



Summary of Fishery Surveys Musser Flowage, Price County, 2010 – 2011

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 Musser Flowage. We set 6 fyke nets and fished them overnight on October 5 – 6, 2010 for 6 net-nights of effort directed toward black crappie. Fyke netting in two periods shortly after the 2011 spring thaw targeted northern pike, walleye, yellow perch, and muskellunge. Five nets fished overnight on April 18 – 19 and 6 nets fished over two nights on April 29 – May 1 resulted in 17 net-nights of fishing effort. An electrofishing survey at night on May 24, 2011 documented the status of largemouth bass and bluegill populations. We sampled 4.0 miles of shoreline in 2.03 hours, including 1.0 mile sub-sampled for panfish in 0.58 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

Musser Flowage is a shallow, 563-acre impoundment on the mainstem of the Elk River, located about 7 miles east of Phillips, WI. Three additional tributaries contribute to an estimated annual discharge of 79 cubic feet per second from the 12-foot-high concrete dam. Maximum depth is 15 feet, and a fourth of the surface area is less than 3 feet deep. Mid-summer 2012 secchi disk depths averaging 2.6 feet indicate low water clarity. Citizen monitoring data collected annually since 1992 consistently reveal high levels of dissolved nutrients that can give rise to severe algae blooms, oxygen-depleted bottom water, and dense aquatic vegetation in summer. Lake map symbols show a lakebed comprised entirely of sand and muck—substrates conducive to vegetative growth. Coontail was found most frequently among 50 native and one invasive aquatic plant species documented in an August 2010 survey. Rooted aquatic plants grow to a maximum depth of 8 feet, but low water clarity limits light penetration, so most of the aquatic vegetation grows between 2 and 4 feet deep. Herbicide applied on targeted areas (0.8 – 23.5 acres) in 2005 – 2010 was ineffective in controlling the invasive curly-leaf pondweed population. In 1996, 1998, and 2002 rock blankets (low-profile layers of 2- to 12-inch diameter field stone) were added at one mid-lake and nine shoreline locations (total = 46,125 square feet) in an attempt to create walleye spawning habitat, but no positive effect on walleye reproduction could be attributed to the rock blankets after several years of evaluation.

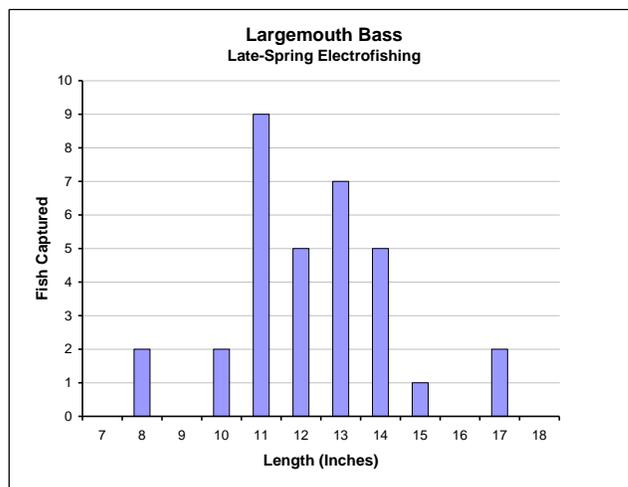
Summary of Results

Sixteen fish species were captured in our 2010 – 2011 netting and electrofishing surveys, including several riverine species (e.g. silver redhorse, shorthead redhorse, creek chub, and white sucker). Though smallmouth bass are common in the Elk River, we found none in Musser Flowage where rocky substrate and crayfish are scarce. Bluegills and black crappies in high abundance appear to be structuring the fish community in a negative way. Largemouth bass and muskellunge share dominance as principle predators but are not able to control the panfish.

Largemouth Bass



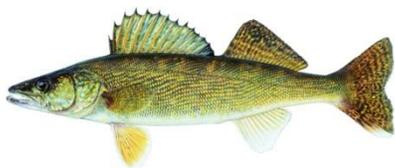
Captured 8.3 per mile or 16 per hour $\geq 8''$	
Quality Size $\geq 12''$	61%
Preferred Size $\geq 15''$	9%
Memorable Size $\geq 20''$	0%



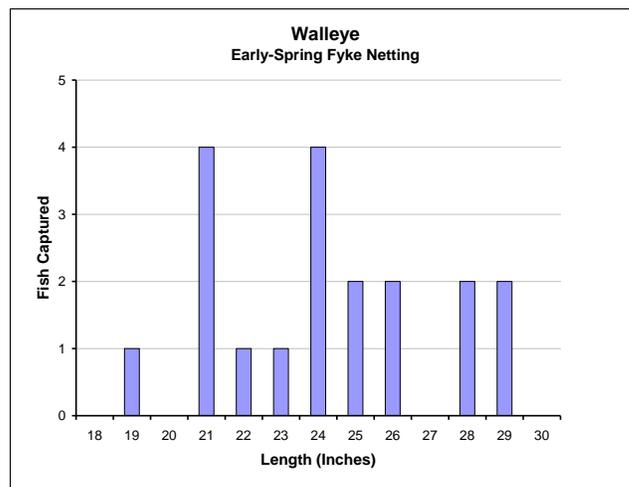
With water temperature 65 – 67°F the timing our late spring electrofishing survey corresponded well with largemouth bass spawning activities. Capture rate and length distribution of largemouth bass ≥ 8 inches point toward relatively low population abundance with a low proportion of legal-sized fish 14 inches and longer—a combination we would normally rate as offering only fair angling opportunity. Largemouth bass are closely associated with woody structure in Musser Flowage. Our method of site selection and inherent difficulties in sampling complex habitat in shallow water may have caused us to underestimate population abundance.

Ages estimated from scales show that largemouth bass grew to 11.9 inches in 6 years (range 11.0 – 12.7; n = 13) and 14.6 inches in 9 years (range 14.0 – 15.0; n = 5)—a slow growth rate 2.7 and 3.5 inches less than the regional average lengths at those ages, which may partially explain the low proportion of 14-inch and longer fish. (Most bass may die naturally before achieving legal size.) Bass starting the year 9.5 to 14.4 inches long gained on average only three-quarter inch (range = 0.26 – 1.47; n = 27) by the end of the growing season. Despite their slow growth, at least a few bass survive long enough to reach preferred size.

Walleye



Captured 1.1 per net-night $\geq 10''$	
Quality Size $\geq 15''$	100%
Preferred Size $\geq 20''$	95%
Memorable Size $\geq 25''$	42%



Early spring fyke nets depict a walleye population in low abundance comprised entirely of large, old fish. High proportions of preferred- and memorable-size walleye in fyke nets indicate low rates of reproductive survival, perhaps because with little or no segregation between littoral and pelagic habitat, young walleye (fry and small fingerlings) face intense competition from abundant bluegill and black crappie for zooplankton and benthic invertebrate food (see bluegill section below). Three walleyes 5 – 7 inches long captured by electrofishing in late spring indicated that a few of the 28,330 small fingerling stocked in June 2010 survived to age 1, possibly because low water clarity allowed them to evade sight-feeding predators. However, the absence of intermediate-size walleyes in our surveys suggest that continuing to plant 2-inch fingerlings at 35 or 50 per acre in alternate years is not an effective strategy to establish and maintain a fishery. If walleye remains an important sport-fish species to Musser Lake anglers, a combined strategy of annual overwinter drawdowns, aggressive stocking of large walleye fingerlings, and restoring the statewide 15-inch minimum length limit on walleye may serve to shift fish community dominance from largemouth bass and muskellunge (both incapable of controlling panfish abundance in lakes of this size) to walleye (the only alternative to achieve predator-prey balance), provided that stocked walleyes do not escape downstream and that Musser Flowage has sufficient areas with suitable light and temperature conditions to sustain a walleye population at moderately high density. Drawdowns of 5 – 6 feet each fall should facilitate predation by concentrating fish in a reservoir volume reduced by about 75%, and the dewatered lakebed exposed to freezing temperatures should decrease vegetative density and compact sediments in the near-shore zone. To substitute or supplement the walleye stocking requested through the Wisconsin Walleye Initiative, the Musser Lake Association could seek authorization to purchase and plant 6- to 8-inch fingerlings, whose behavior and larger size might increase their survival. With few natural or stocked recruits to the adult population, the current regulation that allows anglers to keep walleye of any size is inappropriate, so in 2014 we will initiate a proposal to restore the statewide 15-inch minimum length limit. More young walleyes, effective at controlling panfish abundance by predation, could eventually increase proportions of keeper- and preferred-sized bluegills and black crappies.

Muskellunge



Fall Fyke Nets

Captured 0.8 per net-night $\geq 20''$	
Quality Size $\geq 30''$	100%
Preferred Size $\geq 38''$	80%
Memorable Size $\geq 42''$	60%

Early Spring Fyke Nets

Captured 0.3 per net-night $\geq 20''$	
Quality Size $\geq 30''$	100%
Preferred Size $\geq 38''$	20%
Memorable Size $\geq 42''$	20%

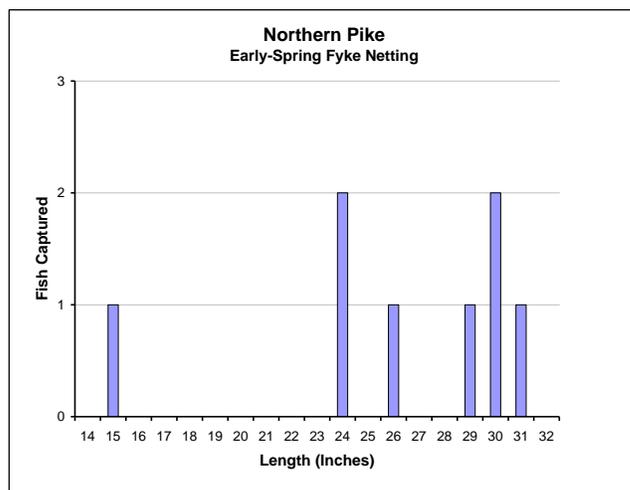
Fyke nets captured adult muskellunge in fall 2010 at a rate nearly three times higher than in early spring 2011, suggesting that with water temperatures only 40 – 46°F, both spring netting dates may have preceded peak spawning activity. Low numbers of muskellunge captured by all methods limit our confidence in interpreting these results; though we believe our surveys collectively represent a low to moderate adult population density with respectable percentages of

preferred- and memorable-size fish. Three muskellunge 15 – 18 inches long captured by electrofishing are presumed to be age-2 survivors of 282 large fingerlings stocked in September 2009 as a strategy to supplement in-lake production of new recruits in alternate years.

Northern Pike



Captured 0.5 per net-night $\geq 14''$	
Quality Size $\geq 21''$	88%
Preferred Size $\geq 28''$	50%
Memorable Size $\geq 34''$	0%



We captured very few northern pike by netting and electrofishing, leading us to speculate that predation on pike eggs and pike larvae by abundant bluegills and black crappies and predation on young pike by dominant largemouth bass and muskellunge control pike abundance and allow half of those 14 inches and longer to attain preferred size.

Yellow Perch

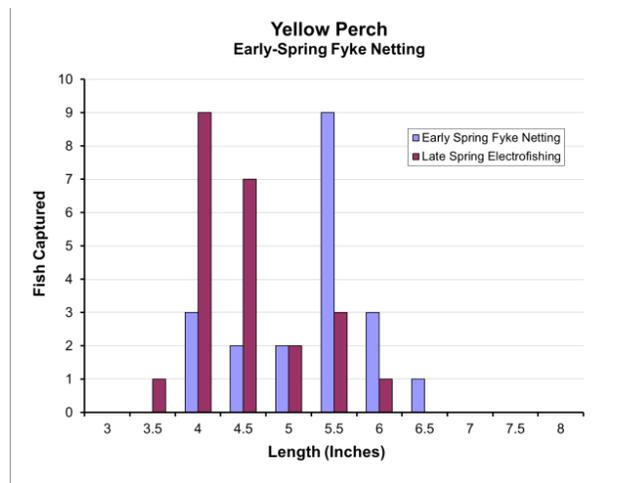


Early Spring Netting

Captured 11 per net-night $\geq 5''$	
Quality Size $\geq 8''$	0%

Late Spring Electrofishing

Captured 6 per mile $\geq 5''$	
Quality Size $\geq 8''$	0%



Capture rate of yellow perch in early spring fyke nets suggests low population abundance, yet subsamples measured from spring netting and electrofishing surveys show an undesirable size structure with no perch attaining quality size. We are not certain why yellow perch are so scarce and so small in Musser Flowage where high algal productivity, suitable habitat, and relatively few large predators should favor their survival. Under low to moderate levels of fishing pressure and predator abundance, neither selective harvest of the largest perch, nor the tendency of adult muskellunge and northern pike to selectively feed from the upper end of the perch population's length distribution, could account for the absence of perch 7 inches and longer. Similar to our hypothesis about walleye and northern pike populations, we suspect that recruitment to the

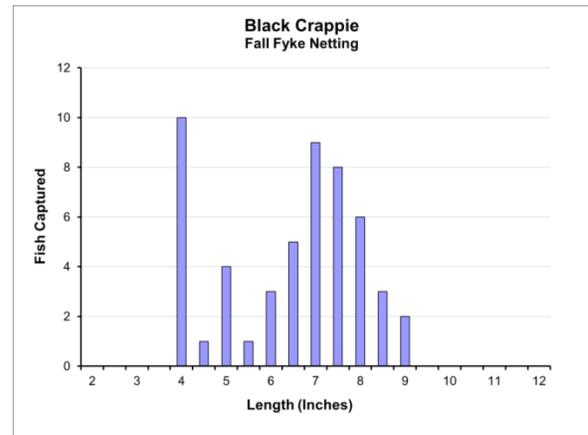
yellow perch population is severely limited by intense competition from and predation by abundant bluegills and crappies, which occupy and use all niches of Musser Flowage’s relatively homogeneous habitat. The shortage of perch, as important food of many species, undoubtedly contributes to low rates of recruitment, survival, and growth in sport fish populations. Because perch eat substantial numbers of young bluegills in winter, efforts to increase perch abundance could indirectly serve to control density and improve size structure of the bluegill population.

Black Crappie



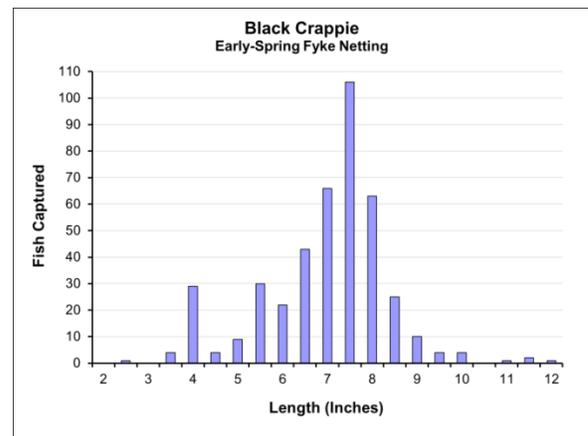
Fall Fyke Netting

Captured 6.8 per net-night $\geq 5''$	
Quality Size $\geq 8''$	27%
Preferred Size $\geq 10''$	0%



Early Spring Fyke Netting

Captured 54 per net-night $\geq 5''$	
Quality Size $\geq 8''$	28%
Preferred Size $\geq 10''$	2%



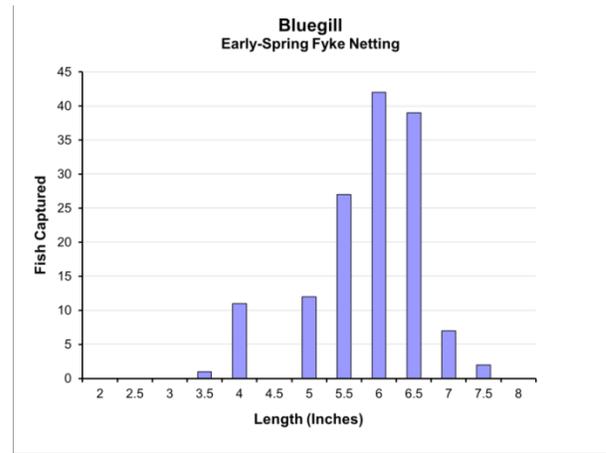
Capture rate of black crappies in early spring fyke nets was eight times greater than in fall fyke nets, but our measures of population size structure were nearly identical in those surveys. Multiple age classes represented in high abundance should offer consistent angling opportunity for several years, but we expect that few anglers will be satisfied by low proportions of crappies 9 inches and longer. Ages determined from scales reveal that black crappie grew very slowly, attaining 7.5 inches in 6 years (range 6.9 – 8.2; n = 11) compared with a regional average length of 10.1 inches at that age. Panfish populations suffer poor growth when predators fail to control panfish abundance. Crappies starting the year at 4.0 – 7.9 inches long gained on average 0.63 inch (range 0.21 – 1.22; n = 40) by the end of the growing season. The low percentage of black crappies 10 – 12 inches long in early spring fyke nets shows that with such meager annual gain few individuals will survive long enough to attain the sizes that anglers prefer.

Bluegill



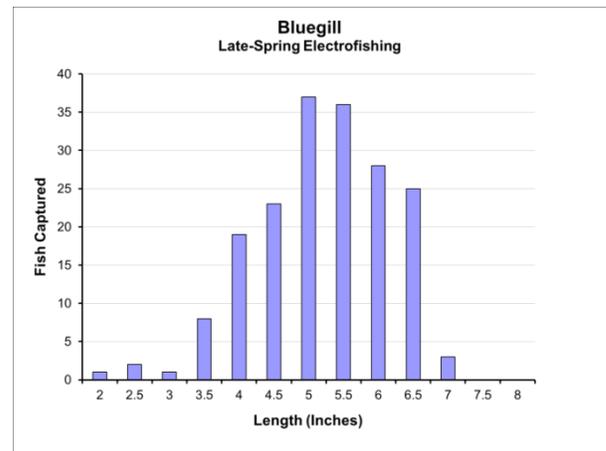
Early-Spring Fyke Netting

Captured 35 per net-night $\geq 3''$	
Quality Size $\geq 6''$	64%
Keeper Size $\geq 7''$	6%
Preferred Size $\geq 8''$	0%



Late-Spring Electrofishing

Captured 180 per mile or 310 per hour $\geq 3''$	
Quality Size $\geq 6''$	31%
Keeper Size $\geq 7''$	2%
Preferred Size $\geq 8''$	0%



Bluegills at high population abundance should offer consistent action to hold the attention of young anglers being introduced to the sport, but our spring surveys clearly show that panfish anglers looking for a meal will be disappointed in the low proportion of keeper-size bluegills and the absence of any bluegills 8 inches or longer. Largemouth bass and muskellunge, in low to moderate population density in Musser Flowage, are ineffective in controlling bluegill abundance by predation. As a result, we suspect that most slow-growing bluegills will succumb to natural causes of mortality before the oldest individuals grow to the sizes anglers prefer. Worse than that, bluegills and black crappies in such high abundance appear to be monopolizing and depleting the available supply of zooplankton and benthic organisms, which are essential for producing and sustaining enough walleye to effectively curb panfish density.

Water level in Musser Flowage has been lowered 6 feet by planned reservoir drawdown from September 2013 through April 2014 to facilitate dam repair and to evaluate the effectiveness of overwinter reservoir drawdown in controlling the invasive curly-leaf pondweed population. Though all risks and benefits of reservoir drawdown must be fully analyzed and regulatory approval must be obtained, a 5- to 6-foot reservoir drawdown repeated annually or biannually could shift dominance and restore balance in this fish community.

The relationships between zooplankton size and predator abundance in seven Connecticut lakes¹ and 35 New York lakes² provide strong evidence that zooplankton size can be a predictive index of predator-panfish balance. Large zooplankton species, more efficient in collecting small particles and capable of

¹ Brooks, J. L., and S. I. Dodson. 1965. Predation, body size and composition of zooplankton. Science (Washington, D.C.). 150:28-35.

² Mills, E. L., D.M. Green, and A. Schiavone, Jr. 1987. Use of zooplankton size to assess the community structure of fish populations in freshwater lakes. North American Journal of Fisheries Management. 7:369-378.

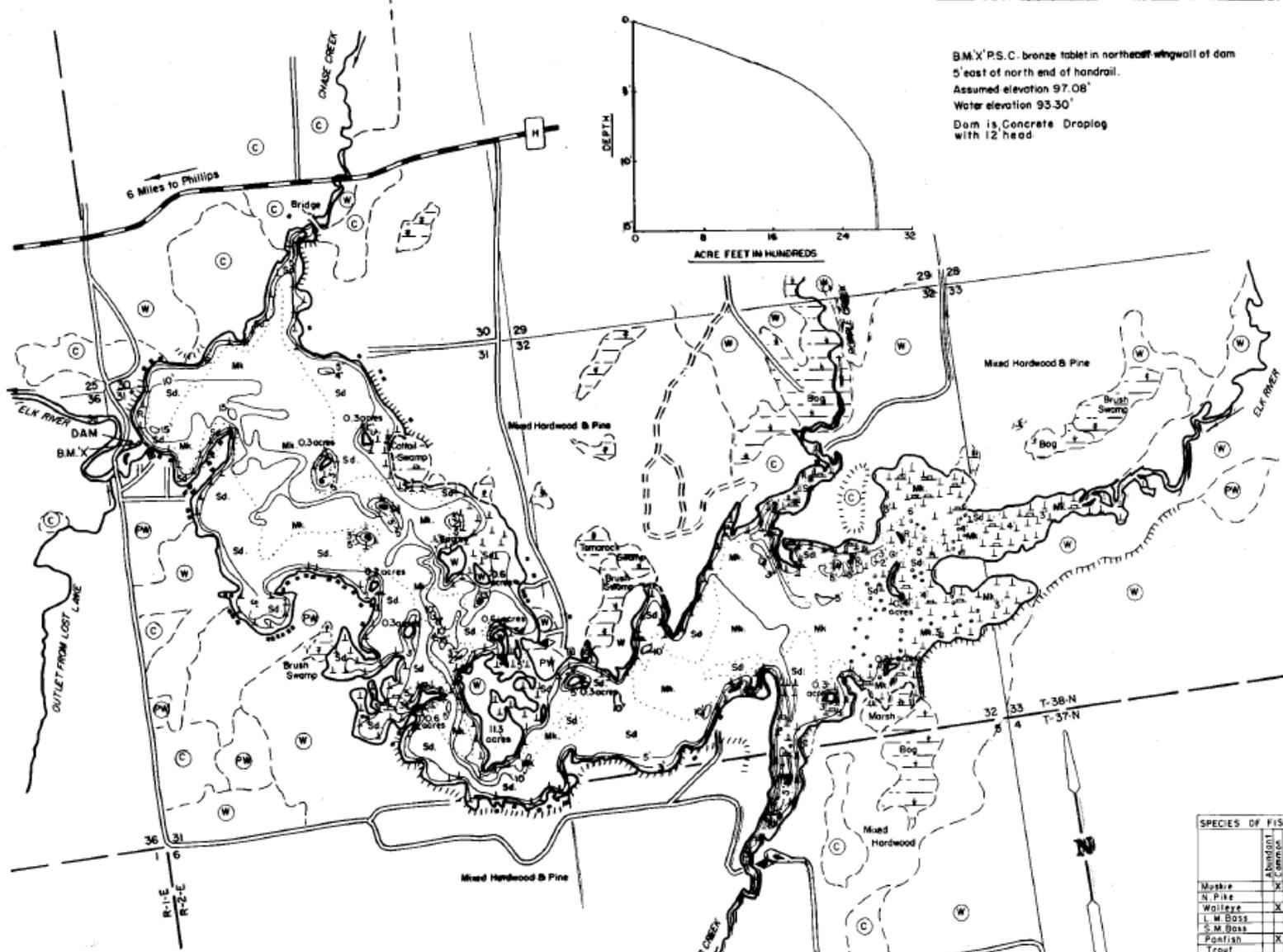
collecting larger particles as well, will competitively exclude their smaller relatives whenever size-dependent predation is of low intensity. Intense predation will eliminate the large zooplankton species, and the relatively immune small species will predominate. The Musser Lake Association could seek funding from a Lakes Protection Grant to monitor zooplankton size in spring and mid-summer to test our hypothesis that intense predation on zooplankton by abundant panfish severely suppresses the reproductive success of walleyes. If average zooplankton size exceeds 0.8 millimeters in June and is much lower by August, then the predation impact of young fish is probably high. On the other hand, if average zooplankton size is low both in spring and mid-summer, it is reasonable to assume that a high abundance of panfish is responsible for the predominance of small zooplankton. Monitoring changes in zooplankton size in Musser Flowage could also serve as an indirect and inexpensive means to evaluate our recommended strategies to restore balance in the fish community during the 6-year intervals between our scheduled fishery surveys. When the ratio of predators to panfish is adequate and predators are successfully controlling panfish density, zooplankton would be expected to be large in both spring and mid-summer.

Survey data collected and analyzed by: Kendal Patrie, Rebecca Pawlak, Greg Rublee, and Jeff Scheirer—
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Written by: Jeff Scheirer—Fishery Biologist, January 9, 2014.

Reviewed by: Dave Neuswanger—Hayward Field Unit Supervisor, January 10, 2014.

Approved for web posting by: Mike Vogelsang— acting Hayward Field Unit Supervisor, December 19, 2014.



BM. X' P.S.C. bronze tablet in northeast wing wall of dam
5' east of north end of handrail.
Assumed elevation 97.08'
Water elevation 93.30'
Dam is Concrete Droplap
with 12' head

EQUIPMENT RECORDING SONAR MAPPED JULY 1966
MO. YR.

- TOPOGRAPHIC SYMBOLS
- (B) Brush
 - (P) Partly wooded
 - (W) Wooded
 - (C) Cleared
 - (A) Pastured
 - (AG) Agricultural
 - BM. Bench Mark
 - Dwelling
 - Resort

- LAKE BOTTOM SYMBOLS
- P. Peat
 - Mk. Muck
 - C. Clay
 - M. Marl
 - Sd. Sand
 - Sl. Silt
 - Gr. Gravel
 - R. Rubble
 - Bn. Bedrock
 - T. Submergent vegetation
 - 1. Emergent vegetation
 - F. Floating vegetation

WATER ELEV. 93.00'



Access Access with Parking Boat Livery
Field work by L. Soper, C. Beach, & Winter Drawn by J. Roth

SPECIES OF FISH	Abundance	
	Common	Rare
Muskie	X	
N. Pike		X
Walleye		X
T. W. Bass		X
S. W. Bass		X
Panfish	X	
Trout		

566.6 ACRES WITH ISLANDS
AREA 353.1 ACRES
UNDER 3 FT. 24 %
OVER 20 FT. 0 %
VOLUME 2790.1 ACRE FT.
TOTAL ALK. 40 P.P.M.
SHORELINE 2.1 MILES
MAX. DEPTH 15 FEET