Comprehensive Fisheries Survey of Thunder Lake, Oneida County Wisconsin during 2006.

Waterbody Identification Code 1618100

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Rhinelander
March, 2007

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EXECUTIVE SUMMARY

A survey targeting gamefish species was conducted in Thunder Lake during spring, 2006. Northern pike (population estimate, PE = 4.5 adults per acre), largemouth bass (PE = 3.2 adults per acre) and walleye (PE = 1.9 adults per acre), were the dominant gamefish, along with low numbers of muskellunge. All game species showed good size and appeared to be in excellent condition. Panfish species were also abundant, but size structure was poor. We found exceptionally high catches of black crappie, bluegill, pumpkinseed, hybrid bluegill x pumpkinseed and yellow perch, along with moderate numbers of yellow and black bullhead. Non-game species include bluntnose minnow, golden shiner, Iowa darter and white sucker. I recommend continuing to manage Thunder Lake for northern pike, largemouth bass, walleye and panfish. Stocked walleye are providing a moderate-density fishery with good size potential, while other species are self-sustaining. Muskellunge stocking would be ineffective because of predation by abundant northern pike.

Lake and location:
Thunder Lake, northeast Oneida County, T38N R10E Sec3. Thunder is in the town of Three Lakes, about 1 mile west of the city of Three Lakes. Thunder is part of the Upper Wisconsin River watershed. The only inlets are six ditches that drain cranberry bogs and wetlands on the east shore. The main outlet is Thunder Ditch which is controlled by a Town of Three Lakes-owned dam and drains to Rice Lake. The dam maintains 2.8 feet of additional head on Thunder Lake. A series of connected ditches east of Thunder Ditch also drain to the Three Lakes Chain of Lakes via Rangeline Creek through a non-functioning concrete structure.

Physical/Chemical attributes (Andrews and Threinen 1966):
Morphometry: 1,768 acres, maximum depth 9 feet.
Watershed: 10.0 square miles, including 1,580 acres of adjoining wetlands.
Lake type: Drained. Dam at outlet holds 2.8 feet of head (structural height = 4.1 feet) and discharges to Thunder Ditch. Recommended Fisheries Stage = dam crest (1,632.7 feet, Tyler 1979).
Basic water chemistry: Soft – alkalinity 26 mg/l, conductance 52 μmhos.
Water clarity: Clear water of low transparency.
Littoral substrate: 60% sand, 20% muck, 15% gravel and some rock.
Aquatic vegetation: abundant
Winterkill: frequent until Thunder Lake Protection and Rehabilitation District installed an aerator in 1984. Partial winterkills still occur in shallow bays.
Boat landing: One concrete plank and 1 gravel ramp with combined parking for 7 vehicles with trailers and 4 additional vehicles.
Other features: Shoreline 65% bog, shrub and coniferous wetlands with a significant amount of upland adjoining the remainder of the lake.

Purpose of Survey: Assess status of game panfish species, assess walleye stocking success and develop management recommendations.
Dates of fieldwork: Walleye and northern pike netting, April 14-19 2006. Panfish netting, June 5-9 2006. Electroshocking (entire shoreline) April 19, May 24, June 2 and June 13 2006.

BACKGROUND

Prior to human modifications, Thunder Lake was a deep marsh. There was no direct outlet, but drainage to the north through wetlands and peat bog fed tributaries to Rice, Townline and Rangeline Lakes. During the 1910's, ditches were constructed in what is now Thunder Lake State Wildlife Area in an attempt to drain the peatlands for farming. Illegal construction of a drainage ditch subsequently connected Thunder Lake to this ditch system in 1917, and a log dam was built at the outlet to the ditch to maintain the lake level. This dam was replaced with a concrete dam in 1938. The current dam was built by the Town of Three Lakes in 1948 after the 1938 dam washed out. The dam adds an additional 2.8 feet of head, changing Thunder Lake from an emergent marsh to a shallow lake. However, seepage through the shoreline ice ridge and surrounding wetlands causes difficulty in controlling the water level. In 1994, Thunder Lake Protection and Rehabilitation District and Town of Three Lakes constructed a short berm, mainly to the east of the dam site, to reduce this seepage. In 1999 Wisconsin Department of Natural Resources (DNR) constructed a higher, 1,200-foot long dike to the west of the dam and placed gravel along the dike shoreline to armor the bank and provide spawning habitat.

Much of the Thunder Lake basin is around 6 feet in depth. Periodic winterkill was a recurring problem on Thunder Lake in the years before aeration. Thunder Lake Protection and Rehabilitation District (hereafter referred to as the "District") was formed in 1982, and the District installed an aerator in 1984. Partial winterkills regularly occur in shallow bays on Thunder, including a kill of mostly panfish in the southwest bay prior to our survey in spring of 2006, but the bulk of the fish population is protected by aeration.

Shallow lakes like Thunder generally alternate between two states: The clear-water state has extensive beds of rooted aquatic vegetation, while the turbid-water state is characterized by algae blooms and low amounts of rooted vegetation. In early 1980s, Thunder Lake shifted to the turbid water state, losing most of its rooted plant beds. Available nutrients were utilized by free-floating algae, which further reduced light penetration. At the same time, winterkill conditions dramatically reduced fish populations and favored bullhead, which are very tolerant to low oxygen levels. Shading by algae and grazing by the burgeoning bullhead population kept rooted aquatic plants from becoming reestablished for several years. Finally, winter aeration and stocking allowed predators including northern pike, largemouth bass and walleye to become reestablished. The District removed 56 tons of bullheads during summer, 1987. Increased predation on bullhead and bullhead removal resulted in a recovery of the fishery and the plant beds by early 1990s. Thunder Lake shifted back to the clear-water state, with large, productive beds of aquatic vegetation.

The file contains three pages of length data (most likely from netting) from September 24-27, 1947 with no additional information. The catch includes 219 walleye (modal length = 13.75 inches), 114 yellow perch (modal length = 7.25 inches), 25 bullhead, 11 unidentified sunfish, 6 northern pike, 3 rock bass, 1 largemouth bass and 1 sucker. This is the last reference to a rock bass collection from Thunder Lake.

A single handwritten page with no date is likely from an electroshocking survey. It gives lengths for 10 yellow perch, 5 bullhead, 4 northern pike and 1 pumpkinseed. Comments state: "Noted a fare [sic] amount of white suckers, B. heads and Y perch. Seen several golden shinners [sic]. Several northern pike seen but not captured. Seen two bluegills or P. seed? No walleyes seen or captured. No muskies seen or captured."

Two nights of spring netting with ½-inch and ¾-inch mesh (2 of each) fyke nets on April 24-26 1989 (8 net-nights) yielded 21 walleye ranging 6 to 10.4 inches in length, along with 36 northern pike (19 to 34.9 inches), 80 yellow perch, 50 pumpkinseed, 40 common shiner and 8 white suckers. This is the only reference to common shiner and may have been miss-identified golden shiner.

A week of panfish netting during June 20-24 1994 (40 net nights) yielded catches (per net-night) of 0.60 walleye, 0.050 largemouth bass, 0.25 northern pike, 148 black bullhead, 6.6 black crappie, 1.8 bluegill, 0.10 bluegill x pumpkinseed hybrids, 1.3 golden shiner, 83.6 pumpkinseed, 0.13 white sucker, 0.33 yellow bullhead and 35 yellow perch. Growth rates were at or above regional averages.

A single night of electrofishing on May 4 2002 by Great Lakes Indian Fish and Wildlife Commission (GLIFWC) resulted in a catch of 44 walleye with an average length of 17.1 inches. Data on other species are not reported.

Fall young-of-year electroshocking surveys were conducted by DNR in 1977, 79, 94-97, 2003 and 2005 and by GLIFWC in 1986, 2001-02, and 2006. A single redear sunfish listed in the 1986 GLIFWC survey was most likely a miss-identified pumpkinseed. Iowa darter were identified in the 2005 survey.

Eight mini-fyke nets targeting juvenile fishes and forage species were fished for one night on August 22-23 2005. Young-of-year largemouth bass and bluegill were abundant, along with lower numbers of other panfish species. A single bluntnose minnow was also captured.

METHODS

Twelve standard fyke nets (¾-inch mesh, bar measure) were set on April 14, 2006. These nets targeted walleye and northern pike and were fished through April 19. Two WDNR-standard alternating current electrofishing boats were used to collect gamefish on April 19, May 24, June 2 and June 13, 2006. Six standard fyke nets (one with ½-inch mesh) were fished June 5-9 2006, targeting panfish. 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 fish per species, per half-inch group.

RESULTS AND DISCUSSION

Walleye

During walleye netting, 1,201 walleye were captured in 5 nights, including 122 recaptures and 24 juvenile fish (walleye of unknown sex shorter than 15 inches), at a rate of 19.4 walleye per net night (Table 1). The electrofishing sample on April 19 yielded 118 walleye (11.1 fish per mile), including 5 juveniles. The mark-recapture population estimate of 3,274 adult walleye ($\pm$ 731 SD), or 1.9 per acre, is above the predicted value of 1.3 for a lake supported by stocking. Walleye showed excellent size structure. An impressive 95% of adult walleye were 15 inches or larger, while 63% were at least 20 inches (Figure 1).

Prior to 1990 there was no minimum length limit on walleye, while during 1990 through 1997 there was a 15-inch minimum length limit. The current 18-inch minimum length limit has been in effect since 1998. This regulation is best suited for lakes with good growth rates and size potential. It seems to be working on Thunder Lake, but one concern is that a severe winterkill may decimate

walleyes that have been stockpiled under the length limit. Aeration provides an oxygenated refuge, but does not completely prevent winterkill. The last regionally severe winter was in 1996, with generally mild conditions since. Anglers on Thunder Lake reported oxygen-stressed fish surfacing in ice holes in 2004, but a late-winter rain averted a potentially severe winterkill.

Table 1. Fish catch per unit effort during a 2006 survey of Thunder 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 shocking runs.

species	spring netting	April 19 shocking	May 24 shocking	June 2 shocking	panfish netting	June 13 shocking
walleye	19.4	8.4	3.1	0.094	1.5	0
largemouth bass	0.73	12.6	13.6	8.7	0.17	9.2
muskellunge	0.17	0	0	0	0	0
northern pike	8.5	0.28	1.0	0.19	0.79	0.66
black bullhead	0.23				0.42	
black crappie	79.6				48.5	
bluegill	90.8				324.5	
hybrid bluegill x pumpkinseed	56.9				39.3	
golden shiner	3.1				7.6	
pumpkinseed	53.8				128.4	
white sucker	4.5				0	
yellow bullhead	5.0				6.2	
yellow perch	116.8				2.0	

Fall surveys are used to gauge walleye recruitment. Catch of young-of-year (YOY) walleyes gives an index of either natural reproduction or small fingerling stocking success, while catch of age-1 fish shows recruitment from the previous year. The modal catch of YOY walleye in lakes supported by good natural reproduction is about 16 per mile of shoreline, and a walleye population will be maintained by one good yearclass every 3 to 4 years. However, YOY catch tends to be lower in heavily-vegetated waters like Thunder, perhaps because the fish are dispersed throughout the abundant shallow habitat. For example, the 1994 and 2001 YOY catches were relatively low, but those yearclasses showed up with stronger age-1 catches the following years (Figure 2). In shallow lakes a lower benchmark for success may be appropriate for fall surveys, especially if a substantial adult population is supported. Post-winterkill fry stocking is often successful because populations of predators and competitors are depleted. The highest YOY catch in Thunder was in 1977 (Figure 2),

when 2 million fry were stocked after a severe winterkill. The 1977 survey report states: “The walleye fingerling captured were very emaciated. This may be due to the tremendous hatch of yellow perch and the resulting competition….With the large numbers of yellow perch present no additional walleye fry stocking is recommended.”

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

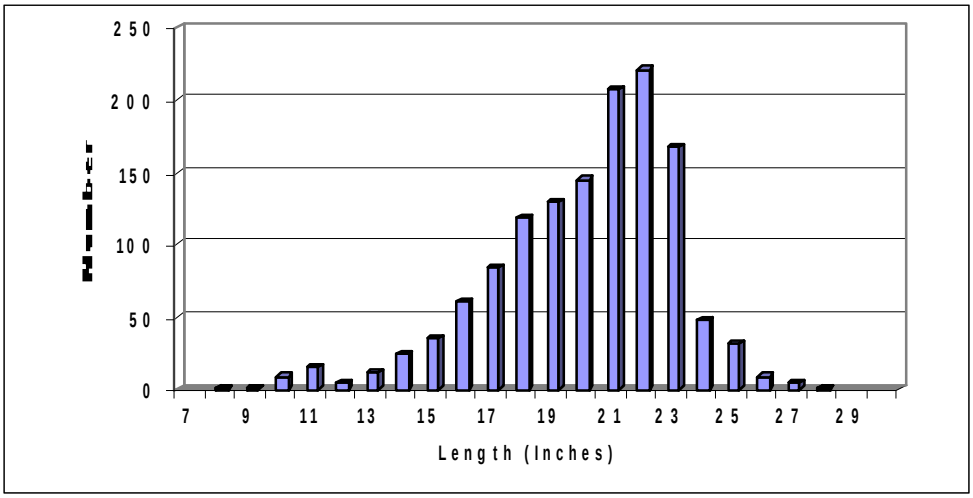


Figure 2. Young-of-year (YOY) and age-1 walleye in fall surveys in Thunder Lake, Oneida County Wisconsin. The solid line at about 16 per mile is the modal number of YOY walleye observed in northern Wisconsin lakes supported by natural reproduction.

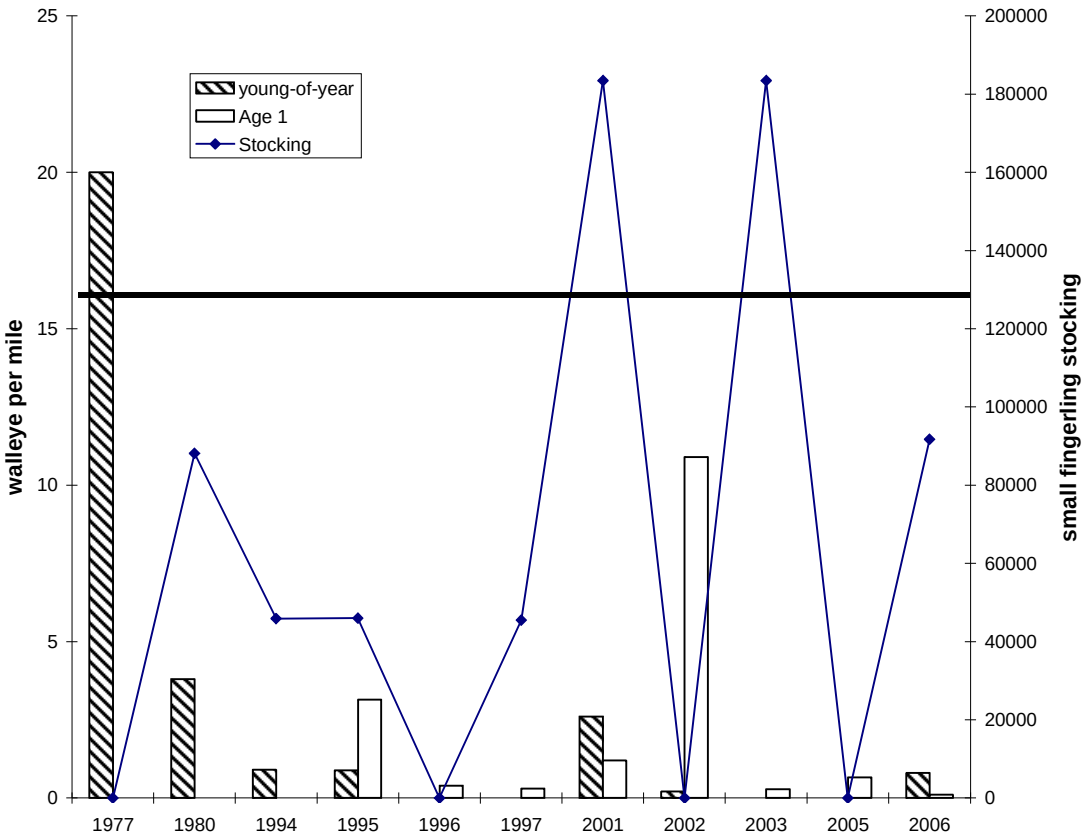


Table 2. Fish stocking record during 1980 through 2006 in Thunder Lake, Oneida County WI.

Year	Species	Size	Number	Comments
1980	largemouth	small fingerling (2.7 inch)	88,120	
1981	largemouth	small fingerling (1 inch)	50,000	
1981	walleye	small fingerling (2.7 inch)	79,360	
1984	walleye	small fingerling (3 inch)	74,385	
1985	walleye	small fingerling (2 inch)	91,000	
1986	walleye	small fingerling (2 inch)	90,000	
1987	walleye	small fingerling (2 inch)	86,800	
1987	walleye	large fingerling (8 inch)	6,000	permit issued to District
1988	walleye	small fingerling (2 inch)	90,000	
1992	largemouth	small fingerling (3 inch)	11,780	Federal Hatchery
1993	largemouth	small fingerling (1.9 inch)	20,000	
1994	walleye	small fingerling (2.5 inch)	45,869	
1995	walleye	small fingerling (2.7 inch)	46,004	
1995	yellow perch	adult (3.8 inch)	46	field transfer – pounds?
1995	bluegill	adult (5.8 inch)	282	field transfer – pounds?
1995	pumpkinseed	adult (5.5 inch)	13	field transfer – pounds?
1997	walleye	small fingerling (2.8 inch)	45,450	
1999	walleye	small fingerling (1.6 inch)	172,734	
2000	walleye	large fingerling (8 inch)	1,500	Thunder Lake District
2001	walleye	small fingerling (1.6 inch)	183,500	
2001	walleye	large fingerling (7 inch)	2,300	Thunder Lake District
2003	walleye	small fingerling (1.7 inch)	183,500	
2003	yellow perch	adult (6.0 inch)	4,100	Thunder Lake District
2004	walleye	large fingerling (6 inch)	600	Thunder Lake District
2004	walleye	yearling (11.5 inch)	1,550	Thunder Lake District
2005	walleye	yearling (10 inch)	2,000	Thunder Lake District
2006	walleye	small fingerling (1.6 inch)	91,735	
2006	walleye	large fingerling (9 inch)	2,000	Thunder Lake District

Largemouth Bass

Five hundred twenty-two largemouth bass were captured during spring sampling, including 15 recaptures of previously-marked fish. The mark-recapture population estimate is 5,584 adult largemouth bass (± 1,850 SD), or 3.2 per acre. Largemouth bass size structure was dominated by 10 to 16 inch fish, with fair numbers of fish up to 18 inches in length (Figure 3). The longest bass was 21 inches and 40.2% were 14 inches and larger. No smallmouth bass were captured during the survey.

Northern Pike and Muskellunge

Five hundred fifty-three northern pike were captured during spring netting and shocking (including 15 recaptures of previously-marked fish). The northern pike population (including sexually mature fish and all fish over 12 inches) was estimated at 7,910 (± 2,042 SD), or 4.5 per acre, using the Schnabel multiple-capture method (Ricker 1975). This is considered moderate density for a northern pike population. Average size of adult northern pike was 23.5 inches and 20.9% of adult pike were 26 inches or larger (Figure 4). The largest northern pike was a 39.4 inch female. The excellent size structure and growth potential in Thunder Lake make it a good candidate for producing more

quality-size northern pike, although the abundant shallow habitat might cause over-abundance of small fish. A protective-slot length limit to encourage harvest of small pike but allow medium-size fish to survive might be appropriate for Thunder Lake.

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

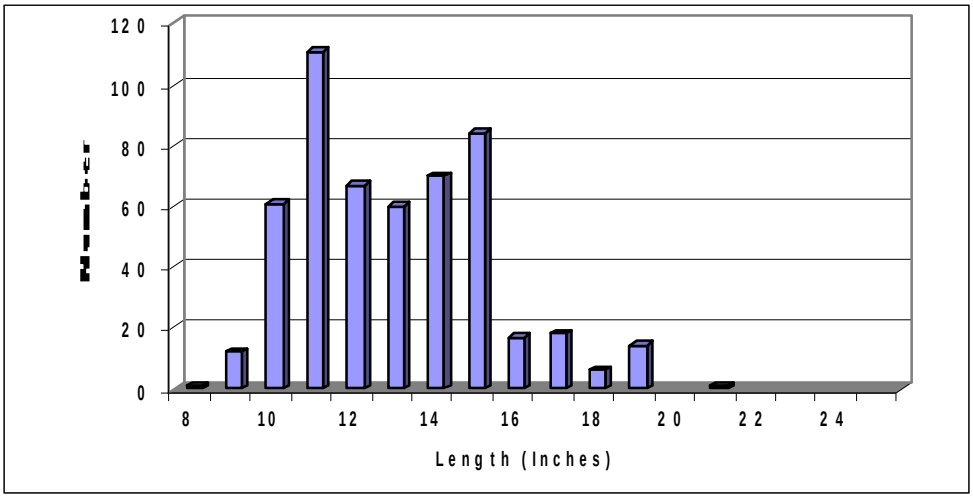
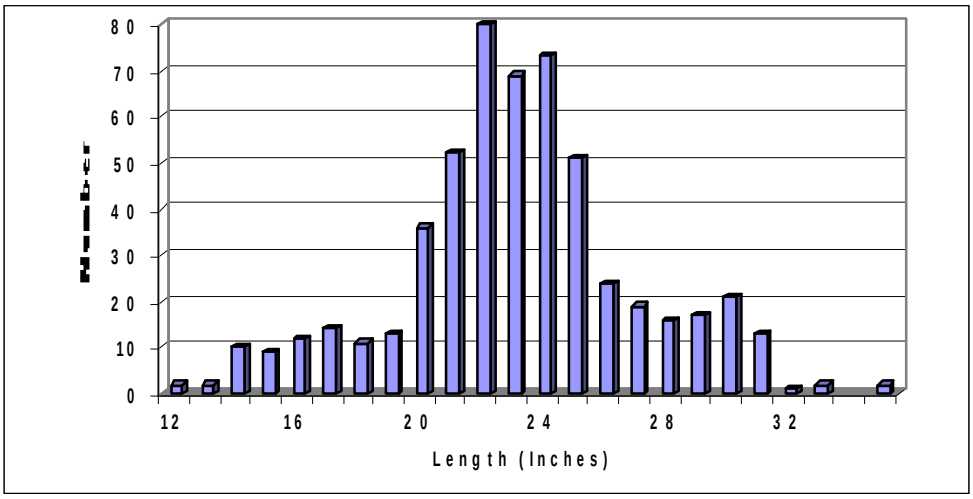


Figure 4. Length-frequency of adult northern pike during 2006 in Thunder Lake, Oneida County Wisconsin.



Only four muskellunge were captured during the survey, ranging from 29.5 to 45.8 inches in length. The largest fish was a 45.8 inch, 34.2 pound female. Between 1938 and 1953 a total of 182,760 fry and 11,007 mid-June fingerling muskellunge were stocked in Thunder Lake, with no stocking reported since that time. Muskellunge stocking is generally ineffective in lakes dominated by northern pike, most likely due to heavy predation by the northern pike (Margenau 1999). Given the strong population of northern pike, history of winterkill and our low catch of muskellunge, it is unlikely that recruitment is occurring. The current population is likely a result of illegal introductions of angler-caught fish.

Panfish

Thunder is a shallow lake with moderate fertility and abundant aquatic vegetation, resulting in high panfish abundance. Bluegill dominated the panfish catch, with a June catch of 324.5 bluegill per net night. There were also high numbers of pumpkinseed, bluegill x pumpkinseed hybrids, yellow perch and black crappie (Table 1). Despite strong gamefish populations, panfish size structure in Thunder Lake was generally poor (Figures 5-10). Bluegill catch of over 150 per net night is considered very high density and is usually associated with over-population and stunting. The high panfish densities in Thunder may be retarding growth. In contrast, bullhead catch was low to moderate (Table 1), but yellow bullhead had much better size structure than other panfish (Figure 10). No rock bass were encountered during our survey, and the only historic report of rock bass is 3 fish from a September 1947 survey.

Figure 5. Length-frequency of bluegill during 2006 in Thunder Lake, Oneida County Wisconsin.

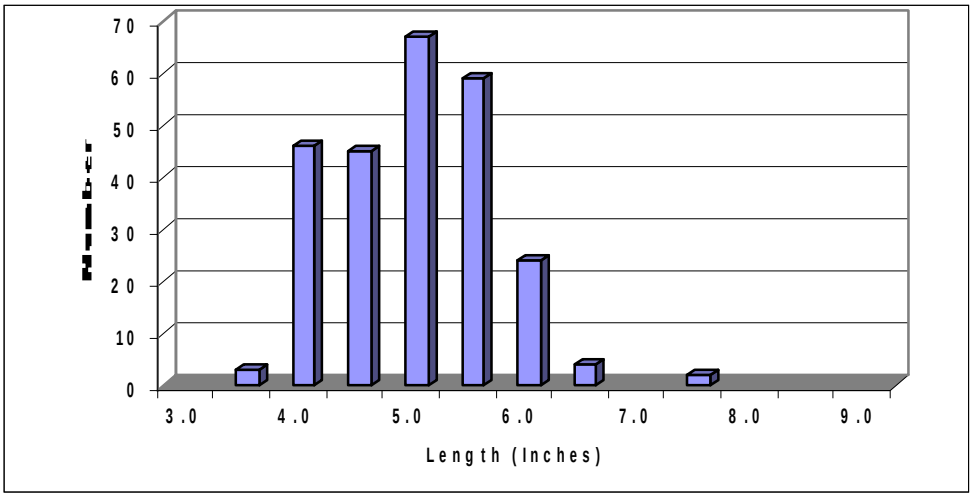


Figure 6. Length-frequency of pumpkinseed during 2006 in Thunder Lake, Oneida County Wisconsin.

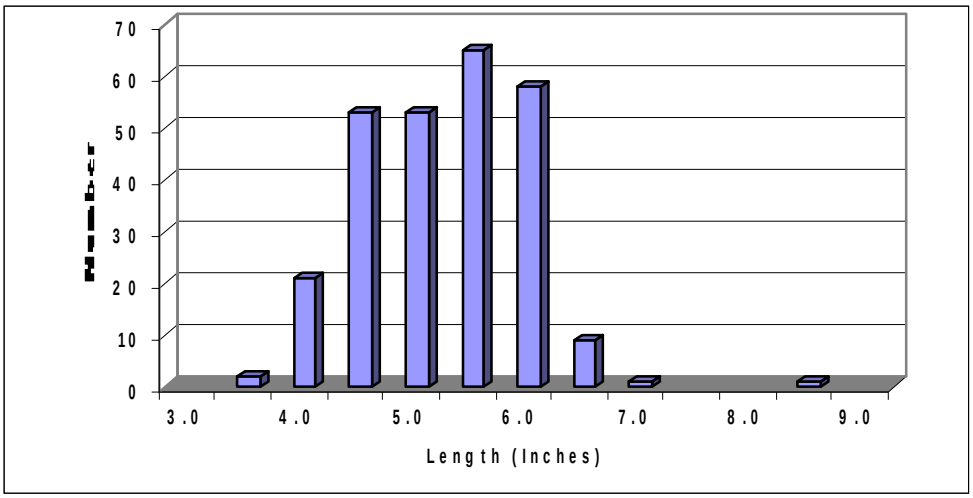


Figure 7. Length-frequency of bluegill x pumpkinseed hybrids during 2006 in Thunder Lake, Oneida County Wisconsin.

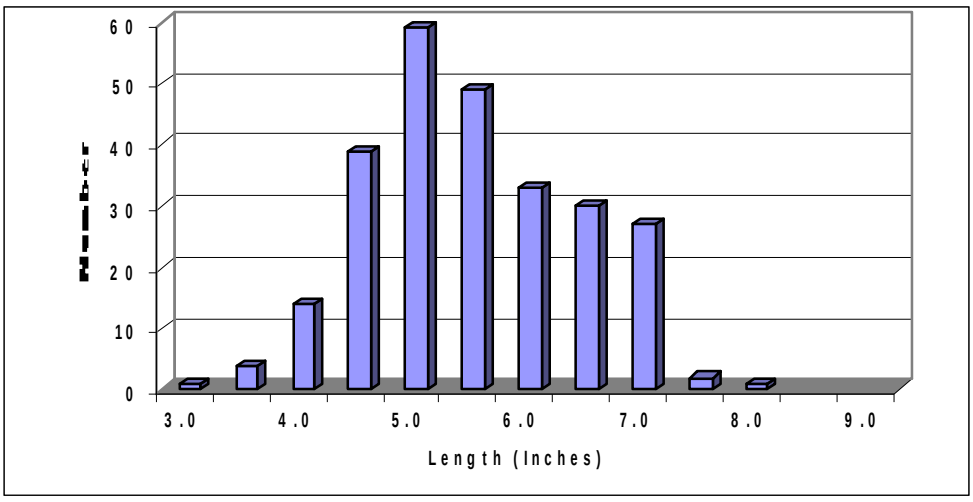


Figure 8. Length-frequency of yellow perch during 2006 in Thunder Lake, Oneida County Wisconsin.

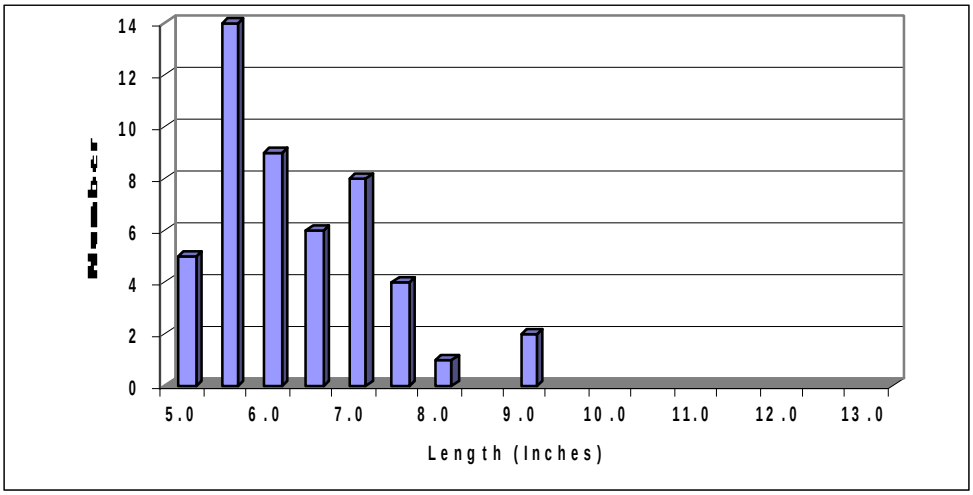


Figure 9. Length-frequency of black crappie during 2006 in Thunder Lake, Oneida County Wisconsin.

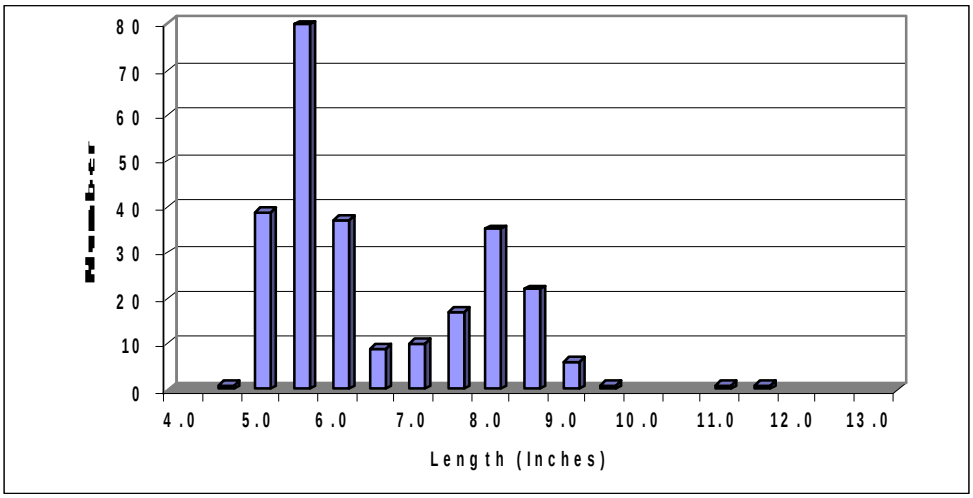
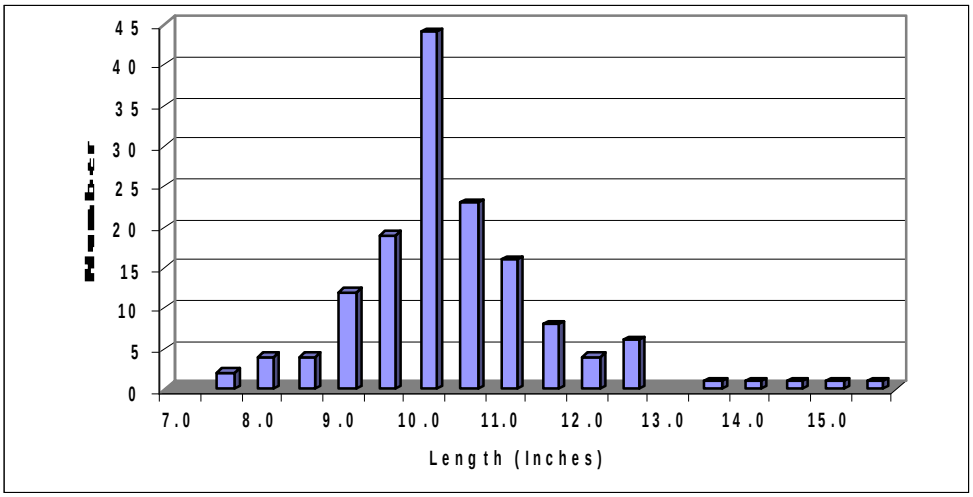


Figure 10. Length-frequency of yellow bullhead during 2006 in Thunder Lake, Oneida County Wisconsin.



MANAGEMENT RECOMMENDATIONS

Thunder Lake supports a diverse fishery. Northern pike and largemouth bass were the dominant gamefish, along with a moderate walleye population that is supported by stocking. Only four muskellunge were captured. Size structure and of all game species was excellent, and the fish appeared to be very healthy. Bluegill dominated the panfish catch, but pumpkinseed, bluegill x pumpkinseed hybrids, yellow perch and black crappie were all found at high abundance. Lower numbers of black and yellow bullhead were also present. Forage and non-game species included white sucker, and golden shiner; Iowa darter and bluntnose minnow were observed in 2005 when fine-mesh nets were used. Stocking maintains the walleye population. Muskellunge stocking is ineffective in lakes with abundant northern pike and is not recommended. Other species are reproducing naturally. Thunder is best managed for largemouth bass, northern pike, walleye and panfish. A protective-slot length limit has potential to protect quality-size northern pike.

ACKNOWLEDGEMENTS

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http://terraserver-usa.com