Crystal Lake

Montcalm County, T10N, R5W, S7,8,17,18
Grand River Watershed, last surveyed 2021

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Environment

Crystal Lake is a 724-acre lake located in the village of Crystal approximately seven miles southeast of the city of Stanton in Montcalm County (Figure 1). The lake has a small inlet on the northeastern shore of the lake and one outlet which drains into Mud Lake immediately to the northeast of Crystal Lake. Crystal Lake is a deep lake for central Michigan with a maximum depth of 70 feet. The lake has large littoral shoals around the majority of the shore with the deepest water concentrated on the far southern shore of the lake. Additional pockets of deep water exist near the middle of Crystal Lake. Marl is the dominant substrate in Crystal Lake, but there are also extensive areas of sand and some pockets of cobble and gravel. A water control structure was established on the outlet in 1932 to maintain the lake level of Crystal Lake. A Michigan Department of Natural Resources (DNR) boating access site is located on the northeast shore of the lake. The boating access site is large with two skid piers, paved parking for 46 vehicles with trailers, and a fully ADA accessible pit toilet. In addition to the DNR boating access site, there is a small Crystal Township boating access site located on the south side of the lake. The parking lot is small and most likely would only have parking for two or three vehicles with trailers. Additionally, there is a six-acre Crystal Township Park located on the east side of Crystal Lake that provides shoreline access and walk on access for anglers during the winter months.

History

Fisheries management of Crystal Lake began in the 1870s by the Michigan Fish Commission. A wide variety of fish species were stocked into Crystal Lake, including American Eel, Lake Trout, Smallmouth Bass, Largemouth Bass, Walleye, Yellow Perch, Bluegill, and sunfishes (most likely Pumpkinseed; Table 1). The bathymetry, substrate, and residential development of Crystal Lake were mapped in February 1941. The initial fisheries survey was completed during June and July 1941 by the Michigan Department of Conservation (pre-cursor to the present day DNR). The survey consisted of limnological testing along with sampling for fish, plants, and invertebrates. A detailed report, for the time, was compiled and indicated that Crystal Lake was "one of the best-known resort lakes in this section of the state" (Funk 1942). The water was quite clear with a Secchi depth of 10 feet and was well oxygenated from the surface to at least 30 feet of water where the dissolved oxygen was 3.9 parts per million (ppm). The aquatic plant survey of Crystal Lake revealed a community dominated by Chara species in the littoral zones and Big Bulrush around the shorelines. The aquatic invertebrate community was dominated by Chironomidae (midges), Ephemeroptera (mayflies), and Coleoptera (beetles) species. Gill nets and seines were used to inventory the fish community of Crystal Lake in June 1941. Twenty fish species were captured during the survey (Table 2). The most abundant fish species were Yellow Perch, Bluegill, and Blacknose Shiner. Aging structures were removed from numerous fish species and growth rates were assessed. Yellow Perch and Pumpkinseed were growing faster than statewide growth rates, whereas Largemouth Bass and Bluegill were growing almost "a year slower" than statewide average growth rates. Stocking of all species was recommended to cease following the 1941 survey as natural reproduction was evident and spawning areas were abundant on the lake.

The next comprehensive survey was completed in September 1946 utilizing a variety of seines and gill nets to sample Crystal Lake. The fish community composition was similar to the 1941 survey, but a few additional fish species were collected. Differences in survey timing likely contributed to the increase in the number of fish species captured in 1946. Similarly in September 1947, another fish survey was completed but only using bag seines.

The next fisheries survey was completed in July 1969. The 1969 survey consisted of only one night of sampling with four gill nets. In April 1970, Rainbow Smelt were transferred from Gull Lake, Kalamazoo County to Crystal Lake. The Rainbow Smelt were transferred prior to spawning in an attempt to establish the species in Crystal Lake. In December 1970, gill nets were set to assess the survival of stocked Rainbow Smelt. No smelt were caught, and the introduction was considered unsuccessful. In the spring of 1971, Rainbow Smelt were once again transferred from Gull Lake to Crystal Lake. No follow-up surveys were completed and the Rainbow Smelt transfer was considered a failed experiment.

The next fisheries survey occurred in November 1978 and utilized mini-fyke nets, large mesh trap nets, and gill nets. The fish community was similar to previous surveys and was dominated by Bluegill, Black Crappie, Largemouth Bass, Northern Pike, Yellow Perch, and Walleye (Table 2). Age structures were collected from Bluegill, Black Crappie, Northern Pike, Largemouth Bass, Yellow Perch, Smallmouth Bass, and Walleye. Black Crappie and Yellow Perch were growing faster than statewide average and Bluegill were growing similar to statewide average. The rest of the species did not have enough samples taken to make comparisons to statewide growth rates. In the fall of 1979, the entire shoreline of Crystal Lake was surveyed using nighttime electrofishing gear. The fish community composition was nearly identical to 1978.

A Walleye index survey was completed by nighttime electrofishing around the entire shoreline of Crystal Lake in the fall of 1983. Nine Walleyes (all under 15 inches in length) were captured which indicated survival from the past two stocking events in 1982 and 1983. The next comprehensive fish survey occurred in June 1990. Gill nets and trap nets were set in Crystal Lake to assess the ongoing Walleye stocking program and other fish populations. Age and growth analysis was conducted on Walleye, Bluegill, Largemouth Bass, and Yellow Perch. Twenty-two Walleyes were captured representing four year-classes (ages 2, 3, 4, and 6). On average, the mean lengths at age for Walleyes in Crystal Lake were approximately three inches above the statewide values. Seventy-four Bluegill were captured representing four year-classes (ages 2-5). Bluegill growth in Crystal Lake was similar when compared to Bluegill growth rates across the state. Based on the 1990 survey results, Crystal Lake was considered to be providing strong fisheries for Walleye, Largemouth Bass, Smallmouth Bass, Northern Pike, Yellow Perch, and panfish, and continued Walleye stocking was recommended.

In May 1997, a trap netting survey was performed on Crystal Lake. The same gamefish species continued to dominate the catch. Age and growth analyses indicated that Bluegill and Largemouth Bass growth was similar to statewide growth rates. Although structures were removed from other species for age determination, there were not enough structures per species to make comparisons to statewide growth data.

The last survey on file was a one-night shoreline electrofishing survey that was completed on September 12, 2000. This survey specifically targeted Walleyes and only Walleyes were netted. Twenty-eight

Walleyes were collected during the survey. Age and growth analysis indicated that Walleyes were growing slower than statewide averages. Four age classes were present (age 0, 2, 4, 6) which corresponded to the previous four years Walleyes were stocked in Crystal Lake.

Current Status

A spring trap netting survey was conducted immediately following ice off in the spring of 2021. The netting survey objectives were 1. To conduct a Walleye population estimate, 2. To conduct a Northern Pike population estimate, 3. To assess the differences in survival and contribution to the fishery between stocked spring fingerling and fall fingerling Walleye, and 4. To assess the liberalized Northern Pike regulation. Eleven trap nets were set on March 20, 2021 and checked every two days before being removed from the lake on March 26, 2021 (Figure 1). On March 27, 2021, a single-pass nighttime electrofishing survey was conducted around the entire shoreline of Crystal Lake. During the netting portion of the survey, all Northern Pike and Walleye were measured to obtain total length, marked with a top caudal fin clip at initial capture, and inspected for top caudal fin clips after the initial day of netting. In addition, age and growth structures were removed from the first 15 male and first 15 female individuals captured in each inch bin (e.g., 15-inch bin includes fish from 15.0 to 15.9 inches in total length) for Northern Pike and Walleyes. Scale samples were removed from Walleyes less than 12 inches in length and dorsal spines were removed from Walleyes 12 inches in length and larger. Dorsal fin rays were the only age and growth sample removed from Northern Pike regardless of length. Weighted age frequencies for Walleye and Northern Pike were calculated using the methods described by Schneider (2000b). In addition to the data collected on Northern Pike and Walleye, other fish species captured during the trap netting survey were identified and measured to inch bin. The electrofishing survey specifically targeted Northern Pike and Walleye; therefore, those were the only species netted. All Northern Pike and Walleye were measured and assessed for a mark during the electrofishing survey.

A total of 453 individual Walleyes were captured during the 2021 spring trap netting survey and electrofishing recapture survey (Figure 2). Four hundred and fifteen Walleyes were initially captured by trap netting and 38 additional Walleyes were initially captured during the electrofishing survey. The legal Walleye population estimate was calculated using the Schumacher/Eschmeyer population estimator and the Lincoln Petersen population estimator with the Chapman modification. The Schumacher/Eschmeyer population estimator utilizes multiple marking events and recapture events (netting and electrofishing survey pooled); whereas the Lincoln Petersen, with the Chapman modification, lumps all netting events into a single marking event and then the recapture event is the electrofishing survey. A total of 453 Walleyes were marked individuals using the Schumacher/Eschmeyer formula and 78 Walleyes were recaptured over the two netting recapture days and one night electrofishing survey. The Schumacher/Eschmeyer adult Walleye population estimate was 1,028 Walleyes with a 95% confidence interval of 827 to 1,359 Walleye. The total Walleye population was similar with an estimate of 1,136 Walleyes and a 95% confidence interval of 906 to 1,523 Walleye. The density estimates equal a legal Walleye population of 1.4 Walleye per acre and an entire Walleye population of 1.6 Walleye per acre. A total of 415 individual Walleyes were marked using the Lincoln Petersen estimator during the trap netting survey. The electrofishing survey (recapture event) captured 62 Walleye of which 24 were previously marked fish. The Lincoln Petersen, Chapman modification Walleye population estimate for all fish was 1,048 Walleye with a 95% confidence interval of 729 to 1,368 Walleye. The density estimate equates to 1.5 Walleye per acre in Crystal Lake. Thus, the two

population estimate models produced very similar results. Walleye population estimates were not separated by sex due to the low number of female Walleye captured across the surveys.

As noted previously, two year-classes of fall fingerling Walleyes stocked into Crystal Lake were marked with ventral fin clips. The fin clips on these known age fish allowed for positive identification of stocked fish and facilitated accurate assessment of age and growth. One hundred and sixty-five clipped Walleyes were captured during the 2021 survey. They were split nearly evenly between age-4 Walleyes (weighted age frequency = 28.04%) denoted by a right ventral fin clip and age-5 Walleyes (weighted age frequency = 26.5%) denoted by a left ventral fin clip. The largest year class of Walleye captured during the 2021 survey was age-6 (weighted age frequency = 28.09; Table 3). This year class of Walleyes corresponds to the most recent stocking of spring fingerling Walleyes in Crystal Lake in 2015 (Table 1). Surprisingly, there were 34 age-1 Walleye and several age-3, age-7, and age-8 Walleyes which do not correspond to any known stocking events. In addition, there were three unclipped fish from the 2017-year class and five unclipped fish from the 2016-year class. These fish presumably were wild.

Across all year classes Walleye in Crystal Lake were growing faster than statewide average (Figure 3; Table 3). Females exhibited more rapid growth than males. Only age classes 4 to 6 had enough samples to facilitate comparisons between the sexes. Relative to males, mean lengths for females were 1.5 inches larger at age 4, 1.7 inches larger at age 5, and 2.2 inches larger at age 6.

A total of 212 Northern Pike were captured during the 2021 spring survey on Crystal Lake. The majority of Northern Pike captured (92%) were under 24 inches in length (Figure 4). A mark-recapture population estimate was attempted, but only three Northern Pike were recaptured across the entire survey. Given the low recapture rate, a population estimate was not feasible. There were enough Northern Pike captured to assess age and growth across year classes. The Northern Pike population was dominated by age-2, age-3, and age-4 fish (Table 3; Figure 5). Northern Pike across all year classes were growing much? slower than Northern Pike statewide.

Bluegill was not a target species of the spring survey; however, 256 Bluegill were captured during the trap net sampling. The Bluegill ranged in length from the 4-inch bin to the 9-inch bin. Given the large number of Bluegill captured, a Schneider Index score was calculated (Schneider 2000a). The Schneider Index provides a score for the Bluegill fishery in a lake that ranges from 1 (very poor) to 7 (superior). The Schneider Index score for Bluegill in Crystal Lake was 6.7 which is between excellent and superior. Most of the Bluegill captured during the 2021 netting survey (80.5%) were over 7 inches in length (Figure 6).

Other game fish species captured during the 2021 netting survey included: Black Crappie (n=3), Hybrid Sunfish (n=11), Pumpkinseed (n=14), Rock Bass (n=25), Smallmouth Bass (n=4), and Yellow Perch (n=4). The low number of individuals captured of these species does not mean the population densities are low in Crystal Lake because the survey timing and gear used were not ideal for targeting these species.

In addition to all the gamefish captured, other species captured included Bowfin, Brown Bullhead, Channel Catfish, White Sucker, and Yellow Bullhead. Most of these species were captured in very low abundance (Table 4).

On September 7, 2021, a dissolved oxygen and water temperature profile was recorded at the deepest basin of Crystal Lake. Crystal Lake was stratified when the profile was recorded with a surface water temperature of 73F and bottom water temperature around 46F (Figure 7). The thermocline was around 20 feet of water, and the Secchi depth was 8.5 feet. From 21 feet to the bottom of Crystal Lake, there was no dissolved oxygen present in the water column.

Analysis and Discussion

Wehrly et al. (2012) classified inland lakes in Michigan based on a variety of variables including lake size, thermal regime, and fish assemblage patterns. The lake classification includes six classes of lakes (1-6). Crystal Lake is one of the few lakes in the Southern Lake Michigan Management Unit (SLMMU) that is classified as a Class 2 lake. Class 2 lakes have high degree-days, intermediate mean water temperatures, large surface areas, and are relatively deep. Due to their size and depth they are expected to be resilient to climate change. Class 2 lake Walleye populations are typically reliant on supplemental stocking as natural reproduction is unlikely to support the fisheries in these lakes (Herbst et al. 2022). Crystal Lake appears to be classified correctly as a class 2 lake based on the lake characteristics and the Walleye population. The Walleye population does have some natural recruitment (approximately 15% during the 2021 survey), but the population is reliant on stocking to sustain a viable fishery.

The adult Crystal Lake Walleye population estimate of 1.4 Walleyes per acre is considered a fair to good fishery (Herbst et al. 2022). The target density of adult Walleye in inland lakes is 2.0 adult Walleye per acre. Given the irregular stocking prior to this survey (no stocking in 2010, 2013, or 2018), the adult abundance estimate is quite high. Additionally, the fall fingerling stockings in 2016 and 2017 were only at 4 Walleyes/acre which would require exceptional survival and low harvest of legal fish to sustain an adult Walleye population of 2 fish per acre.

The last spring fingerling stocking occurred in 2015 at a rate of 50 fish per acre. This stocking event resulted in a large year-class of Walleye that were still contributing to the fishery. Due to the fast growth of Walleye in Crystal Lake, most Walleyes reach legal size (15 inches) by age 3. Given that there were three years of opportunities for harvest, the 127 Walleye captured from the 2015 spring fingerling year class indicates that survival was good. The cost difference between stocking spring fingerling Walleye compared to stocking fall fingerling Walleye is significant. It costs approximately $2,355 to stock 36,000 spring fingerlings compared to $14,220 to stock 3,000 fall fingerlings. Moving forward, spring fingerlings should be the preferred option to stock in Crystal Lake at a rate of 50 fish per acre every other year.

Northern Pike were still abundant in Crystal Lake. The trap net catch-per-unit effort (CPUE) for Northern Pike was 3.1 per net night. Compared to other lakes in SLMMU, this CPUE is slightly lower than the mean CPUE for Northern Pike captured in spring trap net surveys (3.5 Northern Pike/net night). When compared statewide, the CPUE is lower than the mean CPUE of 4.4 Northern Pike per net night for targeted trap netting surveys (Godby et al. 2022). However, CPUE data alone do not provide a robust index of abundance. In the case of Crystal Lake, the capture of Northern Pike was most likely low compared to the entire population since only three individuals were recaptured during the six days of trap netting and one night of electrofishing.

In December 2010, anglers collected aging structures from 36 Northern Pike captured in Crystal Lake. Mean growth indices were -4.0 for age 2, -6.4 for age 3, and -8.8 for age 4. A regulation change was implemented in 2014 which allowed for liberalized harvest of up to 5 Northern Pike daily, but only one fish over 24 inches in length. The 2021 data indicate that Crystal Lake Northern Pike are still growing slowly; however, growth rates have improved since the new regulation was implemented. Most of the Northern Pike collected during the 2021 survey were age 2, 3, or 4. For these age classes, the mean growth indices were -3.1, -2.8, and -3.7, respectively. The few age 5 and older fish that appeared to be growing faster than younger fish which suggests there is a dietary shift as pike approach 24 inches (Table 3). The current regulations appear to be reducing intraspecific competition among young pike while minimizing harvest pressure on fast-growing adults. Six Northern Pike over 30 inches in length were captured during the 2021 survey. This is the first time across all surveys that any Northern Pike over 30 inches were captured in Crystal Lake. This is significant and further indicates that the liberalized regulation might be increasing growth rates of Northern Pike and reducing the bottleneck of high abundance of smaller Northern Pike.

The Bluegill population in Crystal Lake was impressive with so many large individuals. As mentioned earlier, Bluegill were not a targeted species during the spring survey, and the timing of the netting precluded CPUE comparisons with previous sampling efforts. The Schneider Index facilitates objective ratings of Bluegill size structure. In 2021, the Schneider Index was 6.7 which is between excellent and superior. Short trap netting surveys were also conducted in Crystal Lake in 1990 and 1997. Schneider Index scores for the 1990 and 1997 surveys were 2.3 (between poor and acceptable) and 4.0 (satisfactory). Those past survey results must be interpreted with caution as the number of individuals collected was low (70 in 1990 and 67 in 1997).

Management Direction

1. Continue to actively manage the Walleye fishery in Crystal Lake by biennial stocking of spring fingerling Walleye (target = 50 fish/acre). Occasionally stock fall fingerling Walleye when there is surplus in the unit, but never more than once every 4 years.

2. Continue to encourage harvest of Northern Pike with the liberalized regulation which has no minimum size limit and a daily bag limit of 5 fish, but only one fish may be over 24 inches in length.

3. Encourage riparian landowners to maintain and restore natural shorelines and improved connection between the littoral zones and riparian upland habitats.

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Tables and Figures

Table 1. Fish stocked from 1876 to 2022 into Crystal Lake, Montcalm County.

Year	Species	Number Stocked	Life Stage	Average Length (inches)
1876	Lake Whitefish	20,000	Swim-up Fry	N/A
1878	American Eel	5,000	Spring Fingerling	N/A
1878	Lake Trout	7,500	Swim-up Fry	N/A
1894	Lake Trout	20,000	N/A	N/A
1895	Lake Trout	20,000	N/A	N/A
1905	Walleye	150,000	Fry	N/A
1910	Lake Trout	20,000	Fry	N/A
1910	Smallmouth Bass	450	Fingerlings	N/A
1910	Smallmouth Bass	750	Fingerlings	N/A
1933	Largemouth Bass	3,700	3 month	N/A
1933	Walleye	600,000	Swim-up fry	N/A
1934	Bluegill	2,400	Yearling	N/A
1934	Largemouth Bass	1,100	4 month	N/A
1934	Walleye	600,000	Swim-up fry	N/A
1934	Yellow Perch	6,000	8 month	N/A
1935	Largemouth Bass	2,400	4 month	N/A
1935	Smallmouth Bass	600	4 month	N/A
1935	Walleye	510,000	Swim-up fry	N/A
1935	Yellow Perch	12,375	8 month	N/A
1936	Bluegill	1,100	Yearling	N/A
1936	Largemouth Bass	1,485	4 month	N/A
1936	Walleye	375,000	Swim-up fry	N/A
1937	Bluegill	2,460	Adults	N/A
1937	Smallmouth Bass	1,500	4 month	N/A
1937	Smallmouth Bass	107	Adults	N/A
1937	Walleye	375,000	Swim-up fry	N/A
1937	Yellow Perch	12,400	7 month	N/A
1938	Bluegill	2,500	Yearling	N/A
1938	Smallmouth Bass	1,160	4 month	N/A
1938	Walleye	500,000	Swim-up fry	N/A
1939	Bluegill	9,000	5 month	N/A
1939	Largemouth Bass	18	Adults	N/A
1939	Sunfishes	156	Adults	N/A
1939	Walleye	500,000	Swim-up fry	N/A
1939	Yellow Perch	20,000	7 month	N/A
1940	Bluegill	9,000	4 month	N/A
1940	Largemouth Bass	1,200	4 month	N/A
1940	Walleye	300,000	Swim-up fry	N/A

Table 1. Continued

Year	Species	Number Stocked	Life Stage	Average Length (inches)
1941	Bluegill	5,000	4 month	N/A
1941	Bluegill	10,000	4 month	N/A
1941	Largemouth Bass	1,000	4 month	N/A
1941	Largemouth Bass	5,000	4 month	N/A
1941	Smallmouth Bass	1,125	4 month	N/A
1941	Yellow Perch	500,000	Swim-up fry	N/A
1970	Rainbow Smelt	10,000	Adults	N/A
1970	Walleye	600	Fingerling	N/A
1971	Rainbow Smelt	12,600	Adults	N/A
1971	Walleye	120	Yearling	N/A
1978	Walleye	375,000	Fingerling	N/A
1979	Walleye	575,000	Fry	0.35
1980	Walleye	9,988	Unknown	N/A
1982	Walleye	5,163	Unknown	N/A
1983	Walleye	21,720	Unknown	N/A
1985	Walleye	7,110	Spring Fingerling	2.20
1985	Walleye	15,780	Spring Fingerling	1.89
1986	Walleye	20,350	Spring Fingerling	2.01
1986	Walleye	16,966	Spring Fingerling	2.09
1988	Walleye	18,637	Spring Fingerling	1.89
1990	Walleye	40,384	Spring Fingerling	1.50
1991	Walleye	18,056	Spring Fingerling	1.57
1991	Walleye	24,480	Spring Fingerling	1.85
1992	Walleye	122,247	Spring Fingerling	1.18
1994	Walleye	72,530	Spring Fingerling	1.10
1996	Walleye	105,222	Spring Fingerling	1.10
1998	Walleye	73,594	Spring Fingerling	1.26
2000	Walleye	72,400	Spring Fingerling	1.06
2003	Walleye	72,456	Spring Fingerling	0.96
2005	Walleye	72,490	Spring Fingerling	1.08
2011	Walleye	36,540	Spring Fingerling	1.28
2011	Walleye	33,460	Spring Fingerling	1.28
2012	Walleye	36,137	Spring Fingerling	0.94
2015	Walleye	36,000	Spring Fingerling	1.48
2016	Walleye	650	Fall Fingerling	6.02
2016	Walleye	2,245	Fall Fingerling	5.65
2017	Walleye	2,883	Fall Fingerling	6.01
2017	Walleye	184	Fall Fingerling	5.70
2022	Walleye	36,319	Spring Fingerling	1.24

Table 2. Presence, absence of fish species in historical fisheries surveys of Crystal Lake, Montcalm County, Michigan.

Species	1941	1944	1945	1946	1947	1969	1970	1978	1979	1983	1990	1997	2021
Banded Killifish	x	x		x									
Black Crappie				x	x			x		x	x		x
Blackchin Shiner	x			x									
Blacknose Shiner	x	x		x									
Bluegill	x	x	x	x	x	x		x	x	x	x	x	x
Bluntnose Minnow	x	x	x	x									
Bowfin						x		x			x	x	x
Brook Silverside	x			x			x		x	x			
Brown Bullhead						x							x
Channel Catfish													x
Common Shiner	x												
Golden Shiner	x			x									
Iowa Darter				x									
Johnny Darter	x			x									
Largemouth Bass	x	x	x	x	x	x		x	x	x	x	x	x
Least Darter				x									
Logperch			x	x					x				
Longear Sunfish	x	x		x	x	x		x					
Longnose Gar	x		x			x					x		
Mimic Shiner	x			x									
Northern Pike	x			x	x	x	x	x	x		x	x	x
Pumpkinseed	x	x		x	x	x		x			x	x	x
Rainbow Smelt							x						
Smallmouth Bass	x	x	x	x	x	x	x	x	x	x	x	x	x
Spotted Gar				x	x								
Rock Bass	x	x		x	x	x		x	x	x	x	x	x
Walleye								x		x	x	x	x
White Sucker	x			x		x	x	x		x	x		x
Yellow Bullhead	x			x						x	x	x	x
Yellow Perch	x		x	x	x	x	x	x	x	x	x	x	x

Table 3. Age and growth analysis for Northern Pike (top) and Walleye (bottom) captured in Crystal Lake, Montcalm County during the 2021 spring survey.

Species	Age	Number Aged	Length Range (in)	State Average Length (in)	Weighted Mean Length (in)	Mean Growth Index
Northern Pike	2	47	12.2-18.7	17.7	14.6	-2.8
	3	62	14.1-23.8	20.8	18.0	
	4	58	16.2-24.7	23.4	19.7	
	5	15	18.3-33.0	25.5	23.9	
	6	4	21.6-33.0	27.3	26.0	
	7	2	23.9-34.8	29.3	30.0	
	9	1	34.9	N/A	N/A	
	11	1	31.6	N/A	N/A	
	12	1	32.1	N/A	N/A	

Species	Age	Number Aged	Length Range (in)	State Average Length (in)	Weighted Mean Length (in)	Mean Growth Index
Walleye	1	20	9.5-10.6	7.1	10.0	+1.5
	3	2	15.1-15.5	13.9	15.3	
	4	89	16.5-20.9	15.8	18.1	
	5	84	17.1-23.8	17.6	19.4	
	6	90	18.1-25.3	19.2	20.4	
	7	11	18.9-25.4	20.6	21.8	
	8	6	19.3-26.8	21.6	21.6	
	9	7	21.0-25.3	22.4	22.5	
	10	6	21.3-27.0	23.1	23.9	
	11	2	24.0-26.2	N/A	25.1	
	13	1	23.7	N/A	N/A	

Table 4. Number, weights, and lengths for fish species collected during the 2021 spring survey on Crystal Lake, Montcalm County. Fish were captured using large mesh trap nets and nighttime boat electrofishing.

Species	Number	Percent by Number	Weight (lb.)	Percent by Weight	Length Range (in)	Average Length (in)	Percent Harvestable Size[1]
Black Crappie	3	0.2	3.8	0.2	11.0-14.9	12.8	100
Bluegill	256	21.1	109.1	5.4	4.0-9.9	7.7	89
Bowfin	15	1.2	68.7	3.4	20.0-26.9	23.5	N/A
Brown Bullhead	1	0.1	1.1	0.1	13.0-13.9	N/A	N/A
Channel Catfish	1	0.1	11.0	0.5	31.0-31.9	N/A	N/A
White Sucker	22	1.8	66.8	3.3	12.0-24.9	18.8	N/A
Hybrid Sunfish	11	0.9	3.8	0.2	4.0-10.9	7.1	73
Largemouth Bass	52	4.3	83.4	4.1	7.0-20.9	14.5	48
Northern Pike	207	17	334.7	16.6	12.0-34.9	18.9	7
Pumpkinseed	14	1.2	6.5	0.3	5.0-8.9	7.9	93
Rock Bass	25	2.1	10.8	0.5	3.0-10.9	7.8	72
Smallmouth Bass	15	1.2	21.5	1.1	8.0-16.9	13.7	53
Walleye	517	42.6	1,232.2	61.0	9.0-27.9	18.8	93
Yellow Perch	4	0.3	3.0	0.1	8.0-13.9	11.5	100
Yellow Bullhead	72	5.9	63.8	3.2	7.0-14.9	12.1	N/A

[1] Harvestable size is defined as 6 inches for Bluegill, Hybrid Sunfish, Pumpkinseed, and Warmouth and 7 inches for Black Crappie and Yellow Perch.

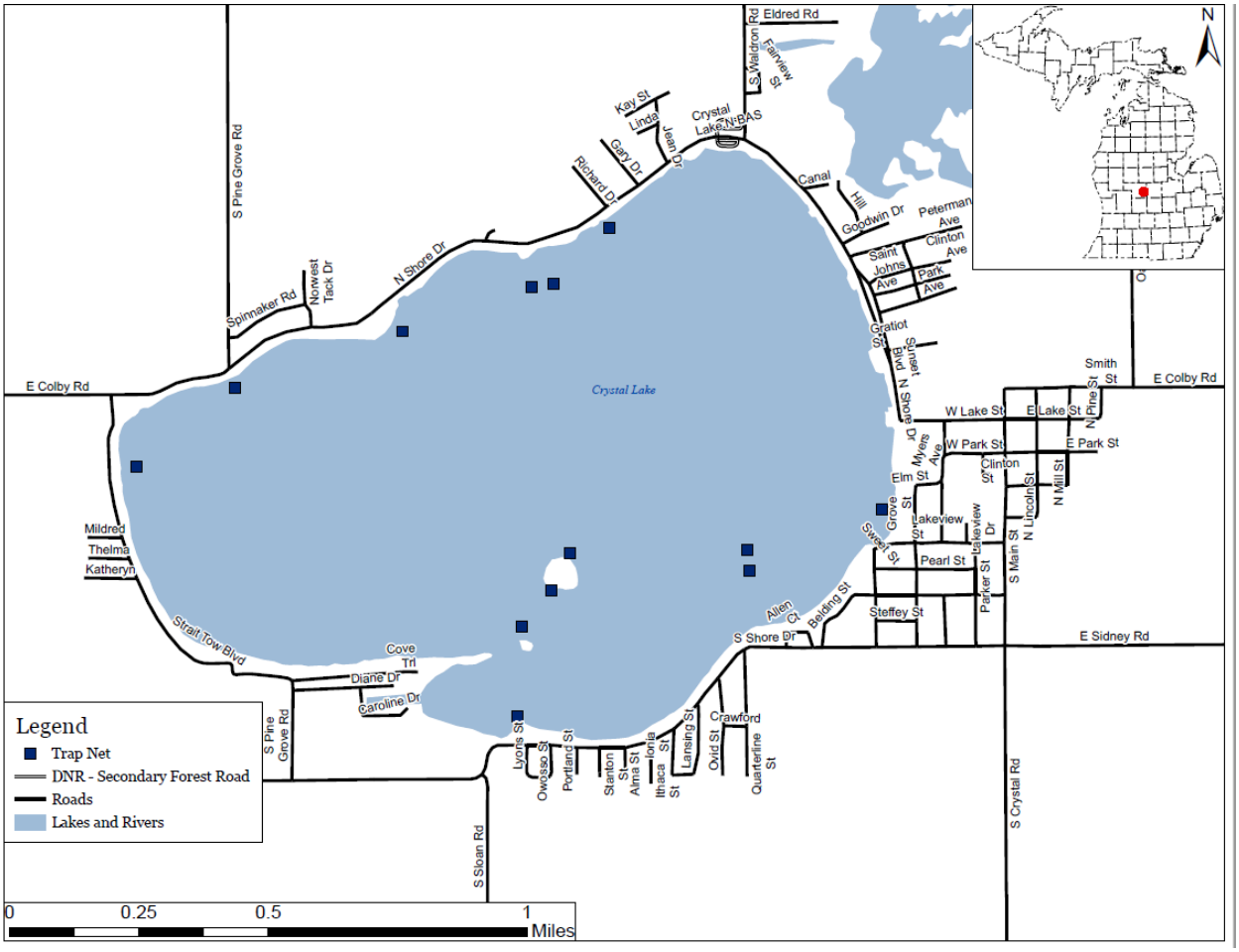

Figure 1. Map of Crystal Lake with squares indicating locations of trap nets set during the 2021 spring trap netting survey

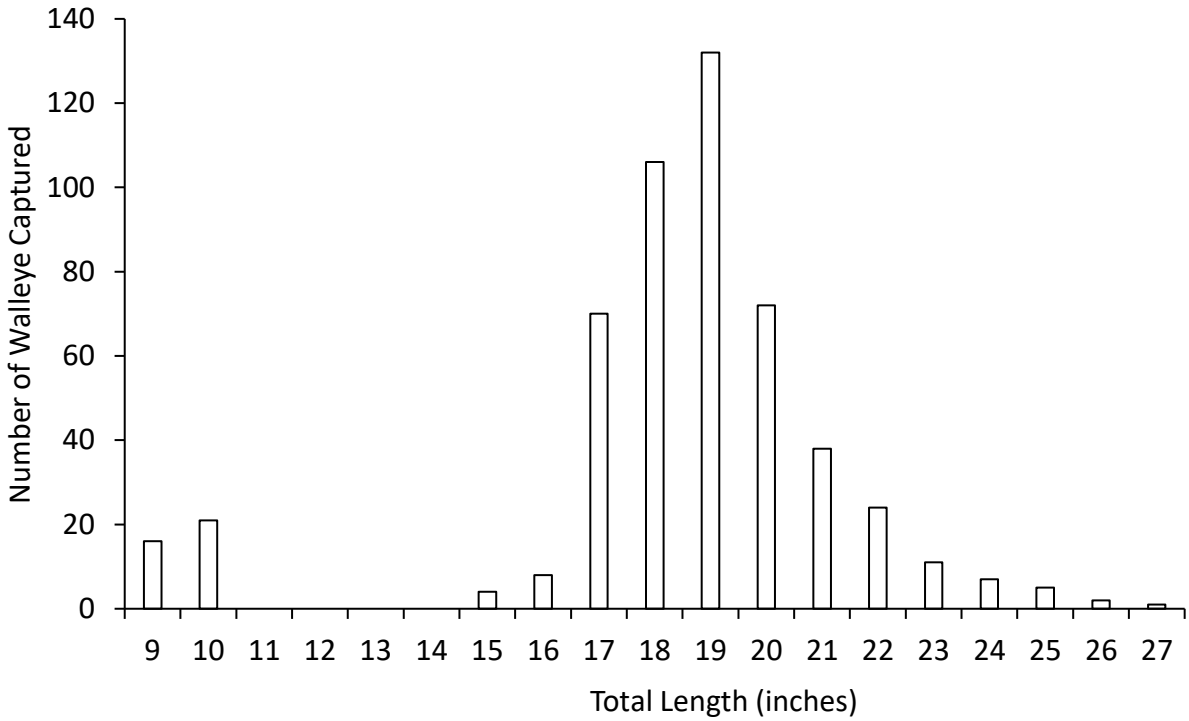

Figure 2. Length frequency distribution of Walleyes captured during the 2021 spring survey on Crystal Lake.

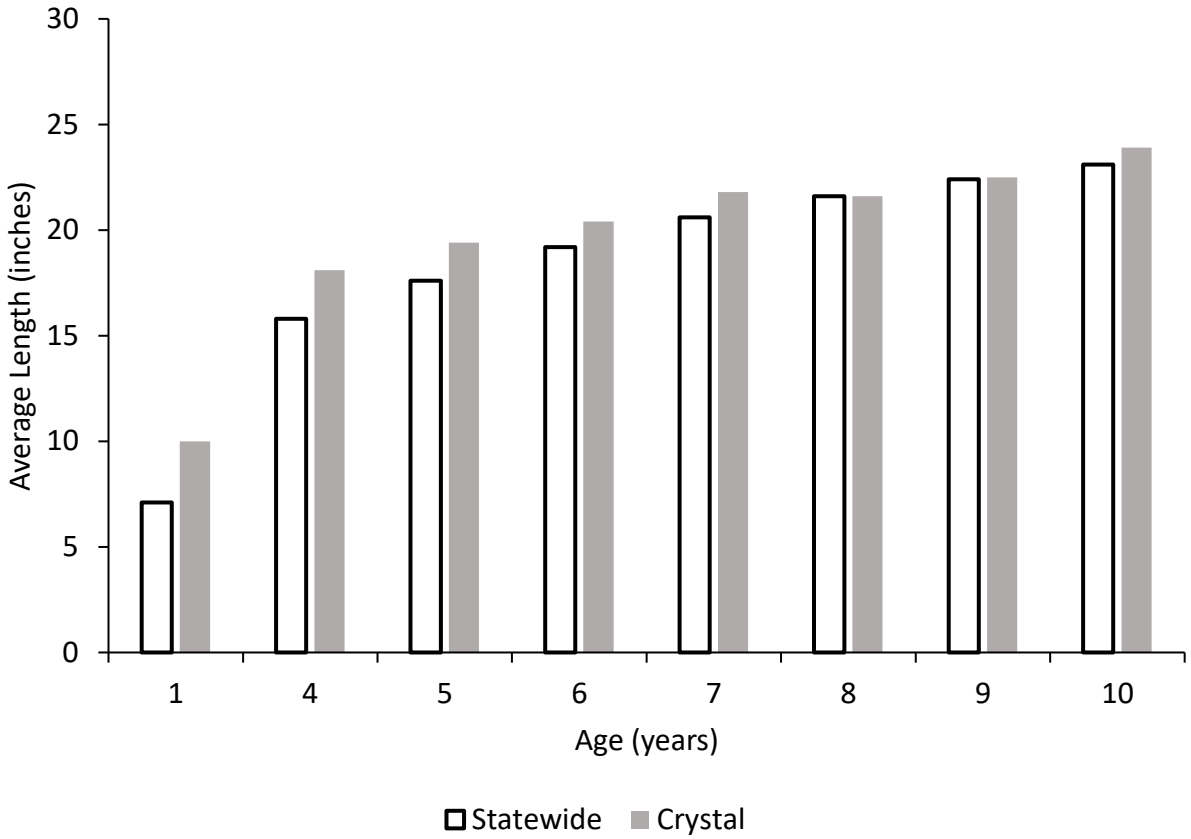

Figure 3. Average length at age of Walleyes in Crystal Lake (gray bars) compared to statewide averages (white bars) determined through age analysis of spine and scale samples collected during the 2021 spring survey. State average lengths from Schneider et al. (2000b).

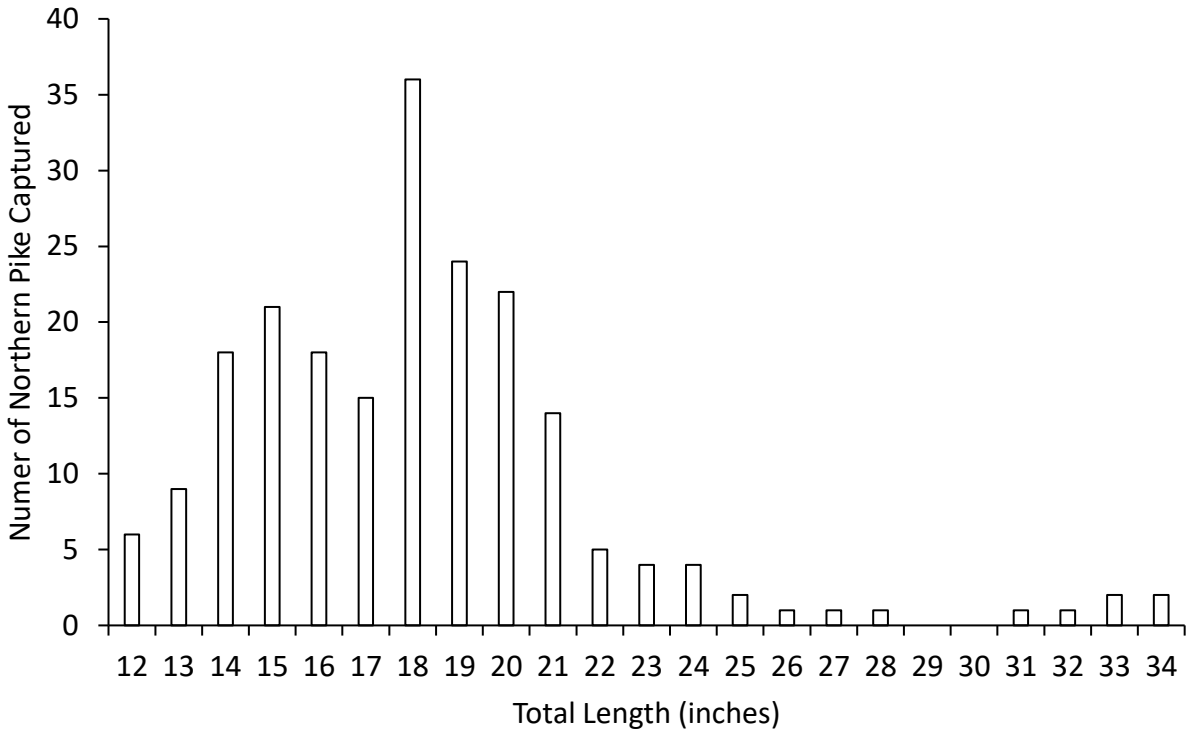

Figure 4. Length frequency distribution of Northern Pike captured during the 2021 spring survey on Crystal Lake.

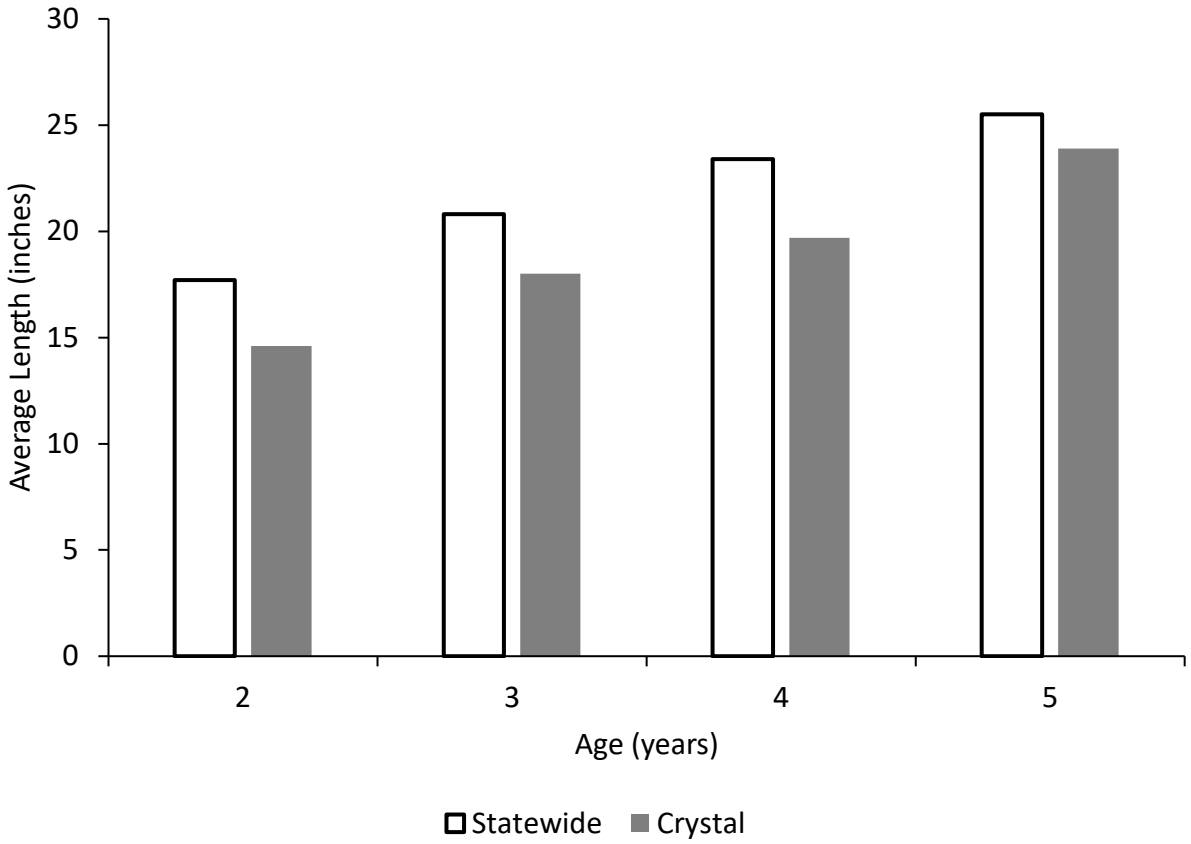

Figure 5. Average length at age of Northern Pike in Crystal Lake (gray bars) compared to statewide averages (white bars) determined through age analysis of spine and scale samples collected during the 2021 spring survey. State average lengths from Schneider et al. (2000b).

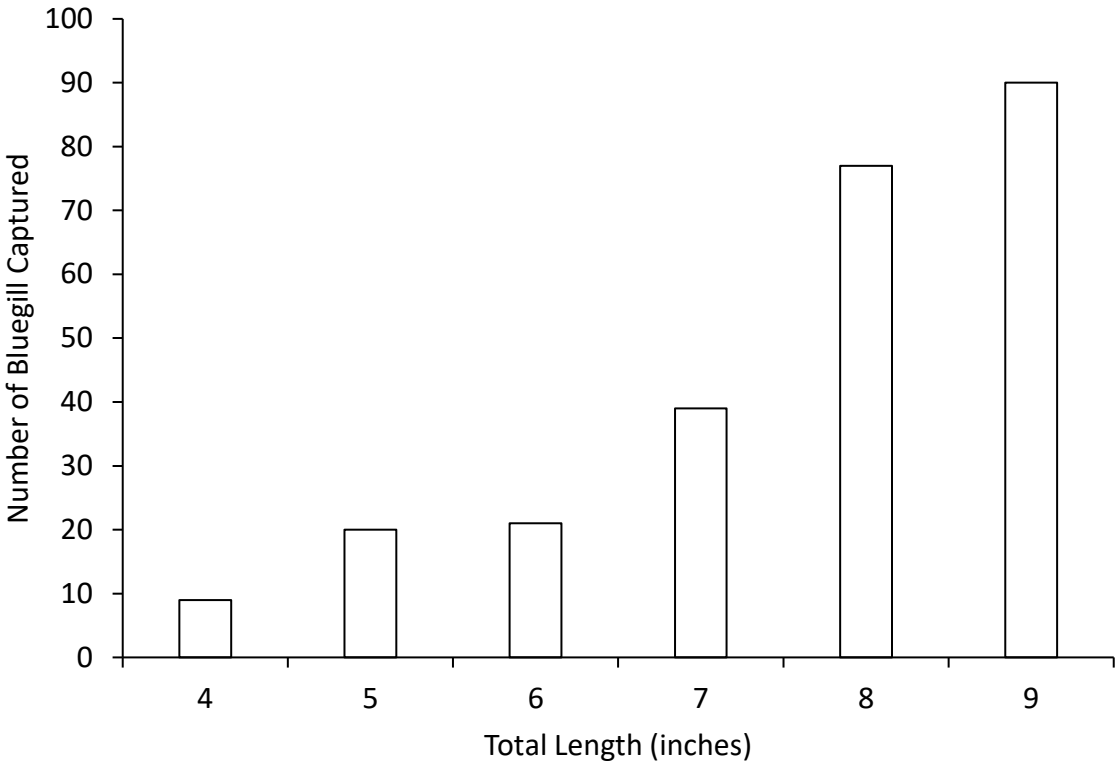

Figure 6. Length frequency distribution of Bluegill captured during the 2021 spring survey on Crystal Lake.

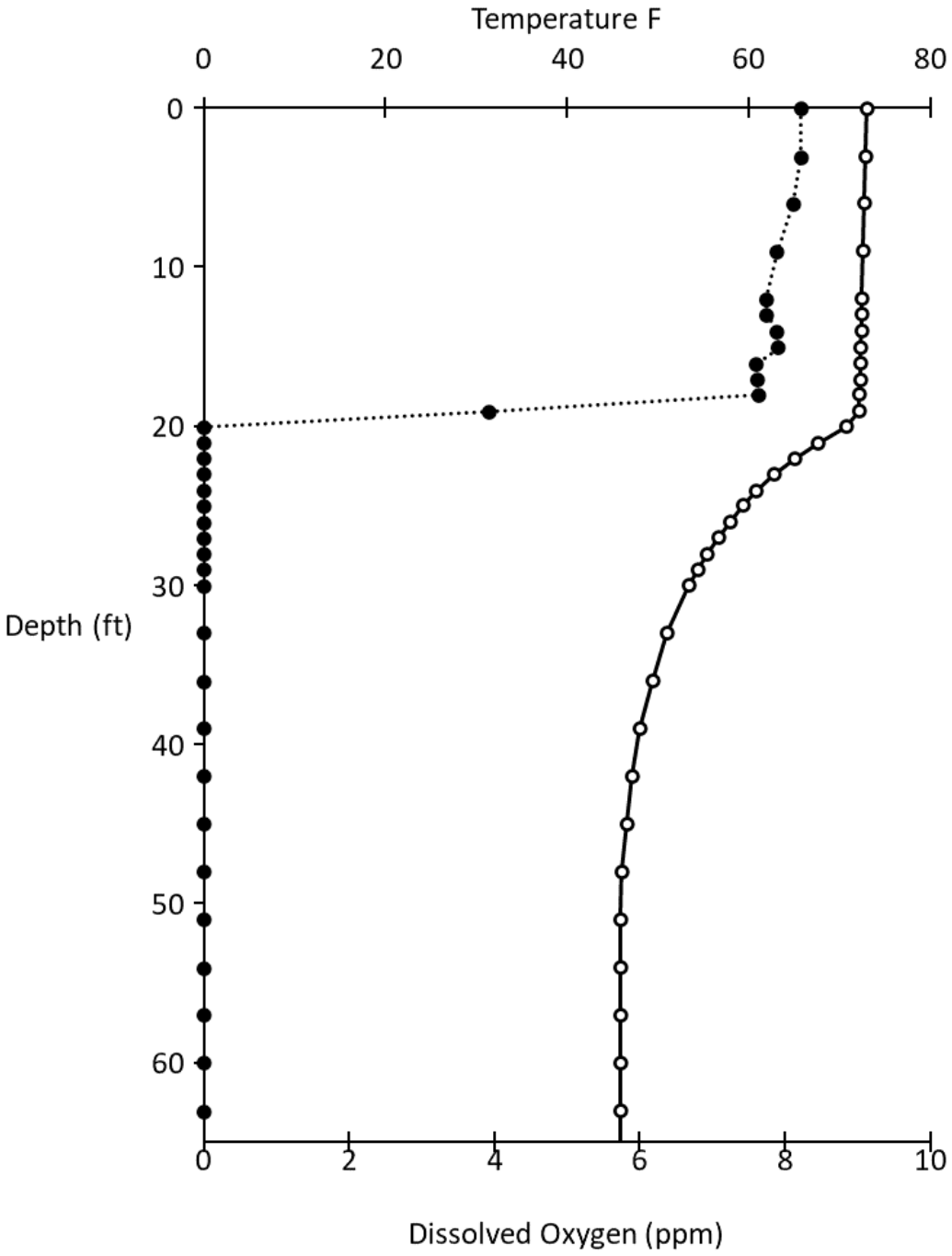

Figure 7. Temperature and dissolved oxygen profile of Crystal Lake which was recorded September 7, 2021. Dashed line with solid circles is dissolved oxygen (ppm) and solid line with open circles is temperature (F).

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