Big Star Lake
Lake County
Pere Marquette River Watershed; Last surveyed summer 2015

Mark A. Tonello, Fisheries Management Biologist

Environment

Big Star Lake is a 912-acre lake located in southwestern Lake County, Michigan within the Pere Marquette River watershed (Figure 1). It is the largest lake in Lake County. The geography surrounding the lake is hilly and forested, with predominantly sandy soils. Big Star Lake consists of three different "arms" or basins that are similar in size. It is a shallow lake with a maximum depth of approximately 25 feet. During normal water levels, over 70% of the lake is shallower than 15 feet. Substrates in Big Star Lake are predominantly sand and organic muck. A few stumps and deadheads provide fish cover. The shoreline of Big Star Lake is heavily developed and Hay (1995) estimated 317 houses or cottages occurred on it at that time. Public access to Big Star Lake is provided by a Michigan Department of Natural Resources (MDNR) site on the western shore, which has a paved launch ramp and parking for 51 vehicles. There is one public organization dedicated to Big Star Lake. It was originally named the "Great Big Star Lake Improvement Association", but eventually was renamed the Big Star Lake Association (BSLA). The BSLA has been advocating for Big Star Lake since 1954.

Because it is a relatively shallow lake, Big Star Lake has an abundance of aquatic vegetation. In the past, there have been problems with Eurasian milfoil and other nuisance aquatic vegetation. MDEQ has issued permits for control of aquatic nuisance vegetation for a number of years (Eric Bacon, MDEQ Water Bureau, personal communication). In 2015, Eurasian milfoil was at very low levels with only 6.5 acres in June and another 3.1 acres in the fall (Restorative Lake Sciences 2015). The 2016 permit from MDEQ for aquatic nuisance macrophytes called for the treatment of 50 acres or less of Eurasian milfoil or curlyleaf pondweed (including some native plant control) with contact herbicides, and another 49 acres of Eurasian milfoil (non-native plant species only) with low doses of Reward or other systemic herbicides. However, Eurasian milfoil levels remained low in June of 2016, with just over 10 acres treated. Excessive Eurasian milfoil can lead to a number of fisheries problems, including poor growth and stunting for a number of important species.

Big Star Lake has no inlet and one intermittent outlet with a lake-level control structure. Water that flows out of Big Star Lake flows through a series of wetlands into Jenks Creek, a tributary of Danaher Creek, which is a tributary of the Pere Marquette River. The legal lake level was set in 1987 at 829.0' above mean sea level. Big Star Lake has a maximum depth of 25 feet at normal lake level; however, the lake is susceptible to fluctuations with the groundwater table. During unusually dry or wet conditions the water level can fluctuate several feet. One restriction on the lake-level control structure is that water cannot be discharged when the water temperature exceeds 68° to protect the brown and/or brook trout in Jenks Creek. The Lake County Road Commission is charged with managing the lake level control structure, and they are planning to remove and replace the existing water level control structure sometime in 2017.

There are several local ordinances related to the operation of watercraft on Big Star Lake. These include a no-wake ordinance on the western bay of Big Star Lake, and a moratorium on high speed boating (including waterskiing and tubing) between the hours of 6:30 pm and 10:30 am the next day.

History

According to official records, Big Star Lake was first stocked with fish in 1876 with Chinook Salmon and Lake Whitefish (Table 1). Brown Trout were stocked in 1893 and 1894, and Lake Trout were stocked in 1894, 1895, and 1897. Due to the shallow, warm nature of Big Star Lake, none of these coldwater species survived. Walleye were first stocked in 1894. These early stockings were likely conducted by the Michigan Fish Commission, which had been established in 1873. Further stockings were conducted by the Michigan Department of Conservation (MDOC; established in 1921), the precursor to the Michigan Department of Natural Resources or MDNR of today. From 1929 through 1941, Big Star Lake was stocked with varying numbers of Largemouth Bass, Smallmouth Bass, Yellow Perch, and Bluegill. Walleye fry were stocked once in this period, in 1935. The early stocking information shown in Table 1 may be incomplete, as many early MDOC stocking records were destroyed in a fire. Several stockings of Northern Pike occurred in the 1960s. In 1980, MDNR began stocking Tiger Muskellunge and that program lasted until 1991, after which it was replaced with a Walleye stocking program. From 1991 to present, Big Star Lake has been stocked with Walleye on a scheduled rotation (Table 1).

The first fisheries survey of Big Star Lake was conducted by the MDOC in 1937 (Brown 1942) and the author recommended discontinuing all fish stocking. He felt that natural reproduction would be sufficient to support the populations of the native game and panfish species found in the lake (Table 2). Also listed as caught in the survey were "straw colored shiner" and "tadpole cat". The "straw colored shiners" were likely Sand Shiners, while the "tadpole cats" were likely juvenile bullhead. One interesting finding of the 1937 survey is that Northern Pike were not captured. Unpublished MDNR file correspondence indicated that Northern Pike were not present in Big Star Lake until sometime in the 1940s. The first official record of them can be found in a 1948 creel census done by Conservation Officers which showed a number of Northern Pike caught. However, it is unclear how Northern Pike were first introduced and who was responsible for the introduction. In other correspondence from the MDNR file, one biologist surmised that Northern Pike were introduced by anglers.

In 1953, MDOC undertook a substantial fisheries survey of Big Star Lake (Table 2) which obtained scale samples used to determine fish growth rates (Taube and Crowe, 1953). The 1953 survey showed that Largemouth Bass, Bluegill, and Black Crappie were growing slowly. The authors stated that "Bluegills and crappies are definitely stunted", but did not recommend management actions to alleviate the stunting.

The MDOC conducted additional fisheries surveys in 1958, 1959, and 1960 (Table 2) which all showed that Bluegill in Big Star Lake were stunted. The lake was treated with Toxaphene in September of 1960 to thin the Bluegill population and allow surviving Bluegill to grow to larger and more desirable sizes. Surveys done in 1961 and 1962, after the treatment, seemed to show substantial reduction in numbers of most fish species. In correspondence dated 1962, MDOC District Fisheries Biologist John MacGregor stated that "I believe the chemical reclamation was a tremendous success, doing precisely what it was designed to do". He also wrote that "extensive netting in 1961 and 1962 showed a marked reduction in the numbers of perch and panfish but no change in the species

composition"; and that, "all species are present in good numbers, and have an increased average length, as is expected by reducing the number of smaller fish". Moderate fish kills were reported by Conservation Officers in the summers of 1967 and 1968. The fish kills were attributed to natural causes, most likely oxygen depletion in certain areas of the lake caused by decaying aquatic vegetation and/or algae blooms, exacerbated by hot summer temperatures.

Northern Pike have been prominent in Big Star Lake since their apparent introduction in the 1940s. Several substantial fall die-offs were noted by lake residents in the late 1950s and early 1960s. Northern Pike fishing, which had reportedly been phenomenal in the winter of 1949-50 (shortly after their introduction to the lake), began to decline through the 1950s. In an attempt to improve Northern Pike fishing, 2,000 fingerlings were stocked in 1961. Correspondence in MDNR files indicates that some biologists believed that a drop in the lake level had denied Northern Pike access to spawning habitat, resulting in a reduced population. Residential development of the shore and removal of natural shoreline vegetation to create beaches may have also played a role in the drop of the Northern Pike population.

A proposal was developed in 1965 to establish an artificial Northern Pike spawning marsh on private property. In 1966, the marsh, located on the eastern shore of the lake near the outlet, was put into production and it continued to operate in 1967, 1968, and 1969. Records indicate that 117 adult Northern Pike were netted from the lake and placed into the marsh in 1968 and 113 adults in 1969. Fisheries Biologist Bill Bullen wrote in 1971 correspondence that Big Star Lake held the largest pike population of any lake he had worked on. He attributed this to the operation of the pike marsh and also to high water levels which had allowed Northern Pike access to prime spawning areas. The spawning marsh did not operate from 1970 through 1972 due to high water levels. An unsuccessful attempt was made to operate the marsh in 1973 which was hampered by continued high water levels and vandalism to the fish trap. In 1974, 210,000 Northern Pike fry were stocked into the marsh, but fisheries personnel were unable to evaluate whether fingerlings eventually migrated out to the lake. In 1975, approximately 300 adult Northern Pike either were stocked or migrated on their own into the marsh, but again, the outlet structure was vandalized, making evaluation impossible. Due to these difficulties, the artificial pike rearing program was abandoned in 1977. A Northern Pike spearing ban and winter harvest closure were also put in place in 1971. This restriction was eventually removed in 2006, making it again legal to spear and ice fish for northern pike.

Additional MDNR fisheries surveys of Big Star Lake were conducted in 1971 and 1979 (Table 2). In the 1971 survey, excellent numbers of Northern Pike, Largemouth Bass, Black Crappie, Bluegill, and Yellow Perch were captured. Although there were still quite a few small Bluegill caught, there were also a fair number of 6 to 8 inch Bluegill available. Age and growth data were not collected in the 1971 survey. Good numbers of Bluegill, Black Crappie, Largemouth Bass, and Northern Pike were caught in the 1979 survey, but total catch was down. Age and growth analysis of the fish caught in 1979 indicated that most species were growing near or slightly above the state average.

In 1980, a total of 7,257 fall fingerling Tiger Muskellunge (a Northern Pike/Muskellunge hybrid) were stocked into Big Star Lake (Table 1). Tiger Muskellunge stocking continued until 1991, when the Tiger Muskellunge program for the entire state was ended. The Tiger Muskellunge program was extremely popular with Big Star Lake anglers and residents, and it provided a good fishery. In a fisheries survey in 1985 (Table 2), 22 Tiger Muskellunge were captured, ranging from 11-31 inches in

length. This indicated good survival (Hay 1985), but age and growth data showed that they were growing very slowly. In the 1985 survey report, Hay (1985) stated that Largemouth Bass, Bluegill, Black Crappie, and Pumpkinseed Sunfish were growing well and that Big Star Lake had "good fish populations, with plenty of legal or acceptable size game fish".

In 1991, a total of 22,382 spring fingerling Walleye were stocked into Big Star Lake, which was the first Walleye introduction since 1935. A total of 273,160 Walleye have been stocked into Big Star Lake from 1991 to present (Table 1). An MDNR fisheries survey was conducted in 1995 (Table 2) which documented good growth and survival of stocked Walleye (Hay, 1995). Populations of other sportfish species in the lake also appeared healthy and desirable in 1995. Bluegill averaged 6.5 inches in length and Northern Pike, Largemouth Bass, and Pumpkinseed Sunfish were also growing faster than the state average. Four Tiger Muskellunge were also caught in the 1995 survey.

Another MDNR comprehensive survey was conducted in 2004 with netting and electrofishing (Table 2; Tonello 2006). The 2004 survey showed fair populations of panfish and Largemouth Bass, but relatively low numbers of Walleye and Northern Pike. White Sucker dominated the 2004 catch, comprising nearly 70% of the netting catch by weight. Recommendations from the 2004 survey (Tonello 2006) were to stock Walleye more frequently and to manually remove White Sucker to reduce competition with other, more desirable species.

Based on recommendations from the 2006 report (Tonello 2006), a manual White Sucker removal effort was conducted by MDNR from April 23 through April 27, 2007 (Table 2; Tonello 2007). Six trap nets were used in the project, set at various locations around the lake. The nets were set with the intentional purpose of targeting White Sucker as they moved inshore for spawning. Several Big Star Lake riparian landowners were helpful with pointing out good locations to set the nets. In the effort, a total of 697 adult White Suckers from 15 to 21 inches in length were removed, weighing a total of 1,549.4 lbs. The White Suckers were placed in net pens at the boat launch, and were all given away to the general public. No further White Sucker removal efforts have been conducted since 2007, due to time and personnel constraints.

In the 2007 White Sucker removal effort, a total of 15 Walleye from 16 to 27 inches in length were also caught in the trap nets (Tonello 2007). They were measured, counted, and aged using cross sections from dorsal fin spines. Age analysis showed that most of them were from the 1999 year class, with a few from the 2002 and 2004 year classes. Walleye had been stocked into Big Star Lake in each of the corresponding years. All were growing faster than the State of Michigan average for that age class. This led to the conclusion that the Walleye fishery in Big Star Lake was likely dependent upon stocking, and that natural reproduction of Walleye was not taking place in Big Star Lake.

On May 5, 2010, an electrofishing survey was conducted on Big Star Lake by MDNR (O'Neal 2010). The survey specifically targeted juvenile Walleye using methods established by Ziegler and Schneider (2000). Approximately 3 miles of shoreline were shocked at night using a 220-volt DC electrofishing boat. In the survey, no juvenile Walleye and only one adult Walleye were caught. The adult Walleye was from the 2002 year class, a year in which Walleye had been stocked into Big Star Lake.

Since 1994, a total of 18 exceptional fish caught from Big Star Lake have been entered into the MDNR Fisheries Division Master Angler program. Master Angler species caught from Big Star Lake have

included Black Crappie, Bluegill, Largemouth Bass, and Northern Pike (Table 3). Six of the 18 entries from Big Star Lake were submitted in 2016. Of those, three were for Bluegill and three were for Black Crappie.

Current Status

The most recent fisheries surveys of Big Star Lake were conducted in 2015. Fish sampling was conducted with trap nets, large-mesh fyke nets, small-mesh fyke nets, inland gill nets, minnow seines, and electrofishing gear. The netting portion of the survey occurred from May 11 through May 15, and the electrofishing and seining portion was completed on June 25. Another electrofishing survey (targeting juvenile Walleye) was conducted during the evening of September 21.

A total of 1,587 fish, representing 13 different species, were caught in the netting portion of the 2015 survey (Table 4). Bluegill were the most frequently collected panfish species in the survey. A total of 1,086 Bluegill from 1 to 10 inches were caught, representing 68.4% of the catch by number. Most of the Bluegill were juveniles captured in the small mesh fyke net. Other panfish species caught included Black Crappie (75 individuals from 4 to 14 inches, averaging 7.8 inches) and Pumpkinseed Sunfish (48 caught from 2 to 9 inches in length). Only 7 Yellow Perch were caught, from 1 to 11 inches in length. Walleye were the most numerous predator species caught by netting, with 25 from 9 to 26 inches caught. Largemouth Bass ranged from 7-16 inches length, with 18 individuals caught. One Northern Pike (28 inches) and one Smallmouth Bass (18 inches) were also caught in the nets. White Suckers were very abundant, with 148 individuals caught, representing approximately 67% of the catch by weight. Other species caught in the netting portion of the 2015 survey included Blacknose Shiner, Bluntnose Minnow, Brown Bullhead, and Iowa Darter.

The inland gill nets were only fished for one net-night in the 2015 survey because of their propensity to be lethal to certain fish species, including Walleye. The Walleye catch from the inland gill nets after one night (13 individuals, some of which did not survive) appeared to be sufficient and the decision was made to remove the inland gill nets to avoid any further Walleye mortality. Trap and fyke nets are less likely to cause mortality for fish caught in them, so we relied heavily on those gear types in the 2015 survey. If the gill nets had been fished for more net-nights, it is likely that the Walleye catch would have been much higher. It is also likely that the Northern Pike and Yellow Perch catches would have been higher if there was more inland gill net effort.

Bluegill captured during the netting part of the 2015 survey (Table 5) were growing just below (-0.1 inches) the state average length at age, while Black Crappie (+1.1 inches) and Pumpkinseed Sunfish (+2.0 inches) were growing faster than the state average. Walleye from the netting portion of the 2015 survey were growing +3.8 inches faster than the state average. There were not enough Largemouth Bass, Northern Pike, Smallmouth Bass, or Yellow Perch were collected during the netting portion of the survey to make inferences regarding age and growth.

A total of 3,064 fish, representing 9 species, were caught in the seining and electrofishing part of the 2015 survey (Table 6). The vast majority of the fish captured in this portion of the survey were Mimic and Sand Shiners. Bluntnose Minnow, Bluegill, Yellow Perch, and Largemouth Bass were also well-represented. The Bluegill and Yellow Perch catch consisted mostly of juveniles. The same was true for the Largemouth Bass catch, although a few larger individuals were present. Other species caught in smaller numbers included Banded Killifish, Black Crappie, and Pumpkinseed Sunfish.

Bluegill captured during the seining and electrofishing portion of the 2015 survey were growing -1.5 inches below the state average (Table 7). Yellow Perch were growing -0.8 inches below the state average, while Largemouth Bass were slightly below (-0.1 inches) the state average.

The final component of the 2015 Big Star Lake fisheries survey was a fall electrofishing effort targeting juvenile Walleye. This effort was similar to a fisheries survey conducted in May of 2010 (O'Neal 2010) and was conducted using methods established by Ziegler and Schneider (2000). Only one 20 inch Walleye was caught in this effort and it was estimated to be age three (from the 2012 year class).

Shoreline data were collected on August 3, 2015 (Table 8). Big Star Lake had 33.1 docks/km, 39.7 dwellings/km, 5.7% shoreline armoring, and 0.0 submerged trees/km. Big Star Lake is heavily-developed with cottages and residences along most of its shoreline. Compared to other shallow, medium-sized lakes in Michigan and in the Central Lake Michigan Management Unit (CLMMU; basically the northwestern portion of the Lower Peninsula), Big Star Lake has an above-average number of docks and dwellings (Wehrly et al. 2015; Table 8). While it had a lower percent of shoreline armoring than other shallow, medium sized lakes, field notes from the survey on August 3 indicated that low water levels at that time had left much shoreline armoring "high and dry"; thus it was not captured in the survey. Under more normal water levels, the percent shoreline armoring for Big Star Lake would be much higher.

Analysis and Discussion

The 2015 MDNR fisheries survey showed that Big Star Lake fish populations have improved since the previous survey in 2004. In particular, the Walleye population seems to be more robust, with good numbers of legal Walleye present. Also, the Walleye were showing exceptional growth for a northwestern Lower Peninsula inland lake. Natural reproduction of Walleye (albeit at low numbers) was documented for the first time in the 2015 survey, with one fish each present from the 2014 and 2006 year classes, neither of which was stocked. Big Star Lake presently offers an excellent opportunity for catching Walleye. It remains to be seen whether Walleye natural reproduction will continue in the future or if this is simply a one-time occurrence.

While the 2015 survey did not produce good numbers of Largemouth Bass, angler reports have been good. The presence of one Smallmouth Bass in the 2015 catch is interesting, as it is the first one to be caught in an MDNR fisheries survey of Big Star Lake since 1979.

The status of the Northern Pike population is uncertain, as only one individual was caught in the 2015 survey. This was likely due at least in part to the fact that the inland gill nets were only fished for one night. Northern Pike populations in Big Star Lake may fluctuate based on water levels (Tonello 2006). It is also possible that residential development along the shoreline and the consequent loss of riparian habitat are interfering with Northern Pike spawning success.

The Bluegill population of Big Star Lake also seems to have improved since 2004. According to the Schneider Index (Schneider 1990) the Bluegill population of Big Star Lake ranked as "poor" in 2004, but improved to "satisfactory" in 2015 (Table 9). Also, six Bluegill of Master Angler size have been caught from Big Star Lake since 2011. This improvement in the Bluegill population of Big Star Lake

may be at least in part due to the Walleye population. Schneider and Lockwood (1997) found that even relatively low densities of adult Walleye in inland lakes improved Bluegill size structure and growth. Bluegill should continue to provide good fishing opportunities on Big Star Lake, as well as being an excellent forage base for predators like Walleye and Largemouth Bass. Continued Walleye stocking should help to keep the Bluegill population from stunting.

The Black Crappie and Pumpkinseed Sunfish populations also appear healthy, although they are not as numerous as Bluegill. Large Black Crappie have also been present in Big Star Lake in recent years, with five Master Angler entries since 2013. There were not enough Yellow Perch were caught in 2015 to make inferences regarding the health of the population.

There appears to be a large population of White Suckers in the lake since they comprised the majority of fish biomass in the catch of the 2015 survey, as they did in the 2004 survey (Tonello 2006). Hayes (1990) showed that populations and growth rates of other more desirable fish species improved in Douglas Lake in Otsego County when the White Sucker population was manually reduced. While the Hayes study showed that White Suckers competed with Yellow Perch for limited invertebrate food resources, other species like Bluegill and juvenile Walleye may also be impacted. Therefore, manual removal of adult White Suckers from Big Star Lake may provide mutual benefit to a number of panfish and gamefish species.

Management Direction

The Walleye fishery of Big Star Lake is extremely popular with riparian landowners and local anglers. In addition, the stocked Walleye are likely helping to keep the Bluegill population in good condition for anglers. Therefore, Walleye fingerlings should continue to be stocked into Big Star Lake to maintain the Walleye fishery. While a few fish from unstocked years were present in the 2015 survey catch, the bulk of the catch came from stocked years. The previous management regime called for stocking 23,000 spring fingerling Walleye (25/acre) every other year. However, the exceptional growth rates found in the 2015 survey indicate that Big Star Lake is capable of supporting more Walleye. Therefore, we will request that 46,000 (50/acre) spring fingerling Walleye be stocked on an every other year basis. Since Big Star Lake was most recently stocked with Walleye in 2015, the next stocking will take place in 2017.

White Suckers represent a large proportion of the biomass of Big Star Lake; manual removals could be done periodically to lower the White Sucker population. Manual removal would be done with trap and fyke nets fished in the spring to target the White Suckers as they enter the shallows to spawn. White Sucker removal could result in better survival of stocked Walleye fingerlings and increased growth rates of panfish. Although a White Sucker manual removal effort was conducted by MDNR in 2007, none have been conducted since then. However, conducting a similar removal effort in the near future is unlikely under current staffing levels.

The Northern Pike population will likely continue to fluctuate with water levels, but those that are present should grow well due to the abundance of White Sucker, which are a preferred prey item. One possible management option would be to stock Northern Pike fingerlings, but there is currently no statewide Northern Pike rearing program. Another potential option would be to stock Muskellunge. The abundant White Sucker population would provide excellent forage for Muskellunge. Tiger Muskellunge were stocked with some success in years past. However, our ability to rear Muskellunge

is limited at this time, and demand is extremely high for those that are reared. If our Muskellunge rearing capacity increases at some point in the future, this management option could be explored. However, this action should only be taken if the public, including the BSLA, was supportive.

Another comprehensive fisheries survey should be conducted within the next ten years to monitor the fish populations of Big Star Lake. In particular, the Walleye population should be targeted to assess the effectiveness of the Walleye stocking program. Other goals of future fisheries surveys should include further scrutiny of the panfish, bass, and Northern Pike populations.

Eurasian milfoil will likely continue to require treatment, at least in some years. We recommend continued small-scale spot chemical treatments for dealing with the Eurasian milfoil. We also recommend that native plants not be treated. A healthy aquatic plant community is critical to healthy fish communities. Many of the desired fish species in Big Star Lake, including Walleye, Northern Pike, Largemouth Bass, Bluegill, Black Crappie, Pumpkinseed Sunfish, and Yellow Perch require healthy native aquatic plant communities.

The remaining riparian wetlands adjacent to Big Star Lake should be protected and considered critical to the continued health of the lake's aquatic community. The Big Star Lake shoreline is already much more developed than most other lakes in Michigan. Future unwise riparian development and wetland loss may result in further deterioration of the water quality and aquatic habitat. Healthy biological communities in inland lakes require suitable natural habitat. Human development within the lake watershed, along the shoreline, and in the lake basin has a tendency to change and diminish natural habitat.

Appropriate watershed management is necessary to sustain healthy biological communities, including fish, invertebrates, amphibians, reptiles, birds and aquatic mammals. Generally for inland lakes this includes maintenance of good water quality, especially for nutrients; preservation of natural shorelines, especially shore contours and vegetation; and preservation of bottom contours, vegetation, and wood structure within a lake. Guidelines for protecting fisheries habitat in inland lakes can be found in Fisheries Division Special Report 38 (O'Neal and Soulliere 2006). Also, the Michigan Natural Shoreline Partnership, an organization dedicated to promoting natural shoreline landscaping to protect Michigan's inland lakes (http://www.mishorelinepartnership.org/), can provide guidance and training on how best to manage the land/water interface for the benefit of Big Star Lake.

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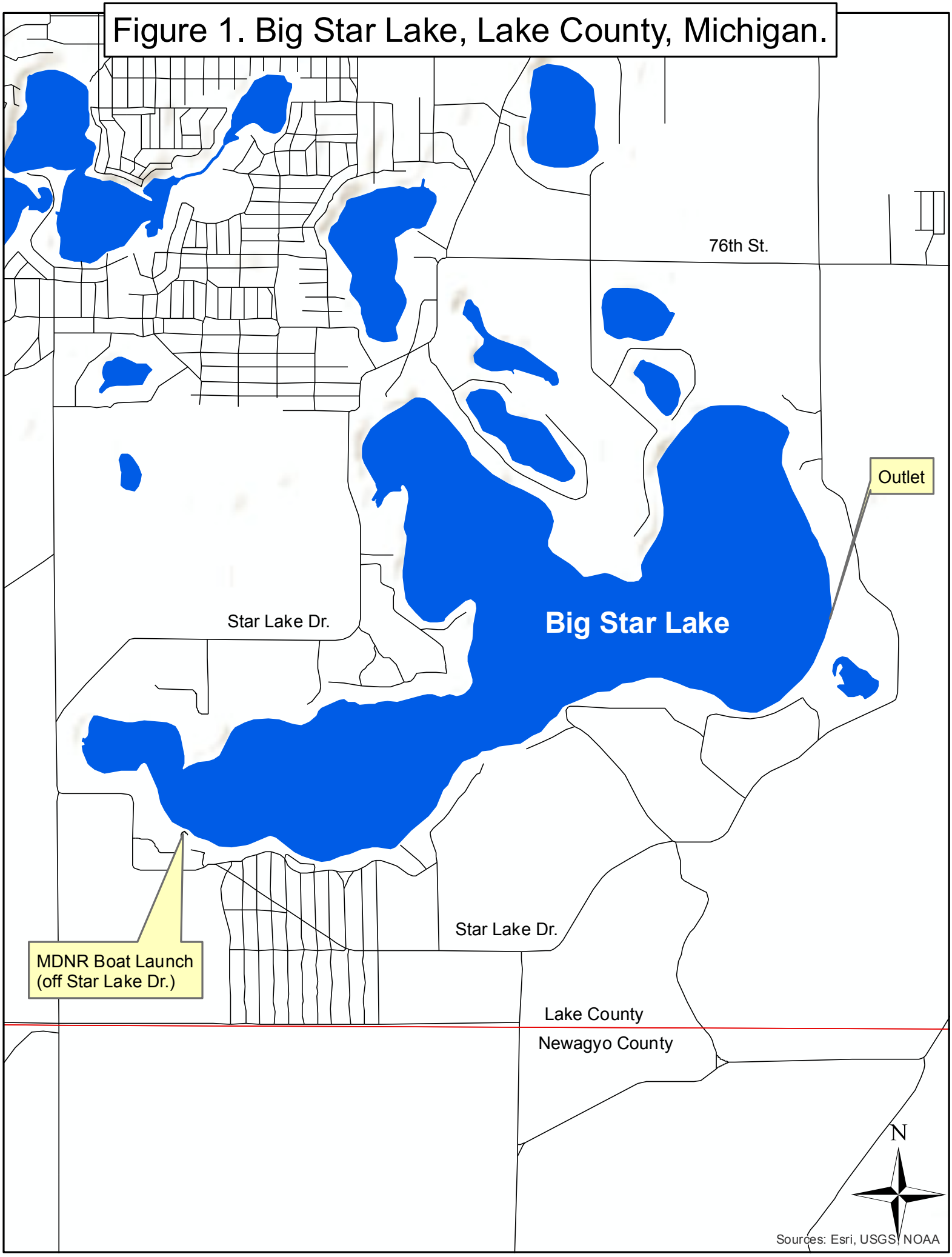
Figure 1. Big Star Lake, Lake County, Michigan.
76th St.
Outlet
Big Star Lake
Star Lake Dr.
Star Lake Dr.
MDNR Boat Launch
(off Star Lake Dr.)
Lake County
Newagyo County
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Sources: Esri, USGS, NOAA

Table 1. Fish stocked in Big Star Lake, Lake County, 1876-2016.

Year	Species	Number	Size	Strain
1876	Chinook Salmon	14,000	fry	
	Lake Whitefish	50,000	fry	Detroit River
1879	Lake Whitefish	70,000	fry	Detroit River
1893	Brown Trout	30,000	unknown	
1894	Brown Trout	25,000	unknown	
	Lake Trout	10,000	unknown	
	Walleye	30,000	unknown	
1895	Lake Trout	20,000	unknown	
1897	Lake Trout	15,000	unknown	
1929	Bluegill	19,000	4-5 mo.	
1930	Smallmouth Bass	6,000	1 mo.	
	Largemouth Bass	400	yearlings	
1931	Largemouth Bass	1,850	2 mo.	
	Bluegill	4,500	5 mo.	
1934	Largemouth Bass	150	4 mo.	
	Bluegill	800	adults	
1935	Smallmouth Bass	1,640	4 mo.	
	Walleye	510,000	fry	
	Yellow perch	3,000	7 mo.	
1936	Largemouth Bass	200	yearlings	
	Yellow perch	20,000	8 mo.	
1937	Bluegill	30,000	4-5 mo.	
1938	Smallmouth Bass	2,320	5 mo.	
	Yellow perch	4,000	6 mo.	
	Bluegill	18,000	3 mo.	
1939	Smallmouth Bass	2,400	4 mo.	
	Largemouth Bass	2,000	3 mo.	
	Yellow Perch	9,000	9 mo.	
	Bluegill	10,000	3 mo.	
1940	Bluegill	5,000	3 mo.	
1941	Largemouth Bass	2,000	3 mo.	
	Bluegill	5,000	3 mo.	
1961	Northern Pike	2,000	fingerlings	
1966	Northern Pike	47	adults	
1980	Tiger Muskellunge	7,257	fall fingerlings	
1981	Tiger Muskellunge	3,600	fall fingerlings	
1982	Tiger Muskellunge	5,000	fall fingerlings	
1983	Tiger Muskellunge	3,000	fall fingerlings	
1984	Tiger Muskellunge	3,240	fall fingerlings	
1985	Tiger Muskellunge	2,400	fall fingerlings	
1986	Tiger Muskellunge	3,000	fall fingerlings	
1987	Tiger Muskellunge	3,100	fall fingerlings	
1988	Tiger Muskellunge	2,600	fall fingerlings	
1989	Tiger Muskellunge	3,600	fall fingerlings	
1990	Tiger Muskellunge	3,600	fall fingerlings	
1991	Tiger Muskellunge	3,600	fall fingerlings	
	Walleye	22,382	spring fingerlings	Muskegon

Table 1 continued

1993	Walleye	18,175	spring fingerlings	Bay De Noc
	Walleye	6,887	fall fingerlings	Bay De Noc
1996	Walleye	20,050	spring fingerlings	Bay De Noc
1999	Walleye	25,390	spring fingerlings	Muskegon
2002	Walleye	25,684	spring fingerlings	Muskegon
2004	Walleye	10,171	spring fingerlings	Muskegon
2005	Walleye	20,102	spring fingerlings	Muskegon
2008	Walleye	28,442	spring fingerlings	Muskegon
2009	Walleye	22,207	spring fingerlings	Muskegon
2012	Walleye	27,586	spring fingerlings	Muskegon
2015	Walleye	46,084	spring fingerlings	Muskegon

Table 2. Presence/absence of fish species in historical fisheries surveys of Big Star Lake, Lake County.

Species	1937	1942	1953	1958	1960	1961	1971	1979	1985	1995	2004	2007	2015
Banded Killifish	x	x									x		x
Black Bullhead							x						
Black Crappie	x	x	x	x	x	x	x	x	x	x	x	x	x
Blacknose Dace									x				
Blacknose Shiner	x	x									x		x
Bluegill	x	x	x	x	x	x	x	x	x	x	x	x	x
Bluntnose Minnow	x	x									x		x
Brown Bullhead							x				x		x
Bullhead spp.										x		x	
Central Mudminnow	x	x											
Creek Chub	x	x											
Emerald Shiner					x								
Golden Shiner					x				x	x	x		
Green Sunfish					x	x							
Iowa Darter													x
Largemouth Bass	x	x	x	x	x	x	x	x	x	x	x	x	x
Mimic Shiner	x	x											x
Northern Pike			x	x	x	x	x	x	x	x	x	x	x
Pumpkinseed	x	x	x		x	x	x	x	x	x	x	x	x
Sand Shiner												x	x
Smallmouth Bass	x	x						x					x
Spottail Shiner										x			
Tiger Muskellunge									x	x			
Walleye		x								x	x	x	x
White Sucker	x	x	x	x		x	x	x	x	x	x	x	x
Yellow Bullhead	x	x	x			x		x	x				
Yellow Perch	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 3. Michigan DNR Master Angler awards issued for fish caught from Big Star Lake, Lake County, Michigan, 1994-2016.

Species	Number of Master Angler awards issued
Black Crappie	9
Bluegill	7
Largemouth Bass	1
Northern Pike	1
Total:	18

Table 4. Number, weight, and length of fish collected from Big Star Lake with trap nets, large mesh fyke nets, small mesh fyke nets, and inland gillnets, May 11-15, 2015.

Species	Number	Percent by number	Weight (pounds)	Percent by weight	Length range (inches)[1]	Average length	Percent legal size[2]
Black Crappie	75	4.73	28.1	4.3	4-14	7.8	48 (7")
Blacknose Shiner	41	2.58	0.1	0.0	1-2	1.8	
Bluegill	1,086	68.43	39.6	6.0	1-10	2.2	9 (6")
Bluntnose Minnow	97	6.11	0.6	0.1	1-3	2.4	
Brown Bullhead	11	0.69	10.0	1.5	10-14	12.4	(7")
Iowa Darter	29	1.83	0.1	0.0	1-2	2.3	
Largemouth Bass	18	1.13	19.1	2.9	7-16	12.2	28 (14")
Northern Pike	1	0.06	5.2	0.8	28-28	28.5	100 (24")
Pumpkinseed	48	3.02	16.2	2.5	2-9	6.9	66 (6")
Smallmouth Bass	1	0.06	3.3	0.5	18-18	18.5	100 (14")
Walleye	25	1.58	93.8	14.3	9-26	21.9	96 (15")
White Sucker	148	9.33	438.8	66.9	4-21	19.4	
Yellow Perch	7	0.44	0.7	0.1	1-11	3.0	14 (7")
Total	1,587	100	655.6	100			

[1]Note some fish were measured to 0.1 inch, others to inch group: e.g., "5"=5.0 to 5.9 inch, 12=12.0 to 12.9 inches; etc.

[2]Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 5. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Big Star Lake with trap nets, large mesh fyke nets, small mesh fyke nets, and inland gill nets, May 11-15, 2015. Number of fish aged is given in parenthesis. A minimum of five fish per age group is statistically necessary for calculating a Mean Growth Index, which is a comparison to the State of Michigan average.

	Age										
Species	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	Mean Growth Index
Black Crappie		5.9 (25)	7.9 (19)	11.5 (11)	12.5 (4)			14.1 (1)				+1.1
Bluegill			4.4 (6)	6.9 (32)	6.1 (11)			9.5 (2)		10.0 (1)		-0.1
Largemouth Bass		7.7 (3)	10.6 (4)	12.4 (4)	13.8 (3)	14.9 (3)	16.2 (1)					--
Northern Pike							28.1 (1)					--
Pumpkinseed Sunfish			6.1 (28)	8.4 (11)	9.0 (3)							+2.0
Smallmouth Bass					18.1 (1)							--
Walleye	9.2 (1)		18.8 (10)			21.9 (3)	24.5 (1)		23.5 (1)	25.8 (8)	25.1 (1)	+3.8
Yellow Perch					11.0 (1)							--

Table 6. Number, weight, and length of fish collected from Big Star Lake with electrofishing and seining, June 25, 2015.

Species	Number	Percent by number	Weight (pounds)	Percent by weight	Length range (inches)[1]	Average length	Percent legal size[2]
Banded Killifish	15	0.5	0.1	0.2	1-2	2.2	
Black Crappie	2	0.1	1.7	4.1	11-11	11.5	100 (7")
Bluegill	76	2.5	1.7	4.1	1-7	2.6	3 (6")
Bluntnose Minnow	115	3.8	0.7	1.7	1-2	2.3	
Largemouth Bass	31	1.0	28.9	70.5	3-16	11.0	23 (14")
Mimic Shiner	1,157	37.8	2.8	6.8	1-2	1.8	
Pumpkinseed	2	0.1	0.6	1.5	3-8	6.0	50 (6")
Sand Shiner	1,602	52.3	3.9	9.5	1-2	1.9	
Yellow Perch	64	2.1	0.6	1.5	1-4	2.6	0 (7")
Total	3,064	100	41.0	100			

[1]Note some fish were measured to 0.1 inch, others to inch group: e.g., "5"=5.0 to 5.9 inch, 12=12.0 to 12.9 inches; etc.

[2]Percent legal size or acceptable size for angling. Legal size or acceptable size for angling is given in parentheses.

Table 7. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Big Star Lake with seining and electrofishing, June 25, 2015. Number of fish aged is given in parenthesis. A minimum of five fish per age group is statistically necessary for calculating a Mean Growth Index, which is a comparison to the State of Michigan average.

Species	Age I	II	III	IV	V	VI	VII	Mean Growth Index
Black Crappie				11.7 (2)				--
Bluegill		3.3 (4)	3.8 (10)	4.9 (2)	6.0 (4)			-1.5
Largemouth Bass	4.4 (6)	8.4 (2)	9.9 (4)	12.8 (11)	14.4 (4)	15.4 (2)	16.4 (2)	-0.1
Pumpkinseed Sunfish		3.9 (1)		8.5 (1)				--
Yellow Perch	3.2 (10)	4.8 (2)						-0.8

Table 8. Shoreline data for Big Star Lake, Lake County, compared with that for other medium, deep lakes in the Central Lake Michigan Management Unit (CLMMU) and statewide (from Wehrly et al. 2015). Sampling was conducted by MDNR Fisheries personnel on August 3, 2015.

	Total docks per km	Dwellings per km	Percent shoreline armoring	Submerged trees per km
Big Star Lake	33.1	39.7	5.7	0.0
Average for medium, shallow lakes in the CLMMU	15.3	17.5	53.5	12.0
Michigan statewide average for medium, shallow inland lakes	2.9	5.7	8.9	46.3

Table 9. Big Star Lake Bluegill size structure rating using the Schneider Index (Schneider 1990) for Bluegill caught from trap nets in the 2004 survey and from large mesh fyke nets and trap nets in the 2015 survey. Schneider Index rankings are as follows: 1 = very poor, 2 = poor, 3 = acceptable, 4 = satisfactory, 5 = good, 6 = excellent, 7 = superior.

Year Surveyed	Average Length (in.)	%>6 in.	%>7 in.	%>8 in.	Growth	Schneider Index
2004 trap nets	5.1	5.9	3.6	1.3	+0.1	
Score	2	1	2	5	4	2.8
2015 trap and LM fyke nets	6.4	61	32	11	-0.1	
Score	4	4	5	6	3	4.4