Aquatic Plant Management Plan

Connors Lake, Lake of the Pines, and Papoose Lake

Sawyer County Wisconsin

July 2024

Sponsored by:

Connors Lake · Lake of the Pines LAKE ASSOCIATION

With Grant Support from:

WISCONSIN DEPT. OF NATURAL RESOURCES

Consulting Partners:

Harmony Environmental
Finding a balance
People Land Water

Ecological Integrity Service, LLC

Connors Lake / Lake of the Pines Lake Association Board Members

Steven Lindahl, President

Matt Plath, Vice President

Kim Poncek, Treasurer

Toni Slack, Corresponding Secretary

Jamie Wilson, Recording Secretary

Mark LaVick

Chris DeMaeulenaere

Cynthia Aigner

Mike Domanico

Don Bluhm

Table of Contents

Introduction 5
Public Input for Development 5
Lake Management Concerns 5
Lake Information 6
Water Quality 8
Lake Trophic State 9
Watershed 10
Aquatic Use and Habitat 11
Primary Human Use Areas 14
Nearby Water Bodies with EWM Present 14
Functions and Values of Native Aquatic Plants 16
Habitat Areas 17
Fishery 18
Fish Management 18
Plant Survey Results 24
Lake of the Pines 24
Connors Lake 29
Comparison to Previous Surveys 33
Eurasian Water Milfoil 35
Recommendations from Project Consultants (2024) 39
Eurasian Water Milfoil Monitoring 40
Mid-Tolerance EWM Grid Sampling Results (2017 – 2023) 42
2023 Connors Lake EWM Survey 43
Lake of the Pines AIS Surveys 44
Aquatic Plant Management 45
Eurasian Water Milfoil Management 46

Herbicide Treatments 46
Hand Removal 47
DASH (Diver Assisted Suction Harvesting) 47
Monitoring EWM Control Results 47
Herbicide Treatment Pre and Post Monitoring 47
Statewide Eurasian Water Milfoil Management Results 48
Unmanaged EWM Populations 48
Access Corridor Management 50
Plan Goals and Strategies 51
Aquatic Plant Management Goals 51
Adaptive Management Approach 51
Goal 1) Eurasian water milfoil growth is kept to a minimal level in Connors Lake. 52
Schedule and roles for herbicide treatments 56
Goal 2) Eurasian water milfoil does not establish and spread into Papoose Lake or Lake of the Pines. 58
Goal 3) No new aquatic invasive species are introduced and established in our lakes. 59
Goal 4) The lakes' diverse native plant communities are preserved. 59
Goal 5) Lake residents understand the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species. 60
Goal 6) Aquatic plant management efforts are carried out in an efficient, cost effective manner. 62
Aquatic Invasive Species Grants 62
Appendix A. Early Detection and Rapid Response to AIS 63
Works Cited 67

TABLES

Table 1. WDNR Lakes Class Impairment Thresholds Deep Lowland Lakes 8

Table 2. WDNR Lakes Classification and Status 8

Table 3. Price County Lakes with EWM Present 14

Table 4. Sawyer County Lakes with EWM Present 15

Table 5. Fish Species of Connors Lake and Lake of the Pines 18

Table 6. Connors Lake Fish Stocking 18

Table 7. Lake of the Pines Fish Stocking 20

Table 8. Walleye Goals and Measured Results 21

Table 9. Fish Spawning Times and Considerations 23

Table 10. Aquatic Plant Survey Rake Fullness Ratings 24

Table 11. Lake of the Pines 2017 Point Intercept Survey Data Summary 25

Table 12. Lake of the Pines 2007 and 2017 Aquatic Plant Surveys Results Comparison 28

Table 13. Connors Lake 2022 Point Intercept Survey Summary 29

Table 14. Connors Lake 2022 Aquatic Plant Species Survey Results 32

Table 15. Connors Lake 2005, 2021, and 2022 Aquatic Plant Surveys Results Comparison 33

Table 16. Species with a Statistically Significant Increases 2005 - 2022 34

Table 17. Species with a Statistically Significant Decreases 2005 - 2022 34

Table 18. Species with a Statistically Significant Increases 2021 - 2022 34

Table 19. Herbicide Treatment of at Least 10 Percent of the Littoral Zone 38

Table 20. Mid-Tolerance EWM Grid Sampling Results (2017 – 2023) 42

Table 21. Connors Lake Dense EWM Beds 2023 43

Table 22. Education Methods, Audience, and Messages 61

FIGURES

Figure 1. Map of Lake of the Pines ... 6

Figure 2. Map of Connors Lake and Papoose Lake ... 7

Figure 3. Connors Lake Condition ... 8

Figure 4. Lake of the Pines Condition ... 8

Figure 5. Lake of the Pines Trophic State Index 2010-2023 ... 9

Figure 6. Connors Lake Trophic State Index through 2023 ... 10

Figure 7. Landcover of the Lakes Watershed ... 11

Figure 8. Connors Lake and Lake of the Pines Watershed ... 12

Figure 9. Lake Area Map ... 13

Figure 10. Plant Rake Fullness ... 24

Figure 11. Lake of the Pines Rake Density 2017 ... 26

Figure 12. Lake of the Pines Species Richness ... 27

Figure 13. Mean Rake Fullness Connors Lake 2022 ... 30

Figure 14. Species Richness Connors Lake 2022 ... 31

Figure 15. Rake Density of Eurasian Water Milfoil ... 35

Figure 16. Frequency of Occurrence of EWM Since 2005 ... 36

Figure 17. Eurasian Water Milfoil Locations Rake Fullness: (July 2005) ... 37

Figure 18. Eurasian Water Milfoil Locations in 2003 ... 37

Figure 19. Potential Eurasian Water Milfoil Control Areas ... 40

Figure 20. Mid-tolerance EWM Sampling Grid ... 42

Figure 21. Dense Areas of EWM Growth – Connors Lake 2023 ... 43

Figure 22. Eurasian Water Milfoil ... 46

Figure 23. Connors Lake North Landing Clean Boats Clean Waters Hours ... 49

Figure 24. Connors Lake North Landing Clean Boats, Clean Waters Boats Inspected ... 49

Figure 25. Class 3/ Mid Tolerance Area Monitoring Grids ... 53

Figure 26. Eurasian Water Milfoil Treatment Areas ... 55

Introduction

This Aquatic Plant Management Plan for Connors Lake, Lake of the Pines, and Papoose Lake in Sawyer County Wisconsin presents a strategy for managing aquatic plants by protecting native plant populations, controlling the growth of Eurasian water milfoil (EWM), and preventing establishment of additional invasive species. The plan includes data about the plant community, watershed, and water quality of the lakes. Based on this data and public input, goals and strategies for the management of aquatic plants in the lake are presented. This plan will guide the Connors Lake/Lake of the Pines Lake Association (Lake Association) and the Wisconsin Department of Natural Resources (WDNR) in aquatic plant management for the lakes over the next five years (from 2025 through 2029). It is an update of a plan completed in 2008 and updated in 2017.

Public Input for Development

The Lake Association Aquatic Plant Management Committee provided input for the development of the original aquatic plant management plan in 2007. The 2017 update was drafted by board representatives and consultants with guidance from WDNR, then reviewed by the full Lake Association Board, and released for public review prior to the July 2017 membership meeting. Public input for 2024 APM plan update included input from the Lake Association Board of Directors and a public meeting held June 15, 2024. The plan was posted for public review on July 2, 2024 with an email announcement to lake residents and a notice in the local newspaper. Public comments were accepted through July 30, 2024.

Lake Management Concerns

The 2007 APM Committee expressed a variety of concerns that are reflected goals and objectives for aquatic plant management in this plan. Aquatic plant management concerns included the following:

- Best treatment methods for Eurasian water milfoil (EWM) in Connors Lake
- Preventing establishment of Eurasian water milfoil in Lake of the Pines
- Protecting existing native plants for various reasons
    - Preventing shoreline erosion
    - Maintaining/improving fishery
    - Preventing spread of invasive species
- Need for resident and lake user education

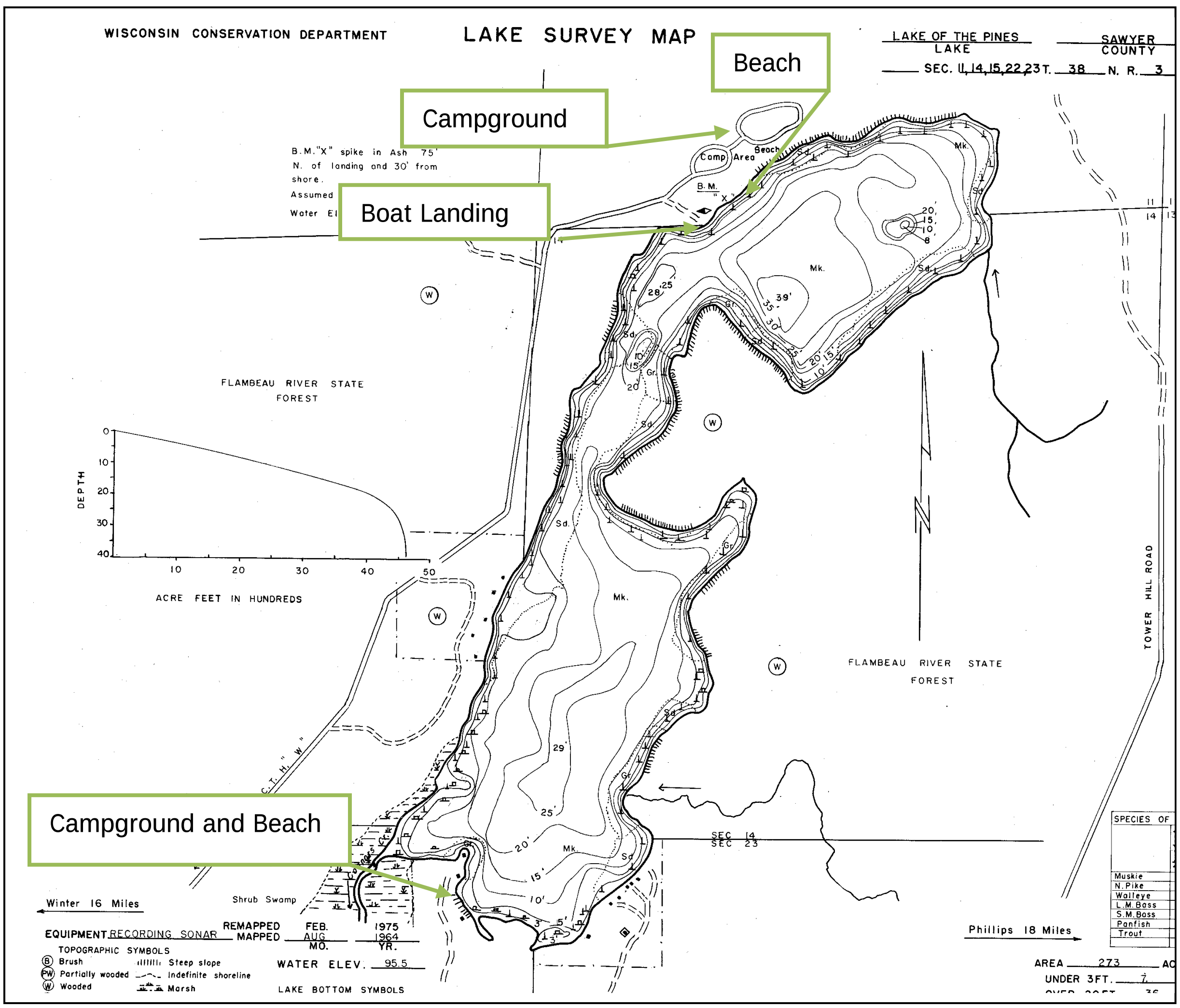
In 2024, most discussion revolved around appropriate measures to effectively control EWM. Some board members, and members of the public, expressed concerns about the use of 2,4-D. Other board members wanted to ensure that cost effective measures where available for a successful EWM control program on Connors Lake.

Lake Information[2]

Lake of the Pines is a 273-acre deep lowland lake with a water body identification code of 2275300. The maximum depth is 39 feet. Lake of the Pines is a drainage lake with unnamed tributaries flowing into the lake and Connors Creek flowing from the lake to Connors Lake. Lake of the Pines is shown as Figure 1.

Connors Lake is a 429-acre deep lowland lake. Its water body identification code is 2275100. The maximum depth is 82 feet. Connors Lake is a drainage lake with Connors Creek flowing into the lake, from Lake of the Pines, and out of the lake at the south end of Connors Lake. A 2-foot rock roller dam is located on the outlet. Connors Lake and Papoose Lake are shown in Figure 2. Papoose Lake is a 2.9-acre widening of Connors Creek found between the two lakes. It has a maximum depth of 14 feet.

The lakes are located in Sawyer County in the Town of Winter (T38N, R03W). Connors Lake is in Section 28. Lake of the Pines is in Section 22.



² From Wisconsin DNR Lakes Pages http://dnr.wi.gov/water

Figure 1. Map of Lake of the Pines

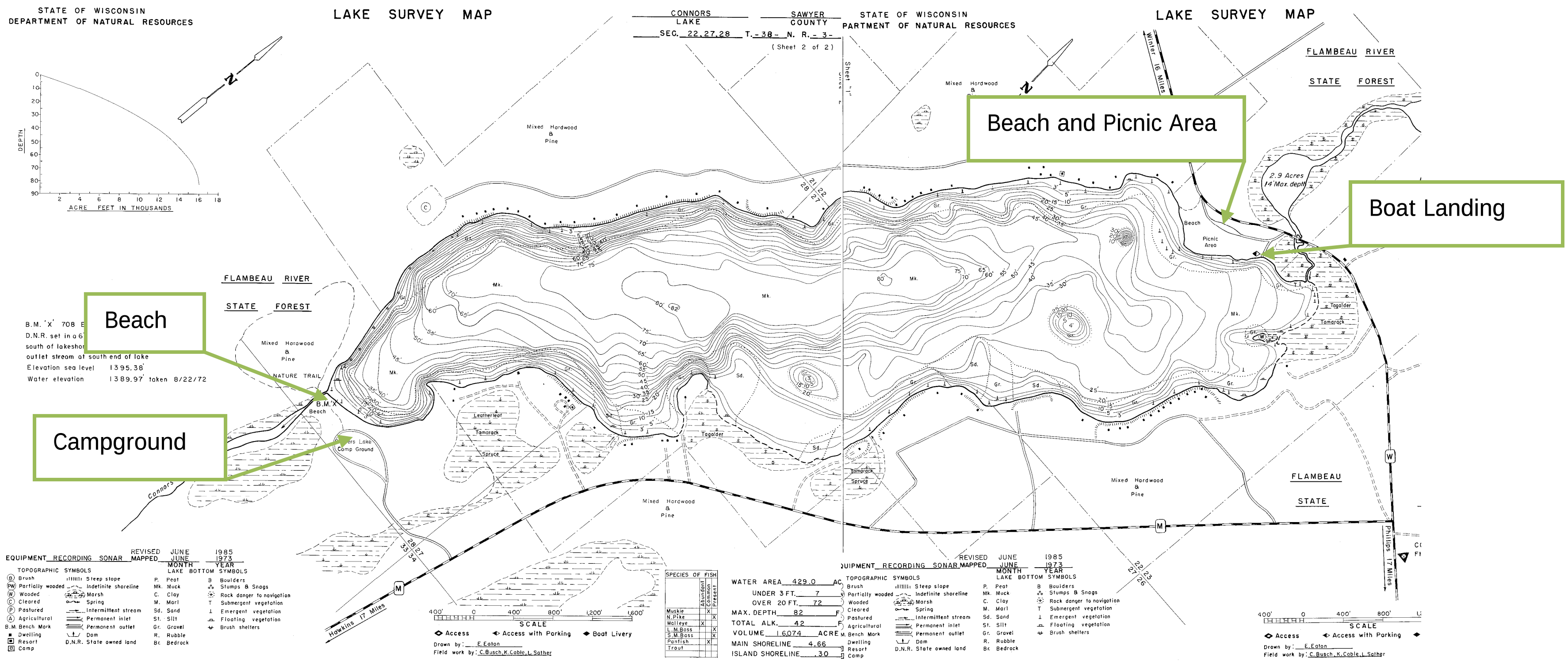


Figure 2. Map of Connors Lake and Papoose Lake

Water Quality

Wisconsin DNR (WDNR) classifies Connors Lake (WBIC 2275100) and Lake of the Pines (WBIC 2275300) as deep lowland lakes. The WDNR sets water quality standards based on lakes classification. Standards for deep lowland lakes are listed in Table 2.

Connors Lake has had a strong Citizen Lake Monitoring Network (CLMN) program since 2007 and has been assessed for water quality every two years since 2010. It has always met state water quality criteria for phosphorus and chlorophyll for Recreation use and Fish and Aquatic Life use as shown in Figure 3. There have been no significant trends in water quality over this time period.

Lake of the Pines was previously listed as impaired for recreational use for chlorophyll based on one elevated sample each year in 2014, 2016, and 2017. Current water quality data (2018-2024) shows that state criteria are being met.

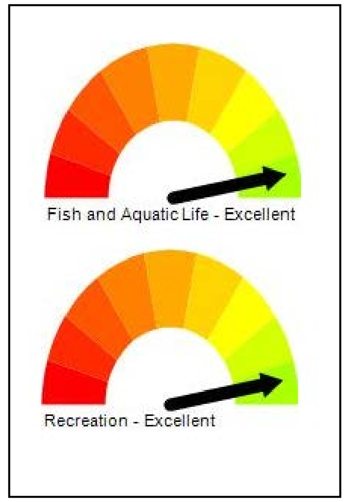


Figure 3. Connors Lake Condition

Table 1. WDNR Lakes Class Impairment Thresholds Deep Lowland Lakes

	Recreation Threshold	Aquatic Life Threshold	Connors Lake Mean (2014 – 2023)[3]	Lake of the Pines Mean (2014-2023)
Total Phosphorus	≥30 µg/L	≥30 µg/L	17 µg/L	20 µg/L
Chlorophyll-a	>5% of days with moderate algae levels (20 µg/L)	≥27 µg/L	5.1 µg/L	10.7 µg/L

Table 2. WDNR Lakes Classification and Status

Lake	Lake Classification	Recreation	Fish and Aquatic Life
Connors Lake	Deep Lowland	Excellent - Clearly Meets	Excellent - Clearly Meets
Lake of the Pines	Deep Lowland	Good	Excellent - Clearly Meets

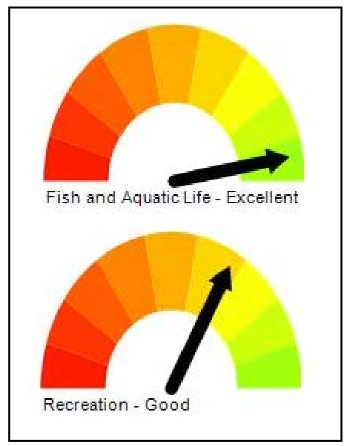


Figure 4. Lake of the Pines Condition

[3] https://dnr-wisconsin.shinyapps.io/WaterExplorer/?stationid=583204

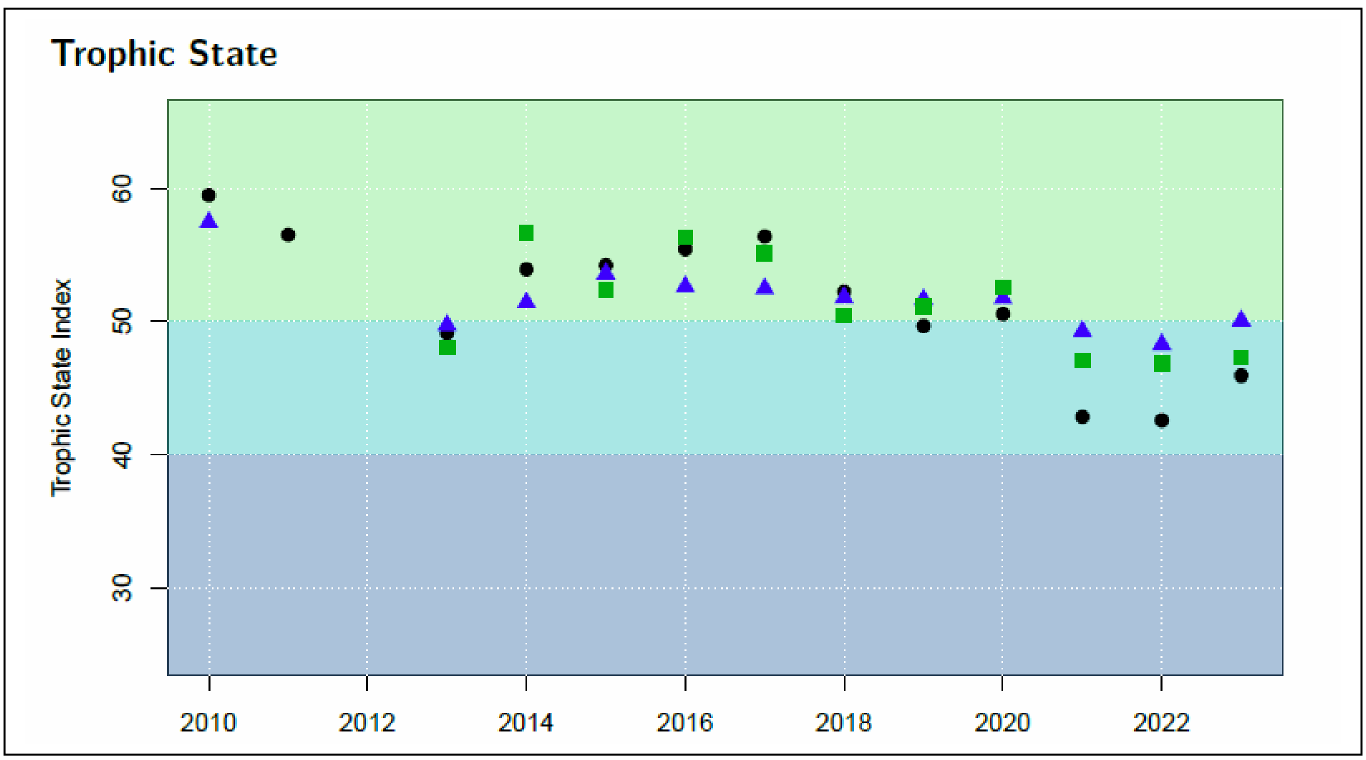
Lake Trophic State

Water quality is frequently reported by the trophic state or nutrient level of the lake. Nutrient rich lakes are classified as eutrophic. These lakes tend to have abundant aquatic plant growth and low water clarity due to algae blooms. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms. Oligotrophic lakes are nutrient poor with little growth of plants and algae.

Secchi depth readings are one way to assess the trophic status of a lake. The Secchi depth reported is the depth at which the black and white Secchi disk is no longer visible when it is lowered into the water. Greater Secchi depths occur with greater water clarity. Factors other than nutrient status (such as tannins in the water) may reduce water clarity and influence Secchi depth results.

Secchi depth readings, phosphorus concentrations, and chlorophyll measurements can each be used to calculate a Trophic State Index (TSI) for lakes. TSI values range from 0 – 110. TSI values from 40 to 50 characterize mesotrophic lakes. Lakes with TSI values greater than 50 are considered eutrophic, and lakes with TSI values below 40 are considered oligotrophic. The TSI equations use late summer (July 15 - September 15) averages of Secchi depth, total phosphorus, and chlorophyll-a.

Volunteers have monitored Lake of the Pines water quality through the WDNR Citizen's Lake Monitoring Program since 2010. Lake of the Pines is a mesotrophic to eutrophic lake as shown in Figure 6. In recent years, there are significant trends of decreasing total phosphorus and Secchi depth for Lake of the Pines.[4]



[4] https://dnr-wisconsin.shinyapps.io/WaterExplorer/?stationid=583204

FIGURE 5. LAKE OF THE PINES TROPHIC STATE INDEX 2010-2023

Volunteers monitored Connors Lake consistently since 2007. Connors Lake is generally mesotrophic measured by TSI values for Secchi depth, Chlorophyll-a, and total phosphorus as shown in Figure 7. There are no trends in any of these values.

Volunteers also take profile measurements of temperature and dissolved oxygen at the deep hole of each lake as part of the Citizen Lake Monitoring Program. Lake of the Pines generally stratifies with oxygen levels below 1 mg/L at depths below 15 to 20 feet from about mid-June through at least late August. Oxygen levels go below 1 mg/L at varied depths a bit later on Connors Lake, beginning somewhere from mid-June to early August. None of the records, which run through early October on Connors Lake and late August for Lake of the Pines, indicate that fall mixing has occurred on either lake by those times.

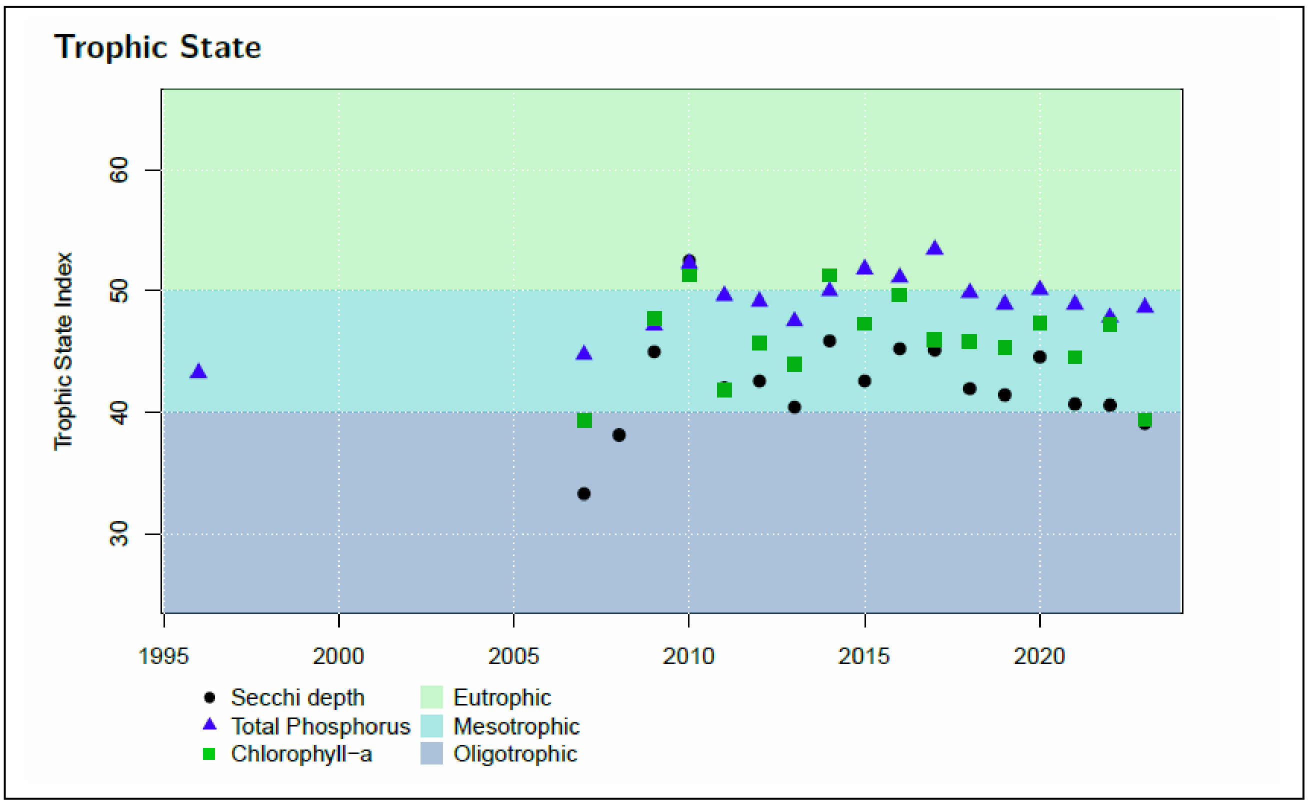


FIGURE 6. CONNORS LAKE TROPHIC STATE INDEX THROUGH 2023

Watershed

The lakes' watershed (Connors Creek), which approximately nine square miles, is part of the Lower North Fork of the Flambeau River watershed (Watershed Identification Key UC11) in the Upper Chippewa River Basin (Figure 8).[5] The lakes' watershed is a statewide priority because it is designated by the WDNR in the top 30% healthiest watersheds in the state. This is an indication that the natural land cover in the watershed should be protected to maintain water quality in the lakes. Land cover area is illustrated in Figure 7. The watershed of the lakes is mostly forested with some waterfront development. There are a total of only about 80 cabins around both lakes with most on Connors Lake. The watershed includes land in the Flambeau River State Forest.

Phosphorus from Watershed Runoff

Phosphorus is the pollutant that most influences the clarity of the lakes because it is the limited ingredient for algae growth.[6] Phosphorus is found dissolved in runoff water and carried in soil particles that erode from bare soil.

Phosphorus runoff from the watershed is determined by how land is used in the lakes' watershed along with watershed soils and topography. When a watershed is maintained in natural vegetation, there is less runoff of pollutants that impact the lake. Agricultural and residential lands tend to contribute greater amounts of phosphorus in runoff than undeveloped lands. Soil erosion is reduced when there is good vegetative cover. Water flow is slowed by tall vegetation, and forest groundcovers and fallen leaves allow runoff water to soak into the ground. In summary, anything that reduces soil erosion, and/or the amount of runoff water flowing from a portion of the watershed, reduces nutrient loading to the lake.

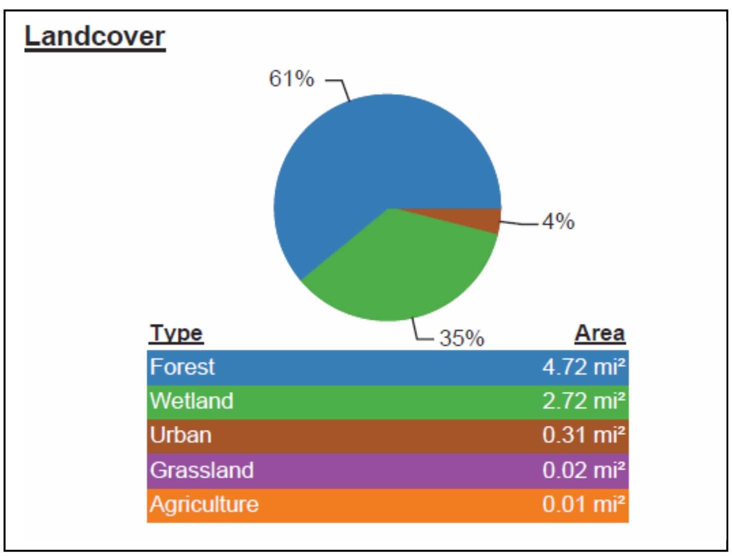


FIGURE 7. LANDCOVER OF THE LAKES WATERSHED

---

[5] Watershed delineated with WDNR Prestolite tool http://dnr.wi.gov/topic/SurfaceWater/PRESTO.html

[6] Based on data from 1996 sample results (nitrogen and phosphorus ratio) for both lakes.

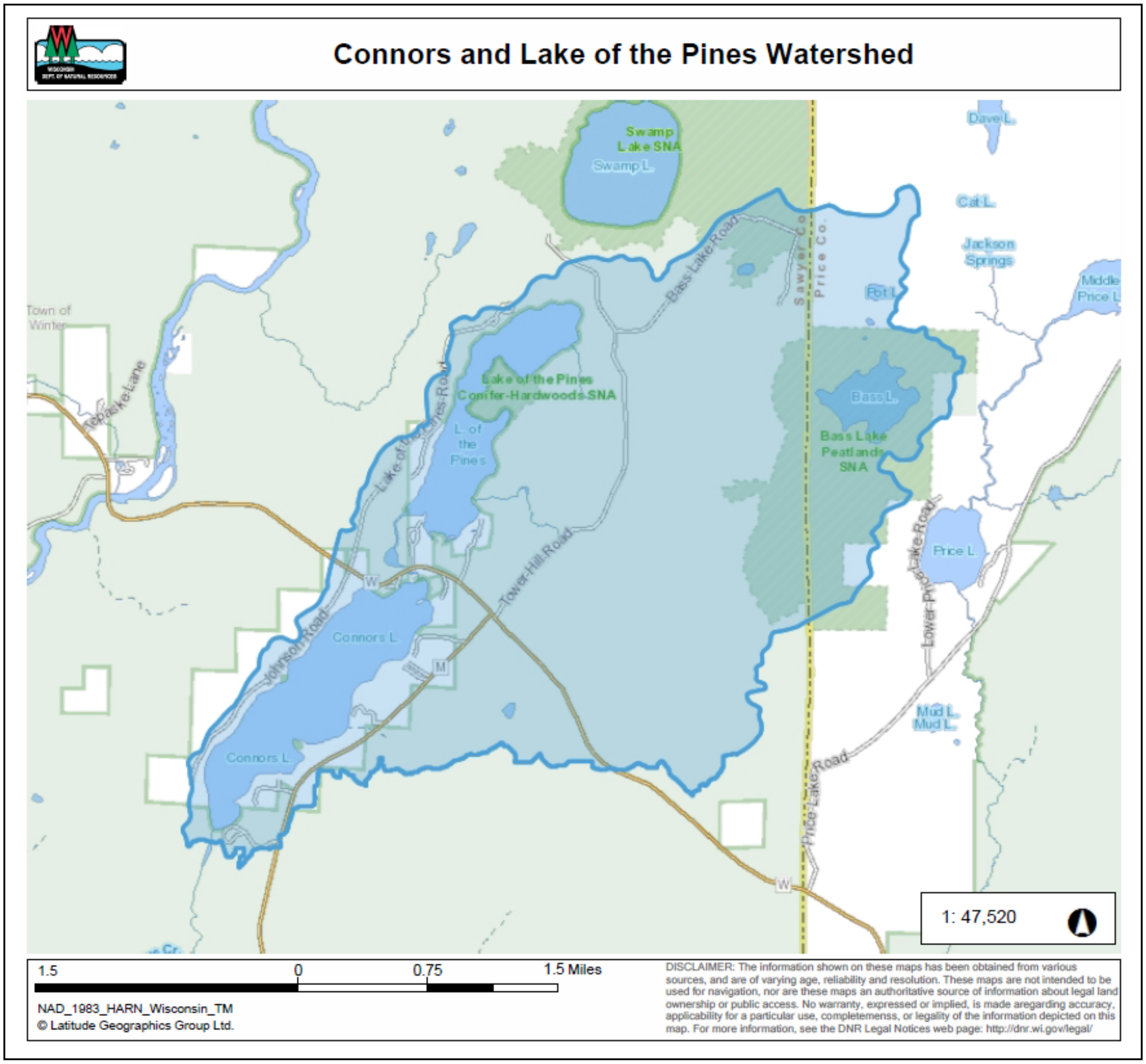


FIGURE 8. CONNORS LAKE AND LAKE OF THE PINES WATERSHED

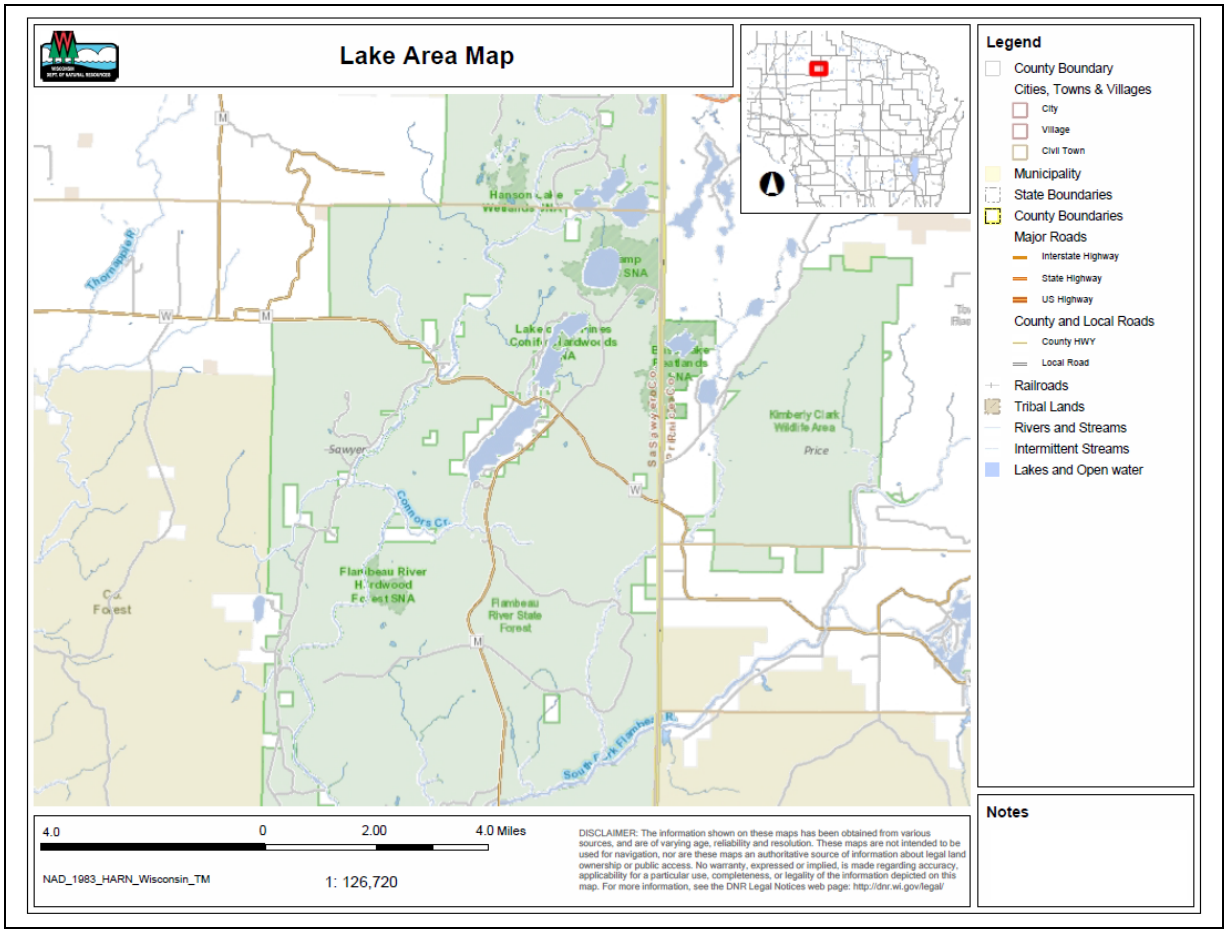


FIGURE 9. LAKE AREA MAP

Aquatic Use and Habitat

Primary Human Use Areas

The lakes are located within the heart of the Flambeau River State Forest. The Flambeau River State Forest has two major campgrounds, each with a public swimming beach, one on Connors Lake and the other on Lake of the Pines. The state forest also has a picnic area and swimming beach on the northern end of Connors Lake, and public boat access points provide day use at both Lake of the Pines and Connors Lake.

Nearby Water Bodies with EWM Present

The control of Eurasian water milfoil (EWM) in Connors Lake is critical because of the high use and recreational value of Connors Lake and connected Lake of the Pines. EWM control is also important because these waters flow directly to the Flambeau River and to several impoundments within the Flambeau River State Forest downstream. Several water bodies in Sawyer County and Price County have EWM or hybrid Eurasian/Northern water milfoil (HWM) present.

Table 3. Price County Lakes with EWM Present[7]

Waterbody	Species	WBIC	Year First Found
Duroy Lake	EWM	2240100	2000
Elk Lake	EWM	2240000	2002
Grassy Lake	EWM	2238100	2002
Lac Sault Dore	EWM	2236800	2004
Long Lake	EWM	2239300	2002
Musser Lake	EWM	2245100	2022
Wilson Lake	EWM	2239400	2002

[7] Information from WDNR web pages (03/11/2024) https://apps.dnr.wi.gov/lakes/invasives/AISLists.aspx?species=EWM&location=51

TABLE 4. SAWYER COUNTY LAKES WITH EWM PRESENT[8]

Waterbody	Species	WBIC	Year First Found
Barber Lake	EWM	2382300	2021
Big Sissabagama Lake	EWM	2393500	2022
Callahan Lake	EWM	2434700	2005
Chippewa Lake (above CTH B)	EWM	2414500	2006
Clear Lake	EWM	1841300	1999
Connors Lake	EWM	2275100	2002
Hayward	HWM	2725500	2012
Hayward Lake	EWM	2725500	2011
Lac Coute Oreilles	EWM	2390800	2017
Chippewa Flowage	EWM	2399700	1991
Little Lac Courte Oreilles	EWM	2390500	2015
Little Round Lake	EWM	2395500	1999
Lost Land Lake	EWM	2418600	2013
Lost Land Lake	HWM	2418600	2014
Mud Lake	EWM	2382200	2005
Mud Lake	EWM	2434800	2005
North Fork Chief River (Chippewa Fl. to Callahan Lake)	EWM	2434000	2006
Osprey Lake	EWM	2395100	2005
Radisson Flowage	EWM	2397400	2003
Round Lake	HWM	2395600	2022
Round Lake (Big Round)	EWM	2395600	1993
Whitefish Lake	EWM	2392000	2008

[8] Information from WDNR web pages (03/11/2024)
https://apps.dnr.wi.gov/lakes/invasives/AISLists.aspx?species=EWM&location=58

Functions and Values of Native Aquatic Plants

Naturally occurring native plants provide a diversity of habitat, help maintain water quality, sustain the fishing quality, and support common lakeshore wildlife from loons to frogs.

Water Quality

Aquatic plants can improve water quality by absorbing phosphorus, nitrogen, and other nutrients from the water that could otherwise fuel nuisance algae growth. Some plants can even filter and break down pollutants. Plant roots and underground stems help to prevent resuspension of sediments from the lake bottom. Stands of emergent plants (with stems that protrude above the water surface) and floating plants help to blunt wave action and prevent erosion at the shoreline.

Fishing

Habitat created by aquatic plants provides food and shelter for both young and adult fish. Invertebrates living on or beneath plants are a primary food source for fish. Other fish, such as bluegills, graze directly on the plants themselves. Plant beds provide important spawning habitat for many fish species. Northern pike eggs adhere to vegetation.

Waterfowl

Plants offer food, shelter, and nesting material. Birds eat both the invertebrates that live on plants and the plants themselves.[9] Emergent plants are especially important.

Protection against Invasive Species

Non-native, invasive species threaten native plants in Northern Wisconsin. The most common, Eurasian water milfoil (EWM) and curly leaf pondweed (CLP), are present in Connors Lake. These species are described as opportunistic invaders. These "invaders" benefit where an opening occurs from removal of plants. Without competition from other plants, invasive species may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed. This concept is easily observed on land where bare soil is quickly taken over by weeds that establish themselves as new occupants of the site. While not providing a guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established in a lake. Invasive species can change many of the natural features of a lake and often lead to expensive annual control plans. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.[10]

---

[9] Above paragraphs summarized from Through the Looking Glass. Borman etal. 1997.

[10] Taken from Aquatic Plant Management Strategy. DNR Northern Region. Summer 2007.

Habitat Areas

The Department of Natural Resources designates *critical habitat areas* that include both *sensitive areas* and *public rights features*. **Critical habitat areas have not been designated or proposed for project lakes.** The c*ritical habitat area* designation provides a holistic approach to ecosystem assessment and protection of those areas within a lake that are most important for preserving the character and qualities of the lake. These sites are those sensitive and fragile areas that support wildlife and fish habitat, provide the mechanisms that protect the water quality in the lake, harbor quality plant communities, and preserve the places of serenity and aesthetic beauty for the enjoyment of lake residents and visitors.

Critical habitat areas include *sensitive areas* that offer critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offer water quality or erosion control benefits to the area (Administrative code 107.05(3)(1)(1)). The Wisconsin Department of Natural Resources is given the authority for the identification and protection of sensitive areas of the lake in this code. *Public rights features* are areas that fulfill the right of the public for navigation, quality and quantity of water, fishing, swimming, or natural scenic beauty. Protecting these *critical habitat areas* requires the protection of shoreline and in-lake habitat.

Fishery

The Wisconsin Lakes book indicates that largemouth bass, smallmouth bass, walleye, panfish, and muskellunge are present in the lakes with relative abundance shown in Table 5. The current plant community is supporting a desirable fishery. Negative changes to the plant community could adversely impact the fish population. The fish present in the lakes depend upon aquatic vegetation for their survival. Stands of aquatic plants provide cover from predatory fish as well as forage areas for fish to feed on small organisms.

TABLE 5. FISH SPECIES OF CONNORS LAKE AND LAKE OF THE PINES

Common Name	**Scientific Name**	**Connors Lake Abundance**	**Lake of the Pines Abundance**
Largemouth bass	*Micropterus salmoides*	Present	Common
Smallmouth bass	*Micropterus dolomieu*	Common	Present[11]
Panfish	*various*	Common	Common
Muskellunge	*Esox masquinongy*	Common	Abundant
Walleye	*Sander vitreus vitreus*	Abundant	Common

Fish Management

The DNR currently stocks large fingerling muskies at a rate of 0.25 per acre every other year in Connors Lake and less frequently in Lake of the Pines. Walleye stocking began on Lake of the Pines in 2014 because of concerns about very low walleye density (Tables 6 and 7). Musky stocking was suspended in Lake of the Pines after the 2017 delivery because of high density and smaller than desirable size structure in the adult population (Scheirer, 2022). A 1985 report suggests that rusty crayfish should be harvested, but rusty crayfish abundance, and their impact on aquatic vegetation, have diminished substantially since then. It also stresses the importance of maintaining the present fish refuge at Connors Creek between the two lakes because it is a major source of natural reproduction for Connors Lake. This area is referred to as Papoose Lake in this plan.

[11] From Fishery Survey Summary Lake of the Pines, Sawyer County, Wisconsin, 2019-2021.

TABLE 6. CONNORS LAKE FISH STOCKING [12]

Year	Source	Species	Age Class	Number Fish	Average Length(in)
2023	DNR	MUSKELLUNGE	LARGE FINGERLING	107	11.9
2021	DNR	MUSKELLUNGE	LARGE FINGERLING	104	14.4
2019	DNR	MUSKELLUNGE	LARGE FINGERLING	103	12.6
2017	DNR	MUSKELLUNGE	LARGE FINGERLING	71	12.3
2012	DNR	MUSKELLUNGE	LARGE FINGERLING	429	13.3
2010	DNR	MUSKELLUNGE	LARGE FINGERLING	189	12.7
2008	DNR	MUSKELLUNGE	LARGE FINGERLING	429	10.5
2006	DNR	MUSKELLUNGE	LARGE FINGERLING	235	11.4
2004	DNR	MUSKELLUNGE	LARGE FINGERLING	427	11.1
2002	DNR	MUSKELLUNGE	LARGE FINGERLING	429	10.4
2000	DNR	MUSKELLUNGE	LARGE FINGERLING	215	12.1
1997	DNR	MUSKELLUNGE	LARGE FINGERLING	108	11.7
1996	DNR	MUSKELLUNGE	FINGERLING	429	10.8
1993	DNR	MUSKELLUNGE	FINGERLING	858	11.9
1992	DNR	MUSKELLUNGE	FINGERLING	858	9
1991	DNR	MUSKELLUNGE	FINGERLING	818	13
1990	DNR	MUSKELLUNGE	FINGERLING	818	9
1989	DNR	MUSKELLUNGE	FINGERLING	377	9
1988	Non-DNR	MINNOWS & CARP	ADULT	15000	3
1988	DNR	MUSKELLUNGE	FINGERLING	818	9
1987	DNR	MUSKELLUNGE	FINGERLING	2454	9
1985	DNR	MUSKELLUNGE	FINGERLING	1218	10
1984	DNR	MUSKELLUNGE	FINGERLING	818	11
1983	DNR	MUSKELLUNGE	FINGERLING	818	9
1982		SMALLMOUTH BASS	FINGERLING	11500	3
1981	DNR	MUSKELLUNGE	FINGERLING	400	9
1980		SMALLMOUTH BASS	FINGERLING	20000	1
1979	DNR	MUSKELLUNGE	FINGERLING	818	11
1978		SMALLMOUTH BASS	FINGERLING	9984	2
1977	DNR	MUSKELLUNGE	FINGERLING	800	7
1976	DNR	MUSKELLUNGE	FINGERLING	1000	8
1975	DNR	MUSKELLUNGE	FINGERLING	349	11
1974	DNR	MUSKELLUNGE	FINGERLING	750	11
1973	DNR	MUSKELLUNGE	FINGERLING	800	13
1972	DNR	MUSKELLUNGE	FINGERLING	400	15

[12] https://apps.dnr.wi.gov/fisheriesmanagement/Public/Summary/Index

TABLE 7. LAKE OF THE PINES FISH STOCKING[13]

Year	Source	Species	Age Class	Number Stocked	Average Length(in)
2023	DNR	MUSKELLUNGE[14]	LARGE FINGERLING	137	11.9
2022	DNR	WALLEYE	LARGE FINGERLING	4091	6.4
2020	DNR	WALLEYE	LARGE FINGERLING	4091	6.5
2018	DNR	WALLEYE	LARGE FINGERLING	4091	6.3
2017	DNR	MUSKELLUNGE	LARGE FINGERLING	158	11.5
2016	DNR	WALLEYE	LARGE FINGERLING	4089	7.1
2015	DNR	MUSKELLUNGE	LARGE FINGERLING	147	12.2
2014	DNR	WALLEYE	LARGE FINGERLING	4091	6.3
2013	DNR	MUSKELLUNGE	LARGE FINGERLING	137	11.6
2011	DNR	MUSKELLUNGE	LARGE FINGERLING	137	11.6
2009	DNR	MUSKELLUNGE	LARGE FINGERLING	273	10.2
2007	DNR	MUSKELLUNGE	LARGE FINGERLING	182	12.4
2005	DNR	MUSKELLUNGE	LARGE FINGERLING	273	11.2
2005	PRIVATE	MUSKELLUNGE	LARGE FINGERLING	276	11
2003	DNR	MUSKELLUNGE	LARGE FINGERLING	273	11.1
2001	DNR	MUSKELLUNGE	LARGE FINGERLING	273	10.5
2000	DNR	MUSKELLUNGE	LARGE FINGERLING	137	11
1997		MUSKELLUNGE	LARGE FINGERLING	137	11
1996		MUSKELLUNGE	LARGE FINGERLING	546	12
1991	DNR	MUSKELLUNGE	FINGERLING	546	12
1990	DNR	MUSKELLUNGE	FINGERLING	546	11
1989	DNR	MUSKELLUNGE	YEARLING	941	13
1988	DNR	MUSKELLUNGE	FINGERLING	1006	11
1987	DNR	MUSKELLUNGE	FINGERLING	1638	9
1986	DNR	MUSKELLUNGE	FINGERLING	546	9
1985	DNR	MUSKELLUNGE	FINGERLING	546	11
1984	DNR	MUSKELLUNGE	FINGERLING	546	11.33
1983	DNR	MUSKELLUNGE	FINGERLING	546	9
1981	DNR	MUSKELLUNGE	FINGERLING	275	7
1979	DNR	MUSKELLUNGE	FINGERLING	546	11
1978		SMALLMOUTH BASS	FINGERLING	7040	2
1977	DNR	MUSKELLUNGE	FINGERLING	450	13
1976	DNR	MUSKELLUNGE	FINGERLING	650	8

[13] https://apps.dnr.wi.gov/fisheriesmanagement/Public/Summary/Index

[14] Stocked in error. DNR suspended muskellunge stocking in 2017.

The DNR developed a Fishery Management Plan for Connors Lake and Lake of the Pines in 2008 and established goals and measurable objectives for important sportfish species (Scheirer and Neuswanger, 2008). Goals and recent survey results for walleye are shown in Table 8 (Wisconsin Department of Natural Resources, 2016) (Scheirer, 2022) (Scheirer, 2023).

Table 8. Walleye Goals and Measured Results[15]

Lake	Method	Goal	Actual	Year
Connors	Fyke Netting and Electrofishing	3-5 adults/acre	2.5	2021/22
Connors	Fyke Netting and Electrofishing	25-35% =>15”	48%	2021/22
Lake of the Pines	Fyke Netting and Electrofishing	3-5 adults/acre	2.2	2021
Lake of the Pines	Fyke Netting	25-35% =>15”	62%	2021

The Department of Natural Resources placed half-log structures in Connors Lake in 1986 to enhance smallmouth bass spawning habitat. Visual observations during annual nesting surveys (1986-1990) demonstrated that smallmouth used the structures, but there was no conclusive evidence of increased recruitment. The DNR Fishery Team has shifted away from promoting fish cribs as fish habitat to produce more or bigger fish. Instead, they now encourage groups and individuals to protect and/or replace the submerged woody structure that shoreland owners often remove from the near-shore zone of lakes for “better” recreational opportunity.[16]

---

[15] Fishery Status Updates. WDNR. Connors Lake and Lake of the Pines. September 2021.

[16] Email communication. Jeffrey Scheirer, WDNR Fisheries Biologist. May 5, 2017.

Potential Aquatic Plant Control Impacts

Local anglers and others have expressed concerns that fish may be negatively impacted with aquatic herbicide treatments. Past herbicide treatments to control Eurasian water milfoil on Connors Lake used 2,4-D (active ingredient is 2,4-dichloro-phenoxyacetic acid).

2,4-D

According to the DNR 2,4-D fact sheet:
Toxicity of aquatic 2,4-D products vary depending on whether the formulation is an amine or an ester. The ester formulations are moderately to highly toxic to freshwater fish and invertebrates; the amine formulations are slightly toxic to practically non-toxic to freshwater fish and invertebrates.

2,4-D does not accumulate at significant levels in fish tissues. Although fish exposed to 2,4-D may take up very small amounts of its breakdown products to then be metabolized, most of these products are rapidly excreted in urine.

In its consideration of exposure risks, the U.S. EPA believes no significant risks will occur to recreational users of water treated with 2,4-D (WDNR, 2022).

A 2022 DNR factsheet which summarizes multiple studies states: *exposure to 2,4-D, even at concentrations legally permitted by the Environmental Protection Agency for use in Wisconsin lakes, can have a negative effect on the survival, behavior, and cognition of early life stages of fish.* It stated further, *scheduling the timing of 2,4-D treatments after fish have completed spawning and larval growth stage development may be beneficial in minimizing non-target influences on these organisms* (WDNR, 2022).

Another study suggested that 2,4-D alters the development and function of neural circuits underlying vision of larval zebra fish and yellow perch and thereby reduces visually guided behaviors required for survival. (Dehnert, 2019). One chemical tested in this study, DMA4 IVM, is an amine formulation (Masiunas, date unknown).

ProcellaCOR

ProcellaCOR (active ingredient florpyrauxifen-benzyl) is an aquatic herbicide approved for use by the Environmental Protection Agency (EPA) in 2017. ProcellaCOR was granted Reduced Risk status by EPA under the Pesticide Registration Improvement Act (PRIA) because of its promising environmental and toxicological profiles in comparison to currently registered herbicides utilized for treatment of invasive water milfoils, and other noxious plant species.

ProcellaCOR EC was not acutely toxic up to its functional limit of solubility (40 ppb) in tests on freshwater invertebrates and freshwater fish, including rainbow trout, fathead minnow, and common carp. It was not chronically toxic to freshwater fish up to limit of functional solubility. Bioaccumulation data in fish showed low bioconcentration factors and rapid depuration[17], suggesting extensive metabolism, and limited risk to predatory birds and mammals that may consume fish. Metabolism data

---

[17] Depuration means the action or process of freeing something of impurities.

for mammals also demonstrates extensive metabolism, indicating bioaccumulation is unlikely. ProcellaCOR EC is also short lived in aquatic metabolism systems (2-6 days), which further limits its potential for bioaccumulation in the environment.

In summary, the potential for acute and chronic risks to fish, aquatic invertebrates, amphibians and other aquatic animals is considered low (Vermont Agency of Natural Resources Department of Environmental Conservation, 2022). There are no risks of concern to human health since no adverse short- or long-term effects, including a lack of carcinogenicity or mutagenicity, were observed in the submitted toxicological studies for florpyrauxifen-benzyl regardless of the route of exposure (WDNR, 2023).

There is potential to remove native plant species which provide important fish and aquatic invertebrate habitat with herbicide treatments. Native species that are labeled as susceptible to 2,4-D include native milfoils (*Myriophyllum spp.*), coontail (*Ceratophyllum demersum*), common waterweed (*Elodea canadensis*), naiads (*Najas spp.*), waterlilies (*Nymphaea spp. and Nuphar spp.*), bladderworts (*Utricularia spp.*) and duckweeds *(Lemna spp.*) (WDNR, 2022).

Native species listed on the product label as susceptible to ProcellaCOR (florpyrauxifen-benzyl) include coontail (*Ceratophyllum demersum*), variable-leaf water milfoil (*Myriophyllum heterophyllum*), watershield (*Brasenia schreberi*), pickerelweed (*Pontederia cordata*) and American lotus (*Nelumbo lutea*) (WDNR, 2023).

Fish spawning times may influence when herbicides are applied. They are summarized below for several species.

Table 9. Fish Spawning Times and Considerations[18]

Fish Species	Spawning Temp. (Degrees F)	Spawning Substrate / Location	Comments
Largemouth Bass Bluegills	Mid 60s – low 70s	Nests are built in 1-6 feet of water.	Nest builders
Walleye	42-50	Rock, rubble, gravel in 1-6 feet of water	Spawning occurs mid-April to mid-May
Musky	49 -60	<3 feet of water	Spawning occurs mid-April to mid-May
Black Crappie	Upper 50s – low 60s	Nests are built in 1-6 feet of water.	Nest builders

[18] Dnr.wisconsin.gov/topic/fishery

Plant Survey Results

Lake of the Pines

Aquatic plant point intercept surveys were completed for Lake of the Pines in 2007 and 2017 (Schieffer, 2007) (Schieffer, 2017). Because there is no active aquatic plant control on the lake, plant surveys occur less frequently than on Connors Lake. Plant survey methods are found in the Aquatic Plant Management companion document which is incorporated by reference (Clemens, 2022).

A rake is used to collect plant samples at each sample point that occurs at depths where plants are likely to grow. Rake fullness is recorded for each species (as described in Table 10 and illustrated in Figure 10) at every sample point. Rake fullness and presence/absence at each sample point are used to generate survey results.

TABLE 10. AQUATIC PLANT SURVEY RAKE FULLNESS RATINGS

Rake Fullness Rating	Criteria for Rake Fullness Rating
1	Plant present, occupies less than ½ tine space
2	Plant present, occupies more than ½ tine space
3	Plant present, occupies all or more than tine space
v	Plant not sampled but observed within 6 feet of boat

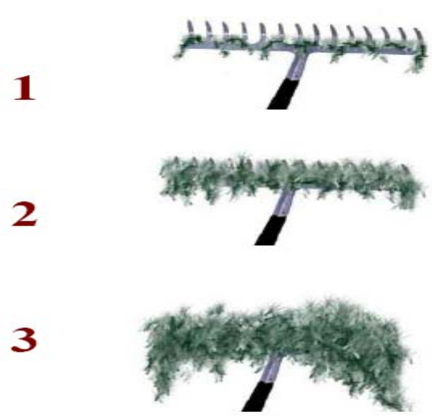


FIGURE 10. PLANT RAKE FULLNESS

The full lake point intercept survey conducted on Lake of the Pines in August 2017, revealed a healthy and diverse aquatic plant community sampling 35 native species. The Simpson's diversity index was 0.94. The dark, tannic water of Lake of the Pines appears to limit the maximum depth of plant growth (12.4 feet in 2017). Table 11 summarizes the results of the 2017 survey.

The coverage of plants in Lake of the Pines is limited. Only 16.3% of sample points had plants sampled. Within the defined littoral zone (depths less than 12.4 feet), 62.73% of the sample points had plants sampled. The littoral zone is narrow, with lake depths increasing rapidly not far from shore. This, coupled with dark water, appears to limit plant growth. The diversity is highest in the more shallow bays, which also possess higher nutrient sediments for plants to grow. Figure 11 shows the rake density and Figure 12 shows the species richness (number of species sampled) at each sample point. A full species list with frequency of occurrence and rake density information is found in the point intercept survey report.

TABLE 11. LAKE OF THE PINES 2017 POINT INTERCEPT SURVEY DATA SUMMARY

Total number of sites in grid	621
Total number of sites with vegetation	101
Total number of sites shallower than maximum depth of plants	161
Frequency of entire sample points with plants	16.3%
Frequency of occurrence at sites shallower than maximum depth of plants	62.73%
Simpson Diversity Index	0.94
Maximum depth of plants	12.4 ft.
Average number of all species per site (shallower than max depth)	2.14
Average number of all species per site (veg. sites only)	3.42
Average number of native species per site (shallower than max depth)	2.14
Average number of native species per site (veg. sites only)	3.42
Species Richness	35
Species Richness (including visuals)	36

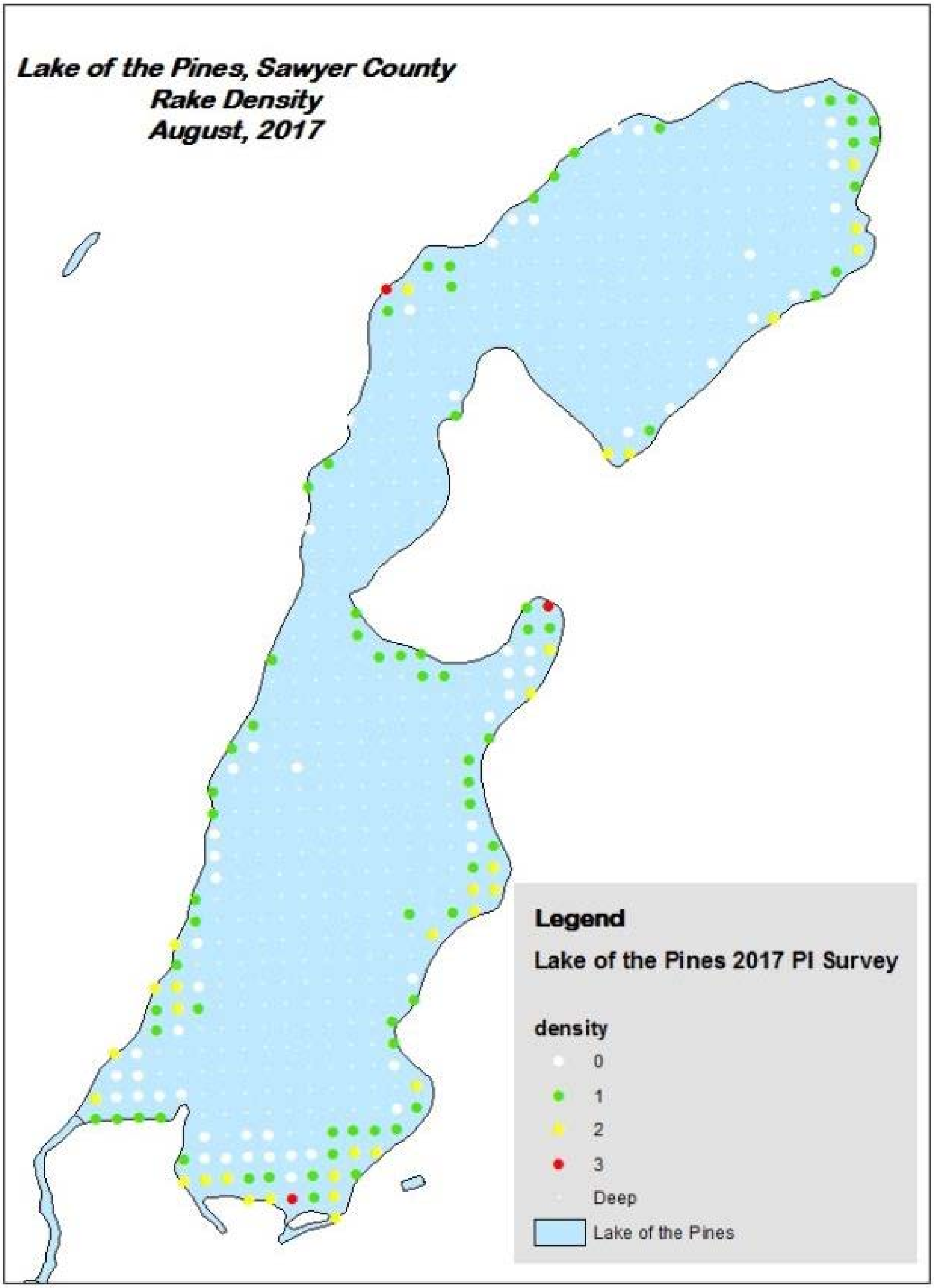


FIGURE 11. LAKE OF THE PINES RAKE DENSITY 2017

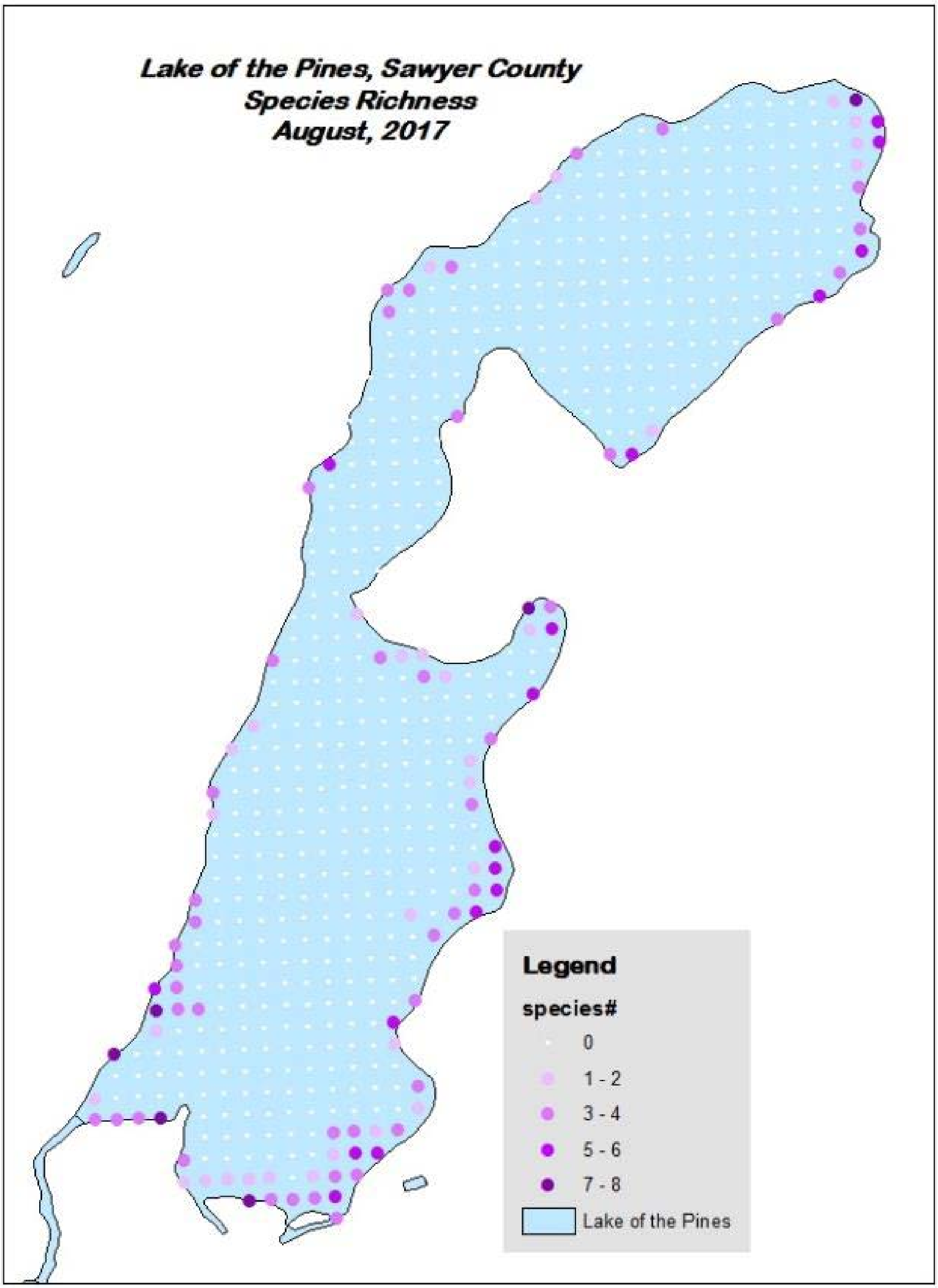


FIGURE 12. LAKE OF THE PINES SPECIES RICHNESS

Summary results from the two surveys of Lake of the Pines are shown in Table 12. Plant diversity increased slightly from 2007 to 2017, as demonstrated by small increases in species richness and Simpson's diversity index. There was a decrease in plant coverage with 20 fewer sample points with plants in 2017 compared to 2007. The dominant species changed too, with the most common plant remaining the same, but the second and third most common changing. These plants are all common in Wisconsin lakes.

The floristic quality index (FQI) for a lake can indicate changes occurring in plant habitat due to human activity. The FQI in Lake of the Pines was 39.0 in 2017 (Table 12), which is substantially higher than the ecoregion (Northern Lakes and Forests) median of 24.3. It indicates a healthy, diverse plant community that reflects little human impact on the plant community.

Overall, the aquatic plant community changes from 2007 to 2017 are no cause for concern. There were significant changes in frequencies of some plants, but the general data overview shows little change, with more increases (7) than decreases (4). No plant management occurred on Lake of the Pines during this time period, so most change is likely due to natural variation in the community and/or sampling variation.

TABLE 12. LAKE OF THE PINES 2007 AND 2017 AQUATIC PLANT SURVEYS RESULTS COMPARISON

	2007	**2017**
Species Richness (number of species sampled)	32	35
Dominant Species	1. *Potamogeton robbinsii* 2. *Potamogeton zosteriformis* 3. *Najas flexilis*	1. *Potamogeton robbinsii* 2. *Valisneria americana* 3. *Myriophyllum sibiricum*
Simpson's Diversity Index	0.91	0.94
Maximum Depth of Plants	11.6	12.4
Floristic Quality Index (FQI)	35.9	39.0
Sites with Vegetation	121	101
Frequency of Occurrence in Littoral Zone	77.07	62.73

Connors Lake

The Department of Natural Resources completed aquatic plant surveys according to the point intercept method for Connors Lake in 2005 and 2007-2015. Ecological integrity Service (Steve Schieffer) completed surveys in 2019, 2021, and 2022. Survey results from 2022 are summarized in Table 13. Connors Lake has a diverse plant community with 35 species of aquatic plants sampled with a rake and 37 sampled and viewed. Table 14 lists these species along with sampling frequency data. Two additional plants were viewed outside of sampling points: *Decodon verticillatus*, Swamp loosestrife and *Sagittaria rigida*, Sessile-fruited arrowhead. Those species sensitive to the herbicides used to control Eurasian water milfoil are highlighted in red (for ProcellaCOR) and orange (for 2,4-D). Light orange shading indicates the plant is susceptible to both herbicides.

The coverage of plants in Connors Lake is limited. The littoral zone (depths were plants grow) contained plant growth at 84.15% of the sample points. However, the littoral zone is narrow in Connors Lake, resulting in plant coverage in only 15.6% of the whole-lake sample point grid. The mean rake fullness map (Figure 13) illustrates the limited coverage of aquatic plants in Connors Lake. Most of the plant growth occurs in a few bays. Musky Bay has the most extensive growth and diversity. This is followed by a small bay just south of Musky Bay and the bay on the northeast end of the lake (Figure 14).

TABLE 13. CONNORS LAKE 2022 POINT INTERCEPT SURVEY SUMMARY

Total number of sites in the entire lake	986
Total number of sites with vegetation	154
Total number of sites is shallower than the maximum depth of plants	183
Frequency of occurrence at sites shallower than the maximum depth of plants	84.15%
Simpson Diversity Index	0.92
Maximum depth of plants	13.70 ft.
Mean depth of plants	3.85 ft.
Average number of all species per site (shallower than max depth)	2.26
Average number of all species per site (vegetated sites only)	2.71
Average number of native species per site (shallower than max depth)	2.22
Average number of native species per site (vegetated sites only)	2.66
Species Richness (number of species sampled)	35
Species Richness (including visuals)	37

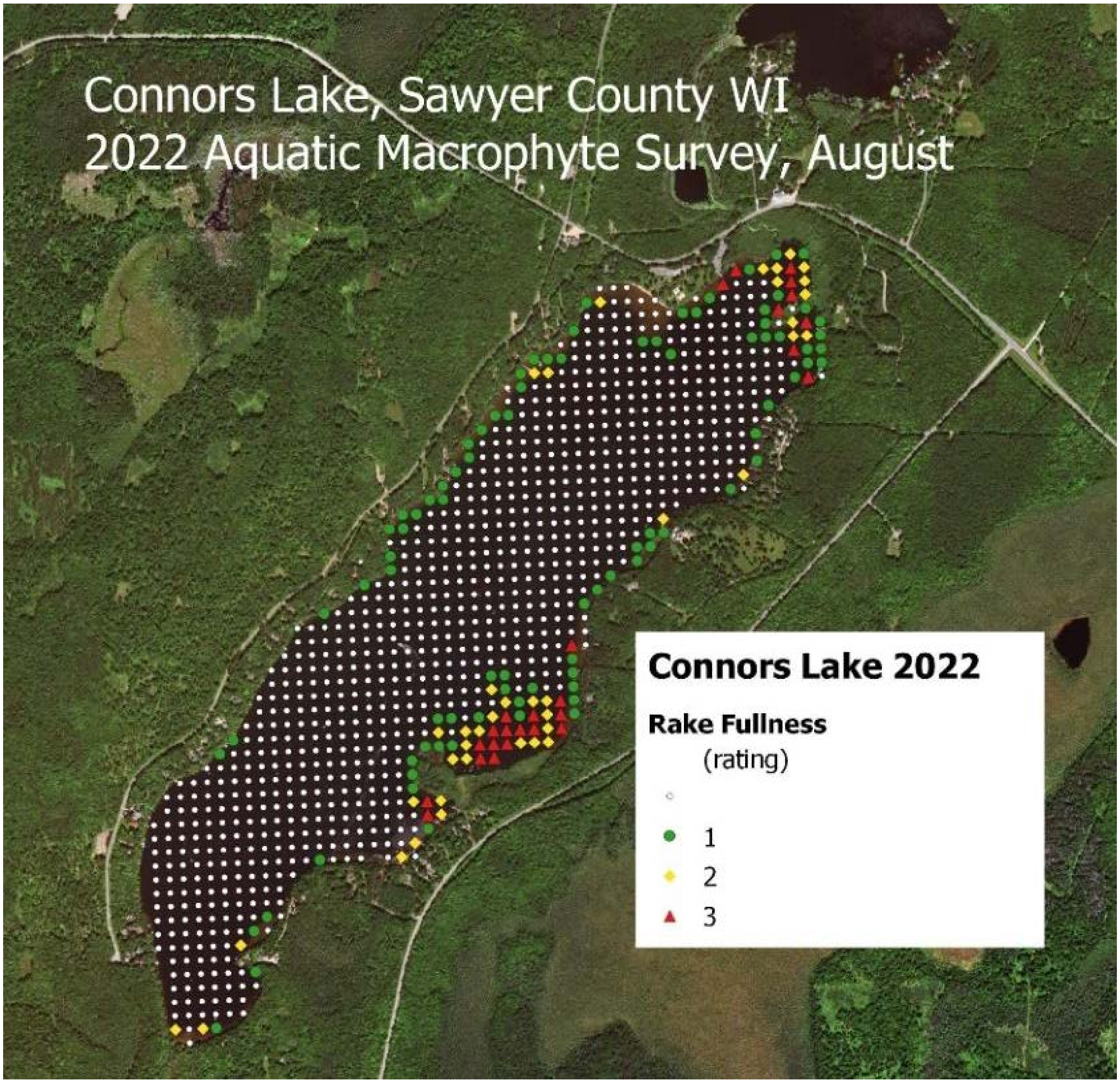


FIGURE 13. MEAN RAKE FULLNESS CONNORS LAKE 2022

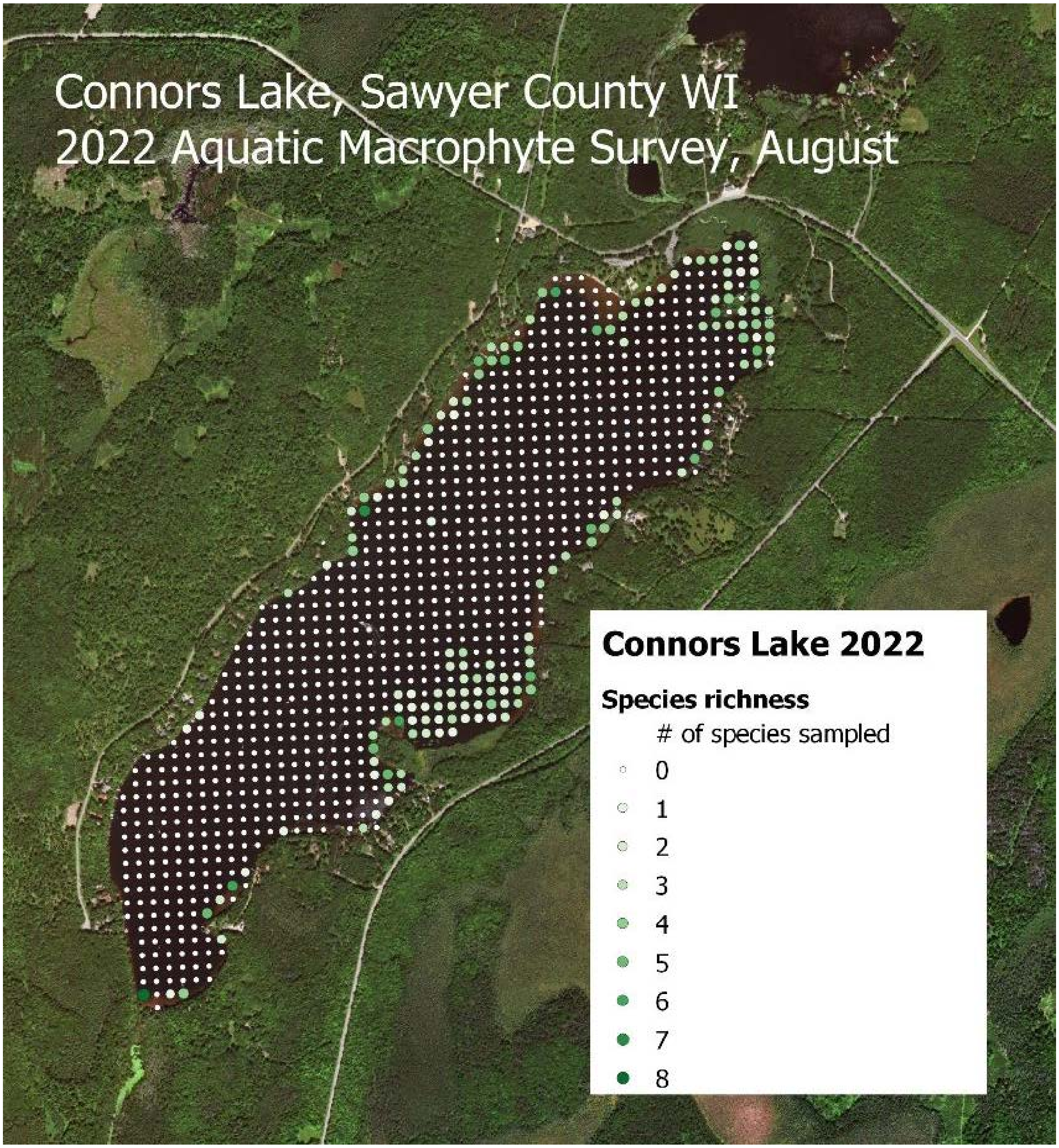


FIGURE 14. SPECIES RICHNESS CONNORS LAKE 2022

TABLE 14. CONNORS LAKE 2022 AQUATIC PLANT SPECIES SURVEY RESULTS[18]

Species	FOO Vegetated	FOO Littoral	Relative Freq.	Number Sampled	Mean Rake Fullness
Potamogeton robbinsii, Fern pondweed	35.71	30.05	13.19	55	1.40
Najas flexilis, Slender naiad	29.87	25.14	11.03	46	1.00
Potamogeton amplifolius, Large-leaf pondweed	27.92	23.50	10.31	43	1.09
Potamogeton gramineus, Variable pondweed	27.27	22.95	10.07	42	1.02
Vallisneria americana, Wild celery	25.97	21.86	9.59	40	1.08
Potamogeton richardsonii, Clasping-leaf pondweed	18.83	15.85	6.95	29	1.48
Schoenoplectus acutus, Hardstem bulrush	18.18	15.30	6.71	28	1.00
Myriophyllum sibiricum, Northern water-milfoil	11.69	9.84	4.32	18	1.00
Eleocharis palustris, Creeping spikerush	9.09	7.65	3.36	14	1.00
Ceratophyllum demersum, Coontail	7.79	6.56	2.88	12	1.25
Elodea canadensis, Common waterweed	7.79	6.56	2.88	12	1.08
Potamogeton zosteriformis, Flat-stem pondweed	7.79	6.56	2.88	12	1.08
Heteranthera dubia, Water star-grass	7.14	6.01	2.64	11	1.00
Myriophyllum spicatum, Eurasian water milfoil	5.19	4.37	1.92	8	1.75
Eleocharis acicularis, Needle spikerush	3.25	2.73	1.20	5	1.00
Nuphar variegata, Spatterdock	2.60	2.19	0.96	4	1.00
Potamogeton pusillus, Small pondweed	2.60	2.19	0.96	4	1.00
Chara sp., Muskgrasses	1.95	1.64	0.72	3	1.00
Nymphaea odorata, White water lily	1.95	1.64	0.72	3	1.00
Pontederia cordata, Pickerelweed	1.95	1.64	0.72	3	1.00
Sagittaria sp., Arrowhead	1.95	1.64	0.72	3	1.00
Bidens beckii, Water marigold	1.30	1.09	0.48	2	1.00
Equisetum fluviatile, Water horsetail	1.30	1.09	0.48	2	1.00
Eriocaulon aquaticum, Pipewort	1.30	1.09	0.48	2	1.00
Isoetes echinospora, Spiny spored-quillwort	1.30	1.09	0.48	2	1.00
Nitella sp., Nitella	1.30	1.09	0.48	2	1.00
Potamogeton illinoensis, Illinois pondweed	1.30	1.09	0.48	2	1.00
Potamogeton spirillus, Spiral-fruited pondweed	1.30	1.09	0.48	2	1.00
Schoenoplectus pungens, Three-square bulrush	1.30	1.09	0.48	2	1.00
Lobelia dortmanna, Water lobelia	0.65	0.55	0.24	1	1.00
Myriophyllum tenellum, Dwarf water-milfoil	0.65	0.55	0.24	1	1.00
Potamogeton epihydrus, Ribbon-leaf pondweed	0.65	0.55	0.24	1	1.00
Potamogeton praelongus, White-stem pondweed	0.65	0.55	0.24	1	1.00
Ranunculus aquatilis, White water crowfoot	0.65	0.55	0.24	1	1.00
Sparganium eurycarpum, Common bur-reed	0.65	0.55	0.24	1	1.00

[18] FOO = Frequency of Occurrence. Those species sensitive to the herbicides used to control Eurasian water milfoil are highlighted in red (for ProcellaCOR) and orange (for 2,4-D). Light orange shading indicates the plant is susceptible to both herbicides.

Comparison to Previous Surveys

A key rationale for conducting aquatic plant surveys is to compare survey results to evaluate any changes in the plant community. This is especially beneficial when management practices such as herbicide treatments were employed. The 2022 survey results were compared to the most recent survey in 2021 and to the oldest survey from 2005.

Changes in the plant community between 2005 and 2022 appear to be minimal based on the broad parameters compared in Table 15. The plant diversity of Connors Lake has remained consistent in recent years, but has increased from 2005. The 2022 survey had the highest species richness, and 2005 had the lowest. Simpson's diversity index is nearly the same in all three surveys. The FQI in 2021 and 2022 were nearly the same, both years higher than the 2005 baseline survey. All FQI results are higher than the ecoregion (Northern Lakes and Forest) median of 24.3.

Table 15. Connors Lake 2005, 2021, and 2022 Aquatic Plant Surveys Results Comparison

Parameter	2005	2021	2022
Species Richness	27	34	35
Simpson's Diversity Index	0.92	0.92	0.92
Native Species per Sample Site	1.5	2.45	2.66
Maximum Depth with Plants	15.5	15.7	13.7
Mean Conservatism Value	7.4	6.9	6.7
Floristic Quality Index	35.4	38.9	38.5
Frequency of Occurrence in Littoral Zone	71.4%	72.8%	84.15%

Changes in the plant community for each survey year (2005 – 2015) were provided in more detail in the 2017 Connors Lake and Lake of the Pines Aquatic Plant Management Plan. Herbicide treatments to control Eurasian water milfoil occurred primarily during this time period. The native species previously found to be susceptible to 2,4-D herbicide (Nault, 2012) were evaluated for potential significant reductions compared with the 2005 aquatic plant survey. **Northern water milfoil** (*Myriophyllum sibiricum*) showed significant reductions in 2009 and 2011 through 2015 when compared with frequency of occurrence in 2005. **Water stargrass** (*Heteranthera dubia*) showed a significant reduction only in 2011 when compared with frequency of occurrence in 2005. **Slender naiad** (*Najas flexilis*) showed reductions in 2008, 2013, and 2015 when compared with frequency of occurrence in 2005.

In Tables 16-18, changes in individual species from 2005 to the 2022 are examined. The herbicide-sensitive plants appear to have recovered in recent years. The only long-term native plant reductions observed were in common waterweed (*Elodea Canadensis),* flat-stem pondweed *(Potamogeton zosteriformis), nitella sp.* and Illinois pondweed *(Potamogeton illinoensis).*[20]

[20] Variable and Illinois pondweed may have been misidentified in 2005, as these numbers were more consistent in subsequent surveys.

Table 16. Species with a Statistically Significant Increases 2005 - 2022

	Number Sampled 2005	Number Sampled 2022	P-value
Potamogeton robbinsii (fern pondweed)	4	55	$7.8X10^{-14}$
Potamogeton gramineus (variable pondweed)*	3	42	$2.2X10^{-10}$
Eleocharis palustris (creeping spikerush)	0	14	$1.0X10^{--5}$
Potamogeton richardsonii (clasping pondweed)	5	29	$1.0X10^{-5}$
Vallisneria americana (wild celery)	15	40	$1.7X10^{-4}$
Schoenoplectus acutus (hard-stem bullrush)	12	28	0.006
Potamogeton pusillus (small pondweed)	0	4	0.04

*

Table 17. Species with a Statistically Significant Decreases 2005 - 2022

	Number Sampled 2005	Number Sampled 2022	P-value
***Myriophyllum spicatum* (Eurasian water milfoil)**	**38**	**8**	**$1.3X10^{-6}$**
Elodea canadensis (common waterweed)	34	12	0.0004
Potamogeton zosteriformis (flat-stem pondweed)	40	12	$2.0X10^{-5}$
Nitella sp.	19	2	$1.1X10^{-4}$
Potamogeton illinoensis (Illinois pondweed)*	13	2	0.003

*Variable and Illinois pondweed may have been misidentified in 2005, as these numbers were more consistent in subsequent surveys.

Table 18. Species with a Statistically Significant Increases 2021 - 2022

	Number Sampled 2021	Number Sampled 2022	P-value
Najas flexilis (slender naiad)	26	46	0.006
Eleocharis acicularis (needle spikerush)	0	5	0.02
Potamogeton richardsonii (clasping pondweed)	15	29	0.02

There were no statistically significant decreases from 2021-2022.

Curly Leaf Pondweed

Curly Leaf Pondweed (*Potamogeton crispus*), a non-native invasive species that grows early in the season, was found in the 2005 plant survey. Because curly leaf pondweed did not appear to be spreading or causing nuisance conditions in Connors Lake[21], early season point intercept surveys have not been completed for the lake.

[21] Schieffer, Steve. Email communication May 2017.

Eurasian Water Milfoil

Figure 15 shows the distribution and density of EWM in Connors Lake in August 2022. EWM had a frequency of 4.62% within the littoral zone (depths where plants grow) and 6.34% in the vegetated littoral zone. By comparison, the frequency of occurrence of the native milfoil (northern water milfoil) was 11.69% in the vegetated littoral zone.

In 2022, EWM was still limited to Musky Bay during the point intercept survey. In years past, it was scattered into other locations on the lake. The EWM frequency of occurrence has ranged from a high in 2005 (27.14%) to a low in 2015 (1.57%). A trend line indicates an overall decline in frequency of EWM since 2005 (Figure 18).

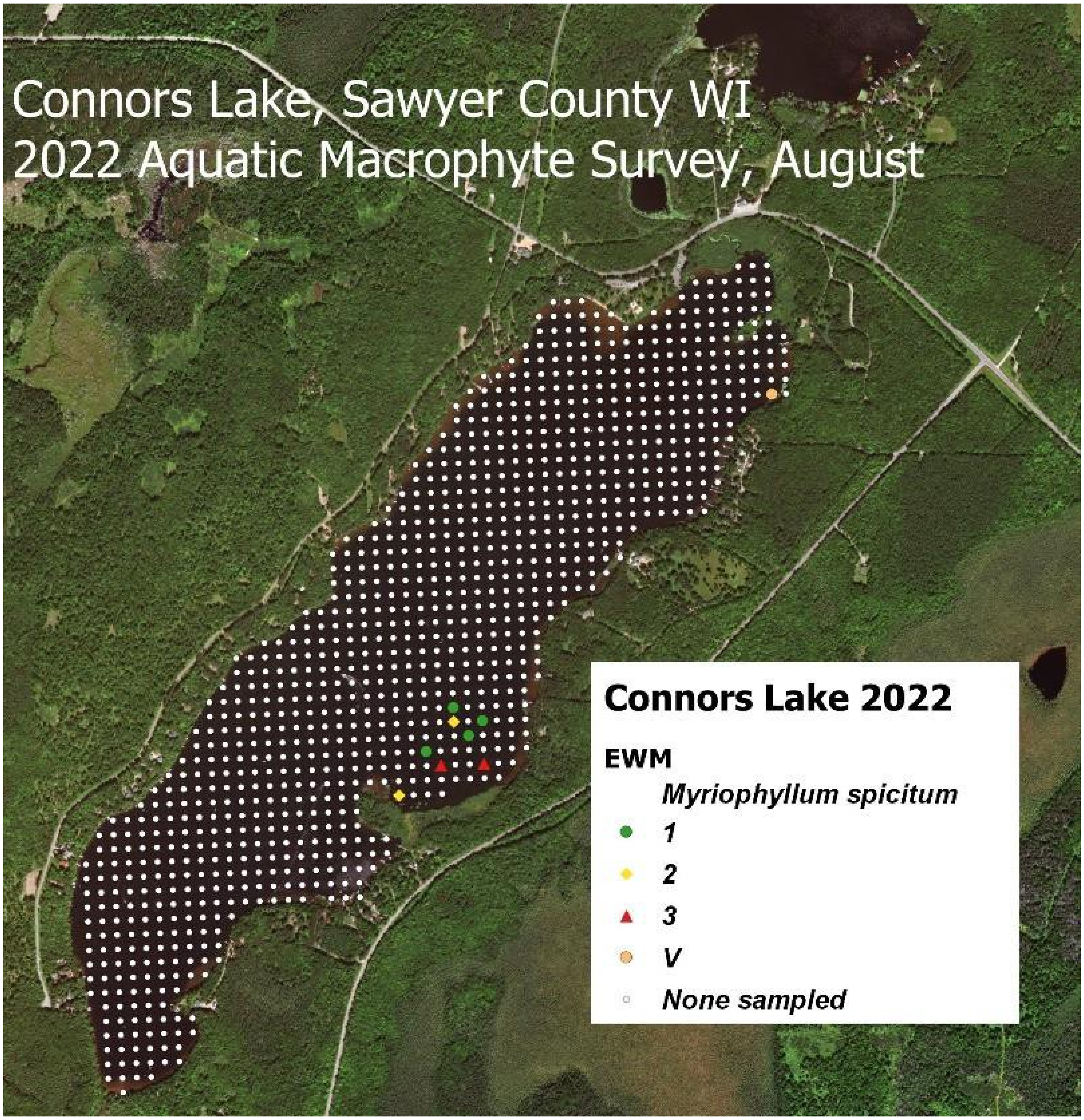


FIGURE 15. RAKE DENSITY OF EURASIAN WATER MILFOIL

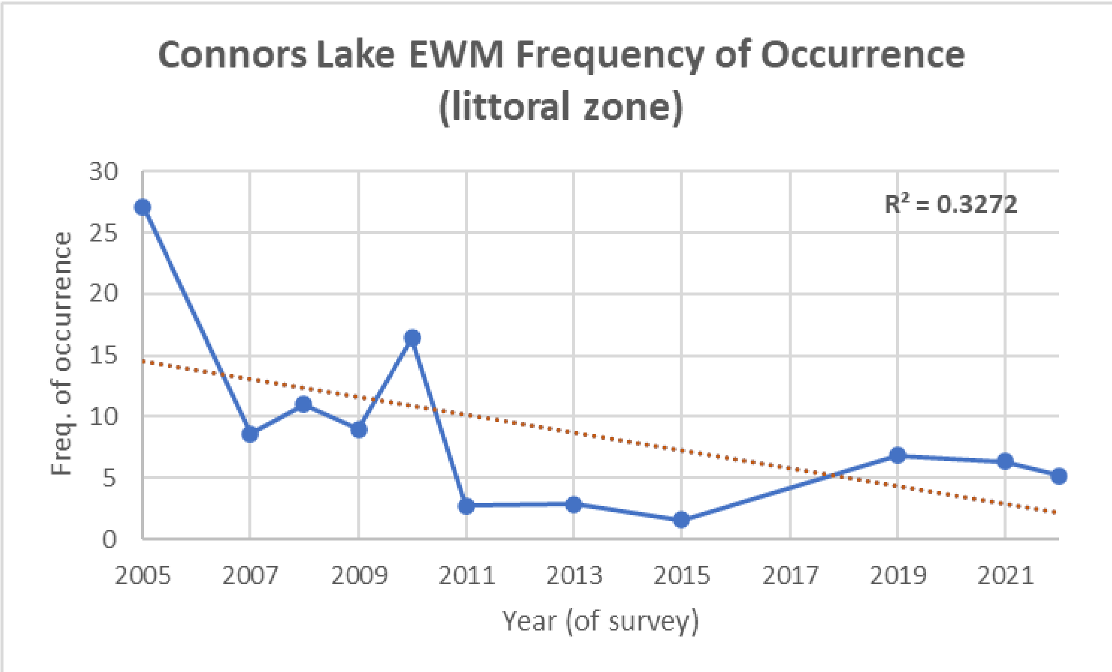


FIGURE 16. FREQUENCY OF OCCURRENCE OF EWM SINCE 2005[22]

Eurasian water milfoil was first discovered by WDNR staffer Craig Roesler in 2002. The June 2003 EWM survey located a total of about 23 acres with significant amounts of EWM growing at depths between 3 and 10 feet (Figure 17). EWM locations in 2005 are shown in Figure 18. Additional maps of EWM growth are found in the 2014 Aquatic Plant Management Plan.

[22] In years when full aquatic plant point intercept surveys were conducted

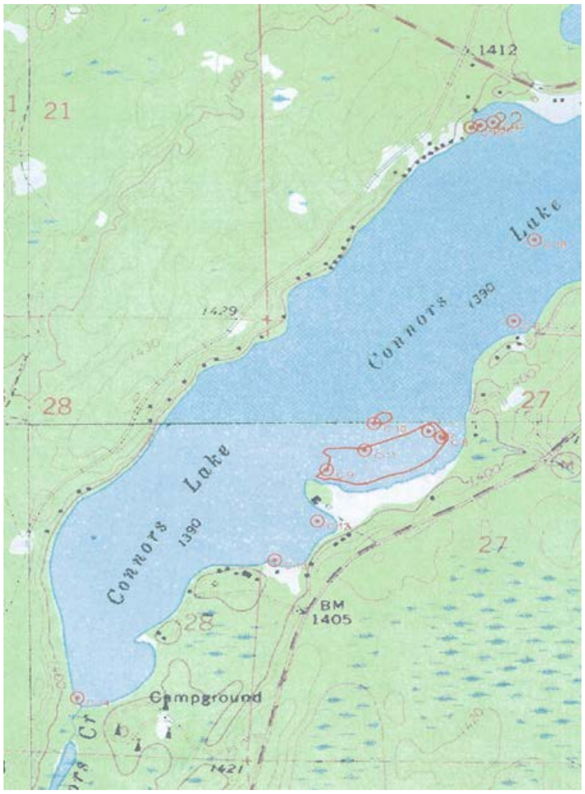


FIGURE 18. EURASIAN WATER MILFOIL LOCATIONS IN 2003

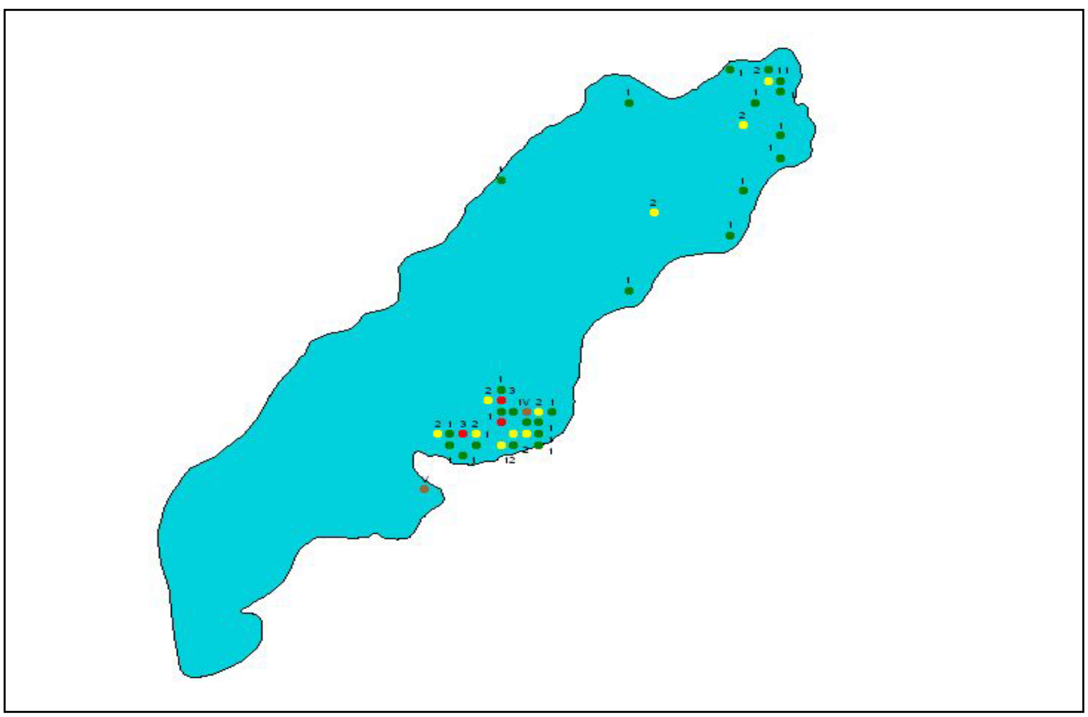


FIGURE 17. EURASIAN WATER MILFOIL LOCATIONS RAKE FULLNESS: ● 1 ● 2 ● 3 (JULY 2005)

A summary of herbicide treatments targeting Eurasian water milfoil is included in Table 19 with more detail including treatment maps included in the 2017 aquatic plant management plan. These early applications included many small, spot treatments.

TABLE 19. HERBICIDE TREATMENT OF AT LEAST 10 PERCENT OF THE LITTORAL ZONE

Treatment Year	Area (acres)
2005 (June)	32
2005 (Sept)	5
2006 (July)	5
2007 (June)	9.8
2009	28.8
2010	18.7
2013	4.73
2015	3.5
2016	3.0

The 2008 Aquatic Plant Management Plan, which guided Connors Lake EWM management, outlined a treatment strategy for various areas of lake. Each area had a “tolerance” designated for presence of EWM and resulting treatment strategy. The treatment strategy emphasized high levels of EWM removal in low tolerance areas and delaying herbicide treatment until EWM reached specific frequency and density thresholds prior to herbicide treatment in other areas. The strategy assumed that treatment as small as 500 square feet could be effective at removing EWM.

The 2008 plan strategy was clearly not followed in plan implementation. In fact, it appears that any amount of EWM was treated in any area of the lake where it was found. For example, in Musky Bay, a designated mid-tolerance area, beds as small as .07 acres with mean density of 1 were treated in 2014. In addition, smaller “spot” treatments involved sprinkling granular 2,4-D over small clumps of plants in 2014 and other years.

Recommendations from Project Consultants (2024)

- Continue to manage using tolerance areas from the 2017 Aquatic Plant Management Plan.
- Use hand-pulling methods to remove scattered EWM.
- Avoid spread of plant fragments during hand-pulling.
- Wait for high density growth prior to herbicide treatment.
- Use ProcellaCOR for small treatment areas.
- If 2,4-D herbicide treatments are used, conduct early in the season prior to extensive native plant growth.
- Do not conduct spot herbicide treatments or use 2,4-D for small scale treatments (<5 acres).
- Consider timing and location of chemical treatments to avoid negative impacts to spawning and fish nursery habitat.
- Equipment used for monitoring must be decontaminated if used on any other water body.
- Avoid herbicide treatments using the same chemical group for more than 2 consecutive years to prevent development of herbicide resistance. [23]

[23] WDNR factsheets for ProcellaCOR (WSSA Group 4 herbicide) and 2,4-D (WSSA Group 4 herbicide) state: *It is important to note that repeated use of herbicides in the same WSSA group (i.e., with the same mechanism of action) can lead to herbicide-resistant plants, even in aquatic environments. In order to reduce the risk of developing resistant genotypes, avoid using the same type of herbicides year after year, and utilize effective integrated pest management strategies as part of any long-term control program.*

Eurasian Water Milfoil Monitoring

The 2017 aquatic plant management plan specified annual late summer monitoring to detect Eurasian water milfoil and identify when and if control measures were warranted. Control standards were established for various areas depending upon amount of public use and resulting risk of spread (Figure 19). Ecological Integrity Service completed annual monitoring including a meandering survey of the entire lake littoral zone and grid sampling within established "mid-tolerance areas" of the lake (Figure 20) (Schieffer, 2017-2023). No herbicide treatments occurred from 2017 through 2023 using the 2017 plan standards.

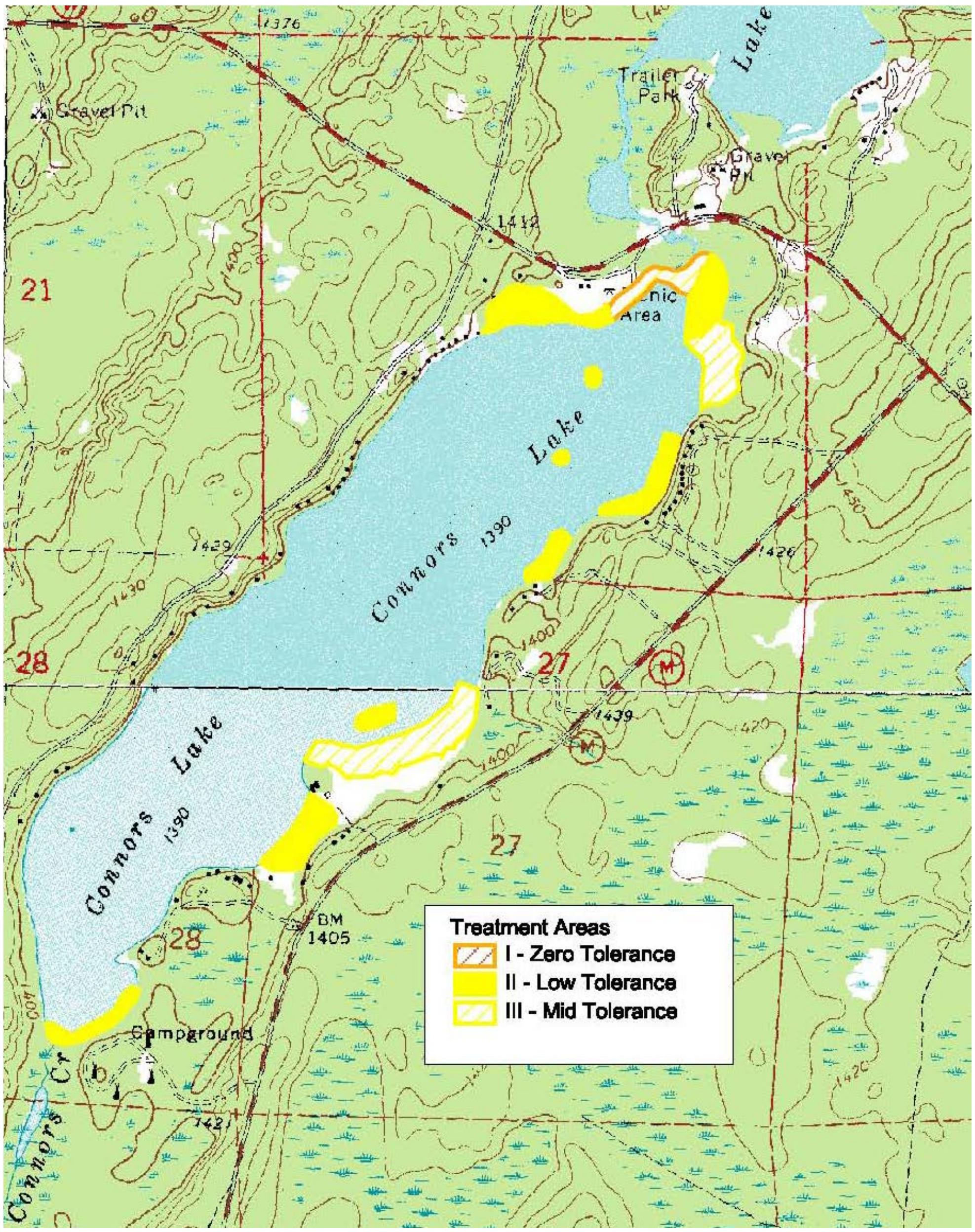


FIGURE 19. POTENTIAL EURASIAN WATER MILFOIL CONTROL AREAS

Areas and Standards for EWM Herbicide Treatment (2017 APM Plan)

Class 1/Zero Tolerance Areas
Treatment standard = any plants visible

A bed of EWM has a EWM mean rake density (according to DNR protocol) >1

Beds of EWM will have >10% frequency of occurrence

Treatment method =

- Diver pulling small populations (scattered plants and beds up to ½ acre) – divers to be contracted if available and cost effective. Use DASH or SCUBA.
- Herbicide treatment for beds >1/2 acre
- Contact herbicide such as diquat or diquat/endothall combination

Class 2/Low Tolerance Areas
Treatment standard = scattered plants in beds to be treated

A bed of EWM has a EWM mean rake density >1

Beds of EWM will have >30% frequency of occurrence

Treatment method =

- Diver pulling small populations (scattered plants and beds up to ½ acre) – divers to be contracted if available and cost effective. Use DASH or SCUBA.
- Herbicide treatment (2,4-D) for beds >3 acres

Class 3/Mid Tolerance Areas (Whole Bay Treatments)
Treatment standard = dense plants in beds to be treated

A bed of EWM has a EWM mean rake density of >1.5

Beds of EWM will have >50% frequency of occurrence

Treatment method =

- Herbicide treatment (2,4-D) for beds >14 acres (Musky Bay) or >7 acres (northeast bay)

Zero Tolerance Areas 2017 total 4 acres

Low Tolerance Areas 2017 total 27 acres

Mid Tolerance Areas 2017 total 24 acres

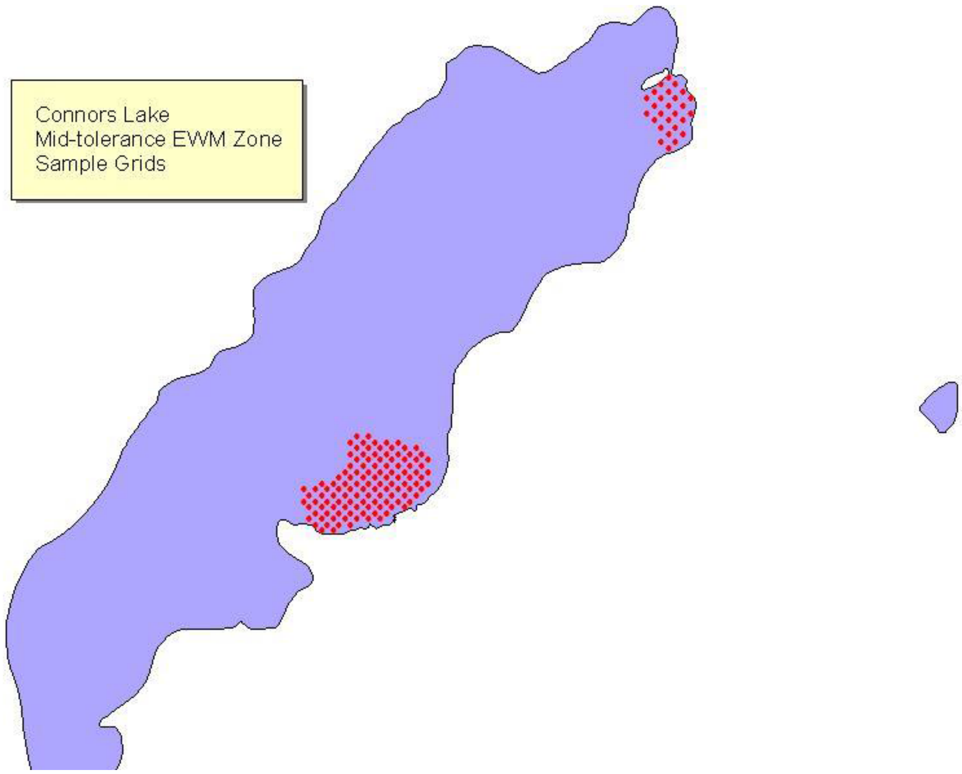


FIGURE 20. MID-TOLERANCE EWM SAMPLING GRID

Mid-Tolerance EWM Grid Sampling Results (2017 – 2023)

Rake samples were taken at each sample point in the grid each year in late summer. Presence/absence and rake density of EWM was recorded for each sample point. Mid-tolerance area standards that would have triggered a whole bay treatment (>50% frequency of occurrence and mean rake density >1.5) were not exceeded from 2017 through 2023.

TABLE 20. MID-TOLERANCE EWM GRID SAMPLING RESULTS (2017 – 2023)

	Musky Bay		**NE Bay**	
	Freq. of Occurrence	**Mean Rake Density**	**Freq. of Occurrence**	**Mean Rake Density**
2017	14.2%	0.17	3.7%	0.04
2018	27%	0.04	0	0
2019	49%	0.84	0	0
2020	31%	0.43	0	0
2021	18%	0.32	0[24]	0
2022	18%	0.40	3.7%	0.04
2023	16%	0.38	23%	0.40

[24] A 1.28-acre bed of dense EWM growth was found between sample grid points in 2021. This bed was not observed in 2022, but a 2.3-acre bed was present in this area in 2023.

2023 Connors Lake EWM Survey

The 2017 aquatic plant management plan treatment standards were exceeded for the first time in 2023 in a "Low-tolerance" area, with a 2.57-acre EWM bed near the picnic area on the north end of Connors Lake. Dense growth was also present in beds in the NE Bay and Musky Bay, although plan treatment standards were not technically exceeded. The effectiveness and low side-effects of ProcellaCOR, a newly available herbicide, may lead to changes in treatment standards when they are re-examined for this plan update.

Figure 21. Dense Areas of EWM Growth – Connors Lake 2023

Table 21. Connors Lake Dense EWM Beds 2023

Area	Classification	Acres	Frequency of Occurrence	Mean Rake Density	Meets Plan Standard? (Y/N)
Picnic Area	Low-Tolerance	2.57	83%	1.96	Y
NE Bay	Mid-Tolerance	2.3	62%	1.25	N
Musky Bay	Mid-Tolerance	10.1	44%	1	N

Lake of the Pines AIS Surveys

Ecological Integrity Service completed meandering surveys of Lake of the Pines from 2012-2023. The aquatic invasive species reed canary grass and narrow leaf cattail were present. Control measures are generally not taken with these species.

Purple loosestrife was located in the 2018 and 2020 surveys at and near the State Forest Campground swimming area. The location and recommendation to remove purple loosestrife was shared with the State Forest personnel. Some purple loosestrife plants were pulled by the plant surveyor in 2018, but they were present in the same location again in 2020 (Schieffer, 2018 and 2020).

Aquatic Plant Management

This section reviews permitting requirements, summarizes potential management methods, and presents aquatic plant management goals and strategies for Connors Lake and Lake of the Pines. Potential management methods are included in more detail in a reference companion document to this plan (Clemens 2022).

Permitting Requirements

The Department of Natural Resources regulates the removal of aquatic plants when chemicals are used, when plants are removed mechanically, and when plants are removed manually from an area greater than 30 feet in width along the shore. The requirements for chemical plant removal are described in Administrative Rule NR 107 – Aquatic Plant Management. A permit is required for any aquatic chemical application in Wisconsin. This includes granular herbicides available through mail order and internet purchase. A Department of Agriculture, Trade, and Consumer Protection pesticide applicator certification (aquatic nuisance control category) may be required to apply chemicals in the water.

The requirements for manual and mechanical plant removal are described in NR 109 – Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations. A permit is required for manual and mechanical removal except for when a riparian (waterfront) landowner manually removes or gives permission to someone to manually remove plants (with the exception of wild rice) from his/her shoreline limited to a 30-foot corridor. A riparian landowner may also manually remove the invasive plants Eurasian water milfoil, curly leaf pondweed, and purple loosestrife along his or her shoreline without a permit. Manual removal means the control of aquatic plants by hand or hand–held devices without the use or aid of external or auxiliary power.[25]

[25] More information regarding DNR permit requirements and aquatic plant management contacts is found on the DNR web site www.dnr.wi.gov.

Eurasian Water Milfoil Management

Eurasian water milfoil is an invasive, submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Eurasian water milfoil grows best in mucky sediments. It has a history of becoming dominant in nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water milfoil is adapted for rapid growth early in spring and can form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in single-species stands. These stands of Eurasian milfoil provide only a single habitat and can disrupt predator-prey relationships by fencing out larger fish and reduce the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Cycling of nutrients from sediments to the water column by Eurasian water milfoil may lead to deteriorating water quality and algae blooms in infested lakes. [26]

Eurasian water milfoil might be confused with a number of other submersed plants, including other water milfoils. Northern water milfoil (present in Connors Lake and Lake of the Pines) has fewer than 12 leaf segments on each side of the leaf axis, whereas Eurasian water-milfoil has 14 or more leaf segments on each side of the leaf axis. Northern water milfoil has somewhat stouter stems than Eurasian water-milfoil. Hybrids of Eurasian and northern water milfoil are also found in Wisconsin Lakes. Like pure Eurasian water milfoil, EWM-NWM hybrids grow very quickly and can choke waterways, hampering boat access, fish passage, and water supply intakes.

FIGURE 22. EURASIAN WATER MILFOIL

[26] Taken from WDNR, 2014 http://dnr.wi.gov/topic/Invasives/fact/EurasianWatermilfoil.html

Herbicide Treatments

Herbicides used to control EWM include 2,4-D, triclopyr, fluridone, endothall, and diquat.[27] Florpyrauxifen-benzyl (ProcellaCOR) was registered with the EPA for aquatic use in 2017.

Wisconsin DNR research indicates that larger scale herbicide treatments result in more consistent reduction of the target plant than smaller treatments. This conclusion is based upon data collected from many Wisconsin lakes where herbicides were used for EWM control (Nault, 2015). Herbicides can dissipate off of small treatment sites very rapidly. For example, 2,4-D dissipated rapidly after it was applied to 98 small (0.1-10 acre) treatment areas across 22 study lakes with application rates of 2-4 parts per million (ppm).

Hand Removal

Hand pulling can be an effective tool in small areas of sparse EWM growth where herbicide use cannot be justified or within areas where sparse EWM remains following an herbicide treatment. Depending upon depth, SCUBA divers, snorkelers, or waders may remove EWM. Hand pulling should occur before algae blooms limit the water clarity needed for viewing EWM underwater. Volunteers need to be trained to identify EWM so that only it is removed.

DASH (Diver Assisted Suction Harvesting)

With Diver Assisted Suction Harvesting (DASH), divers pull aquatic invasive plants from the lake-bed by hand. A suction line transports removed plants to the surface. This method is most appropriate for relatively small and less dense areas of invasive plant growth. Poor water clarity makes it difficult to use DASH (Wisconsin Lakes Convention, 2016). DASH EWM removal rates vary with area and density of plant growth. DASH is considered mechanical removal and requires a WDNR permit.

Monitoring EWM Control Results

Regular monitoring is critical to an effective invasive species control program. Pre and post monitoring should be conducted in areas where control measures are implemented to measure effectiveness of herbicide and impacts on non-target species. Meandering surveys of the littoral zone are used to identify potential spread of the target invasive species and potential new invasions. For effective long-term control, monitoring must continue indefinitely once target control is initially achieved.

Herbicide Treatment Pre and Post Monitoring

Standard methods are available from the WDNR. These methods are used with any herbicide treatment to control EWM.

---

[27] https://dnr.wisconsin.gov/topic/Invasives/fact/EurasianWatermilfoil.html

Statewide Eurasian Water Milfoil Management Results[28]

Of the lakes with Eurasian water milfoil, the majority currently have populations at low frequencies, with relatively few lakes exhibiting very dense EWM growth. Historically, once EWM was first reported in a waterbody, many lake users perceived the waterbody as "infested" or "diseased" and were fearful that the invasive plant would quickly "kill" the lake or make it unusable.

To look at the current frequency of EWM in waterbodies across the state, researchers compiled the most recent aquatic plant point-intercept data on 397 lakes and flowages with EWM populations. Analysis of this data found that the majority of lakes surveyed had very low frequencies (less than 10 percent) of EWM observed in the littoral zone (area of the lake where there is enough light for plants to grow). This low frequency is below the level where most lake users would consider the plant to be a "nuisance." Many of managers of the waterbodies with very low frequencies were following aquatic plant management plans which included regular monitoring and control to prevent EWM spread.

However, other lakes with very low EWM populations had not undergone any active management, providing evidence that in certain lakes there may be environmental conditions that limit EWM's ability to spread. In contrast, relatively few lakes had EWM observed as a dominant plant species, which could likely cause recreational and ecological impairments. Examination of lakes with high EWM frequencies revealed that while some of these lakes were not being actively managed, there were other lakes that were. It was suggested that the actively managed lakes with poor results should explore alternative management strategies.

In general, higher EWM populations tended to occur on reservoirs and flowages versus natural lakes, lakes in the south versus the north, and in lakes where EWM had been established longer versus newly established populations in lakes. This statewide data analysis illustrates that while EWM can undoubtedly become a dominant species capable of causing recreational and aesthetic nuisances in certain lakes, more often than not it does not exhibit these tendencies. Interestingly, this trend of nonnative species being "rarely common and commonly rare" has also been documented across many other invasive species, many for which control is not attempted.

Unmanaged EWM Populations

The Wisconsin DNR has continued to monitor trends in Eurasian watermilfoil growth in unmanaged populations with the following additional findings:

- EWM isn't always associated with lower native plant species richness. Herbicides can also negatively affect native plant populations.
- EWM populations vary over time with varying trajectories of growth observed.
- Although EWM can exist at low levels in some lakes for many years, disruptive events like floods or nutrient pulses can cause EWM to increase (WDNR, 2021).

---

[28] Taken entirely from: Nault, Michelle. The Science Behind the So-Called Superweed. Wisconsin Natural Resources. August 2016.

Monitoring and Education

In past years, volunteers provided boater education through the Department of Natural Resources Clean Boats, Clean Waters Program at the Connors Lake North Access. Clean Boats, Clean Waters boater education has not occurred in recent years on Connors Lake or Lake of the Pines.

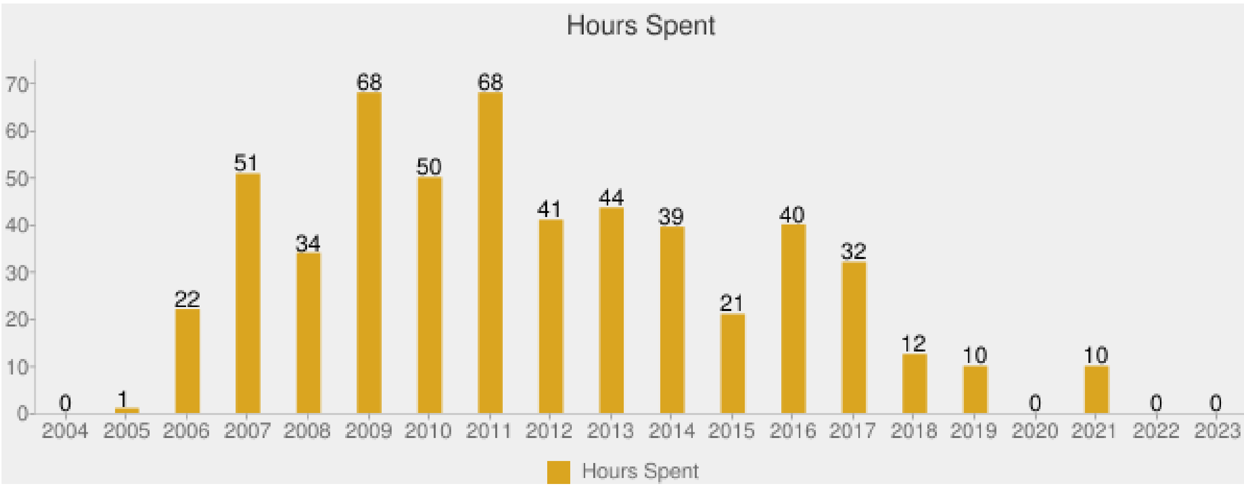


Figure 23. Connors Lake North Landing Clean Boats Clean Waters Hours

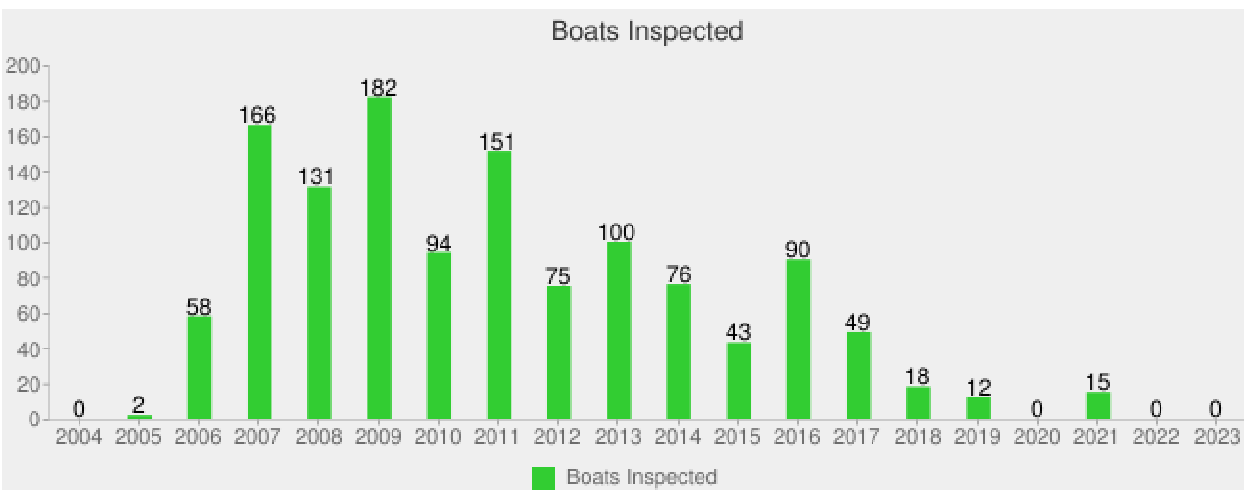


Figure 24. Connors Lake North Landing Clean Boats, Clean Waters Boats Inspected

Access Corridor Management

There are no reports of herbicide use to maintain access corridors around docks and for swimming areas in front of individual properties on project lakes. Nor does the DNR have any records of complaints of nuisance plant conditions. This plan does not recommend any use of herbicides to manage native plant beds but instead, focuses on control and prevention of invasive species.

The Department of Natural Resources Northern Region Aquatic Plant Management Strategy (May 2007) requires documentation of severely impaired navigation or nuisance conditions before native plants may be managed with herbicides. Severe impairment or nuisance will generally mean that vegetation grows thickly and forms mats on the water surface.

Plan Goals and Strategies

Aquatic Plant Management Goals

Goal 1) Eurasian water milfoil growth is kept to a minimal level in Connors Lake.

Goal 2) Eurasian water milfoil does not establish and spread into Papoose Lake or Lake of the Pines.

Goal 3) No new aquatic invasive species are introduced and established in our lakes.

Goal 4) The lakes' diverse native plant communities are preserved.

Goal 5) Lake residents understand the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species.

Goal 6) Aquatic plant management efforts are carried out in an efficient, cost effective manner.

Implementation for each goal is described on following pages.

Goals are broad statements of desired results.

Objectives are the measurable accomplishments toward achieving a goal. Methods to evaluate progress toward plan objectives are listed below the objectives and are included in the implementation plan as "Evaluation Actions."

Actions are the steps taken to accomplish objectives and ultimately goals.

An **Implementation Plan Spreadsheet** that describes timeline, cost estimate, and responsible parties will be used to track action implementation.

Adaptive Management Approach

The EWM treatment areas, standards, and methods will be reviewed each year to see if they are effective and cost efficient. Changes may be made to the treatment approach based upon project results and newly evaluated, available treatment methods and herbicides. Significant changes will be documented as brief addendums to the aquatic plant management plan to be reviewed by the Lake Association Board and the Department of Natural Resources. A public review process will occur for plan amendments.

Goal 1) Eurasian water milfoil growth is kept to a minimal level in Connors Lake.

Objectives and Actions

Note: Control areas mentioned below are shown on the map in Figure 26.

Objective A. No detectable EWM grows near areas of high public use such as boat launches and high-use resorts.

Action. Conduct control according to standards and methods outlined for Class 1/Zero Tolerance Areas.

Action. Hand pull very scattered plants with volunteers or contracted services. Wading, snorkeling, or SCUBA may be employed depending upon depth of growth and plant density. Volunteers will be trained in hand-pulling methods to correctly identify EWM and avoid spread of plant fragments.

Action. Contract DASH services where EWM growth is beyond the ability of volunteers to manage. DNR permits are required for DASH harvesting. .

Objective B. Contain the growth of EWM in moderate and low public use areas of the lake with a less aggressive treatment approach.

Action. Conduct control according to standards and methods outlined for Class 2/Low Tolerance Areas and Class 3/Mid Tolerance Areas.

Action. Hand pull very scattered plants with volunteers or contracted services as described for Objective A.

Objective C. Use the best available treatment technology for Eurasian water milfoil for effective treatment while minimizing impacts to native aquatic plants and fisheries.

Action. Treat EWM early in the day when the winds are calm.

Action. Consider timing and location of chemical treatments to avoid negative impacts to spawning and fish nursery habitat.

Action. Equipment used for monitoring must be decontaminated if used on any other water body.

Action. Avoid herbicide treatments using the same chemical for more than 2 consecutive years to prevent development of herbicide resistance. [29]

Action. Evaluate and consider use of new herbicides and control measures as they become available.

---

[29] WDNR factsheets for ProcellaCOR (WSSA Group 4 herbicide) and 2,4-D (WSSA Group 4 herbicide) state: *It is important to note that repeated use of herbicides in the same WSSA group (i.e., with the same mechanism of action) can lead to herbicide-resistant plants, even in aquatic environments. In order to reduce the risk of developing resistant genotypes, avoid using the same type of herbicides year after year, and utilize effective integrated pest management strategies as part of any long-term control program.*

Objective D. Identify location of EWM plants and beds and monitor effectiveness of treatment.

EVALUATION Action. Monitor EWM location and treatment effectiveness according to DNR recommended pre and post AIS monitoring methods. Record point intercept rake fullness results for both EWM and native plants.

EVALUATION Action. Monitor an established grid of monitoring points in the Class 3/Mid Tolerance Areas using point intercept method.

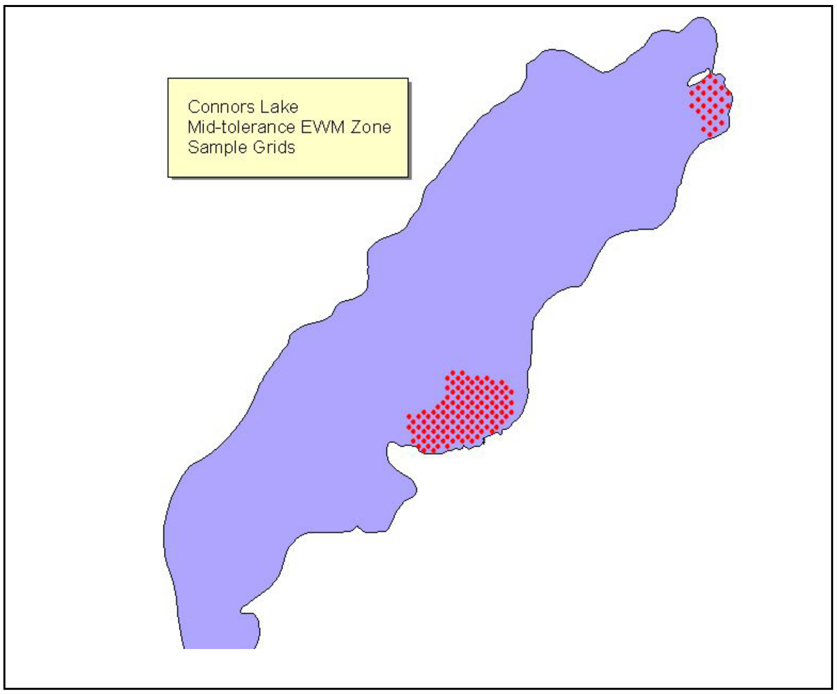


FIGURE 25. CLASS 3/ MID TOLERANCE AREA MONITORING GRIDS

Objective E. The Lake Association will utilize resources effectively and efficiently.

Action. Volunteers will regularly (every 2 weeks) monitor areas of high public use (Class 1/Zero Tolerance Areas) in Connors Lake and mark where EWM plants are located.

Action. Volunteers or contractors will hand pull EWM in shallow areas of high public use in Connors Lake.

Action. Volunteers will monitor known locations of EWM in Connors Lake the first three weeks of May (approximately one month after ice-out) and one month following treatment, noting locations of EWM on a map and recording GPS points.

Action. Consultants will be hired to perform tasks that are beyond the ability or time commitment of volunteers.

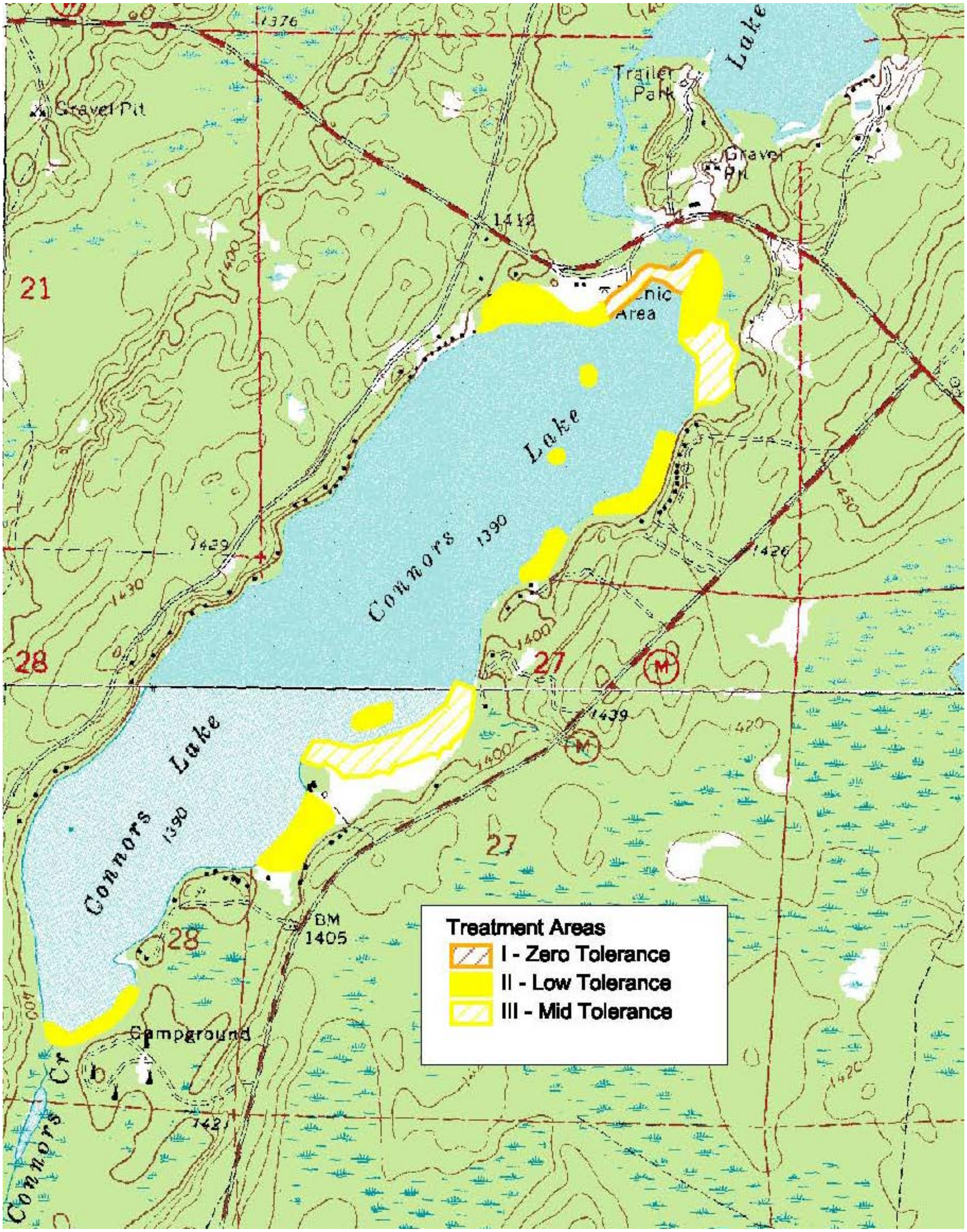


FIGURE 26. EURASIAN WATER MILFOIL CONTROL AREAS

Areas and Standards for EWM Control

Class 1/Zero Tolerance Areas

Control standard = any EWM plants visible

A bed of EWM has a EWM mean rake density (according to DNR protocol) >1

Beds of EWM will have >10% frequency of occurrence

Control method =

- Hand pulling (very scattered plants up to 400 ft^2). Volunteer hand-pulling will be supported with training.
- DASH (scattered plants and beds up to ½ acre). Will be contracted; DNR permit required.
- Herbicide treatment for beds ≥1/2 acre. Use ProcellaCOR or an approved contact herbicide.

Class 2/Low Tolerance Areas

Control standard = scattered plants in beds to be treated

A bed of EWM has a EWM mean rake density >1

Beds of EWM will have >30% frequency of occurrence

Control method =

- Hand pulling (very scattered plants up to 400 ft^2). Volunteer hand-pulling will be supported with training. May be employed following herbicide treatment.
- DASH (scattered plants and beds up to ½ acre). Will be contracted; DNR permit required.
- Herbicide treatment ProcellaCOR for beds 1- 5 acres. Other approved herbicides appropriate for size of control area may be selected. In general, systemic herbicides require treatment areas >5 acres.

Class 3/Mid Tolerance Areas

Control standard = dense plants in beds to be treated

A bed of EWM has a EWM mean rake density of >1.5

Beds of EWM will have >50% frequency of occurrence

Control method =

- Herbicide treatment requires a minimum bed size of 5 acres. Appropriate, approved herbicide will be selected for treatment.

Zero Tolerance Areas currently total 4 acres

Low Tolerance Areas currently total 27 acres

Mid Tolerance Areas currently total 24 acres

Notes: *Designated tolerance areas, maps, and EWM density criteria were unchanged from the 2017 plan. Appropriate growth characteristics and bed sizes for hand-pulling and DASH were decreased based on expected limits of these methods. Smaller herbicide treatment areas were added with the use of ProcellaCOR based on anticipated effectiveness. These standards provide a more flexible management approach while still limiting herbicide use. Additional control measures may be evaluated and selected for use.*

Schedule and roles for herbicide treatments

Feb/March preceding treatment

Lake Association Board: Contract with herbicide applicator. Apply for aquatic plant management permit from DNR. Permit will be based upon potential acreage mapped in late summer of preceding year using standards for treatment of EWM areas.

Spring preceding treatment (May)

Volunteers: Check for presence of EWM in suspected locations and note GPS locations. Volunteers to notify Lead AIS Volunteer of locations via email or telephone. Lead AIS Volunteer will provide them to Monitoring Consultant.

Prior to treatment (late May to early June)

Monitoring Consultant: check treatment areas that were mapped the previous late summer (with assistance of Lead AIS Volunteer) and provide specific treatment area and locations to herbicide applicator, Lake Association, and DNR permit staff.

Herbicide treatment (late May to early July)

Herbicide applicator: apply herbicide according to permit conditions and herbicide label requirements.

Lead AIS Volunteer: supervise herbicide applicator, notifying applicator when new EWM growth reaches one inch and overseeing permit conditions such as location and timing of treatment, and wind conditions that preclude treatment.

Four weeks following treatment

Volunteers: mark suspected locations of remaining EWM with GPS points. Volunteers to notify Lead AIS Volunteer of locations via email or telephone. Lead AIS Volunteer will provide results to Monitoring Consultant.

Late Summer

Monitoring Consultant: Monitor EWM and native aquatic plant growth by conducting point intercept survey within designated current-year treatment areas.

Monitoring Consultant: Map EWM beds and location of individual plants. Compare results to treatment standard and prepare potential treatment area for next season.

Monitoring Consultant and Lead AIS Volunteer: Identify areas for potential treatment in following year. Conduct point intercept survey of EWM and native plants in selected treatment areas.

Goal 2) Eurasian water milfoil does not establish and spread into Papoose Lake or Lake of the Pines.

Objective A. Prevent the introduction of EWM into Papoose Lake or Lake of the Pines.

Action. Ensure that public education efforts are in place to prevent the spread of EWM from Connors Lake and other nearby lakes – see goal # 5.

Action. Establish rapid response to identification of EWM in Papoose Lake or Lake of the Pines.

Objective B. Monitor Lake of the Pines regularly to rapidly identify any areas where EWM becomes established.

Action. Establish regular volunteer monitoring in areas of high public use and in areas where Northern water milfoil is present (Monitor once a month). High public use areas include the campgrounds, boat landings, and resorts mapped in Figure 1.

Action. Hire a consultant to complete an AIS Meandering Survey emphasizing areas of high public use and areas where Northern water milfoil is present (annually).

Action. Complete point intercept survey of Papoose Lake when area is navigable and to coincide with a Connors Lake or Lake of the Pines point intercept survey.

Objective C. Remove any detectable EWM plants found in Papoose Lake or Lake of the Pines.

Action. Conduct treatment according to standards and methods outlined for Class 1/Zero Tolerance Areas.

Goal 3) No new aquatic invasive species are introduced and established in our lakes.

Objective A. Lake residents understand the threat of new invasive species and take action to minimize their spread.

Objective B. Lake residents can identify potential invasive species and/or know who to contact for identification.

Actions to be detailed under Goal #5.

Action. Consider AIS prevention measures at the boat landings and campgrounds in cooperation with the Flambeau River State Forest.

Goal 4) The lakes' diverse native plant communities are preserved.

Objective A. Herbicide use selectively targets invasive species avoiding impacts to native plants.

Action. See Goals 1 and 2.

EVALUATION Action. Conduct a whole lake aquatic plant survey of Connors Lake every 5 years and Lake of the Pines every 5-7 years.

Objective B. Limit removal of native plants in waterfront corridors.

Action. Recommend hand removal only (not herbicides) if needed to maintain access for swimming and navigation.

Action. Limit hand clearing to only what is needed to maintain recreation and navigability to open water. The maximum access corridor width is 30 feet. Invasive species may be removed along the entire shoreline by hand.

Objective C. Increase residents' and lake users' understanding about the role and importance of native plants and the means to preserve them.

Action. See Goal #5

Goal 5) Lake residents understand the importance of native aquatic plants, the means to protect them, and the threat of aquatic invasive species.

Audience

A. Lake residents

B. Lake users

C. Resort visitors

Messages

1. Include messages regarding the long-term nature of lake management.
2. Discuss the importance of native aquatic plants to the lakes and residents.
3. Describe how lake residents and users can best preserve native plants – no wake near shore, only limited clearing/raking for dock access and swimming, preventing introduction of invasive species, etc.
4. Lake residents may remove EWM from their entire shoreline without a permit using hand removal techniques like hand pulling or raking.
5. Be sure to remove all plant fragments when raking or hand pulling EWM. A second person to pick up or net plant fragments is recommended.
6. Dispose of EWM plant fragments well away from the water. It is fine to compost these plants.
7. A permit is required to use herbicides in the water. Fines may result if herbicides are applied in the water without the appropriate permit.
8. Affirm that lakes are public resources.
9. How to identify and prevent introduction of other aquatic invasive species. Explain which species are potential threats to our lakes. Include pictures for identification.
10. Volunteers are needed to help with aquatic plant management education and monitoring.
11. An aquatic plant management plan guides our plant management efforts.
12. It is not possible to eradicate Eurasian water milfoil once it is established in a lake. Our plan is geared to minimize the growth and spread of this invasive plant.
13. Explain past EWM treatment methods and results and how native plants are recovering where EWM was treated.
14. Encourage Lake Association membership to support aquatic plant management.

Actions

Newsletter articles (Lake Association)

Direct mail

Clean Boats, Clean Waters public landing monitoring and education

Kiosks at boat landings and campgrounds

Distribute DNR and UWEX publications.

Flambeau Forest newsletter (annually)

Annual and special meetings

Workshops/instruction (for hand pulling invasive species)

TABLE 22. EDUCATION METHODS, AUDIENCE, AND MESSAGES

Method	Audience	Message
Newsletter articles	A	1-14
Direct mail	A	10, 14
Clean Boats, Clean Waters	A, B, C	1-14
Kiosks	A, B, C	1-14
DNR UWEX publications	A, B, C	1-14
Flambeau Forest newsletter	A, B, C	1-14
Annual and special meetings	A	1-14
Workshops/instruction	A	4, 5, 6, 9, 10

Goal 6) Aquatic plant management efforts are carried out in an efficient, cost effective manner.

Objective A. Volunteer resources are used whenever feasible.

Action: Seek volunteers from lake residents.

Action. Provide appropriate training for lake volunteers.

Action: Acknowledge volunteer efforts through recognition in newsletter, thank you notes, and small gifts of appreciation.

Objective B. Donations from lake residents supplement lake management funds.

Action: Solicit donations for EWM control efforts annually, summarizing control efforts and success to date.

Objective C. Seek Department of Natural Resources Aquatic Invasive Species Grants.

Action: Apply for DNR grants with draft currently due by September 15 and final applications due by November 15 of each year

Aquatic Invasive Species Grants

Department of Natural Resources Surface Water Grants are available to assist in funding some of the action items as indicated in the action plan. Grants provide up to 75% funding. Applications are accepted each year with a final digital deadline of November 15.

A $10,000 DNR grant is funding 67% of the cost of this plan update along with 3 years of EWM monitoring on Connors Lake and 3 years of AIS surveys on Lake of the Pines.

Previous Grants

The Lake Association received an education and planning AIS grant in 2007 and completed an aquatic plant management plan by May 2008. The Department of Natural Resources approved the aquatic plant management plan July 3, 2008. An AIS Control grant was awarded in 2008. The control grant ended December 31, 2013.

Grant AEPP 411-14 provided $18,482 from October 1, 2013 through December 31, 2017. The grant project scope included monitoring for the EWM control program, a plant survey for Lake of the Pines, and the update of the aquatic plant management plan.

Appendix A. Early Detection and Rapid Response to AIS

Connors Lake/Lake of the Pines Lake Association

Purpose

The purpose of this procedure is to provide guidance to the Connors Lake/Lake of the Pines Lake Association (Lake Association) on how to identify and respond to introduction of aquatic invasive species. Connors Lake already has both Eurasian water milfoil (EWM) and curly leaf pondweed (CLP) present, so the risk of establishment of these species in Lake of the Pines and Papoose Lake is high. New invasive species also may be introduced into the lakes.

Wisconsin DNR grants are available to control pioneer infestations of invasive species. *Pioneer infestation* means a small population of aquatic invasive species in the early state of colonization or re-colonization. For rooted aquatic plants, a pioneering population covers a small area, is typically sparse, and will have been verified during the preceding 5 years. A pioneering population will cover an area that is less than 3 acres or has colonized less than 3% of the habitable area of the lake, whichever is greater.

Procedure

1. The Lake Association, will work together with Sawyer County and the Department of Natural Resources Aquatic Plant Management and grant staff to implement this procedure.
2. Lake residents and visitors will be informed of who to contact if they see a plant they suspect might be Eurasian water milfoil (EWM) or another invasive species.
3. If the tentative AIS identification is credible, the lake contact will mark the location with a uniquely identified small float, and a GPS waypoint will be entered for the float. The lake contact will then inform Sawyer County and the Wisconsin Department of Natural Resources (WDNR) of suspected AIS.
4. Within 72 hours of notification, the lake contact or Sawyer County will collect and bag two entire intact rooted adult specimens of the suspect plants and deliver them to WDNR.
5. The DNR will verify if a pioneer infestation of an invasive species is found and rapid response is appropriate. It is up to the Lake Association to document the extent of growth to verify a pioneer infestation.
6. If an AIS infestation is identified, the DNR will work together with the Lake Association and Sawyer County to develop an appropriate control method including pre and post monitoring and follow-up control and reporting requirements. If appropriate, already established standards and procedures for EWM control and monitoring on Connors Lake Class 1 areas will be followed for consistency.

Control methods may include hand pulling, use of divers to manually or mechanically remove the AIS from the lake bottom, application of herbicides, and/or other methods.

7. Lake Association will notify lake residents of AIS presence and provide guidance for individual action. DNR will post signs at boat landings.

8. DNR will notify Lake Association contact verbally and via email when control project is authorized. Follow-up written notification will include conditions and procedures for the project, APM permit applications, and grant applications.

9. Lake contact or his/her designee then completes an APM permit application if required.

10. Contractor or volunteers carry out control measures as authorized by the DNR. (e.g., herbicide application by contractor, divers or volunteers to hand pull). Consultants may be hired to complete pre and post monitoring requirements. The Lake Association may borrow money and/or solicit donations in order to carry out control measures. Consider a reserve fund for EWM rapid response.

11. Lake Association completes rapid response application and submits to DNR.

12. Lake Association reports results of the completed project and requests reimbursement from DNR.

13. Lake Association will continue ongoing pre and post monitoring and treatment according to Class 1 EWM standards developed for Connors Lake unless areas are otherwise designated. Other monitoring methods to be completed by DNR, Sawyer County, and/or the Lake Association as deemed appropriate and necessary.

AIS Contacts

Connors Lake/Lake of the Pines Lake Association

Lake AIS Contact	Cynthia Aigner (612) 599-1034 caigner3329@gmail.com

Sawyer County Land Conservation Department

AIS Coordinator	Natalie Erler (715) 638-3266 natalie.erler@sawyercountygov.org
Zoning and Conservation Administrator	Jay Kozlowski, (715) 634-8288 jay.kozlowski@sawyercountygov.org

Wisconsin Department of Natural Resources

AIS Notice, Grants	Ben Schleppenbach (715) 939-9890 Benjamin.schleppenbach@wisconsin.gov
APM Permits	Callie Lier (715) 401-2497 Callie.Lier@wisconsin.gov

Herbicide Contractor

Northern Aquatic Services	Dale Dressel, 715-755-3507 ddressel@centurytel.net

Monitoring and Divers

Ecological Integrity Services	Steve Schieffer, 715-554-1168 ecointegservice@gmail.com

References

Borman, Susan, Robert Korth and Jo Tempte. *Through the Looking Glass*. University of Wisconsin-Extension. Stevens Point, Wisconsin. 1997. 248 p.

Crow, Garrett E. and C. Barre Hellquist. *Aquatic and Wetland Plants of Northeastern North America*. The University of Wisconsin Press. Madison, Wisconsin. Volumes 1 and 2. 2000. 880p.

Harmony Environmental. *Aquatic Plant Management Plan. Deer Lake. Polk County, Wisconsin.* July 2006.

Harmony Environmental. *Grindstone Lake, Sawyer County, WI. Aquatic Plant Management Plan.* February 2007.

LaRue, Elizebeth A., Mathew P. Zuellig, Michael D. Netherland, Mark A. Heilman, and Ryan A.Thum. *Hybrid watermilfoil lineages are more invasive and less sensitive to a commonly used herbicide than their exotic parent (Myriophyllum sibiricum).* Evolutionary Applications. ISSN 1752-4571. Blackwell Publishing Ltd. 2012.

Nault, et. al., *Control of Invasive Aquatic Plants on a Small Scale.* Lakeline. 2015.

Nault, Michelle. *The Science Behind the So-Called Superweed.* Wisconsin Natural Resources. August 2016.

Nichols, Stanley A. *Distribution and Habitat Descriptions of Wisconsin Lake Plants*. Wisconsin Geological and Natural History Survey. Bulletin 96. Madison Wisconsin.1999. 266 p.

Nichols, Stanley A. *Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications.* Journal of Lake and Reservoir Management 15 (2): 133-141. 1999.

North American Lake Management Society. *Managing Lakes and Reservoirs.* 2001.

University of Wisconsin-Extension. *Citizen Lake Monitoring Manual*. Revised 2006.

University of Wisconsin-Extension. *Aquatic Plant Management in Wisconsin*. April, 2006 Draft. 46 p.

University of Wisconsin – Madison. Wisconsin State Herbarium. WISFLORA: Wisconsin Vascular Plant Species. www.botany.wisc.edu/wisflora/

Wisconsin Department of Natural Resources. Northern Region. *Aquatic Plant Management Strategy.* Summer 2007.

Wisconsin Department of Natural Resources. *Determining Standing Stock and Harvest on Connors Lake and Lake of the Pines, Sawyer County.* 1985.

Wisconsin Department of Natural Resources. *Large Scale Treatment Research in Wisconsin* PUB-SS-1077. 2011.

Works Cited

Clemens, C. (2022). *MANAGING AQUATIC PLANTS IN NORTHERN WISCONSIN Aquatic Plant Management Companion Document.*

Gavin Dehnert, W. K. (2019). 2,4-Dichlorophenoxyacetic acid containing herbicide impairs essential visually guided behaviors of larval fish. *Aquatic Toxicology*, 1-12.

Masiunas, J. (n.d.). *Herbicides Containing 2.4-D.* University of Illinois.

Nault. (2012). Herbicide Treatment in Wisconsin Lakes. *Lakeline 32*, 1-5.

Nault. (2015). Control of Invasive Aquatic Plants. *Lakeline*, 35-39.

Neuswanger, J. S. (2008). *Fishery Management Plan Flambeau River State Forest Lakes Sawyer and Price Counties, Wisconsin. December 2008.* Wisconsin Department of Natural Resources.

Scheirer, J. (2022). *Fishery Survey Summary, Lake of the Pines, Sawyer County, Wisconsin, 2019-2021.* Wisconsin Department of Natural Resources.

Scheirer, J. (2023). *Fishery Survey Summary Report. Connors Lake, Sawyer County, WI.2019-2022.*

Schieffer, S. (2012). *Minocqua Kawaguesa Weevil Bed Analysis 2010-2012.*

Schieffer, S. (2017). *Aquatic Macrophyte Survey:Lake of the Pines, Sawyer County, Wisconsin.*

Schieffer, S. (2017-2023). *Connors Lake 2023 EWM Evaluation.*

Schieffer, S. (2018 and 2020). *Lake of the Pines AIS Survey Results.*

Vermont Agency of Natural Resources Department of Environmental Conservation. (2022). *Aquatic Nuisance Control Permit, ProcellaCOR EC Aquatic Toxicity Review.*

WDNR. (2011). *Large Scale Treatment Research in Wisconsin PUB-SS-1077.*

WDNR. (2021). *Eurasian water milfoil: Long-term trends in unmanged populations.*

WDNR. (2022). *2,4-D Chemical Fact Sheet.*

WDNR. (2022). *Effects of 2,4-D application on early life stages of fish.*

WDNR. (2023). *Florpyrauxifen-Benzyl Chemical Fact Sheet.*

Wisconsin Department of Natural Resources. (2016). *Fishery Status Update. Connors Lake and Lake of the Pines, September 2016.*

Wisconsin Lakes Convention. (2016).