FISH SURVEY REPORT

Lake Lemon

January 3, 2018

Prepared for:
Lake Lemon Conservancy District
7599 North Tunnel Road
Unionville, IN, 47468

Prepared by:
Aquatic Control Inc.
P.O. Box 100
Seymour, IN 47274

Table of Contents

List of Figures

List of Tables

INTRODUCTION

Lake Lemon is a 1,650-acre impoundment in Monroe and Brown Counties, Indiana. A Standard Survey of the fish community and other physical, biological, and chemical factors directly affecting the fish community was completed at Lake Lemon on November 1st and 2nd, 2017. The major objectives of this survey and report are:

1. To provide a current status report on the fish community of the lake.
2. To compare the current characteristics of the fish community with established indices and averages for Indiana lakes.
3. To provide recommendations for management strategies to enhance or sustain the sport fish community.

The data collected are adequate for the intended uses; however, there will be unanswered questions regarding aspects of the fish population and other related factors of the biological community in the lake. All fish numbers used in the report are based on the samples collected and should not be interpreted to be absolute or estimated numbers of fish in the lake. General information regarding water chemistry, fish communities, and methods are described in Appendix A. A detailed fish collection table is presented in Appendix B.

RESULTS AND DISCUSSION

WATER CHEMISTRY

Water quality parameters were measured at three stations (Table 1). Water temperatures ranged from 52.2 degrees Fahrenheit at the surface of Station 1 to 46.5 degrees at the bottom of the Station 3. Dissolved oxygen ranged from 9.54 parts per million (ppm) at the surface of the Station 2 to 6.43 ppm at a depth of 21 feet at Station 1. A desirable oxygen level for sustaining healthy, stress free fish was present throughout the water column at all stations (Figure 1). These numbers indicate Lake Lemon was de-stratified at the time of the survey. Alkalinity is the capacity of solutes in an aqueous solution to neutralize acid. The alkalinity level was 51.3 ppm as calcium carbonate ($CaCO_3$) at the surface and bottom of Stations 1 & 2. The alkalinity level at Station 3 was 68.4. Water hardness is a measure of the amount of calcium and magnesium salts in water. The hardness level ranged from 85.5 at the bottom of Station 2 to 136.8 at the surface of Station 3. The pH ranged from 6.92 to 7.15 at the surface, and ranged from 7.09 to 7.25 at the bottom, which is normal for lakes in this area. The nitrate-nitrogen level ranged from 0.5 ppm to 0.6 ppm at the surface. Levels of nitrate-nitrogen on the bottom were 0.4

ppm at the Stations 1 & 2, and 0.5 ppm at Station 3. The ortho-phosphate (phosphorus available for immediate uptake by plants) levels ranged from a high of 0.03 ppm at Stations 2 & 3 to a low of 0.01 ppm at Station 1. Ortho-phosphate levels were substantially higher at the upper end of the lake. Secchi disk readings were 2.5-feet at Stations 1 & 3, and 3.5-feet at Station 2. Based upon nutrient levels and secchi disk readings, Lake Lemon is remains classified as a eutrophic lake. Lake Lemon is currently capable of sustaining a healthy fish community.

Table 1. Selected water quality parameters measured on Lake Lemon, November 1, 2017.

Station 1

Sample Depth (ft.)	Temp. (°F)	Dissolved Oxygen (ppm)	pH (standard units)	Total Alkalinity (ppm)	Total Hardness (ppm)	Nitrate/ Nitrogen (ppm)	Ortho phosphate (ppm)	Total phosphorus (ppm)
Surface	52.2	7.69	6.92	51.3	102.6	0.60	0.01	0.13
3	52.6	7.42	-	-	-	-	-	-
6	52.6	7.30	-	-	-	-	-	-
9	52.7	7.25	-	-	-	-	-	-
12	52.6	7.26	-	-	-	-	-	-
15	52.6	7.32	-	-	-	-	-	-
18	52.6	7.21	-	-	-	-	-	-
27	52.5	6.43	7.09	51.3	85.5	0.40	0.01	0.12

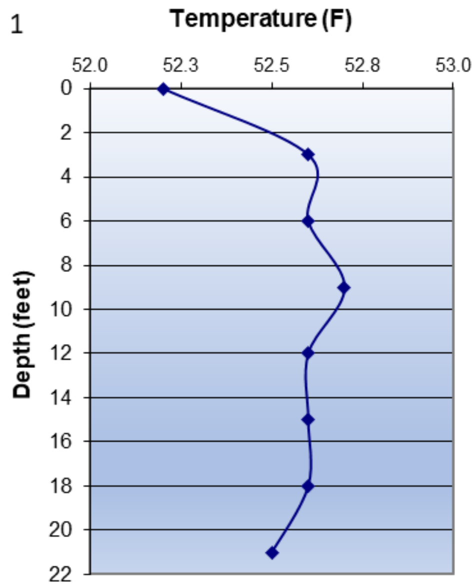
Station 2

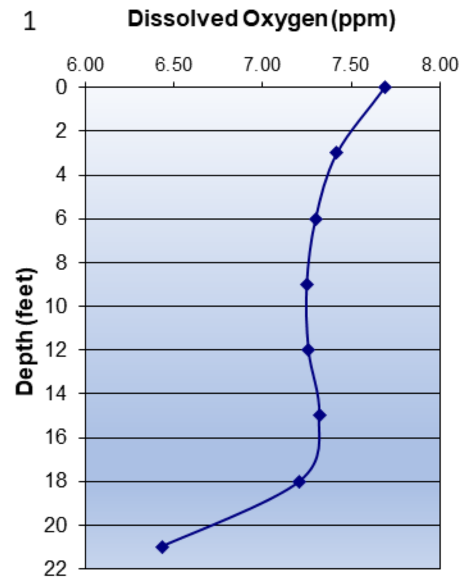
Sample Depth (ft.)	Temp. (°F)	Dissolved Oxygen (ppm)	pH (standard units)	Total Alkalinity (ppm)	Total Hardness (ppm)	Nitrate/ Nitrogen (ppm)	Ortho phosphate (ppm)	Total phosphorus (ppm)
Surface	49.9	9.54	7.15	51.3	85.5	0.50	0.03	0.16
3	50.1	9.36	-	-	-	-	-	-
6	50.1	9.29	-	-	-	-	-	-
9	50.1	9.26	-	-	-	-	-	-
11	50.1	9.25	7.25	51.3	85.5	0.40	0.01	0.15

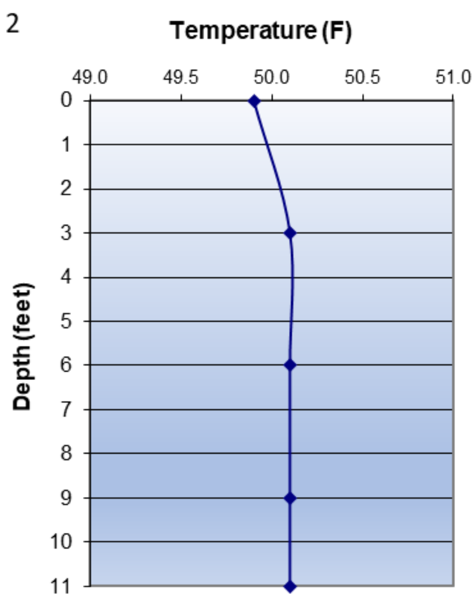
Station 3

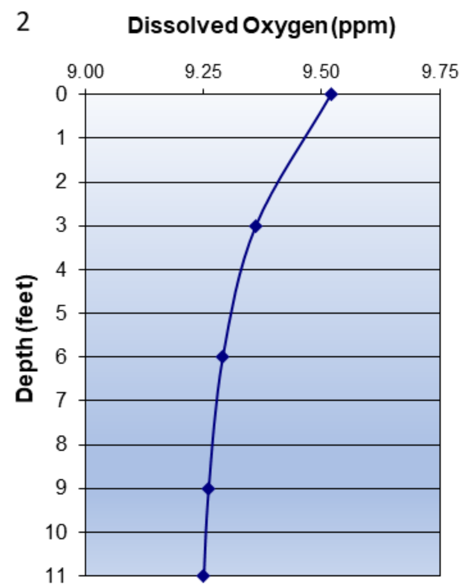
Sample Depth (ft.)	Temp. (°F)	Dissolved Oxygen (ppm)	pH (standard units)	Total Alkalinity (ppm)	Total Hardness (ppm)	Nitrate/ Nitrogen (ppm)	Ortho phosphate (ppm)	Total phosphorus (ppm)
Surface	46.4	8.81	7.08	68.4	136.8	0.50	0.03	0.18
3	46.5	8.60	-	-	-	-	-	-
6	46.5	8.40	-	-	-	-	-	-

*Dashes indicate no sample was taken at selected depth for given parameter.


1
Temperature (F)
52.0
52.3
52.5
52.8
53.0
Depth (feet)
0
2
4
6
8
10
12
14
16
18
20
22


1
Dissolved Oxygen (ppm)
6.00
6.50
7.00
7.50
8.00
Depth (feet)
0
2
4
6
8
10
12
14
16
18
20
22


2
Temperature (F)
49.0
49.5
50.0
50.5
51.0
Depth (feet)
0
1
2
3
4
5
6
7
8
9
10
11


2
Dissolved Oxygen (ppm)
9.00
9.25
9.50
9.75
Depth (feet)
0
1
2
3
4
5
6
7
8
9
10
11

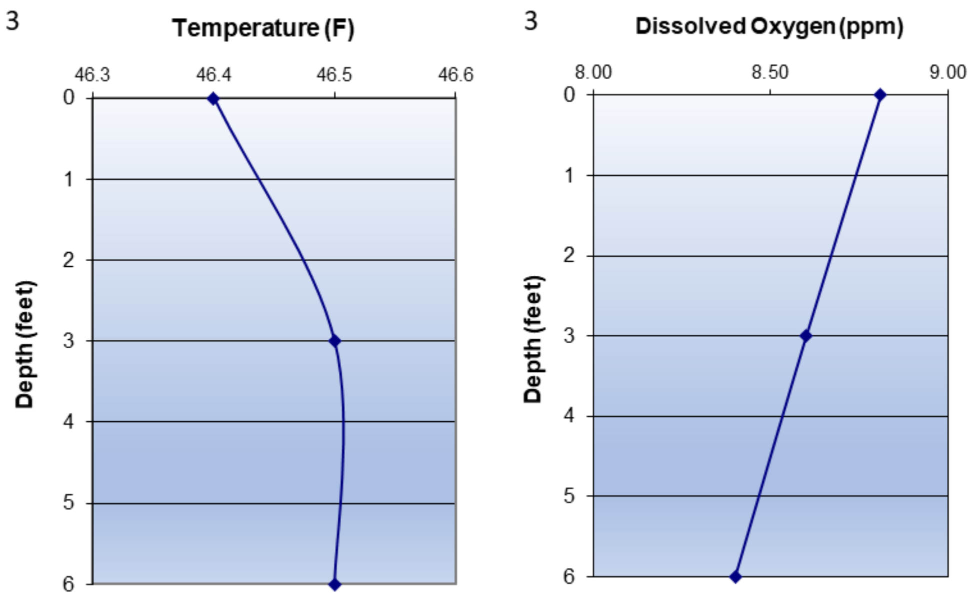


Figure 1. Temperature and dissolved oxygen profiles for 3 stations at Lake Lemon, November 1, 2017.

FISH COLLECTION

The same electrofishing zones (Figure 2) that were sampled in 2009 were sampled again during this survey; however, the sites located near the American lotus and spatterdock beds were moved out due to low water depths.

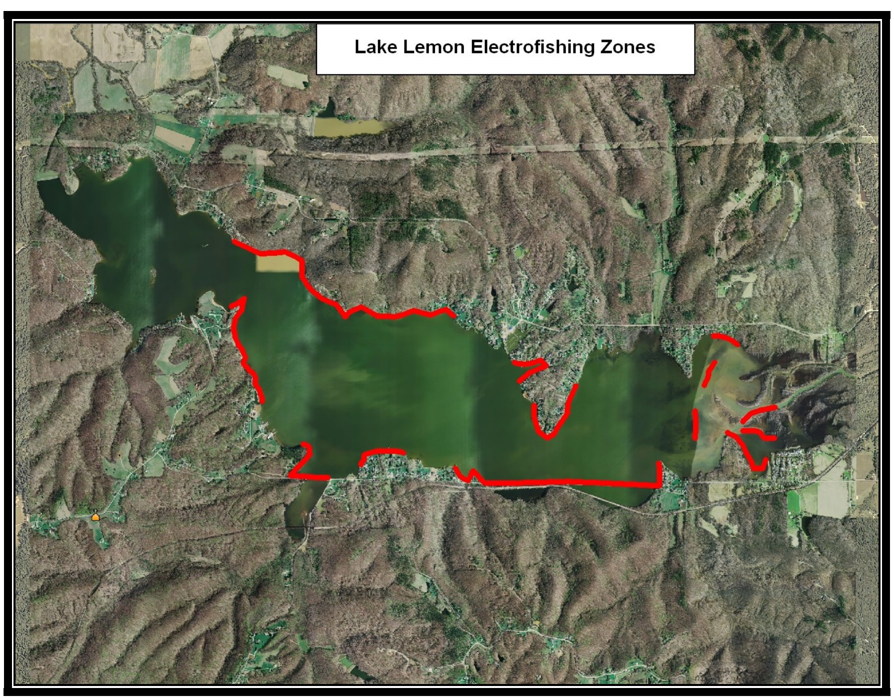


Figure 2. Lake Lemon 2017 electrofishing zones.

A total of 2,142 fish weighing 716.01 pounds and representing twenty-five species was collected from Lake Lemon (Table 2 & Figure 3). Bluegill *Lepomis macrochirus* was the most abundant species comprising 26.84% of the fish collected. Gizzard shad *Dorosoma cepedianum* was the second most abundant species (16.34%), followed by largemouth bass *Micropterus salmoides* (11.67%), brook silverside *Labidesthes sicculus* (7.66%), longear sunfish *Lepomis megalotis* (6.72%), spotted sucker *Minytrema melanops* (6.58%), golden redhorse *Moxostoma erythrurum* (6.30%), yellow bass *Morone mississippiensis* (3.64%), green sunfish *Lepomis cyanellus* (3.50%), redear sunfish *Lepomis microlophus* (3.08%), black crappie *Pomoxis nigromaculatus* (2.89%), golden shiner *Notemigonus crysoleucas* (1.21%), white crappie *Pomoxis annularis* (1.12%), warmouth *Lepomis gulosus* (0.75%), common carp *Cyprinus carpio* (0.37%), bluntnose minnow *Pimephales notatus* (0.37%), logperch *Percina caprodes* (0.28%), northern hogsucker *Hypentelium nigricans* (0.14%), chestnut lamprey *Icthyomyzon castaneus* (0.14%), black redhorse *Moxostoma duquesnei* (0.09%), yellow perch *Perca flavescens* (0.09%), bowfin *amia calva* (0.05%), brown bullhead *Ameiurus nebulosus* (0.05%), Johnny darter *Etheostoma nigrum* (0.05%), and spotfin shiner *Cyprinella spiloptera* (0.05%). Green sunfish are not desirable in ponds of this size.

Table 2. Species collected from Lake Lemon, November 1, 2017.

Species	N	% N	Size Range (in)	Total Weight (lbs.)	% Wt	N/hr.
Bluegill	575	26.84	<3-8.0	53.81	7.52	135
Gizzard shad	350	16.34	3.0-13.0	58.32	8.15	82
Largemouth bass	250	11.67	3.0-21.0	225.02	31.43	59
Brook silverside	164	7.66	<3-5.0	1.73	0.24	39
Longear sunfish	144	6.72	3.0-6.5	9.30	1.30	34
Spotted sucker	141	6.58	5.0-18.0	145.15	20.27	33
Golden redhorse	135	6.30	6.0-18.0	97.09	13.56	32
Yellow bass	78	3.64	4.0-9.5	9.87	1.38	18
Green sunfish	75	3.50	<3-8.0	7.52	1.05	18
Redear sunfish	66	3.08	3.5-10.0	20.02	2.80	16
Black crappie	62	2.89	4.0-10.0	14.35	2.00	15
Golden shiner	26	1.21	<3-7.5	0.70	0.10	6
White crappie	24	1.12	3.5-10.5	5.70	0.80	6
Warmouth	16	0.75	3.0-8.0	2.16	0.30	4
Common carp	8	0.37	17.0-29.0	55.76	7.79	2
Bluntnose minnow	8	0.37	<3-3.5	0.08	0.01	2
Logperch	6	0.28	3.5-6.0	0.17	0.02	1
Northern hogsucker	3	0.14	8.5-14.0	2.06	0.29	1
Chestnut lamprey	3	0.14	8.0-9.5	0.26	0.04	1
Black redhorse	2	0.09	5.5-16.0	1.76	0.25	0
Yellow perch	2	0.09	7.5-8.0	0.36	0.05	0
Bowfin	1	0.05	23.5	4.70	0.66	0
Brown bullhead	1	0.05	6.5	0.10	0.01	0
Johnny darter	1	0.05	<3	0.01	0.00	0
Spotfin shiner	1	0.05	<3	0.01	0.00	0
Total	2142	100.00		716.01	100.00	0

N=Number of individuals
%N=percent number of a species compared to total number of fish collected
%Wt=percent weight of a species compared to total weight of all fish collected
N/hr.=catch rate of species (number of fish of a species collected/hr. of electrofishing effort

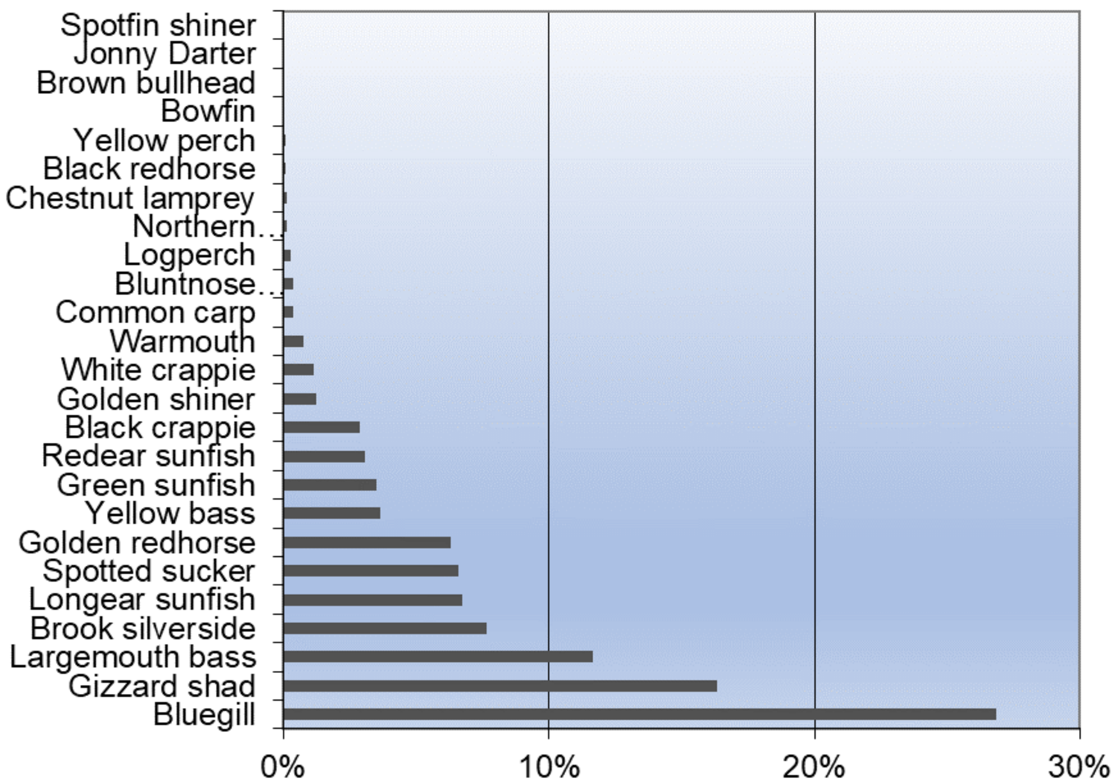


Figure 3. Relative abundance of species collected from Lake Lemon, November 1, 2017.

Bluegill

Bluegill (Figure 4) was the most abundant species collected (26.84%) and ranked sixth by weight (7.52%). Individuals ranged in size from less than 3.0 to 8.0 inches (Figure 5). The length frequency of bluegill collected over the past two years is illustrated in Figure 6. The PSD, or proportional stock density, was 39, which is within the desired range of 20-40 for bluegill (proportion of quality fish within a population, see Appendix A). The PSD was 43 in 2009. Catch rates dropped from 220 fish/hr. in 2009 to 135 fish/hr. in this survey. Condition factors (measurement of overall plumpness) were below average for most size ranges. Bluegill weights were found to be below standard weights in most size ranges (Figure 7). While the population continues to exhibit a relatively balanced PSD, there remains a lack of individuals greater than 7.0 inches in length.

Figure 4. Photograph of bluegill, *Lepomis macrochirus*.

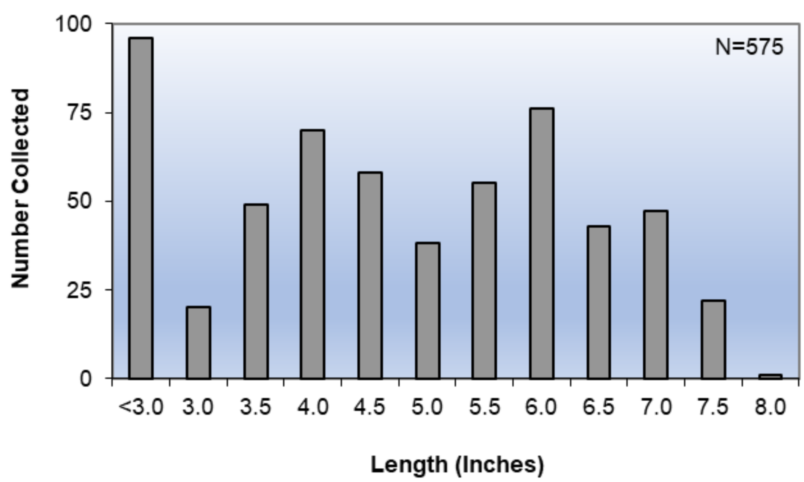


Figure 5. Length frequency distribution of bluegill collected from Lake Lemon, November 1, 2017.

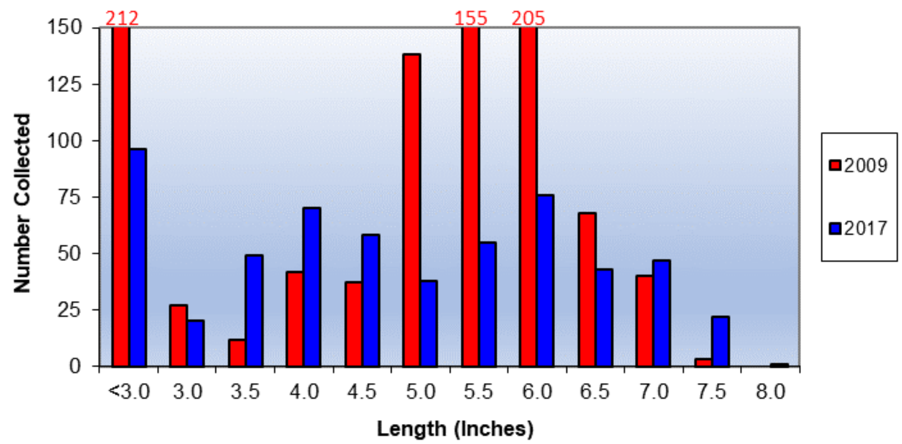


Figure 6. Length frequency distribution of bluegill over the past two surveys.

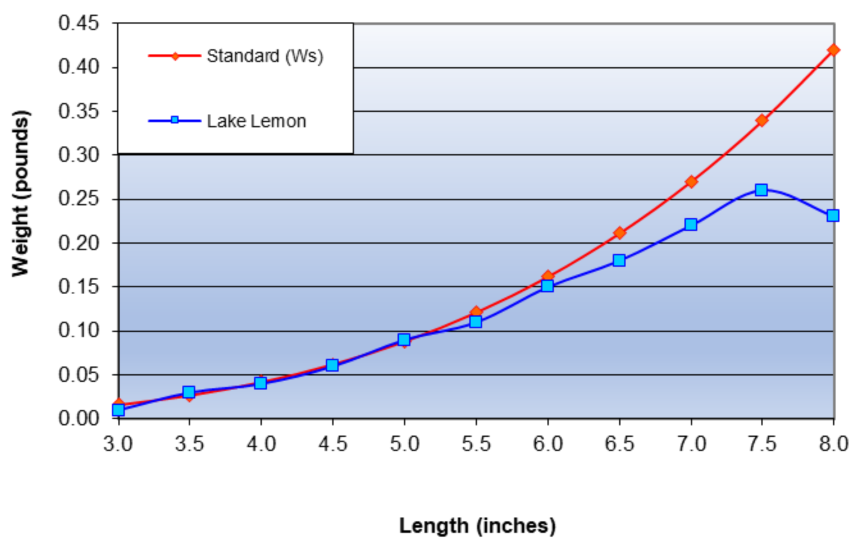


Figure 7. Comparison of Lake Lemon bluegill weights to standard bluegill weights.

Gizzard shad

Gizzard shad (Figure 8) was the second most abundant species collected (16.34%), and ranked fourth by weight (8.15%). Gizzard shad was also the second most abundant species collected in 2009. Individuals ranged in size from less than 3.0 to 13.0 inches (Figure 9). Figure 10 illustrates the length frequency of gizzard shad over the past two surveys. The CPUE for this survey was 82 fish per hour, compared to 133 fish per hour in the last survey. This could be attributed to the fact that the lake was not at normal pool during the survey. Predatory fish typically feed more effectively on gizzard shad when water levels are lowered. Largemouth bass typically grow well in the lakes containing gizzard shad, especially individuals that are 15.0 inches and larger; however, gizzard shad grow rapidly and reach sizes that bass cannot eat. Small shad also negatively affect desirable species through competition for food resources and habitat. This species has a very high reproductive potential. The gizzard shad population should continue to be monitored closely.

Figure 8. Photograph of gizzard shad, *Dorosoma cepedianum*.

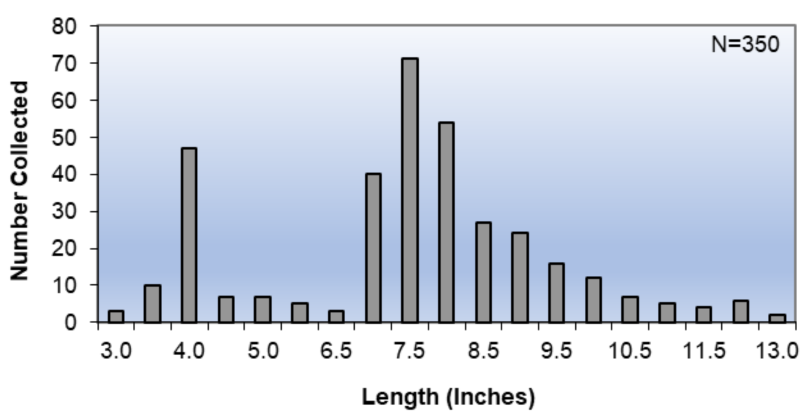


Figure 9. Length frequency distribution of gizzard shad collected from Lake Lemon, November 1, 2017.

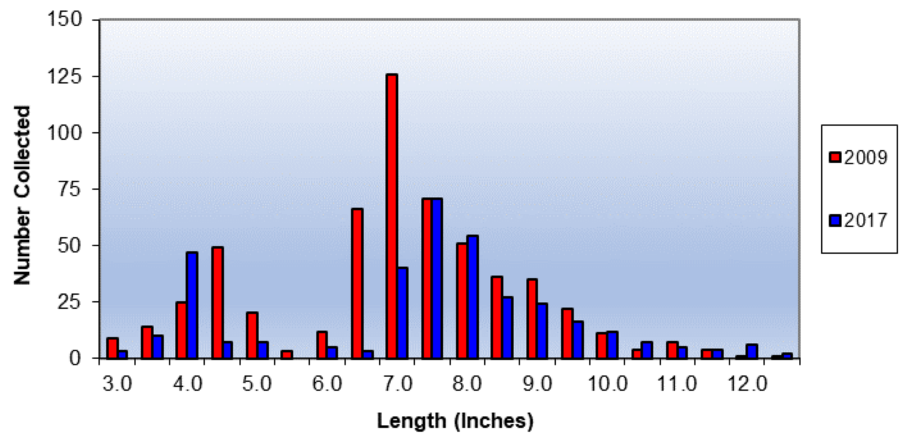


Figure 10. Gizzard shad length frequency over the past two surveys.

Largemouth Bass

Largemouth bass (Figure 11) was the third most abundant species collected (11.67%) and ranked first by weight (31.43%). A total of 250 largemouth bass ranging in size from less than 3.0 to 21.0 inches was collected (Figure 12). The length frequency of largemouth bass over the past two surveys is illustrated in Figure 13. The catch rate for largemouth bass was 59 fish per hour compared to 67 fish per hour in 2009. Proportional stock density for largemouth bass was 61, an increase from 43 in the previous survey. This is just above the ideal range of 40-60 for a balanced, exploited population. Condition factors (measurement of overall plumpness) were average for most size classes. The average weights for the bass were below average compared to standard weights in most sizes collected (Figure 14).

Figure 11. Photograph of largemouth bass, *Micropterus salmoides*.

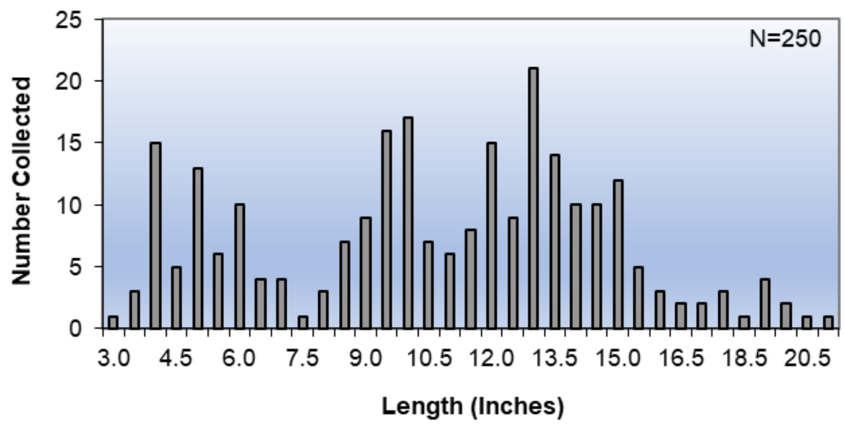


Figure 12. Length frequency distribution of largemouth bass collected from Lake Lemon, November 1, 2017.

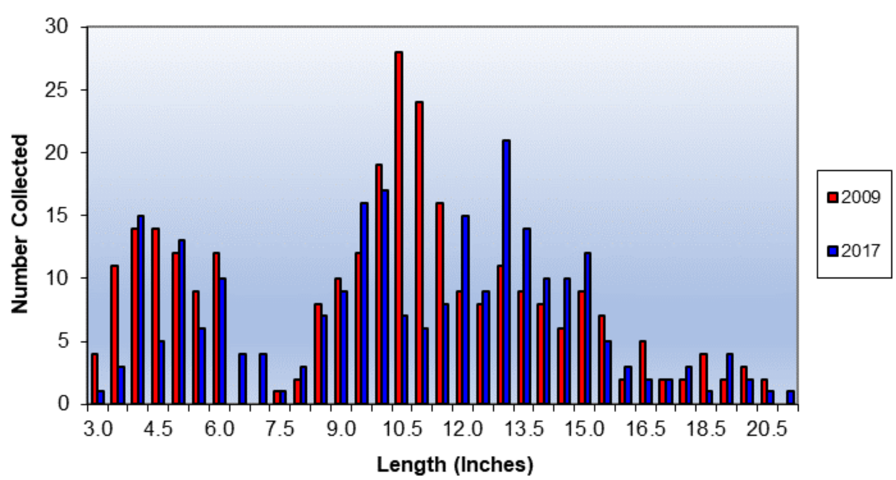


Figure 13. Length frequency distribution of largemouth bass over the past two surveys.

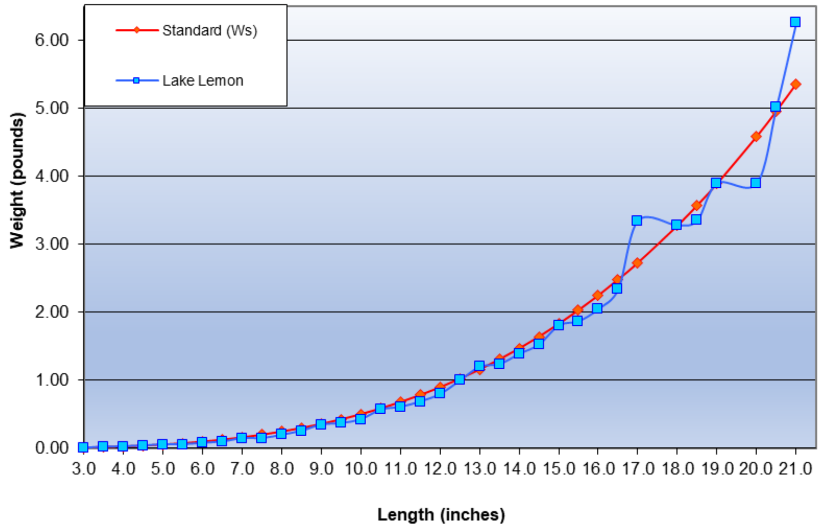


Figure 14. Comparison of Lake Lemon largemouth bass weights to standard largemouth bass weights.

Brook silverside

A total of 164 brook silverside (Figure 15) was collected during the survey. This species wasn't collected in the previous survey. Brook silverside likely provide an additional forage fish for largemouth bass and other predatory fish.

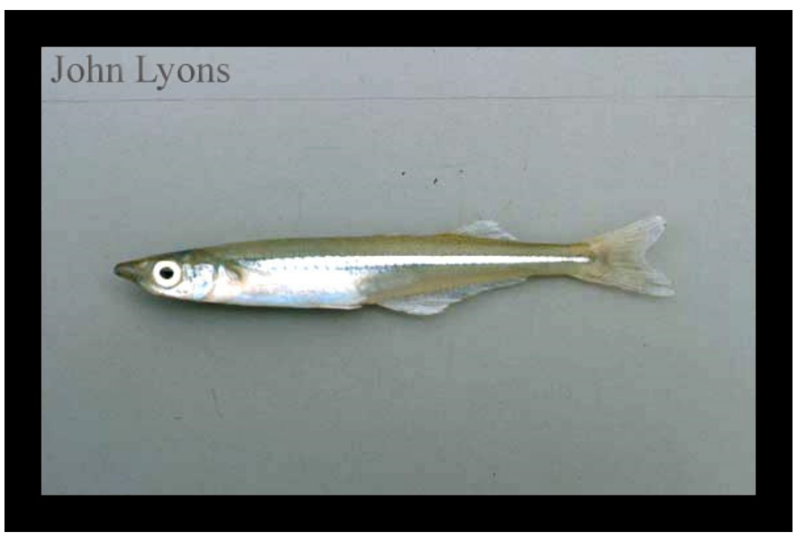


Figure 15. Photograph of brook silverside, *Labidesthes sicculus*.

Longear sunfish

Longear sunfish (Figure 16) was the fifth most abundant species collected (6.72%). This species was the sixth most abundant species collected in the previous survey. Individuals ranged from 3.0 to 6.5 inches. Longear sunfish, while very palatable, tend to reach smaller sizes than bluegill, and aren't typically targeted by sport fisherman.

Figure 16. Photograph of longear sunfish, *Lepomis megalotis.*

Spotted sucker and Golden redhorse

Spotted sucker (Figure 17) was the sixth most abundant species collected (6.58%), but ranked second by weight (20.27%). The CPUE was 33 fish per hour compared to 20 fish per hour in the previous survey. A total of 141 spotted suckers were collected. Golden redhorse (Figure 18) was the seventh most abundant species collected (6.30%), and ranked third by weight (13.56%). A total of 135 golden redhorse were collected. Suckers and redhorse feed on the bottom, causing a reduction in water clarity. They also disturb desirable fish species nests and consume fish eggs. All suckers and redhorse that are caught should be removed from the lake. Fisherman using live bait should be discouraged from dumping live bait into Lake Lemon. This will lower the chances of introducing more undesirable species into the lake.

Figure 17. Photograph of spotted sucker, *Minytrema melanops.*

Figure 18. Photograph of golden redhorse, *Moxostoma erythrurum*.

Yellow bass

Yellow bass (Figure 19) was the eight most abundant species collected (3.64%), compared to fourth in the 2009 survey (6.85%). Continued harvest of this species and predation of young-of-the-year yellow bass should keep numbers low.

Figure 19. Photograph of yellow bass, *Morone mississippiensis.*

Yellow perch

Two yellow perch (Figure 20) were collected during the survey, compared to four in 2009. This species may continue to provide limited angling opportunities, but will provide additional forage for predatory species.

Figure 20. Photograph of yellow perch, *(Perca flavescens)*.

Redear sunfish

A total of 66 redear sunfish (Figure 21) ranging in size from 3.5 to 10.0 inches was collected during the sample. In 2009, the catch rate was 11 fish per hour, compared to 16 fish per hour in this survey. A large percentage of redear collected were quality fish. This species should provide another angling opportunity in Lake Lemon. As in 2009, a small percentage of young-of-the-year redear were collected, indicating reproduction continues to be poor. Redear are not prolific spawners like bluegill. They inhabit deeper water and feed primarily upon insects and snails. They also tend to grow faster than bluegill.

Figure 21. Photograph of redear sunfish, *Lepomis microlophus*.

Other species

There were fifteen other species collected during the survey. These species comprised 11.06% of fish sampled and included: green sunfish, black crappie, golden shiner, white crappie, warmouth, common carp, bluntnose minnow, logperch, northern hog sucker, chestnut lamprey, black redhorse, bowfin, brown bullhead, Johnny darter, and spotfin shiner. The majority of these species pose no serious threat to the fishery at Lake Lemon.

Figure 22. Photograph of green sunfish, *Lepomis cyanellus*.

Figure 23. Photograph of black crappie, *Pomoxis nigromaculatus*.

Figure 24. Photograph of golden shiner, *Notemigonus crysoleucas.*

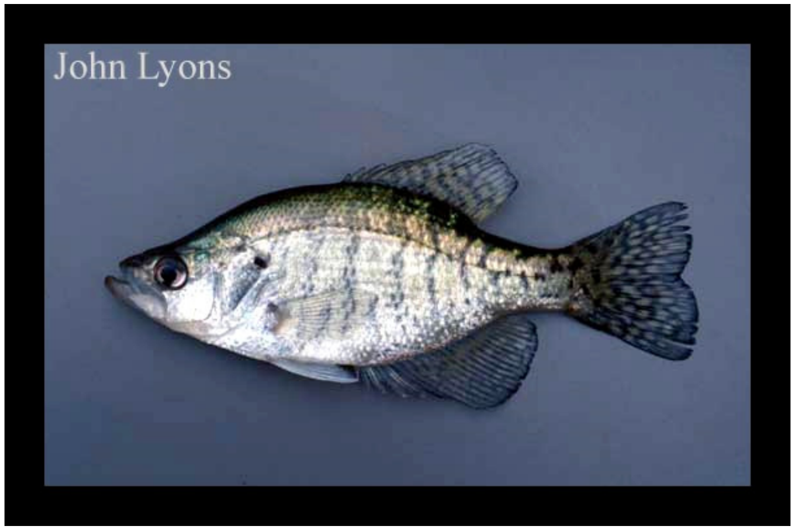


Figure 25. Photograph of white crappie, *Pomoxis annularis.*

Figure 26. Photograph of warmouth, *Lepomis gulosus*.

Figure 27. Photograph of common carp, *Cyprinus carpio.*

Figure 28. Photograph of bluntnose minnow, *Pimephales notatus.*

Figure 29. Photograph of logperch, *Percina caprodes.*

Figure 30. Photograph of northern hog sucker, *Hypentelium nigricans.*

Figure 31. Photograph of chestnut lamprey, *Icthyomyzon castaneus*.

Figure 32. Photograph of black redhorse, *Moxostoma duquesnei.*

Figure 33. Photograph of bowfin, *Amia calva.*

Figure 34. Photograph of brown bullhead, *Ameiurus nebulosus*.

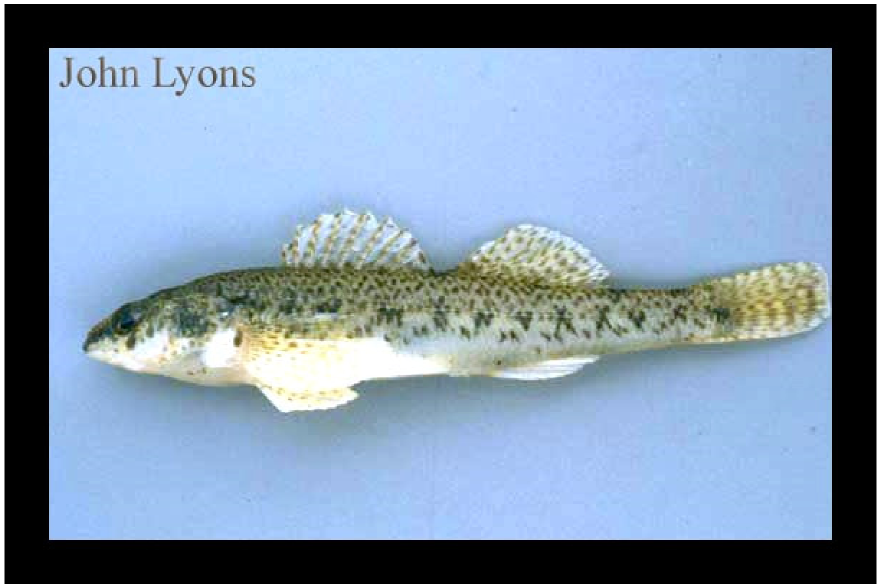


Figure 35. Photograph of Johnny darter, *Etheostoma nigrum*.

Figure 36. Photograph of spotfin shiner, *Cyprinella spiloptera*.

SUMMARY AND RECOMMENDATIONS

It appears that Lake Lemon continues to support a relatively balanced fish population which should provide many different angling opportunities. It appears that the implemented management strategies continue to have a positive impact on the fishery. The largemouth bass population is still nearly balanced, gizzard shad numbers have not increased heavily, and yellow bass abundance has declined once again. While there were more bluegill collected over 7.0 inches during this survey compared to the last, the population continues to grow slow, which is typical in lakes that contain gizzard shad. Harvest of bluegill should remain encouraged, in order to reduce competition and increase growth rates. There is still no need for additional predators, as the gizzard shad population hasn't steadily increased; however, this population should be monitored closely.

The following recommendations, **listed in order of importance**, will help protect and enhance the fishery in Lake Lemon:

1. Maintain the 14.0-inch minimum length limit on largemouth bass along with limits on bass tournament sizes and timing that has been established.
2. No harvest restrictions are necessary on bluegill or yellow bass at this time. Harvest of these species may reduce competition, in order to obtain larger sizes.
3. Continue to encourage best management practices by homeowners and work with residents in the watershed to reduce siltation and nutrient inputs into the lake.
4. Conduct a Standard Fish Survey in 2020 in order to monitor the effects of the above recommendations and assess needs for further management activities.
5. Continue selective herbicide control of Eurasian watermilfoil. Native vegetation control should be limited to high use areas.

Prepared by: Aquatic Control Inc.
Jimmy Ferguson, Pond Maintenance Supervisor

APPENDIX A

GENERAL INFORMATION

In order to help understand our analysis and recommendations, basic principles of water chemistry and the physical attributes of water must be understood. Sources of dissolved oxygen (D.O.) in water include uptake from the atmosphere and photosynthesis. Decreases in D.O. are mostly attributed to the respiration of plants, animals, and aerobic bacteria that occur in a lake or pond. Large quantities of plants may produce oxygen depletion during the nighttime hours as plants stop photosynthesis and utilize oxygen for respiration. Dissolved oxygen levels below 5.0 are considered undesirable in ponds and lakes (Boyd, 1991). Lower levels of D.O. may stress fish and decrease the rate of decomposition of organic matter entering or produced within a lake or pond. If oxygen depletion is determined to be a problem in a lake or pond, solutions exist to help improve conditions. Vegetation control to reduce overly abundant vegetation may improve conditions. Aeration systems may also be used to increase oxygen levels and promote the breakdown of organic matter.

Water temperature of a lake or pond affects the activity of "cold-blooded" animals such as fish and invertebrates as well as the amount of D.O. that water is capable of holding. Deeper ponds and lakes may thermally stratify in the summer months and result in deeper waters becoming depleted of oxygen. Lake stratification is a result of the peculiar property of water density changes with temperature. The density of all liquid changes with changes in temperature, however, water behaves in a special way. As most liquids are cooled the density, or relative weight, of the liquid increases due to the compaction of the molecules in the liquid, and conversely, as liquids are heated the density decreases. Water, because of its unique characteristics, is at its maximum density at 4 degrees Centigrade, or approximately 39.2 degrees Fahrenheit. When water is either heated above this temperature or cooled below this temperature its density decreases. This is why ice floats, or forms on the surface of lakes and ponds. A normal cycle of stratification in lakes in our region of the country, in early spring after ice out is as follows: the lake water will all be nearly the same temperature shortly after ice out and wind action on the lake surface will induce circulation of the entire volume of water. As spring advances and the increased sunlight energy warms the surface waters, these become lighter and tend to separate from the deeper waters and essentially float on top of the cooler water. This continues until there is a very stable "layering" or stratification of water in the lake. There are three distinct layers of water in stratified lakes, as described by limnologists:

1. Epilimnion (upper warm layer) - this is, generally speaking, confined to the top 10 ft. to 15 ft. of the lake volume. This is a warm region, mixed thoroughly by wind to a more or less uniform temperature. It is also the zone of most photosynthetic production and is usually high in dissolved oxygen.

2. Thermocline or Metalimnion (middle layer of rapidly changing temperature) this layer is the area in the lake where temperature decreases rapidly, usually about 1 degree centigrade or more per meter (or approximately 3 ft.). Oxygen depletion generally begins in this layer.

3. Hypolimnion (deep, cold layer) - this layer is relatively unaffected by wind mixing or motor boat activity, and is often devoid of oxygen. Oxygen is depleted by the decomposition of dead organic matter falling from the upper waters as well as external sources such as leaves and grass clippings that sink to the bottom of the lake.

Once this stratification is established (usually by early to mid-June, in our area) it is very stable and stays intact until the fall turnover, which is caused by decreasing surface water temperatures (causing increased density), and the mixing of the lake waters by the wind. The lake then circulates completely for a period of time, usually until ice cover forms, sealing off the surface of the lake from the atmosphere. A reverse stratification then sets in where the water just under the ice is just above 32 degrees Fahrenheit with increasing temperature with depth to a temperature of 39.2 degrees Fahrenheit. Decomposition continues in the bottom throughout the winter, resulting in oxygen depletion in the bottom waters. This progresses towards the surface throughout ice cover and can cause an oxygen depletion fish kill under the ice during severe winters. After the ice melts, the lake begins to circulate again, and the cycle has completed itself. This phenomenon has a profound affect on the biological and chemical components of the lake ecosystem. Alkalinity is the ability of water to buffer against pH changes upon the addition of an acid or base. The alkalinity of a lake or pond is generally determined by the characteristics of the watershed or local geology. As a general guideline a well-buffered system has an alkalinity of 50 parts per million (ppm) or greater. Well buffered systems have potential for moderate to high productivity. Alkalinity is important in determining algaecide dosages, particularly copper sulfate. The maximum safe dosage for fish of copper sulfate if total alkalinity is less than 50 ppm is 0.25 ppm or .68 pounds / acre-foot, 1.00 ppm or 2.7 pounds / acre-foot for a total alkalinity range of 50 to 200 ppm, and 1.5 ppm or 4.0 pounds / acre- foot for a total alkalinity greater than 200 ppm.

Hardness is a measure of the calcium and magnesium (and some other ions) concentrations in water. The concept of hardness comes from the field of domestic water supply. It is a measure of soap requirements for adequate lather formation and is an indicator of the rate of scale formation in hot water heaters. Hardness and alkalinity are sometimes used interchangeably; however, these parameters sometimes have very different values. Waters containing a hardness measure of greater than 75 ppm may be considered hard and are often clearer and weedier then soft waters (Walker et al., 1985).

Nitrogen can exist in several forms within a body of water, including: ammonia, nitrite, nitrate, and organic nitrogen (amino acids and proteins). Ammonia results from the biological decomposition of organic matter by bacteria. During the process of nitrification, nitrate (which is directly available for plant uptake) is formed from the complete biological oxidation of ammonia in which nitrite is an intermediate product. Nitrate is a major plant nutrient. The most important forms of nitrogen for the growth of algae include ammonia and nitrate. Total nitrogen levels above 1.9 ppm are generally indicative of nutrient enrichment or eutrophic conditions (Wetzel, 1983). Inorganic nitrogen (nitrite, nitrate, ammonia, and ammonium) levels greater than 0.30 ppm are indicative of eutrophic lakes and ponds (Sawyer, 1948). Nitrogen in surface waters cannot be controlled by any economical method. Blue-green algae can fix nitrogen directly from the atmosphere unlike other forms of plants.

Phosphorus is a major plant nutrient and is most often the limiting factor for algae and macrophyte (vascular plants) growth within an aquatic system. Total phosphorus levels in excess of 0.03 ppm indicate eutrophic conditions (Vollenwieder, 1968). Waters with excessive plant growth high nutrients and degraded water quality are typical of eutrophic lakes and ponds. Ortho-phosphorus is a measure of the dissolved inorganic phosphorus available for immediate plant uptake. Concentrations of ortho-phosphate above 0.045 ppm may be considered critical concentrations above which nuisance algae blooms could be expected (Sawyer, 1948). The remainder of the total phosphorus is most likely bound onto particulate material and although not immediately available for uptake, could become available through biochemical degradation. Dissolved phosphorus is absorbed from the water column primarily by phytoplankton. Phosphorus supply to aquatic macrophytes is primarily from the sediment rather than from the water column. Phosphorus is released from sediment under anaerobic conditions but is precipitated to the sediment under aerobic conditions. Phosphorus can be precipitated from the water column by use of alum (aluminum sulfate). Sediment phosphorus can be inactivated and made unavailable to macrophytes by heavy applications of alum to the sediment surface.

EQUIPMENT AND METHODS

Water quality analysis equipment used in this survey included a YSI ProODO oxygen-temperature meter with 60 ft. remote sensing probe, a Hach field test kit, and a Wildco Alpha Water bottle sampler. The following water quality parameters were measured and recorded: dissolved oxygen, temperature, pH, total hardness, total alkalinity, nitrate-nitrogen, and orthophosphate. The parameters selected are the major water quality factors influencing the lakes productivity and fish health. Water quality testing to determine nutrient levels was completed in the lab using a Hach DR/2010 photospectometer. Fish sampling was done with the use of an electrofishing boat. Electrofishing is simply the use of electricity to capture fish for the evaluation of population status. Various types of equipment are in use today, however, most fisheries biologists agree that pulsed DC current is more efficient and less harmful to the fish collected than AC current. Electrofishing with an experienced crew using proven equipment is probably the least selective method of sampling warm water fish species in the temperate waters of our area. Evaluation of electrofishing efficiencies have shown that night electrofishing is a reliable method for sampling populations of largemouth bass, bluegill, and redear sunfish, and generally detects the presence of green sunfish and other scaled fish species. The method is less efficient for sampling populations of channel catfish, bullheads, and crappie (Reynolds and Simpson, 1976). The largest bias in electrofishing is generally that of collecting more large fish of a given species than smaller individuals. This is due to the differential effect of the electric current on fish of different sizes, interference with collection from dense weed beds, if present, as well as the potential bias of the person dipping stunned fish (Nielsen & Johnson, 1983). Many years of experience by our personnel has reduced this bias to an acceptable level.

Electrofishing equipment used in this survey consisted of a 16-foot workboat equipped with a Midwest Lake Electrofishing Systems Infinity Box powered by a 6500-watt portable generator and a boom mounted electrosphere designed by Coffelt Manufacturing. The electrosphere allows the use of higher voltages at lower amperage. This has proven to improve the efficiency of the electrofishing technique with lower damage to captured fish. The electrofisher was operated in the pulsed DC mode using an output level of 300 to 500 volts. The increased effectiveness of this electrofishing system makes fish of all species, including channel catfish, more vulnerable to capture. This results in a better sampling of all fish species with a higher capture rate of the more vulnerable species (bass, bluegill, redear, and green sunfish) in the samples taken. All fish collected were placed in water filled containers aboard the sampling boat for processing. A sub-sample of up to five specimens from each species was taken in each one-half inch group. The individual fish in these sub samples were weighed to the nearest hundredth pound for average weight determinations. Additional specimens were recorded by length group.

Field data was summarized and is presented in table and graph form. Condition factors and relative weight calculations (standard measurements of the relative plumpness) were calculated for important species using standard formulas (Anderson and Gutreuter, Carlander 1977, Hillman 1982, Wege and Anderson 1978). Relative weight is a comparison of fish weights at certain sizes to standard calculated weights at those sizes. Relative weights of 100 or greater are considered good. An important procedure used in our evaluation of the bass – bluegill populations, and other species to a lesser extent, is the Proportional Stock Density Index. This population index was developed by intensive research into dynamics of fish population structure, primarily in largemouth bass - bluegill dominated populations (Anderson 1976), and subsequent field testing by numerous fisheries research and management biologists in mid-western states. Bluegill samples are divided into three major groups: those less than 3.0 inches in length, those 3.0 inches and larger, and those 6.0 inches and larger. The group 3.0 inches and larger are called the "stock". The 6.0-inch and larger individuals are considered to be "quality" or harvestable size. Bluegill PSD is the percentage of bluegill "stock" that is in the harvestable size. Largemouth bass samples are separated into "stock size" (8.0 inches plus) and quality size (12.0 inches plus), for PSD calculations. Largemouth bass PSD is the percentage of bass "stock" that are of a "quality" or harvestable size.
This study, and subsequent studies and application of the techniques developed in those studies, have shown that fish populations that are producing, or are capable of producing, a sustained annual harvest of "quality" largemouth bass and bluegill have certain characteristics. These include the following:

1. Reasonably high numbers of bluegill smaller than 2.5 inches (young-of-the-year)
2. Proportional Stock Density index of 20 - 40 for bluegill.
3. Bluegill growth which results in a length of 6.0 inches by age III or IV, with low numbers of age V or older fish.
4. Proportional Stock Density index of 40 - 60 for largemouth bass.
5. A minimum of 20 adult bass per acre.
6. A maximum of 50% annual mortality (harvest) of bass in age II - V.
7. Growth rate that results in 8-inch bass reaching quality size (12 inch plus) in approximately 1 year.
8. No missing year classes in ages 0 - V.
9. A maximum of 10% of the lake bottom covered by dense weed beds.

These parameters, and other factors, are used in the evaluation and development of recommendations from Aquatic Control surveys.

LITERATURE CITED AND REFERENCE LIST

Anderson, R. 1973. Applications of theory and research to management of warmwater fish populations. Trans. Am. Fish. Soc. 102(1)164-171.

Anderson, R. 1976. Management of small warmwater impoundments. Fisheries 1(6): 5-7, 26-28.

Anderson, R., and S.J. Gutreuter. 1983. Length, weight, and associated structural indices Pages 283-300 in L. A. Nielsen and D. L. Johnson, editors. Fisheries Techniques. American Fisheries Society, Bethesda, Maryland.

Arnold, D.E. 1971. Ingestion, assimilation, survival, and reproduction by *Daphnia pulex* fed seven species of blue-green algae. Limnology and Oceanography. 16: 906-920.

Bennett, C. W. 1971. Management of lakes and ponds. Van Nostrand Reinhold. G. New York 375 pp.

Boyd, C.E. 1990. Water quality in ponds for Aquaculture. Auburn Univ. Ag. Exp. Sta. Auburn, Al. 252 pp.

Calhoun, A. (editor) 1966. Inland Fisheries Management. State of California. Dept. of Fish & Game, 546 pp.

Carlander, K. D. 1969 & 1977. Handbook of freshwater fishery biology. Vols. 1 & 2. Iowa State University Press, Ames, Iowa, Vol 1. 752 pp, Vol 2, 409 pp.

Cole, Gerald, A. 1983. Textbook of Limnology. 3 ed. Dept. of Zoology, Arizona State Univ. Tempe, AZ. The C.V. Mosby Co. St. Louis.

D'ltri, F. (editor) 1985. Artificial reefs Marine and Freshwater applications, Lewis Publishers, Inc. Chelsea, MI 589 pp.

Funk, J. L. (editor) 1974. Symposium on overharvest and management of largemouth bass in small impoundments. North Central Div. Am. Fish. Soc. Sp. Publ. No. 3 116 pp.

Hayes, J. W., and T. E. Wissing. 1996. Effects of stem density of artificial vegetation on abundance and growth of age-0 bluegills and predation by largemouth bass. Transactions of the American Fisheries Society 125:422-433

Hillman, W.P. 1982. Structure and dynamics of unique bluegill populations. Master's Thesis. University of Missouri, Columbia.

Indiana Dept of Nat. Res. 1966, 1985, 1988, Guidelines for the evaluation of sport fish populations in Indiana. Unpublished data.

Johnson, D.L. & Stein, R.A. 1979. (editors) Response of fish to habitat structure in standing water. North Cen. Am. Fish Soc. Sp. Publ. No. 6. 77pp.

Kornman, L.E. 1990. Evaluation of a 15-inch minimum size limit on Black Bass at Grayson Lake, Bull. #90. State of KY Dept. of Fish & Wildlife Res. 71pp.

Kwak, T. J., M. G. Henry. 1995. Largemouth bass mortality and related causal factors During live release fishing tournaments on a large Minnesota lake. North American Journal of Fisheries Management 15: 621-630.

Lawrence, J.M. 1958. Estimated size of various forage fishes largemouth bass can swallow. Proc. of 11th Annual Conf. S.E. Assoc. Fish & Game Comm. 220-225.

Lyons, John. Fish of Wisconsin Identification Database. Picture of Gizzard Shad. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018. < http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=56>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Brook Silverside. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018. < http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=26>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Spotted Sucker. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018. < http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=148>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Golden Redhorse. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018. < http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=57>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Yellow Bass. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=164>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Yellow Perch.

30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=166>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of Black Crappie.</u> 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=11>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of Golden Shiner.</u> 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=58>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of White Crappie.</u> 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=161>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of Common Carp.</u> 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=33>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of Bluntnose Minnow.</u> 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=23>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of Logperch.</u> 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=79>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of Northern Hog Sucker.</u> 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=93>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of Chestnut Lamprey.</u> 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=38>

Lyons, John. <u>Fish of Wisconsin Identification Database. Picture of Black Redhorse.</u>

30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=12>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Bowfin. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=24>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Brown Bullhead. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=29>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Johnny Darter. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=69>

Lyons, John. Fish of Wisconsin Identification Database. Picture of Spotfin Shiner. 30 June 2004. University of Wisconsin Center for Limnology, Wisconsin Sea Grant, Wisconsin Dept. of Natural Resources. 5 Jan. 2018.
< http://www.seagrant.wisc.edu/home/Default.aspx?tabid=605&FishID=146>

McComas, S. 1993. Lake Smarts the First Lake Maintenance Handbook. Terrene Institute, Washington, D.C. 215pp.

Mittelbach, G. G. 1981. Foraging efficiency and body size: a study of optimal diet and Habitat use by bluegills. Ecology 65:1370-1386

National Academy of Sci. 1969. Eutrophication, causes, consequences, correctives. Washington D.C. 658pp.

Nielsen, L.A. and Johnson, D.L. (editors) 1983. Fisheries Techniques. Am. Fish. Soc. Southern Printing Co., Inc. Blacksburg, VA. 468 pp.

Novinger, G.D. & Dillard, J. 1978. New approaches to the management of small impoundments. North Cen. Div. Am. Fish. Soc. Sp. Publ. No. 5. 132 pp.

Pereira, D.L., S.A. Pothaven, and B. Vondracek. 1999. Effects of Vegetation Removal on Bluegill and Largemouth Bass in Two Minnesota Lakes. North American Journal of Fisheries Management 19: 748-756.

Pflieger, W. L. 1975. The Fishes of Missouri. Missouri Department of Conservation. 343pp.

Prather, K.W. 1990. Evaluation of a 12-16 Inch Slot limit on largemouth bass at Elmer Davis Lake. State of KY. Dept. of Fish & Wildlife Res. Bull. #89. 18pp

Reynolds & Simpson. 1976. Evaluation of fish sampling methods and rotenone census. pages in: Novinger & Dillard. 1978. New approaches to the management of small impoundments. N.C. Div. Am. Fish. Soc. Sp. Publ. No. 5 132 pp.

Ruttner, Franz. 1953. Fundamentals of limnology. 3rd edition. Univ. of Toronto Press. Toronto. 261pp.

Sawyer, C. N. 1948. Fertilization of Lakes by Agricultural and Urban Drainage. Journal of the New England Water Works Association, 61 109-127.

Savino, J.F., and R.A. Stein. 1982 Predator-prey interactions between largemouth bass and bluegills as influenced by simulated, submerged vegetation. Transactions of the American Fisheries Society 111: 255-256 Sport Fishing Inst. 1975. Black Bass Biology & Management. Washington. D.C. 534pp.

Strange, R. J., C. R. Berry, and C. B. Schreck. 1975. Aquatic Plant control and reservoir fisheries. Pages 513-521 in R. H. Stroud, editor. Predator-prey systems in fisheries management. Sport Fishing Institute, Washington D.C.

Taras, M. J., A. E. Greenberg, R. D. Hoak, and M. C. Rand eds. 1971. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, Washington D.C. 874pp.

U S E.P.A. 1976. Quality Criteria for Water. U.S. Govt. Printing Office. 256 pp.

Vollenweider, R. A. 1968. Scientific Fundamentals of the Eutrophication of Lakes and Flowing Waters, with Particular Reference to Nitrogen and Phosphorous as Factors in Eutrophication. OECD Report No. DAS/CSI/68.27, Paris.

Wege & Anderson. 1978. Relative Weight(Wr): A new Index of condition for largemouth bass. pages in: Novinger & Dillard. 1978. New approaches to the management of small impoundments. N.C. Div. Am. Fish Soc. Sp. Publ. No. 5. 132pp.

Werner, E.E., and D.J. Hall. 1988. Ontogenetic niche shifts in bluegill: the foraging rate predation risk trade-off. Ecology 69:1352-1366

Wiley, M. J. W. Gorden, S. W. Waite, and T. Powless. 1984. The relationship between aquatic macrophytes and sport fish production in Illinois ponds: a simple model. North American Journal of Fisheries Management 4:111-119

Appendix B

Fish Collection Table

SIZE GROUP (IN)	N	%N	AVERAGE WEIGHT (lbs.)	TOTAL WEIGHT(lbs.)	CONDITION FACTOR	WS	RELATIVE WEIGHT
BLUEGILL							
<3.0	96	16.70%	0.01	0.96	-	-	-
3.0	20	3.48%	0.01	0.20	3.70	0.02	61
3.5	49	8.52%	0.03	1.47	7.00	0.03	111
4.0	70	12.17%	0.04	2.80	6.25	0.04	95
4.5	58	10.09%	0.06	3.48	6.58	0.06	96
5.0	38	6.61%	0.09	3.42	7.20	0.09	102
5.5	55	9.57%	0.11	6.05	6.61	0.12	91
6.0	76	13.22%	0.15	11.40	6.94	0.16	93
6.5	43	7.48%	0.18	7.74	6.55	0.21	85
7.0	47	8.17%	0.22	10.34	6.41	0.27	81
7.5	22	3.83%	0.26	5.72	6.16	0.34	77
8.0	1	0.17%	0.23	0.23	4.49	0.42	55
TOTAL	575			53.81			
GIZZARD SHAD							
3.0	3	0.86%	0.01	0.03			
3.5	10	2.86%	0.02	0.20			
4.0	47	13.43%	0.02	0.94			
4.5	7	2.00%	0.04	0.28			
5.0	7	2.00%	0.04	0.28			
6.0	5	1.43%	0.07	0.35			
6.5	3	0.86%	0.09	0.27			
7.0	40	11.43%	0.09	3.60			
7.5	71	20.29%	0.13	9.23			
8.0	54	15.43%	0.17	9.18			
8.5	27	7.71%	0.21	5.67			
9.0	24	6.86%	0.24	5.76			
9.5	16	4.57%	0.30	4.80			
10.0	12	3.43%	0.37	4.44			
10.5	7	2.00%	0.42	2.94			
11.0	5	1.43%	0.51	2.55			
11.5	4	1.14%	0.59	2.36			
12.0	6	1.71%	0.64	3.84			
13.0	2	0.57%	0.80	1.60			
TOTAL	350			58.32			
LARGEMOUTH BASS							
3.0	1	0.40%	0.01	0.01	3.70	0.01	-
3.5	3	1.20%	0.02	0.06	4.66	0.02	-

4.0	15	6.00%	0.03	0.45	4.69	0.03	-
4.5	5	2.00%	0.04	0.20	4.39	0.04	-
5.0	13	5.20%	0.06	0.78	4.80	0.06	-
5.5	6	2.40%	0.06	0.36	3.61	0.07	-
6.0	10	4.00%	0.08	0.80	3.70	0.10	-
6.5	4	1.60%	0.10	0.40	3.64	0.13	-
7.0	4	1.60%	0.15	0.60	4.37	0.16	-
7.5	1	0.40%	0.15	0.15	3.56	0.20	75
8.0	3	1.20%	0.20	0.60	3.91	0.25	81
8.5	7	2.80%	0.26	1.82	4.23	0.30	87
9.0	9	3.60%	0.35	3.15	4.80	0.36	98
9.5	16	6.40%	0.37	5.92	4.32	0.43	87
10.0	17	6.80%	0.43	7.31	4.30	0.50	86
10.5	7	2.80%	0.57	3.99	4.92	0.59	97
11.0	6	2.40%	0.61	3.66	4.58	0.68	90
11.5	8	3.20%	0.69	5.52	4.54	0.78	88
12.0	15	6.00%	0.80	12.00	4.63	0.90	89
12.5	9	3.60%	1.00	9.00	5.12	1.02	98
13.0	21	8.40%	1.20	25.20	5.46	1.16	103
13.5	14	5.60%	1.24	17.36	5.04	1.31	95
14.0	10	4.00%	1.39	13.90	5.07	1.47	95
14.5	10	4.00%	1.53	15.30	5.02	1.64	93
15.0	12	4.80%	1.81	21.72	5.36	1.83	99
15.5	5	2.00%	1.87	9.35	5.02	2.03	92
16.0	3	1.20%	2.05	6.15	5.00	2.25	91
16.5	2	0.80%	2.34	4.68	5.21	2.48	94
17.0	2	0.80%	3.35	6.70	6.82	2.73	123
18.0	3	1.20%	3.28	9.84	5.62	3.28	100
18.5	1	0.40%	3.36	3.36	5.31	3.58	94
19.0	4	1.60%	3.90	15.60	5.69	3.89	100
20.0	2	0.80%	3.90	7.80	4.88	4.59	85
20.5	1	0.40%	5.02	5.02	5.83	4.96	101
21.0	1	0.40%	6.26	6.26	6.76	5.36	117
TOTAL	250			225.02			

BROOK SILVERSIDE

<3.0	10	6.10%	0.01	0.10
3.0	32	19.51%	0.01	0.32
3.5	39	23.78%	0.01	0.39
4.0	74	45.12%	0.01	0.74
4.5	8	4.88%	0.02	0.16
5.0	1	0.61%	0.02	0.02
TOTAL	164			1.73

LONGEAR SUNFISH

3.0	9	6.25%	0.02	0.18
3.5	22	15.28%	0.04	0.88
4.0	42	29.17%	0.04	1.68
4.5	25	17.36%	0.06	1.50
5.0	24	16.67%	0.09	2.16
5.5	15	10.42%	0.11	1.65

6.0	5	3.47%	0.17	0.85
6.5	2	1.39%	0.20	0.40
TOTAL	144			9.30

SPOTTED SUCKER

5.0	1	0.71%	0.05	0.05
5.5	3	2.13%	0.08	0.24
6.0	5	3.55%	0.10	0.50
6.5	7	4.96%	0.11	0.77
7.0	3	2.13%	0.13	0.39
8.0	3	2.13%	0.20	0.60
8.5	2	1.42%	0.24	0.48
9.0	1	0.71%	0.31	0.31
9.5	2	1.42%	0.35	0.70
10.0	5	3.55%	0.42	2.10
10.5	5	3.55%	0.49	2.45
11.0	9	6.38%	0.53	4.77
11.5	3	2.13%	0.58	1.74
12.0	11	7.80%	0.67	7.37
12.5	1	0.71%	0.62	0.62
13.0	3	2.13%	0.93	2.79
13.5	1	0.71%	1.02	1.02
14.0	11	7.80%	1.22	13.42
14.5	16	11.35%	1.36	21.76
15.0	20	14.18%	1.51	30.20
15.5	9	6.38%	1.48	13.32
16.0	7	4.96%	1.71	11.97
16.5	2	1.42%	1.97	3.94
17.0	8	5.67%	2.11	16.88
17.5	2	1.42%	2.08	4.16
18.0	1	0.71%	2.60	2.60
TOTAL	141			145.15

GOLDEN REDHORSE

6.0	2	1.48%	0.07	0.14
6.5	4	2.96%	0.10	0.40
7.0	8	5.93%	0.15	1.20
7.5	6	4.44%	0.17	1.02
8.0	18	13.33%	0.20	3.60
8.5	20	14.81%	0.21	4.20
9.0	8	5.93%	0.29	2.32
9.5	5	3.70%	0.31	1.55
10.0	2	1.48%	0.33	0.66
10.5	1	0.74%	0.40	0.40
11.0	4	2.96%	0.46	1.84
11.5	1	0.74%	0.52	0.52
12.0	6	4.44%	0.63	3.78
12.5	1	0.74%	0.80	0.80
13.0	5	3.70%	0.81	4.05
13.5	2	1.48%	0.99	1.98
14.0	7	5.19%	1.09	7.63

14.5	3	2.22%	1.12	3.36
15.0	7	5.19%	1.44	10.08
15.5	5	3.70%	1.46	7.30
16.0	6	4.44%	1.79	10.74
16.5	5	3.70%	1.88	9.40
17.0	4	2.96%	2.05	8.20
17.5	3	2.22%	2.24	6.72
18.0	2	1.48%	2.60	5.20
TOTAL	135			97.09

YELLOW BASS

4.0	21	26.92%	0.02	0.42
4.5	11	14.10%	0.05	0.55
5.0	1	1.28%	0.06	0.06
6.5	7	8.97%	0.12	0.84
7.0	10	12.82%	0.15	1.50
7.5	14	17.95%	0.19	2.66
8.0	7	8.97%	0.24	1.68
8.5	3	3.85%	0.27	0.81
9.0	3	3.85%	0.33	0.99
9.5	1	1.28%	0.36	0.36
TOTAL	78			9.87

GREEN SUNFISH

<3.0	8	10.67%	0.01	0.01
3.0	3	4.00%	0.03	0.09
3.5	3	4.00%	0.03	0.09
4.0	6	8.00%	0.04	0.24
4.5	10	13.33%	0.05	0.50
5.0	10	13.33%	0.09	0.90
5.5	10	13.33%	0.11	1.10
6.0	12	16.00%	0.14	1.68
6.5	9	12.00%	0.20	1.80
7.0	3	4.00%	0.23	0.69
8.0	1	1.33%	0.42	0.42
TOTAL	75			7.52

REDEAR SUNFISH

3.5	1	1.52%	0.02	0.11
4.5	1	1.52%	0.06	0.06
5.0	6	9.09%	0.08	0.48
5.5	7	10.61%	0.10	0.70
6.0	7	10.61%	0.13	0.91
6.5	8	12.12%	0.19	1.52
7.0	8	12.12%	0.24	1.92
7.5	4	6.06%	0.30	1.20
8.0	4	6.06%	0.36	1.44
8.5	3	4.55%	0.41	1.23
9.0	9	13.64%	0.54	4.86
9.5	3	4.55%	0.63	1.89

10.0	5	7.58%	0.74	3.70
TOTAL	66			20.02

BLACK CRAPPIE

4.0	2	3.23%	0.02	0.04
5.0	1	1.61%	0.05	0.05
5.5	1	1.61%	0.05	0.05
6.0	4	6.45%	0.09	0.36
6.5	3	4.84%	0.09	0.27
7.0	1	1.61%	0.15	0.15
7.5	6	9.68%	0.19	1.14
8.0	20	32.26%	0.22	4.40
8.5	9	14.52%	0.27	2.43
9.0	7	11.29%	0.30	2.10
9.5	6	9.68%	0.41	2.46
10.0	2	3.23%	0.45	0.90
TOTAL	62			14.35

GOLDEN SHINER

<3.0	1	3.85%	0.01	0.01
3.0	9	34.62%	0.01	0.09
3.5	8	30.77%	0.01	0.08
4.0	4	15.38%	0.02	0.08
5.0	1	3.85%	0.06	0.06
6.0	1	3.85%	0.06	0.06
7.0	1	3.85%	0.14	0.14
7.5	1	3.85%	0.18	0.18
TOTAL	26			0.70

WHITE CRAPPIE

3.5	1	4.17%	0.03	0.03
4.0	1	4.17%	0.02	0.02
4.5	1	4.17%	0.06	0.06
7.0	1	4.17%	0.15	0.15
7.5	6	25.00%	0.20	1.20
8.0	4	16.67%	0.21	0.84
8.5	2	8.33%	0.26	0.52
9.0	3	12.50%	0.32	0.96
9.5	4	16.67%	0.35	1.40
10.5	1	4.17%	0.52	0.52
TOTAL	24			5.70

WARMOUTH

3.0	1	6.25%	0.01	0.01
3.5	1	6.25%	0.04	0.04
4.0	3	18.75%	0.07	0.21
4.5	3	18.75%	0.08	0.24
5.0	2	12.50%	0.10	0.20
6.0	3	18.75%	0.20	0.60

6.5	1	6.25%	0.22	0.22
7.5	1	6.25%	0.30	0.30
8.0	1	6.25%	0.35	0.35
TOTAL	16			2.17

COMMON CARP

17.0	1	12.50%	2.60	2.60
22.5	2	25.00%	2.96	5.92
23.0	1	12.50%	5.97	5.97
25.0	1	12.50%	7.76	7.76
26.5	2	25.00%	10.11	20.22
29.0	1	12.50%	13.29	13.29
TOTAL	8			55.76

BLUNTNOSE MINNOW

<3.0	3	37.50%	0.01	0.03
3.0	3	37.50%	0.01	0.03
3.5	2	25.00%	0.01	0.02
TOTAL	8			0.08

LOGPERCH

3.5	1	16.67%	0.01	0.01
4.0	2	33.33%	0.02	0.04
4.5	2	33.33%	0.03	0.06
6.0	1	16.67%	0.06	0.06
TOTAL	6			0.17

NORTHERN HOGSUCKER

8.5	1	33.33%	0.26	0.26
10.5	1	33.33%	0.50	0.50
14.0	1	33.33%	1.30	1.30
TOTAL	3			2.06

CHESTNUT LAMPREY

8.0	2	66.67%	0.05	0.10
9.5	1	33.33%	0.16	0.16
TOTAL	3			0.26

BLACK REDHORSE

5.5	1	5.88%	0.11	0.11
16.0	1	5.88%	1.65	1.65
TOTAL	2			1.76

YELLOW PERCH

7.5	1	50.00%	0.16	0.16

8.0	1	50.00%	0.20	0.20
TOTAL	2			0.36

BOWFIN

23.5	1	100.00%	4.70	4.70
TOTAL	1			4.70

BROWN BULLHEAD

6.5	1	100.00%	0.10	0.10
TOTAL	1			0.10

JOHNNY DARTER

<3.0	1	100.00%	0.01	0.01
TOTAL	1			0.01

SPOTFIN SHINER

<3.0	1	100.00%	0.01	0.01
TOTAL	1			0.01