Heart lake

Otsego County
Au Sable River watershed, last surveyed in 2020

Neal Godby, Senior Fisheries Biologist

Environment

Heart Lake is a 63-acre natural lake located in southcentral Otsego County (Figure 1). Heart Lake has a shoreline distance of 1.5 miles, and a contributing watershed area of 266 acres. The lake has a maximum depth of 117 feet (Figure 2), with mostly sand and organic substrates and some gravel. There is a boat ramp on the south end of the lake operated by the Department of Natural Resources Parks and Recreation Division. There are no inlets or outlets to the lake. Heart Lake has Type B trout regulations and is annually stocked with 4,000 yearling Rainbow Trout (Eagle Lake strain). The lake is also featured on the Department of Natural Resources Trout Trails website (DNR - Trout Trails in Lake Huron Watershed (Basin) (michigan.gov)).

History

Heart Lake has a long history of fisheries management and has been managed as a trout lake since 1949 following an initial survey of water chemistry measurements taken in July of that year along with a hook and line survey. The lake was reported to have Smallmouth Bass, perch, Bluegill, carp, and pike, but the survey crew was unable to catch any fish at that time. Perch and Bluegill were reportedly small and numerous, but heavily infested with tape worm. The water chemistry measurements indicated a thermocline was established from 20 feet to 28 feet in depth. Dissolved oxygen dropped to 4.0 parts per million (ppm) at 60 feet, 2.9 ppm at 70 feet, and 1.7 ppm at 100 feet in depth. Rainbow Trout were stocked in the lake starting in 1949.

The 1950s saw continued Rainbow Trout stocking, with stocking occurring annually throughout the decade. The only note in the file from that time period was for the 1959 trout season opening day, when six boats and 50 anglers were counted. Fishing success however was noted to be poor due to cold weather and cold water temperatures.

Rainbow Trout stocking continued in the 1960s, with stocking occurring every year that decade except for 1960 and 1967. A temperature profile was done in August 1966 and indicated that the thermocline was established between 24 and 36 feet in depth. A netting survey was done in September of 1966 using six experimental gill nets to check on trout growth and for the presence of other fish. Rainbow Trout were noted to be extremely thin, and an abundance of small Yellow Perch was noted as well.

The 1970s saw numerous fisheries management activities take place on Heart Lake. A gill net survey was done in August of 1972 to determine the success of trout stocking. A total of 2000 feet of gill nets were set and caught Yellow Perch, Largemouth Bass, Rainbow Smelt, and Rainbow Trout. The Yellow Perch were growing about at the statewide average, while other species were growing well above average. A temperature and dissolved oxygen profile done at that time showed a thermocline from 20-30 feet in depth, with dissolved oxygen of 6 ppm at 24 feet and 2 ppm at 26 feet. A lake volume analysis was done in February 1974, and estimated the lake had 2,304.8 acre-feet of water. A lake volume

analysis is typically done when planning a chemical treatment of the lake so that the appropriate amount of chemical can be ordered and applied.

A temperature profile and gillnet survey occurred in August 1974. The lake was thermally stratified, with the thermocline established between 26 and 30 feet in depth. Dissolved oxygen decreased from 12 ppm at 40 feet to 2 ppm at 50 feet. The gill net survey found Yellow Perch to be abundant, and only one Rainbow Trout was captured. A public meeting was then held to discuss the fish management program for Heart Lake, with a partial thinning of suckers and perch proposed by fisheries managers to improve fishing in the lake. Of the 26 people in attendance, 24 were in favor of the action, and the thinning was planned for the spring of 1975. Another lake volume analysis was done in February 1975 in advance of the treatment and estimated 2,220.2 acre-feet of water in Heart Lake.

The chemical treatment of Heart Lake was done in early May 1975 for five days using Antimycin A-concentrate at a target concentration of 2.5 parts per billion. The purpose of the treatment was to remove a portion of the Yellow Perch and White Sucker populations to improve the survival and growth of the stocked Rainbow Trout. Four gill nets were set and tended before the treatment started to document conditions and allow for a comparison to post-treatment surveys. Over 3400 Yellow Perch were captured in this effort. Dead fish collected after the treatment included Yellow Perch, Common White Sucker, Rainbow Smelt, Rock Bass, Bluntnose Minnow, Largemouth Bass, Rainbow Trout, Northern Pike, Bluegill, and Common Carp. Yellow Perch and Common White Sucker populations were reported as greatly reduced from the treatment. A follow-up gill net survey was done that month to evaluate the recent chemical treatment. It was noted that the partial kill of Yellow Perch had been primarily males, as the females had not moved in yet to spawn. The survey showed that the number of Yellow Perch was much lower.

A hook and line survey was done in September 1975, and the biologist observed "apparently the partial treatment insured good survival and growth of the rainbow trout, increased the growth of the remaining yellow perch and favored reproduction of large mouth bass." The goal of the partial thinning of suckers and perch was to improve Rainbow Trout survival and overall fishing and appears to have been successful.

Two more gillnet surveys were done in the 1970s: one in November 1977 and one in October 1979. The 1977 survey used six gill nets to check on trout survival and growth. Twenty-one Rainbow Trout were captured, and growth was reported to be "average for a treated lake and survival seems to be adequate." Yellow Perch and smelt growth were good, attributed to the treatment having removed a large portion of the standing crop. The fishing report indicated excellent catches of trout taken, but there were many complaints of undersized fish. The 1979 survey utilized 12 gill nets to check on the current year stocking of 2,000 steelhead. The survey analysis reported the growth and survival to be average, but Yellow Perch size had increased dramatically and was expected to provide an excellent fishery. Fishing for trout was reportedly slow with little fishing pressure.

Rainbow Trout stocking in Heart Lake occurred every year in the 1970s except for 1972-74 when no fish were stocked. Of the stocked years, Steelhead (Michigan strain Rainbow Trout) were stocked in 1975 and 1979.

Fisheries management in Heart Lake was less active in the 1980s, with one survey in that decade. That survey, done in April and May 1986, involved substantial effort and was done to assess the trout population and conduct a manual removal of Yellow Perch, smelt, and suckers. A total of 14 fine-mesh fyke nets were used, with effort totaling 197 net lifts / 291 net nights. The effort removed a total of about 60 pounds per acre of species such as Northern Pike, Rainbow Smelt, Yellow Perch, and suckers. Rainbow Trout stocking, which occurred from 1980-1986, was discontinued and Splake were stocked during 1987 to 2001 (Table 1). No fish were stocked in Heart Lake 1988 or 1989. The 1986 survey report indicated that the Rainbow Smelt population may be impacting the survival of Rainbow Trout, so the decision was made to stock Splake instead.

Two fisheries surveys were done on Heart Lake in the 1990s, both of which were stocking evaluations using gill nets. The 1990 survey reported excellent over-winter survival of stocked Splake as evidenced by the presence of multiple year classes. Some Northern Pike were also collected. Winter ice fishing pressure had increased significantly due to the Splake planting program. The 1997 stocking evaluation found a much different situation - only 10 sublegal Splake were caught, and survival of recent plants had been low along with slower growth. Northern Pike were present in many year classes with some larger fish captured. Yellow Perch were plentiful. It was noted that anglers were likely cropping off the fast growing Splake that reached legal size by winter and pike predation was also taking its toll.

A stocking evaluation was done in 2001 using gill nets. No Splake were captured during that survey, as Splake survival had been poor. A fisheries management prescription was written in December 2001 discontinuing the Splake stocking in Heart Lake. Although Splake stocking had initially been successful, survival in recent years had declined so the decision was made to return to stocking Rainbow Trout.

A general survey of Heart Lake was done in May 2002 as part of the Status and Trends survey program, which standardizes gear and effort based on lake size. Several gear types were used, including fyke nets, gill nets, and trap nets, to survey a variety of fish species and sizes in different habitats. Although general in nature, the survey was also used to evaluate previous Splake and Rainbow Trout stockings. Four Splake were captured during the survey, along with 11 other species of fish. Limnological measurements were taken during this survey, and showed that the lake was thermally stratified with dissolved oxygen dropping below 6.5 ppm below 39 feet, and below 3 ppm at 57 feet.

Heart Lake was included in a Rainbow Trout strain evaluation study in the 2000s, so much of the survey effort for the rest of that decade revolved around that study. Surveys of Heart Lake for the study were done at least annually from 2004-2008. The study evaluated the relative performance of Eagle Lake strain Rainbow Trout (RBT-EL) and Michigan strain Rainbow Trout (RBT-MI, Steelhead) in a number of inland lakes in Michigan. Equal numbers of each strain were stocked in the lake each year with different fin clips used for strain differentiation. Performance of each strain was evaluated through voluntary angler reports as well as fishery-independent surveys using graded-mesh gill nets and/or boat electrofishing. The study concluded that Steelhead (RBT-MI) were captured more frequently during surveys than RBT-EL and were caught more frequently by anglers, showing that the Steelhead strain had better survival and return to creel than did RBT-EL (Caroffino and Nuhfer 2014).

A trout stocking evaluation was done in 2008 as the final survey of this waterbody for the Rainbow Trout strain evaluation. Very few trout were captured during that survey, so Common White Sucker removals were done in 2011 and 2012. A total of 203 adult suckers (668 pounds) were removed in 2011, and 47

suckers were removed in 2012. Although the sucker removals were not specifically evaluated in Heart Lake, subsequent evaluations in other Michigan waters and elsewhere have concluded that they are often not effective (e.g., Zorn et al. 2020).

Current Status

Northern Lake Huron Management Unit personnel surveyed Heart Lake on October 7-8, 2020, with gill nets to evaluate the survival of Rainbow Trout in the lake. Effort consisted of two experimental gill-net lifts and 5 straight-run gill-net lifts. Whereas experimental gill nets are comprised of different mesh sizes, straight-run gill-nets are all one mesh size to target a particular species or size of fish. Two of the straight-run gill nets had 2.5-in mesh and two had 3.0-in mesh. The fifth straight run gill net was 2.5-in mesh and was set as a floating net to fish the upper eight feet of the water column.

A total of 44 fish were captured during the survey representing six species (Table 2). Four of the fish captured were Rainbow Trout and were 13.5 - 23.6 inches in total length. The Rainbow Trout are surviving winter, with age-2, -3, -4, and -5 fish all captured during the survey. Although not enough trout were captured to generate a growth index, the fish were generally at the statewide average lengths-at-age for this species. The age-3 and age-5 trout were above average length (Table 3).

Analysis and Discussion

This survey was a stocking evaluation targeted for Rainbow Trout. The other species encountered during the are typical representatives of the fish community of Heart Lake. The presence of four year classes of trout indicates some survival and winter carryover of the stocked trout. Trout growth appears to be acceptable, with each fish being approximately at the statewide length-at-age. The age-3 fish, however, was growing very well at over two inches larger than the statewide average length at that age and the age-5 trout was one inch larger than average. Sample sizes were low, however, and we were not able to calculate a mean growth index.

Heart Lake has been managed as a trout lake for over 70 years and continues to be managed appropriately as such. In recent years, the fishing has been somewhat variable according to angler reports, from "okay" to "amazing!"

Management Direction

1. Continue to stock 4,000 yearling rainbow trout annually in Heart Lake. The fish are surviving and appear to be providing a targeted fishery based on angler reports.
2. An assessment of the fishing effort generating by trout stocking in Heart Lake should be made through a creel survey or other methods.

References

Caroffino, D.C., and A.J. Nuhfer. 2014. Evaluation of two strains of rainbow trout stocked into inland lakes in Michigan. Michigan Department of Natural Resources, Fisheries Report 01, Lansing

Zorn, T. G., M. S. Mylchreest, and A. W. Abrahamson. 2020. Effects of White Sucker removal and stocking on growth of fishes in northern lakes. North American Journal of Fisheries Management 40:718-725.

Table 1. Stocking history for Heart Lake (Otsego County), 1979-2020.

Year	Species	Strain	Number of fish stocked	Avg. length (in)	Life Stage
1979	Rainbow Trout	Michigan	2000	6.16	Yearling
1980	Rainbow Trout	Michigan	2000	3.96	Yearling
1981	Rainbow Trout	Harrietta	2000	6.36	Yearling
1982	Rainbow Trout	Harrietta	2000	7.64	Yearling
1983	Rainbow Trout	Harrietta	2360	6.64	Yearling
1984	Rainbow Trout	Unknown	1900	6.2	Yearling
1985	Rainbow Trout	Shasta	2500	6.76	Yearling
1986	Rainbow Trout	Shasta	2190	7.36	Yearling
1987	Splake		16800	7.32	Fall fingerling
1990	Splake		3000	6.76	Yearling
1991	Splake		2580	6.12	Yearling
1992	Splake		3000	6.68	Yearling
1993	Splake		2500	7.32	Yearling
1994	Splake		3595	6.28	Yearling
1995	Splake		3190	6.6	Yearling
1996	Splake		3600	7.28	Yearling
1997	Splake		3040	6.96	Yearling
1998	Splake		3210	6.12	Yearling
1999	Splake		3330	6.84	Yearling
2000	Splake		2880	6.92	Yearling
2001	Splake		3070	7.16	Yearling
2002	Rainbow Trout	Eagle Lake	3160	6.52	Yearling
2003	Rainbow Trout	Eagle Lake	3450	6.2	Yearling
2004	Rainbow Trout	Eagle Lake	2000	7	Yearling
2004	Rainbow Trout	Michigan	2000	7.68	Yearling
2005	Rainbow Trout	Eagle Lake	2000	6.72	Yearling
2005	Rainbow Trout	Michigan	2000	8.08	Yearling
2006	Rainbow Trout	Eagle Lake	2000	7.56	Yearling
2006	Rainbow Trout	Michigan	2000	7.96	Yearling
2007	Rainbow Trout	Eagle Lake	2000	7.04	Yearling
2007	Rainbow Trout	Michigan	2000	8	Yearling
2008	Rainbow Trout	Eagle Lake	2000	6.68	Yearling
2008	Rainbow Trout	Michigan	2000	7.92	Yearling
2009	Rainbow Trout	Eagle Lake	2000	7	Yearling
2009	Rainbow Trout	Michigan	2000	7.36	Yearling
2010	Rainbow Trout	Eagle Lake	4100	6.48	Yearling
2011	Rainbow Trout	Eagle Lake	4100	6.4	Yearling
2012	Rainbow Trout	Eagle Lake	4000	6.48	Yearling

Year	Species	Strain	Number of fish stocked	Avg. length (in)	Life Stage
2013	Rainbow Trout	Eagle Lake	4100	6.92	Yearling
2014	Rainbow Trout	Eagle Lake	4100	7.16	Yearling
2015	Rainbow Trout	Eagle Lake	4100	6	Yearling
2016	Rainbow Trout	Eagle Lake	4000	6.68	Yearling
2017	Rainbow Trout	Eagle Lake	4400	7.28	Yearling
2018	Rainbow Trout	Eagle Lake	4300	7.2	Yearling
2019	Rainbow Trout	Eagle Lake	4400	7.56	Yearling
2020	Rainbow Trout	Eagle Lake	3900	7.56	Yearling
2021	Rainbow Trout	Eagle Lake	4000	8.32	Yearling

Table 2. Number, weight, and length by species captured during the October 2020 survey of Heart Lake (Otsego County).

Species	Number	Percent by Number	Length Range (in)
Bluegill	1	2.3	6-6
Largemouth bass	1	2.3	18-18
Northern pike	7	15.9	28-35
Rainbow trout	4	9.1	13-23
Rock bass	26	59.1	4-7
Smallmouth bass	5	11.4	6-14

Table 3. Lengths and ages of rainbow trout captured during the October 2020 survey of Heart Lake.

Length (in) of Rainbow Trout	Age	State avg length (in)
13.5	II	13.5
18.7	III	16.5
19.1	IV	19.5
23.6	V	22.6

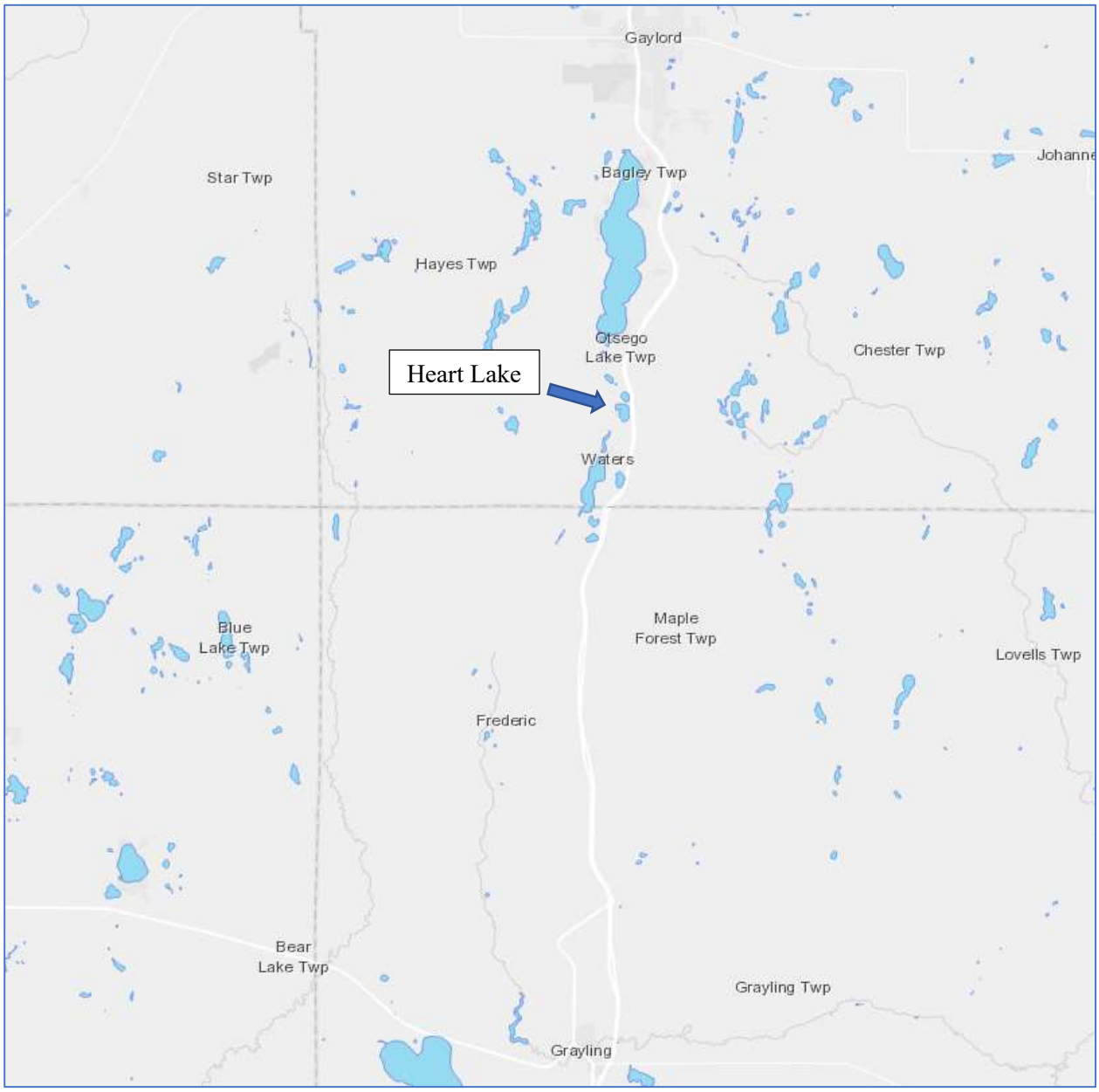

Figure 1. Locator map for Heart Lake (Otsego County).

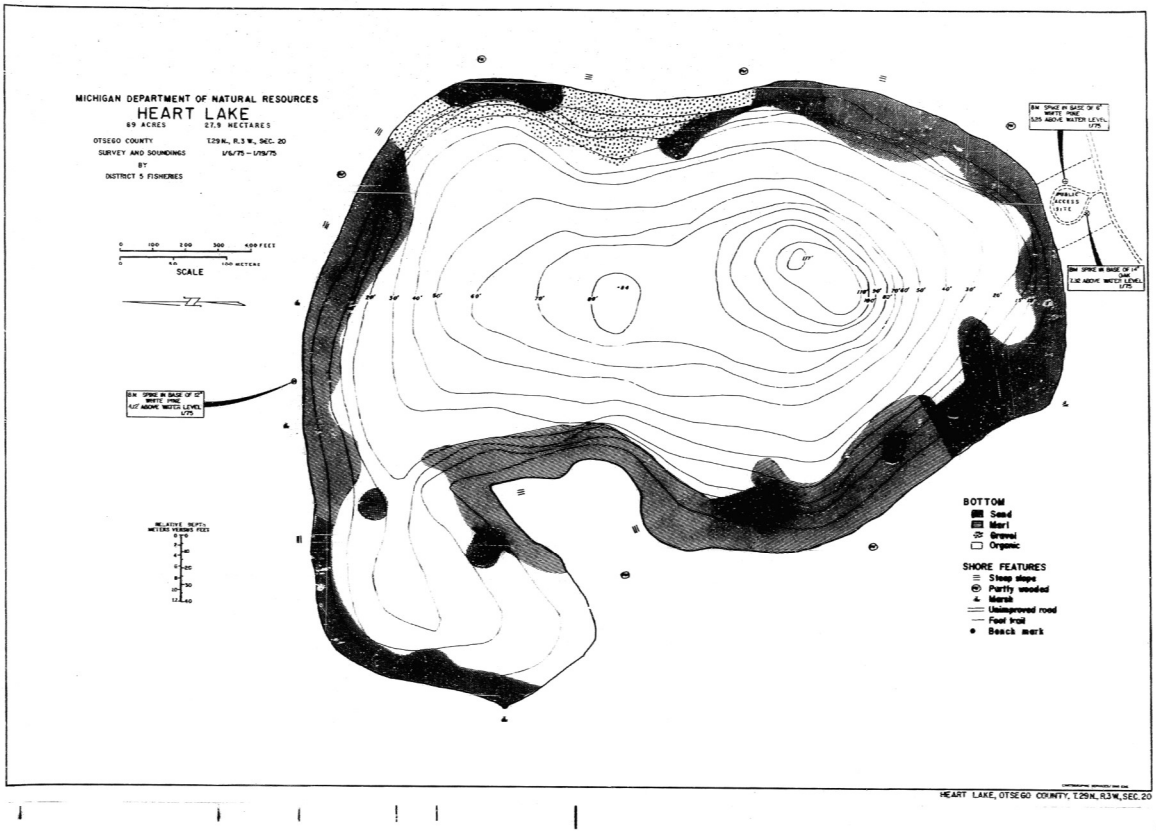

Figure 2. Depth map for Heart Lake (Otsego County). Depth contours are in 10-foot intervals.

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Dave Borgeson, Unit Review and Approval

Troy Zorn, External Reviewer

Tim Cwalinski, SFR Facilitator

Randall M. Claramunt, Desktop Publisher and Approval