Lost Lake
Schoolcraft County, T47N/R14W/Section 10, and 11
Manistique River watershed, last surveyed 2021

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Environment

Location
Lost Lake is a 12-acre natural lake located in Seney Township in northeast Schoolcraft County (T47N/R14W/Sec. 10, and 11) in Michigan's Upper Peninsula (Figure 1). The town of Seney is located approximately 11.5 miles south of Lost Lake. Seney is located near the M-77 and M-28 intersection which is the northeast border of the Seney National Wildlife Refuge.

Geology and Geography
The geological bedrock formations encompassing Lost Lake include the Black River and Prairie Du Chien groups. The rock types in this region are sedimentary (i.e., limestone), formed during the Paleozoic period (MDNR 2001). The landform surficial geology of Lost Lake is comprised of moraine (82%) and glacial outwash (18%) materials. Additionally, course textured materials (100%) surround Lost Lake providing strong groundwater inputs. Soil types in this region are dominated by Kalkaska and Garlic sand types (USDA 2017). Course textured materials and the predominance of sand provide cold and clean aquatic conditions suitable for cold-water fish species such as trout. Adjacent landcover of Lost Lake is dominated by forest (87.2%), urban (8.6%), and water (4.2%). The immediate shoreline of Lost Lake is well forested and sandy with gradual drop-offs descending in the northcentral portion of the lake to a depth near 50 feet.

Watershed Description
Lost Lake is located within the Fox River drainage which serves as a tributary to the Manistique River watershed. Lost Lake has no inlets or outlets. Therefore, water levels are likely regulated by groundwater inputs, precipitation, and seasonal evaporation.

Chemical and physical characteristics
Since 1950, Lost Lake has been surveyed several times to gather limnological information that has included alkalinity (mg/L), dissolved oxygen (mg/L), water temperature (°F), pH, and conductivity (mS/cm).

Alkalinity is a measure of buffering capacity and plays an important role in determining a waterbody's pH and overall productivity (Wehrly et al. 2015). Alkalinity values in Michigan inland lakes can be classified into low (<49.5 mg/L), medium (49.5 to 141.5 mg/L), and high categories (>141.5 mg/L). In Lost Lake, alkalinity was measured in 1975 and 1976 was recorded to be 68.4 and 119.7 mg/L, respectively. Historical alkalinity values for Lost Lake are considered `medium' suggesting this waterbody, despite its clear appearance, may have a greater buffering capacity during spring runoff and may be more productive than other waterbodies in the Upper Peninsula region.

Dissolved oxygen or "DO" is a critical component to aquatic habitat in aquatic ecosystems. In lakes, DO may be derived from the atmosphere as well as from aquatic plants as a byproduct of

photosynthesis. Levels of DO can limit the distribution and growth of fish in lakes as well as the size composition and biomass of zooplankton. Concentrations of DO begin to limit cool- and warmwater fish populations below 3.0 mg/L and are often lethal below 0.5 mg/L (Wehrly et al. 2015). As DO becomes limited, two regions of a lake that are characterized by low levels of DO can occur. The hypoxic region, which is characterized by having low levels (e.g., less than 4.0 mg/L) of DO and the anoxic region which contains no DO. DO is often most limiting to fish during the late winter or summer period as ice covers the lake surface or as ambient air temperatures reach seasonal highs, respectively. In Lost Lake, winter DO was measured on 24 March 1976 and 3 March 2021 (Figure 2). Dissolved oxygen profiles from 2021 suggest that Lost Lake becomes hypoxic (<3.0 mg/L) at approximately 18 feet deep. Although data points are limited compared to 2021, DO measured in winter 1976 suggest that DO may have become hypoxic at a depth greater than 30 feet. In 2021, anoxic (no DO) conditions were recorded at a depth of 30 feet. Summer DO was measured on 29 August 1975 (Figure 3) suggesting Lost Lake exhibits hypoxic and anoxic condition at approximately 24 and 27 feet deep, respectively.

Thermal stratification occurs in deeper lakes during the summer months and is characterized by three water layers. The uppermost layer (epilimnion) is typically warmer and has adequate levels of sunlight to support photosynthesis. The middle layer (metalimnion) is the region where a more significant change in water temperature occurs. The point at which temperature change or drop is the greatest in this middle layer is called the `thermocline'. The bottom layer (hypolimnion) lies directly below the thermocline and typically contains less dissolved oxygen compared to other layers. In Lost Lake, water temperature was recorded in August of 1950, 1975, and 1982 (Figure 4). Water temperatures measured in 1950 and 1975 suggest that Lost Lake thermally stratifies, and the thermocline was located at the 20- and 21-foot depths, respectively. Initial water temperatures collected in 1982 show that the surface water was much warmer compared to 1950 and 1975 (Figure 4). However, water temperature dropped rapidly after a depth of 5-feet whereafter more favorable temperatures for trout were recorded. Water temperature data collected in 1982 may have been gathered at a different location, compared to those collected in 1950 and 1975, which may explain the difference observed.

Conductivity and pH were measured in Lost Lake on 4 March 2021. Conductivity ranged from 0.074 to 0.140 mS/cm from the water surface to 50 feet deep. Lost Lake pH ranged from 7.2 to 6.6 from the water surface to 50 feet deep.

Lost Lake is positioned on a north-northwest to south-southeast axis with a total fetch length of 1,010 feet (north to south) and an average depth of approximately 24 feet. Based upon lake fetch length and average depth, the shore of Lost Lake has the potential to receive 5-inch waves (low energy) during a 35 mile per hour windstorm (WI DNR 2022). Shoreline erosion caused by natural wind events is unlikely and hard armoring in this waterbody is not justifiable. Therefore, based upon the natural low energy potential in Lost Lake, hard armoring materials (e.g., steel, limestone, vinyl, rip rap) should not be used to modify the shoreline.

Development, public ownership, and access

Nearshore areas of Lost Lake are largely undeveloped and remain in a natural state. The surrounding land adjoining Lost Lake is held in private ownership yet is registered under the Commercial Forest Program (By authority of Part 511, 1994 PA 451, as amended). Therefore, the eastern shore is accessible to the public for recreation, most notably for fishing.

History

Fisheries management began in Lost Lake during the 1940s and 1950s as fisheries managers sought to identify small inland lakes that would be suitable for single-species or trout management. Given the small size and remote location, Lost Lake was considered by fisheries managers to be a `good' candidate for trout stocking and that a `no live bait' regulation should be placed on the lake. During this time, Lost Lake was reported by anglers to have an abundant population of undersized Yellow Perch and Northern Pike. However, land surrounding Lost Lake was held in private ownership by Cleveland Cliffs Iron Company under lease by Northwoods Lumber Company of Manistique. The owner of the Northwoods Lumber Company had reportedly planted Bluegill in Lost Lake and was not interested in providing public access to the lake. Due to private ownership status, managers recommended that the lake not be considered for trout management at that time.

By the mid-1970s, Lost Lake was again considered for trout management and fisheries managers began conducting inquiries about ownership and public access. In 1975, the Institute of Fisheries Research visited Lost Lake and noted that a single logging camp existed along the shore of the lake and that the lake was considered `semi-private' with ownership still held by Cleveland Cliffs Iron Company and the Northwoods Lumber Company. A company cook was interviewed and reported that several people had tried to fish the lake in past four years, however few fish were reported captured. Additional shoal observations found no sign of fish life after Bluegill were reportedly stocked decades prior. To date, there are no records of Bluegill being stocked in Lost Lake suggesting this may have been an undocumented private plant.

On 8 September 1975 a fisheries netting survey was conducted to gather fish community information from Lost Lake. A total of four experimental gill nets were set for one night (4 net nights total effort). Fish captured included Northern Pike, Yellow Perch, and Common White Sucker. Angler reports and fisheries survey data were consistent showing that Northern Pike and Yellow Perch were abundant and growing well below state average length. Following this survey, managers recommended that Lost Lake be chemically treated with Rotenone (fish toxicant) to begin single-species trout management for Rainbow Trout.

Following the survey conducted in 1975, fisheries managers drafted a chemical reclamation project proposal for Lost Lake. The project entailed treating Lost Lake with approximately 80 gallons of Rotenone to remove non-target species from approximately 180 acre-feet of water (1.5 mg/L concentration). In the 1970s, the cost of a gallon of Rotenone was reported to be $8.01 (or $42.20 in year 2022, (CPI 2022)). Following chemical treatment, Lost Lake was proposed to be stocked with 600 yearling Rainbow Trout. Although Rainbow Trout management was initially recommended, only Brook Trout have been stocked in Lost Lake to date.

On 24 March 1976, Lost Lake was mapped by the Michigan Department of Natural Resources and was reported to be 37.6 acres. However, this calculation was likely in error as present-day mapping software shows that Lost Lake is approximately 12.0 acres. During this mapping survey, managers noted that all surrounding land was owned by Cleveland Cliffs Iron Company and was open to the public for recreation.

Following chemical treatment in 1975, another Rotenone treatment was administered in Lost Lake on 29 June 1976. The concentration of that treatment was reported to be 1.5 mg/L. Species collected post-treatment included Northern Pike, Yellow Perch, Common White Sucker, Golden Shiner, Largemouth Bass, and Brown Bullhead. After the 1976 treatment, Brook Trout have been stocked in Lost Lake semi-annually through 2021 (excluding 1988, 1989, 1990, 2010, and 2020) (Table 1). After three years of stocking Brook Trout, fisheries managers conducted an angling survey in August of 1977 to evaluate the success of trout management in Lost Lake. No Brook Trout were captured during this survey. However, additional angling and creel surveys were conducted in September of the same year with promising results. More than 235 Brook Trout were observed captured by area anglers and fish were noted to be in excellent condition. Following these observations, fisheries managers recommended that Lost Lake be added to the list of designated trout lakes.

By the 1980s, Lost Lake was established as a remote inland lake managed to provide angling opportunities for Brook Trout. Lost Lake was surveyed by fisheries managers three times to quantify the abundance of Brook Trout, monitor for non-target species, and make any changes necessary to maintain trout management. On 5 August 1982 a general fisheries netting survey was conducted in Lost Lake to evaluate the trout fishery using three fyke nets and one experimental gill net (total effort four net nights). Species captured included Golden Shiner and Brook Trout. A total of nine Brook Trout were captured ranging from 11.0 to 17.0 inches total length. Brook Trout captured averaged 13.3 inches and all of the catch met the minimum size for harvest.

On 29 May 1984 a general fisheries netting survey was conducted in Lost Lake to evaluate the trout fishery using 5 fyke nets set for two nights (total effort ten net nights). Species captured included Brook Trout, Common White Sucker, Northern Redbelly Dace, Fathead Minnows, and Golden Shiner. A total of 26 Brook Trout were captured ranging from 5.0 to 17.0 inches. Brook Trout captured averaged 8.0 inches and approximately 15 percent of the catch met the minimum size for harvest. Fisheries managers noted at this time that Brook Trout stocked in 1980 and 1981 survived well, however those planted in 1982 were not represented in the catch. A recommendation was made to continue Brook Trout management in Lost Lake. Minnows were noted to be abundant, similar to when Lost Lake was surveyed in 1982 and that Golden Shiners had been transferred to Lost Lake from Rainy Lake (Luce County). Fisheries managers also noted that fishing pressure on Lost Lake appeared to be `heavy' and the size of Brook Trout captured was `cropped' as a result.

On 24 August 1988 a general fisheries netting survey was conducted in Lost Lake to evaluate the trout fishery using three experimental gill nets set for one night (total effort three net nights). Fisheries managers noted that only one Brook Trout (19.2 inches) and no other species were captured. A hook-and-line surveyed accompanied the netting effort, however no Brook Trout were captured. Although no Brook Trout were captured, fisheries managers noted that fish were observed on a hydrograph but suspended in the water column. After more than a decade of Brook Trout management, Lost Lake had become a popular destination for anglers seeking remote fishing opportunities for trout in Michigan's Upper Peninsula.

During the 1990s, management for Brook Trout in Lost Lake included netting surveys to continually evaluate the trout fishery, followed by additional chemical reclamations used to remove non-target species. On 6 September 1994, a general fisheries netting survey was conducted in Lost Lake to evaluate the trout fishery using fyke nets. A total of five fyke nets were set for one night (total effort

five net nights). Species captured included Yellow Perch, Pumpkinseed Sunfish, Golden Shiner, Creek Chub, Fathead Minnow, and Brook Trout. Only two Brook Trout were captured, of which one was legal size, suggesting that non-target species were negatively impacting the fishery. Following survey results, fisheries managers recommended that a chemical reclamation take place to remove non-target species and restore Brook Trout management. Prior to a chemical reclamation treatment, Lost Lake was again surveyed on 13 May 1999 to quantify the abundance of stocked Brook Trout using two fyke nets and two experimental gill nets. All nets were set for one night for a total effort of four net nights. Species captured included Brook Trout, Yellow Perch, Pumpkinseed Sunfish, and Golden Shiner. A total of 8 Brook Trout were captured ranging from 7.0 to 8.0 inches total length. Brook Trout captured averaged 7.3 inches in total length and none of the fish captured met the minimum size for harvest. Fisheries managers noted that many small Pumpkinseed Sunfish were captured prompting additional consideration for a chemical reclamation effort the following Fall.

On 26 October 1999 a treatment using Rotenone, at a concentration of 1.5 mg/L (or 80 gallons), was administered in Lost Lake to remove non-target species. Species collected included Yellow Perch, Pumpkinseed Sunfish, Golden Shiner, Common White Sucker, Longnose Sucker and darters. In the late 1990s, fish toxicant cost approximately $33.00 (equivalent to $57.75 in year 2022, CPI (2022)) per gallon, showing a 36.8 percent increase in cost (adjusted for inflation) compared to the 1970s when trout management began in Lost Lake. Following chemical reclamation, Brook Trout stocking and trout management resumed in Lost Lake with positive reports and photographs being provided from anglers.

During the 2000s, fisheries managers continued to receive positive feedback from anglers seeking remote trout fishing opportunities in Lost Lake. On 18 May 2005 a general fisheries netting survey was conducted in Lost Lake to quantify the abundance of Brook Trout using six fyke nets and four experimental gill nets. A total of two net pulls were reported for a total effort of twelve fyke net nights and eight experimental gill net nights. Fish captured included Brook Trout and Fathead Minnow. A total of 30 Brook Trout were captured ranging from 6.0 to 16.0 inches total length and 82 percent of the catch met or exceeded the minimum size for harvest. Age and growth analysis from Age-1 to Age-4 Brook Trout suggested that growth of Brook Trout in Lost Lake was comparable to the state average. During this time, fisheries managers noted that Lost Lake was providing a nice remote fishery for Brook Trout and that trout management should continue. However, reports of non-target species began to occur in the late 2000s (2009) prompting additional consideration for chemical reclamation treatments to occur.

By the 2010s, anglers had noted that Bluegill were abundant in Lost Lake and these observations were confirmed by area biologists. This resulted in unfavorable fishing reports by anglers that annually visited Lost Lake. Prior to the introduction of Bluegill, Lost Lake reportedly produced Brook Trout in excess of 18.0 inches, so anglers were interested in seeing Brook Trout management continue. There was also a request by an angler to have Lost Lake regulations changed to a Type D trout lake to prevent future introduction of non-target species. However, given that Bluegill were illegally introduced, a change in regulation would not have prevented the introduction. In Fall of 2010, Lost Lake was again chemically reclaimed using 60 gallons of Rotenone to remove non-target species and restore Brook Trout management. Species collected after treatment included Bluegill, Fathead Minnow, and Iowa Darter. Following chemical reclamation, Brook Trout stocking and trout management resumed in Lost Lake.

During the 2010s angler feedback was largely positive after the removal of non-target species and there was interest by Fisheries Division to quantify angler effort in Lost Lake. Due to the remote location, sending creel clerks to Lost Lake was not considered feasible. Therefore, in 2018, a wildlife game camera was temporarily installed to quantify angler effort in Lost Lake. During the 2020s fisheries managers began to gather data to provide a more thorough evaluation of the Brook Trout fishery in Lost Lake. Angler effort data had been gathered in 2018, so additional data were needed to evaluate the fishery including a winter limnological survey as well as a netting survey conducted in 2021.

Current Status

Three surveys were used to determine the current status of the Lost Lake fishery. The first survey consisted of an angler use survey to quantify angler effort in Lost Lake. To quantify angler effort, a wildlife game camera was deployed near a Lost Lake access area. A total of 61 angler trips were recorded from 11 May to 30 September 2018.

The second of three surveys, conducted in March of 2021, was a winter limnology profile collected from the deepest portion of Lost Lake to measure DO (mg/L) and water temperature (°F). Winter limnology data were used to evaluate water column habitat during the stressful winter period when ice cover can limit oxygen availability. The Lost Lake water column was sampled at three-foot intervals from the water surface to the point of anoxia (0.0 mg/L DO) and then every five feet thereafter to a maximum depth of 50 feet.

The third survey consisted of a netting evaluation conducted on 4 October 2021, to quantify the abundance of Brook Trout in Lost Lake. Similar to surveys conducted in the past, gear types used included small- and large-mesh fyke nets. Small- and large-mesh fyke nets were used for a total of 11 net nights. All Brook Trout captured were enumerated and total length was measured to the nearest tenth of an inch. Age structures (10 per inch group) were collected from all trout captured. Other species captured were enumerated and measured to the nearest inch. A total of 39 fish weighing 27.3 pounds and representing 2 species were captured. Species captured included Brook Trout and Creek Chub. A total of 37 Brook Trout were captured ranging from 10.0 to 19.0 inches total length. Brook Trout captured averaged 11.7 inches in length and all fish captured met the minimum size for harvest. Brook Trout captured were in good condition growing approximately 1.2 inches above the state average.

In addition to the three surveys referenced above, historical limnology profiles, nettings surveys, and more recent angler reports are all referenced in the Analysis and Discussion section to further evaluate the Lost Lake fishery. Historical limnology profiles were collected during the winter of 1976 and summer of 1950, 1975, and 1982. Historical netting surveys were conducted in 1982, 1984, 1988, 1994, 1999 and 2005. Recent angler reports were received after the 2021 fishing season on Lost Lake.

Analysis and Discussion

Lost Lake is a small and deep natural lake with an undeveloped shoreline that was historically inhabited by an abundant population of undersized Yellow Perch and Northern Pike. Nearly fifty years ago management of Lost Lake was adjusted to accommodate single-species or trout management that

included periodic chemical reclamations and annual stocking of Brook Trout. MDNR Fisheries Division annually stocks approximately 200 inland lakes in Michigan to provide diverse angling opportunities to resident and non-resident trout anglers. East of the Ford River watershed, the Northern Lake Michigan Management Unit of Fisheries Division manages several inland lakes in Michigan's Upper Peninsula for trout species including Brook Trout, Brown Trout, Rainbow Trout, and Splake.

Lakes managed for trout species in this region are often small (less than 100 acres) compared to other inland lakes and are regulated (Type A through D) specifically to provide anglers with diverse angling opportunities. Additionally, these small inland lakes are remote and provide a unique wilderness experience sought by many anglers. As stated earlier, Lost Lake is a remote 12-acre lake that has been managed successfully as a Brook Trout fishery for nearly 50 years. To evaluate lakes managed for trout there are several criteria that may be used that include biological, social and economic components. Evaluating biological criteria requires having information about capture efficiency, survival, and growth of stocked Brook Trout as well as measurements of available lake habitat (e.g., oxygen, temperature). Social criteria include information pertaining to angler satisfaction with the fishery. Lastly, economic criteria compare the estimated revenue generated from each angler trip (Dexter and O'Neal 2004) to the total cost of annually stocking a lake as well as the cost of chemical reclamation.

Since 1982, the catch per unit effort (CPUE) of Brook Trout in Lost Lake has ranged from 0.3 to 3.4 Brook Trout per net night and was highest (3.4 fish per net night) during the most recent survey conducted in 2021 (Table 2). Years with the lowest Brook Trout catch rates correspond to years when non-target species were abundant requiring chemical reclamation. Following treatment, catch rates of Brook Trout in survey gear improved. Generally, Brook Trout catch rates in Lost Lake suggest that stocked fish are surviving from one year to the next with the highest survival occurring most recently in 2021. Average size of Brook Trout captured has ranged from 7.8 to 19.5 inches in total length (Table 2). The average minimum and maximum size of Brook Trout captured during all survey years is 8.9 and 15.4 inches, respectively (Table 2). Age at length analysis suggests that Brook Trout stocked in Lost Lake tend to grow at rates comparable to or above the state average suggesting that stocking rates are appropriate given the amount of forage available in the lake.

Designated trout lakes should have minimum DO concentrations of 7.0 mg/L, while other inland lakes should contain 5 feet of the water column where minimum DO concentrations range from 2.0 to of 5.0 mg/L (Dexter and O'Neal 2004). Also, inland lakes stocked with trout should not exceed 69 °F for optimum growth and survival of trout (Dexter and O'Neal 2004).

During winter of 2021, more than 20 feet of the water column contained DO greater than 2.0 mg/L (Figure 2). The highest recorded DO measurement from Lost Lake in winter 2021 was 6.2 mg/L, which is less than that preferred for trout lake designation. Comparing winter DO profiles in 2021, to those collected in 1976, suggests that hypolimnetic hypoxia may be occurring in Lost Lake. In 1976, DO ranged from 11.0 to 4.0 mg/L from the water surface to 30 feet deep. A recent summer DO profile was not available, however, historical samples gathered during summer of 1950 and 1976 suggest that Lost Lake contained sufficient DO to support trout from the water surface to 25 feet deep. More recent summer DO profiles should be collected to determine if hypolimnetic hypoxia is occurring in Lost Lake during additional stressful periods. In addition to DO, summer water temperature can limit the

growth and survival of stocked trout as inland lakes reach their warmest temperatures. As stated earlier, A recent summer limnology profile is not available however, historical samples do provide insight. For example, water temperature profiles were collected from Lost Lake in 1950, 1975, and 1982 (Figure 4). These data suggest that summer water temperatures remained low (below 69 °F) in depths of the water column that also provided sufficient DO for trout growth and survival. Recent Brook Trout catch rates also suggest that the current conditions are suitable for growth and survival. However, winter and summer limnology profiles should continue to be gathered in the future to monitor lake habitat in response to climate change.

Social data, in the form of angler reports, have been received by Fisheries Division regarding trout angling opportunities in Lost Lake. Most recently, anglers have noted that Lost Lake is a high catch rate fishery where a number of fish can be captured in a relatively short period of time. Also, anglers have reported that Brook Trout reach an attractive size (19.0 inches) resulting in annual fishing trips to this waterbody and other lakes near the Alger, Schoolcraft, and Luce County areas. Nearly all reports from anglers have been positive, with those reporting the presence of non-target species (during the late 1990s) being the exception. These data suggest that angler satisfaction with the Lost Lake Brook Trout fishery is high, and that trout management should continue.

The cost associated with trout management in Lost Lake includes annual stocking of yearling Brook Trout and treatments needed to remove non-target species. These costs are then compared to angler trip revenue values and can help determine if a stocking program is economically successful (Dexter and O'Neal 2004). Currently, Lost Lake is prescribed to annually receive 550 yearling Brook Trout (annual cost $2,657). Since the beginning of trout management (1976), Lost Lake has been chemically reclaimed twice to remove non-target species. This suggests that Lost Lake, on average, may need chemical reclamation every 23 years to maintain trout management. Treatment of Lost Lake requires a minimum of 60 gallons of Rotenone that ranges in price from $65 to $75 per gallon (total cost range $3,900 to $4,500). Therefore, the average annual cost of chemical reclamation over a 23-year period ranges from $170 to $196 per year. Adding the cost of stocking to that of chemical reclamation suggests that trout management in Lost Lake costs approximately $2,827 to $2,853 annually. Annual angler trip revenue was estimated to be $2,745 based upon the number of angler trips observed in 2018 multiplied by $45 which represents an estimated angler trip revenue value (Dexter and O'Neal 2004, adjusted for inflation). It is noteworthy to mention that 2018 was accompanied by significant amounts of precipitation during the spring and summer months that likely resulted in an underestimate of the number of anglers that visit Lost Lake on an annual basis. Regardless, the estimated revenue generated from angler trips is comparable to the annual costs of trout management in Lost Lake suggesting that this is a successful program economically.

Management Direction

Biological, social, and economic criteria used to evaluate trout management in Lost Lake have been met and Brook Trout management should continue here in the future. However, there is concern regarding the potential for hypolimnetic hypoxia to be occurring in deeper portions of Lost Lake. Additionally, the potential loss of public access is a concern for MDNR Fisheries Division and state-licensed anglers seeking remote trout fishing opportunities. Moving forward there are strategies that may be adopted to maintain proper management of the Lost Lake fishery.

1). Continue to survey the catch rate, survival, and growth of stocked Brook Trout using small- and large-mesh fyke nets. Document the presence and abundance of non-target species (e.g., Bluegill, Yellow Perch, Pumpkinseed Sunfish).

2). Additional winter and summer limnological surveys should be conducted to monitor hypolimnetic hypoxia and lake warming in response to climate change. These assessments should occur prior to the expiration of stocking prescriptions to provide information needed to justify a continuation in trout management.

3). Continue to conduct outreach to area anglers that frequent inland lakes for Brook Trout angling opportunities.

4). Deployment of wildlife game cameras have been documented to be a useful tool to estimate the number of angler trips and to generate an estimated revenue value. This tool should be utilized prior to the end of the next prescription cycle to evaluate angler use.

5). Continue to advocate for public access to areas surrounding Lost Lake to ensure state hatchery vehicles and anglers can access Lost Lake.

6). Continue trout management in Lost Lake with Type A regulations. Type A trout lakes have a possession season from the last Saturday in April through October 31st. All tackle may be used in Lost Lake except minnows. The daily possession limit is 5 trout, with no more than 3 trout greater than 15.0 inches. The minimum size limit for harvest of Brook Trout is 10.0 inches.

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Table 1. Year, number (N) planted, and size (TL inches) of Brook Trout stocked in Lost Lake, Schoolcraft County Michigan.

Year	N Planted	Size (TL)
1976	1200	
1977	800	
1978	4300	
1979	900	3.82
1980	900	2.64
1981	900	2.09
1982	900	2.05
1983	880	3.5
1984	900	3.94
1985	1000	2.13
1986	1000	2.28
1987	1000	6.26
1991	1200	2.32
1992	1200	3.07
1993	1200	2.83
1994	1200	2.6
1996	550	6.77
1997	510	7.56
1998	550	5.83
1999	550	6.46
2000	550	6.69
2001	550	6.38
2002	550	6.61
2003	550	7.17
2004	550	6.5
2005	550	6.81
2006	530	7.52
2007	550	6.42
2008	605	6.69
2009	580	6.5
2011	605	7.99
2012	470	8.03
2013	550	8.23
2014	620	7.91
2015	495	7.8
2016	560	8.31
2017	605	7.95
2018	605	8.94
2019	580	7.83

2021	590	8.62

Table 2. Year, catch per unit effort (CPUE), number captured (N), average (Avg.) size (Total Length, inches), minimum size, and maximum size of trout captured during netting surveys in Lost Lake, Schoolcraft County, Michigan.

Year	CPUE	N	Avg. Size (TL)	Min. Size (TL)	Max. Size (TL)
1982	2.25	9	13.3	11.0	17.0
1984	2.60	26	8.0	5.0	17.0
1988	0.33	1	19.5	19.5	19.5
1994	0.40	2	8.5	4.0	12.0
1999	1.00	4	7.8	7.0	8.0
2005	1.50	30	11.0	6.0	16.0
2021	3.36	37	11.7	10.0	19.0
Avg.	1.64	16	11.4	8.7	15.4

Figure 1. Map of Lost Lake (46.481199 -86.032182) located in northeast Schoolcraft County, Michigan.

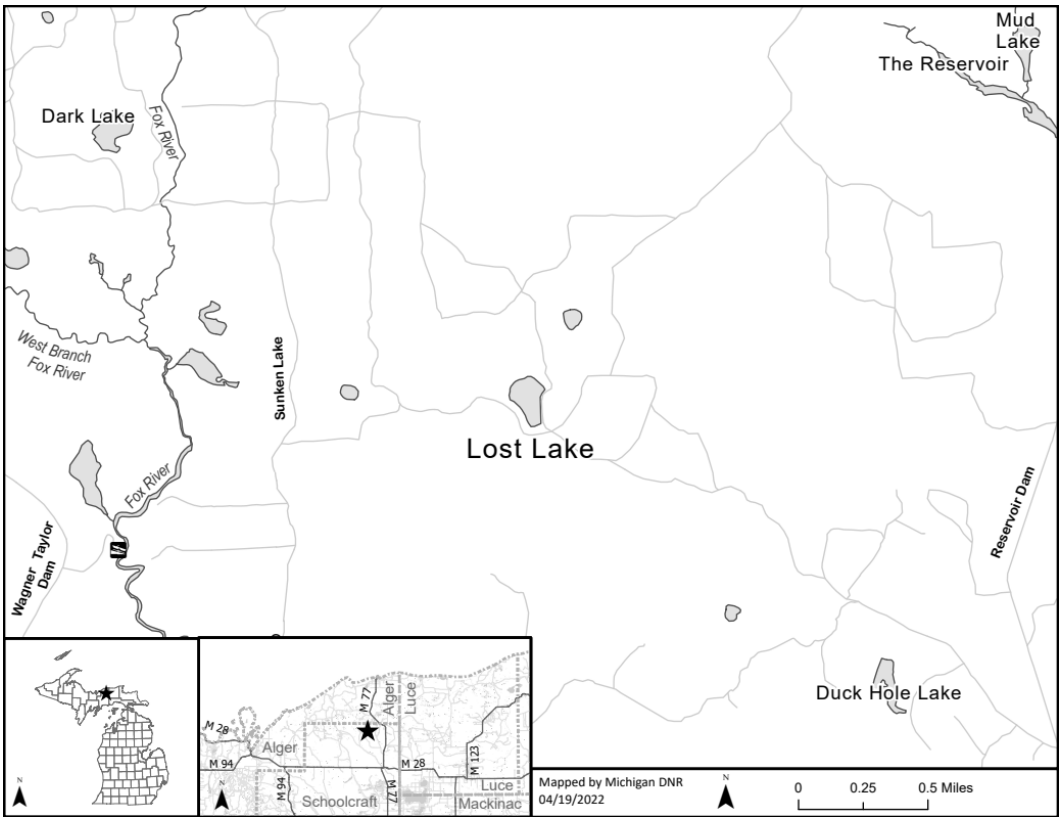


Figure 2. Winter depth (ft) and dissolved oxygen (mg/L) recorded in 1976 (diamonds) and 2021 (circles) from Lost Lake, Schoolcraft County Michigan.

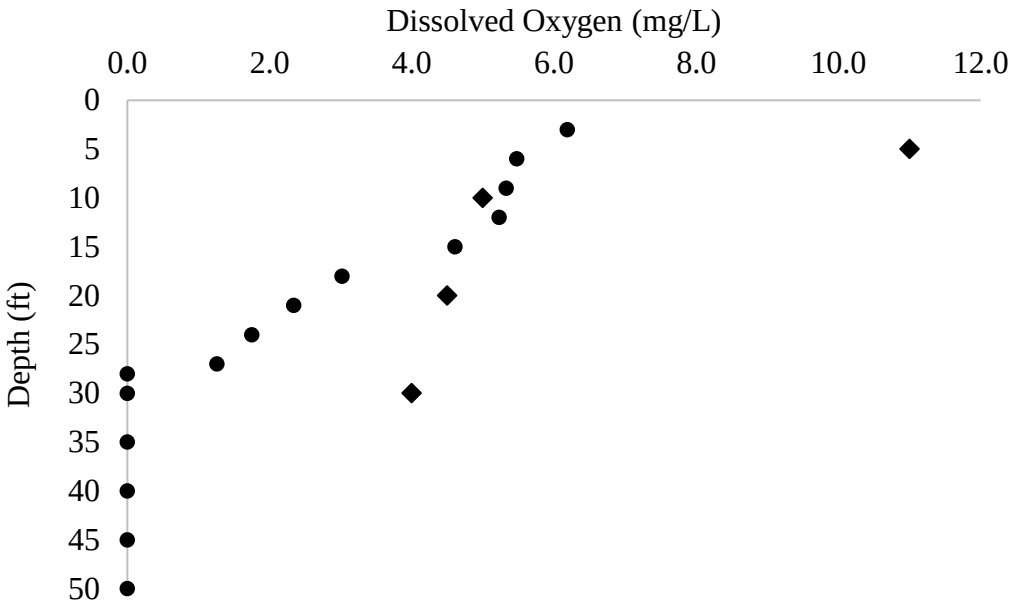


Figure 3. Summer depth (ft) and dissolved oxygen (mg/L) recorded in 1975 from Lost Lake, Schoolcraft County Michigan.

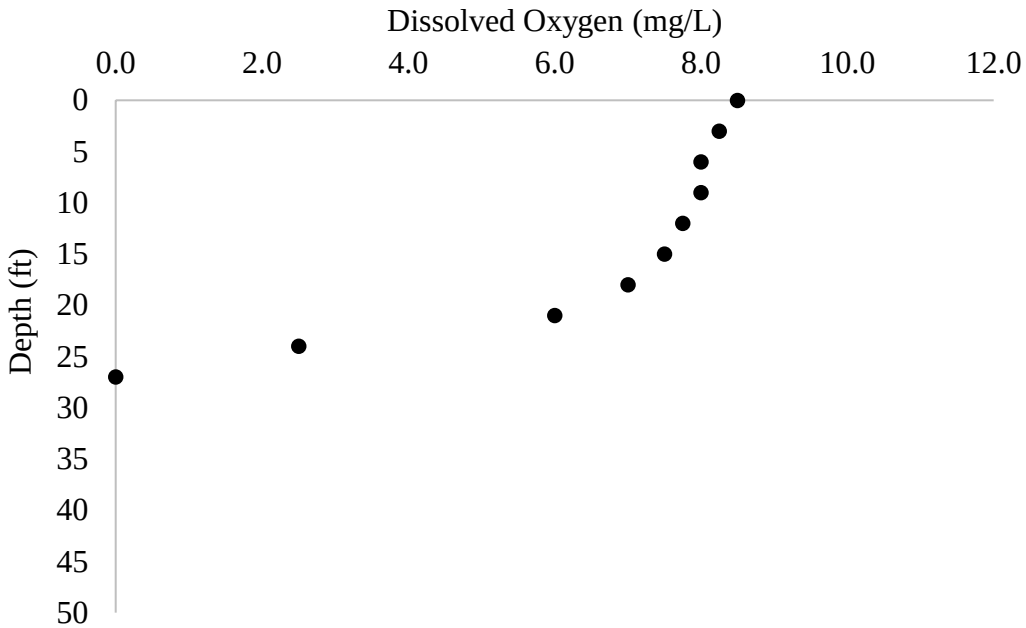
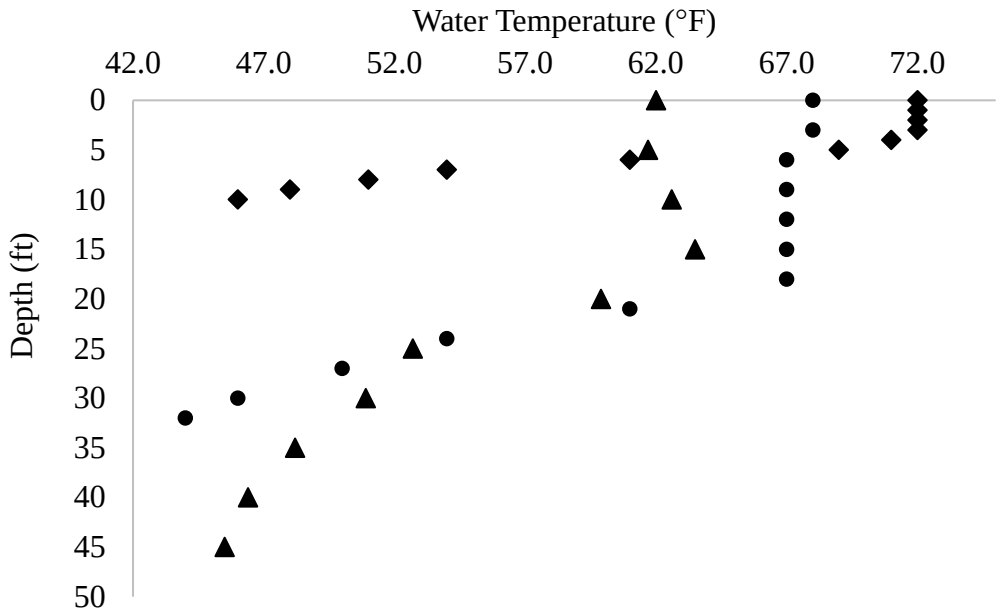


Figure 4. Summer depth (ft) and water temperature (°F) recorded in August of 1950 (triangles), 1975 (circles), and 1982 (diamonds) from Lost Lake, Schoolcraft County Michigan.



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