Indian Lake
Livingston County, T04N, R05E S17
Shiawassee River Watershed, Last surveyed 2015

Joseph M. Leonardi, Fisheries Biologist

Environment

Indian Lake (aka: Indian Lake South) is located in north Livingston County near Howell, MI and lies within the Oak Grove State Game Area (Figures 1 & 2). It is one of three lakes (Bain, Patterson) associated with the headwaters of the Yellow River Drain - a tributary to the South Branch Shiawassee River. The South Branch Shiawassee River flows northerly to the mainstem Shiawassee River which flows to the Saginaw River which discharges into Saginaw Bay of Lake Huron.

The Yellow River Drain watershed lies within the Ionia district of the Southern Lower Michigan Regional Landscape Ecosystem and is described by features identified in the Lansing sub-district (Albert 1994). The Lansing sub-district description includes medium textured ground moraines with kettle lakes and wetlands dispersed among pitted outwash deposits. Soil textures range from sand to clay with a common occurrence of sandy loam on the elevated moraines, sand on the outwash, and organic peat in the depressions. The topography of the Yellow River Drain watershed is characterized by undulating hills which represents the highest elevations in the Shiawassee River watershed.

Indian, Bain, and Patterson lakes are considered mesotrophic kettle lakes. They are surrounded by undulating hills whose depressions form an extensive wetland drainage complex. Although agriculture is the dominant land use, the immediate area is undeveloped wetland and oak-hickory forest. The State of Michigan (DNR, Wildlife Division) owns most of the land surrounding Indian Lake and manages it as the Oak Grove State Game Area.

Indian Lake is elongate in shape with an irregular shoreline. It is estimated to be 78 acres with a perimeter of 4.2 miles and a fetch of 0.9 miles. Indian Lake is characterized by having abrupt contour changes reaching a maximum depth to 43 feet (Figure 3). The bottom substrate is a combination of sand and organic matter in the littoral and general muck in the deep water zone. The lake is classified as a warmwater lake where mid-summer water temperature in the epilimnion is typically >70F. Limnological parameters measured in August 2015 found thermocline development between 9-21 feet. Critical oxygen concentration (>3 mg/l) was not available at depths >15 feet. pH ranged from 8.0 at the surface to 7.5 at the lake bottom and total alkalinity was 198 mg/L. August measurements of secchi disk (10.0 ft.), total phosphorus (8.7 ug/L), and chlorophyll-a (2.5 ug/L) yielded a Trophic Status Index (TSI) of 40 on a scale of 0-100. A TSI of 40 is consistent with mesotrophic classification. Mesotrophic lakes generally have intermediate nutrient levels, moderate water clarity, relatively abundant aquatic vegetation, and support diverse biological communities. All limnological parameters measured in 2015 were consistent with previous measurements and are typical of the region.

Aquatic vegetation is common and seasonally excessive in the shallow water of Indian Lake. Emergent cattails, bulrushes, leather-leaf, and arrowhead surround the lake perimeter. Chara, water lily, milfoil, and curly-leaf pondweed are common submergent vegetation. Collectively, this vegetation provides the principle cover for fish and other aquatic oriented organisms.

Development is light on Indian Lake and virtually all of the shoreline remains in a natural state of emergent vegetation. Four private residences exist on the west shore but are located well off the open water perimeter. DNR, Wildlife Division maintains a boat access site on Latson Road (Figure 1). The boat launch is small and only convenient for small boats (< 16 ft.). Bain and Patterson lakes are also accessed using this boat launch. No-wake restrictions apply to Indian, Bain, and Patterson lakes.

History

No specific fisheries management has occurred on Indian Lake. The lake has self-sustained its warmwater fishery. Fish community surveys conducted in 1980, 1993, and 2001 have documented at least 18 species of fish (Table 1). Historic surveys indicate a stable fish community dominated by Bluegill, Largemouth Bass, Black Crappie, Pumpkinseed, Northern Pike, and bullhead (spp.).

Current Status

In May 2015, Fisheries Division conducted a fisheries survey of Indian Lake using large and small mesh fyke nets, experimental gill nets, and electrofishing equipment. The use of multiple gear types helps to present a generalized picture of the fish community. Large mesh fyke nets are used to capture larger (>3 inches) fish species that inhabit the littoral zone or that move inshore at night. Small mesh fyke nets capture representative samples of small-bodied nongame species and smaller sizes (<3 inches) of sport fishes that inhabit the littoral zone. Experimental gill nets sample fishes that occupy offshore waters and are particularly effective at capturing Yellow Perch and Northern Pike. Night electrofishing is best at capturing species and life stages that inhabit the littoral zone or that move inshore at night and is particularly effective with catching Largemouth Bass.

A total of 1,106 fish representing 18 species were collected in the 2015 survey (Table 2). Electroshocking accounted for 51% of the total catch, large mesh fyke nets accounted for 42%, small mesh fyke nets accounted for 6%, and experimental gill nets accounted for 1%, respectively. Bluegill were the most common species accounting for 56% of the catch. Largemouth Bass comprised 13% of the catch. Yellow and brown bullheads comprised 10% of the catch followed by Pumpkinseed (5%), Black Crappie (4%), Warmouth (2%), and Northern Pike (1%). Blackchin Shiner, Bowfin, Common White Sucker, Grass Pickerel, Green Sunfish, Lake Chubsucker, and Yellow Perch were collected in low abundance.

A total of 620 Bluegill averaging 5.0 inches were collected in the 2015 survey (Table 2). Forty-nine percent of the Bluegill were collected electrofishing and 43% were collected with large mesh fyke nets. Average size of the Bluegill large mesh fyke net catch was 5.9 inches compared to 4.7 inches with electrofishing gear. Forty-seven percent of the large mesh fyke net catch met or exceeded the acceptable harvest size of 6 inches compared to 19% electrofishing. Bluegill size structure was dominated by fish in the 4-6 inch size range. Age and growth analysis indicated Bluegill were growing at State average having a mean growth index of -0.1 (Table 3). Multiple year classes (n=7) were present and longevity appeared to peak at 6 years.

A total of 140 Largemouth Bass averaging 10.2 inches were collected in the 2015 survey (Table 2). Night electrofishing accounted for 91% of the catch and large mesh fyke nets accounted for 7% of the

catch. Average size of Largemouth Bass collected electrofishing was 10.2 inches compared to 8.7 inches collected with large mesh fyke nets. Fourteen percent of the total Largemouth Bass catch met or exceeded the minimum size limit of 14 inches. Age and growth analysis indicated Largemouth Bass were growing below State average having a mean growth index of -0.4 (Table 3). Multiple year classes were evident (n=9) and Largemouth Bass longevity appeared to extend beyond 7 years.

A total of 56 Pumpkinseed sunfish averaging 5.6 inches were collected in the 2015 survey (Table 2). Large mesh fyke nets accounted for 84% of the Pumpkinseed sunfish catch. Twenty-eight percent of the Pumpkinseed sunfish catch met or exceeded the acceptable harvest size of 6 inches. Age and growth analysis indicated Pumpkinseed sunfish were growing at State average having a mean growth index of 0.0 (table 3). Multiple year classes (n=5) were evident and longevity appeared to peak at 5 years.

A total of 48 Black Crappie averaging 7.3 inches were collected in the 2015 survey (Table 2). Large mesh fyke nets accounted for 96% of the Black Crappie catch. Fifty percent of the total Black Crappie catch met or exceeded the acceptable harvest size of 8 inches. Age and growth analysis indicated Black Crappie were growing slightly below State average having a mean growth index of -0.2 (Table 3). Multiple year classes were evident (n=8) and longevity appeared to peak at 7 years.

Other important sportfish were captured in relatively low abundance in the 2015 survey (Table 2). Of note, 6 northern pike averaged 30.8 inches and 101 Yellow Bullhead averaged 9.7 inches (Table 2). Blackchin Shiner appear as a forage species but it is likely small centrachids comprise most of the forage base.

Analysis and Discussion

In southern Michigan warmwater lakes, Bluegill are typically the most abundant fish species present and play a key role in community structure and overall sport fishing quality (Schneider 1981). Schneider (1990) suggests indices of Bluegill characteristics which can be used to classify the status of populations. The "Schneider Index" uses size scores of length frequency and relates them to a subjective ranking system ranging from "very poor" to "superior". Using the Schneider Index for classifying Bluegill populations, in 2015, Indian Lake scored a 3.0 for an "acceptable" rank (Table 4). In comparison to previous surveys, there appears to be a recent shift in size structure towards smaller and younger fish (Table 4). However, differences in the Schneider Index may represent cycles of Bluegill abundance and size structure or it is possible the "snapshot" nature of these fisheries surveys may not accurately depict the population in a true manner. Relative abundance of Bluegill captured in 2015 was significantly lower than previous surveys and might suggest an inefficient sample size for true size structure estimation. Age and growth data suggests few Bluegill are living beyond 6 years and therefore are not achieving a larger size given the existing habitat and forage conditions of the lake. Mortality of larger and older Bluegill is either by natural causes or potentially by angler harvest. Overall, the Bluegill population and size structure of Indian Lake is acceptable and offers reasonable expectations for anglers to catch fish in the 6-7 inch size range.

Largemouth Bass are one of the most highly sought after sportfish in Michigan and night electrofishing is particularly effective at capturing them as they move into the littoral zone for feeding. Fisheries Division's Status and Trends Program (Wehrly et. al. 2015) incorporates standardized night electrofishing procedures for bass and allows for statewide and regional comparisons. Using catch per

effort (CPE) data, the status of the 2015 Indian Lake Largemouth Bass fishery can be compared to other similar water bodies (Figure 4). In terms of relative abundance, CPE (254 fish/hour) was greater than the mean value (91 fish/hour) for comparable lakes. In terms of biomass, CPE (100 lbs./hour) was above the mean value (60 lbs./hour) indicating a presence of adult fish. In terms of percent legal sized fish captured, 16% percent of the Largemouth Bass captured electrofishing in 2015 were legal compared to the mean value of 16 percent. CPE data suggests the Largemouth Bass fishery of Indian Lake is in very good shape with a size structure skewed towards large and older fish. Juvenile Largemouth Bass appeared in moderate numbers and indicate good potential for recruitment into the harvestable fishery.

In 2015, and in previous surveys, Black Crappie occurred in relatively low abundance. A self-sustaining population is evident but survey catch rates have been typically low. Part of this may be due to difficulty in sampling as Black Crappie tend to inhabit the deeper cool water zone during the time period of when the surveys were conducted. Yet, the 2015 survey indicated a small population exists with fish in the 7-10 inch size range available to anglers.

The 2015 survey, and past surveys, indicate other sportfish occur in low abundance in Indian Lake. Pumpkinseed sunfish are present and provide an opportunity for anglers to catch fish in the 6 inch size range. Northern Pike have been documented in each survey and three of the six fish captured in 2015 were greater than 30 inches. Yellow and brown bullheads are common and may provide for an additional recreational experience.

Management Direction

Indian Lake currently supports a typical southern Michigan warmwater fishery. The primary sportfish (Bluegill and Largemouth Bass) available to anglers appear in good shape and no specific fisheries management is suggested at this time. Surveys conducted on Bain and Patterson lakes indicate similar fisheries. The ownership of State land and undeveloped shoreline makes each of these lakes appealing to local anglers and should be protected.

References

Albert, D.A. 1994. Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin: A working map and classification, fourth addition. Michigan Department of Natural Resources, Michigan Natural Features Inventory, July 1994, Lansing, Michigan.

Schneider, J.C. 1981. Fish communities in warmwater lakes. Michigan Department of Natural Resources, Fisheries Research Report 1890, Ann Arbor.

Schneider, J.C. 1990. Classifying bluegill populations from lake survey data. Michigan Department of Natural Resources, Fisheries Technical Report No. 90-10, Ann Arbor.

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, 2015. Ann Arbor.

Figure 1. Location of Indian Lake within the Oak Grove State Game Area.

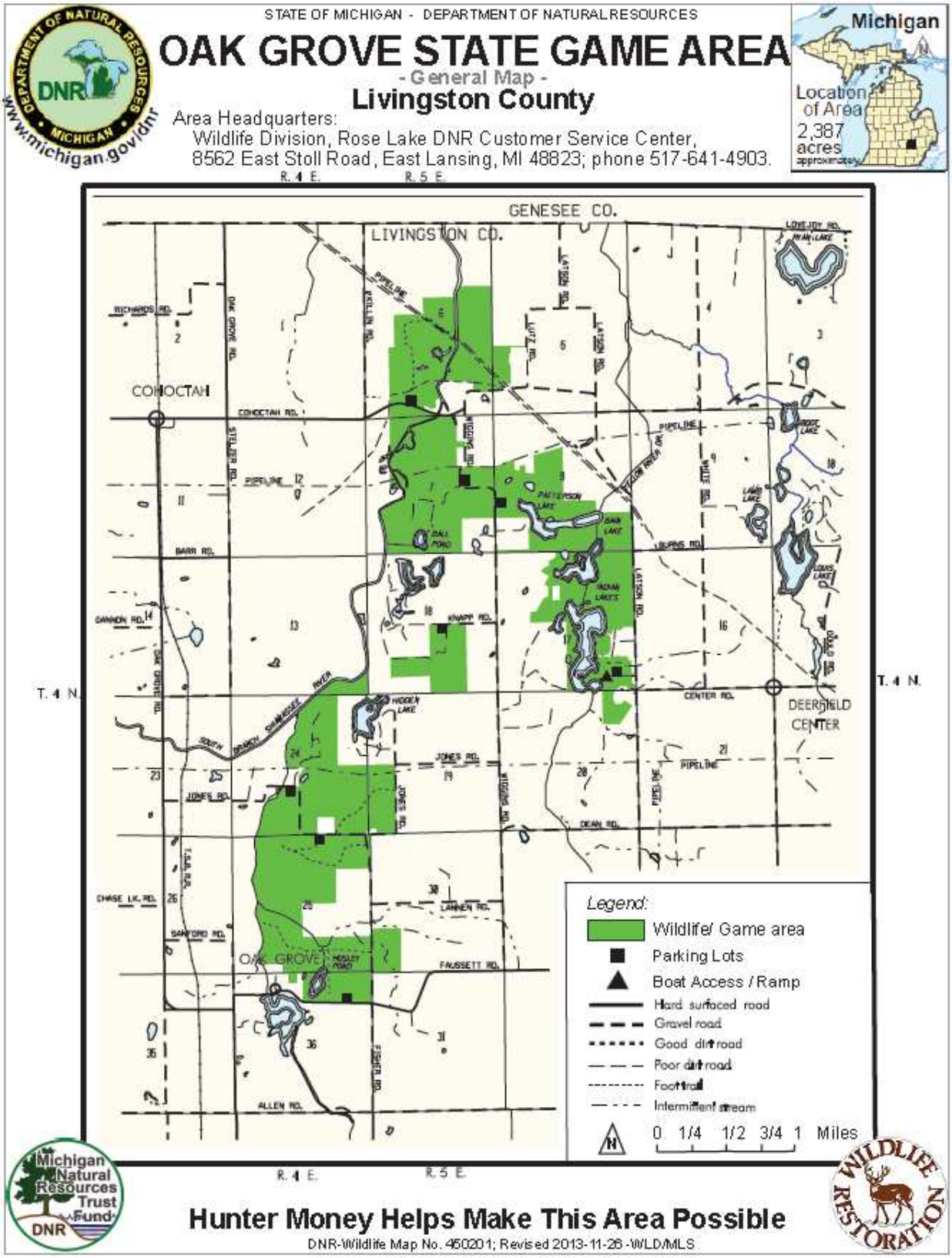


Figure 2. Aerial view depicting the location of Indian Lake, Livingston County.

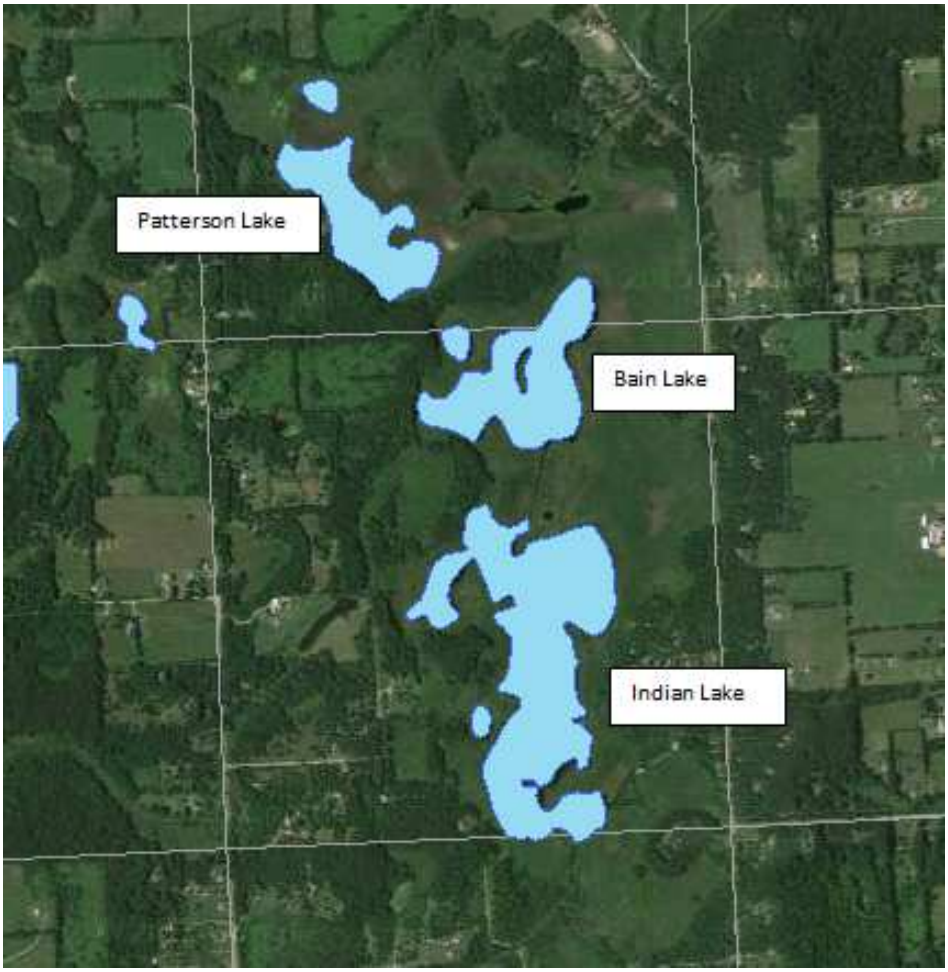


Figure 3. Hydrographic map of Indian Lake, Livingston County.

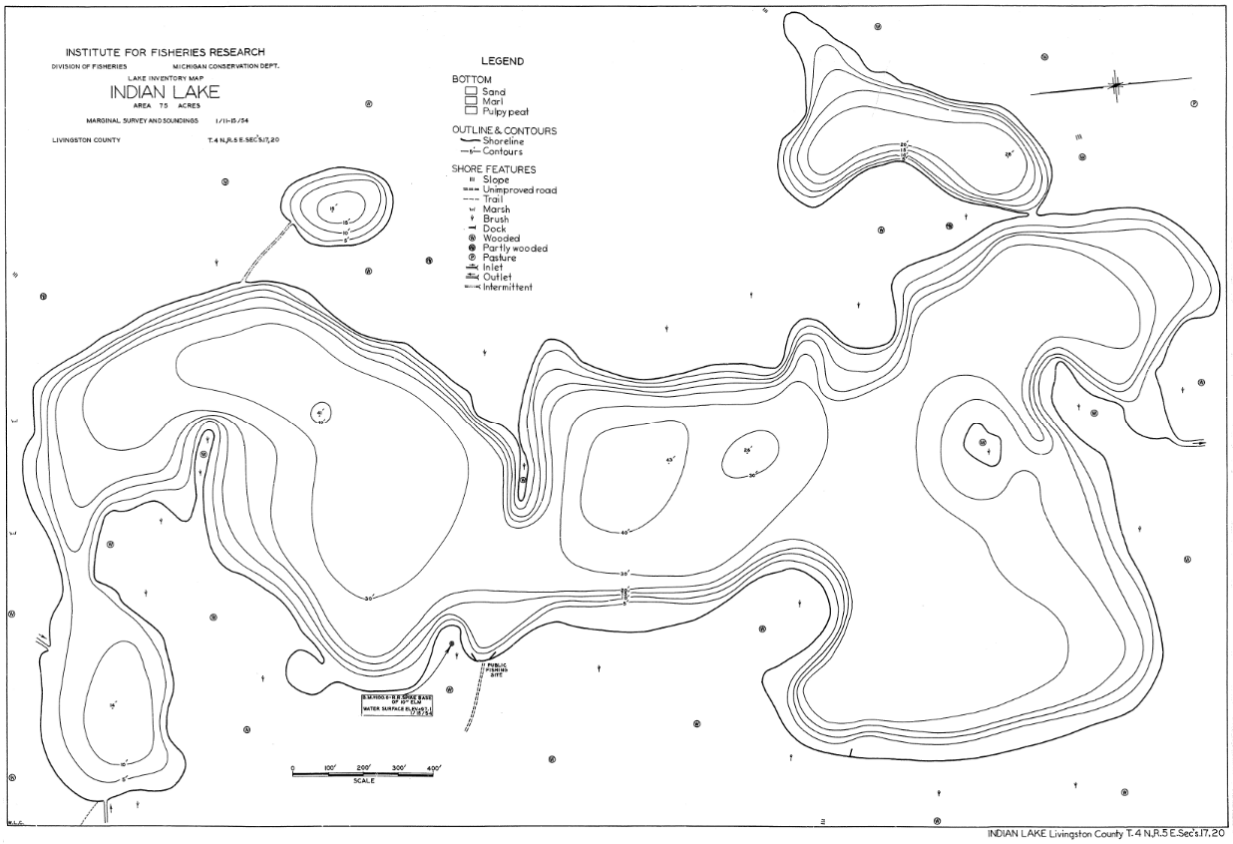
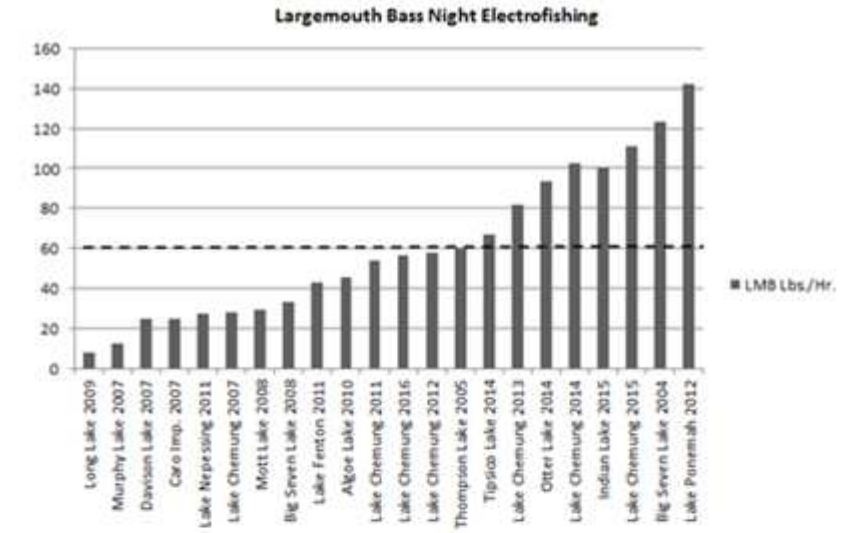
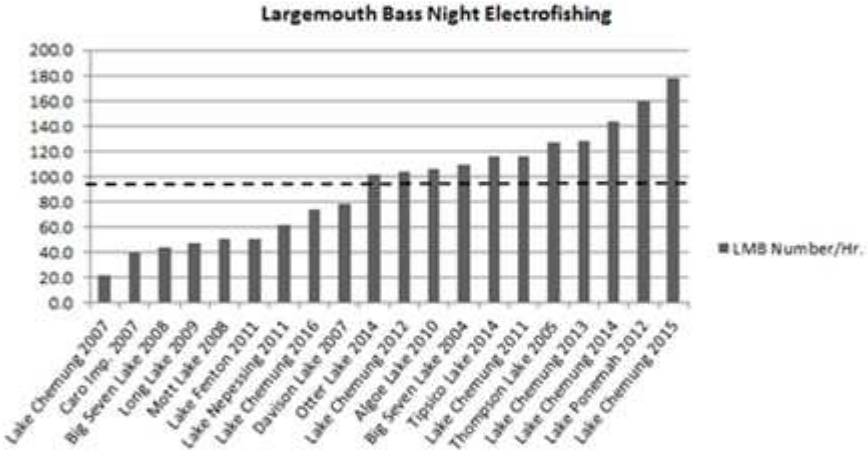


Figure 4. Largemouth Bass catch per effort (number/hour, lbs./hr., % legal) for select waters in Southern Lake Huron Management Unit. Dashed line equals the mean value.





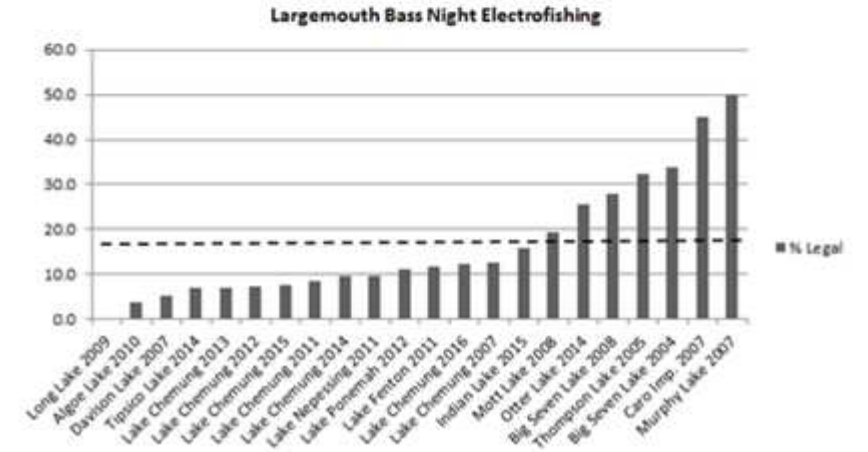


Table 1. List of fishes in Indian, Bain, and Patterson lakes, Livingston County.

Common name	**Scientific Name**
Gars	
Longnose Gar	*Lepisosteus osseus*
Bowfins	
Bowfin	*Amia calva*
Carps and minnows	
Blackchin Shiner	*Notropis heterodon*
Brook Silverside	*Labidesthes sicculus*
Common Carp	*Cyprinus carpio*
Mudminnows	
Central Mudminnow	*Umbra limi*
Suckers	
Lake Chubsucker	*Erimyzon sucetta*
White Sucker	*Catostomus commersoni*
Bullhead catfishes	
Brown Bullhead	*Ameiurus nebulosus*
Channel Catfish	*Ictalurus punctatus*
Yellow Bullhead	*Ameiurus natalis*
Pikes	
Northern Pike	*Esox lucius*
Grass Pickerel	*Esox americanus*
Sunfishes	
Black Crappie	*Pomoxis nigromaculatus*
Bluegill	*Lepomis macrochirus*
Green Sunfish	*Lepomis cyanellus*
Largemouth Bass	*Micropterus salmoides*
Pumpkinseed	*Lepomis gibbosus*
Warmouth	*Lepomis gulosus*
Perches	
Yellow Perch	*Perca flavescens*

Table 2. Total catch (all gear) from Indian Lake, June, 2015. Data from MDNR, Fisheries Division.

Common name	Number	Percent by number	Weight (lbs.)	Percent by weight	Length range (in.)*	Average length (in.)	Percent legal size**
Black Crappie	48	4.3	11.7	3.0	5-10	7.3	50
Blackchin Shiner	14	1.3	0.0	0.0	1-2	1.9	100
Bluegill	620	56.0	66.6	16.8	1-7	5.0	30
Bowfin	23	2.1	92.5	23.3	14-27	22.1	100
Brook Silverside	6	0.5	0.0	0.0	3-4	3.8	100
Brown Bullhead	13	1.2	8.37	2.1	9-13	11.0	100
Central Mudminnow	15	1.4	0.2	0.1	2-5	3.4	100
Common Carp	3	0.3	9.7	2.43	19-20	18.8	100
Common White Sucker	7	0.6	4.6	1.1	9-18	8.9	100
Grass Pickerel	6	0.5	0.4	0.1	4-8	7.0	100
Green sunfish	2	0.2	0.2	0.1	5-5	5.5	0
Hybrid sunfish	2	0.2	0.5	0.1	7-8	7.0	100
Lake Chubsucker	12	1.0	1.7	0.4	4-9	5.8	100
Largemouth Bass	140	12.7	104.3	26.2	3-19	10.2	14
Northern Pike	6	0.5	37.9	9.6	24-35	29.7	100
Pumpkinseed	56	5.1	8.38	2.1	3-7	5.6	25
Warmouth	27	2.4	3.0	0.8	2-7	5.1	11
Yellow Bullhead	101	9.1	46.3	11.7	5-11	9.7	99
Yellow Perch	5	0.5	0.4	0.1	3-8	5.3	50
All species total	1106		396.9				

* Note some fish may be measured to 0.1 inch, others to inch group.
** Percent legal or acceptable size for angling.

Table 3. Age and growth data from selected sportfish, Indian Lake, Livingston County. Data collected June 2015.

Species/Age	No. aged	Length range (in.)	State avg. length (in.)	Weighted mean length (in.)	Weighted age frequency (%)	Mean growth index*
Black Crappie						-0.2
Age II	17	5.50-6.60	6.5	5.95	48.50	
Age III	6	6.60-9.40	7.9	7.72	11.12	
Age IV	15	8.20-10.10	8.9	8.64	38.45	
Age V	1	9.20-9.20	9.7	9.20	0.43	
Age VII	1	10.80-10.80	11.1	10.80	1.50	
Bluegill						-0.1
Age 0	2	1.7-1.8		1.75	0.96	
Age I	19	1.50-3.20	2.4	2.13	37.28	
Age II	12	2.90-4.50	4.2	3.85	17.05	
Age III	20	3.90-7.00	5.3	5.63	25.41	
Age IV	15	5.10-7.50	6.2	6.53	17.37	
Age V	4	5.50-7.10	6.9	6.40	1.69	
Age VI	1	7.40-7.40	7.4	7.4	0.24	
Largemouth Bass						-0.4
Age I	4	3.30-5.30	5.4	3.83	5.51	
Age II	18	5.50-7.90	8.7	6.38	27.05	
Age III	32	7.10-13.40	10.6	9.57	36.89	
Age IV	18	8.60-16.80	12.0	11.56	13.79	
Age V	7	11.00-18.90	13.7	16.60	3.88	
Age VI	9	12.30-17.00	15.0	14.94	7.75	
Age VII	6	13.10-19.20	16.7	17.99	4.12	
Age VIII	2	14.00-19.70	17.6	17.26	1.00	
Pumpkinseed						-0.0
Age III	18	4.10-6.80	5.2	4.94	71.25	
Age IV	9	5.10-6.80	5.8	6.02	22.93	
Age V	2	6.60-7.40	6.3	7.32	5.82	

*****Mean growth index is the average deviation from the state average length at age and requires a minimum of 5 samples in an age group.

Table 4. Indian Lake bluegill classification using trap net or large mesh fyke net data and the Schneider Index (Schneider 1990). Size score is given in parenthesis.

Sample date	6/9/89	6/18/93	5/31/01	6/4/15
Sample size	1091	540	529	264
Average length (inches)	6.6 (5)	7.1 (6)	6.5 (5)	5.9 (3)
% $\geq$ 6 inches	73 (4)	83 (5)	66 (4)	47 (3)
% $\geq$ 7 inches	37 (5)	66 (6)	29 (3)	12 (4)
% $\geq$ 8 inches	3 (5)	16 (6)	3 (5)	0 (2)
Schneider Index	4.75	5.75	4.25	3.00
Rank[1]	Satisfactory	Good	Satisfactory	Acceptable

[1]Rank: 1 = Very poor, 2 = Poor, 3 = Acceptable, 4 = Satisfactory, 5 = Good, 6 = Excellent, 7 = Superior