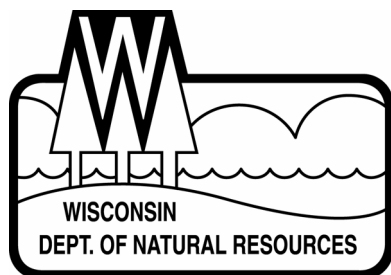


Fisheries Survey of Manson Lake, Oneida County Wisconsin during 2006.

Waterbody Identification Code 1517200



John Kubisiak
Senior Fisheries Biologist
Rhinelanders
July, 2007



Your purchase of fishing equipment
and motor boat fuel supports boating
access and Sport Fish Restoration.

Fisheries Survey of Manson Lake, Oneida County Wisconsin during 2006.

John Kubisiak
Senior Fisheries Biologist
July, 2007

EXECUTIVE SUMMARY

A survey targeting gamefish species was conducted in Manson Lake during spring, 2006. Largemouth and smallmouth bass were the dominant game species. Walleye were low density (population estimate, PE = 1.3 adults per acre), along with low numbers of northern pike and muskellunge. Muskellunge growth rates were about average, while length-at-age of other game species lagged behind regional averages. Bluegill dominated the panfish catch, followed by rock bass and yellow perch. Black crappie, pumpkinseed and black and yellow bullhead were found at low abundance. Non-game species include blacknose shiner, bluntnose minnow, golden shiner, johnny darter and white sucker. Walleye and muskellunge show some natural reproduction, but periodic stocking seems to be required to maintain their populations over the long term. Recent declines in Eurasian watermilfoil may provide improved spawning conditions for muskellunge. I recommend managing Manson Lake for bass and panfish, with stocked walleye and muskellunge providing a secondary fishery.

Lake and location:

Manson Lake, Oneida County, T36N R07E Sec 32

Located in southwest Oneida County. Manson is in the town of Woodboro, about 11 miles southwest of the city of Rhinelander. Manson is part of the Upper Wisconsin River watershed. The inlet drains Roe and Stag Lakes. Inlet and outlet are both named Manson Creek.

Physical/Chemical attributes (Andrews and Threinen 1966):

Morphometry: 236 acres, maximum depth 54 feet.

Watershed: 4.0 square miles, including 12 acres of adjoining wetlands.

Lake type: Drainage. Inlet and outlet are Manson Creek.

Basic water chemistry: Soft – alkalinity 26 mg/l, conductance 66 µmhos.

Water clarity: Clear water of high transparency.

Littoral substrate: 55% sand, 15% rubble, 15% boulders, 10% gravel and some muck.

Aquatic vegetation: Moderate. Aquatic invasive species include purple loosestrife, Eurasian watermilfoil and curly leaf pondweed.

Winterkill: none reported.

Boat landing: Concrete plank ramp with parking for 2 vehicles with trailers and 1 additional vehicle.

Other features: Shoreline 95% upland with a limited amount of wetland adjoining the lake.

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

Dates of fieldwork: Walleye netting April 12-16 2006.

Bass netting May 22-26 2006.

Mini-fyke netting August 28-29 2006.

Hook-and-line bass marking May 31 2006.

Electroshocking (entire shoreline) April 16, May 31, June 8 and September 13 2006.

BACKGROUND

An August 1949 netting survey found good numbers of smallmouth bass, walleye and northern pike, along with two muskellunge (Burdick 1951). Largemouth bass had been stocked for several years, but only two young-of-year were captured. Muskellunge and walleye had also been stocked regularly for a number of years. Bluegill were abundant, along with good numbers of crappie, rock bass, perch and 'sunfish' (likely pumpkinseed). Panfish showed good size structure and growth, except bluegill and rock bass were slow growing after age 3. Smallmouth bass were growing above average, northern pike and muskellunge about average and walleyes slightly below average. For future management "It is suggested that any future plantings in Manson Lake be made with the intent to manage this body of water as smallmouth bass rather than walleye waters." (Burdick 1951).

A netting survey during June 9-12 1969 found "a mediocre population of predator game fish." (Berndt 1972). Only 6 walleye, 4 smallmouth bass, 2 northern pike and 2 muskellunge were captured in 24 net nights. The low net catch was partially attributed to cold, rainy weather. Bluegill were abundant, with 50.7 per net night, along with good numbers of rock bass, black crappie and pumpkinseed and low numbers of yellow perch, white sucker, golden shiner, yellow bullhead, black bullhead and burbot (in declining order). Berndt (1972) recommended three years of large fingerling walleye stocking at 50 per acre: "After this three year period the lake should be surveyed to see what effect this rather heavy stocking rate had in establishing walleye year classes. Muskellunge fingerling stocking is recommended on the assumption natural reproduction is not adequate to maintain a satisfactory muskellunge fishery." At that time, large fingerling walleye were generally stocked in August or September at 2 to 4 inches in length. Walleye were stocked in 7 years between 1970 and 1978; muskellunge were stocked in 4 years over the same period.

An April 16-20 1990 netting survey consists of a single summary page of walleye catch: 85 male walleye had a modal size of 13.2 inches, while 22 females had modes at 18.2 and 19.7 inches. 11 unknown-sex fish were also captured. Catch per net night is not given, but was likely either 4.9 or 3.7 per net night, if either 6 or 8 nets were set for 4 nights. At this time, Manson had not been stocked with walleye since 1978, indicating a moderate population supported by natural reproduction. Small fingerling walleye were subsequently stocked in odd-numbered years during 1991 through 1997.

A walleye mark-recapture population estimate was conducted by DNR in 2000. The adult walleye population was estimated at 3.5 adults per acre. Most of the fish were between 11 and 15 inches in length, but there were fish of all sizes out to 27 inches. This compares to a predicted adult walleye population of 3.6 per acre in an average 236-acre lake with good natural reproduction, with a 95% prediction interval of 1.2 to 10.9 adult walleye per acre.

Fall young-of-year (yoy) electroshocking surveys were conducted by DNR in 1961, 81, 90, 2000 and 2006 and Great Lakes Indian Fish and Wildlife Commission (GLIFWC) in 1992-96, and 2002-05.

Angler creel surveys were conducted in 2000 and 2006 (reported separately and summarized below). The surveys covered the entire gamefish season during May through early March, excluding the low-effort month of November. Angler effort was an estimated 49.4 hours per acre in 2000 and 52.8 during 2006, compared to a 1990-2005 Oneida County average of 38.8 hours per acre. Walleye and northern pike catch and harvest declined between the two surveys, while largemouth bass and bluegill increased in 2006 (Table 1). Other species were remarkably similar between years.

Prior to 1990, there was no minimum length limit on walleye; a 15-inch minimum was in place during 1990 through 1996; during 1997 through 2003 there was no minimum length limit (but only 1 fish could be over 14 inches) and from 2004 to present a 15-inch minimum length limit has been in place. Walleye harvest decreased dramatically in 2006 compared to 2000 (Table 1), at least partly because the change in fishing regulations required fish smaller than 15 inches to be released.

Table 1. Angler creel survey results from Manson Lake, Oneida County Wisconsin during 2000 and 2006. Creel surveys were conducted during the gamefish open season (early May through early March), excluding the low-effort month of November.

	Total catch (2006)	Total catch (2000)	Total harvest (2006)	Total harvest (2000)	Mean length of harvested fish (2006)	Mean length of harvested fish (2000)
walleye	173	861	36	198	20.0	12.9
largemouth bass	1759	450	46	21	15.9	17.0
smallmouth bass	2159	2485	29	42	14.8	16.8
muskellunge	140	100	0	0		
northern pike	13	210	12	4	25.4	26.7
black crappie	801	626	548	394	10.8	10.6
bluegill	17,566	9016	4649	3394	7.0	6.3
pumpkinseed	44	53	0	38		7.4
rock bass	4552	3006	513	324	8.1	6.3
yellow perch	3413	3323	1660	1169	8.2	7.4

METHODS

Eight standard fyke nets (3/4" bar measure) were set on April 12 2006. These nets targeted walleye and northern pike and were fished through April 16. Five standard fyke nets were fished May 22 through 26, targeting largemouth and smallmouth bass. Additional bass were captured by hook-and-line on May 31. Six mini-fyke nets (3/16" bar mesh with 1" bar mesh exclusion netting across the mouth) were fished one night on August 28-29, targeting juvenile and non-game fish. A WDNR-standard alternating current electrofishing boat was used to collect fish on April 16, May 31, June 8 and September 13 2006. Length or length category (nearest half-inch) was recorded for all gamefish. Adult gamefish were given a left-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, 221 walleye were captured in 4 nights, including 33 recaptures and 9 juvenile fish (walleye of unknown sex shorter than 15 inches), at a rate of 6.9 walleye per net night (Table 2). The electrofishing sample on April 16 yielded 27 walleye (4.7 fish per mile), including 6 juveniles. The mark-recapture population estimate of 305 adult walleye (± 42 SD), or 1.3 per acre, is below the predicted value of 3.6 for a 236-acre lake supported by natural reproduction, but is within the 95% prediction interval of 1.2 to 10.9 per acre.

Walleye showed fairly good size structure: nearly 25% of adult walleye were 15 inches or larger, while 9.4 % were at least 20 inches (Figure 1). The low number of 17 to 21-inch fish indicates several years of near-zero recruitment, but the relatively large number of 12 to 14 inch fish is a good sign of recent recruitment and may indicate a yearclass that is just starting to reach maturity.

Anglers released 79% of their walleye catch (Table 1), a sign that fish smaller than the 15-inch minimum length limit were being caught and released.

Figure 1. Length-frequency of adult walleye during 2006 in Manson Lake, Oneida County WI.

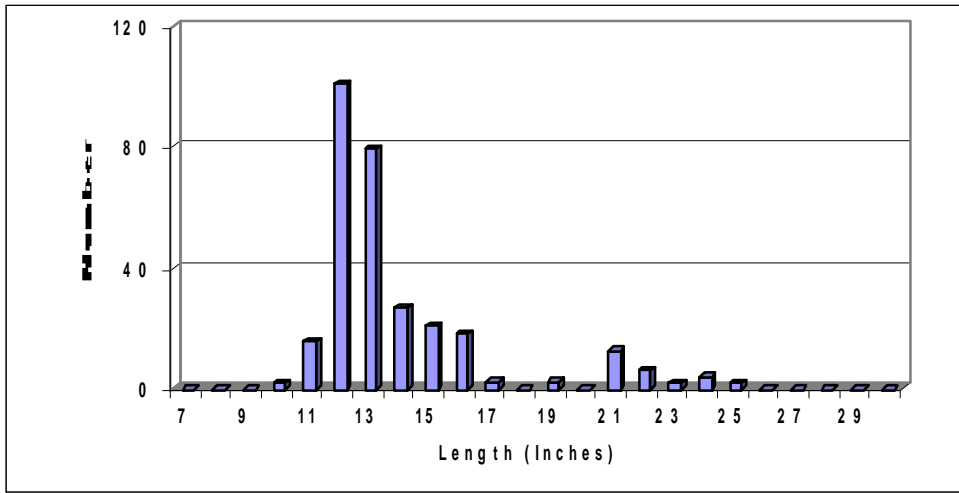


Table 2. Fish catch per unit effort during a 2006 survey of Manson Lake, Oneida County Wisconsin. Netting catch rates are reported as number of fish per net night, while electrofishing catch rates are number of fish per mile of shoreline. Only gamefish data were collected during April shocking and only basses during May and June shocking. Non-game data were only collected from two 0.5-mile index stations on September 13.

species	walleye netting	April 16 shocking	bass netting	May 31 shocking	June 8 shocking	Aug 29 mini-fyke	Sept 13 shocking
walleye	6.9	4.7	0			0	6.4
largemouth bass	0.25	2.5	3.0	10.0	10.8	1.3	3.9
smallmouth bass	0.17	0	5.7	16.1	16.7	0.67	4.4
muskellunge	0.46	0	0.20			0	0.28
northern pike	1.1	0.83	0			0	1.4
black bullhead	0.031		2.7			0	0
black crappie	3.1		7.1			0	0
blacknose shiner	0		0			0	1.0
bluegill	6.9		72.6			30.2	108.0
bluntnose minnow	0		0			15.8	1.0
golden shiner	0.16		0			0	1.0
johnny darter	0		0			0.17	0
pumpkinseed	0.031		1.2			0	0
rock bass	5.4		15.1			2.0	17.0
white sucker	0.37		0			0	0
yellow bullhead	0		4.9			0	0
yellow perch	22.8		0			3.0	2.0

Walleye recruitment was strong in 1994-96, but was otherwise weak. A walleye population can be sustained by one good yearclass every 3 to 4 years. Stocking occurred in most years after 1990 (Table 3), making it difficult to determine the extent of natural reproduction. Fall surveys occurred in non-stocked years of 1961, 81, 90, 2002, 04 and 06 and prior to fall stocking in 1996, 2000 and 05. Three of these years (1981, 1990 and 1996) produced catches of age-0 walleye ranging from 8.5 to 49.4 per mile, while the other 6 surveys found 0 to 4.2 per mile, suggesting that recruitment is sustained primarily by stocking with a small amount of natural reproduction. Walleye growth was slow, with length-at-age generally close to a year behind regional averages (Appendix A).

Table 3. Fish-stocking record during 1970 through 2006 in Manson Lake, Oneida County WI.

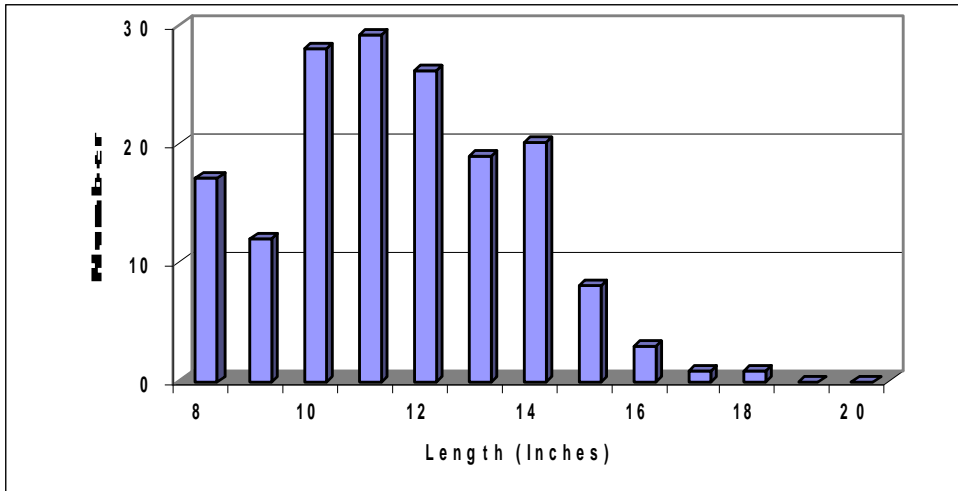
Year	Species	Size	Number	Comments
1970	walleye	small fingerling (3 inch)	2,575	
1970	walleye	small fingerling	5,000	
1971	muskellunge	large fingerling	1,200	
1972	walleye	large fingerling (5 inch)	5,000	
1973	walleye	small fingerling (3 inch)	12,032	
1974	walleye	small fingerling (3 inch)	6,000	
1975	walleye	small fingerling (3 inch)	6,000	
1975	muskellunge	large fingerling (11 inch)	300	
1976	walleye	small fingerling (3 inch)	14,000	
1977	muskellunge	large fingerling (8 inch)	400	
1978	walleye	small fingerling (2 inch)	11,000	
1979	muskellunge	large fingerling (10 inch)	200	
1984	muskellunge	large fingerling (9 inch)	200	
1991	walleye	small fingerling (2.7 inch)	5,824	
1991	walleye	large fingerling (9 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
1992	walleye	large fingerling (9 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
1993	walleye	small fingerling (2 inch)	11,544	
1993	walleye	large fingerling (9 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
1994	walleye	large fingerling (9 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
1995	walleye	small fingerling (2.1 inch)	11,800	
1995	walleye	large fingerling (9 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
1996	walleye	large fingerling (9 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
1997	walleye	small fingerling (2 inch)	12,347	
1998	walleye	large fingerling (9 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
1999	walleye	large fingerling (9 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
2000	walleye	large fingerling (6 inch)	2,000	Tom. Fishing Unlim. / Manson Assoc.
2001	walleye	large fingerling (6 inch)	2,300	Tom. Fishing Unlim. / Manson Assoc.
2003	walleye	large fingerling (6 inch)	3,000	Manson Lake Association
2005	walleye	large fingerling (6.5 inch)	4,000	Manson Lake Association

Largemouth Bass

During spring sampling, 183 largemouth bass were captured, including 10 recaptures of previously-marked fish and 89 juvenile fish less than 8 inches in length. The largemouth population estimate of 5.4 adults per acre is accompanied by a coefficient of variation of $\pm 48\%$. This suggests a strong bass population, but very poor confidence in the exact number. Another 8 juvenile largemouth were captured in August mini-fyke nets, and 14 largemouth were captured during the fall electroshocking

survey. Largemouth bass size structure showed good numbers of 10 to 15-inch fish (Figure 2), and 20.1% were 14 inches and larger. The longest largemouth bass was 18.4 inches. Length-at-age was not quite a year behind northern Wisconsin averages, indicating slightly slow growth (Appendix A).

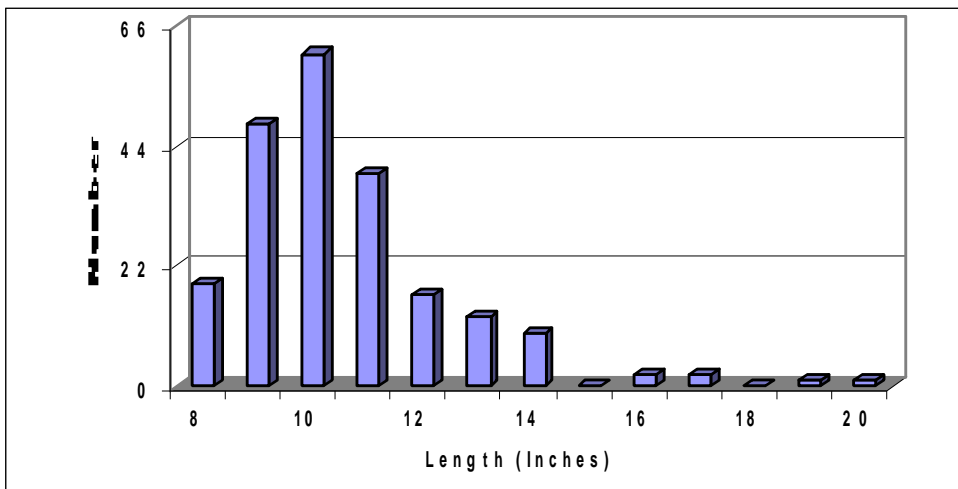
Figure 2. Length-frequency of largemouth bass during 2006 in Manson Lake, Oneida County Wisconsin.



Smallmouth Bass

Two hundred fifty-six smallmouth bass were captured during spring sampling, including 19 recaptures of previously-marked fish and 191 juvenile fish less than 8 inches in length. Similar to largemouth, too few smallmouth were recaptured to generate a precise population estimate, but the data indicate a strong population of 4.5 adult smallmouth per acre, \pm 35%. Four juveniles were captured in August mini-fyke nets and fifteen smallmouth bass were captured during the fall electroshocking survey. Smallmouth were generally smaller than largemouth bass. Smallmouth numbers were dominated by 9 to 12 inch fish (Figure 3) and only 8% were at least 14 inches. The longest bass was a 20.2 inch smallmouth. Similar to largemouth, length-at-age was about a year behind northern Wisconsin averages (Appendix A).

Figure 3. Length-frequency of smallmouth bass during 2006 in Manson Lake, Oneida County Wisconsin.

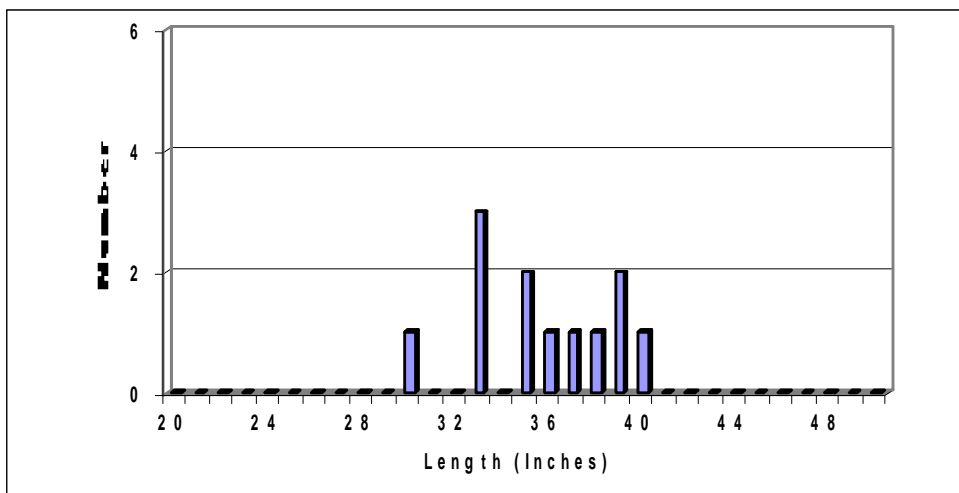


Muskellunge

Thirteen muskellunge were captured during spring netting and shocking, including no recaptures and 1 juvenile fish, 18.5 inches in length and 2 years of age. Average length of the adult muskellunge was 36 inches, and the largest fish captured was a 40 inch female aged at 10 years (Figure 4). Muskellunge were generally growing at or above average (Appendix A).

Muskellunge were last stocked in 1984, so the current population is a result of natural reproduction. However, the low numbers we encountered indicate poor recruitment. Northern pike inhibit muskellunge recruitment, but the pike population in Manson is also very low, suggesting a habitat limitation for both species. Non-native Eurasian watermilfoil invaded Manson Lake prior to 1989, the year it was documented by DNR. Non-native curly leaf pondweed and purple loosestrife are also found in Manson Lake, but have not increased to nuisance levels. For several years Eurasian watermilfoil comprised almost all of the vegetation in Manson Lake, but the native milfoil weevil *Eurhychiopsis lecontei* attacked it and has dramatically reduced its extent since mid-1990s. Muskellunge spawn in May on dead plants that remain from the previous year. Eurasian watermilfoil fragments into small segments in fall and drifts around over the winter. Thus, the milfoil provides a poor spawning substrate because it does not support the muskellunge eggs above the bottom. At the same time, it displaces other plants that provide better spawning habitat. With weevils keeping it in check, the Eurasian watermilfoil is mostly absent from the shallow bays where muskellunge spawn, and native plants have re-colonized those areas. Protection of native aquatic plant beds including reeds, rushes and pondweeds should be encouraged. Brushy shorelines consisting of native plants should also be encouraged to provide wintering habitat for the milfoil weevil. Unlike brushy shoreline, mowed lawns do not provide weevil wintering habitat. Stocking is warranted to reestablish a strong muskellunge population that can better take advantage of improvements in spawning habitat.

Figure 4. Length-frequency of adult muskellunge during 2006 in Manson Lake, Oneida County Wisconsin.

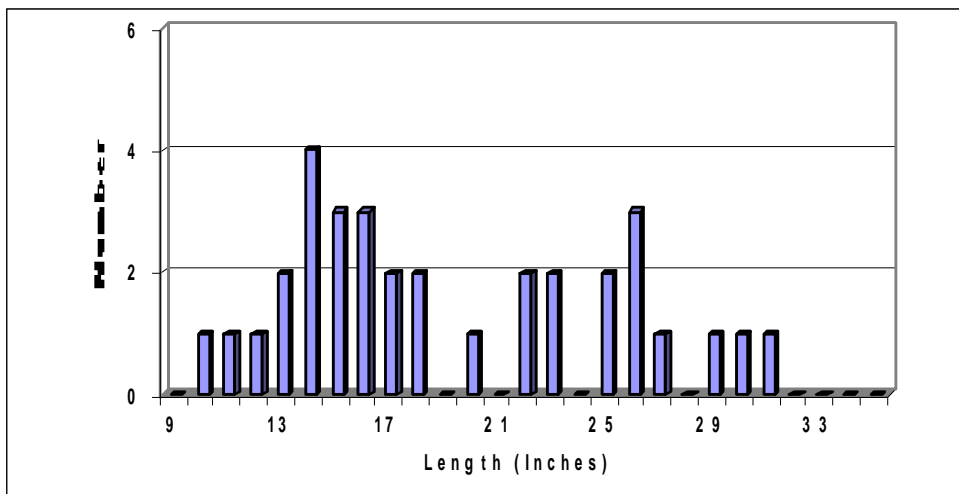


Northern Pike

Fourty northern pike were captured during spring netting and shocking (including no juveniles and 7 recaptures). Another 5 northern pike were captured during fall shocking. The northern pike population (including sexually mature fish and all fish over 12 inches) was estimated at 78 (± 29 SD), or 0.33

per acre, using the Schnabel multiple-capture method (Ricker 1975). As with the bass estimates, this is an imprecise population estimate ($\pm 37\%$), but it suggests that the population is at a low density: Less than 2 adults per acre is considered low density for northern pike. Pike were growing slowly, with lengths-at-age behind the regional averages (Appendix A). Average size of adult northern pike was 19.7 inches and 21% of adult pike were 26 inches or larger (Figure 5). The largest northern pike was a 31.6 inch female aged at 12 years.

Figure 5. Length-frequency of adult northern pike during 2006 in Manson Lake, Oneida County Wisconsin.



Panfish

Manson is relatively shallow with moderate fertility and abundant aquatic vegetation, resulting in high panfish abundance. A targeted panfish survey was not performed, and netting during the cold early spring period typically yields high catches of yellow perch and crappie but few bluegill or pumpkinseed. Perch catch was high during April walleye netting, while bluegill and moderate numbers of rock bass dominated the panfish catch during late May bass netting and fall electroshocking (Table 2). My observation from the deck of a boomshocker was that bluegill size was adequate for anglers. This was borne out by an estimated angler harvest of 4,649 bluegill with an average size of 7.0 inches.

MANAGEMENT RECOMMENDATIONS

Manson Lake supports a diverse fishery. Largemouth and smallmouth bass were the dominant gamefish, along with low populations of walleye, northern pike and muskellunge. Size structure of walleye was poor. This likely reflects angler harvest of larger fish and increased recruitment from large fingerlings stocked by Manson Lake Association in recent years. Growth rates were poor for all gamefish except muskellunge. Bluegill were the dominant panfish, followed by rock bass and yellow perch. Low numbers of pumpkinseed, black crappie and yellow and black bullhead were also present. Forage and non-game species include blacknose shiner, bluntnose minnow, golden shiner, johnny darter and white sucker. Walleye and muskellunge show some natural reproduction, but adult numbers are low and stocking should be resumed to increase their populations. Declines in Eurasian watermilfoil since mid-1990s should improve muskellunge spawning conditions. Manson is best managed for bass and panfish, with northern pike and stocked walleye and muskellunge providing a secondary fishery.

ACKNOWLEDGEMENTS

Mike Coshun supervised the field work for this survey with assistance from Jason Halverson, Marty Kiepke, Steve Kramer, Steve Timler, Tim Tobias, Joelle Underwood, Dave Van de Water and me. Steve Kramer assigned ages from fish scales and entered and summarized data. Creel summary was provided by Tim Tobias. Mike Coshun calculated the walleye and bass population estimates. Manson Lake Association provided private stocking data that were omitted from the lake file. Lake Association President Mike Barnes and Laura Herman shared their observations about Eurasian watermilfoil and the milfoil weevil in Manson Lake.

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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 samples with at least 50 lengths (includes male walleye and largemouth and smallmouth bass), the aged subsamples were applied against the full length-frequency to eliminate bias from a non-random subsample.

Table A.1. Female walleye length-at-age in Manson Lake, Oneida County Wisconsin during 2006.

Age	Number of fish	Manson avg length	Northern WI avg
4			14.7
5			16.1
6	1	17.3	17.6
7	2	16.3	19.5
8	2	20.6	21.2
9	1	21.0	22.6
10	1	22.4	23.8
11	3	21.8	24.9
12			25.8
13	1	24.3	26.9
14	1	21.7	27.5
15			28.0
16			27.7
17	1	26.1	

Table A.2. Male walleye length-at-age in Manson Lake, Oneida County Wisconsin during 2006.

Age	Number of fish	Manson avg length	Northern WI avg
2			10.6
3	6	10.9	11.6
4	16	12.1	13.0
5	12	13.9	14.5
6	4	15.5	15.8
7	13	15.9	16.9
8	2	16.3	18.1
9			18.9
10			19.7
11			20.4
12			20.6
13			21.3
14			22.0

Table A.3. Largemouth bass length-at-age in Manson Lake, Oneida County Wisconsin during 2006.

Age	Number of fish	Manson avg length	Northern WI avg
2			6.6
3	1	8.7	8.9
4	7	9.1	10.5
5	11	11.2	12.1
6	13	12.6	13.6
7	7	13.9	14.9
8	3	14.6	15.8
9	3	15.9	16.2
10	1	17.3	17.1
11	1	18.4	17.8
12			18.2

Table A.4. Smallmouth bass length-at-age in Manson Lake, Oneida County Wisconsin during 2006.

Age	Number of fish	Manson avg length	Northern WI avg
2			6.9
3	4	8.1	9.3
4	15	9.3	11.8
5	18	11.9	13.5
6	11	13.3	15.2
7	4	14.1	16.1
8	2	14.6	17.1
9	1	17.5	17.7
10	3	17.1	18.3
11			18.5
12	1	20.0	19.8

Table A.5. Female muskellunge length-at-age in Manson Lake, Oneida County Wisconsin during 2006.

Age	Number of fish	Manson avg length	Northern WI avg
6	1	33.5	33.7
7	1	37.0	35.8
8	1	39.0	38.1
9			39.5
10	1	40.0	41.0
11			43.2
12			43.7
13			44.3
14			47.5

Table A.7. Female northern pike length-at-age in Manson Lake, Oneida County Wisconsin during 2006.

Age	Number of fish	Manson avg length	Northern WI avg
3			16.9
4			20.4
5	3	16.1	23.1
6			24.4
7	1	26.1	27.3
8	3	25.8	28.8
9	2	28.0	32.1
10	1	26.7	33.8
11			
12	1	31.6	

Table A.6. Male muskellunge length-at-age in Manson Lake, Oneida County Wisconsin during 2006.

Age	Number of fish	Manson avg length	Northern WI avg
4			27.3
5	1	30.5	29.2
6	1	33.0	31.5
7	1	33.5	33.3
8	1	36.0	34.4
9			35.8
10	1	39.0	37.3
11			37.9
12			39.0
13	1	38.4	38.9

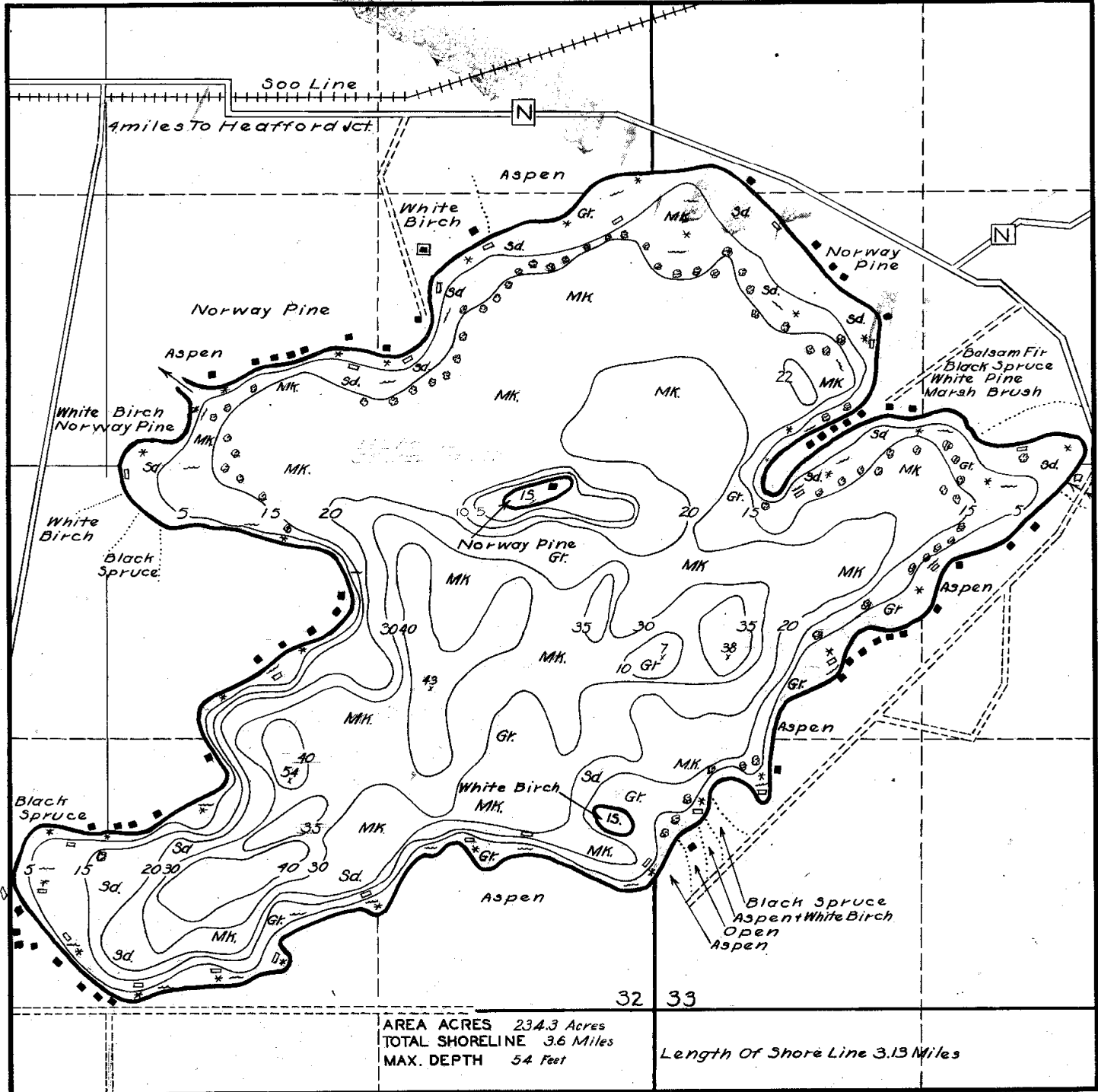
Table A.8. Male northern pike length-at-age in Manson Lake, Oneida County Wisconsin during 2006.

Age	Number of fish	Manson avg length	Northern WI avg
2	2	11.8	13.4
3	2	14.0	16.2
4	4	14.9	18.9
5	2	18.3	20.6
6	3	20.7	22.3
7	1	22.1	23.4
8	1	23.0	24.8
9	1	25.6	23.9
10			21.5

LAKE SURVEY MAP

WISCONSIN CONSERVATION DEPARTMENT
 BIOLOGY DIVISION
 LAKE AND STREAM IMPROVEMENT SECTION

LAKE MANSON
 SECTION 32-33
 TOWNSHIP 36 N
 RANGE 7 E
 TOWN OF WOODBORO
 COUNTY ONEIDA



AREA ACRES 234.3 Acres
 TOTAL SHORELINE 3.6 Miles
 MAX. DEPTH 54 Feet

Length Of Shore Line 3.13 Miles

DATE May 11, 1939
 COMPILED BY E. H.
 TRACED BY W.R.S.
 SOURCE OF INFORMATION
Camp Tomahawk 64-3
Survey Project
 SOUNDINGS Intervals 200 Ft.
Camp Tomahawk 64-3
 DATES OF MAP REVISION _____
 WORK AGENCY ECC

SCALE 1 inch = 440 feet

LAKE IMPROVEMENT RECORD

TYPE	DATE	3/22/39			
○=1 BRUSH REFUGES		85			
—=5 SAPLING TANGLES		140			
□=5 SPAWNING BOXES		120			
*=5 MINNOW SPAWNERS		192			
TOTAL		537			

- LEGEND**
- WEED BEDS
 - ROCKY SHOALS
 - Sd SAND
 - C/ CLAY
 - Gr GRAVEL
 - MK MUCK
 - DWELLING
 - ABANDONED DWELLING
 - RESORT