Grand Sable Lake

Alger County, T49N, R14W, Sec. Many
Lake Superior watershed, last year surveyed 2004

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Environment

Grand Sable is a scenic undeveloped lake located in Alger County, about 6 miles southwest of Grand Marais. The 630 acre lake lies within the boundaries of the Pictured Rocks National Lakeshore (PRNL). The shoreline is mostly wooded with mixed hardwoods, conifers, and cedar species. Most of the surrounding soils are sandy. Sand dunes 200 ft high are located on the north end. The county road along the north end, H-58, was recently relocated slightly out into the lake to fight the continuous sand erosion from those dunes. At the same time, rock riprap was placed along the shoreline paralleling the road. Very little of the rock, however, was placed onto horizontal substrate in the lake. There is a PRNL day use area located at the north end, just east of the sand dunes, which has picnic tables, litter barrels, and a swimming beach. Sable Creek provides an outlet from the lake into Lake Superior, while Towes, Rhody, and DeMull Creeks flow into the lake. The access site for Grand Sable Lake is located off of Co. Rd. 714, west of M77. The access site is maintained by the National Park Service. There is a concrete boat launch, a courtesy pier, and a large parking area. The site also has picnic areas and pit toilets.

Grand Sable Lake has a maximum depth of 85 feet, but averages around 35-40 feet (Figure 1). The banks drop off quite rapidly. Even so, the shoreline at the public access site on the northeast shoreline remains shallow for over 200 feet, dropping quickly into deep water. The littoral zone substrate is sandy, while in the depths the bottom is more organic, with abundant pulpy peat. Water color was stained brown with a secchi depth of 12 ft in a 1949 limnology survey. The water was well oxygenated, with dissolved oxygen concentration at the surface of 8.3 mg/l and a bottom concentration of 5.6 mg/l. Alkalinity readings ranged from 22 to 52 mg/l CaCo3, and the lake had a pH of about 8.0. Grand Sable Lake remains well oxygenated today (Table 1). Water temperature in June, 2004, ranged from 63F at the surface to 50F at the 58 ft bottom of the vertical profile. Dissolved oxygen remained at or above 11 mg/l down to 55 ft, then fell to 3.7 mg/l at 58 ft. The pH ranged from 7.5 at the surface to 7.7 at 10-25 ft, then slowly fell to 7.2 at 58 ft.

History

Access to the lake before the area became part of the PRNL was from the small park on the north end. At that time, the park was managed by the village of Grand Marais. A 1949 fisheries survey documented the presence of rock bass, northern pike, yellow perch, smallmouth bass, white suckers, and minnow species. Past stocking efforts included rainbow trout, splake, smelt, smallmouth, largemouth, pike, bluegills, and lake trout. Many of those species showed excellent survival, and produced good fisheries. However, all stocking efforts except for lake trout stocking were discontinued in 1980 due to the PRNL management plan for their waters (Memorandum of Understanding). The National Park Service wished to maintain native or naturalized fish species. Lake trout stocking ceased in 2004, again because of the PRNL management plan.

Smelt spawning runs were evaluated in 1980, and were documented in all three tributary streams. Towes Creek was then opened for annual smelt dipping from April 1 - May 31. That season for smelt dipping still exists today. In 1985, a manual removal was conducted for white suckers, resulting in removal of 6.8 lbs per acre. The survey catch in a 1989 survey showed the same species diversity as the 1949 survey. Similar to a gill net survey in 1984, the catch was still dominated by lake trout. Lake trout ranged from 10 to 34 inches, and had an average length of 25.3 inches. The stocked lake trout were experiencing excellent survival, with many year classes present. Smallmouth bass, rock bass, northern pike, and white suckers were also present, but in low numbers.

More comprehensive netting surveys were initiated in 1995, using fyke, trap, and gillnets. For that reason, the species abundance was markedly different from that previously documented with gillnet only surveys. Suckers comprised 51% of the catch biomass. Smallmouth bass were numerous, but only 4% were legal sized at 12+ inches. Length ranges of northern pike and smallmouth bass implied significant angler harvest as the fish become legal sized. Rock bass and yellow perch were above average size, with 31% and 39% of the catch acceptable to anglers. Only one smelt was captured.

The 2001 netting survey followed Fisheries Division's Status and Trends guidelines, which added shoreline seines to the standard mix of fyke, trap, and gillnets. Northern pike catch per unit of effort (CPE) almost tripled compared to the 1995 survey, with 19% larger than 24 inches. In contrast, there was a large drop in smallmouth bass and yellow perch CPE, with a concurrent slowing of both their growth rates. Suckers again comprised about 50% of the catch biomass. No lake trout were captured. A follow-up gillnet survey during spring 2002 also failed to capture any lake trout, despite the continuous annual stocking program.

Current Status

The 2004 Status and Trends survey produced differing results from the 1995 and 2001 surveys. Our 2001 and 2002 surveys raised concern about lake trout survival. Once again, in 2004, we only captured two despite setting several suspended gill nets specifically targeting lake trout (Table 2). They were large, 24 and 30 inches, and comprised 3% of the catch biomass. In comparison, lake trout caught in 1995 comprised 11%, and their sizes ranged from 12 - 25 inches. For that reason, we still had the same concern regarding lake trout survival in 2004. At least part of the answer may lie in the stocking program. The last adults stocked were in 1995, and the yearling program changed to fall fingerling in 1997 (Table 3). Almost concurrently with that change in age of fish stocked, the northern pike population began to increase in number and average size. No other factors changed significantly. Zooplankton populations appeared adequate, while dissolved oxygen and normal pH occur almost to the deepest parts of the lake (Table 1). The annual stocking program of 20,000 fall fingerling lake trout ended in 2005. Data gathered during the 2004 survey implied no benefit to the Grand Sable Lake fishery by continuing that stocking program.

Size distributions of fish caught in 2004 implied reduced angling harvest for northern pike, smallmouth bass, rock bass, and yellow perch. All were present in good numbers and sizes. Northern pike comprised 31% of the catch biomass with 56% larger than 24 inches. The rock bass population had 62% larger than 6 inches, and the smallmouth bass population had 24% larger than 14 inches. The

perch population comprised 1.5% of the catch biomass. Their average size rose somewhat, however, with 27% over 7 inches.

A concern from the 1995 survey was the size of the white sucker population. Results from 2004 showed that while their percent of the catch biomass declined from 55% in 2001 to 49%, their size distribution changed significantly. We did not catch the smaller fish in this survey, and average size was about five inches larger. Increased predation is the likely dominant factor in such a change.

Analysis and Discussion

The catch summary for the 2004 Status and Trends survey showed that only six species comprised 80% of the fish number captured and roughly 100% of the catch biomass (Table 4). Lake trout, northern pike, and smallmouth bass comprised 42% of the catch biomass, while rock bass and yellow perch comprised 10% and white suckers comprised 48%. The sucker population consisted of larger individuals, with 88% larger than 16 inches. Most of the young suckers were apparently utilized by the predators as forage. Many of each sport fish species were larger than the legal or acceptable minimum sizes, indicating an absence of significant angling mortality.

Only the northern pike were growing faster than state average (Table 5). Rock bass and smallmouth bass were growing slower, while yellow perch growth was roughly equal to state average. Oldest fish captured were age six for northern pike, age eight for yellow perch, age nine for smallmouth bass, and age 10 for rock bass. Mortality estimates from catch curve comparisons (Robson and Chapman 1961) between the 2001 and 2004 surveys indicate decreased angling harvest for northern pike, smallmouth bass and yellow perch (Table 6). Pike estimated mortality fell from 56% in 2001 (using ages 2-8) to about 50% (using ages 4-6). Twelve pike aged 3 (22.7 in average size) experienced an estimated mortality of only 20% compared with 50% for twelve pike aged 4 (25.9 in average size). The difference implied that angling harvest was a significant mortality for the pike population. Smallmouth bass numbers in 2001 gave an estimated 46% mortality, while in 2004 the estimate was 28%. Yellow perch estimates likewise fell, from 57% in 2001 to 36% in 2004. The fish community appeared to be doing well, and was in good balance in 2004. We expect it to remain stable for several years. The next active management effort will be a follow-up survey in about ten years.

Management Direction

Grand Sable Lake cannot be considered a two-story lake because the cool water species inhabit the entire oxygenated habitat. Lake trout became scarce even during the final years of the annual stocking regime, which ended due to the Memorandum of Understanding with the PRNL. Tributary streams contain native brook trout, but none were captured during summer netting surveys in the lake itself. Specific Grand Sable Lake management, then, must target maintenance of northern pike, rock bass, smallmouth bass, and yellow perch populations. Since the white sucker population is apparently supplying a large proportion of the forage base, it should be allowed to remain at its current proportion of the catch biomass.

References

Robson, D.S. and D.G. Chapman. 1961. Catch curves and mortality rates. Transactions of the American Fisheries Society 90: 181-189.

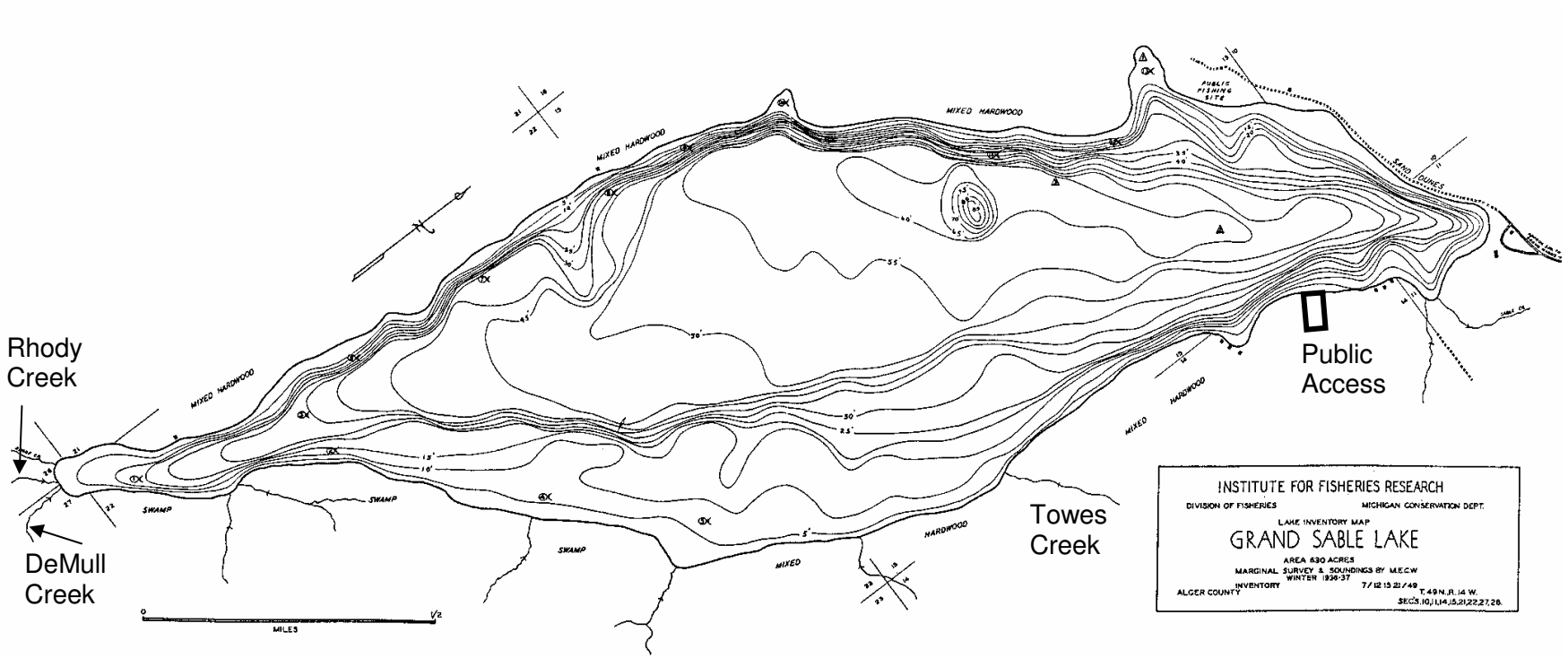

Figure 1 – Grand Sable Lake contour map.

Table 1 – Physical and chemical vertical profiles, Grand Sable Lake, Alger County, June 15, 2004.

Depth	Temperature (F)	Dissolved oxygen (mg/l)	Dissolved oxygen % saturation	pH	Specific conductance
1	63	11.8	123	7.5	101
5	63	11.7	121	7.6	101
10	62	11.6	119	7.7	101
15	60	11.5	115	7.7	101
20	59	11.4	113	7.7	102
25	59	11.4	112	7.7	101
30	56	11.6	111	7.6	101
35	54	11.7	109	7.6	101
40	52	11.7	106	7.6	101
45	51	11.5	104	7.5	101
50	51	11.3	102	7.5	101
55	51	11.0	99	7.5	102
58	50	3.7	33	7.2	114

Table 2 – Number, weight, and length by species for Grand Sable Lake, Alger County, from a status and trends survey using fyke, trap, and gill nets, and seines, June 14-18, 2004.

Species	Number	Percent by number	Weight (lbs.)	Percent by weight	Length range (in.)[1]	Average length (in.)	Percent legal size[2]
Creek chub	4	1	0	0	4 – 5	5.3	100
Common shiner	72	12	2	0	2 – 5	4	100
White sucker	85	15	237	49	8 – 23	18.9	100
Golden Shiner	1	0	0	0	5.5	5.5	100
Lake trout	2	0	15	3	24 – 30	27.5	100
Logperch	6	1	0	0	2 – 3	3	100
Northern pike	43	7	152	31	17 - 30	24.7	56
Rock bass	252	44	48	10	1 - 10	6.1	62
Smallmouth bass	29	5	23	5	3 - 18	9.9	24
Rainbow smelt	2	0	0	0	6 - 7	7	100
Splake hybrid	1	0	0	0	8.5	8.5	0
Spottail shiner	10	2	0	0	2 - 4	3.9	100
Yellow perch	70	12	8	2	3 - 10	6	27

[1] Note some fish may be measured to 0.1 inch, others to inch group: e.g., “5” = 5.0 to 5.9 inches, “12” = 12.0 to 12.9 inches, etc.

[2] Percent legal or acceptable size for angling.

Table 3 – Fish stocking history of Grand Sable Lake, Alger County, from 1980 – 2005.

Date	Species	Strain	Age	Mark	Number	Size (in)	Weight (lbs)
05/15/1980	Lake Trout		Yearling	none	10,000	4.8	277
04/22/1981	Lake Trout	Marquette	Yearling	none	10,000	5.3	372
05/05/1982	Lake Trout	Marquette	Yearling	none	10,000	5.2	348
05/04/1983	Lake Trout	Marquette	Yearling	none	10,000	5.8	479
05/04/1983	Lake Trout		Adult	adipose	1,000	13	550
05/16/1983	Lake Trout		Adult	none	340	15.8	332
08/10/1984	Lake Trout		Fall fingerling	none	125,000	3.6	1100
10/31/1985	Lake Trout		Adult	none	800	15	669
05/20/1986	Lake Trout		Yearling	right pectoral	10,000	6.3	689
04/17/1987	Lake Trout	Marquette	Yearling	none	10,130	6.2	506
09/10/1987	Lake Trout	Marquette	Adult	none	2,000	8.7	336
10/27/1987	Lake Trout	Marquette	Fall fingerling	none	13,344	5.1	452
05/31/1988	Lake Trout	Marquette	Adult	none	200	29.8	2182
06/01/1988	Lake Trout	Marquette	Adult	none	287	29.8	3133
04/30/1990	Lake Trout	Marquette	Yearling	adipose	5,432	6.2	323
04/30/1990	Lake Trout	Marquette	Yearling	none	11,800	5.9	616
04/29/1991	Lake Trout	Lk Superior	Yearling	none	11,900	5.8	565
05/11/1992	Lake Trout	Lk Superior	Yearling	none	15,000	5.5	810
05/21/1993	Lake Trout	Marquette	Yearling	none	15,000	5.7	678
05/15/1995	Lake Trout	Marquette	Adult	right pectoral	1,200	10.6	350
06/05/1996	Lake Trout	Marquette	Yearling	right pectoral	12,000	6.2	706
10/03/1997	Lake Trout	Marquette	Fall fingerling	adipose	20,000	4.6	498
10/09/1998	Lake Trout	Marquette	Fall fingerling	left ventral	20,000	4.8	562
11/01/1999	Lake Trout	Marquette	Fall fingerling	left pectoral	20,000	5	625
09/28/2000	Lake Trout	Marquette	Fall fingerling	right pectoral	20,000	4.6	475
10/10/2001	Lake Trout	Marquette	Fall fingerling	left ventral, right pectoral	20,000	5	627
10/04/2002	Lake Trout	Marquette	Fall fingerling	right pectoral	20,000	5.2	770
11/26/2003	Lake Trout	Marquette	Fall fingerling	left pectoral, right ventral	20,000	4.8	615
10/20/2004	Lake Trout	Marquette	Fall fingerling	left ventral	20,000	5.2	586
10/12/2005	Lake Trout	Marquette	Fall fingerling	left pectoral	20,000	4.1	468

Table 4 - Catch summary for the Grand Sable Lake Status and Trends survey using fyke, trap, gillnets, and seines, June 14-18, 2004.

Species	Lake trout		Northern pike		Rock bass		Smallmouth bass		White sucker		Yellow Perch	
Legal size (in)	>=10		>=24		>=6		>=14		>=		>=7	
Avg. length (in)	27.5		24.7		6.1		10.2		19		5.2	
Avg. weight (lb)		7.6		3.5		0.2		0.9		3		0.1
	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.
Total	2	15.3	43	151.7	206	39.9	26	22.2	77	217.2	51	3.1
No. legal	2		24		128		7		77		5	
% Legal size	100%		56%		62%		27%		100%		10%	
% Total catch	0%	3%	9%	34%	41%	9%	5%	5%	15%	48%	10%	1%
CPE	0	0.3	0.8	2.9	3.9	0.8	0.5	0.4	1.5	4.1	1	0.1
Inch group												
0												
1					2							
2					2	0						
3					11	0.3	1	0			5	0
4					28	1.6	2	0.1			25	0.4
5					35	4.2	5	0.4			13	0.7
6					80	16	1	0.1			3	0.3
7					36	11.3	2	0.4				
8					8	3.7	1				2	0.5
9					3	1.9	1	0.4			2	0.7
10					1	0.9	2	1.2	1	0.5	1	0.5
11							1	0.8	2	1.2		
12												
13							3	3.8				
14							2	3.1				
15							2	3.8	3	4.4		
16							2	4.6	3	5.3		
17			1	1.1					10	21.1		
18			1	1.3			1	3.3	16	40.1		
19			3	4.7					14	40.3		
20			2	3.7					15	50.3		
21			1	2.2					8	31.2		
22			3	7.4					4	17.9		
23			8	22.8					1	5.1		
24	1	5.1	4	13								
25			2	7.2								
26			5	20.8								
27			5	23.3								
28			5	26.1								
29			2	11.6								
30	1	10.2	1	6.5								
31												
Sample total:	2	15.3	43	151.7	206	39.9	26	22.2	77	217.2	51	3.1
All species total:	Number:		499	Weight:		451.8						

Table 5 - Average total length (inches) at age, and growth relative to the state average, for five species of fish from Grand Sable Lake, Alger County,with trap, fyke, gillnets, and seines, June 14-18, 2004. Number of fish aged is given in parentheses.

	Ages										Mean Growth
Species	I	II	III	IV	V	VI	VII	VIII	IX	X	Index*
Lake trout						24.4	30				----
						(1)	(1)				
Northern pike		19	22.7	25.9	26.9	28.2					1.2
		(4)	(12)	(12)	(11)	(1)					
Rock bass	3.4	3.4	4.7	5.8	6.3	6.9	7.5	8.2	8.9	9.6	-1
	(1)	(3)	(11)	(9)	(18)	(7)	(6)	(1)	(1)	(1)	
Smallmouth bass	4.3	6.3	9.2	10.0	14.2	15.2			18.2		-1.3
	(4)	(8)	(2)	(3)	(7)	(2)			(10		
Yellow perch	4.5	5.2	6.8	7.8	8.3	9.1	9.4	9.8			-0.1
	(14)	(19)	(2)	(2)	(5)	(1)	(1)	(3)			

* Mean growth index is the average deviation from the state average length at age.

Table 6 – Mortality estimates (percent) for four species from Grand Sable Lake using catch curve data from netting surveys in 2001 and 2004. Estimates were made using the Robson-Chapman catch curve mortality method (Robson and Chapman 1961).

	2001			2004		
Species	Ages	% annual mortality	Instant[1] mortality	Ages	% annual mortality	Instant[1] mortality
Northern pike	2 – 8	56	83	4 – 6	50[2]	Unknown[2]
Rock bass	---	---		5 – 11	48	65
Smallmouth bass	2 - 7	46	62	1 - 9	28	33
Yellow perch	3 – 6	57	85	1 - 8	36	48

[1] Instant mortality is "Instantaneous Mortality" in the methodology. Higher instantaneous (summer) mortality estimates for predators are presumably due to increased angling harvest. Higher summer mortalities for perch and panfish are presumably due to both angling harvest and increased predation due to higher predator metabolism produced by warmer temperature.

[2] 2004 northern pike weighted age frequency data did not allow the Robson-Chapman methodology to produce a valid Chi-Square verification of similar mortalities across a series of ages.