Aurora Lake Fishery Evaluation

Prepared for:

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1.0 Introduction

EnviroScience, Inc. performed a fish community survey on Aurora Lake in Portage County, Ohio on May 6th and 7th, 2002. The fish community was evaluated by electrofishing three sampling zones which included representative near-shore habitats (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.

Exotic species were not returned to the lake during and the fishery evaluation. All Common carp (*Cyprinus carpio*) and White amur (*Ctenopharyngodon idella*) collected during the survey were euthanized, and disposed. Additional species specific electrofishing and removal were conducted for carp and amur after the initial fishery survey (Figure 1-1).

2.0 Methods

Night-boat electrofishing was 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 Fish Survey

A Smith-Root® 5.0 GPP Electrofisher was used to sample the fish community at three zones. The electrofisher supplied pulsed-direct current to anodes mounted to a boom on the front of a 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.

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.

Electrofishing was conducted 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.

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 bow toward the shore and/or submerged objects while shocking the near shore area. The boat continued in this manner in one direction down the shoreline.

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 fish data sheets (Appendix A). 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.   All results were recorded on fish data sheets for each sampling site.

2.2 Catch per Unit Effort and Proportional Stock Density

An attempt was made to apply equal electrofishing effort (approximately 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, bluegill, and black crappie 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, Murphy and Willis 2000). A quality size fish is the minimum length that most anglers prefer to catch. A stock length fish is a fish at approximate maturity, and/or an individual that is the minimum length of fish that can provide recreational value. 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 (8cm and 15cm), respectively, while black crappie are ≥5.0 inches and ≥8.0 inches (13cm and 20cm), (Anderson 1979, Murphy and Willis 2000).

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. The black crappie was also chosen for this survey since it was an abundant component of the community in the 2001 and 2002 evaluation. Analysis of PSD values can also identify problems with reproduction, growth and mortality. To sustain quality bass fishing, optimum PSD values for largemouth bass are 40-60, bluegill PSD values are 20-40, and crappie values should be 30-60 (Anderson, 1979, Murphy and Willis 2000).

3.0 Results

3.1 Fish Survey

In total, 13 species of fish were encountered in the Aurora Lake study area (Table 3-1). The fish collection totaled 448 individuals and 172.1 kg of fish (Tables 3-2 and 3-3). The four dominant fish species in contribution to total abundance included the bluegill sunfish, black crappie, pumkinseed sunfish, and the common carp (Table 3-2; Figure 3-1). Common carp, contributed (75.5%) to the total mass, while bluegill sunfish, white amur, and channel catfish contributed 6.1, 4.5, and 4.4% to the mass, respectively (Table 3-3; Figure 3-2).

A total of 45 carp (129.9 lbs, 58.9 kg) and 1 amur (7.8 lbs, 3.54 kg) were removed from the lake during the fishery evaluation. During the additional exotic species removal, total of 57 (369.5 lbs 167.6 kg) carp and one amur (21.2 lbs 9.63 kg) were removed from the lake (Table 3-4).

3.2 Catch per Unit Effort and Proportional Stock Density

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 2, where values of 161.8 and 170.2 fish were recorded, respectively (Table 3-5). The lowest CPUE of 115 was recorded at zone 3.

The proportional stock density was calculated for largemouth bass, bluegill sunfish, and black crappie. There were too few largemouth bass collected to calculate an accurate PSD per site. The PSD for the total number of bass collected was 29 (Table 3-6). Despite the low PSD, the length distribution and abundance of the bass appear to have improved slightly sice the 2001 survey (Figure 3-3, EnviroScience, Inc. 2001). The PSD values for bluegill sunfish were very high (range, 93-131) indicating an unbalanced, yet outstanding bluegill fishery. Many of the stock length bluegill collected in 2001 may have grown to quality size by 2002 (Figure 3-4). The PSD values calculated for both crappie species were generally low which indicates a low proportion of quality size white and black crappie in Aurora Lake.

Length frequency histograms were created for bass and bluegill to evaluate trends in the fish community between the 2001 and 2002 surveys. There was a considerable increase in the number of bass in the 8-12 inch range since 2001 (Figure 3-3). The number of harvestable size (6 inch) bluegill also increased since 2001 (Figure 3-4).

4.0 Discussion and Year Comparison

The dominant fish species present during the evaluation of Aurora Lake was the northern bluegill sunfish (*Lepomis macrochirus*). This species comprised nearly 45% of the fish abundance in the lake and 6% of the fish mass. Black and white crappie together comprised 21% of the abundance, while the largemouth bass contributed 4.7% to the abundance. The bass abundance is considered a low percentage for a top predator, yet is nearly double the percent abundance (2.4%) from the 2001survey. In a healthy bass fishery, largemouth bass should contribute approximately 15% to the abundance (ODNR, 1996).

The average length of bluegill was 12.6 cm (4.96 in.), while the average length for bass (excluding juveniles) was 24 cm (9.44 in). Therefore, the average size bass may be too small to efficiently consume the most common food source (4.9 inch bluegill). 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 angler pressure, and sub-optimal spawning conditions. Largemouth bass are often associated with muck bottoms and aquatic vegetation. Largemouth bass can tolerate moderate siltation, however, spawning may not be successful in nests that are frequently disturbed by heavy siltation from the watershed, or the activities of exotic species.

In 2002 common carp and white amur 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. A total of 528 lbs of carp and amur were removed from the lake between the fish survey and exotic species removal. The removal effort may have slightly reduced the adult reproducing carp population, however, future surveys will be needed to verify the direct (lowered population) and indirect effects (lowered turbidity) of carp removal. A reduction in carp numbers and average length has been observed after continued removal efforts (EnviroScience, Inc. 2000). However, caution should be used when the decision is made to cease periodic carp removal. Discontinuing exotic species removal may enable the remaining young, prolific carp population to expand considerably.

The Proportional Stock Density (PSD) values calculated for bluegill in Aurora Lake are high. The average PSD (110) is moderately high for a healthy mixed bass/bluegill fishery. It appears that many of the stock length bluegill collected in 2001 grew to quality size by 2002. As predicted, the bluegill PSD increased from 2001 to 2002, indicating a larger number of harvestible size (quality size) bluegill in Aurora Lake (Figure 3-4). The excellent bluegill population should be harvested by anglers. The high bluegill PSD may be associated with high mortality of adult bass, which in turn could be due to over harvest (Reynolds and Babb 1978). The bass population may also have poor reproductive success associated with water quality and the activities of exotic species.

The bass abundance and length distribution appears to have increased slightly since the 2001 survey (Table 3-1, EnviroScience, Inc. 2001). The Aurora Lake Association stocked bass in the Fall of 2001. The survival or mortality of these fish is not known, however, the number of fish in the 8-12 inch size range has increased considerably since 2001 (Figure 3-3).

The results of two years of fishery evaluation indicate that Aurora Lake has become a bluegill dominated lake. The population of largemouth bass may be inadequate to maintain a sport fishery for bass, and to control the bluegill population. A more balanced population of bluegill, and bass would better suit the Aurora Lake fishery for recreational use. Suggestions were made by EnviroScience, Inc. in 2001 to achieve such a fishery. These included, encouraging selective harvesting of bluegill and crappie while harvesting only the bass greater than 15 inches in length. Catch and release of bass greater than 15 inches was encouraged. The intention was to reduce the number of large bluegill and crappie to relieve juvenile bass from predation and reduce the average size of crappie and bluegill to a range that may be more efficiently preyed upon by bass. EnviroScience also suggested augmenting the bass population after a reduction in bluegill and crappie (1 to 2 years of selective angling) could be verified. Ideally, this management practice would result in an increase in the bass population in the >12 inch category. Maintaining an adult population of largemouth bass would ensure predation on small bluegills, and adequate spawning to replenish the population.

EnviroScience, Inc. believes the above management strategy is still relevant to Aurora Lake. The bass population has remained relatively low since the Fall 2001 stocking, and the lake is dominated by bluegill. Stocking of largemouth bass may be implemented to appease the anglers in the community, however, it should be conducted in the Spring during favorable growth and acclimation conditions. EnviroScience encourages the Aurora Lake Association to continue to address the water quality issues that undermine the biological integrity of Aurora Lake. This will ensure that the implemented fishery management practices are successful.

Table 3-1 Fish Species List

Common Name	Scientific Name
black crappie	*Poxomis nigromaculatus*
brook silverside	*Labidesthes sicculus*
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	% Abundance	Total
black crappie	39	17	4	13.4	60
brook silverside	1	9	0	2.2	10
common carp	10	21	14	10.0	45
channel catfish	0	5	11	3.6	16
golden shiner	1	0	6	1.6	7
largemouth bass	5	9	7	4.7	21
pumpkinseed sunfish	10	9	16	7.8	35
bluegill sunfish	72	84	45	44.9	201
warmouth sunfish	2	5	0	1.6	7
white amur	1	0	0	0.2	1
white crappie	18	9	7	7.6	34
yellow bullhead	3	0	1	0.9	4
yellow perch	0	3	4	1.6	7
Total	**162**	**171**	**115**	**100**	**448**

Figure 3-1

Table 3-3 Electrofishing Mass Results (kg)

Species	Zone 1	Zone 2	Zone 3	% Total Mass	Total
black crappie	3.70	1.31	0.36	3.12	5.37
brook silverside	0.01	0.04	0.05	0.05	0.09
common carp	29.1	60.3	40.5	75.5	129.9
channel catfish	0	2.78	4.82	4.42	7.61
golden shiner	0.02	0	0.15	0.10	0.17
largemouth bass	3.68	1.43	0.72	3.38	5.82
pumpkinseed sunfish	0.62	0.36	0.82	1.05	1.80
bluegill sunfish	4.10	4.76	1.66	6.11	10.52
warmouth sunfish	0.06	0.28	0	0.20	0.34
white amur	7.82	0	0	4.55	7.82
white crappie	1.23	0.41	0.20	1.07	1.84
yellow bullhead	0.49	0	0.15	0.37	0.64
yellow perch	0	0.08	0.07	0.08	0.15
Total	**50.82**	**71.69**	**49.16**	**100**	**172.1**

Fig 3-2 Fish % Biomass

Table 3-4 Abundance and Mass(kg) of Exotic Species

Abundance	Zone E1	Zone E2	Total
common carp	30	27	57
white amur	0	1	1
Mass			
common carp	88.53	79.08	167.61
white amur	0	9.63	9.63

Table 3-5 Catch per Unit Effort for 2000 seconds fished

Species	Zone 1	Zone 2	Zone 3
black crappie	39	16.9	4.0
brook silverside	1.0	9.0	0
common carp	9.99	20.9	14.0
channel catfish	0	5.0	11.0
golden shiner	1.0	0	6.0
largemouth bass	5.0	9.0	7.0
pumpkinseed sunfish	10.0	9.0	16.0
bluegill sunfish	71.9	83.6	45.0

warmouth sunfish	2.0	5.0	0
white amur	1.0	0	0
white crappie	18.0	9.0	7.0
yellow bullhead	3.0	0	1.0
yellow perch	0	3.0	4.0
Total	**161.8**	**170.2**	**115**

Table 3-6 Proportional Stock Density (PSD) Results

Species	Zone 1	Zone 2	Zone 3	Total
black crappie	3	8	33	6
bluegill sunfish	108	131	93	114
white crappie	14	25	0	15
largemouth bass	N/A	N/A	N/A	29

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

Fig 3-3

Fig 3-4

5.0 References

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Appendix A

Fish Data Sheets