Walled Lake
Montmorency County, T32N, R01E, Section 31
Black River watershed, surveyed in 2016

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Environment

Walled Lake is a 42 acre natural lake in northwest Montmorency County (Figure 1). There is no inlet or outlet, but it lies within the Black River sub-watershed, and Cheboygan River drainage. The bowl shaped lake is generally deep, with its deepest location over 60 feet (Figure 2). Aquatic vegetation is sparse, and bottom substrate is primarily sand with some silty areas. Walled Lake is currently under private ownership, with a landowner who is considering selling to the State of Michigan. Most of the land surrounding this private parcel is under State of Michigan ownership, and part of the Pigeon River Country State Forest. Thus, parcel acquisition aligns well with land ownership policy which states that private land surrounded by state forest land is of higher priority for acquiring. No formal records of fish stocking exist for Walled Lake. No current fishing regulations apply for Walled Lake since it has no inlet or outlet, and is surrounded by private land.

History

No fish community surveys have ever occurred at Walled Lake prior to this one. A former caretaker for the adjacent and once private Blue Lakes Ranch provides some insight into the fish community of Walled Lake. During the late 1960s, Dave Smethurst (Dave Smethurst, personal communication) found little to no fish living in Walled Lake. It was after this time that he transferred Bluegill and Largemouth Bass from nearby Silver Lake into Walled Lake. By the early 1980s he noticed a fishable population of both of these species.

The purpose of this survey was to gather baseline data on the lakes current fish community and structure while still under private ownership. Managers then could analyze this data to evaluate the following: 1) if Walled Lake has a fish population worthwhile to state recreational anglers, and 2) to evaluate if Walled Lake would be an appropriate lake classified by the DNR manual for "Guidelines for Selection of Quality Non-Trout Fishing Lakes", as stated by Sendek et al. 2016.

Current Status

The amount of fishing pressure and harvest at Walled Lake, while under private ownership, is unknown. It is estimated to be light when compared to lakes which are open to harvest by the public. The spawning and growing environment appears to be adequate, and the deeper water of Walled Lake likely offers cool water refuge to fish such as bluegill.

A recent fish management survey was completed on Walled Lake by the Michigan Department of Natural Resources (MDNR) Fisheries Division in late May and early June 2016. This survey was done to evaluate the fish community and determine the possibility of designating Walled Lake as a new "Quality Non-Trout Fishing Lake" if it were transferred to state ownership. Sampling effort consisted of four large-mesh trap-net lifts, four large-mesh fyke-net lifts, and two mini-fyke net lifts. Other standard fish survey methods such as gill-nets or shoreline boomshocking were not used due to the

inability to launch the boat, and inappropriateness of using gill-nets on a private lake. Surface water temperature throughout the three day survey ranged from 69-71 degrees Fahrenheit. Black spot, a fish parasite common to many northern Michigan lakes, was present on some fish within Walled Lake.

A total of 474 fish were captured from eight different species during the survey (Table 1). Species diversity was low compared to large northern Michigan lakes, but considered normal for an isolated small inland natural lake. Bluegill, Largemouth Bass, Pumpkinseed, and Yellow Perch were the game fish, although most species were generally uncommon except for Bluegill. Bluegill and Largemouth Bass were the fish species captured in our sample that represent the greatest opportunity for developing a quality sport fishing experience for anglers. The size and age structure of Bluegill and Largemouth Bass were evaluated to assess interactions among additions (recruitment), growth, and losses (natural mortality and fishing mortality) in the population.

Bluegills are common in Walled Lake representing 64% of our total sample in the survey. A range of ages and sizes were collected. The sample was dominated by 7 and 8 inch Bluegill, but fish up to 11 inches were also collected (Table 2). We were able to establish Bluegill ages 1 through 10 in our sample (Table 3). Fish age 4 were most abundant, but a good distribution of older fish was also found, suggesting that Bluegill can live fairly long in Walled Lake.

One tool used by managers to evaluate fish growth in a lake is the Growth Index (GI) (Schneider 2000). This index calculates the average deviation (inches) from the seasonal state average lengths at age established through extensive sampling by Fisheries Division across many lakes and years in Michigan. Positive GI values indicate fish are growing relatively faster than the established state averages and negative values indicate fish are growing relatively slower. Bluegills in Walled Lake have a GI value of 1.1, meaning that they are growing over an inch faster than similar aged Bluegill across the state. Slow growth commonly indicates that few large fish will be produced, food supply is limited, and recruitment is not properly balanced by sources of mortality (Schneider et al. 2000). Growth of Walled Lake Bluegill is good, especially for older fish. Bluegill have the benefit of living longer and larger in Walled Lake due to limited exploitation and good growth.

Another evaluation tool for Michigan Bluegill populations was devised by Schneider (1990). He developed an empirical scoring system based on length-frequency statistics of Bluegill sampled with several types of gear. Schneider's indices were average length, and proportions of the catch larger than 6", 7", and 8". Resulting scores of 3 to 4 indicate average population size structure, scores of 1 to 2 indicate populations lacking large fish (and usually slow-growing, but possibly short-lived), and scores of 5 to 7 indicate unusually high proportions of relatively large Bluegill (which are fast growing or long-lived). Applying the tool to our Bluegill sample for Walled Lake resulted in a score of 6.75, thus categorizing the lakes current Bluegill population between excellent and superior. The results from this scoring system indicate that Bluegill harvest is held in check at Walled Lake and that growth of this species is good.

Sendek (2006) specifically proposed another tool to assess the current status of a lake relative to the goals of "quality" fishing, and to assess the potential of a lake to currently or potentially produce quality fish in the future. Proportional Stock Density (PSD) can provide information on the current status of a lake, based on the size distribution of fish in a survey (Anderson 1976). PSD (%) is determined from lengths of fish captured in a sample of the fish population. It is equal to the number of

fish in the sample greater than or equal to an established minimum stock size and multiplied by 100. Similar to PSD, Relative Stock Density (RSD) can be calculated to characterize the size distribution of the population relative to even larger size categories including preferred, memorable, and trophy categories (Wege and Anderson 1978). For Bluegill, the established minimum stock size is 3-inches, the quality stock size is 6-inches, preferred stock size is 8-inches, memorable stock size is 10-inches, and trophy stock size is 11-inches.

Sendek proposed that for Michigan, the designation of a "Quality Non-Trout Fishing Lake" requires regulations aimed at producing fish populations that maintain a targeted proportion of preferred and larger fish; however, he also suggested that future validation of the RSD criteria is needed as additional "Quality Non-Trout Fishing Lakes" are established. The current guidelines for establishing a "Quality Non-Trout Fishing Lake" for Bluegill targets a population sample with 60% preferred fish (8-inch and larger in sample), 5% memorable fish (10-inch and larger), and 1% in the trophy category (11 inch and larger). The RSD-8 of Bluegill based on the sample of fish collected in Walled Lake was a very respectable 49% (Table 4), while the RSD-10 was 3%. Both of these are near the quality lake goal categories (Table 4). With the previous results, Walled Lake already provides a high quality Bluegill fishery, and management actions designed to maintain such quality would need to address harvest. Winterkill is not an issue at this deep kettle lake, so mortality of Bluegill from recreational harvest would need to be managed to maintain the current high quality fish population.

Largemouth Bass, the natural predator of Bluegill, are also found in Walled Lake but were not captured in high numbers during the netting effort (Table 1). Only one legal sized (15 inches or larger) specimen was collected, while most were 13 to 14 inches long (Table 2). Large bass often control Bluegill numbers, but having fewer big Largemouth Bass in Walled Lake also reduces mortality on Bluegill numbers, allowing more to reach preferred sizes. Growth of bass was very poor, especially for bass age-6 and older (Table 3). Despite the low sample size, eight year classes of Largemouth Bass were collected. This bass size structure is similar to the bass population in nearby kettle lakes such as Town Corner Lake (Cwalinski 2011) and South Blue Lake.

Other species collected in Walled Lake include Green Sunfish, Pumpkinseed, Yellow Perch, Creek Chub, Central Mudminnow, and Blacknose Shiner. All were collected in relatively low numbers (Table 1). Perch and Pumpkinseed offer additional fishing opportunity and can reach respectable sizes (Table 2). Having a low species diversity is normal for a small, isolated kettle lake in northern Michigan. The lower species diversity (e.g. no white suckers) also reduces competition for food resources for favorable game fish such as Bluegill.

Analysis and Discussion

Walled Lake exhibits a high quality panfish population, both in terms of panfish growth and longevity. This is likely a result of its current private nature under one family's ownership. Most small kettle lakes nearby with deep water habitat can grow large Bluegill, yet their numbers tend to get cropped off quickly by the angling public. Recruitment, growth, and mortality rate appear relatively good for Bluegill in Walled Lake. In addition, many small northern Michigan lakes with limited primary productivity have Bluegill populations that are targeted by anglers and which can exhibit "boom and bust" fisheries governed by high periodic harvest when populations of desirable sized fish are larger. These boom Bluegill fisheries are often followed by a resting period when exploitation drops off because harvest rate, size of fish, or both fall below angler expectations for the lake. This is likely

common at many northern Michigan lakes, especially in the region around Walled Lake. Since Bluegill harvest is likely low in Walled Lake, a boom and bust Bluegill population cycle is not occurring. Our sample size for Largemouth Bass was lower based on the recent (and only) fish community survey of Walled Lake, but the numbers and growth rates are similar to nearby kettle lakes that are currently under State of Michigan ownership. It is likely that this species is at its carrying capacity, and that suppressed growth rates reduce the number of large predator bass.

Management Direction

Walled Lake is currently under private ownership. The current owners have expressed a desire to sell the land (which includes Walled Lake) to the State of Michigan to be managed as an MDNR state forest parcel. Our (Fisheries Division) desire was to: 1) analyze the fish community of Walled Lake prior to any potential land transaction occurring, and 2) determine if the fish community is worthy of a "Quality Non-Trout Fishing Lake" as established by MDNR guidelines (Sendek et al. 2016) (Schneider 2000). Relatively few lakes in Michigan are established as quality lakes (which have restrictive fishing regulations), despite the large number of lakes that exist in Michigan. Regionally, there are three in northeastern Michigan. This includes Jones Lake (Crawford County), Wakely Lake (Crawford County), and South/North Blue lakes (Montmorency County). South Blue Lake is within the Pigeon River Country State Forest about two miles north of Walled Lake, has a high quality fish population, and is very popular among anglers. The same can be said about Wakely Lake. Anglers regionally and from across Michigan seek these special fishing opportunities where high catch rates are deemed more important than easy access or fish harvest and consumption. Walled Lake has these special qualities (relatively high stock density values) and should be considered for more restrictive fishing regulations if the land and lake becomes open to public recreation.

Quality fishing lake criteria (Sendek et al. 2016) proposes several criteria for determining the suitability of a lake for quality non-trout fishing lake designation. These include angler access; contaminant and fish consumption concerns; frequency of winter-kill events; fish population dynamics; level of public support for such designation; evaluation of the outcomes from designation; and any social-political concerns in play at the time of designation. Not all criteria need to be met at the same time however.

Angler Access

A lake designee (Quality Non-Trout Fishing Lake) must have public access. Currently, this is not the case; however, this could change in the future. We fisheries professionals feel it was important to assess the aquatic community prior to the lake coming under any state ownership (potentially). Watercraft restrictions are encouraged because a pristine, tranquil setting is often associated with a quality fishing experience. This is the case for the lakes currently managed under the quality designation, and for a few other lakes in the Pigeon River Country State Forest (Sinkhole Lakes, Cornwall Flooding). The management plan for the Pigeon River Country state forest also supports this concept and aims to provide "quiet recreational experiences" (Michigan Department of Natural Resources 2007).

The entire shoreline of Walled Lake is forested, and public ownership would ensure forest protection in its perpetuity. If made public land, it is likely that anglers would have some form of short walk to the lake to protect this riparian zone (similar to nearby South/North Blue lakes). Additionally, limiting

the use of motorized vessels should be considered for Walled Lake through appropriate land use orders.

Contaminant Concerns

In some cases, lake designees may have contaminant concerns and advisories against consuming fish by the Michigan Department of Community Health. There are no known contaminant concerns for fish in Walled Lake so no such disincentive exists. Consequently, compliance with any potential harvest restrictions on Walled Lake would remain largely a law enforcement issue.

Fish Winter-Kill

Lakes with frequent winter-kill events (more than once every ten years), are not considered good candidates for quality fishing and regulation designation. This is because both cool and warm water game fish species often have life spans that can exceed ten years, and lakes with frequent winter-kill events do not allow for the longevity and growth normally associated with producing quality fish of the desired age and size.

Based on our age and growth analysis for Bluegill and Largemouth Bass, winter-kill does not appear to occur at Walled Lake. We believe the current availability of old, large fish indicates an absence of winter-kill events. Another way of stating this is that a "quality" fishing lake would not be a quality lake if high mortality rates from winter-kill events (lack of dissolved oxygen in the winter water column) continually plagued a fish population. Walled Lake has deep water refugia and sparse vegetation. Shallow, vegetated lakes in northern Michigan are more generally plagued by fish winter-kill.

Population Dynamics

Only lakes with the potential to produce a quality fishery should be considered for designation. Growth, recruitment, and mortality are three biological factors that must be considered in determining if a specific lake is a good candidate. Key game fish species should have growth rates likely to produce individuals of large size. A reasonable balance between annual recruitment and mortality is also necessary to allow adequate numbers of fish to survive to older age groups.

Our preliminary analysis of growth, age distribution, and mortality, along with additional indices for Bluegill, suggests no inherent factors are present in Walled Lake limiting the abundance of large fish. Similar lakes in the region have good potential to produce large Bluegill (either through growth or longevity), yet the harvest component often limits their availability at very large sizes (10 inch and larger). A similar lake (South Blue Lake) that is adjacent to Walled Lake has Bluegill that reach nearly 12 inches due to limitations on harvest and more restrictive fishing regulations. We feel that restrictive regulations and prohibited harvest on Walled Lake Bluegill would allow for similar fishing opportunity if under state ownership. The Largemouth Bass population lacks quality in Walled Lake, but this is similar to other deep kettle lakes with a good Bluegill population and limited productivity. The true value from a quality fishery perspective for Walled Lake would be manifested from Bluegill population structure, not from Largemouth Bass.

Public Support

It is critical anglers understand that successful implementation of Quality Non-Trout Fishing Lake designation requires compliance with restrictive regulations. Without public support or significant law enforcement, compliance is likely to be inadequate and the new regulations will be ineffective in developing or maintaining a quality fishery. Compliance has been acceptable at nearby South and North Blue lakes based on the actual fish community structure (Bluegill) and from law enforcement reports. We believe this would also be true for restrictive fishing regulations at Walled Lake. Quality lake designation could restrict all fish harvest, the types of tackle allowed, and length of the open fishing season at Walled Lake. Tweaking of restrictions could also be considered (i.e. limited harvest, harvest of perch, etc). Consideration should be given to public opinion regarding this proposal.

Evaluation

Evaluation of lakes designated as quality should be conducted within ten years. It would be reasonable to believe that under restrictive regulations the fishery would not change from its current structure based on the 2016 survey results. If negative changes had occurred, it would likely be a result of non-adherence to the regulations by the angling public. A follow-up evaluation of the fish community at Walled Lake would still be a good idea to determine use (angling pressure and harvest) and fish response.

Social and Political Concerns

Some anglers value the ability to catch memorable or even trophy sized fish, while de-emphasizing harvest. There does seem to be a growing trend towards this opinion in Michigan. This trend seems to be less species specific but spans a wide range of game fish species of interest, and requests for more quality angling opportunities continue to increase. Fisheries Division continues to look for these rare opportunities to accommodate such angling interests while still providing harvest opportunities for the angling public. Currently, less than 1% of Michigan lakes have "Quality Non-Trout Lake" fishing designation and regulations.

Establishment of quality fishing lake regulations for Walled Lake is consistent with recommendations of the Pigeon River Country Concept of Management (Michigan Department of Natural Resources 2007). This plan represents more than 30 years of agency and public collaboration in setting management direction of the Pigeon River Country. Over that time we have worked closely with the Pigeon River Country Advisory Council and the public to be responsive to the needs and wishes of the people recreating in the Pigeon River Country. The plan provides that lakes containing species of fish other than trout be managed to protect and sustain those species of fish, and the habitats upon which they depend, in a manner that provides recreational angling opportunities appropriate for each individual lake. The plan specifically says that fishery management actions may include the establishment of restrictive fishing regulations using the guidance documented by Sendek et al. (2016). In addition, the purchase of new property for fishing opportunity and establishment of special fishing regulations on a non-trout lake satisfy two specific strategies within Michigan Department of Natural Resources' Fisheries Division Strategic Plan (Michigan Department of Natural Resources 2013), including: 1) identify and catalog areas where fishing access is needed, prioritize locations, and work

with partners to address these needs, and 2) implement fishing regulations expressly designed to create special and unique fishing opportunities.

As such we believe our recommendations sufficiently accommodate the current social and political concerns existing for Walled Lake, should it fall under ownership in the future by the State of Michigan.

References

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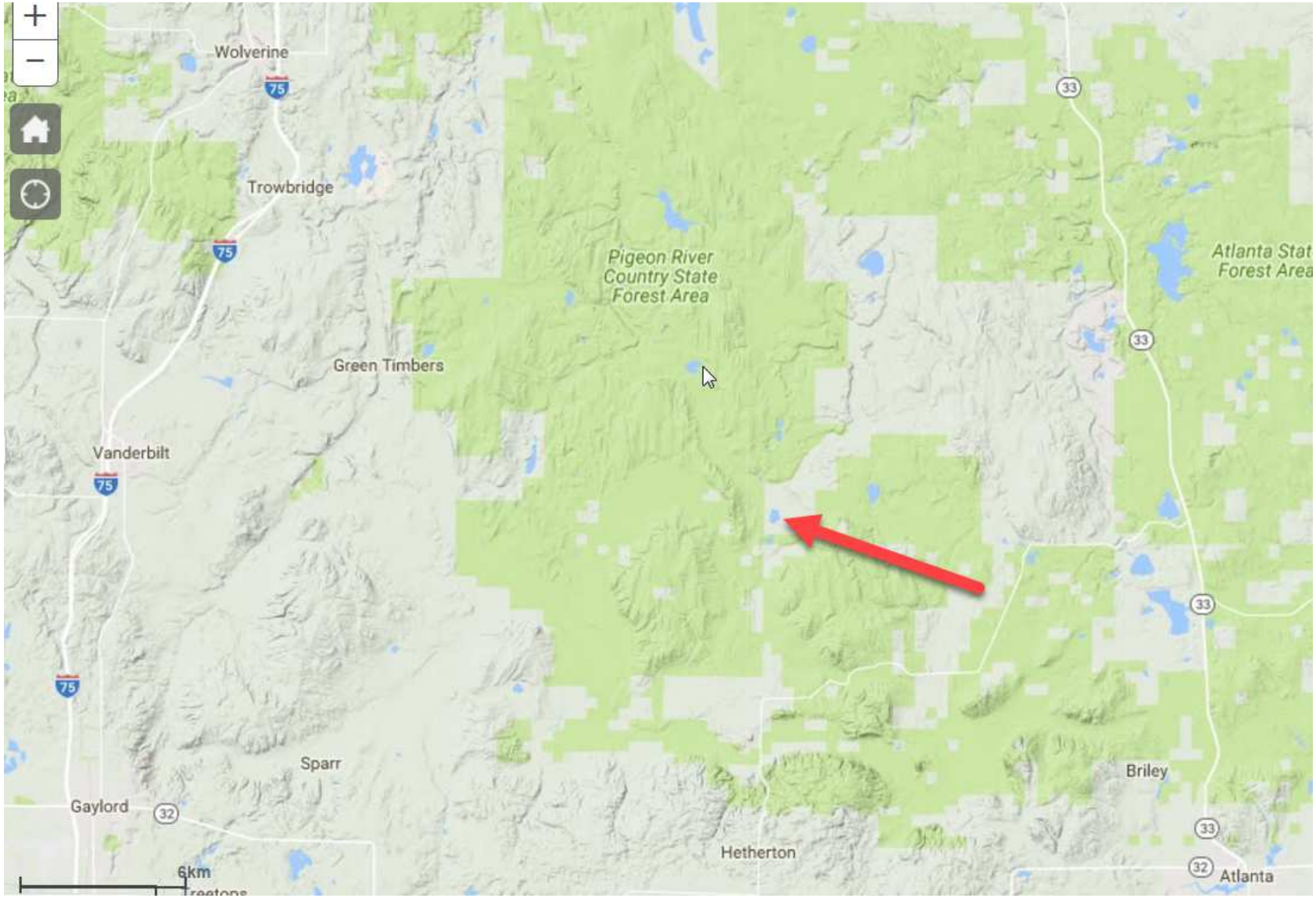

Figure 1. Location of Walled Lake in Montmorency County with the neighboring Pigeon River Country State Forest. Arrow indicates lake location.

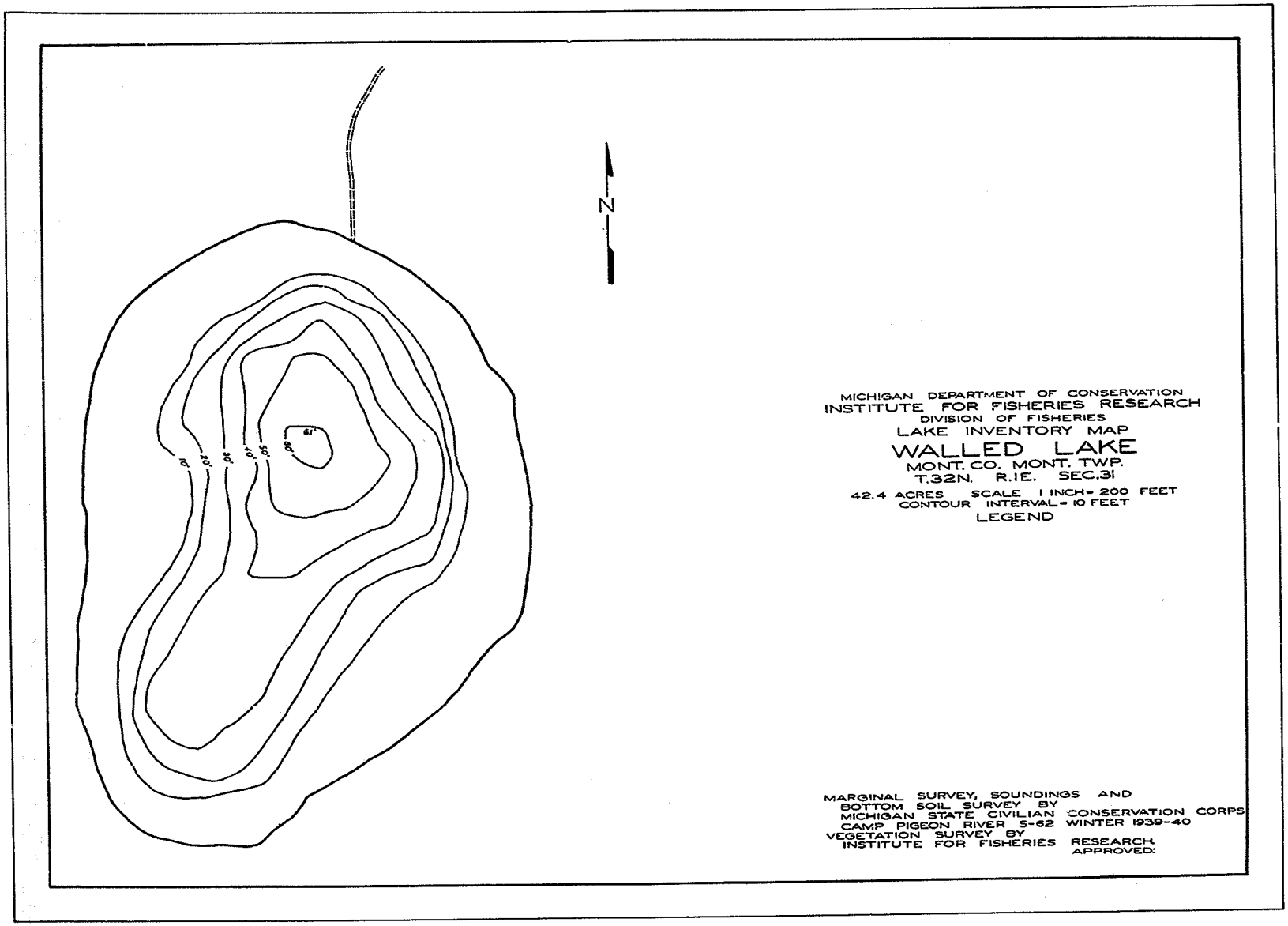

Figure 2. Bathymetric map of Walled Lake.

Table 1. Species collected during the 2016 Walled Lake survey.

Species	Number Collected	Percent of Total Catch
Bluegill	304	64%
Blacknose Shiner	129	27%
Largemouth Bass	15	3%
Pumpkinseed	9	2%
Yellow Perch	9	2%
Green Sunfish	5	1%
Creek Chub	2	<1%
Central Mudminnow	1	<1%

Table 2. Length frequency of game fish collected during the 2016 Walled Lake survey.

Length (in)	Largemouth Bass	Bluegill	Pumpkinseed	Yellow Perch
1				
2				1
3		6		
4		2		
5		7		
6		39	2	
7		101	6	
8		95	1	
9	1	44		2
10	2	10		3
11	2			
12				3
13	3			
14	6			
15	1			

Table 3. Age and growth of bluegill and largemouth bass in Walled Lake 2016.

Species/Age	No. Aged	Length Range (in)	State Average Length (in)	Mean growth index*
Bluegill				+1.1
Age I	1	3.6	1.8	
Age II	6	3.6 – 4.0	3.8	
Age III	7	4.6 – 5.7	5.0	
Age IV	21	5.5 – 8.1	5.9	
Age V	5	6.4 – 8.2	6.7	
Age VI	6	8.0 – 9.0	7.3	
Age VII	8	8.6 – 9.7	7.8	
Age VIII	7	8.5 – 10.6	8.2	
Age IX	5	10.1 – 10.7	8.6	
Age X	1	10.9	8.9	
Largemouth Bass				
Age II	1	9.7	7.1	-3.3
Age III	2	10.3 – 10.7	9.4	
Age IV	2	11.6 – 11.9	11.6	
Age V	1	13.5	13.2	
Age VI	1	13.7	14.7	
Age VII	2	13.7 – 14.0	16.3	
Age VIII	5	14.0 – 14.3	17.4	
Age IX	1	15.0	18.3	
Pumpkinseed				
Age VI	4	6.7 – 7.3	6.6	
Age VII	4	7.1 – 8.0	7.1	
Age VIII	1	7.2	7.5	
Yellow Perch				
Age V	4	9.5 – 10.2	8.5	
Age VI	3	10.2 – 12.0	9.4	
Age VII	2	12.0 – 12.6	10.3	

* compared to the statewide average for the species across all ages

Table 4. The percentage of fish in netting or electrofishing samples that should be met or exceeded to achieve relative stock density values for quality lake fishing criteria. The 2016 results for Walled Lake bluegill is also listed using small- and large-mesh fyke nets, and large mesh trap nets.

Species/Location	Preferred (% 8 in and larger)	Memorable (% 10 in and larger)	Trophy (% 11 in and larger)
Bluegill-quality lake goal	60%	5%	1%
Bluegill-Walled Lk 2016	49%	3%	0%