Summary of Fishery Surveys
Amacoy Lake, Rusk County, 2010-2011

Survey Effort

WDNR's Fisheries Management Team from Park Falls completed fyke netting and electrofishing surveys in fall 2010 and spring 2011 to assess the relative abundance and size structure of important fish populations in 278-acre Amacoy Lake. We set 5 fyke nets and fished them overnight on September 21 – 22, 2010 for 5 net-nights of effort directed toward black crappie. Fyke netting after the spring thaw at water temperatures 45 – 48°F targeted spawning northern pike, walleye, yellow perch, and muskellunge. Five nets fished overnight on May 2 – 4, 2011 resulted in 10 net-nights of fishing effort. With water temperature at 57 – 61°F our nighttime electrofishing survey on May 17, 2011 was well-timed to represent the status of largemouth bass and bluegill populations during their early spawning activities. We sampled 90% of Amacoy Lake's 3⅓-mile perimeter in 1.53 hours, including a half mile sub-sampled for panfish in 0.25 hour. Quality, preferred, and memorable sizes referenced in this summary are based on standard proportions of world record lengths developed for each species by the American Fisheries Society. "Keeper size" is based on known angler behavior.

Habitat Characteristics

Amacoy is a soft-water drainage lake, located between State Highway 40 and the Chippewa River about 5 miles south of Bruce, WI. Maximum and average depths are 20 and 13 feet, respectively, and 8% of the surface area is less than 3 feet deep. Three small tributaries drain Amacoy Lake's 5.3-square-mile watershed. Half of the lake's 1.9-square-mile direct drainage area is used for agriculture, and the remainder is wild—primarily forest and wetlands. Within the direct drainage, livestock, row crops, and a golf course are potential sources of nutrients (phosphorus and nitrogen) that may contribute to Amacoy Lake's eutrophic condition. A comparison of fossil remains (mostly diatoms—unicellular plants whose identifiable glass-like structure resists decomposition) at the top and bottom of sediment cores suggests that Amacoy Lake was moderately eutrophic before European settlement and that nitrogen may have increased since the late 1800s. Algal blooms, dense aquatic vegetation, and oxygen-depleted bottom water are likely to occur in late summer. Secchi disk depths averaging 4.1 feet during 1986 – 2012 indicate moderately low water clarity (range 3.1 – 7.2; n = 19) during mid-summer peaks in algal production. The water is neither acidic nor alkaline, but nearly neutral (pH = 7.2). Bottom materials are predominantly gravel and sand near shore and muck offshore. Flat-stem pondweed and coontail were dominant among 16 aquatic plant species recorded in a 2008 survey. Rooted aquatic plants covered nearly 60% of the near-shore zone and grew to a depth of 13 feet, suggesting the water is quite clear when algae are not blooming in mid-summer.

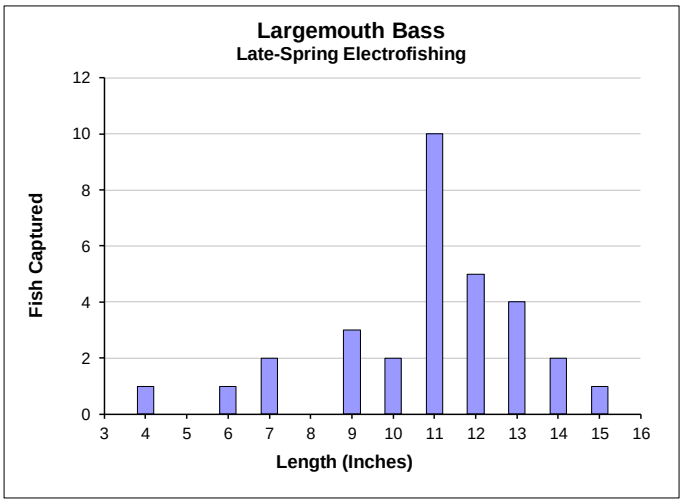
In recent years herbicides were applied to sparse stands of non-native curly-leaf pondweed. In 1999 – 2001 eighty-four conventional log fish cribs were installed in deep water, and in winter 2003 Rusk County Wildlife Restoration Association placed cobble and boulders (8- to 20-inch diameter) along the east shore. Much of the shoreline is steeply sloped, and residential development is moderate. Rusk County maintains a public boat access on the west shore. The outlet stream courses just over a mile through emergent wetlands and hardwood swamp to the Chippewa River. In 1970 a flood control structure was built across the outlet stream about 100 yards upstream from its confluence with the Chippewa River to prevent flood waters from damaging riparian dwellings on Amacoy Lake. Unidirectional flap-gates fitted on the downstream end of two 40-inch-diameter culverts through the dike allow continuous discharge from Amacoy Lake and prevent river flood waters from backing up into the lake—effectively increasing and stabilizing lake level and interrupting fish movement between the lake and river.

Summary of Results and Comparisons with Past Surveys

Projections from a 2003 creel survey indicate that Amacoy Lake receives heavy open-water and ice fishing pressure (69 hours per acre), ranking in the 90th percentile among 185 surveys completed on northern Wisconsin lakes < 500 acres from 1990 to 2008. Though the gear, methods, and timing of our surveys were not selected to provide an exhaustive representation of the fish community, the 13 species captured by netting and electrofishing were typical of fertile, weedy lakes of similar size where largemouth bass are the principal predator and bluegills are their primary prey. Populations of black crappie, yellow perch, pumpkinseed, yellow bullhead, golden shiner, and white sucker may also serve as prey for the bass. We captured a few green sunfish and warmouth rarely encountered in other lake surveys. Northern pike and walleye, both in low abundance, play a minor role in structuring the fish community. The smallmouth bass, channel catfish, lake sturgeon, and redhorse that we often find in nearby lakes with unobstructed connection to our floatable rivers were conspicuously absent—possibly because installation of flood control devices has disrupted the interactions between river and lake ecosystems and segregated communities and habitats that were once physically and functionally linked.

Largemouth Bass

Captured 9.0 per mile or 18 per hour ≥ 8"	
Quality Size ≥ 12"	44%
Legal Size ≥ 14"	11%
Preferred Size ≥ 15"	4%

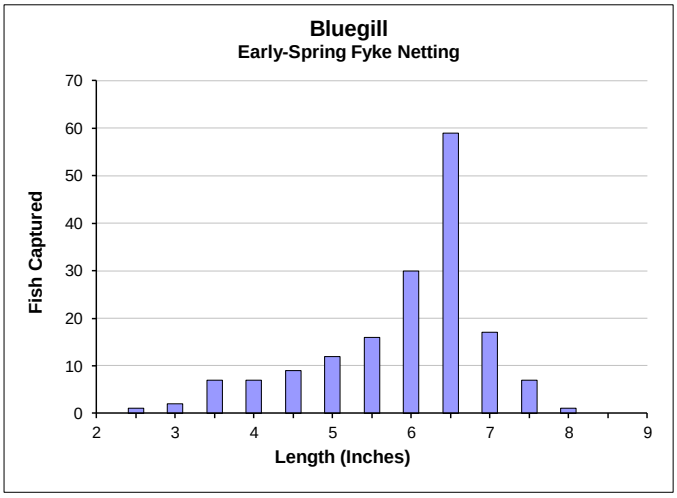


Our relatively low electrofishing capture rate of largemouth bass in 2011 was consistent with a 2003 estimate of low population density (2.4 – 5.8 bass ≥ 8″ per acre). But size structure had declined since 2003 when 38% of largemouth bass were of legal size and 25% were 15 inches or longer. Assuming that annual harvest has remained as low as estimated in a 2003 creel survey (0.5 largemouth bass per acre), age and increment analysis using scales suggests that a large portion of the slow-growing largemouth bass population dies of natural causes before the oldest individuals can attain the size that anglers prefer. Largemouth bass grew to 10.3 inches in 5 years (range 9.9 – 11.0; n = 4) and 12.3 inches in 8 years (range 12.0 – 12.8; n = 3)—2.4 and 5.0 inches below the regional average lengths at those ages. The youngest legal-size bass were 9 – 11 years old. Largemouth bass 10.0 – 14.3 inches long at capture had gained on average only 0.7 inch (range 0.4 – 1.4; n = 22) in their most recent growing season. With no evidence of excessive recruitment or high population density, we do not know why largemouth bass grow so slowly in this productive system. Historically, largemouth bass have been the dominant predator in the fish community, but at relatively low density they fail to control bluegill abundance in Amacoy Lake. Perhaps the strong behavioral preference that largemouth bass share with other predators to select cylinder-shaped prey like yellow perch (now relatively scarce) over platter-shaped bluegill (now relatively abundant) with excessive escape cover (aquatic plants) has created shortage in the midst of plenty—possibly impairing growth rates in several populations.

Bluegill

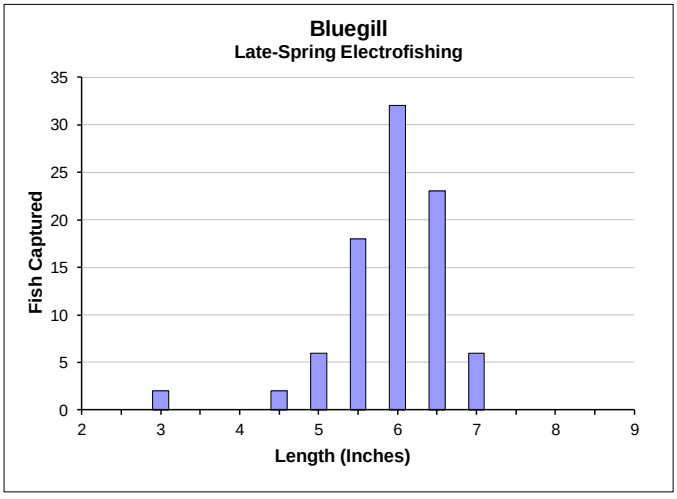
Early Spring Fyke Nets

Captured 17 per net-night ≥ 3"	
Quality Size ≥ 6"	68%
Keeper Size ≥ 7"	15%
Preferred Size ≥ 8"	0.6%



Late Spring Electrofishing

Captured 186 per mile or 372 per hour ≥ 3"	
Quality Size ≥ 6"	69%
Keeper Size ≥ 7"	7%

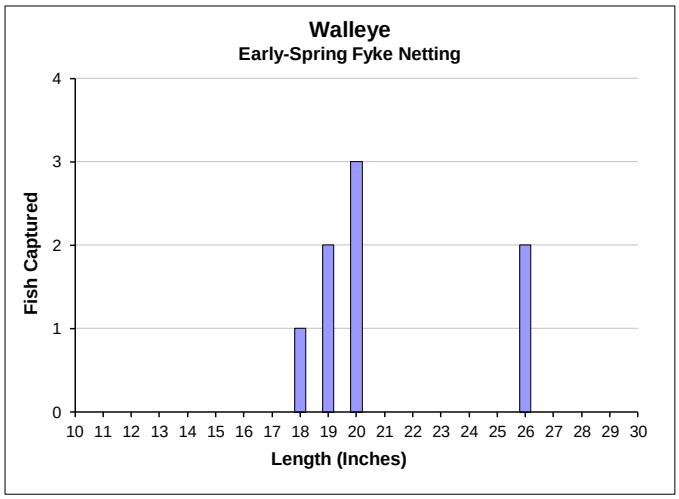


Our relatively high spring electrofishing capture rate of bluegill suggests high abundance. Predictably, growth rate was slower than normal. Without regard to variable growth rates between sexes and among males exhibiting different reproductive strategies, combined analysis of scales suggest that bluegills attained 5.7 inches in 5 years (range 5.0 – 5.9; n = 5) and 6.9 inches in 8 years (range 6.6 – 7.0; n = 6)—about 0.7 and 1.0 inch shorter than the average lengths at those ages in northern Wisconsin. Bluegill starting the year 4.2 to 7.5 inches long gained on average only 0.5 inch by the end of the growing season (n = 29). Slow growth rate explains why we observed so few "keeper size" and larger bluegills in spring fyke netting and electrofishing samples.

Overabundance, slow growth, and unsatisfactory size structure of bluegill reflects insufficient predatory control. Additionally, selective angler harvest of the largest, fastest-growing males (under a statewide bag limit of 25 panfish daily) may have negatively affected social and behavioral mechanisms known to regulate reproductive success, abundance, and growth rate in bluegill populations. In the 2003 – 2004 fishing season (open water and ice covered), anglers harvested an estimated 8,492 bluegills (30.5/acre) whose average length was 6.6 inches. Nearly 39% of the annual bluegill harvest was taken in May and June when the largest, nest-guarding male bluegills are most vulnerable to angling. Removing the largest males would reduce proportions of keeper- and preferred-size bluegill by shifting the energy budget of smaller, younger males towards reproduction and away from growth. With few or no large parental males to inhibit spawning by smaller males, smaller parental males mature and reproduce at younger ages, their growth rate slows sooner, and their ultimate size decreases. Strategies aimed toward improving bluegill size distribution should aggressively focus on protecting large parental males.

Walleye

Captured 0.8 per net-night ≥ 10"	
Quality Size ≥ 15"	100%
Preferred Size ≥ 20"	63%
Memorable Size ≥ 25"	25%

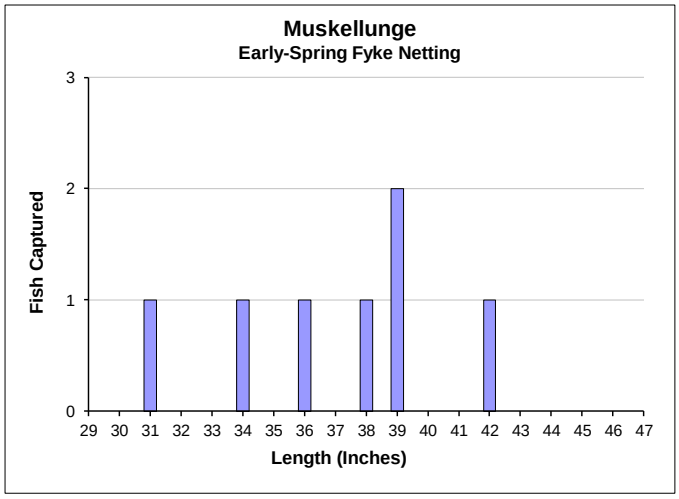


Length distribution and capture rate of walleye in early spring fyke nets portray a low-density population comprised exclusively of large, old, fast-growing fish with size structure nearly identical to that recorded in 2003 when 60% of the estimated 1.5 adults per acre in Amacoy Lake were 20 inches or longer. Fall fyke netting and late-spring electrofishing yielded similar characterizations of the walleye population. Analysis of spines taken in 2003 revealed that males and females combined nearly attained preferred size in only 6 years (mean 19.9; range 16.4 – 24.1; n = 77). High proportions of preferred- and memorable-size walleye and the absence of walleye < 18 inches long in all three surveys suggest that neither in-lake reproduction nor stocking small fingerlings (1½ – 2 inches) has been a reliable source of new recruits that grow to adulthood. In fall 1997 – 2003 electrofishing surveys, capture rates averaging 0.3 fingerling per mile (range 0 – 1.6; n = 7) documented negligible survival of walleye hatched in the lake or stocked at rates of 50 or 100 small fingerlings per acre in 1999 – 2003.

After one year of post-project evaluation, the shoreline rock blanket had no positive effect on walleye reproductive success. Because habitat conditions and fish community composition favor other species, and because we found no evidence that young walleye survived their first summer, we will likely discontinue stocking small walleye fingerlings in Amacoy Lake. Walleyes 18 – 29 inches long captured in 2010 and 2011may be survivors from 6,000 large fingerlings (5 – 8 inches) stocked in fall 1992, 1995, and 1997. Stakeholders could possibly maintain a bonus fishery for walleye by purchasing and planting large fingerlings with permit approval. Walleye fingerlings stocked in fall at 6 – 8 inches long may have a size or behavioral advantage over small fingerlings to avoid predation. Additional predatory pressure from young walleye could augment the currently insufficient effect of largemouth bass in controlling excessive recruitment of young bluegills and black crappies.

Muskellunge

Captured 0.7 per net-night ≥ 20"	
Quality Size ≥ 30"	100%
Preferred Size ≥ 38"	57%
Memorable Size ≥ 42"	14%



Our capture rate of muskellunge in early-spring 2011 fyke nets ranked in the 44th percentile among Class A2 waters that offer "quality action" fishing opportunity for muskellunge—a near-central rank, which suggests a moderate population abundance appropriate for statewide management objectives in this category. In 2003 Amacoy Lake anglers caught one muskellunge in 32 hours of fishing compared to the goal for Class A2 action waters (one muskellunge per 25 hours of muskie-directed effort). Fyke nets and electrofishing captured muskellunge of memorable size, but none longer than 43 inches. Several young muskellunge 17.5 – 19 inches long incidentally captured by electrofishing in late spring 2011 were presumed to be age-2 survivors of large fingerlings stocked in 2009 that appear to be growing at an average rate. In the same survey a 13-inch yearling muskellunge (presumed age) suggests that limited natural reproduction occurs in Amacoy Lake (because no muskellunge were stocked in 2010), though continued stocking seems necessary to maintain an action fishery. Assessing natural recruitment along with adult population status in surveys scheduled in fall 2017 and spring 2018 would allow us to adjust the current stocking rate (one large fingerling per acre) and frequency (alternate years), if necessary. WDNR's Fish Health Specialist could not determine from color photographs the cause of extensive lesions on two of five adult muskellunge captured by electrofishing.

Northern Pike

Early Spring Fyke Nets

Captured 0.1 per net-night ≥ 14"	
Quality Size ≥ 21"	100%

Late Spring Electrofishing

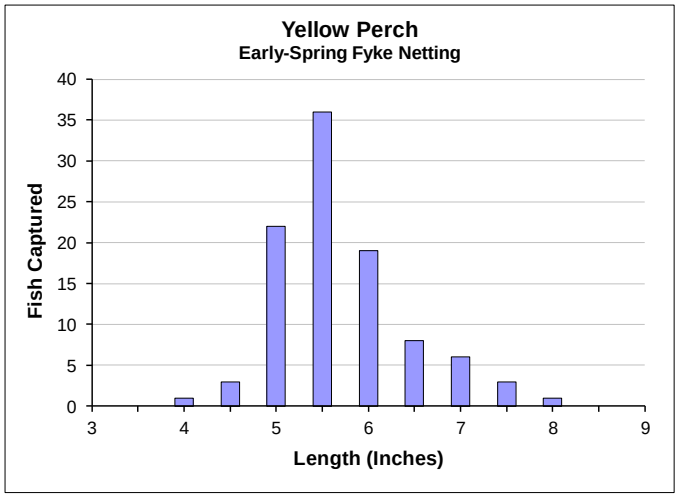
Captured 1.3 per mile or 2.6 per hour ≥ 14"	
Quality Size ≥ 21"	75%

Northern pike were nearly absent in early spring 2011 fyke nets. However, six pike 11 – 26.5 inches long captured incidentally in our late spring electrofishing survey represent a low-density population whose abundance and size structure have decreased substantially since April 13-18, 1966 when a trap net near the inlet stream captured 60 spawning pike 14 – 37 inches long per lift. Following the alleged invasion (or unauthorized introduction) of northern pike and displacement of muskellunge in Amacoy Lake, predatory pressure and competition from abundant pike were once believed to prevent successful reproduction of fingerlings stocked to restore the native muskellunge population. The apparent shift in dominance between these related species now favors muskellunge survival, and the flood control structure may prevent Chippewa River pike from invading again.

Yellow Perch

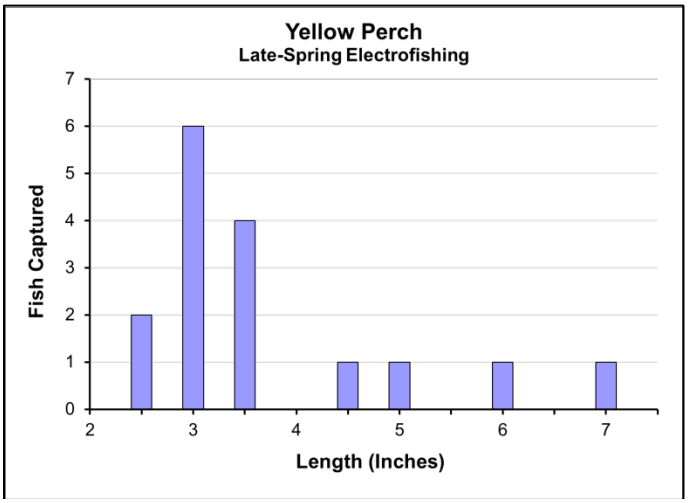
Early Spring Fyke Nets

Captured 9.5 per net-night ≥ 5"	
Quality Size ≥ 8"	1%



Late Spring Electrofishing

Captured 6.0 per mile or 12 per hour ≥ 5"	
Quality Size ≥ 8"	0%

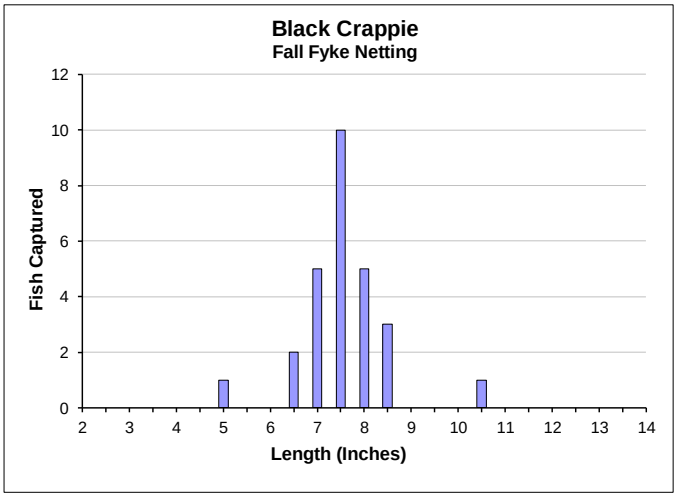


Our relatively low capture rate of yellow perch in early spring fyke nets indicated low abundance similar to levels recorded in other shallow, eutrophic lakes and impoundments with low water clarity and largemouth bass dominant in the fish community. Electrofishing captured moderate numbers of perch 2.5 – 3.5 inches long, indicating successful natural reproduction. But even a low density of predators seems to be effectively controlling the recruitment of young perch (a preferred food item) to adulthood. The near absence of perch longer than 8 inches probably results from size-selective predation by both anglers and muskellunge that prefer to eat the largest perch. Likely to be disappointed by the average length of perch harvested (7.6 inches), Amacoy Lake anglers kept only 16% of the estimated 5,092 perch caught in 2003, directing 4 – 6 times as much effort toward more abundant bluegill and black crappie populations with larger shares of quality- and keeper-size fish.

Black Crappie

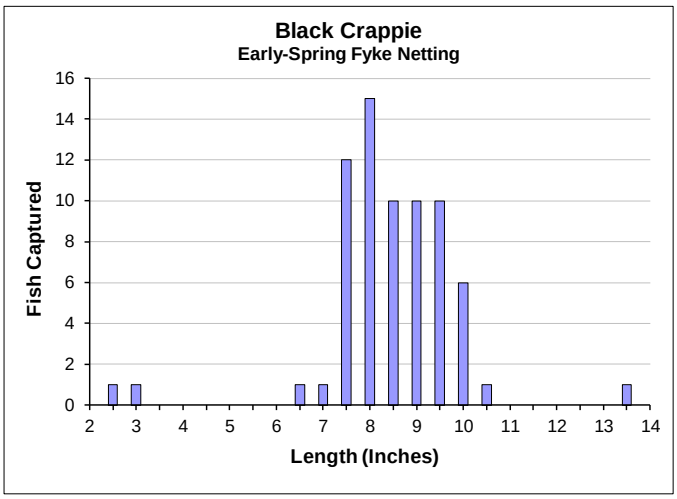
Fall Fyke Nets

Captured 5.4 per net-night ≥ 5"	
Quality Size ≥ 8"	33%
Preferred Size ≥ 10"	4%



Early-Spring Fyke Nets

Captured 6.7 per net-night ≥ 5"	
Quality Size ≥ 8"	79%
Preferred Size ≥ 10"	12%
Memorable Size ≥ 12"	1%



Low capture rates of black crappie in fall 2010 and early spring 2011 fyke nets represent low population abundance, yet analysis of scales indicates a slower-than-average growth rate usually associated with higher density. Crappie grew to 7.9 inches long in 6 years (range 7.4 – 8.5; n = 14) compared with the regional average length of 10.1 inches at that age. Black crappie 7.0 – 8.9 inches long at capture had gained on average only 0.5 inch (range 0.2 – 0.9; n = 24) in their most recent growing season. Fall and spring fyke nets captured crappies in all age classes, suggesting reliable, but variable recruitment to the population.

Amacoy Lake's high and stable water level, nutrient concentrations, and volume-to-discharge ratio favor the production and retention of zooplankton—important food that controls survival and growth of young crappies. Vegetative coverage in Amacoy Lake was within the optimal range (25 – 85%) for crappie reproduction and growth. Competition with abundant bluegill for shared food (mostly zooplankton and insect larvae) along with low abundance of young perch as food later in summer may be responsible for slow growth in the crappie population. In turbid or stained water, growth and survival rates would suffer if larger crappies are unable to switch to larger invertebrates or fish as prey and instead continue to eat zooplankton despite the high costs of capturing such small units of energy. Proportions of quality- and preferred-size crappies were higher in early spring versus fall nets, probably because early spring netting targeted mature fish preparing to spawn. Black crappie was the most sought-after sport fish in Amacoy Lake, attracting 38% of directed effort in 2003 when anglers caught 59 and harvested 32 crappies per acre. Under heavy fishing pressure, we predict that selective harvest of the largest crappies will perpetuate a boom-and-bust pattern in population abundance and size structure as favorable environmental conditions result in strong year classes that grow to desirable sizes. With slow growth rate of individual fish, the crappie population would probably not benefit from additional harvest restriction because a large percentage of fish would die of natural causes before reaching preferred size. Nonetheless, a reduced daily bag limit might help to distribute the harvest more evenly among anglers.

Survey data collected and analyzed by: Kendal Patrie, Rebecca Pawlak, Greg Rublee, and Jeff Scheirer—WDNR Fishery Team, Park Falls.

Written by: Jeff Scheirer—Fishery Biologist, March 27, 2013.

Reviewed by: Dave Neuswanger—Hayward Field Unit Supervisor, April 4, 2013

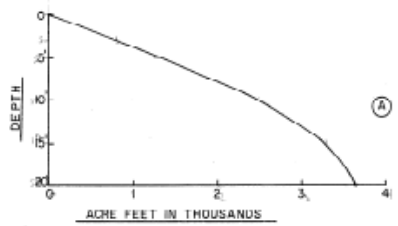
Approved for web posting by: Steve Avelallemant—Northern Administrative District Supervisor, 04/05/2013

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

LAKE SURVEY MAP

AMACOY LAKE — RUSK COUNTY

SEC. 25,26,35,36 T. -34- N. R. -8- W.



N

Department of Natural Resources Bench Mark.
3" Square cut into northwest corner of concrete base of water pump located 35' south of center-line of access road and 40' west of edge of lake.
Assumed Elevation 100.00'
Water Elevation 95.00'

EQUIPMENT RECORDING SONAR MAPPED JULY 1969
MONTH 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
- Bc. Bedrock
- B Boulders
- Stumps & Snags
- Rock danger to navigation
- T Submergent vegetation
- Emergent vegetation
- Floating vegetation
- Brush shelters

400' 0 400' 800' 1,200' 1,600'
SCALE

◆ Access ◆ Access with Parking ◆ Boat Livery

Drawn by: J. Roth
Field work by: C. Busch, C. Reiter, S. Johannes

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

WATER AREA 278.0 ACRES
UNDER 3 FT. 8 %
OVER 20 FT. 4 %
MAX. DEPTH 20 FEET.
TOTAL ALK. 36 P.P.M.
VOLUME 3,634.8 ACRE FT.
SHORELINE 3.66 MILES
3.35 MILES OF SHORELINE EXCLUDING ISLAND