Comprehensive Fisheries Survey of Two Sisters Lake, Oneida County Wisconsin during 2005.

Waterbody Identification Code 1588200

John Kubisiak
Senior Fisheries Biologist
Rhinelander
August, 2006

WISCONSIN
DEPT. OF NATURAL RESOURCES

SPORT FISH RESTORATION

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EXECUTIVE SUMMARY

A survey targeting gamefish species was conducted in Two Sisters Lake during spring, 2005. Walleye (population estimate, PE = 2.8 adults per acre), northern pike (PE = 0.9 per acre), muskellunge (PE = 0.14 per acre), smallmouth (PE = 1.0 per acre) and largemouth bass were found at moderate abundances. Walleye and muskellunge growth rates are about average, while northern pike and bass length-at-age was around a year behind average by age 5 or 6. Bluegill dominated the panfish catch, along with moderate numbers of rock bass, yellow perch and black crappie. Pumpkinseed, and yellow and black bullheads were also present. Non-game species include bluntnose minnow, cisco, common shiner, creek chub, golden shiner, greater redhorse, hornyhead chub, johnny darter, mimic shiner and white sucker. I recommend continuing to manage Two Sisters Lake for muskellunge, walleye, bass and panfish. Walleye stocking is likely to be a continuing need to maintain the fishery in the face of predation by cisco.

Lake and location:
Two Sisters Lake, Oneida County, T38N R8E Sec19
Located in central Oneida County in the town of Newbold, about 2 miles north of McNaughton. Two Sisters is part of the Upper Wisconsin River watershed. It has no inlet and the outlet is Two Sisters Creek.

Physical/Chemical attributes (Andrews and Threinen 1966):
Morphometry: 719 acres, maximum depth 64 feet.
Watershed: 4 square miles, including 152 acres of adjoining wetlands.
Lake type: Spring. Outlet forms Two Sisters Creek.
Basic water chemistry: Soft – alkalinity 26 mg/l, conductance 72 μmhos.
Water clarity: Clear water of very high transparency.
Littoral substrate: 65% sand, 25% gravel and some muck.
Aquatic vegetation: moderate beds of vegetation, mainly in the bays.
Winterkill: None.
Boat landing: Gravel and concrete ramp with parking for 13 vehicles with trailers and 1 additional vehicle.
Other features: Shoreline 90% upland with coniferous-shrub wetlands adjoining limited portions of the lake basin.

Purpose of Survey: Assess status of gamefish species and develop management recommendations.

Dates of fieldwork: Walleye netting, April 17-22 2005.
Muskellunge netting April 26-May 6 2005.
Mini-fyke netting August 22-23 2005.
Electroshocking (entire shoreline) April 24, June 2, June 9 and October 11 2005.
Hook-and-line bass marking June 1, 2005.

BACKGROUND

A seine haul with a 2,000 foot seine was made on July 22, 1955. The catch consisted of 9 smallmouth bass, 3 northern pike, 7 rock bass, 1 whitefish (15.1 inches, possibly a large cisco), 317 yellow perch and 49 walleyes, 3.0 to 8.9 inches in length (all presumed to be naturally reproduced).

A June 1, 1960 electroshocking survey to investigate "complaints of poor fishing success and increasing numbers of panfish" collected 44 walleye, 1 smallmouth bass, 1 muskellunge, and numerous perch, rock bass and bluegill (1960 Oneida County annual report). A clipping from the annual report states "Because of the abundance of panfish, it is recommended that Two Sisters Lake be placed on the muskellunge stocking quota and stocked at the rate of 5 per acre or 3,500 fish in 1961."

A July, 1965 electroshocking survey is only represented by a clipping from the 1965 Oneida County annual report. It states "This lake has an abundance of spawning areas for walleyes and natural reproduction of walleyes is good. Since periodic plantings of muskellunge were made, this lake has yielded some excellent catches including very large size fish." Continued muskellunge stocking was recommended.

A fyke net and electroshocking survey during May 4-7, October 27-29 and November 17, 1975 is represented by gamefish length-frequency data in the file. The length-frequency includes 155 walleye (mean length = 17.6 inches; five fish were 30.0 to 30.9 inches), 26 muskellunge (mean = 34.7 inches; largest fish was 46.5 to 46.9 inches), 7 northern pike (mean = 19.8 inches) and three smallmouth bass (mean = 8.8 inches).

Four mark-recapture population estimates were conducted, resulting in adult walleye population estimates (number per acre) of 2.1 (1988), 3.1 (1992), 1.9 (1998) and 3.8 (2002). Adult walleye include all sexually mature fish and fish of unknown sex 15 inches and larger. Total walleye population estimates (all fish 7 inches and larger) for the same years 3.0, 7.75, 4.7 and 8.2 fish per acre. The walleye surveys showed a good number of larger fish, including 7 walleyes over 30 inches in 1988 and 1 in 1998.

Adult muskellunge population estimates include all fish 30 inches and larger (32 inches and larger in the 1988 estimate). The muskellunge population was estimated at 0.16 fish per acre (1988), 0.12 (1993), 0.35 (1997) and 0.16 (2002). The largest muskellunge in each survey were over 50, 47.5, 48 and 49 inches, respectively.

I used the Schnabel multiple-capture method (Ricker 1975) to estimate the adult northern pike population from the 2002 data at 0.41 fish per acre ($\pm$ 0.04 SD), including sexually mature fish and all fish 12 inches and larger. The largest pike handled in the 2002 survey was a 43.5-inch female.

Bass population estimates were calculated in 2002, including all fish 8 inches and larger. The largemouth bass population was estimated at 1.4 per acre and the smallmouth estimate was 1.2 per acre. The largest individuals for both species were just over 17 inches.

Angler creel surveys were conducted in 1988, 92, 98, 2002 and 05 (reported separately).

Fall young-of-year electroshocking surveys were conducted by DNR in 1975, 85, 87, 88, 89, 92, 93, 97, 98, 2001, 02, 03 and 05 and by Great Lakes Indian Fish and Wildlife Commission (GLIFWC) in 1990, 91, 93, 94, 97 and 2004.

METHODS

Eight standard fyke nets (3/4" bar measure) were set on April 17, 2005. These nets targeted walleye and northern pike and were fished through April 22. Ten standard fyke nets were fished April 26 through May 6, targeting muskellunge. Eight mini-fyke nets (3/16" bar mesh with 1" bar mesh exclusion netting across the mouth) were fished one night on August 22-23, targeting juvenile and non-game fish. Two WDNR-standard alternating current electrofishing boats were used to collect fish on April 24, June 2, June 9 and October 11, 2005. Hook-and-line was used to capture and mark additional bass on June 1, 2005. Recapture netting for muskellunge was conducted April 25 – May 2, 2006. Length or length category (nearest half-inch) was recorded for all gamefish. Adult gamefish were given a right-ventral fin clip and juveniles were given a top-tail clip for use in mark-recapture population estimates. Age structures (scales or spines) were removed from ten gamefish per species, per half-inch group.

RESULTS AND DISCUSSION

Walleye

During walleye netting, 758 walleye were captured in 5 nights, including 144 recaptures but no juvenile fish (walleye of unknown sex shorter than 15 inches), at a rate of 26.7 walleye per net night (Table 1). The electrofishing sample on April 24 yielded 219 walleye (24 fish per mile), including 2 juveniles. The mark-recapture population estimate of 2004 adult walleye ($\pm$ 264 SD), or 2.8 per acre, is somewhat below the predicted value of 3.5 adult walleye for a lake supported by natural reproduction, but well above the 1.4 per acre predicted for a stocked lake. The total walleye population (including all fish 7 inches and larger) was estimated at 3.7 per acre ($\pm$ 0.6 SD). Walleye showed excellent size structure, with a 19.9 inch average adult length. Nearly half (43%) of adult walleye were 20 inches or larger, while 10% were at least 25 inches (Figure 1). Walleye growth rates were at or above the regional average (Appendix A).

Despite the presence of good spawning gravel, natural recruitment by walleyes in Two Sisters Lake is minimal due to predation by a cisco population. This results in low numbers of young-of-year walleyes in fall surveys. Except for 1998, strong walleye yearclasses correspond to stocking (Figure 2). Privately-funded stocking of about 0.5 to 2.5 large fingerling walleyes per acre occurred in 1983, 2001 and 2003 (Table 2). Large fingerlings are stocked in fall, typically after electroshocking surveys are complete, but they should show up as age-1 fish the following year.

Figure 1. Length-frequency of adult walleye during 2005 in Two Sisters Lake, Oneida County WI.

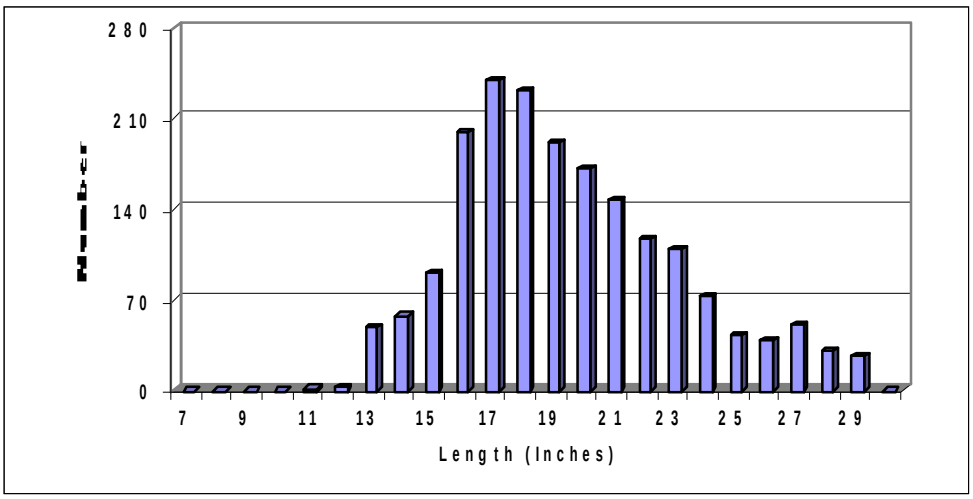


Figure 2. Walleye young-of-year surveys and small fingerling stocking in Two Sisters Lake, Oneida County Wisconsin. The solid line at about 16 per mile is a benchmark value for recruitment to the fishery.

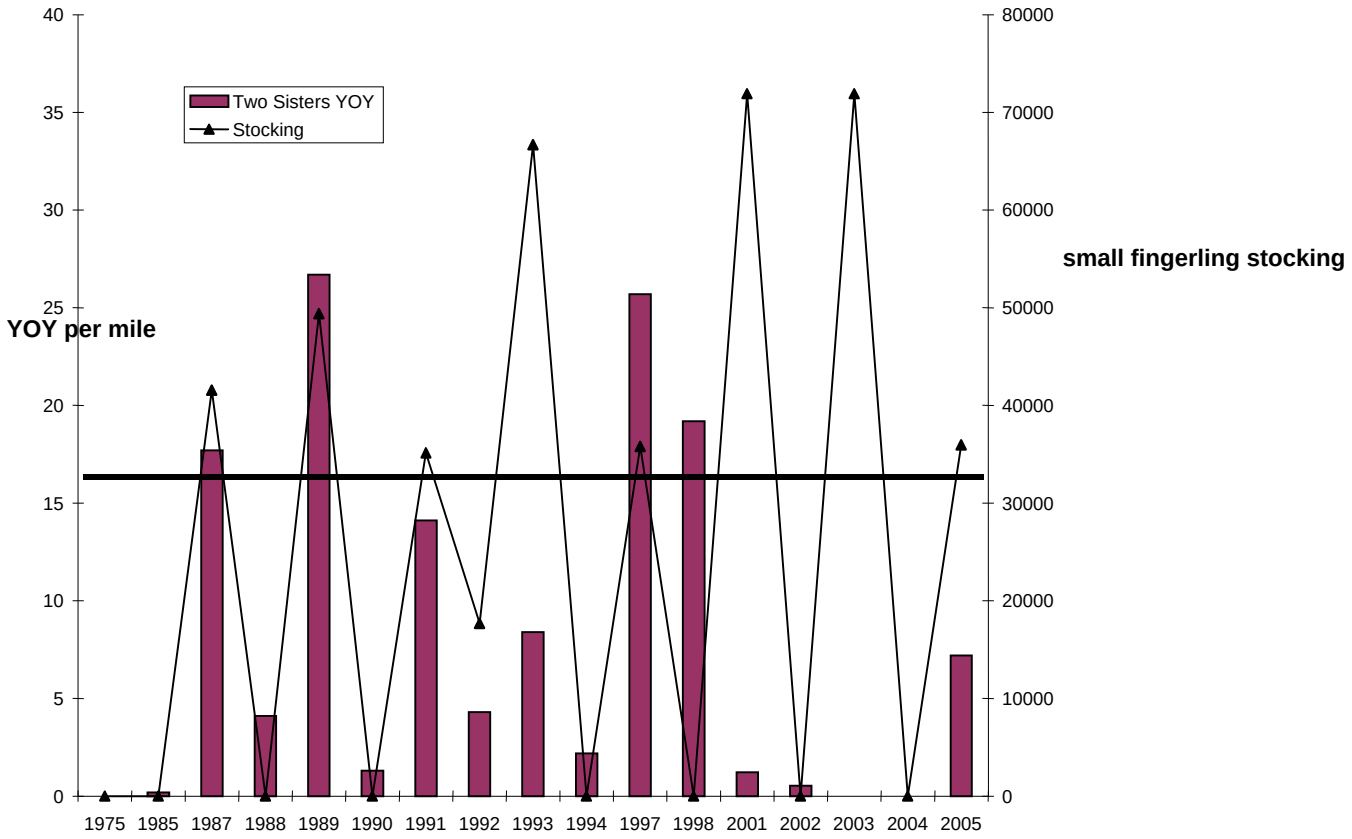


Table 1. Fish catch per unit effort during a 2005 survey of Two Sisters Lake, Oneida County Wisconsin. Netting catch rates are reported as number of fish per net night, while electrofishing catch rates are number of fish per mile of shoreline. Only gamefish data were collected during April shocking and non-game data were only collected from two 0.5-mile index stations on October 11.

species	walleye netting	April 24 shocking	muskie netting	June 2 shocking	June 9 shocking	Aug 23 mini-fyke	Oct 11 shocking
walleye	26.7	23.5	2.1	11.0	0	0.4	7.7
largemouth bass	0	0.1	0.1	3.5	5.6	5.9	5.0
smallmouth bass	0.05	0.4	0.04	12.3	12.1	2.4	2.5
muskellunge	0.5	0.7	0.3	0.3	0	0.1	0.3
northern pike	1.1	0.7	0.7	0.7	0	0	2.0
black bullhead	0.03		0			0	0
black crappie	0.4		0.3			0	1.0
bluegill	0.9		4.8			22.6	107.0
hybrid bluegill x pumpkinseed	0		0			0	1.0
bluntnose minnow	0		0			20.1	2.0
cisco	0		0			0	1.0
common shiner	0.07		0.01			0	6.0
creek chub	0.05		0			0	0
golden shiner	0		0.02			0	0
greater redhorse	0.5		0.05			0	0
hornyhead chub	0		0			0.1	0
johnny darter	0		0			0.3	1.0
mimic shiner	0		0			0	12.0
pumpkinseed	0		0.05			0.1	2.0
rock bass	2.6		0.9			3.3	22.0
unidentified sunfish	0		0.1			0	0
white sucker	0.5		0.3			0	2.0
yellow bullhead	0		0.03			0.1	2.0
yellow perch	0.5		1.6			1.3	8.0

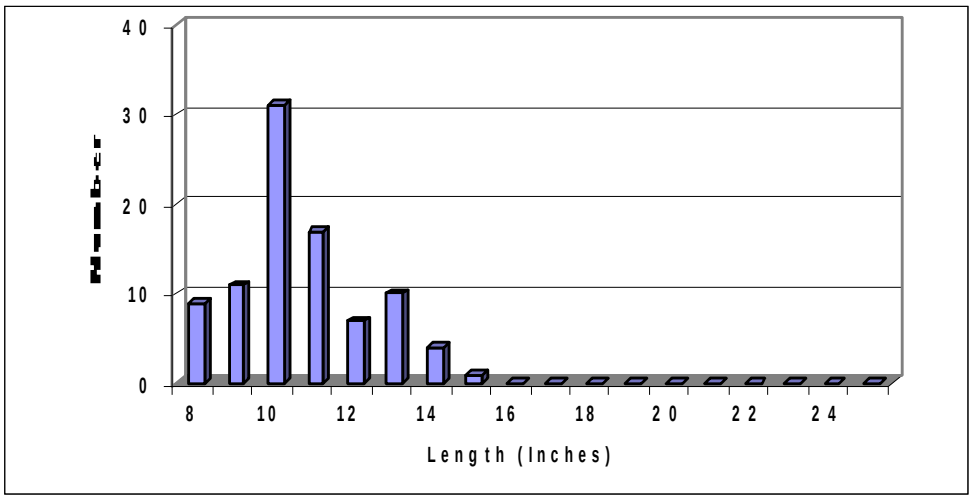
Table 2. Fish stocking record during 1980 through 2005 in Two Sisters Lake, Oneida County WI.

Year	Species	Size	Number	Comments
1980	muskellunge	large fingerling (8 inch)	1,400	
1982	walleye	small fingerling (3 inch)	12,000	
1983	walleye	large fingerling (7 inch)	400	Permit issued to Lake Assoc.
1983	muskellunge	large fingerling (10 inch)	700	
1985	muskellunge	large fingerling (10 inch)	1,408	
1986	walleye	small fingerling	35,000	
1987	walleye	small fingerling	41,565	
1989	walleye	small fingerling (2 – 4 inch)	49,406	
1990	muskellunge	large fingerling (11 inch)	1,370	
1991	walleye	small fingerling (2.2 inch)	35,144	
1991	muskellunge	large fingerling (10.5 inch)	700	
1992	walleye	fry (0.2 inch)	688,500	
1992	muskellunge	fry (0.6 inch)	35,750	
1992	walleye	small fingerling (2 inch)	17,686	
1992	muskellunge	large fingerling (9.8 inch)	850	
1993	muskellunge	fry	10,500	
1993	walleye	small fingerling	30,540	
1995	walleye	fry	1,000,000	
1995	muskellunge	fry	168,000	
1995	walleye	small fingerling	36,144	
1996	muskellunge	fry (0.5 inch)	100,000	
1996	muskellunge	large fingerling (10.7 inch)	1,400	
1997	walleye	fry	500,000	
1997	walleye	small fingerling	35,973	
1998	walleye	fry (0.3 inch)	1,000,000	
1998	muskellunge	fry (0.5 inch)	56,000	
1999	walleye	small fingerling (1.5 inch)	71,900	
2000	walleye	fry (0.3 inch)	2,000,000	
2000	muskellunge	fry (0.5 inch)	62,600	
2001	muskellunge	fry (0.5 inch)	162,000	
2001	walleye	small fingerling (1.6 inch)	71,900	
2001	walleye	large fingerling (6 inch)	700	Two Sisters Lake Assoc.
2003	walleye	small fingerling (1.3 inch)	71,900	
2003	walleye	large fingerling (6.5 inch)	1,675	Two Sisters Lake Assoc.
2005	walleye	small fingerling (1.3 inch)	35,947	

Largemouth Bass

One hundred and one largemouth bass were captured during spring sampling, including only two recaptures of previously-marked fish and 14 juvenile fish less than 8 inches in length. Another 47 juvenile largemouth were captured in August mini-fyke nets and 20 were captured during the fall electroshocking survey. The longest largemouth was 15.2 inches, and only 6% were 14 inches and larger (Figure 3). Largemouth bass growth rates were about ½-year behind average (Appendix A).

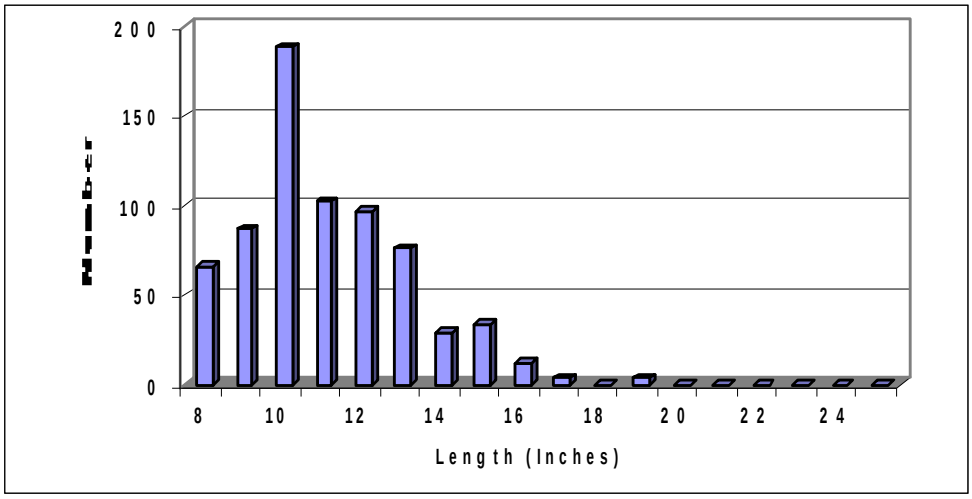
Figure 3. Length-frequency of largemouth bass during 2005 in Two Sisters Lake, Oneida County Wisconsin.



Smallmouth Bass

Spring sampling resulted in a catch of 246 smallmouth, including 23 recaptures and 23 juvenile fish smaller than 8 inches. Another 19 juveniles were captured during August mini-fyke netting and ten smallmouth were captured during fall shocking. The adult smallmouth population (including all fish 8 inches and larger) was estimated at 701 (± 133 SD) or 1.0 per acre. The largest smallmouth was 19.8 inches long and 12% were 14 inches or larger (Figure 4). Similar to largemouth, the smallmouth were growing about a year behind the regional average (Appendix A).

Figure 4. Length-frequency of smallmouth bass during 2005 in Two Sisters Lake, Oneida County Wisconsin.



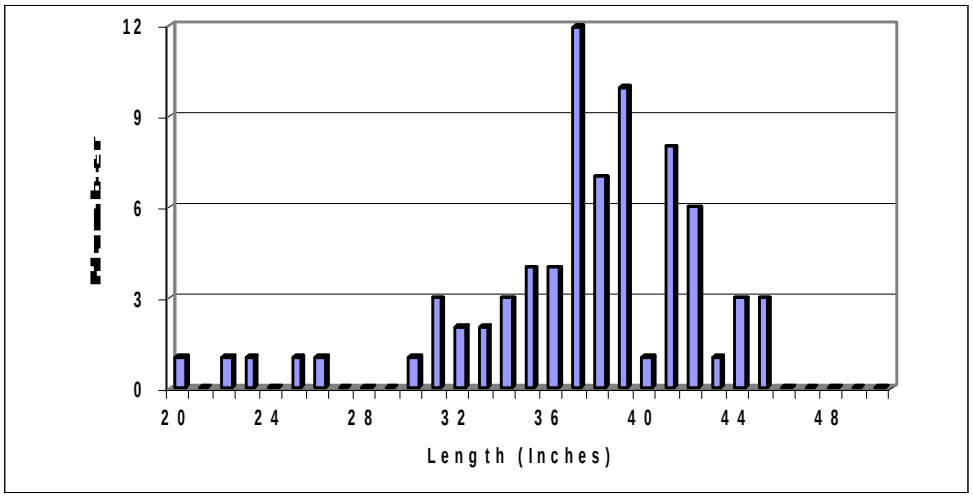
Muskellunge

Fifty-nine muskellunge were captured during spring netting and shocking, including 6 recaptures. Six juvenile muskellunge, including three age-1 fish from 9 to 12.1 inches, were captured during spring shocking; one was captured during summer mini-fyke netting and one (18 to 18.4 inches,

likely age-1) was captured during fall shocking. The largest fish captured in 2005 was a 42.6 inch female aged at 13 years, but several fish up to 45.9 inches were captured in 2006 (Figure 5). The recapture portion of the mark-recapture population estimate was conducted by netting during spring, 2006 resulting in an estimated adult muskellunge population (including fish 30 inches and longer) of 104 (± 17 SD) or 0.14 fish per acre.

According to records in the lake file, muskellunge fry were stocked in 1939, 40 and 41 and fingerlings were stocked beginning with 366 in 1958 and 1,801 in 1960. A 1960 survey recommended muskellunge stocking, and the 1965 Oneida County annual report states "Since periodic plantings of muskellunge were made, this lake has yielded some excellent catches including very large size fish." At age seven, a female muskellunge in northern Wisconsin averages 35.8 inches (Appendix A), so it likely that the excellent muskellunge catches in 1965 were mainly the result of naturally-reproduced fish. Currently, muskellunge have not been stocked in Two Sisters Lake since a 2001 fry stocking and large fingerlings were last stocked in 1996 (Table 2), so our capture of six juvenile muskellunge is further evidence that natural reproduction is occurring.

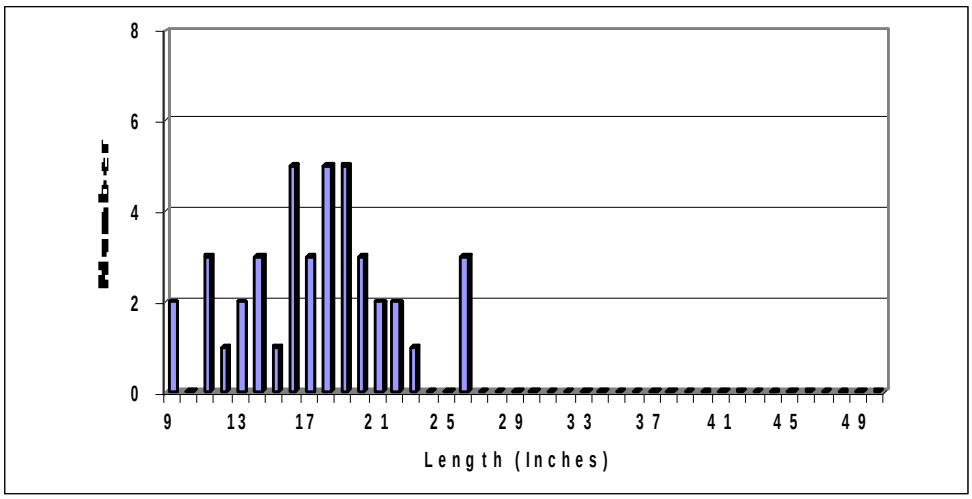
Figure 5. Length-frequency of adult muskellunge during 2005 and 2006 in Two Sisters Lake, Oneida County Wisconsin.



Northern Pike

One hundred twenty-three northern pike were captured during spring netting and shocking (including 3 juvenile and 10 recaptures). Another 9 northerns were captured during fall shocking. The northern pike population (including sexually mature fish and all fish over 12 inches) was estimated at 625 (± 197 SD), or 0.9 per acre, using the Schnabel multiple-capture method (Ricker 1975). Although this is higher than the 2002 estimate of 0.41 per acre, northern pike populations less then 2 fish per acre are considered low-density. Pike lengths-at-age were about a year behind the regional average (Appendix A). Average size of adult northern pike was 18.6 inches and the largest northern pike was a 28.4 inch fish of unknown sex (Figure 6).

Figure 6. Length-frequency of adult northern pike during 2005 in Two Sisters Lake, Oneida County Wisconsin.



Panfish

Two Sisters has low fertility and moderate aquatic vegetation, resulting in relatively low panfish abundance. A targeted panfish survey was not performed, but bluegill dominated the panfish catch, along with moderate numbers of rock bass, yellow perch and black crappie (Table 1).

MANAGEMENT RECOMMENDATIONS

Two Sisters Lake supports a diverse, well-balanced fishery. Walleye were the dominant gamefish, along with moderate populations of smallmouth bass and muskellunge and low densities of largemouth bass and northern pike. Size structure of walleyes was excellent. Muskellunge size was fairly good, but lower numbers of fish over 40 inches were found than in previous surveys. Few bass exceeded 15 inches. Bluegill were the dominant panfish, followed by rock bass. Lower numbers of black crappie, pumpkinseed, yellow perch and yellow and black bullhead were also present. Forage and non-game species included white suckers, bluntnose minnow, cisco, common shiner, creek chub, golden shiner, hornyhead chub, johnny darter, and mimic shiner. Good numbers of greater redhorse, listed by the State of Wisconsin as a threatened species, were also present. The muskellunge population is reproducing naturally. Some natural reproduction of walleye is occurring, but predation on walleye fry by cisco restricts the contribution of natural reproduction. Maintenance stocking of small fingerling walleye helps maintain the population. Two Sisters is best managed for muskellunge, walleye and panfish, with bass providing a secondary fishery.

ACKNOWLEDGEMENTS

Mike Coshun supervised the field work for this survey with assistance from Steve Ave'Lallemant, Dave Brum, Doug Day, Kevin Gauthier, Steve Gilbert, Jason Halverson, Marty Kiepke, Steve Kramer, Steve Timler, Tim Tobias, Joelle Underwood, Dave Van De Water, Mike Vogelsang, Doug Yonker and me. Steve Kramer assigned ages from fish scales. Dave Van De Water entered and summarized data. Mike Coshun calculated the walleye, bass and muskellunge population estimates.

LITERATURE CITED

Andrews, L. M. and C. W. Threinen. 1966. Surface water resources of Oneida County. Wisconsin Conservation Department, Madison, Wisconsin. 284 pages.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bull 191, Dept. Env. Fish. Mar. Sci., Ottawa.

Cover image courtesy of TerraServer-USA website and the United States Geological Survey. http://terraserver-usa.com

APPENDIX A
FISH AGE RESULTS

The walleye and smallmouth bass aged sub-sample was applied against the full length-frequency to eliminate bias from a non-random subsample.

Table A.1. Female walleye length-at-age in Two Sisters Lake, Oneida County Wisconsin during 2005.

Age	Number of fish	Two Sisters avg length	Northern WI avg
5			16.1
6	20	19.7	17.6
7	27	20.7	19.5
8	20	22.1	21.2
9	7	23.2	22.6
10	8	24.8	23.8
11	2	24.0	24.9
12	3	25.5	25.8
13	3	26.5	26.9
14	1	27.8	27.5
15	5	26.9	28.0
16	6	27.3	27.7
17	8	27.9	
18	9	27.7	

Table A.2. Male walleye length-at-age in Two Sisters Lake, Oneida County Wisconsin during 2005.

Age	Number of fish	Two Sisters avg length	Northern WI avg
3	10	13.6	11.6
4	5	14.4	13.0
5	5	14.9	14.5
6	13	16.3	15.8
7	19	17.6	16.9
8	12	18.1	18.1
9	8	18.4	18.9
10	8	19.2	19.7
11	4	20.0	20.4
12	4	20.5	20.6
13	1	19.2	21.3
14	0		22.0
15	2	22.8	21.6
16	2	23.1	
17	2	22.4	
18	2	24.8	
20	1	24.3	

Table A.3. Largemouth bass length-at-age in Two Sisters Lake, Oneida County Wisconsin during 2005.

Age	Number of fish	Two Sisters avg length	Northern WI avg
3	2	8.7	8.9
4	7	10.4	10.5
5	14	11.3	12.1
6	9	12.7	13.6
7	9	13.9	14.9

Table A.3. Smallmouth bass length-at-age in Two Sisters Lake, Oneida County Wisconsin during 2005.

Age	Number of fish	Two Sisters avg length	Northern WI avg
3	13	8.6	9.3
4	23	10.6	11.8
5	9	12.3	13.5
6	15	13.8	15.2
7	11	15.0	16.1
8	1	16.1	17.1
12	1	19.8	19.8

Table A.4. Female muskellunge length-at-age in Two Sisters Lake, Oneida County Wisconsin during 2005.

Age	Number of fish	Two Sisters avg length	Northern WI avg
7	2	37.2	35.8
8	1	36.1	38.1
9	2	39.0	39.5
10	3	40.9	41.0
11	3	41.7	43.2
12	1	41.5	43.7
13	1	42.6	44.3

Table A.5. Male muskellunge length-at-age in Two Sisters Lake, Oneida County Wisconsin during 2005.

Age	Number of fish	Two Sisters avg length	Northern WI avg
5	3	29.4	29.2
6	2	32.1	31.5
7	2	33.2	33.3
8	2	35.8	34.4
9	2	36.8	35.8
10	9	38.5	37.3
11	3	38.8	37.9
12	1	36.3	39.0

Table A.6. Female northern pike length-at-age in Two Sisters Lake, Oneida County Wisconsin during 2005.

Age	Number of fish	Two Sisters avg length	Northern WI avg
1			13.1
2	1	13.0	14.4
3	10	14.6	16.9
4	7	17.8	20.4
5	4	20.7	23.1
6	3	21.0	24.4
7	3	25.9	27.3

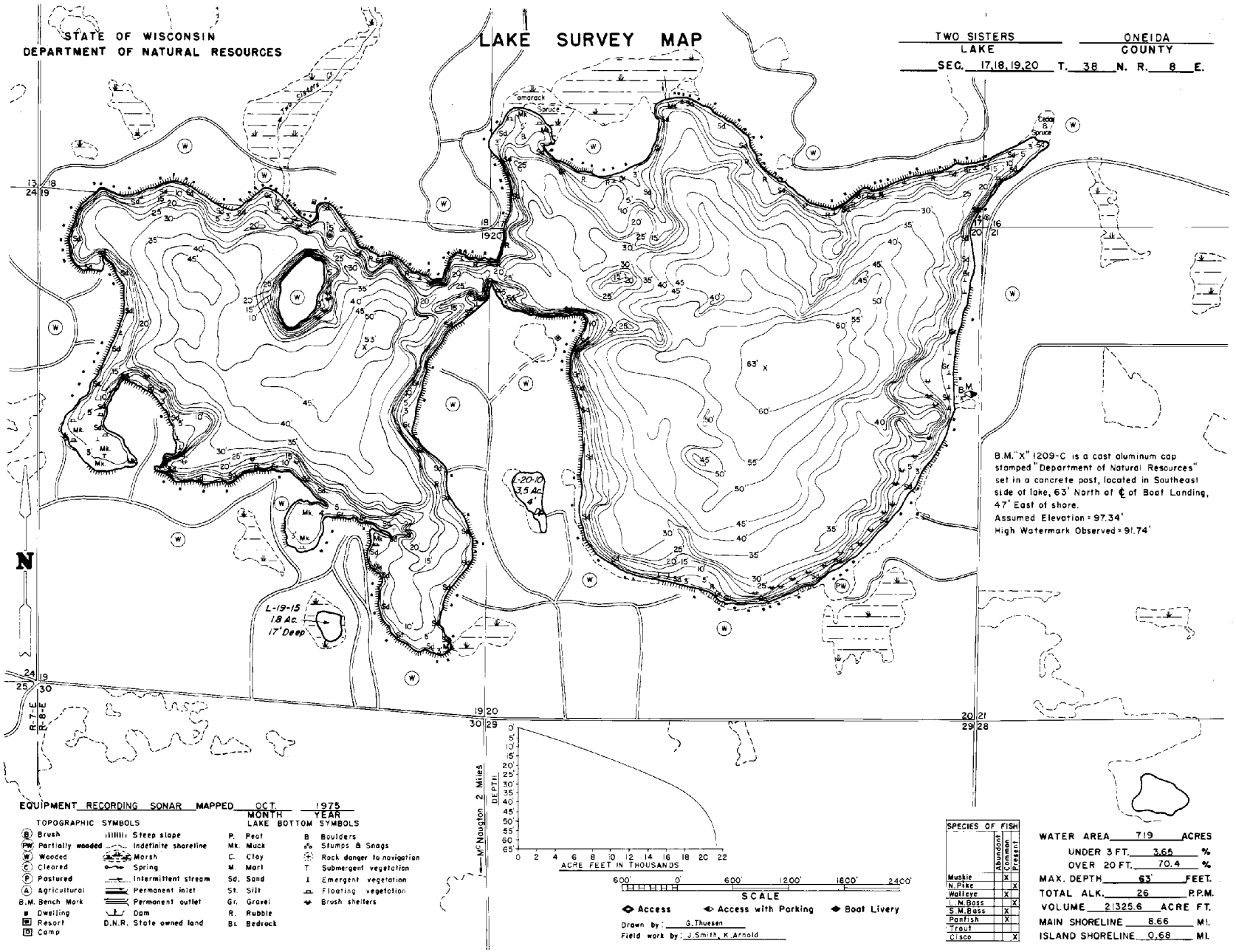
Table A.7. Male northern pike length-at-age in Two Sisters Lake, Oneida County Wisconsin during 2005.

Age	Number of fish	Two Sisters avg length	Northern WI avg
1			10.7
2	3	11.3	13.4
3	8	15.1	16.2
4	10	16.8	18.9
5	3	18.8	20.6
6	1	20.2	22.3
7	1	25.0	23.4

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

LAKE SURVEY MAP

TWO SISTERS LAKE — ONEIDA COUNTY
SEC. 17,18,19,20 T. 38 N. R. 8 E.



B.M. "X" 1209-C is a cast aluminum cap stamped "Department of Natural Resources" set in a concrete post, located in Southeast side of lake, 63' North of ℄ of Boat Landing, 47' East of shore.
Assumed Elevation = 97.34'
High Watermark Observed = 91.74'

EQUIPMENT RECORDING SONAR MAPPED OCT. (MONTH) 1975 (YEAR)

TOPOGRAPHIC SYMBOLS

- (B) Brush
- (PW) Partially wooded
- (W) Wooded
- (C) Cleared
- (P) Pastured
- (A) Agricultural
- B.M. Bench Mark
- Dwelling
- Resort
- Camp
- Steep slope
- Indefinite shoreline
- Marsh
- Spring
- Intermittent stream
- Permanent inlet
- Permanent outlet
- Dam
- D.N.R. State owned land

LAKE BOTTOM SYMBOLS

- P. Peat
- Mk. Muck
- C. Clay
- M. Marl
- Sd. Sand
- St. Silt
- Gr. Gravel
- R. Rubble
- Bl. Bedrock
- B Boulders
- Stumps & Snags
- Rock danger to navigation
- T Submergent vegetation
- Emergent vegetation
- Floating vegetation
- Brush shelters

◆ Access ◆ Access with Parking ◆ Boat Livery

Drawn by: G. Thuesen
Field work by: J. Smith, K. Arnold

SPECIES OF FISH	Abundant	Common	Present
Muskie		X	
N. Pike			X
Walleye		X	
L.M.Bass			X
S.M.Bass	X		
Panfish		X	
Trout			
Cisco			X

WATER AREA 719 ACRES
UNDER 3 FT. 3.65 %
OVER 20 FT. 70.4 %
MAX. DEPTH 63' FEET.
TOTAL ALK. 26 P.P.M.
VOLUME 21325.6 ACRE FT.
MAIN SHORELINE 8.66 MI.
ISLAND SHORELINE 0.68 MI.