FEMP/SUB-080
UC-702

ELECTROFISHING SURVEY OF THE GREAT MIAMI RIVER SEPTEMBER 1994 ANNUAL REPORT

by
Lane E. Stocker Michael C. Miller
Rebecca L. Evans
Richard W. Koch

Department of Biological Science
University of Cincinnati, ML 0006
Cincinnati, Ohio 45221
(513) 556-9751

January 1995

PREPARED FOR THE
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
P.O. BOX 538704
CINCINNATI, OHIO 45253-8704

Under Contract DE-AC05-92OR21972
U.S. Department of Energy
FERNALD FIELD OFFICE

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Fish sampling by electroshocking in the Great Miami River upstream and downstream the Fernald site (September 25 and 26, 1994) was designed to determine changes in the health of the fish community compared to the previous ten years and to collect samples for uranium analyses in fish filets. Samples of 853 fish, from 27 species, eight families and three sites at river mile (RM) 38, RM 24, and RM 19 provided seventy-eight samples for uranium analyses by an independent laboratory. The biomass of fish caught per hour was greatest at RM 24 > RM 19 > RM 38. The diversity index and the heaviest fish community was RM 24 > RM 38 > RM 19. The pooled site at RM 38 near Hamilton was diagnostically separated from the other sites by the young-of-the-year (YOY) golden redhorse, smallmouth bass and golden shiner. The dams at Hamilton acted as an effective barrier against fish migration upriver. Larger freshwater drum, gizzard shad, channel catfish and flathead catfish, which might be expected in rapid current reaches of mid-sized rivers characterize RM 24. The pool at RM 19 was distinguished from the others by YOY gizzard shad, bluegill, and longear sunfish. Thus the fish community in 1994 was separated ecologically by the physical features of the habitat more than by water quality differences between sites. These data suggest that the Fernald effluents in September were having no detectable effects on the distribution of fishes, independent of changes in habitat quality separated on physical attributes of the river channel at each site.

Compared to previous years, the number of fish captured per unit effort was much higher. This could be a result of the low river flow in conjunction with new electroshocking equipment. Even with the higher densities, the fish captured tended to be heavier fish than average for previous years. Normally when fish densities are increased there is a compensatory decrease in growth rates of the residents. Shannon diversity was not significantly different between sites or between years.

Water samples were taken at RM 38, RM 24, RM 19, and three additional sites (RM 42, RM 27, and RM 12) in order to help demonstrate downstream trends. Physical and chemical parameters for each site were observed. All parameters tested showed typical downstream trends. PO_4, NO_3, NH_4 levels and secchi depth decreased downstream while pH, SO_4, and total chlorophyll levels increased. All sites had supersaturated levels of dissolved oxygen except for RM 24. The supersaturated oxygen could have been bubbled off in the riffles. Water temperature increased with the time of day.

The fish community in 1994 was healthy at all sites, reflecting changes in the physical habitat and not changes in water quality. This type of fish community, characterized by high species diversity and high individual numbers, is what is expected in a clean river.

INTRODUCTION

Each August or September from 1984 to the present, the status of the Great Miami River (GMR) fishery has been examined at three or four sites as part of a survey of uranium content of fish fillets (1984-1990, 1993 and 1994) and whole fish (1991 and 1992) (Figures 1-4). The fish community in the river had been studied only sporadically before 1980, when the Ohio Environmental Protection Agency (OEPA) began surveying the streams, rivers, and lakes in Ohio to determine compliance with clean water standards. The surveying effort necessitated the development of a new set of indices and standardized sampling methods for fish and macroinvertebrates (OEPA, 1988). Since multiple sites have been monitored annually for an extended number of years using similar methods and sample sizes, comparison to OEPA's surveys (1980, 1987, and 1990) over the length of the river is warranted (Rankin *et al.*, 1990). Moreover, the OEPA established a series of high quality reference streams in the state by ecoregion, province of similar soils, bedrock, morphometry, and drainage that allows comparison of biological health between equal-sized bodies of water courses.

The fish communities of the GMR near the Fernald site are affected by the Ohio River as well as upstream processes. The Ohio River and the many tributary streams of the GMR serve as a source and a refugium for biotic diversity. Between 1957 and 1959, fish sampling in the middle Ohio River identified 83 species of fish in lock and dam rotenone studies conducted in the fall (Pearson and Krumholz, 1984; Krumholz, 1981). Additional studies on Ohio River tributaries have found more species. An ORSANCO study (Ohio River Valley Water Sanitation Commission, 1962) found 108 species of fish in the Ohio River and by 1970 the cumulative species list of the fish for the Ohio River (a total of 983 river miles) was 120. Between 1974 and 1986, an average of 22 species of fish were found in single day samples from the GMR (n=2,100 to 3,700 individuals). Hence, approximately one fifth of the cumulative fish species can be found in a single day's sample. The remaining species are globally rare, restricted to unique micro-habitats, associated with tributary streams, accidentally washed-in from reservoirs, or only temporal residents of the river. The diversity in middle-sized rivers is determined in part by migration of fish species such as the white bass, sauger, mooneye, hybrid striped bass, gizzard shad, and carp from big rivers. It is also determined in part by migration of smaller stream species into larger rivers, such as minnows, darters, northern hognose suckers, and white suckers. Mid-sized rivers have a high diversity of lithophils belonging to true river fish species, the suckers, buffalos, carpsuckers, redhorses (Catostomidae), and catfishes (Ictaluridae). Washout from upstream reservoirs and ponds may contribute species of fish such as largemouth bass, sunfishes, and young-of-the-year (YOY) gizzard shad.

The diversity of fish in a given reach of stream is a function of the water quality (chemical variables), size of the stream, habitat structure (riparian zone), energy base (allochthonous or autochthonous), flow regime (riffle or pool), and biotic interactions (competition and predation risk) (Karr, 1981; Karr *et al.*, 1986). The OEPA has coded a system of assessing habitat quality. Their Quality Habitat Environmental Index (QHEI) includes current velocity, bank stability, canopy, riparian vegetation, in-stream cover, gradient, channel morphology, channel width, and channel depth (OEPA, 1988). The standardization of electroshocking methods and the use of multicomponent indices, such as the Index of Biotic Integrity (IBI) and the Index of Well-Being (Iwb) (Gammon, 1976b), has allowed the OEPA to characterize the water quality of the GMR and its tributary streams over the past decade (OEPA, 1990).

The GMR is a multi-stressed river receiving significant industrial and domestic sewage pollution from sites near Dayton, OH (Yoder *et al.*, 1976; Beckett, 1978, 1977; Moller, 1986). Rankin *et al.* (1990) summarized the factors that degrade Ohio's running waters. These factors include municipal and industrial point sources and agricultural and non-point sources. Municipal and industrial point sources affect the most river miles. Non-point sources, such as agriculture, can cause channelization and siltation which lead to habitat modification. These are the two most serious contributors to non-point habitat impairment.

The GMR headwaters have exceptional water quality as assessed by the multicomponent indices for fish and macroinvertebrates called the Index of Community Integrity (ICI). Headwater reference sites have 19-21 species and clean tributaries have 17 to 30 species of fish samples in a single day (Table 1).

Upstream of the Fernald site, major sources of pollutants exist that may affect the biological water quality downriver. These include the cities of Dayton (RM 50) and Hamilton (RM 38). Toxins, excess nutrients, sewage, bacteria, and thermal enrichments are contaminants generated by urban and industrial centers. Sites below Dayton have shown IBI, Iwb, and ICI values in the poor to very poor range between 1985 and 1989 (Rankin *et al.*, 1990). The concentrations of all pollutants appear to drop in the area of the river near the Fernald site. This could be due to the enforcement of water pollution laws and the construction of sewage plants along the GMR. However, low-flow pollution loading and elevated temperatures have combined to cause large fish kills. During the 1988 drought, approximately 261,000 fish were enumerated in a major kill caused by high temperatures near Hamilton (Rankin *et al.*, 1990).

IBI results, used by the Ohio Department of Natural Resources (ODNR) for fish communities, range from 20 (poor or degraded) to 40 (good) for various sample sites from the Ohio River to Dayton. Between 1980 and 1989, no site between RM 19 and RM 38 reached an IBI of greater than 33 (fair to moderate impact) (Rankin *et al.*, 1990). The Iwb is a composite index of numbers and weights calculated as Shannon Indices. The modified Iwb ranges from 7.7 to 8.1 in the Fernald site reach in 1989 on a scale of 1 to 10, ten being the best (OEPA, 1990). The ICI ranged from 40 to 50 in the area of Fernald site; classified as good or enriched to exceptional (OEPA, 1988). Only at Hamilton and Dayton does the ICI show degradation to the fair or impacted level. The habitat quality of the GMR is the most variable, QHEI of 50-80, between RM 19 and RM 38 (OEPA, 1988). The lowest quality of habitat was found in Hamilton (Fig. 2). Thus the extensive surveys of the OEPA and ODNR over the past decade show an enriched or degraded river in the area of the Fernald site, improving from point source degradation upriver.

This report emphasizes the comparison among the years, sites, and subsamples on the status of the fishery in terms of numbers, health, species richness, and diversity. With the eleven year database, changes or trends in the status of the river biota can be followed. If abnormal changes occurred at a given site or year, they may be apparent as deviations of species composition or evenness, changes in mean or modal length and weight, and/or changes in condition as observed in length-weight distributions among sites.

Fish samples were collected and fillets were analyzed for uranium content (versus whole and filleted fish in 1991 and 1992). They were shipped as per instructions by the Fernald Environmental Restoration Management Corporation to an independent contract laboratory. The fisheries analysis contained in this report focuses on the areas that are upstream of the Fernald site's effluent line, near the effluent line, and downstream of the effluent line potentially impacted by the Fernald site effluents. Hence, the survey of fish community status and fish radionuclide concentrations around the Fernald site attempts to detect a continuum of improving water quality downriver from Dayton and Hamilton, where dams and channel modification by gravel dredging have severely changed the physical habitat and migration probabilities of fish.

METHODS

Electrofishing: Pulsed DC electrofishing is among the most efficient method of collecting relatively unbiased samples with respect to fish size and species, especially in shallow, turbid waters (Gammon, 1976). Fish were electroshocked with a 5.0 GPP portable electrofisher (Smith-Root, Inc., Vancouver, WA) from a five meter flat-bottom boat. A DC current at 60 cycles per second was used. The anodes are located at the end of a two meter boom, one at each front corner of the boat. The anodes themselves are umbrella-shaped with four vertical cables extending 30 centimeters beneath the surface of the water. The cathode is the boat. The electroshocking transformer is powered by a gasoline-driven, 9 horsepower, Briggs and Stratton generator, delivering 5,000-watts of 120-volt AC at 16 amperes. The shocker delivers approximately 4 to 8 amperes (at 500 to 1000 volts), depending on the conductivity of the water. The system is similar to the type 'A' rig specified by the OEPA in routine boat electrofishing (OEPA ,1988, WQPA-SWS-3, 30 Sept. 1989). Two people, standing behind a railing on the bow of the boat, catch fish with long-handled (3 m) dip nets. The netters control the electroshocker with a foot-operated "dead-man" switch. The fish lose their equilibrium momentarily in the small area of electrical field near the anode, allowing them to be netted. Thus, the effective area and depth for stunning fish may depend on the species and their size. Large fish are reported to be the most sensitive to the electric field. Almost all fish recover within five minutes in an aerated central well (Vibert, 1967) Some of the larger game fish (largemouth bass, smallmouth bass, and striped bass) greater than fifteen centimeters were identified, measured, and released immediately after gill motion and equilibrium appeared normal, as specified in our State of Ohio Scientific Collecting Permit. No endangered species were captured.

At each site, four subsamples were taken (approximately 10 minutes each) to compare fish numbers, biomass, and species composition in the subsamples within each site's reach. The subsamples were not intended to be replicates of habitat, but to examine variability in spatial sections of each site's reach and to develop a cumulative species list by site. The cumulative number of species for each site was intended to determine if the total sample was large enough to contain most of the species at that particular site. All samples were collected in accordance with Fernald site quality assurance plan (SSOP-0036).

Sample Preparation: The fish collected for uranium analysis and biological survey were placed in plastic bags identified by subsample number, combined by site in a larger bag, immediately placed in a cooler on ice, and the coolers were locked and sealed in the field. The sealed coolers containing the fish were then brought back to a radionuclide-free laboratory at the University of Cincinnati for identification and processing. For each subsample, the fish were identified to species, weighed, and measured (Clay, 1975; Pflieger 1975; Smith, 1979; Trautman, 1981; Boschung *et al.*, 1983; Page and Burr, 1991). Any external abnormalities, such as fin rot, diseases, or fungus were noted. The fish were decapitated, eviscerated, and fins removed to make modified fillets. Some scales, skin, and bones remained with the fillets. These modified fillets are approximately what people would consume if they ate fish from the GMR. The modified fillets from each species or trophic grouping (planktivore, insectivore, piscivore, and benthivore) were adjusted to a wet weight of at least 200 grams, labeled sequentially within each site by species and/or trophic group, and sealed into resealable plastic bags. Fish from each collection site were processed as a group. After processing one group, the area was cleaned so that contamination between groups would not occur. The upstream or control site was processed first in order to minimize any possible cross contamination of uranium from the Fernald site. Any fish that was deemed too small for the uranium analysis was discarded and incinerated at the University of Cincinnati or preserved for the

University's private fish collection. Any waste from the fish preparation was also incinerated at the University of Cincinnati.

Water Analysis: Water analysis was performed both in the field and at the University of Cincinnati laboratory. Conductivity (microSiemens/cm^2) was measured in the lab using a YSI Model 31 conductivity meter and platinum electrode (Yellow Springs Instruments Co., Yellow Springs, OH). Dissolved oxygen (ppm O_2 at 0.25 m) and temperature (°C) were measured in the field using a YSI Model 57 meter (Yellow Springs Instruments Co., Yellow Springs, OH). The turbidity was measured in the field using a secchi disk (m) and standard measuring techniques. The pH was measured electrometrically using a Cole-Parmer Model 5985-80 digi-sense pH meter (Cole-Parmer Instrument Co., Chicago, IL) standardized by a pH 7 and pH 10 standard buffer. Suspended chlorophyll was separated by filtration on glass-fiber filters, extracted in 10 ml of 90% acetone for 48 hours at 4° C in darkness (Wetzel and Likens 1991), and analyzed spectrometrically. Soluble reactive phosphate was determined colorimetrically by absorbance of phosphomolybdate at 890 nm in filtrate using the HACH methods (method 490) and the HACH DR/2000 spectrophotometer (HACH, Inc., Loveland, Colorado). Ammonia concentrations were determined colorimetrically by absorbance of salicylate/cyanurate (method 385). Nitrate concentrations were measured by cadmium reduction to nitrite (method 355). Sulfate concentrations were determined colorimetrically by absorbance (method 680). The ammonia, nitrate, and sulfate measurements also used the HACH DR/2000 spectrophotometer (HACH, Inc., Loveland, Colorado). These measurements were designed to discern effects of eutrophication and algal growth, sewage enrichment, and gravel mining activities on the water quality at our sites.

Additional water samples were collected from RM 42, RM 27, and RM 12 in an effort to better document the downstream gradient trends previously found in past studies. These additional samples were collected on the same day as the other water samples, 25 September, 1994. These water samples were analyzed in the same manner and using the same equipment as were RM 38, RM 24, and RM 19.

Statistics: Statistical analysis was performed using the statistical package SYSTAT 5.03 for DOS. Multiple pairwise comparisons were performed using Tukey Honestly Significant Difference (HSD) post F test. All statistically significant results have $p \leq 0.05$ (two tailed). One way ANOVAs were used to examine the effect of location and year on parameters of fish community structure. Since the sites were far enough apart and the same fish were not likely to be in the same river location in the next year, ANOVA with years as repeated measures was not needed.

SITE DESCRIPTION

Three sites on the GMR were used for electrofishing in 1994 (Fig. 1). Two of these sites have been sampled annually at the same time of year since 1984 (RM 24 and RM 19) (Figs. 3 and 4). A third site was added upstream in 1991 as an additional control at RM 38 (Fig. 2). This added site at RM 38 is isolated from the downstream sites by two dams. The site was purposefully chosen in an effort to prevent migration of fish upstream from the RM 24 area. The dams serve as an effective barrier to fish migration except during periods of high water flow.

RM 38 is located at the confluence of Talawanda Creek and the GMR, in Hamilton (Fig. 2). The riparian community is relatively undisturbed, and the habitat provided by fallen trees, rocky shoals, and pools increases habitat heterogeneity. The site is located just upriver of the outlet of Seven Mile Creek up to and around bridge abutments of the US Route 127 bridge. A 490 meter reach of the river was sampled in four 10 minute subsamples. The first subsample began on the east side of the river, starting directly across from the boat ramp, approximately 100 meters above the dam. The sampling started downstream of the boat ramp for 60 meters, continuing across the river for 35 meters and upstream along the west shore for another 15 meters. The second subsample was taken along the west side of the river, starting about 500 meters above the dam, and extending upstream 120 meters along the west side of the GMR. The third subsample began 52 meters downstream of the Talawanda Creek on the west side of the river. The subsample proceeded upstream to the creek, 52 meters along the south shore of the creek, across the creek and 26 meters downstream on the north shore of the creek. The fourth subsample began at the mouth of the Talawanda Creek on the west shore of the GMR and continued upstream for 110 meters.

RM 24 is near Stricker's Grove Park and the Fernald site's effluent line (Fig. 3). The mixing zone is a deep, fast section of river with strong eddy currents just below the effluent line. This site is on the outside of a long curve on the western shore. It is steep-sided with a fairly rapid current, the fastest of the survey sites. Some riparian trees, both standing and fallen, provide good cover and high fish species diversity on the east side. The average pool depth here is 1.8 meters. A 770 meter section of the river around the effluent line was sampled. The sampling was divided into four subsamples each lasting 10 minutes. The first subsample of 160 meters began just below the effluent pipe and continued upstream for 80 meters. Sampling continued across the river and down the east shore. The second subsample was taken from the effluent pipe and continued downriver, through a riffle, for approximately 50 meters. Both sides of the river were sampled and some of the area was covered a second time for a total subsampling length of 180 meters. The third subsample began just below the riffle and continued downstream for 50 meters. The entire area of the river, both shores, was covered twice for a total length of 200 meters. The fourth subsample began approximately 200 meters upstream from the effluent pipe and continued upstream for 115 meters. Both shores of the river were sampled. The west side had a steeply banked and wooded shoreline, but the east side had a flat, gravel shoreline.

RM 19 is found at the outfall of Paddys Run, which is the historic drainage route of stormwater runoff from the Fernald site (Fig. 4). A pool has been created here by 25 years of dredging by a gravel company. The western shore, unaffected by the dragline operations, contains many large boulders and submerged logs, and has good riparian vegetation which provides excellent cover for young fish and structure for adult fish. The eastern shore is steep gravel without vegetation and is unattractive to most fish. The average pool depth is about 2 meters. This site has the slowest current and is pond-like in many respects. Four subsamples were taken, each approximately 10 minutes in duration with a combined distance of 570 meters. The first subsample started 50 meters downstream of old railroad bridge abutments near Dravo Park and ran downstream for 120 meters. The sampling for the first subsample was restricted to the west shore. The second subsample consisted of 100 meters along the west shore and among the bridge abutments. The third subsample started on the west shore approximately 170 meters below the bridge abutments and continued downstream for 200 more meters. The fourth and final subsample was taken from the eastern shore. There has been no dredging activity along the eastern shore for the past two years. The subsample began approximately 70 meters downstream of the bridge abutments and continued downstream for 150 meters.

Samples were collected at RM 38 on 25 September, 1994 and at RM 24 and RM 19 on 26 September, 1994 (Table 2, Figures 1-4). Each site was sampled for about 40 minutes (RM 38= 40.04 min., RM 24 = 40.01 min., and RM 19 = 40 00 min.). At each site, four equally timed subsamples were taken, each about 10 minutes in duration.

The total distance electrofished was 0 49 km, 0 77 km, and 0.57 km at RM 38, RM 24, and RM 19, respectively. This distance is the number of kilometers of shore traversed, rather than the kilometers of river electrofished. The river was too wide to consider a pass down either side a representative sample for all the fish in the whole river. The habitat was different on each side of the river and these differences dictated the necessary distance of shore to be electrofished. Poor habitat required less time to electrofish than good habitat, but the fish yield was higher in the good habitat. This is one explanation for the difference in distance electrofished at each site. RM 38 and RM 19 were pooled sections of river; RM 24 was flowing water primarily in open runs. RM 24 had the best development of riparian zone structure that fish prefer.

Both time and distance have biases in interpretation. Time and volume of water sampled were not biased by the speed of movement. The active stun zone was small (2 x 1.5 x 0.5-1 m deep) that the volume of water sampled remained nearly constant. The use of fish/kilometer for reporting is more common and it eliminates some of the biases.

RESULTS AND DISCUSSION

Physical, Chemical Parameters:

Site Comparisons: Physical and chemical data for the three sites show a slight change in conductivity from RM 38 to RM 19 (Table 2). RM 38 was sampled in the late morning (11:20 a.m.) and RM 24 and RM 19 were sampled in the mid-afternoon (2:30 p.m. and 3:15 p.m., respectively). The slight difference in conductivity could be due to diel variation in production and dissolution carbonates caused by diurnal swings in oxygen (Table 2). High pH, temperature, and low concentrations of free CO_2 found in mid-afternoon can reduce the solubility of carbonate/bicarbonate causing precipitation of marl from saturated solutions.

The oxygen concentration was slightly lower at morning sampling sites due to diurnal variation in photosynthesis and respiration of the seston and benthos. Oxygen concentration at RM 38 and RM 19 were supersaturated, but the concentration level at RM 24 was less than saturated. Oxygen could be exhausted to the atmosphere with vigorous mixing at the rapids at RM 24.

Soluble reactive PO_4 (SRP) concentrations, suspended algal chlorophyll concentrations, ammonia and nitrate concentrations, and secchi depth support the hypothesis of increasing trophy of the river (Table 2). The SRP, normally the limiting nutrient controlling algal biomass, was high with 1.123 to 1.554 mg PO_4^{-3}/liter. The concentration of SRP dropped from upriver to downriver as the PO_4 was utilized by algal growth. The concentration of sulfate increased from RM 38 to RM 19 (Table 2). The algal chlorophyll, as a measure of algal biomass, showed the same pattern with an increase downriver (Table 2). The algal chlorophyll concentration was between 44.887 and 56.524 µg/liter, equivalent to what might be found in a eutrophic lake (Wetzel, 1983). These levels were higher than the levels found in 1993. Normally, sestonic chlorophyll is a minor portion of river algal biomass, because most is attached to rocks as periphyton or epilithon. Concentrations of NH_4^+ stay relatively constant downstream (Table 2), while NO_3 concentrations slightly increase down river (Table 2). Secchi depth decreased very slightly downriver.

Down River Trends: Physical and chemical data for the six sites sampled, RM 42 to RM 12, help to show downstream trends. It is difficult to get a complete picture of river nutrients with three sites. The nutrients PO_4, NO_3, and NH_4 decline from RM 42 downstream to RM 12 (Fig. 6), as though there was a large point source of nutrients. This source is likely to be domestic and industrial sewage treatment plants south of Dayton. A pattern of decreasing conductivity (Fig. 7) would be further evidence for the addition of and uptake of total salts downstream from a point source. Normally, the conductivity would be expected to increase cumulatively down river as the water resembles groundwater instead of rainwater, as it may have started in headwater streams. Sulfate concentrations, normally generated from weathering of rocks and mineralization of protein, does not show any obvious pattern down river. This evidence suggests that this reach below Hamilton is a zone where nutrients from Dayton sewage treatment plant and industry are assimilated into new algal biomass. Hence the nutrients are expected to decline further from the source.

The algal biomass should increase down stream and the oxygen supersaturation should be enhanced (Fig. 8). The chlorophyll as an index of algal biomass in the plankton did increase, but especially at the most ponded sites at RM 38 and RM 19. In response, supersaturated oxygen was in pools and lost to the atmosphere with vigorous mixing at the rapids at RM 24. Oxygen could be a function of time of day, since oxygen supersaturation may develop progressively during the day as photosynthesis proceeds. This pattern was not clear in the 1994 data. Clearly, temperature of the river did appear to increase as the time of day progressed.

The inorganic N:P ratio, by weight, is an index of relative availability to algae. A physiological ratio of 7:1 for N:P, by weight, is required for healthy growth of algae and higher plants. Both N and P concentrations decrease down river (Table 2), however, P droppes further than N. Probably P disappearance and some N disappearance is caused by algal growth; however, NO_3, which is mobile in interstial water, appears to be resupplied over the reach from groundwater or other sources. In the GMR on 25 September, 1994, the 'best' ratio occurred upriver towards the presumptive source at Dayton. As algal growth proceeds, the less soluble PO_4 is differentially retained. NO_3- is freely mobile in interstitial waters and appears to be augmented by the downstream transect since the N:P ratio rises continuously from 13:1 to 33:1.

In the eutrophic reach of river below Dayton, stress associated with diel variation in oxygen or nutrients was not perceived to be a stress on fishery. The differences between the fish communities were related to distance from the Ohio River and habitat characteristics at each site.

Fish Parameters:

Species Richness: This year 853 fish (vs. 224 fish in 1993 and 491 fish in 1992), from 27 species (vs. 26 spp. in 1993 and 23 spp. 1992), in eight families, were collected from the three sites in the GMR (Figs. 10 and 11, Table 3). No threaten or endangered species were captured. The most diverse families from the river were the Catostomidae (nine species) and Centrarchidae (five species) (Table 3). The number of different species per site ranged from 15 at RM 38 to 20 species at RM 24. The most numerous species was the gizzard shad (Clupeidae) with 244 individuals, followed by golden redhorse (Catostomidae) with 136 individuals, and longear sunfish (Centrarchidae) with 104 individuals (Table 3). Species diversity appears to be slightly greater than has been observed in the past. RM 24 had the highest number of species ever caught for this study with 20 species.

Statistically, a grouped, one way ANOVA showed that among the years 1984 to 1994, there was a difference in the number of species captured by year ($F = 3.540$, $df = 10, 24$, $p = 0.005$ HS) (Table 5), but not by location ($F = 0.597$, $df = 3, 31$, $p = 0.622$ NS). A post F comparison by Tukey's HSD shows that the number of species caught in 1994 is significantly different from the number caught in 1990 and 1993. The number of species of fish caught in 1991 is also significantly different from the number caught in 1990. This year's study had the most species collected, on average, per site. Previous to this, the collection years 1985 and 1991 netted the most species The collection years 1990 and 1992 still had the fewest number of species collected.

The sites were electroshocked for 2404, 2401, and 2400 seconds at RM 38, RM 24, and RM 19 respectively (Table 4). The fish diversity and density varies with habitat complexity, including topography of the shore, the depth of the pool, the nature of the current, and the amount of vegetation in and over the water (Gammon *et al*, 1983; Yoder and Gammon, 1976, OEPA, 1988). In 1994, 422, 300, and 557 fish were collected per hour at RM 38, RM 24 and RM 19, respectively

(Fig. 12, Tables 4 and 5), compared to 72.5, 35, and 90.2 fish per hour in 1993 and 175, 106, and 305 fish per hour in 1992 (Table 5) from the respective locations (RM 38, RM 24, and RM 19). RM 19 had the greatest number of fish collected and the most fish caught per hour. RM 24 had the fewest fish collected, but it had the most biomass collected per hour of all the sites (Fig. 13). RM 24 had the heaviest average fish, two times heavier than RM 38 and three times that of RM 19, and the longest average length of the three study sites (Table 6). Larger and more mature fish were found at RM 24. It has a swifter current that usually excluded the smaller fish. A grouped, one way analysis of variance using four sites from 1984-1994, found significant differences in the number of fish caught per hour between years ($F = 4.898$, $df = 9, 22$, $p = 0.001$ HS) (Table 5) However, there was no significant difference found among the number of fish caught between RM (38, 28, 24, and 19) ($F = 1.575$, $df = 3, 28$, $p = 0.218$). This year a larger number of fish were caught per km and subsample. A post F comparison by Tukey's HSD shows that the number of fish caught per hour in 1994 is significantly different from the number of fish caught per hour for every other year. This could be due to low water flow this year. The low water flow would concentrate fish into a smaller amount of water, making electrofishing more effective. The increase in capture rate could also be a result of the new electrofishing equipment which was used this year for the first time for this study. Even though more fish were caught, the general trend of capture did not change. As usual, more fish were returned per unit effort at RM 19 > RM 38 > RM 24.

Species Diversity Indices: The diversity of fish at each site was measured by the Shannon-Wiener (H' or Hbar) index based on the information theory using log base 2 (Krebs, 1989). This index of diversity is increased by the number of species in a sample and the relative uniformity of the numbers of individuals of each species. Samples with fewer species or one species being very dominant have low calculated diversity (H'). The maximum diversity (Hmax) that can be attained in any sample is fixed by the number of species, assuming equal numbers of individuals in all species collected at the site. Gizzard shad dominated the fish community at RM 19. Their numbers had the greatest effect on reducing the diversity at that site (Tables 3 and 7, Fig. 14). At RM 38, golden redhorse accounted for 39% of all fish caught. This is a change from a gizzard shad dominated community found in last year's sampling. At RM 24, freshwater drum was the dominant species, the same as last year, accounting for 24.5% of all fish caught. Gizzard shad, accounting for 20.5% of fish caught, was a close second. At RM 19, gizzard shad accounted for 52% of all fish collected; this is a 2% increase from last year. RM 24 had the highest diversity and the highest evenness (H'= 2.315, E=0.773) (Table 7, Fig. 14) and was dominated by gizzard shad and freshwater drum. The eleven year mean for H' and evenness shows a trend of RM 38 > RM 24 > RM 19 and RM 24 > RM 38 > RM 19, respectively (Table 7). RM 28 was not sampled in 1993 and 1994. Thus, the trend for diversity in 1994 (RM 24 > RM 38 > RM 19) differed from the trend of the means (RM 38 > RM 24 > RM 28 > RM 19). It is possible that the mean diversity trend is affected by the very low diversity found in 1985, 1990 and 1992 at RM 19.

For the diversity index Hbar, a grouped, one way ANOVA disclosed no significant differences between years (F= 0.803, df =10, 24, p = 0.627 NS) or site (F= 2.183, df = 3, 31, p = 0.110 NS) in the GMR. On average the index was highest at RM 38, RM 24, RM 28, and RM 19, decreasing in that order. This is the same trend that was apparent in 1993. Amongst the years, Hbar was highest in 1986 and 1985 and lowest in 1992.

The grouped, one-way ANOVA revealed a significant difference in mean evenness between RM (F= 6.951, df = 3, 31, p=0.001 HS). RM 19 had significantly lower evenness than RM 28 and RM 24 in a post F comparison of means, but RM 19 was not significantly different than RM 38. The eleven-year mean evenness at RM 19 is statistically lower than other locations possibly because of the high proportion of gizzard shad present in the large dredged pool at RM 19. The years of highest average evenness were 1986 and 1985, contrasting to the years of lowest evenness in 1991 and 1992. In the past two years, there appears to be no further trend towards lower diversity or evenness.

3. Community Coefficients: Differences in community structure can be seen by comparing the similarity of species composition from the three sites. The community coefficient (CC) is a measure of the proportion of species shared by any two sites. It is calculated as two times the number of shared species (c) divided by the sum of all the species found at the two sites (a and b).

$$\text{Community Coefficient} = 2c / a+b$$

A CC of 1.0 indicates that the two sites have identical species composition, while a CC of 0.0 means there are no shared species (Krebs 1989). A low CC may reflect differences of habitat due to geographical separation or a pollution gradient.

The CC shows that all three sites (RM 38, 24, and 19) are similar (CC = ca. 0.50) (Table 8). RM 24 and 19 are more similar (CC = 0.76) than are RM 38 and 24 and RM 38 and 19 (CC = 0.63 and 0.50, respectively). Another way to examine species data at several sites is to observe how many species are found at only one site, two sites, etc.. For 1994, 10 species were found at only one site, 9 are found at two sites, and 8 at all three sites, compared with 15, 5, and 6, respectively, for 1993 (Table 3).

Weight/Length Distributions: The weight and length frequency distributions of fish collected were calculated as percent per size and cumulative percent per size (Tables 9 and 10). The modal weight is observed to be between 25 to 50 grams (g) for fish caught at RM 38, RM 24 and RM 19 (Table 9). Cumulative distribution of proportion of fish by weight shows the effect of size classes in composition of the fishery. If the cumulative weight distribution rises quickly, then small fish dominate. This is the form of the distribution found in at RM 38 and RM 19 (Fig. 15), the two most ponded sites. In both of these sites, more than 74% of the fish accumulated were less than 100 g in size (Fig. 15). RM 38 had a large number of YOY golden redhorse, longear sunfish and smallmouth bass. RM 19 was dominated by YOY gizzard shad, bluegill and longear sunfish. On the other hand if the cumulative weight distribution curve increases slowly, then the fishery is dominated by larger fish. This is the distribution found at RM 24, with less than 38% of these fish weighing less than 100 g (Fig. 15). The large differences in distribution stemmed from the large number of YOY at the two pooled sites, RM 38 and RM 19.

The length frequency distributions (Table 10) show the modal length of fishes at RM 38 (10 to 12 cm) was the smallest. RM 24 had the longest modal length (28 to 30 cm), and a bimodal distribution of fish at sizes from eight to 18 cm and 24 to 36 cm (Table 10). RM 19's modal length of the distribution is 12 to 14 cm. The diagram of cumulative proportion of fish by length (Fig. 16) illustrates a gradual rise to the asymptote. In a uniform sized distribution, the curve rises linearly to the asymptote. This graphically shows that there is a slightly even distribution of fish from different length classes, similar to last year; however, there is still a large number of small fish. Clearly RM 38 and RM 19 are dominated by more small fish than any others, with at least 72% of the fish being less than 20 cm (Table 10, Fig. 16). RM 24 had the largest and most uniform size frequency with a more linear rise in the cumulative frequency curve. RM 24 has a more even rise in cumulative frequency this year compared to last year. The dramatic rise in the frequency found from 22 to 30 cm, which accounted for 51% of the fish from RM 24, is not present. The curve of the cumulative frequency plot can help to describe a site. When skewed to the young of one species, the curves imply enrichment in food or habitat. When uniform and linear, the curves suggests an older population, which could mean a uniformly fast current or a condition that has lead to a loss of the more sensitive young fish. The young-biased curves at RM 38 and RM 19 to probably reflect enrichment and pooling that favor gizzard shad and immature fish. The loss of young fishes probably reflect habitat conditions and current, not a toxic stress, at RM 24.

The changes in growth rate and condition can be examined for common species using (length x wet weight) distributions. This curve, reflecting allometry of length and weight, deviations in weight per unit length, shows changes in the condition of the fish (amount of fat stored). Deviations from the allometric curve of length and weight may indicate poor growth conditions at particular sites or in the river as a whole. Gizzard shad is the most common species at most sites. There were many YOY (6 to 14 cm) and one year-old fish (16 to 27 cm) at RM 24 and 19 (Fig. 17). Mostly larger fish (2+ years) were found at RM 38; this is a change from last year where mostly YOY and one year olds were found at this site. RM 19 had a large number of YOY gizzard shad; most of the 193 gizzard shad caught at RM 19 were YOY.

The smallmouth and striped bass were summed to show a consistent length/weight relationship at RM 38, 24, and 19 (Fig. 18). The bass appear to vary more as they get larger. This is done to the combination of the two different species. The two species are both bass; however, they are in separate families. This could be the cause of the high-end variation. The related sunfishes appear to have a looser correlation than some of the other graphs (Figure 19). This graph is a combination of the longear sunfish and bluegill. There are some YOY sunfish that do not appear to follow the growth curve too closely; they are underweight for their size. All of these fish come from RM 24, a fast moving site. They may have a more difficult time obtaining food than YOY at other sites because they are preyed upon more heavily by larger fish in the swifter currents. The freshwater drums are found in a couple of size classes distributed in RM 24 and 19 (Fig. 20). There were no small (0 to 12 cm) freshwater drum at RM 24 and there were only larger drum (>20 cm) found at RM 19. There were no freshwater drum found at RM 38 as there were last year. Carp at all three sites appeared to be growing equally well (Fig 21). There is a clear difference in size distribution for one year old carps and carps that are two years old or greater. The combined Catostomidae show a similar growth curve with all other fish graphed (Fig. 22). It appeared that the larger suckers were found at RM 24 and RM 19 while the smaller suckers were found mainly at RM 38.

In conclusion, pooling at RM 38 and 19 by damming or dredging, made them good nurseries for young gizzard shad and golden redhorse that contributed to their abundance. All fish species appear to be in same condition of health independent of site, based on their weight/length ratios.

Sampling Adequacy: In 1992, the total sample was subdivided into subsamples to examine variance by habitat within sites and adequacy of sampling effort to capture most of the species. In 1993 and 1994, attempts were not made to take replicates, but to maximize the habitat sample differences; hence the term subsample. At all RM locations sampled, the number of species per subsample was relatively constant (Fig. 11). The cumulative number of fish per subsample found RM 38 and RM 19 at an asymptote, but not for RM 24 (Fig. 23). RM 24 were under-sampled for number of fish; however, the fish tat were captured at this site were larger than the other sites on average.

Ordination by Detrended Correspondence Analysis (DECORANA OR DCA): DCA is a multivariate, eigenvector matrix manipulative technique to evaluate the differences in standard deviation units between communities at particular sites or between species at those sites using an algorithm which reduces the data to two unrelated ordinates (ter Braak, 1986). Using only the species abundance data, the algorithm iterates to a solution that describes the differences in communities using only the species composition data The ordination for communities using species data is underlain by the ordination of the species in community-defined space. Using the DCA, the relative position of the species on each ordinate is proportional to the effect of each community on the ordinate. Hence two sites that are very dissimilar communities and share few species will be at extremes of the axis and will be significantly different if they are more than two standard deviation units apart on the axis. The eigenvector method allows us to partition the variance to determine what proportion of the separation of communities or species is explained by species or communities, respectively.

The DCA for sites using transformed species abundances (each corrected to 100% for differences in species number) showed that the fish communities of RM 38 and RM 19 were two standard deviation units apart on the first axis which explained 32.6% of the total variance in site differences. The second axis provided little separation at all among fish communities at the three sites (Fig. 24). The four subsamples were tightly clustered on the first axis at all sites compared to the variation between river mile sites.

The DCA for species by site showed associations of species responsible for separating the sites so cleanly. Similar to 1993, the community at RM 38 above the Hamilton dams was characteristic of small or mid-order rivers with spotfin shiner, northern hog sucker, bluntnose minnow, golden shiner and yellow bullhead. Some medium-large river species separated this site: shorthead redhorse, golden redhorse, highfin carpsucker and carp. RM 24 in a narrow, fast moving section of river was dominated by Ictalurids (channel and flathead catfish), Catostomids (two buffaloes, two redhorses, and four suckers), the drum and the striped bass. Finally RM 19, pooled by gravel mining and below the CG&E pipeline crossing, was dominated by large river fish some of that might have come from the Ohio River (sauger, gizzard shad, river carpsucker, crappie, and bluegill). Interestingly, the distribution of fish species on the first ordinate was very similar between years 1993 and 1994. Despite the prolonged drought of 1994, the base flow was not much different between the two years and the factors underlying the fish distribution appeared to be similar. In 1994 compared to 1993, the physical/chemical and biological attributes of the sites were more important to fish composition than were the microhabitats sampled in the four 10 minute subsamples.

CONCLUSIONS

The fishery of the Great Miami River has been relatively stable over the last eleven years, 1984-1994. Over the eleven years of sampling, forty-nine species have been recorded. During the 1994 survey, twenty-seven species were captured (Table 3 and Appendix A) compared with twenty-six in 1993. This year, a greater number of fish was caught, 853, compared with last year's capture of 224. The possible severe degradation of the fish community below the Fernald site, apparent in 1992, was no longer present in 1993 and 1994. RM 24 had the highest number of species caught per site this year with 20 species (Table 5), which is also the greatest number of species caught per site for any of the years surveyed.

RM 38 is protected from the upstream migration of fish by the two dams at Hamilton. In 1991, RM 38 had many redhorse and northern hogsuckers, typical for mid-sized streams prior to cultural development. However, in 1992, RM 38 was dominated by warm water species from ponded habitats, sunfish, bass, and white suckers. It appears that this year RM 38 has returned to a site dominated by river species. River species, probably breeding in isolation, were common: golden redhorse, smallmouth bass, golden shiner, and channel catfish. Low water flow this year disallowed fish navigation upriver past the dams.

RM 19 and 24 are influenced by the backwater species, which migrate up from the dam-regulated Ohio River. Fish from RM 38 could have originated from upstream of Hamilton or migrated up river during a previous year or during the spring high flow conditions prior to the low flow conditions. However, there are several distinct lines of evidence that suggest these dams prevent the summer interchange of individuals that live in the down-river reaches of the Great Miami River with those living above Hamilton.

The diversity and evenness of the sites are highly influenced by the numbers of gizzard shad and freshwater drum. RM 24 had the highest diversity, but was still dominated by freshwater drum and gizzard shad populations. RM 19 could be considered a nursery for gizzard shad since greater than 50 % of the fish caught at RM 19 were YOY gizzard shad (Table 3). Sixteen additional species were found at this site; many of which are big river species such as: stripped bass, sauger, freshwater drum, carp, and large gizzard shad. Other fish species appear to be in the same condition of health, independent from site, as seen in the length/weight plots (Figs. 17 through 22).

From circumstantial evidence the fish community at RM 38 has been isolated from migration during the summer of 1993. RM 24 and 19 can be influenced by effluents from the city of Hamilton and migration from the Ohio River. Only one fish out of 853 collected and examined showed any sign of differential pollution stress among the three sites causing ulcers, skin fungi, and/or growth anomalies. In this regard, there are no discernible significant effects of the Fernald site on the population, size, numbers, condition, or species richness of the fish communities in the Great Miami River in 1994.

One point that was very evident in the report is the importance of multiple subsamples. The DCA showed that subsamples clustered tightly for all RM sites with no overlap on axis one at all. Subsamples were larger in 1994 and sufficient to represent the fish community based on the criteria of reaching a species number asymptote (Fig 23)

Fish communities are good indices of water quality and habitat quality. In the absence of pollutant stressors, fish species utilize river sections by their unique habitat requirements. In 1994, habitat differences appeared to be connected with fish community structure by site, similar to the conclusion reached in 1993. In 1992, the survey appeared to show that fish were separated by an upstream source of nutrient enrichment. This enrichment set up a gradient of decreasing water quality and fish community species richness down river. This condition was not repeated in the late summer of 1993 or 1994 despite the low water flow. The 1994 survey tended to have more fish collected and a larger average size.

REFERENCES

Beckett, D.C. 1977. Compositional Variation and Ordination of Macroinvertebrates in a Multistressed River System. Masters of Science Thesis. 76 p.

Beckett, D.C. 1978. Ordination of Macroinvertebrate Communities in a Multi-stressed River System. p. 748-770. In J.H. Thorp and J.W Gibbons (eds.) Energy and Environmental Stress in Aquatic Systems. CONF-771144 NTIS. Springvalley, VA.

Boschung Jr., H. T., J. D. Williams, D. W. Gotshall, D. K. Caldwell, and M. C. Caldwell. 1983. The Audubon Society Field Guise to North American Fishes, Whales and Dolphins. Alfred A. Knopf, Inc., New York. 848p.

Clay, W.M. 1975. The fishes of Kentucky. Kentucky Dept. of Fish & Wildlife Resources, Frankfort, Ky. p 416.

Gammon, J.R. 1973. The effect of thermal inputs on the populations of fish and macroinvertebrates in the Wabash River. Purdue Univer. Water Research Center Tech. Rept. no. 86.

Gammon, J.R. 1976a. The fish population of the middle 340 km of the Wabash River. Purdue Univer. Water Research Center Tech. Rept. No. 32.

Gammon, J.R. 1976b. The fish populations of the middle 340 km of the Wabash River. Purdue Univer. Water Resources Res. Cen. Tech. Rep. 86. 73p.

Gammon, J.R., M.D. Johnson, C.E. Mays, D.A. Schiappa, W.L. Fisher and B. L. Pearman. 1983. Effects of Agriculture on Stream Fauna in Central Indiana. USEPA. EPA-600/S3-83-020. 5p.

Karr, J.R. 1981. Assessment of biotic integrity using fish communities. Fisheries 6(6): 21-27.

Karr, J. D., K. D. Fausch, P. l. Angermier, P. R. Yant, and I. J. Schlosser. 1986. Assessing Biological Integrity in Running Waters: A Method and its Rationale. Ill. Nat. Hist. Surv. Spec. Publ. S. 28p.

Krebs, C.J. 1989. Ecological Methods. Harper and Row, N.Y.654p.

Krumholz, L.A. 1981. Observations in changes in the fish population of the Ohio River from Rafinesque to 1980. Trans. Ky. Acad. Sci. 41: 1-15.

Miller, M. C., G. Gibeau, M. Kelly, J. Schneider, and T. Linnabary. 1987. Fish of the Great Miami River 10 September 1987. Draft Report, Westinghouse Materials Company of Ohio, Cincinnati, OH. p. 39.

Moller, B.J. 1986. Corlisol Levels in Carp (*Cyprinus carpio*) from the Great Miami River as an Indicator of Environmentally Induced Stress. Masters of Science Thesis, 84 p.

OEPA. 1988. Biological Criteria for the Protection of Aquatic Life: Vol. II: Users Manual for Biological Field Assessment of Ohio Surface Waters. Div. of Water Quality Planning and Assessment. OEPA. 124p.

OEPA. 1990. Compendium of Biological Results from Ohio Rivers, Streams and Lakes: 1989 Edition. Division of Water Quality Planning & Assessment, OEPA. 132p.

Ohio River Valey Water Sanitation Commission. 1962. Aquatic Life Resources of the Ohio River. ORSANCO, Cincinnati, OH. 218p.

ORSANCO. 1980. Assessment of Water Quality Conditions, Ohio River Mainstem 1978-1979. Ohio River Sanitation Commission, Cincinnati.

Page, Lawrence M. and Burr, Brooks M. 1991. A Field Guide to Freshwater Fishes. Peterson Field Guides, Houghton Mifflin Co., Boston. 432p.

Pearson, W.D. and L.A. Krumholz. 1984. Distribution and status of Ohio River fishes. ORNL

/SUB/79-7831/1. Oak Ridge Nat. Lab., Oak Ridge, TN. 401p.
Pearson, W.D. and B.J. Pearson. 1989. Fishes of the Ohio River. Ohio J. Sci. 89: 181-187.
Pflieger, W.L. 1975. The fishes of Missouri. Missouri Dept. of Conservation. 342p.
Rankin, E.T., C.O. Yoder, & D. Mishne. 1990. Ohio Water Resource Inventory-Executive Summary & Vol. 1. OEPA. Columbus. 136p.
Smith, P.W. 1979. The fishes of Illinois. U. of Illinois Press, Urbana.Ill. 413p.
Ter Braak, C.J.F. 1986. Canonical correspondence analysis: a new eigenvector technique for multivartiate direct gradient analysis. Ecology 67: 1167-1179.
Trautman, M. B. 1981. The fishes of Ohio. Ohio State U. Press. 782p.
Vibert, R.(ed.). 1967. Fishing with electricity. F.A.O. United Nations. 276p.
Vondracek, B. and Robert LeHew. 1992. Population dynamics and ecology of Lake Erie gizzard shad. In "Ohio Cooperative Fish and Wildlife Research Unit, 1991 Annual Report", ODW, OSU, USFWS and WMI. 54p.
Wetzel, R.G. 1983. Limnology 2nd ed. Saunders, Philadelphia. 767p.
Wetzel. R. and G.E. Likens. 1991. Limnological Analyses. Second Edition. Springer-Verlag, New York 391p.
Yoder, C.O. and J.R. Gammon. 1976. Spatial and temporal distributions and abundance of fishes in the Middle Ohio River. Rept. for Dayton Power and Light Co. 113p.

Figure 1. Overview map of the sampling sites in the Great Miami River, 1994.

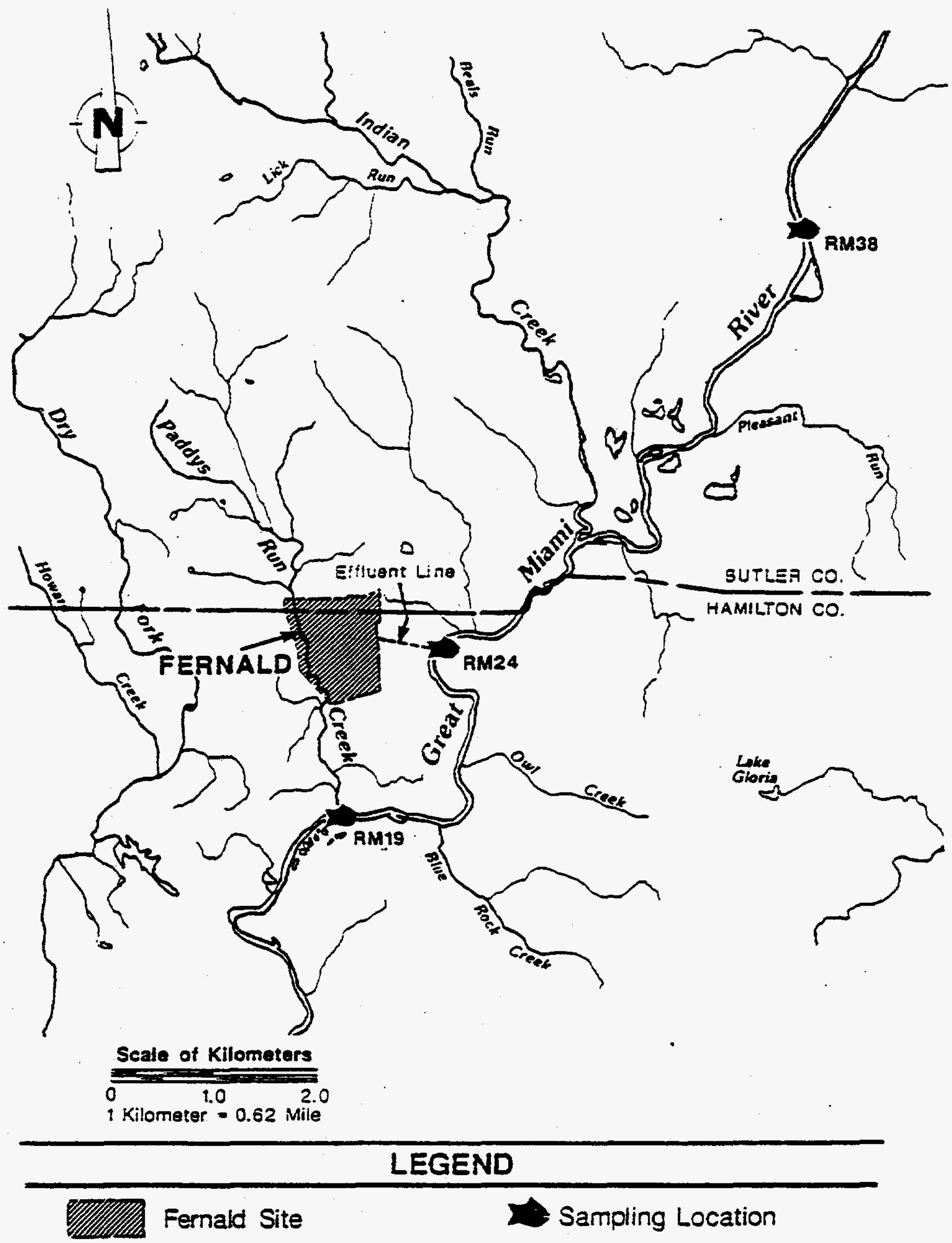


Figure 2. Map of river mile 38

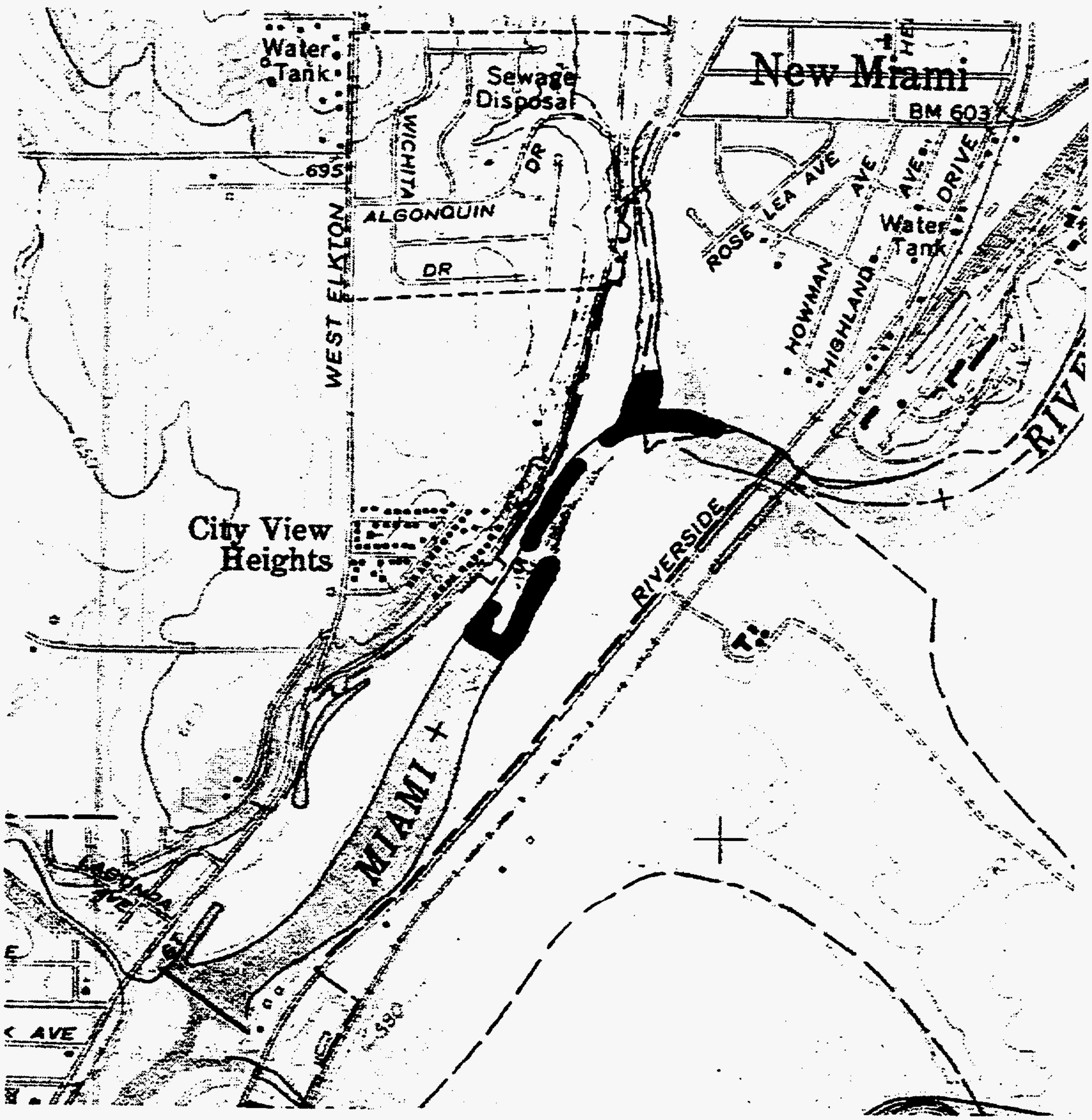


Figure 3. Map of river mile 24.

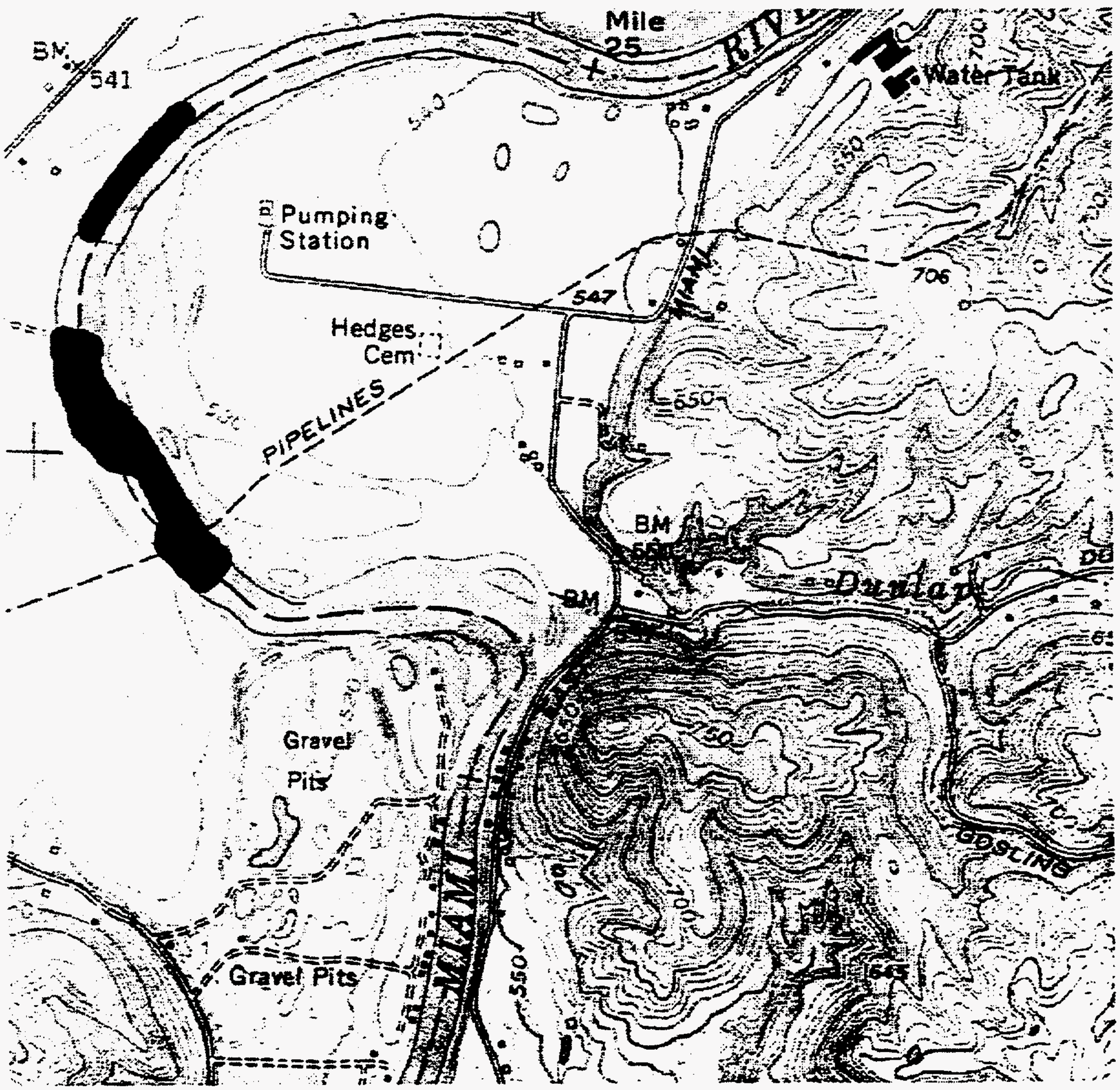


Figure 4. Map of river mile 19.

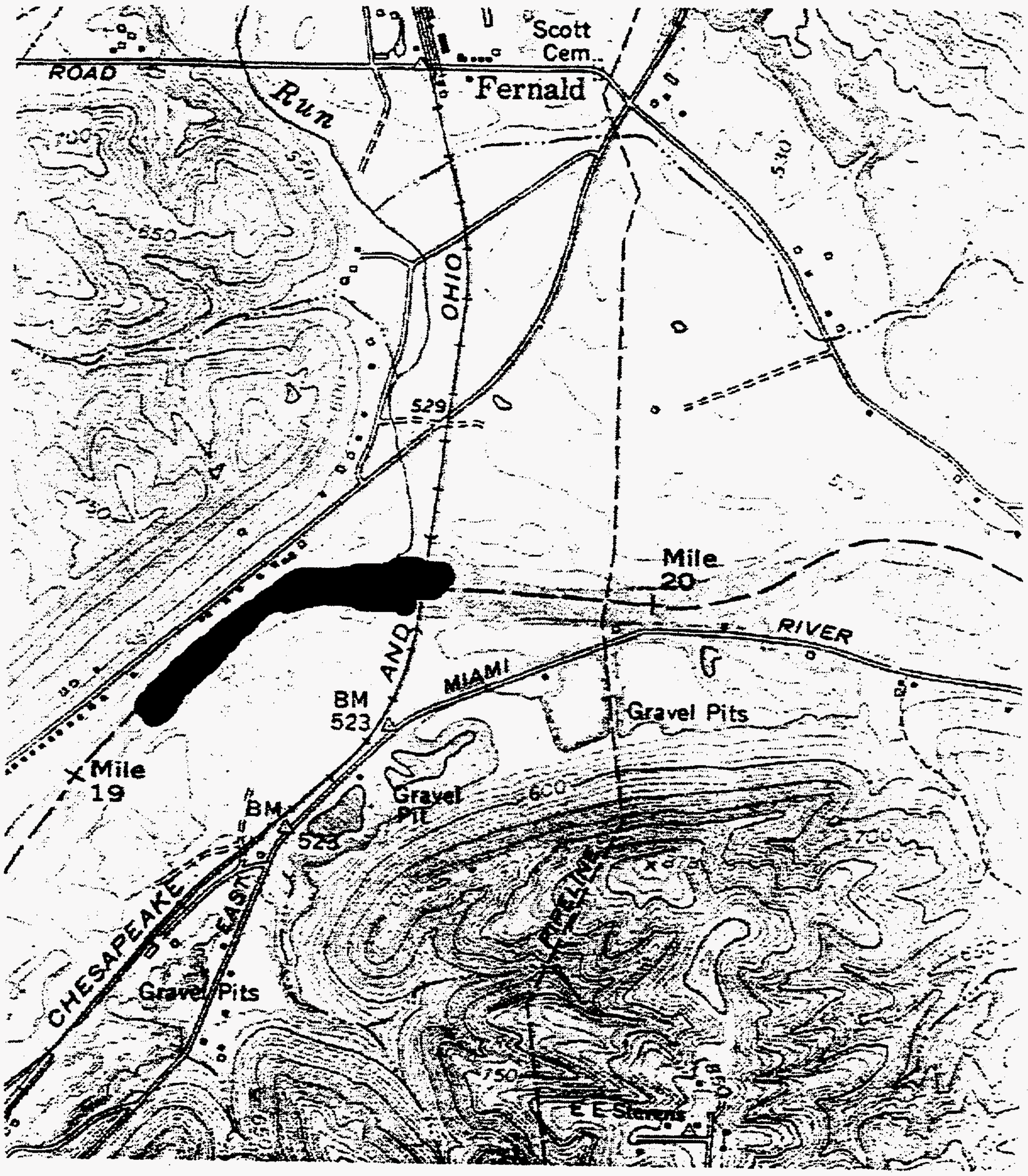


Figure 5. Index of Biotic Integrity, Index of Well Being, and Index of Habitat Quality in the Great Miami River from the Ohio River (RM 0) to Dayton (RM 50) from OEPA data, 1980, 1987, 1989.

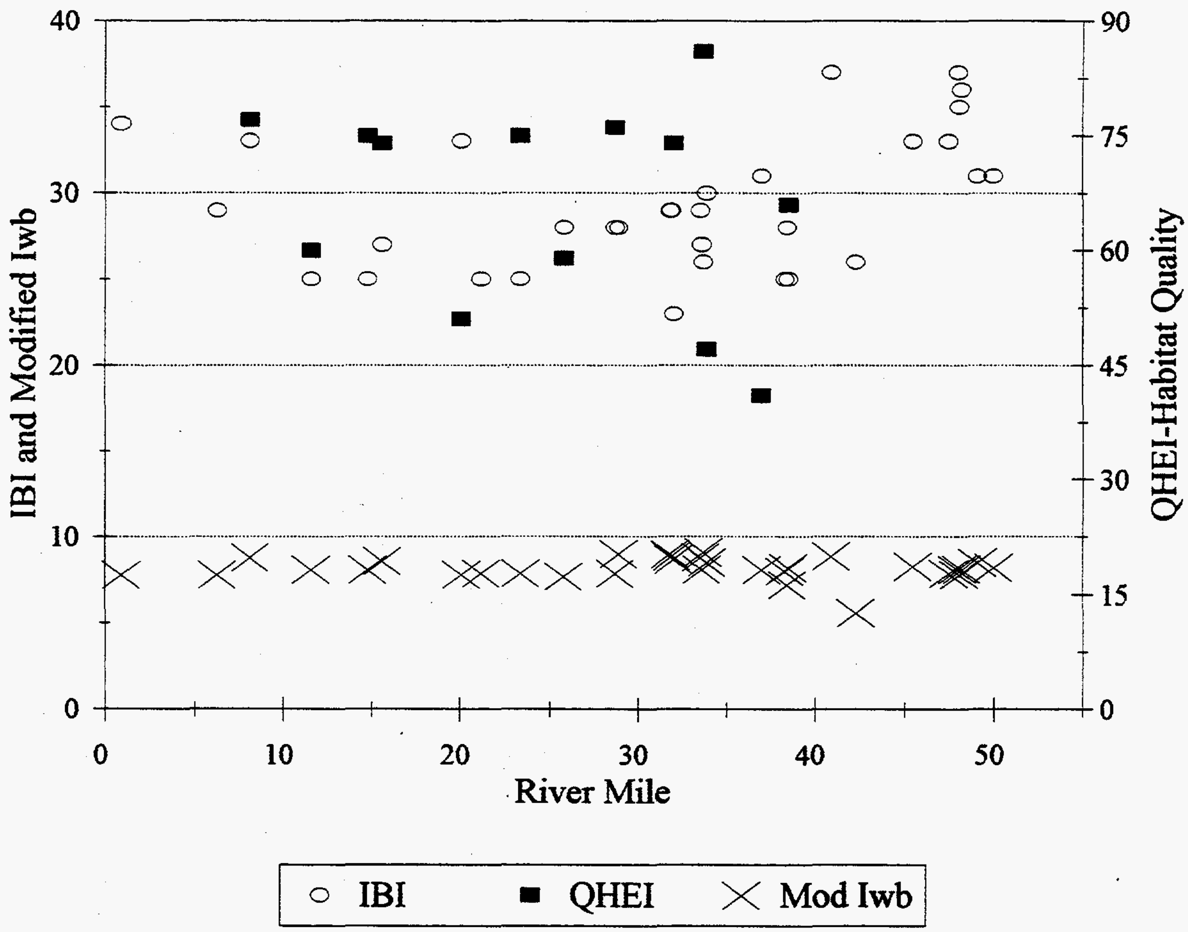


Figure 6. Phosphate, nitrate, and ammonia concentrations found at each site in the Great Miami River, 1994.

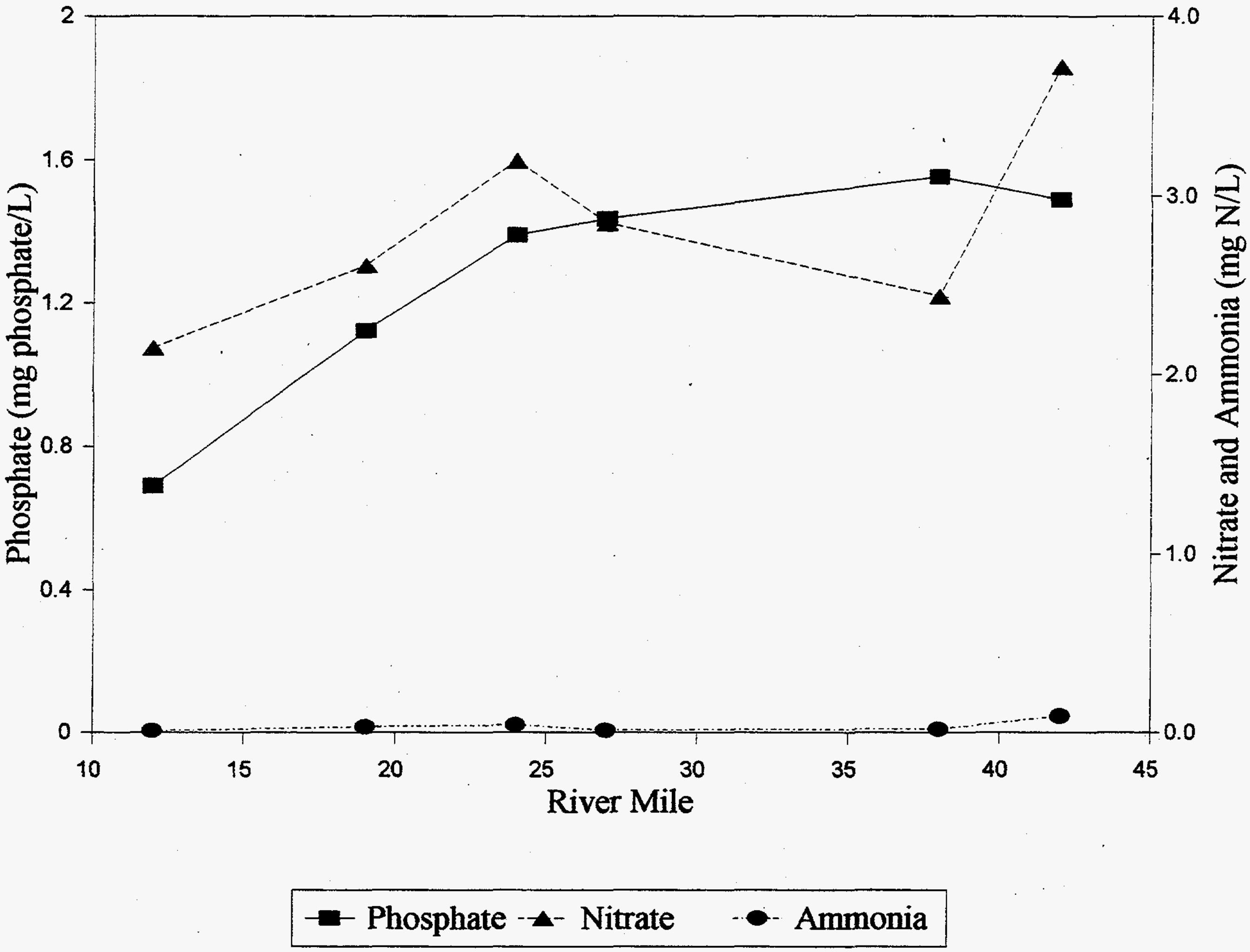


Figure 7. Sulfate concentrations and conductivity levels found at each site in the Great Miami River, 1994.

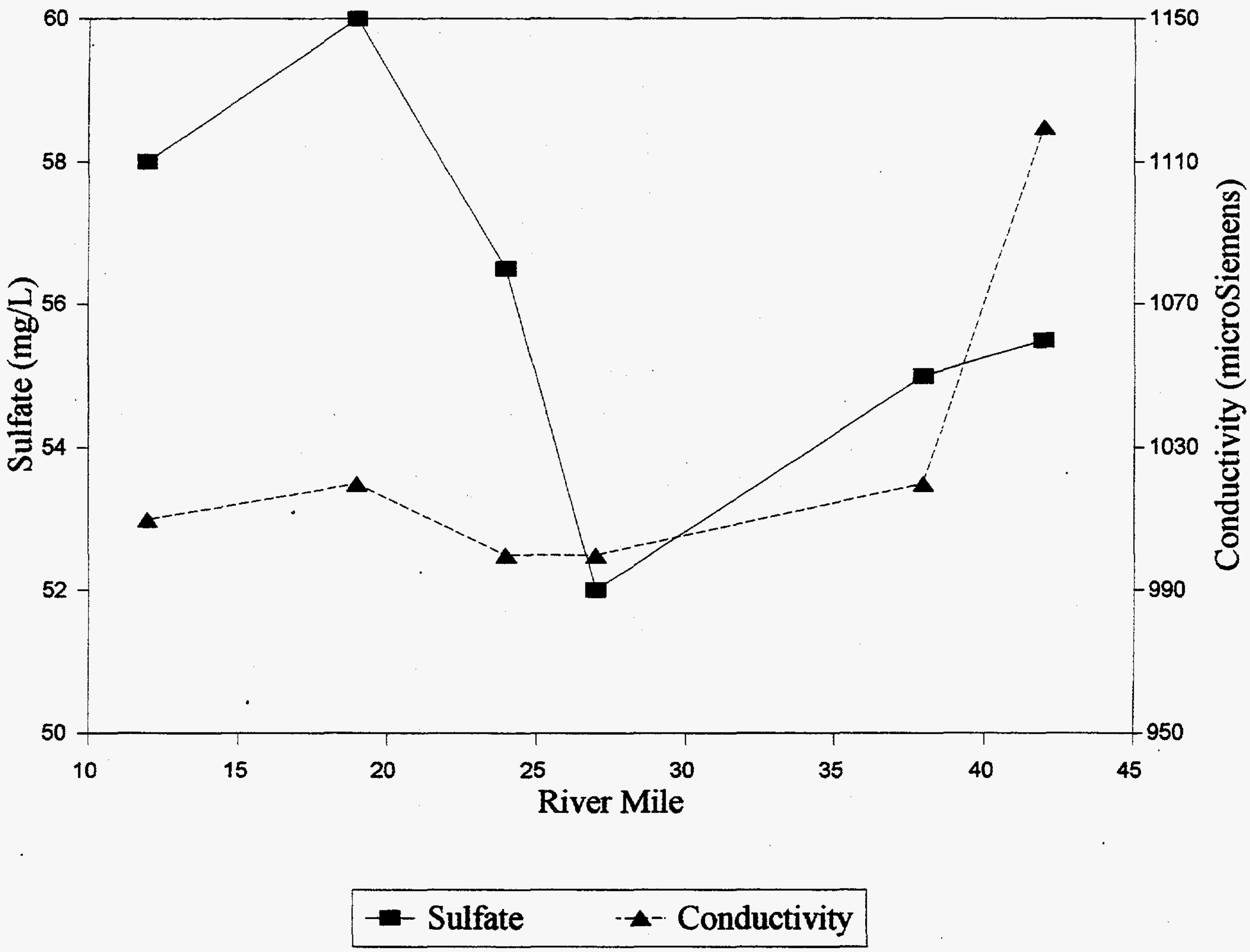


Figure 8. Levels of pH and oxygen concentrations found at each site in the Great Miami River, 1994.

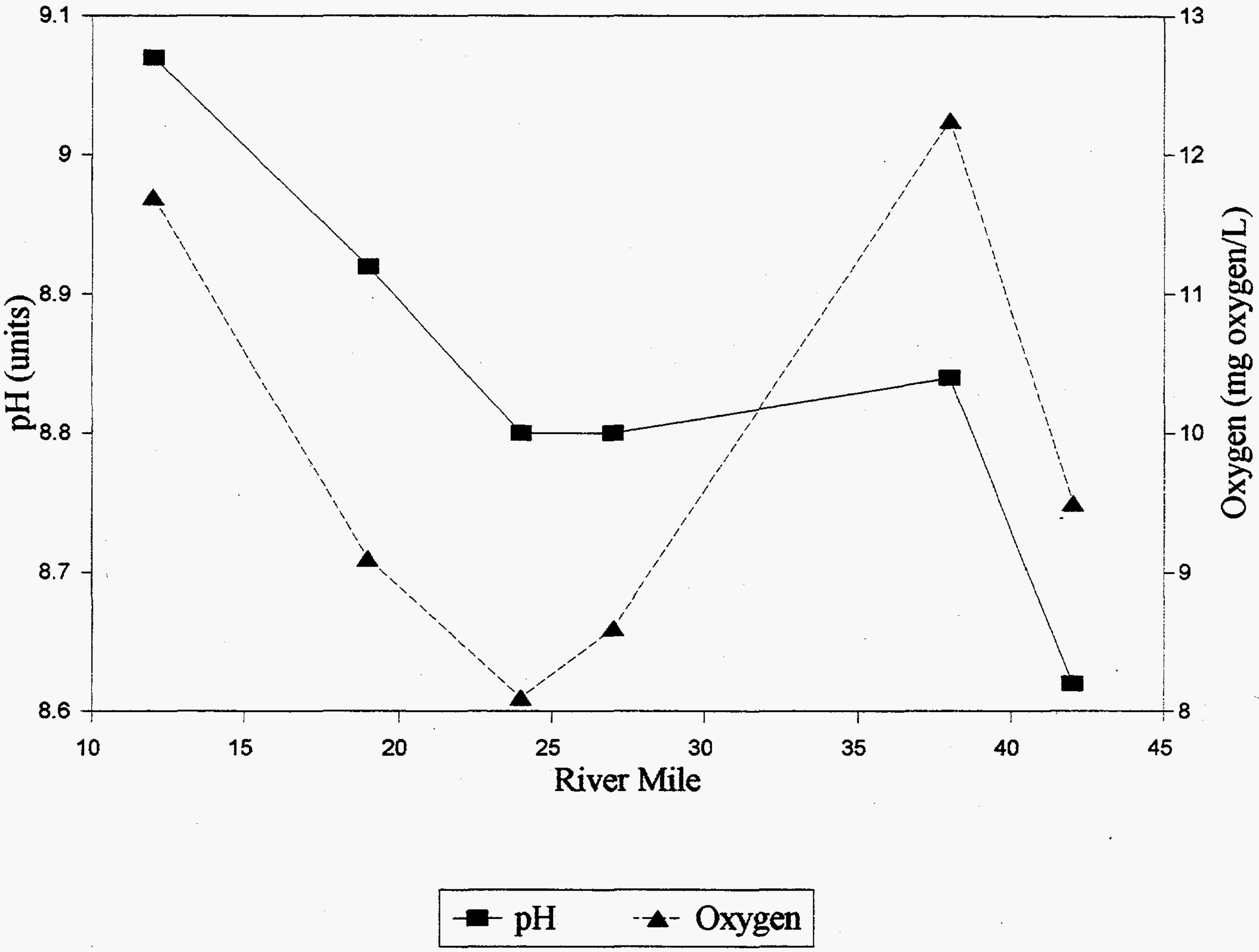


Figure 9. Inorganic nitrogen to phosphorus ratio, by weight, for each site in the Great Miami River, 1994.

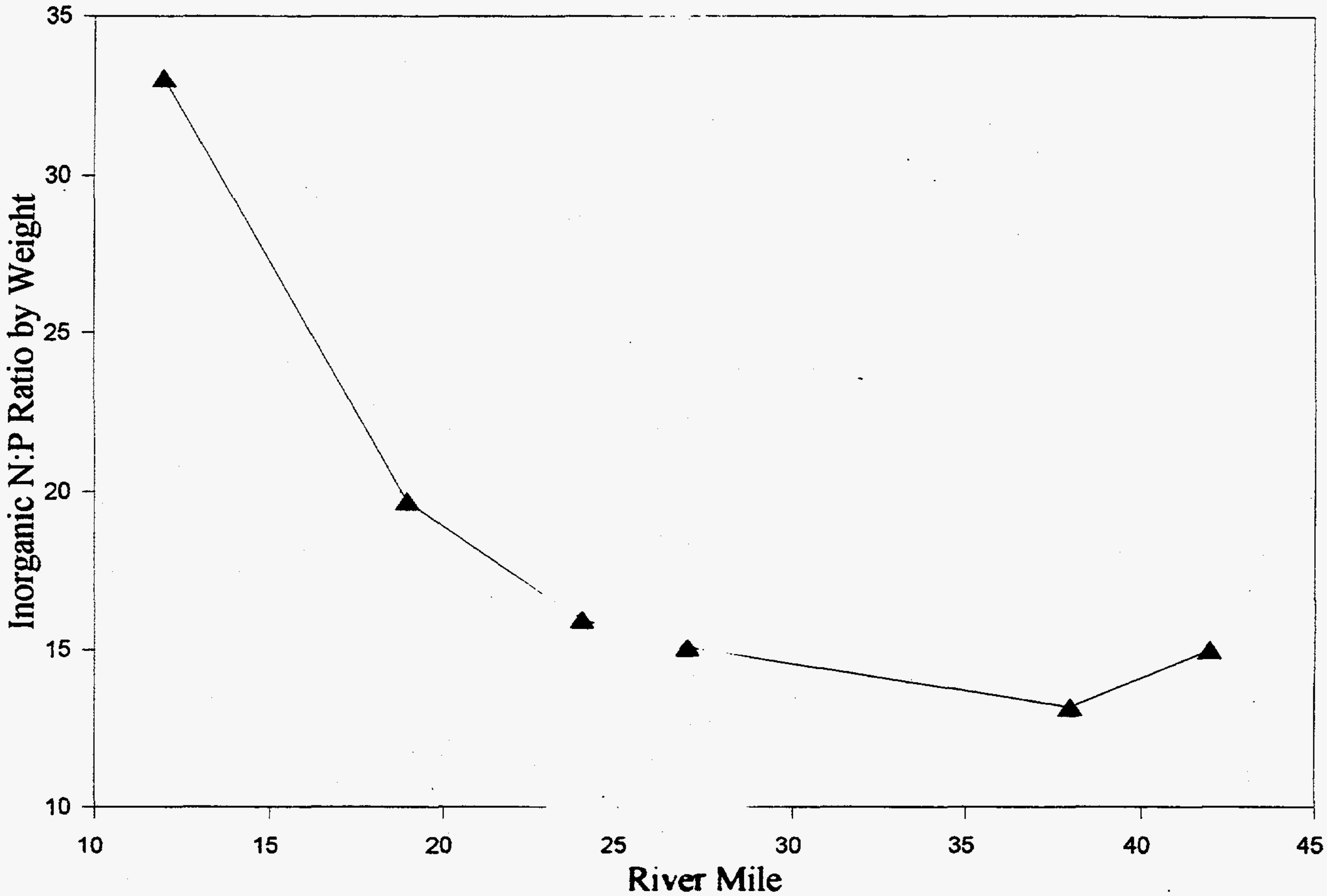


Figure 10. The number of species and the number of fish per site in the Great Miami River, 1994.

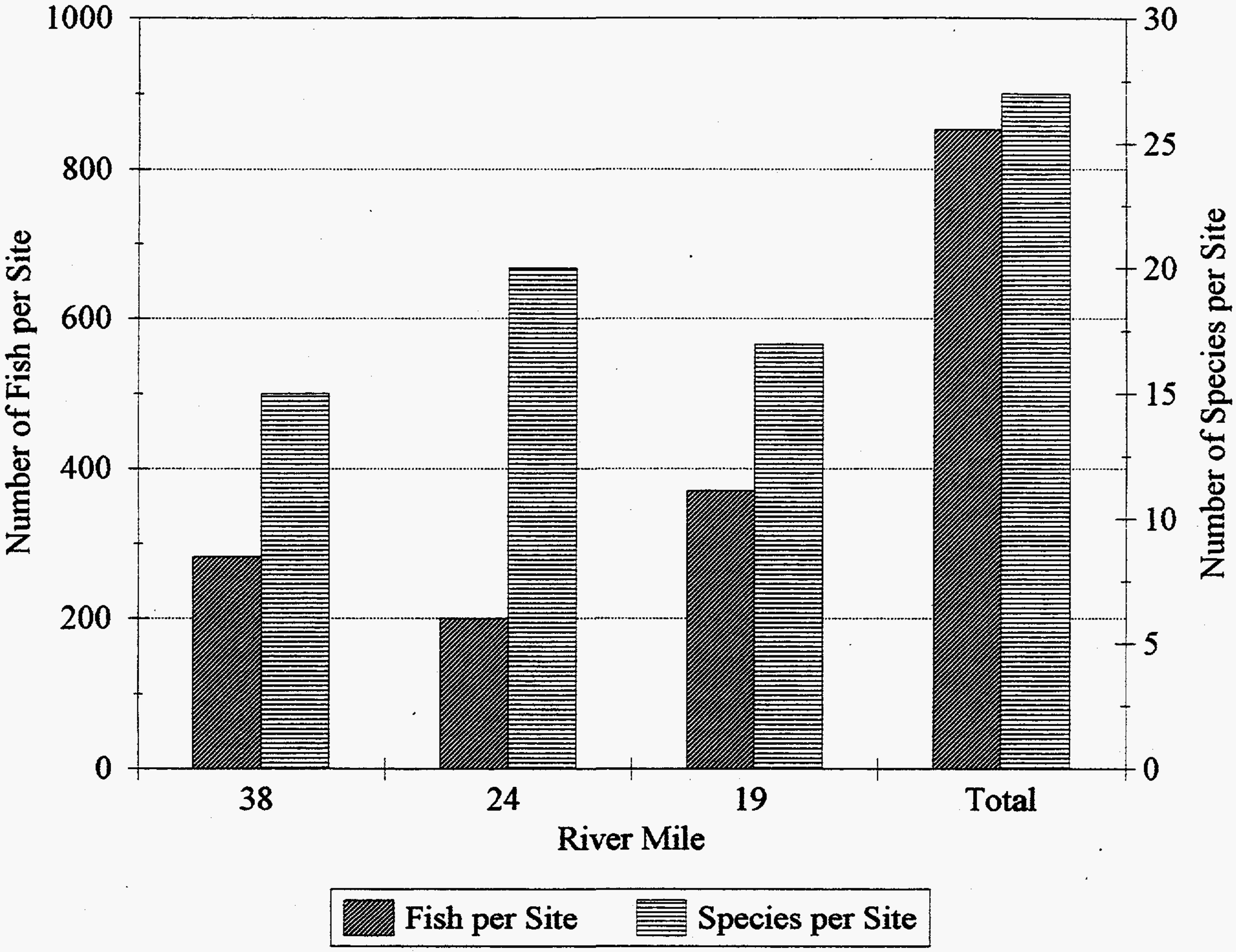
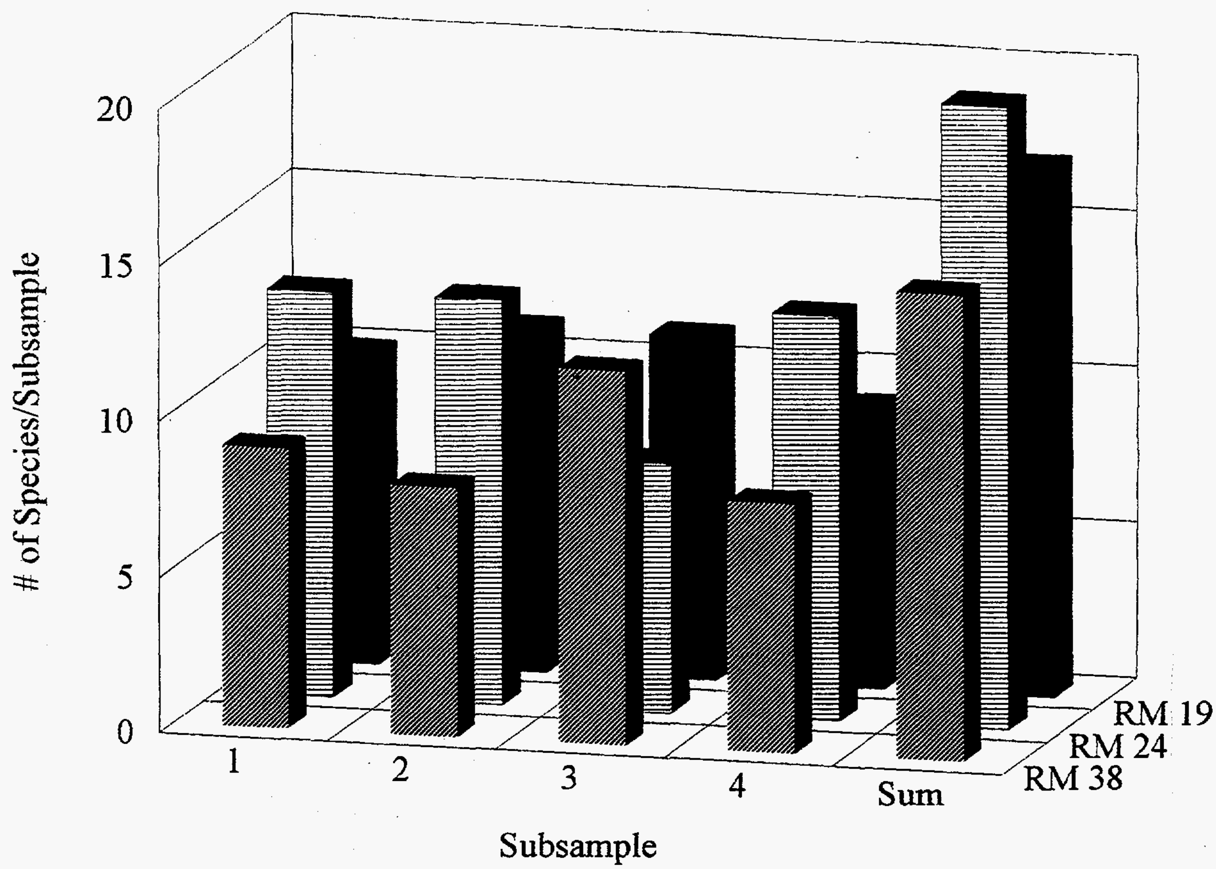


Figure 11. The number of fish species in four subsamples at three river sites in the Great Miami River, 1994.



Note: The duration of each subsample was approximately 10 minutes.

Figure 12. The number of fish caught per hour and the number of fish caught per kilometer in the Great Miami River, 1994.

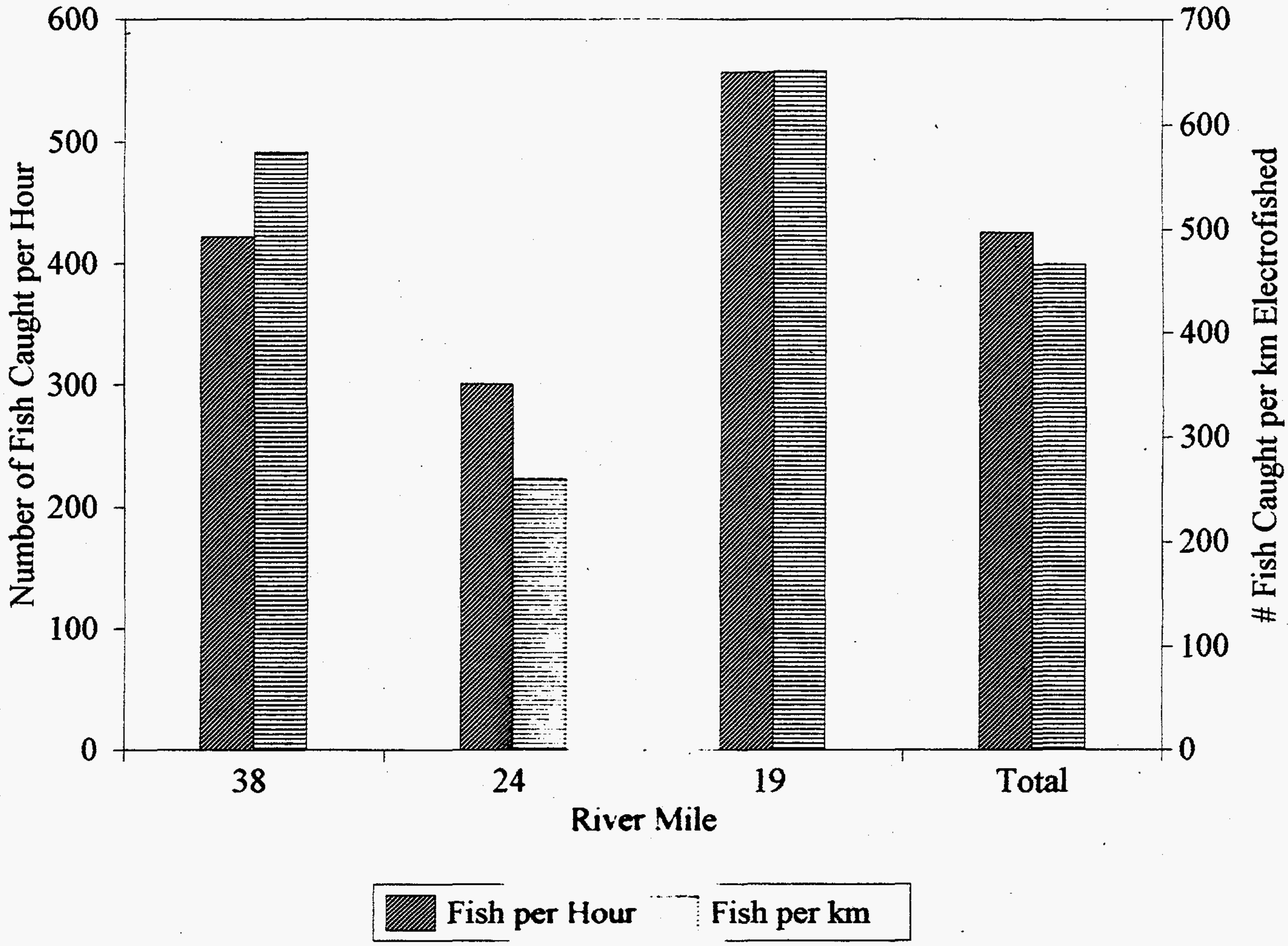


Figure 13. The total weight and the biomass per hour of fish captured at each site in the Great Miami River, 1994.

Figure 14. Shannon Diversity Index of fish captured in the Great Miami River, 1994.

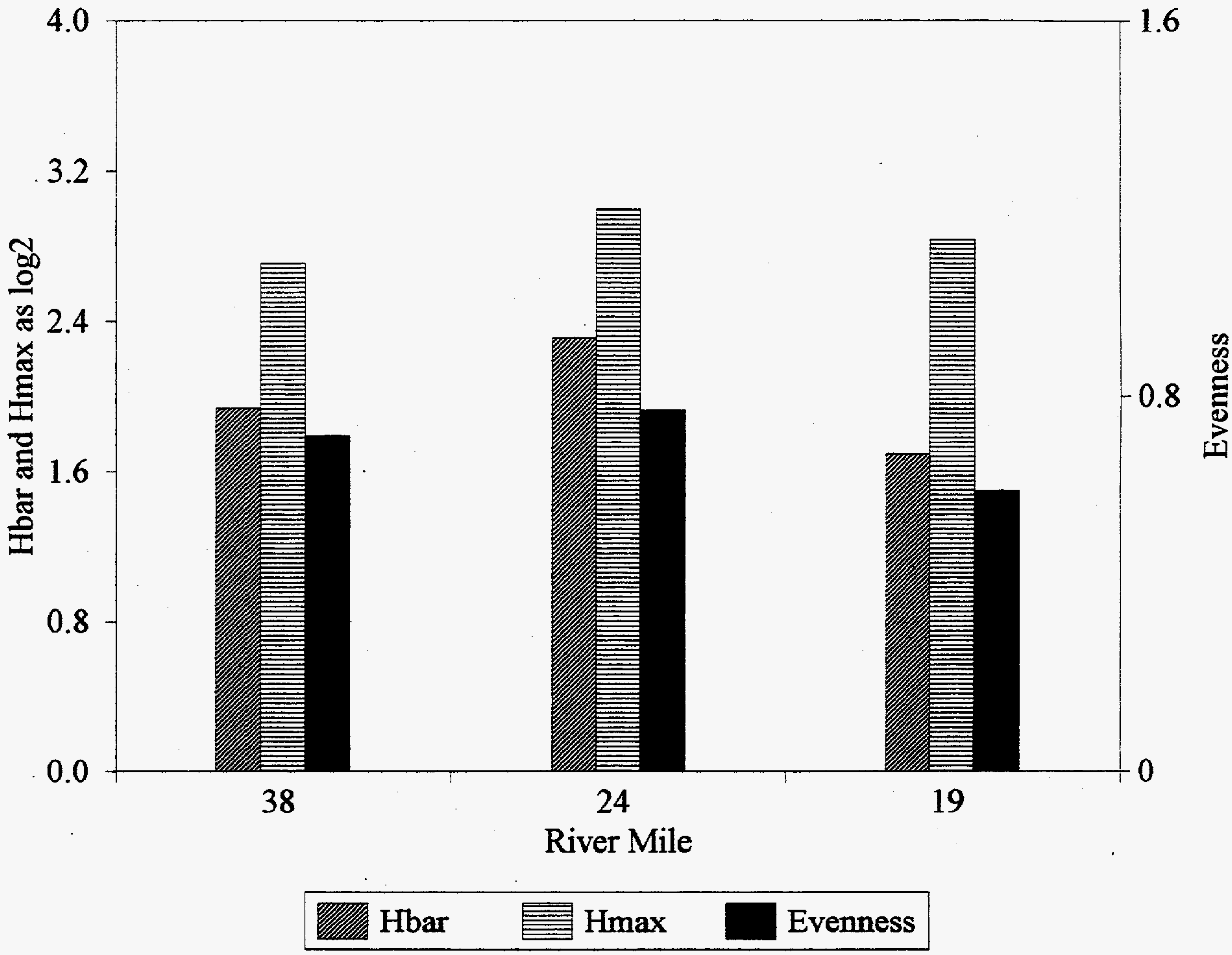


Figure 15. The cumulative proportion of fish by weight captured in the Great Miami River, 1994.

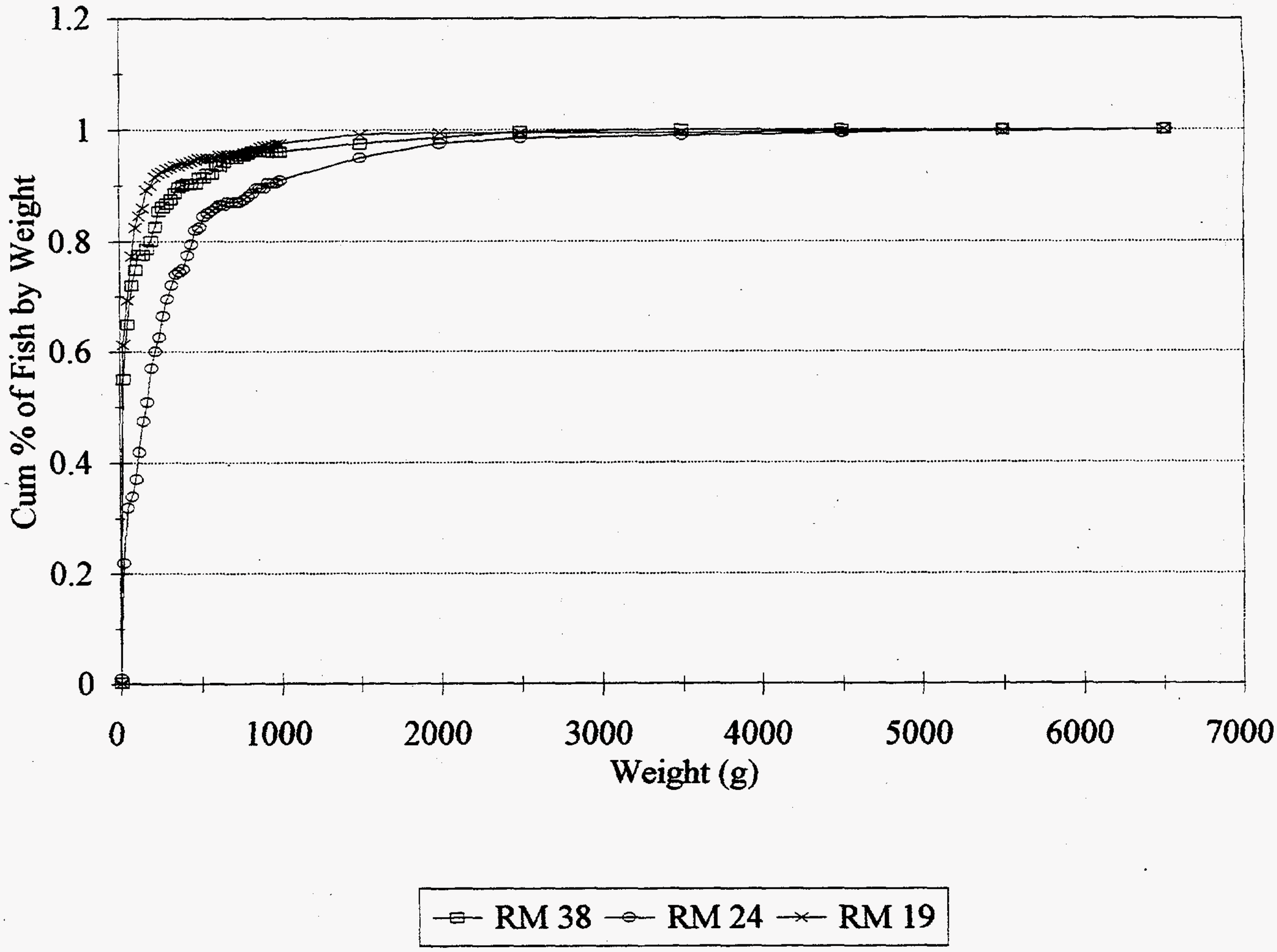


Figure 16. The cumulative proportion of fish by length captured in the Great Miami River, 1994.

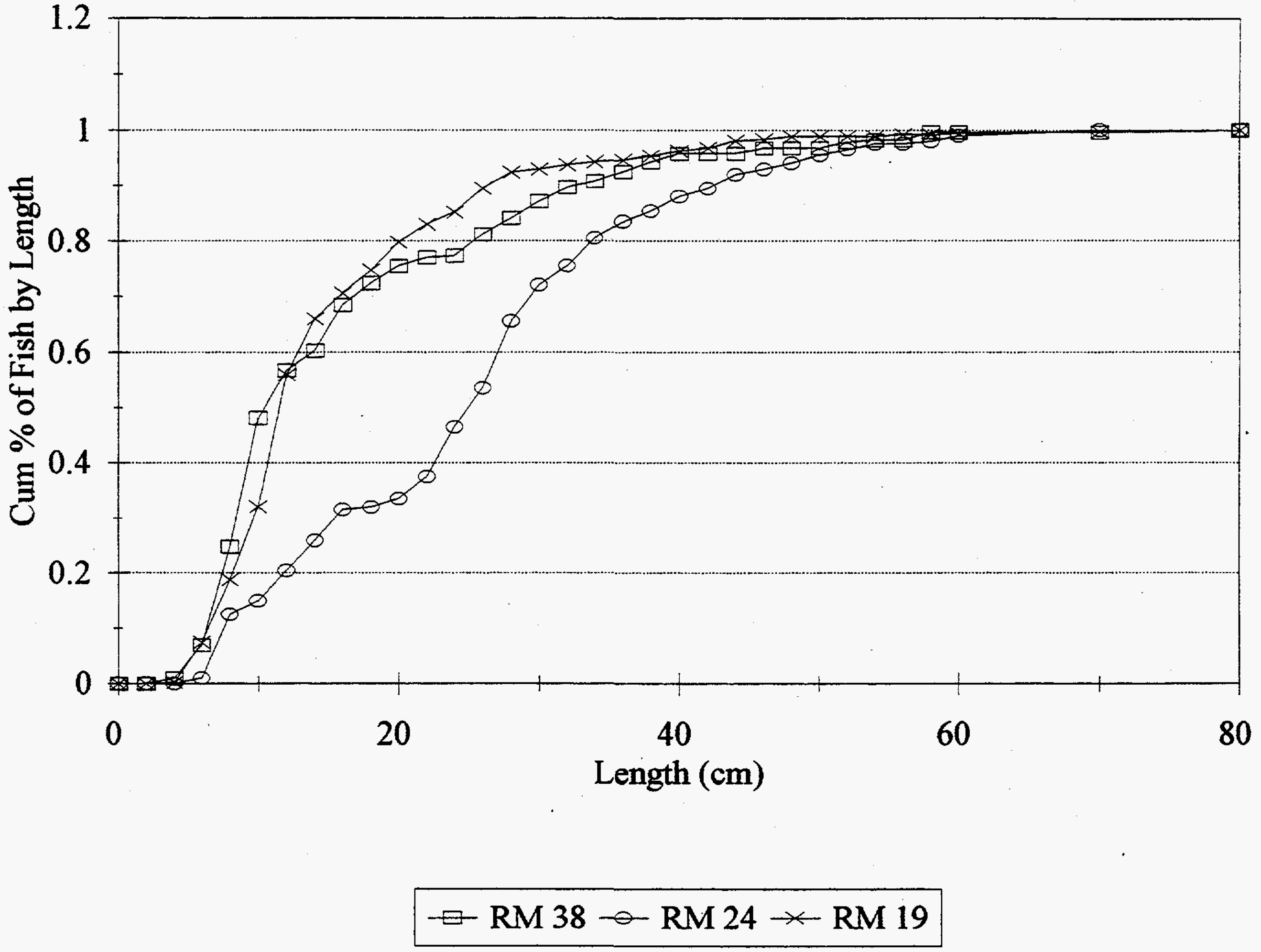


Figure 17. Length/weight relationship for gizzard shad in the Great Miami River, 1994.

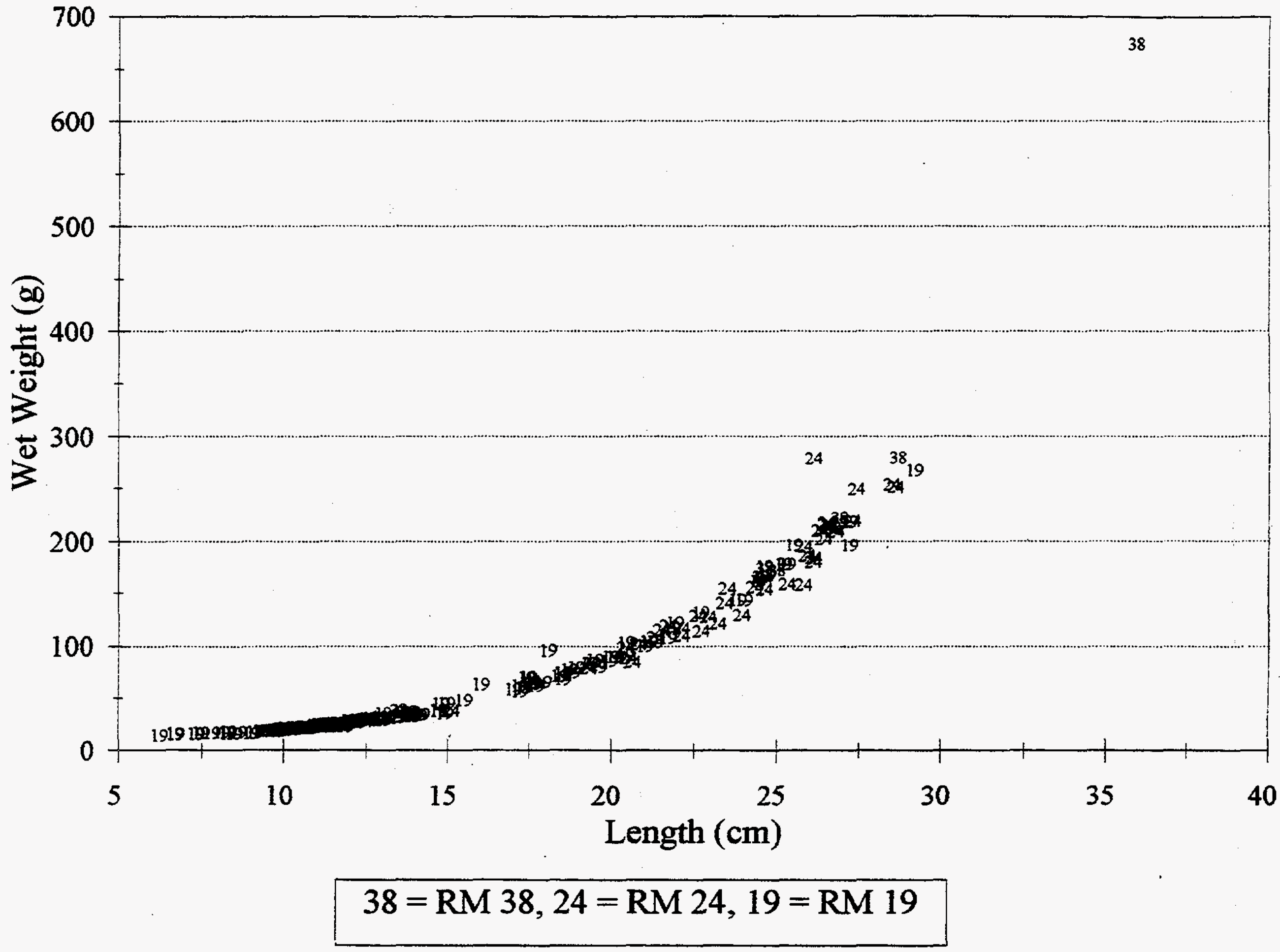
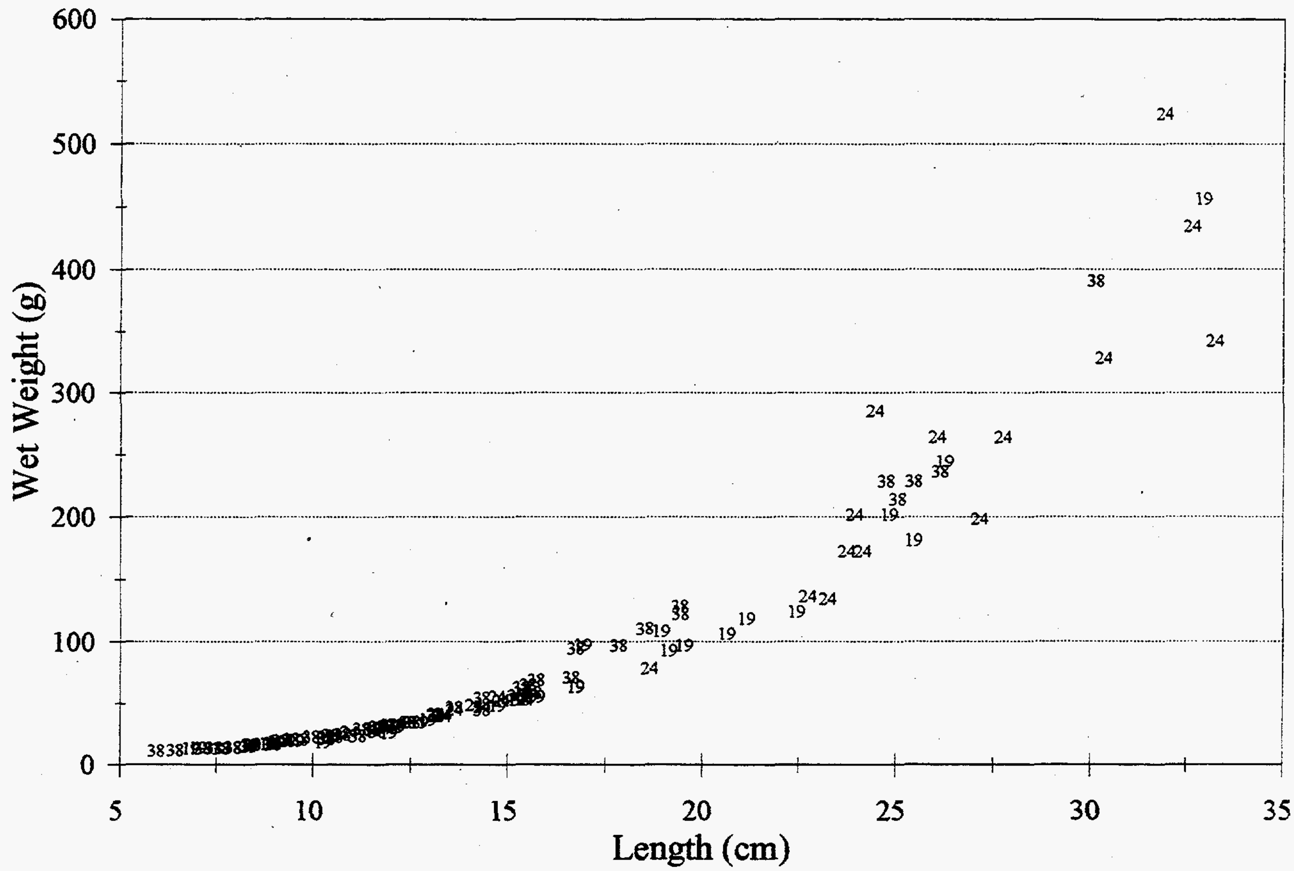
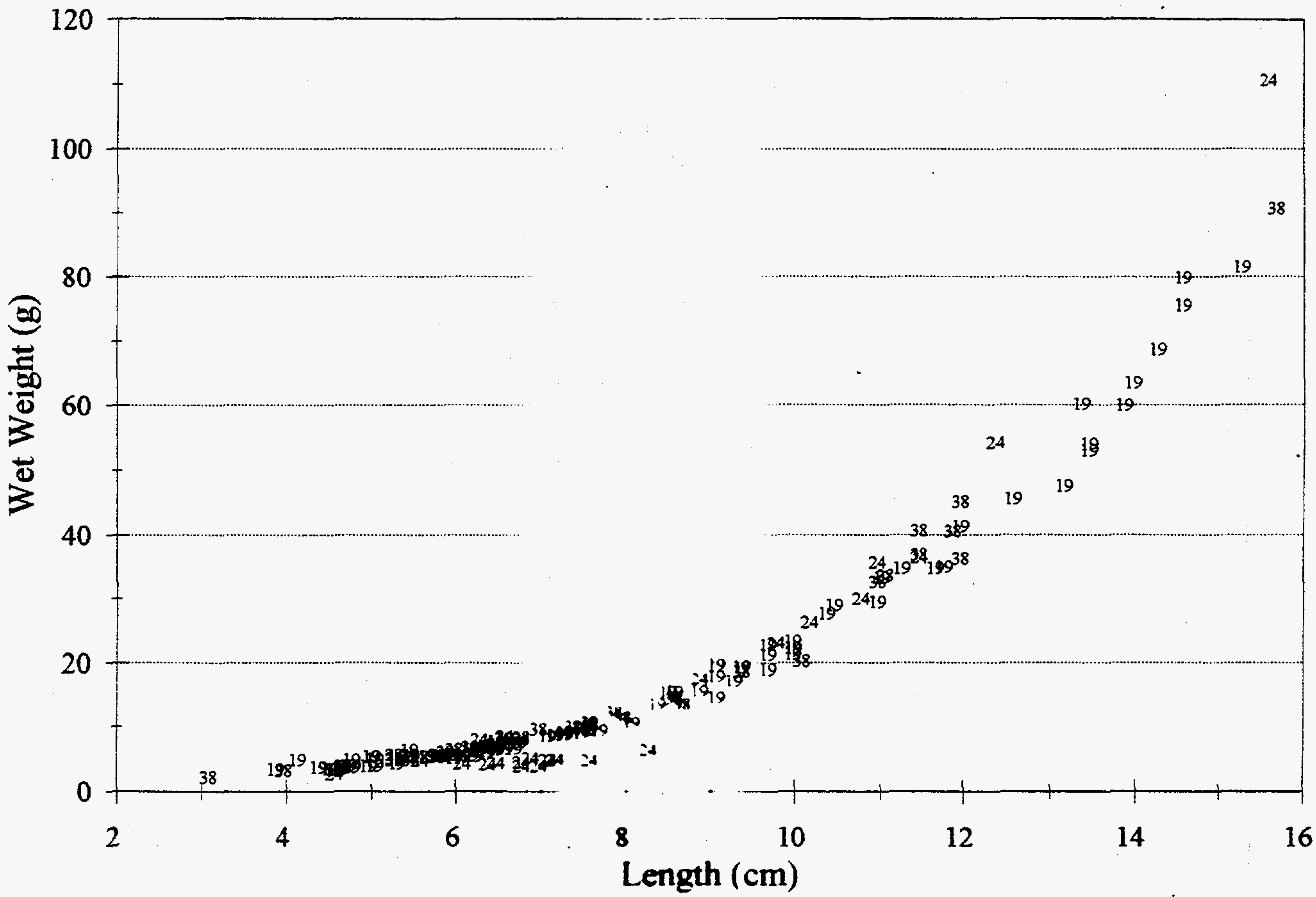


Figure 18. Length/weight relationship for striped and smallmouth bass in the Great Miami River, 1994.



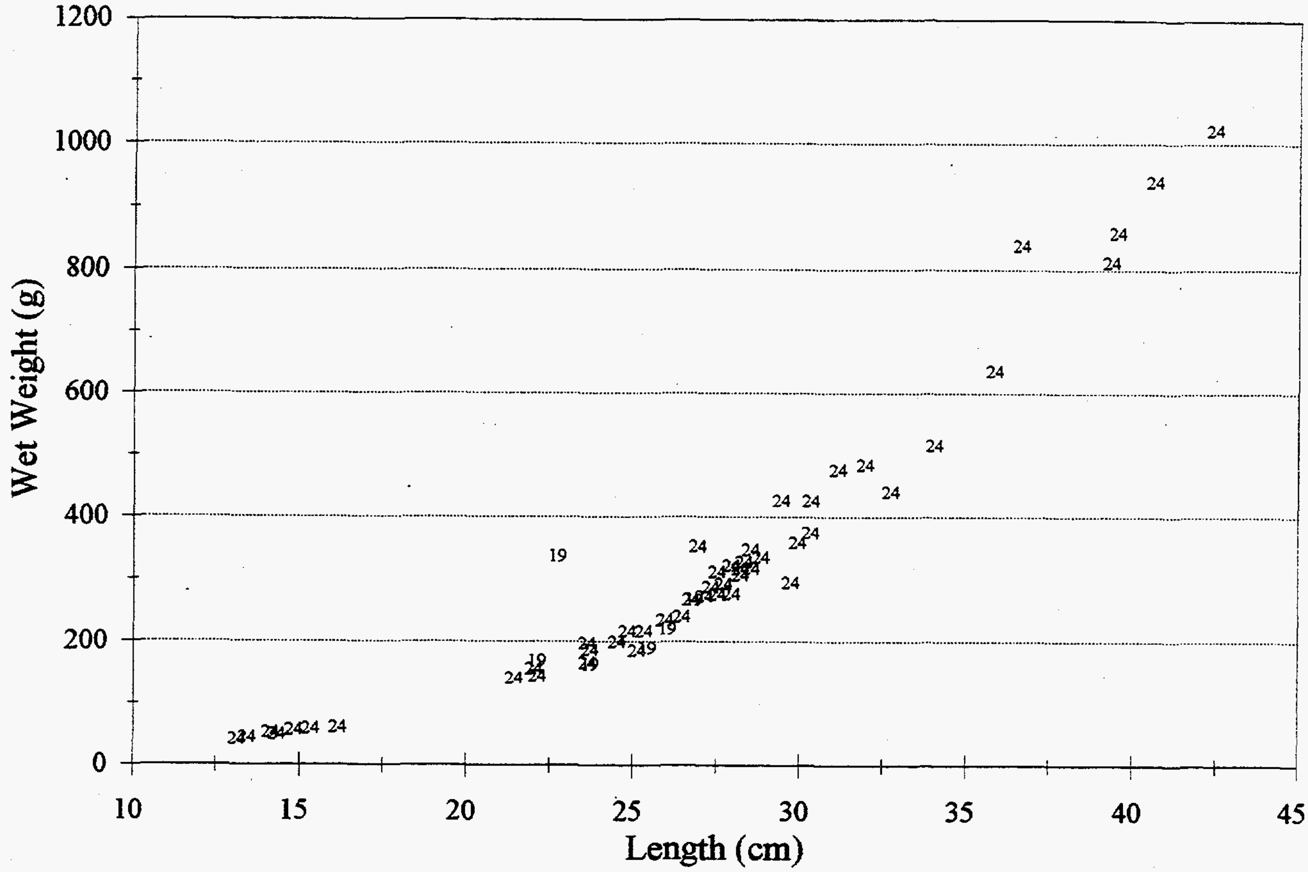
38 = RM 38, 24 = RM 24, 19 = RM 19

Figure 19. Length/weight relationship for sunfish in the Great Miami River, 1994.



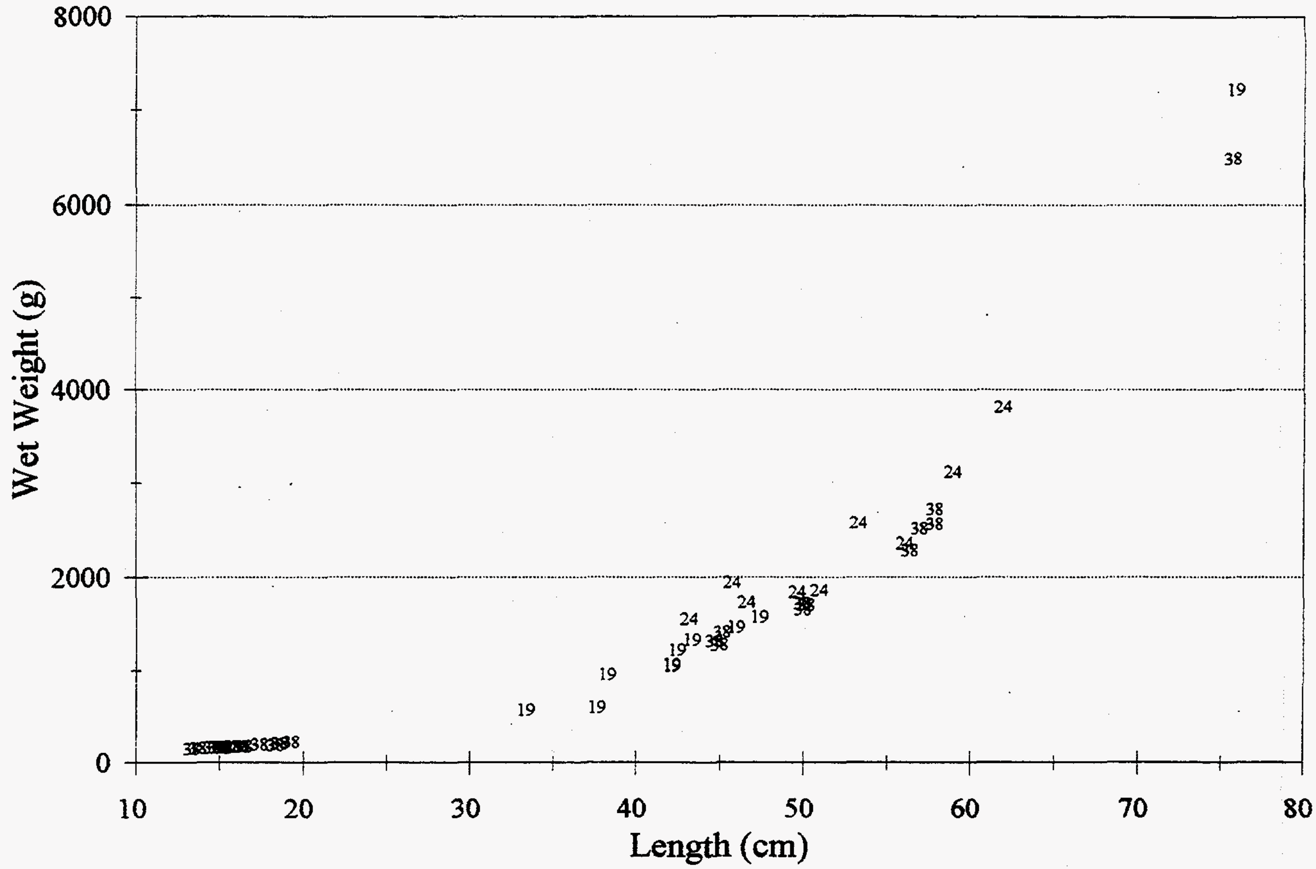
38 = RM 38, 24 = RM 24, 19 = RM 19

Figure 20. Length/weight relationship for freshwater drum in the Great Miami River, 1994.



38 = RM 38, 24 = RM 24, 19 = RM 19

Figure 21. Length/weight relationship for carp in the Great Miami River, 1994.



38 = RM 38, 24 = RM 24, 19 = RM 19

Figure 22. Length/weight relationship for Catostomidae in the Great Miami River, 1994.

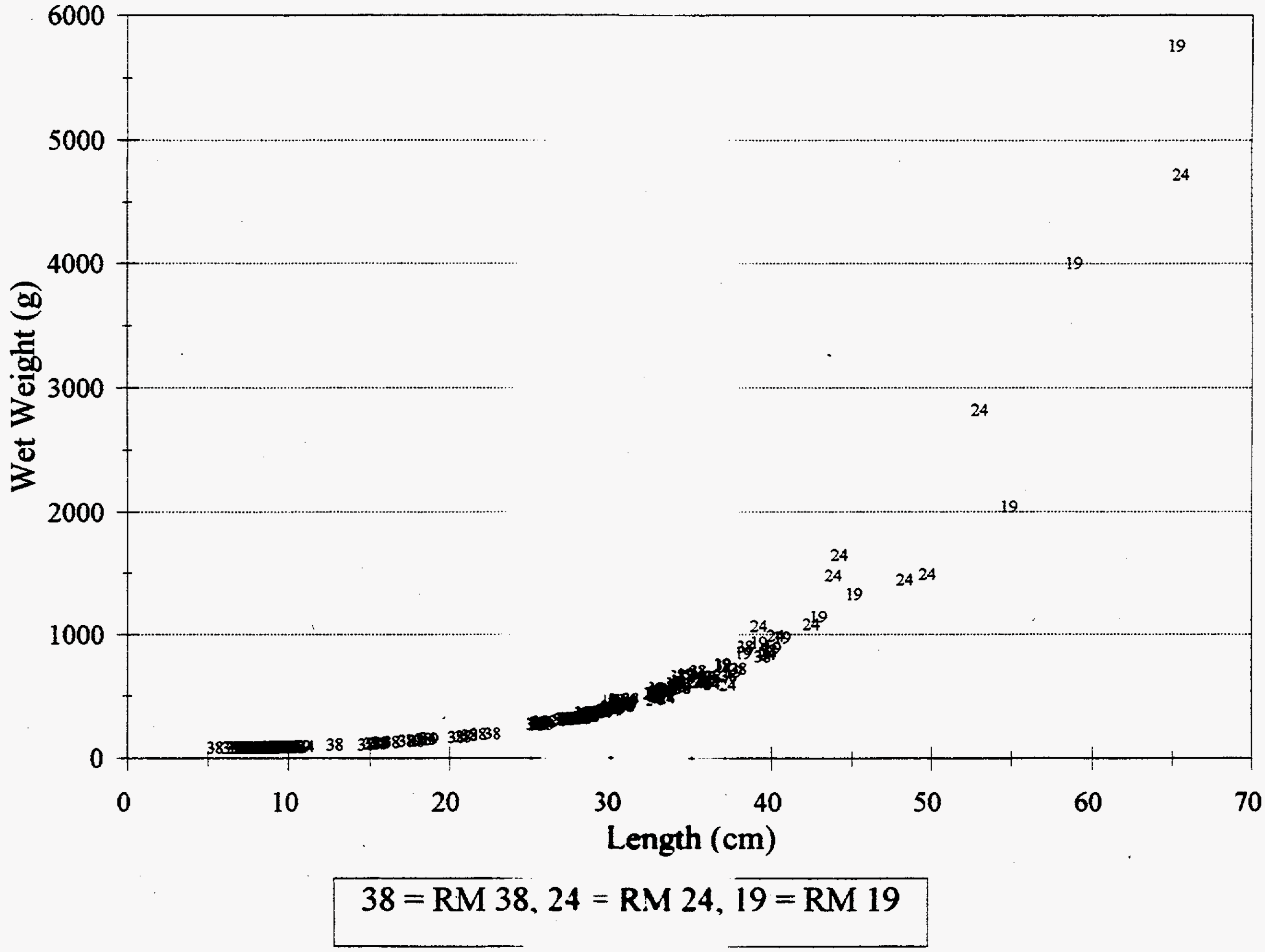


Figure 23. The cumulative number of fish species per number of fish at each river site in the Great Miami River, 1994.

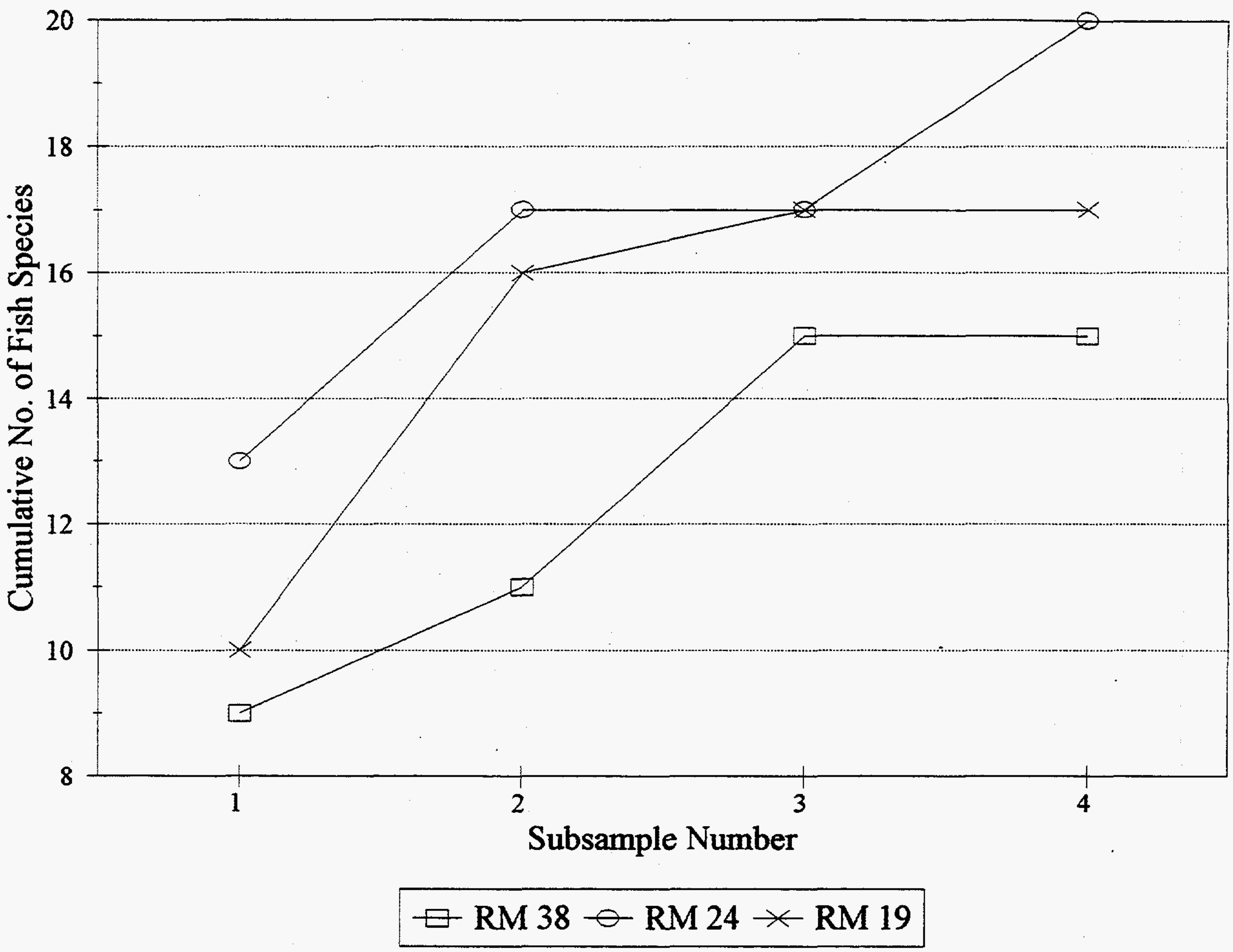
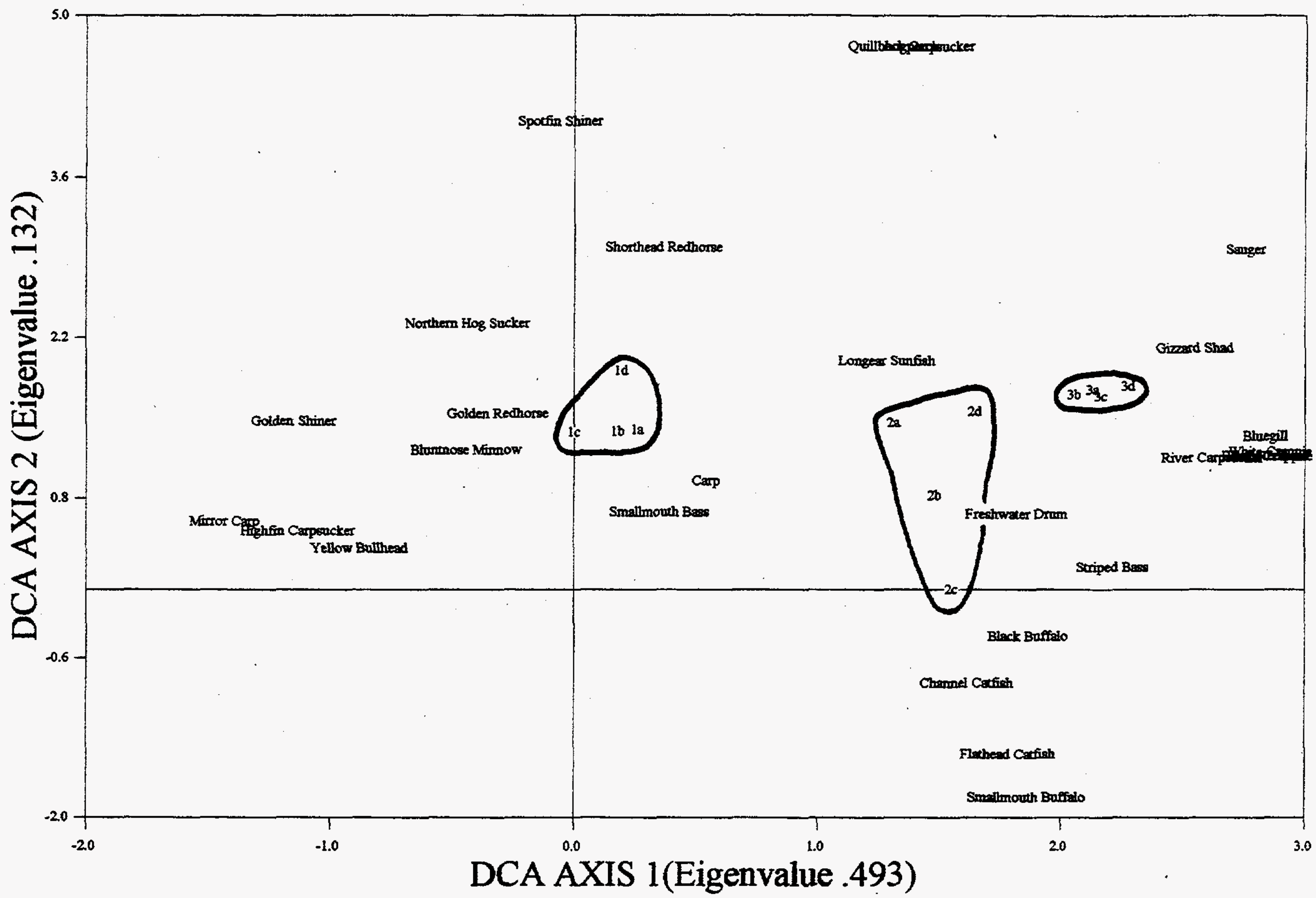


Figure 24. Detrended Correspondence Analysis of sites using fish species composition in the Great Miami River, 1994.



Note: The fish species have been iterated by the same ordination as the sites in order to show the relative relationship between species and sites.

Table 1. Biotic and drainage data from OEPA for the Great Miami River for reference sites for comparison of other sites in the drainage area (data 1980 to 1986).

GMR Tributaries	RM	Year	D	ECOREG	Drainage	Mean	Iwb	IBI
Backpack Shocker					miles^2	Spp. #		
Twin Creek	0.2	1986	A	ECBP	316.0	21.7	9.1	49
Fourmile Creek	0.3	1980	A	ECBP	315.0	18.7	8.8	49
Mad River	1.2	1984	A	ECBP	655.0	17.0	8.7	33
Indian Creek	4.1	1983	D	ECBP	77.0	26.3	8.9	43
Whitewater River	9.4	1985	D	ECBP	45.0	25.5	10.3	46
Stillwater River	51.2	1983	D	ECBP	106.0	30.7	8.9	45
Boat Shocker								
Loramie Creek	0.1	1982	A	ECBP	201.0	17.0	8.6	47
Green Creek	16.0	1982	A	ECBP	607.0	22.7	9.1	49
GMR Mainstem	88.1	1980	A	ECBP	1150.0	20.7	8.3	37
GMR Mainstem	91.0	1980	A	ECBP	1161.1	18.7	8.6	33

Data from OEPA Ecological Assessment Section, 1988 Biological Criteria for the Protection of Aquatic Life: Vol. II: Users Manual for Biological Field Assessments of Ohio Surface Waters. Columbus, OH.

Table 2. Physical and chemical parameters for all sites sampled in the Great Miami River, 1994

Parameters	Units	RM 42	RM 38	RM 27	RM 24	RM 19	RM 12
Date	September	25	25	25	25	25	25
pH	units	8.62	8.84	8.80	8.80	8.92	9.07
Temperature	degrees Centigrade	18.6	18.0	18.8	19.0	19.5	20.7
Conductivity	micro Siemens	1120	1020	1000	1000	1020	1010
Secchi Depth	meters	NA	0.31	NA	0.28	0.30	0.23
Dissolved Oxygen	parts per million	9.50	12.30	8.60	8.10	9.10	11.70
Phosphate	mg Phosphate/L	1.490	1.554	1.436	1.392	1.123	0.069
Nitrate	mg Nitrate/L	3.721	2.442	2.849	3.198	2.616	2.151
Ammonia	mg Ammonia/L	0.092	0.022	0.016	0.043	0.033	0.011
Sulfate	mg Sulfate/L	76.545	75.843	71.629	77.949	82.865	80.056
Total Chlorophyll	ug Chlorophyll/L	31.731	46.475	42.799	44.887	56.524	54.502

Note: Only RM 38, RM 24, and RM 19 were sampled for fish.

Table 3. Common name, family, and numbers of fish collected by site in the Great Miami River, 25 and 26 September 1994.

#	Common Name	Family	River Mile 38					River Mile 24					River Mile 19					Total
			Subsample					Subsample					Subsample					
			1	2	3	4	Sum	1	2	3	4	Sum	1	2	3	4	Sum	
1	Gizzard Shad	Clupeidae	7	0	1	2	10	11	3	0	27	41	54	29	53	57	193	244
2	Black Buffalo	Catostomidae	0	0	0	0	0	3	1	1	0	5	0	1	1	0	2	7
3	Black Redhorse	Catostomidae	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
4	Golden Redhorse	Catostomidae	21	49	29	10	109	6	3	0	8	17	0	7	1	2	10	136
5	Highfin Carpsucker	Catostomidae	4	0	3	0	7	0	0	0	0	0	0	0	0	0	0	7
6	Northern Hog Sucker	Catostomidae	0	0	4	0	4	2	0	0	0	2	0	0	0	0	0	6
7	Quillback Carpsucker	Catostomidae	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
8	River Carpsucker	Catostomidae	0	0	0	0	0	0	1	0	0	1	3	1	2	1	7	8
9	Shorthead Redhorse	Catostomidae	0	0	2	1	3	0	0	0	1	1	0	1	0	0	1	5
10	Smallmouth Buffalo	Catostomidae	0	0	0	0	0	0	1	1	0	2	1	0	0	0	1	3
11	Black Crappie	Centrarchidae	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
12	Bluegill	Centrarchidae	0	0	1	0	1	0	0	0	1	1	7	7	35	3	52	54
13	Longear Sunfish	Centrarchidae	7	22	3	3	35	18	3	0	3	24	17	0	21	7	45	104
14	Smallmouth Bass	Centrarchidae	3	18	26	4	51	7	2	2	3	14	5	0	10	3	18	83
15	White Crappie	Centrarchidae	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	2
16	Bluntnose Minnow	Cyprinidae	0	4	0	0	4	1	0	0	0	1	0	0	0	0	0	5
17	Carp	Cyprinidae	8	8	4	5	25	3	3	1	2	9	3	3	4	0	10	44
18	Golden Shiner	Cyprinidae	6	4	5	3	18	0	0	0	0	0	0	0	0	0	0	18
19	Mirror Carp	Cyprinidae	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	2
20	Spotfin Shiner	Cyprinidae	0	0	3	6	9	1	1	0	5	7	0	0	0	0	0	16
21	Channel Catfish	Ictaluridae	1	2	0	0	3	0	2	2	3	7	2	0	0	0	2	12
22	Flathead Catfish	Ictaluridae	0	0	0	0	0	0	1	1	1	3	0	0	0	0	0	3
23	Yellow Bullhead	Ictaluridae	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
24	Striped Bass	Percichthyidae	0	0	0	0	0	5	2	2	3	12	0	2	1	11	14	26
25	Logperch	Percidae	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1
26	Sauger	Percidae	0	0	0	0	0	0	0	0	2	2	0	0	3	3	6	8
27	Freshwater Drum	Sciaenidae	0	0	0	0	0	12	16	4	17	49	2	0	3	1	6	55
	Total Fish		58	108	82	34	282	71	39	14	76	200	95	54	134	88	371	853
	Species Total		9	8	12	8	15	13	13	8	13	20	10	11	11	9	17	27
	Shannon Diversity Index																	
	Diversity/Individual	Hbar					1.939					2.315					1.693	
	Hmax	Hmax					2.708					2.996					2.833	
	Evenness	E					0.716					0.773					0.598	

Table 4. Analysis of subsamples at each of the site locations in the Great Miami River, 1994.

	River Mile 38					River Mile 24					River Mile 19					Total
	Subsample					Subsample					Subsample					
	1	2	3	4	Sum	1	2	3	4	Sum	1	2	3	4	Sum	
Individuals	58	108	82	34	282	71	39	14	76	200	95	54	134	88	371	853
Species	9	8	12	8	15	13	13	8	13	20	10	11	11	9	17	27
Time shocked (sec.)	600	601	604	599	2404	601	600	600	600	2401	600	600	600	600	2400	7205
Fish shocked/hour	348	647	489	204	422	425	234	84	456	300	570	324	804	528	557	426
Individuals/species	6	14	7	4	19	5	3	2	6	10	10	5	12	10	22	32
Distance shocked (km)	0.11	0.12	0.16	0.11	0.49	0.16	0.18	0.20	0.23	0.77	0.12	0.10	0.20	0.15	0.57	1.83
Fish/km	527	900	522	324	573	444	217	70	330	260	792	540	670	587	651	466

Table 5. The number of fish captured per hour and the number of species captured by river mile and by year from the Great Miami River, 1984 to 1994.

	Number of Fish per Hour				Number of Species per Site			
Yr/Site	RM 38	RM 28	RM 24	RM 19	RM 38	RM 28	RM 24	RM 19
1984						15	12	15
1985		104	84	314		11	19	16
1986		98	79	266		12	15	16
1987		73	75	102		10	11	10
1988		146	3	154		15	12	15
1989		120	69	136		13	12	16
1990		65	60	119		8	10	7
1991	67	225	174	100	18	14	15	15
1992	175	133	106	305	13	13	8	7
1993	73		35	90	13		11	19
1994	422		300	426	15		20	17
Mean	184.2	120.5	98.5	201.2	14.8	12.0	13.3	13.8
Coef.Var.	90.2%	41.9%	85.0%	58.3%	16.0%	19.5%	27.9%	29.2%

Table 6. Mean weight and length of fish electroshocked by year and by river mile in the Great Miami River, 1984 to 1994.

	Weight of Fish (g)				Length of Fish (cm)			
Yr/Site	RM 38	RM 28	RM 24	RM 19	RM 38	RM 28	RM 24	RM 19
1984								
1985		623	376	115		23.8	26.3	18.5
1986		471	271	160		30.5	23.3	23.8
1987		180	260	130		26.0	28.0	23.0
1988		175	135	62		25.0	23.5	14.5
1989		195	186	110		21.8	21.0	17.4
1990		289	316	187		30.3	29.4	23.5
1991	140	166	157	56	16.9	21.8	17.6	14.8
1992	39	345	150	53	10.3	25.7	21.9	16.6
1993	244		494	118	18.6		31.2	16.6
1994	176		386	137	16.0		24.8	14.9
Mean	149.9	305.5	273.1	112.8	15.4	25.6	24.7	18.4
Coef. Var.	57.2%	54.6%	43.9%	39.7%	23.2%	13.1%	16.7%	20.2%

Table 7. Species diversity and evenness using the Shannon Information Index (Hbar (log base 2)) by year and by river mile in the Great Miami River, 1984 to 1994.

	H bar/Individual				Evenness			
Yr/Site	RM 38	RM 28	RM 24	RM 19	RM 38	RM 28	RM 24	RM 19
1984		2.24	1.70	2.06		0.58	0.48	0.53
1985		2.93	3.82	1.28		0.85	0.90	0.32
1986		2.62	3.40	2.20		0.73	0.87	0.55
1987		1.68	2.33	2.78		0.51	0.89	0.40
1988		2.23	2.33	2.78		0.57	0.75	0.71
1989		2.18	2.43	1.96		0.59	0.68	0.49
1990		2.33	2.03	1.04		0.78	0.61	0.37
1991	3.11	2.10	2.82	1.75	0.45	0.47	0.58	0.32
1992	2.55	2.49	1.68	0.49	0.69	0.67	0.56	0.18
1993	1.80		2.07	2.10	0.70		0.86	0.71
1994	1.94		2.32	4.69	0.72		0.77	0.60
Mean	2.35	2.31	2.45	2.10	0.64	0.64	0.72	0.47
Coef.Var.	25.7%	15.2%	27.2%	52.5%	19.8%	19.9%	20.7%	36.2%

Table 8. Community coefficients of species similarity between sites in the Great Miami River, 1994.

RM	38	24	19
38	1	0.63	0.50
24	0.63	1	0.76
19	0.50	0.76	1

Table 9. Weight frequency distribution of fish electroshocked in the Great Miami River, 25 and 26 September 1994.

Weight Frequency Distribution				
Grams	Total	RM 38	RM 24	RM 19
0	4	1	2	1
25	422	154	42	226
50	78	28	20	30
75	54	20	4	30
100	33	8	6	19
125	26	8	10	8
150	16	0	11	5
175	22	3	7	12
200	19	4	12	3
225	19	7	6	6
250	15	8	5	2
275	11	2	8	1
300	10	2	6	2
325	8	2	5	1
350	8	3	4	1
375	4	3	1	0
400	4	1	1	2
425	6	1	5	0
450	5	0	4	1
475	6	0	5	1
500	5	3	1	1
525	4	0	4	0
550	3	2	1	0
575	1	0	1	0
600	5	4	1	0
625	3	0	1	2
650	2	2	0	0
675	3	2	1	0
700	1	0	0	1
725	0	0	0	0
750	1	1	0	0
775	2	0	1	1
800	2	1	1	0
825	3	1	1	1
850	3	0	2	1
875	1	0	0	1
900	1	0	0	1
925	2	0	2	0
950	1	0	0	1
975	1	0	0	1
1000	1	0	1	0
1500	18	4	8	6
2000	9	3	5	1
2500	5	3	2	0
3500	2	1	1	0
4500	2	0	1	1
5500	1	0	1	0
6500	1	0	0	1
SUM	853	282	200	371

Table 10. Length frequency distribution of fish electroshocked in the Great Miami River, 25 and 26 September 1994.

Length Frequency Distribution				
cm	Total	RM 38	RM 24	RM 19
0	0	0	0	0
2	0	0	0	0
4	4	3	0	1
6	46	17	2	27
8	115	50	23	42
10	120	66	5	49
12	124	24	11	89
14	58	10	11	37
16	51	23	11	17
18	27	11	1	15
20	31	9	3	19
22	24	4	8	12
24	27	1	18	8
26	41	11	14	16
28	43	8	24	11
30	24	9	13	2
32	17	7	7	3
34	15	3	10	2
36	12	5	6	1
38	12	5	4	3
40	12	4	5	3
42	5	0	3	2
44	10	0	5	5
46	6	3	2	1
48	4	0	2	2
50	3	0	3	0
52	5	3	2	0
54	3	1	2	0
56	1	0	0	1
58	5	4	1	0
60	3	0	2	1
70	3	0	2	1
80	2	1	0	1
SUM	853	282	200	371

Appendix A. Listing of common names, species, and families in the Great Miami River, 1994.

#	Common Name	Species	Family
1	Gizzard Shad	*Dorosoma cepedianum*	Clupeidae
2	Bluntnose Minnow	*Pimephales notatus*	Cyprinidae
3	Carp	*Cyprinus carpio sp.*	Cyprinidae
4	Golden Shiner	*Notemigonus crysoleucas*	Cyprinidae
5	Mirror Carp	*Cyprinus carpio*	Cyprinidae
6	Spotfin Shiner	*Cyprinella spilopterus*	Cyprinidae
7	Black Buffalo	*Ictiobus niger*	Catostomidae
8	Black Redhorse	*Moxostoma duquesnei*	Catostomidae
9	Golden Redhorse	*Moxostoma erythrurum*	Catostomidae
10	Highfin Carpsucker	*Carpiodes velifer*	Catostomidae
11	Northern Hog Sucker	*Hypentelium nigricans*	Catostomidae
12	Quillback	*Carpiodes cyprinus*	Catostomidae
13	River Carpsucker	*Carpiodes carpio*	Catostomidae
14	Shorthead Redhorse	*Moxostoma macrolepidotum*	Catostomidae
15	Smallmouth Buffalo	*Ictibus bubalus*	Catostomidae
16	Channel Catfish	*Ictalurus punctatus*	Ictaluridae
17	Flathead Catfish	*Ictalurus olivaris*	Ictaluridae
18	Yellow Bullhead	*Ictalurus natalis*	Ictaluridae
19	Striped Bass	*Morone saxatilis*	Percichthyidae
20	Black Crappie	*Pomoxis nigromaculatus*	Centrarchidae
21	Bluegill	*Lepomis macrochirus*	Centrarchidae
22	Longear Sunfish	*Lepomis megalotis*	Centrarchidae
23	Smallmouth Bass	*Micropterus dolomieui*	Centrarchidae
24	White Crappie	*Pomoxis annularis*	Centrarchidae
25	Logperch	*Percina caprodes*	Percidae
26	Sauger	*Stizostedion canadense*	Percidae
27	Freshwater Drum	*Aploinotus grunniens*	Sciaenidae

Appendix B. Listing of the lengths and weights of fish captured at River Mile 38, 1994.

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
1	1	1	carp	Cyprinidae	58	2622	103	544	dup1 wt=606
2	1	2	carp	Cyprinidae	50.1	1546	102	694	
3	1	3	carp	Cyprinidae	18.7	102	101	224	
4	1	4	carp	Cyprinidae	18.5	84	101	224	
5	1	5	carp	Cyprinidae	15.9	64	101	224	
6	1	6	carp	Cyprinidae	15	52	101	224	
7	1	7	carp	Cyprinidae	15	56	101	224	
8	1	8	carp	Cyprinidae	15.3	54	101	224	
9	1	1	gizzard shad	Clupeidae	36	664	104	420	
10	1	2	gizzard shad	Clupeidae	28.8	270	105	258	
11	1	3	gizzard shad	Clupeidae	26.7	204	105	258	
12	1	4	gizzard shad	Clupeidae	25.1	162	106	208	
13	1	5	gizzard shad	Clupeidae	26.8	202	106	208	
14	1	6	gizzard shad	Clupeidae	24.6	156	107	206	
15	1	7	gizzard shad	Clupeidae	24.7	164	107	206	
16	1	1	channel catfish	Ictaluridae	38	496	108	362	
17	1	1	yellow bullhead	Ictaluridae	32.5	358	108	362	
18	1	1	highfin carpsucker	Catostomidae	37.1	674	109	618	
19	1	2	highfin carpsucker	Catostomidae	34	528	109	618	
20	1	3	highfin carpsucker	Catostomidae	32.9	490	110	432	
21	1	4	highfin carpsucker	Catostomidae	30.5	360	110	432	
22	1	1	smallmouth bass	Centrarchidae	15.3	48	111	458	
23	1	2	smallmouth bass	Centrarchidae	12.6	26	111	458	
24	1	3	smallmouth bass	Centrarchidae	9	8	111	458	
25	1	1	golden shiner	Cyprinidae	10	10.2	112	266	
26	1	2	golden shiner	Cyprinidae	9.6	8.8	112	266	
27	1	3	golden shiner	Cyprinidae	8.8	7.3	112	266	
28	1	4	golden shiner	Cyprinidae	9	6.4	112	266	
29	1	5	golden shiner	Cyprinidae	8.4	5	112	266	
30	1	6	golden shiner	Cyprinidae	7.7	4.5	112	266	
31	1	1	golden redhorse	Catostomidae	40	790	113	358	
32	1	2	golden redhorse	Catostomidae	35.9	538	114	248	
33	1	3	golden redhorse	Catostomidae	31.2	362	115	398	
34	1	4	golden redhorse	Catostomidae	30	334	115	398	
35	1	5	golden redhorse	Catostomidae	31.1	336	116	556	
36	1	6	golden redhorse	Catostomidae	30.5	334	116	556	
37	1	7	golden redhorse	Catostomidae	27.4	244	116	556	
38	1	8	golden redhorse	Catostomidae	29.3	290	117	672	
39	1	9	golden redhorse	Catostomidae	27.7	238	117	672	
40	1	10	golden redhorse	Catostomidae	28.3	282	117	672	
41	1	11	golden redhorse	Catostomidae	29.6	302	117	672	
42	1	12	golden redhorse	Catostomidae	28.2	246	118	262	
43	1	13	golden redhorse	Catostomidae	21	94	118	262	
44	1	14	golden redhorse	Catostomidae	9.6	9.9	118	262	
45	1	15	golden redhorse	Catostomidae	10	11.4	118	262	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
46	1	16	golden redhorse	Catostomidae	9.3	9	118	262	
47	1	17	golden redhorse	Catostomidae	9.4	9.9	118	262	
48	1	18	golden redhorse	Catostomidae	9.9	8.8	118	262	
49	1	19	golden redhorse	Catostomidae	9.5	8.5	118	262	
50	1	20	golden redhorse	Catostomidae	8.4	6.7	118	262	
51	1	21	golden redhorse	Catostomidae	8	6.3	118	262	
52	1	1	longear sunfish	Centrarchidae	11.5	35.2	119	369	
53	1	2	longear sunfish	Centrarchidae	11	31	119	369	
54	1	3	longear sunfish	Centrarchidae	9.4	17.1	119	369	
55	1	4	longear sunfish	Centrarchidae	6.8	6.8	119	369	
56	1	5	longear sunfish	Centrarchidae	5.9	4.5	119	369	
57	1	6	longear sunfish	Centrarchidae	5.3	4	119	369	
58	1	7	longear sunfish	Centrarchidae	5.3	3.5	119	369	
59	2	1	carp	Cyprinidae	75.9	6378	120	2220	
60	2	2	carp	Cyprinidae	15	52.3	121	288	
61	2	3	carp	Cyprinidae	19.4	113	121	288	
62	2	4	carp	Cyprinidae	16.6	66	121	288	
63	2	5	carp	Cyprinidae	16.4	66	121	288	
64	2	6	carp	Cyprinidae	15.4	54	121	288	
65	2	7	carp	Cyprinidae	14.7	52	121	288	
66	2	8	carp	Cyprinidae	13.9	50	121	288	
67	2	1	mirror carp	Cyprinidae	13.5	36	121	288	ununiform scales
68	2	1	channel catfish	Ictaluridae	52.6	1204	124	400	
69	2	2	channel catfish	Ictaluridae	31.5	234	124	400	
70	2	1	smallmouth bass	Centrarchidae	30.2	382	123	226	
71	2	2	smallmouth bass	Centrarchidae	13.2	31	111	458	
72	2	3	smallmouth bass	Centrarchidae	11.7	18.7	111	458	
73	2	4	smallmouth bass	Centrarchidae	11.3	20.8	111	458	
74	2	5	smallmouth bass	Centrarchidae	11.6	20.5	111	458	
75	2	6	smallmouth bass	Centrarchidae	12.2	23.8	111	458	
76	2	7	smallmouth bass	Centrarchidae	10.6	14.9	111	458	
77	2	8	smallmouth bass	Centrarchidae	9.5	12.3	111	458	
78	2	9	smallmouth bass	Centrarchidae	10.4	14.4	111	458	
79	2	10	smallmouth bass	Centrarchidae	9.2	11	111	458	
80	2	11	smallmouth bass	Centrarchidae	9.7	12.3	111	458	
81	2	12	smallmouth bass	Centrarchidae	8.5	8.1	111	458	
82	2	13	smallmouth bass	Centrarchidae	7.5	6	111	458	
83	2	14	smallmouth bass	Centrarchidae	7.7	5	111	458	
84	2	15	smallmouth bass	Centrarchidae	7.2	4.8	111	458	
85	2	16	smallmouth bass	Centrarchidae	6.5	3.7	111	458	
86	2	17	smallmouth bass	Centrarchidae	8	6.4	111	458	
87	2	18	smallmouth bass	Centrarchidae	6	3	111	458	
88	2	1	golden redhorse	Catostomidae	37.5	584	122	448	
89	2	2	golden redhorse	Catostomidae	28.4	238	122	448	
90	2	3	golden redhorse	Catostomidae	26	190	125	472	
91	2	4	golden redhorse	Catostomidae	25.5	190	125	472	
92	2	5	golden redhorse	Catostomidae	21.4	102	125	472	
93	2	6	golden redhorse	Catostomidae	17.4	56	125	472	
94	2	7	golden redhorse	Catostomidae	9	7.7	125	472	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
95	2	8	golden redhorse	Catostomidae	8.1	5.7	125	472	
96	2	9	golden redhorse	Catostomidae	7	3.8	125	472	
97	2	10	golden redhorse	Catostomidae	7.2	4.4	125	472	
98	2	11	golden redhorse	Catostomidae	8.3	6.7	125	472	
99	2	12	golden redhorse	Catostomidae	7.2	4.1	125	472	
100	2	13	golden redhorse	Catostomidae	8.8	7.4	125	472	
101	2	14	golden redhorse	Catostomidae	9.2	8	125	472	
102	2	15	golden redhorse	Catostomidae	10.7	10.3	125	472	
103	2	16	golden redhorse	Catostomidae	8	5.6	125	472	
104	2	17	golden redhorse	Catostomidae	7.2	4.2	125	472	
105	2	18	golden redhorse	Catostomidae	9	7.8	125	472	
106	2	19	golden redhorse	Catostomidae	8.2	6.6	125	472	
107	2	20	golden redhorse	Catostomidae	7.3	4.4	125	472	
108	2	21	golden redhorse	Catostomidae	8.3	6	125	472	
109	2	22	golden redhorse	Catostomidae	9.1	7.5	125	472	
110	2	23	golden redhorse	Catostomidae	7	4	125	472	
111	2	24	golden redhorse	Catostomidae	7.2	4.6	125	472	
112	2	25	golden redhorse	Catostomidae	7.2	4.5	125	472	
113	2	26	golden redhorse	Catostomidae	7.2	5.5	125	472	
114	2	27	golden redhorse	Catostomidae	8.5	6.4	125	472	
115	2	28	golden redhorse	Catostomidae	8	5.8	125	472	
116	2	29	golden redhorse	Catostomidae	8.9	7.3	125	472	
117	2	30	golden redhorse	Catostomidae	8	5.4	125	472	
118	2	31	golden redhorse	Catostomidae	9.2	8.9	125	472	
119	2	32	golden redhorse	Catostomidae	8.6	7.1	125	472	
120	2	33	golden redhorse	Catostomidae	8.6	7.4	125	472	
121	2	34	golden redhorse	Catostomidae	7.7	5	125	472	
122	2	35	golden redhorse	Catostomidae	8.5	6.6	125	472	
123	2	36	golden redhorse	Catostomidae	8.5	7.2	125	472	
124	2	37	golden redhorse	Catostomidae	8.9	8.5	125	472	
125	2	38	golden redhorse	Catostomidae	8.5	6.4	125	472	
126	2	39	golden redhorse	Catostomidae	8.5	7.4	125	472	
127	2	40	golden redhorse	Catostomidae	8.2	5.8	125	472	
128	2	41	golden redhorse	Catostomidae	8.7	7.7	125	472	
129	2	42	golden redhorse	Catostomidae	9.6	9.2	125	472	
130	2	43	golden redhorse	Catostomidae	8.8	7.3	125	472	
131	2	44	golden redhorse	Catostomidae	7	4	125	472	
132	2	45	golden redhorse	Catostomidae	6.8	3.6	125	472	
133	2	46	golden redhorse	Catostomidae	8	5.4	125	472	
134	2	47	golden redhorse	Catostomidae	8	5.9	125	472	
135	2	48	golden redhorse	Catostomidae	8.4	6	125	472	
136	2	49	golden redhorse	Catostomidae	9.7	9.6	125	472	
137	2	1	golden shiner	Cyprinidae	7.9	4.7	112	266	
138	2	2	golden shiner	Cyprinidae	8.9	6.8	112	266	
139	2	3	golden shiner	Cyprinidae	7	3.3	112	266	
140	2	4	golden shiner	Cyprinidae	7	3.4	112	266	
141	2	1	longear sunfish	Centrarchidae	12	34.6	119	369	
142	2	2	longear sunfish	Centrarchidae	8.7	11.9	119	369	
143	2	3	longear sunfish	Centrarchidae	7.9	10.7	119	369	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
144	2	4	longear sunfish	Centrarchidae	8.6	12.8	119	369	
145	2	5	longear sunfish	Centrarchidae	7	8.1	119	369	
146	2	6	longear sunfish	Centrarchidae	7.6	9.2	119	369	
147	2	7	longear sunfish	Centrarchidae	6.5	5.8	119	369	
148	2	8	longear sunfish	Centrarchidae	6.2	5.2	119	369	
149	2	9	longear sunfish	Centrarchidae	6.6	6.7	119	369	
150	2	10	longear sunfish	Centrarchidae	7.4	8.3	119	369	
151	2	11	longear sunfish	Centrarchidae	6.3	5.1	119	369	
152	2	12	longear sunfish	Centrarchidae	6.5	5.1	119	369	
153	2	13	longear sunfish	Centrarchidae	5.5	3.9	119	369	
154	2	14	longear sunfish	Centrarchidae	5.5	3.2	119	369	
155	2	15	longear sunfish	Centrarchidae	5.8	3.7	119	369	
156	2	16	longear sunfish	Centrarchidae	4	1.5	119	369	
157	2	17	longear sunfish	Centrarchidae	5.8	4	119	369	
158	2	18	longear sunfish	Centrarchidae	5.6	3.7	119	369	
159	2	19	longear sunfish	Centrarchidae	6	4.9	119	369	
160	2	20	longear sunfish	Centrarchidae	5.3	3.3	119	369	
161	2	21	longear sunfish	Centrarchidae	4.7	2.2	119	369	
162	2	22	longear sunfish	Centrarchidae	3.1	0.6	119	369	
163	2	1	bluntnose minnow	Cyprinidae	4.7	0.9	112	266	
164	2	2	bluntnose minnow	Cyprinidae	5.1	1.2	112	266	
165	2	3	bluntnose minnow	Cyprinidae	4.2	0.7	112	266	
166	2	4	bluntnose minnow	Cyprinidae	3.1	0.5	112	266	
167	3	1	smallmouth bass	Centrarchidae	24.8	220	137	270	
168	3	2	smallmouth bass	Centrarchidae	26.2	228	137	270	
169	3	3	smallmouth bass	Centrarchidae	25.1	206	138	446	
170	3	4	smallmouth bass	Centrarchidae	19.5	120	138	446	
171	3	5	smallmouth bass	Centrarchidae	18.6	102	138	446	
172	3	6	smallmouth bass	Centrarchidae	16.8	86	138	446	
173	3	7	smallmouth bass	Centrarchidae	15.8	60	138	446	
174	3	8	smallmouth bass	Centrarchidae	15.6	56	138	446	
175	3	9	smallmouth bass	Centrarchidae	15.4	54	138	446	
176	3	10	smallmouth bass	Centrarchidae	15.7	50	138	446	
177	3	11	smallmouth bass	Centrarchidae	16.7	62	111	458	
178	3	12	smallmouth bass	Centrarchidae	15.6	48	111	458	
179	3	13	smallmouth bass	Centrarchidae	15.4	44	111	458	
180	3	14	smallmouth bass	Centrarchidae	14.4	46	111	458	
181	3	15	smallmouth bass	Centrarchidae	17.9	88	111	458	
182	3	16	smallmouth bass	Centrarchidae	12	24	111	458	
183	3	17	smallmouth bass	Centrarchidae	11.9	22	111	458	
184	3	18	smallmouth bass	Centrarchidae	14.4	36	111	458	
185	3	19	smallmouth bass	Centrarchidae	12.5	26	111	458	
186	3	20	smallmouth bass	Centrarchidae	10.5	15.9	111	458	
187	3	21	smallmouth bass	Centrarchidae	10	14.3	111	458	
188	3	22	smallmouth bass	Centrarchidae	11.2	15.1	111	458	
189	3	23	smallmouth bass	Centrarchidae	10.8	16	111	458	
190	3	24	smallmouth bass	Centrarchidae	8.5	7.5	111	458	
191	3	25	smallmouth bass	Centrarchidae	8.4	7	111	458	
192	3	26	smallmouth bass	Centrarchidae	8	5.5	111	458	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
193	3	1	golden redhorse	Catostomidae	38.1	644	134	662	
194	3	2	golden redhorse	Catostomidae	34.6	488	134	662	
195	3	3	golden redhorse	Catostomidae	28.9	256	135	410	
196	3	4	golden redhorse	Catostomidae	25.6	188	135	410	
197	3	5	golden redhorse	Catostomidae	27.4	230	135	410	
198	3	6	golden redhorse	Catostomidae	21.9	112	136	360	
199	3	7	golden redhorse	Catostomidae	17.4	61.1	136	360	
200	3	8	golden redhorse	Catostomidae	17.4	55.9	136	360	
201	3	9	golden redhorse	Catostomidae	16.5	47.4	136	360	
202	3	10	golden redhorse	Catostomidae	15.3	37.7	136	360	
203	3	11	golden redhorse	Catostomidae	15.7	40.3	136	360	
204	3	12	golden redhorse	Catostomidae	15.8	43.1	136	360	
205	3	13	golden redhorse	Catostomidae	15.7	38.8	136	360	
206	3	14	golden redhorse	Catostomidae	7.9	4.3	136	360	
207	3	15	golden redhorse	Catostomidae	6.6	2.3	136	360	
208	3	16	golden redhorse	Catostomidae	9.5	8.9	136	360	
209	3	17	golden redhorse	Catostomidae	9	7.5	136	360	
210	3	18	golden redhorse	Catostomidae	8.4	6.3	136	360	
211	3	19	golden redhorse	Catostomidae	10.1	9.9	136	360	
212	3	20	golden redhorse	Catostomidae	9.6	10	136	360	
213	3	21	golden redhorse	Catostomidae	9.6	8.4	136	360	
214	3	22	golden redhorse	Catostomidae	10.3	10.2	136	360	
215	3	23	golden redhorse	Catostomidae	9.6	9.1	136	360	
216	3	24	golden redhorse	Catostomidae	10.6	12.3	136	360	
217	3	25	golden redhorse	Catostomidae	14.9	29.2	136	360	
218	3	26	golden redhorse	Catostomidae	7.3	2.9	136	360	
219	3	27	golden redhorse	Catostomidae	7.1	2.4	136	360	
220	3	28	golden redhorse	Catostomidae	5.6	1.1	136	360	
221	3	29	golden redhorse	Catostomidae	13	26	136	360	
222	3	1	northern hog sucker	Catostomidae	27.1	234	131	308	
223	3	2	northern hog sucker	Catostomidae	25.6	208	131	308	
224	3	3	northern hog sucker	Catostomidae	22.8	120	131	308	
225	3	4	northern hog sucker	Catostomidae	8	6.1	131	308	
226	3	1	highfin carpsucker	Catostomidae	38.5	820	132	276	
227	3	2	highfin carpsucker	Catostomidae	34.3	590	133	556	
228	3	3	highfin carpsucker	Catostomidae	31.4	402	133	556	
229	3	1	carp	Cyprinidae	57.1	2408	126	890	
230	3	2	carp	Cyprinidae	56.5	2180	127	684	
231	3	3	carp	Cyprinidae	45.3	1298	130	580	
232	3	4	carp	Cyprinidae	45.1	1162	129	452	
233	3	1	mirror carp	Cyprinidae	50.1	1604	128	574	
234	3	1	shorthead redhorse	Catostomidae	19.9	78.5	142	768	
235	3	2	shorthead redhorse	Catostomidae	19.9	73.5	142	768	
236	3	1	gizzard shad	Clupeidae	14	26.7	112	266	
237	3	1	bluegill	Centrarchidae	15.7	89.1	119	369	
238	3	1	longear sunfish	Centrarchidae	11.1	32	119	369	
239	3	2	longear sunfish	Centrarchidae	10.1	18.7	119	369	
240	3	3	longear sunfish	Centrarchidae	8	9.9	119	369	
241	3	1	golden shiner	Cyprinidae	9.3	7.7	112	266	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
242	3	2	golden shiner	Cyprinidae	9.5	8.3	112	266	
243	3	3	golden shiner	Cyprinidae	9.4	6.5	112	266	
244	3	4	golden shiner	Cyprinidae	9.1	6.1	112	266	
245	3	5	golden shiner	Cyprinidae	6.5	2.1	112	266	
246	3	1	spotfin shiner	Cyprinidae	10.9	11.9	112	266	
247	3	2	spotfin shiner	Cyprinidae	8.1	4.2	112	266	
248	3	3	spotfin shiner	Cyprinidae	7.3	3.6	112	266	
249	4	1	carp	Cyprinidae	50.3	1594	139	852	
250	4	2	carp	Cyprinidae	44.8	1200	140	398	
251	4	3	carp	Cyprinidae	58	2456	141	640	
252	4	4	carp	Cyprinidae	17.5	91.5	141	640	
253	4	5	carp	Cyprinidae	15.2	54.8	141	640	
254	4	1	smallmouth bass	Centrarchidae	25.5	220	143	154	
255	4	2	smallmouth bass	Centrarchidae	19.5	114	143	154	
256	4	3	smallmouth bass	Centrarchidae	13.7	38.1	143	154	
257	4	4	smallmouth bass	Centrarchidae	10.4	12.8	143	154	
258	4	1	golden redhorse	Catostomidae	39.6	740	142	768	
259	4	2	golden redhorse	Catostomidae	35.6	630	142	768	
260	4	3	golden redhorse	Catostomidae	36.5	578	144	618	
261	4	4	golden redhorse	Catostomidae	36.2	576	144	618	
262	4	5	golden redhorse	Catostomidae	30	320	145	480	
263	4	6	golden redhorse	Catostomidae	25.3	196	145	480	
264	4	7	golden redhorse	Catostomidae	18.5	73.3	145	480	
265	4	8	golden redhorse	Catostomidae	18	60.3	145	480	
266	4	9	golden redhorse	Catostomidae	8.4	6.2	145	480	
267	4	10	golden redhorse	Catostomidae	8.6	6.3	145	480	
268	4	1	shorthead redhorse	Catostomidae	20.5	87.8	145	480	
269	4	1	gizzard shad	Clupeidae	27	212	112	266	
270	4	2	gizzard shad	Clupeidae	13.6	28.9	112	266	
271	4	1	golden shiner	Cyprinidae	9.2	8.5	112	266	
272	4	2	golden shiner	Cyprinidae	7.8	5.2	112	266	
273	4	3	golden shiner	Cyprinidae	7.4	4.2	112	266	
274	4	1	longear sunfish	Centrarchidae	11.9	38.9	119	369	
275	4	2	longear sunfish	Centrarchidae	11.5	39	119	369	ulcer behind ear flap
276	4	3	longear sunfish	Centrarchidae	12	43.5	119	369	
277	4	1	spotfin shiner	Cyprinidae	9	6.8	112	266	
278	4	2	spotfin shiner	Cyprinidae	8.6	5.5	112	266	
279	4	3	spotfin shiner	Cyprinidae	8.1	4.7	112	266	
280	4	4	spotfin shiner	Cyprinidae	7.5	4	112	266	
281	4	5	spotfin shiner	Cyprinidae	7.2	2.9	112	266	
282	4	6	spotfin shiner	Cyprinidae	6	1.7	112	266	

Appendix C. Listing of the lengths and weights of fish captured at River Mile 24, 1994.

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
1	1	1	gizzard shad	Clupeidae	27.4	209	201	355	
2	1	2	gizzard shad	Clupeidae	25.9	185	201	355	
3	1	3	gizzard shad	Clupeidae	26	176	201	355	
4	1	4	gizzard shad	Clupeidae	26.6	207	202	299	
5	1	5	gizzard shad	Clupeidae	25.9	148	202	299	
6	1	6	gizzard shad	Clupeidae	24.4	146	202	299	
7	1	7	gizzard shad	Clupeidae	26.9	199	203	386	
8	1	8	gizzard shad	Clupeidae	20.9	92	203	386	
9	1	9	gizzard shad	Clupeidae	23.5	131	203	386	
10	1	10	gizzard shad	Clupeidae	23.6	145	203	386	
11	1	11	gizzard shad	Clupeidae	22.7	119	203	386	
12	1	1	freshwater drum	Sciaenidae	36.7	822	204	464	
13	1	2	freshwater drum	Sciaenidae	35.9	620	205	317	
14	1	3	freshwater drum	Sciaenidae	27.8	275	206	272	
15	1	4	freshwater drum	Sciaenidae	27.6	258	206	272	
16	1	5	freshwater drum	Sciaenidae	28.4	311	207	295	
17	1	6	freshwater drum	Sciaenidae	26	218	207	295	
18	1	7	freshwater drum	Sciaenidae	24.6	182	208	339	
19	1	8	freshwater drum	Sciaenidae	26.5	223	208	339	
20	1	9	freshwater drum	Sciaenidae	14.2	36.6	208	339	
21	1	10	freshwater drum	Sciaenidae	14.9	41.3	208	339	
22	1	11	freshwater drum	Sciaenidae	14.4	34.3	208	339	
23	1	12	freshwater drum	Sciaenidae	13.5	29.2	208	339	
24	1	1	black buffalo	Catostomidae	53.2	2744	209	756	
25	1	2	black buffalo	Catostomidae	44	1398	210	390	
26	1	3	black buffalo	Catostomidae	39.4	989	211	328	
27	1	1	quillback	Catostomidae	40.4	912	212	279	
28	1	1	golden redhorse	Catostomidae	42.6	1001	213	356	
29	1	2	golden redhorse	Catostomidae	35.4	531	214	397	
30	1	3	golden redhorse	Catostomidae	34.3	504	214	397	
31	1	4	golden redhorse	Catostomidae	33	452	215	268	
32	1	5	golden redhorse	Catostomidae	29.7	303	215	268	
33	1	6	golden redhorse	Catostomidae	7.9	5.5	k	k	uc collection
34	1	1	northern hog sucker	Catostomidae	35.4	585	216	212	
35	1	2	northern hog sucker	Catostomidae	8.7	7.2	216	212	
36	1	1	logperch	Percidae	13.1	23.2	k	k	uc collection
37	1	1	smallmouth bass	Centrarchidae	13.4	31.3	217	264	
38	1	2	smallmouth bass	Centrarchidae	11.7	22	217	264	
39	1	3	smallmouth bass	Centrarchidae	14.9	43.5	217	264	
40	1	4	smallmouth bass	Centrarchidae	14.4	39	217	264	
41	1	5	smallmouth bass	Centrarchidae	13.4	32.3	217	264	
42	1	6	smallmouth bass	Centrarchidae	11.8	21.2	217	264	
43	1	7	smallmouth bass	Centrarchidae	24.5	277	k	k	returned
44	1	1	longear sunfish	Centrarchidae	12.4	52.5	219	234	
45	1	2	longear sunfish	Centrarchidae	10.2	24.7	219	234	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
46	1	3	longear sunfish	Centrarchidae	9.8	21.4	219	234	
47	1	4	longear sunfish	Centrarchidae	6.6	7	219	234	
48	1	5	longear sunfish	Centrarchidae	6.3	6.5	219	234	
49	1	6	longear sunfish	Centrarchidae	6.4	5.4	219	234	
50	1	7	longear sunfish	Centrarchidae	8.3	4.8	218	48	
51	1	8	longear sunfish	Centrarchidae	7.2	3.2	218	48	
52	1	9	longear sunfish	Centrarchidae	7.1	3.3	218	48	
53	1	10	longear sunfish	Centrarchidae	6.8	2.2	218	48	
54	1	11	longear sunfish	Centrarchidae	7	2.3	218	48	
55	1	12	longear sunfish	Centrarchidae	7.6	3.1	218	48	
56	1	13	longear sunfish	Centrarchidae	6.9	3.5	218	48	
57	1	14	longear sunfish	Centrarchidae	6.5	2.7	218	48	
58	1	15	longear sunfish	Centrarchidae	6.8	2.9	218	48	
59	1	16	longear sunfish	Centrarchidae	6.1	2.6	218	48	
60	1	17	longear sunfish	Centrarchidae	6.4	2.5	218	48	
61	1	18	longear sunfish	Centrarchidae	4.6	1	218	48	
62	1	1	bluntnose minnow	Cyprinidae	7.1	3.3	218	48	
63	1	1	spotfin shiner	Cyprinidae	7.9	5.4	218	48	
64	1	1	carp	Cyprinidae	56.2	2250	220	428	
65	1	2	carp	Cyprinidae	46.7	1620	221	438	
66	1	3	carp	Cyprinidae	51.1	1749	222	424	
67	1	1	striped bass	Percichthyidae	33.3	334	k	k	returned
68	1	2	striped bass	Percichthyidae	23.3	126	k	k	returned
69	1	3	striped bass	Percichthyidae	23.8	164	k	k	returned
70	1	4	striped bass	Percichthyidae	27.2	190	k	k	returned
71	1	5	striped bass	Percichthyidae	18.7	70	k	k	returned
72	2	1	freshwater drum	Sciaenidae	42.5	1006	223	572	
73	2	2	freshwater drum	Sciaenidae	39.6	842	223	572	
74	2	3	freshwater drum	Sciaenidae	31.2	460	224	368	
75	2	4	freshwater drum	Sciaenidae	40.7	923	224	368	
76	2	5	freshwater drum	Sciaenidae	32.8	424	225	240	
77	2	6	freshwater drum	Sciaenidae	28.3	300	225	240	
78	2	7	freshwater drum	Sciaenidae	27	335	226	240	
79	2	8	freshwater drum	Sciaenidae	28	305	226	240	
80	2	9	freshwater drum	Sciaenidae	26.8	250	226	240	
81	2	10	freshwater drum	Sciaenidae	27.2	255	227	288	
82	2	11	freshwater drum	Sciaenidae	29.8	278	227	288	
83	2	12	freshwater drum	Sciaenidae	28.6	330	227	288	
84	2	13	freshwater drum	Sciaenidae	28	259	228	202	
85	2	14	freshwater drum	Sciaenidae	23.8	169	228	202	
86	2	15	freshwater drum	Sciaenidae	22.2	128	228	202	
87	2	16	freshwater drum	Sciaenidae	16.2	45.6	228	202	
88	2	1	smallmouth buffalo	Catostomidae	65.7	4648	234	1196	
89	2	1	carp	Cyprinidae	45.9	1830	229	420	
90	2	2	carp	Cyprinidae	49.8	1730	230	508	
91	2	3	carp	Cyprinidae	43.3	1443	231	342	
92	2	1	golden redhorse	Catostomidae	39.9	761	232	246	
93	2	2	golden redhorse	Catostomidae	36.4	521	233	311	
94	2	3	golden redhorse	Catostomidae	33.6	410	233	311	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
95	2	1	gizzard shad	Clupeidae	26.2	174	235	253	
96	2	2	gizzard shad	Clupeidae	24.7	144	235	253	
97	2	3	gizzard shad	Clupeidae	22.2	107	235	253	
98	2	1	channel catfish	Ictaluridae	39.4	562	236	265	
99	2	2	channel catfish	Ictaluridae	9.6	8.3	236	265	
100	2	1	flathead catfish	Ictaluridae	35.9	429	236	265	
101	2	1	river carpsucker	Catostomidae	44.4	1570	237	522	
102	2	1	black buffalo	Catostomidae	49.9	1411	238	434	
103	2	1	longear sunfish	Centrarchidae	15.6	109	219	434	
104	2	2	longear sunfish	Centrarchidae	10.8	28.3	219	434	
105	2	3	longear sunfish	Centrarchidae	5.6	3.1	219	434	
106	2	1	striped bass	Percichthyidae	15.5	44.1	217	434	
107	2	2	striped bass	Percichthyidae	24	194	k	k	returned
108	2	1	smallmouth bass	Centrarchidae	13.7	35.8	217	434	
109	2	2	smallmouth bass	Centrarchidae	11	18.1	217	434	
110	2	1	spotfin shiner	Cyprinidae	7.7	4.1	218	434	
111	3	1	freshwater drum	Sciaenidae	32	469	239	480	
112	3	2	freshwater drum	Sciaenidae	27.4	271	239	480	
113	3	3	freshwater drum	Sciaenidae	28.3	290	239	480	
114	3	4	freshwater drum	Sciaenidae	25.2	168	239	480	
115	3	1	channel catfish	Ictaluridae	43.5	830	243	556	
116	3	2	channel catfish	Ictaluridae	41.1	670	243	556	
117	3	1	flathead catfish	Ictaluridae	47.4	1058	243	556	
118	3	1	smallmouth bass	Centrarchidae	14.8	47.1	217	556	
119	3	2	smallmouth bass	Centrarchidae	32.7	426	k	k	returned
120	3	1	smallmouth buffalo	Catostomidae	58.5	3338	240	690	
121	3	1	carp	Cyprinidae	59.1	3016	241	510	
122	3	1	black buffalo	Catostomidae	48.5	1367	242	225	
123	3	1	striped bass	Percichthyidae	32	516	k	k	returned
124	3	2	striped bass	Percichthyidae	27.8	256	k	k	returned
125	4	1	gizzard shad	Clupeidae	28.7	242	244	468	
126	4	2	gizzard shad	Clupeidae	27.5	240	244	468	
127	4	3	gizzard shad	Clupeidae	28.6	244	244	468	
128	4	4	gizzard shad	Clupeidae	26.2	269	244	468	
129	4	5	gizzard shad	Clupeidae	26.4	200	244	468	
130	4	6	gizzard shad	Clupeidae	25.4	149	245	300	
131	4	7	gizzard shad	Clupeidae	21.8	109	245	300	
132	4	8	gizzard shad	Clupeidae	22.2	100	245	300	
133	4	9	gizzard shad	Clupeidae	22.8	104	245	300	
134	4	10	gizzard shad	Clupeidae	20.7	75	245	300	
135	4	11	gizzard shad	Clupeidae	20.5	89	246	340	
136	4	12	gizzard shad	Clupeidae	19.4	69	246	340	
137	4	13	gizzard shad	Clupeidae	26.6	205	246	340	
138	4	14	gizzard shad	Clupeidae	24.7	155	246	340	
139	4	15	gizzard shad	Clupeidae	26.5	192	246	340	
140	4	16	gizzard shad	Clupeidae	23.3	111	246	340	
141	4	17	gizzard shad	Clupeidae	26.2	170	246	340	
142	4	18	gizzard shad	Clupeidae	23	118	247	486	
143	4	19	gizzard shad	Clupeidae	24	120	247	486	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
144	4	20	gizzard shad	Clupeidae	21.6	105	247	486	
145	4	21	gizzard shad	Clupeidae	21.4	98	247	486	
146	4	22	gizzard shad	Clupeidae	20.6	79	247	486	
147	4	23	gizzard shad	Clupeidae	15.2	28.4	248	286	
148	4	24	gizzard shad	Clupeidae	13	20.4	248	286	
149	4	25	gizzard shad	Clupeidae	12.5	20.4	248	286	
150	4	26	gizzard shad	Clupeidae	11.4	14.4	248	286	
151	4	27	gizzard shad	Clupeidae	12.5	17.6	248	286	
152	4	1	freshwater drum	Sciaenidae	39.4	795	249	348	
153	4	2	freshwater drum	Sciaenidae	34.1	500	249	348	
154	4	3	freshwater drum	Sciaenidae	29.5	410	250	280	
155	4	4	freshwater drum	Sciaenidae	28.9	318	250	280	
156	4	5	freshwater drum	Sciaenidae	30	341	250	280	
157	4	6	freshwater drum	Sciaenidae	27.6	295	251	302	
158	4	7	freshwater drum	Sciaenidae	30.4	410	251	302	
159	4	8	freshwater drum	Sciaenidae	28.6	300	251	302	
160	4	9	freshwater drum	Sciaenidae	30.4	358	252	248	
161	4	10	freshwater drum	Sciaenidae	24.9	200	252	248	
162	4	11	freshwater drum	Sciaenidae	25.4	200	252	248	
163	4	12	freshwater drum	Sciaenidae	23.7	180	253	232	
164	4	13	freshwater drum	Sciaenidae	22.1	140	253	232	
165	4	14	freshwater drum	Sciaenidae	23.7	149	253	232	
166	4	15	freshwater drum	Sciaenidae	21.5	124	253	232	
167	4	16	freshwater drum	Sciaenidae	15.4	42.3	253	232	
168	4	17	freshwater drum	Sciaenidae	13.2	25.5	253	232	
169	4	1	golden redhorse	Catostomidae	33.4	460	254	416	
170	4	2	golden redhorse	Catostomidae	33.7	475	254	416	
171	4	3	golden redhorse	Catostomidae	32.6	440	254	416	
172	4	4	golden redhorse	Catostomidae	33	429	255	346	
173	4	5	golden redhorse	Catostomidae	32.8	390	255	346	
174	4	6	golden redhorse	Catostomidae	26.8	223	255	346	
175	4	7	golden redhorse	Catostomidae	18.7	79	256	258	
176	4	8	golden redhorse	Catostomidae	11.2	14.9	256	258	
177	4	1	shorthead redhorse	Catostomidae	37.4	512	256	258	
178	4	1	flathead catfish	Ictaluridae	50.9	1330	257	360	
179	4	1	channel catfish	Ictaluridae	36.7	402	257	360	
180	4	2	channel catfish	Ictaluridae	11.1	11	257	360	
181	4	3	channel catfish	Ictaluridae	10.4	10.1	257	360	
182	4	1	smallmouth bass	Centrarchidae	14.2	40.1	217	264	
183	4	2	smallmouth bass	Centrarchidae	13.2	32.5	217	264	
184	4	3	smallmouth bass	Centrarchidae	26.1	256	k	k	returned
185	4	1	longear sunfish	Centrarchidae	11	34	219	234	
186	4	2	longear sunfish	Centrarchidae	8.9	15.9	219	234	
187	4	3	longear sunfish	Centrarchidae	6.8	6.6	219	234	
188	4	1	bluegill	Centrarchidae	11.5	34.8	219	234	
189	4	1	spotfin shiner	Cyprinidae	6.9	2.2	218	48	
190	4	2	spotfin shiner	Cyprinidae	7.4	2.7	218	48	
191	4	3	spotfin shiner	Cyprinidae	7.5	2	218	48	
192	4	4	spotfin shiner	Cyprinidae	7.5	2.6	218	48	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
193	4	5	spotfin shiner	Cyprinidae	6.8	1.9	218	48	
194	4	1	carp	Cyprinidae	62.1	3705	258	686	
195	4	2	carp	Cyprinidae	53.4	2468	259	732	
196	4	1	striped bass	Percichthyidae	22.8	128	k	k	returned
197	4	2	striped bass	Percichthyidae	30.4	320	k	k	returned
198	4	3	striped bass	Percichthyidae	24.2	164	k	k	returned
199	4	1	sauger	Percidae	29.2	188	k	k	returned
200	4	2	sauger	Percidae	31.1	228	k	k	returned

Appendix D. Listing of the lengths and weights of fish captured at River Mile 19, 1994.

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
1	1	1	gizzard shad	Clupeidae	10.4	11.9	301	230	
2	1	2	gizzard shad	Clupeidae	12.4	17.5	301	230	
3	1	3	gizzard shad	Clupeidae	12.6	20.7	301	230	
4	1	4	gizzard shad	Clupeidae	12.7	21	301	230	
5	1	5	gizzard shad	Clupeidae	10.9	11.8	301	230	
6	1	6	gizzard shad	Clupeidae	10.5	12	302	187	
7	1	7	gizzard shad	Clupeidae	10.3	11.1	302	187	
8	1	8	gizzard shad	Clupeidae	11.1	14.7	302	187	
9	1	9	gizzard shad	Clupeidae	12.1	18.6	302	187	
10	1	10	gizzard shad	Clupeidae	11.4	13.2	302	187	
11	1	11	gizzard shad	Clupeidae	11.6	15.4	302	187	
12	1	12	gizzard shad	Clupeidae	10.8	12	303	316	
13	1	13	gizzard shad	Clupeidae	12.5	19.4	303	316	
14	1	14	gizzard shad	Clupeidae	14.3	24.8	303	316	
15	1	15	gizzard shad	Clupeidae	10.1	12	303	316	
16	1	16	gizzard shad	Clupeidae	11.4	13.8	303	316	
17	1	17	gizzard shad	Clupeidae	12.0	14.9	303	316	
18	1	18	gizzard shad	Clupeidae	15.1	35.7	303	316	
19	1	19	gizzard shad	Clupeidae	11.2	13.9	303	316	
20	1	20	gizzard shad	Clupeidae	8.2	7.8	303	316	
21	1	21	gizzard shad	Clupeidae	8.4	8.4	303	316	
22	1	22	gizzard shad	Clupeidae	13.0	22.1	305	287	
23	1	23	gizzard shad	Clupeidae	13.5	22.8	305	287	
24	1	24	gizzard shad	Clupeidae	17.6	60.5	305	287	
25	1	25	gizzard shad	Clupeidae	13.9	24.8	305	287	
26	1	26	gizzard shad	Clupeidae	13.7	26.8	305	287	
27	1	27	gizzard shad	Clupeidae	15.6	39	306	309	
28	1	28	gizzard shad	Clupeidae	12.7	21.4	306	309	
29	1	29	gizzard shad	Clupeidae	8.6	6.9	306	309	
30	1	30	gizzard shad	Clupeidae	16.1	53.6	306	309	
31	1	31	gizzard shad	Clupeidae	11.3	15.6	306	309	
32	1	32	gizzard shad	Clupeidae	13.9	27.5	307	228	
33	1	33	gizzard shad	Clupeidae	10.0	11.3	307	228	
34	1	34	gizzard shad	Clupeidae	11.2	15.9	307	228	
35	1	35	gizzard shad	Clupeidae	11.4	14.2	307	228	
36	1	36	gizzard shad	Clupeidae	13.3	21.8	307	228	
37	1	37	gizzard shad	Clupeidae	9.6	9.4	307	228	
38	1	38	gizzard shad	Clupeidae	8.7	7.8	308	265	
39	1	39	gizzard shad	Clupeidae	11.1	14.6	308	265	
40	1	40	gizzard shad	Clupeidae	17.3	52.3	308	265	
41	1	41	gizzard shad	Clupeidae	10.4	11.4	308	265	
42	1	42	gizzard shad	Clupeidae	13.1	25.7	308	265	
43	1	43	gizzard shad	Clupeidae	11.4	14	308	265	
44	1	44	gizzard shad	Clupeidae	11.7	12.9	308	265	
45	1	45	gizzard shad	Clupeidae	13.3	21.9	309	252	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
46	1	46	gizzard shad	Clupeidae	14.8	29	309	252	
47	1	47	gizzard shad	Clupeidae	11.6	12.8	309	252	
48	1	48	gizzard shad	Clupeidae	10.5	12.1	309	252	
49	1	49	gizzard shad	Clupeidae	14.0	25.4	309	252	
50	1	50	gizzard shad	Clupeidae	11.3	14.2	310	236	
51	1	51	gizzard shad	Clupeidae	12.0	13.3	310	236	
52	1	52	gizzard shad	Clupeidae	10.9	12.1	310	236	
53	1	53	gizzard shad	Clupeidae	14.8	27.9	310	236	
54	1	54	gizzard shad	Clupeidae	9.9	9.6	310	236	
55	1	1	carp	Cyprinidae	42.3	941	312	434	
56	1	2	carp	Cyprinidae	33.5	461	313	708	
57	1	3	carp	Cyprinidae	37.8	492	313	708	
58	1	1	river carpsucker	Catostomidae	38.4	768	314	381	
93	1	1	river carpsucker	Catostomidae	45.3	1251	323	790	
94	1	2	river carpsucker	Catostomidae	37.1	683	324	330	
59	1	1	bluegill	Centrarchidae	11.1	31.6	315	270	
60	1	2	bluegill	Centrarchidae	4.8	3.3	315	270	
61	1	3	bluegill	Centrarchidae	4.2	3.2	315	270	
62	1	4	bluegill	Centrarchidae	9.1	16.3	315	270	
63	1	5	bluegill	Centrarchidae	11.7	33.1	315	270	
64	1	6	bluegill	Centrarchidae	10.0	20.6	315	270	
65	1	7	bluegill	Centrarchidae	4.4	2	315	270	
66	1	1	longear sunfish	Centrarchidae	6.0	4	316	214	
67	1	2	longear sunfish	Centrarchidae	4.7	1.9	316	214	
68	1	3	longear sunfish	Centrarchidae	5.9	3.9	316	214	
69	1	4	longear sunfish	Centrarchidae	6.5	4.9	316	214	
70	1	5	longear sunfish	Centrarchidae	4.8	2.1	316	214	
71	1	6	longear sunfish	Centrarchidae	4.6	1.9	316	214	
72	1	7	longear sunfish	Centrarchidae	5.0	2.3	316	214	
73	1	8	longear sunfish	Centrarchidae	4.8	2	316	214	
74	1	9	longear sunfish	Centrarchidae	6.2	3.8	316	214	
75	1	10	longear sunfish	Centrarchidae	6.8	6	316	214	
76	1	11	longear sunfish	Centrarchidae	5.1	2.4	316	214	
77	1	12	longear sunfish	Centrarchidae	5.3	2.7	316	214	
78	1	13	longear sunfish	Centrarchidae	5.0	3.7	316	214	
79	1	14	longear sunfish	Centrarchidae	5.0	3.8	316	214	
80	1	15	longear sunfish	Centrarchidae	3.9	1.8	316	214	
81	1	16	longear sunfish	Centrarchidae	4.7	2	316	214	
82	1	17	longear sunfish	Centrarchidae	4.8	2.2	316	214	
83	1	1	channel catfish	Ictaluridae	27.9	212	318	164	
84	1	2	channel catfish	Ictaluridae	18.4	79	318	164	
85	1	1	smallmouth bass	Centrarchidae	9.6	11.5	319	328	
86	1	2	smallmouth bass	Centrarchidae	14.8	40	319	328	
87	1	3	smallmouth bass	Centrarchidae	17.0	89	319	328	
88	1	4	smallmouth bass	Centrarchidae	7.1	5.3	319	328	
89	1	5	smallmouth bass	Centrarchidae	6.9	4.9	319	328	
90	1	1	freshwater drum	Sciaenidae	25.5	173	320	246	
91	1	2	freshwater drum	Sciaenidae	23.8	147	320	246	
92	1	1	smallmouth buffalo	Catostomidae	65.4	5678	321	1744	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
95	1	1	white crappie	Centrarchidae	28.0	328	k	k	returned
96	2	1	carp	Cyprinidae	42.3	952	325	498	
97	2	2	carp	Cyprinidae	38.4	838	326	416	
98	2	3	carp	Cyprinidae	46.1	1350	327	476	
99	2	1	river carpsucker	Catostomidae	40.8	893	330	360	
100	2	1	golden redhorse	Catostomidae	11.0	13.4	331	246	
101	2	2	golden redhorse	Catostomidae	9.5	9.8	331	246	
102	2	3	golden redhorse	Catostomidae	9.9	11.4	331	246	
105	2	4	golden redhorse	Catostomidae	39.4	856	311	482	
106	2	5	golden redhorse	Catostomidae	30.0	388	311	482	
107	2	6	golden redhorse	Catostomidae	25.8	218	311	482	
108	2	7	golden redhorse	Catostomidae	18.9	70.6	311	482	
103	2	1	black redhorse	Catostomidae	30.4	392	331	246	
104	2	1	black buffalo	Catostomidae	55.0	1958	322	918	
109	2	1	shorthead redhorse	Catostomidae	37.8	620	317	280	
110	2	1	gizzard shad	Clupeidae	19.4	74.6	304	394	
111	2	2	gizzard shad	Clupeidae	20.1	80.1	304	394	
112	2	3	gizzard shad	Clupeidae	14.9	34.8	304	394	
113	2	4	gizzard shad	Clupeidae	18.2	86	304	394	
114	2	5	gizzard shad	Clupeidae	20.5	93	304	394	
115	2	6	gizzard shad	Clupeidae	10.6	12	328	402	
116	2	7	gizzard shad	Clupeidae	13.1	19.3	328	402	
117	2	8	gizzard shad	Clupeidae	10.7	13	328	402	
118	2	9	gizzard shad	Clupeidae	13.6	21.7	328	402	
119	2	10	gizzard shad	Clupeidae	14.1	23.1	328	402	
120	2	11	gizzard shad	Clupeidae	11.7	16.1	328	402	
121	2	12	gizzard shad	Clupeidae	13.1	21	328	402	
122	2	13	gizzard shad	Clupeidae	10.6	11.7	328	402	
123	2	14	gizzard shad	Clupeidae	12.3	19.3	329	262	
124	2	15	gizzard shad	Clupeidae	8.4	7.4	329	262	
125	2	16	gizzard shad	Clupeidae	7.9	7.2	329	262	
126	2	17	gizzard shad	Clupeidae	7.6	7.4	329	262	
127	2	18	gizzard shad	Clupeidae	8.2	8	329	262	
128	2	19	gizzard shad	Clupeidae	8.4	7.9	329	262	
129	2	20	gizzard shad	Clupeidae	6.8	6.4	329	262	
130	2	21	gizzard shad	Clupeidae	7.4	6.2	329	262	
131	2	22	gizzard shad	Clupeidae	6.3	5	329	262	
132	2	23	gizzard shad	Clupeidae	7.4	5.9	329	262	
133	2	24	gizzard shad	Clupeidae	6.8	5.7	329	262	
134	2	25	gizzard shad	Clupeidae	11.6	13.9	329	262	
135	2	26	gizzard shad	Clupeidae	6.8	5.4	329	262	
136	2	27	gizzard shad	Clupeidae	8.4	6.4	329	262	
137	2	28	gizzard shad	Clupeidae	13.0	19.7	329	262	
138	2	29	gizzard shad	Clupeidae	15.0	25.8	329	262	
139	2	1	bluegill	Centrarchidae	7.5	8.2	332	360	
140	2	2	bluegill	Centrarchidae	5.5	4.8	332	360	
141	2	3	bluegill	Centrarchidae	7.3	7.5	332	360	
142	2	4	bluegill	Centrarchidae	7.7	7.8	332	360	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
143	2	5	bluegill	Centrarchidae	5.1	3.4	332	360	
144	2	6	bluegill	Centrarchidae	5.5	4	332	360	
145	2	7	bluegill	Centrarchidae	8.5	13.8	332	360	
146	2	1	striped bass	Percichthyidae	33	448	k	k	returned
147	2	2	striped bass	Percichthyidae	22.5	116	k	k	returned
148	2	1	black crappie	Centrarchidae	23	156	k	k	returned
149	2	1	white crappie	Centrarchidae	23	160	k	k	returned
150	3	1	carp	Cyprinidae	76	7120	354	1174	
151	3	2	carp	Cyprinidae	47.5	1462	340	402	
152	3	3	carp	Cyprinidae	43.5	1220	341	322	
153	3	4	carp	Cyprinidae	42.6	1108	342	324	
154	3	1	river carpsucker	Catostomidae	43.1	1062	343	384	
155	3	2	river carpsucker	Catostomidae	34.8	604	344	344	
156	3	1	black buffalo	Catostomidae	59	3924	345	916	
157	3	1	freshwater drum	Sciaenidae	26.9	250	346	224	
158	3	2	freshwater drum	Sciaenidae	26.1	204	346	224	
159	3	3	freshwater drum	Sciaenidae	22.8	321	346	224	
160	3	1	smallmouth bass	Centrarchidae	19	100	319	328	
161	3	2	smallmouth bass	Centrarchidae	13	28	319	328	
162	3	3	smallmouth bass	Centrarchidae	12.2	22	319	328	
163	3	4	smallmouth bass	Centrarchidae	12	18	319	328	
164	3	5	smallmouth bass	Centrarchidae	10.3	10	319	328	
165	3	6	smallmouth bass	Centrarchidae	9.1	10.1	319	328	
166	3	7	smallmouth bass	Centrarchidae	8.9	8.6	319	328	
167	3	8	smallmouth bass	Centrarchidae	8.4	7.9	319	328	
168	3	9	smallmouth bass	Centrarchidae	9	9.1	319	328	
169	3	10	smallmouth bass	Centrarchidae	8.4	6.8	319	328	
170	3	1	golden redhorse	Catostomidae	30.3	300	350	202	
171	3	1	gizzard shad	Clupeidae	27.3	208	348	394	
172	3	2	gizzard shad	Clupeidae	22	112	348	394	
173	3	3	gizzard shad	Clupeidae	27.3	186	348	394	
174	3	4	gizzard shad	Clupeidae	24.7	166	348	394	
175	3	5	gizzard shad	Clupeidae	27.3	208	349	556	
176	3	6	gizzard shad	Clupeidae	27	208	349	556	
177	3	7	gizzard shad	Clupeidae	21.9	106	349	556	
178	3	8	gizzard shad	Clupeidae	23.9	134	349	556	
179	3	9	gizzard shad	Clupeidae	24.5	152	349	556	
180	3	10	gizzard shad	Clupeidae	25.4	168	349	556	
181	3	11	gizzard shad	Clupeidae	24.8	158	351	390	
182	3	12	gizzard shad	Clupeidae	25.3	168	351	390	
183	3	13	gizzard shad	Clupeidae	21.4	94	351	390	
184	3	14	gizzard shad	Clupeidae	21.8	98	351	390	
185	3	15	gizzard shad	Clupeidae	21.2	94	351	390	
186	3	16	gizzard shad	Clupeidae	17.4	50	351	390	
187	3	17	gizzard shad	Clupeidae	17.8	52.3	352	290	
188	3	18	gizzard shad	Clupeidae	18.6	62.8	352	290	
189	3	19	gizzard shad	Clupeidae	18.5	61	352	290	
190	3	20	gizzard shad	Clupeidae	18.9	64.4	352	290	
191	3	21	gizzard shad	Clupeidae	17.1	49.2	352	290	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
192	3	22	gizzard shad	Clupeidae	17.6	55.1	352	290	
193	3	23	gizzard shad	Clupeidae	19.6	77.2	352	290	
194	3	24	gizzard shad	Clupeidae	18.8	67.3	352	290	
195	3	25	gizzard shad	Clupeidae	18	56.1	353	314	
196	3	26	gizzard shad	Clupeidae	19.7	70.1	353	314	
197	3	27	gizzard shad	Clupeidae	18.6	65.1	353	314	
198	3	28	gizzard shad	Clupeidae	20.2	80.3	353	314	
199	3	29	gizzard shad	Clupeidae	21.1	90	353	314	
200	3	30	gizzard shad	Clupeidae	17.7	54	353	314	
201	3	31	gizzard shad	Clupeidae	19	70	353	314	
202	3	32	gizzard shad	Clupeidae	17.3	47	353	314	
203	3	33	gizzard shad	Clupeidae	10.9	12	355	250	
204	3	34	gizzard shad	Clupeidae	10.5	11.4	355	250	
205	3	35	gizzard shad	Clupeidae	14	23.3	355	250	
206	3	36	gizzard shad	Clupeidae	10.2	10.1	355	250	
207	3	37	gizzard shad	Clupeidae	11.8	16.2	355	250	
208	3	38	gizzard shad	Clupeidae	18.6	64	355	250	
209	3	39	gizzard shad	Clupeidae	10.9	12.2	355	250	
210	3	40	gizzard shad	Clupeidae	11.2	14.4	355	250	
211	3	41	gizzard shad	Clupeidae	10.5	11.9	355	250	
212	3	42	gizzard shad	Clupeidae	13.5	23.2	355	250	
213	3	43	gizzard shad	Clupeidae	11.9	14.6	355	250	
214	3	44	gizzard shad	Clupeidae	10	10.1	355	250	
215	3	45	gizzard shad	Clupeidae	9.1	6.9	355	250	
216	3	46	gizzard shad	Clupeidae	11.5	13.6	355	250	
217	3	47	gizzard shad	Clupeidae	11.8	15.1	355	250	
218	3	48	gizzard shad	Clupeidae	10	9.3	355	250	
219	3	49	gizzard shad	Clupeidae	10.1	10.5	355	250	
220	3	50	gizzard shad	Clupeidae	11.1	14.5	355	250	
221	3	51	gizzard shad	Clupeidae	10.1	9.8	355	250	
222	3	52	gizzard shad	Clupeidae	9.2	7.2	355	250	
223	3	53	gizzard shad	Clupeidae	9.5	9	355	250	
224	3	1	bluegill	Centrarchidae	15.3	80	356	268	
225	3	2	bluegill	Centrarchidae	14.6	74	356	268	
226	3	3	bluegill	Centrarchidae	13.2	46	356	268	
227	3	4	bluegill	Centrarchidae	13.5	52.4	356	268	
228	3	5	bluegill	Centrarchidae	14	61.9	356	268	
229	3	6	bluegill	Centrarchidae	13.9	58.3	356	268	
230	3	7	bluegill	Centrarchidae	13.4	58.6	356	268	
231	3	8	bluegill	Centrarchidae	13.5	51.4	356	268	
232	3	9	bluegill	Centrarchidae	12.6	44	332	306	
233	3	10	bluegill	Centrarchidae	11	27.8	332	306	
234	3	11	bluegill	Centrarchidae	9.4	17.8	332	306	
235	3	12	bluegill	Centrarchidae	10	19.8	332	306	
236	3	13	bluegill	Centrarchidae	8.6	13.8	332	306	
237	3	14	bluegill	Centrarchidae	10	20.6	332	306	
238	3	15	bluegill	Centrarchidae	8.1	9	332	306	
239	3	16	bluegill	Centrarchidae	7.5	7.4	332	306	
240	3	17	bluegill	Centrarchidae	6.1	4	332	306	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
241	3	18	bluegill	Centrarchidae	4.6	1.8	332	306	
242	3	19	bluegill	Centrarchidae	6.5	5.1	332	306	
243	3	20	bluegill	Centrarchidae	6.1	3.7	332	306	
244	3	21	bluegill	Centrarchidae	7.3	7.4	332	306	
245	3	22	bluegill	Centrarchidae	7.6	8.1	332	306	
246	3	23	bluegill	Centrarchidae	6.4	4.6	332	306	
247	3	24	bluegill	Centrarchidae	7.3	7.2	332	306	
248	3	25	bluegill	Centrarchidae	6.7	5	332	306	
249	3	26	bluegill	Centrarchidae	6.7	6	332	306	
250	3	27	bluegill	Centrarchidae	6	3.5	332	306	
251	3	28	bluegill	Centrarchidae	7.1	6.9	332	306	
252	3	29	bluegill	Centrarchidae	7.5	8	332	306	
253	3	30	bluegill	Centrarchidae	4.7	2	332	306	
254	3	31	bluegill	Centrarchidae	6.5	5.5	332	306	
255	3	32	bluegill	Centrarchidae	7.2	7.2	332	306	
256	3	33	bluegill	Centrarchidae	6.5	5	332	306	
257	3	34	bluegill	Centrarchidae	6.6	5	332	306	
258	3	35	bluegill	Centrarchidae	6.2	3.9	332	306	
259	3	1	longear sunfish	Centrarchidae	14.3	67.1	358	334	
260	3	2	longear sunfish	Centrarchidae	14.6	78.3	358	334	
261	3	3	longear sunfish	Centrarchidae	12	39.7	358	334	
262	3	4	longear sunfish	Centrarchidae	10.4	26	358	334	
263	3	5	longear sunfish	Centrarchidae	9.7	21.1	358	334	
264	3	6	longear sunfish	Centrarchidae	10.5	27.3	358	334	
265	3	7	longear sunfish	Centrarchidae	9.7	17.4	358	334	
266	3	8	longear sunfish	Centrarchidae	10	20.8	358	334	
267	3	9	longear sunfish	Centrarchidae	8.9	14	358	334	
268	3	10	longear sunfish	Centrarchidae	10	21.7	358	334	
269	3	11	longear sunfish	Centrarchidae	11.8	33.3	358	334	
270	3	12	longear sunfish	Centrarchidae	9.3	15.6	358	334	
271	3	13	longear sunfish	Centrarchidae	9.1	13	358	334	
272	3	14	longear sunfish	Centrarchidae	8.4	12	358	334	
273	3	15	longear sunfish	Centrarchidae	5.5	3.7	358	334	
274	3	16	longear sunfish	Centrarchidae	6	4	358	334	
275	3	17	longear sunfish	Centrarchidae	5.7	3.8	358	334	
276	3	18	longear sunfish	Centrarchidae	6.4	5.4	358	334	
277	3	19	longear sunfish	Centrarchidae	6.5	6.2	358	334	
278	3	20	longear sunfish	Centrarchidae	5.9	3.8	358	334	
279	3	21	longear sunfish	Centrarchidae	5.8	3.9	358	334	
280	3	1	striped bass	Percichthyidae	25.5	173	k	k	returned
281	3	1	sauger	Percidae	26	132	k	k	returned
282	3	2	sauger	Percidae	25.5	122	k	k	returned
283	3	3	sauger	Percidae	27	148	k	k	returned
284	4	1	bluegill	Centrarchidae	6.2	4.7	332	306	
285	4	2	bluegill	Centrarchidae	7.6	9	332	306	
286	4	3	bluegill	Centrarchidae	6.3	4.9	332	306	
287	4	1	longear sunfish	Centrarchidae	11.3	33.1	358	334	
288	4	2	longear sunfish	Centrarchidae	9.7	19.6	358	334	
289	4	3	longear sunfish	Centrarchidae	9.1	18.1	358	334	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
290	4	4	longear sunfish	Centrarchidae	6.6	6.7	358	334	
291	4	5	longear sunfish	Centrarchidae	6.6	6.6	358	334	
292	4	6	longear sunfish	Centrarchidae	6.5	5.5	358	334	
293	4	7	longear sunfish	Centrarchidae	6.2	5.3	358	334	
294	4	1	gizzard shad	Clupeidae	29.3	258	359	404	
295	4	2	gizzard shad	Clupeidae	24.6	156	359	404	
296	4	3	gizzard shad	Clupeidae	25.6	186	359	404	
297	4	4	gizzard shad	Clupeidae	24.1	134	359	404	
298	4	5	gizzard shad	Clupeidae	22.8	122	360	282	
299	4	6	gizzard shad	Clupeidae	20	76	360	282	
300	4	7	gizzard shad	Clupeidae	20.5	82	360	282	
301	4	8	gizzard shad	Clupeidae	19.5	74	360	282	
302	4	9	gizzard shad	Clupeidae	17.5	60	360	282	
303	4	10	gizzard shad	Clupeidae	18.6	58	360	282	
304	4	11	gizzard shad	Clupeidae	14	26.4	360	282	
305	4	12	gizzard shad	Clupeidae	14.2	24.3	355	250	
306	4	13	gizzard shad	Clupeidae	13.6	23.2	355	250	
307	4	14	gizzard shad	Clupeidae	12.5	19.7	355	250	
308	4	15	gizzard shad	Clupeidae	12.4	17.9	355	250	
309	4	16	gizzard shad	Clupeidae	11	12.7	355	250	
310	4	17	gizzard shad	Clupeidae	11.1	13.4	355	250	
311	4	18	gizzard shad	Clupeidae	11.3	14.6	355	250	
312	4	19	gizzard shad	Clupeidae	11.1	12.9	361	282	
313	4	20	gizzard shad	Clupeidae	10.8	12.4	361	282	
314	4	21	gizzard shad	Clupeidae	10.8	12.1	361	282	
315	4	22	gizzard shad	Clupeidae	12.2	18.5	361	282	
316	4	23	gizzard shad	Clupeidae	11.2	13.8	361	282	
317	4	24	gizzard shad	Clupeidae	11.5	15.1	361	282	
318	4	25	gizzard shad	Clupeidae	10.4	12.2	361	282	
319	4	26	gizzard shad	Clupeidae	10.3	11.4	361	282	
320	4	27	gizzard shad	Clupeidae	10.2	10	361	282	
321	4	28	gizzard shad	Clupeidae	9.6	9.1	361	282	
322	4	29	gizzard shad	Clupeidae	11	12.8	361	282	
323	4	30	gizzard shad	Clupeidae	9.8	9.4	361	282	
324	4	31	gizzard shad	Clupeidae	10.5	11.1	361	282	
325	4	32	gizzard shad	Clupeidae	9.4	8.9	361	282	
326	4	33	gizzard shad	Clupeidae	11	13.7	361	282	
327	4	34	gizzard shad	Clupeidae	10.6	11.8	361	282	
328	4	35	gizzard shad	Clupeidae	10.8	12.6	361	282	
329	4	36	gizzard shad	Clupeidae	10.1	10.6	361	282	
330	4	37	gizzard shad	Clupeidae	10.8	12	361	282	
331	4	38	gizzard shad	Clupeidae	11.1	13.8	361	282	
332	4	39	gizzard shad	Clupeidae	9.2	7.9	361	282	
333	4	40	gizzard shad	Clupeidae	9.7	9.4	361	282	
334	4	41	gizzard shad	Clupeidae	10	10.4	361	282	
335	4	42	gizzard shad	Clupeidae	10.7	12.7	361	282	
336	4	43	gizzard shad	Clupeidae	11.2	14.2	361	282	
337	4	44	gizzard shad	Clupeidae	10.1	10.3	361	282	
338	4	45	gizzard shad	Clupeidae	10.5	12	361	282	

#	Sub. #	No.	Common Name	Family	Length (cm)	Weight (g)	Bag #	Bag Wt (g)	Notes
339	4	46	gizzard shad	Clupeidae	11.5	14.8	361	282	
340	4	47	gizzard shad	Clupeidae	10.4	11.8	361	282	
341	4	48	gizzard shad	Clupeidae	9.9	9	361	282	
342	4	49	gizzard shad	Clupeidae	11.2	14	361	282	
343	4	50	gizzard shad	Clupeidae	9.5	8.6	361	282	
344	4	51	gizzard shad	Clupeidae	11.2	13.3	361	282	
345	4	52	gizzard shad	Clupeidae	10.2	11.5	361	282	
346	4	53	gizzard shad	Clupeidae	11	12.8	361	282	
347	4	54	gizzard shad	Clupeidae	10.4	10.8	361	282	
348	4	55	gizzard shad	Clupeidae	10.7	12	361	282	
349	4	56	gizzard shad	Clupeidae	10.5	12.3	361	282	
350	4	57	gizzard shad	Clupeidae	10.8	12.6	361	282	
351	4	1	golden redhorse	Catostomidae	28.4	290	362	460	
352	4	2	golden redhorse	Catostomidae	17.9	66	362	460	
353	4	1	river carpsucker	Catostomidae	40.2	812	362	460	
354	4	1	sauger	Perdidae	24.8	118	k	k	UC collection
355	4	2	sauger	Perdidae	26	124	k	k	returned
356	4	3	sauger	Perdidae	27.7	158	k	k	returned
357	4	1	freshwater drum	Sciaenidae	22.2	152	347	228	
358	4	1	smallmouth bass	Centrarchidae	12.3	25.5	347	228	
359	4	2	smallmouth bass	Centrarchidae	11.6	20.5	347	228	
360	4	3	smallmouth bass	Centrarchidae	9	9.2	347	228	
361	4	1	striped bass	Percichthyidae	16.8	54.4	347	228	
362	4	2	striped bass	Percichthyidae	15.8	46.5	347	228	
363	4	3	striped bass	Percichthyidae	12.8	25.9	347	228	
364	4	4	striped bass	Percichthyidae	16.8	54.8	347	228	
365	4	5	striped bass	Percichthyidae	15.3	45.1	347	228	
366	4	6	striped bass	Percichthyidae	21.2	110	k	k	returned
367	4	7	striped bass	Percichthyidae	24.9	194	k	k	returned
368	4	8	striped bass	Percichthyidae	26.3	236	k	k	returned
369	4	9	striped bass	Percichthyidae	20.7	98	k	k	returned
370	4	10	striped bass	Percichthyidae	19.2	84	k	k	returned
371	4	11	striped bass	Percichthyidae	19.6	88	k	k	returned