Fisheries Survey of Squash Lake, Oneida County Wisconsin during 2009.

Waterbody Identification Code 1019500

John Kubisiak
Senior Fisheries Biologist
Rhinelander
December, 2011

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EXECUTIVE SUMMARY

A survey targeting walleye was conducted in Squash Lake during spring and fall, 2009. Largemouth bass and walleye (population estimate = 2.0 adults per acre) were the dominant gamefish, with moderate numbers of smallmouth bass and northern pike. All game species appeared to be in very good condition. We captured good numbers of quality-size but relatively few trophy-size gamefish. Panfish catch was low, but we noted exceptional bluegill size. Panfish and nongame species included black crappie, bluegill, bluegill x pumpkinseed hybrids, rock bass, yellow bullhead, yellow perch and white sucker. I recommend managing Squash Lake for walleye, bass, northern pike and panfish. All species are self-sustaining. The current walleye regulation of "No minimum length limit on walleye, but only one fish over 14 inches is allowed" should be changed to a more protective 18 inch minimum length limit.

Lake and location:
Squash Lake is a seepage lake in the Upper Wisconsin River watershed. It is located in south-central Oneida County, T36N R08E Sec19. Squash Lake is in the town of Crescent, about 4 miles west of the city of Rhinelander.

Physical/Chemical attributes (Andrews and Threinen 1966):
Morphometry: 396 acres with maximum depth of 74 feet (1975 lake map).
Watershed: 4.5 square miles, including 8 acres of adjoining wetlands.
Lake type: Seepage (no inlet or outlet)
Basic water chemistry: Soft – alkalinity 19 mg/l, conductance 51 µmhos.
Water clarity: Clear water of high transparency.
Littoral substrate: 40% sand, 35% gravel, 15% rubble and some muck.
Aquatic vegetation: moderate. Eurasian water milfoil was first reported in 2009.
Winterkill: none.
Boat landing: One concrete plank ramp with parking for about 5 vehicles with trailers.
Other features: Shoreline 95% upland with a limited amount adjoined by bog and meadow wetland.

Purpose of Survey: Assess status of the walleye population and develop management recommendations. This survey was originally planned in collaboration with the University of Wisconsin, Stevens Point Fisheries Society, a student subunit of Wisconsin Chapter of the American Fisheries Society. Early ice-out, logistical issues and severe weather that put off electrofishing resulted in Department of Natural Resources staff conducting the survey.
Dates of fieldwork: Gamefish netting, April 16 to April 21 2009. Electrofishing (or shocking) the entire shoreline, April 25 and September 22, 2009.

BACKGROUND

During October 28-30, 1952, 243 cisco averaging 10 inches were stocked. During October, 1955, 2 large mesh and 2 small mesh fyke nets were set along with an experimental 50-foot vertical gill net to assess the cisco population. The nets were moved daily, but no cisco were captured. The catch included 33 walleye (9-19 inches), 8 smallmouth bass, 9 largemouth bass, 145 sucker, 21 perch, 18 crappie, 18 bluegill and 1 bullhead. Remarks by Milton Burdick include "Some good smallmouth fishing, walleyes small. Lake appears to have an abundant population of large suckers."

A single sheet of netting data is from four days of netting during May 13-17, 1956 (12 net nights). The catch was 339 walleye (10 – 20 inches), 2,165 sucker, 5 crappie, 11 bluegill and 4 smallmouth.

On July 21, 1964, a dissolved oxygen profile was taken to look at the suitability of Squash for lake trout introduction. At 25 feet, Oxygen was 6.0 parts per million and temperature was 68 F, while at 30 feet, Oxygen was 3.7 parts per million and temperature was 61 F. The marginal oxygen levels in water 65 F or colder and the relatively low area of water deeper than 30 feet resulted in a recommendation that lake trout not be introduced. Management for walleye and smallmouth bass was suggested (Morehouse 1964).

A netting and shoreline seining survey was conducted during 1970 (Berndt 1972). Thirty net lifts during April 27-39, 1970 captured 31.4 walleye, 0.5 northern pike and 0.4 smallmouth bass per net-night. "Test netting indicated a good population of walleyes. Year classes are well represented from years the lake wasn't stocked." No fish stocking was recommended. Panfish and rough fish catch per net-night included 4.4 bluegill, 2.7 yellow perch, 0.1 black crappie and 1.4 yellow bullhead and 8.2 white sucker. Four seine hauls on August 25, 1970 captured 30 yoy smallmouth bass, 53 bluegill, 9 warmouth and 96 "minnows." Largemouth bass, rock bass, pumpkinseed, bluntnose minnow and common shiner were also listed as present, possibly because of prior surveys since they are not listed in the catch records. Aquatic vegetation was described as "generally lacking".

A netting and electrofishing survey was conducted during 1976 (Serns 1977). Fifteen net lifts during April 19-22, 1976 captured 23.3 walleye, 1.1 northern pike and 1.1 smallmouth bass per net night. "The results of the netting indicates a good walleye population, with a total catch of 350. The size range was from 9.5-29.9 inches with an average length of 15 inches." Non-game fishes per net night include 0.4 black crappie, 10.9 bluegill, 0.3 rock bass, 20.7 white sucker, 0.2 yellow bullhead and 1.5 yellow perch. Bluntnose minnow, mimic shiner and mottled sculpin are additional species noted during June 21 and/or August 18, 1976 electrofishing. The June 21 electrofishing "...catch of yearlings indicates good natural reproduction of walleyes in 1975. The electrofishing survey also indicated smallmouth bass natural reproduction in 1974..." August 18 electrofishing "indicated excellent walleye natural reproduction had occurred in 1976." Walleye growth was average through age IV and above average after. Northern pike, bluegill, yellow perch and smallmouth bass were growing above average. Rusty crayfish were listed as abundant, although not as dense as in nearby Crescent Lake. At least one commercial trapper was trapping crayfish in Squash Lake.

A mark-recapture walleye survey in 1991 estimated 2,003 adult walleye (± 135 SD), or 5.1 per acre. Thirty percent of the walleye were 15 inches or larger and 1.4% were at least 20 inches. The crew recorded 39.3 walleye, 0.63 northern pike (13.3 to 23.1 inches) and 0.037 largemouth bass (one fish, 16.0 inches) per net night. Only walleye were picked up during electrofishing, at 34.5 per mile.

A single night of electrofishing was conducted on April 20, and six mini-fyke nets (1/8 inch mesh) were set on August 10-11, 2005 in response to angler complaints of low walleye catch. The

electrofishing catch included 224 adult walleye (30.3 per mile) and 36 juveniles 5 to 15 inches in length. Males were 11 to 19.9 inches in length with a mode at 16.2 inches. Female lengths were scattered between 15 and 20.4 inches. The mini-fykes captured mostly juveniles of 11 species, with catch rates of 9.5 largemouth, 2.8 smallmouth, 1.6 walleye, 80 bluegill, 48 bluntnose minnow, 2.5 green sunfish, 2.2 yellow bullhead, 2.0 yellow perch, 1.5 rock bass, 0.67 pumpkinseed and 0.16 black crappie per net night. It is likely that either the juvenile green sunfish or the warmouth (Berndt 1972) were misidentified. Both species are rare in the region and fairly similar in appearance, especially as juveniles.

A 9-month stratified-random angler creel survey was conducted during May 4 1991 through March 1 1992, excluding the month of November. Angler effort of 37.1 hours per acre was nearly identical to the Oneida County average of 37.2. Northern pike were the dominant gamefish caught (1,517), followed closely by walleye (1,150), smallmouth bass (790) and largemouth bass (364). Bluegill were the dominant panfish caught (7,517), followed by rock bass (1,749), yellow perch (1,101) and black crappie (95).

Fall young-of-year (yoy) electrofishing surveys were conducted by DNR in 1961, 76, 81, 85, 91, 2005 and 2009 and by GLIFWC in 1990, 92-94, 96-98, 2000-04 and 06-07. The 2005 survey added golden shiner to the species list with a single individual, 3.5 to 3.9 inches in length.

METHODS

The ice was out except for some remnant shoreline ice when 8 standard fyke nets (¾-inch mesh, bar measure) were set on April 16, 2009. Eight nets were fished through April 20, and 5 nets remained through April 21. Effort was 37 net-nights. A WDNR-standard alternating current electrofishing boat was used to collect gamefish on April 25, and juvenile gamefish on September 22, 2009. Length or length category (nearest half-inch) was recorded for all gamefish during spring. Adult gamefish were given a right-ventral fin clip and juveniles were given a top-tail clip for use in mark-recapture population estimates, but only walleye were clipped during the April 20 electrofishing run. Age structures (scales or spines) were removed from ten fish per species, per half-inch group.

RESULTS AND DISCUSSION

Walleye

During walleye netting, 465 walleye were captured in 5 nights, including 66 recaptures, at a rate of 12.6 walleye per net night (Table 1). The electrofishing sample on April 25 yielded 209 walleye (28.2 fish per mile), including 2 juveniles (unknown-gender fish less than 15 inches in length). The mark-recapture population estimate of 809 adult walleye (± 57 SD), or 2.0 per acre, is below the predicted value of 3.5 for a 396-acre lake supported by natural reproduction, but within the normal range (95% prediction interval) of 1.1 to 10.7 adult walleye per acre. Walleye showed a good range of sizes up to 20 inches but few fish over 20 inches and only one fish over 25 inches were captured (Figure 1). The largest walleye was a 25.6-inch female aged at 9 years with a scale. 79% of adult walleye were 15 inches or larger but only 3.9% exceeded 20 inches in length. This compares to the 1991 results of 30% at least 15 inches and 1.4% over 20 inches. In 1976, 39% of adults were at least 15 and 1.1% 20 inches and in 1970 only 2 of 812 walleye were over 20 inches. Low abundance of large fish is often seen in lakes with very high recruitment and harvest. In contrast, deep, clear lakes like Squash tend to be more difficult for anglers to fish, which often allows more fish to survive to larger size. Given the good growth rates in Squash Lake (Appendix A, Figures 2 and 3), the low number of walleye 25 inches and larger is puzzling, but it is consistent with past surveys.

Relative weight (a measure of 'plumpness,' where a higher number means a plumper fish) of male walleye increased from 66.4 in 1991 to 81.9 in 2009. Female relative weight (which is also influenced by presence of eggs) increased from 75.7 to 84.8. Male walleye length-at-age was above average until age 7, then very close to the regional averages; female length-at-age was about average through age 8 (Appendix A, Figures 2 and 3). By comparison, in 1991 at a population of 5.1 per acre, male walleye length-at-age was average until age 7, when they dropped slightly behind; females were mostly near average except for a small number of older fish, which were slow-growing (Appendix A, Figures 2 and 3). The increased relative weight and length-at-age indicate that walleye were better fed in 2009 than in 1991, probably due to the decline in abundance.

Fall surveys show consistent weak to moderate natural reproduction of walleye in Squash Lake (Figure 4). The modal yoy catch across northern Wisconsin waters supported by natural reproduction is about 16 yoy per mile. However, some lakes like Squash are able to maintain a walleye population despite much lower catch in fall surveys. It is unclear if this is because low numbers of yoy survive exceptionally well in these lakes, or if more fish are there but fail to show up in the electrofishing catch because of lake and habitat characteristics. The current walleye regulation "No minimum length limit on walleye, but only one fish over 14 inches is allowed" is inappropriate for a lake with weak recruitment, and it should be changed to an 18 inch minimum length limit.

Table 1. Fish catch per unit effort during a 2009 survey of Squash Lake, Oneida County WI. 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 shocking runs and only juvenile-size fish were collected on September 22.

species	spring netting	April 25 shocking	Sept 22 shocking
walleye	12.6	28.2	0.71
largemouth bass	0.67	17.6	0.43
northern pike	0.89	4.1	0.14
smallmouth bass	0.76	3.2	0.43
black crappie	2.0		
bluegill	2.4		
hybrid bluegill x pumpkinseed	0.081		
rock bass	6.2		
white sucker	2.7		
yellow bullhead	2.1		
yellow perch	0.054		

Figure 1. Length-frequency of adult walleye during 2009 in Squash Lake, Oneida County WI.

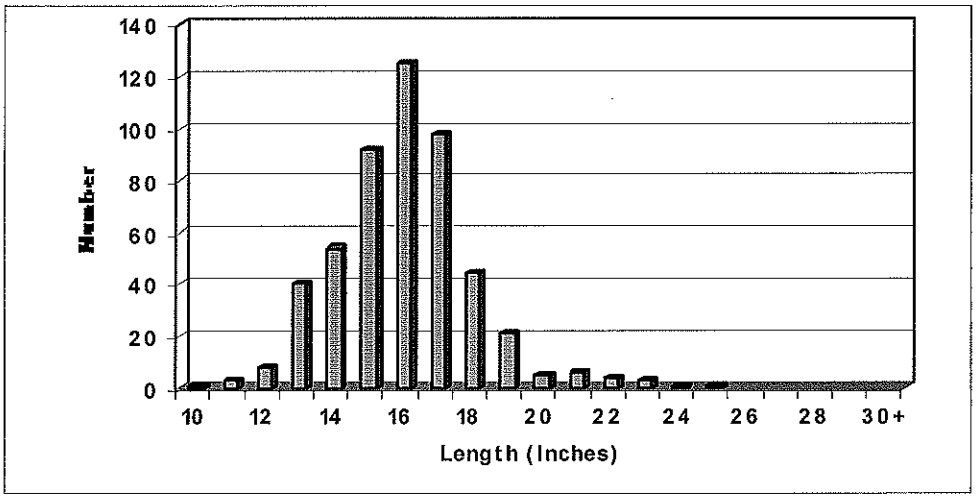


Figure 2. Male walleye length-at-age during 2009 and 1991 in Squash Lake, Oneida County WI.

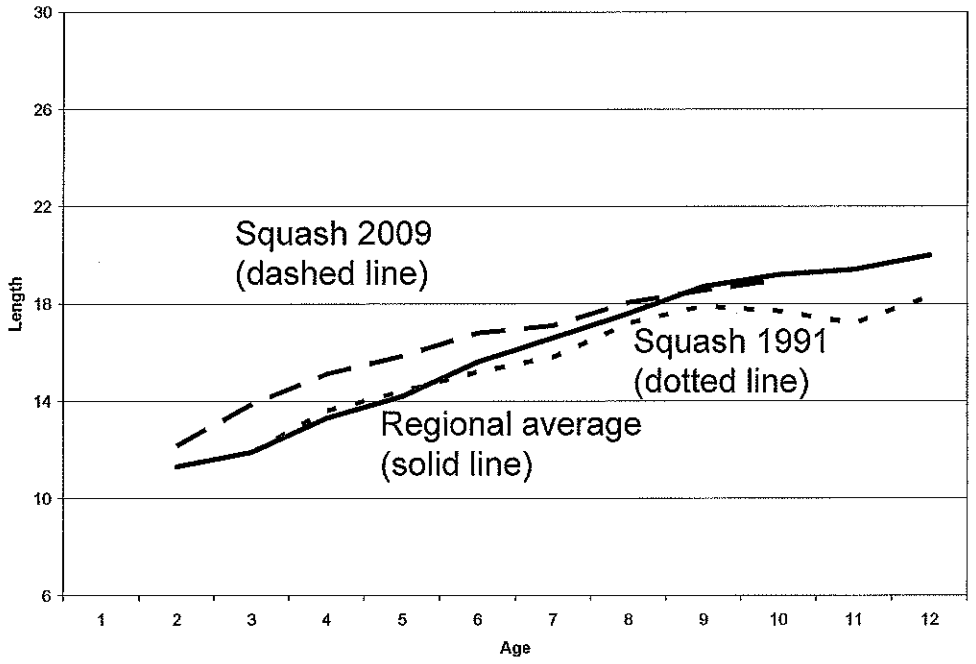


Figure 3. Female walleye length-at-age during 2009 and 1991 in Squash Lake, Oneida County WI.

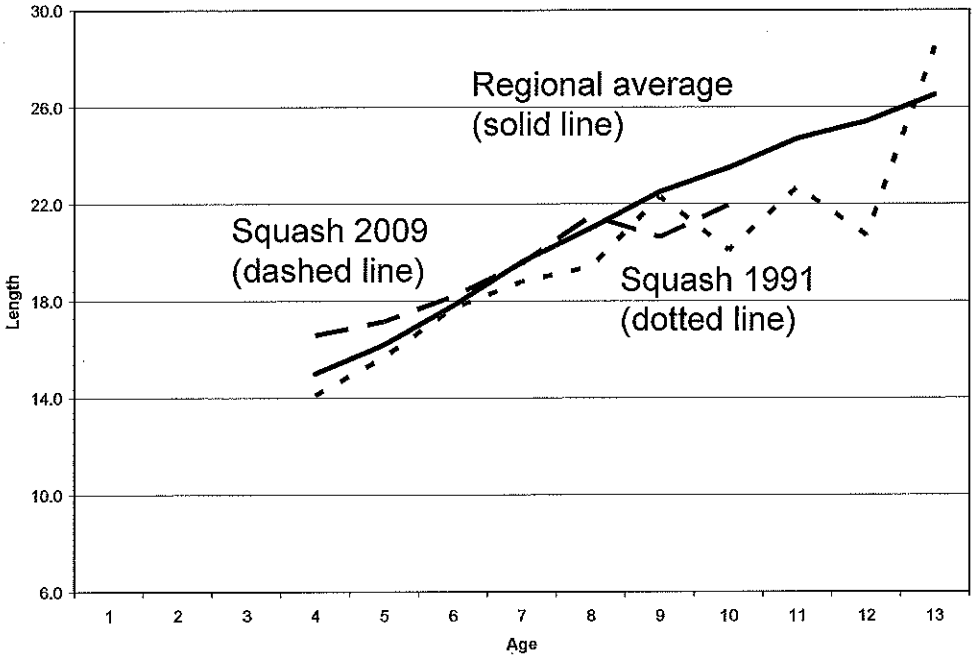
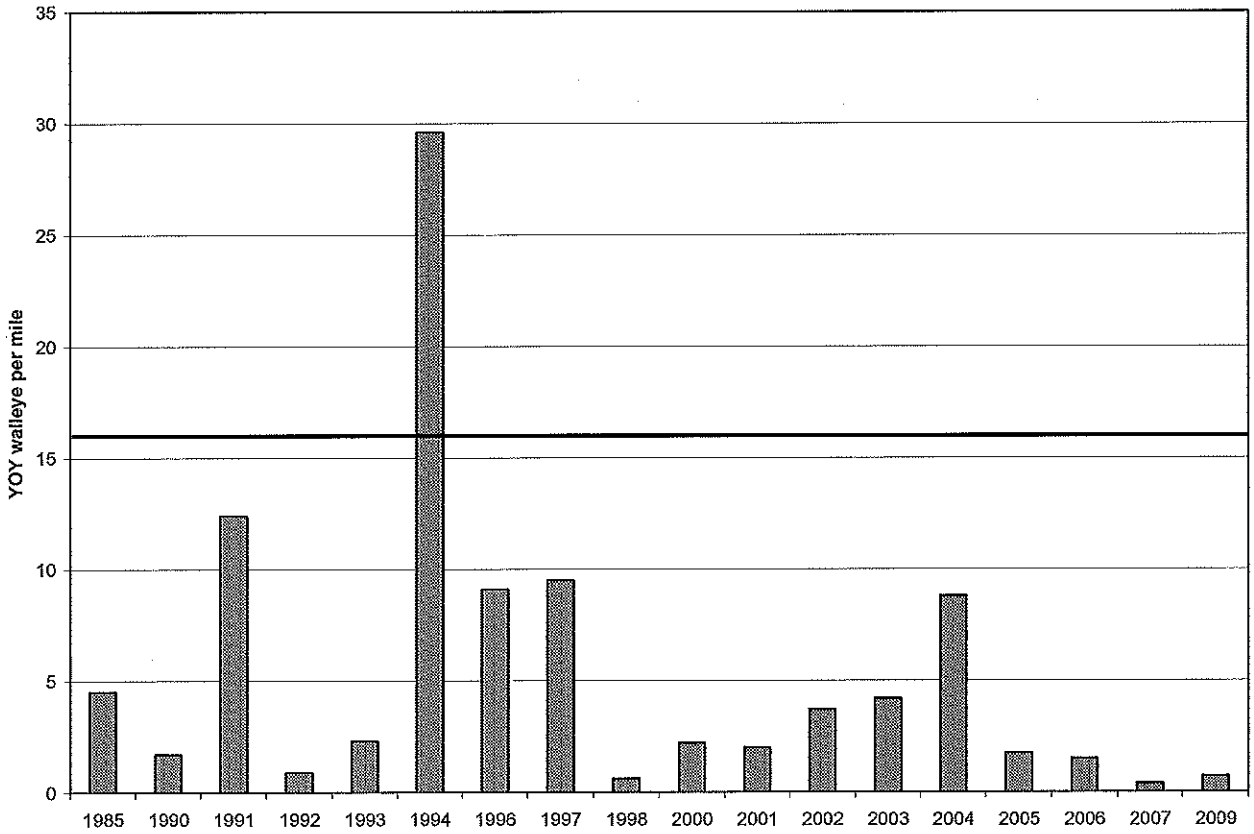


Figure 4. Walleye young-of-year (yoy) surveys in Squash Lake, Oneida County Wisconsin. The solid horizontal line marks the modal catch of 16 yoy walleye per mile of shoreline in northern Wisconsin lakes supported by natural reproduction.



Largemouth and Smallmouth Bass

Twenty-five largemouth bass were captured during spring netting (including 1 recapture of a previously-marked fish) and 130 during April 25 electrofishing. Bass were measured but not fin-clipped on April 25, so a population estimate was not attempted. Largemouth size was dominated by 13 to 15 inch fish, and 43% were 14 inches and larger (Figure 5). The longest largemouth were two 17.4-inch fish weighing 2.4 and 2.5 pounds, both aged at 7 based on a scale. Largemouth were growing a little ahead of regional averages (Appendix A), and relative weight was 87.9.

Fifty-two smallmouth bass were captured during the survey, 26 during netting and 24 during April 25 electrofishing. The majority of smallmouth were distributed fairly evenly from 12 to 16 inches (Figure 6) and the largest was 16.7 inches, weighed 2.4 pounds and was age 8 based on a scale. Smallmouth length-at-age was a year or more behind regional averages (Appendix A). Relative weight was 85.7

Spring surveys suggest that Squash historically had a strong smallmouth population, but largemouth bass increased in abundance and surpassed smallmouth in recent years. No largemouth and 4 smallmouth were captured in 4 days of netting in May, 1956. Largemouth are listed as "present" in a 1970 species list (Berndt 1972) but they are not included in the catch records; 13 smallmouth were captured in spring and 30 were captured by summer seining in that survey. Only a single 2.5-inch largemouth and 53 smallmouth were captured in the 1976 survey (Serns 1977). A single 16.0-inch largemouth was captured in 3 days of netting during 1991. The 1991 creel survey projected angler catch at 790 smallmouth and 364 largemouth bass. Thirteen fall surveys in 1955 through 2009 (excluding another 9 surveys where only walleye are reported) generally show low catch of both species, but more smallmouth are captured in most years through 1998. After 1998, largemouth dominate in the fall, 2000 and 2005 surveys, while equal but low numbers of both species were captured in 2001 and 2009.

Figure 5. Length-frequency of adult largemouth bass during 2009 in Squash Lake, Oneida Co. WI.

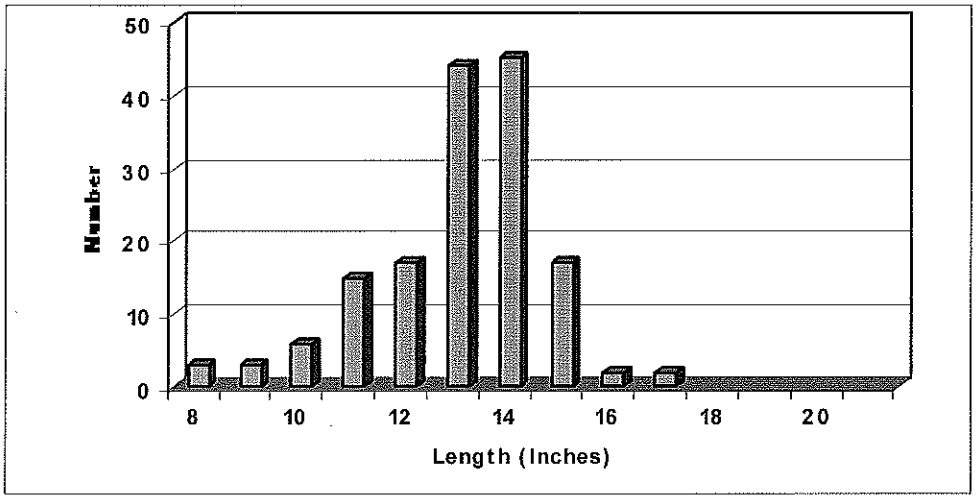
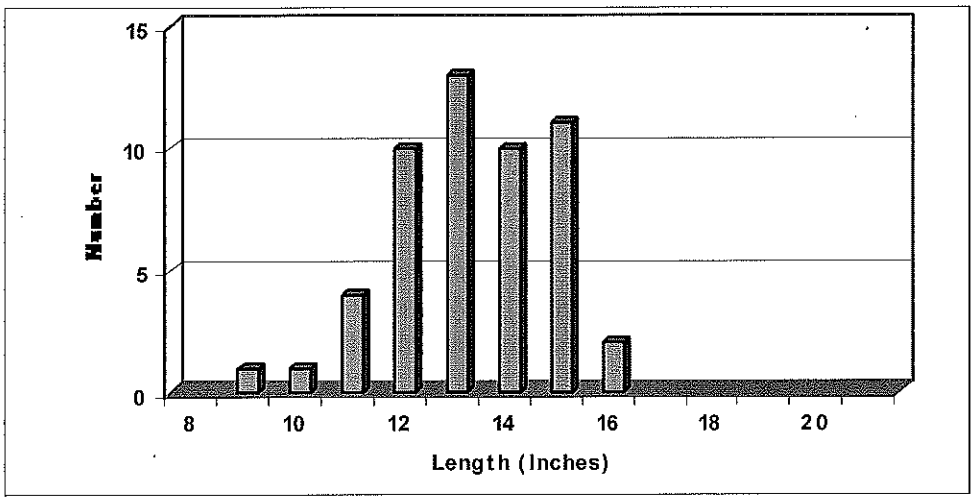


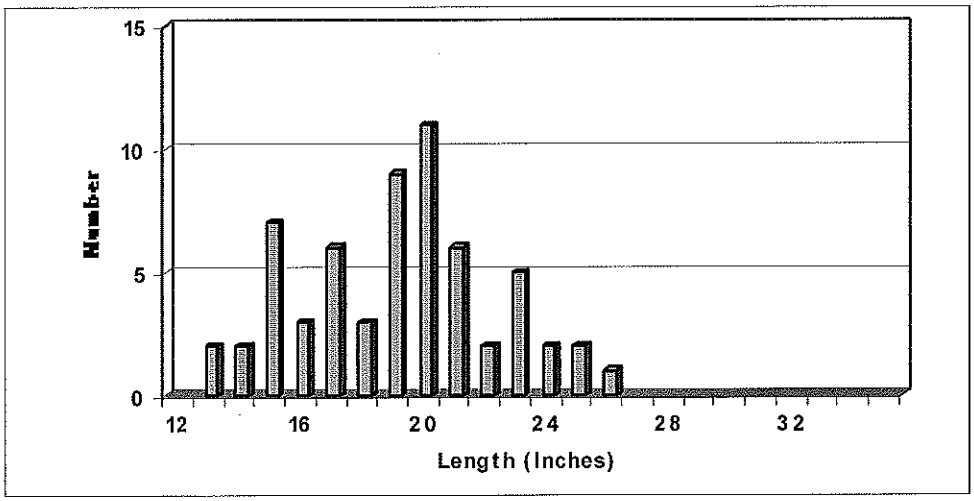
Figure 6. Length-frequency of adult smallmouth bass during 2009 in Squash Lake, Oneida Co. WI.



Northern Pike

We captured 63 northern pike (including 1 recapture of a previously-marked fish and 1 immature fish less than 12 inches in length). Average size of adult northern pike was 19.6 inches (Figure 7). The largest pike was a 26.3 inch female that weighed 3.1 pounds and was aged at 7 from a scale. Length-at-ages were about average through age 4 and about a year behind regional averages for older ages (Appendix A).

Figure 7. Length-frequency of adult northern pike during 2009 in Squash Lake, Oneida Co. WI.



Panfish

Squash is a deep, clear lake with low fertility. Nearshore aquatic vegetation is moderate, although rooted macrophytes grow to depths exceeding 15 feet, and nitella is present in 20-30 feet of water. The vegetation will undoubtedly change with the recent introduction of non-native Eurasian watermilfoil, which had established scattered stands and had likely had been present for one or more years when discovered in 2009. Centrarchid panfish are vegetation-oriented, and their abundance is often low but with good size potential in lakes like Squash. April netting is too cold and early for

most panfish species, but we caught low numbers of rock bass, bluegill, yellow bullhead, black crappie, bluegill x pumpkinseed hybrids and yellow perch (Table 1). Pumpkinseed must be present to produce the hybrids, but none were captured due to the early timing of the survey; 8 pumpkinseed were captured in 2005. We captured a number of 10-inch bluegill, and one exceptional fish that measured 12.0 inches.

MANAGEMENT RECOMMENDATIONS

Walleye and largemouth bass were the dominant gamefish, with moderate numbers of smallmouth bass and northern pike. We found good numbers of quality-size gamefish, but low numbers of very large fish. Panfish catch was light, but netting was too early to expect a high catch. Rock bass, bluegill, yellow bullhead, black crappie, bluegill x pumpkinseed hybrids and yellow perch were all present, along with white sucker. Trout were stocked in Squash Lake most years from 1988 through 2006. However, relatively large numbers of catchable-size trout did not make a strong contribution to the angler creel and stocking was discontinued. Rusty crayfish were considered abundant and were being trapped commercially in 1976 (Serns 1977), but have declined to low numbers. Squash is best managed for walleye, bass, northern pike and panfish. I recommend that the current walleye regulation of "No minimum length limit on walleye, but only one fish over 14 inches is allowed" be changed to a more restrictive 18 inch minimum length limit.

ACKNOWLEDGEMENTS

Steve Timler and I supervised the field work for this survey with assistance from Jason Halverson, Gina Rammer and Tim Tobias. Steve Timler assigned fish ages from scales and Mike Coshun calculated the walleye population estimate.

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

APPENDIX A
FISH AGE RESULTS

For species and genders with at least 50 lengths, the aged subsamples were applied against the full length-frequency to eliminate bias from a non-random subsample.

Table A.1. Male walleye length at age in Squash Lake, Oneida County Wisconsin during 2009 and 1991.

Age	No. fish 2009	Squash average 2009	No. fish 1991	Squash average 1991	Northern WI avg.
2	6	12.2			11.3
3	16	13.9	21	11.9	11.9
4	8	15.1	13	13.6	13.3
5	10	15.8	4	14.4	14.2
6	7	16.8	10	15.2	15.6
7	7	17.1	8	15.8	16.6
8	10	18.0	4	17.2	17.6
9	4	18.5	2	17.9	18.7
10	2	19.0	4	17.7	19.2
11			3	17.2	19.4
12	1	16.8	2	18.3	20.0
13					
14			1	19.0	

Table A.2. Female walleye length at age in Squash Lake, Oneida County Wisconsin during 2009 and 1991.

Age	No. fish 2009	Squash average 2009	No. fish 1991	Squash average 1991	Northern WI avg.
4	6	16.6	19	14.1	15.0
5	16	17.2	13	15.7	16.2
6	9	18.2	6	17.7	17.8
7	12	19.6	12	18.8	19.6
8	11	21.5	8	19.4	21.0
9	6	20.6	4	22.3	22.5
10	3	22.0	1	20.1	23.5
11			3	22.7	24.7
12			1	20.7	25.4
13			1	28.5	26.5

Table A.3. Largemouth bass length at age in Squash Lake, Oneida County Wisconsin during 2009.

Age	Number of fish	Squash avg. length	Northern WI avg.
2			6.6
3	3	9.0	8.9
4	14	11.2	10.5
5	14	13.0	12.1
6	20	14.1	13.6
7	11	14.7	14.9
8			15.8
9			16.2
10			17.1

Table A.4. Smallmouth bass length at age in Squash Lake, Oneida County Wisconsin during 2009.

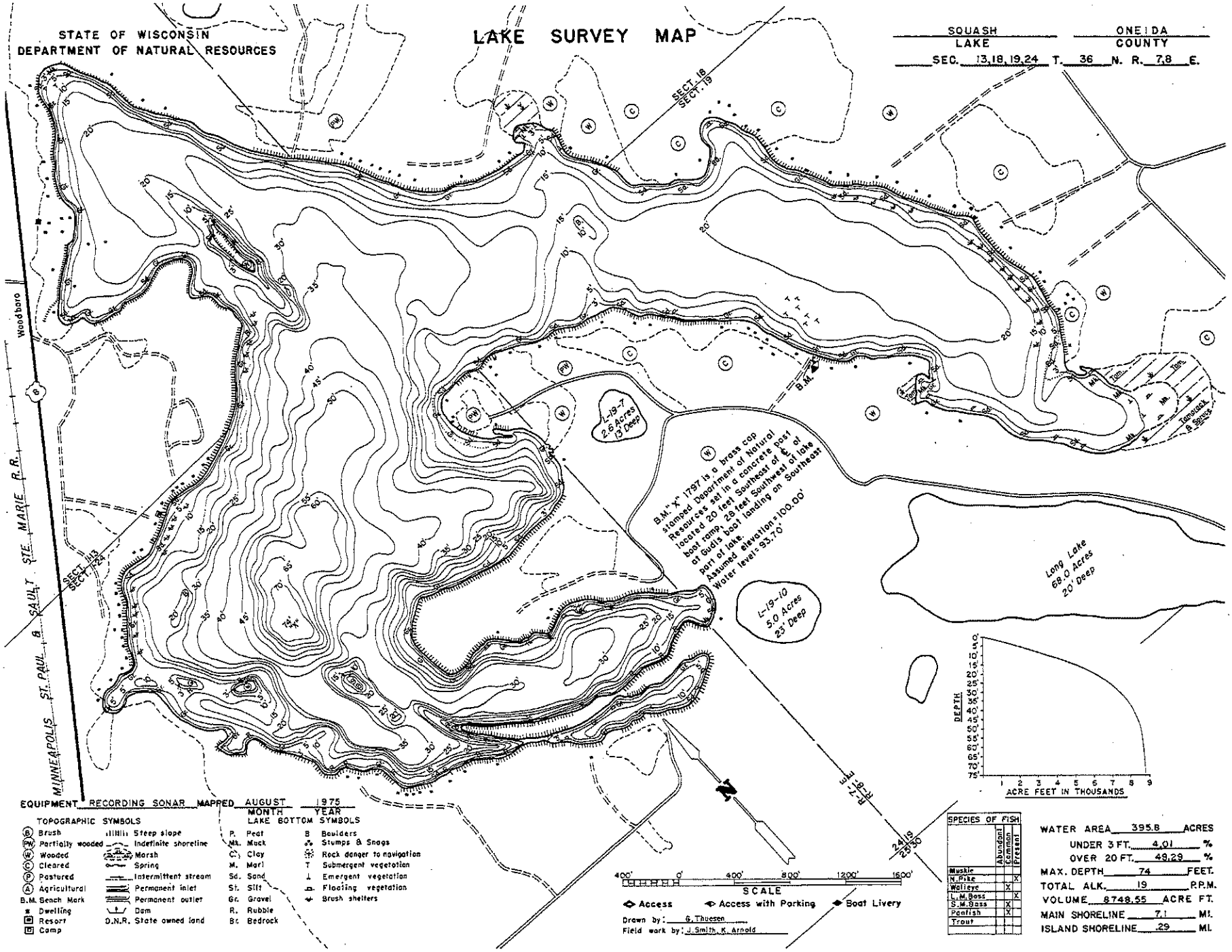
Age	Number of fish	Squash avg. length	Northern WI avg.
2			6.9
3			9.3
4	1	11.1	11.8
5	2	11.7	13.5
6	8	13.2	15.2
7	9	14.6	16.1
8	11	14.4	17.1
9	3	14.5	17.7
10			18.3

Table A.5. Male northern pike length at age in Squash Lake, Oneida County Wisconsin during 2009.

Age	Number of fish	Squash avg. length	Northern WI avg.
2	1	15.5	13.4
3	3	15.1	16.2
4	7	18.3	18.9
5	3	18.7	20.6
6	5	21.7	22.3
7	1	22.0	23.4
8			24.8
9			23.9

Table A.6. Female northern pike length at age in Squash Lake, Oneida County Wisconsin during 2009.

Age	Number of fish	Squash avg. length	Northern WI avg.
2			
3	10	17.7	16.9
4	7	19.1	20.4
5	5	21.2	23.1
6	1	24.1	24.4
7	1	26.3	27.3
8			28.8
9			32.1


STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES
LAKE SURVEY MAP
SQUASH LAKE
ONEIDA COUNTY
SEC. 13,18,19,24 T. 36 N. R. 7,8 E.
SECT. 18
SECT. 19
SECT. 13
SECT. 24
Woodboro
ST. PAUL & SAULT STE. MARIE R.R.
MINNEAPOLIS
L-19-7
2.6 Acres
13' Deep
L-19-10
5.0 Acres
23' Deep
Long Lake
68.0 Acres
20' Deep
B.M. "X" 1797 is a brass cap stamped Department of Natural Resources set in a concrete post located 20 feet Southeast of boat ramp, 28 feet Southwest of lake part of Gudis boat landing on Southeast.
Assumed elevation=100.00'
Water level=95.70'
B.M.
Tamarack
Tamarack & Spruce
DEPTH
ACRE FEET IN THOUSANDS
EQUIPMENT RECORDING SONAR MAPPED AUGUST 1975
MONTH YEAR
TOPOGRAPHIC SYMBOLS
Brush
Partially wooded
Wooded
Cleared
Pastured
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
Br. Bedrock
B Boulders
Stumps & Snags
Rock danger to navigation
T Submergent vegetation
Emergent vegetation
Floating vegetation
Brush shelters
400' 0' 400' 800' 1200' 1600'
SCALE
Access
Access with Parking
Boat Livery
Drawn by: G. Thuesen
Field work by: J. Smith, K. Arnold
SPECIES OF FISH
Abundant
Common
Present
Muskie
N. Pike
Walleye
L.M. Bass
S.M. Bass
Panfish
Trout
WATER AREA 395.8 ACRES
UNDER 3 FT. 4.01 %
OVER 20 FT. 49.29 %
MAX. DEPTH 74 FEET.
TOTAL ALK. 19 P.P.M.
VOLUME 8748.55 ACRE FT.
MAIN SHORELINE 7.1 MI.
ISLAND SHORELINE .29 MI.