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REPORT

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Final Report

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# ELECTROFISHING SURVEY OF THE GREAT MIAMI RIVER

**DATE: 17 OCTOBER 1990**
**3 NOVEMBER 1990**

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BY: Dr. Michael C. Miller, Ph.D.
Lloyd Ross
William Rowe
Rebecca Bixby
Robert Davenport
James Engman

Department of Biological Sciences
University of Cincinnati, ML 006
Cincinnati, OH 45221
(513) 556-9751, 9758

Prepared for:
Environmental Safety Division
Westinghouse Materials Corp
Cincinnati, Ohio

**INTRODUCTION:**

This 1990 report is a continuation to our report on the status of the fishery of the Great Miami River in September 1989. A complete historical perspective is contained in Miller et al. (1987). This report will emphasize the comparison between the years, stations and on the status of the fishery in terms of numbers, biomass, species richness, and diversity. Although the collection was performed later this year than any of the other years surveyed, it should still provide comparable data for this level of sampling intensity. Therefore, with seven years of data we should be able to follow trends in the river biota. If deviations occur they may be apparent as changes in species composition or redundancy, changes in mean or modal length and weight, or as deviations in growth rates as observed in length-weight distributions between stations.

The samples were taken for uranium content of fillets. They were shipped as per instructions by Westinghouse Materials Company of Ohio to the IT Corporation, Oak Ridge, Tennessee. The fisheries analysis contained in this report focuses on the areas that are upstream of the Westinghouse Materials Company of Ohio facility at Fernald, Ohio and those potentially impacted by WMCO effluents.

**METHODS:**

Electrofishing with pulsed DC is amongst the most efficient methods of collecting fish samples unbiased with respect to size and species (Gammon 1976). Fish were electroshocked with a 240 volt, pulsed direct current transformer at 60 cps aboard a 16 foot flat-bottom boat. The anode is located at the end of a 10 foot boom and consists of 2-6 vertical cables, extending 4-5 inches beneath the surface of the water. The cathode,which is composed of 5 three foot long cables extending well under the bow of the boat. The electroshocking transformer is powered by a gasoline driven ONAN generator delivering 3500 watts of 120 volt AC at 29 amps. The shocker delivered about 3.6-4.2 amps depending on the conductivity of the water. Two persons standing behind a railing on the bow caught fish with 10 foot long dip nets. The netters are in control of the electroshocker with a foot-operated "dead-man" switch. The fish lose their equilibrium momentarily in the immobilizing electrical field allowing them to be netted. Some fish are drawn to the anode. Thus the effective area and depth may be dependent upon species and size of fish. Large fish are reported to be the most sensitive. Almost all recover in a aerated, central well(Vibert 1967). Some of the larger gamefish caught were identified, measured and released immediately after gill motion and equilibrium appeared normal.

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The fish are placed on ice immediately after a shocking sequence and brought back to a radiation-free laboratory at the University of Cincinnati. Fishes are identified to species, weighed, measured and their gender is determined (after Clay 1975, Pflieger 1975,Smith 1979, Trautman 1981). They are then decapitated, eviscerate and grouped by species group or trophic status into resealable plastic bags. These bags of fillets were weighed and adjusted to a nominal weight of => 400 gms. Fish from each station were processed as a group at a time. The area was then cleaned and fish from the next station were processed completely so that contamination between stocks could not occur.

Physical-chemical measurements from each station included: 1) temperature (C) and 2) dissolved oxygen (ppm $O_2$) both with a YSI Model 57 meter (Yellow Springs Instruments Co), 3) percent oxygen saturation assumes 1 atm. of pressure at the ambient river temperature taken from table 6-1 in Wetzel and Likens (1979) and 4) conductivity (umhos*cm-2) determined with a YSI Model 33.

**SITE DESCRIPTION:**

Three stations on the Great Miami River have been used for electrofishing every year since 1985 at about the same season, namely, late summer. In this sampling period, two additional stations were sampled seventeen days after the original collection. These stations will be useful for gradient analysis and determining potential impact farther downstream of the site.

Station I is at river mile 28 near the City of Cincinnati's Bolton Water Works, upstream of any WMCO influence. The site is a straight section of shallow pool below a sharp curve and above a small rapids. A backwater thumb projects from the section of pool behind a bar above the rapids. The shores of the thumb and river on both sides are covered with overhanging riparian vegetation, with many treefalls in the river. The average pool depth was 1.1 meters. Several snags on the bottom make this the best habitat for fish using the criteria of Gammon (1973) found on the Wabash and the Ohio Rivers. The pool is cobble covered, the sides are moderately steep and rocky on the eastern shore. The current here is faster than that found at site 3 and slower than station 2.

Station 2 is located at river mile 24 near Stricker's Grove Park and the outfall pipe from WMCO's stormwater treatment plant. The mixing zone is a deep, fast section of river with strong eddy currents just below. This site is on the outside of a long curve, the western shore. It is steep-sided with a fairly rapid current. Some riparian trees, either standing or fallen, provide good cover and high fish species diversity. The average pool depth here is 1.8 meters. This station always has the fastest current.

Station 3 is found at river mile 19.3, the outfall of Paddy's Run, which is the historic drainage route of the WMCO facility. It is a pool created by 25 years dredging by Welch's Sand and Gravel Co. The western shore is unaffected by the dragline operations and contains many submerged and emergent macrophytes, which provide excellent cover for young fish. The eastern shore is steep gravel without vegetation and is unattractive to most fish. The average pool depth is about 2 meters. The current is the slowest here and the site is pond-like in many respects.

Station 4 is located at aproximately river mile 1.2 and is a slow moving backwater of the Great Miami River with ideal habitat for a nursury.

Station 5 is at the mouth of the Great Miami River as it joins with the Ohio River.

**RESULTS:**

Physio-chemical data for 17 October 1990 show a slight increase in conductivity from upriver to Paddy's Run (table 1). The temperature increased throughout the day in a characteristic pattern of diurnal warming. The oxygen concentration and the percent oxygen saturation were similar at all stations (~9.7 ppm and 92%). In most of the past years this survey was conducted when the water level on the Great Miami River was at it's summer pool depth (~3.0 ft.), this year the water level was 5.1 ft.

This year we gathered 295 fishes from 14 species in 9 families from the traditional three stations, collectively (table 2). The most diverse families were the Suckers (Catostomidae) with 5 species. Centrarchidae was represented by 1 species this year compared to 6 last year. The number of species per station ranged from 7 to 10. The most numerous species was the gizzard shad (Clupeidae) with 229 individuals followed by river carpsucker (Catostomidae) n=20, freshwater drum (Scianidae) n=10, and the carp (Cyprinidae) n=7. The number of species caught do not differ statistically between stations but do between years ($p = 0.015$). This is most likely a result of the late sampling and the low number of Centrarchidae found this year.

We electroshocked stations 1, 2 and 3 for 45.1, 41.8 and 47.5 minutes, respectively. We collected 49, 42 and 94 fish from the respective stations (table 2). Stations 4 time is not available but had 89 fish collected and station 5 was sampled for 23 minutes and had 26 fish taken. The susceptibility of fish to shocking varies with topography of the shore, the depth of the pool, the nature of the current and with the amount vegetation in and over the water (Yoder and Gammon, 1976). The number of fish caught per hour 65, 60 and 119 from sites 1, 2 and 3 reveals a very high harvest from station 3 relative to 1 and 2. We believe this increase is due to the deepwater found at station 3, which is preferred habitat of gizzard shad, the dominant fish at station 3. The lower numbers taken from stations 1

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and 2 are believed to be due to swift currents moving fish out of reach of the nets and reducing the boats maneuverability and not because of an absence of fish or suitable habitat. These observations are not statistically different from the catches of previous years by one-way analysis of variance (table 3) (Systat, Systat, Inc.) However the stations do show a significant difference (p = 0.041). This is from the high density of gizzard shad found at site 3.

TABLE 3. **THE NUMBER OF FISH ELECTROSHOCKED/hr AND THE NO. OF SPECIES IDENTIFIED AT EACH STATION BY YEAR, 1984-1989.**

| | INDIVIDUALS/hr | | | SPECIES | | |
|---|---|---|---|---|---|---|
| YEAR STATION | I | II | III | I | II | III |
| 1984 | | - | - | - | 15 | 12 | 15 |
| 1985 | | 104 | 84 | 314 | 11 | 19 | 16 |
| 1986 | | 89 | 79 | 266 | 12 | 15 | 16 |
| 1987 | | 73 | 75 | 102 | 10 | 11 | 10 |
| 1988 | | 146 | 195 | 154 | 15 | 12 | 15 |
| 1989 | | 120 | 69 | 136 | 13 | 12 | 16 |
| 1990 | | 65 | 60 | 119 | 8 | 10 | 7 |
| MEAN | | 100 | 94 | 182 | 12 | 13 | 14 |

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ONE-WAY ANOVA COMPARISONS BY YEAR AND STATION

| VARIABLE | F RATIO | PROBABILTY |
|---|---|---|
| FISH/hr X YEAR | 0.907 | 0.508 |
| FISH/hr X STATION | 3.976 | 0.041 * |
| SPECIES X YEAR | 3.993 | 0.015 * |
| SPECIES X STATION | 0.459 | 0.639 |

The diversity of fishes at each station was measured by the information theory using log base 2 (H') (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. The maximal diversity (Hmax) that can be attained in any sample is fixed by the number of species, assuming evenness in the number of individuals in all species. Gizzard shad dominated the fish community at all stations and their numbers had the greatest effect on diversity (Table 4 ). The highest diversity and evenness was found at station 1 (H'= 2.33, E = .78)(Fig. 1), the site with a relatively low number of gizzard shad (31 out of 49) and high river carpsuckers (n = 7). At stations 1 and 2 gizzard shad accounted for over 63 and 61% of all fish taken but at stations 3 and 4 the shad comprised 83 and 87% of all fish sampled. The percentage would most likely be similar at station 5 but many shad had to be released during sampling. This would also lower the diversity and evenness but not significantly. The results are not significantly different from previous years for sites 1, 2 and 3. Station diversity and evenness for this sampling shows the highest upstream, declining downriver. The 7 year mean for Hbar and Evenness shows a trend of II>III>I. The one-way anova reveals a significant difference in mean evenness between station (p=0.009, table 5).

TABLE 5. **SPECIES DIVERSITY AND EVENNESS USING INFORMATION INDEX (log base 2) BY STATION AND YEAR, 1984-1989.**

| | | H' | | | EVENNESS | | |
|---|---|---|---|---|---|---|---|
| YEAR | STATION | I | II | III | I | II | III |
| 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 |
| MEAN | | 2.32 | 2.58 | 2.01 | 0.66 | 0.74 | 0.48 |

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ONE-WAY ANOVA COMPARISONS BY YEAR AND STATION

| VARIABLE | F RATIO | PROBABILITY |
|---|---|---|
| H' X YEAR | 0.826 | 0.569 |
| H' X STATION | 1.420 | 0.268 |
| EVENNESS X YEAR | 0.375 | 0.883 |
| EVENNESS X STATION | 6.177 | 0.009 * |

Differences in community structure can be seen by comparing the similarity of species composition from the three stations. The community coefficient (CC) is a measure of the proportion of species shared by any two locations. 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)

$$CC = 2c / a+b$$

A CC of 1.0 means the two stations 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 pollutional gradient. The community coefficient between stations I and II was 0.0.56 this is quite similar to the CC of stations II and III, 0.59. The degree of similarity between sites I and III was lower (0.40) (table 4 and fig 2). Between stations 3, 4 and 5 all community coefficients were greater than 0.7 (3-4, 0.77; 3-5, 0.83; 4-5, 0.73). All comparisons between sites 1 or 2 and 3, 4 or 5 were below 0.63 (2-4). The community coefficients may indicate that stations 1 and 2 should be considered to be similar to each other but different from stations 3, 4 and 5, which are similar.

We examined the mean weight (fig. 3) and length of fish by station (fig 4). Unlike past years, the largest fishes occur at station 2 (316.4 gm, 29.4 cm) followed closely by station I (289.2 gm, 30.3 cm) and station III a distant third (187.4 gm, 23.5 cm). Stations 4 and 5 had even lower mean sizes (65.8 and 110.0 gm, 15.0 and 21.1 cm) Table 6 shows the historical mean lengths and mean weights of fishes at the traditional three sites. This year also reveals a significant difference in mean fish length and weight between the stations (p =0.0200, 0.039) using one-way anova.

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TABLE 6. **MEAN WEIGHT AND LENGTH OF FISHES CAUGHT BY STATION AND YEAR, 1985-1989.**

| | | WEIGHT (gm) | | | LENGTH (cm) | | |
|---|---|---|---|---|---|---|---|
| YEAR | STATION | I | II | III | I | II | III |
| 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 |
| MEAN | | 322 | 257 | 127 | 26.2 | 25.3 | 20.1 |

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ONE-WAY ANOVA COMPARISONS BY YEAR AND STATION

| VARIABLE | F RATIO | PROBABILITY |
|---|---|---|
| WEIGHT X YEAR | 1.498 | 0.262 |
| WEIGHT X STATION | 4.047 | 0.039 * |
| LENGTH X YEAR | 1.839 | 0.180 |
| LENGTH X STATION | 5.176 | 0.020 * |

We calculated the weight and length frequency distributions (table 7). We found the modal weight to be between 100-125 grams for fishes caught at stations 3 and 125-150 grams for fishes from site 1 and 2 (fig. 5, fig 6 enlarged fig 5). Station 4 shows a modal weight of 25-50 grams and 5 at 75-100 grams. Figure 7 represents the weight distribution as the cumulative proportion of fish. The slope of the line from each station rises with of the abundance of a particular weight class. Station 3, 4 and 5 has the greatest initial slope due to the predominance of small shad (>80% of fish < 200 gm). Station 1 and 2 show very similar line with nearly 65% of these fish weighing less than 200 gm. Site I has the lowest slope as result of the absence of young-of-the year (Y-O-Y) fishes. Using one-way anova and subsequent tukey HSD multiple comparisons (Systat, Systat, inc.) it is seen that station comparisons 1-4, 2-3, 2-4 and 3-4 are significantly different ($p = 0.05$) in mean weight (Appendix F)

The length frequency distributions (fig. 8) show the modal lengths of fishes at site I (27-29 cm) was greater than site II (24-26 cm) which was greater than site III (20-22 cm) which was greater than site 5 (18-20 cm) and site 4 the shortest (12-14 cm). The cumulative percent frequency by length diagram (fig. 9) is a sigmoid plot since few fish under 10 cm were netted. The curves from stations I and II are close, separated only by 4 cm. Site IV shows almost 60% of the fish less than 14 cm, mostly young of the year shad. One-way anova and then tukey HSD multiple comparisons (Systat, Systat, inc.) shows that the mean length between all station comparisons except 1-2 and 3-5 are statistically significant at or below $p = 0.038$ (Appendix F).

We've determined that the five stations vary in the sizes of residents and that there is some overlap in the species present at the stations. In order to determine if the fish are growing at the same

rate at all stations, we plotted length X weight of the most common species or families at all sites. This length to weight relationship is a condition factor or fatness factor per unit length. Fish in poor condition will be longer per unit weight than fish in good condition. Among small fish, especially Y-O-Y, the probability of overwinter survival is a function of condition. If one station had fish below the length X weight plots of the other two stations, then we could infer that growth conditions were not as good because of a lack of food or pollutional stress.

Figure 10 shows 7 carp from the five sites. One carp from station 3 may indicate a stressed condition but all others appear to be healthy. Figure 11 is a scattergram of gizzard shad from sites 1, 2 and 3. A tight pattern exists up to 22 cm. As fish age or grow longer, their condition or weight will be more variable. Not surprisingly, more large shad are found at site 1, the upstream station. This is likely a result of the young of the year surviving in previously unsampled backwater nurseries such as site 4. Fig 12 shows a scattergram of site 1, 4 and 5. This curve is expected for as fish will reach maximal length and slow growth but continue to put on mass. All of the stations together produce a very tight curve showing many small shad at site 4 with less frequent large shad usually located at site 1. The length X weight relationship for the Sucker family (Catostomidae, fig. 14) shows a large gap from 25-33 cm. The lack of individuals in this size class was evident last year but at 15-24 cm. It may be an artifact from a low birth year during the low flows of 1987 and 1988. Overall the scattergram suggests equal growth. Only 1 largemouth bass (Centrarchidae) was caught this year. It was captured at station 2, below the effluent outfall along a sandbar. The poor representation of the Centrarchidae may be due to the late season and the movement of sunfish and bass to the Ohio for overwintering. The invertebrate (the common food item of Centrarchidae) density may also be sparse at this late season.

Several points, such as mean length, mean weight, eveness, and total numbers shocked, have indicated that station 3, 4 and 5 may be different in community structure. To further investigate this change in communities, the percentage similarities were calculated from a double standardization of the raw counts (Table 8) to avoid the heavy weighting of extremely dominated communities (shad in 3 and 4) and graphed by using the Bray-Curtis or Wisconsin polar ordination (see Cottam, Goff, and Whittaker, 1973). The percent similarities confirms the results of the community coefficient but it is more dramatic (Fig 15). The percent similarity takes in to acount not only the presences absence but also the proportions that each species is found. It has been shown that many communities may only score 85% similarity to replicate samples of the same community. Samples 3, 4 and 5 are all scored at least 45 % similar to each other (Table 8). Station 2 is only 11% similar to 5 and 31 and 30% to 3 and 4. Station 1 is rated as 16% similar to 3, 4 and 5 and 32% to 2. The Bray-Curtis ordination graphs communities along the x-axis based on dissimilarity using the most dissimilar sites as the end points. The y-axis is graphed using two different end points but still based on dissimilarity. The Bray-Curtis ordination clusters groups stations 3, 4 and 5 with 1 and 2

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appearing not as tightly grouped but distinctly seperate from the three downstream sites (fig 16). The grouping of the downstream communities is most likely due to a change in river morphometry and habitat along with a greater influence from the Ohio river on the composition of the fish communities. This change of communities over a spatial gradient is not a surprising event.

**SUMMARY**

The fishery of the Great Miami River been stable over the last seven years, 1984-1990. The species pool over 7 years is 46 species, compared to the 110 species which have been identified in this section of the Ohio River (Pearson 1989). The lower stations (3, 4 and 5) are influenced by the backwater species which migrate up from the flow-controlled Ohio River. On the average, largest fish occur upstream of the WMCO facility at Fernald, OH, at station I and tend to get smaller as one goes downstream (station II > station III > V > IV) as gizzard shad become more dominate and the frequency of young of year increases. For this sampling the diversity (H') of the fish community is greatest at site I. Slightly lower diversity is downstream at site II, where the WMCO effluent pipe discharges into the river and the most redundant community is found at site III, the confluence of Paddy's Run and the Great Miami River. The greatest number of species occur at site II>I>III>IV>V. Site I is has higher diversity due to a more equitable distribution amoung the species. The jumble of indicators is a result of the variable habitat and stream morphology found at the five stations. The stations were chosen primarily to capture fish which may have impacted upon by WMCO effluent or runoff. Secondary consideration is the availability of a convenient launch site. Despite the habitat differences, fish from all sites appear to be the same condition of health, as seen in the length X weight plots. In conclusion, fishes of the Great Miami River show significant differences in weight and length by station and in community evenness by station.

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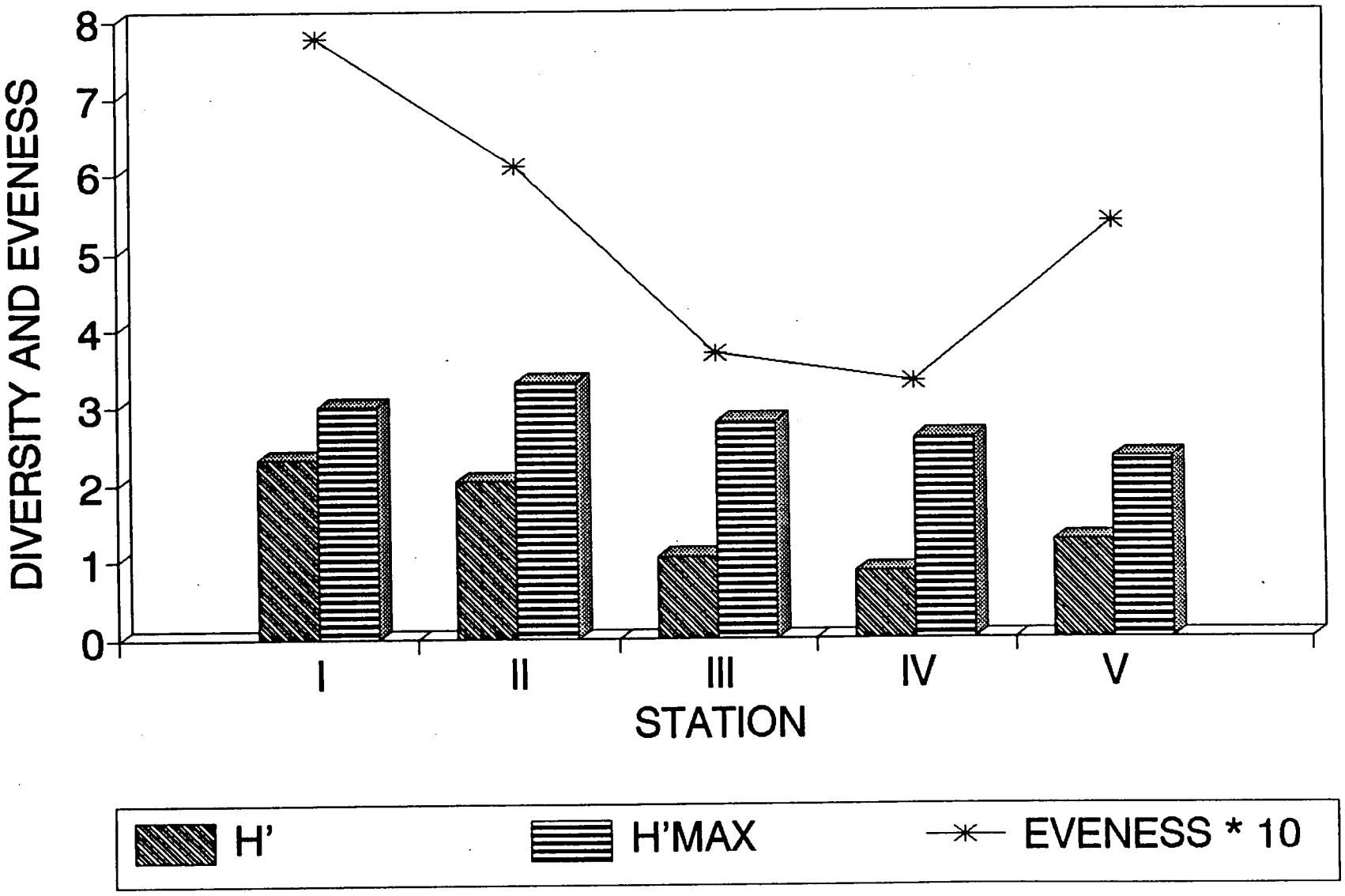
# DIVERSITY AND EVENNESS
## BY STATION, GREAT MIAMI RIVER, 1990

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# COMMUNITY COEFFICIENTS BETWEEN STATIONS
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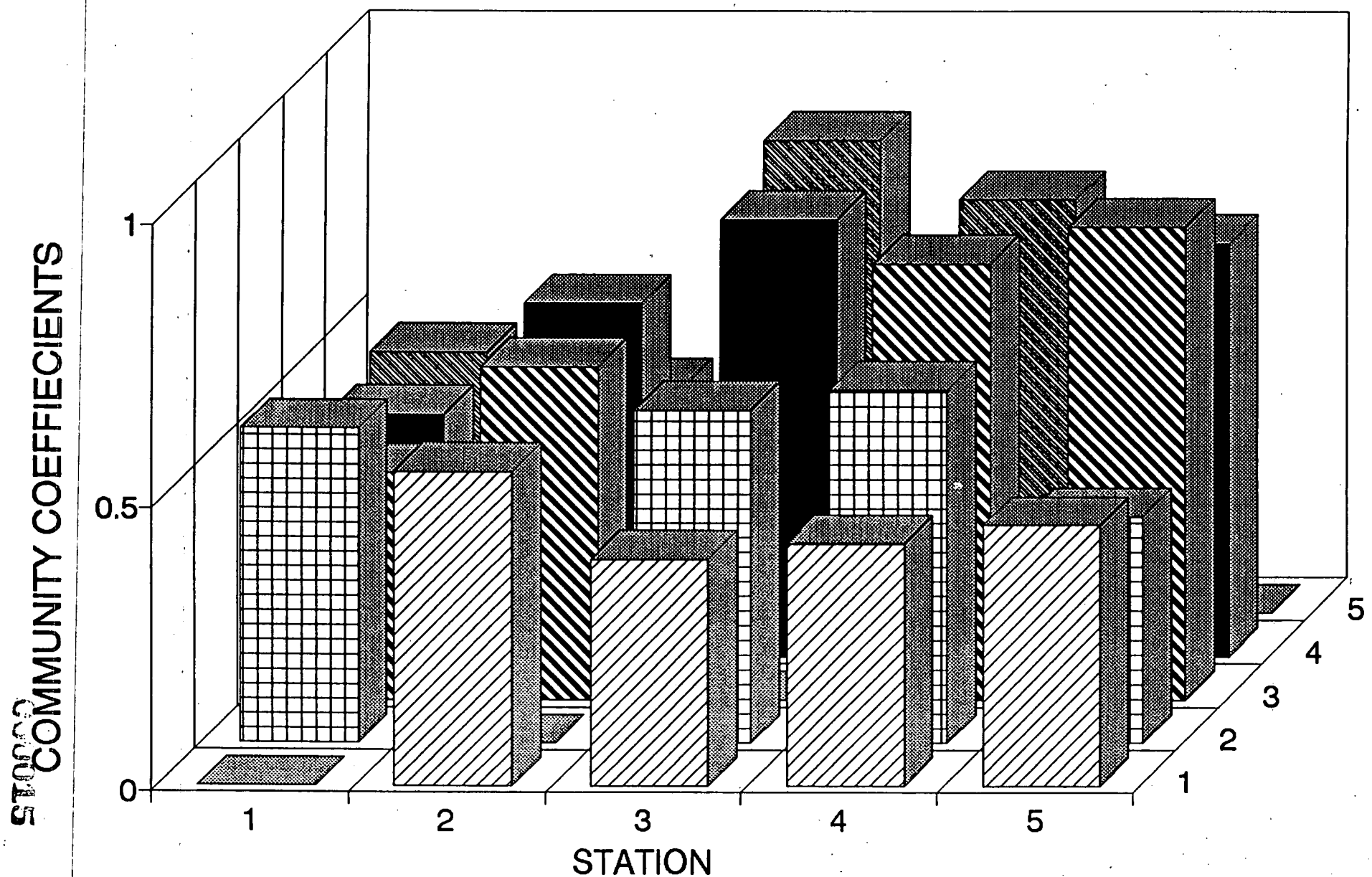


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# MEAN FISH WEIGHT BY STATION

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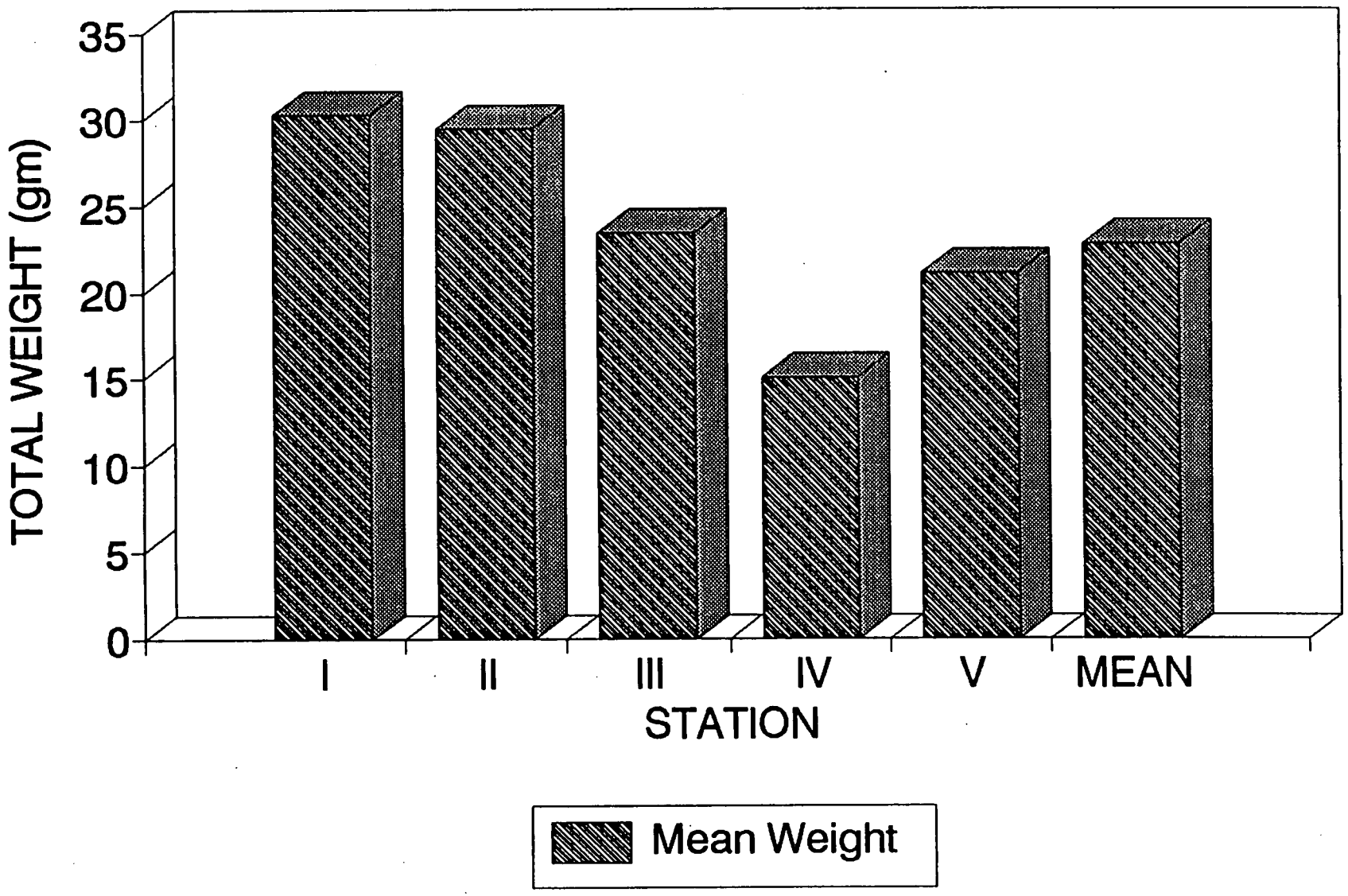


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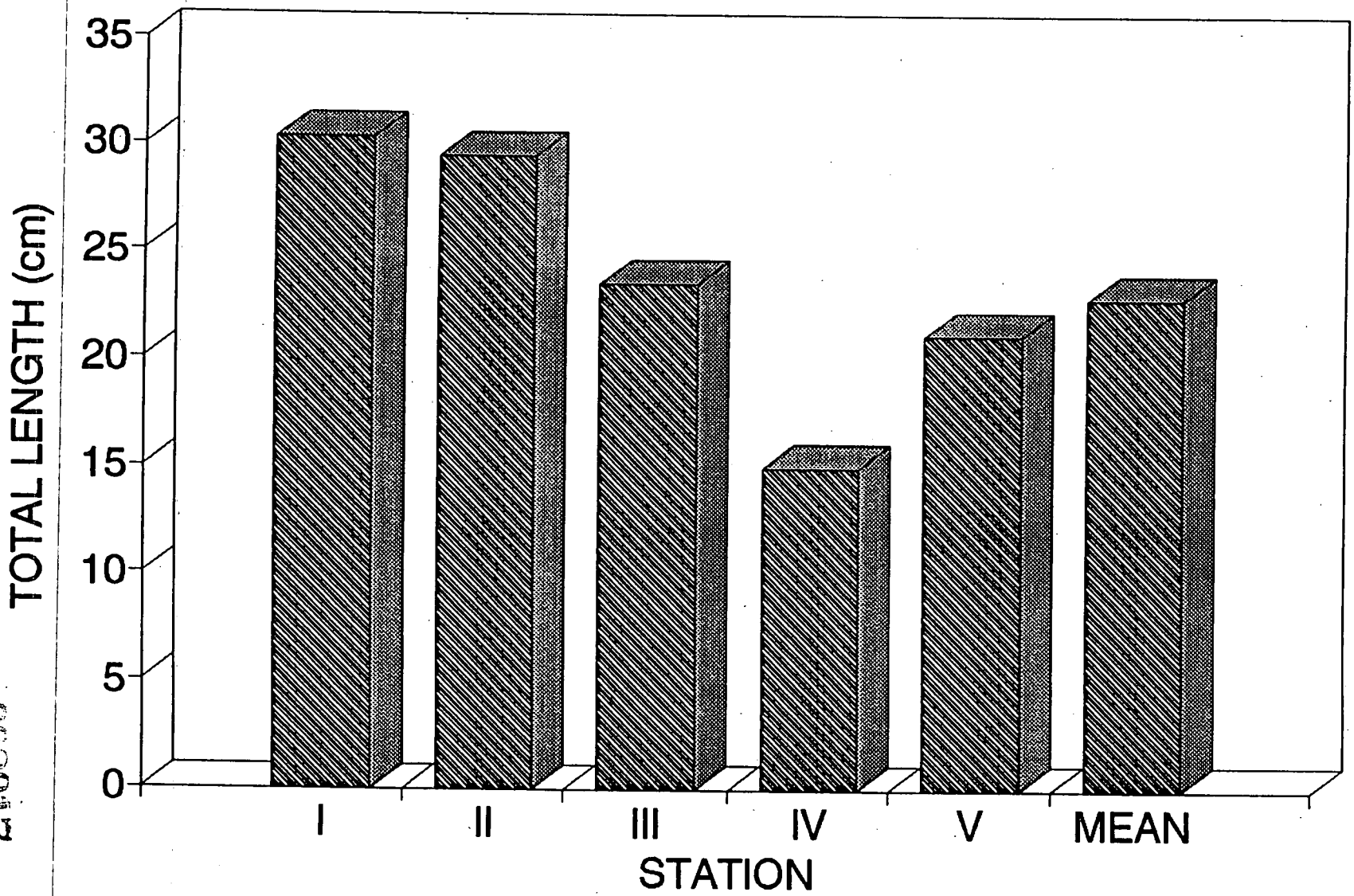


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# WEIGHT FREQEUNCY DISTRIBUTION
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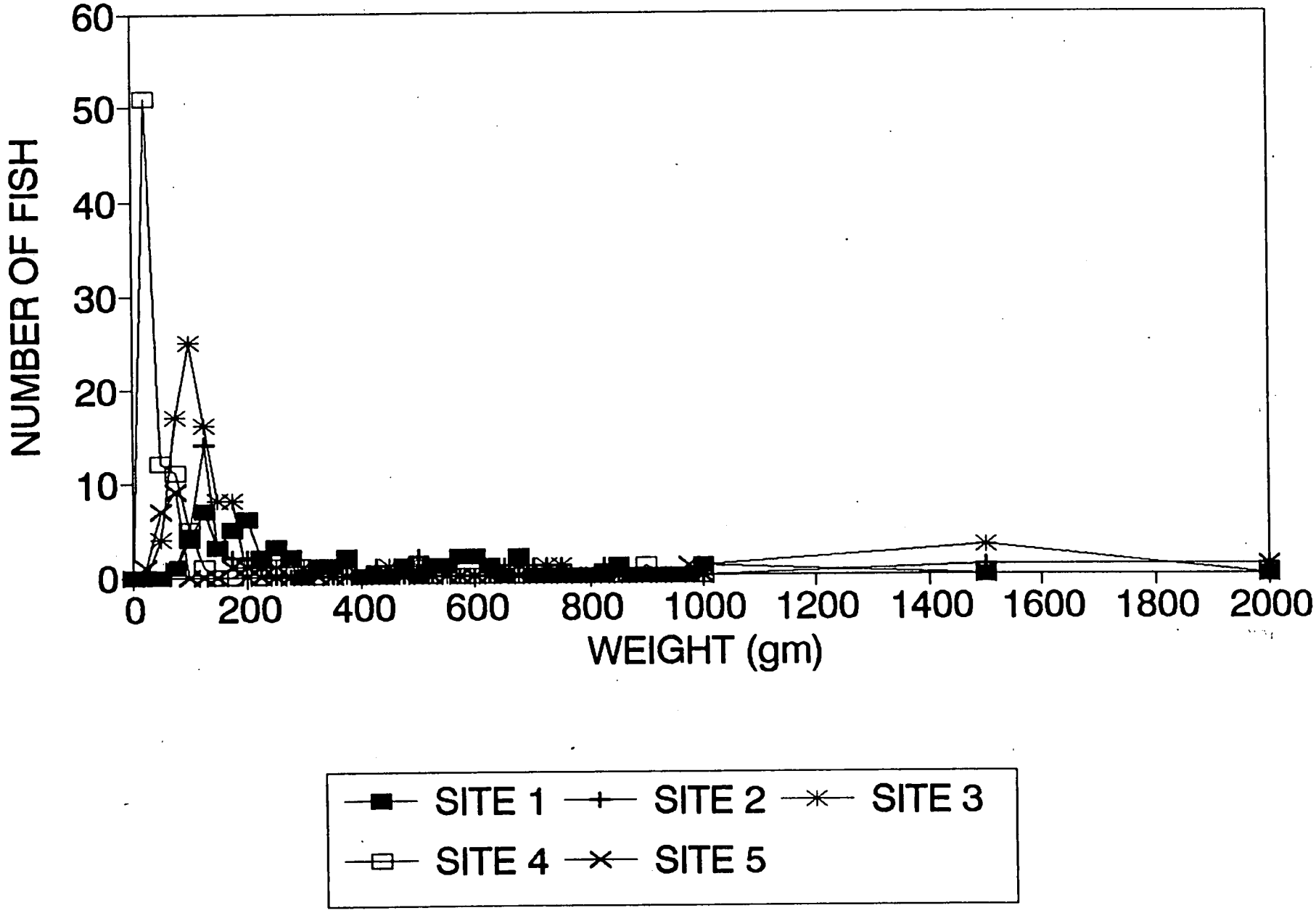


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# WEIGHT FREQEUNCY DISTRIBUTION (<600 gm)
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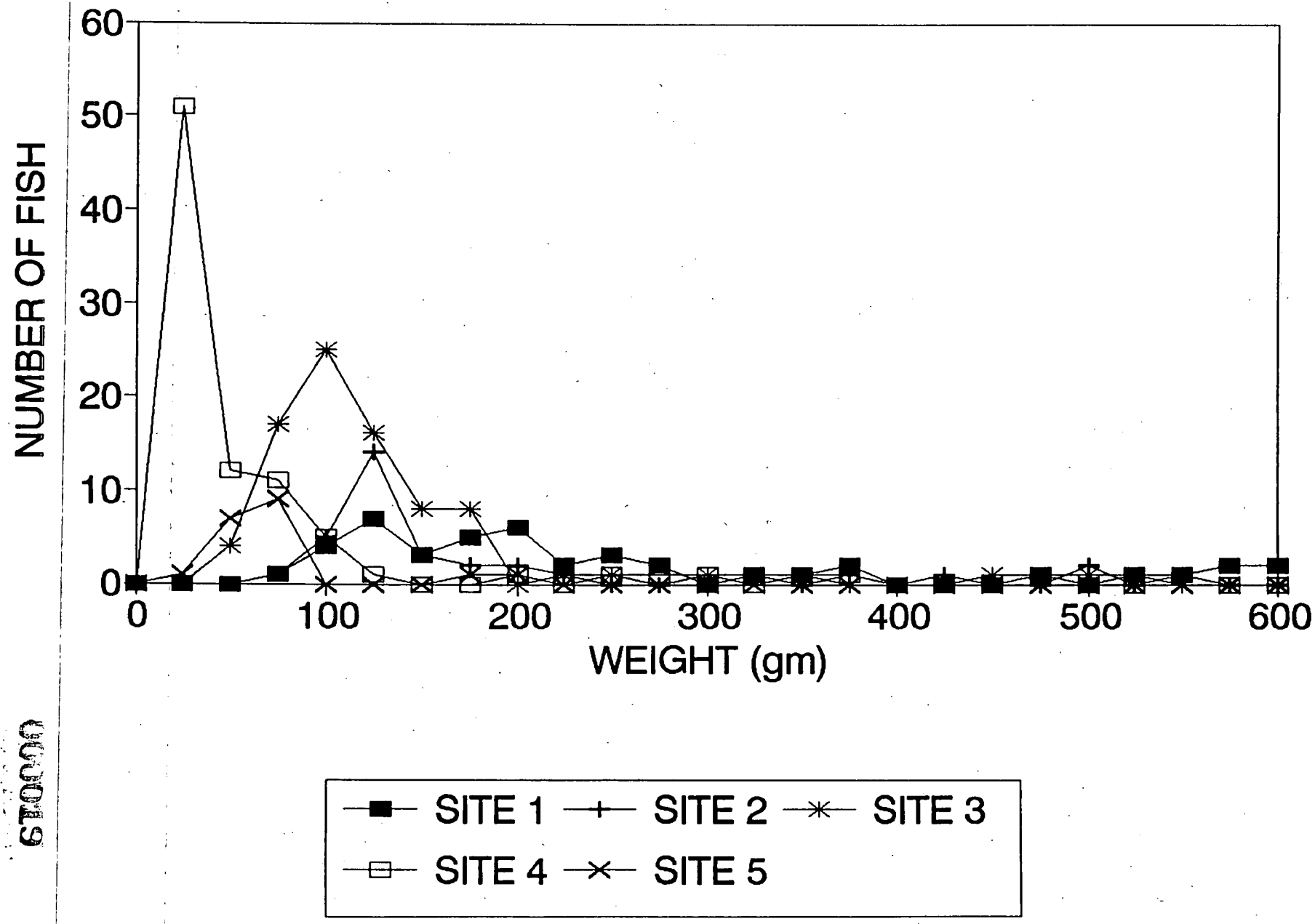


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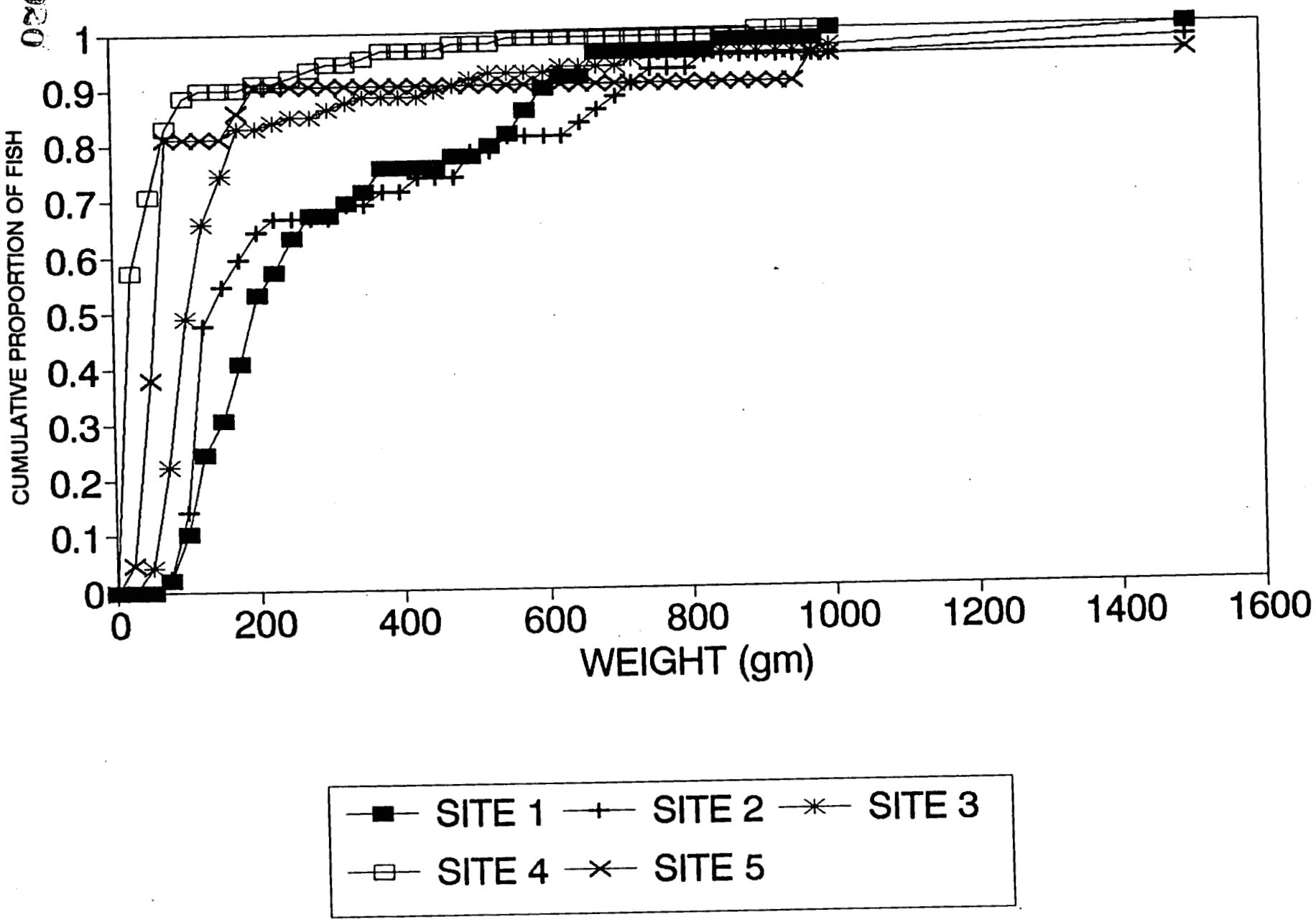
# CUMULATIVE WEIGHT DISTRIBUTION
# GREAT MIAMI RIVER, AUTUMN 1990

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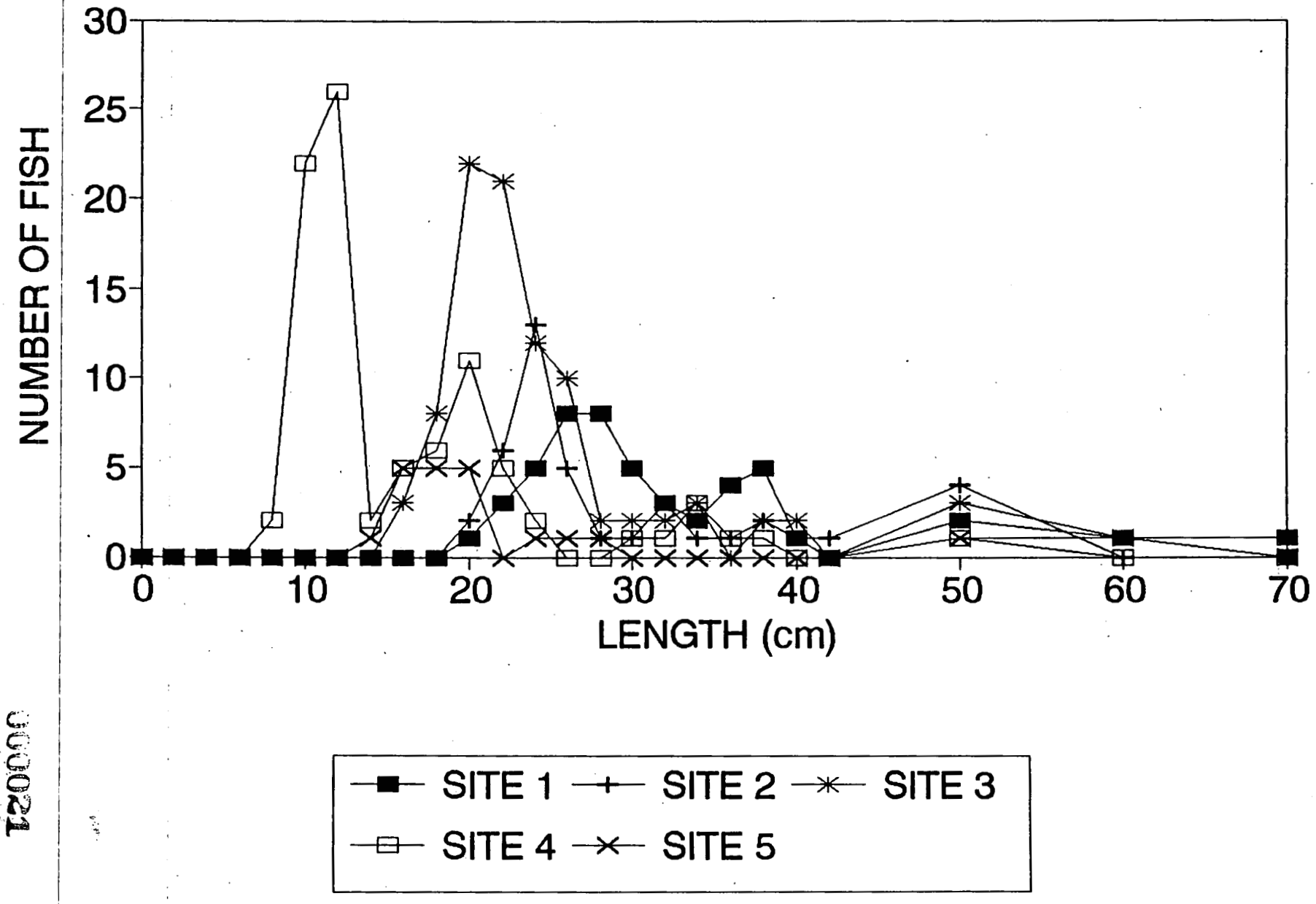
# LENGTH FREQEUNCY DISTRIBUTION
## GREAT MIAMI RIVER, AUTUMN 1990

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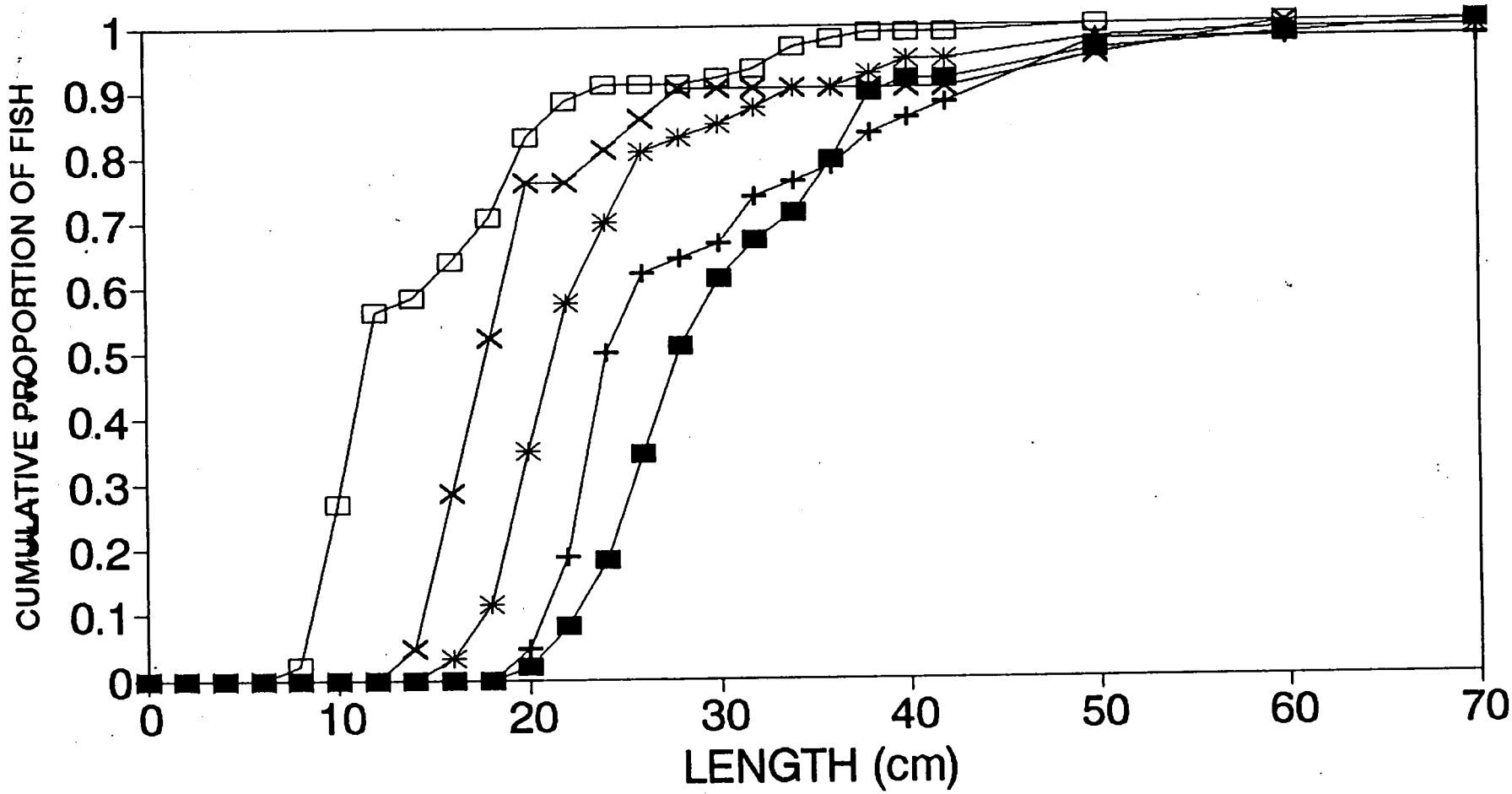
# CUMULATIVE LENGTH DISTRIBUTION
# GREAT MIAMI RIVER, AUTUMN 1990




SITE 1 SITE 2 SITE 3
SITE 4 SITE 5

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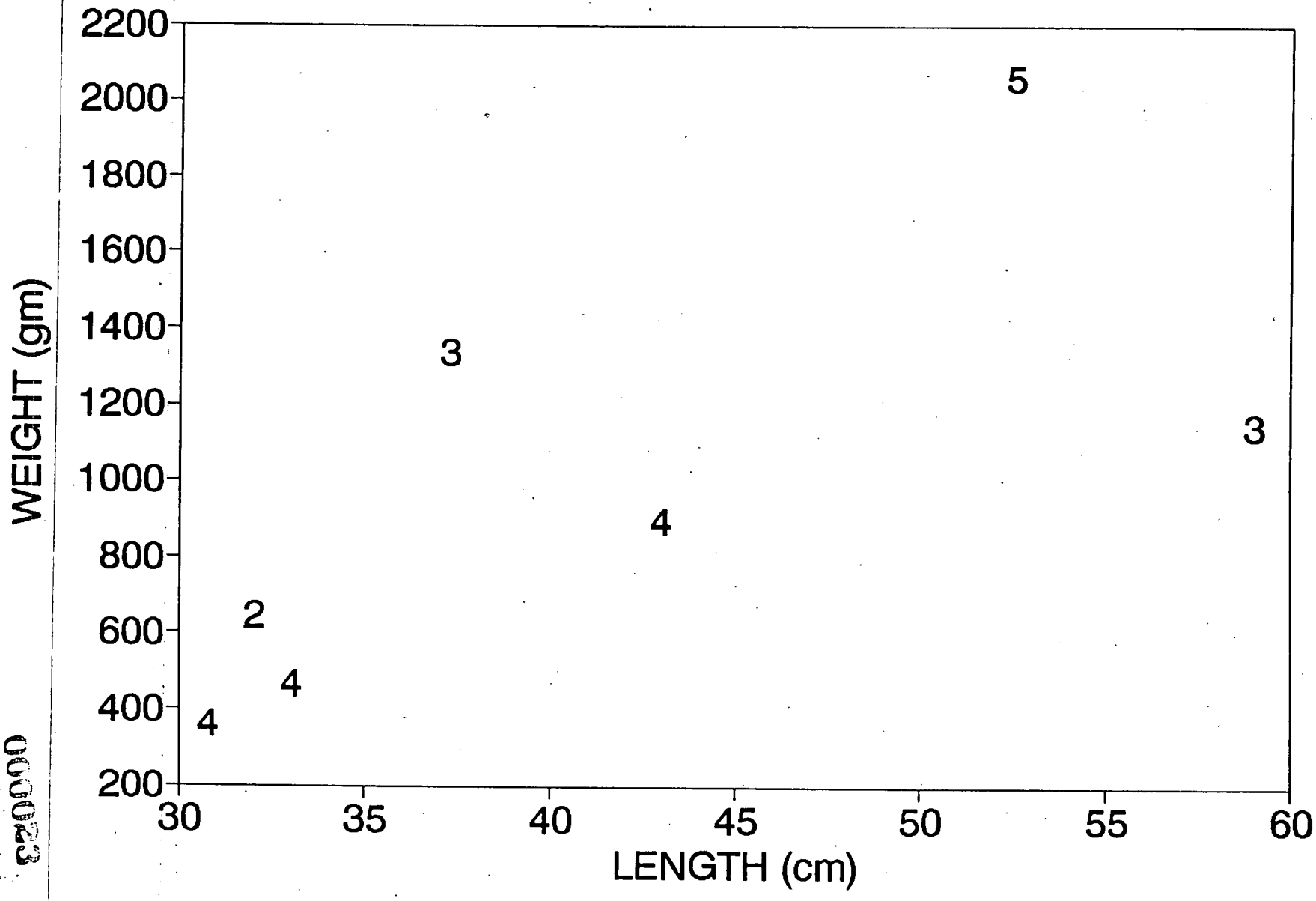
# LENGTH/WEIGHT RELATIONSHIP CARP BY STATION, GREAT MIAMI RIVER, 1990

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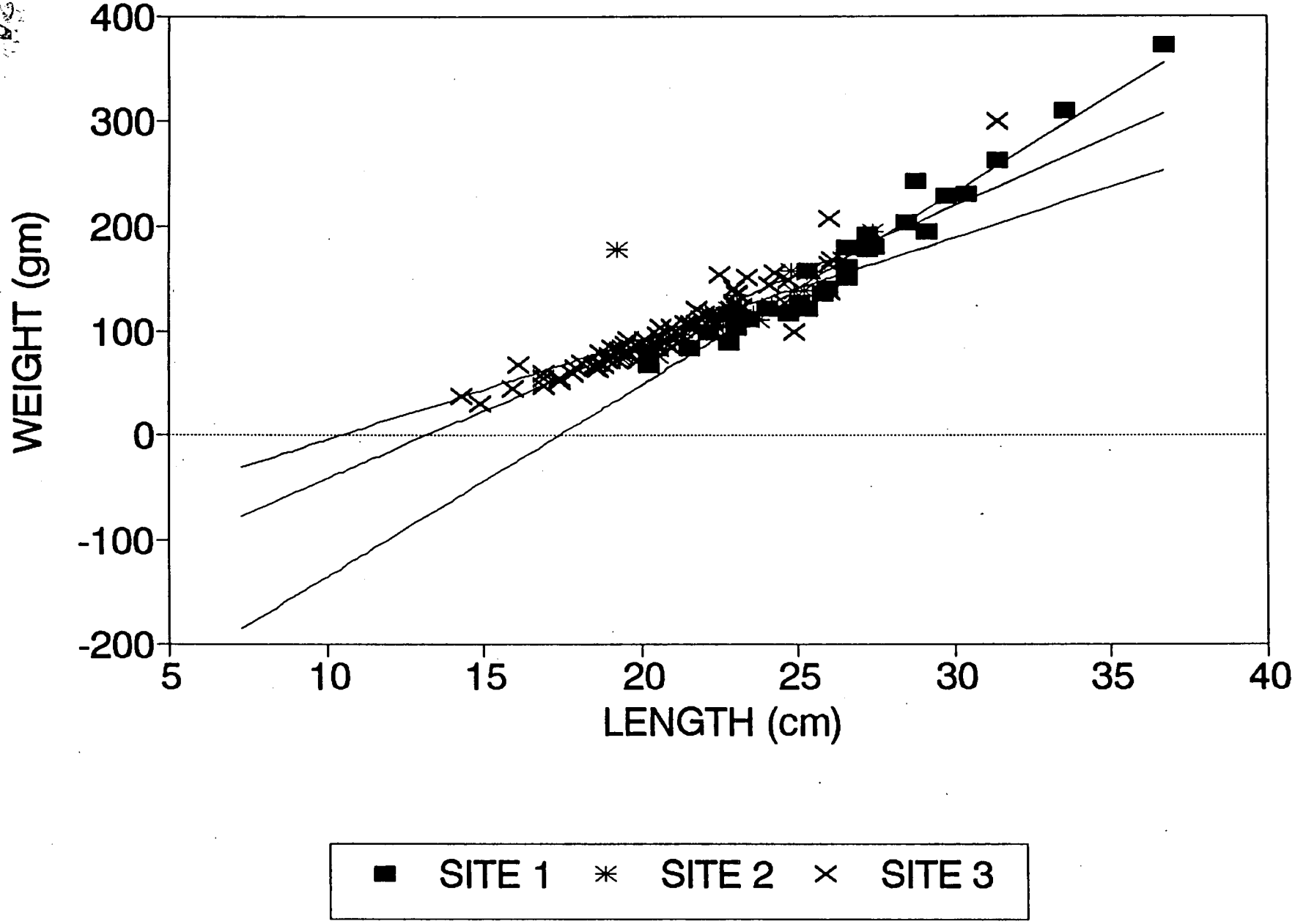
# LENGTH/WEIGHT RELATIONSHIP GIZZARD SHAD
# GREAT MIAMI RIVER, OCT 1990

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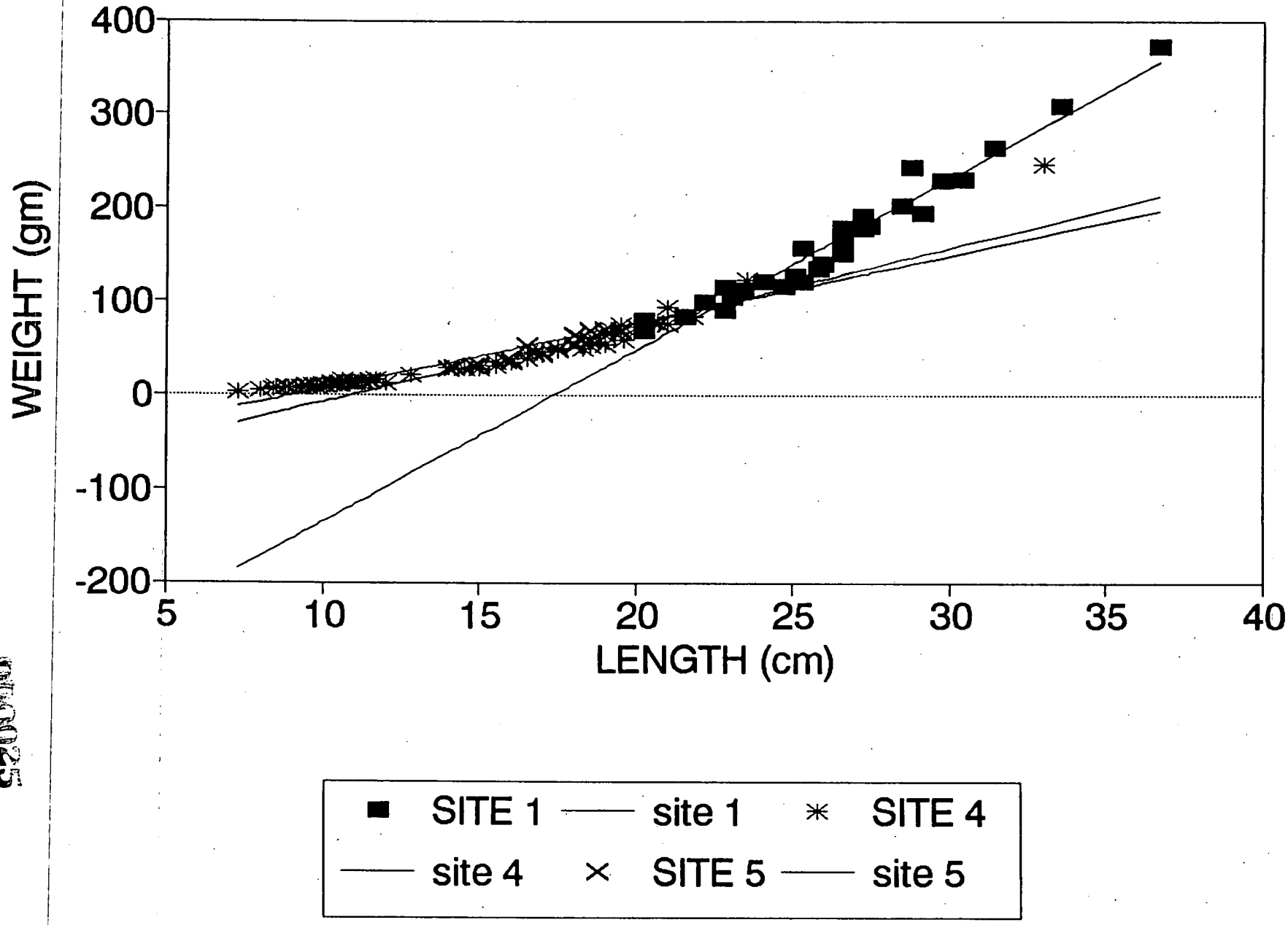
# LENGTH/WEIGHT RELATIONSHIP GIZZARD SHAD
# GREAT MIAMI RIVER, AUTUMN 1990

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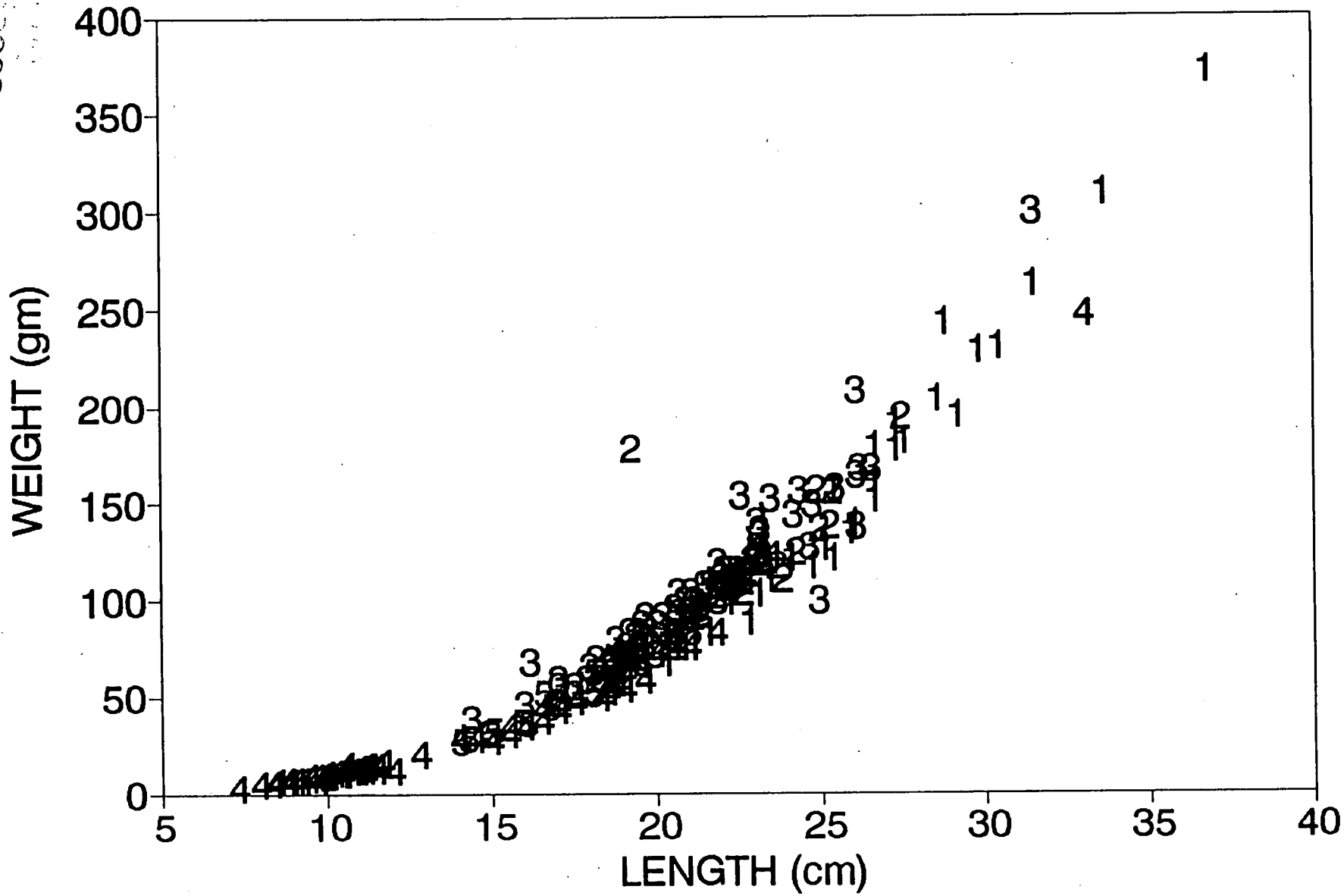
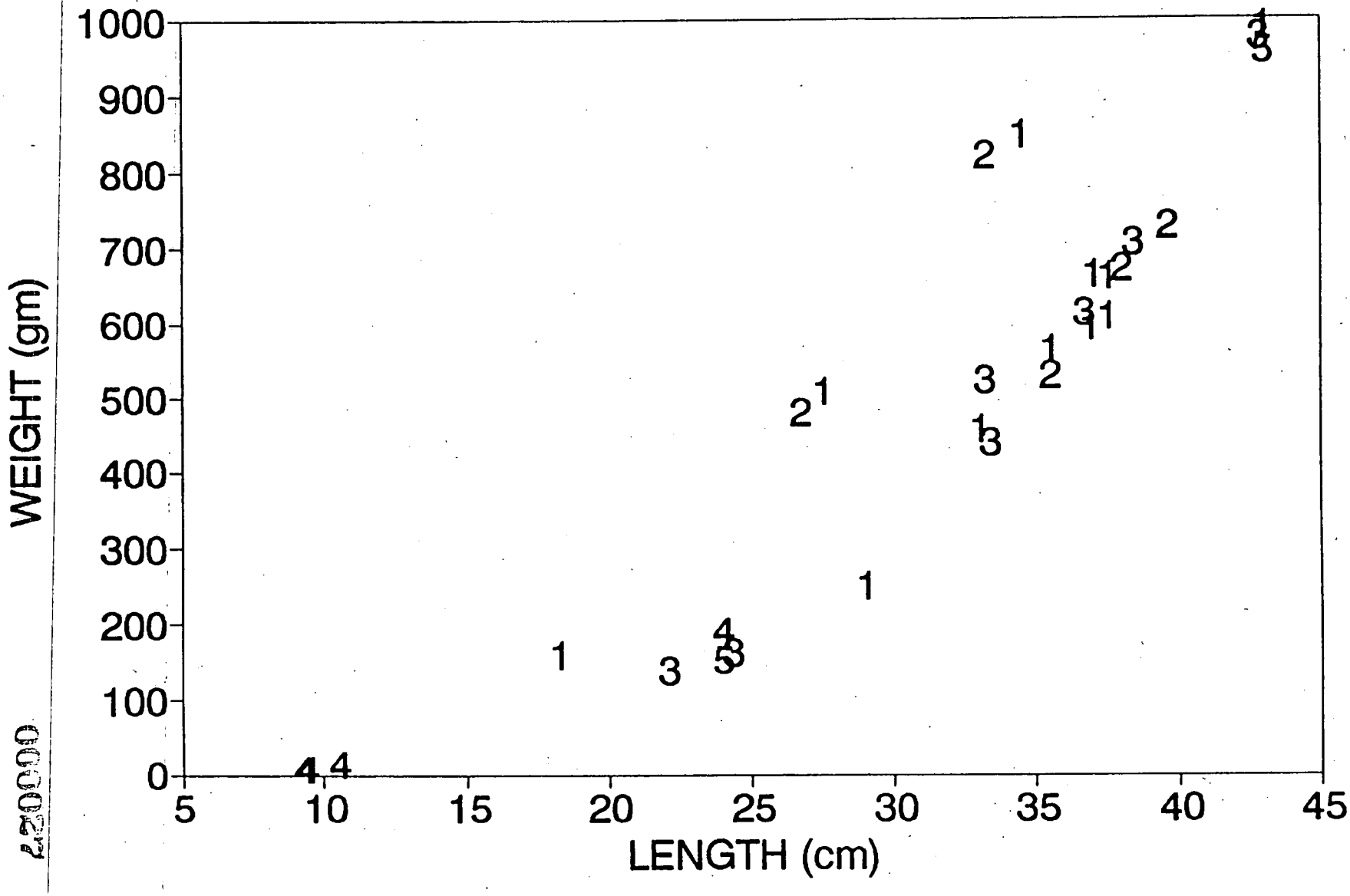
# LENGTH/WEIGHT RELATIONSHIP GIZZARD SHAD BY STATION, GREAT MIAMI RIVER, 1990



# LENGTH/WEIGHT RELATIONSHIP SUCKERS
## BY STATION, GREAT MIAMI RIVER, 1990

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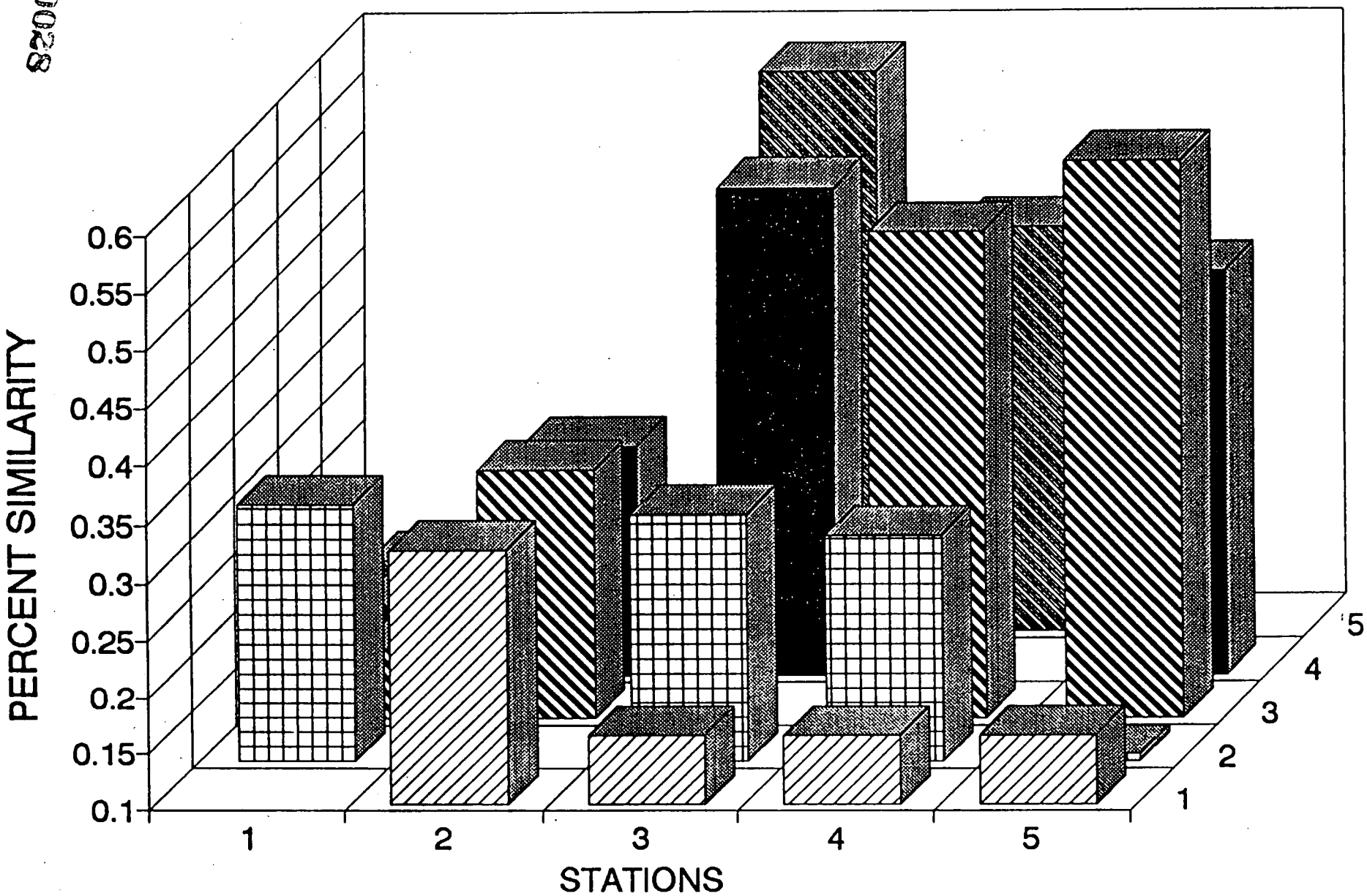
# PERCENT SIMILARITY FOR ALL STATIONS (DOUBLE STANDARDIZED) ON THE GMR

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# BRAY-CURTIS POLAR ORDINATION FOR STATIONS FROM THE GREAT MIAMI RIVER

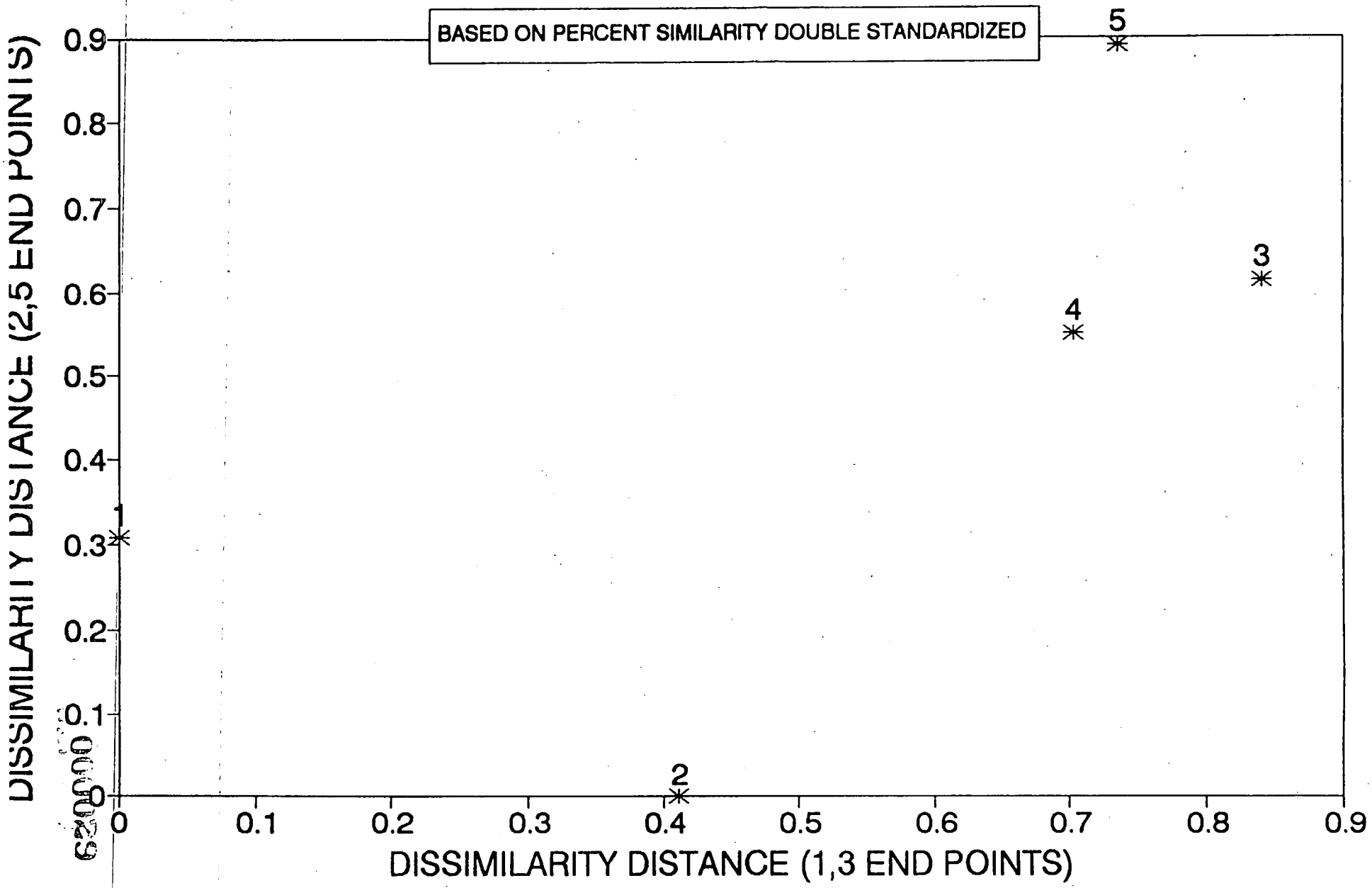


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Table 1. Physical characteristics of Great Miami River, Autumn 1990

| | TEMP. ( C) | OXYG (ppm) | % O2 S | COND. (umhos/cm) | TIME | SHOCK TIME | # of fish | fish/hour |
|---|---|---|---|---|---|---|---|---|
| SITE 1 | 13.70 | 9.50 | 89.62 | 627.00 | 8:48 | 45.10 | 49.00 | 65.19 |
| SITE 2 | 14.00 | 9.80 | 94.50 | 616.00 | 11:17 | 41.80 | 42.00 | 60.29 |
| SITE 3 | 14.70 | 9.70 | 93.54 | 702.00 | 14:10 | 47.50 | 94.00 | 118.74 |

TABLE 2: SUMMARY OF FISH CAUGHT BY STATION, FAMILY, SHOCK TIME, MEAN WEIGHT, AND MEAN LENGTH

| COMMON NAME | FAMILY | SITE I | II | III | IV | V |
|---|---|---|---|---|---|---|
| RIVER CARPSUCKER | CATASTOMIDAE | 7 | 0 | 7 | 4 | 2 |
| QUILLBACK CARPSUCKER | CATASTOMIDAE | 3 | 3 | 0 | 0 | 0 |
| BLACK BUFFALO | CATOSTOMIDAE | 0 | 2 | 1 | 0 | 0 |
| BLACK REDHORSE | CATOSTOMIDAE | 1 | 2 | 0 | 0 | 0 |
| LARGEMOUTH BUFFALO | CATOSTOMIDAE | 1 | 0 | 0 | 0 | 0 |
| LARGE MOUTH BASS | CENTRARCHIDAE | 0 | 1 | 0 | 0 | 0 |
| GIZZARD SHAD | CLUPEIDAE | 31 | 27 | 78 | 77 | 16 |
| CYPRINUS CARPIO | CYPRINIDAE | 0 | 1 | 2 | 3 | 1 |
| CHANNEL CATFISH | ICTALURIDAE | 0 | 2 | 3 | 1 | 0 |
| LONGNOSE GAR | LEPISOSTEIDAE | 3 | 1 | 0 | 0 | 0 |
| WHITE BASS | PERCICHTHYIDAE | 0 | 1 | 0 | 1 | 0 |
| STRIPED BASS | PERCICHTHYIDAE | 0 | 0 | 1 | 0 | 1 |
| SAUGER | PERCIDAE | 1 | 0 | 0 | 0 | 0 |
| DRUM | SCIAENIDAE | 2 | 2 | 2 | 3 | 1 |
| TOTAL NUMBER FISH SHOCKED | | 49 | 42 | 94 | 89 | 21 |
| SHOCK TIME IN MINUTES | | 45.1 | 41.8 | 47.5 | NA | 23 |

| STATION | MEAN LENGTH (CM) | MEAN WEIGHT (GM) |
|---|---|---|
| I | 30.33 | 289.2 |
| II | 29.44 | 316.4 |
| III | 23.45 | 187 |
| IV | 15 | 65.8 |
| V | 21.07 | 110 |
| MEAN | 22.77 | 186.7 |

TABLE 3. **THE NUMBER OF FISH ELECTROSHOCKED/hr AND THE NO. OF SPECIES IDENTIFIED AT EACH STATION BY YEAR, 1984-1989.**

| YEAR | STATION | INDIVIDUALS/hr I | II | III | SPECIES I | II | III |
|---|---|---|---|---|---|---|---|
| 1984 | | - | - | - | 15 | 12 | 15 |
| 1985 | | 104 | 84 | 314 | 11 | 19 | 16 |
| 1986 | | 89 | 79 | 266 | 12 | 15 | 16 |
| 1987 | | 73 | 75 | 102 | 10 | 11 | 10 |
| 1988 | | 146 | 195 | 154 | 15 | 12 | 15 |
| 1989 | | 120 | 69 | 136 | 13 | 12 | 16 |
| 1990 | | 65 | 60 | 119 | 8 | 10 | 7 |
| MEAN | | 100 | 94 | 182 | 12 | 13 | 14 |

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ONE-WAY ANOVA COMPARISONS BY YEAR AND STATION

| VARIABLE | F RATIO | PROBABILTY |
|---|---|---|
| FISH/hr X YEAR | 0.907 | 0.508 |
| FISH/hr X STATION | 3.976 | 0.041 * |
| SPECIES X YEAR | 3.993 | 0.015 * |
| SPECIES X STATION | 0.459 | 0.639 |

Table 4. The Diversity, Evenness and Community Coefficients for all stations in the Great Miami River.

| | Diversity (H') | H'MAX | EVENNESS |
|---|---|---|---|
| STATION I | 2.331659 | 2.999975 | 0.777226 |
| STATION II | 2.031899 | 3.3219 | 0.611668 |
| STATION III | 1.036838 | 2.807331 | 0.369332 |
| STATION IV | 0.857161 | 2.584941 | 0.331598 |
| STATION V | 1.24945 | 2.321908 | 0.538113 |

Matrix table of Community Coefficients

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | | 0.56 | 0.40 | 0.43 | 0.46 |
| 2 | 0.56 | | 0.59 | 0.63 | 0.40 |
| 3 | 0.40 | 0.59 | | 0.77 | 0.83 |
| 4 | 0.43 | 0.63 | 0.77 | | 0.73 |
| 5 | 0.46 | 0.40 | 0.83 | 0.73 | |

TABLE 5. **SPECIES DIVERSITY AND EVENNESS USING INFORMATION INDEX (log base 2) BY STATION AND YEAR, 1984-1989.**

| YEAR | STATION | H′ I | H′ II | H′ III | EVENNESS I | EVENNESS II | EVENNESS III |
|---|---|---|---|---|---|---|---|
| 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 |
| MEAN | | 2.32 | 2.58 | 2.01 | 0.66 | 0.74 | 0.48 |

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ONE-WAY ANOVA COMPARISONS BY YEAR AND STATION

| VARIABLE | F RATIO | PROBABILITY |
|---|---|---|
| H′ X YEAR | 0.826 | 0.569 |
| H′ X STATION | 1.420 | 0.268 |
| EVENNESS X YEAR | 0.375 | 0.883 |
| EVENNESS X STATION | 6.177 | 0.009 * |

TABLE 6. **MEAN WEIGHT AND LENGTH OF FISHES CAUGHT BY STATION AND YEAR, 1985-1989.**

| YEAR | STATION | WEIGHT(gm) I | WEIGHT(gm) II | WEIGHT(gm) III | LENGTH(cm) I | LENGTH(cm) II | LENGTH(cm) III |
|---|---|---|---|---|---|---|---|
| 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 |
| MEAN | | 322 | 257 | 127 | 26.2 | 25.3 | 20.1 |

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ONE-WAY ANOVA COMPARISONS BY YEAR AND STATION

| VARIABLE | F RATIO | PROBABILITY |
|---|---|---|
| WEIGHT X YEAR | 1.498 | 0.262 |
| WEIGHT X STATION | 4.047 | 0.039 * |
| LENGTH X YEAR | 1.839 | 0.180 |
| LENGTH X STATION | 5.176 | 0.020 * |

able 7. Length and weight frequency distributions of fish electroshocked from Great Miami River, Autumn 199

| m | SITE 1 | SITE 2 | SITE 3 | SITE 4 | SITE 5 | TOTAL |
|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8.00 | 0.00 | 0.00 | 0.00 | 2.00 | 0.00 | 2.00 |
| 10.00 | 0.00 | 0.00 | 0.00 | 22.00 | 0.00 | 22.00 |
| 12.00 | 0.00 | 0.00 | 0.00 | 26.00 | 0.00 | 26.00 |
| 14.00 | 0.00 | 0.00 | 0.00 | 2.00 | 1.00 | 3.00 |
| 16.00 | 0.00 | 0.00 | 3.00 | 5.00 | 5.00 | 13.00 |
| 18.00 | 0.00 | 0.00 | 8.00 | 6.00 | 5.00 | 19.00 |
| 20.00 | 1.00 | 2.00 | 22.00 | 11.00 | 5.00 | 41.00 |
| 22.00 | 3.00 | 6.00 | 21.00 | 5.00 | 0.00 | 35.00 |
| 24.00 | 5.00 | 13.00 | 12.00 | 2.00 | 1.00 | 33.00 |
| 26.00 | 8.00 | 5.00 | 10.00 | 0.00 | 1.00 | 24.00 |
| 28.00 | 8.00 | 1.00 | 2.00 | 0.00 | 1.00 | 12.00 |
| 30.00 | 5.00 | 1.00 | 2.00 | 1.00 | 0.00 | 9.00 |
| 32.00 | 3.00 | 3.00 | 2.00 | 1.00 | 0.00 | 9.00 |
| 34.00 | 2.00 | 1.00 | 3.00 | 3.00 | 0.00 | 9.00 |
| 36.00 | 4.00 | 1.00 | 0.00 | 1.00 | 0.00 | 6.00 |
| 38.00 | 5.00 | 2.00 | 2.00 | 1.00 | 0.00 | 10.00 |
| 40.00 | 1.00 | 1.00 | 2.00 | 0.00 | 0.00 | 4.00 |
| 42.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 50.00 | 2.00 | 4.00 | 3.00 | 1.00 | 1.00 | 11.00 |
| 60.00 | 1.00 | 0.00 | 1.00 | 0.00 | 1.00 | 3.00 |
| 70.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 2.00 |
| SUM | 49.00 | 42.00 | 94.00 | 89.00 | 21.00 | 295.00 |

| gm | SITE 1 | SITE 2 | SITE 3 | SITE 4 | SITE 5 | TOTAL |
|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 25.00 | 0.00 | 0.00 | 0.00 | 51.00 | 1.00 | 52.00 |
| 50.00 | 0.00 | 0.00 | 4.00 | 12.00 | 7.00 | 23.00 |
| 75.00 | 1.00 | 1.00 | 17.00 | 11.00 | 9.00 | 39.00 |
| 100.00 | 4.00 | 5.00 | 25.00 | 5.00 | 0.00 | 39.00 |
| 125.00 | 7.00 | 14.00 | 16.00 | 1.00 | 0.00 | 38.00 |
| 150.00 | 3.00 | 3.00 | 8.00 | 0.00 | 0.00 | 14.00 |
| 175.00 | 5.00 | 2.00 | 8.00 | 0.00 | 1.00 | 16.00 |
| 200.00 | 6.00 | 2.00 | 0.00 | 1.00 | 1.00 | 10.00 |
| 225.00 | 2.00 | 1.00 | 1.00 | 0.00 | 0.00 | 4.00 |
| 250.00 | 3.00 | 0.00 | 1.00 | 1.00 | 0.00 | 5.00 |
| 275.00 | 2.00 | 0.00 | 0.00 | 1.00 | 0.00 | 3.00 |
| 300.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 2.00 |
| 325.00 | 1.00 | 1.00 | 1.00 | 0.00 | 0.00 | 3.00 |
| 350.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 3.00 |
| 375.00 | 2.00 | 1.00 | 0.00 | 1.00 | 0.00 | 4.00 |
| 400.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 425.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 450.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 |
| 475.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 3.00 |
| 500.00 | 0.00 | 2.00 | 1.00 | 0.00 | 0.00 | 3.00 |
| 525.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 |
| 550.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 | 3.00 |
| 575.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| 600.00 | 2.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.00 |
| 625.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 |
| 650.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 675.00 | 2.00 | 1.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| 700.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 725.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 2.00 |
| 750.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 2.00 |
| 775.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 800.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 825.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 850.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| 875.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 900.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 1.00 |
| 925.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 950.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 975.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 1.00 |
| 1000.00 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 2.00 |
| 1500.00 | 0.00 | 1.00 | 3.00 | 0.00 | 0.00 | 4.00 |
| 2000.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| | | | | | 1.00 | 1.00 |
| SUM | 49.00 | 42.00 | 94.00 | 89.00 | 21.00 | 295.00 |

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Table 8. Table of double standardization, percent similarity, and Bray-Curtis [illegible] e, X and Y values.

SUMMARY TABLE OF FISH SHOCKED AFTER DOUBLE STANDARDIZATION

| COMMON NAME | FAMILY | I | II | III | IV | V |
|---|---|---|---|---|---|---|
| RIVER CARPSUCKER | CATASTOMI | 0.082 | 0 | 0.139 | 0.1 | 0.11 |
| QUILLBACK CARPSUCKER | CATASTOMI | 0.117 | 0.114 | 0 | 0 | 0 |
| BLACK BUFFALO | CATOSTOMI | 0 | 0.152 | 0.133 | 0 | 0 |
| BLACK REDHORSE | CATOSTOMI | 0.078 | 0.152 | 0 | 0 | 0 |
| LARGEMOUTH BUFFALO | CATOSTOMI | 0.234 | 0 | 0 | 0 | 0 |
| LARGE MOUTH BASS | CENTRARC | 0 | 0.228 | 0 | 0 | 0 |
| GIZZARD SHAD | CLUPEIDAE | 0.032 | 0.027 | 0.136 | 0.17 | 0.08 |
| CYPRINUS CARPIO | CYPRINIDA | 0 | 0.033 | 0.114 | 0.22 | 0.16 |
| CHANNEL CATFISH | ICTALURID | 0 | 0.076 | 0.199 | 0.09 | 0 |
| LONGNOSE GAR | LEPISOSTEI | 0.176 | 0.057 | 0 | 0 | 0 |
| WHITE BASS | PERCICHTH | 0 | 0.114 | 0 | 0.26 | 0 |
| STRIPED BASS | PERCICHTH | 0 | 0 | 0.199 | 0 | 0.55 |
| SAUGER | PERCIDAE | 0.234 | 0 | 0 | 0 | 0 |
| DRUM | SCIAENIDA | 0.047 | 0.046 | 0.08 | 0.16 | 0.11 |
| | | 1 | 1 | 1 | 1 | 1 |

Matrix table of Percent similarities, after double standardization.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | | 0.32 | 0.1606 | 0.161 | 0.161 |
| 2 | 0.322045 | | 0.3142 | 0.296 | 0.105 |
| 3 | 0.160557 | 0.31 | | 0.519 | 0.579 |
| 4 | 0.160557 | 0.3 | 0.5191 | | 0.446 |
| 5 | 0.160557 | 0.11 | 0.5789 | 0.446 | |
| ME | 0.200929 | 0.26 | 0.3932 | 0.355 | 0.323 |

End points, e, x and y values.

| Station | X | e | Y | e |
|---|---|---|---|---|
| 1 | 0 | 0 | 0.308 | 0.765 |
| 2 | 0.41 | 0.7144 | 0 | 0 |
| 3 | 0.84 | 0 | 0.613 | 0.56 |
| 4 | 0.7 | 0.5882 | 0.55 | 0.733 |
| 5 | 0.74 | 0.5475 | 0.89 | 0 |
| End points used | 1-3 | | 2-5 | |

able 9: Species Occurences in Electroshocking Samples taken from the Great Miami River between 1984 and 1990.

| EAR | 1984 | | | 1985 | | | 1986 | | | 1987 | | | 1988 | | | 1989 | | | 1990 | | | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COMMON NAME | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | OF SPECIES |
| IZZARD SHAD | 65 | 85 | 171 | 7 | 9 | 131 | 17 | 13 | 114 | 36 | 11 | 93 | 54 | 65 | 54 | 60 | 35 | 100 | 31 | 27 | 78 | 1256 |
| YPRINUS CARPIO | 3 | 3 | 13 | 15 | 3 | 3 | 31 | 12 | 1 | 6 | 3 | 3 | 7 | 8 | 2 | 2 | 2 | 9 | 0 | 1 | 2 | 129 |
| ARGE MOUTH BASS | 1 | 0 | 12 | 8 | 1 | 3 | 2 | 1 | 16 | 2 | 0 | 2 | 3 | 6 | 12 | 5 | 0 | 1 | 0 | 1 | 0 | 76 |
| MALL MOUTH BASS | 4 | 6 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 3 | 9 | 1 | 0 | 3 | 0 | 0 | 0 | 36 |
| LUEGILL SUNFISH | 6 | 0 | 11 | 8 | 1 | 6 | 0 | 1 | 7 | 1 | 0 | 0 | 2 | 6 | 14 | 0 | 0 | 1 | 0 | 0 | 0 | 64 |
| ONGEAR SUNFISH | 7 | 0 | 23 | 1 | 4 | 3 | 3 | 7 | 9 | 0 | 0 | 0 | 0 | 0 | 40 | 6 | 0 | 4 | 0 | 0 | 0 | 107 |
| /HITE CRAPPIE | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| ED EAR SUNFISH | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| REEN SUNFISH | 5 | 2 | 8 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 25 |
| /HITE BASS | 3 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 3 | 3 | 8 | 1 | 1 | 7 | 0 | 1 | 0 | 40 |
| AUGER | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 3 | 1 | 0 | 0 | 12 |
| IGHFIN CARPSUCKER | 1 | 0 | 1 | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 10 |
| IVER CARPSUCKER | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 8 | 2 | 0 | 2 | 1 | 1 | 1 | 9 | 8 | 1 | 7 | 7 | 0 | 7 | 63 |
| EDHORSE | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| HANNEL CATFISH | 1 | 2 | 2 | 1 | 4 | 2 | 7 | 13 | 2 | 0 | 3 | 1 | 2 | 6 | 40 | 5 | 10 | 3 | 0 | 2 | 3 | 109 |
| MERALD SHINER | 2 | 4 | 9 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| IMEPAHLES | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| RUM | 2 | 1 | 0 | 2 | 1 | 1 | 2 | 6 | 5 | 0 | 18 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 2 | 2 | 2 | 50 |
| POTTED BASS | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| UNFISH (UNIDENT.) | 0 | 0 | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| OLDEN REDHORSE | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 5 | 8 | 0 | 6 | 0 | 1 | 0 | 0 | 1 | 9 | 1 | 0 | 0 | 0 | 35 |
| LATHEAD CATFISH | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 7 |
| LUE CATFISH | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ORTHERN HOGSUCKER | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| HORT HEAD REDHORSE | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| UILLBACK CARPSUCKER | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 | 3 | 0 | 12 |
| ILVER REDHORSE | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 |
| INNOW UNIDENT. | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| LACK CRAPPIE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| OONEYE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| OCK BASS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 5 |
| KIPJACK HERRING | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |
| TIPPED BASS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 11 |
| VARMOUTH BASS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ONGNOSE GAR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 4 | 2 | 1 | 3 | 1 | 0 | 14 |
| UMPKINSEED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| LACK REDHORSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 0 | 7 |
| MALLMOUTH BUFFALO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| HANNEL MIMIC SHINER | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| ONGFIN CARPSUCKER | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| UCKERMOUTH MINNOW | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| ELLOW BULLHEAD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| HORTHEAD REDHORSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| ROWN BULLHEAD | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| LACK BUFFALO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 |
| ARGEMOUTH BUFFALO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| otal fish recovered | 104 | 113 | 263 | 52 | 40 | 160 | 73 | 79 | 180 | 51 | 56 | 122 | 85 | 111 | 217 | 97 | 69 | 145 | 49 | 42 | 94 | 2202 |

TOTAL FISH 84-90

000037

12298

Appendix A. List of fish, weights, lengths, sex, family, and bag number sent in for analysis for station I.

| STATION | COMMON NAME | FAMILY | LENGTH | WEIGHT | SEX | SPECIES | BAG # |
|---|---|---|---|---|---|---|---|
| 1 | LONG NOSE GAR | LEPISOSTEI | 65 | 549 | M | Lepisosteus osseus | 1-4 |
| 1 | LONG NOSE GAR | LEPISOSTEI | 50.5 | 221 | M | Lepisosteus osseus | 1-3 |
| 1 | LONG NOSE GAR | LEPISOSTEI | 46.9 | 178 | F | Lepisosteus osseus | 1-14 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 33.55 | 310 | M | Dorosoma cepedianum | 1-16 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 31.40 | 264 | M | Dorosoma cepedianum | 1-17 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 30.39 | 231 | M | Dorosoma cepedianum | 1-17 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 36.72 | 372 | M | Dorosoma cepedianum | 1-18 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 29.75 | 230 | F | Dorosoma cepedianum | 1-18 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 28.74 | 244 | M | Dorosoma cepedianum | 1-19 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 27.22 | 192 | M | Dorosoma cepedianum | 1-19 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 28.49 | 204 | F | Dorosoma cepedianum | 1-19 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 27.48 | 182 | M | Dorosoma cepedianum | 1-20 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 26.59 | 152 | I | Dorosoma cepedianum | 1-20 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 26.59 | 162 | I | Dorosoma cepedianum | 1-20 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 25.32 | 158 | I | Dorosoma cepedianum | 1-21 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 29.12 | 196 | F | Dorosoma cepedianum | 1-21 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 27.22 | 178 | F | Dorosoma cepedianum | 1-21 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 26.59 | 180 | F | Dorosoma cepedianum | 1-22 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 24.69 | 118 | I | Dorosoma cepedianum | 1-22 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 25.32 | 122 | I | Dorosoma cepedianum | 1-22 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 25.96 | 140 | I | Dorosoma cepedianum | 1-22 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 26.59 | 160 | F | Dorosoma cepedianum | 1-23 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 24.06 | 122 | I | Dorosoma cepedianum | 1-23 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 22.79 | 116 | I | Dorosoma cepedianum | 1-23 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 22.16 | 100 | I | Dorosoma cepedianum | 1-23 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 24.06 | 122 | I | Dorosoma cepedianum | 1-24 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 23.04 | 104 | I | Dorosoma cepedianum | 1-24 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 25.83 | 136 | I | Dorosoma cepedianum | 1-24 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 20.26 | 68 | I | Dorosoma cepedianum | 1-24 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 25.07 | 128 | I | Dorosoma cepedianum | 1-25 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 22.79 | 90 | I | Dorosoma cepedianum | 1-25 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 21.52 | 84 | I | Dorosoma cepedianum | 1-25 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 23.42 | 112 | I | Dorosoma cepedianum | 1-25 |
| 1 | GIZZARD SHAD | CLUPEIDAE | 20.26 | 80 | I | Dorosoma cepedianum | 1-25 |
| 1 | RIVER CARPSUCKER | CATOSTOMI | 36.9 | 595 | F | Carpiodes carpio | 1-7 |
| 1 | RIVER CARPSUCKER | CATOSTOMI | 43 | 990 | F | Carpiodes carpio | 1-10 |
| 1 | RIVER CARPSUCKER | CATOSTOMI | 37.5 | 663 | F | Carpiodes carpio | 1-5 |
| 1 | RIVER CARPSUCKER | CATOSTOMI | 18.2 | 160 | M | Carpiodes carpio | 1-16 |
| 1 | RIVER CARPSUCKER | CATOSTOMI | 37.5 | 610 | M | Carpiodes carpio | 1-8 |
| 1 | RIVER CARPSUCKER | CATOSTOMI | 37 | 664 | F | Carpiodes carpio | 1-6 |
| 1 | RIVER CARPSUCKER | CATOSTOMI | 35.5 | 564 | F | Carpiodes carpio | 1-9 |
| 1 | QUILLBACK | CATOSTOMI | 29 | 252 | M | Carpiodes cyprinus | 1-12 |
| 1 | QUILLBACK | CATOSTOMI | 27.5 | 509 | F | Carpiodes cyprinus | 1-13 |
| 1 | QUILLBACK | CATOSTOMI | 33 | 459 | F | Carpiodes cyprinus | 1-11 |
| 1 | BLACK REDHORSE | CATOSTOMI | 34.5 | 849 | F | Moxostoma duquesnei | 1-15 |
| 1 | SAUGER | PERCIDAE | 36 | 342 | F | Stizostedion canadense | 1-3 |
| 1 | DRUM | SCIAENIDA | 36 | 555 | M | Aplodinatus gunniens | 1-2 |
| 1 | DRUM | SCIAENIDA | 36 | 555 | M | Aplodinatus gunniens | 1-2 |
| 1 | DRUM | SCIAENIDA | 38.2 | 590 | M | Aplodinatus gunniens | 1-2 |
| 1 | LG MOUTH BUFFALO | CATOSTOMI | 30.8 | 364 | U | Ictiobus cyprinellus | PRESERVE |

Appendix B. List of fish, weights, lengths, sex, family, and bag number sent for analysis for station II.

| STATION | COMMON NAME | FAMILY | LENGTH | WEIGHT | SEX | SPECIES | BAG # |
|---|---|---|---|---|---|---|---|
| 2 | LONG NOSE GAR | LEPISOSTEI | 71.7 | 688 | M | Lepisosteus osseus | 2-7 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 22.4 | 113 | I | Dorosoma cepedianum | 2-19 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 20.5 | 76 | I | Dorosoma cepedianum | 2-19 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 23.8 | 111 | I | Dorosoma cepedianum | 2-19 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 22.4 | 105 | I | Dorosoma cepedianum | 2-17 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 21.3 | 97 | I | Dorosoma cepedianum | 2-16 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 21.1 | 92 | I | Dorosoma cepedianum | 2-16 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 22.1 | 107 | I | Dorosoma cepedianum | 2-17 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 23.1 | 134 | I | Dorosoma cepedianum | 2-16 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 25.2 | 139 | I | Dorosoma cepedianum | 2-15 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 24.2 | 125 | I | Dorosoma cepedianum | 2-19 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 23.2 | 120 | I | Dorosoma cepedianum | 2-16 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 25.3 | 156 | I | Dorosoma cepedianum | 2-14 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 22.8 | 121 | I | Dorosoma cepedianum | 2-17 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 19.3 | 75 | I | Dorosoma cepedianum | 2-17 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 22.7 | 114 | I | Dorosoma cepedianum | 2-17 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 24.8 | 157 | I | Dorosoma cepedianum | 2-14 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 23 | 125 | M | Dorosoma cepedianum | 2-14 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 21.7 | 103 | I | Dorosoma cepedianum | 2-18 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 20.8 | 91 | I | Dorosoma cepedianum | 2-16 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 22.7 | 116 | I | Dorosoma cepedianum | 2-18 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 24.9 | 137 | I | Dorosoma cepedianum | 2-14 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 22.6 | 105 | I | Dorosoma cepedianum | 2-15 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 21.3 | 93 | I | Dorosoma cepedianum | 2-15 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 22.6 | 110 | I | Dorosoma cepedianum | 2-15 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 23.6 | 118 | I | Dorosoma cepedianum | 2-18 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 27.4 | 195 | M | Dorosoma cepedianum | 2-14 |
| 2 | GIZZARD SHAD | CLUPEIDAE | 19.2 | 178 | I | Dorosoma cepedianum | 2-15 |
| 2 | CARP | CYPRINIDA | 32 | 648 | F | Cyprinus carpio | 2-8 |
| 2 | QUILLBACK | CATOSTOMI | 26.7 | 480 | F | Carpiodes cyprinus | 2-4 |
| 2 | QUILLBACK | CATOSTOMI | 39.6 | 728 | M | Carpiodes cyprinus | 2-12 |
| 2 | QUILLBACK | CATOSTOMI | 38 | 673 | F | Carpiodes cyprinus | 2-11 |
| 2 | BLACK REDHORSE | CATOSTOMI | 33.2 | 822 | M | Moxostoma duquesnei | 2-3 |
| 2 | BLACK REDHORSE | CATOSTOMI | 35.5 | 530 | I | Moxostoma duquesnei | 2-13 |
| 2 | CHANNEL CATFISH | ICTALURID | 39.2 | 488 | M | Ictalurus punctatus | 2-6 |
| 2 | CHANNEL CATFISH | ICTALURID | 38.4 | 416 | M | Ictalurus punctatus | 2-6 |
| 2 | WHITE BASS | SERRANIDA | 24 | 321 | M | Marone chrysops | 2-1 |
| 2 | LARGE MOUTH BASS | CENTRARC | 30.5 | 722 | F | Micropterus salmoides | 2-2 |
| 2 | DRUM | SCIAENIDA | 25.7 | 220 | F | Aplodinatus gunniens | 2-5 |
| 2 | DRUM | SCIAENIDA | 25.5 | 364 | F | Aplodinatus gunniens | 2-5 |
| 2 | BLACK BUFFALO | CATOSTOMI | 49 | 1608 | M | Ictiobus niger | 2-9 |
| 2 | BLACK BUFFALO | CATOSTOMI | 47.2 | 1369 | M | Ictiobus niger | 2-10 |

Appendix C. List of fish, weights, lengths, sex, family, and bag number sent in for analysis for station III.

| STATION | COMMON NAME | FAMILY | LENGTH | WEIGHT | SEX | SPECIES | BAG # |
|---|---|---|---|---|---|---|---|
| 3 | GIZZARD SHAD | CLUPEIDAE | 31.4 | 300 | F | Dorosoma cepedianum | 3-32 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 26 | 208 | M | Dorosoma cepedianum | 3-32 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.2 | 96 | I | Dorosoma cepedianum | 3-27 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 15.9 | 46 | I | Dorosoma cepedianum | 3-31 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 25.4 | 158 | M | Dorosoma cepedianum | 3-33 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 24.7 | 149 | I | Dorosoma cepedianum | 3-32 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.1 | 100 | I | Dorosoma cepedianum | 3-28 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.1 | 84 | I | Dorosoma cepedianum | 3-29 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.8 | 90 | I | Dorosoma cepedianum | 3-28 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 22.3 | 108 | I | Dorosoma cepedianum | 3-28 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.7 | 84 | I | Dorosoma cepedianum | 3-27 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.3 | 82 | I | Dorosoma cepedianum | 3-28 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 23.2 | 124 | I | Dorosoma cepedianum | 3-26 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 17.4 | 52 | I | Dorosoma cepedianum | 3-25 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 14.9 | 32 | I | Dorosoma cepedianum | 3-19 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 18.1 | 70 | I | Dorosoma cepedianum | 3-27 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 23 | 140 | I | Dorosoma cepedianum | 3-33 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 26.1 | 168 | M | Dorosoma cepedianum | 3-33 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 26 | 138 | I | Dorosoma cepedianum | 3-34 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 24.1 | 144 | I | Dorosoma cepedianum | 3-33 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 24.6 | 128 | M | Dorosoma cepedianum | 3-34 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.5 | 88 | I | Dorosoma cepedianum | 3-26 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 16.9 | 60 | I | Dorosoma cepedianum | 3-26 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 23.4 | 152 | I | Dorosoma cepedianum | 3-34 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 14.3 | 39 | I | Dorosoma cepedianum | 3-23 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 16.9 | 48 | I | Dorosoma cepedianum | 3-22 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.9 | 112 | I | Dorosoma cepedianum | 3-23 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21 | 84 | I | Dorosoma cepedianum | 3-21 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 26 | 164 | M | Dorosoma cepedianum | 3-32 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 17.4 | 56 | I | Dorosoma cepedianum | 3-20 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 16.1 | 68 | I | Dorosoma cepedianum | 3-21 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 18.8 | 68 | I | Dorosoma cepedianum | 3-22 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 18.7 | 80 | I | Dorosoma cepedianum | 3-22 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 22.9 | 120 | I | Dorosoma cepedianum | 3-25 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.4 | 108 | I | Dorosoma cepedianum | 3-23 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 17.9 | 66 | I | Dorosoma cepedianum | 3-24 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.6 | 105 | I | Dorosoma cepedianum | 3-31 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19 | 72 | I | Dorosoma cepedianum | 3-19 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.5 | 88 | I | Dorosoma cepedianum | 3-20 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 22.5 | 154 | I | Dorosoma cepedianum | 3-21 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 26.5 | 168 | M | Dorosoma cepedianum | 3-34 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20 | 88 | I | Dorosoma cepedianum | 3-30 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.6 | 104 | I | Dorosoma cepedianum | 3-29 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 18.6 | 64 | I | Dorosoma cepedianum | 3-25 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 18.9 | 72 | I | Dorosoma cepedianum | 3-31 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 24.3 | 156 | I | Dorosoma cepedianum | 3-21 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.9 | 72 | I | Dorosoma cepedianum | 3-22 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.3 | 84 | I | Dorosoma cepedianum | 3-20 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 24.9 | 100 | I | Dorosoma cepedianum | 3-21 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.4 | 76 | I | Dorosoma cepedianum | 3-26 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.8 | 100 | I | Dorosoma cepedianum | 3-30 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.8 | 100 | I | Dorosoma cepedianum | 3-30 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.5 | 84 | I | Dorosoma cepedianum | 3-31 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 16.9 | 56 | I | Dorosoma cepedianum | 3-19 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.2 | 72 | I | Dorosoma cepedianum | 3-24 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19 | 76 | I | Dorosoma cepedianum | 3-31 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 22.3 | 112 | I | Dorosoma cepedianum | 3-24 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 18.5 | 66 | I | Dorosoma cepedianum | 3-24 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 18.6 | 70 | I | Dorosoma cepedianum | 3-31 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | GIZZARD SHAD | CLUPEIDAE | 21 | 104 | I | Dorosoma cepedianum | 3-30 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.6 | 76 | I | Dorosoma cepedianum | 3-26 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.8 | 108 | I | Dorosoma cepedianum | 3-29 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 23 | 128 | I | Dorosoma cepedianum | 3-30 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 18.5 | 68 | I | Dorosoma cepedianum | 3-25 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 22.2 | 116 | I | Dorosoma cepedianum | 3-29 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 22 | 116 | I | Dorosoma cepedianum | 3-29 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.6 | 108 | I | Dorosoma cepedianum | 3-27 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 23.2 | 124 | I | Dorosoma cepedianum | 3-24 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.6 | 94 | I | Dorosoma cepedianum | 3-19 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.1 | 92 | I | Dorosoma cepedianum | 3-23 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 22.4 | 116 | I | Dorosoma cepedianum | 3-28 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 17.8 | 60 | I | Dorosoma cepedianum | 3-23 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 23.1 | 136 | I | Dorosoma cepedianum | 3-20 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.6 | 92 | I | Dorosoma cepedianum | 3-27 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 20.5 | 96 | I | Dorosoma cepedianum | 3-20 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 21.8 | 120 | I | Dorosoma cepedianum | 3-22 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.7 | 84 | I | Dorosoma cepedianum | 3-19 |
| 3 | GIZZARD SHAD | CLUPEIDAE | 19.4 | 84 | I | Dorosoma cepedianum | 3-25 |
| 3 | CARP | CYPRINIDA | 37.3 | 1340 | F | Cyprinus carpio | 3-5,6 |
| 3 | CARP | CYPRINIDA | 59 | 1148 | M | Cyprinus carpio | 3-3,4 |
| 3 | RIVER CARPSUCKER | CATOSTOMI | 33.2 | 524 | F | Carpiodes carpio | 3-11 |
| 3 | RIVER CARPSUCKER | CATOSTOMI | 22.1 | 141 | I | Carpiodes carpio | 3-35 |
| 3 | RIVER CARPSUCKER | CATOSTOMI | 38.4 | 706 | M | Carpiodes carpio | 3-9 |
| 3 | RIVER CARPSUCKER | CATOSTOMI | 33.4 | 440 | F | Carpiodes carpio | 3-10 |
| 3 | RIVER CARPSUCKER | CATOSTOMI | 24.3 | 163 | I | Carpiodes carpio | 3-35 |
| 3 | RIVER CARPSUCKER | CATOSTOMI | 42.8 | 976 | F | Carpiodes carpio | 3-7,8 |
| 3 | RIVER CARPSUCKER | CATOSTOMI | 36.7 | 614 | F | Carpiodes carpio | 3-12 |
| 3 | CHANNEL CATFISH | ICTALURID | 39.3 | 482 | I | Ictalurus punctatus | 3-14 |
| 3 | CHANNEL CATFISH | ICTALURID | 44.3 | 730 | M | Ictalurus punctatus | 3-13 |
| 3 | CHANNEL CATFISH | ICTALURID | 32.8 | 232 | I | Ictalurus punctatus | 3-15 |
| 3 | DRUM | SCIAENIDA | 29.9 | 340 | M | Aplodinatus gunniens | 3-16 |
| 3 | DRUM | SCIAENIDA | 28.1 | 320 | M | Aplodinatus gunniens | 3-17 |
| 3 | BLACK BUFFALO | CATOSTOMI | 42.6 | 1090 | M | Ictiobus niger | 3-1,2 |
| 3 | STRIPED BASS | SERRANIDA | 30.1 | 464 | M | Morone saxatilis | 3-18 |

Appendix D. List of fish, weights, lengths, sex, family, and bag number sent in for analysis for station IV.

| STATION | COMMON NAME | FAMILY | LENGTH | WEIGHT | SEX | SPECIES | BAG # |
|---|---|---|---|---|---|---|---|
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.5 | 14.31 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.7 | 17.21 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11 | 13.7 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11 | 13 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.6 | 15.8 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.1 | 9.69 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 8 | 5.1 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.2 | 13.3 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 8.9 | 7 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.3 | 11.3 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11 | 12.62 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.5 | 10.5 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 12 | 12.38 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 8.5 | 7.02 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10 | 9.77 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.1 | 14 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 15 | 27.9 | I | Dorosoma cepedianum | 4-14 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 15.5 | 35.3 | I | Dorosoma cepedianum | 4-14 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 19.5 | 75 | I | Dorosoma cepedianum | 4-11 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.9 | 12.26 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.3 | 11.67 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.5 | 9.3 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 18.8 | 58 | I | Dorosoma cepedianum | 4-12 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 15.5 | 31 | I | Dorosoma cepedianum | 4-13 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 16.5 | 44.5 | I | Dorosoma cepedianum | 4-13 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 16.5 | 38.5 | I | Dorosoma cepedianum | 4-13 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 14.5 | 28.7 | I | Dorosoma cepedianum | 4-14 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.8 | 7.23 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 19.2 | 68.1 | I | Dorosoma cepedianum | 4-12 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 23.5 | 124 | I | Dorosoma cepedianum | 4-10 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 19 | 64 | I | Dorosoma cepedianum | 4-11 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 19.5 | 67.7 | I | Dorosoma cepedianum | 4-10 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 20.5 | 78 | I | Dorosoma cepedianum | 4-10 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 21 | 76 | I | Dorosoma cepedianum | 4-11 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 16 | 35.4 | I | Dorosoma cepedianum | 4-13 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 17.5 | 49.4 | I | Dorosoma cepedianum | 4-14 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.4 | 10.48 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.5 | 14.9 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.9 | 9.47 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 12.8 | 21.2 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.2 | 14.3 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 7.3 | 3.45 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 19.6 | 60 | I | Dorosoma cepedianum | 4-12 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 17.5 | 48.4 | I | Dorosoma cepedianum | 4-14 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 20 | 73 | I | Dorosoma cepedianum | 4-11 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.5 | 8.94 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 14 | 28.9 | I | Dorosoma cepedianum | 4-14 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.5 | 13.35 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 18.3 | 50.4 | I | Dorosoma cepedianum | 4-13 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 17 | 47.2 | I | Dorosoma cepedianum | 4-14 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.5 | 8.28 | I | Dorosoma cepedianum | 4-15 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 17 | 43.6 | I | Dorosoma cepedianum | 4-13 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.1 | 7.89 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.1 | 7.6 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.3 | 14.57 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.7 | 9.34 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 21 | 94 | I | Dorosoma cepedianum | 4-10 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 19 | 54.6 | I | Dorosoma cepedianum | 4-12 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.5 | 10.76 | I | Dorosoma cepedianum | 4-15 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.9 | 9.68 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 18.5 | 53.3 | I | Dorosoma cepedianum | 4-12 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.5 | 12.66 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.5 | 12.67 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 8.8 | 7.18 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10 | 10.3 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10 | 9.09 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10 | 10.3 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.8 | 12.61 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 9.3 | 7.8 | I | Dorosoma cepedianum | 4-16 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 21.8 | 84 | I | Dorosoma cepedianum | 4-11 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 8.4 | 5.71 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10 | 10.3 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 33 | 248 | M | Dorosoma cepedianum | 4-9 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 20.7 | 76 | I | Dorosoma cepedianum | 4-10 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 18.5 | 57.7 | I | Dorosoma cepedianum | 4-12 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 11.2 | 13.76 | I | Dorosoma cepedianum | 4-17 |
| 4 | GIZZARD SHAD | CLUPEIDAE | 10.8 | 12.4 | I | Dorosoma cepedianum | 4-16 |
| 4 | CARP | CYPRINIDA | 43 | 896 | M | Cyprinus carpio | 4-1 |
| 4 | CARP | CYPRINIDA | 30.8 | 366 | F | Cyprinus carpio | 4-3 |
| 4 | CARP | CYPRINIDA | 33 | 472 | M | Cyprinus carpio | 4-2 |
| 4 | RIVER CARPSUCKER | CATOSTOMI | 10.5 | 14.4 | I | Carpiodes carpio | PRESERV |
| 4 | RIVER CARPSUCKER | CATOSTOMI | 24 | 191.8 | I | Carpiodes carpio | 4-8 |
| 4 | RIVER CARPSUCKER | CATOSTOMI | 9.4 | 9.62 | I | Carpiodes carpio | PRESERV |
| 4 | RIVER CARPSUCKER | CATOSTOMI | 9.3 | 10.1 | I | Carpiodes carpio | PRESERV |
| 4 | CHANNEL CATFISH | ICTALURID | 38 | 292 | M | Ictalurus punctatus | 4-7 |
| 4 | WHITE BASS | SERRANIDA | 10 | 14.6 | I | Marone chrysops | PRESERV |
| 4 | DRUM | SCIAENIDA | 32.8 | 340 | I | Aplodinatus gunniens | 4-6 |
| 4 | DRUM | SCIAENIDA | 28.5 | 268 | I | Aplodinatus gunniens | 4-4 |
| 4 | DRUM | SCIAENIDA | 35.2 | 542 | I | Aplodinatus gunniens | 4-5 |

Appendix E. List of fish, weights, lengths, sex, family, and bag number sent in for analysis for station V.

| STATION | COMMON NAME | FAMILY | LENGTH | WEIGHT | SEX | SPECIES | BAG # |
|---|---|---|---|---|---|---|---|
| 5 | GIZZARD SHAD | CLUPEIDAE | 18.5 | 68.6 | I | Dorosoma cepedianum | 5-6 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 14 | 27.5 | I | Dorosoma cepedianum | 5-6 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 16.5 | 52.3 | I | Dorosoma cepedianum | 5-6 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 19 | 70.8 | I | Dorosoma cepedianum | 5-6 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 18.2 | 60.57 | I | Dorosoma cepedianum | 5-7 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 19.5 | 68 | I | Dorosoma cepedianum | 5-7 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 18 | 52.4 | I | Dorosoma cepedianum | 5-7 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 16.7 | 45.4 | I | Dorosoma cepedianum | 5-7 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 14.8 | 31.01 | I | Dorosoma cepedianum | 5-8 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 15 | 33 | I | Dorosoma cepedianum | 5-8 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 18.5 | 60 | I | Dorosoma cepedianum | 5-7 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 15.8 | 37.2 | I | Dorosoma cepedianum | 5-8 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 16 | 37 | I | Dorosoma cepedianum | 5-8 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 18 | 63.9 | I | Dorosoma cepedianum | 5-6 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 18 | 54.1 | I | Dorosoma cepedianum | 5-6 |
| 5 | GIZZARD SHAD | CLUPEIDAE | 14.2 | 29 | I | Dorosoma cepedianum | 5-8 |
| 5 | CARP | CYPRINIDA | 52.5 | 2062 | F | Cyprinus carpio | 5-2.1,5-2.2 |
| 5 | RIVER CARPSUCKER | CATOSTOMI | 43 | 958 | F | Carpiodes carpio | 5-4 & 5-5 |
| 5 | RIVER CARPSUCKER | CATOSTOMI | 24 | 155 | M | Carpiodes carpio | 5-4 & 5-5 |
| 5 | DRUM | SCIAENIDA | 25 | 186 | I | Aplodinatus gunniens | 5-9 |
| 5 | STRIPED BASS | SERRANIDA | 26.8 | 24.6 | M | Morone saxatilis | 5-1 |

Appendix F. Anova of length and weight for all fish shocked.

7298

by station

```
>stat wtgm/tukey
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          1.000
TOTAL OBSERVATIONS:      49
                       WTGM
  N OF CASES                49
  MEAN                 289.204
  STANDARD DEV         220.968
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          2.000
TOTAL OBSERVATIONS:      42
                       WTGM
  N OF CASES                42
  MEAN                 316.429
  STANDARD DEV         347.007
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          3.000
TOTAL OBSERVATIONS:      94
                       WTGM
  N OF CASES                94
  MEAN                 187.074
  STANDARD DEV         243.904
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          4.000
TOTAL OBSERVATIONS:      89
                       WTGM
  N OF CASES                89
  MEAN                  65.767
  STANDARD DEV         132.983
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          5.000
TOTAL OBSERVATIONS:      21
                       WTGM
  N OF CASES                21
  MEAN                 198.875
  STANDARD DEV         471.212
DDDD
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by station
>stat lencm/tukey
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          1.000
TOTAL OBSERVATIONS:      49
                      LENCM
  N OF CASES                49
  MEAN                  30.327
  STANDARD DEV           8.541
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          2.000
TOTAL OBSERVATIONS:      42
                      LENCM
  N OF CASES                42
  MEAN                  29.441
  STANDARD DEV          12.390
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          3.000
TOTAL OBSERVATIONS:      94
                      LENCM
  N OF CASES                94
  MEAN                  23.449
  STANDARD DEV           7.229
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          4.000
TOTAL OBSERVATIONS:      89
                      LENCM
  N OF CASES                89
  MEAN                  15.166
  STANDARD DEV           7.455
THE FOLLOWING RESULTS ARE FOR:
          STATION      =          5.000
TOTAL OBSERVATIONS:      21
                      LENCM
  N OF CASES                21
  MEAN                  21.048
  STANDARD DEV           9.615
DDDD
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