



Results of Angler Age Structure Collection for Northern Pike and Winter Creel on Gull Lake, Barry and Kalamazoo Counties.

T1S/R9W/Sec 1,2,12; T1S/R10W1/Sec 6,7,8,17,18,20; T1N/R10W/Sec 36; and T1N/R9W 10W/Sec 31.

Surveyed May 2018 through May 2019

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Introduction

Gull Lake has a surface area of 2,030 acres and a maximum depth of 110 feet. This lake is one of the largest in the region, supports a diverse fishery including both warm and coldwater species, and serves as an important recreational site. The most important stream inflow to Gull Lake is Prairieville Creek, which enters on its northern end. Rainbow Smelt, Brown Trout, and White Suckers utilize this creek for spawning. Gull Lake is also connected to Little Long Lake on the west side by a small stream. The Gull Lake outflow, which flows year-round, is regulated by a sluiceway dam. Gull Lake has been managed as a two story coldwater fishery since 1965 when Rainbow Trout were introduced. Lake Trout, Rainbow Trout, and Atlantic Salmon (limited stocking in 1974 through 1978) were stocked periodically from the 1970s through early 1990s (see Dexter 1991). These stockings resulted in a popular coldwater fishery, with many Rainbow Trout larger than 10 pounds reported. The fishery declined in the 1990s due to a combination of improvements in water quality, zebra mussel colonization, and high rainbow trout stocking rates (average = 11/acre during 1979-1996) resulting in limited zooplankton prey. Atlantic Salmon stocking was discontinued after 1992. Low-density stocking (2/acre) of Rainbow Trout did not produce an acceptable fishery during the late 1990s and early 2000s, and stocking was discontinued after 2006. Brown Trout were stocked from 1996 through 2006. Creel data and angler reports indicated limited harvest of this species. From 2007 through 2017, yearling Lake Trout were stocked in Gull Lake at a rate of 3 per acre and adult broodstock Lake Trout were stocked when available (2006, 2009, 2016). Based on angler reports, stocking of adult Lake Trout yielded good returns to the creel, but survival of yearling Lake Trout was poor and was discontinued in 2018. The Wolf Lake State Fish Hatchery began experimentally producing yearling Steelhead in 2016 that were expected to survive better in inland lakes than other strains stocked in Gull Lake in the past (Diana 2013; Caroffino and Nuhfer 2014). Steelhead were believed to rely less on fish prey, and biologists hypothesized that a low-level stocking could produce a fishery that would not impact Rainbow Smelt populations. The reduced stocking rate was established from other lakes where these species coexist (e.g. Higgins Lake). Yearling Steelhead were stocked in Gull Lake in 2017 and 2018 (11,000 and 10,041 fish respectively) to determine the feasibility to reestablish the fishery.



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Rainbow Smelt were stocked in Gull Lake beginning in 1950 to create a fishery. Stocking was conducted in 1950 through 1953 resulting in a self-sustaining Rainbow Smelt population and a popular fishery. Water quality declined in the 1970s resulting in reduced oxygen available in the deeper cold water in Gull Lake. This led to a decline in the smelt fishery and the last smelt run for this population was observed in Prairieville Creek in 1983. Managers began stocking smelt to recover smelt populations in 1991. There was a combination of adult fish and egg transfers from 1991 through 2001 resulting eventually in a rebounded fishery. Smelt runs were monitored in Prairieville Creek from 2005 through 2010 and large runs of fish were observed each year. A fish kill occurred on June 10, 2016 that was comprised mostly of smelt. Thousands of dead fish were observed along the eastern shore of the lake following a large storm with sustained high winds. No outward signs of disease or stress were evident and the best estimate of the cause of the kill was thermal stress due to the time of year and the wind conditions during the storm. There are concerns that the smelt population has declined, and that predation may be impacting the ability of the population to rebound. Anglers have complained that smelt are not being caught under the ice and Northern Pike growth rates have declined. As a result, SLMMU discontinued stocking yearling Lake Trout and paused adult Lake Trout stocking in 2018 to allow for some temporary reduction of predators in Gull Lake. Steelhead stocking was initiated, but at the low density of 4.9 per acre. During 2018-2019, many Lake Trout and Northern Pike diets included unusually high quantities of plastic lures, and anglers speculated that this pattern was related to a lack of prey.

Northern Pike provide an important fishery in Gull Lake. Many anglers target Northern Pike through the ice in winter and by casting or trolling in open water. Angler reports have indicated that most fish captured are 22 through 25 inches and the number of legal-sized fish has declined in recent years. Past survey efforts in Gull Lake targeting Northern Pike have had limited success. Gull Lake has exceptionally clear water with spring Secchi depth often exceeding 25 feet making trap nets surveys difficult (White and Hamilton 2014). Anglers have asked for modified regulations (e.g., slot limits) to provide better fishing opportunities on Gull Lake. However, without length and age data it is difficult to determine if the reported lack of larger fish is due to excess exploitation/mortality or poor growth.

SLMMU initiated spring monitoring of the Rainbow Smelt spawning run in Prairieville Creek in 2017 – 2019 to determine the magnitude of the smelt run and estimate if reproduction was occurring. A voluntary creel survey was conducted in the winter of 2018-2019 and Northern Pike anglers collected spines from fish caught in the summer of 2018. In addition, a voluntary winter creel was conducted from 2018-2019 to evaluate catch and harvest during the winter fishery. We used angler reports and the creel data from 2018-2019 to evaluate the success of Steelhead stocking in Gull Lake. The objective of this report is to summarize these efforts and outline future fisheries management objectives for Gull Lake.

Methods



Smelt spawning runs were monitored in Prairieville Creek in spring of 2018 and 2019. Spotlight surveys were conducted in the evening after dark or in the morning prior to first light. The presence of Rainbow Smelt, other fish species, and amphibians were recorded on each date. Surface water temperature was recorded in Prairieville Creek approximately 200 feet upstream from the mouth and in Gull Lake at the end of the dock at the launch site. Observations were used to determine the size of the Rainbow Smelt run and estimate potential reproduction and recruitment.

Northern Pike age structures were collected by anglers from February through October 2018. Anglers were recruited through coordination with the Gull Lake Quality Organization (GLQO), online angling forums, and biologist angler contacts. Anglers were instructed to collect the first three dorsal spines as close to the base as possible and report total length and date of capture. Scale envelopes and instructions were provided. In addition, the parking lot attendant at the boat ramp collected spines from anglers at the ramp who were willing to participate.

Spines were sectioned and mounted, and annuli were counted to assign age using methods outlined by Schneider et al. (2000) and utilized in the Status and Trend Protocol (Wehrly DRAFT). Length-at-age was used to compare the size of Gull Lake fish to the statewide average for Northern Pike of each age class reported in Schneider et al. (2000). Because fish were collected by anglers at different times of year, fish could not collectively be compared to the statewide average as growth likely occurred between capture dates. An index was utilized to evaluate growth and account for time elapsing between captures. Once an age was assigned to a fish, the statewide average length for that age class and capture month is subtracted from the total length of the individual fish to represent the deviation from the statewide mean for that fish (e.g., an age-3 Northern Pike of 22 inches captured in May: 22 inches - statewide average of 20.8 inches = +1.2 indicating it was 1.2 inches larger than the state average). Index scores were averaged for each age class to evaluate how fish of each age class compare to the statewide average lengths. Index score was used to normalize size-at-age for each fish to the values for July by adding the index value to the July statewide average to better represent estimated length-at-age. The difference between the state average mean length for each age class and mean length-at-age from surveys was used to calculate size differences for each age class. Age classes represented by a minimum of five fish were averaged to provide an index of fish growth (Schneider et al. 2000). Growth index scores between +1 and -1 are considered similar to the state average while scores less than -1 and greater than +1 are considered below or above the state average, respectively.

A voluntary angler creel survey was conducted on Gull Lake during the winter of 2018 through 2019. Volunteer anglers were recruited through the GLQO, online forums, and biologist communication with anglers. Anglers were asked to complete a creel form on each trip (Appendix A). Anglers were asked to report the date, number of anglers, number of hours, and species targeted for each trip. In addition anglers were asked to report the number of fish caught and released and the number of fish kept for Largemouth Bass, Smallmouth Bass, Northern Pike, Bluegill or Sunfish, Yellow Perch, Black Crappie, Rock Bass, Rainbow Trout, Lake Trout, Smelt, and other species. Anglers were asked to report lengths of any Northern Pike, Rainbow



Trout, or Lake Trout caught. Creel forms were distributed in the GLQO newsletter, electronically, or were available at two popular local establishments (Beer and Skittles near the south bay and NEDS on Gull Lake near the boat ramp). Angler reports were accepted by mail, email, or drop off at the Michigan Department of Natural Resources (DNR) office in Plainwell.

Results

A total of 69 Northern Pike spines were submitted to the DNR from Gull Lake in 2018. The average length of submitted fish was 24.1 inches and ranged from 12.3 to 31.5 inches. Fifty-seven percent of fish submitted were greater than 24 inches and legal to harvest. Northern Pike total growth index score was -0.8, which is at the low end of the average range. Individual age classes index scores were close to the state average for ages 3 and 4 but declined for ages over 5 (Figure 1). Adjusted Northern Pike average length-at-age was similar to the state average for ages 1 through 4, but much lower for ages over 5 (Figure 2). Almost half of the age-4 fish captured were over 24 inches in length (45%) with 3 fish over 28 inches that were likely females. Fish age-5 and up were a mix of legal and sub-legal sized fish.

A total of 33 angler trips were reported in the 2018-2019 winter volunteer creel survey. Eighteen (55%) were solo trips while the remaining were 2 angler and one trip with 3 anglers. Trips averaged 4 hours for a total of 197 angler hours reported. A total of 16 trips targeted Rainbow Smelt (48%) with the remaining mostly targeting Bluegill/Sunfish, Black Crappie, Rock Bass, or Yellow Perch (combined = 36%), or Northern Pike (6%). There was one trip each targeting Lake Trout and Rainbow Trout. Anglers reported a total of 1,414 fish caught of which 89 were released. Smelt were captured in the highest number (1,168 fish) and none were released. A total of 11 Northern Pike were reported ranging from 19 to 28 inches. Five of the 11 Northern Pike reported were larger than 24 inches and all legal fish were harvested. No Rainbow Trout or Lake Trout were caught. Smelt anglers average catch rate was 10.9 fish per hour compared to 3.8 fish per hour for other anglers. Smelt catch ranged from 3 fish to 145 in a trip with an average of 73 fish per trip.

Prairieville Creek was monitored for the presence of spawning Rainbow Smelt in the Spring of 2018 and 2019. There were 35 monitoring events on 33 separate dates from March 22 through May 9, 2018.

The peak of Rainbow Smelt runs observed in Prairieville Creek during previous monitoring efforts in 2005 occurred from April 8 through April 16. Temperatures were not recorded on these dates, but the stream temperature was 58 F on April 8 at 5:00 AM and had been above 50 F for a week. In 2018, water temperatures in Prairieville Creek did not exceed 50 F until April 26 due to a cold spring. Approximately 40 smelt were observed in Prairieville Creek exhibiting spawning behavior on May 5, 2018. This is a low number of fish compared to peak spawning observed during the smelt recovery efforts in 2005 through 2010, but was evidence that reproduction was occurring. Water temperature had already reached 52 F in Prairieville Creek



by March 26, 2019 but receded to below 50 F until April 16, 2019. Very few smelt were observed in Prairieville Creek from April 8 through 10, 2019.

Discussion

Northern Pike in Gull Lake were growing slower than the statewide average, but the mean growth index for all ages combined was within the average range. Growth rates of younger fish were similar to the state average but declined at age 5. Sex was not reported for most fish and many of the older fish of smaller lengths were likely males with a few larger females caught. Because the growth rates of fish age 1 – 4 were not low, there is no indication that prey is limiting growth for these age classes. Older fish may be experiencing slower growth, but these fish are most likely targeting large-bodied prey and supplementing with smelt opportunistically. Very few smelt were reported in diets of caught fish. White Suckers were observed in high numbers spawning in Prairieville Creek indicating there should be some large-bodied prey available for Northern Pike. The status of the White Sucker adult population is unknown. White Sucker spawning runs should be protected and any opportunities to expand connectivity from Gull Lake to tributaries should be considered to promote reproduction.

The most recent fish population survey that captured Northern Pike was conducted on Gull Lake in 2002. Seventy-eight fish were captured ranging from 14-36 inches. Growth index scores were +1.3 demonstrating above average growth for Northern Pike. Spring trap net surveys were conducted on Gull Lake in 2002 in an attempt to collect eggs for rearing. During the spring targeted trap net surveys CPE was 1.4 fish per net night. This catch rate is near the median for surveys conducted in March and April in SLMMU from 2000 through 2019. An angler creel was conducted in 2002 which observed negligible harvest for Northern Pike. Catch rates were low at 0.04 fish per hour of angler effort and an estimated 868 fish were caught, but almost all fish observed in the creel were released. Anglers have reported a perceived decline in numbers since 2002 and we have observed decreased average length-at-age based on spines collected in this study. Because of these observations, it is not likely that the density of fish has increased resulting in an overabundant Northern Pike population that would result in increased competition for prey. The 2002 survey took place early in smelt reintroduction efforts and the population density of smelt presumably was low, especially a few years earlier when most of the pike captured were maturing. Therefore, it is unlikely that the decrease in Northern Pike growth rates observed in this study can be attributed solely to changes in the Rainbow Smelt population. Rainbow Trout were stocked in 2017 and 2018 and theoretically could have affected pike growth through competition for prey. However, the lack of trout in the creel data and angler reports indicates that survival of stocked fish was poor and that there was minimal potential for competition between Rainbow Trout and pike. In fact, the stocked Rainbow Trout likely became a supplemental food source for Northern Pike.

Whereas it is possible that the observed decline in growth indices for age 5 and older Northern Pike is due to a shortage of suitable prey, there is a plausible alternative explanation.



Recreational harvest may be the primary factor responsible for the scarcity of large Northern Pike in Gull Lake. Average length-at-age can be an indicator of growth; however, it is influenced by size structure and minimum length limits. If relatively fast-growing individuals are selectively harvested, slow-growing fish eventually make up a larger portion of the catch in an age group resulting in reduced lengths at age. Growth of fish age 1 through 4 in Gull Lake was similar to the state average. These year classes had not recruited to the fishery (with the exception of a few larger age-4 individuals). Thus, the decline in growth indices corresponded to the age at which average or fast-growing individuals attained legal size for harvest. Rather than a reduced growth rate for older fish, it is possible that larger fish are being cropped off by harvest. Harvest also can alter the sex ratio within fish populations. Male Northern Pike exhibit slow growth at older age classes. Adult female Northern Pike tend to be larger than their male counterparts and are more vulnerable to angling mortality.

Gull Lake is a large lake where pike are exhibiting average to low growth rates despite moderate densities of fish. Management could focus on continuing to provide a harvest-based fishery. Because growth rates of younger fish are not low, fish should continue to recruit to the fishery by reaching 24 inches by age 4. This would result in a fishery similar to the existing one with most of the Northern Pike being near the 24-inch limit, with few larger females available for harvest. Alternatively, we could consider protecting larger fish using a slot limit which would allow for harvest of smaller fish, but protect larger spawning females and allow for continued growth. Slot limits are generally successful when growth rates are high enough that fish will continue to grow once they reach the lower limit of the protected slot. It is not clear if this will occur in Gull Lake. If growth rates are low, fish will enter the slot, but will not reach advanced size. A protective slot would reduce the number of large fish harvested and would likely result in an increase in average size. Anglers would need to be satisfied with harvesting smaller fish with the potential for catching some quality fish that would be released. This could increase the trophy potential in Gull Lake if growth rates were high enough to reach the upper slot limit.

In the Great Lakes and large inland lakes, Rainbow Smelt have been reported to begin spawning runs into streams when stream temperatures reach 50 degrees F and continue through 65 degrees F. However, temperatures and dates vary among systems (O'Brien et al 2012). Past observations in Prairieville Creek indicated that spawning occurred early in April with water temperatures in the mid 50s. A colder than average spring in 2018 kept water temperatures cool past the typical spawning time and fish were not observed until early May. The few fish observed in 2019 were in early April similar to past years. Rainbow Smelt spawning appears to typically occur in Prairieville Creek in early April, but timing can change based on water temperatures. Despite the few fish spawning in Prairieville Creek, Rainbow Smelt populations appear to be rebounding with young fish observed. Rainbow Smelt generally spawn in the Great Lakes region by running up streams but can successfully spawn on gravel shoals (Rupp 1965; O'Brien et al 2012). It is possible that Rainbow Smelt are utilizing shoals or other tributaries for spawning in Gull Lake. Prairieville Creek is shallow and there is a large sand delta at the mouth that can reduce access to the stream while the lake is drawn down. Prairieville Creek is also subjected to modification and disturbance due to the proximity to the park with mowed lawn to the edge of the stream. DNR removed a rock dam that was built in Prairieville Creek prior to the



2019 spawning run which had resulted in sediment deposition over the gravel that is utilized for egg deposition. Disturbances may have resulted in the selection of alternative spawning grounds. Although extensive monitoring occurred, observers may have missed the spawning peak. Protection of Prairieville Creek and other potential spawning locations is critical to maintaining Rainbow Smelt populations.

Spotlight surveys of Prairieville Creek resulted in limited to no observed spawning activity in 2018. However, Rainbow Smelt fishing in the winter of 2018-2019 was good with many anglers reporting nights with over 100 fish caught. Smelt of multiple age classes were reported, but no age analysis was conducted to verify. Despite good catch overwinter, few smelt were observed spawning in Prairieville Creek during intensive spotlighting surveys in 2019. Preliminary reports from the 2019-2020 winter fishery indicate that some smelt are being caught in low numbers including small fish (2-3 inches) likely from the 2019 year class. Anglers are reporting marking large schools of fish that are likely Rainbow smelt. The 2019-2020 winter fishery has been limited due to poor ice conditions and anglers have been limited to the south bay. If poor ice conditions continue, it will limit information that can be gathered from angler reports but will also reduce angling pressure and may enhance survival of Rainbow Smelt as a result.

The Rainbow Smelt population appears to continue to be self-sustaining and there are signs of rebounding population density following the 2016 fish kill. Rainbow Smelt populations express cyclical patterns and are subject to fluctuations in density often attributed to recruitment variability and cannibalism (He and LaBar 1994; Henderson and Nepszy 1989; O'Brien et al 2012) or mortality events (Nsembukya-Katuramu et al. 1981; Schaefer et al. 1981). The status of the smelt fishery will continue to be monitored through spawning surveys and angler reports. Spawning surveys should focus on exploring alternative spawning locations for monitoring as little activity has been observed in Prairieville Creek. There may be additional critical areas that require protection to ensure continued successful reproduction of Rainbow Smelt. Reintroduction and stocking would be difficult due to low population densities in historic source populations and increased concerns regarding potential transfer of pathogens or invasive species into Gull Lake. Maintaining and enhancing the existing population is the best method to ensure a continued fishery.

No Steelhead captures were reported in the creel survey. There was one report of a Steelhead being captured during the fall of 2019, but the report was not substantiated. Many anglers targeted Steelhead using tactics that were successful in the past on Gull Lake with no success. Steelhead production was limited in 2019 and fish were not available to stock in Gull Lake for the spring of 2020.

Management Direction

Steelhead stocking will be discontinued. There is no justification to continue allocating resources to low level stocking of Steelhead as it has not created a fishery. In addition,



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discontinuing the stocking program will eliminate any potential for Steelhead to interfere with rehabilitation of the smelt population in Gull Lake.

We will continue to stock Lake Trout brood stock when available at a maximum rate of 0.25 fish per acre (500 fish). Stocking will occur every-other or every third year as fish are available. This effort will continue to produce a low-density fishery that is popular among anglers and unique for this part of the state of Michigan.

We will hold at least one public meeting in 2020 and continue discussions with the GLQO to determine the desired management of the Gull Lake Northern Pike population. There are two management options that can be considered. 1) Continue to maintain a harvest-based Northern Pike fishery using the statewide regulation of a 2 fish bag limit and 24 inch minimum size limit; or 2) manage Gull Lake to protect larger sized Northern Pike and allowing harvest on smaller fish using a slot limit of a 2 fish bag with a protected slot (no harvest) from 24 to 34 inches. Because growth rates of smaller fish are not depressed, they should continue to recruit to the fishery with a 24-inch size limit. If harvest is limiting the number of larger fish, the slot limit should allow for a shift in size structure. However, if growth rates of larger fish are actually being limited by a shortage of large-bodied prey, these protected fish may not grow to the upper limit of the slot. The success of slot limits depends on angler participation and regulation goals should align with angler preferences. If the protected slot limit is the preferred option, SLMMU will submit the regulation change proposal in January 2021. If the proposal is supported by the Lake Michigan Basin Team and the Natural Resources Commission, it would go into effect on April 1, 2022.



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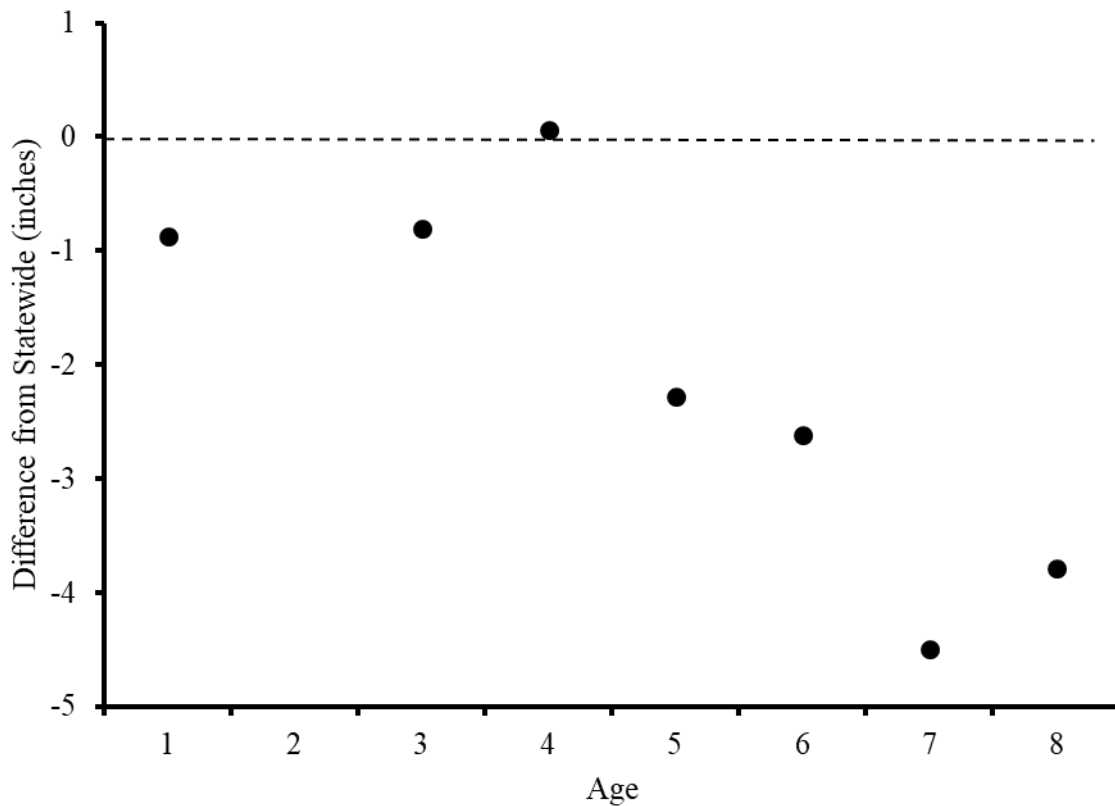


Figure 1. The average difference from the statewide mean length at age for fish captured by anglers in Gull Lake in 2018. The length for each fish captured in Gull Lake was subtracted by the statewide average for the month of capture and averaged by age class. Negative values indicate fish were smaller than the statewide average for that age class.

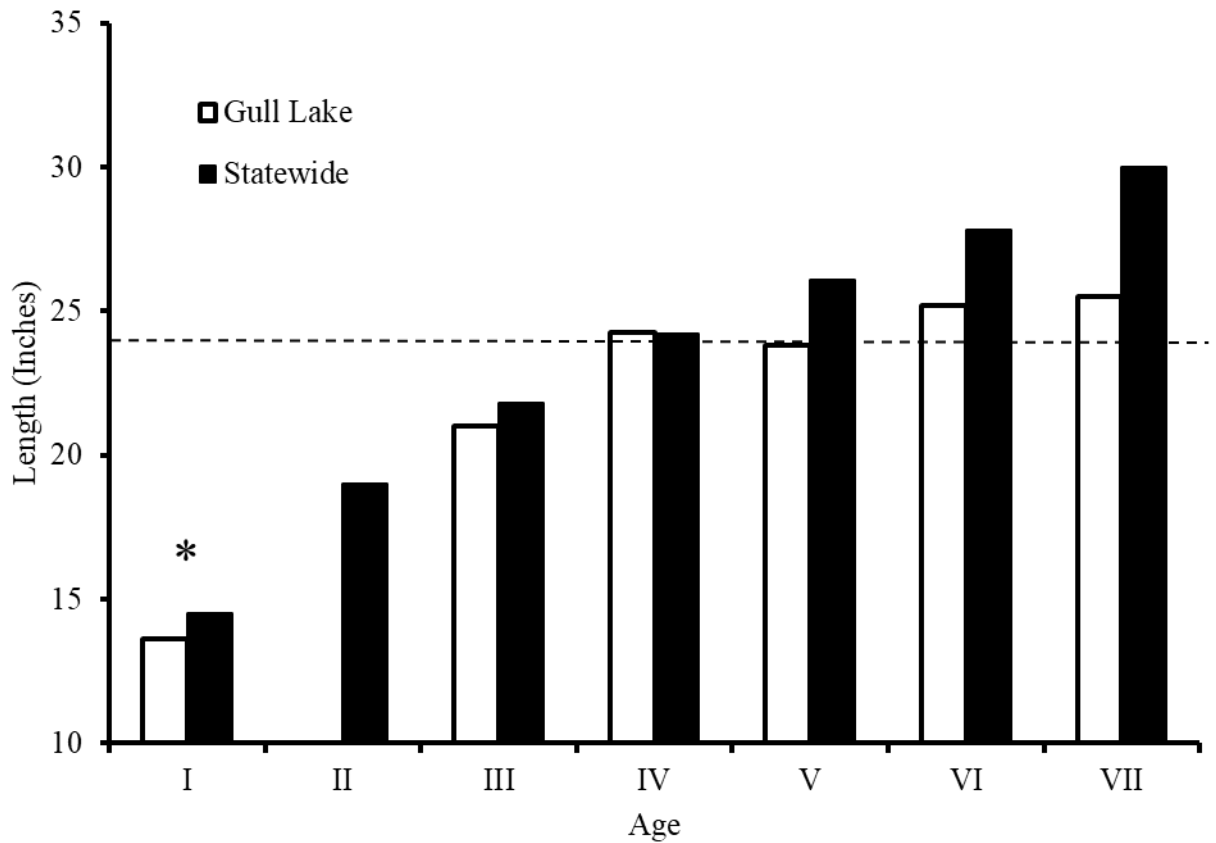


Figure 2. Estimated average length for fish from Gull Lake captured by anglers compared to the statewide average length-at-age for June/July. The dashed line represents the 24-inch minimum size limit. Asterix indicates age classes represented by less than 5 individuals.



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Appendix A. Creel form distributed to anglers during the winter creel in 2018-2019.

GULL LAKE VOLUNTEER FISHERIES SURVEY

The Gull Lake Quality Organization and MDNR are conducting a volunteer fisheries survey of Gull Lake to provide information for future management of the lake. Please take a moment to fill out and return this survey even if you did not catch any fish.

Thank you for your cooperation!

1. Date Fished: _____
2. Name: _____
3. Number of anglers: _____
4. Number of hours fished: _____
5. Species targeted: _____

SPECIES	# KEPT	# RELEASED
Largemouth Bass		
Smallmouth Bass		
Northern Pike		
Bluegill or Sunfish		
Yellow Perch		
Black Crappie		
Rock Bass		
Rainbow Trout		
Lake Trout		
Smelt		
Other Species		

Please record lengths for any northern pike, rainbow trout, or lake trout caught.

Species	Fish #								
	1	2	3	4	5	6	7	8	9
Northern Pike									
Rainbow Trout									
Lake Trout									

Please email completed survey forms to MDNR Fisheries Biologist Matt Diana at dianam@michigan.gov or mail them to 621 N. 10th Street, Plainwell, MI 49080