

Kirby Lake Report

Barron County, Wisconsin

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Aquatic Plant and Habitat Services LLC

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Aquatic plant & habitat surveys • Lake management plans • Grant writing • Environmental Education

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Waterbody & Watershed Characteristics

Kirby lake is a seepage lake situated in a hydrogeologically-complex area with groundwater likely flowing westward toward Sand Creek (Watershed Inventory, 1994). The direct tributary drainage area (the area which drains directly into Kirby Lake) is 449 acres (**Table 1**). Water sources include several small intermittent tributaries and precipitation while water is lost through an intermittent outflow and to a greater degree through groundwater flow or evaporation (Rose & Robertson, 1998).

Table 1. Waterbody and watershed information from the Watershed Inventory Findings Report (WIFR), 1994 and Rose & Robertson, 1998. All data from Rose & Robertson is during a 12-month study from November 1995 to November 1996.

Characteristic	Source	Measurements
Surface area	WIFR 1994	92 ac
Volume	WIFR 1994	720 ac-ft
Maximum depth	WIFR 1994	19 ft
Mean depth	WIFR 1994	8 ft
Direct watershed area	WIFR 1994	449 ac
Watershed area	Rose & Robertson 1998	1070 ac
Surface inflow estimate	WIFR 1994	310.5 ac-ft / yr
Surface inflow *	Rose & Robertson 1998	229 ac-ft
Inflow from precipitation *	Rose & Robertson 1998	309 ac-ft
Water loss to Evaporation	Rose & Robertson 1998	219 ac-ft
Water loss to Groundwater	Rose & Robertson 1998	163 ac-ft
Water loss to surface outflow	Rose & Robertson 1998	269 ac-ft
Water residence time estimate	WIFR 1994	2.3 yrs
Sediment load estimate (1990)**	WIFR 1994	19,487 lbs/year
Phosphorus load estimate (1990)**	WIFR 1994	25.5 lbs/yr
Lead load estimate (1990)**	WIFR 1994	14.6 lbs/yr

**1995-1996 had higher than average precipitation before and during the study*

***Estimates based on 1990 land use of direct watershed*

1990 Land Use

Table 2. Land use information from 1990 retrieved from the Watershed Inventory Findings Report, 1994.

	Land Use Category	Acres	Percent
URBAN	Residential	13	2.9
	Transportation/Utilities	5	1.1
	Recreation	2	0.5
	SUBTOTAL	20	4.5
RURAL	Woodland & Wetland	337	75
	Water	92	20.5
	SUBTOTAL	429	95.5
TOTAL		449	100

Loons

Citizen monitoring of loons was done in 2009 and 2011 revealing loon arrival on Kirby Lake in mid-april and departure in mid-September (SWIMS, 2012). In 2009, one loon pair resided on Kirby Lake and successfully produced two loon chicks. In 2011, one loon pair resided on Kirby Lake and was unsuccessful in producing chicks due to eagle predation. During both years, the loons established nests on islands.

Fish

Stocking

Table 3. Fish stocking information from the WDNR Kirby Lake webpage, 2012.

Year	Species	Age Class	Average Fish Length (in)
2011	Northern Pike	Large Fingerling	6.40
2011	Largemouth Bass	Large Fingerling	2.60
2010	Northern Pike	Large Fingerling	8.60
1999	Northern Pike	Fry	0.30
1998	Northern Pike	Fry	0.50
1996	Northern Pike	Fry	0.40
1994	Northern Pike	Fry	1.00
1992	Northern Pike	Fry	1.00
1991	Northern Pike	Fry	1.00
1990	Northern Pike	Fry	1.00
1989	Northern Pike	Fry	3.00
1988	Northern Pike	Fry	1.00
1988	Largemouth Bass	Fingerling	1.00
1986	Northern Pike	Fry	1.00
1985	Northern Pike	Fry	1.00
1984	Northern Pike	Fry	1.00

Fish Surveys

Table 4. Most recent electroshocking data retrieved from SWIMS, 2012.

Species	Sum Abundance
Black Crappie	1
Bluegill	56
Golden Shiner	1
Largemouth Bass	5
Pumpkinseed	1
Yellow Bullhead	2

Aquatic Invasive Species

Table 5. Aquatic Invasive Species (AIS) and years that were surveyed in Kirby Lake, Barron County, WI. All survey results were negative for detection of listed AIS.

Aquatic Invasive Species	Year(s) surveyed
Curly-leaf pondweed	2008-2010
Purple Loosestrife	2008-2010
Eurasian water-milfoil	2008-2010
Freshwater jellyfish	2009
Zebra mussels	2008-2010
Hydrilla	2008-2009
Fishhook water flea	2008-2009
Spiny water flea	2009
Banded mystery snail	2009
Chinese mystery snail	2009
Rusty Crayfish	2009

Water Quality

Temperature and Dissolved Oxygen

According to Citizen Lake Monitoring (CLM) data, Kirby Lake is dimictic with thermal stratification occurring in the fall and summer (SWIMS, 2012). Hypoxia (low oxygen) occurred in July 2010 and May-June 2011 (**Table 6**). Data suggest that healthy fish populations require 2-5 mg/l for moderately tolerant warm-water species and 5-9 mg/l for cold-water species (Kalf, 2002).

Table 6. Citizen Lake Monitoring temperature and dissolved oxygen data revealing hypoxia in the hypolimnion of Kirby Lake, Barron County, WI.

Date	Depth (ft)	Temp (°F)	Oxygen (mg/l)
7/27/2010	12	71.6	1.9
5/26/2011	18	52.8	1.07
6/17/2011	9	64.5	0.11
6/17/2011	12	62.7	0.05
6/17/2011	15	58.3	0.04
6/17/2011	18	57.4	0.036
6/18/2011	9	65.4	0.12
6/18/2011	12	61.5	0.06
6/18/2011	15	58	0.04

Aeration System

To avoid fish winter kill in Kirby Lake, a compressed air system was installed in 1989 by Barron County with technical and financial assistance from WDNR (Cornelius, 2006). The Lake District was then charged with maintenance of the system. Since installation, winterkill has been minimal (Cornelius, 2006). Dissolved oxygen levels in the winter of 1995 were 11 mg/l but decreased by late winter (Rose & Robertson, 1998)

Water Clarity

Secchi data for the “deep hole” site in Kirby Lake is available from 1992 to 2011 but no data is available from 2002-2004. Secchi depths ranged from 4 feet to 12 feet with an overall average of 6.5 feet (SWIMS, 2012).

The average summer (June-August) Secchi depth between 1992 and 2011 ranged from 4 feet to 7.7 feet. The overall summer average was 6.2 feet (Figure 1), which classifies Kirby Lake as a mesotrophic system. However, mean summer values range from mesotrophic to eutrophic conditions. Linear trendline analysis indicates a minor decrease in water clarity, however the R^2 value for the trendline is low ($y=0.0252x + 5.9364$, $R^2=0.0215$).

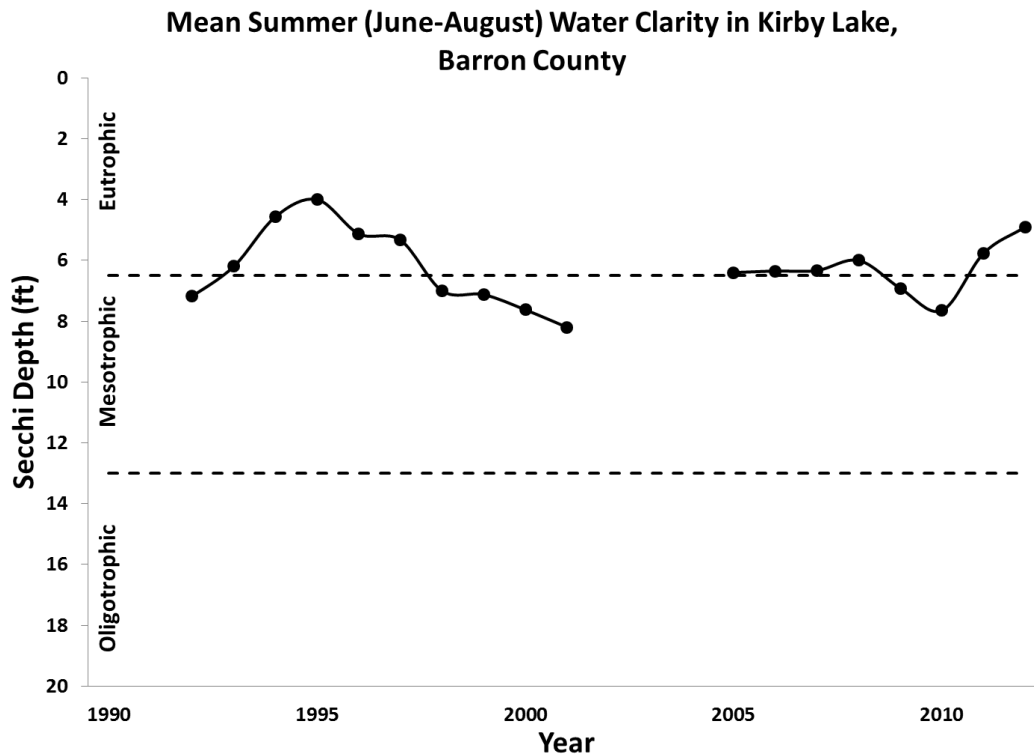


Figure 1. Mean summer water clarity measurements in Kirby Lake, Barron County, WI. Water clarity measurements were collected by citizen lake monitoring volunteers using a Secchi disk.

Phosphorus

Total phosphorus data is available from 1993 through 2001 and 2010-2011. Total phosphorus measurements ranged from 14 $\mu\text{g/L}$ to 50 $\mu\text{g/L}$ (SWIMS, 2012). The overall summer average of 25 $\mu\text{g/L}$ classifies Kirby Lake as a eutrophic lake (Figure 2). Rose & Robertson (1998) determined the total estimated phosphorus input from precipitation and surface water inflow to be approximately 51 pounds during a 12-month study. Inflowing intermittent streams contributed 88% of the total phosphorus. Of those inflowing streams, one site on the southwest shore of the lake contributed 46% of the phosphorus load. This site drains nearly the entire watershed area of Kirby Lake that is west of 4th Street. Approximately 35% of the total phosphorus load was exported via surface outflow while the rest remained in the lake basin or was discharged with groundwater outflow (Rose & Robertson, 1998).

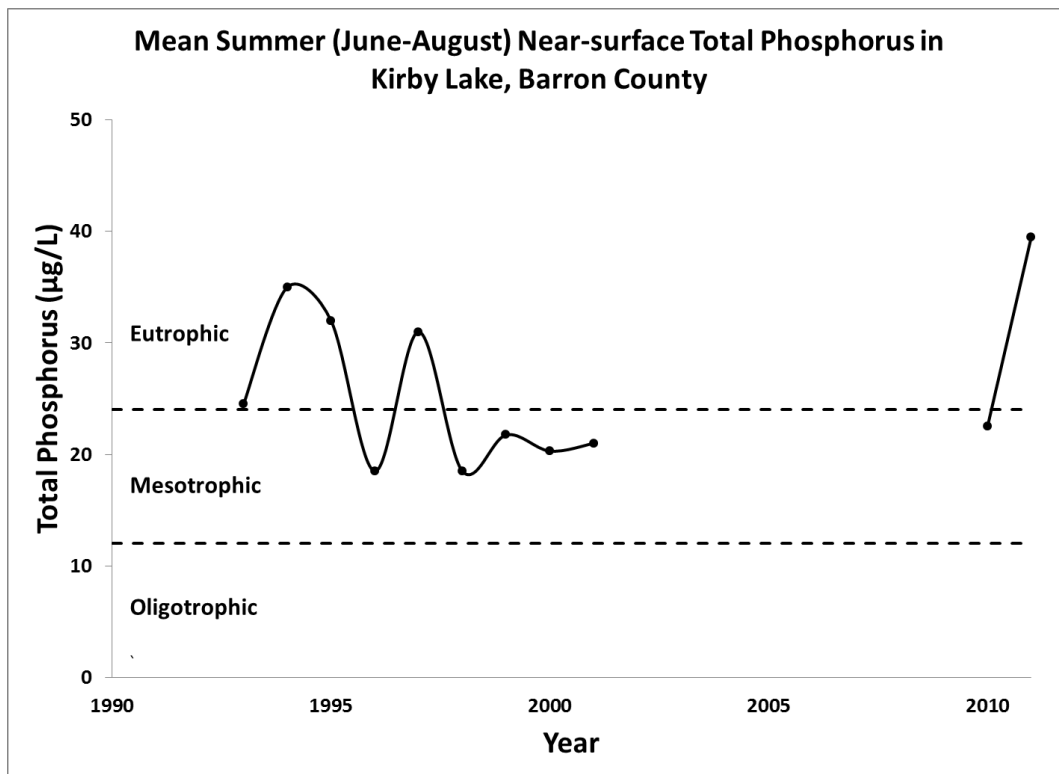


Figure 2. Mean summer near-surface total phosphorus measurements in Kirby Lake, Barron County, WI. Phosphorus samples were collected by citizen lake monitoring volunteers.

Chlorophyll-*a*

Chlorophyll *a* has been measured from 1993 through 2001 and 2010-2011 (Figure 3). Chlorophyll *a* measurements ranged from 1.4 to 83.6 µg/L (trophic state values 37-68) during the summer months of those years (SWIMS, 2012). The overall summer average was 12.5 µg/L (trophic state value 54), which classifies Kirby Lake as a eutrophic lake. In 2011, summer Chlorophyll *a* measurements ranged from 14.1 to 15.2 µg/L (trophic state value 55 for both measurements).

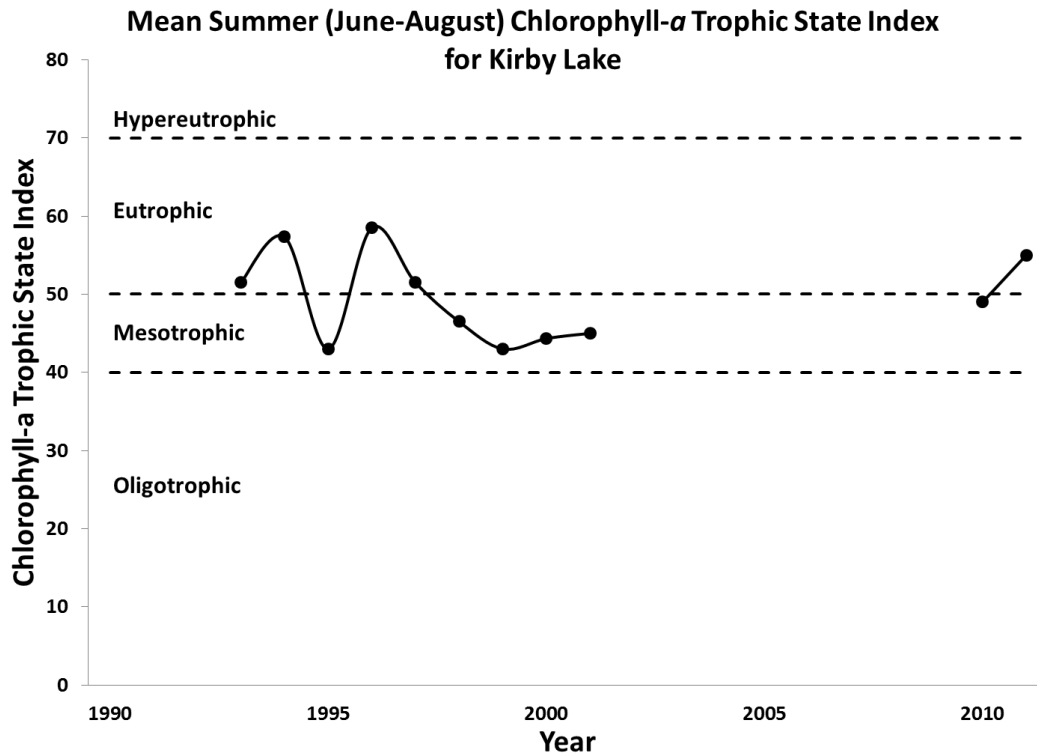


Figure 3. Mean summer trophic state index measurements for Kirby Lake, Barron County, WI. Chlorophyll-*a* samples were collected by citizen lake monitoring volunteers.

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