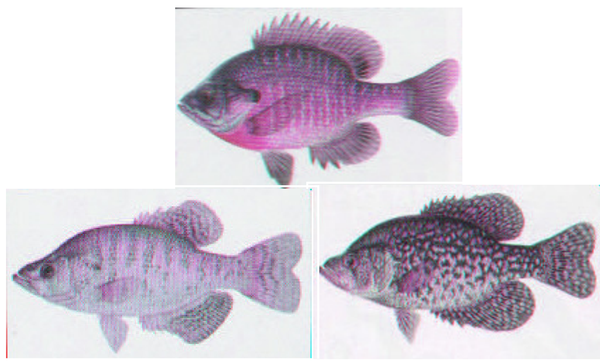
Aurora Lake Fishery Evaluation



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Prepared for:

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1.0 Introduction

EnviroScience, Inc. performed a fish population survey on Aurora Lake in Portage County, Ohio on May 9th and 10th, 2001. The fishery of the lake was evaluated through four sampling zones which included representative near-shore habitats used by the fish community (Figure 1-1). The goal of the study was to assess the current health of the Aurora Lake fishery and make recommendations for future management.

2.0 Methods

Two different sampling techniques, night-boat electrofishing and hoop netting, were used to collect fish community data from representative habitats within Aurora Lake. Length and weight data were recorded for every fish species collected. The collection methods are summarized in the following paragraphs.

2.1 Electrofishing

A Smith-Root® 5.0 GPP Electrofisher was used to sample the fish community of four zones in the lake. The electrofisher used pulsed-direct current from anodes mounted to a boom on the front of a 5.33 m (17'6") boat. The available peak current from the electrofishing unit is 1,000 volts and 5,000 watts. The output of the unit was adjusted according to the conductivity of the water body being sampled. Lower conductivity water, requires higher voltage to effectively sample the area. Applying higher voltage will increase the electrical current flowing through the water.

Electrofishing occurred at night because of the well-established tendency of fish to rise within four to six feet of the surface to night feed. When shocked, the fish became temporarily stunned and floated to the surface where they were netted. To aid in capture, the boom of the boat was also equipped with three 250 watt flood lamps.

Figure 1-1 Site Map and Sampling Locations

The degree to which fish are affected by electric current is a function of their surface area. Generally, larger fish are more sensitive to the electric currents. The electrofisher was adjusted to 45% (600 volts at 4-8 amps) of its available power at 120 pulses per second. Depending on the response of the fish, the electrofisher was adjusted to minimize/avoid adverse effects on the fish.

To improve sampling efficiency, EnviroScience incorporated a second boat to net stunned fish which surfaced after the electrofishing boat passed through the area. This two person 4.45 m (14'6") boat was equipped with a Brinkman® Q-Beam 400,000 C.P. spotlight, nets, and an oxygenated live well.

Each of the sampling zones were approximately 500 m (1640.4 ft.) in length and all available habitat was sampled for approximately 2000 seconds. The boat was maneuvered by directing the boat's bow to the shore and/or submerged objects while shocking the near shore area. The boat continued in this manner in one direction down the shoreline until the end of the 500 m zone.

Electrofishing was controlled by the netter at the bow of the boat using a foot pedal equipped with a "dead man" switch. Positive pressure cut-off switches located inside the electrofishing unit allowed the driver to turn off the electrofishing unit if necessary. The netters were responsible for capturing all observed fish and the driver was responsible for maneuvering the boat along the shore, and within and around fish habitat.

The landing nets have 2.5 m (8.20 ft.) long handles and 3.0 mm (0.12 in.) Atlas® mesh knotless netting. Captured fish were immediately placed into on-board live wells. When sampling was complete, the fish were transported to the field station where they were processed and released unharmed.

All fish were weighed, measured for total length, and examined for the presence of gross external anomalies. Gross external or DELT (deformities, erosions, lesions, and tumors) anomalies are defined as externally visible skin or subcutaneous disorders. Anomalies were recorded on the fish data sheet. Exact counts of anomalies present on each fish were not made, although light and heavy infestations were noted for certain types of anomalies.

In the case of samples comprised entirely of one size class of the same species (e.g. adults, juveniles, young-of-the-year), weighing was performed on a subsample of 50 individuals either as individuals or in aggregate as a species. If there was a noticeable variation in sizes between individual fish of a species, individual weights were taken.

With smaller species (e.g. sunfish) weighing was completed in aggregate. If more than 50 individuals of one species were collected, a subsample of at least 50 fish was weighed and the remainder counted. All results were recorded on fish data sheets for each sampling site (Appendix A).

2.2 Hoop netting

Hoop nets were set at four locations representing deep-water habitats (Figure 1-1). The hoop nets were 3.0 feet (0.9 meters) in diameter with 1 inch (2.54 centimeter) bar mesh. Each hoop net was baited with freshly euthanized fish and fastened to a cement block which anchored the net to the lake bottom. The nets remained in the water for 24 hours and checked after a twelve hour interval. Fish collected in the hoop nets were identified, counted, recorded, and returned to the lake unharmed.

2.3 Catch per Unit Effort and Proportional Stock Density

An attempt was made to apply equal electrofishing effort (roughly 2000 seconds) in each 500 meter sampling zone. The catch per unit effort (CPUE) was calculated for 2000 seconds, allowing for equal comparison between zones.

To gain further insight to the quality of the bass, and bluegill populations, a Proportional Stock Density (PSD) was determined. This value was calculated by dividing the number of quality size fish by the total number of fish that were longer than the minimum stock size and multiplying the quotient by 100 (Anderson, 1979). A quality sized fish is an adult reproducing fish. A stock size fish is an individual that can be potentially recruited into the adult population and eventually become quality size. The minimum stock and quality sizes for largemouth bass are ≥8.0 inches and ≥12.0 inches (20cm and 30cm), respectively. The stock and quality sizes for bluegill are ≥3.0 inches and ≥6.0 inches (7.6 cm, 15cm), respectively (Anderson 1979). The PSD provides valuable understanding of the current adult population and an estimate of recruitment for the following season. The PSD is typically calculated for bass and bluegill, which are generally the major fish of concern to anglers and fishery managers. Analysis of PSD values can also identify problems with reproduction, growth and mortality. To sustain quality bass fishing, optimum PSD values for largemouth bass should be 40-60% while bluegill PSD values should be 20-40% (Anderson, 1979).

3.0 Results

3.1 Electrofishing

In total, 14 species of fish were encountered in the Aurora Lake study area (Table 3-1). The fish collection totaled 544 individuals and 204.9 kg of fish (Tables 3-2 and 3-3). The four dominant fish species in contribution to total abundance included three centrarchids (family Centrarchidae), the bluegill sunfish, white crappie, black crappie, and a cyprinid (family Cyprinidae) common carp (Table 3-2; Figure 3-1). Common carp, contributed the greatest

(73.5%) to total mass, while white amur, bluegill sunfish, and largemouth bass contributed 7.5, 4.5, and 4.3% to the mass, respectively (Table 3-3; Figure 3-2). When common carp and white amur (two exotic/introduced species) are removed from the mass calculation, the species with the greatest contribution to biomass are bluegill sunfish, largemouth bass, black crappie, and white crappie, in descending order, respectively. Two large bass (7.25 and 5.5 lbs) collected in zone 1 contributed the majority of the mass of this fish species. Neither common carp nor amur were returned to the lake after collection. A total of 54 carp (150.7 lbs, 332.2 kg) and 2 amur (34.1 lbs, 15.5 kg) were effectively removed from the lake. Two additional white amur were observed during the survey, however they could not be captured.

Table 3-1 Fish Species List

Common Name	Scientific Name
black crappie	*Poxomis nigromaculatus*
brook silverside	*Labidesthes sicculus*
brown bullhead	*Ictalurus nebulosus*
channel catfish	*Ictalurus punctatus*
common carp	*Cyprinus carpio*
golden shiner	*Notemigonus crysoleucas*
largemouth bass	*Micropterus salmoides*
pumpkinseed sunfish	*Lepomis gibbosus*
northern bluegill sunfish	*Lepomis macrochirus*
warmouth sunfish	*Lepomis gulosus*
white amur	*Ctenopharyngodon idella*

white crappie	*Pomoxis anularis*
yellow bullhead	*Ictalurus natalis*
yellow perch	*Perca flavescens*

Table 3-2 Electrofishing Abundance Results

Species	Zone 1	Zone 2	Zone 3	Zone 4	% Abundance	Total
black crappie	59	8	2	6	13.8	75
brook silverside	0	1	0	5	1.1	6
brown bullhead	0	1	0	0	0.2	1
common carp	9	18	13	14	9.9	54
channel catfish	1	0	0	6	1.3	7
golden shiner	2	1	0	3	1.1	6
largemouth bass	5	5	2	1	2.4	13
pumpkinseed sunfish	9	9	17	16	9.4	51
bluegill sunfish	52	45	41	81	40.3	219
warmouth sunfish	3	0	1	0	0.7	4
white amur	1	0	1	0	0.4	2
white crappie	41	22	11	15	16.4	89
yellow bullhead	1	1	1	1	0.7	4
yellow perch	1	0	1	11	2.4	13
Total #	**184**	**111**	**90**	**159**	**100**	**544**

Table 3-3 Electrofishing Mass Results (kg)

Species	Zone 1	Zone 2	Zone 3	Zone 4	% Total Mass	Total
black crappie	6.1	0.6	0.1	0.4	3.6	7.28
brook silverside	0.0	0.004	0.0	0.021	0.01	0.03
brown bullhead	0.0	0.1	0.0	0.0	0.1	0.13
common carp	25.2	46.5	40.8	38.2	73.5	150.7
channel catfish	0.4	0.0	0.0	2.7	1.5	3.02
golden shiner	0.1	0.1	0.0	0.1	0.1	0.29
largemouth bass	7.0	1.5	0.3	0.01	4.3	8.84
pumpkinseed sunfish	0.5	0.4	0.7	0.7	1.1	2.29
bluegill sunfish	2.4	1.7	1.4	3.8	4.5	9.25
warmouth sunfish	0.1	0.0	0.9	0.0	0.5	0.97
white amur	6.4	0.0	9.1	0.0	7.5	15.47
white crappie	3.2	1.5	0.3	0.7	2.8	5.68
yellow bullhead	0.1	0.1	0.2	0.2	0.3	0.57
yellow perch	0.04	0.0	0.03	0.4	0.2	0.42
Total #	**51.5**	**52.5**	**53.8**	**47.1**	**100**	**205**

The number of fish caught per 2000 seconds of electrofishing was calculated for each sampling zone.

Catch per unit effort was highest at zones 1 and 4, where values of 159 and 155 fish were recorded, respectively (Table 3-4). The lowest CPUE of 89.9 was recorded at zone 3.The CPUE was also calculated

Fig 3-1 Fish % Abund

Fig 3-2 Fish % Biomass

for species with particular sportfishing importance (Figures 3-3 to 3-6). The highest average CPUE (52.4) was calculated for the bluegill sunfish. This species made up a major proportion of the abundance throughout the lake and the CPUE was highest in zone 4 (Figure 3-3). The CPUE of largemouth bass was highest at zone 2 and lowest at zone 4 (Figure 3-3), while the average CPUE for this species (3.07) was lower than other sportfish (Table 3-4). The average CPUE's for white crappie and black crappie were 20.7 and 16.7, respectively. The highest and lowest CPUE's for these species were calculated from zones 1 and 3, respectively (Figures 3-5 and 3-6).

Table 3-4 Catch per Unit Effort for 2000 seconds fished

Species	Zone 1	Zone 2	Zone 3	Zone 4
black crappie	50.9	7.98	2.0	5.9
brook silverside	0.0	1.00	0.0	4.9
brown bullhead	0.0	1.00	0.0	0.0
common carp	7.78	17.9	13.0	13.7
channel catfish	0.86	0.0	0.0	5.90
golden shiner	1.73	1.00	0.0	2.92
largemouth bass	4.32	5.00	2.00	0.97
pumpkinseed sunfish	7.80	8.98	17.0	15.6
bluegill sunfish	44.9	44.9	41.0	79.0
warmouth sunfish	2.60	0.0	1.00	0.0
white amur	0.86	0.0	1.00	0.0

white crappie	35.4	22.0	11.0	14.6
yellow bullhead	0.86	1.00	1.00	0.97
yellow perch	0.86	0.0	1.00	10.7
Total #	**159.0**	**111.0**	**90.0**	**155.0**

Figures 3-1 through 3-3

The proportional stock density was calculated for largemouth bass and bluegill sunfish. As mentioned above, a healthy mixed bass/bluegill fishery should have PSD's for bass between 40 and 60% while bluegill PSD values should be 20 to 40%. There were too few largemouth bass collected to calculate an accurate PSD. The bluegill PSD values ranged from 22.9 to 45.5, while the average for all sampling zones was 35.7%.

Table 3-5 Proportional Stock Density (PSD) Results

Species	Zone 1	Zone 2	Zone 3	Zone 4	Average
largemouth bass	N/A	N/A	N/A	N/A	N/A
bluegill sunfish	45.5	22.9	34.8	40.0	35.7

N/A- not applicable due to low numbers of largemouth bass

3.2 Hoop netting

The four baited hoop nets yielded four fish taxa and 26 individuals during the first 12 hours of the 24 hour hoop net sampling period (Table 3-6). No additional fish were collected in the remaining 12 hours. No fish were collected from net 2 (Figure 1-1; Table 3-6)

Table 3-6 Hoop net Abundance Results

Species	Net 1	Net 2	Net 3	Net 4	Total
black crappie	5	0	10	2	17
pumpkinseed sunfish	1	0	0	1	2
white crappie	1	0	3	1	5
yellow bullhead	0	0	0	2	2
Total #	**7**	**0**	**13**	**6**	**26**

4.0 Discussion and Recommendations

The dominant fish species present during the evaluation of Aurora Lake was the northern bluegill sunfish (*Lepomis macrochirus*). This species comprised 40% of the fish abundance in the lake and 24% of the fish mass when carp and amur are removed from the calculation. Black and white crappie together comprised 30% of the abundance, while the largemouth bass contributed 2.4% to the abundance. The bass abundance is considered a low percentage for a top predator. In a healthy bass fishery, largemouth bass should contribute approximately 15% to the abundance (ODNR, 1996). The average length of the bluegill and crappie were 12.2 cm (4.8 in.) and 16.3 cm (6.4 in), respectively, while the average length for bass (excluding juveniles) was 27.3 cm (10.8 in). Therefore, the average size bass may be too small to efficiently consume the most common food sources (4.8 inch bluegill and 6.4 inch crappie). Additionally, the abundance values suggest that the largemouth bass are too few in number to maintain a reproducing population in Aurora Lake. This may be due to angling pressure on adults and predation on bass fry by the abundant bluegill sunfish, and both black and white crappie.

Common carp and white amur together comprised over 80% of the fish mass. Common carp are an introduced species, and are considered and undesirable "rough fish" due to their feeding and breeding activities, which disturb the sediment, other spawning fish, and uproot aquatic vegetation. White amur can be beneficial in controlling aquatic macrophytes when stocked properly, however they are often overstocked and overgraze the aquatic vegetation. Few aquatic macrophytes were observed in the sampling zones. This may be partially due to overgrazing by the stocked amur population, and aggravated by the activities of carp. Additionally, the feeding activities of carp and amur can indirectly increase water turbidity by exposing sediments, facilitating resuspension by wave action. Vegetation should slowly return as the remaining amur die and their grazing pressure is reduced. If aquatic vegetation does return, it should be left to grow in areas where it does not hinder and swimming and boating. Studies of water nutrients, plankton, and sediment inputs from the watershed could aid in determining the most significant causes of turbidity.

The abundance and CPUE results showed variability in the fish community between sampling zones. This suggests that certain fish taxa may exploit specific regions of the lake more than others (Figures 3-1 to 3-4). The low total abundance and CPUE data at zone 3 may be due to poor habitat in the area around the dam. Artificial habitat consisting of hawthorn brush piles or loose block and boulders may be added in varying depths to attract fish to this area. The majority of the remaining lakeshore appeared to have suitable habitat to attract fish. Observations during the fishery survey, indicated that roughly 58% of the shoreline of Aurora Lake consisted of natural woody/shrub vegetation. There was also an abundance of boulders in zone 2, and large woody debris in zone 4, which make excellent fish habitat.

The Proportional Stock Density (PSD) values calculated for bluegill in Aurora Lake range from normal to high. The average PSD (35.7%) is moderately high for a healthy mixed bass/bluegill fishery. From the low bass abundance, it appears that the bluegill PSD may be increasing in Aurora Lake. In situations where bluegill PSD's are high, the problem may be associated with high mortality of adult bass

(Reynolds and Babb 1978). The mortality may be due to over harvest, but could also be attributed to low food availability, or poor reproductive success. It appears that Aurora Lake currently produces more harvestible size (quality size) bluegill and crappie than bass. The excellent bluegill population can be utilized by anglers, which would bolster the bass population under proper management.

The results of the fishery evaluation show the potential for a bluegill/crappie dominated lake. The population of largemouth bass may be inadequate to maintain a sport fishery for bass, and to control bluegill and crappie populations. A more balanced population of bluegill, crappie, and bass would better suit the Aurora Lake fishery for recreational use. However, several steps will should be initiated to achieve, and manage such a fishery. EnviroScience, Inc. suggests that the managers of Aurora Lake encourage selective harvesting of bluegill and crappie while harvesting only the bass greater than 15 inches in length. However, catch and release of greater than 15 inch bass should be encouraged. Reducing the number of large bluegill and crappie will relieve juvenile bass from predation by these two fish and also reduce the average size of crappie and bluegill to a range that may be more efficiently preyed upon by bass. Once the crappie and bluegill populations have been reduced (1 to 2 years of selective angling), the bass population may be augmented by stocking 25-50 four to six inch bass/acre. Ideally, this management practice will result in an increase in the bass population in the >12 inch category. Maintaining an adult population of largemouth bass will ensure predation on small bluegills, and adequate spawning to replenish the population.

Currently, Aurora Lake is dominated by bluegill. The bass populations are relatively low, which is unfavorable for mixed sportfishing. The data collected will allow for future comparisons after a management plan has developed and implemented. EnviroScience believes that a management plan which protects adult bass and encourages the continued harvest of bluegill and crappie can help the Aurora Lake fishery meet the expectations of many of the anglers in the community.

5.0 References

Anderson, R. O. 1979. New approaches to recreational fishery management. Missouri Cooperative Fishery Research Unit.

Austin, M., Devine, H., Goedde, L., Greenlee, Hall, T., M., Johnson, L., Moser, P. 1996. *Ohio Pond Management Handbook a guide to managing pond for fishing and attracting wildlife.* Division of Wildlife, Ohio Department of Natural Resources.

Novinger, G.D., and R.E. Legler. 1978. Bluegill population structure and dynamics. N. Central Div. Am. Fish. Soc., Spec. Publ. No. 5.

Ohio Environmental Protection Agency. 1987. *Biological Criteria for the Protection of Aquatic Life,* Volume II.

Reynolds, J.B., and L.R. Babb. 1978. Structure and dynamics of largemouth bass populations. N. Central. Div. Am. Fish. Soc. Spec. Publ. No. 5.

Trautman, M. 1981. *Fishes of Ohio*. Ohio State University Press, Columbus, Ohio.

Appendix A

Fish Data Sheets