Management Priority: 8

NA-01570-01

LAKE MANAGEMENT PLAN

Ecological Lake Class: 22

Region	Area	D.O.W Number	County	D.O.W. Lake Name	Acreage
2	Grand Rapids 216	31-0532	Itasca	Pokegama Lake	6612 surface 1978 Littoral

Long Range Goal: Maintain a walleye gill net catch greater than 8.0/gill net. Reduce the northern pike gill net catch to 5.0/net and maintain a size structure where PSD exceeds 50 and memorable pike are present. Maintain largemouth and smallmouth bass electrofishing rates at 35 and 15 per hour of electrofishing with RSD-P exceeding 20. Provide muskellunge fishing opportunities.

Operational Plan: Conduct spring electrofishing for muskellunge in 2015. Conduct a population assessment in 2015 to assess the status of the fish community setting 15 gill nets and 15 trap nets. Include spring electrofishing for largemouth and smallmouth bass. Collect bony parts from walleye, northern pike, largemouth bass, smallmouth bass, and bluegill. Conduct a smelt assessment in the fall of 2015.

Stock Mississippi River strain walleye fingerlings annually at a rate of one pound/littoral acre (1,978 pounds) and up to 200 lbs of surplus fingerlings when available (since 2006). Stock Leech Lake strain muskellunge at a rate of 1 per littoral acre (1,978) every other year (since 2008). Stock surplus lake trout (Gillis strain) when available.

Encourage anglers and spear-fishers to harvest small northern pike and release pike exceeding 24 inches.

Midrange Objective: Monitor the abundance, size structure and growth rates of the walleye and northern pike populations as well as any changes in the rest of the fish community. Monitor smelt abundance.

Potential Plan:
Conduct spring panfish assessments, fall tullibee and whitefish assessments, special spring muskellunge and northern pike assessments and fall walleye electrofishing if time is available.

TOTAL $

Past Surveys:
Lake Management Plan – 1987,1997, 2002, 2006, 2011
Initial Survey - June 1949
Resurvey - August 1975, August 1984
Population Assessment - August 1979, July 1990, July 1995, July 2000, July 2005, June 2010
Smelt Assessment - October 1986, June 1987, September 1995, October 2000, October 2005, October 2010
Fall YOY walleye electrofishing - 2005, 2006, 2010
Lake Trout Investigation - July 1964
Lake Map – 1940
Whitefish/Tullibee Sportnetting Checks - Various years 1970 - 1990
Shoreline Seining Natural Reproduction Checks - Various years, 1950 – 1980
Creel survey - 2000-2001

Check the appropriate boxes below:

- ☐ **Superior National Forest**
- ☐ **Chippewa National Forest**
- ☐ **Leech Lake Indian Reservation**
- ☐ **1854 Ceded Territory**

Primary Species Mgt:	Secondary Species Mgt:	
Walleye/Northern pike/ Muskellunge	Largemouth and Smallmouth bass	
Area Supervisor Signature:	**Date:**	
Regional Manager Signature:	**Date:**	

NARRATIVE:

Pokegama Lake is a large, sprawling lake near Grand Rapids, MN in the Mississippi River watershed. Pokegama Lake has six small inlets, and outlets to the Mississippi River where the US Army Corp of Engineers (US ACE) controls water levels at the Pokegama Dam. The lake has a surface area of 6,612 acres at normal pool, a littoral area of 1,978 acres and a maximum depth of 112 feet. Pokegama is deep and clear. The Secchi disk transparency during the June 2010 assessment was 15 feet in the main basin, indicating good water clarity. Much of the lakeshore has been developed for residential housing. Multiple public accesses can be found around the lake.

Pokegama Lake is in ecological lake class #22. Lakes in this classification are relatively large (mean = 3,545 acres), deep (mean = 101.6 feet), have a mean littoral area of 38%, have relatively high alkalinity (mean = 146.8 ppm) and are moderately clear (mean Secchi disk = 9.9 feet). Other class 22 lakes in the area include Deer, Swan, and Cutfoot Sioux lakes.

Various surveys and past management:

The lake management plan (LMP) for Pokegama Lake was last revised in 2006. Walleye and northern pike were the primary management species and largemouth and smallmouth bass were the secondary management species. The long range goals of the plan were to improve the walleye gill net catch to 11.0 per gill net and reduce the northern pike gill-net catch to 5.0/net. Other goals included: improving northern pike size structure to a proportional stock density of quality sized pike (PSD) of 65 and a relative stock density of preferred sized pike (RSD-P) of 20, maintaining largemouth and smallmouth bass electrofishing rates at 35 and 15 per hour of electrofishing, maintaining memorable size of smallmouth bass with an relative stock density (RSD-M) of 15, and improving largemouth bass size structure to an RSD-M of 5. There are no special or experimental regulations on Pokegama Lake but statewide seasons and limits apply.

A summary of catches of select species from past surveys is summarized in Table 1.

Table 1. Pokegama Lake net catch rates for select species from 1994-2010

Date	No. of Nets (gill/trap)	Walleye (GN)	Northern pike (GN)	Yellow perch (GN)	Tullibee (GN)	Bluegill (TN)
7/5/1949	23/0	2.6	4.7	15.7	3.1	N/A
8/4/1975	15/12	2.2	4.1	11.8	4.0	0.5
8/13/1979	16/0	1.6	6.4	31.3	8.2	N/A
8/13/1984	15/14	5.3	5.3	17.5	1.1	3.5
7/29/1990	11/10	8.5	6.3	15.7	0.4	4.5
7/31/1995	15/12	10.8	7.8	43.7	0	15.3
7/31/2000	13/15	6.7	8.1	29.9	0.4	11.2
7/25/2005	15/12	5.5	7.6	20.8	0.5	12.9
6/28/2010	15/15	8.2	10.6	32.9	0.1	31.1
Pokegama Lake						
Lake mean		5.7	6.8	24.4	2.0	11.3
Lake median		5.5	6.4	20.8	0.5	11.2
Ecological Lake Class 22						
1st quartile		4.0	3.0	7.1	0.5	3.7
Median		6.6	5.0	17.1	1.6	15.3
3rd quartile		9.6	7.9	33.9	5.2	42.8

Stocking History

Fish stocking has been an important part of the management of Pokegama Lake. The lake was periodically stocked with bass, crappie, stream trout, lake trout, pike, whitefish and sunfish from 1909 until 1970. Northern pike and walleye were the primary species stocked from 1970-1980. Most of the northern pike were stocked from winter rescue operations, a common practice of the era, but the practice was discontinued as evidence indicated these stockings did not benefit the lake. Most recently, walleye fingerlings have been stocked annually at a rate of 1 pound per littoral acre since 2006. Surplus lake trout are stocked when available to provide bonus angling opportunities. Muskellunge were stocked in 2008 and 2010 to provide additional angling opportunities. Table 2 summarizes fish stocking in recent years.

Table 2. Recent stocking history of Pokegama Lake (1985-2010)

Year	Lake trout		Muskellunge		Walleye	
	Number	Pounds	Number	Pounds	Number	Pounds
1985	15,660	1,462				
1986					35,376	1,745
1988					106,961	2,018
1990					13,630	1,576
1991	25,000	1,000				
1992					36,868	1,000
1994					15,098	952
1997	1,871	1,588				
1998	338	1,951			7,505	993
2000					24,591	921
2001					71,430	1,978
2002					16,030	1,986
2004	825	411			122,746	3,965
2005					19,976	1,116
2006	1,055	485			37,207	1,966
2007					16,625	1,994
2008			1,978	440	40,973	1,978
2009	404	1,530			27,204	1,975
2010			1,978	480	31,650	1,978

Walleye

Walleye catches were historically low in Pokegama Lake as the walleye gill net catch rate was below the first quartile for lake class 22 in the first three assessments. Catch rates increased in subsequent assessments and have been above the lake class median since 1990. Size structure for gill net sampled walleye was also generally low in the first three assessments but has improved since 1984. The number of walleye exceeding 25 inches has increased in the past 4 assessments (Table 2) and the population currently had a favorable size structure for anglers in 2010.

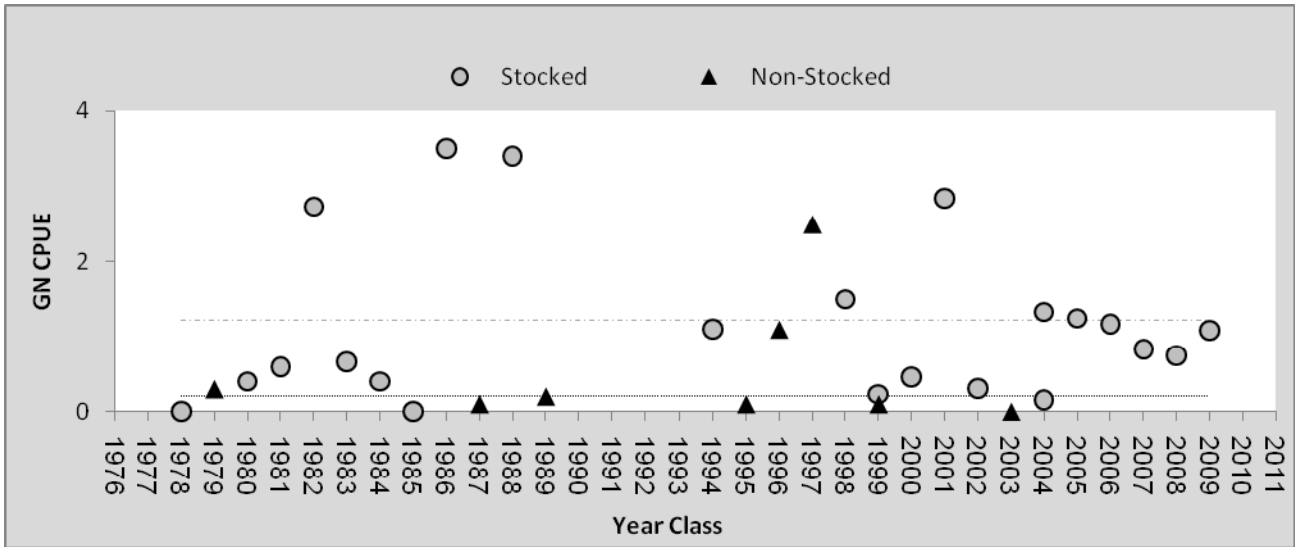
The walleye population appears to be maintained primarily via stocking, although the frequency of past stocking makes evaluating the extent of natural reproduction problematic. Catches of age 1-6 walleye have generally corresponded to stocked year classes (Figure 1) since 1978. Fall electrofishing assessments in 2005, 2006, and 2010 suggested poor natural reproduction in those years as only 4 young of the year walleye (YOY) were captured in 2006 and zero YOY walleye were captured in 2005 and 2010.

Table 2. Pokegama Lake walleye size structure for fish sampled in gill nets.

Year	Sample	PSD	RSD-P	PSD-M
1949*	49	49	8	0
1975*	24	50	17	0
1979*	24	13	4	0
1984*	81	25	4	1
1990	82	57	7	0
1995	125	93	40	3
2000	87	84	26	7
2005	64	89	34	9
2010	122	81	49	12
Lake 1st Quartile		49	7	0
Lake Median		57	17	1
Lake 3rd Quartile		84	34	7

**Gill nets and trap nets combined. PSD based on a quality size of 15 inches, RSD-P based on a preferred size of 20 inches, RSD-M based on a memorable size of 25 inches.*

Figure 1. Gill net catch rate of age 1-6 walleye for stocked and non-stocked years.



Fingerling stocking appears to be more successful than fry stocking. The 1975 and 1979 surveys evaluated a period of fry stocking and resulted in catch rates of 2.2 and 1.6/gill net. Fry stocking did not appear to contribute to the walleye population and walleye stocking switched to fingerlings. Catch rates have increased since fingerling stocking was initiated in 1980, as catches averaged 7.5/gill net in 6 assessments from 1984-2010.

Walleye were captured at a rate of 8.2/gill net in the most recent 2010 assessment, which was above the lake class and lake medians for Pokegama Lake, but below the 2006 LMP goal of 11.0/gill net. That goal was ambitious given the historical catch rates on Pokegama and the fact that similar lakes rarely produce catches over 10.0/gill net. The walleye population was dominated by relatively large fish as walleye averaged 19.4 inches and walleye up to 29 inches were sampled. PSD was 81, RSD-P was 49, and RSD-M was 12, indicating excellent angler opportunity to catch large walleye.

Northern pike

Northern pike gill net catch rates have varied considerably. Catch rates were fairly stable from 1949 to 1990, but have since increased as the four highest catch rates occurred in the last four assessments. The gill net catch has generally been within the lake class interquartile range, although the third quartile value was exceeded in 2000 and again in 2010.

Northern pike size structure has generally been poor in all assessments (Table 3). Past growth rates were similar to statewide averages with fish averaging 25 inches by age 6. Anecdotal information from anglers indicates that Pokegama frequently produces northern pike exceeding 6 pounds. The Pokegama Lake prey base includes cold water pelagic species such as whitefish, tullibee, and rainbow smelt. It is likely that summer gill net sampling results in a poor assessment of larger pike in Pokegama as larger individuals may be found suspended over deep water that is not effectively sampled by gill nets.

Table 3. Pokegama Lake northern pike size structure for fish sampled in gill nets.

Year	Stock Sample Size	PSD	RSD-P	PSD-M
1949*	101	20	4	1
1975*	56	36	4	0
1979*	100	27	2	0
1984*	79	45	1	0
1990	60	50	5	0
1995	90	52	8	2
2000	102	54	1	0
2005	87	45	3	0
2010	138	54	4	1
Lake 1st Quartile		36	2	0
Lake Median		45	4	0
Lake 3rd Quartile		52	4	1

**Gill nets and trap nets combined. PSD based on a quality size of 21 inches, RSD-P based on a preferred size of 28 inches, RSD-M based on a memorable size of 34 inches.*

The catch rate and size structure goals from the 2006 LMP were not met in 2010 as the catch rate of 10.6/gill net was above the third quartile value for the lake class and was the highest on record for Pokegama Lake. Northern pike from the gill net catch averaged 20.3 inches and the largest individual exceeded 34 inches. The size structure was moderate as PSD (21 inches) was 54. Few individuals exceeded the preferred size of 28 inches as RSD-P was 4 and RSD-M was 1. Age analysis indicated that 8 year classes were present (ages 1-7, and 9) and most fish were relatively young, as the average age was 3.1 years. Only 22% of the sampled pike were age-5 or older, suggesting high mortality of older, larger fish. Growth was relatively fast, with individuals typically exceeding 21 inches in 3 years and 28 inches in 7 years.

Bass

Spring electrofishing catch rates for bass have been variable (Table 4) and might not be a good indicator of changes in population abundance. Size structures have also varied, but have generally been favorable for anglers. PSD (12 inches) of largemouth bass has varied from 37 to 67 and RSD-P (15 inches) has varied from 12 to 23. PSD (11 inches) of smallmouth bass has ranged from 66 to 78 and RSD-P has ranged from 11 to 43. Anecdotal angler reports and fishing tournament results indicate largemouth and smallmouth bass exceeding 5 pounds are occasionally caught from Pokegama Lake and connected waters.

Both largemouth and smallmouth bass were relatively abundant in the 2010 electrofishing assessment. The largemouth catch was near the 2006 LMP goal and the smallmouth catch exceeded the goal. Both populations had quality size structures, but neither met the LMP goal for producing memorable sized bass (>20 inches for largemouth and >17 inches for smallmouth bass). Size structure can be highly variable and it is probable that larger fish were present but were not in shallow water during the electrofishing

assessment. Sampled largemouth bass averaged 12.5 inches and the largest individual exceeded 18 inches. PSD of largemouth bass exceeding 12 inches and RSD-P of bass exceeding 15 inches were 67 and 18. Age analysis identified 7 year classes (ages 2-8) and recruitment was inconsistent as the 2005 and 2006 year classes comprised 56% of the sample. Growth was average with individuals exceeding 12 inches by age 5 and 15 inches by age 7. Smallmouth bass were generally smaller, averaging 11.5 inches and the largest individual exceeded 15 inches. PSD (11 inches) and RSD-P (14 inches) for smallmouth bass were 66 and 11. Recruitment was inconsistent as the 2006 year class comprised 69% of the sample. Growth was somewhat slow, as individuals exceeded 12 inches in 5 years. Given the relative abundance and size structure, good angling opportunities exist for these species.

Table 4. Electrofishing catches for bass (number per hour of on-time).

Year	Largemouth bass	Smallmouth bass
6/5/1995	3.7	4.4
6/22/2000	36.7	18.5
6/7/2005	55.6	4.2
6/1/2010	33.9	25.0
Lake 1st Quartile	26.4	4.4
Lake Median	35.3	11.5
Lake 3rd Quartile	41.4	20.1

Yellow perch
Yellow perch gill net catch rates have been within the interquartile range in all assessments except 1995, when catches slightly exceeded the range. Yellow perch were the most common species in the gill net catch in 2010. The catch rate of 32.9 per net was near the lake class third quartile and exceeded the long term mean for Pokegama Lake. Size structure has generally been poor with few fish sampled over eight inches. Anecdotal reports from anglers suggest large perch are caught at certain times of the year and may provide some recreational and harvest value. Although the popularity of the fishery may be limited by poor size structure, yellow perch are an important prey species for a variety of predatory fish.

Bluegill
The bluegill population appears to have increased over the past few assessments. The 2010 catch rate of 31.1/trap net was above the lake class median and was the highest trap net catch recorded for Pokegama Lake. Size structure was modest as bluegill averaged 6.1 inches. Some large bluegills were present, as individuals exceeding 9 inches were captured. PSD (6 inches) was 46 and RSD-P (8 inches) was 5. Age analysis identified 9 year classes (ages 2-10). The age distribution was balanced as bluegill averaged 5.4 years of age and 62% of the sampled fish were age 5 or older. Growth was average for the lake class, with individuals typically exceeding 6 inches in 6 years. Given the abundance and size structure, moderate angling opportunities exist.

Black crappie
Black crappie gill net catch rates have generally been low varying from 0 to 0.7/net. Trap net catch rates have also been low varying from 0.1 to 0.4/net. Black crappie are likely concentrated in localized areas and are not sampled well in our assessment nets. Size structure has been good with fish up to 11 inches sampled.

Tullibee
Tullibee catches have varied among assessments, but have generally declined since the 1980s. Tullibee were captured at a rate of 0.13/gill net in 2010, below the 25% quartile for the lake class and below the historical mean for Pokegama Lake. Above average temperatures during the last decade and the introduction of rainbow smelt may be linked to the apparent decline. It should be noted, however, that tullibee are difficult to sample due to their pelagic nature and summer gill net catches may not represent actual population trends. Tullibee are occasionally sought after by sports gill netters and low abundance may limit the popularity of the fishery. Tullibee are an important prey fish linked to the production of large gamefish including northern pike, walleye, and muskellunge.

Lake Whitefish

Lake whitefish gill net catch rates have been low, varying from 0.1 to 0.2/net. Catches of whitefish in special gill nets set to sample lake trout have varied from 0.5 to 3.5/net. Anglers reported catching large whitefish in 1994 and 1995, including one weighing 12 pounds in 1994. Whitefish were not sampled in the 2010 assessment. Gill nets do not accurately reflect the abundance of whitefish due to their schooling and pelagic nature. Recreational whitefish netting and spearing for whitefish are popular activities on Pokegama Lake.

Lake trout

Early accounts from local residents suggest lake trout were native to Pokegama Lake, but stocking predates fish surveys so the early status of lake trout is unknown. No evidence exists to indicate that lake trout currently reproduce in the lake and the presence of lake trout is believed to be due to stocking. Anglers and whitefish netters have occasionally reported catching lake trout. They are currently stocked when surplus fish are available and provide a unique angling opportunity. Lake trout were last stocked in 2009 when over 400 adults were stocked.

A lake trout investigation in 1964 used 13 deep-water gill net sets to assess whether lake trout were present. No lake trout were sampled, although 21 whitefish, 311 tullibee and 129 yellow perch were captured. Two deep-water gill nets were set in summer assessments to sample lake trout starting in 1990. No lake trout were sampled in these deep-water gill nets in 1990 or 1995 and a single lake trout was sampled in 2000. No lake trout were sampled in 2005 and the deep water sets were moved shallower in 2010 to standardize the number of conventional gill net sets.

Other fishes

Other fish species sampled by gill nets and trap nets include bowfin, black bullhead, brown bullhead, yellow bullhead, burbot, common shiner, mottled sculpin, rock bass, shorthead redhorse, pumpkinseed sunfish, rainbow smelt, trout perch and white sucker**.** Additional species sampled while seining include; banded killifish, bluntnose minnows, fathead minnow, Johnny and Iowa darters, logperch, and blackchin, blacknose, emerald, mimic, golden and spottail shiners**.**

Creel Studies

An angler survey was conducted from May 13 through October 15, 2000 and from December 16, 2000 through March 4, 2001. Fishing pressure during the summer season was 44,689 hours or 6.8 hours/acre. This was low compared to 17.4 hours/acre for 29 previously surveyed class 22 lakes. The three most harvested species were northern pike, yellow perch, and walleye. Walleye were the most sought after species with 44% of all anglers seeking walleye. Walleye angler catch and harvest rates were 0.03 fish/hour and 0.02 fish/hour, respectively. This was also quite low compared to catch and harvest rates of 0.2/hour and 0.1/hour for previously surveyed lakes. Northern pike were the second most sought after species with 31% of anglers seeking northern pike. Angler catch and harvest rates for northern pike were 0.2/hour and 0.1/hour, respectively. These catch and harvest rates were higher than rates for previously surveyed lakes.

Winter angling and spearing pressure was 6,193 hours or 0.9 hours/acre. This was also quite low compared to 3.3 hours/acre for previously surveyed lakes. Fishing pressure was fairly evenly split between spearing and fish house/open ice anglers. The three most harvested species were northern pike, yellow perch, and walleye. Northern pike were the most sought after species with 79% of all anglers targeting northern pike. Angling was good for northern pike with a harvest rate similar to previously surveyed lakes, and walleye harvest rates were lower than previously surveyed lakes.

In general, anglers were fairly dissatisfied with their angling experience with only 25% and 16% of summer and winter anglers rating their fishing experience a five or higher on a scale of one to 10.

An aerial creel survey was conducted on 90 lakes across Itasca County during the summer of 2001. The results showed that Pokegama Lake had a total use of 5.9 craft hours/acre. This was comparable to other lake class 22 lakes.

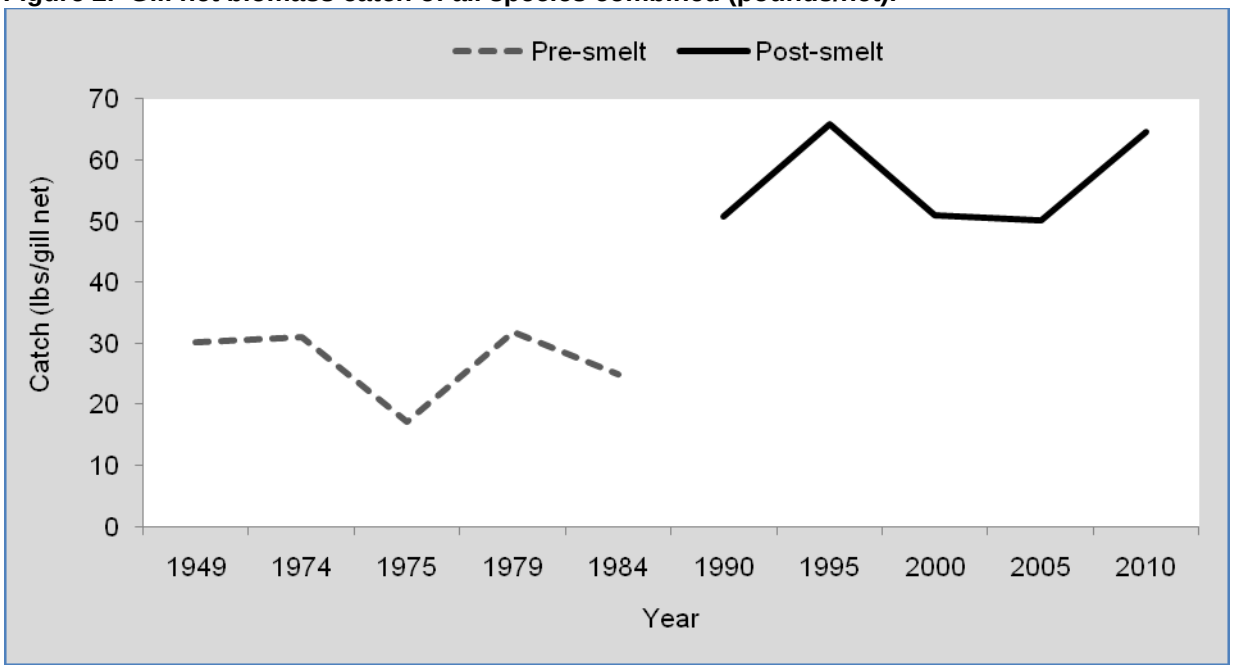
Exotic species

Rainbow smelt are a regulated invasive species in Minnesota. Native to the Atlantic and Pacific oceans, smelt entered the Great Lakes accidentally in 1912 when they escaped from an inland lake in Michigan where they had been stocked as forage fish. Smelt quickly spread throughout Lake Michigan and were first discovered in Lake Superior in 1946 (www.dnr.state.mn.us). Smelt may negatively impact aquatic communities by disrupting food webs and predation on and competition with native species.

Rainbow smelt were first sampled in 1985 after local residents had reported a spawning run in Sugar Brook. The origin of the smelt is unknown but their occurrence may have been the result of accidental bait bucket release or intentional illegal stocking. Special assessments using small-mesh gill nets have been conducted to sample rainbow smelt. Early assessments were conducted at different times of the year and used a variety of gill net mesh sizes. Mesh sizes have been standardized and assessments have been conducted in the fall since 1995. Catches have ranged from 17.0/gill net in 2000 to 99.0/gill net in 2005. The catch of 31.0/gill net in 2010 suggest smelt remained relatively abundant despite relatively high catches of walleye and northern pike. YOY smelt were noted in the fall electrofishing sample in 2010, indicating natural reproduction had occurred that spring.

Smelt dip netting in Sugar Brook provides a small spring fishery and smelt provide an additional prey species for walleye and northern pike. Smelt seem to be providing some benefit to Pokegama Lake as the total fish weight caught per gill net has increased sustainably since smelt were introduced (Figure 2).

Figure 2. Gill net biomass catch of all species combined (pounds/net).



Rusty crayfish are a large crayfish native to the Ohio River basin that were discovered in Minnesota around 1960 and are confirmed in about 50 Minnesota waters, mostly in central and northern counties. Rusty crayfish are a regulated invasive species in Minnesota. They likely spread through dumping of bait buckets aquariums, and activities of commercial aquaculture. Rusty crayfish are aggressive invaders. They can harm native fish communities by feeding on their eggs and young, drive out or hybridize with native crayfish, and eliminate aquatic vegetation (www.dnr.state.mn.us).

Rusty crayfish were first documented in 1988 when they were observed by scuba divers. In the 1990 assessment, eight were sampled in a gill net in the Wendigo Arm. By 1995, most of the gill nets contained at least 20 crayfish, with a maximum of nearly 100, and approximately 20% of these were rusty crayfish.

The survey crew reported there were a fair number of rusty crayfish in some gill nets in the 2000, 2005, and 2010 assessments.
Pokegama Lake is known to contain mystery snails. The Chinese mystery snail is native to Asia. It was brought to California in 1892 as a food source and found in Massachusetts in 1915, likely an aquarium release. The historic range of the banded mystery snail is the southeastern U.S., primarily in the Mississippi River system up to Illinois. It is a popular aquarium snail that's been released in Minnesota. Both snails can form dense aggregations and disrupt native populations. Snail die offs are often considered a nuisance by landowners as dead snails litter the lakeshore.

Plant Community
The 1984 survey described a diverse aquatic plant community with approximately 3% of the lake surface covered with emergent vegetation. Much of the littoral zone was carpeted with submerged species growing to a depth of 12 feet. Canada waterweed, coontail, northern water milfoil, muskgrass, bushy pondweed, and sago pondweed were abundant species. Emergent and floating plants were scattered around the lake and included bulrush, cattail, sedge, and waterlily. Emergent and floating leaf plants are especially beneficial as they act as a buffer to wave action, reducing erosion. These plants also provide important overhead cover and spawning habitat for several species of fish in the shallow shoalwater areas.

A partial lake plant survey was conducted by the Minnesota County Biological Survey in June of 2000. This survey also identified a diverse plant community. No rare species were identified.

Water Quality
The 1984 assessment indicated hard water with low phosphorus fertility. Alkalinity was 109 ppm, pH was 8.4, and total phosphorus was 0.013 ppm. The US Army Corp, with help from the lake association, monitored water quality from 1990-1995. Total phosphorus (0.019 ppm) and mean chlorophyll-*a* (2.6 ppm) values were within the expected range for minimally impacted lakes in the MPCA's Northern Lakes and Forests Ecoregion and mean Secchi transparency (16.1 feet) was higher than the expected range. The resulting Trophic State Index value of 41 characterized the lake as mesotrophic, bordering on oligotrophic. Secchi disk readings from 1975 to 2009 have averaged 15 feet. The Carlson trophic index for the Secchi disk was 38, indicating an oligotrophic status (www.pca.state.mn.us).

Present limiting factors:
Pokegama Lake is deep and clear, conditions which can result in slow warming and cold spring water temperatures. Walleye reproduction is believed to be limited more by thermal conditions than physical habitat, as the lake may warm too slowly for good fry hatching and rearing.

Pokegama Lake has the key elements of a deep lake, providing a cool-water refuge and soft-rayed prey such as smelt, tullibee, and white sucker to produce a northern pike fishery with good size structure. The creel survey and past netting assessments indicate a northern pike fishery of modest to poor size structure, however. The pike population appears to have increased in Pokegama Lake over time. The increasing catch rate could signal future declines in the production of large pike. Average size is typically small and growth is poor when northern pike occur at high density, although the growth rates remained good in 2010. Anglers should be encouraged to harvest small northern pike and release pike over 24 inches to help improve the size structure.

Introduced rainbow smelt populations have been associated with reduced or even failed recruitment for some species, especially coregonids (whitefish and tullibee) and lake trout, but also walleye. It is believed the presence of smelt is responsible for the virtual elimination of not only whitefish, but also walleye natural reproduction in Burntside Lake, in northern Minnesota. Smelt may partially explain the very low tullibee catch rates in recent assessments on Pokegama. Whitefish have been typically sampled at such low rates that even a dramatic decline in actual abundance may not be evident in the net catch. It is difficult to determine whether walleye reproduction has been impacted in Pokegama Lake because of the frequency of stocking.

Optimum temperature and dissolved oxygen conditions for lake trout may be lacking for part of the year. Dissolved oxygen/temperature profiles collected in the years 1990-1991 (US ACE) indicated that in July,

August and September, dissolved oxygen concentrations were often below 5 ppm at depths where the temperature was 50°F, the optimum temperature for lake trout. Current total phosphorus levels (0.019 ppm) were near the threshold level (0.020 ppm) for trout lakes, so any increase in nutrient loading could eliminate the already limited lake trout fishery. Any further eutrophication of the lake could jeopardize its ability to support a lake trout population.

Habitat fragmentation may impact Pokegama Lake. Pokegama was once part of an expanse of interconnected, free flowing waterways on the upper Mississippi River. Dams at the Lake Winnibigoshish and Cass Lake outlets, as well as the Pokegama dam result in major long term barriers to fish movement and may have isolated some historical populations. Manipulation of water levels may also impact the fishery, as high spring flows influence fish migration and spawning success.

Social considerations:

Pokegama Lake shoreline ownership is primarily private and is one of the most developed lakes in the county. The 1984 survey stated that 60% of the watershed was private homes and 40% was mixed hardwoods, conifers and swamps. There were six resorts and 777 homes or cabins at that time. The Itasca County Land Parcel database was queried in 2011 (Table 5) and suggests that residential density has increased since the 1984 survey as 1,254 parcels were classified as residential (www.co.itasca.mn.us).

Table 5. Pokegama Lake land use classification from the Itasca County Land Parcel database.

Classification	Number of Parcels	Acres	Percent of Acreage
Residential	1254	2469	72%
Rural Vacant Land	116	391	11%
State administered	20	338	10%
Resort	12	63	2%
Municipal	6	25	1%
Mining	3	22	1%
Tax Forfeited-Real Estate	4	18	1%
Apartment (4 or more units)	1	3	<1%
Bed and Breakfast (up to 5 units)	1	1	<1%
Commercial Preferred	2	4	<1%
County Public Property	2	16	<1%
Manufactured Home Park	2	16	<1%
Streets and Roadways	1	0	<1%

Past assessments have included fish collection for contaminant testing. The Minnesota Fish Consumption Advisory bulletin has recommended restrictions on consumption for northern pike and walleye to one meal/week for the general public and one meal/month for children and pregnant women.

Pokegama Lake is a popular recreational area with pleasure boaters representing 48% of all recreational use in the 2000 creel survey. Multiple public access points exist around the lake.

Habitat development and protection:

The Greater Pokegama Lake Association (GPLA) is active in promoting and educating shoreline owners in the use of Best Management Practices to limit the amount of nutrients reaching the water. These include maintaining vegetation along the shoreline to limit erosion and to slow and filter run-off, leaving ice ridges intact, using no phosphorus fertilizers and minimizing their use on lawns, maintaining conforming septic systems and limiting erosion. Limiting nutrient inputs is especially important in Pokegama Lake given the fragile nature of the lake trout population. Given the amount of recreational use that Pokegama Lake receives, long term effects (e.g. eutrophication leading to poor water quality) could be much more dramatic and must be considered along with the short term impacts of not limiting nutrient inputs.

Department of Natural Resources (DNR) Enforcement Division, with help from DNR Forestry and the lake association, inventoried aquatic vegetation on Pokegama Lake in 1994. Aerial photographs and videotape from boats were used to document the presence and extent of shoreline vegetation, emergent vegetation, and erosion. These photographs could prove a useful tool for enforcing aquatic plant removal and zoning violations as well as being used for educational purposes. DNR fisheries and enforcement staff selected Pokegama Lake as one of several lakes to focus on shoreline protection in 2000 and 2001. Several days each year were spent touring the shoreline property determining compliance with existing shoreline protection standards.

Minnesota Department of Transportation widened the Highway 169 crossing over the Wendigo Arm in 2005. The fisheries office was involved in the design of the new crossing and walleye spawning habitat was incorporated into the final design.

Land Acquisition and AMAs

DNR fisheries owns and administers several parcels as aquatic management areas (AMA) which protect nearly 100 acres of land including 1,722 feet of stream bank and 3,790 feet of lakeshore (Figure 3, Table 6). Pokegama Lake AMA includes 3 disconnected parcels. Two parcels found near the Wendigo Arm, west of the Wood tick access, encompass 30 acres along Wood tick Lake. A dump site was identified in the fall of 2010 and cleaned up. The site was posted with signage, including a no dumping sign. The third parcel is located on the west end of Salter Bay and protects a large wetland complex. Little Pokegama AMA protects a marsh on the south side of the County Rd 17 bridge near the Sherry's Arm access. Sugar Brook AMA is located along Sugar Brook off County Rd 239 and provides access for spring smelt netters.

Figure 3. Pokegama Lake and surrounding area.

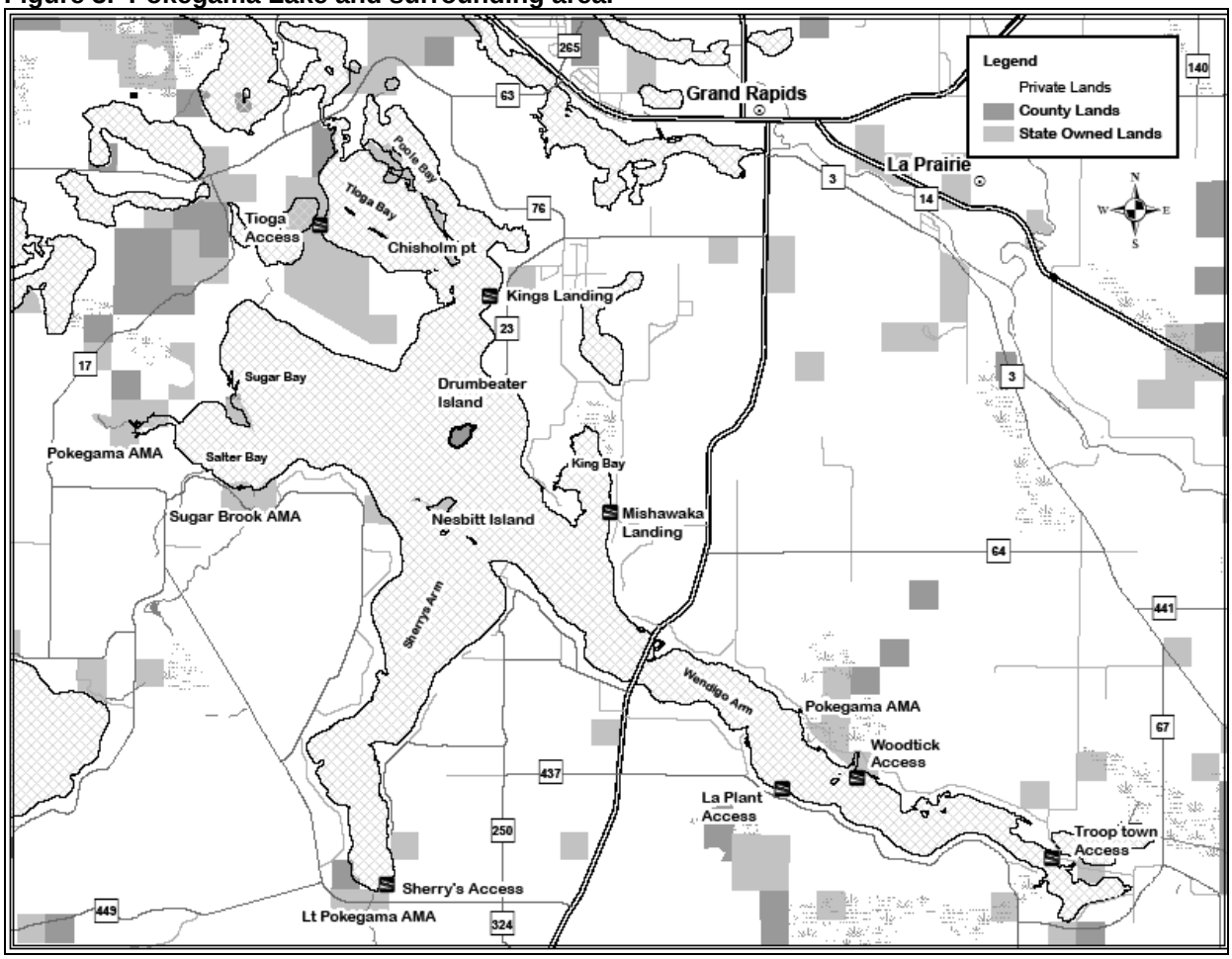


Table 6. AMAs on Pokegama Lake.

AMA Name	Acres	Stream bank (feet)	Lakeshore (feet)
Little Pokegama AMA	15.2	756	0
Pokegama Lake AMA	70.3	0	2575
Sugar Brook AMA	12.9	966	1215
Grand Total	**98.4**	**1,722**	**3,790**

Chisholm Point was purchased as a Scientific and Natural Area with financial help from the GPLA. Nesbitt Island is owned by the State of Minnesota and Drumbeater Island is owned by Itasca County.

Commercial Fishery:

Contract removal of bullhead, bowfin, burbot, yellow perch, and suckers were conducted in the late 1940's but no potential commercial fishery exists at present.

Survey needs:

The initial muskellunge assessment will be conducted in the spring of 2015 using boat electrofishing to determine good locations for future assessments and partially examine the status of muskellunge in Pokegama. Spring electrofishing for bass should be repeated in 2015 when water temperatures are around 66 °F. A population assessment will be conducted in July 2015, including 15 gill nets and 15 trap nets. Bony parts should be collected from walleye, northern pike, largemouth and smallmouth bass, and bluegill for age and growth analysis. A smelt assessment, repeating the gill net sets of 2010, will also be conducted in early October 2015.

Potential surveys

Pokegama Lake has an expanding bluegill population that appears to be providing good angling opportunities. A spring trap net panfish assessment should be considered when time allows.
Limited data exists for large northern pike in Pokegama. Future ice out muskellunge and northern pike trap net assessments will be conducted to better understand the esocid populations. Data suggests that the tullibee population has declined and little data exists on lake whitefish and lake trout. A fall special assessment should be considered to better understand the status of these species. The contribution of natural walleye reproduction is still unclear, fall YOY electrofishing could be conducted in the future.

Other management tools:

Muskellunge stocking is expected to improve angling opportunities in Pokegama. Fishing for muskellunge is becoming increasingly popular across the state and the Grand Rapids area. Discussions with the local chapter of Muskies Inc., responses to a question asked in the 2000-2001 Pokegama Lake creel survey, and broad public input indicated support for managing muskellunge in Pokegama Lake. Muskellunge are native to Pokegama Lake and the lake has adequate prey and habitat to produce trophy fish. The first stocking occurred in 2008.

The walleye population has well balanced age and size distributions suggesting that current harvest rates is sustainable and the lake would likely not benefit from a length based regulation. The northern pike size structure has historically been poor. Pokegama Lake has the potential to produce large northern pike and a special regulation may help maintain or improve opportunities for large pike. A length based pike regulation may not be socially acceptable, however, as pike were very popular with anglers and spear-fishers in the 2000 creel survey and were harvested at a relatively high rate.

Stocking plan:

Mississippi River strain walleye fingerlings will be stocked annually at a rate of one pound/littoral acre (1,978 pounds) and up to 200 lbs of surplus fingerlings when available (since 2006). Leech Lake strain muskellunge will be stocked at a rate of 1 per littoral acre (1,978) every other year (since 2008) through 2016, followed by a period of evaluation to determine if natural reproduction is occurring. Surplus lake trout

yearlings (Mountain strain) can be stocked at a rate of up to 5/surface acre (33,060) when available. Larger brood stock culls could also be stocked to provide an immediate lake trout fishery.

Public input:
A news release published in local newspapers invited public comment on a draft version of this management plan in February 2006.

Revised by: Dave Weitzel, 2011
This plan replaces the 2006 plan.

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