

Inguadona 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	Leech Lake River	descriptive
Minor Watershed	8073	descriptive
Lakeshed	Inguadona Lake - Boy River (807300)	descriptive
Ecoregion	Northern Lakes and Forest	descriptive
Lake Area	1,125 acres	descriptive
Miles of Shoreline	11.10	descriptive
Miles of Stream	1.91	descriptive
Miles of Road	9.3	descriptive
Lake Max Depth	79 ft. (24.1 m)	descriptive
Lake Mean Depth	20 ft. (6.1 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, 2008	+
Lake Vegetation Survey/Plan	None	x
Forestry Practices	None	+
Development Classification	General Development	-
Shoreline Development Index	2.4	-
Total Lakeshed to Lake Area Ratio (total lakeshed includes lake area)	4.8:1	x
Public Lake Accesses	1	x
Inlets	5 – Trelipe Creek, Northby Creek, Boy River, 2 Unnamed	x
Outlets	1 – Boy River	x
Shoreland Conservation Potential (% shoreland identified for conservation)	36%	+
Feedlots	None	+
Agriculture Zoning	21 acres within 200 ft of lake; 888 acres > 200 ft from lake	-
Public Land : Private Land	0.6:1	-
Wetland Coverage	20%	+
Lake Transparency Trend	North basin – declining trend (99.9% probability); south basin – improving trend (95% probability)	x
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.

Inguadona Lake is found within the **Upper Mississippi River Basin**, which includes the **Leech Lake River Major Watershed** as one of its sixteen major watersheds (Figure 1). The basin covers 20,000 square miles, while the Leech Lake River Watershed covers 1,335 square miles (approximately 854,349 acres). Inguadona Lake falls within **minor watershed 8073**, one of the 75 minor watersheds that comprise the Leech Lake River 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. Inguadona Lake falls within the **Inguadona Lake - Boy River (807300) lakeshed**, covering 5,377 acres (includes lake area) (Figure 3). Even though Inguadona Lake receives water from minor watersheds 8049, 8050, 8051, and 8071, for the purpose of this assessment it is decided that only the immediate lakeshed be inventoried and assessed.

Inguadona 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 Inguadona 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 (49%)					23%	Public (28%)		
	Developed	Agriculture	Forested Uplands	Other	Wetlands	Open Water	County	State	Federal
Land Use (%)	2%	10%	19%	6%	12%	23%	0%	15%	13%
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 development and protection efforts	Open, pasture, grassland, shrubland	Protected				
Potential Phase 3 Discussion Items	Shoreline restoration	Restore wetlands; CRP	Forest stewardship planning, 3 rd party certification, SFIA, local woodland cooperatives		Protected by Wetland Conservation Act		County Tax Forfeit Lands	State Forest	National Forest

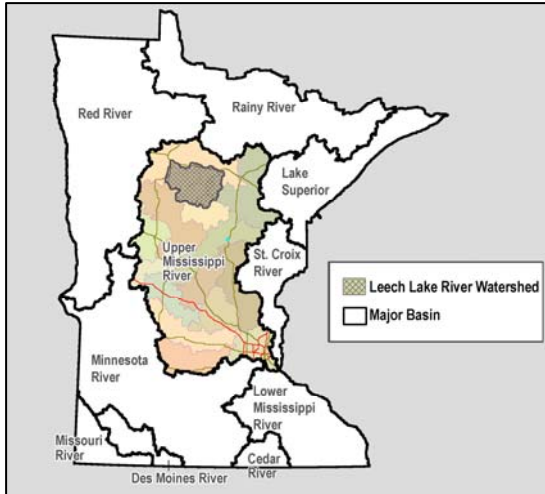


Figure 1. Upper Mississippi Basin and the Leech Lake River Watershed.

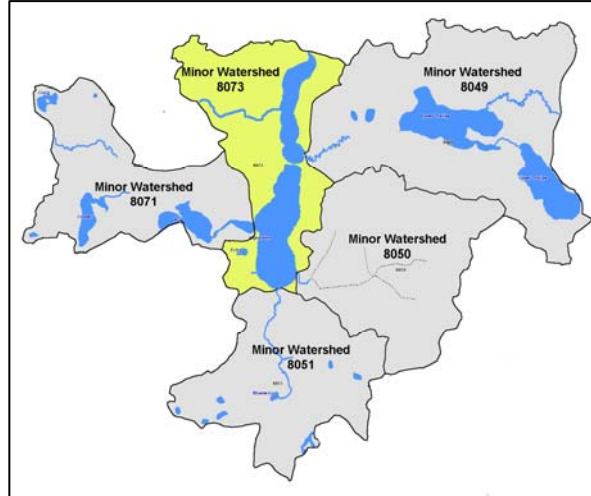


Figure 2. Minor Watersheds 8073, 8049, 8050, 8051, & 8071 contribute water to Inguadona Lake.

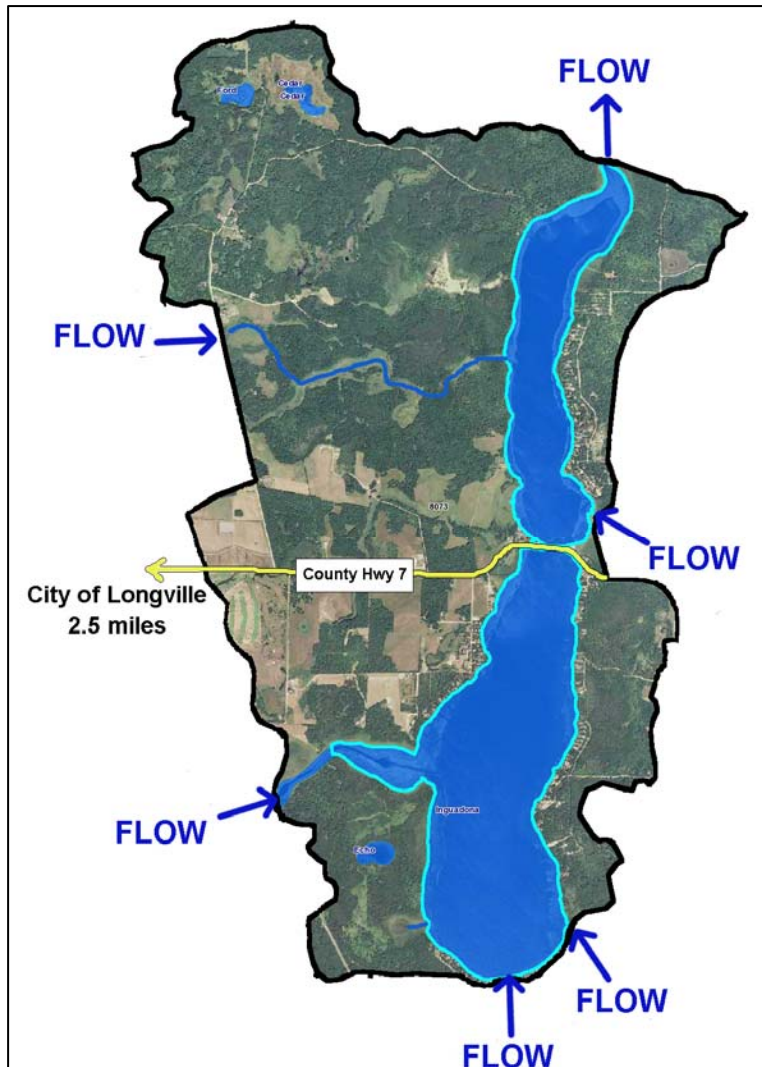


Figure 3. The Inguadona Lake - Boy River (807300) Lakeshed (Aerial Imagery 2008 1M).

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.

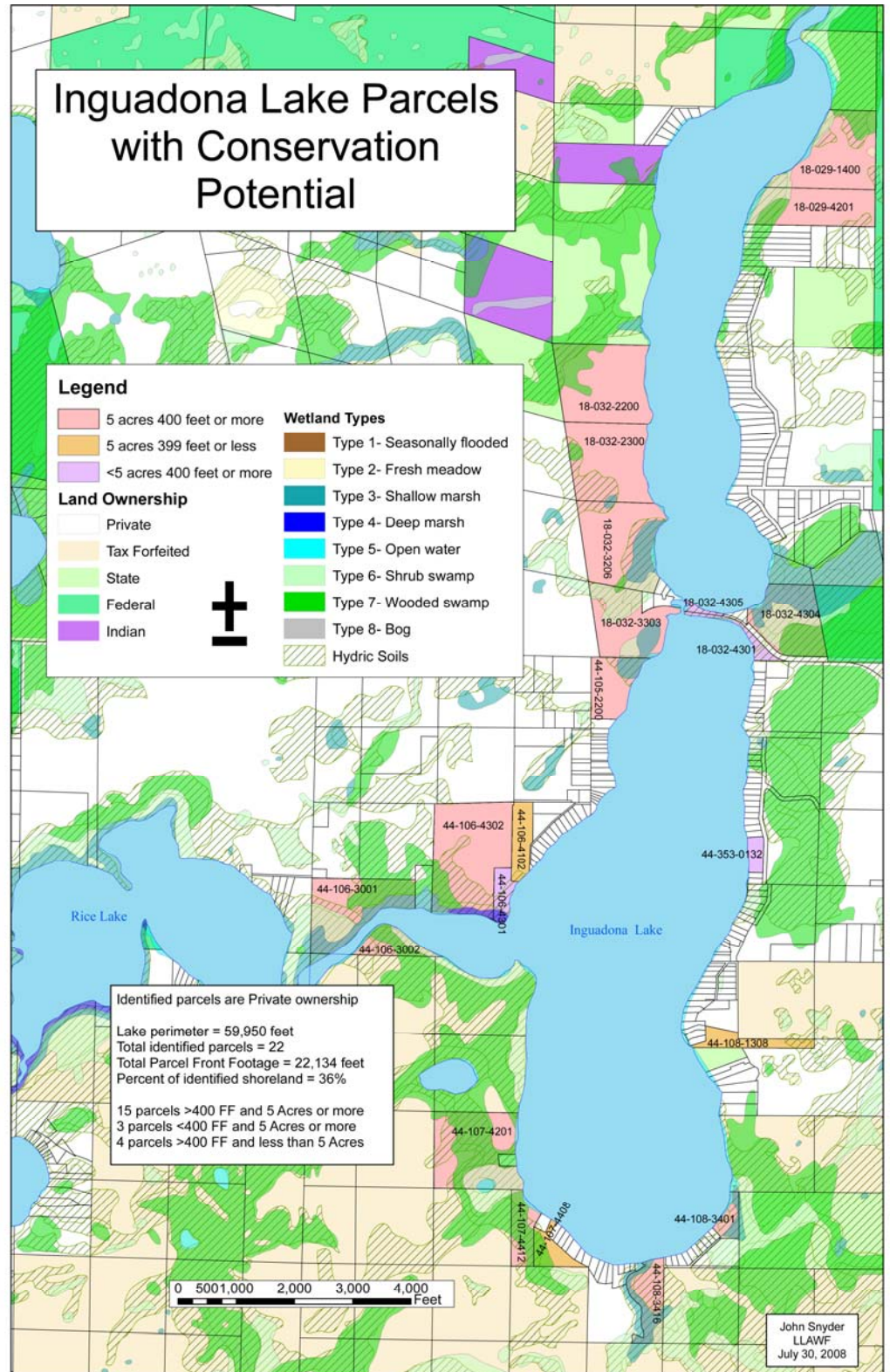


Figure 4. Lake parcels with conservation potential (developed by John Snyder, LLAWF).

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 land's 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 describes the land's inability to absorb water, the higher the % impervious intensity the more area that water cannot penetrate into the soils. Monitoring the changes in land use can assist in future planning procedures to address the needs of future generations.

Phosphorus export, which is the main cause of lake eutrophication, depends on the type of land cover occurring in the lakeshed. Figure 5 depicts Inguadona 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 Inguadona 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 increase in grass/shrub/wetland cover (46.6%). In acreage, grass/shrub/wetland cover has also increased the most (373 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.

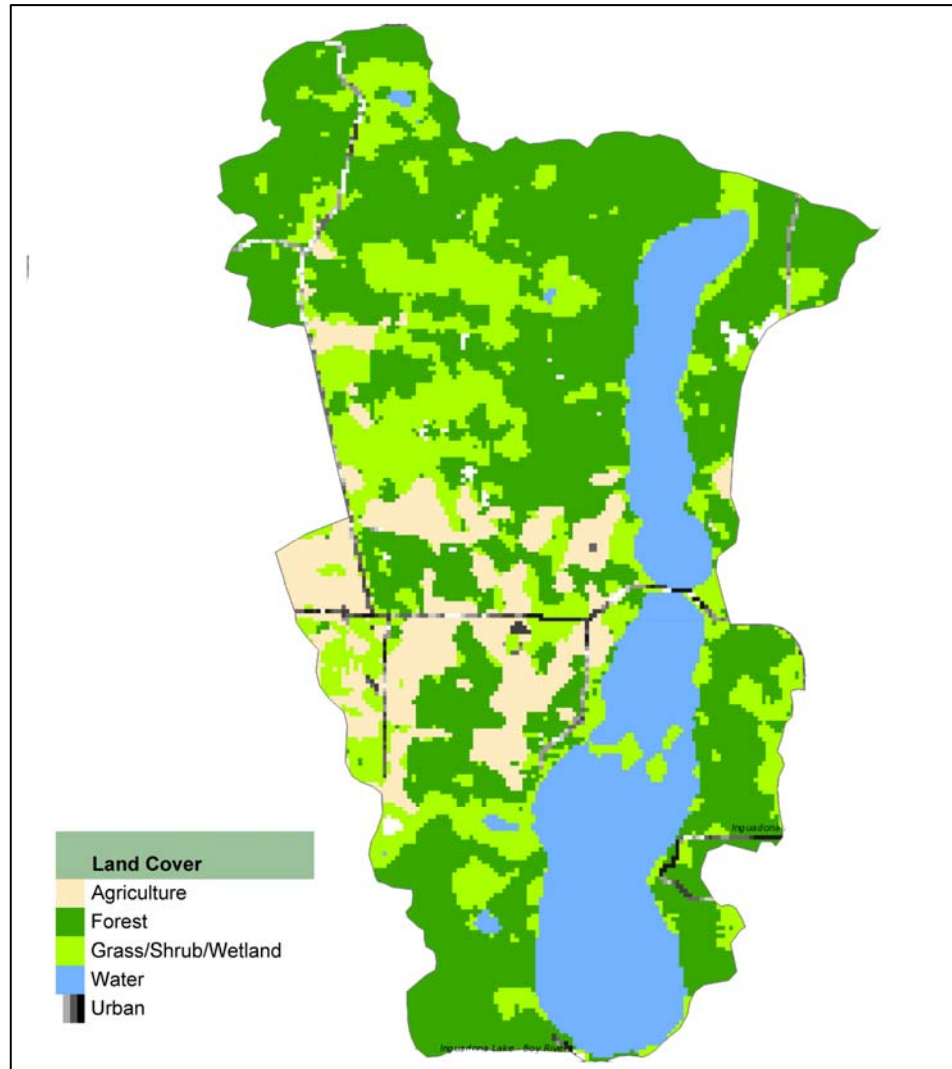


Figure 5. The Inguadona Lake - Boy River (807300) lakeshed land cover (<http://land.umn.edu>).

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

Land Cover	1990		2000		% Change 1990 to 2000
	Acres	Percent	Acres	Percent	
Agriculture	643	11.96	548	10.19	14.8 % Decrease
Forest	2,669	49.64	2,521	46.88	5.5 % Decrease
Grass/Shrub/Wetland	800	14.88	1,173	21.82	46.6 % Increase
Water	1,155	21.48	1,018	18.93	11.9 % Decrease
Urban	110	2.05	117	2.18	6.4 % Increase
Impervious Intensity %					
0	5,317	98.88	5,277	98.14	0.8 % Decrease
1-10	15	0.28	15	0.28	No Change
11-25	22	0.41	27	0.5	22.7 % Increase
26-40	9	0.17	23	0.43	155.6 % Increase
41-60	11	0.2	19	0.35	72.7 % Increase
61-80	4	0.07	14	0.26	250 % Increase
81-100	0	0	2	0.04	200 % Increase
Total Area	5,377		5,377		
Total Impervious Area (Percent Impervious Area Excludes Water Area)	15	0.36	34	0.78	126.7 % Increase

Demographics

Inguadona 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, both Inguadona and Trelipe Townships have higher extrapolated growth projections.

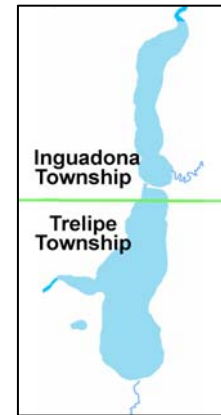
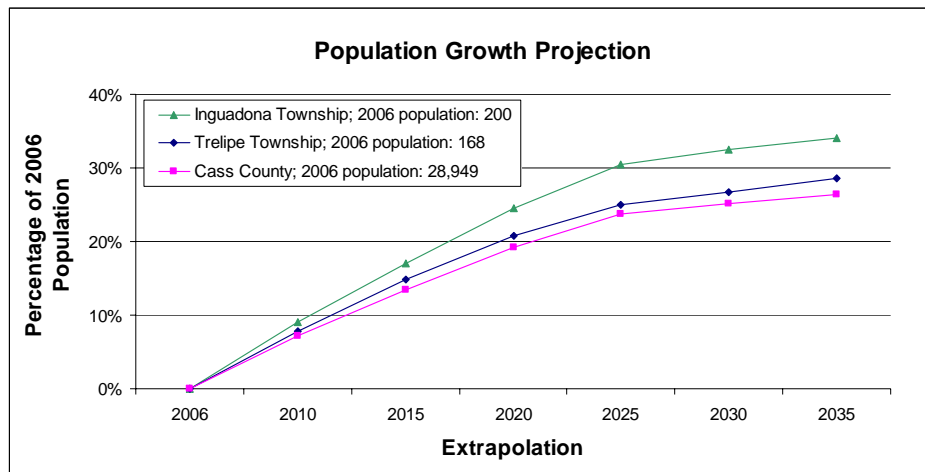


Figure 6. Population growth projection for the townships around Inguadona Lake and Cass County (source: <http://www.demography.state.mn.us/resource.html?id=19332>).



Status of the Fishery (DNR, as of 07/30/2007)

Inguadona Lake is a 1,116-acre lake located near Longville, Minnesota that has 11.10 miles of shoreline and a maximum depth of 79 feet. There is a state-owned public access on the southeast shore. The Minnesota Department of Natural Resources (MNDNR) has classified Minnesota lakes into 43 different classes based on physical, chemical, and other characteristics. Inguadona Lake is in Lake Class 25; lakes in the class are generally deep, clear, hard-water lakes with irregular shorelines.

Northern pike are abundant in Inguadona Lake. The average length of this species sampled in MNDNR test nets was 20 inches and fish ranged from 15 to 30 inches. No muskellunge were caught in MNDNR test nets in 2007, however no sampling (such as spring trapping) was done to target this species. Walleye from 7 to 27 inches were found. Walleye abundance was lower than in previous years. Largemouth bass from 5 to 18 inches were sampled in 2007. Abundance of bluegill in Inguadona was similar to that found in other Lake Class 25 waters. Average length of bluegill in 2007 sampling was about 6 inches, though there were a few fish in the 7-, 8-, and 9-inch categories. Black crappie from 4 to 11 inches were caught. A small number of cisco (tullibee), ranging from 11 to 13 inches, were collected during MNDNR sampling, and yellow perch in the 4 to 7 inch range were found as well.

Other species available for anglers include bowfin (dogfish), brown bullhead, greater redhorse, pumpkinseed sunfish, rock bass, white sucker, and yellow bullhead. Anglers can help maintain or improve the quality of fishing by practicing selective harvest. Selective harvest allows for the harvest of smaller fish for table fare, but encourages release of medium- to large-sized fish. Releasing these fish can help maintain balance in the fish community in Inguadona Lake and provide anglers the opportunity to catch more and larger fish in the future.

Shoreline areas on the land and into the shallow water provide essential habitat for fish and wildlife that live in or near Minnesota's lakes. Overdeveloped shorelines can't support the fish, wildlife, and clean water that are associated with natural undeveloped lakes. Shoreline habitat consists of aquatic plants, woody plants and natural lake bottom soils. Plants in the water and at the water's edge provide habitat, prevent erosion and absorb excess nutrients. Shrubs, trees, and woody debris such as fallen trees or limbs provide good habitat both above and below the water and should be left in place. By leaving a buffer strip of natural vegetation along the shoreline, property owners can reduce erosion, help maintain water quality, and provide habitat and travel corridors for wildlife.

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=11012000>