1994

# FINAL REPORT
# FISH POPULATION STUDY
# AND MANAGEMENT PLAN
# SHARON LAKE
# HAMILTON COUNTY, OHIO

Submitted to:

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ENVIRONMENTAL SERVICES

## 1.0 PURPOSE

The Hamilton County Park District (HCPD) manages the Sharon Woods Lake in north central Ohio for public enjoyment, especially by local recreational anglers (Figure 1). The lake is stocked annually with a variety of game fish and receives heavy fishing pressure. Fishing techniques are restricted to rod and reel. Shore fishing is generally not permitted except in a small area reserved for children and handicapped patrons near the boat house. Bass are to be returned to the lake, except during tournaments and most other species have numerical and size restrictions. A voluntary creel census, conducted by HCPD, appeared to show a decrease in the number of desirable game fish species, like bass, catfish and crappie. Unfortunately, this type of fish population survey is often incomplete and inaccurate. As part of the HCPD's lake management program, KEMRON Environmental Services was enlisted to gather baseline fisheries data by conducting a population survey. The following report describes the methods used during the field survey and for the statistical analysis. The existing fish populations will be enumerated and characterized, and recommendations to maximize the recreational fishery, without negatively impacting water quality or the complex relationships between the fishes and other species present in the lake will be explored.

## 2.0 DESCRIPTION OF PROJECT

### 2.1 Site Description

Sharon Woods Lake was constructed in the early 1970's by damming Sharon Creek, a major tributary of Mill Creek. The lake covers approximately 35 acres, with an maximum depth of sixteen feet. The lake's 4.95 square mile watershed is mostly in Butler County and is highly urbanized with a nearly equal amount of residential and commercial property. Generally the southern arm of the lake and west bank of the northern arm are tree-lined, while the exposed northeastern bank is covered with turf grasses.

KEMRON conducted electrofishing surveys at four areas in Sharon Lake. The first bank survey began at the boat ramp and headed south to the Sharon Road bridge, then back to the ramp (Figure 2). The second cruise started at the Sharon Road bridge at the opposite bank and continued to a position directly across from the boat launch. The third cruise encompassed the entire southeast arm of the lake. This bank distance covered approximately 40 percent of the lake's shoreline. Four bank areas were fished during the second day. The same three as on the first day and the bay near the apartment buildings across from the boat launch. This cruise provided an additional five percent of very productive shoreline, for a total shoreline coverage of approximately 45 percent.

### 2.2 Electrofishing

KEMRON conducted fish surveys of Sharon Lake on April 19, 21 and 26, 1994.

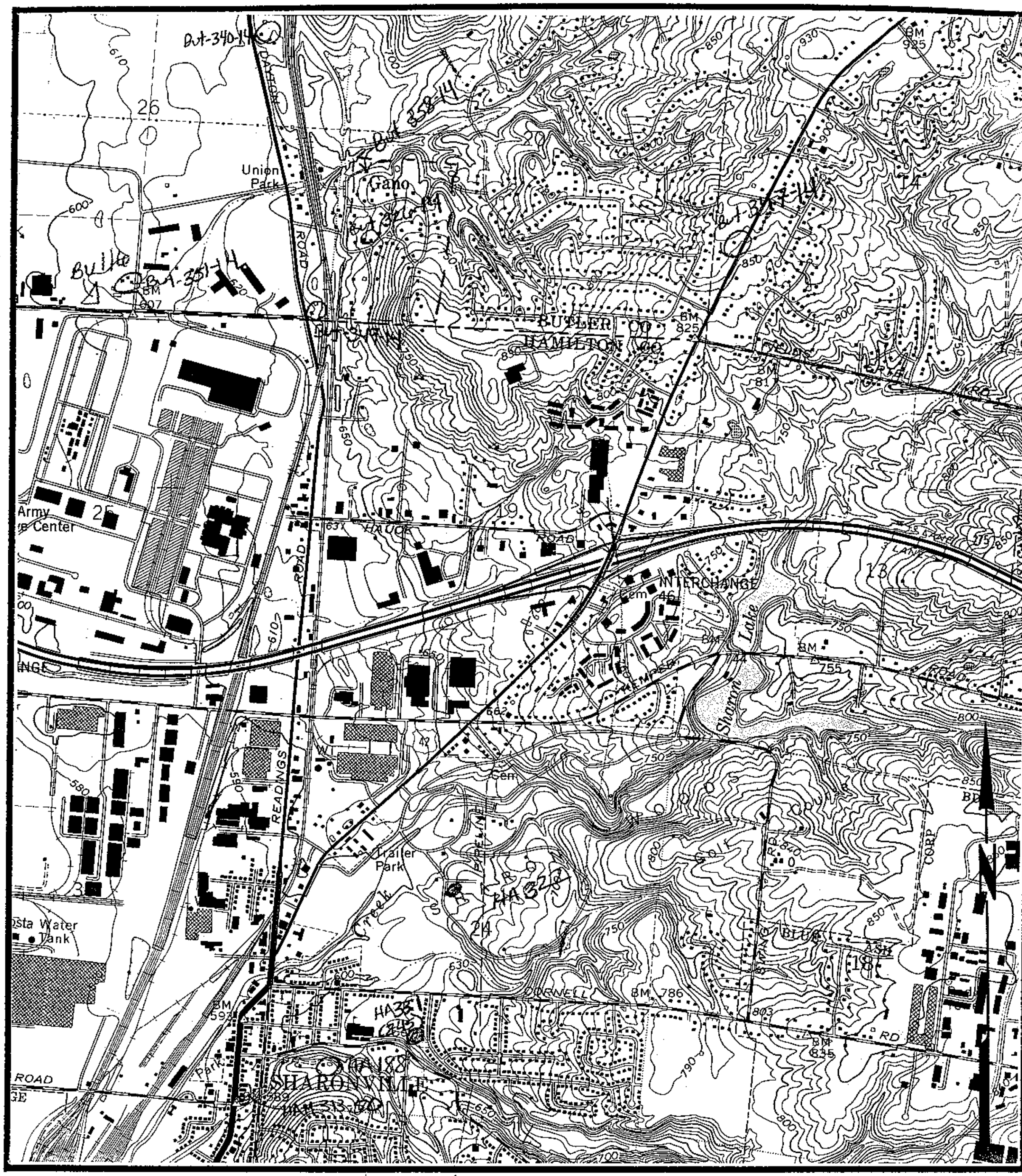


Figure 1 - USGS topographic showing the location of Sharon Woods Lake in northern Hamilton County, Ohio (Glendale, OH quadrangle, scale is 1:24,000).

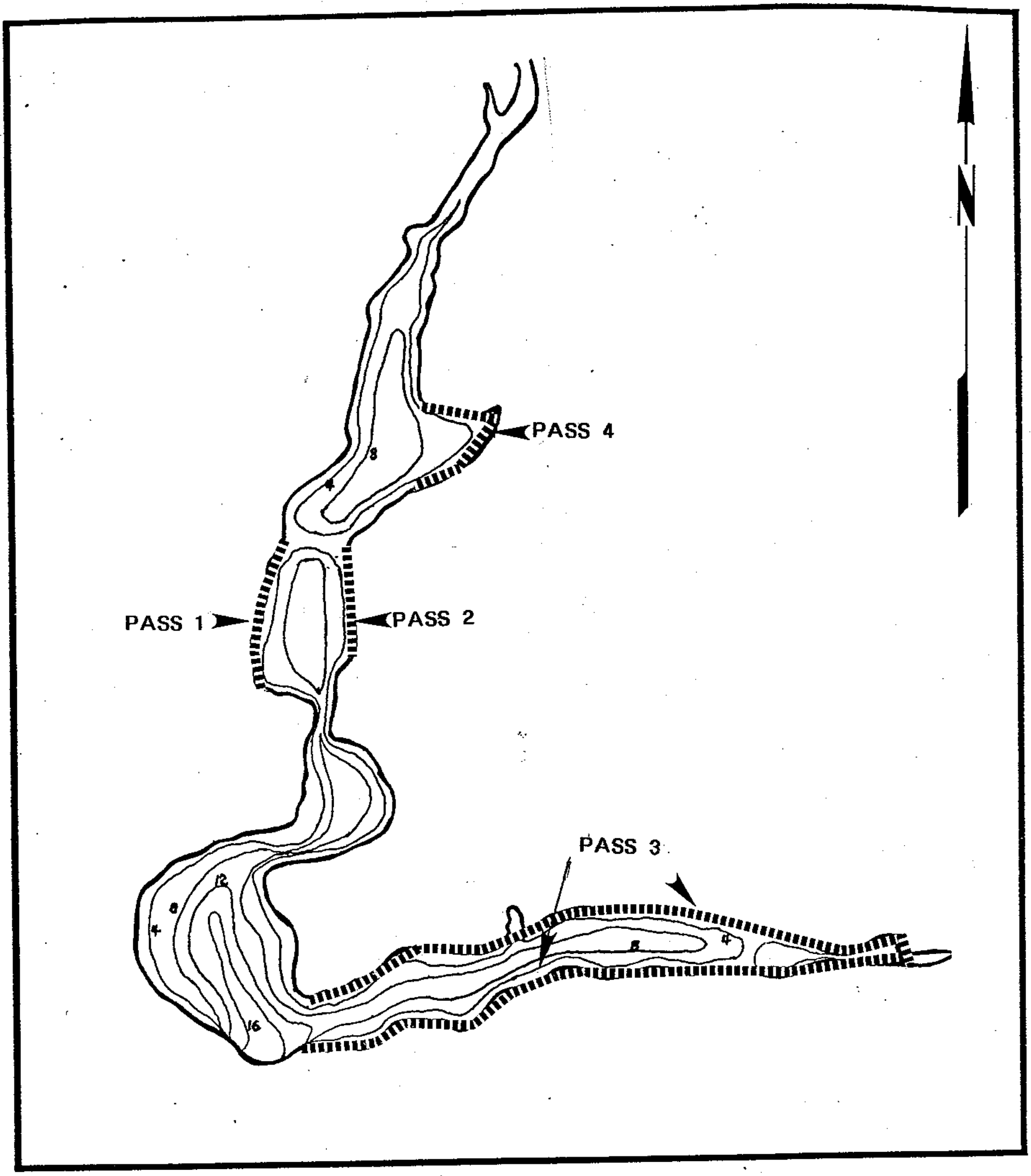


Figure 2 - Bathymetric map of Sharon Woods Lake showing the location of electrofishing bank surveys in April 1994 (Scale, 1 inch equals ~1,000 feet).

Electrofishing was accomplished with a boat-mounted, pulsed DC electrofishing unit. Pulses were produced with Smith-Root IV electrofisher and gasoline-powered 3,000 watt/220 volt generator. The electrodes each consisted of fifteen steel rods suspended from 24-inch diameter fiberglass rings. The rings were attached to the boat by ten-feet sections of 4-inch diameter PVC pipe and placed in the water to create a shallow electric field. The converter supplied 140 volts DC at 60 pulses per second. The pulse width was adjusted to maintain an electrical current of approximately 4 amps.

The electrofishing unit was operated by a 3-person team: one person operated the boat and controlled the converter, while two people netted fish from the forward deck. The fishing technique was to slowly cruise as close to the shore as possible. Shoreline segments were identified and measured on a bathymetric map. Electrofishing passes were generally 1,000 seconds in duration. The time period was extended if the area was unproductive. Fish swimming involuntarily toward the anode would be stunned, netted, and placed in a live well until the end of a pass. Captured fish were identified to species, weighed to the gram, measured the total length from snout to the end of the caudal fin, checked for anomalies, and returned unharmed to the lake in the same general location from which they were captured.

### 2.3 Population Estimates

During the first two days of the survey, KEMRON personnel marked each fish, larger than four inches with a hole in the caudal or tail fin. On the last field trip each of the previously sampled shorelines was resurveyed to recapture any marked fishes. To maximize the sample size, no fish were measured during this day. The mark and recapture method provided the most reliable population estimates. This method is based on the premise that marked organisms released to the population will be recaught in numbers proportional to their abundance in that population (Wetzel and Likens 1979). According to this procedure:

$$N = (S*M)/R$$

where

N = estimate of total number in population
S = total number of organisms in a sample from the population
M = total number of marked organisms in the population
R = number of marked organisms in a sample

Ninety five percent and 99 percent confidence intervals were also calculated to insure a more reliable population estimate.

### 2.4 Health Status and Growth Rates

All individuals netted on the first two electrofishing survey days were identified to species, measured to the nearest millimeter, weighed to the nearest gram. Juvenile fishes and some larger age classes were pooled and weighed together and the length range was determined for the group. Observations of physical anomalies and sexual condition if evident was recorded.

The weight to length ratio is often used as a means to determine the plumpness or inferred health of a given fish or population of fishes. A condition factor for each measured and weighed fish was calculated following methods described by Carlander (1969; 1977). The method utilizes the following formula:

$$K = M*10^5/L^3$$

where

K = total length condition factor
M = mass in grams
L = length in millimeters
$10^5$ = brings the value of K near unity

The K value or condition factor was compared to other populations listed in Carlander (1969; 1977).

Age determination of representative individuals from each species were performed by counting annual rings on scales harvested from the front of the body (usually behind the pectoral fin, except minnow scales, which should be removed from above the lateral line). One to several scales were be harvested from each age class and species of fish. Plastic impressions of the scales were made to facilitate viewing on a projection microscope.

### 2.5 Growth Rates and Age Classes

Length-frequency graphs were plotted for all species. Peaks in this kind of graph can reveal the mode or average length of the various age classes in a population. Another method to verify the age of a fish population utilizes scales. As fish grow in length, new scales are not added, existing scales expand to fill the body. Fish scales are known to grow in proportion with the rest of the fish throughout its lifetime (Jearld, 1983). For fish without scales, like catfish, bones from the inner ear (otoliths) or the spiny rays of the pectoral fins can removed and micro-sectioned for viewing. Rapid growth during the summer is characterized by widely spaced circuli or growth rings in bony material. Fish grow slowly in cold water and the circuli are closely spaced during this season. These closely spaced circuli appear as dark bands or annuli, with characteristic cutting over areas. Age determinations were verified by counting annuli on scales harvested from representative fishes. Plastic impressions of the scales were made to facilitate viewing with a projection microscope. The distance from the center of the scale, its focus or nucleus, to each annuli was measured and a proportional length was calculated by multiplying the fish's total body length by the proportion of each annulus' distance from the focus.

### 2.6 Predator/Prey Analysis

The relative proportions of piscivorous fish and planktivorous fish in a population is a good measure of the long-term viability of a fishery. Planktivorous fish are the forage fish or food items of many adult sport fish. Forage fish must be abundant enough to provide adequate food for the maturing predator population. However, an overabundance of planktivorous fish may reduce the zooplankton population, which can cause a nuisance algal bloom. Decaying algae blooms may deplete the dissolved oxygen in a small lake or reservoir, which can cause a massive fish kill.

A biomass-based ratio from between three and six to one (3-6 gm forage fish:1 gm carnivore fish, F/C) is considered ideal in most reservoirs (Swingle 1950; in Anderson and Gutreuter 1983). Another ratio uses the biomass of young fish or those small enough to be eaten compared to the biomass of the average-sized carnivores (Y/C). The desired range for this of this ratio is between 1.0 and 3.0 to one. Selective stocking or removal of fishes is intended to achieve a more desirable fish population. Selective removal of fishes is difficult in the field. Large mesh gill nets will indiscriminately capture adults while letting small fish pass. Individuals species can be removed if a key aspect of their behavior can be exploited. Selective stocking is not without its drawbacks too. When fish are released into a new environment, their behavior and survivorship cannot be predicted with complete certainty. Habitat requirements for juveniles are often quite different from those of adult. If proper habitat and food items are not available, adult forage fish may feed on the eggs or fry of a desirable game species, thereby reducing instead of increasing their numbers.

### 2.6 Community Diversity

Community based data was used to calculate several diversity indices. The information index (Shannon 1948) can predict the degree of uncertainty that the next species encountered in a population will be the same as the previous one by using the formula:

$$H' = -\sum_{i=1}^{s} P_i \log_2 P_i$$

where $P_i$ is the proportion of individuals in *i*-th species. The higher the value of H, the greater is the degree of uncertainty or the more diverse is the population. A value of 1.0

is the lowest degree of uncertainty. This index is sensitive to both the number of species and the proportional makeup of each species.

Community evenness (E) was determined using the ratio of the diversity (H') and the theoretical maximum diversity for the total number of species (S) present.

$$E = H'/H_{max}$$

where

$$H_{max} = \log_2 S$$

The Index of Well Being (Iwb) utilizes parameters already obtained and used separately: numbers of individuals (N), biomass (B), and the information index ($H'_{MN}$) derived from species numbers, as above, and the information index ($H'_{MB}$) derived from species biomass (OEPA 1988). The modified Iwb excludes species considered tolerant of environmental pollution. This index uses relativized data for all calculations. OEPA relativizes data gathered by boat on a per kilometer basis and on a 0.3 kilometer basis when data are obtained by wading.

$$Iwb = 0.5 \ln N + 0.5 \ln B + H'_{MN} + H'_{MB}$$

The Index of Biological Integrity (IBI) has been a useful method of evaluating fish population data (OEPA 1988). The modified IBI uses 12 community metrics and can be utilized throughout the State of Ohio, in headwaters, streams, large rivers, and lakes. Each value is compared to a reference site within a similar geographical region with little human influence. Ratings of 5, 3, and 1 identify whether a metric approximates (5), deviates somewhat (3), or deviates strongly (1) from the reference site. Summations for the IBI can range from a high score of 60 to a low of 12. Values of are assigned categories of exceptional (60-50), good (48-36), fair (34-27), poor (26-18), and very poor (18-12). An IBI data sheet is provided in Section 3.5.

## 3.0 RESULTS

### 3.1 Population Estimate

One hundred fifty-six (156) fish representing eight species were captured the first day (Table 1). Three passes were made on the first day for a total electrofishing time of 3,095 seconds or approximately 52 minutes. On the second day of fishing with the addition of a fourth

**Table 1 - Summary fish catch by day at Sharon Lake, Spring 1994.**

| FISH SPECIES | April 19 | April 21 | April 26 | TOTAL |
|---|---|---|---|---|
| Gizzard shad (*Dorosoma cepedianum*) | 0 | 1 | 0 | 1 |
| Rainbow trout (*Salmo gairdneri*) | 0 | 2 | 0 | 2 |
| Golden shiner (*Notemigonus chysoleucas*) | 1 | 3 | 12 | 16 |
| Channel catfish (*Ictalurus punctatus*) | 1 | 7 | 7 | 15 |
| Yellow bullhead (*Ictalurus natalis*) | 2 | 5 | 13 | 20 |
| White crappie (*Pomoxis annularis*) | 10 | 37 | 123 | 170 |
| Largemouth bass (*Micropterus salmoides*) | 63 | 141 | 364 | 568 |
| Green sunfish (*Lepomis cyanellus*) | 3 | 5 | 6 | 14 |
| Bluegill sunfish (*Lepomis macrochirus*) | 72 | 84 | 140 | 296 |
| Pumpkinseed sunfish (*Lepomis gibbosus*) | 4 | 12 | 3 | 19 |
| TOTAL | 156 | 297 | 668 | 1121 |

survey area, two hundred ninety-seven (297) fish representing ten species were captured during 4,807 seconds or approximately 80 minutes of electrofishing (Table 1). Four marked fish were recaptured on the second day, however these were not used in the final population estimate.

Six hundred sixty-eight (668) fish, of eight species were captured on the third day. None of these were measured, weighed, or marked. All four previously surveyed banks were extensively patrolled for a total of 7,808 seconds or approximately 130 minutes. Twenty-one marked fish, representing three species, were recaptured on the third day. According to the procedure outlined in Section 2.1, the estimated total fish population in Sharon Woods Lake is 14,410 fishes with a 95 percent confidence interval of +/-5,923 and a 99 percent CI of +/-7,797. Estimated population levels of the three recaptured species exceeded or were very close to the 95 percent confidence interval. Thus we can predict with 99 percent certainty that the fish population of Sharon Lake is between 6,613 and 23,207.

Estimated population sizes of the three recaptured species are as follows: largemouth bass is 6,188; white crappie is 964; and bluegill sunfish is 7,280. Except for the bass population, these estimates exceeded the 95 percent confidence interval.

### 3.2 Health Status

The plumpness or condition factor (K) of the 453 specimens were calculated using the total lengths, weights and the formula described in Section 2.2. The mean values and ranges for each species are shown in Table 2, as is the range of condition in other Mid-Western lakes. Data for sunfishes (*Lepomis* spp.) were pooled for this exercise.

The mean condition factor and range calculated for most species of fish sampled from Sharon Lake are comparable to other populations surveyed by Carlander (1969, 1977). The sunfishes had a smaller "K" value than other populations. In general, the younger/shorter fish were more plump than the older/longer fish.

Length to weight ratios of the eight dominant species were compared graphically on double log plots (Figures 2A-2F). Coefficients of correlation were generally high for most (>0.60, maximum $r^2$ = 1.00) and straight lines could be seen for each species plot expect the channel catfish. The correlation coefficient for golden shiner was 93.7 percent; yellow bullhead was 69.7 percent; channel catfish was 32.5 percent; white crappie was 97.2 percent; largemouth bass was 99.1 percent; and bluegill was 86.2 percent.

### 3.3 Growth Rates and Age Classes

Length-frequency graphs were plotted for the three numerically dominant species (Figures 3A-3C). Peaks in these kinds of graphs may reveal the mode or average length of the various age classes. Two peaks or age classes appear in the white crappie and largemouth bass populations and three age groups may be present among the bluegill. Unfortunately growth rates vary widely between populations, years and among individuals within the same population. As all of the fishes in Sharon Lake are result of recent stocking efforts by the Park District, growth rates will be highly variable.

Scale measurements and proportional lengths of representative fishes are presented in Table 3. Our survey was probably performed prior to spawning of most species, thus young-of-the-year were gathered only for bluegill.

One large **gizzard shad** was identified from Sharon Lake. The 410-mm specimen was determined to be four years old. This fish was estimated to grow nearly 170-mm during its first year, 110-mm more (~280-mm total) in its second year, 70-mm during its third, and about 50-mm in the year prior to this survey (Table 3). These estimated lengths are within the ranges reported for gizzard shad in Carlander (1969).

The small **golden shiner** sample warranted no graph. The 160-mm specimen appeared to be in the first age class (Table 3). However, Carlander (1969) reports golden shiners of this size in the second age class.

**Table 2 - Summary fish health statistics at Sharon Lake, Spring 1994.**

| FISH SPECIES | SAMPLE SIZE "N" | MEAN LENGTH (mm) | LENGTH RANGE (mm) | MEAN WEIGHT (gm) | MEAN "K" VALUE | "K" RANGE SHARON | OTHER "K" RANGE* |
|---|---|---|---|---|---|---|---|
| Gizzard shad | 1 | 410 | - | 909.10 | 1.32 | - | 1.11 |
| Rainbow trout | 2 | 350 | 340-360 | 495.50 | 1.16 | - | - |
| Golden shiner | 4 | 150 | 130-160 | 44.00 | 1.29 | 1.15-1.37 | 1.03-2.37 |
| Channel catfish | 7 | 500 | 370-590 | 1195.00 | 1.00 | 0.49-1.57 | 0.5-1.33 |
| Yellow bullhead | 8 | 261 | 190-310 | 309.86 | 1.62 | 0.79-2.17 | 2.05-4.45 |
| White crappie | 47 | 180 | 100-240 | 111.48 | 1.60 | 1.18-2.10 | 0.55-1.94 |
| Largemouth bass | 204 | 225 | 110-500 | 277.04 | 1.31 | 0.97-2.19 | 1.26-1.52 |
| Bluegill sunfish | 180 | 127 | 40-170 | 54.13 | 2.17 | 1.50-3.76 | 2.5-5.7 |
| TOTAL | 453 | - | - | 85,277 | | | - |
| ESTIMATE/MEAN | 14,410 | - | - | 188.25 | 2,712,743 | | - |

*from Carlander 1969; 1977

The length-frequency plot for **white crappie** shows two distinct peaks at 120-mm and 230-mm (Figure 3A). The two specimens whose scales were examined were both greater than 200-mm and determined to be two years old (Table 3). These lengths are within the ranges reported in Carlander (1977).

Three peaks in the **largemouth bass** graph clearly delineate the age classes of this species (Figure 3B). Of the six bass examined four were longer than 340-mm. Two of these fishes were placed in Age Class II and two in I. The two small fish (<200-mm) were placed in Age Class I. These unusual values may be sampling error or odd growth of nursery fishes.

Three age classes are represented in the **bluegill** population (Figure 3C): <80-mm are young-of-the-year, 90-mm to 120-mm are one year, and >120-mm are two years; as averaged from the three specimens and data from Carlander (1977).

### 3.4 Predator/Prey Analysis

The ratio of biomass of forage fishes (sum weights of all species except bass) to carnivorous fish (sum weights of bass) is 0.40. The largemouth bass population comprises more than 70 percent of the total fish biomass in Sharon Lake. This value is far below the optimum values of 3.0 to 6.0. The ratio of young fish to carnivorous fish is not practical with electrofishing techniques as larger fish are often preferentially gathered and are more

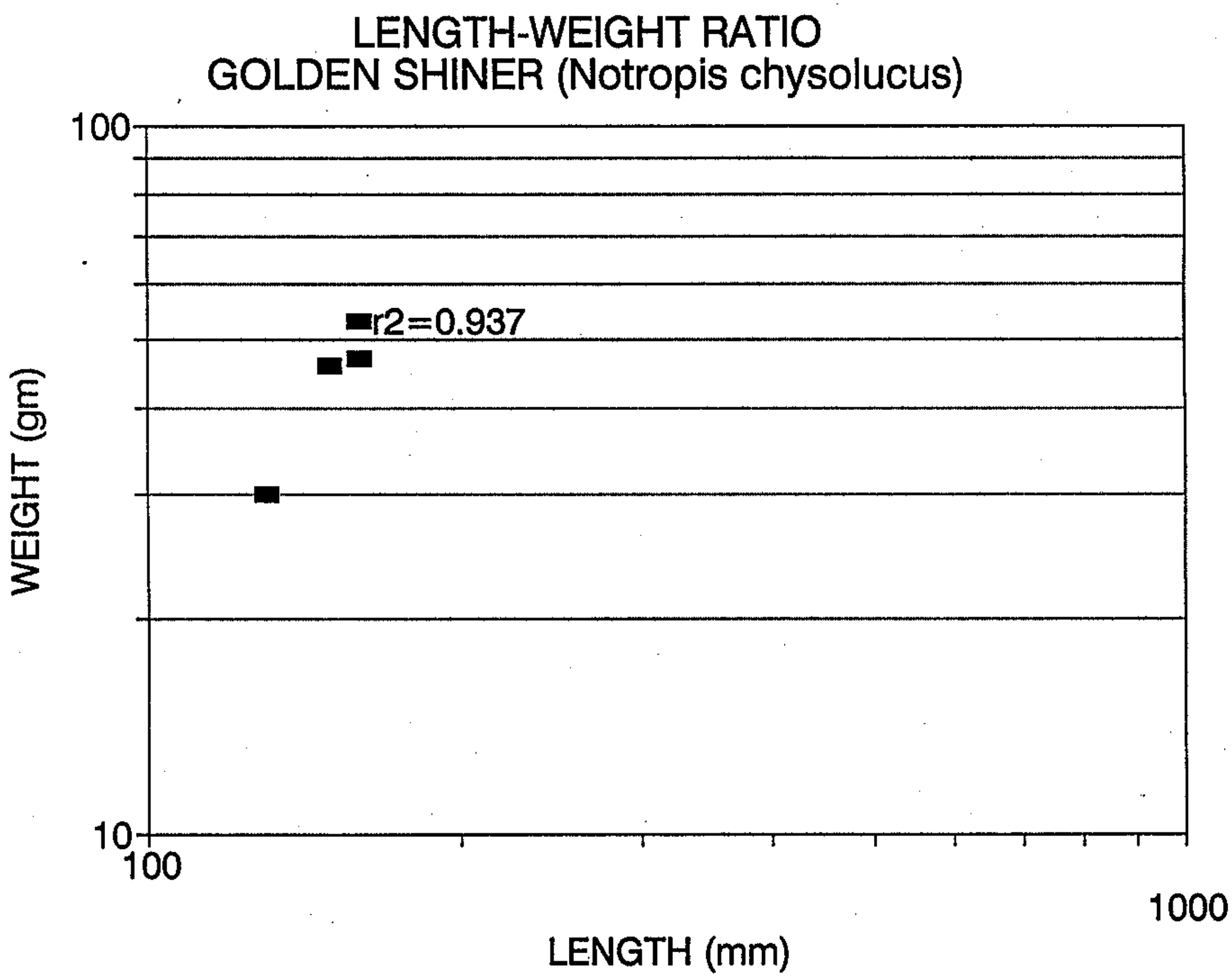
LENGTH-WEIGHT RATIO
GOLDEN SHINER (Notropis chysolucus)
100
10
WEIGHT (gm)
r2=0.937
100
1000
LENGTH (mm)

**Figure 2A**

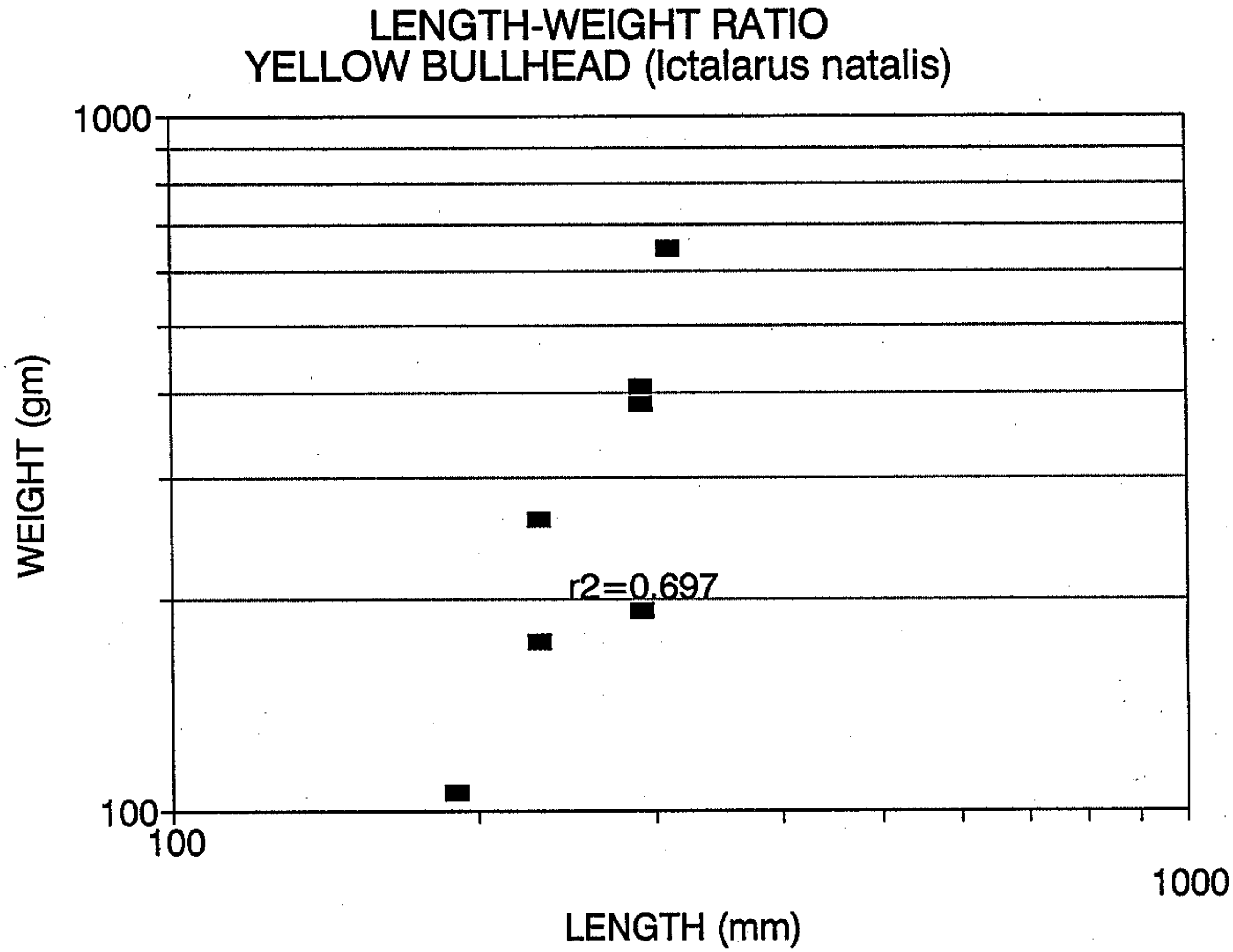
LENGTH-WEIGHT RATIO
YELLOW BULLHEAD (Ictalarus natalis)
1000
100
WEIGHT (gm)
r2=0.697
100
1000
LENGTH (mm)

**Figure 2B**

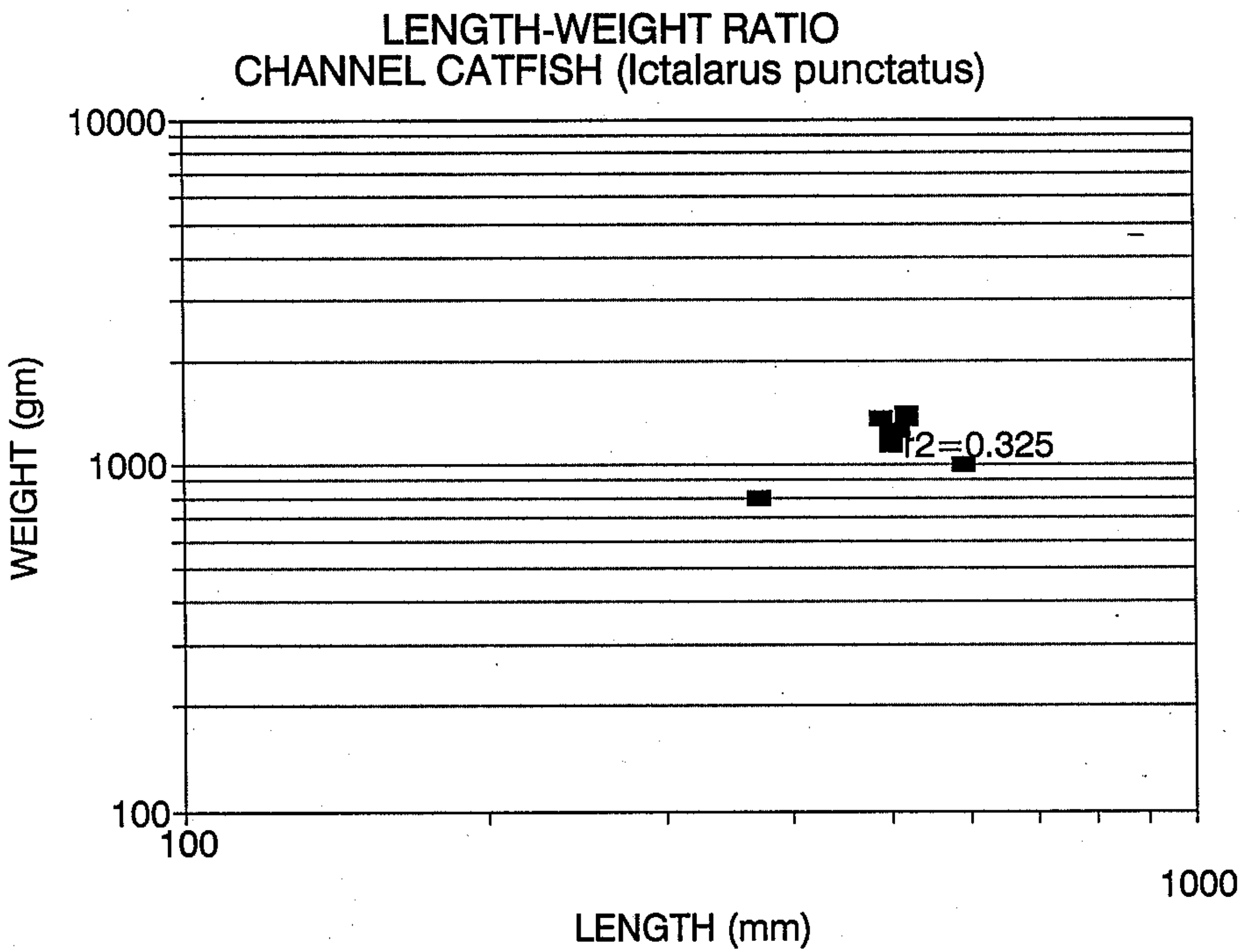
LENGTH-WEIGHT RATIO
CHANNEL CATFISH (Ictalarus punctatus)
10000
1000
100
WEIGHT (gm)
r2=0.325
100
1000
LENGTH (mm)

**Figure 2C**

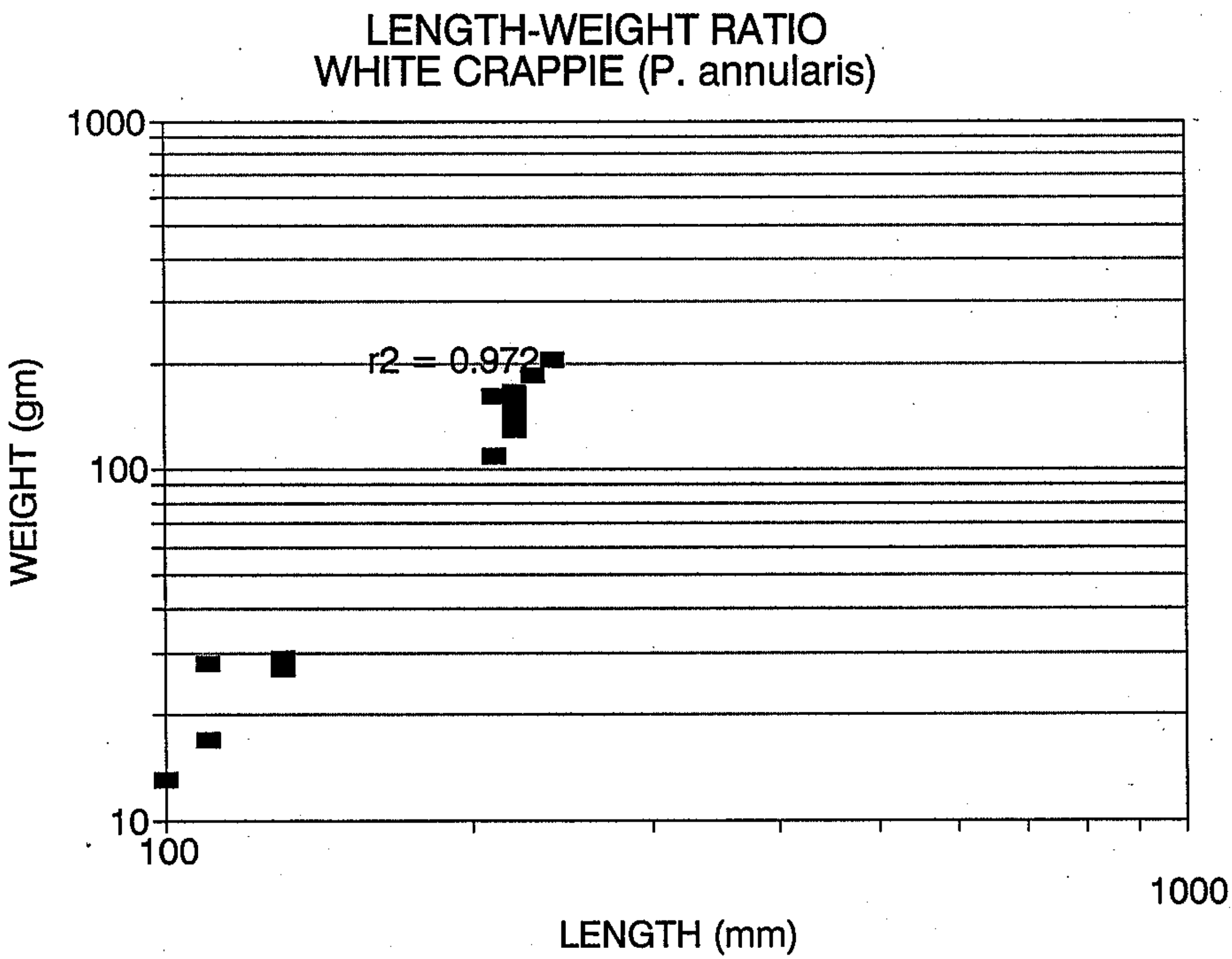
LENGTH-WEIGHT RATIO
WHITE CRAPPIE (P. annularis)
r2 = 0.972
WEIGHT (gm)
1000
100
10
100
1000
LENGTH (mm)

**Figure 2D**

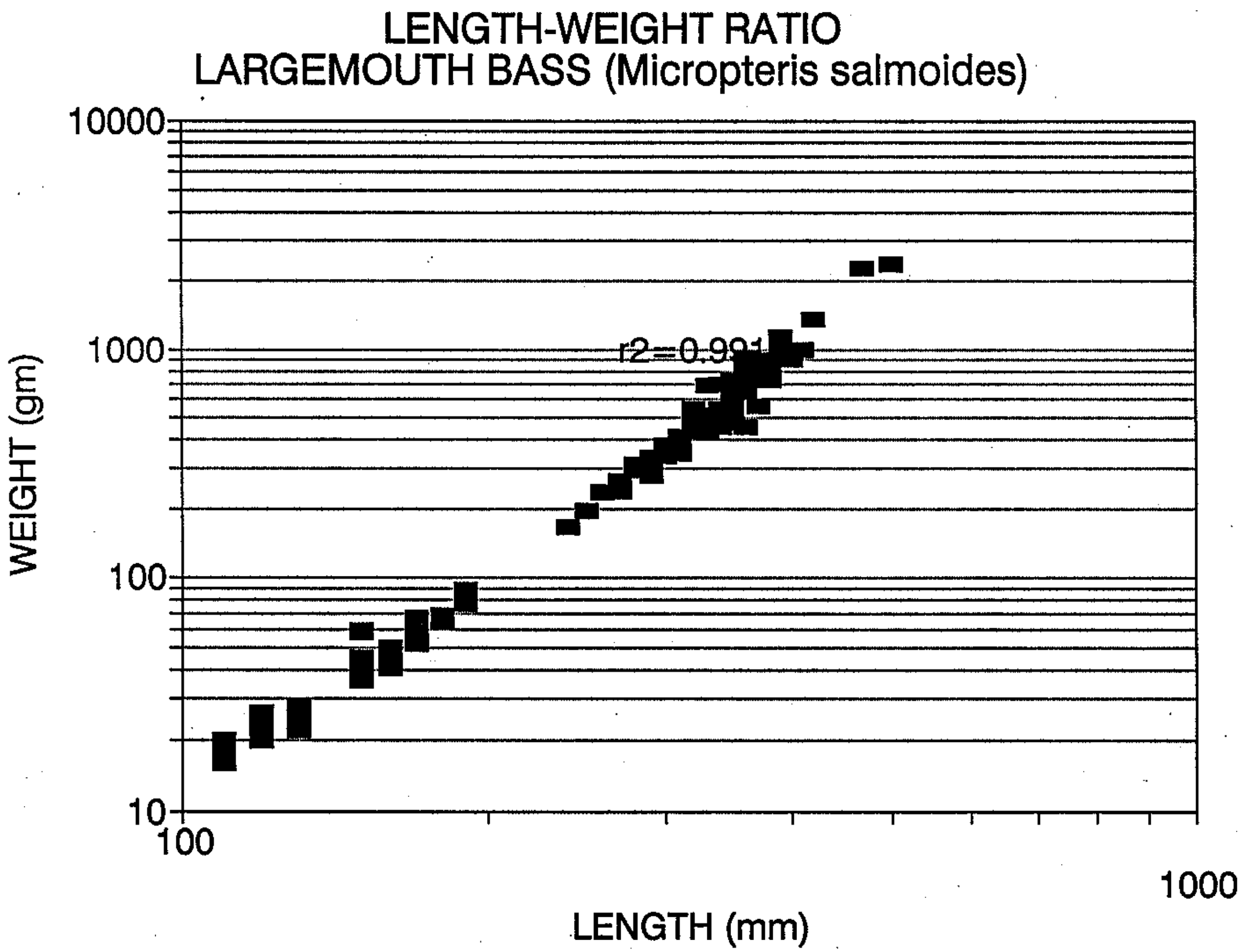
LENGTH-WEIGHT RATIO
LARGEMOUTH BASS (Micropteris salmoides)
WEIGHT (gm)
10000
1000
100
10
r2=0.991
100
1000
LENGTH (mm)

**Figure 2E**

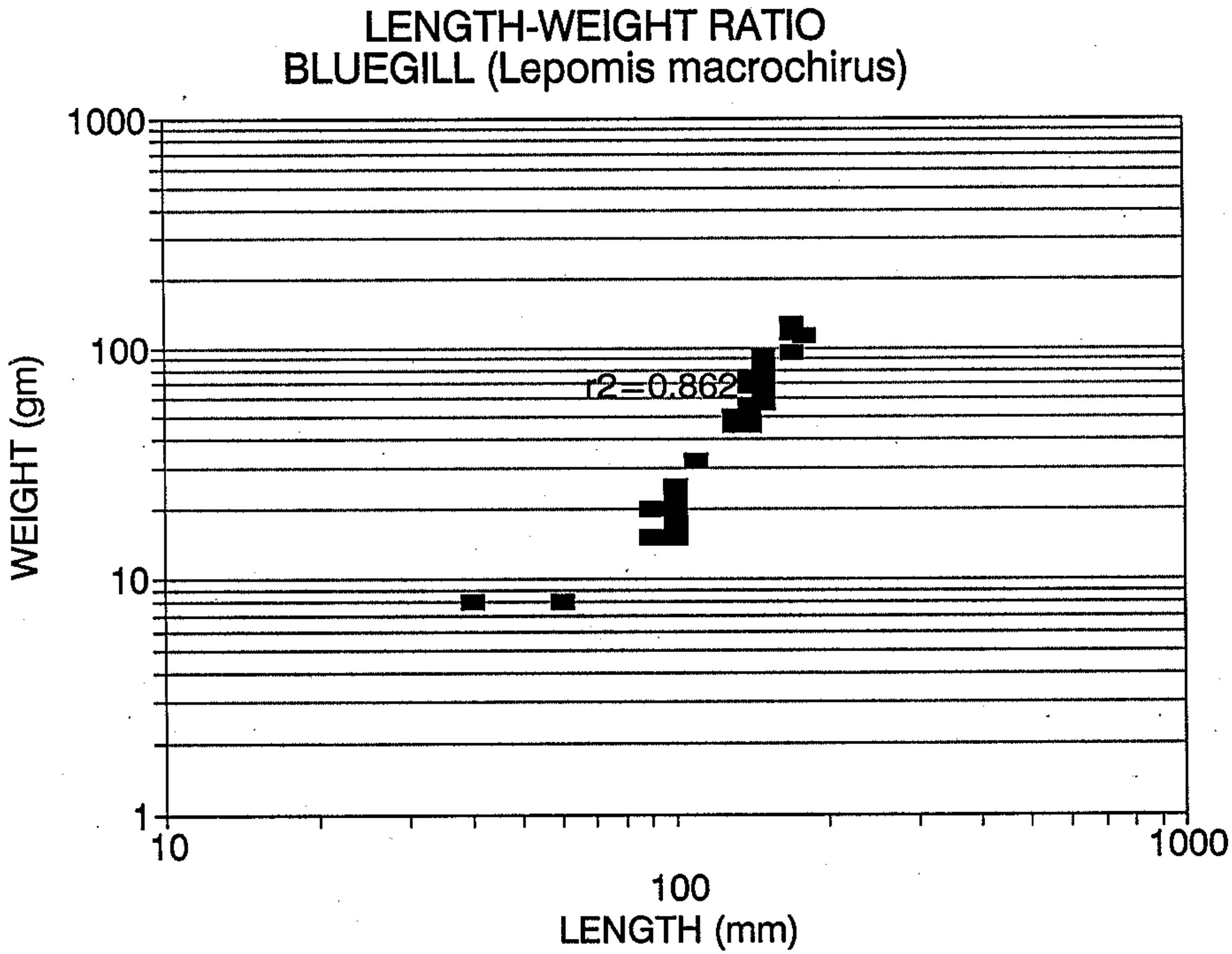
LENGTH-WEIGHT RATIO
BLUEGILL (Lepomis macrochirus)
WEIGHT (gm)
1000
100
10
1
r2=0.862
10
100
1000
LENGTH (mm)

**Figure 2F**

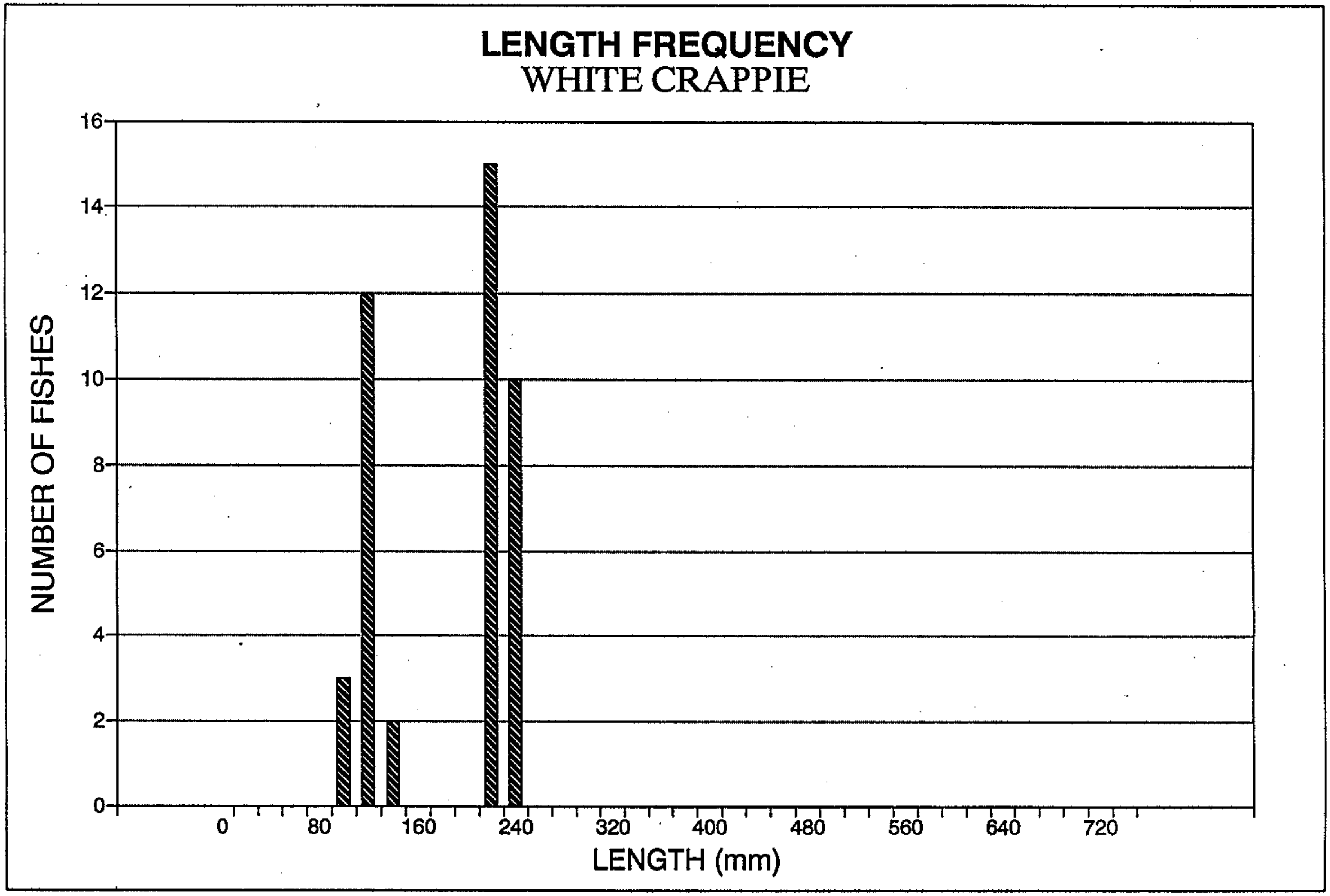
LENGTH FREQUENCY
WHITE CRAPPIE
NUMBER OF FISHES
16
14
12
10
8
6
4
2
0
0
80
160
240
320
400
480
560
640
720
LENGTH (mm)

**Figure 3A**

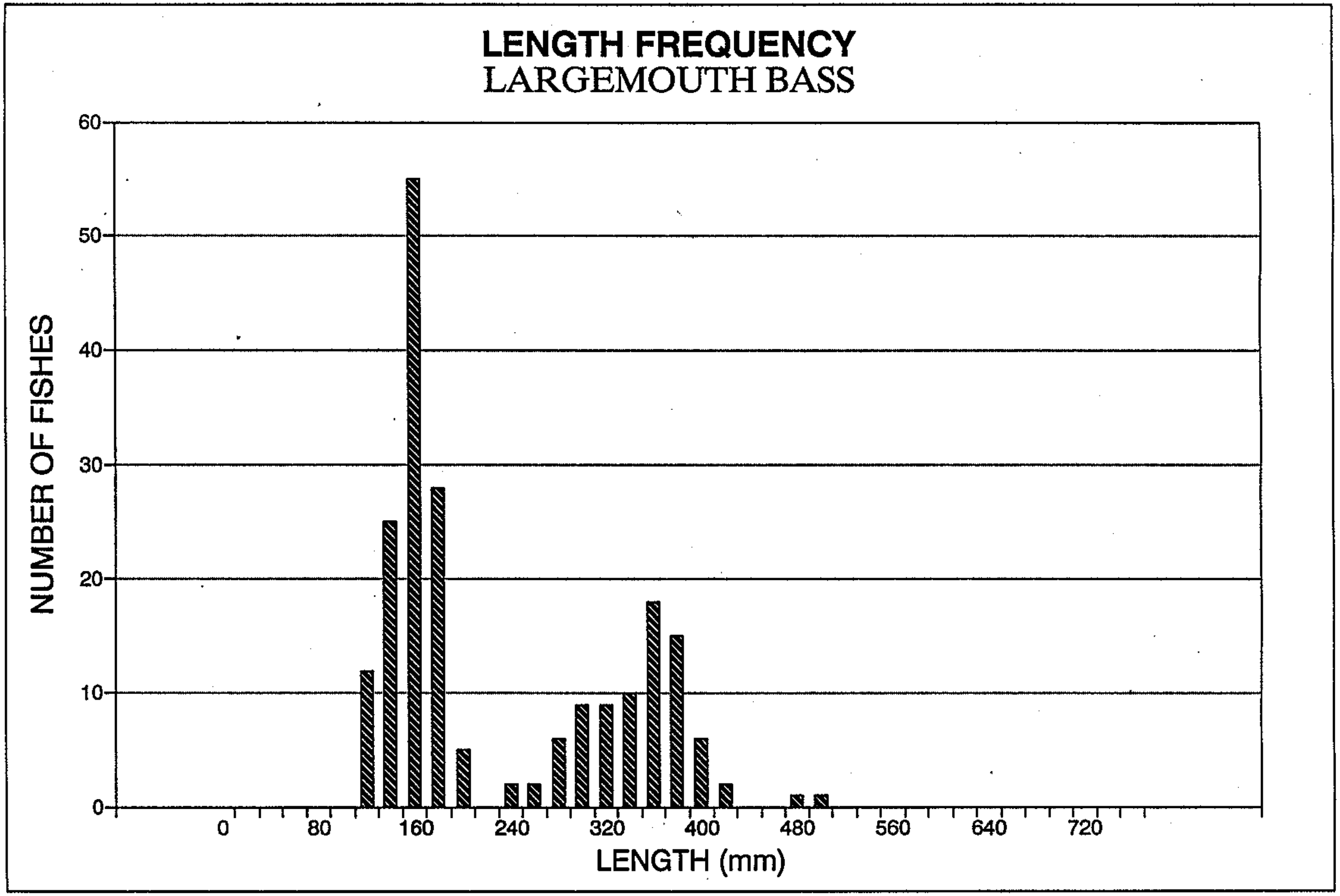
LENGTH FREQUENCY
LARGEMOUTH BASS
NUMBER OF FISHES
0
10
20
30
40
50
60
0
80
160
240
320
400
480
560
640
720
LENGTH (mm)

**Figure 3B**

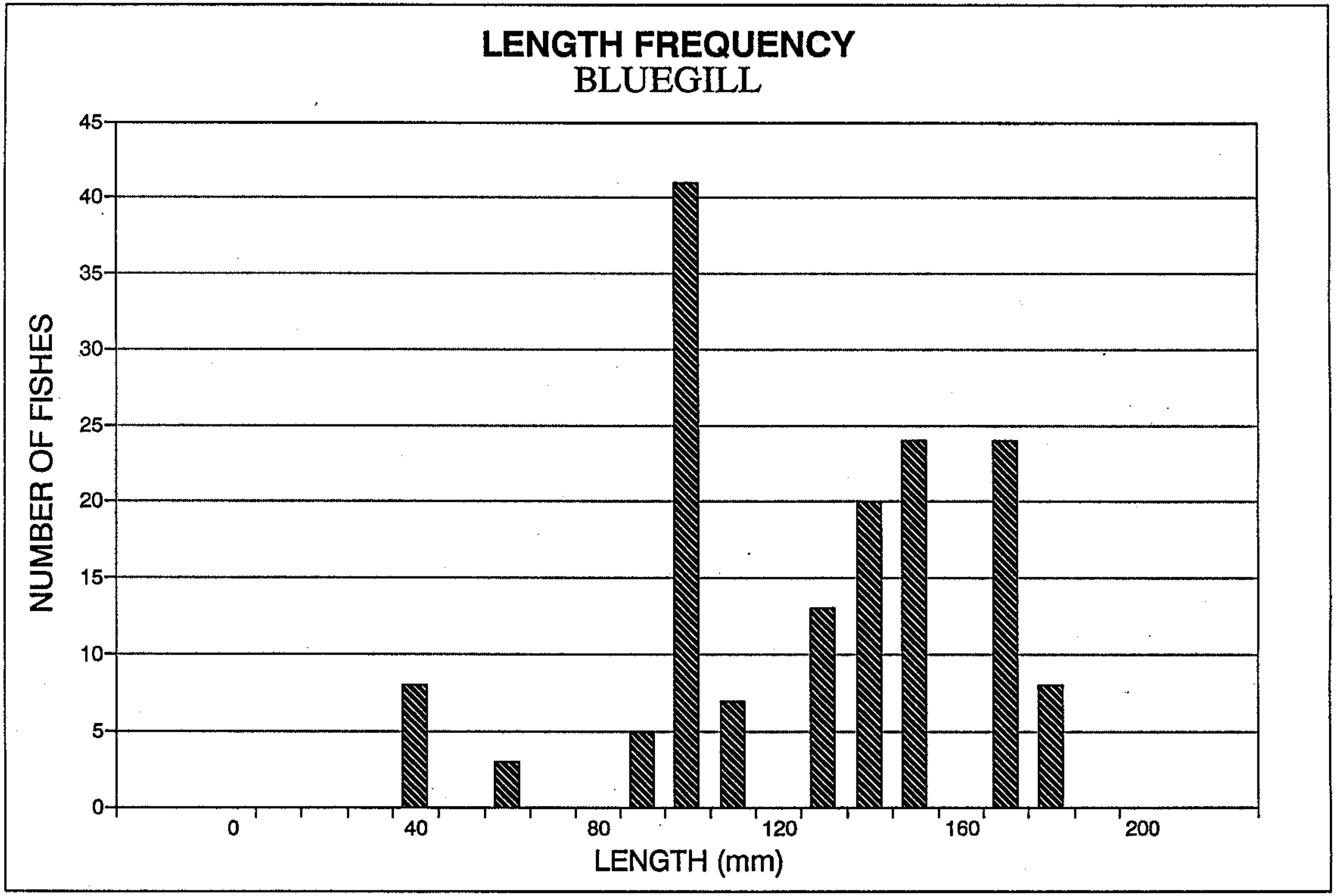
LENGTH FREQUENCY
BLUEGILL
NUMBER OF FISHES
45
40
35
30
25
20
15
10
5
0
0
40
80
120
160
200
LENGTH (mm)

**Figure 3C**

Table 3 - Fish scale measurements and proportional lengths at each annulus.

| SPECIES | LENGTH (mm) | WEIGHT (gm) | SCALE DATA (mm) | | | | |
|---|---|---|---|---|---|---|---|
| | | | TOTAL | I | II | III | IV |
| GIZZARD SHAD | 410 | 909.09 | 340 | 140 | 230 | 280 | 325 |
| calculated length at annulus | | | 410.00 | 168.82 | 277.35 | 337.65 | 391.91 |
| GOLDEN SHINER | 160 | 53 | 100 | - | - | - | - |
| calculated length at annulus | | | 160.00 | - | - | - | - |
| WHITE CRAPPIE | 210 | 109 | 155 | 115 | 140 | - | - |
| calculated length at annulus | | | 210.00 | 155.81 | 189.68 | - | - |
| WHITE CRAPPIE | 220 | 130 | 140 | 103 | 130 | - | - |
| calculated length at annulus | | | 220 | 161.86 | 204.29 | - | - |
| LG.MOUTH BASS | 370 | 909.09 | 220 | 125 | 195 | - | - |
| calculated length at annulus | | | 370 | 210.23 | 327.95 | - | - |
| LG.MOUTH BASS | 340 | 545.45 | 163 | 130 | - | - | - |
| calculated length at annulus | | | 340 | 271.17 | - | - | - |
| LG.MOUTH BASS | 110 | 16 | 36 | - | - | - | - |
| calculated length at annulus | | | 110.00 | - | - | - | - |
| LG.MOUTH BASS | 150 | 36 | 30 | - | - | - | - |
| calculated length at annulus | | | 150.00 | - | - | - | - |
| LG.MOUTH BASS | 410 | 1,000 | 240 | 165 | 197 | - | - |
| calculated length at annulus | | | 410 | 281.88 | 336.54 | - | - |
| LG.MOUTH BASS | 390 | 1,000 | 105 | 80 | - | - | - |
| calculated length at annulus | | | 390.00 | 297.14 | - | - | - |
| BLUEGILL | 150 | 66 | 125 | 60 | 110 | - | - |
| calculated length at annulus | | | 150.00 | 72.00 | 132.00 | - | - |
| BLUEGILL | 140 | 56 | 124 | 65 | 100 | - | - |
| calculated length at annulus | | | 140.00 | 73.39 | 112.90 | - | - |

susceptible to the electric field. Also this survey was performed before most species of fish spawn. Young-of-the-year forage fish are simply not available until the warm summer months and they are best gathered by small mesh, cone-shaped, larval fish nets.

### 3.5 Community Diversity

Information Index (H') was calculated to be 1.80. This value is moderate for fish-stocked impoundments and also shows a modest degree of evenness (60.0 percent) among the ten species present. These values are more meaningful when compared over time at a site or to other similar reservoirs in the same geographic area. Perhaps the other HCPD lakes will be surveyed to provide comparable data.

The modified Index of Well Being (Iwb) was calculated to be 8.05 The "usual assortment of fish species were present"; species richness was relatively high; and some sensitive species were present. This value shows Sharon Lake to be in compliance with levels established by the Clean Water Act.

. The following section lists the twelve questions or metrics required for the calculation of the modified Index of Biological Integrity. The answers and scores for the Sharon Forest Lake fishery are briefly explained.

**METRIC 1: What is the total number of fish species?** The size of the drainage area will affect this metric in headwater and wading sites, but not for boat sites. Ten species were identified in Sharon Lake for score of 3.

**METRIC 2: What is the proportion of round-bodied sucker (Catostomidae) species to the population?** Darter species are counted in smaller waters. Round-bodied suckers are sensitive to environmental perturbations. This group includes species of the genera *Hypentelium* (northern hog sucker), *Moxostoma* (redhorses), *Minytrema* (spotted sucker), and *Erimyzon* (chubsuckers). None of these genera were present in Sharon Lake for a score of 1.

**METRIC 3: What is the number of sunfish species in the population?** Sunfish are sensitive to environmental disturbance in their preferred habitats, too. Black basses (*Micropterus* spp.) and red-eared sunfish (*Lepomis microlophus*) are excluded. Three Centarchids give a score of 3.

**METRIC 4: What is the number of suckers species in the population?** The Catostomids are widely distributed family of long-lived individuals (10-20 years), and can provide a long-term assessment of environmental conditions. No sucker species were earn 1 point.

**METRIC 5: What is the number of intolerant species in the population?** The OEPA lists the fish species known to be generally restricted to high-quality waters. None of the species observed in Sharon Lake are intolerant, scores 1 point.

**METRIC 6: What is the percent abundance of tolerant species in the population?** The OEPA lists the fish species known tolerate poor quality waters. Green sunfish, golden shiner, and yellow bullhead were the tolerant species observed in Sharon Lake; 30 percent scores 1 points.

**METRIC 7: What is the percent abundance of omnivorous species in the population?** The OEPA lists the usual feeding guild fish species. Omnivores can feed on many different items, usually a characteristic of a degraded food base. Gizzard shad was the only omnivore observed in Sharon Lake; 10 percent scores 5 point.

**METRIC 8: What is the proportion of insectivorous species in the population?** This component measures middle range biological integrity. Insectivores will be replaced by omnivores as disturbance increases. Golden shiner, yellow bullhead, bluegill, and green sunfish are insectivores; 50 percent scores 5 points.

**METRIC 9: What is the proportion of top carnivore species in the population?** This component measures biological integrity at the top of the food chain. Largemouth bass are only carnivores; 10 percent scores 3 points.

**METRIC 10: What is the number of individuals (excluding tolerants) per kilometer in the sample?** When lake conditions are good, more fish will there. This metric is relativized for a stable sampling area. Golden shiner, green sunfish, and yellow bullhead were excluded. Day 3 yielded 637 individuals in approximately 3.60 kilometers; 177 fish per kilometer scores 3 points.

**METRIC 11: What is the proportion of individuals utilizing simple lithophilic spawning?** These fish require clean gravel to spawn. High sediment or silt loads will destroy these unguarded, bottom-dwelling eggs. No candidates were found; score 1 point.

**METRIC 12: What is the proportion of individuals with Deformities, Eroded fins, Lesions, and Tumors (DELT)?** These anomalies are caused by bacterial, fungal, viral, and parasitic infections, neoplastic diseases and chemicals. Their occurrence is generally a indication of stress or environmental degradation. Approximately two percent of the population showed a DELT: score 3 points.

The modified Index of Biological Integrity was calculated to be 26. This score is between fair and poor. Sharon Lake is **not** in compliance with standards established by the Clean Water Act of 1977.

## 4.0 DISCUSSION

The desired situation of having a high-yielding sport fishery at Sharon Lake can be obtained by using one or a combination of several common techniques and regulations, which include:

1) closed areas
2) closed seasons
3) limitation of total catch
4) limitation of the amount of fishing (amount of gear used or amount of time it is in use
5) restrictions on the type of gear used
6) restrictions on the size of fish that may be landed

Closed areas could be established in Sharon Lake. Bank fishing is not allowed, but it is practiced at night and in the off-season as evidenced by the trails and litter found during the survey. For closed areas to be useful, the refugia must provide suitable habitat, such as a clean and varied substrate and adequate riparian vegetation. Closed areas should have or must be modified to achieve the desired habitat.

The lake is closed in winter. This is an economic consequence not a biological necessity. Closing the lake during breeding season (April through June), once every three or four years will permit more successful broods of some species, which may be beneficial to the fishery.

Creel limits already exist for some species. Decreasing or increasing the limits may alter the existing fishery. Limiting the amount of fishing (gear or time) is a concern mostly for commercial fisheries. However, restricting the type of gear, such as live bait and barbed hooks can help a sport fishery recover or stabilize after years of high fishing pressure.

Size restrictions on middle-range, desirable species can keep the most active and largest group of breeding fish in the fishery. Trophy-sized fishes above a threshold size can be landed, however those between the young adult and large size must be returned to the lake.

## 5.0 SUMMARY

The Sharon Lake fishery is young and apparently in a state flux. The "plumpness" of the fishes as measured by the mean Condition Factor (K) for each species is nearly equal to or slightly below the values reported in Carlander (1969, 1977). The fish populations were determined to be "good" in OEPA's modified Index of Well Being (Iwb) but only fair or poor in the modified Index of Biological Integrity (IBI). The total fish population for the reservoir is estimated to be 14,410, with a 99 percent confidence interval (CI) of +/-7,797.

The prey biomass to predator biomass ratio was estimated to be 0.4:1 - an ideal ratio is between 3 and 6 to 1. This would indicate an extreme overabundance of the top carnivore, largemouth bass or too few forage fish. Stocking more forage fishes, such as golden shiners, may improve this ratio. Another method to achieve the ideal ratio is to reduce the bass population with an open season or a high-profile tournament. Since the survey was conducted prior to spawning for many species, this ratio can fluctuate seasonally. Surveys conducted in summer and fall may produce different results. The desired situation would be a high number of game or predatory species.

A total biomass estimate for the fishery was calculated at approximately 2,713 kilograms or nearly three metric tons (mean fish weight of 188.25 gm times 14,410). Due to the time of year of this survey and the electrofishing methodology, small and young-of-the-year fishes of most species were not gathered. This top-end measurement of productivity, can also be estimated with a bottom-up measurement using the mid-summer, total chlorophyll *a* concentration in the water column and classifying the water body with the Trophic State Index (TSI, Carlson 1977 in Olem and Flock 1990).

Recommendations for lake management is problematic following a single sampling event such as the one detailed in this report. Such short-term monitoring provides a brief glimpse into the dynamic processes involved in population regulation in an artificial recreational impoundment. Current data would appear to indicate that the lake is not in a stable equilibrium and certainly contains a larger number of predators than occur in a natural ecosystem. However, with heavy fishing pressures this may be the most desirable situation. Current stocking plans should include the members of the sucker family (*Catostomidae*) as they are good indictors of environmental quality in lakes and they would fill an empty niche in the aquatic ecosystem. A predator removal program might be in order if the Park District does not wish to stock more forage fishes (ie. shad and shiners).

To better manage the fish population of Sharon Lake, it is recommended that the Park District continue to closely monitor the fish population for a period of two to five years in order to evaluate natural and human influences to the species diversity and abundance. Other sampling methods, including netting and seining, may be utilized to augment the electrofishing data. In addition, a monthly monitoring regime for the lake to measure surface and hypolimnetic temperature, dissolved oxygen, total phosphorus, chlorophyll *a*, and secchi depth should be undertaken. These parameters can provide useful information in making future lake management decisions.

## 6.0 BIBLIOGRAPHY


Anderson R. O. and S. J. Gutreuter. 1983. *Length, weight, and associated structural indices.* pp. 283-300. In Nielsen, L. A. and D. L. Johnson (eds). 1983. Fisheries Techniques. American Fisheries Society. Southern Printing Company. Blacksburg, Virginia. 468 p.

Carlander, K. D. 1969. Handbook of freshwater fishery biology, Volume 1. The Iowa State University Press. Ames, Iowa. 752 p.

Carlander, K. D. 1977. Handbook of freshwater fishery biology, Volume 2. The Iowa State University Press. Ames, Iowa. 431 p.

Jearld, A. JR. 1983. *Age Determination.* pp. 301-324. In Nielsen, L. A. and D. L. Johnson (eds). 1983. Fisheries Techniques. American Fisheries Society. Southern Printing Company. Blacksburg, Virginia. 468 p.

Ohio Environmental Protection Agency. 1988. Biological criteria for the protection of aquatic life, Vol. I, II, and III. Columbus, Ohio.

Olem, H. and G. Flock, eds. 1990. Lake and reservoir restoration guidance manual. Second edition. EPA 440/4-90-006. Prepared by North American Lake Management Society for U. S. Environmental Protection Agency.

Pflieger, W. L. 1975. The fishes of Missouri. Missouri Department of Conservation. St. Louis, Missouri. 343 p.

Shannon, C. E. 1948. *The mathematical theory of communications.* Bell Systems Technical Journal. No. 27. pp. 379-423, 623-656.

Trautman, M. B. 1980. The fishes of Ohio. The Ohio State University Press. Columbus, Ohio. 782 p.

Wetzel R. G. and G. E. Likens. 1979. Limnological Analysis. W. B. Saunders Company. Philadelphia, PA. 357 p.