



## **Fishery Survey Summary**

# **Lake of the Pines, Sawyer County, Wisconsin, 2019-2021**

### **Introduction**

Several Wisconsin Department of Natural Resources (DNR) fisheries teams completed netting, electrofishing and angler use surveys in 2019–2021 to assess the status of important sport fish populations in Lake of the Pines. Fyke netting and electrofishing surveys completed shortly after the spring thaw targeted walleye, muskellunge, northern pike and yellow perch, and their catches yielded estimates of walleye and musky population density. An electrofishing survey in late spring characterized the abundance and size structure of Lake of the Pines' largemouth bass, smallmouth bass and bluegill populations. Those results helped evaluate the effectiveness of three experimental panfish harvest regulations. Fall electrofishing evaluated walleye recruitment. We estimated angling pressure, catch and harvest from a year-round creel survey, using modified procedures to limit the spread of human coronavirus. 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 the team's description for black crappie and yellow perch  $\geq 9$  inches and bluegill  $\geq 7$  inches, based on observed angler behavior.

### **HABITAT AND PUBLIC ACCESS CHARACTERISTICS**

Lake of the Pines is located within the Flambeau River State Forest about 17 miles east of Winter, WI and 20 miles west of Phillips, WI. Sometimes called Pickerel Lake, this 273-acre, hard water lake drains about a half mile via Connors Creek and Papoose Lake to Connors Lake. The maximum depth is 39 feet, and the average depth is 17 feet. The nearshore lakebed has 60% sand, 20% gravel and 20% muck. Secchi depth ranged from 4 to 6.5 feet and averaged 5.3 feet in the summer from 2010 to 2020.

Water clarity was exceptionally high in 2021 and 2022 when Secchi depth ranged from 9 to 14 feet. Organic compounds leaching from wetlands imparts a tea-colored stain. Lake of the Pines is classified with other cool, stained-water lakes with complex fish communities.

Nutrient and chlorophyll levels in samples collected by citizen volunteers in 2021 allow us to classify Lake of the Pines among mesotrophic lakes that have moderate fertility and mid-range biological productivity. By late June, the water column usually stratifies into a warm upper layer and a colder bottom stratum where dissolved oxygen drops below the concentrations fish need to survive and thrive. Few, if any, fish will occupy depths greater than 15 feet in summer until mixing occurs again in fall. The shorelands are mostly upland forests held in public ownership. The DNR maintains a boat ramp, fishing pier, swimming beach and campground on the northwest shore.

### **SURVEY EFFORT**

Shortly after the ice thawed, when water temperature ranged from 43°F to 55°F, we captured, tagged and released spawning muskellunge and measured walleye in 117 net-nights of fyke netting effort from April 25-May 13, 2019. Typically, we estimate musky

population numbers from spring fyke net samples in consecutive years, but the coronavirus pandemic suspended netting planned in spring 2020. In spring 2021, we resumed netting and electrofishing surveys to estimate the adult density of muskellunge and walleye by standard mark-recapture methods. We directed 64 net-nights of fyke netting effort toward walleye, muskellunge and northern pike from April 1-9, 2021, when water ranged from 40 to 55°F. Eighty additional net-nights of fyke net effort targeted only muskellunge until April 21, 2021, when water temperature had decreased to 47°F. On April 9, 2021, we targeted walleye again by nighttime electrofishing along the entire perimeter, sampling 4.74 shoreline miles in 2.18 hours of electrofishing effort when water temperature was 51°F.

With water temperatures between 59°F and 63°F, our May 18, 2021 electrofishing survey coincided with the early spawning activities of smallmouth bass, largemouth bass and bluegill. We dip-netted game fish along 3.00 shoreline miles in 1.42 hours, and we subsampled all fish species for 2.00 miles in 0.98 hours.

We measured walleye recruitment annually in 2018-2021 as the number of age-0 fingerlings and age-1 yearlings captured per shoreline mile in fall electrofishing surveys. Fall electrofishing targeted young walleye, but we collected all game fish along the entire shoreline each year.

Survey Date	Electrofishing Miles	Electrofishing Hours	Water Temperature °F
Oct. 4, 2018	4.88	2.47	56
Sept. 17, 2019	4.91	2.33	68
Sept. 15, 2020	5.17	2.45	63
Oct. 4, 2021	5.00	2.22	66

At the onset of the coronavirus pandemic, the DNR modified its standard creel survey methods to protect staff and the public from disease exposure. Angler counts to estimate fishing effort began on May 23, 2020, three weeks after the fishing season opened on May 2, 2020. The creel clerk began interviewing anglers on July 13, 2020. Typically, creel clerks count and interview anglers on a randomized schedule through the entire fishing season. The late start of angler counts did not affect estimates of fishing pressure for the month of May. However, the delayed interviews affected our ability to estimate directed effort, catch rate and harvest rate in May and June. For walleye, muskellunge, bluegill and yellow perch in those two months only, we estimated catch and harvest by multiplying total fishing effort derived from angler counts in May and June 2020 by the average “general catch rate” and average “general harvest rate” from creel surveys on Lake of the Pines in 1995 and 2013. For all species in the remaining months, we used standard protocols and calculations to estimate catch and harvest. For species not listed above, directed effort, catch and harvest are underestimated for the open-water period and the entire fishing season because May and June are excluded from those totals.

# Results and Discussion

## FISH COMMUNITY

Though not specifically designed to evaluate diversity, our combined netting and electrofishing efforts captured 13 fish species in 2021 compared to 14 collected by those methods in 2012-2019. Fish community composition in Lake of the Pines reflected the species found in the cool-dark-complex lake class. Walleye and muskellunge were the dominant predators, and yellow perch, bluegill and black crappie were the three most abundant panfish populations. Other important forage included soft-rayed, tube-shaped white sucker and golden shiner that predators prefer over spiny-rayed, platter-shaped fish.

## WALLEYE

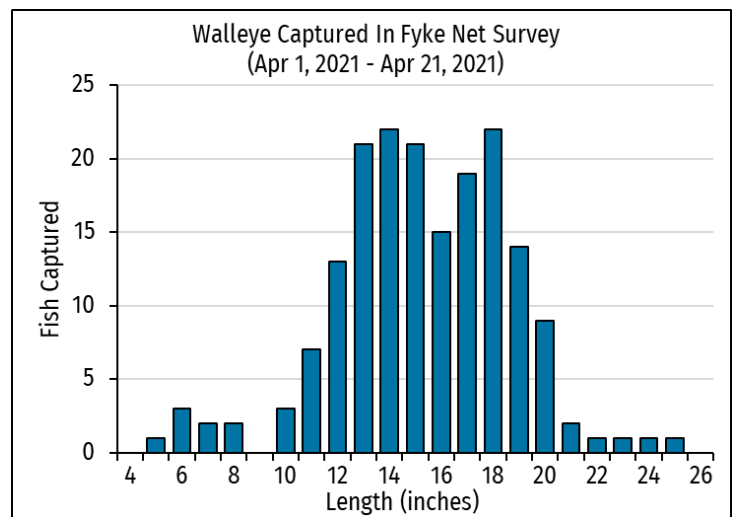
Early spring fyke netting captured 218 walleyes at a rate of 3.3 fish  $\geq$  10 inches per net-night. That netting catch rate was between the 25<sup>th</sup> and 50<sup>th</sup> percentile among lakes in the complex-cool-dark classification. Those walleyes captured just once in nets ranged from 5.5 to 25.5 inches and averaged 15.6 inches long. Early spring electrofishing captured 397 walleyes, including 15 that we marked and released in our netting survey.

Electrofishing catch rates were 22 walleyes  $\geq$  10 inches per mile or 47 per

hour. Those not handled before ranged from 5.0 to 23.0 inches and averaged 8.5 inches. From these netting and electrofishing samples, we estimated that the Lake of the Pines' walleye population had 592 adults or 2.2 adults per acre (95% confidence interval = 367-817; coefficient of variation = 0.19). Walleye density in 2021 was eight times higher than in 2013 but still below our goal to have 3-5 adults per acre. However, with 62% of walleyes in fyke nets at least 15 inches and 9% at least 20 inches long, the population exceeded its size objective to have 25-35% at least 15 inches long. The ratio of males to females was 1.3.

Female walleye reached the legal size of 15 inches in four growing seasons (n=2), while male walleye needed five years to attain 15 inches (n=23). Ring counts on sectioned dorsal spines revealed that, on average, males grew to 12.1 inches in three years (n=5), 13.4 inches in four years (n=31) and 16.2 inches in six years (n=7). Female walleye reached 17.9 inches in six years (range 16.5-19.2; n=14), 18.6 inches in seven years (range 17.0-20.7; n=28) and 20.7 inches in eight years (range 19.9-22.3; n=11). In a pooled sample of males, females and walleye whose gender was unknown, growth trailed the regional average by 2.4 and 1.3 inches at ages 3 and 4, by 0.8 inches at age 5 and by 0.4 inches at ages 6 and 7. However, the growth of walleye in Lake of the Pines outpaced the regional average by 0.6 inches at age 8 (n=12), by 1.4 inches at age 9 (n=2) and by 3.2 inches at age 10 (n=2). We found no females less than 14.2 inches long and four years old and no males longer than 20 inches.

Concerned about very low walleye density, coarsely measured at 0.3 adults per acre in 2013, the DNR began stocking walleye in 2014 at a rate of 15 large fingerlings per acre in even-

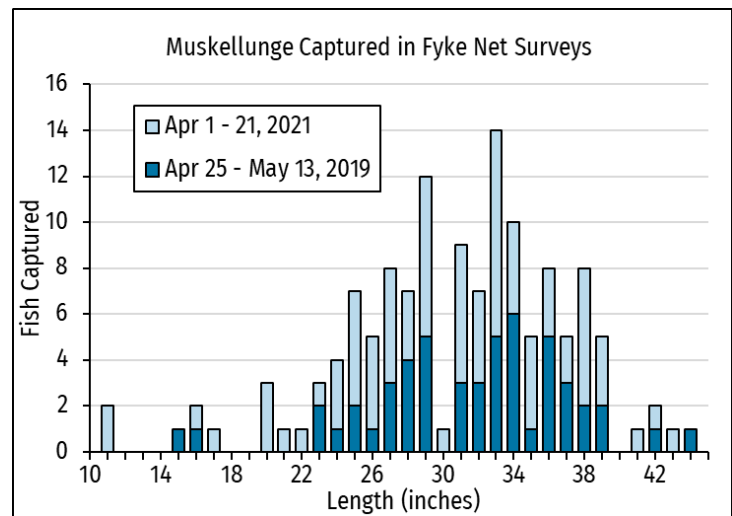


numbered years. To date, Lake of the Pines has received 16,362 fingerlings 6-7 inches long—the only walleye stocked and logged among electronic records dating back to 1972. We use the number of age-0 fingerlings captured per shoreline mile in fall electrofishing surveys as our standard assessment of walleye recruitment. Fingerling catch rates ranging from 0 to 9.6 and averaging 2.4 fingerlings per mile in nine fall electrofishing surveys from 1997 to 2021 show that natural reproduction has added few recruits to the walleye population in the last 25 years. The fingerlings stocked in 2014 may have matured to produce a modest 2020 year class (9.6 fingerlings per mile), but recruitment remains below average among walleye populations sustained by natural reproduction and stocking combined. Unless fall electrofishing captures more than 25 fingerlings per mile to indicate satisfactory natural recruitment, walleye stocking will continue while the broad-scale evaluation of the Wisconsin Walleye Stocking Initiative is completed. Angling harvest is managed under the standard walleye regulation for Wisconsin’s Ceded Territory. Three walleyes from 15 inches but less than 20 inches may be kept, except one fish may be over 24 inches from the first Saturday in May through the first Sunday in March.

From angler counts and interviews, we estimated that anglers caught 769 walleyes and kept 118 in the 2020–2021 fishing season, using the modified calculation described above. Walleye attracted 2,562 angler hours, or 13.5% of the directed fishing effort. Harvested walleyes ranged from 12.3 to 28.1 inches and averaged 18.1 inches. One harvested walleye measured in the creel survey was less than legal size, and two legal-size fish were longer than 24 inches. Ice anglers accounted for about 18%, 17% and 58% of the annual walleye catch, harvest and fishing effort directed toward them.

## MUSKELLUNGE

Fyke netting in spring 2019 captured 52 muskellunge that ranged from 15.6 to 44.1 inches and averaged 32.0 inches long at a rate of 0.44 muskies per net-night. Two years later, in spring 2021, fyke nets captured 82 muskellunge ranging from 11.0 to 43.8 inches and averaging 30.6 inches long<sup>1</sup> at a catch rate of 0.57 fish per net-night. In both years, these catch rates ranked near the median value of 0.52 muskies per fyke net-night among lakes in the complex-cool-dark lake class.

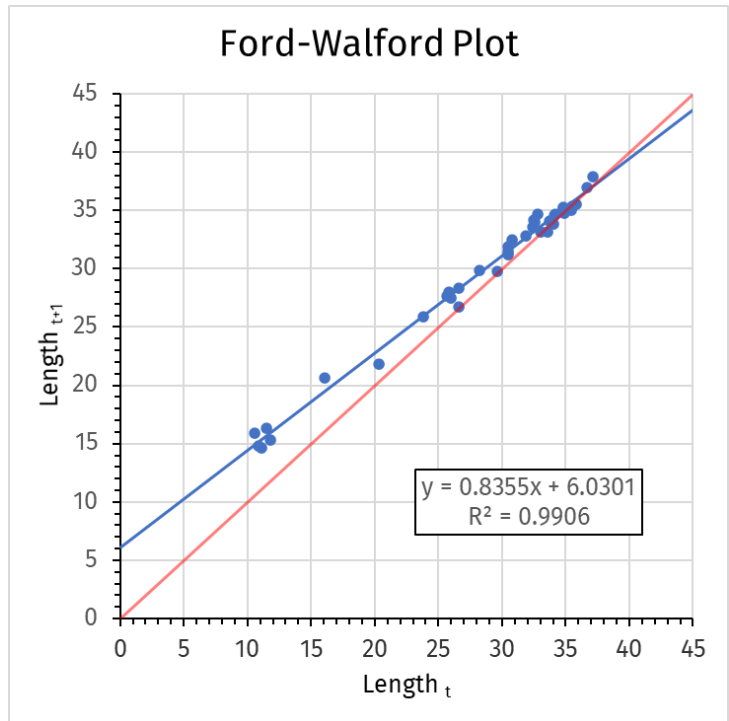


The coronavirus pandemic interrupted our standard protocol for estimating muskellunge population density from fyke net samples typically gathered in consecutive years. Most fishery surveys were suspended statewide in spring 2020 as a safeguard against human disease transmission. Based on nontypical samples separated by two years, we estimated

<sup>1</sup> Detections of uniquely coded Passive Integrated Transponder (PIT) tags revealed that nine muskellunge captured in spring 2019 were captured again in spring 2021. The length statistics and chart data for 2021 include those nine muskies recaptured after two years.

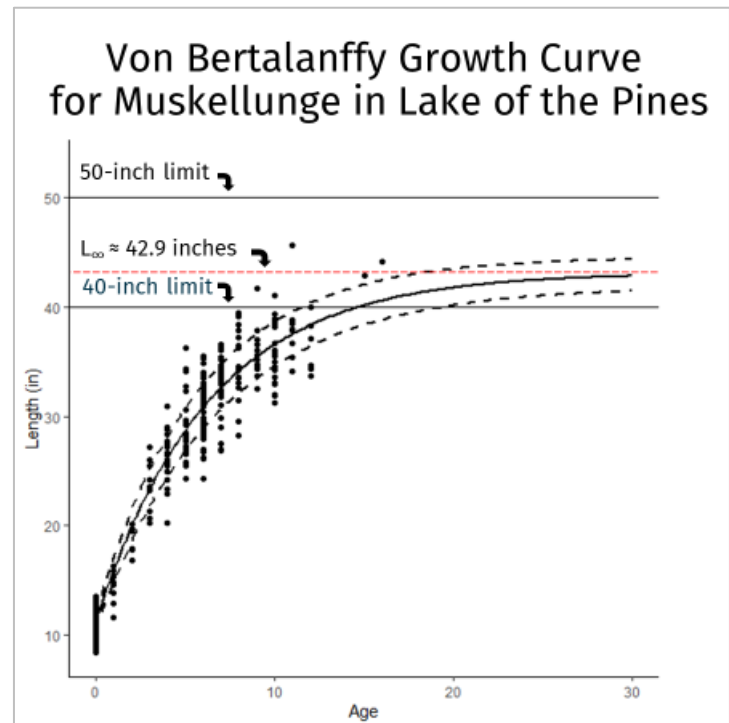
that Lake of the Pines had 448 adults  $\geq 20$  inches (95% confidence interval=186-709; coefficient of variation=0.298) or 1.64 adults per acre. By comparison, the musky population density was 1.24 adults per acre in 2015-2016 and 1.48 adults per acre in 2009-2010. All recent estimates far surpassed our goal for a muskellunge population at a low to moderate density of 0.1 to 0.2 adults per acre.

In a combined sample of muskies  $\geq 20$  inches from both years, 14% were preferred-size fish at least 38 inches long, and 3% were memorable-size fish 42 inches or longer. The population fell far short of its size objective to have 10-20% of muskellunge attain memorable size. However, this goal may be unrealistic when the adult population density is consistently as high as it is in Lake of the Pines. From a Ford-Walford plot of 39 tagged muskies that were each measured at time (t) and measured again upon recapture 346-384 days later



again upon recapture 346-384 days later at time (t+1), we can expect most muskellunge in this high-density population will “top out” near an ultimate length of 36.7 inches—nearly an inch less than the ultimate length

predicted from 25 tagged muskies recaptured through fall 2019. We also completed a more robust analysis of length at known ages and at ages estimated from cross-sectioned anal fins rays collected in 2015, 2016, 2019 and 2021. The von Bertalanffy growth model predicted that muskellunge will approach the asymptotic length of 42.9 inches in Lake of the Pines. On average, males grew to 26.0 inches in four years (range 20.3-29.0; n=11), to 29.9 inches in six years (range 24.3-35.5; n=28) and to 33.3 inches in eight years (range 28.2-37.9; n=9). The youngest females in the aged sample averaged 31.2 inches at age 5 (range 26.5-36.2; n=4), 32.9 inches at age 7 (range 26.9-36.2; n=11) and 38.0 inches long at age 10 (range 32.9-41.0; n=7). In a combined sample of 96 males, 54 females, one hybrid and 26 muskies whose gender was unknown, average length surpassed the regional averages by 0.9 to 2.6 inches at ages 2 and 3. The average length at ages 4 and 5 nearly matched the regional norms. However, the mean length of muskies in



Lake of the Pines trailed the regional averages by 0.9 to 3.6 inches at ages 6-11 and by 5.2 inches at age 12. The longest, oldest and fastest-growing female muskellunge was 44.1 inches at age 16, exceeding the von Bertalanffy model's ultimate length prediction by 1.2 inches.

With adult muskellunge density currently more than 1500% above the desired range, it will be difficult, perhaps impossible, to reduce population abundance and improve size structure with our conventional management strategies. In 2017 we suspended the 40-year history of frequent, sometimes excessive, musky stocking, and now natural recruitment alone sustains the population. Decreasing or eliminating the 40-inch minimum length limit and promoting selective harvest of small- and intermediate-size muskellunge would probably not help to improve their population status, given the deeply rooted catch-and-release principles held by many musky anglers. Muskellunge received 3,013 hours of directed angling effort in the 2020-2021 fishing season, accounting for 39% of the open-water total and making them the most popular summertime fishing target in Lake of the Pines. Estimates that used surrogate catch and harvest rates for May and June show that anglers caught and released 220 muskellunge but kept none in 2020.

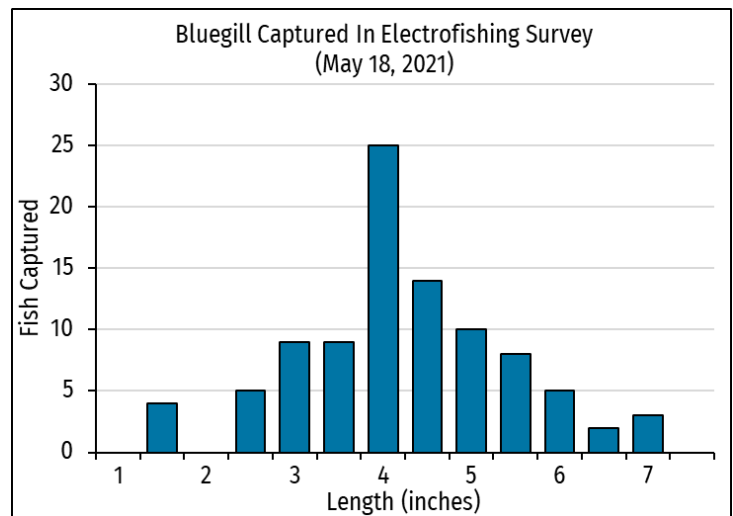
Capture and transport of muskies from Lake of the Pines downstream to Connors Lake have been suggested as a potential strategy to relieve crowding and improve the status of several sport fish populations in both lakes. This labor-intensive approach would face substantial challenges, however. PIT tag detections in scheduled surveys reveal that muskellunge voluntarily move in both directions between these waters. Of the eleven individuals that we tagged in one lake and recaptured in the other, three moved from Connors Lake to Lake of the Pines, five moved from Lake of the Pines to Connors Lake and three made round trips. The period between detections in different lakes ranged from seven days to eight and a half years. Our presence for tag detection on these waters is episodic, with capture gear deployed only for a few hours or weeks in scheduled survey years. Therefore, we do not know how many fish move and how often they move between these lakes. Any benefits gained from a fish transfer could be cancelled by natural fish movement through this unobstructed corridor, especially if muskellunge exhibit homing behavior. Decisions on transporting live fish within and beyond connected waters need careful scrutiny of costs, risks, benefits and chances for success.

Measurable objectives for muskellunge were developed in 2008, based on local stakeholders' expressed interest in size over number and their strong preference to release most muskellunge caught. The goals for important sport fish populations were applied uniformly to the four major lakes in the Flambeau River State Forest, recognizing that adjustments may be warranted to accommodate lake-specific conditions and new information as it becomes available. Now that stocking has been suspended, the muskellunge population in Lake of the Pines may eventually stabilize toward lower abundance, a moderate rate of natural recruitment and faster growth to produce the desired proportion of memorable-size fish. Relying on natural processes, perhaps those looked-for improvements in musky population status could be realized over the course of 20 years, [as we noticed in nearby Butternut Lake after stocking ended in 1999](#). Extraordinary measures would undoubtedly be necessary to achieve our present-day objectives within a shorter period. Alternatively, the existing goals for musky numbers and size could be

modified to reflect more realistic expectations for this population. The high-density musky population in Lake of the Pines currently offers fast-fishing action, which can be enticing to novice musky anglers and enjoyable for state forest visitors.

## BLUEGILL

In our late spring electrofishing survey, we caught 94 bluegills that ranged from 1.5 to 7.0 inches and averaged 4.4 inches long. The electrofishing catch rate of 86 bluegills  $\geq$  3 inches per hour indicated the low to moderate abundance desired within the objective range of 50-100 bluegills  $\geq$  3 inches per hour. Our spring electrofishing catch rate of 43 bluegills  $\geq$  3 inches per mile ranked near the 25<sup>th</sup> percentile among lakes in the cool-dark-complex classification. Bluegill numbers have decreased substantially since late spring 2013 electrofishing captured 638



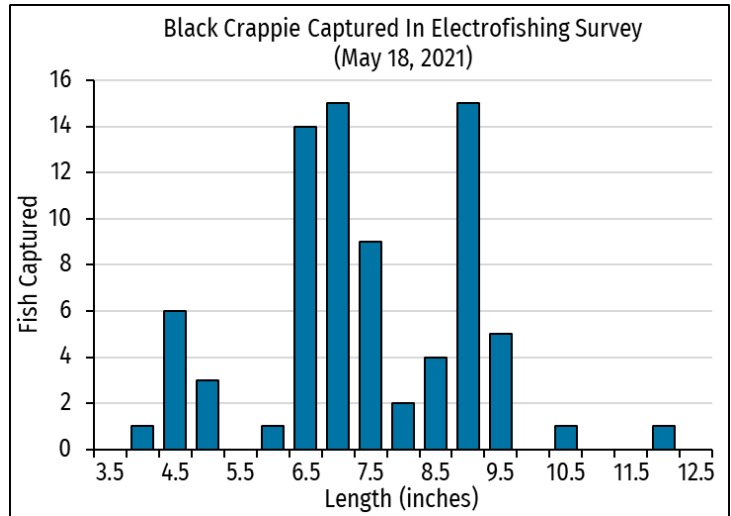
bluegills  $\geq$  3 inches per hour, perhaps because walleyes are now plentiful enough to control bluegill abundance by predation. Despite favorable bluegill abundance and modest gains in length distribution since our late spring electrofishing survey in 2013, the population's size structure did not meet our goal to have 5-10% at least 8 inches long. Our recent sample had no preferred-size bluegills  $\geq$  8 inches, and only 4% were keeper-size fish  $\geq$  7 inches.

In a [broad-scale evaluation](#) that began in 2016, the DNR applied three experimental panfish harvest regulations on 94 lakes where angling harvest appeared to be a problem. For five fishing seasons before this spring 2021 electrofishing survey, anglers could keep a daily bag limit of 25 panfish but only 10 of any one species in Lake of the Pines. So far, this experimental panfish harvest restriction has not increased bluegill length by one half to one inch, as intended. The average bluegill length decreased by 0.6 inches in Lake of the Pines since our last electrofishing surveys in late spring 2013, but the proportion of bluegill  $\geq$  7 inches increased from 0% to 3.5% in the same period. This special regulation will remain in place, at least until 2026, while the trial and evaluation of three new panfish regulations continues.

Modified creel survey projections reveal that anglers caught 3,235 bluegills and harvested 268 in 2,198 hours, or 11.6% of directed fishing effort. Most of the bluegill catch (86%) and harvest (81%) and half of the bluegill fishing effort took place in May through October. The creel clerk measured 13 bluegills from 6.5 to 8.0 inches long harvested in December, January and March, but none were taken in the open-water season. Ice anglers selectively harvested the largest bluegills. In that small sample, 77% were keeper-size bluegills  $\geq$  7 inches, and 15% were preferred-size fish  $\geq$  8 inches that were not detected by electrofishing.

## BLACK CRAPPIE

In early spring 2019 and 2021, we focused fyke netting effort exclusively toward walleye and muskellunge. We did not count and measure black crappies captured in fyke nets for comparison with our objectives that describe the moderate density and moderate share of preferred-size fish  $\geq 10$  inches that stakeholders want in the crappie population. Late spring electrofishing captured 77 black crappies 4.2 to 12.0 inches long at rates of 35 crappies  $\geq 5$  inches per mile or 71 per hour. In that sample, 31% were keeper-size crappies  $\geq 9$  inches, 3% attained preferred size, and one crappie reached memorable size  $\geq 12$  inches. The average length of crappies in electrofishing samples increased from 6.0 inches in spring 2013 (n=29) to 7.6 inches in spring 2021.



Ages estimated from the whole or cross-sectioned ear bones extracted from 40 crappies revealed slower-than-average growth to age 2, followed by near average growth rates at ages 3-7. On average, crappies in Lake of the Pines grew to 7.2 inches in three years (range 6.6-7.9; n=15), and they attained keeper size  $\geq 9$  inches in five years (mean=9.3 inches; range 8.5-12; n=10).

Black crappies were the most sought-after fish species in Lake of the Pines, attracting 7,392 angler-hours or 39% of the directed fishing effort from July 2020 to March 2021. In that period, anglers caught 7,504 crappies and harvested 3,968. Virtually all of the estimated catch (94%), harvest (98%) and fishing effort directed at crappies (92%) occurred in the ice-covered season, though estimates of these values are missing for May and June 2020. The creel clerk measured 202 crappies in winter and none in the open-water season. Harvested crappies ranged from 7.5 to 13.5 inches and averaged 9.9 inches long. The length distribution of harvested crappies did not reflect the length distribution of our electrofishing sample. As expected, anglers are keeping the largest crappies they catch. Nearly 43% of crappies taken by anglers were 10 inches or longer, compared to 3% in those sizes captured by electrofishing. The 25/10 bag limit on panfish may help to distribute winter crappie harvest more equitably among anglers.

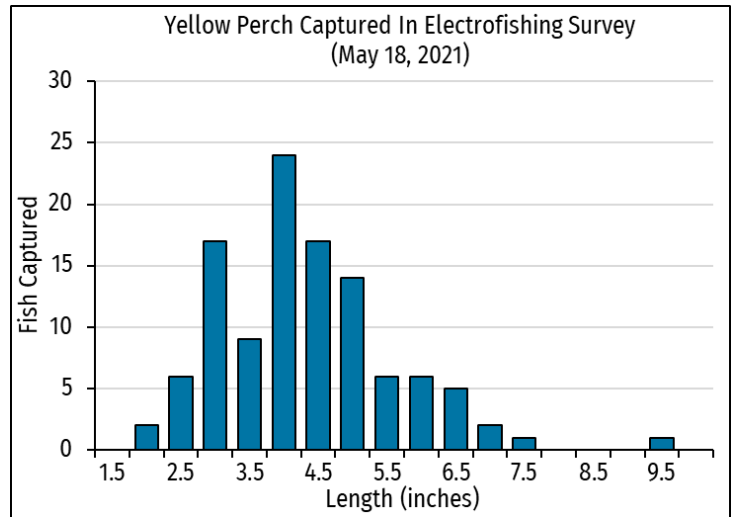
## YELLOW PERCH

The late-spring electrofishing sample had 110 yellow perch that ranged from 2.3 to 9.5 inches and averaged 4.5 inches long. Electrofishing captured 55 perch of all sizes per mile or 112 per hour and 18 perch  $\geq 5$  inches per mile or 36 per hour, but we do not know if electrofishing catch rates can properly represent the relative abundance of the perch population. If they do, then the total perch number was similar in 2013, when the electrofishing catch rate was 50 perch per mile for all sizes. A larger sample in 2021 revealed that the average length



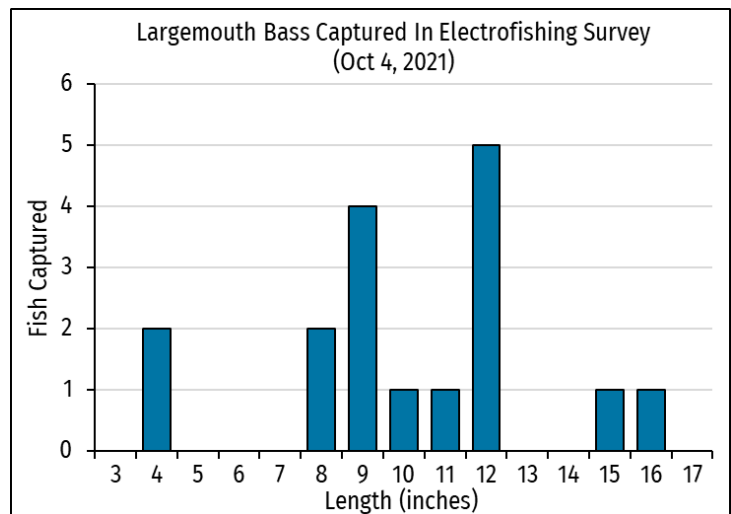
increased from 3.7 inches in 2013. Anglers who want a meal of perch will undoubtedly be disappointed in the population's size structure. Our samples included only one perch longer than 8 inches in 2021 and none in 2013.

The creel survey results also reflected unsatisfactory perch size. Anglers kept only about 5% of the estimated 3,493 perch that they caught in 1,293 hours of directed fishing effort. Eighty-seven percent of the catch and 74% of the harvest occurred in the open-water seasons, but all 10 perch measured in the year-long creel survey were harvested in winter. They ranged from 7.5 to 12.2 inches and averaged 9.0 inches long. Based on preliminary findings, the experimental panfish harvest restriction in effect since 2016 is not likely to increase yellow perch size in Lake of the Pines. Currently, anglers may keep a daily bag limit of 25 panfish, but no more than 10 of any one species.



### LARGEMOUTH BASS AND SMALLMOUTH BASS

Late spring electrofishing, our chosen method to assess black bass population status, captured two largemouth bass 8.5 and 17.6 inches long and three smallmouth bass that ranged from 4.2 to 18.4 inches long. The electrofishing catch rate of 0.7 largemouth bass per mile indicated very low population abundance, ranking below the 25<sup>th</sup> percentile in the class of lakes with cool, dark water and complex fish communities. Largemouth bass abundance has decreased since spring 2013, when the electrofishing catch rate of 6.0 largemouth bass per mile ranked just above the median value for that category. We caught similar numbers of both species by electrofishing in early spring 2021 when we targeted adult walleye.



Though a larger sample is preferred, we can cautiously gauge largemouth bass size structure from the incidental electrofishing catch in our fall 2021 walleye recruitment survey. That sample included three smallmouth bass and 17 largemouth bass ranging from 4.0 to 16.5 inches and averaging 10.5 inches long. The average length decreased by 0.7 inches when compared to the sample of 18 largemouth bass captured by electrofishing in late spring 2013.

Partial-year projections show that anglers caught 37 largemouth bass and 28 smallmouth bass and kept none of either species in 432 and 429 hours of directed fishing effort over the course of the 2020-2021 creel survey. Annual catch, harvest and directed angling effort for largemouth bass and smallmouth bass are underestimated because May and June are excluded from the totals.

Anglers may catch and release smallmouth bass or largemouth bass at any time. A daily bag limit of five largemouth bass may be kept from the first Saturday in May through the first Sunday in March. In the Northern Bass Management Zone, a daily bag limit of five largemouth bass or smallmouth bass in total may be kept beginning on the third Saturday in June through the first Sunday in March. We foresee no need to modify bass harvest regulations in Lake of the Pines at this time.

## **NORTHERN PIKE**

Fyke nets set for walleye and muskellunge in spring 2021 captured 58 northern pike at a rate of 0.9 pike per net-night. That catch rate nearly matched the 25<sup>th</sup> percentile value for northern pike in cool, dark lakes with complex fish communities. We cannot characterize the population's size distribution because northern pike were counted but not measured in the spring 2021 fyke netting survey. No data was recorded for pike from fyke netting in spring 2019, and fyke nets captured only two pike in spring 2013. Anglers may keep a daily bag limit of five northern pike of any size. Anglers caught eight northern pike and kept one 27.2 inches long in 1,366 hours of fishing effort directed toward pike in July-October 2020 and December 2020-March 7, 2021. Estimates of directed effort, catch and harvest could not be calculated for northern pike in May and June 2020; therefore, those annual totals are underestimated.

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