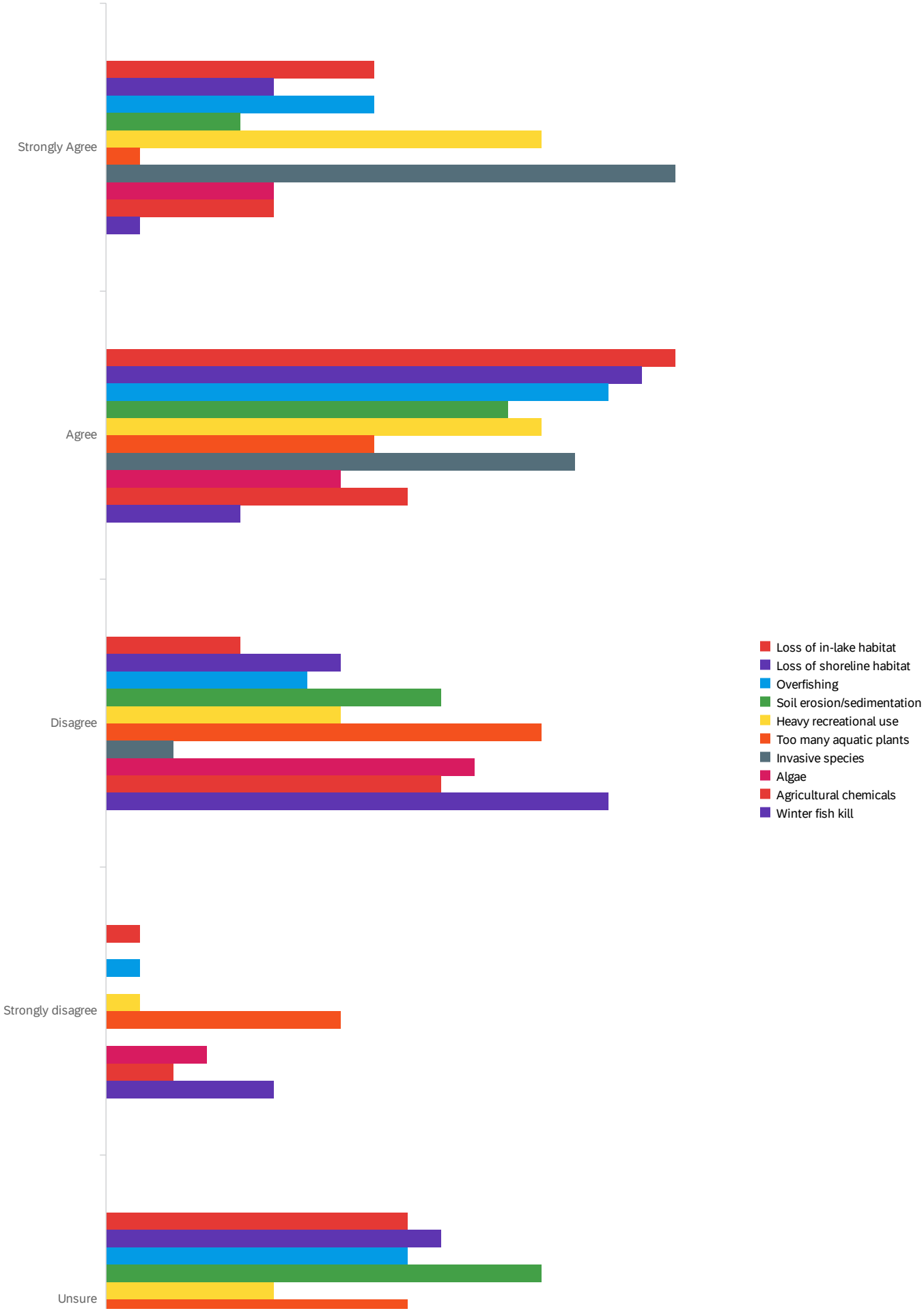
Q58 - Do you believe fish from Boulder Lake are safe to eat?

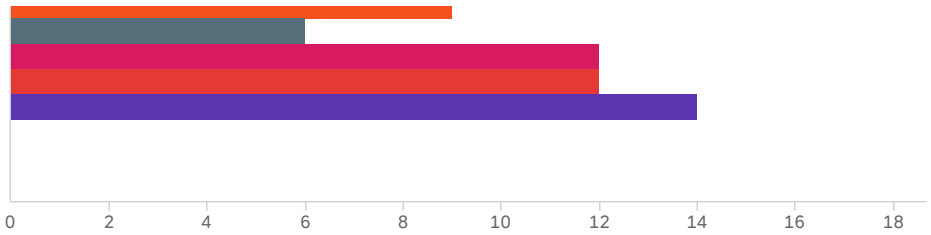


#	Field	Choice Count	
1	Definitely Yes	76%	28
2	Probably Yes	16%	6
3	Probably No	0%	0
4	Definitely No	0%	0
5	Unsure	8%	3
			37

Showing rows 1 - 6 of 6

Q59 - What do you think is the greatest threat to the fishery in Boulder Lake in the next 10 years?


Strongly Agree
Agree
Disagree
Strongly disagree
Unsure
Loss of in-lake habitat
Loss of shoreline habitat
Overfishing
Soil erosion/sedimentation
Heavy recreational use
Too many aquatic plants
Invasive species
Algae
Agricultural chemicals
Winter fish kill



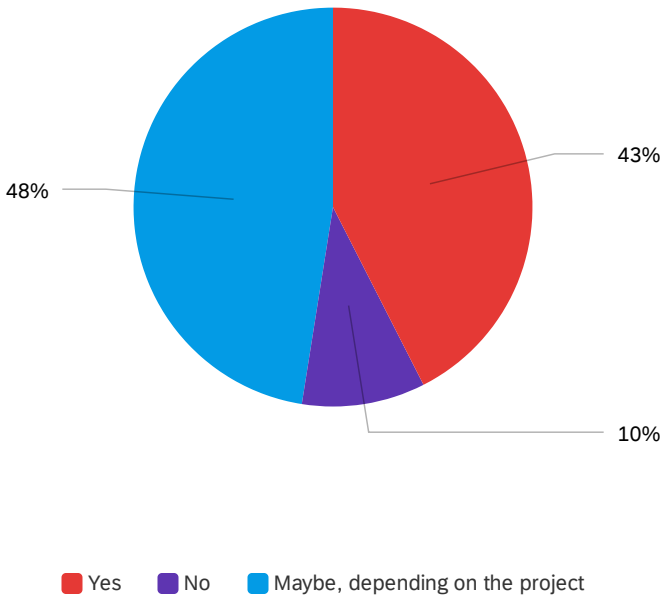
#	Field	Strongly Agree		Agree		Disagree		Strongly disagree		Unsure		Total
1	Loss of in-lake habitat	21%	8	44%	17	10%	4	3%	1	23%	9	39
2	Loss of shoreline habitat	13%	5	42%	16	18%	7	0%	0	26%	10	38
3	Overfishing	21%	8	38%	15	15%	6	3%	1	23%	9	39
4	Soil erosion/sedimentation	10%	4	31%	12	26%	10	0%	0	33%	13	39
5	Heavy recreational use	33%	13	33%	13	18%	7	3%	1	13%	5	39
6	Too many aquatic plants	3%	1	21%	8	34%	13	18%	7	24%	9	38
7	Invasive species	44%	17	36%	14	5%	2	0%	0	15%	6	39
8	Algae	13%	5	18%	7	29%	11	8%	3	32%	12	38
9	Agricultural chemicals	13%	5	24%	9	26%	10	5%	2	32%	12	38
10	Winter fish kill	3%	1	10%	4	38%	15	13%	5	36%	14	39

Showing rows 1 - 10 of 10

Q61 - Do you have any additional comments regarding Boulder Lake?

Do you have any additional comments regarding Boulder Lake?
No
Loss of rooted aquatic vegetation has reduced spawning opportunities and cover for fish. I am opposed to expanding the present campgrounds.
I would like to better understand how a cell tower was installed so close to the lake that it ruins the aesthetics of the lake and no notification to residents or lake association occurred. It seems as though this was done covertly.
Lets keep it as it is and improve if possible
Boulder Lake has National Campground that offers all the access to the above mentioned recreational activities. I believe this could be a targeted group for educating about water quality.
not at this time
Bass problem.
Make it a catch and release for game fish. Don't bother with pike or walleye. Perhaps musky or smallmouth bass, totally catch and release on these, may provide sport. Again, they need a food source.
Boulder Lake is a great lake for many reasons. But getting people informed and involved in keeping or lake a nice lake is a very important item most people don't understand. Anyone can make a difference.
The lake has an excessive amount of weekend pressure due to the two campgrounds onthe lake. They are most likley causing invasive species in the lake.
This survey referred to Bear Paw Lake, make certain that is noted. The Federal Gov. should reduce the nuber of campsites to reduce the traffic.
Been visiting Boulder Lake since 1960. I like the fact that it has not changed too much. Concerned about Jet Ski's and the damage they may do to the fish but we do tubing which is not much better.
Maintain the habitat for loons and bald eagles on the lake.
Loons, an important part of the lake not mentioned in survey. Their habitat is not being supported.
Don't change things, it's perfect just the way it is.

Q63 - Would you be interested in volunteering on a project on your lake (such as shoreland restoration planting, invasive species monitoring/removal, water quality monitoring, highway cleanup, etc.)?



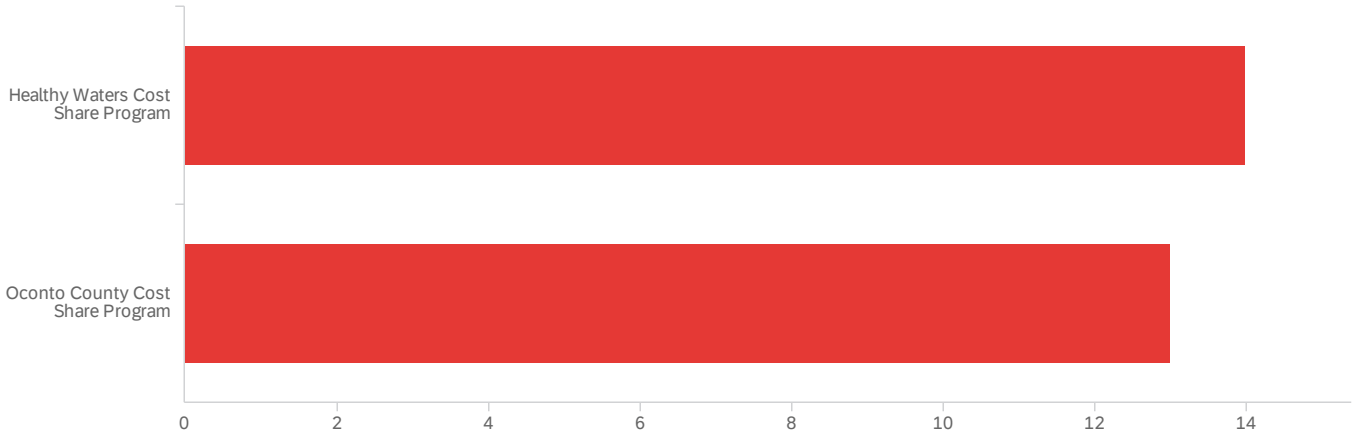
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Would you be interested in volunteering on a project on your lake (such as shoreland restoration planting, invasive species monitoring/removal, water quality monitoring, highway cleanup, etc.)?	1	3	2	1	1	40

#	Field		Choice Count
1	Yes	43%	17
2	No	10%	4
3	Maybe, depending on the project	48%	19
			40

Showing rows 1 - 4 of 4

Q64 - Are you aware of the following programs available to you from Oconto County?

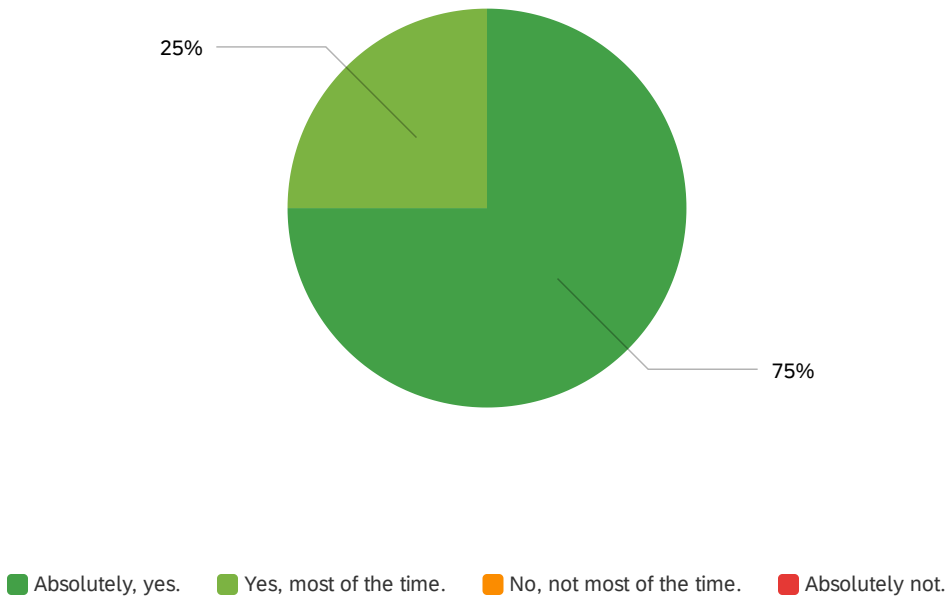
(Check all that apply)



#	Field		Choice Count
1	Healthy Waters Cost Share Program	52%	14
2	Oconto County Cost Share Program	48%	13
			27

Showing rows 1 - 3 of 3

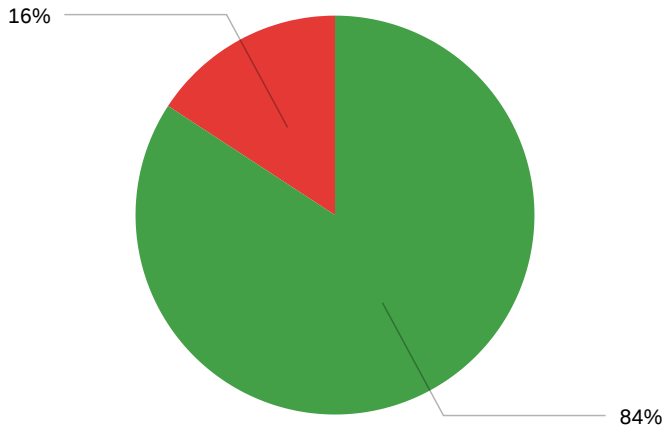
Q67 - No Wake is allowed on Boulder Lake between 5pm and 10am. Do you like the No Wake rules as they are?

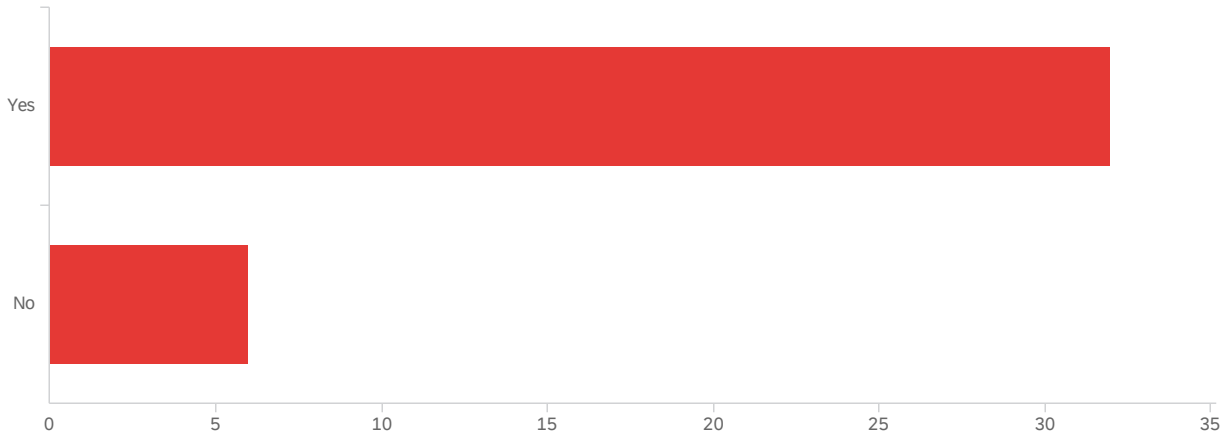


Q68 - If you think the No Wake rules should be adjusted, in what way?

If you think the No Wake rules should be adjusted, in what way?
Move to 6 or 7 pm in summer
No
No wake from 4 P.M. to 11 A.M.
The existing rule are perfect, they just need to be informed. The users of the national forest campground do not seem to be educated about the rules when they check in to camp ground. The forest service needs to improve their process of informing campers. It would be great if this was a checked box for understanding upon registration. The campground recreational use is the heaviest impact on our lake but goes unmonitored and unchecked.
Think they could start at 6p instead of 5p
I think they are good, but if adjustment will happen, it should be to extend no wake hours, not shorten them.
good as is if they times are followed
No wake after 4:00 on weekdays.
9am to 6pm
No
No
Need additional enforcement
6 pm on holiday weekends; would also support 6 pm on weekends all summer
Better enforcement of hours
Maybe, maybe...one extra hour of wake on the late side (til 6). Maybe. Not a huge deal. Don't reduce them though!

Q69 - Are you a member of the Boulder Lake Private Homes Association?





End of Report

Appendix D

Appendix D. 2021 EWM Management and Monitoring Report (Onterra)

INTRODUCTION

Boulder Lake, Oconto County, is a 370-acre spring lake with a maximum depth of 11 feet (Photo 1). A majority of the shoreline is privately owned with the exception of a portion that is owned by the US Forest Service, which includes a campground, swimming beach, and boat ramp on the south shore. The lake receives significant recreational use during the summer months. The primary citizen-based organization leading management activities on Boulder Lake is the Boulder Lake Private Home Association (BLPHA).

Photo 1. Boulder Lake, Oconto County, WI.

Eurasian watermilfoil (*Myriophyllum spicatum*; EWM) was first discovered in Boulder Lake in 2012. Following this discovery, the BLPHA secured grant funds through the Wisconsin Department of Natural Resources (WDNR) to initiate a monitoring and control plan. In the fall of 2012, the BLPHA contracted with an aquatic herbicide applicator to target the newly discovered EWM in the lake. An herbicide treatment of 2.7 acres was conducted in the fall of 2012 in the northeast corner of the lake. Surveys conducted in the spring of 2013 determined that the EWM levels in the lake were too low to warrant control with herbicides and instead a hand-removal effort with continued monitoring was recommended. Hand-removal of EWM took place in 2013 and 2014, with no EWM being located during surveys conducted in 2015 and continued monitoring being recommended to ensure the EWM population remained low. Hand-removal of EWM has taken place every year from 2012 to 2017 by BLPHA volunteers in a proactive effort to control EWM.

The BLPHA contracted with Onterra to conduct a meander-based EWM mapping survey in 2017. During this survey, it was again determined that the EWM populations were too small for herbicides to be effective so hand-removal efforts were recommended for 2018.

In January 2018, the BLPHA was awarded an AIS-EDR grant through the WDNR to coordinate EWM hand-harvesting control efforts, both professional- and volunteer-based, and evaluate their efficacy through the end of 2019. For a number of factors, COVID-19 included, the final year of project was delayed. This report discusses the monitoring and control actions completed during the final year (2021) of this project. This project provides the final deliverable for AIRR-231-18.

2021 EWM MANAGEMENT AND MONITORING STRATEGY

Based upon the previous EWM mapping data, the EWM population of Boulder Lake was quite dense in certain locations, but these locations were relatively small (< 1 acre) and in the center of the lake where they would be most exposed to water movement. Based upon Onterra's experience, these parameters are the most difficult to overcome for an herbicide treatment to be successful. After several years of contracted hand-harvesting/DASH, the BLPHA wanted to attempt an herbicide treatment strategy while WDNR grant funds were still available.

Working with an herbicide applicator company, the BLPHA considered a few herbicide strategies and the potential for combining with a barrier curtain. The logistics of having the BLPHA construct barrier curtains in time for a spring 2021 treatment were too great, so they pursued an herbicide with a reportedly lower concentration and exposure time (CET) requirement than other herbicides like 2,4-D. Following consultation with Onterra and SePRO, an expanded buffer around the target EWM colonies and a higher dose were determined to be warranted. Map 1 reflects the final ProcellaCOR™ strategy with an application rate of 5.0 PDU's over each site totaling 2.4 acres.

The herbicide application was completed on June 18, 2021 between 5:15 and 6:30 am by Schmidt's Aquatic, LLC. The applicator noted light winds (2-3 mph) and a surface water temperature of 74°F at the time of the treatment. Wind speed and wind gust data were accessed from the nearest station in Shawano, WI, which is approximately 30 miles to the south. Wind speeds increased around 10 am with wind gusts of 10-15 mph reported.

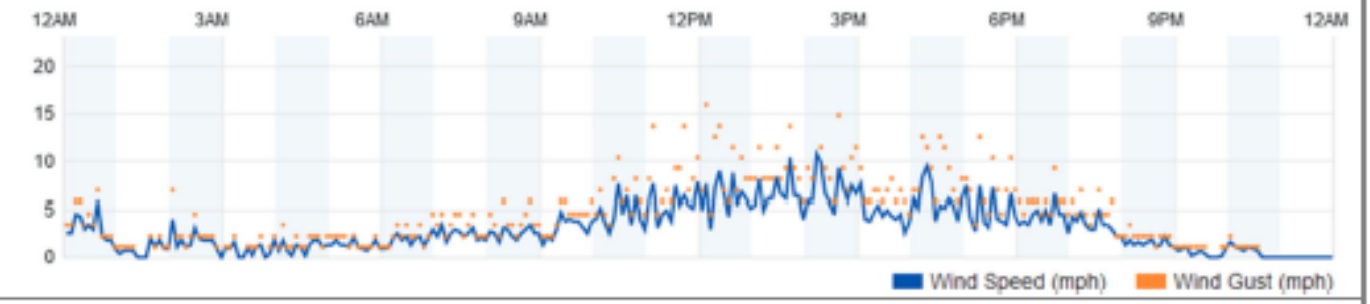


Figure 1. Wind speed surrounding 2021 herbicide treatment. Extracted image from Weather Underground Shawano station:
https://www.wunderground.com/dashboard/pws/KWISHAWA17/graph/2021-06-18/2021-06-18/daily

LATE-SUMMER EWM PEAK-BIOMASS SURVEY RESULTS

Onterra conducted a 2021 Late-Summer EWM mapping survey to assess the effectiveness of the herbicide treatment during the *year-of-treatment*. The EWM mapping survey offers a full account (census) of where a particular species exists in the lake. During the EWM mapping survey, the entire littoral area of the lake is surveyed through visual observations from the boat (Photo 2). Field crews supplement the visual survey by deploying a submersible camera along with periodically doing rake tows. The EWM population is mapped using sub-meter GPS technology by using either 1) point-based or 2) area-based methodologies. Large colonies >40 feet in diameter are mapped using polygons (areas) and are qualitatively attributed a density rating based upon a five-tiered scale from *highly scattered* to *surface matting*. Point-based techniques were applied to AIS locations that were considered as *small plant colonies* (<35 feet in diameter), *clumps of plants*, or *single or few plants*.

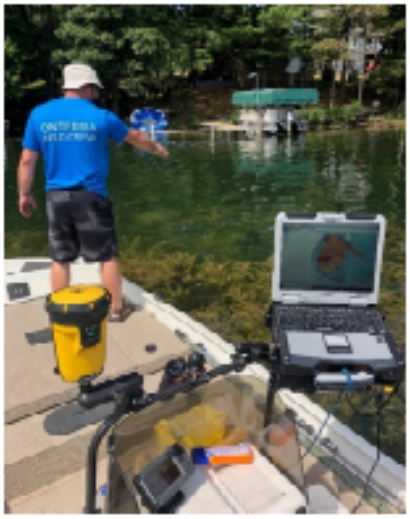


Photo 2. EWM mapping survey on a Waushara County, WI lake. Photo credit Onterra.

The Late-Summer EWM Peak-Biomass Survey was conducted on August 20, 2021 to qualitatively assess the herbicide management efforts as well as to understand the peak growth (peak-biomass) of the EWM population throughout the lake and to consider management options for the following year. Due to the expansive littoral zone, the entirety of Boulder Lake was systematically meandered and EWM populations were mapped by using the same methodology described above. Survey crews supplemented the survey with a submersible camera when applicable to investigate priority locations including areas that were in deeper water depths. Conditions during the late-summer survey were noted as excellent with sunny skies and calm winds. With the exceptionally clear water in Boulder Lake, the majority of the EWM population could be observed visually from the bow of the survey boat.

The results of the late-summer survey are displayed on Map 1, with the majority of the EWM being located within the treatment site A-21 and in front of the Echo Valley Resort boat landing. Figures 1 and 2 display a comparison of the two 2021 treatment sites from before treatment (June 2019) to after treatment (August 2021).

Site A-21 contained numerous *clumps* of EWM as well as a couple *single or few plants* and *small plant colonies* during the June 2019 survey (Figure 2, left frame). After the 2021 ProcellaCOR™ treatment, a decrease in EWM was observed within the site in the late-summer survey with a few *clumps of plants* identified in the site, one *single or few plants,* and two *small plant colonies* (Figure 2, right frame).

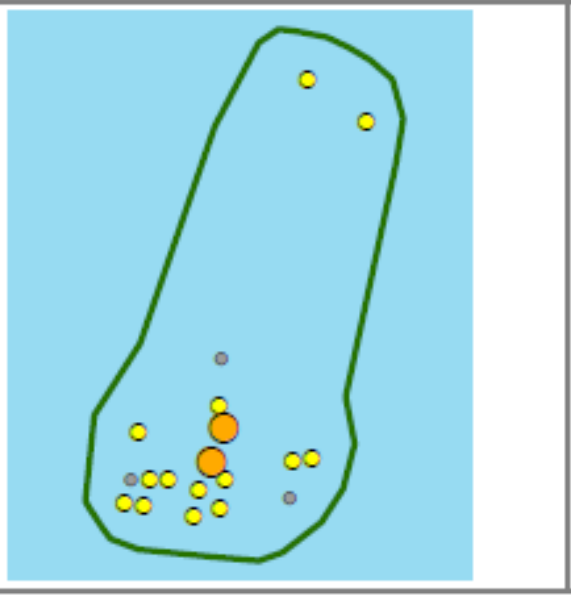


Figure 2. A-21 June 2019 pre- and August 2021 Post- ProcellaCOR™ treatment EWM Survey Results. Refer to Map 1 for legend of symbology.

A *clump of plants* and a small *highly dominant* colony was located in site B-21 in the early-summer 2019 survey (Figure 3, left frame). Following the 2021 ProcellaCOR™ treatment during the summer of 2021, several *single or few plants* and one *clump of plants* remained present in the site at the time of the 2021 late-summer survey (Figure 3, right frame).

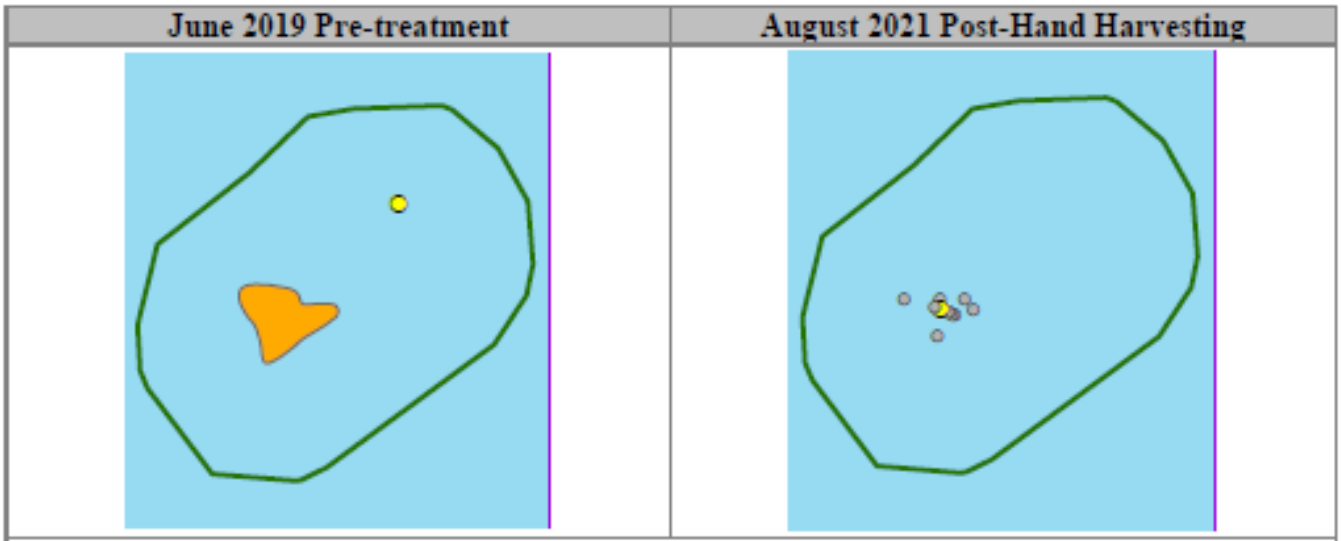


Figure 3. B-21 June 2019 pre- and August 2021 Post- ProcellaCOR™ treatment EWM Survey Results. Refer to Map 2 for legend of symbology.

CONCLUSIONS AND DISCUSSION

The 2021 ProcellaCOR™ spot treatments targeting EWM that were undertaken in Boulder Lake fell short of suppression expectations. EWM reductions were observed within the treatment sites, with some EWM rebound occurring in late-August. The treatments likely provided seasonal relief for part of the summer but did not provide longer-term control. The small size and exposed nature of these treatment sites are factors that often lead to insufficient herbicide concentrations and exposure times (CETs). Typically, a single treatment site of less than 3 acres, particularly in an off-shore and exposed part of a lake, is extremely difficult to hold herbicide concentrations and exposure times sufficient to be effective. While ProcellaCOR has proven effective in challenging situations on other systems, the parameters of these treatments were too difficult to overcome.

The 2021 footprint and density of the EWM population has remained about the same and almost entirely within the same areas as located during the early-summer 2019 survey. The EWM population in Boulder Lake remains isolated to a few locations in the lake with only one area large/dense enough to use area-based mapping methods near the resort boat landing observed with a *scattered* density rating. The current EWM population is likely not having any recreational or ecological impacts to the lake, with concerns for expansion being the largest motivation for continued management by the BLHPA.

At current levels, no areas of EWM in Boulder Lake are appropriate for traditional herbicide control techniques as the areas are too small and too exposed in the lake to be effective. Contracted hand-harvesting and DASH efforts are typically employed for EWM populations of this level, but at a higher amount of effort than employed in the past on Boulder Lake. This increased effort becomes costly, even more expensive than herbicide management techniques that some lake groups feel are more effective than hand-harvesting.

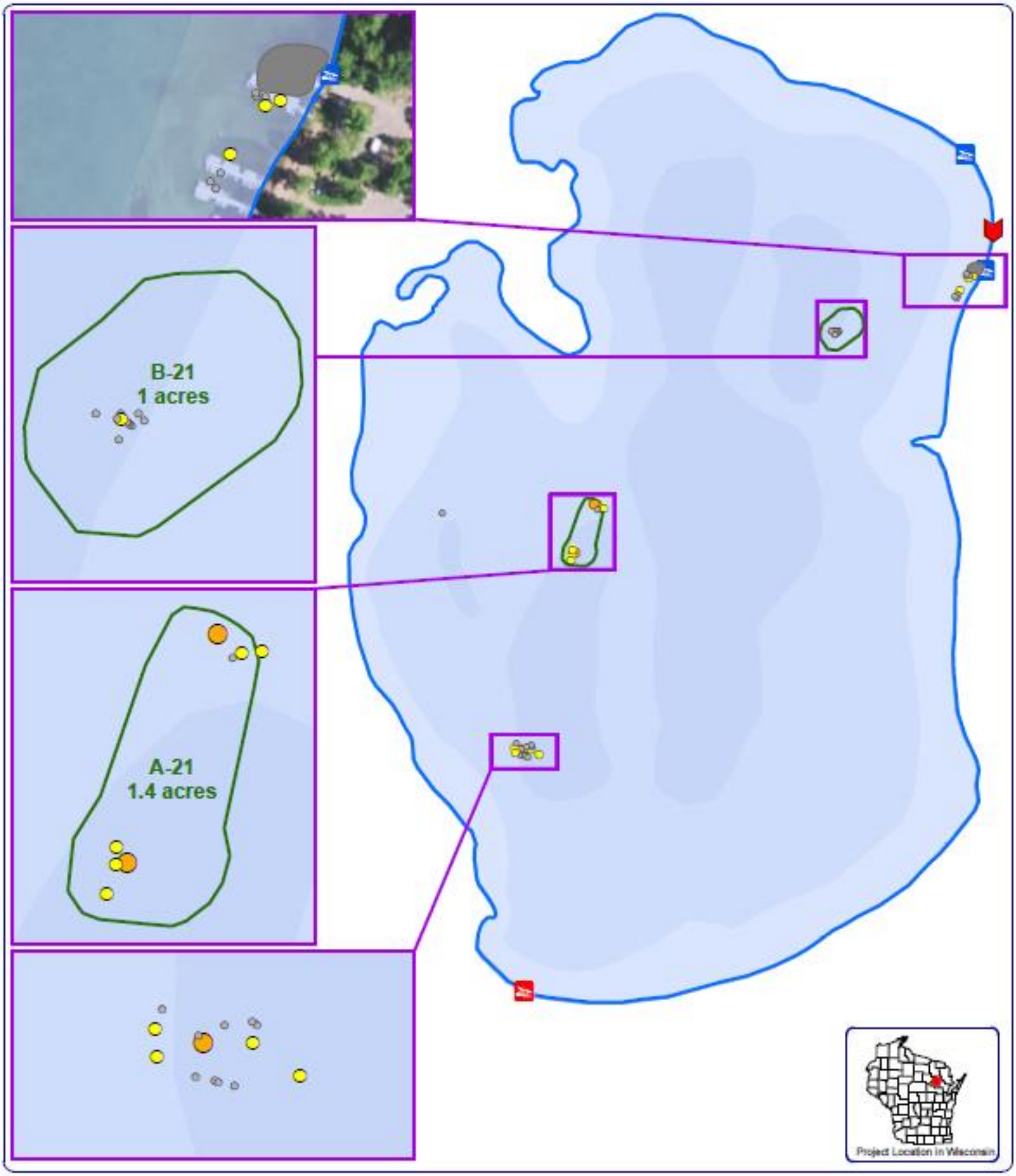
As was discussed prior to the 2021 treatment, the BLPHA may consider continued investigation of herbicide treatment in combination with a barrier curtain. Although these research trials have typically taken place with an economical-priced herbicide like 2,4-D, the 2021 trial treatments on Boulder Lake proved the difficulty of these treatment scenarios and would justify an herbicide with reportedly shorter CET requirements. At the time of this writing, florpyrauxifen-benzyl (ProcellaCOR™), a combination of 2,4-D/endothall (Chinook®), and a combination of diquat/endothall (Aquastrike™) are examples of herbicides with reported short exposure time requirements that are employed for invasive watermilfoil control in Wisconsin. Along with a few stipulations related to visibility of the curtain, a WDNR permit is not required for temporary placement of a barrier curtain so long as access is not denied to any part of the system and the curtain is in place for no more than 96 hours. Barrier curtain construction it typically conducted by the lake group, requiring advance planning efforts.

Volunteer based hand-removal efforts are encouraged and should be considered depending on the volunteer's abilities and availabilities. Areas most appropriate for a volunteer-based removal effort include isolated *single plants* that are located closer to shore in shallower water that can be reached relatively easily by wading into the lake or using snorkeling gear.

There are WDNR AIS grant funds available to assist lake groups with EWM management and monitoring activities. To be eligible to apply for grants that provide cost share for AIS control and monitoring, "a current plan has a completion date of no more than 5 years prior to submittal of the recommendation for approval. The department may determine that a longer lifespan is appropriate for a

given management plan if the applicant can demonstrate it has been actively implemented and updated during its lifespan. However, a point-intercept survey of the aquatic plant community conducted within 5 years of the year an applicant applies for a grant is required." It is important to note that even if the Plan and point-intercept survey were completed within the last five years, the lake groups sill needs to receive determination of eligibility at least 60 days prior to the grant application deadline. Separate from organizational eligibility, this step is confirming that the project seeking grant funding is specifically supported and discussed within the lake group's management plan. For instance, if the management plan does not outline the use (how/why/when) of barrier curtains as an aspect of EWM management, the lake group is not eligible for a grant to fund a treatment with a barrier curtain.

With the assistances of UW Steven's Point as a part of an Oconto County-led effort, the BLPHA is currently engaged in a management planning process. Historically the function of county-led planning projects has been to provide a solid base management plan with supplemental and focused aquatic plant management plans being developed subsequently by the lake group often with help from a private consulting firm.



650
Feet

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Sources:
Roads & Hydro: WDNR
Bathymetry: WDNR, digitized by Onterra
Orthophotograph: NAIP, 2020
Aquatic Plants: Onterra, 2021
Map Date: September 21, 2021 - KM

Legend

EWM Survey Results August 20, 2021

- Highly Scattered (none found)
- Scattered
- Dominant (none found)
- Highly Dominant (none found)
- Surface Matting (none found)
- Single or Few Plants
- Clumps of Plants
- Small Plant Colony
- 2021 Herbicide Treatment Site (ProcellaCOR at 5 PDU)

Map 1
Boulder Lake
Oconto-Langlade Counties

August 2021 EWM Survey Results