



Budd Lake – 2021 Status and Trends

2021 Status and Trends Lake Report



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On the cover: Pumpkinseed. Credit: Joseph R. Tomelleri ©

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Introduction

The Inland Lake Status and Trends Program (LSTP) of the Michigan DNR is a statewide program with annual management unit obligations. The purpose is to conduct standardized fishery and limnological sampling on public inland lakes greater than 10 acres that allows for statewide comparisons over a one-to-two-week period in late spring or early summer (e.g., when water temperatures are 55-80°F). Multiple gear types are used in an effort to randomly sample different habitats and to collect information on a range of species and size classes:

- *Large-mesh fyke net* consist of a lead (4' x 100'), a front frame made up of two rectangles (4' x 6'), and a pot end made up of three hoops (4' diameter) and two throats. The mesh size of 1.5 in captures larger (> 3 in) species that inhabit the littoral zone or move inshore at night. Nets are set overnight perpendicular to the shoreline.
- *Small-mesh fyke net* consist of a lead (3.5' x 50'), a front frame made up of two rectangles (3.5' x 6'), and a pot end made up of three hops (3' diameter) and two throats. The mesh size of 3/16 in captures small (< 3 in) species that inhabit the littoral zone or move inshore at night. Nets are set overnight perpendicular to the shoreline.
- *Experimental gill nets* consist of five monofilament panels of 1.5, 2.0, 2.5, 3.0, and 4.0-in-stretch mesh, each 25 feet in length. Gill nets should be set in offshore areas and may not be suitable for all lakes biologically or socially.
- *Seine* is 5' tall and 25' long with a mesh size of 3/16 in to capture small (< 3 in) species that inhabit the littoral zone. Seines should be deployed parallel to shore and then formed into a semi-circle by keeping the nearshore end stationary and pulling the offshore end in an arc. The seine can then be pulled toward shore trapping fish between the shoreline and the seine.
- *Boom shocking* is completed at night as catch rates and the number of species encountered tends to be higher than during the day. A minimum of three 10-minute passes should be made in the littoral zone parallel to the shore. All species of all sizes should be netted.
- *Trap net* consist of a lead (6' x 100'), two wings and heart (3' x 6'), and a pot with a single throat. The mesh size of 1.5 in captures larger (< 3 in) species that inhabit the littoral zone or move inshore at night. Nets are set overnight perpendicular to the shoreline.

Budd Lake has undergone several management regimes initiated by the Michigan Department of Natural Resources (MDNR) since the 1930s starting with supplemental stocking of warmwater species (e.g., bass and panfish). Stocking was discontinued in 1941 when warmwater species became well established in the lake. In 1955, MDNR shifted management focus to stocking Muskellunge. Budd Lake is one of the few closed basin lakes in the state where stocking of Northern Strain Muskellunge is allowed following the recommendations of the Michigan DNR Esocid team. The 1959 seining survey documented Muskellunge survival but ultimately poor spawning success. This conclusion led to a spear fishing closure in 1960 to protect large spawners and construction of artificial spawning habitat followed by a rotenone treatment and the stocking on mature Muskellunge. This program was deemed a failure in 1961 because no fry



were observed leading to the removal of the spawning structure the following year. However, Muskellunge stocking continued with the latest event in 2019 (Table 1).

In addition to Muskellunge, there have been two distinct phases of Walleye management in Budd Lake. Walleyes were stocked sporadically from 1983 to 1996 (Table 1). The 1999 survey failed to document good survival or abundance of adult Walleye. Additionally, the Lake Association had little feedback on any success of these plants. Stocking was discontinued after the 1999 survey. Several years after stocking stopped, anglers began to report increased catches of Walleye which reignited the interest in establishing a Walleye fishery by the Lake Association. Stocking of Walleye resumed in 2006 with the most recent Walleye stocking occurring in 2021 (Table 1).

Discretionary surveys were conducted in 2020 and 2021 to document relative abundance, size structure, and determine the age and growth of Muskellunge, Walleye, and Northern Pike. Muskellunge were PIT tagged to perform a population estimate. There weren't enough individuals collected either year to determine the mean growth index. The results of these surveys can be found separately in the MDNR Fish Collection database.

Two weeks prior to a scheduled Status and Trends survey in 2007, Budd Lake experienced a fish kill. A concerned angler reported hundreds of dead fish around the shoreline while he was fishing. Moribund fish were collected, and samples tested positively for VHS (viral Hemorrhagic septicemia). This virus can easily be transported and spread by moving infected fish, by transporting and using infected baitfish, and by releasing fishing boat live-well or bilge water. It is unknown how exactly it got into Budd Lake though. Anglers should be aware that this disease poses no risk to humans and other warm-blooded animals. Despite this fish kill, the 2007 survey noted a fish community similar to that collected in 1983 and 1999 except the size structure of bass and panfish appears to have improved. VHS remained undetected until 2011, it is suggested that this virus remains in waterbodies once infected but can be at undetected levels.

The objectives of this survey were to 1) identify all fish species present, 2) determine age and growth to evaluate stocking success, and 3) collect limnological data including temperature and dissolved oxygen profiles, nutrient concentrations, and shoreline alterations.

Table 1. Fish stocked by the MI DNR and Budd Lake Association in Budd Lake, Clare County, 1979-2021.

Year	Species	Strain	Number	Average Length (in)	Operation
1979	Tiger Muskellunge	Hybrid	800	5.28	State
1980	Tiger Muskellunge	Hybrid	800	6.77	State
1980	Tiger Muskellunge	Hybrid	1,000	8.46	State
1981	Tiger Muskellunge	Hybrid	2,000	6.57	State
1982	Tiger Muskellunge	Hybrid	2,000	5.83	State



1983	Walleye		3,700	0	Private
1983	Tiger Muskellunge	Hybrid	1,500	7.4	State
1984	Tiger Muskellunge	Hybrid	1,200	7.17	State
1985	Muskellunge	Northern	809	13.7	State
1987	Muskellunge	Northern	1,643	6.18	State
1989	Walleye	Muskegon	19,512	1.81	State
1989	Muskellunge	Northern	772	8.19	State
1991	Walleye	Muskegon	9,655	1.77	State
1992	Walleye	Bay De Noc	10,501	1.97	State
1995	Walleye	Muskegon	22,720	1.81	State
1995	Muskellunge	Northern	2,036	4.02	State
1995	Walleye	Muskegon	8,859	3.5	State
1996	Walleye	Muskegon	21,000	1.69	State
1997	Muskellunge	Northern	285	11.46	State
2000	Muskellunge	Northern	500	10.59	State
2003	Muskellunge	Northern	500	10.67	State
2003	Redear Sunfish		1,100	6	Private
2003	Walleye		115	7.01	Private
2004	Redear Sunfish		400	1.88	Private
2004	Yellow Perch		2,600	2.5	Private
2005	Muskellunge	Iowa	1,000	11.61	State
2006	Walleye	Tittabawassee	20,347	1.85	State
2006	Smallmouth Bass		1,000	3	Private
2006	Yellow Perch		1,625	5	Private
2009	Walleye	Muskegon	13,089	1.58	State
2009	Muskellunge	Iowa	350	10.71	State
2010	Redear Sunfish		1,050	3.46	Private
2011	Largemouth Bass		630	3.51	Private
2012	Smallmouth Bass		2,000	3.43	Private
2012	Muskellunge	Great Lakes	300	9.48	State
2013	Walleye	Muskegon	8,832	1.39	State
2014	Walleye	Muskegon	11,200	1.81	State
2014	Muskellunge	Great Lakes	263	8.94	State
2014	Redear Sunfish		1,150	3.5	Private
2014	Yellow Perch		840	4.5	Private
2015	Black Crappie		1,000	3.43	Private
2015	Yellow Perch		1,500	3.94	Private
2016	Walleye	Muskegon	12,821	2.08	State
2016	Black Crappie		1,000	4.49	Private
2016	Redear Sunfish		1,000	2.82	Private
2017	Muskellunge	Northern	508	9.57	State
2017	Bluegill		1,357	4.53	Private



2017	Yellow Perch		1,000	4.53	Private
2018	Walleye	Muskegon	17,736	1.64	State
2018	Redear Sunfish		750	4.53	Private
2018	Yellow Perch		1,300	5.51	Private
2019	Muskellunge	Northern	350	11.1	State
2019	Black Crappie		1,000	4	Private
2019	Bluegill		1,070	4.5	Private
2020	Redear Sunfish		1,000	4.5	Private
2021	Walleye	Muskegon	13,398	1.58	State
2021	Black Crappie		750	3.5	Private
2021	Yellow Perch		650	3.5	Private

Study Area

Budd Lake is a 175-acre natural lake in Harrison, Clare County (Figure 1). The lake is a closed basin with no major inlets or outlets connecting it to other watersheds. The lake is heavily developed with houses surrounding the shoreline, except for Wilson State Park on the northwest end of the lake. Budd Lake is relatively shallow with a maximum depth of 34 feet and many large shoal areas extending 50-300 feet into the lake. Budd Lake has abundant public access for shore fishing and boat anglers alike. Wilson State Park provides shore fishing and carry-in launch access. A wooden public fishing platform is on the western shoreline of the lake and provides additional shore fishing. Finally, a public boat launch site with 14 parking slots, that is operated and maintained by the city of Harrison, is located off Grant Road.

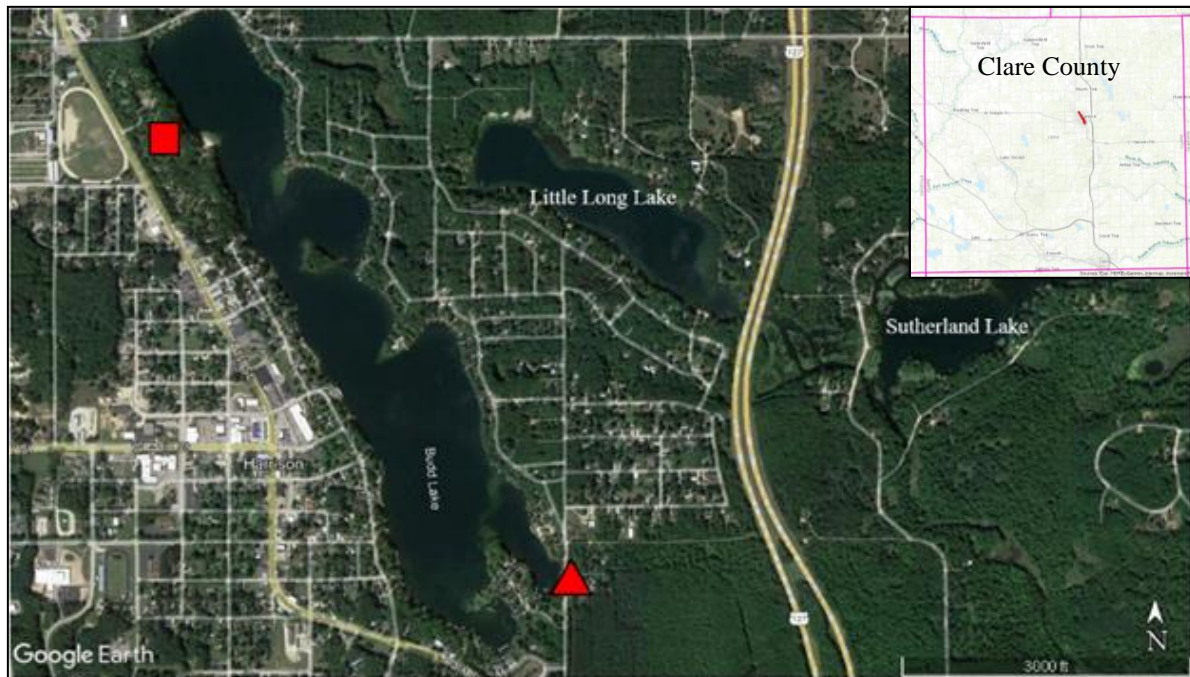


Figure 1. Budd Lake in Clare County, Michigan. The square indicates the location of the Wilson State Park, and the triangle is the location of the public boat launch.



Methods

Budd Lake was surveyed using a variety of gear types outlined in the Status and Trends Lakes protocol from June 7 to June 11, 2021, as described by Wehrly et al. (in press; Figure 2). Sampling gears used included one seine net, one trap net, four experiment gillnets, two small mesh and four large mesh fyke nets, and roughly one mile of shoreline was boomshocked. Total effort for the survey was four seine hauls and 23 net-nights. A limnological survey (e.g. dissolved oxygen and temperature regime, shoreline alteration) was conducted on August 9, 2021.

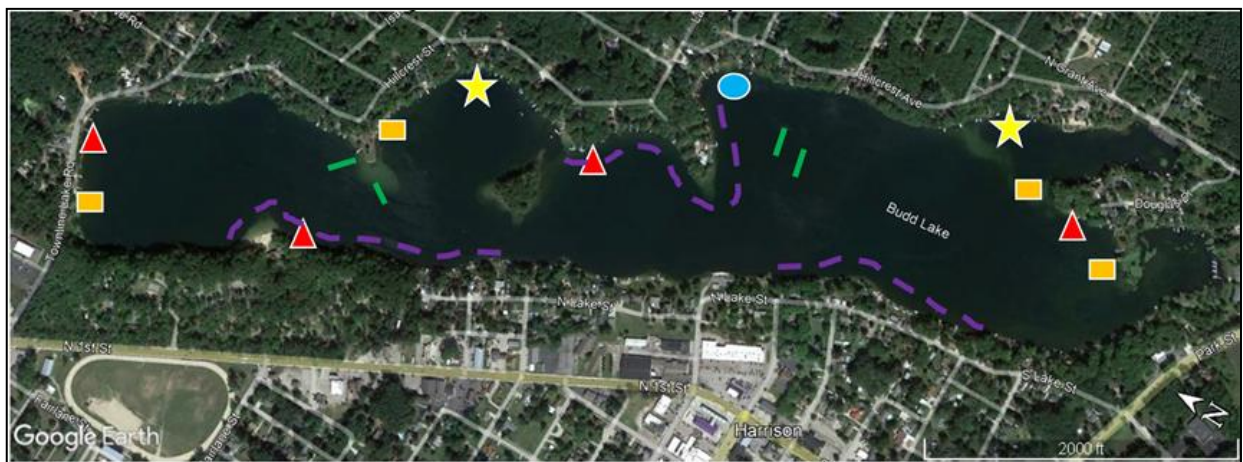


Figure 2. Location of gear set June 7-11, 2021, on Budd Lake. Circle = trap net; Square = large mesh fyke nets; Star = small fyke nets; triangle = seine; gillnet = solid line; boomshocking = dashed line.

Results

Limnology

The lake contained 152 small docks, 34 large docks, 193 dwellings, and 29 submerged trees. Based on data collected in 19 segments around the shoreline, the average percentage of armored shoreline was approximately 17% (0-60%). Docks provide some shade for fish, but submerged trees offer more valuable fisheries habitat.

Water temperatures in Budd Lake were fairly uniform from top to bottom. The thermocline was deep, occurring around 16-18 feet. This depth is where the rapidly dissolved oxygen rapidly declines falls below 2.0 ppm, which is considered hypoxic and inadequate for many fish species, was between 18 and 19 ft. The pH of Budd Lake varied from 9.32 at the surface to 8.38 at the bottom. The specific conductivity ranged from 490 to 562 μ S/cm.

Water temperatures during the netting averaged 75°F.



Table 2. Temperature, dissolved oxygen (DO), and pH profile from the water surface to the bottom in Budd Lake, Clare County, Michigan, August 2021.

Depth (ft)	Temperature (°F)	Dissolved Oxygen (ppm)	pH	Specific conductance (mS/cm)
0	77.00	8.08	9.32	.4900
1	77.00	8.24	9.26	.4930
2	76.90	8.06	9.27	.4930
3	76.90	8.08	9.26	.4930
4	76.90	8.07	9.26	.4920
5	76.80	8.03	9.25	.4920
6	76.50	8.27	9.25	.4920
7	76.40	8.01	9.25	.4920
8	76.30	7.96	9.24	.4920
9	76.10	8.04	9.23	.4930
10	76.00	7.91	9.22	.4920
11	75.60	7.68	9.21	.4930
12	75.30	7.35	9.19	.4930
13	75.00	7.06	9.15	.4930
14	74.60	6.61	9.11	.4940
15	74.10	6.05	9.06	.4950
16	73.60	5.55	9.01	.4960
17	72.60	4.62	8.96	.5000
18	70.60	2.86	8.89	.5060
19	69.30	1.56	8.82	.5090
20	67.30	0.94	8.77	.5130
21	64.40	0.76	8.73	.5150
22	62.00	0.92	8.71	.5140
23	59.30	1.12	8.68	.5150
24	58.50	0.49	8.58	.5260
25	56.60	0.30	8.49	.5400
26	56.30	0.26	8.41	.5570
27	56.60	0.23	8.38	.5620



Fisheries

A total of 3,313 fish representing 18 species were captured in Budd Lake (Table 3). The fish community was dominated by panfish (76% by number) and made up largely by Bluegill (61.3%). All other species collected made up 7% or less of the fish community. The sport piscivore community included Largemouth Bass, Muskellunge, Northern Pike, and Walleye which made up roughly 5.5% of the total catch by number but 32.8% by weight (lbs.). Additional 'roughfish' piscivores included Bowfin, Brown Bullhead, and Yellow Bullhead and made up only 3% of the total catch by number and just over 13% by weight. The forage base for small piscivorous fish species collected in this survey was made up of Blackchin Shiner, Banded Killifish, Bluntnose Minnow, and Sand Shiner. These species made up 15.5% of the total catch and all ranged from 1 to 2 in.

A total of 21 Black Crappie averaging 8.6 in were collected with 95% of the catch larger than the 6-in minimum size limit (MSL). Large mesh fyke nets and trap nets accounted for 43% and 52% of the total catch, respectively. The remaining catch was collected using small mesh fyke nets. All three gear types captured individuals of similar size. Age and growth analysis indicated Black Crappie were growing below state average with a mean growth index of -1.1. Multiple year classes (ages 3-8) were found suggesting stable recruitment to the harvestable fishery.

A total of 2,032 Bluegill averaging 4.9 in were collected with all six survey gear types with 28% of the catch larger than the 6-in MSL. Large and small fyke nets accounted for 69% of the total catch with seine nets accounting for the smallest percentage (0.2%) of Bluegill caught. Experimental gillnets, large mesh fyke nets, and trap nets captured the largest Bluegill with a mean total length of 6 in. Bluegills captured in seines and small fyke nets were the smallest with a mean total length of 1.6 in. Age and growth analysis indicated Bluegill were growing slightly below state average with a mean growth index of -0.8. A Schneider Index score of 1.75 was calculated based on several of the above parameters, which indicated that this bluegill population is generally poor to very poor (Schneider 1990). This is a decrease from the 2007 score of 2.5 (poor to acceptable). However, multiple year classes (ages 3-10) were found suggesting stable recruitment to the harvestable fishery.

A total of 214 Pumpkinseed averaging 6.8 in were collected with 92% of the catch larger than the 6-in MSL. All gear types captured Pumpkinseed with the large mesh fyke net accounting for 67% of the total catch. The experimental gillnet and small mesh fyke net caught the smallest (on average) and fewest individuals. Age and growth analysis indicated Pumpkinseed were growing slightly above state average with a mean growth index of +0.4. Multiple year classes (age 1-10) were found suggesting stable recruitment to the harvestable fishery.

In addition to the above panfish, Budd Lake has a harvestable population of Green Sunfish. Green Sunfish averaged 4.5 in with 67% being larger than the 6-in MSL. Twelve hybrid sunfish were collected in Budd Lake with an average length of 7.2 in. These individuals were not aged. This hybridization could be natural or the result of 2017 and 2019 stocking events.



A total of 158 Largemouth Bass averaging 11.3 in were collected with 28% of the catch larger than the 14-in MSL. Electrofishing accounted of 76% of the total catch followed by large mesh fyke nets (16%) and trap nets (8%). There were no large differences in mean TL of Largemouth Bass captured among all three gear types. Age and growth analysis indicated Largemouth Bass were growing below the state average with a mean growth index of -1.0. Multiple year classes (ages 1-9) were found suggesting stable recruitment to the harvestable fishery.

A total of 53 Yellow Perch averaging 8.7 in were collected with 57% of the catch larger than the generally accepted 7-in minimum size for harvest (although there is not a mandated MSL). Experimental gillnets accounted for 87% of the total catch with most of the remaining catch captured in the large mesh fyke nets (13%). The large mesh fyke nets caught the largest individuals on average (10.1 in) compared to the gillnet (7.3 in). Age and growth analysis indicated Yellow Perch were growing below state average with a mean growth index of -1.2. Multiple year classes (ages 3-9) were found suggesting stable recruitment to the harvestable fishery.

A total of 19 Northern Pike averaging 23.9 in were collected with 37% of the catch being larger than the 24 in MSL. Experimental gillnets accounted for 79% of the total catch followed by the large mesh fyke net and trap net. All harvestable individuals were collected in the gillnet and trap net. Age and growth analysis indicated Northern Pike were growing below state average with a mean growth index of -1.0. Multiple year classes (ages 2-9) were found suggesting stable recruitment to the harvestable fishery.

One 35.5-in Muskellunge and one 22.5-in Walleye was captured in the large mesh fyke net and experimental gillnet, respectively. The Muskellunge was age-17 and tagged with a PIT tag (3d91bf20cbf28). The Walleye was age-15. Neither individual was a recapture from the 2021 discretionary survey that was conducted in April.

Table 3. Fish species captured during the June 2021 Status and Trends survey on Budd Lake. Columns represent number of fish, percent by number, length range (in) and mean length of each species captured.



Species	Number	Percent by number	Length Range (in.)	Mean Length (in.)
Banded killifish	90	2.7	1-2	2.4
Black crappie	21	0.6	6-12	8.6
Blackchin shiner	2	0.1	1-1	1.5
Bluegill	2,032	61.3	1-8	4.9
Bluntnose minnow	187	5.6	1-2	2
Bowfin	6	0.2	19-31	25.4
Brown bullhead	40	1.2	7-13	11.1
Green sunfish	3	0.1	2-6	4.5
Hybrid Sunfish	12	0.4	5-8	7.2
Largemouth bass	158	4.8	4-19	11.3
Muskellunge	1	0	35-35	35.5
Northern pike	19	0.6	19-32	23.9
Pumpkinseed	214	6.5	2-9	6.8
Rock bass	183	5.5	1-11	7.2
Sand shiner	234	7.1	1-2	2.1
Walleye	1	0	22-22	22.5
Yellow bullhead	57	1.7	6-12	9.7
Yellow Perch	53	1.6	6-12	8.7

Conclusions

The timing of the Status and Trends surveys are not ideal for targeting Muskellunge, Walleye, and Northern Pike; therefore, our survey likely underrepresented the population size of these predatory fish species. This is also supported by the results of the 2021 ice-out discretionary survey where 23 Muskellunge, 4 Northern Pike, and 4 Walleye were captured, which is a more appropriate time of year to target these species. Status and Trends surveys are timed to provide a snapshot of the entire community (late spring – early summer). The size structure of all species aged, except Pumpkinseed, were below state average, contrary to the 2007 survey. Results of this survey, combined with the recent discretionary surveys, suggest a predator-prey imbalance with a high abundance of predator species. The high presence of predation can cause prey species, like panfish, to mature at a smaller size to ensure the survival of the species. Midwest Glacial Lakes Partnership (MGLP) rank the shoreline disturbance at 62% on Budd Lake, which is well above the state average of roughly 40%. Along with the high abundance of predators, shoreline disturbance of Budd Lake likely plays a significant role in the poor size structure of this diverse community as all species collected depend on littoral zone vegetation at some point in their life cycle.



Despite the poor size structure, a wide range of ages were collected for each species indicating successful recruitment into the fishery and offers a wide range of angling opportunities. The use of best management practices for shoreline protection (e.g. replacement of seawalls with vegetation and woody structures) is highly recommended for Budd Lake. The reduction or elimination of predator stocking (Muskellunge and Walleye) should be considered when the prescription (Rx 3273) expires in 2023.

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