



Fishery Survey Summary

Connors Lake, Sawyer County, Wisconsin, 2019-2022

Introduction

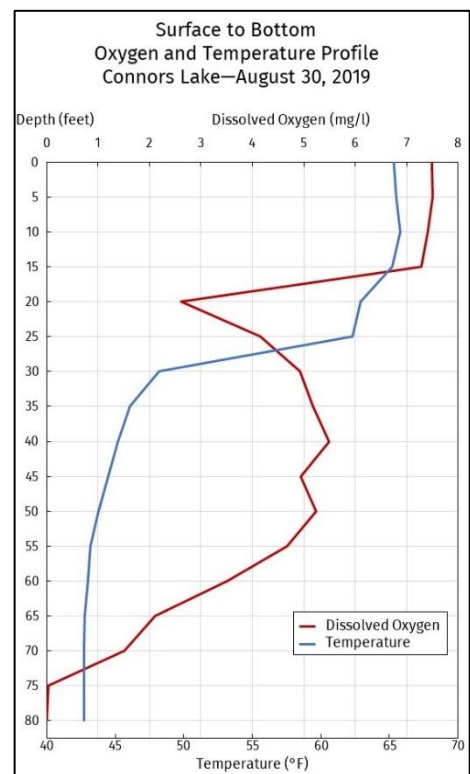
Several fisheries teams from the Wisconsin Department of Natural Resources (DNR) and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) completed netting, electrofishing and angler use surveys in 2019–2022 to assess the status of important sportfish populations in Connors Lake. Fyke netting and electrofishing surveys completed shortly after the spring thaw targeted walleye, muskellunge and northern pike, and their catches yielded estimates of walleye and musky population density. An electrofishing survey in late spring characterized the abundance and size structure of Connors Lake’s smallmouth bass, largemouth bass and bluegill populations. Those results helped evaluate the effectiveness of three experimental panfish harvest regulations. Fall electrofishing surveys evaluated walleye recruitment. We estimated angling pressure, catch and harvest from a year-round creel survey. Quality, preferred, memorable and trophy 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 ≥ 9 inches and bluegill ≥ 7 inches, based on observed angler behavior.

HABITAT AND PUBLIC ACCESS CHARACTERISTICS

Connors Lake is a 429-acre drainage lake located within the Flambeau River State Forest about 17 miles east of Winter, WI and 20 miles west of Phillips, WI. Its maximum depth is 82 feet, and its average depth is 38 feet. The nearshore lakebed is roughly comprised of 75% sand, 20% gravel and 5% muck. The water is clear. Secchi depth ranged from 4.3 to 22.5 feet and averaged 11 feet in the summer from 2007 to 2022.

Water clarity was exceptionally high in 2021 and 2022 when Secchi depth ranged from 10.5 to 15 feet in July and August. Organic compounds leaching from wetlands impart a tea-colored stain, but turbidity from suspended algae is typically low. Connors Lake is classified with other cool, clearwater lakes with complex fish communities. Nutrient and chlorophyll levels in samples collected by citizen volunteers in 2007-2022 allow us to classify Connors Lake among mesotrophic lakes with moderate fertility and mid-range biological productivity.

In summer, the lake routinely stratifies (at 25-30 feet in early July 2019) to form a warmer upper layer where oxygen can dissolve from the atmosphere and a cooler lower layer. The surface-to-bottom measurements of dissolved oxygen did not have the pattern we typically see in stratified lakes. Temporarily isolated from the air, oxygen concentrations in the cool, deep layer of most stratified lakes usually decline as summer progress, and as



a rule, few, if any, fish will occupy the bottom layer until mixing occurs again in the fall. In Connors Lake, however, oxygen levels sagged just above the depth with the greatest temperature gradient, then mysteriously rebounded and remained adequate for fish survival at depths of 25 to 60 feet. We do not know if fish can traverse the low oxygen zone to occupy the mid-range depths in late summer.

Connors Creek, a small navigable stream, flows from Lake of the Pines into the north end of Connors Lake, and on the south end, it drains to the North Fork Flambeau River. Connors Creek is designated as a fish refuge between Lake of the Pines and Connors Lake, where no fishing is allowed from April 1 to May 14. The DNR maintains a public boat ramp, swimming beach and picnic area on the north shore and a campground on the south shore.

SURVEY EFFORT

Shortly after the ice thawed, when water temperature ranged from 41°F to 51°F, the DNR’s Fishery Research Team captured, tagged and released spawning muskellunge in 88 net-nights of fyke netting effort from April 27 to 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 59 net-nights of fyke netting effort toward walleye, muskellunge and northern pike from April 2-9, 2021, when water ranged from 43 to 49°F. On April 9, 2021, we targeted walleye again by nighttime electrofishing along the entire perimeter, sampling 5.05 shoreline miles in 2.20 hours of electrofishing effort when the water temperature was 48°F. An additional 107 net-nights of fyke net effort targeted only muskellunge until April 30, 2021, when water temperature had decreased to 47°F.

With water temperatures between 60°F and 61°F, our May 27, 2021 electrofishing survey coincided with the early spawning activities of smallmouth, largemouth bass and bluegill. We dip-netted gamefish along 3.00 shoreline miles in 1.27 hours, and we subsampled all fish species for 2.00 miles in 0.83 hours.

The DNR or the GLIFWC measured walleye recruitment annually in 2019-2022 as the number of age-0 fingerlings and age-1 yearlings captured per shoreline mile in fall electrofishing surveys.

Resource Agency	Survey Date	Electrofishing Miles	Electrofishing Hours	Water Temperature °F
DNR	Sept. 23, 2019	3.00	1.37	67
GLIFWC	Sept. 24, 2020	5.00	2.70	65
DNR	Sept. 29, 2021	5.12	2.23	68
DNR	Sept. 20, 2022	5.21	2.33	71

Creel clerks counted and interviewed anglers on a randomized schedule through the entire 2021-2022 fishing season to estimate fishing pressure, catch and harvest in Connors Lake.

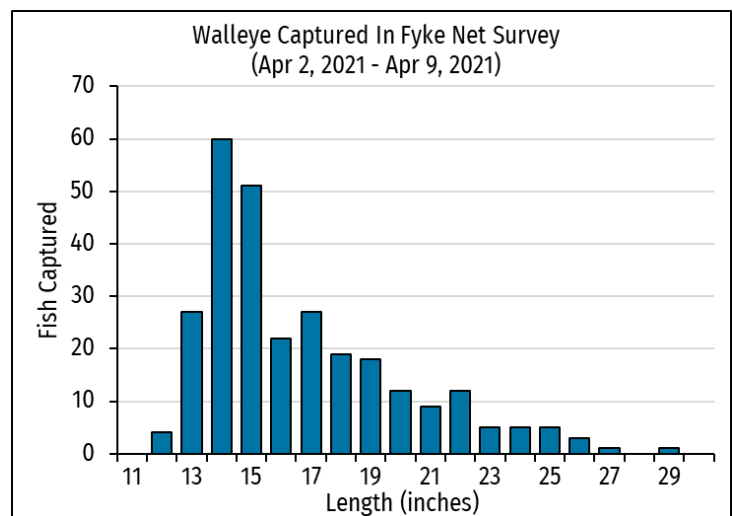
Results and Discussion

FISH COMMUNITY

Though not specifically designed to evaluate diversity, our combined netting and electrofishing efforts in 2021 captured 12 fish species and one hybrid (northern pike x muskellunge), commonly known as tiger musky. The species count matched the number collected by those methods in 2012-2019. Fish community composition in Connors Lake reflected the species found in the cool-clear-complex lakes category. Walleye was the predominant predator. Bluegill was the most abundant panfish in our recent samples, but we suspect that yellow perch would outnumber bluegill, if we had counted the perch caught in fyke nets. We occasionally see a black crappie in surveys that target other species, so crappies are present in trace abundance that seems too low to support a fishery. From creel survey projections, anglers caught eight crappies and kept none in 390 hours of directed fishing effort. Other important forage included soft-rayed, tube-shaped white sucker, golden shiner and common shiner that predators prefer over spiny-rayed, platter-shaped fish.

WALLEYE

Early spring fyke netting captured 313 walleyes at a rate of 5.3 fish \geq 10 inches per net-night. That netting catch rate was between the 50th and 75th percentile among lakes in the complex-cool-clear classification. Those walleyes captured just once in nets ranged from 12.5 to 29.0 inches and averaged 16.9 inches long. Early spring electrofishing captured 260 walleyes, including 44 that we marked and released in our netting survey. Electrofishing catch rates were 38 walleyes \geq 10 inches per mile or 88 per hour. Those not handled before ranged from 6.0 to 25.5 inches and averaged 12.6 inches.

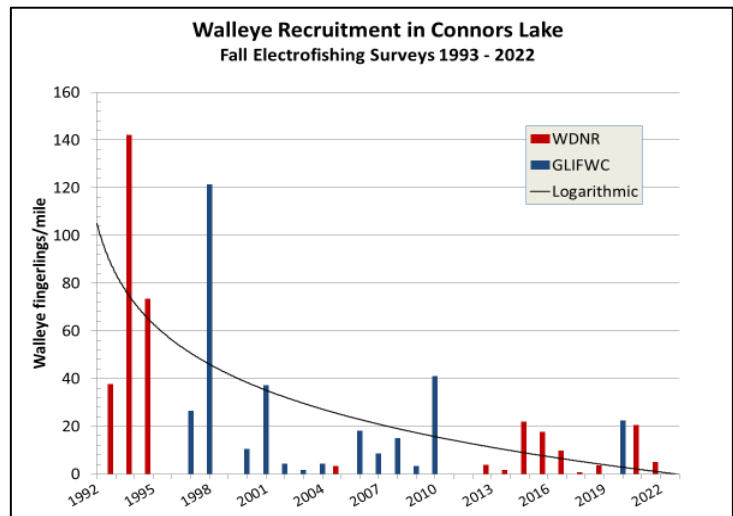


From these netting and electrofishing samples, we estimated that the walleye population in Connors Lake had 1,000 adults or 2.3 adults per acre (95% confidence interval = 747-1,254; coefficient of variation = 0.129). Walleye density in 2021 was similar to the preceding estimate of 2.5 adults per acre in 2013 but still below our goal to have three to five adults per acre. However, with 48% of walleyes in fyke nets at least 15 inches and 8% 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 two to one.

Female walleye reached the legal size of 15 inches in four growing seasons, while male walleye needed five or six years to reach legal size in Connors Lake. Ring counts on sectioned dorsal spines revealed that, on average, males grew to 12.9 inches in three years (range 12.6-13.4; n=4), 13.9 inches in four years (range 12.9-15.1; n=13), 14.8 inches in five years (range 12.9-16.1; n=15) and 16.0 inches in six years (range 14.9-17.0; n=6). Female walleye reached 17.2 inches in five years (range 15.0-19.2; n=7), 20.4 inches in eight years

(range 18.6-22.0; n=9) and 22.8 inches in ten years (range 17.9-26.5; n=16). In a pooled sample of males, females and walleye whose gender was unknown, growth trailed the regional averages by 0.4 at ages 3-5 and by 0.1 to 1.2 inches at ages 8-12. However, the growth of walleye in Connors Lake matched the regional average of 19.0 inches at age 7, and their lengths exceeded the regional averages by 0.2, 1.0 and 3.0 inches at ages 6, 13 and 14 (n=23, 2 and 1). We found no females less than 17.2 inches long and five years old. The longest and oldest male walleye was 20.3 inches at age 12.

Natural reproduction is the walleye population's sole source of new recruits to replace the adults that die from fishing and natural causes. Walleyes were stocked into Connors Lake as fry or fingerlings in 1933-1946 and 1951, but we found no records of walleye stocking since those years. We use the number of age-0 fingerlings captured per shoreline mile in fall electrofishing surveys as our standard assessment of walleye recruitment. Natural recruitment was variable but generally strong, with fingerling catch rates ranging from 26 to



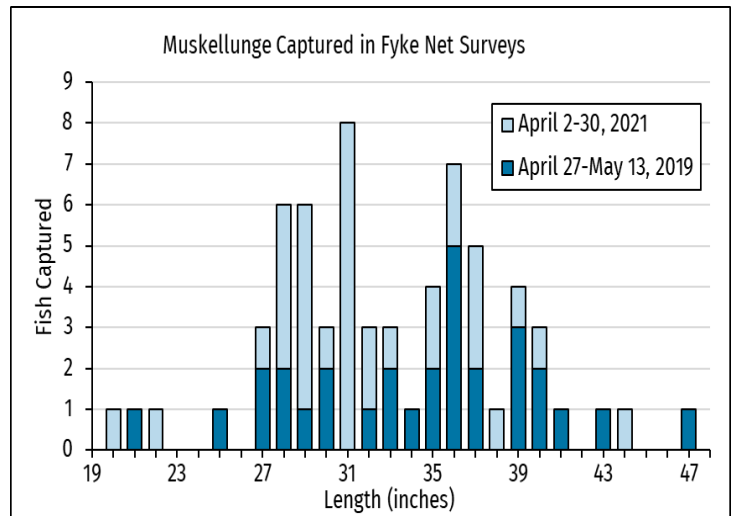
142 and averaging 80 fingerlings per mile in five fall electrofishing surveys from 1993 to 1998. By comparison, the walleye population gained far fewer recruits from 2000 to 2022 when the electrofishing catch rate in 21 annual surveys averaged 12 fingerlings per mile (range 0.7-41). Declining walleye recruitment is not unique to Connors Lake. Fishery managers in the neighboring states and provinces have observed similar downward trends in walleye populations that once had reliable recruitment but now struggle to sustain themselves. Despite the downturn in recruitment, in-lake production still manages to maintain Connors Lake's walleye population below but near the goal of three to five adults per acre. Self-sustaining populations are always preferred over those maintained by stocking, and they usually offer better fishing than stocked lakes. Consequently, walleye in Connors Lake will continue to serve as a "control" population with no stocking treatment, so researchers can measure natural fluctuations in walleye abundance while they try to identify the underlying cause of faltering recruitment and complete the broad-scale evaluation of the *Wisconsin Walleye Stocking Initiative*.

Angling harvest is managed under the standard walleye regulation for Wisconsin's Ceded Territory. Three walleye 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 550 walleyes and kept 72 in the 2021-2022 fishing season. Walleye attracted 3,506 angler hours, or 24.5% of the directed fishing effort, making them the most sought-after fish species in Connors Lake. Harvested walleyes ranged from 14.9 to 18.5 inches and averaged 16.5 inches. One harvested walleye measured in the creel survey was slightly less than legal size, and no legal-size fish were longer than 24 inches. Anglers who fished in the open water seasons accounted for 99% of

the annual walleye catch, all of the angling harvest and 80% of the fishing effort directed toward walleye.

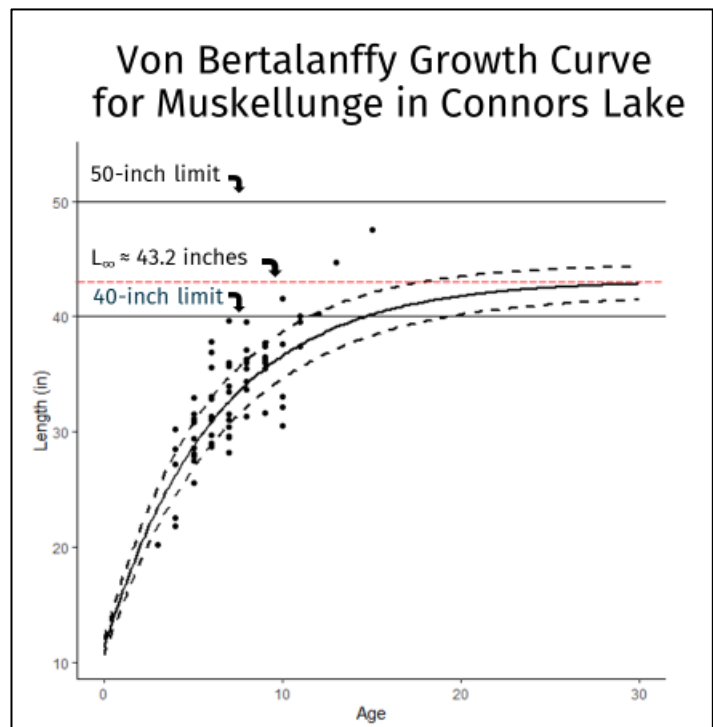
MUSKELLUNGE

Fyke netting in spring 2019 captured 30 muskellunge that ranged from 21.8 to 47.5 inches and averaged 34.7 inches long at a rate of 0.34 muskies per net-night. Two years later, in spring 2021, fyke nets captured 35 muskellunge ranging from 20.2 to 44.7 inches and averaging 32.3 inches long¹ at a catch rate of 0.21 fish per net-night. Among lakes in the complex-cool-clear lake class, the netting catch rate in 2019 ranked between the 25th and 50th percentiles and just below the 25th percentile in 2021. By comparison, fyke netting captured 24 muskellunge in 15 net-nights at a much higher rate of 1.6 muskies per net-night in the spring of 2013.



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 the spring of 2020 as a safeguard against human disease transmission. Based on nontypical samples separated by two years, we estimated that Connors Lake had 180 adults ≥ 20 inches (95% confidence interval=58-302; coefficient of variation=0.345) or 0.42 adults per acre. Though the confidence interval on this projection is quite wide, the point estimate of musky abundance in Connors Lake surpassed our goal to have a muskellunge population at a low to moderate density of 0.1 to 0.2 adults per acre.

In a combined sample of muskies ≥ 20 inches from both years, 19% were preferred-size fish at least 38 inches long,



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

11% were legal-size fish ≥ 40 inches and 4.6% were memorable-size fish 42 inches or longer. The population fell short of its size objective to have 10-20% of muskellunge attain memorable size. At first glance, the largest musky in our recent surveys suggests that this population has the capability to produce fish that approach or perhaps attain trophy size of 50 inches or longer. However, in a more robust analysis of length at ages estimated from cross-sectioned anal fins rays collected in 2015, 2016, 2019 and 2021, the von Bertalanffy growth model predicts that muskellunge will generally “top out” at an ultimate length of 43.2 inches in Connors Lake. On average, males grew to 29.3 inches in five years (range 25.6-32.9; n=7), and females attained 34.5 inches in seven years (range 30.4-39.6; n=3). In an aggregated sample of 26 males, 11 females, one hybrid and 19 muskies whose gender was unknown, growth outpaced the regional averages by 0.4 to 1.3 inches at ages 4-6 and by 1.6 inches at age 13. However, the growth of muskies in Connors Lake trailed the regional averages by 0.3 at age 3 and by 0.8 to 4.4 inches at ages 7-12. The aged sample had no females less than 28.1 inches long and five years old. The longest, oldest and fastest-growing female muskellunge was 47.5 inches at age 15, exceeding the regional average length by 4 inches at that age and surpassing the von Bertalanffy model’s ultimate length prediction by 4.3 inches.

We can infer that the new recruits added to the muskellunge population stem from stocking and natural reproduction, though we do not know the relative contributions of these sources. The DNR has stocked muskies into Connors Lake since 1936. The stocking frequency, stocking rate and the size/age class of the stocked fish varied widely in that period. Most recently, we stock muskellunge in odd-numbered years at a rate of 0.25 large fingerlings per acre. Their average length ranged from 12.3 to 14.4 inches in the last three stocked batches. We also detected some in-lake production and recruitment. In five electrofishing surveys and one netting survey completed between 2013 and 2021, we incidentally captured nine muskies 9.6 to 12.3 inches long that were presumed to be natural fingerlings. We caught those fingerlings in years when no musky stocking occurred, or in one year, four months prior to stocking. Their individual lengths were less than or equal to the average batch lengths of the fingerlings stocked 12 to 15 months before our chance encounters. The von Bertalanffy growth model predicts that hatchery-reared fingerlings stocked at 13.3 to 12.3 inches should be about 16 inches long after one year at large. This substantial difference in size boosts our confidence that all nine fingerlings in the collective bycatch had natural, rather than hatchery, origin. Putting stocking on hold or further reducing the stocking rate or stocking frequency may help move Connors Lake’s musky population closer to its size and density objectives.

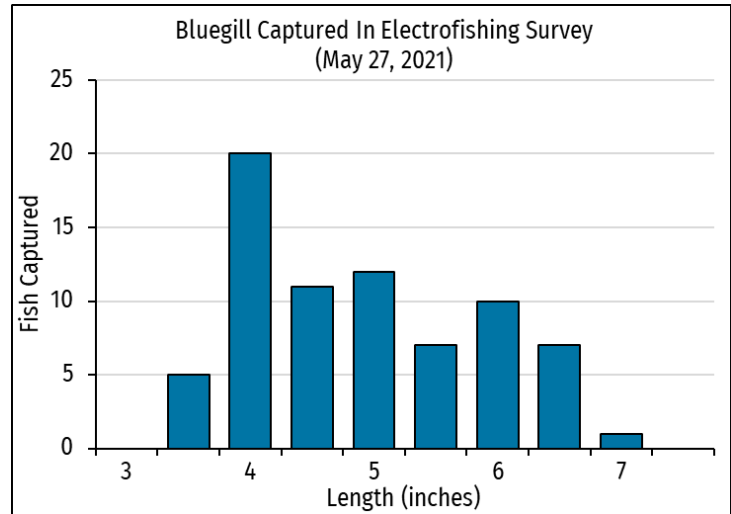
PIT tag detections in scheduled surveys show that muskellunge voluntarily moved in both directions between Connors Lake and Lake of the Pines. Of the eleven individuals that we tagged in one lake and recaptured in the other, three moved from Connors Lake to Lake of the Pines, five moved from Lake of 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.

Muskellunge received 3,235 hours of directed angling effort in the 2021-2022 fishing season, accounting for 23% of the open-water total and making them the second most popular summertime fishing target in Connors Lake. Creel survey projections show that anglers caught and released 114 muskellunge but kept none in 2021.

BLUEGILL

In our late spring electrofishing survey, we caught 73 bluegills that ranged from 3.5 to 7.4 inches and averaged 5.1 inches long. The electrofishing catch rate of 88 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 37 bluegills per mile ranked just above the 25th percentile among lakes in the cool-clear-complex classification. These catch rates indicate that the relative abundance of bluegill has decreased by two-thirds

since June 2013, when electrofishing captured 102 bluegills \geq 3 inches per mile or 243 per hour. This change is surprising because Connors Lake had just as many walleyes to control bluegill abundance by predation in 2013 and 2021. Despite lower bluegill numbers, their size did not improve at all since our last measures. The bluegill 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 one grew to keeper size \geq 7 inches.

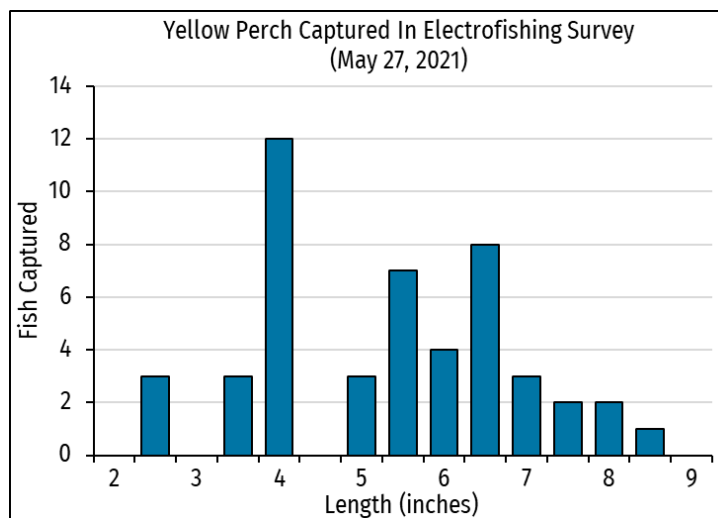


In a [broad-scale evaluation](#) that began in 2016, the DNR applied three experimental panfish harvest regulations on 94 lakes where angling harvest appeared to be a problem. For five fishing seasons before this spring 2021 electrofishing survey, anglers could keep a daily bag limit of 25 panfish but only 10 of any one species in Connors Lake. So far, this experimental panfish harvest restriction has not increased bluegill length by one-half to one inch in the study lakes, as intended. In Connors Lake's bluegill population, the average length and the proportions of quality-, keeper- and preferred-size fish at least 6, 7 and 8 inches long were virtually unchanged since our last electrofishing survey in late spring 2013. This special regulation will remain in place, at least until 2026, while the trial and evaluation of three new panfish regulations continues.

Anglers caught plenty of bluegills in Connors Lake, but few were big enough to keep for a meal. Creel survey projections reveal that anglers caught 1,899 bluegills but harvested only 62 in 1,445 hours, or 10.1% of the directed fishing effort. Almost all of the bluegill catch and harvest and 82% of the bluegill fishing effort took place from May through October. The creel clerk measured 10 bluegills from 6.0 to 7.5 inches long harvested in June, July and October, but only eight bluegills were kept, and none were measured in the ice-covered season.

YELLOW PERCH

The late-spring electrofishing sample had 48 yellow perch that ranged from 2.6 to 8.7 inches and averaged 5.5 inches long. Electrofishing captured 24 perch of all sizes per mile or 58 per hour and 15 perch ≥ 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 32 perch per mile for all sizes. A larger sample in 2021 revealed that the average length increased from 4.2 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.



Ring counts on whole or cross-sectioned ear bones extracted from 39 yellow perch show that their average lengths of 2.8 inches at age 1 (range 2.6-3.0; $n=3$) and 4.0 inches at age 2 (range 3.5-4.3; $n=10$) trailed the regional averages by 1.1 and 0.8 inches at those ages. Their growth rate quickened at ages 3-5 when their average length matched or slightly exceeded the regional averages.

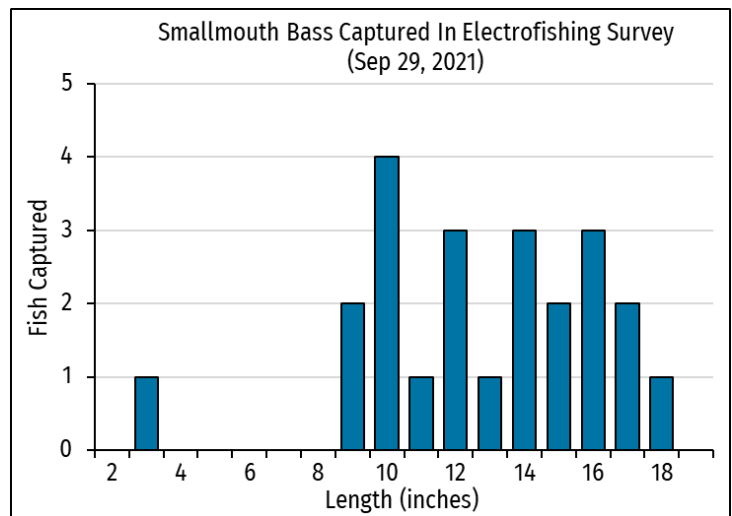
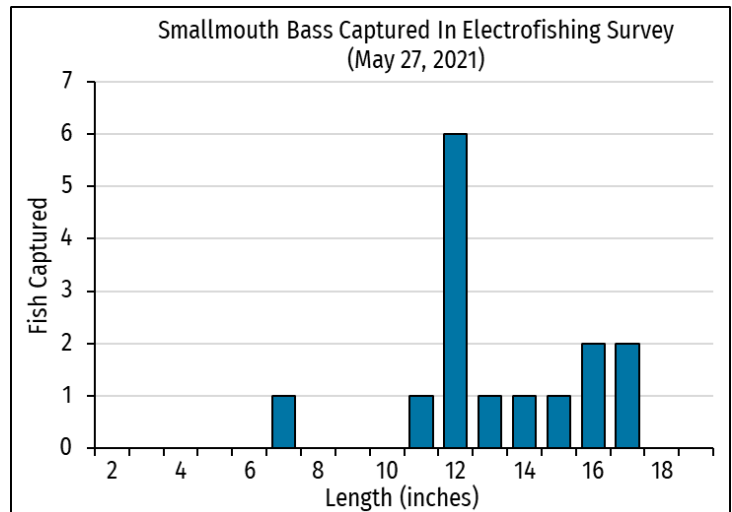
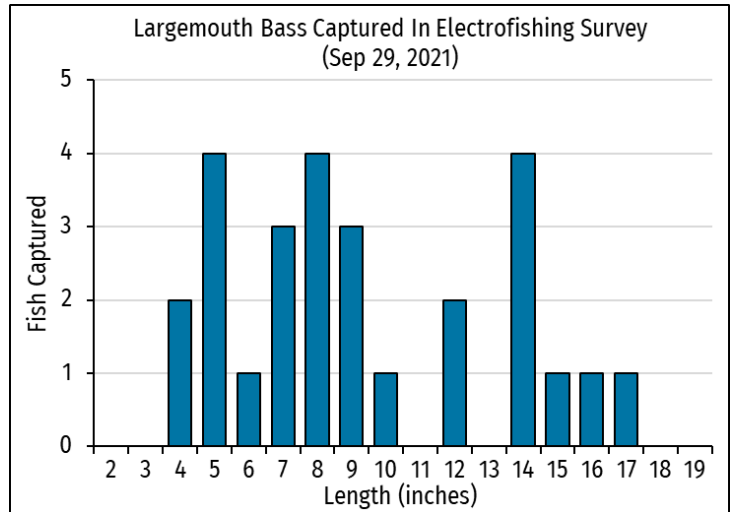
The creel survey results also reflected unsatisfactory perch size. Anglers kept only about 7% of the estimated 5,675 perch that they caught in 1,551 hours of directed fishing effort. Eighty-four percent of the catch and 97% of the harvest occurred in the open-water seasons. All but two of the 56 perch measured in the year-long creel survey were harvested in summer. They ranged from 6.7 to 9.8 inches and averaged 7.9 inches long. Anglers kept some keeper-size perch ≥ 9 inches that we did not detect by electrofishing. Based on preliminary findings, the experimental panfish harvest restriction in effect since 2016 is not likely to increase yellow perch size in Connors Lake. Currently, anglers may keep a daily bag limit of 25 panfish but no more than 10 of any one species.

With a satisfactory growth rate at ages 3-5 and a moderate level of angler harvest, we suspect that the size structure of the yellow perch population is influenced more by predation than by fishing. Tube-shaped perch are among the favorite foods of walleye, muskellunge, northern pike and largemouth bass. Much like anglers, each of these predators tends to selectively seek out and eat the largest and oldest perch to obtain an efficient ration. We found no perch longer than 8.7 inches in our late spring electrofishing sample and no perch older than five years in our aged sample.

LARGEMOUTH BASS AND SMALLMOUTH BASS

Late spring electrofishing, our chosen method to assess black bass population status, captured only two largemouth bass, 14.3 and 14.8 inches long. The electrofishing catch rates of 0.67 largemouth bass per mile in spring 2021 closely matched the rate of 0.64 bass per mile recorded in spring 2013. Those electrofishing catch rates indicated a largemouth bass population at very low abundance in both years, ranking well below the 25th percentile in the class of lakes with cool, clear water and complex fish communities. We incidentally caught five largemouth bass between 14.0 and 16.0 inches by electrofishing in early spring 2021 when we targeted adult walleye. In the fall of 2021, the electrofishing bycatch in our walleye recruitment survey had 27 largemouth bass that ranged from 4.6 to 17.0 inches and averaged 9.7 inches. We can cautiously gauge largemouth bass size structure from this largest sample. Excluding 10 largemouth bass less than 8 inches, 53% were quality-size fish ≥ 12 inches, 41% were legal-size bass ≥ 14 inches and 18% attained preferred size of 15 inches or longer.

In May 2021, we captured 15 smallmouth bass at electrofishing capture rates of five bass ≥ 7 inches per mile or 12 per hour. Their lengths ranged from 7.3 to 17.3 inches and averaged 13.5 inches. Electrofishing that targeted young walleye in the fall of 2021 incidentally captured 23 smallmouth bass ranging from 3.3 to 18.4 inches and averaging 13.2 inches long. The electrofishing capture rates of four bass ≥ 7 inches per mile or 10 per hour in the fall of 2021 mirrored the moderate population abundance indicated by the catch rates in our late-spring 2021 electrofishing survey. We also caught 14 smallmouth bass between 11.5 and 19.5 inches by electrofishing directed at adult walleye in the early spring of 2021. All three electrofishing samples suggest that smallmouth bass in Connors Lake had a favorable size structure. Their average length



varied from 13.2 to 15.0 inches. The proportions of preferred-size bass ≥ 14 inches ranged from 40% to 79%, and the shares of memorable-size fish ≥ 17 inches ranged from 13% to 21%.

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. Projections show that anglers caught 629 smallmouth bass and 70 largemouth bass in 1,818 and 1,299 hours of directed fishing effort, respectively, over the course of the 2020-2021 creel survey. They kept 3.8% of the smallmouth bass and 8.6% of the largemouth bass in the estimated annual catches. Because anglers release most of the bass they catch, we foresee no need to modify bass harvest regulations in Connors Lake at this time.

NORTHERN PIKE

Fyke nets set for walleye and muskellunge in spring 2021 captured 101 northern pike at a rate of 1.7 pike per net-night. That catch rate is positioned about midway between the 50th and 75th percentile values for northern pike in cool, clear 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 five pike in spring 2013. Anglers may keep a daily bag limit of five northern pike of any size. Anglers caught 254 northern pike, and they kept 26 that averaged 23.3 inches long in 964 hours of fishing effort directed toward pike. Anglers spent 26% of their annual fishing effort targeting northern pike in winter, but they caught only eight pike and kept none in the ice-covered season.

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