



Lake Related Activities at the Ramsey County Boat Access, May 2023

White Bear Lake Data Summary and Trend Analysis Through 2024

Data Review Through 2024

Prepared for:
White Bear Lake
Conservation District



Prepared by:
Steve McComas
Jo Stuckert
Connor McComas
Blue Water Science
St. Paul, MN 55116

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White Bear Lake Data Summary and Trend Analysis Through 2024

Summary

This report brings together existing information and water quality data on White Bear Lake.

White Bear Lake has a surface area of 2,416 acres and drainage area to the lake of about 7,500 acres.

Lake Levels: Since lake level records have been kept starting in 1901, the highest lake level has been 926.7 feet in 1943 and the lowest level was 918.84 feet in 2013.

Ice Out: Ice out dates have been collected since 1928. The earliest ice out date was March 8, 2024 and the latest ice out date was May 4, 1950 and 2018.

Water Quality Data: Trend analyses were conducted for Secchi disc transparency, total phosphorus, chlorophyll a, and chloride and results are summarized in Table 1.

Table 1. Summary of trend analyses of White Bear Lake data for four parameters.

Parameter	Trend	Length of Data Base (4 or more readings/year)
Secchi disc (clarity)	increase	70 years
Total phosphorus	decrease	70 years
Chlorophyll <u>a</u> (algae)	decrease	54 years
Chloride	increase	70 years

Secchi disc transparency is increasing and total phosphorus and chlorophyll is decreasing. These are indications that water quality has improved over time. Although chloride levels are increasing, chlorides are increasing in many of the metropolitan lakes. Possible sources of chloride are primarily from road salt deicing runoff.

Aquatic Plants and Zebra Mussels: Aquatic plant coverage has increased over the decades. The number of aquatic plant species have ranged from 15 to 25 in plant surveys. Eurasian watermilfoil (EWM) was first observed in 1988. Some years no EWM was treated but the greatest number of acres treated was 174 acres in 2010. Zebra mussels were first observed in 2014. The last quantitative survey was in 2023 and estimated zebra mussels covered an estimated 625 acres or 26% of the lake area attached to aquatic plants.

Fish: Fish surveys from 1954 through 2022 were reviewed. The number of fish species found has varied from 9 to 18. In the 2022 gillnet survey, 14 fish species were observed. Northern pike counts were above average at 11.19 fish/net and walleyes at 0.73 fish/net were below average. Fish stocking over the years has been primarily walleyes and muskies. Northern pike haven't been stocked since 1970.

Summer Boat Inventory: Since 1999, there has been a substantial increase in kayaks, personal watercraft, pontoons, and paddleboards. There has been a noticeable decrease in the number of fishing boats (rear-tiller boats) and sailboats. Overall the total number of watercraft has increased since 1999.

Table 2. Summer boat counts for White Bear Lake.

Date	Lakeshore Owner Boats	Boats from Three Marinas	Total
1999	900	524	1,424
2002	1,127	556	1,683
2004	1,078	545	1,623
2005	1,232	561	1,793
2008	1,155	570	1,725
2024	1,479	636	2,115

Shoreline Structures: The number of lifts increased from 1999 to 2024 while the number of docks has remained about the same since 1999. The number of powered boats and sail boats per dock at 2 watercraft per dock in 2024 is similar to the 2002 boat/dock ratio which was also 2 watercraft per dock. However, in 2024 when human powered craft are included, all boats per dock is 3.1 boats/dock.

Boat Launches: Boat launches from the 2 public accesses (Ramsey County and Matoska Park) have decreased from 1999 to 2024 for peak and off-peak days. Commercial Bay launches have decreased on peak days but not off-peak days. The most common boat type launched on peak days was runabouts and on off-peak days, it was fishing boats.

Boat Density: Boat density (lake acres/boat) has been determined on three or four peak-use days and two or three off-peak use days on 3 occasions from 1999 to 2024. Peak-use days included weekend or holiday days and off-peak days were mid-week weekdays. On peak and off peak days the north bay has the highest density of boats. It appears the boating density on the peak days has decreased since 1999 but stayed about the same for off-peak days. For three peak days in 2024, the boat density over the whole day averaged 18 acres per boat for the whole lake. The mid-afternoon of peak days had the highest boat density.



White Bear Lake Data Summary and Trend Analysis Through 2024

Introduction

The goal of a trend analysis for White Bear Lake is to examine available lake related data to determine if lake conditions are changing for the better, for the worse, or are staying the same.

The primary water quality indicators used to determine water quality are Secchi disc readings, phosphorus concentrations, and chlorophyll a concentrations. Other parameters, such as chloride, are examined as well and give some insight into lake trends or are related to the lake environment.

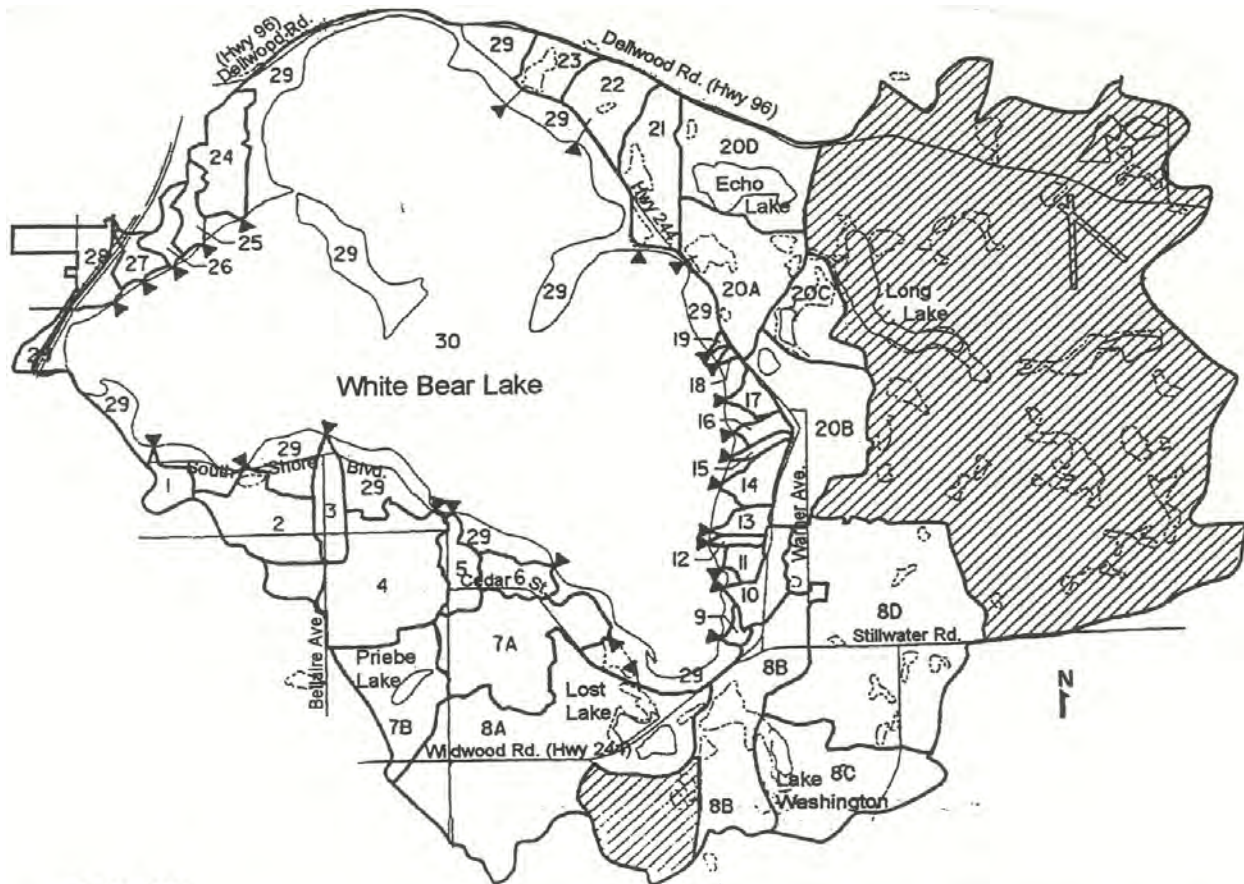
Lake and Watershed Characteristics

A watershed map is shown in Figure 1 and a list of subwatershed acreages is shown in Table 3. The total watershed area to White Bear Lake is about 7,500 acres.

A map of White Bear Lake is shown in Figure 2. White Bear Lake at 2,416 acres is one of the larger lakes in the metropolitan area.

Table 3. Subwatershed drainage areas for White Bear Lake (source: Rice Creek Watershed District, 1998: Report on 1997 water quality monitoring. Rice Creek Watershed District, Arden Hills, MN).

Subwatershed	Drainage Area (acres)	Subwatershed	Drainage Area (acres)
1. Lake view	21	15. Neville	7
2. Joy	83	16. Locust	13
3. County Park	39	17. Neptune	14
4. Bellaire	156	18. Rose	3
5. East County Line	31	19. Park	3
6. Elm Park	32	20a. St. Germaine	500
7a. Lower Priebe Lake	138	20b. Quail	149
7b. Upper Priebe Lake	97	20c. Wildwood	68
8a. Lost Lake	437	20d. Echo Lake	165
8b. Willernie	162	21. Penn	88
8c. Lake Washington	164	22. Yacht Club	63
8d. Stillwater	406	23. Northeast White Bear Lake	43
9. Ash	6	24. Johnson	60
10. Dahlia	34	25. Stewart	23
11. Elm	10	26. Banning	21
12. Grove	6	27. Burson	20
13. Hickory	16	28. Shady	56
14. Juniper	31	29. Shoreline Land	562



LEGEND

Potentially Contributing Areas
 4 Storm Sewer Outfall
 Watershed Boundary

1. Lake View	8C. Lake Washington	17. Neptune	24. Johnson
2. Joy	8D. Stillwater	18. Rose	25. Stewart
3. County Park	9. Ash	19. Park	26. Banning
4. Bellaire	10. Dahlia	20A. St. Germaine	27. Burson
5. East County Line	11. Elm	20B. Quail	28. Shady
6. Elm Park	12. Grove	20C. Wildwood	29. Shoreland
7A. Lower Priebe Lake	13. Hickory	20D. Echo Lake	30. White Bear Lake
7B. Upper Priebe Lake	14. Juniper	21. Penn	
8A. Lost Lake	15. Neville	22. Yacht Club	
8B. Willemie	16. Locust	23. N.E. White Bear Lake	

Figure 1. Map of White Bear Lake subwatersheds. White Bear Lake watershed area is 11.8 square miles or about 7,550 acres.

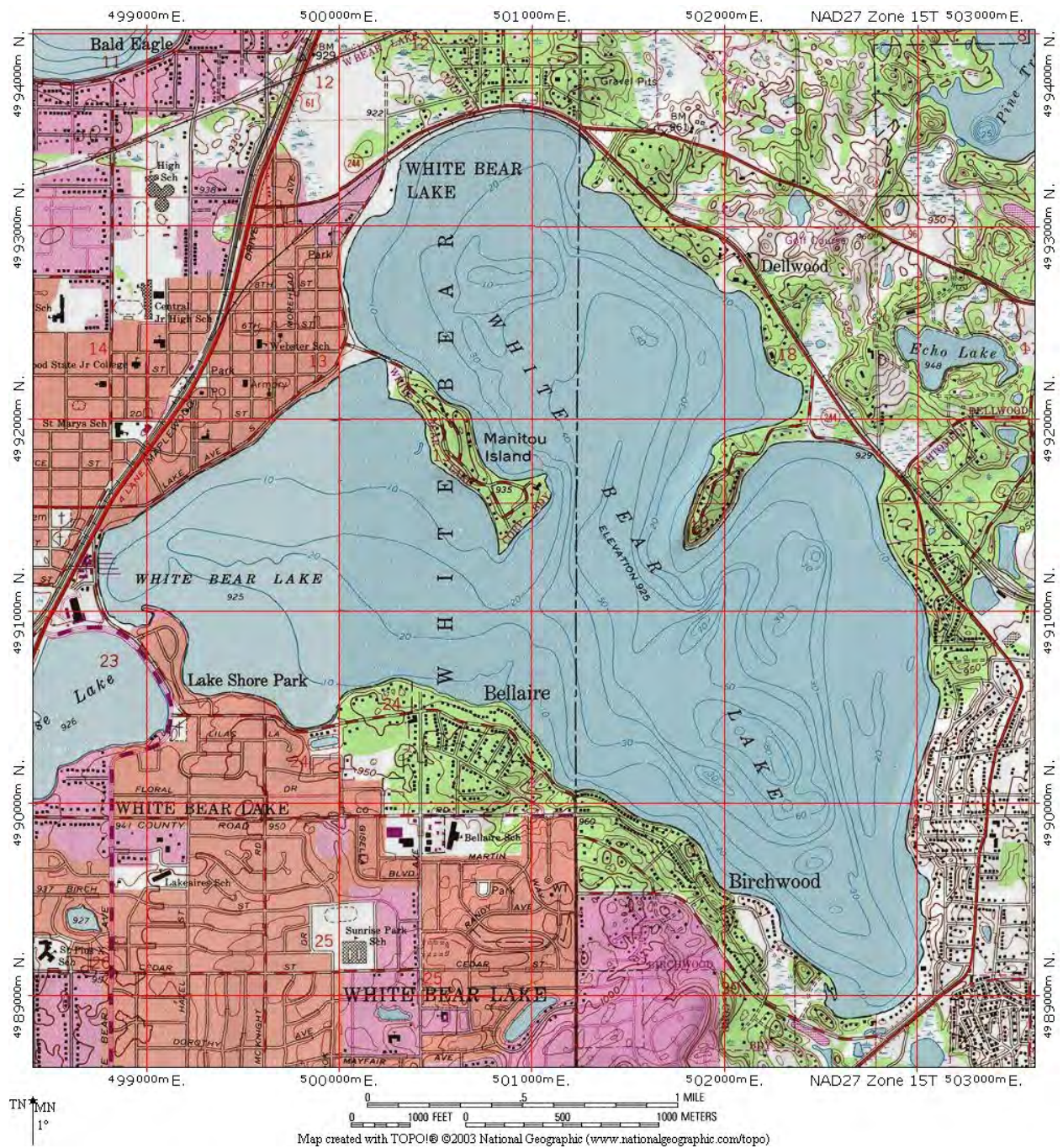


Figure 2. USGS map of White Bear Lake, Washington County, Minnesota. White Bear Lake has a surface area of 2,416 acres, a maximum depth of 82 feet and a mean depth of 18 feet.

Lake Levels and Weather Data

This section lists information on:

- Lake levels
- Ice out dates
- Rainfall and temperature

Lake Levels: Annual average lake level elevations as well as the annual minimum and maximum are shown in Figure 3. Since records have been kept starting in 1901, the highest lake elevation was in 1906 at 927 feet but officially, in the MnDNR database, the highest elevation is recorded at 926.7 in 1943 and the lowest was 918.84 feet in 2013.

Ice Out Dates: Ice out has been recorded since 1928. The earliest ice out date was March 8, 2024 and the latest ice out date was May 4, 1950 and 2018 (Table 4). Ice out dates using Julian days (calendar days, 1-365) are graphed in Figure 4.

Rainfall and Temperature: Annual rainfall recorded since 1891 for the Minneapolis/St. Paul weather station is shown numerically in Table 5 and graphically in Figure 5. The highest recorded annual rainfall was 43 inches occurring in 2019. The lowest recorded annual rainfall was 12 inches in 1910.

Mean annual temperatures recorded since 1932 are shown in Table 5 and Figure 5. The coldest mean annual temperature was recorded in 1972 at 41°F and warmest mean annual temperature was recorded in 2012 and 2024 at 51°F.

White Bear Lake Levels from 1923 - 2024

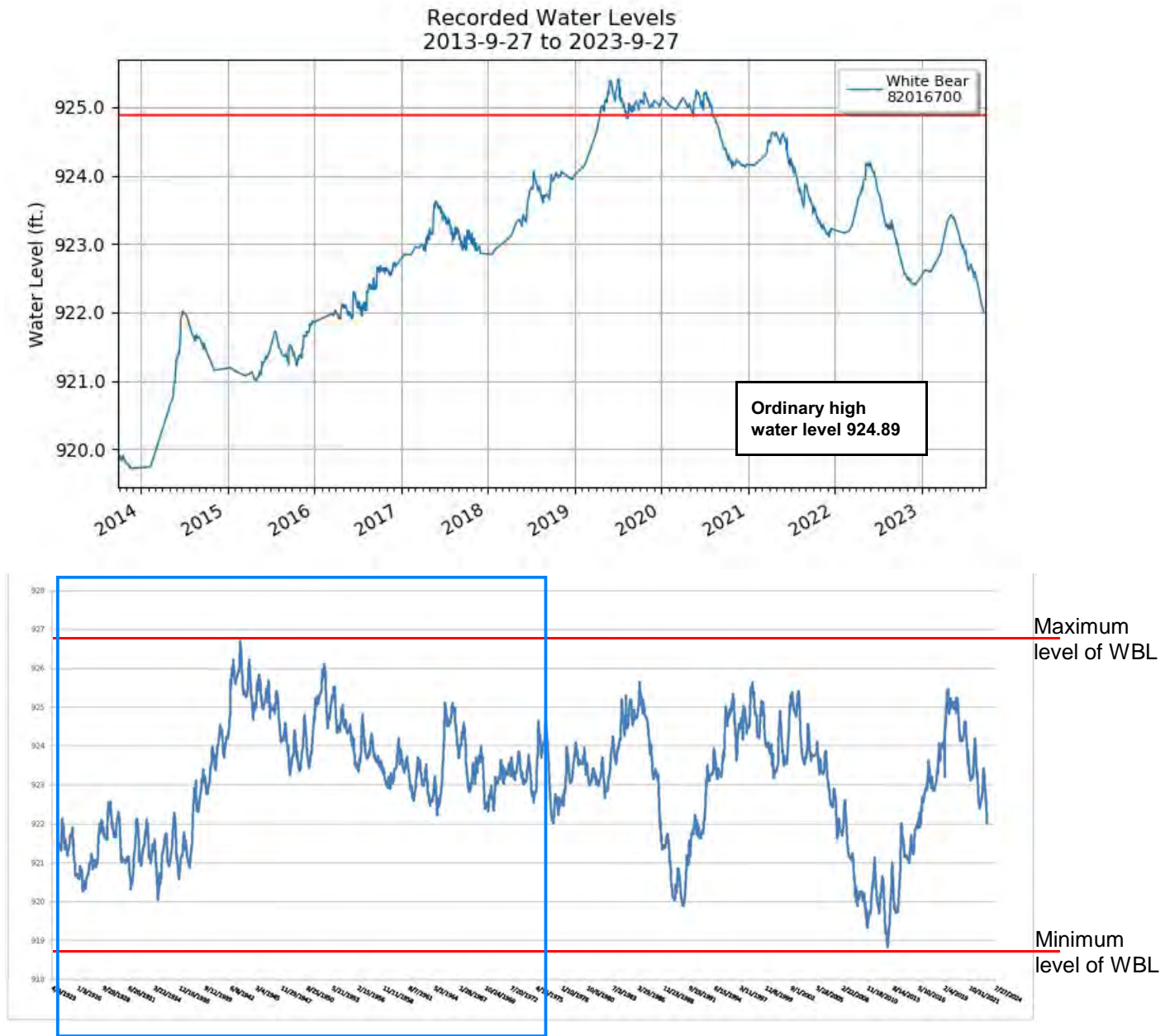


Figure 3. Lake levels for White Bear Lake from 2013 to 2024 are shown above and lake levels from 1923 to 2024 are shown in the bottom graph. White Bear Lake was augmented by local wells to maintain the lake levels is shown with the blue outline.

Ice Out Dates

Table 4. White Bear Lake ice out dates from 1928. Julian days are calendar days 1-365.

	Ice out date	Julian Day
1928	4.2	92
1929	4.4	94
1930	4.4	94
1931	4.7	97
1932	4.11	101
1933	4.18	108
1934	4.8	98
1935	4.10	100
1936	4.23	113
1937	4.19	109
1938	3.31	90
1939	4.16	106
1940	4.25	115
1941	4.13	103
1942	4.6	96
1943	4.13	103
1944	4.15	105
1945	3.29	88
1946	3.30	89
1947	4.17	107
1948	4.10	100
1949	4.12	102
1950	5.4	124
1951	4.29	119
1952	4.21	111
1953	4.10	100
1954	4.17	107
1955	4.11	101
1956	4.21	111
1957	4.20	110
1958	4.11	101
1959	4.12	102
1960	4.13	103
1961	4.14	104
1962	4.25	115
1963	4.11	101

	Ice out date	Julian Day
1964	4.13	103
1965	5.2	122
1966	4.9	99
1967	4.9	99
1968	3.31	90
1969	4.17	107
1970	4.17	107
1971	4.16	106
1972	4.25	115
1973	4.4	94
1974	4.22	112
1975	4.28	118
1976	4.7	97
1977	4.11	101
1978	4.17	107
1979	4.23	113
1980	4.19	109
1981	3.29	88
1982	4.19	109
1983	4.14	104
1984	4.14	104
1985	4.12	102
1986	4.8	98
1987	3.24	83
1988	4.7	97
1989	4.17	107
1990	4.4	94
1991	4.7	97
1992	4.10	100
1993	4.19	109
1994	4.6	96
1995	4.3	93
1996	4.24	114
1997	4.18	108
1998	4.3	93
1999	4.2	92

	Ice out date	Julian Day
2000	3.21	80
2001	4.19	109
2002	4.15	105
2003	4.11	101
2004	4.7	97
2005	4.9	99
2006	4.9	99
2007	4.1	91
2008	4.23	114
2009	4.11	101
2010	4.1	91
2011	4.13	103
2012	3.19	79
2013	5.1	121
2014	4.23	113
2015	4.2	92
2016	3.16	76
2017	3.23	82
2018	5.4	124
2019	3.18	108
2020	4.2	93
2021	3.29	88
2022	4.20	110
2023	4.18	108
2024	3.8	68

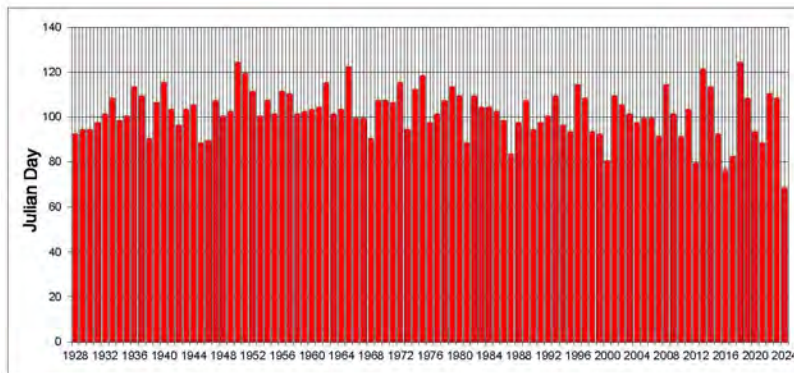


Figure 4. Ice out dates for White Bear Lake in Julian days (calendar days, 1-365) for 1928 to 2024. For example, Julian Day 100=April 10, Julian Day 120=April 30.

Rainfall and Temperature

Table 5. Minneapolis/St. Paul annual rainfall (inches) and mean temperature (°F).

	Annual Rainfall (inches)	Mean Temp (F)
1891	25	
1892	37	
1893	30	
1894	23	
1895	21	
1896	31	
1897	28	
1898	26	
1899	25	
1900	35	
1901	22	
1902	32	
1903	36	
1904	31	
1905	34	
1906	35	
1907	26	
1908	34	
1909	30	
1910	12	
1911	40	
1912	26	
1913	26	
1914	31	
1915	34	
1916	28	
1917	26	
1918	28	
1919	27	
1920	27	
1921	24	
1922	26	
1923	21	
1924	28	
1925	19	
1926	26	
1927	30	
1928	26	
1929	24	
1930	24	
1931	22	
1932	23	45
1933	24	47
1934	23	47
1935	28	45
1936	19	44
1937	23	44
1938	28	47

	Annual Rainfall (inches)	Mean Temp (F)
1939	25	46
1940	29	44
1941	27	48
1942	31	46
1943	23	44
1944	29	47
1945	27	44
1946	29	46
1947	31	45
1948	17	46
1949	25	47
1950	22	42
1951	35	42
1952	24	46
1953	28	47
1954	24	46
1955	20	46
1956	26	45
1957	28	46
1958	16	46
1959	27	46
1960	22	44
1961	26	44
1962	29	42
1963	20	44
1964	26	46
1965	40	43
1966	25	43
1967	25	43
1968	38	45
1969	19	45
1970	31	44
1971	29	44
1972	24	41
1973	21	47
1974	19	44
1975	35	45
1976	17	45
1977	35	45
1978	30	44
1979	31	43
1980	22	45
1981	28	46
1982	30	44
1983	39	46
1984	37	45
1985	32	44
1986	37	46

	Annual Rainfall (inches)	Mean Temp (F)
1987	32	50
1988	19	46
1989	23	44
1990	33	47
1991	37	46
1992	30	45
1993	32	44
1994	30	46
1995	26	46
1996	26	43
1997	34	45
1998	33	49
1999	31	48
2000	32	46
2001	34	48
2002	38	47
2003	23	46
2004	27	46
2005	33	48
2006	28	49
2007	34	48
2008	22	45
2009	25	45
2010	33	48
2011	27	48
2012	30	51
2013	33	45
2014	35	43
2015	36	48
2016	40	50
2017	32	49
2018	34	46
2019	43	45
2020	30	48
2021	26	49
2022	23	46
2023	30	50
2024	37	51

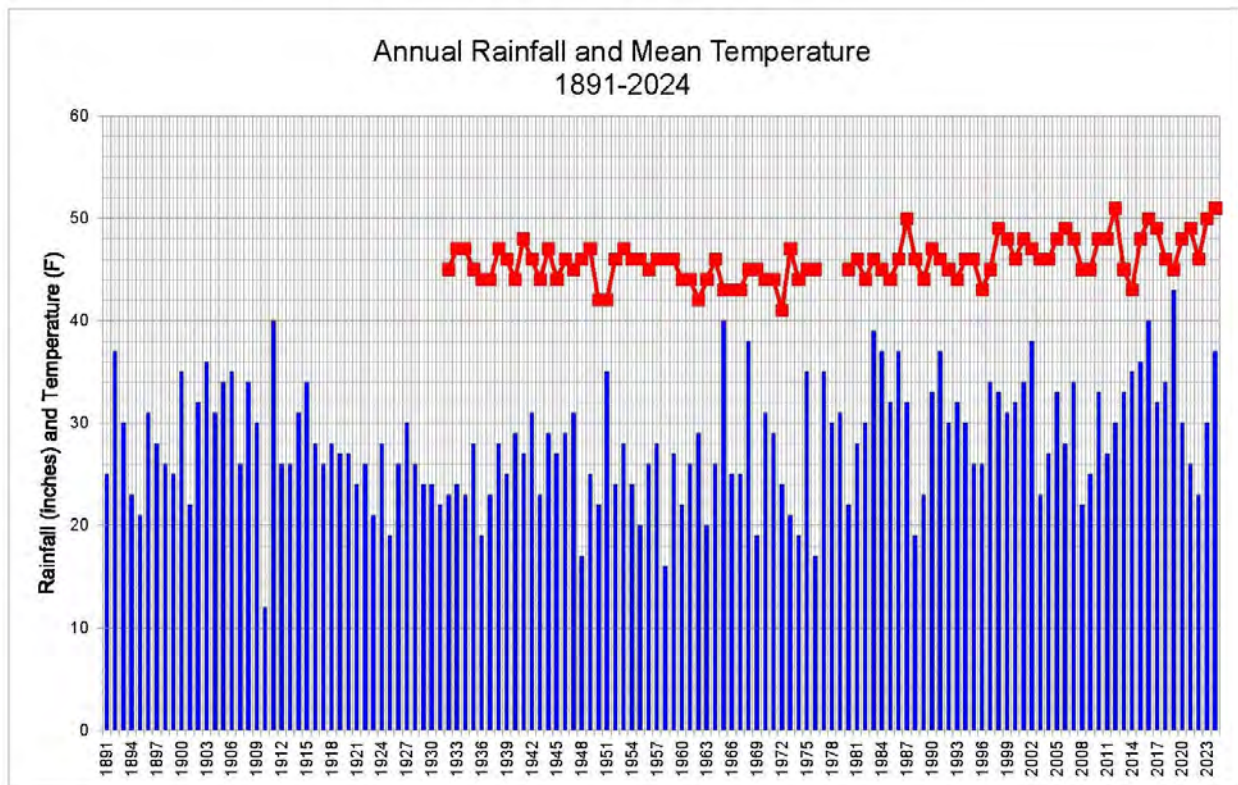


Figure 5. Minneapolis/St. Paul annual rainfall (inches) is shown as bars and mean annual temperature (°F) is shown with the squares.

Water Quality Indicators: Clarity, Phosphorus, and Algae

This section lists information on:

- Water clarity (determined by Secchi disc)
- Phosphorus
- Algae (determined by chlorophyll *a*)
- Trophic State Index and Lake Report Card
- Chloride

Trophic indicators are parameters that represent lake water quality. Three commonly used trophic indicators are Secchi disc transparency, lake phosphorus concentrations, and chlorophyll *a* concentrations. A summary of the trophic indicator data base is shown in Table 6. From this database, statistical tests were run by the MPCA to determine if the water quality indicators were increasing, decreasing, or staying the same. A summary of those test results is shown in Table 7. Data are graphed for Secchi disc transparency (Figure 6), total phosphorus (Figure 7), and chlorophyll *a* (Figure 8).

Table 6. Annual averages (May-September) for total phosphorus, Secchi disc, and chlorophyll *a* used in the trend analysis. Blank spaces indicate data not available.

	Total Phos (ug/l)	Secchi Disc (m)	Chl a (ug/l)
1954	1	2.4	
1962			
1967			
1969	22	3.7	
1970	29	2.3	5.6
1971		2.1	1.4
1974		2.6	
1975	43	2.4	14.8
1976	20	3.2	6.3
1977	35	1.6	6
1978	26	1.5	3.9
1979	24	2.4	4.6
1980	29	2.5	9.2
1981	31	3.7	
1983	30	3	1.5
1984	19	3.1	
1985	20	3.7	1
1986	10	3.1	1
1987	20	3.6	1
1988	23	3.2	4.4
1989	19	3.4	3.5
1990	21	3.5	6.4
1991	19	3.5	6.6
1992	18	4	5.6
1993	16	4.4	4.4
1994	18	3.3	6.5
1995	28	3.9	7.6
1996	19	4	4.9
1997	16	4.4	4
1998	24	3.8	5.2
1999	22	3.4	7.6
2000	14	4.4	3
2001	16	4.1	9
2002	21	4.7	5
2003	17	4.7	4
2004	14	5.0	3.2
2005	11	4.7	3.1
2006	15	4.0	6.2
2007	13	3.3	6.4
2008	15	3.7	4.8
2009	14	3.7	3.3
2010	22	3.6	4.4
2011	21	3.1	5.4
2012	22	2.9	5.5
2013	18	3.7	5.0
2014	19	3.2	4.3
2015	18	3.3	5.3
2016	13	3.8	3.1
2017	16	6.4	2.5
2018	19	6.6	3.5
2019	15	6.9	3
2020	16	6.8	3.5
2021	20	5.5	1.9
2022	17	4.4	3.7
2023	14	5.0	2.8
2024	23	4.4	4.6

Table 7. Summary of trend analyses of White Bear Lake data for three primary trophic indicators using water quality data up to 2024.

Parameter	Trend	Data Base Used (4 or more readings/year)
Secchi disc	increase	70 years
Total phosphorus	decrease	70 years
Chlorophyll <u>a</u>	decrease	54 years

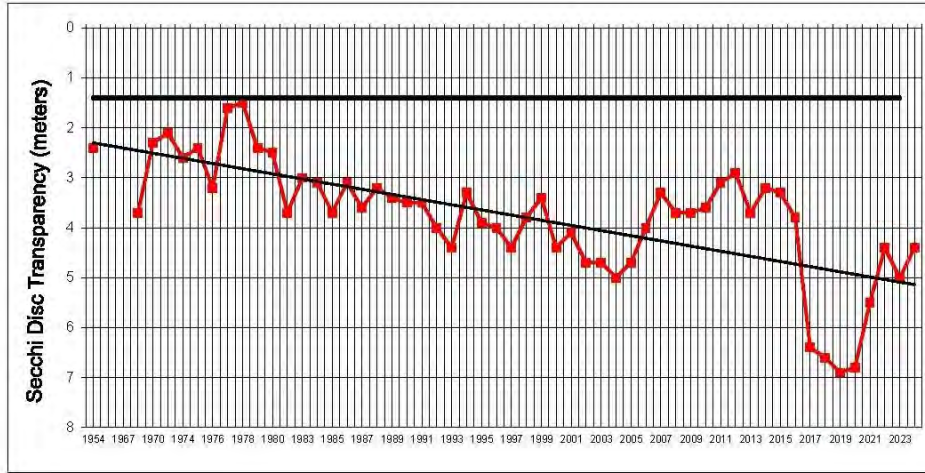
Secchi disc: The summer average Secchi disc transparency for 2024 was 4.4 meters (14.5 feet). This is good water clarity for lakes in the metropolitan area and is good quality for lakes in the Central Hardwood Forest ecoregion. Water clarity as measured by the secchi disc has been increasing since 1954 (Figure 6). The dramatic increase in clarity from 2016 to 2021 was likely influenced by zebra mussel filtering activities.

Total phosphorus: The summer average total phosphorus concentration for 2024 was 23 parts per billion. This is low for lakes in the metropolitan area and good for lakes in the Central Hardwood Forest ecoregion but a little higher compared to averages from the last decade. Total phosphorus concentrations have been declining since 1969 (Figure 7).

Chlorophyll a: The summer average chlorophyll a concentration for 2024 was 4.6 parts per billion. This is low for lakes in the metropolitan area and good for lakes in the Central Hardwood Forest ecoregion. Trend analysis indicates chlorophyll has decreased since 1970 (Tables 6 and 7 and Figure 8).

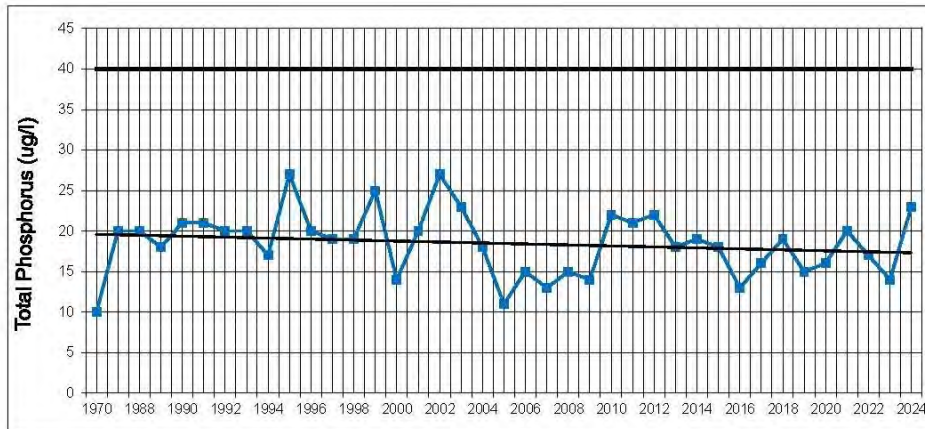
White Bear Lake remains in an unimpaired status based on MPCA ecoregion criteria (Figures 6, 7, and 8).

Long Term Secchi Disc Clarity, Total Phosphorus, and Chlorophyll



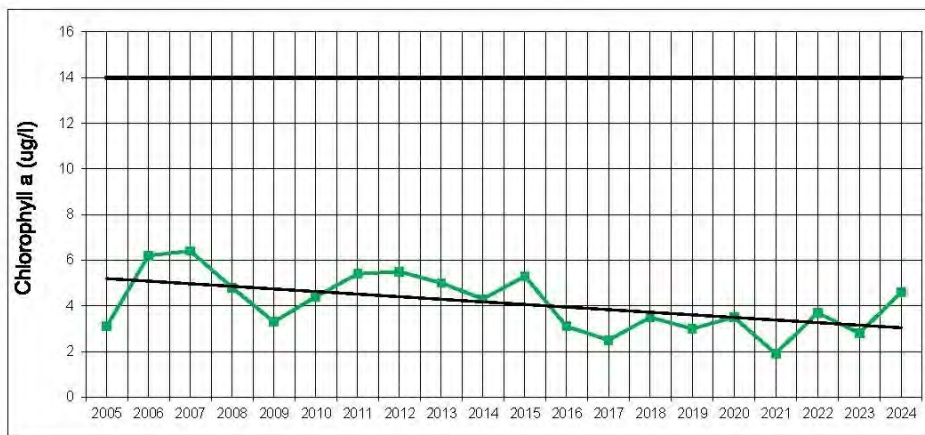
Ecoregion value*:
Secchi disc: 1.4 m

Figure 6. Historical Secchi disc (m) transparency for White Bear Lake. Water transparency is improving.



Ecoregion value*:
Total phosphorus:
40 ug/l

Figure 7. Historical total phosphorus (ug/l) concentrations for White Bear Lake. Total phosphorus concentrations are decreasing.



Ecoregion value*:
Chlorophyll a: 14 ug/l

Figure 8. Historical chlorophyll a (ug/l) concentrations for White Bear Lake. Chlorophyll concentrations are decreasing.

*ecoregion value is the water quality goal for lakes in the North Central Hardwood Forest Ecoregion. Lakes with clarity greater than 1.4 m, with phosphorus less than 40 ug/l, and with chlorophyll a less than 14 ug/l meet Ecoregion Criteria and are considered unimpaired. Ecoregion values are shown in the graphs with a thick black line.

Trophic State Index

A water quality index was established in the late 1970s (Carlson, R.E. 1977. A trophic state index for lakes, *Limnol and Oceanog* 2:361-368) that converted Secchi disc, chlorophyll *a*, and phosphorus measurements (trophic state indicators) into a numerical index from about 20 to 100. Trophic state indicators for White Bear Lake for 2024 are shown below in Figure 9. The average of the three indicators show White Bear Lake is a mesotrophic lake, meaning it is a lake with moderate fertility.

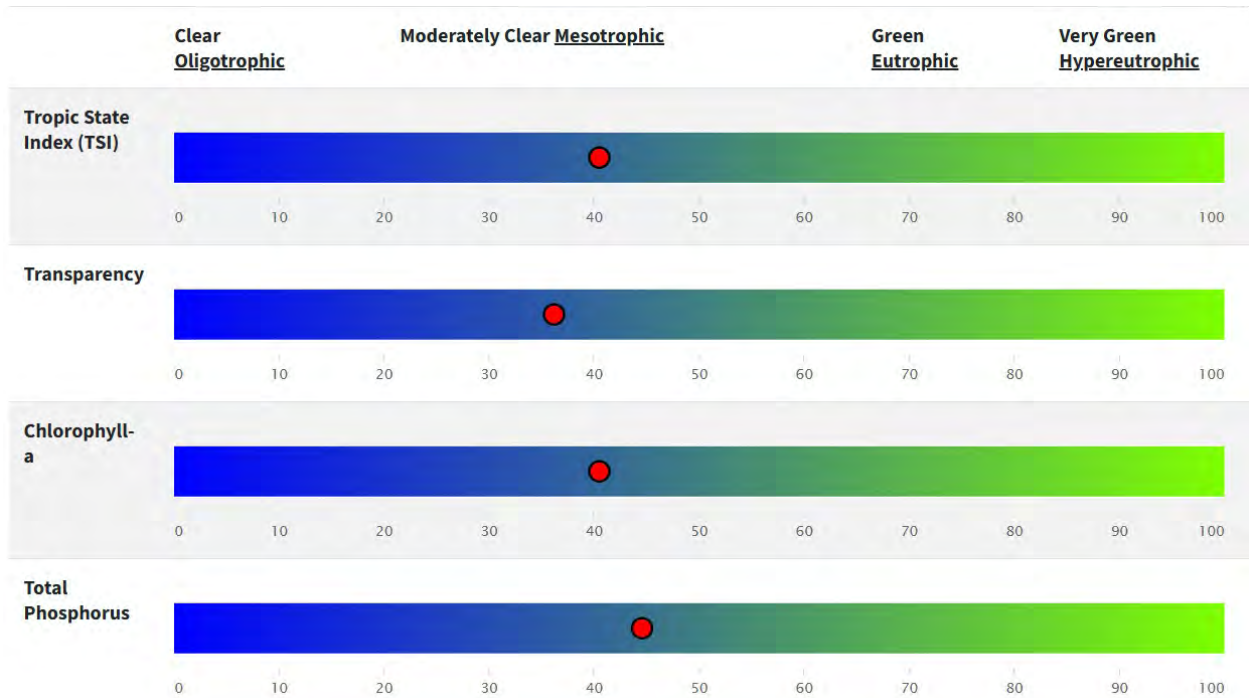


Figure 9. Trophic state index for White Bear Lake based on the average of the last 10 years of data. White Bear Lake is a mesotrophic lake. The x-axis scale is roughly from 0 to 100, where 100 is the most eutrophic.

Lake Report Card

Although White Bear Lake lies in the Central Hardwood Forest Ecoregion, it is also within the Twin City metropolitan area. In the 1980s, Dick Osgood, who was then with the Met Council, established a metropolitan lake report card grading system. The grading criteria are shown in Table 8. Data from the three trophic state indicators in Table 6 have been converted to lake grades and the grades are shown in Table 9. White Bear Lake is in the top 10% of the lakes in the metro area in terms of the three trophic state indicators.

Table 8. Grading criteria used by the Met Council and developed by Dick Osgood (May-September averages).

Grade	Percentile	Phosphorus (ug/l)	Chlorophyll a (ug/l)	Secchi Disc (m)
A	<10	<23	<10	>3.0
B	10-30	23-32	10-20	2.2-3.0
C	30-70	32-68	20-48	1.2-2.2
D	70-90	68-152	48-77	0.7-1.2
F	>90	>152	>77	<0.7

Table 9. Lake report card grades for White Bear Lake based on May-September averages, where available.

	Secchi Disc (water clarity)	Phosphorus (nutrients)	Chlorophyll (algae)
1954	B	A	
1969	A	A	
1970	B	B	A
1971	C		A
1974	B		
1975	B	C	B
1976	A	A	A
1977	C	C	A
1978	C	B	A
1979	B	B	A
1980	B	B	A
1981	A	B	
1983	A	B	A
1984	A	A	
1985	A	A	A
1986	A	A	A
1987	A	A	A
1988	A	A	A
1989	A	A	A
1990	A	A	A
1991	A	A	A
1992	A	A	A
1993	A	A	A
1994	A	A	A
1995	A	B	A
1996	A	A	A
1997	A	A	A
1998	A	B	A
1999	A	A	A
2000	A	A	A
2001	A	A	A
2002	A	A	A
2003	A	A	A
2004	A	A	A
2005	A	A	A
2006	A	A	A
2007	A	A	A
2008	A	A	A
2009	A	A	A
2010	A	A	A
2011	A	A	A
2012	B	A	A
2013	A	A	A
2014	A	A	A
2015	A	A	A
2016	A	A	A
2017	A	A	A
2018	A	A	A
2019	A	A	A
2020	A	A	A
2021	A	A	A
2022	A	A	A
2023	A	A	A
2024	A	B	A

Chloride

Chlorides are derived from dissolved salts. Chloride concentrations have been sampled off and on since 1962 (Table 10 and Figure 10). Chloride levels in White Bear Lake are increasing significantly (Figure 10). However, chloride concentrations are increasing in nearly all the metropolitan lakes and in many lakes statewide. Road salt runoff into the lake is one significant source. Present concentrations are moderate and monitoring should continue. The State standard for lake impairment is greater than 230 ppm. Currently White Bear Lake is at 54 ppm. At the current rate of increase using the last 15 years of data, WBL would hit 230 mg/l of chlorides in 200 years.

Table 10. Chloride concentrations for White Bear Lake.

	Chloride Concentrations (ppm)		Chloride Concentrations (ppm)		Chloride Concentrations (ppm)
1954		1991	28	2013	41
1962	4.6	1992	24	2014	40
1967		1993	24	2015	
1969	8.8	1994	25	2016	40
1970		1995	28	2017	
1971		1996	33	2018	40
1974		1997	29	2019	42
1975		1998	30	2020	45
1976		1999	31	2021	46
1977	13	2000	21	2022	46
1978	13	2001	33	2023	49
1979	12	2002	31	2024	54
1980	18	2003	31		
1981		2004	31		
1983		2005	32		
1984	15	2006	37		
1985		2007	36		
1986		2008	39		
1987		2009	38		
1988	21	2010	41		
1989	27	2011	39		
1990	28	2012	37		

State Standard for Lake Impairment: >230 ppm (mg/l) chloride

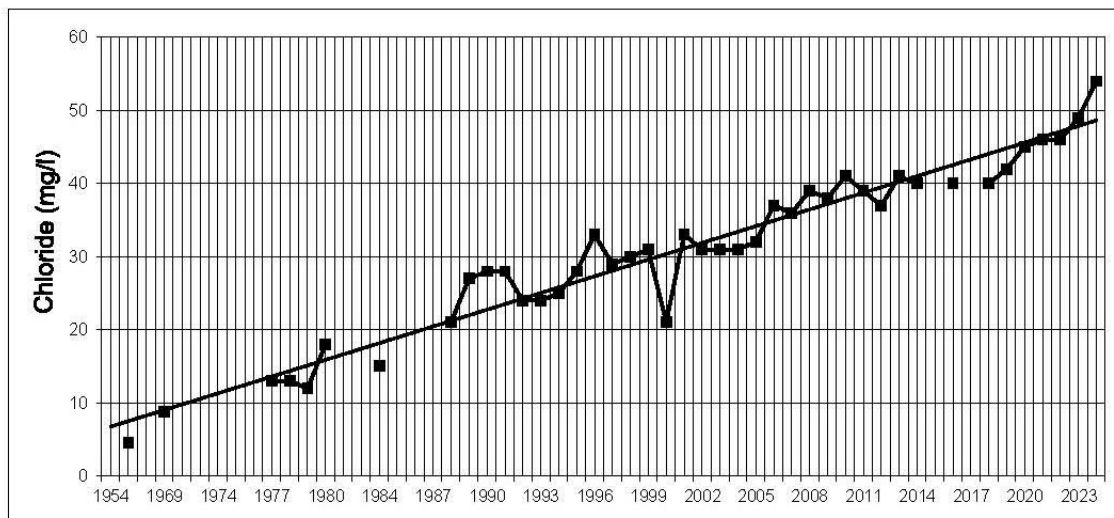


Figure 10. Historical chloride concentrations (mg/l) for White Bear Lake. Chloride concentrations are increasing.

Aquatic Plants and Zebra Mussels

This section lists information on:

- Aquatic plant surveys: line transects (1997-2010) and point intercept (2011 and 2023).
- Aquatic plant control by herbicides or harvesting.
- Eurasian watermilfoil distribution maps.
- Zebra mussel distribution.

Aquatic Plant Surveys: One way to gage species diversity is by listing the species of aquatic plants in the lake. In the 1954 MnDNR fish survey, there was no aquatic plant species list but the narrative stated aquatic plants grew to a depth of nine feet and covered less than ten percent of the area of the lake. Cattails, bulrushes, submerged pondweeds, and coontail were common in extensive beds in the shallow west bay. Submerged pondweeds grew in a narrow belt around the rest of the lake with occasional patches of bulrush, cattail, and arrowhead (Pg 2, 1954 MnDNR fish survey). Plants probably have always grown to some extent in White Bear Lake. Aquatic plant species lists were first compiled in the 1970s. We compared a 1973 Ramsey County survey with line transect surveys up to 2010 (Table 11) and found only a few changes in the plant community. More comprehensive aquatic plant point intercept surveys were conducted in 2011 and 2023 (Table 12). One of the most significant changes was Eurasian watermilfoil being discovered in 1988.

Aquatic Plant Control by Herbicides or Harvesting: The first recorded aquatic plant control measures were reported in 1924 on White Bear Lake.

Eurasian Watermilfoil Distribution Maps: Eurasian watermilfoil was first recorded in White Bear Lake in 1988 (Table 13). By 1991, milfoil was widely distributed around the lake (Figure 13). Chemical treatment peaked in 2010. Milfoil is still widely distributed in White Bear Lake, and has reached the surface causing potential nuisance conditions in several locations. However most of the Eurasian watermilfoil growth is of the non-nuisance type meaning it is present, but not a nuisance.

Aquatic Plant Surveys: Line Transects Surveys Through 2010

Table 11. Comparison of aquatic plant occurrence for years with quantitative line transects surveys from 1973 - 2010. The 1973 survey covered just the western side of White Bear Lake. Surveys in 1984 and 1989 were conducted by the MnDNR and surveys from 1997-2010 were conducted by Blue Water Science.

	1973 % Occur 45 stat	1984*	1989*	1997 % Occur 76 stat	1998 % Occur 110 stat	1999 % Occur 120 stat	2000 % Occur 125 stat	2001 % Occur 122 stat	2002 % Occur 122 stat	2003 % Occur 121 stat	2004 % Occur 121 stat	2005 % Occur 123 stat	2006 % Occur 125 stat	2007 % Occur 125 stat	2008 % Occur 125 stat	2009 % Occur 118 stat	2010 % Occur 118 stat
Water marigold (<i>Bidens beckii</i>)			R	9	1	9	9	7	5	12	7	7	2	7	8	7	13
Coontail (<i>Ceratophyllum demersum</i>)	94	A	C	34	51	56	34	46	32	45	38	46	51	50	51	43	68
Chara (<i>Chara</i> sp)	67		C	30	34	42	38	40	35	31	37	42	34	22	21	21	17
Moss (<i>Drepanocladus</i> sp)				0	1	2						1	2				
Needle spike rush (<i>Eleocharis acicularis</i>)								2				1	1				
Elodea (<i>Elodea canadensis</i>)	18		O	3	5	6	5	3	2	5	10	9	6	9	2	7	2
Star duckweed (<i>Lemna trisulca</i>)	13			0	0	1										1	
Northern milfoil (<i>Myriophyllum sibiricum</i>)	30	A	C	37	44	33	40	33	25	45	41	24	6	18	10	3	
Eurasian + Hybrid milfoil (<i>M. spicatum</i>)	--		P	21	56	35	55	63	57	50	57	60	56	62	56	68	56
Naiads (<i>Najas</i> sp)	2	A	A	29	25	45	25	17	16	31	32	31	27	16	20	23	21
Nitella (<i>Nitella</i> sp)	13			0	1												
White waterlily (<i>Nymphaea</i> sp)								1	1								
Cabbage (<i>Potamogeton amplifolius</i>)	26	C	C	12	26	5	8	8	7	11	13	17	11	9	3	4	12
Curlyleaf pondweed (<i>P. crispus</i>)	51		P	3	0	2		2			1	1	1	1		1	
Leafy pondweed (<i>P. foliosus</i>)		C															
Variable pondweed (<i>P. gramineus</i>)	3			0	15	26	18	23	20	7	25	21	12	6	7	3	2
Illinois pondweed (<i>P. illinoensis</i>)						20	15	21	25	23	15	4	16	5	2		
Floatingleaf pondweed (<i>P. natans</i>)			O											2			1
Whitestem pondweed (<i>P. praelongus</i>)	36						2	3	1			17	5	14	22	19	15
Claspingleaf pondweed (<i>P. richardsonii</i>)	2	C	C	30	32	27	42	28	33	33	27	28	21	21	16	10	17
Robbins pondweed (<i>P. robbinsii</i>)	42		O	20	17	24	33	28	15	27	23	33	28	39	27	30	34
Flatstem pondweed (<i>P. zosteriformis</i>)	78		C	29	29	43	8	15	24	21	36	36	42	18	26	16	7
Stringy pondweed (<i>P. sp</i>)	3			0	9	18	4	3	5	1	10	2	14	6	3	1	1
Buttercup (<i>Ranunculus</i> sp)	7			0	12	1	1	1	2	4	2	2					
Slender arrowhead (<i>Sagittaria graminea</i>)				3	1		2	2			2	1	2				
Three square (<i>Scirpus americanus</i>)								2						2		4	3
Sago pondweed (<i>Stuckenia. pectinata</i>)		A	O	3	6	4	10	4	2	5	2	7	2	6	4	1	1
Bladderwort (<i>Utricularia</i> sp)									1								
Water celery (<i>Vallisneria americana</i>)	11	A	O	24	36	38	26	32	16	22	17	24	18	25	18	15	20
Water stargrass (<i>Zosterella dubia</i>)	14			29	15	12	17	8	5	14	6	9	2	2		3	5
Filamentous algae	27										2	2	2	3	2	4	
Number of Species	18	8	15	16	20	21	20	24	21	18	21	25	23	22	17	21	18

*1984 and 1989: A=abundant, C=common, O=occasional, P=present, R=rare

Aquatic Plant Surveys: Point Intercept Surveys 2011 and 2023

In the August 2023 point intercept survey, the dominant aquatic plant based on occurrence was naiads (Table 12). A total of 24 submerged species, 1 floatingleaf species, and 2 emergent species were observed. Aquatic plant occurrence increased for most species from 2011 to 2023 (Table 12). A decrease in occurrence was found for marsh marigold, chara, and Eurasian watermilfoil.

Table 12. Summary of aquatic plant occurrence results from plant point intercept surveys conducted in 2011 and 2023.

	Occurrence (317 sites)	
	8-14-11	8-11-23
Emergent		
Spike rush (<i>Eleocharis palustris</i>)	1	
Sagittaria (<i>Sagittaria sp</i>)		2
Three square (<i>Schoenoplectus sp</i>)	5	2
Bulrush (<i>Scirpus sp</i>)	1	
Cattails (<i>Typha sp</i>)	1	
Floatingleaf		
Spatterdock (<i>Nuphar variegata</i>)		
White lily (<i>Nymphaea odorata</i>)		1

	Occurrence (317 sites)	
	8-14-11	8-11-23
Submergents		
Marsh marigold (<i>Bidens beckii</i>)	13	7
Coontail (<i>Ceratophyllum demersum</i>)	66	110
Chara (<i>Chara sp</i>)	47	31
Moss (<i>Drepanocladus sp</i>)		1
Elodea (<i>Elodea canadensis</i>)	11	61
Water stargrass (<i>Heteranthera dubia</i>)	3	53
Star duckweed (<i>Lemna trisulca</i>)	2	9
Northern watermilfoil (<i>Myriophyllum sibiricum</i>)	2	26
Eurasian watermilfoil (<i>Myriophyllum spicatum</i>)	63	37
Naiads (<i>Najas sp</i>)	46	112
Nitella (<i>Nitella sp</i>)		1
Cabbage (<i>Potamogeton amplifolius</i>)	10	19
Curlyleaf pondweed (<i>Potamogeton crispus</i>)		4
Fries pondweed (<i>P. friesii</i>)		1
Variable pondweed (<i>P. gramineus</i>)	2	10
Illinois pondweed (<i>P. illinoensis</i>)	1	27
Whitestem pondweed (<i>P. praelongus</i>)	34	36
Claspingleaf pondweed (<i>P. richardsonii</i>)	16	43
Fern pondweed (<i>P. robbinsii</i>)	48	69
Stringy pondweed (<i>P. sp</i>)	6	27
Flatstem pondweed (<i>P. zosteriformis</i>)	25	88
Buttercup (<i>Ranunculus aquatilis</i>)		1
Sago pondweed (<i>Stuckenia pectinata</i>)	4	6
Water celery (<i>Vallisneria americana</i>)	36	45
Number of submerged species	19	24
Depth (feet) of plant colonization	15	23
Percent Submerged Aquatic Plant Coverage (%)	54%	62%

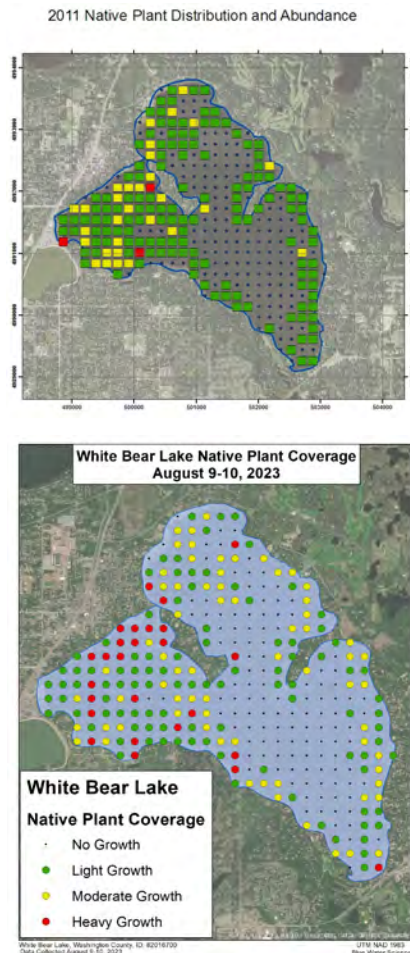


Figure 11. Native plant data based on point intercept surveys for 2011 and 2023.

Aquatic Plant Control

Two types of aquatic plant controls have been recorded in White Bear Lake based on MnDNR records and a reference from a 1925 report by Coates. Acres treated by herbicides and by mechanical means are listed in Table 13. In addition copper sulfate usage is listed also. Copper sulfate use since 1979 has declined substantially. Sodium arsenite use was common up to 1958 and 2-4-D was first mentioned in permit applications in 1958. Chemical treatment has been more common than mechanical treatment since 1956 when the MnDNR permitting program began.

An early record of harvesting was described in a 1925 report for cutting aquatic plants in White Bear Lake in 1924 and is summarized below:

1924: "Perhaps the most noticeable effects of weed cutting was in the southwest bay at White Bear Lake, adjacent to the St. Paul Auto Club. Here the weed growth caused the waters of the bay to be more or less stagnant and not adaptable to boating. Two weeks' operation cut practically all the weeds in this bay and hundreds of tons of wet weeds were removed from the lake. Wave action on the west shore, that had been counteracted by the weed growth was restored and cut weeds were washed far upon the beach." pg 100

"The operating costs has averaged \$10.00 per day or approximately \$1.00 per acre under normal operating conditions." pg 102
(From: Coats, P.N. , 1925. Special report on lake improvement. Ramsey County Report submitted to County Commissioners).

Assuming the weed cutter covered 10 acres /day and worked for two weeks (10 working days), more than 100 acres of plants may have been cut in 1924 in White Bear Lake.

1956: First chemical treatment recorded for aquatic plants.

1988-2001 and 2010-2024: Eurasian watermilfoil was first observed as a single plant near a public dock on the west side of the lake and 2 acres were treated (Table 13). EWM was found on the west side in 1989 and 1990 but in 1991, EWM had spread around much of White Bear Lake. EWM hand pulling was used in 1991 (12 acres), 1992 (3 acres), and several additional years (Table 13). The greatest number of acres treated was in 2010 (174 acres) during a period of low lake levels in White Bear Lake (Figure 12). Since 2014, EWM treatments have varied from 12 acres (2020) to 85 acres (2015)(Table 13). The distribution of EWM from 1988 to 2024 is shown in Figure 13.

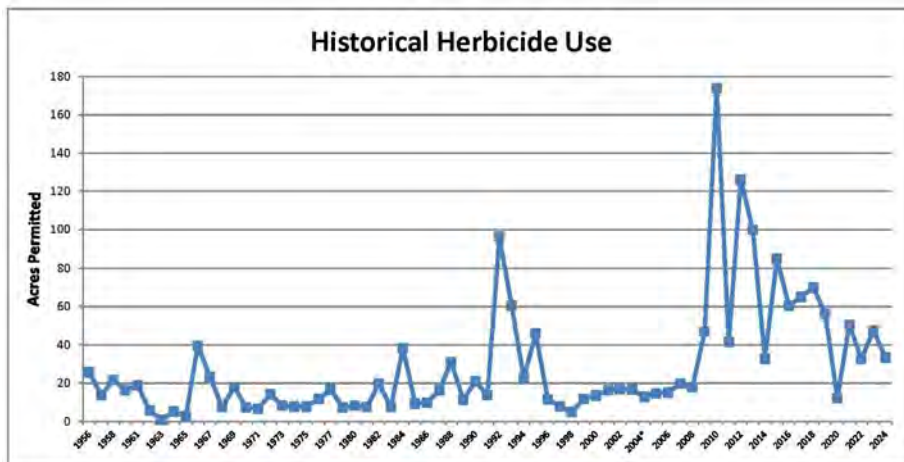


Figure 12. Permitted acres of aquatic plants treated in White Bear Lake based on MnDNR permit applications for 1956 through 2024.

Table 13. White Bear Lake herbicide treatments and mechanical removal of aquatic plants. Source: based on available data from MnDNR-Ecological Services records. Blank spaces indicate the data were not available.

Year	Acres Treated				Fila algae/ Chara Acres Treated	Copper Sulfate		
	Chemical		Mechanical			Acres Permitted	Acres Treated	Pounds Used
	Permitted	EWM Treated	Permitted	Treated				
1924				100				
1956	25.7							
1957	13.8							
1958	21.7							
1960	16.3							
1961	18.8							
1962	5.6							
1963	0.9							
1964	5.2							
1965	2.7							
1966	39.7				28.0		7400.0	
1967	23.4				28.0		3700.0	
1968	7.6				22.4		3700.0	
1969	17.93				28.4		3800.0	
1970	7.33				28.00		3700.0	
1971	6.6				28.00		3705.0	
1972	14.23				21.12		3360.0	
1973	8.27				21.34		2725.0	
1974	7.81				21.12		2760.0	
1975	7.81				4.27		2765.0	
1976	11.78				4.0	22.59	3833.0	
1977	16.77		0.06			22.44	2835.0	
1979	7.35				9.76	1.15	50.0	
1980	8.16		1.6		8.16			
1981	7.55		0.12		3.67			
1982	19.62		1.43		10.55			
1983	7.66		1.46		7.66	1.32	100.0	
1984	38.36		3.21		18.84	1.37	291.0	
1985	9.43		1.17		4.97	1.15	50.0	
1986	9.94				5.08	1.15	150.0	
1987	16.41				4.79	1.43	185.5	
1988	31.1	2.0			7.30	1.42	200.0	
1989	11.27	8.8			4.89	1.20	56.0	
1990	20.93	6.3			2.15	3.2*	123.0	
1991	13.81	3.3	12.00	0	0*	3.2	106.0	
1992	96.37	76.5	3.00	0.1		13.5	176.4	
1993	60.60	46.0	4.10	0		8.4	6.9	124.1
1994	22.51	9.3		0.1		8.6	8.7	248.0
1995	46.00	52.2				6.4	6.2	255.5
1996	11.5	18.6				8.4	7.1	145.9
1997	8.0	7.4	0.34	0.05		8.9	7.4	276.8
1998	5.0	11.7				8.3	8.9	695
1999	11.74	12.6	0.05	0.05		15.9	12.6	493.3
2000	13.6	13.5				13.5	13.5	428.3
2001	16.2	11.6			0.4	16.3	6.6	456.1
2002	17.1				0.1	14.7		
2003	16.5					13.4		
2004*	12.9							
2005*	14.7		0.33			7.4		
2006	15.1		0.39			1.2		
2007	19.8		0.23			16.6		
2008	17.8							
2009	47							
2010	174	174						
2011	41.6	41.6						
2012	126	125.6						
2013	100	100.5						
2014	32.8	33.2						
2015	85	85.1						
2016	60.4	60.4						
2017	65.1	65.1						
2018	69.9	69.9						
2019	56.42	56.42						
2020	12.17	12.17						
2021	50.53	50.52						
2022	32.7	32.70						
2023	47.67	46.67						
2024	33.4	33.43						

* acres treated with copper sulfate are also combined with chemical treatment. Often a permit covers both herbicide and copper sulfate treatment in a single permit.

Eurasian Watermilfoil Maps from 1988-2024

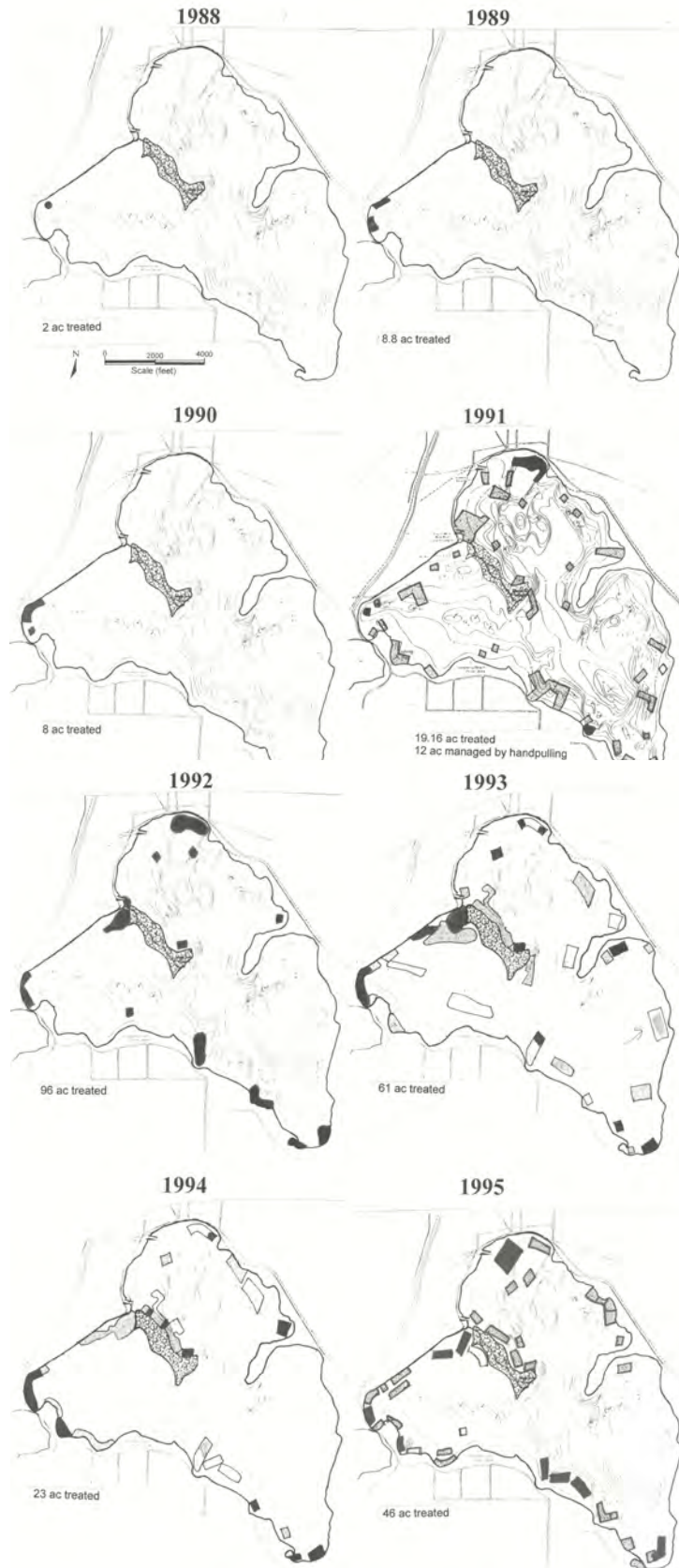


Figure 13. Distribution of Eurasian watermilfoil in White Bear Lake over the years.

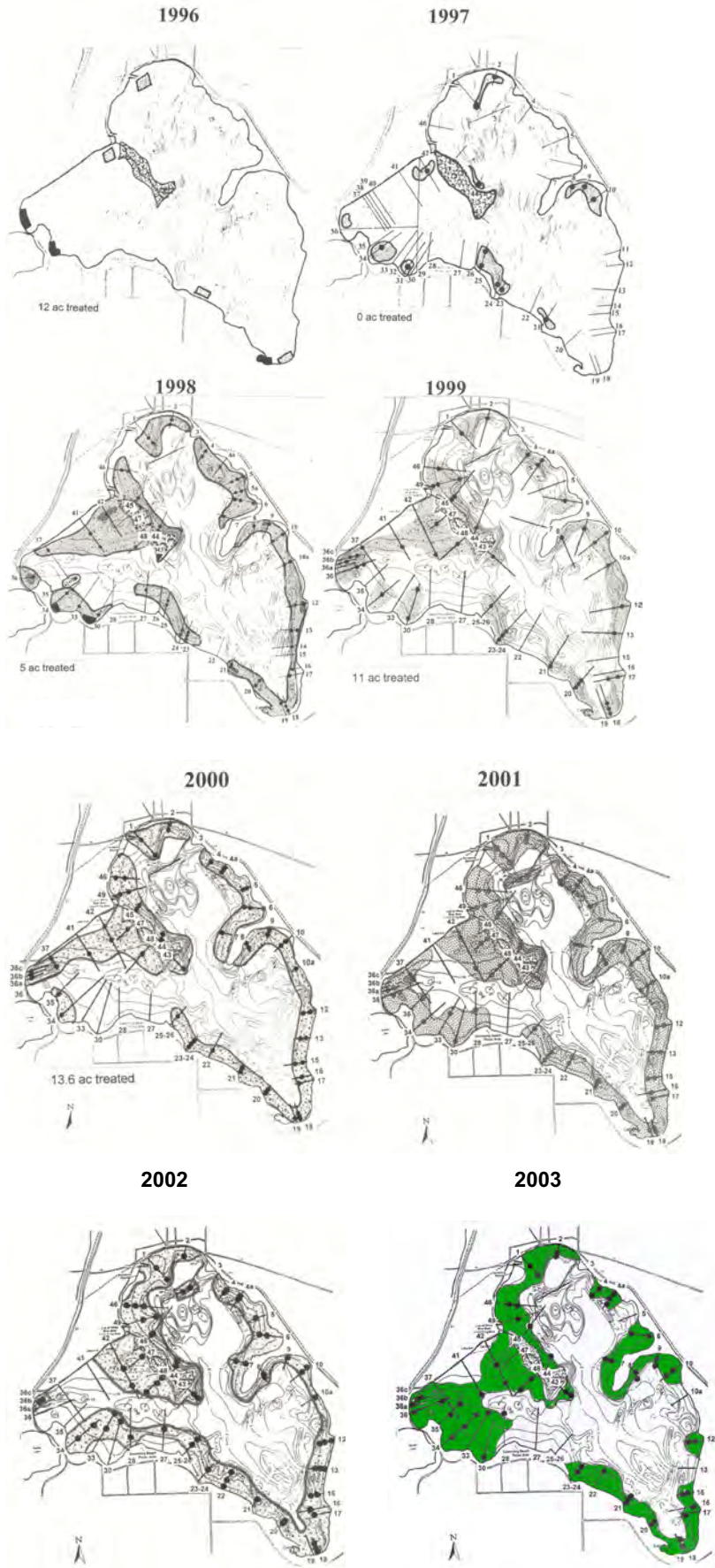


Figure 13. Continued.

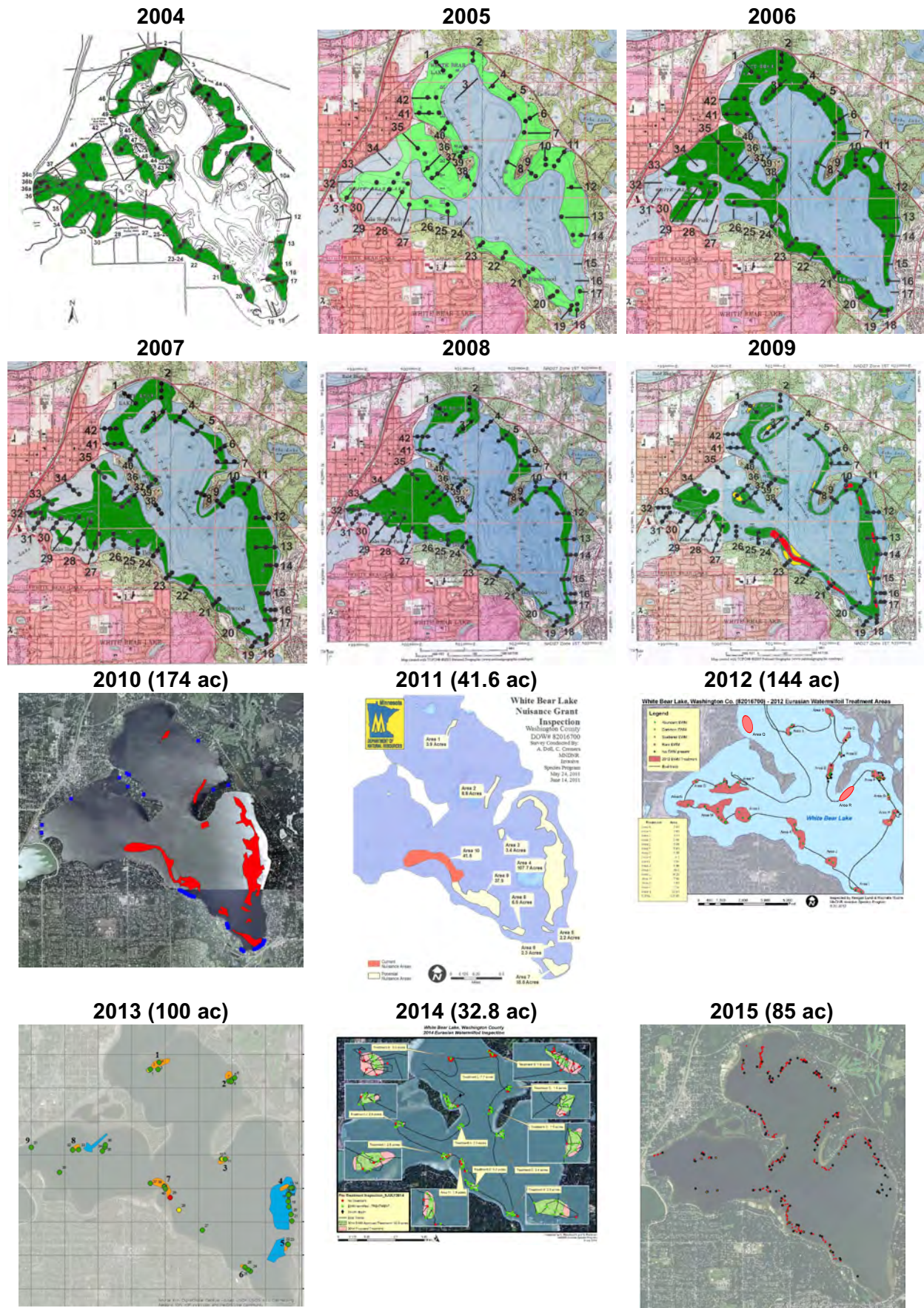


Figure 13 - continued.

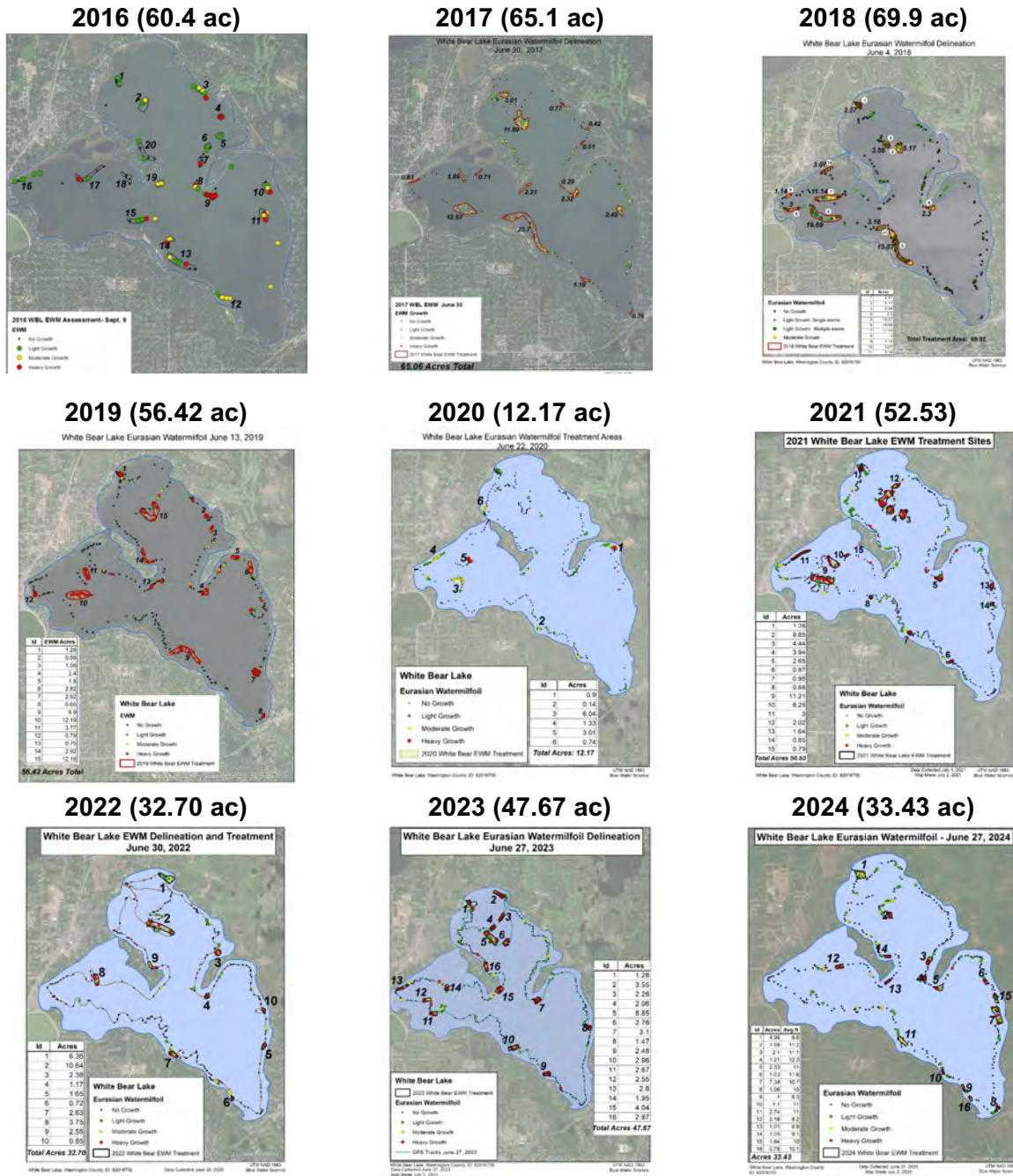


Figure 13 - concluded.

Legend

- EWM area treated (1988-2003)
- EWM found but not treated (1988-2002)
- EWM found but not treated (2003-2005)
- Area checked but no EWM found (1988-2005)
- Numbered transect; milfoil location shown with a black dot (1997-2005)

White Bear Lake EWM Hotspots Based on Treatments From Previous Years: Areas of EWM treatments from 2012 to 2023 show areas of persistent heavy growth in Figure 14.

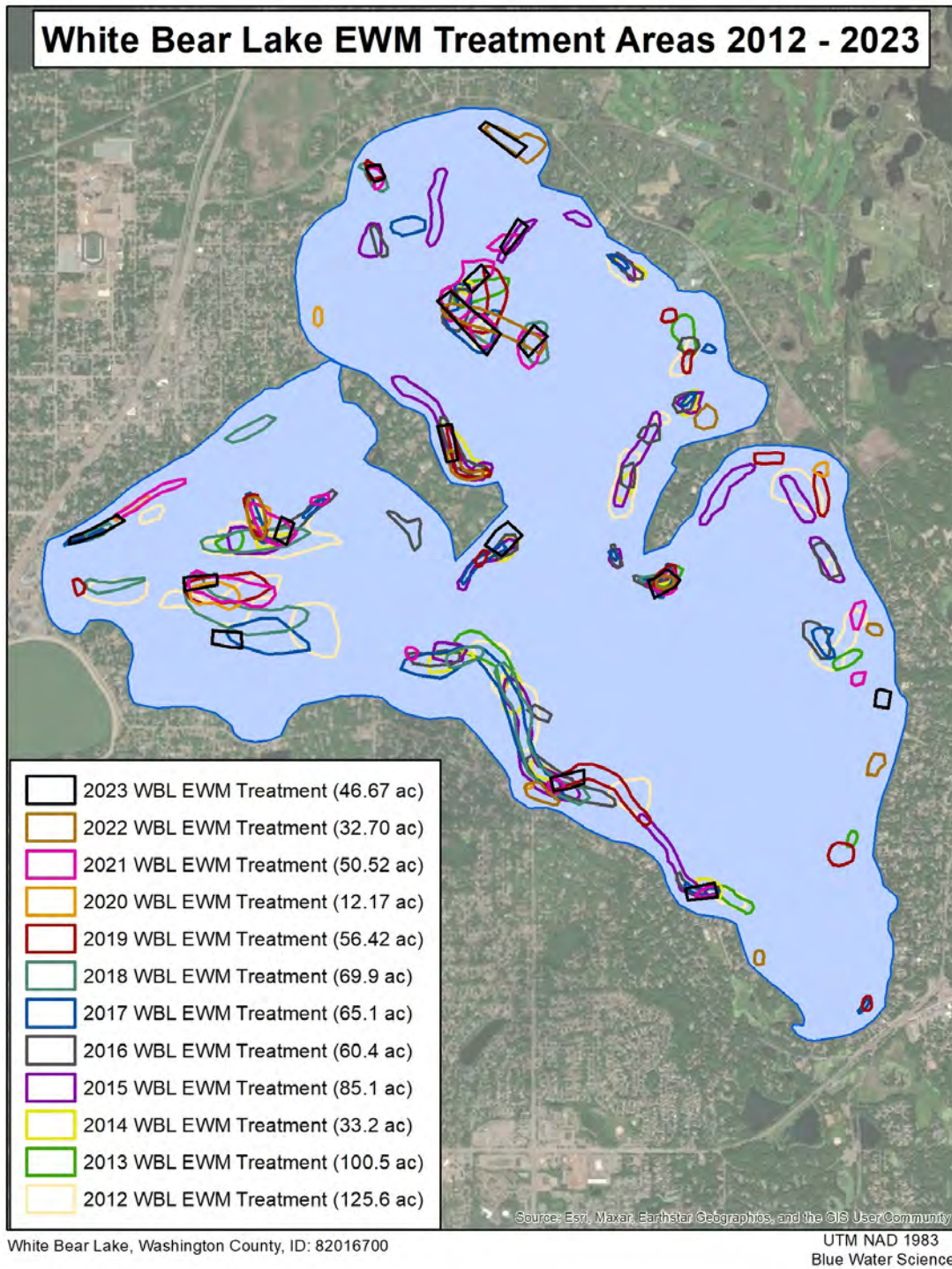


Figure 14. Hotspot map for Eurasian watermilfoil treatments conducted in 2012-2023.

White Bear Lake Zebra Mussel Distribution

Zebra mussels were first observed in White Bear Lake in 2014. In the course of a point intercept aquatic plant survey sponsored by the Rice Creek Watershed District, the presence of any zebra mussels on the aquatic plant sample were noted. A map showing the distribution of zebra mussels on aquatic plants in 2023 is shown in Figure 15. Zebra mussels were distributed throughout most of the White Bear Lake plant growing depths (out to 23 feet of water). The estimated coverage of zebra mussels were 26% of White Bear Lake or approximately 625 acres.

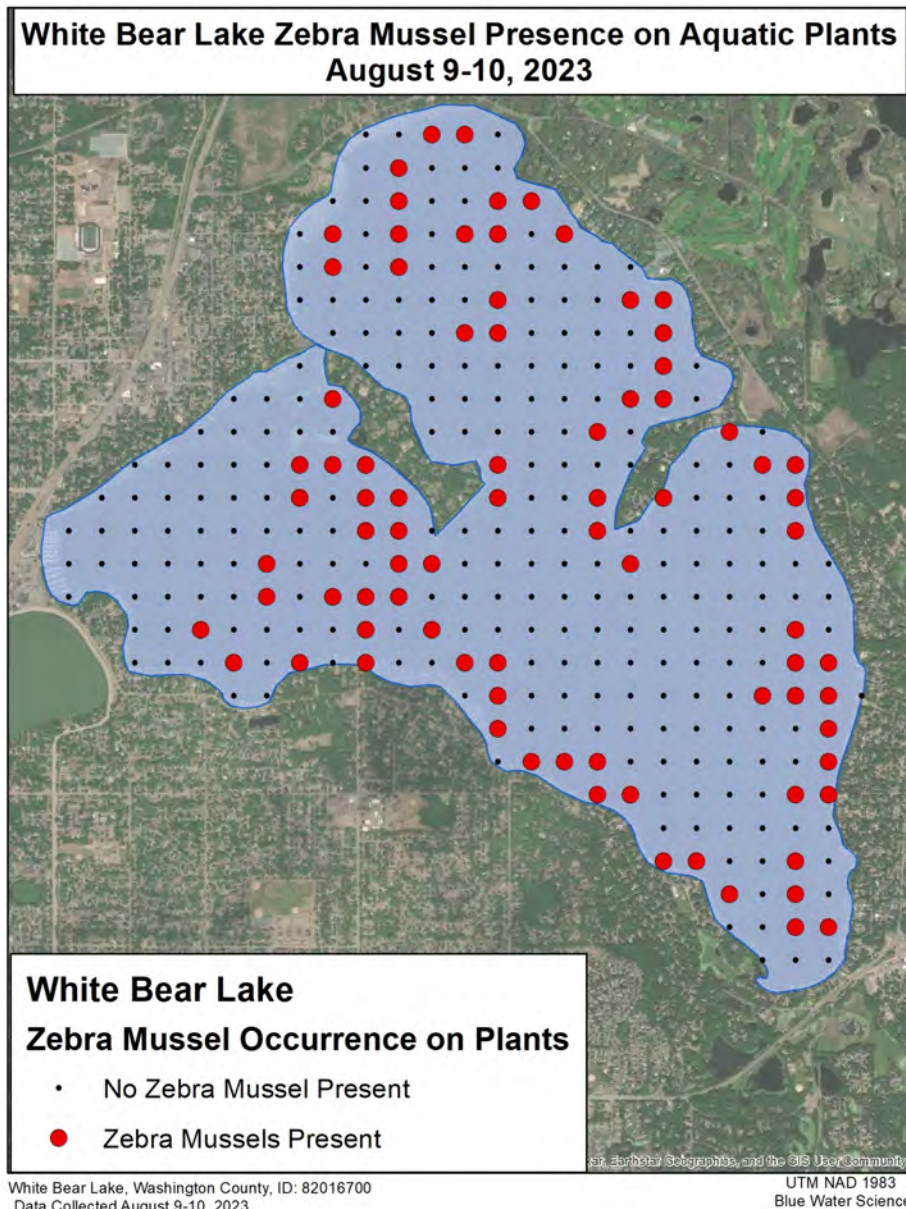


Figure 15. Zebra mussel distribution on aquatic plants was recorded during the point intercept survey that was conducted on August 9 and 10, 2023.

Fish

This section lists information on:

- Fish survey results
- Fish stocking records

Fish Survey Results: Fish survey results from MnDNR surveys going back to 1954 are shown in Table 14. The fish community is in good shape. In 2022, the last survey reported, walleye numbers are below the local average and northern pike are above average. Largemouth bass and bluegills are within range of typical fish communities for lakes like White Bear. No long term trends stand out. As is typical for fish communities and incorporating the randomness of fish surveys, fish populations change from survey to survey and that is reflected in survey results.

Fish Stocking Records: A summary of fish stocking records for White Bear Lake is shown in Table 15. Stocking first occurred in 1908, but records have been combined from the period of 1908 to 1945. At least eight different fish species have been stocked over the years with the dominant species being the walleye. Muskies were first stocked in 1975 then in 1990, and nearly every year through 2023 (Table 15). Walleyes have been stocked starting in 1908 and frequently since then (Table 15).

Fish Survey Results

Table 14. White Bear Lake historical fish survey data. Results are shown as the average number of fish per net. Green shading indicates highest catch/net for that species.

TRAPNET DATE	8.2.54	7.21.75	8.2.79	7.31.84	7.31.89	7.25.94	7.19.99	7.26.04	7.28.08	7.21.14	7.21.16	7.23.18	Local Average
Black bullhead		0.3		0.2	0.4	0.4	0.3		0.25				0.3-2.1
Black crappie	0.6	1.7	0.2	1.7	0.2	0.2	1.6	5.4	1.33	3.33	1.17	0.64	0.3-1.7
Bluegill	4.7	48.1	13.8	32.8	42.6	47.8	38.8	36.2	48.58	33.67	27.50	6.55	3.7-42.9
Bowfin	0.4	0.9	0.1	0.1	0.2	0.4	0.3	0.1	0.50	0.08	0.08	0.27	0.3-1.1
Brown bullhead	0.2	0.3	0.2	0.1		0.1		0.1					
Carp		0.4	0.7	0.2		0.2		0.2		0.17	0.08	0.27	0.2-1.0
Common sucker	0.2												
Green sunfish	0.2	0.1	0.1	0.1	0.1	0.1		trace		0.33	0.33		0.2-1.0
Hybrid sunfish	0.6	2.3	0.7	1.0	1.7	1.1	2.5	1.3	10.17	6.92	3.08	1.00	NA
Largemouth bass		0.2	0.2	0.4	0.3	1.5	0.4	0.2	0.83	0.75	0.50	0.45	0.4-1.4
Muskellunge								0.2		0.08		0.09	0.1-0.3
Northern pike		0.5	0.7	0.6	0.4	0.4	0.4	1.0	0.42	0.42	0.33	0.55	NA
Pumpkinseed	1.5	5.6	1.8	2.9	4.1	4.5	5.1	3.9	2.50	4.17	3.83	2.55	1.6-6.9
Rock bass	0.1	0.4	0.1	0.1	0.4	0.2	0.3	0.3	0.33	0.42	0.58	0.09	0.7-3.3
Sauger													
Smallmouth bass			0.1			0.2		trace		0.08			0.1-0.6
Walleye		0.1		0.3	0.2	0.4	0.2	0.6	0.75	0.42	0.50	0.36	0.3-0.9
White sucker		0.1	0.5	0.1				0.1					
Yellow bullhead	0.1	1.7	0.4	4.0	3.0	1.3	1.5	0.4	0.25	0.17	0.33	0.36	0.9-4.8
Yellow perch		0.2		0.1	0.1	0.4	0.1	0.2	0.25	0.17			0.7-3.7
NUMBER OF SPECIES	10	16	14	16	13	16	12	18	12	15	12	12	

GILLNET DATA	8.2.54	7.21.75	8.2.79	7.31.84	7.31.89	7.25.94	7.19.99	7.26.04	7.28.08	7.21.14	7.21.16	7.23.18	7.18.22	Local Average
Black bullhead		1.4	6.1	2.9	2.0	4.2	2.3	trace		0.08	0.25	0.58	0.18	0.5-4.1
Black crappie	4.5	2.8	3.0	0.3	0.9	1.2	2.5	1.0	1.38	1.50	5.58	2.00	2.82	0.2-1.1
Bluegill	0.7	34.0	42.0	6.9	6.7	14.4	20.9	20.8	17.25	11.58	4.50	9.67	8.18	NA
Bowfin				0.1										
Brown bullhead	0.6	0.3	1.4	0.3		0.5	0.1	trace		0.08			0.09	0.3-1.6
Carp						0.1								
Common sucker	1.1													
Green sunfish		0.1								0.08	0.08		0.09	0.1-0.5
Hybrid sunfish		4.4	1.9	0.6		0.1	2.9	0.2		3.67	1.08	4.08	3.18	NA
Largemouth bass	1.4	1.0	1.9	0.3	0.4	0.5	0.6	0.3		0.58	0.83	3.50	1.64	0.3-1.2
Muskellunge						0.1		trace						
Northern pike	0.5	10.1	10.0	7.4	8.9	9.1	12.1	6.1	6.62	7.17	10.58	7.42	10.18	3.0-7.9
Pumpkinseed	1.8	6.4	10.4	1.7	1.6	4.0	4.5	4.3	1.0	1.58	3.83	8.83	11.91	NA
Rock bass	0.3	4.1	2.6	0.7	0.3	1.7	2.1	1.8	0.12	0.25	0.67	1.00	6.64	1.0-6.6
Sauger										0.08				NA
Smallmouth bass	0.3	0.8	0.3	0.1		0.1	0.2	trace	0.38	0.08	0.17	0.17	0.18	0.2-0.9
Walleye	3.1	1.3	2.6	2.1	6.7	4.3	4.2	2.0	2.50	2.50	2.17	0.92	0.73	4.0-9.6
White bass					0.1			trace						
White sucker		0.9	0.4	0.1	0.1	0.2	0.4							
Yellow bullhead	0.7	4.6	7.0	3.6	4.6	10.9	3.0	0.7	0.38	0.42	0.83	3.75	10.64	0.6-6.4
Yellow perch	5.1	1.8	1.1	0.1		0.9	6.8	9.8	13.0	11.83		0.25	1.73	7.1-33.9
NUMBER OF SPECIES	12	15	14	15	11	16	14	15	9	15	12	12	14	

Status of the Fishery (from the 2022 White Bear Lake targeted fish survey conducted by the MnDNR): White Bear Lake is a mesotrophic, Class 22 (In the context of Minnesota DNR lake classification system, Class 22 is a hard-water lake, typically found in the north central portion of the state). Surface acreage is 2,427 with 1,314 acres being littoral (54.4%) and the lake has a maximum depth of 83 feet. The primary management species in White Bear Lake are Walleye and Muskellunge. The current Walleye stocking rate varies between 0.65 and 1.0 lbs./littoral-acre annually (854 pounds and 1,314 pounds respectively) in an effort to evaluate the effects of fingerling stocking density on year class strength. The Muskellunge stocking rate is 1.0 fish/littoral-acre annually, when available. Supplemental stocking of Muskellunge has occurred under permit by local sportsman clubs. All Muskellunge stocked in White Bear Lake from 1990 to present have been the Leech Lake strain. This lake has become a popular Muskellunge fishery due to the water clarity and the quality size of fish present in the population. Muskellunge are sampled by a separate two year survey that is conducted on its own schedule. A gillnet survey was conducted in July with electrofishing for Bass occurring in early June. The previous survey took place in 2020.

Walleye were sampled by gill nets at a rate of 0.7 fish per net. This is well below the 25th percentile for the lake class and the lowest rate ever sampled however, catch rates have long been low, only once exceeding the 25th percentile for the lake class after the 1999 survey. Four fish per net is the mid-range management goal and correlates to 25th percentile for the lake class. It is far from being met but, again, has only been exceeded once in the previous 10 surveys. Mean size exceeded the 75th percentile for the lake class and was the largest in recent history with an average length of 19.7 inches. Sizes ranged from 15.2 to 24.5 inches. Ages of these fish were relatively evenly distributed from 3 to 8 years old.

Northern pike were sampled at a rate of 10.2 fish per gill net. This exceeds the 75th percentile for the lake class and is high but not untypical relative to historical catches. Mean size exceeded the lake class mean and was the largest in modern history with an average length of 21.6 inches. Lengths ranged from 13.7 to 31.3 inches with 5% of fish over 30 inches.

Yellow perch were sampled at a rate of 1.7 fish per gill net. This is well below the 25th percentile for the lake class but typical relative to recent surveys. Yellow perch catch rates have always been below the lake class mean. Mean size was also small, equal to the 25th percentile for the lake class, with an average length of 6.4 inches.

Largemouth bass were sampled by electrofishing at a rate of 26 fish per hour. This is equal to the previous survey and typical relative to the lakes history. Fish sizes were relatively evenly distributed from 4 to 18.5 inches with a mean length of 11.7 inches. Largemouth bass were also well represented with a similar size distribution in the gill net catch.

Smallmouth bass have been consistently sampled in low numbers in previous surveys and this one was no different. Three smallmouth bass were sampled between electrofishing and gill nets from 12 to 15 inches. While other game fish species were sampled, summer gill netting does not produce data that is reliable for making inferences as to their abundance or size structure. Other species sampled were: black bullhead, brown bullhead, green sunfish, hybrid sunfish, pumpkinseed, rock bass, and yellow bullhead.

Fish Stocking Records

Table 15. White Bear Lake fish stocking records.

	Largemouth Bass					Muskie				Northern pike				Walleye					Crappie					Sunfish			
	cans	?	fgl	yr1	ad1	fry	fgl	yr1	ad1	fry	fgl	yr1	ad1	cans	fry	fgl	yr1	ad1	cans	fgl	yr1	ad1	?	?	fgl	yr1	ad1
1908-1945*	15	1,800	21,502	480						116,000			75	352	13,721,775	113	984		33	177,755	1,465	60	1,305	1,060	176,800		
1945			1,000										14							100					4,000		4
1946			10,125	2	8																					6,500	3
1947					13								10				4,700				576	273				5,200	12
1948			15,000																								
1949			11,700														105,600										
1950											30,000						4,000										
1951			1,500																								
1952			75,000	1,230																							
1953			37,350																								
1954																											
1955													2,500	147													
1958																											
1959													10,000	51													
1961													20,000														
1963																	300,000										
1964																	500,000										
1965													635	100													
1966																	500,000										
1967																	1,944										
1968																	500,000										
1969																	282										
1970																	1,150										
1971																	102										
1972																											
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fry=recently hatched fish, fgl=fish are about a finger long, yr1=yearling fish, ad1=adult fish
 * 1908-1945: additional stocking records include: 10 cans = bass/crappie; 13 cans and 16,000 fgl = lake trout; 50 yr1 = striped bass
 the data recorded under walleyes were classified as "pike" in the first stocking records.
 Minnow stocking: 1945 5,000 adult minnows; 1946 79,925 adult minnows; 1946 5,625 minnows ?
 ** Tiger muskies.
 a = 2002 Smallmouth bass were stocked.

Lake Use Summary

This section lists information on:

- Summer boat inventory
- Shoreline structures
- Boat launches
- Boat density

Summer Boat Inventory: Based on shoreline boat inventory counts, since 1999, there has been a substantial increase in kayaks, personal watercraft, pontoons, and paddleboards. There has been a noticeable decrease in the number of fishing boats (rear-tiller boats) and sailboats (Table 16). Overall the total number of watercraft has increased since 1999.

Shoreline Structures: The number of lifts increased from 2002 to 2024 while the number of docks has remained about the same since 1999. The number of powered boats and sail boats per dock at 2 watercraft per dock in 2024 is similar to the 2002 boat/dock ratio which was also 2 watercrafts per dock. However, in 2024 when human powered craft are included, all boats per dock is 3.1 boats/dock.

Boat Launches: Boat launches from the 2 public accesses have decreased from 1999 to 2024 for peak and off-peak days (Table 20). Commercial Bay launches have decreased on peak days but not off-peak days. The most common boats launched on peak days were runabouts and on off-peak days, it was fishing boats (Table 21).

Boat Density: Boat density (lake acres/boat) has been determined on three or four peak-use days and two or three off-peak use days on 3 occasions from 1999 to 2024. Peak-use days included weekend or holiday days and off-peak days were mid-week weekdays.

Boat density on the open lake was determined by an observer using a boat to travel around White Bear Lake to record the number and type of boats for each 1.5 hour interval from 6:00 am to 9:00 pm. On peak and off peak days the north bay has the highest density of boats (Table 22). It appears the boating density on the peak days has decreased since 1999 but stayed about the same for off-peak days (Table 22). For peak days in 2024, the boat density was 18 acres per boat for the whole lake. The MnDNR uses a 20 acres per boat density as a guideline for safe boating. For a few hours on peak days, the lake acres per boat is less than 20 ac/boat.

Summer Boat Inventory - Overview

Results from the 1999, 2002, 2004, 2005, 2008, and 2024 shoreline boat inventories are summarized in Tables 16, 17, 18, and 19. There was an overall increase in the number of riparian boats in 2024 compared to 1999, with the largest numerical increase in the personal watercraft (PWC) category. Kayaks have increased substantially since 2008 and the most popular watercraft is the pontoon which has been steadily increasing since 1999. On the other hand, fishing boats have been declining since 2004 and canoes since 2008. Overall total boat numbers in 2024 are up from 1999 (Table 16).

Boat inventories from three marinas are listed in Table 17. In Commercial Bay, the total number of watercraft have increased with pontoons having the largest increase in number and sailboat numbers have decreased. Watercraft numbers have declined at Matoska Park and fishing boats and sailboats had the largest declines (Table 17). At the White Bear Yacht Club, sailboats have increased since 2008 (Table 18).

When watercraft numbers are combined from the riparian inventory and marinas, the total number of watercraft have increased to 2,115 watercraft from 1,725 in 2008 (Table 18).



Figure 16. Boat lifts and docks along the shoreline on July 23, 2008.

Summer Boat Inventory - Data

Table 16. White Bear Lake Shoreline Boat Inventory (June 16, 1999, July 24, 2002, June 16, 2004, July 12, 2005, 2008, and August 20 and July 17, 2024).

Boat Type	Riparian Boat Inventory (residential and multiple docks)(using boat categories from previous inventories)						
	1999	2002	2004	2005	2008	2024	Percent Change from 1999 to 2024
Fishing	144	141	144	121	90	40	-260%
PWC (personal watercraft)	27	52	48	68	80	127	+370%
Runabout	267	354	343	400	336	318	+19%
Sailboat	179	195	156	180	157	82	-54%
Pontoon	175	197	189	230	248	368	+110%
Sailboard	6	13	15	10			-100%
Other	11		6	11	11	2	-450%
Canoe	73*	123*	136*	161*	192*	43	-41%
Kayak						349	
Paddleboat	18	52	41	51	41	17	-6%
Paddleboard						133	
ALL CRAFT	900	1,127	1,078	1,232	1,155	1,479	+64%
<i>(Human powered)**</i>	<i>(91)</i>	<i>(175)</i>	<i>(177)</i>	<i>(212)</i>	<i>(233)</i>	<i>(542)</i>	

* Canoe category for 1999-2008 includes kayaks.

** Human powered includes: canoe, kayak, paddleboat, and paddleboard

Table 17 Boat inventory from three of the largest marinas.

Boat Type	Commercial Bay						Matoska Park						WB Yacht Club					
	1999	2002	2004	2005	2008	2024	1999	2002	2004	2005	2008	2024	1999	2002	2004	2005	2008	2024
Fishing	16	1	12	1	12	10	29	37	40	39	32	6	4	3	3	2	2	
PWC		1	1	2		1								1				
Runabout	91	107	100	120	138	133							2	8	3	7	12	10
Sailboat	170	172	155	152	119	36	36	36	28	32	44	23	27	20	24	24	22	52
Pontoon	113	137	150	147	149	304								2				6
Sailboard						4												
Other	2						2	4			4	11		4	12	11	2	0
Canoe	20			7	3		12	20	14	15	20	17		1	2	2	11	
Kayak						8						14						
Paddleboat								1	1		1			1				
ALL CRAFT	412	418	418	429	421	496	79	98	83	86	100	72	33	40	44	46	49	68
<i>(Human powered)*</i>	<i>(20)</i>	<i>(0)</i>	<i>(0)</i>	<i>(7)</i>	<i>(3)</i>	<i>(8)</i>	<i>(12)</i>	<i>(21)</i>	<i>(15)</i>	<i>(15)</i>	<i>(20)</i>	<i>(32)</i>	<i>(0)</i>	<i>(2)</i>	<i>(2)</i>	<i>(2)</i>	<i>(11)</i>	<i>(0)</i>

* Human powered includes: canoe, kayak, and paddleboat

Table 18. Total number of boats observed combining riparian and marina locations.

Boat Type	BOAT TOTALS Riparian and Marinas						
	1999	2002	2004	2005	2008	2024	% change 1999 - 2024
Fishing	193	182	199	163	136	56	-70%
PWC	27	54	49	70	80	128	+374%
Runabout	360	469	446	527	486	461	+28%
Sailboat	412	423	363	388	342	193	-53%
Pontoon	288	336	339	377	397	678	+135%
Sailboard	6	13	15	10		4	-33%
Other	15	8	18	22	17	13	
Canoe	105	144	152	185	226	60	-43%
Kayak						371	
Paddleboat	18	54	42	51	41	18	0%
Paddleboard						133	
ALL CRAFT	1,424	1,683	1,623	1,793	1,725	2,115	+33%
<i>(Human powered)*</i>	<i>(123)</i>	<i>(198)</i>	<i>(194)</i>	<i>(236)</i>	<i>(267)</i>	<i>(582)</i>	

* Human powered includes: canoe, kayak, paddleboat, and paddleboard

Shoreline Structures

The number of lifts increased from 2002 to 2024 while the number of docks has remained about the same since 1999. The total number of docked powered boats and sailboats have increased from 1999 but is similar in 2024 compared to 2005 and 2008. In 2024, when all craft are considered, the total number of boats per dock is 3.1 which is higher than previous inventories. The increase is due primarily to an increase in kayaks and paddleboards.

Table 19. White Bear Lake riparian shoreline structure inventory (June 16, 1999, July 24, 2002, June 16, 2004, July 12, 2005, 2008, and 2024).

Boat Type	SHORELINE STRUCTURE INVENTORY						
	1999	2002	2004	2005	2008	2024	% Change from 2002 to 2024
Docks	472 (est)	473	472	478	467	476	+1%
Lifts		582	673	765	723	653	+12%
Buoys		21	31	40	28	23	+1%
Rafts		23	21	27	24	4	-82%
Inflatable Rafts		14	14	30	16	8	-43%
Swimming Rafts						4	--
Rave Rafts						3	--
TOTALS		1,113	1,211	1,340	1,258	1,168	+5%
Powered boats and sailboats*	792	939	881	999	911	935	-0.4%
Docked boats* per dock	1.7	2.0	1.9	2.1	2.0	2.0	0
Total Boats	900	1,127	1,078	1,232	1,155	1,479	+31%
All boats per dock	1.9	2.4	2.3	2.6	2.5	3.1	+29%

*does not include canoes, kayaks, paddleboats, sailboards, and other



Figure 17. Example of dock density on the White Bear Lake shoreline (Google Earth).

Boat Launches

Boat launches from the 2 public accesses have decreased from 1999 to 2024 for peak and off-peak days (Table 20). Commercial Bay launches from boat slips has decreased in peak days but not off-peak days. The most common boat launched on peak days were runabouts and on off-peak days, it was fishing boats (Table 21). In previous studies, in 1999, 2002, and 2005 Blue Water Science staff were at each access throughout the sample timeframe.

Table 20. Average number of launches for each time interval in 1999, 2002, 2005, and 2024.

	Peak Day (average)								Off Peak Day (average)							
	Two Accesses				Commercial Bay				Two Accesses				Commercial Bay			
	1999	2002	2005	2024 (DNR) (n=50 days)	1999	2002	2005	2024 (n=3 days)	1999	2002	2005	2024 (DNR) (n=64 days)	1999	2002	2005	2024 (n=2 days)
6:00-7:30	25	--	26	5	4	--	5	2	8	--	6	4	0	--	1	1
7:30-9:00	17	--	24	8	6	--	8	9	10	--	8	6	1	--	4	5
9:00-10:30	36	26	20	1	20	12	10	9	10	8	10	7	2	6	4	2
10:30-12:00	40	36	28	12	38	32	21	17	10	4	12	9	4	3	4	3
12:00-1:30	43	36	34	22	59	35	23	22	10	12	16	8	6	3	10	7
1:30-3:00	39	28	28	12	57	26	27	32	14	10	18	8	8	4	5	8
3:00-4:30	31	14	26	10	33	18	19	26	16	20	20	9	10	8	8	11
4:30-6:00	25	9	20	7	26	9	19	26	30	14	28	14	13	9	11	16
6:00-7:30	25	--	18	1	21	--	18	11	23	--	26	4	15	--	9	22
7:30-9:00	9	--	4	no data	22	--	3	3	2	--	4	2	5	--	6	3
TOTAL	290	149	226	78*	286	132	153	157	133	68	148	71*	64	33	62	75

*MnDNR inspectors were not always present at both accesses. Therefore 2024 boat launch rates are under sampled compared to previous surveys.

Table 21. Types of boats on White Bear Lake in 1999, 2002, 2005, and 2024. Based on all boats launched from Ramsey County landing, Matoska landing, and Commercial Bay.

	Peak				Off Peak			
	1999 (6am-9 pm)	2002 (9 am-6 pm)	2005 (6 am-9 pm)	2024 (all times)	1999 (6 am- 9pm)	2002 (9 am-6 pm)	2005 (6 am-9 pm)	2024 (all times)
Fishing	13%	7%	18%	23%	30%	8%	15%	43%
Kayak/Canoe	0.3%	1%	0.7%	0.7%	0.5%	3%	3%	0.7%
PWC	4%	7%	4%	5%	5%	7%	3%	6%
Runabout	52%	54%	44%	33%	42%	57%	56%	23%
Sail	14%	16%	12%	2%	10%	7%	6%	2%
Pontoon	16%	13%	17%	28%	10%	16%	13%	18%
Waterski	0.7%	1%	4%	9%	2%	1%	4%	5%
Other	0.7%	1%	0.3%	0.3%	1%	1%	0%	0.9%

Boat Density on White Bear Lake

Boat density (lake acres/boat) has been determined on three or four peak-use days and two or three off-peak use days on 3 occasions from 1999 to 2024. Peak-use days included weekend or holiday days and off-peak days were mid-week weekdays.

Boat density on the open lake was determined by an observer using a boat to travel around White Bear Lake to record the number and type of boats for each 1.5 hour interval from 6:00 am to 9:00 pm. On peak and off peak days the north bay has the highest density of boats (Table 22). It appears the boating density on the peak days has decreased since 1999 but stayed about the same for off-peak days (Table 22). For peak days in 2024, the boat density was 18 acres per boat for the whole lake. Although 2024 peak density was more dense than the MnDNR recommended 20 acres per boat guideline for high speed watercraft the highest boat density occurred in North Bay which also had the highest number of rafting boats anchored in shallow water.

Table 22. White Bear Lake boat counts were taken over 10 time periods in a 15-hour day for peak and off-peak days. Boat counts were taken in three sectors for each time period. The numbers reflect the average for peak and off-peak days of the maximum boat counts for a time interval during the day.

	1999		2005		2024		1999		2005		2024	
	PEAK (3 days)		PEAK (3 days)		PEAK (3 days)*		OFF-PEAK (3 days)		OFF-PEAK (2 days)		OFF-PEAK (2 days)	
	# of boats	ac/boat	# of boats	ac/boat	# of boats	ac/boat	# of boats	ac/boat	# of boats	ac/boat	# of boats	ac/boat
North Bay (739 ac)	75	10	46	16	67	11	26	28	35	21	26	28
South Bay (1,036 ac)	60	17	57	18	37	28	30	35	22	47	33	31
West Bay (645 ac)	41	16	40	16	32	20	20	32	23	28	21	31
Whole lake (2,420 ac)	176	14	143	17	136	18	76	32	80	30	80	30

*May 27, 2024, Memorial Day-Monday data not included due to rain.

