Thunder Lake Lakeshed Assessment

The lakeshed vitals table identifies where to focus organizational and management efforts for each lake. Criteria were developed using limnological concepts to determine the effect to lake water quality.

Lakeshed Vitals		Rating
Major Basin	Upper Mississippi River	descriptive
Major Watershed	Mississippi River - Grand Rapids	descriptive
Minor Watershed	9125	descriptive
Lakeshed	Big Rice Lake (912502)	descriptive
Ecoregion	Northern Lakes and Forests	descriptive
Lake Area	1,347 acres	descriptive
Miles of Shoreline	15.9	descriptive
Miles of Stream	0.89	descriptive
Miles of Road	17.1	descriptive
Lake Max Depth	95 ft. (22.5 m)	descriptive
Lake Mean Depth	23.95 ft. (7.3 m)	+
Water Residence Time	NA	NA
Municipalities	None	+
Sewage Management	Individual waste treatment systems (septic systems and holding tanks)	-
Public Drainage Ditches	None	+
Lake Management Plan	Healthy Lakes & Rivers Partnership program, 2006	+
Lake Vegetation Survey/Plan	Survey Completed 2008	+
Forestry Practices	Multiple areas of proposed clear-cut with reserves – time of harvest unknown	-
Development Classification	General Development	-
Shoreline Development Index	3.1	-
Total Lakeshed to Lake Area Ratio (total lakeshed includes lake area)	6.8:1	x
Public Lake Accesses	1	x
Inlets	2 – Unnamed	x
Outlets	1 – Unnamed	x
Shoreland Conservation Potential (% shoreland identified for conservation)	52%	+
Feedlots	None	+
Agriculture Zoning	16 acres > 200 ft. from lake	x
Public Land : Private Land	1.2:1	+
Wetland Coverage	13%	+
Lake Transparency Trend	Improving trend (95% probability)	+
Exotic Species	None	+

Rating Key:
+ beneficial to the lake
- possibly detrimental to the lake
x *warrants attention*

Lakeshed

Understanding a lakeshed requires the understanding of basic hydrology. A watershed is the area of land that drains into a surface water body such as a stream, river, or lake and contributes to the recharge of groundwater. There are three categories of watersheds: 1) basins, 2) major watersheds, and 3) minor watersheds.

Thunder Lake is found within the **Upper Mississippi River Basin**, which includes the **Mississippi River - Grand Rapids Major Watershed** as one of its sixteen major watersheds (Figure 1). The basin covers 20,000 square miles, while the Mississippi River - Grand Rapids Watershed covers 2,074 square miles (approximately 1,327,229 acres). Thunder Lake falls within **minor watershed 9125**, one of the 132 minor watersheds that comprise the Mississippi River - Grand Rapids Major Watershed (Figure 2).

Within this watershed hierarchy, lakesheds also exist. A lakeshed is defined simply as the land area that drains to a lake. While some lakes may have only one or two minor watersheds draining into them, others may be connected to a large number of minor watersheds, reflecting a larger drainage area via stream or river networks. Thunder Lake falls within the **Big Rice Lake (912502) lakeshed**, covering 9,189 acres (includes lake area) (Figure 3). Even though Thunder Lake receives water from minor watershed 8074, for the purpose of this assessment it is decided that only the immediate lakeshed be inventoried and assessed.

Thunder Lake Lakeshed Water Quality Protection Strategy

Each lakeshed has a different makeup of public and private lands. Looking in more detail at the makeup of these lands can give insight on where to focus protection efforts. The protected lands (easements, wetlands, public land) are the future water quality infrastructure for the lake. Developed land and agriculture have the highest phosphorus runoff coefficients, so this land should be minimized for water quality protection.

A large percentage of Thunder Lake's lakeshed is made up of private forested uplands. This land can be the focus of development and protection efforts in the lakeshed.

	Private (37%)					17%	Public (46%)		
	Developed	**Agriculture**	**Forested Uplands**	**Other**	**Wetlands**	**Open Water**	**County**	**State**	**Federal**
Land Use (%)	2%	0.5%	23%	5.5%	6%	17%	0%	42%	4%
Runoff Coefficient Lbs of phosphorus/acre/ year	0.45 - 1.5	0.26 - 0.9	0.09		0.09		0.09	0.09	0.09
Description	Focused on Shoreland	Cropland	Focus of develop-ment and protection efforts	Open, pasture, grass-land, shrub-land	Protected				
Potential Phase 3 Discussion Items	Shoreline restoration	Restore wetlands; CRP	Forest stewardship planning, 3rd party certification, SFIA, local woodland cooperatives		Protected by Wetland Conservation Act		County Tax Forfeit Lands	State Forest	National Forest

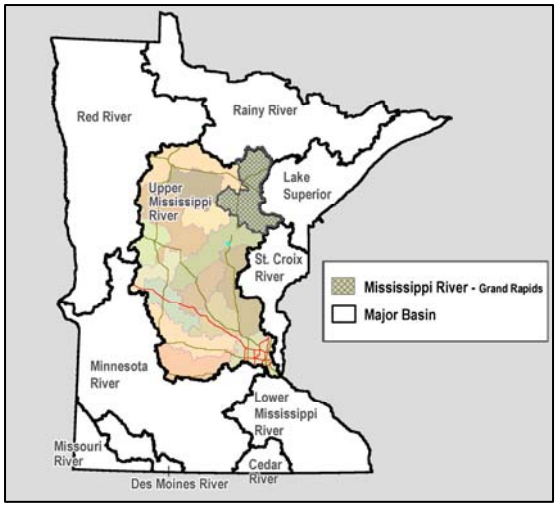

Figure 1. Upper Mississippi Basin and the Mississippi River - Grand Rapids Watershed.

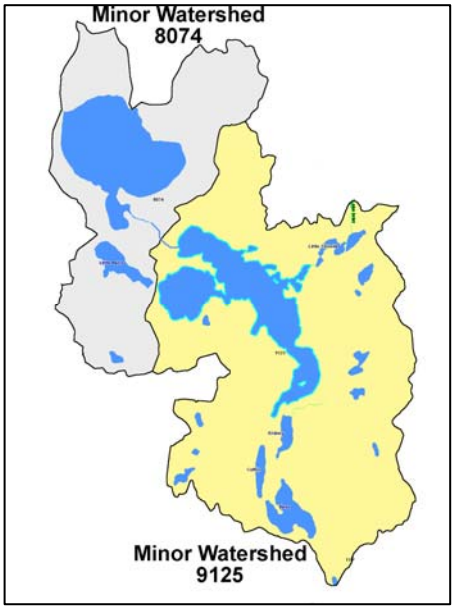

Figure 2. Minor Watersheds 9125 & 8074 contribute water to Thunder Lake.

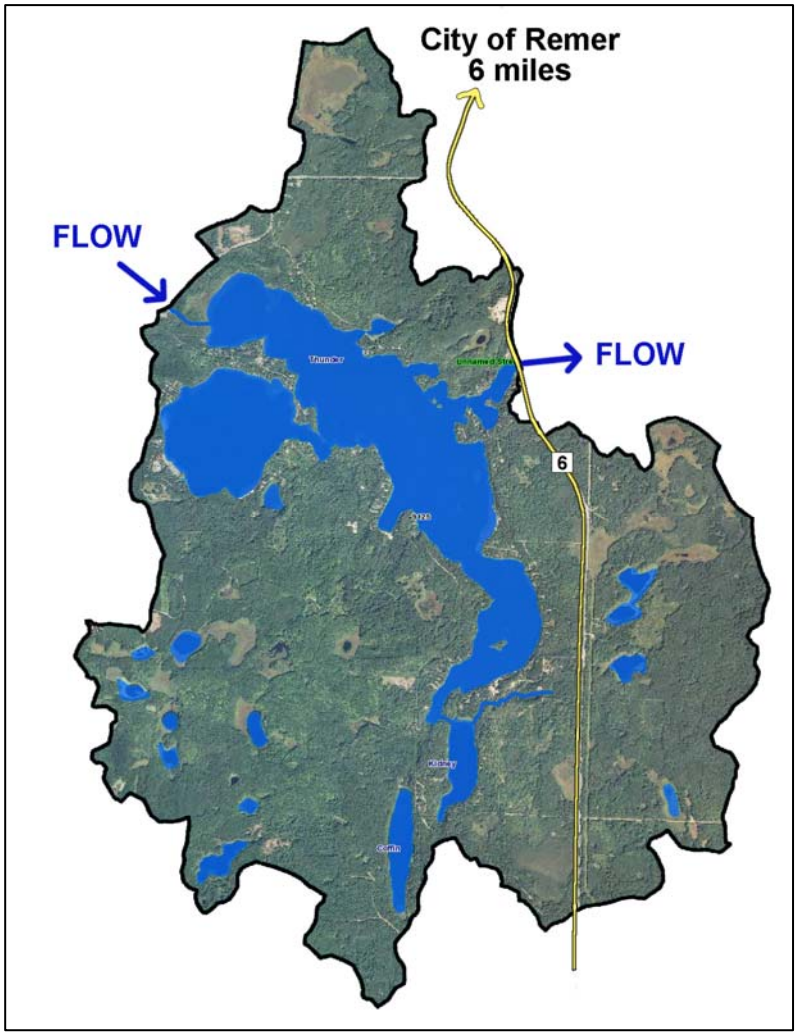

Figure 3. The Big Rice Lake (912502) Lakeshed (Aerial Imagery 2008 1M).

Conservation Easement Potential

In an ever-growing society, today's landscapes are being urbanized more and more to sustain the ever-growing population and behavior of recreational usage. In Minnesota, the land of ten thousand lakes, it is only natural to develop properties within the boundaries and beauty of our lakes and streams. Conservation efforts to limit or slow down the development process can only assist in the preservation of the lakeshed and inevitably the water quality of water bodies found within. Figure 4 identifies parcels within the lakeshed that are large enough to warrant the investigation of parcel conservation practices and purchase.

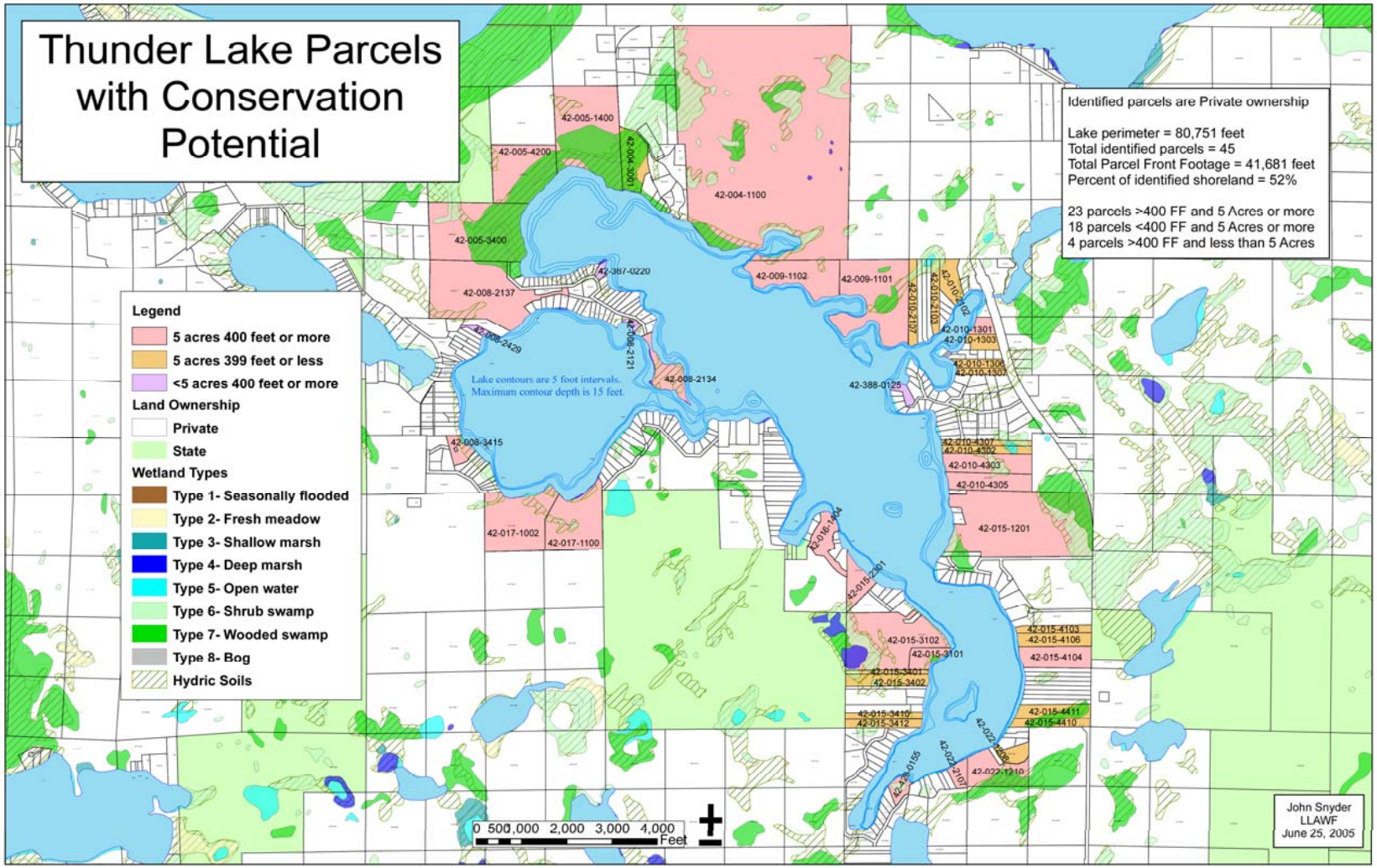

Figure 4. Lake parcels with conservation potential (developed by John Snyder, LLAWF).

Land Cover / Land Use

The activities that occur on the land within the lakeshed can greatly impact a lake. Land use planning helps ensure the use of land resources in an organized fashion so that the needs of the present and future generations can be best addressed. The basic purpose of land use planning is to ensure that each area of land will be used in a manner that provides maximum social benefits without degradation of the land resource.

Changes in land use, and ultimately land cover, impact the hydrology of a lakeshed. Land cover is also directly related to the lands ability to absorb and store water rather than cause it to flow overland (gathering nutrients and sediment as it moves) towards the lowest point, typically the lake. Impervious intensity decribes the lands inability to absorb water, the higher the % impervious intensity the more area that water cannot penetrate in to the soils. Monitoring the changes in land use can assist in future planning procedures to address the needs of future generations.

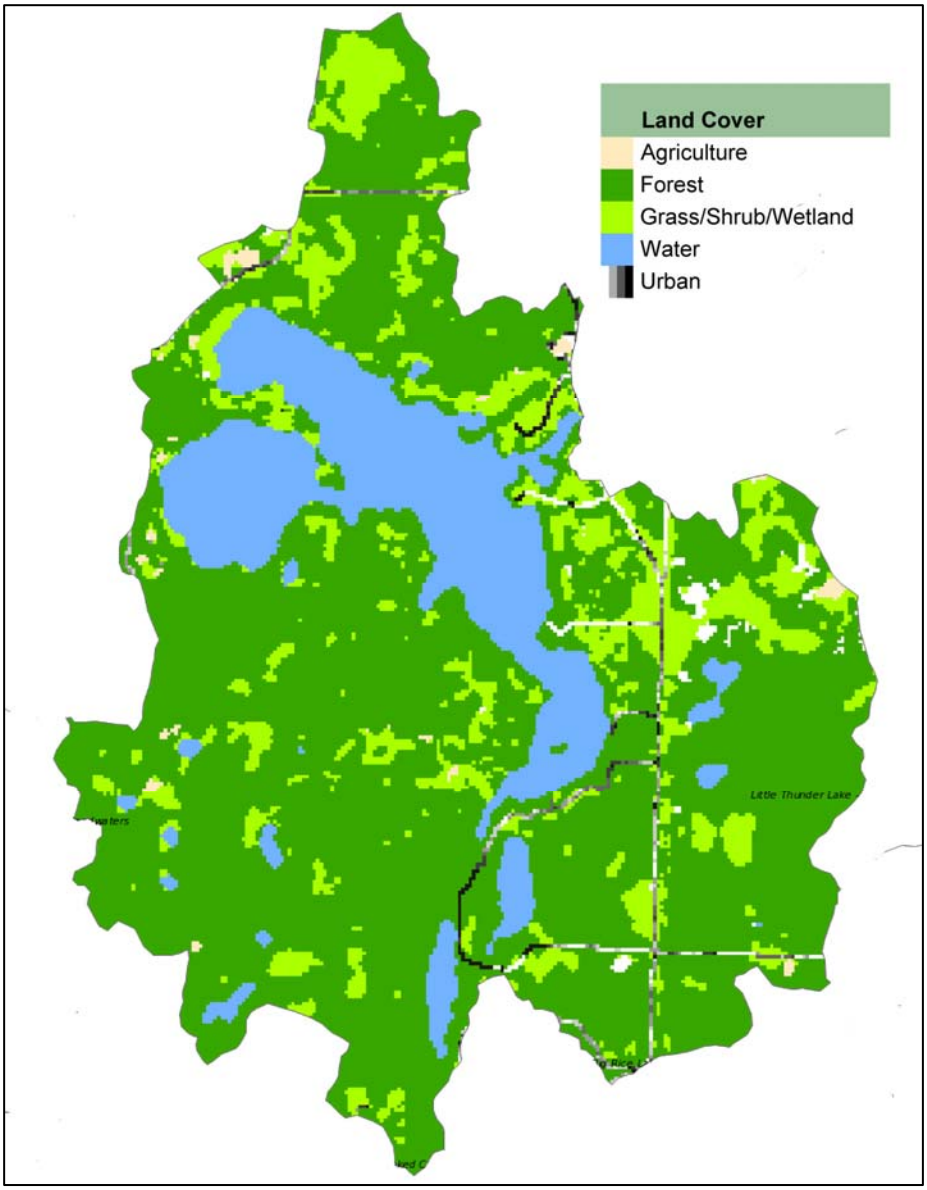

Figure 5. The Big Rice Lake (912502) lakeshed land cover (http://land.umn.edu).

Phosphorus export, which is the main cause of lake eutrophication, depends on the type of land cover occurring in the lakeshed. Figure 5 depicts Thunder Lake's lakeshed land cover.

The University of Minnesota has online records of land cover statistics from years 1990 and 2000 (http://land.umn.edu). Table 1 describes Thunder Lake's lakeshed land cover statistics and percent change from 1990 to 2000. Due to the many factors that influence demographics, one cannot determine with certainty the projected statistics over the next 10, 20, 30+ years, but one can see the transition within the lakeshed from agriculture, forest, and water acreages to grass/shrub/wetland and urban acreages. The largest change in percentage is the decrease in agriculture cover (50.5%); however, in acreage, grass/shrub/wetland cover has increased the most (346 acres). In addition, the impervious intensity has increased, which has implications for storm water runoff into the lake. The increase in impervious intensity is consistent with the increase in urban acreage.

Table 1. Thunder Lake's lakeshed land cover statistics and % change from 1990 to 2000 (http://land.umn.edu).

	1990		2000		% Change
Land Cover	**Acres**	**Percent**	**Acres**	**Percent**	**1990 to 2000**
Agriculture	97	1.06	48	0.52	50.5 % Decrease
Forest	6,292	68.47	6,229	67.79	1.0 % Decrease
Grass/Shrub/Wetland	907	9.87	1,253	13.64	38.1 % Increase
Water	1,720	18.72	1,478	16.08	14.1 % Decrease
Urban	174	1.89	182	1.98	4.6 % Increase
Impervious Intensity %					
0	9,073	98.74	9,030	98.27	0.5 % Decrease
1-10	45	0.49	27	0.29	40 % Decrease
11-25	46	0.5	30	0.33	34.8 % Decrease
26-40	18	0.2	26	0.28	44.4 % Increase
41-60	6	0.07	22	0.24	266.7 % Increase
61-80	2	0.02	27	0.29	1,250 % Increase
81-100	0	0	27	0.29	2,700 % Increase
Total Area	9,189		9,189		
Total Impervious Area (Percent Impervious Area Excludes Water Area)	20	0.27	71	0.92	255 % Increase

Demographics

Thunder Lake is classified as a general development lake. General development lakes usually have more than 225 acres of water per mile of shoreline and 25 dwellings per mile of shoreline, and are more than 15 feet deep.

The Minnesota Department of Administration Geographic and Demographic Analysis Division extrapolated future population in 5-year increments out to 2035. These projections are shown in Figure 6 below. Compared to Cass County as a whole, Thunder Lake Township has a slightly higher extrapolated growth projection.

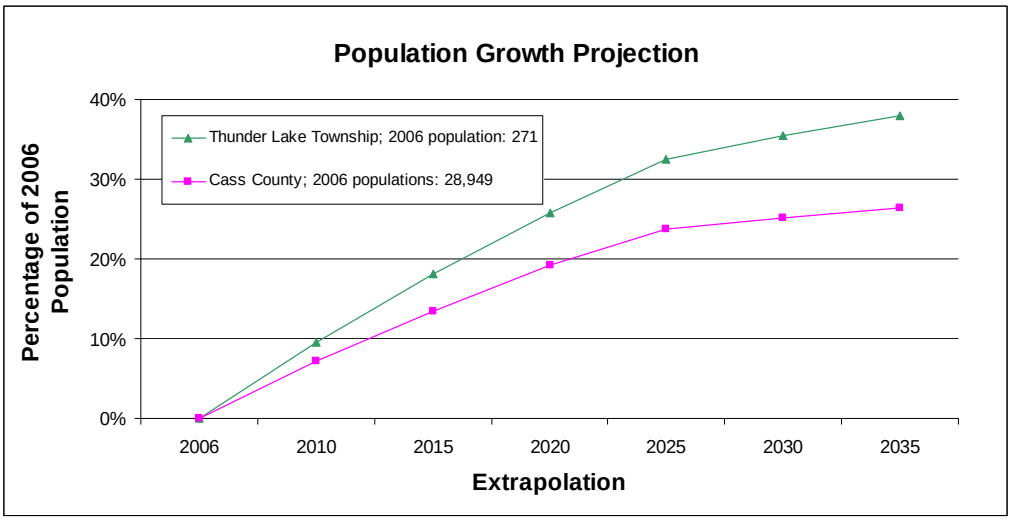

Figure 6. Population growth projection for Thunder Lake Township and Cass County (source: http://www.demography.state.mn.us/resource.html?Id=19332).

Status of the Fishery (DNR, as of 6/19/2006)

Walleye fingerlings are currently stocked in odd numbered years. The walleye catch rate was average when compared to similar lakes (5.5/gill net). Average size was 17.1" and 2.0 lbs., with 93% of the fish measuring 12" or larger.

The northern pike catch rate was average (3.8/gill net). Average size was 22.7" and 2.7 lbs., with 24% of the fish measuring 24" or larger.

Largemouth bass were captured in good numbers while spring electrofishing (113.3/hr run-time). Average length was 11.9" and 46% were 12" or larger. Largemouth bass were also caught in above average numbers in gill nets.

Smallmouth bass were captured at the rate of 16.7/hr run-time during spring electrofishing. Average length was 13.4" and 60% were 12" or larger. The gill net catch rate was above average (3.6/gill net) and the highest to date. Average length of these fish was 14.4". Some younger smallmouth were caught in trap nets (average length 6.4").

The black crappie catch rate was average in trap nets (1.0/trap net). Average length was 7.9" and 35% of the fish were 8" or larger.

The bluegill catch rate was above average (48.1/trap net). Average length was 5.8" and only 7% of the fish were 7" or larger.

Yellow perch and tullibee are important forage species. The yellow perch catch rate was above average, with an average length of 6.5". The tullibee catch rate was average, with an average length of 14.2".

Other fish species captured included bowfin, burbot, common shiner, hybrid sunfish, lake whitefish, pumpkinseed, rock bass, white sucker, and yellow bullhead.

See the link below for specific information on gillnet surveys, stocking information, and fish consumption guidelines. http://www.dnr.state.mn.us/lakefind/showreport.html?downum=11006200