

## **Bush Lake**

Oakland County, 05N, 07E, Section 34  
Shiawassee River Watershed, last surveyed 2024

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### **Environment**

Bush Lake, a 110-acre lake near Holly, Michigan (Figure 1), is a medium (100-1,000 ac), deep (thermally stratified), mesotrophic lake supporting warm- and cool-water fish species within the Shiawassee River watershed. The substrate in Bush Lake is dominated by sand in areas less than ten ft deep and organic muck at greater depths (Figure 2). Despite the sandy substrate, aquatic vegetation is abundant in the littoral zone and provides the primary form of fish cover. Bush Lake has a deep basin at the southwest end with a maximum depth of 47 ft and another shallower basin at the north end, separated by a sandy shoal (Figure 2). The landscape within the 698-acre catchment area of Bush Lake is primarily developed with some wetlands and forested areas as well (Figure 3).

Bush Lake has a small inlet and outlet. Water flows into Bush Lake via a narrow canal under Grange Hall Road from Lake Mauna Loa. Water leaves the lake over Bush Lake Dam. The gravity dam is owned by the Village of Holly. A new water control structure was built in 2011 and has a structural height of 5.5-ft and a head height of 4.5-ft. The structure has a low downstream hazard potential and received a "satisfactory" rating during the 2022 inspection.

### **History**

Bush Lake was previously sampled by Fisheries Division in July 1985. That survey utilized trap nets and spanned two nights. A total of 673 fish representing 12 different species were collected (Table 1). Most of the fish captured in the survey were Bluegill *Lepomis macrochirus* (60%) and Pumpkinseed *Lepomis gibbosus* (14%). No other surveys by Fisheries Division have occurred at Bush Lake. Additionally, no recent stocking events have taken place. However, Bluegill, Largemouth Bass *Micropterus salmoides*, and Yellow Perch *Perca flavescens* were stocked by the Department of Natural Resources in the 1930s and 1940s (Table 2).

### **Current Status**

The most recent survey for Bush Lake was a fish community survey completed May 13 to May 16, 2024. This survey utilized three large-mesh fyke nets, two small-mesh fyke nets, two experimental gill nets, one trap net, seining, and nighttime boat electrofishing to capture a wide variety of the fish community (Wehrly et al. 2015; Table 3). Total effort for the survey was nine net-nights for large-mesh fyke nets, four net-nights for small-mesh fyke nets, four net-nights for experimental gill nets, three net-nights for trap nets, four seine hauls, and 65 min of electrofishing. The purpose of this survey was to collect information on a range of fish species and size classes by using multiple gear types in different habitats. The objectives were to determine fish species present and relative abundance, size-structure, and mean growth index for select species.

All fish captured were identified to species and measured to total length (TL; inch group). For Northern Pike *Esox lucius*, Largemouth Bass, and panfish, the ages of up to 10 fish per inch group were estimated

from scale and spine samples. To estimate age from scales, four to six scales were pressed onto acetate film and the impressions were viewed under a microscope. For estimating age from dorsal spines, a thin cross-section of the dorsal spine was cut using a Dremel grinding and cutting tool. Mineral oil was added to the section for clarity when viewed under a microscope. Mean growth indices were calculated as described by Schneider et al. (2000) for age groups represented by five or more fish.

A total of 2,273 fish representing 25 species were collected during this survey (Table 4). A variety of panfish were captured including Bluegill, Black Crappie *Pomoxis nigromaculatus*, Pumpkinseed, Rock Bass *Ambloplites rupestris*, and Yellow Perch. Bluegill were the most frequently captured panfish species in the survey, with individuals ranging from 1-9 in (mean TL = 5.5 in; Table 4). Over 30% of the 1,273 Bluegill captured were larger than 6 in (Table 4), which is the assumed minimum length at which anglers typically consider them suitable for harvest. The mean growth index of Bluegill was -0.4, which suggests growth rates are like the statewide average, and the oldest individual captured was estimated to be nine years old. The Bluegill population in Bush Lake scored a "poor/acceptable" rating using the Schneider Index for classifying Bluegill populations (Schneider 1990). Rock Bass, the next most frequently captured panfish species in the survey, ranged in size from 1-10 in (mean TL = 7.0 in; Table 4). Almost 70% of the Rock Bass captured were above the angler-preferred 6 in minimum length for harvest (Table 4). There were 70 Pumpkinseed captured, and they ranged in size from 4-8 in (mean TL = 7.2 in; Table 4). Over 90% of the 70 Pumpkinseed captured were above the angler-preferred 6 in minimum length for harvest (Table 4). The mean growth index for Pumpkinseed was 1.3, which suggests their growth was much faster than the statewide average. However, only three of the seven age classes represented had over five individuals for the growth index to be calculated. Therefore, the exceptional growth rate should be interpreted with some caution. The oldest Pumpkinseed captured was estimated to be 10 years old.

Bowfin *Amia calva*, Largemouth Bass, Longnose Gar *Lepisosteus osseus*, and Northern Pike were the top predators captured in Bush Lake. A total of 93 Largemouth Bass up to 18 in long (mean TL = 10.2 in; Table 4) were collected; 38% of the fish exceeded the 14 in minimum size limit (Table 4). Largemouth Bass had a mean growth index of -0.3, suggesting they are growing at an average rate compared to populations across the state. Furthermore, twelve year classes of Largemouth Bass were present in the system, with the oldest individual estimated to be twelve years old. Seventeen Northern Pike were captured, and they ranged in size from 13-26 in TL (Table 4). Only three of the Northern Pike exceeded the 24 in minimum length limit for harvest. Too few Northern Pike were sampled to make inferences about growth rates.

Several forage species were captured in the survey including Bluntnose Minnow *Pimephales notatus*, Brook Silverside *Labidesthes sicculus*, Brook Stickleback *Culaea inconstans*, Central Mudminnow *Umbra limi*, Johnny Darter *Etheostoma nigrum*, Logperch *Percina caprodes*, Mimic Shiner *Notropis volucellus*, and Sand Shiner *Notropis stramineus*.

A continuously recording (1-hr interval) temperature logger was deployed April 23, 2024, and retrieved October 2, 2024. The device was attached to a t-stake and submerged approximately 1 ft below the surface. July had the highest mean monthly surface water temperature. Additionally, the highest mean daily surface water temperature was 83°F and occurred on August 1, 2024 (Figure 4).

### Analysis and Discussion

The fish community of Bush Lake can be described as follows:

1. The panfish community is clearly dominated by Bluegill with consistent reproduction and recruitment. The Bluegill population is abundant, but harvest is likely limited based on size-structure.
2. Black Crappie, Pumpkinseed, Rock Bass, Warmouth *Lepomis gulosus*, and Yellow Perch are present at lower abundances.
3. Largemouth Bass population with consistent recruitment and average growth rates.
4. Northern Pike population with few individuals available for harvest.
5. Diverse forage population with various abundances across species.

The Bush Lake fish community is comprised of primarily warm water species and aligns with the expansive littoral zone. The panfish community in Bush Lake offers diversity with some opportunity for harvest. The Schnieder Index score for Bluegill in Bush Lake was "poor/acceptable," however some fish (>30% of the catch) were larger than 6 in TL. Proportional stock density (PSD) estimates the ratio of "stock" sized fish, to the total population of fish captured. Stock size for Bluegill is 6 in and the PSD for Bluegill captured in nets was 44, while Largemouth Bass PSD from the electrofishing catch was 63 (Figure 5). This suggests the populations of these species are relatively balanced. Both Largemouth Bass and Bluegill growth rates were similar to the statewide average for each species. In some cases, high densities of predators or prey results in slow growth rates and a low PSD.

The largest component of the predator fish community was Largemouth Bass. Largemouth Bass are both an effective predator and popular species for anglers to target. Largemouth Bass growth in Bush Lake is average compared to growth rates across the state and the largest individual captured was 18 in TL. Additionally, the age-structure estimates from Largemouth Bass indicate some level of recruitment is occurring each year. Conversely, few Northern Pike were collected, and Bush Lake has a limited amount of deep, cool water habitat which Northern Pike prefer during summer.

The forage fish community is diverse in Bush Lake and adds to the overall diversity of the fish community. Wehrly et al. (2015) reported the mean number of species collected in other medium-sized, deep lakes sampled in the Southern Lake Huron Management Unit was 14.3 and this survey documented 25 species.

### Management Direction

Future management ideas for Bush Lake include:

1. Protect undeveloped areas of watershed.
2. Rehabilitate and mitigate disturbed shoreland areas.

No specific fisheries management actions are proposed for Bush Lake and no changes to fishing regulations are recommended. Natural recruitment is sustaining the fish community in this system and no stocking efforts are necessary.

Bush Lake is like many inland lakes in southeast Michigan with extensive development within the watershed and along the shoreland. It is estimated that almost 50% of the Bush Lake watershed and 50% of the Bush Lake shoreland are disturbed according to the Midwest Glacial Lakes Partnership

Conservation Planner (<http://ifrshiny.seas.umich.edu/mglp/>). The recommendation is to protect the undeveloped areas of the watershed and rehabilitate the developed shoreland areas by encouraging private riparian landowners to maintain a portion of their shoreline undeveloped or with a greenbelt. Some undisturbed areas exist in the northwest part of the lake and need to be valued. Several riparian owners have manicured turf grass to the water's edge. Native plantings along the shoreline and buffer strips with no-mow sections should be implemented. These changes will provide better habitat in the riparian area and reduce unnatural nutrient inputs to Bush Lake. Shoreline Living, a document produced by the Midwest Glacial Lake Partnership, provides success stories aimed at riparia owners interested in improving their shoreline to be more environmentally beneficial.

### References

- Midwest Glacial Lakes Partnership. 2019. Midwest Glacial Lakes Partnership Conservation Planner. Available from: [midwestglaciallakes.org/conservationplanner](http://midwestglaciallakes.org/conservationplanner).
- Schneider, J. C. 1990. Classifying bluegill populations from lake survey data. Michigan Department of Natural Resources, Fisheries Technical Report No. 90-10. Ann Arbor.
- Schneider, J. C., P. W. Laarman, and H. Gowing. 2000. Age and growth methods and state averages. Chapter 9 in Schneider, J. C. (editor). 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor, MI.
- Wehrly, K. E., D. B. Hayes, and T. C. Wills. 2015. Status and trends of Michigan inland lake resources 2002-2007. Michigan Department of Natural Resources Fisheries Report 08. Institute for Fisheries Research, Ann Arbor, Michigan.

**Table 1.** Species, catch, length range (inches), and average length (inches) for all species caught during 1985 survey in Bush Lake, Oakland County, Michigan.

<b>Species</b>	<b>Catch</b>	<b>Length range (in.)</b>	<b>Average length (in.)</b>
Black Crappie	29	4-8	7.8
Bluegill	401	3-8	5.4
Bowfin	9	15-27	21.7
Brown Bullhead	45	8-14	11.1
Green Sunfish	1	5	5.5
Largemouth Bass	23	6-12	9.2
Longnose Gar	13	19-34	26.2
Northern Pike	1	23	23.5
Pumpkinseed	94	4-7	5.6
Rock Bass	14	4-7	5.8
Yellow Bullhead	42	7-12	9.8
Yellow Perch	1	8	8.5

**Table 2.** Stocking year, species, and number stocked in Bush Lake, Oakland County, Michigan.

<b>Year</b>	<b>Species</b>	<b>Number</b>
1933	Bluegill	4,000
1934	Bluegill	2,000
1935	Bluegill	3,000
	Yellow Perch	5,000
1936	Bluegill	2,000
	Largemouth Bass	525
	Yellow Perch	5,000
1937	Bluegill	8,000
	Largemouth Bass	450
1938	Bluegill	4,550
1939	Bluegill	3,000
	Bluegill	4,000
	Yellow Perch	2,000
1940	Bluegill	5,000
	Largemouth Bass	300
1941	Bluegill	4,000
	Largemouth Bass	800
1942	Bluegill	10,000
	Largemouth Bass	800
1943	Bluegill	5,000
	Largemouth Bass	400
1944	Bluegill	2,000
	Largemouth Bass	500
1945	Bluegill	2,400
	Largemouth Bass	480

**Table 3.** Gear specifications for the 2024 survey in Bush Lake, Oakland County, Michigan.

<b>Gear Type</b>	<b>Stretch Mesh Size (in)</b>	<b>Pot Dimensions (length x width, ft)</b>	<b>Lead Dimensions (length x width, ft)</b>	
Trap net	1.5	8 x 5	150 x 6	
Large-mesh fyke net	1.5	6 x 4	100 x 4	
Small-mesh fyke net	0.18	6 x 3.5	50 x 4	
	<b>Stretch Mesh Size (in)</b>	<b>Stretch Mesh Increment (in)</b>	<b>Panel Dimensions (length x width, ft)</b>	<b>No. of Panels</b>
Experimental gill net	1.5-4.0	0.5	25 x 6	5
	<b>Stretch Mesh Size (in)</b>	<b>Total Length (ft)</b>	<b>Height (ft)</b>	
Seine	0.18	25	5	
	<b>Current</b>	<b>Duty Cycle</b>	<b>Amps</b>	
Electrofishing	Pulse DC	60	7	

**Table 4.** Species, catch, length range (inches), and average length (inches) for all species collected during 2024 survey in Bush Lake, Oakland County, Michigan. Percent of individuals above legal size or estimated acceptable size for harvest for select species collected. Harvestable size is assumed to be 6 in for Bluegill, Green Sunfish, Hybrid Sunfish, Pumpkinseed, and Rock Bass, and 7 in for Black Crappie and Yellow Perch. Legal size for harvest is 14 in for Largemouth Bass and 24 in for Northern Pike.

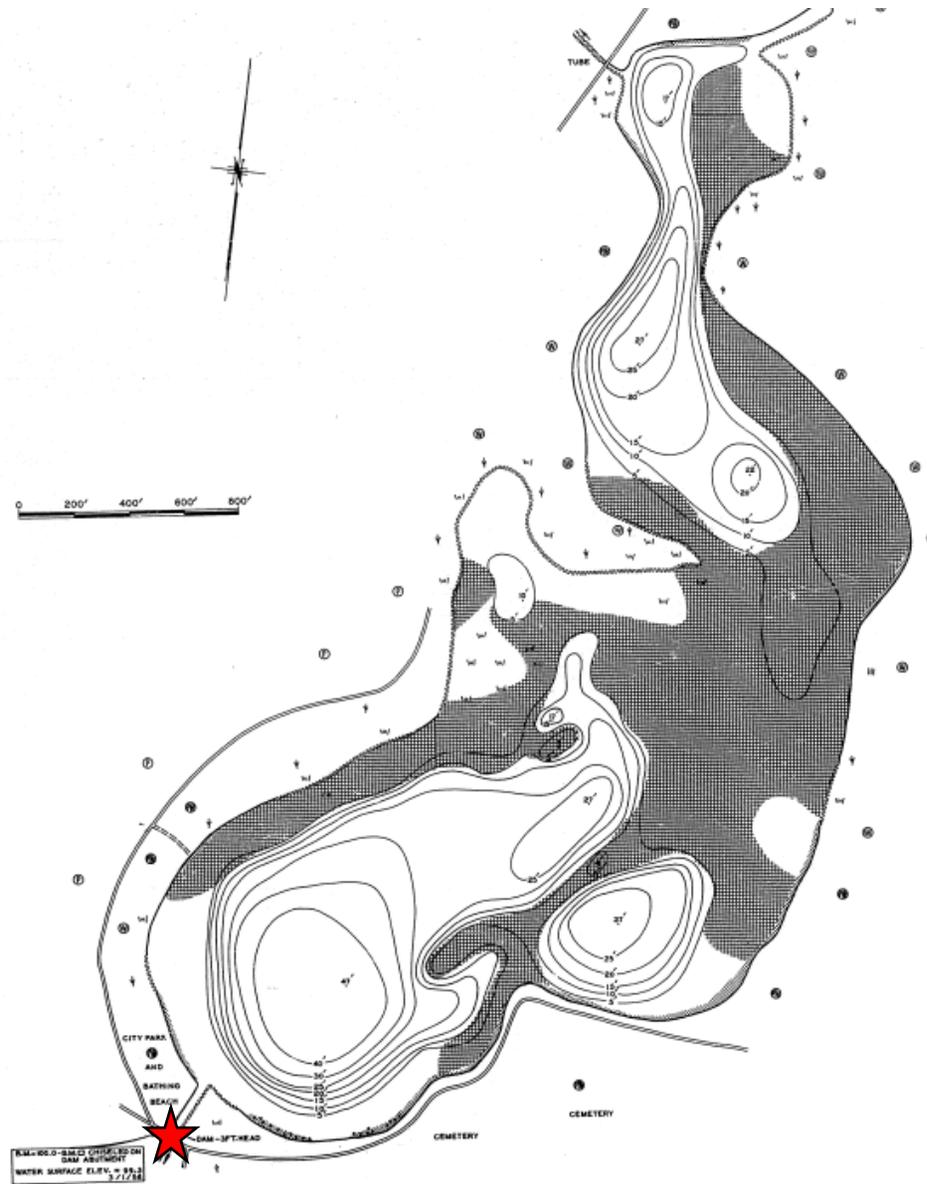
<b>Species</b>	<b>Catch</b>	<b>Length range (in.)</b>	<b>Avg. length (in.)</b>	<b>Percent harvestable</b>
Black Crappie	22	8-11	9.4	100
Bluegill	1,273	1-9	5.5	37
Bluntnose Minnow	281	1-3	2.3	-
Bowfin	8	20-23	22.4	-
Brook Silverside	1	3-3	3.5	-
Brook Stickleback	1	1-1	1.5	-
Brown Bullhead	19	10-14	12	-
Central Mudminnow	2	2-2	2.5	-
Common Carp	4	20-34	27.2	-
Grass Pickerel	2	7-9	8.5	-
Green Sunfish	1	4-4	4.5	0
Hybrid Sunfish	3	5-7	6.8	67
Johnny Darter	1	1-1	1.5	-
Largemouth Bass	93	2-18	10.2	38
Logperch	79	1-2	1.8	-
Longnose Gar	16	25-37	29.2	-
Mimic Shiner	46	1-1	1.5	-
Northern Pike	17	13-26	21.6	18
Pumpkinseed	70	4-8	7.2	94
Rock Bass	99	1-10	7	69
Sand Shiner	100	1-1	1.5	-
Warmouth	35	2-6	5.2	20
White Sucker	1	16-16	16.5	-
Yellow Bullhead	95	6-13	10.6	-
Yellow Perch	4	4-7	5.7	25



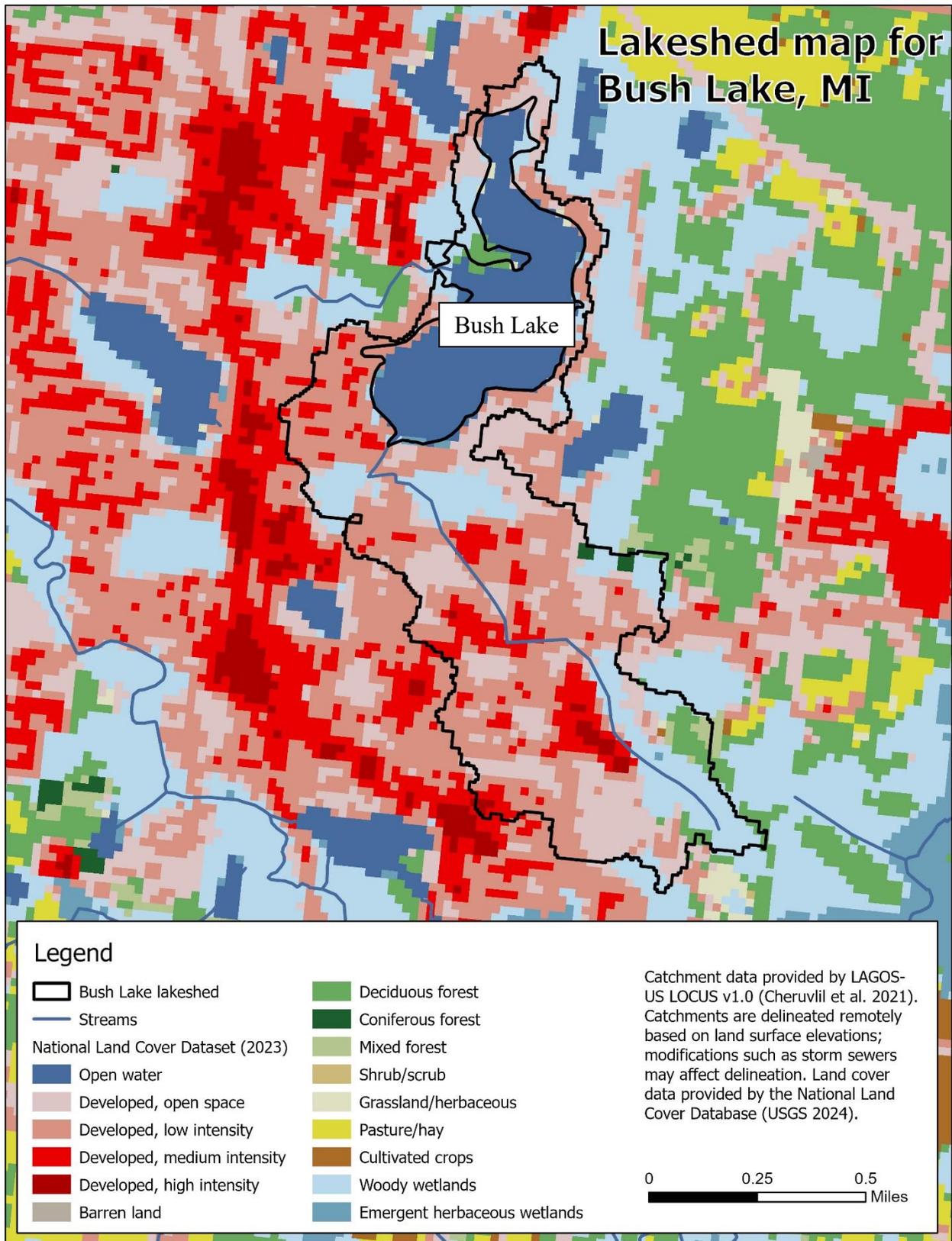
**Figure 1.** Lakedshed map for Bush Lake, Oakland County, Michigan.

INSTITUTE FOR FISHERIES RESEARCH  
 DIVISION OF FISHERIES MICHIGAN CONSERVATION DEPT.  
 LAKE INVENTORY MAP  
**BUSH LAKE**  
 AREA 110 ACRES  
 MARGINAL SURVEY AND SOUNDINGS 2/27 28 29 & 3/1/56  
 OAKLAND COUNTY T.5 N.R.7.E.SEC.5,27,34

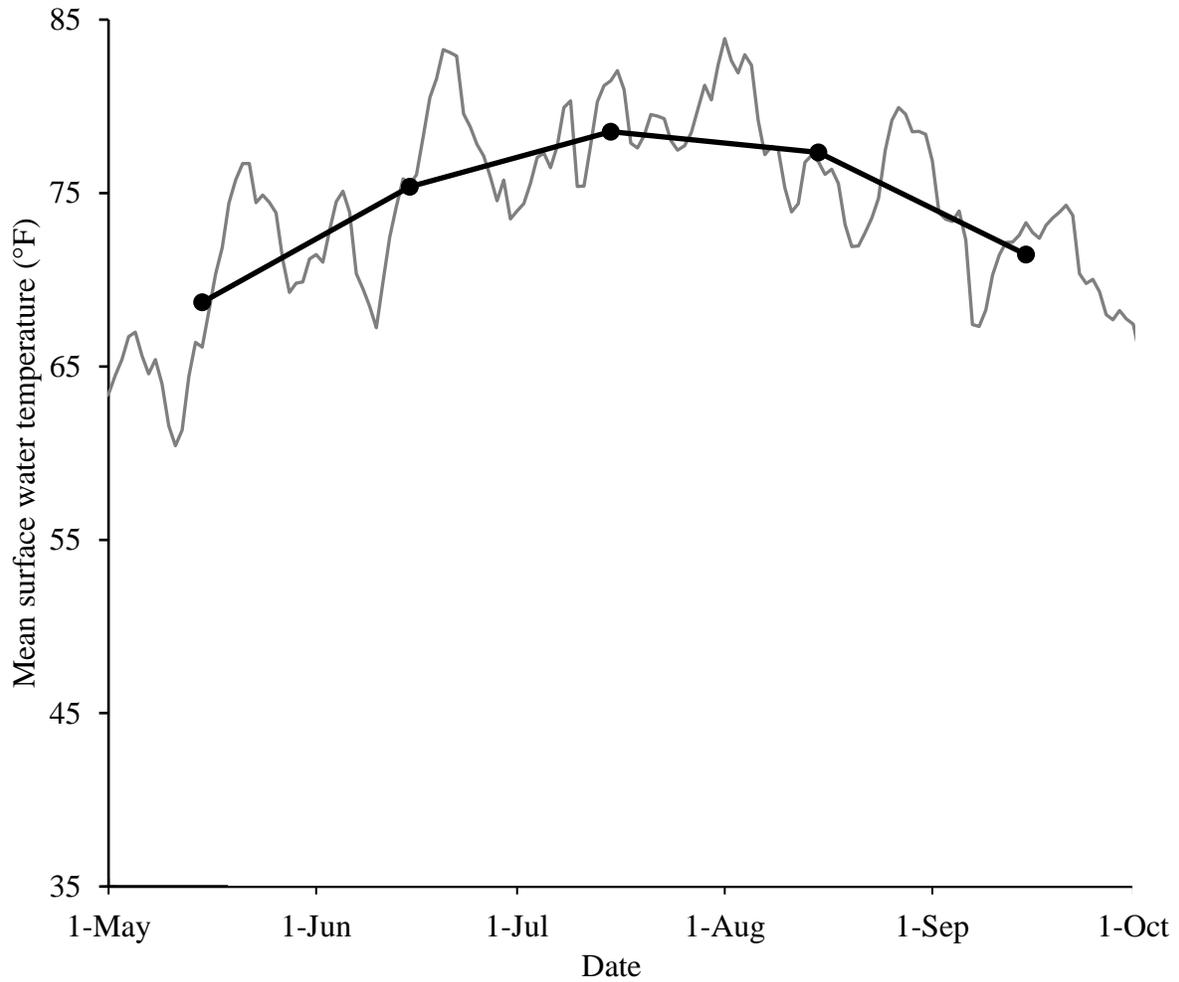
- LEGEND**
- BOTTOM**
- Sand
  - ▨ Marl
  - Organic
  - ⋯ Gravel
- OUTLINE & CONTOURS**
- Shoreline
  - Contours
- SHORE FEATURES**
- ▨ Slope
  - Improved road
  - - - Unimproved road
  - - - Encroaching shore
  - W Marsh
  - † Brush
  - ⊙ Wooded
  - ⊙ Partly wooded
  - ⊙ Pasture
  - Outlet



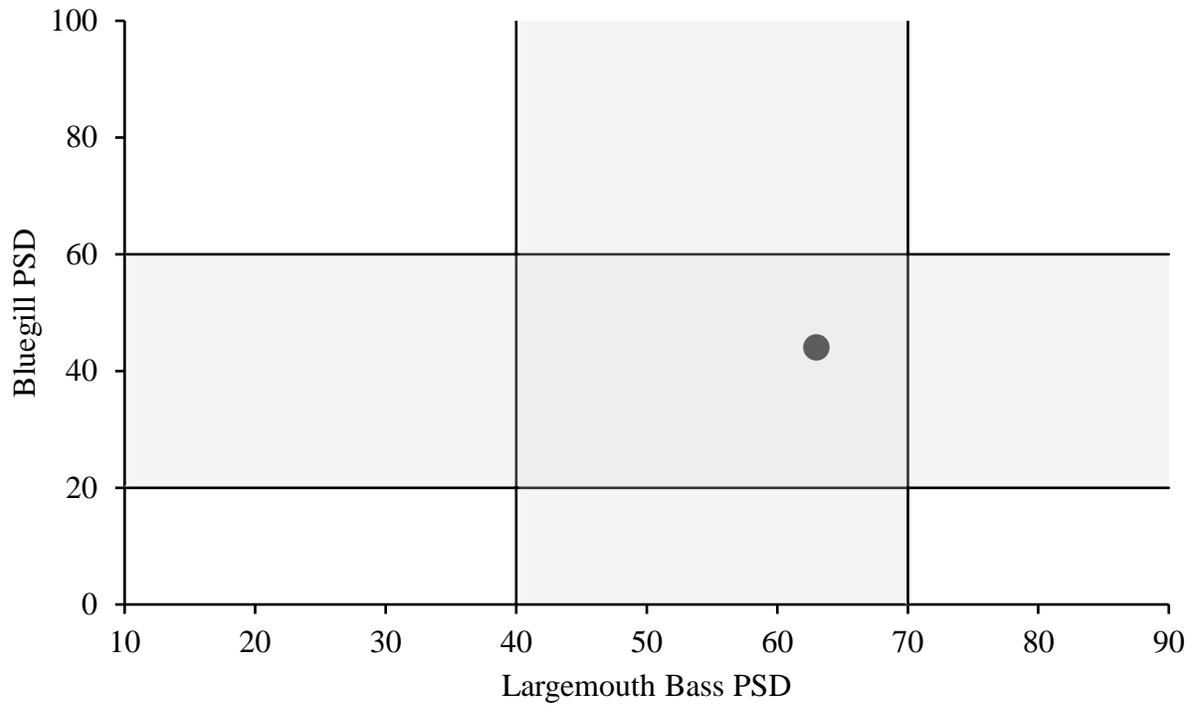
**Figure 2.** Bush Lake, Oakland County, Michigan bathymetric map with Bush Lake Dam denoted by red star.



**Figure 3.** Land cover within the network catchment for Bush Lake, Oakland County, Michigan.



**Figure 4.** Mean daily (grey line) and mean monthly (black line) surface water temperature in Bush Lake, Oakland County, Michigan from May to October 2024.



**Figure 5.** Tic-tac-toe plot of Proportional Size Distribution (PSD) values for Bluegill and Largemouth Bass collected during 2024 survey in Bush Lake, Oakland County, Michigan. Overlapped shaded areas represent a balanced predator-prey relationship.

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