Environmental & Water Quality Operational Studies

MISCELLANEOUS PAPER E-80-1

AQUATIC HABITAT STUDIES ON THE LOWER MISSISSIPPI RIVER, RIVER MILE 480 TO 530

Report 5

FISH STUDIES—PILOT REPORT

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November 1980
Report 5 of a Series

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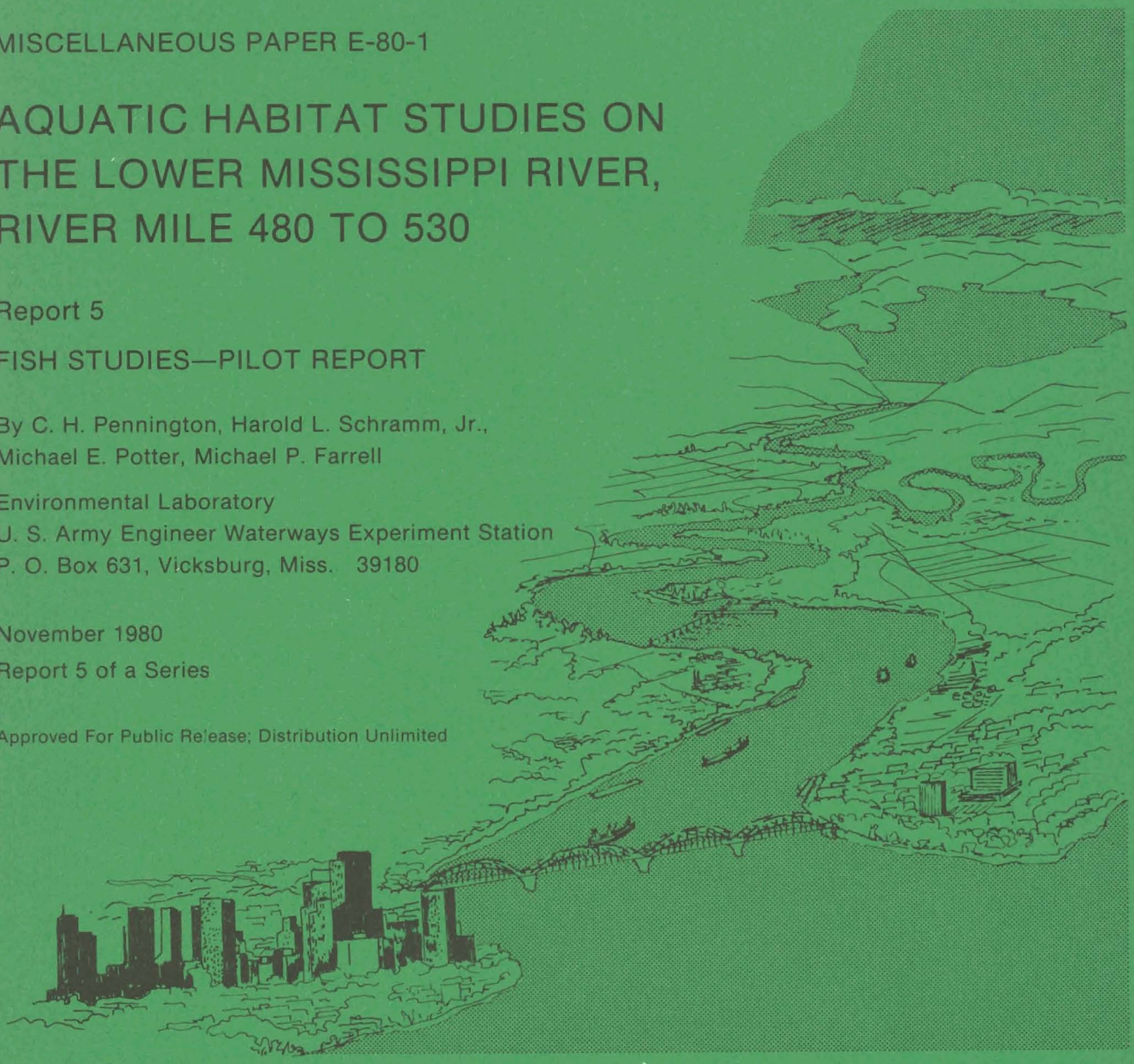

Prepared for Office, Chief of Engineers, U. S. Army
Washington, D. C. 20314

Under EWQOS Work Unit VIIB

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: Miscellaneous Paper E-80-1
2. GOVT ACCESSION NO.:
3. RECIPIENT'S CATALOG NUMBER:

4. TITLE *(and Subtitle)*: AQUATIC HABITAT STUDIES ON THE LOWER MISSISSIPPI RIVER, RIVER MILE 480 TO 530; Report 5, FISH STUDIES--PILOT REPORT

5. TYPE OF REPORT & PERIOD COVERED: Report 5 of a series

6. PERFORMING ORG. REPORT NUMBER:

7. AUTHOR(s): C. H. Pennington, Michael P. Farrell, Harold L. Schramm, Jr., Michael E. Potter

8. CONTRACT OR GRANT NUMBER(s):

9. PERFORMING ORGANIZATION NAME AND ADDRESS: U. S. Army Engineer Waterways Experiment Station, Environmental Laboratory, P. O. Box 631, Vicksburg, Miss. 39180

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: EWQOS Work Unit VIIB

11. CONTROLLING OFFICE NAME AND ADDRESS: Office, Chief of Engineers, U. S. Army, Washington, D. C. 20314

12. REPORT DATE: May 1981

13. NUMBER OF PAGES: 101

14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*:

15. SECURITY CLASS. *(of this report)*: Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT *(of this Report)*: Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*:

18. SUPPLEMENTARY NOTES: Available from National Technical Information Service, Springfield, Va. 22161

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*:

Aquatic habitats
Environmental studies
Fisheries
Fishes
Lower Mississippi River
Sampling

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*:

A pilot study on the Lower Mississippi River, river mile 480 to 530, was conducted from April through December 1978. The objectives of this study were to train and familarize field crews with habitats within the study area, with sampling techniques, and with fish species, while concurrently providing basic data on the distribution and abundance of fish in various habitats and refining sampling techniques.

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DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

20. ABSTRACT (Continued).

During the pilot study several gears and procedures were used and evaluated with regard to efficiency, replicability, species selectivity, size selectivity, and catch rate. Also, representative and important fish habitats were identified and sampled for fish. Fish diversity and abundance were based on the records from a variety of sampling gears.

The diversity of sampling gears used adequately represented the fish fauna of most habitats. Seines were found to be a very valuable gear for estimating the diversity and abundance of fish in shoreline habitats. Hoop nets and electroshocking were effective along natural banks, revetted banks, dike fields, and other areas with flowing water. Gill nets were more effective than trammel nets in slack-water areas of the study reach. Trawling was an effective technique in dike fields and areas with unobstructed bottoms.

Based on species composition and relative numerical frequency, three recognizable fish communities occur in the Lower Mississippi River. They are the standing-water community, the flowing-water community, and the shallow shoreline community.

Numerical catch per unit of effort (C/f) was used as an idex of abundance. For most gear types in most habitats, C/f was highly variable. C/f varied over time, among habitats, sites within a habitat, and between samples within a habitat. Considering the wide variations in C/f, the standing-water fish community was most abundant in abandoned channels and the oxbow lake. C/f in flowing water was highest in the chute connecting Lake Lee with the river. The flowing-water fish community was collected in similar abundance from the natural bank, revetted bank, dike field, sandbar, and temporary secondary channel habitats, with the temporary secondary channel habitat exhibiting the greatest abundance.

Abandoned channels, oxbow lakes, revetted banks, natural banks, dike fields, and sandbars appear very important to the fishery of the river based on diversity and abundance. Dike fields are especially interesting because of the diversity of habitats within a dike field. Standing-water, flowing-water, and inshore fish communities are well represented in dike fields.

A complete listing of the reports in the series "Aquatic Habitat Studies on the Lower Mississippi River, River Mile 480 to 530" is as follows:

Report 1: Introduction
Report 2: Aquatic Habitat Mapping
Report 3: Benthic Macroinvertebrate Studies--Pilot Report
Report 4: Diel Periodicity of Benthic Macroinvertebrate Drift
Report 5: Fish Studies--Pilot Report
Report 6: Larval Fish Studies--Pilot Report
Report 7: Management of Ecological Data in Large River Ecosystems
Report 8: Summary

PREFACE

The work described in this report is part of the Environmental and Water Quality Operational Studies (EWQOS), Work Unit VIIB, conducted by the U. S. Army Engineer Waterways Experiment Station (WES) for the Office, Chief of Engineers, U. S. Army. This report is one of a series of eight reports which discusses the results of a pilot study on the Lower Mississippi River, river miles 480 to 530. The pilot study was completed by the Waterway Habitat and Monitoring Group (WHMG), Environmental Systems Division (ESD), Environmental Laboratory (EL), WES.

This report, Report 5 of the series, contains data on the fisheries portion of the study. The report includes information concerning gear evaluation and the distribution and relative abundance of adult and juvenile fishes associated with 11 different habitat types found within the main-line levees along the river. Fish were collected from the river between river miles 499 to 530 during April-December 1978.

The report was prepared by Drs. C. H. Pennington, H. L. Schramm, Jr., M. P. Farrell, and Mr. M. E. Potter under the supervision of Dr. Thomas D. Wright, Chief, WHMG, Mr. Bob O. Benn, Chief, ESD, Dr. Jerome L. Mahloch, Program Manager, EWQOS, and Dr. John Harrison, Chief, EL.

COL John L. Cannon, CE, was Commander and Director of WES during field conduct of this study. COL Nelson P. Conover, CE, was Commander and Director of WES during preparation of this report. Mr. Fred R. Brown was Technical Director of WES.

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CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
acres	4046.873	square metres
cubic feet per second	0.02831685	cubic metres per second
feet	0.3048	metres
inches	2.54	centimetres
miles (U. S. statute)	1.609344	kilometres
pounds (mass)	0.4535924	kilograms

1978. The objectives of the pilot study were to train and familarize field crews with habitats within the study area, with sampling techniques, and with fish species, while concurrently providing basic data on the distribution and abundance of fish in various habitats and refining sampling techniques.

4. The general approach of the fisheries team for the pilot study was to use and evaluate a wide variety of fish sampling gear and determine the effectiveness of the gear types at different river stages and in different habitat types. Initially, the fisheries team took monthly fish samples with all gear types. Additional sampling was conducted, as needed, to detect changes in fish distribution and abundance as the hydrology of the river changed.

5. An important purpose of the pilot study was to develop and refine methods of assessing the fisheries of the Lower Mississippi River. Many sampling gears and procedures have been used to assess fishery resources. During the pilot study several gears and procedures were used and evaluated with regard to efficiency, replicability, species selectivity, size selectivity, and catch rate. The results of the comparisons were to be used during the remainder of EWQOS field research to describe the fisheries of each habitat. Throughout the pilot study, procedures were reevaluated to determine more efficient ways to use the various sampling methods.

6. A second purpose of the pilot study was to identify representative and important fish habitats. Fish diversity and abundance in each habitat were based on the catch records from a variety of sampling gears.

7. Important physical, chemical, and biotic parameters of all habitats sampled for fish during the pilot study were described. Therefore, the fisheries team became aware of the diverse conditions and habitats and the associated fish communities that exist in the Lower Mississippi River. Based on this information, a limited number of representative or important fish habitats were to be selected for the intensive research effort to be conducted following the pilot study.

PART II: STUDY AREA

General Description

8. The area selected as the field study site was a 50-mile reach of the Lower Mississippi River between Lake Providence, Louisiana, and Greenville, Mississippi (Figure 1). The following criteria were used for selecting the study area:

a. The existence of an extensive hydraulic and hydrologic data base.

b. Plans by the U. S. Army Engineer Vicksburg District to conduct potamology studies in the study reach during the time frame of the EWQOS.

c. The presence of a variety of dike and revetment structures.

d. A high diversity of characteristic floodplain and riverine aquatic habitats.

9. The study reach is confined on both sides by main-line levees constructed by the Corps of Engineers for flood control purposes. Leveed floodplain width ranges from 2 to 6 miles. Backwater habitats between the levees and the main stem river channel have indirect or seasonal connections with the river and are submerged during floods. No tributaries enter the river within the study reach.

10. Average discharge of the river at Vicksburg, Mississippi, is approximately 561,000 ft^3/sec. There is a 60-ft stage differential in water surface elevation at Vicksburg between extreme low and high water stages. Mean water velocity within the main channel is between 3 to 6 ft/sec with a maximum recorded velocity of 15 ft/sec during extreme high river flows. Hydrographs for the river at Vicksburg show the greatest discharges occurring from February through March and the least discharges from July through October.

11. The aquatic areas within the study site were classified into twelve habitat types. These habitats were the main channel, permanent secondary channels, temporary secondary channels, sandbars, natural banks, revetted banks, dike fields, abandoned river channels (Types I and II), oxbow lakes, borrow pits, and the inundated floodplain. Detailed

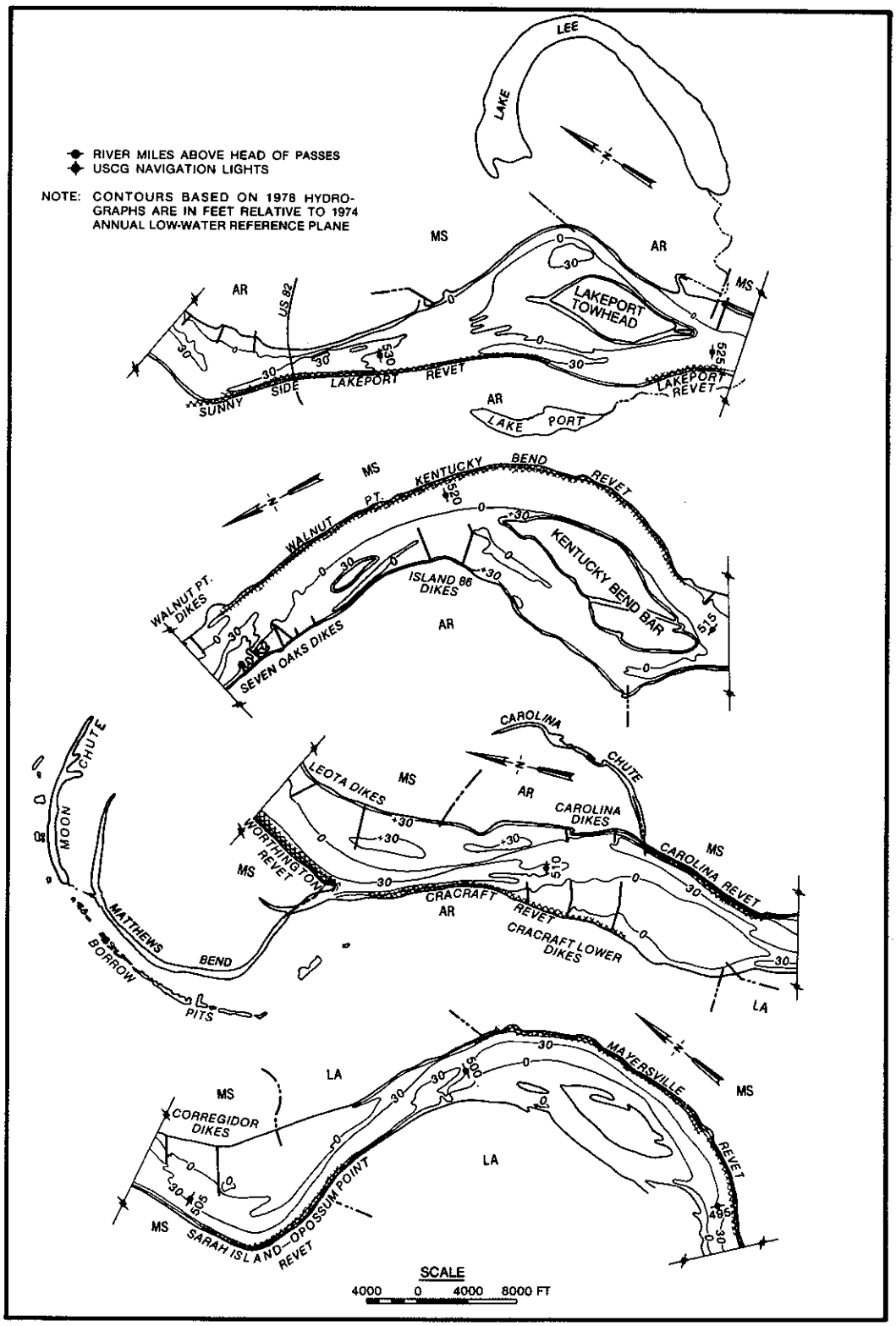

Figure 1. Map of study area

descriptions of the habitats and the study are found in Reports 1 and 2 of this series.

Collecting Sites

12. All habitats, except the main channel, were sampled for fish at least once during the pilot study.

13. Matthews Bend was the only example of an abandoned river channel (Type I) within the study area. Fish were sampled from stations located at the upper and lower (downstream) ends of the channel with gill and trammel nets (Figure A1). Nets were set perpendicular to the shoreline and fished at the water's surface.

14. Habitats classified as abandoned river channels (Type II) included Moon and Carolina Chutes (Figures A1 and A2). Surface and bottom set gill and trammel nets were fished perpendicular and parallel to shore within the abandoned channels.

15. Lake Lee was the only oxbow lake within the study area. Four open water and eight shoreline stations were sampled with gill and trammel nets (Figure A3). The open water stations were located approximately in the center of the lake. Nets were set perpendicular to the main axis of the oxbow and stations were 650 ft apart. Both bottom and surface sets were used. At each end of Lake Lee, two stations along the concave and two stations on the convex shoreline were fished. Nets were set perpendicular and adjacent to shore and fished at three stations along the convex bank of the oxbow. Stations in the chute connecting Lake Lee to the river were fished with gill nets, hoop nets, and slat traps.

16. Habitats classified as natural banks included (a) the right bank between Sunnyside-Lakeport Revetment at river mile 526 to 527.5 (Figure A3), (b) the right bank along Island 88 at river mile 514 to 515 (Figure A4), and (c) the left bank at river mile 499.9 to 500.7 located upstream of the Mayersville Revetment (Figure A5). Fish were sampled from all three areas with hoop nets and with electroshocking along the bank near the Mayersville Revetment.

17. Stations along the revetment at Walnut Point-Kentucky Bend,

Lakeport, Sunnyside, Cracraft, and Mayersville were sampled for fish with hoop nets (Figures A4, A5, A6, A7, A8 and A9). Electroshocking was used only at the Mayersville Revetment. A prerevetment and postrevetment study was conducted along natural and revetted banks associated with the Mayersville Revetment.

18. From April through December 1978, routine fish sampling was conducted monthly with hoop nets to monitor changes in fish populations associated with natural and revetted riverbanks within the study area at Mayersville. The following three sections of the river bank were chosen for study (Figure 2):

a. An existing revetted bank composed of stone riprap and articulated concrete mattress (ACM) that was placed in 1970 and extends from river mile 499.1 to 499.7.

b. A reach of natural bank extending from river mile 499.7 to 500.4. This section of bank was recently modified for bank

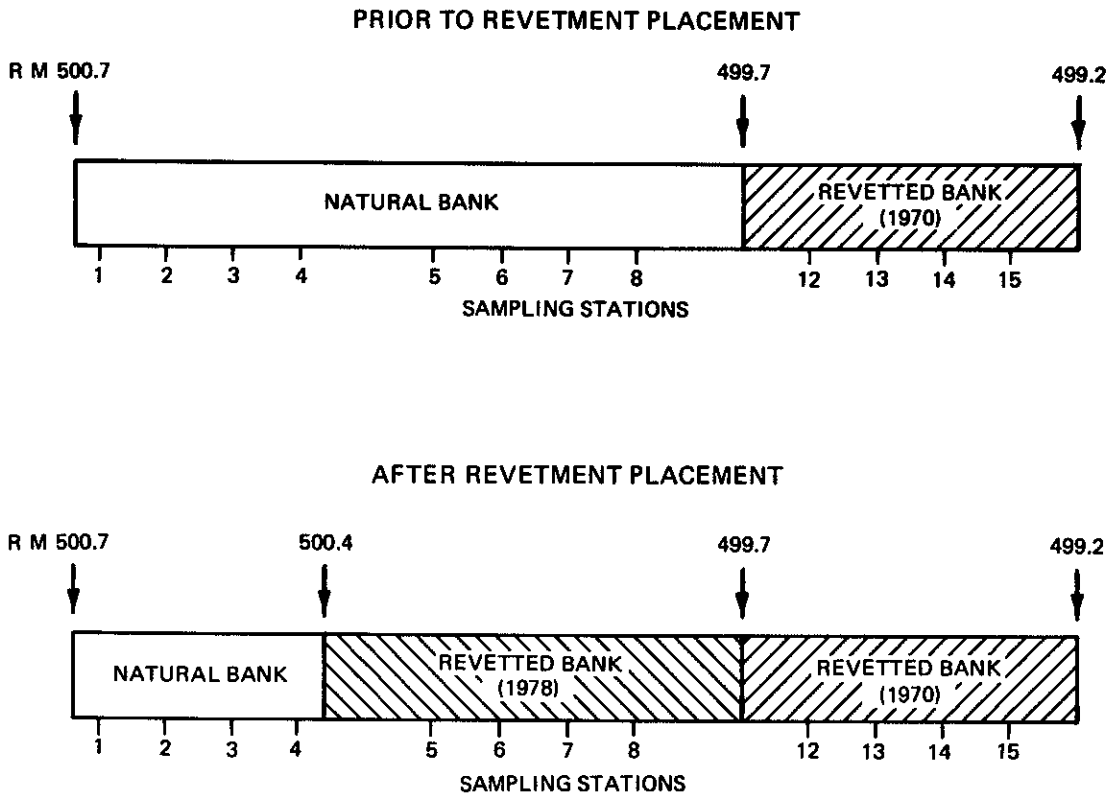

Figure 2. Diagram of Mississippi River left bank near Mayersville, Mississippi, illustrating station locations prior to and after revetment placement in 1978

stabilization with the placement of 3500 ft of ACM revetment in August 1978. Upper bank paving began on 24 August 1978 and was completed on 5 December 1978.

c. A natural bank section that extends upstream of the new revetment to river mile 500.7.

There were four sampling stations within each riverbank section. Stations within each section were 300 ft apart.

19. Fish sampling stations were established above and below dikes in the Island 86 Dike Field, Seven Oaks Dike Field, Walnut Point Dike Field, Leota Dike Field, and Lower Cracraft Dike Field (Figures A6, A7, A9 and A10). Stations were established to investigate both longitudinal and transverse distribution of fish in the dike fields. Samples were collected with hoop nets, slat traps, and electroshocking in lotic areas. Although dike fields are primarily a lotic water habitat, areas of standing water occurred at low water stages and were sampled with gill and trammel nets. Sandbars in the dike fields were sampled with 15- and 25-ft seines.

20. Sandbars were sampled at Lakeport Towhead and Kentucky Bend Bar (Figures A3 and A4). Fish sampling was conducted in shallow water adjacent to shoreline on main channel and secondary channel sides on the islands with 15- and 25-ft seines and 2- and 3-ft hoop nets. Gill nets and 15-ft seines were used to sample a pool on Kentucky Bend Bar that was isolated from the river during the summer at low water.

21. American Cutoff was the only permanent secondary channel sampled. Samples were collected from the right side of the channel adjacent to Lakeport Towhead and from the left side of the channel adjacent to the mainland with 2- and 3-ft hoop nets (Figure A3). A small chute parallel to American Cutoff that connects with the chute into Lake Lee was sampled with trammel nets.

22. Kentucky Bar Chute was the only temporary secondary channel in the study reach. At nearshore stations along the mainland and island shores of the channel and in areas of shallow water with inundated willow trees sampling was conducted with 2- and 3-ft hoop nets and 15- and 25-ft seines (Figure A4).

23. Fish samples were collected in a 5-acre borrow pit near

Matthews Bend with surface-set gill and trammel nets and 15-ft seines (Figure A1).

24. Inundated floodplain habitats existed during flood stage only. Fish were sampled on the floodplain at river mile 524.2 along the right bank with trammel and hoop nets (Figure A7).

PART III: MATERIALS AND METHODS

Description of Gear

25. Numerous problems exist in assessing the fish of large rivers. Most fish are highly mobile, and species composition in a given reach of the river changes with seasons of the year and riverflow stage. Previous studies on gear selectivity indicated that while certain gear types might adequately capture specific species or a certain size range of fish, no one gear is adequate for capturing all sizes of all species found in large river systems. For this reason, several gear types were used so that the fishing efficiency of each gear type could be assessed at different river stages and in different habitats. The various gear used are described in the following paragraphs.

Gill nets and trammel nets

26. Gill nets and trammel nets are effective fishing devices in obstructed, slack-water areas of any depth. Gill nets are considered highly species- and size-selective. Trammel nets are purportedly less size-selective and are considered to catch a wide diversity of fish species. A great deal of information about the diversity and abundance of fish can be gained by fishing different mesh sizes of gill or trammel nets simultaneously. Although typically fished in slack-water habitats, these nets can be fished in flowing water by setting the nets parallel to the direction of flow or by allowing the nets to drift with the current. Gill and trammel nets were set so that fish samples were taken from the surface or bottom strata.

27. The experimental nylon gill nets were 150 ft long and either 8 ft or 12 ft deep. The nets consisted of six 25-ft sections of 1, 1-1/2, 2, 2-1/2, 3, and 3-1/2 in. square mesh.

28. Nylon trammel nets were also 150 ft in length and either 8 ft or 12 ft deep. When the square mesh size of the inner panel was 2 in., the outer panels were 8 in. And when the inner panel was constructed of 3-in. square mesh netting, outer panels were 12-in. square mesh.

Hoop nets

29. These traplike nets capture fish in standing and slowly flowing water of shallow to moderate depth. Often hoop nets may be fished in habitats with moderate amounts of vegetation or cover. Hoop nets are species- and size-selective; however, different methods of fishing hoop nets and different mesh sizes provide additional information. Three different sizes of hoop nets were used during the pilot study. All three sizes were double-throated and each had seven fiberglass hoops. The following hoop net sizes were used: (a) mouth diameter of 2 ft, 10 ft long, with netting of 1-in. square mesh, (b) mouth diameter of 3 ft, 15 ft long, and 1-in. square mesh netting, and (c) mouth diameter of 4 ft, 16 ft long, and 1-1/2-in. square mesh netting. Hoop nets were fished unbaited.

Slat traps

30. These wooden traps can be fished in a wide variety of conditions. They are especially useful in water of moderate depth and can be fished effectively in areas of heavy cover. Slat traps are strongly species- and size-selective. Wooden slat traps used during the pilot study were 15 in. in diameter and 4 ft long. Two narrowing wooden throats were located on one end of the trap, and a removable side door was positioned on the opposite end so that captured fish could be removed. The traps were fished unbaited.

Seines

31. Seining is an effective fish-capture technique in shallow, unobstructed shoreline habitats. Seines can be used in flowing and slack waters. Two seine sizes were used and evaluated. One was a "common sense" minnow seine constructed with 1/8-in. square mesh delta netting. The seine was 15 ft long and 4 ft deep. The other seine was a 25-ft-long by 6-ft-deep bag seine. The bag was 6 by 6 ft, and the netting was 3/8-in. square mesh. Seines were pulled in the direction of current flow.

Trawls

32. Trawling is a means for capturing fish in deep, open water. Trawls can be fished on the bottom, at the surface, or in midwater.

The use of different mesh sizes and trawling speeds largely determines the size, and to some extent, the species composition of the catch. A 16-ft semiballoon otter trawl with 1-1/2-in. square mesh body and a 3/8-in. square mesh cod end was used. A cod liner constructed with 1/8-in. square mesh netting was used when actively trawling. The trawl was pulled downstream with the current.

Electroshocker

33. Electroshocking effectively captures certain species of fish in relatively shallow water. This technique can be used in standing or rapidly flowing waters and is effective in areas of dense vegetation or cover. The electroshocking unit employed was the commercially built Smith-Root, Inc., Type VI electroshocker. Two output modes were provided, AC or pulsating DC. The DC pulse rate could be selected between 60 and 120 pulses/sec. The peak DC voltage was adjustable from 0 to 840 v. The AC output was at 60 Hz/sec and adjustable in output voltage from 0 to 600 v.

Plankton nets

34. Plankton nets are used to capture larval, postlarval, and young-of-the-year fish in fairly unobstructed waters. The nets can be fished in flowing and slack waters and at different depths. A conical net, 19.7 in. in diameter, was used during the pilot study. Mesh size of the net material was 500 microns.

Gear Evaluation

35. Knowledge of the relative efficiency and selectivity of gear used for sampling is necessary for effective planning of field investigations. All gears are selective to some degree and the use of a variety of sampling devices gives a better indication of fish population diversity than would any one gear.

36. The fish collecting devices used during the pilot study were evaluated for their efficiency and selectivity by one or more of the following methods:

a. To evaluate gear selectivity, comparisons of the

length-frequency distribution of the catches by different kinds of gear fished in the same waters were made. When the length-frequency distribution of the catch is different among the gears, selection by at least one of the gears is manifest.

b. Frequency of occurrence of a species in the collection made with a particular gear is thought to indicate the efficiency and selectivity of the gears. The assumption is that the higher the percentage of occurrence, the more effective the gear is in taking a particular species.

c. The last method used to evaluate the gears was to determine the average length of each species caught by each gear. This was used as a crude measure of size selectivity of the various gears.

37. Gear evaluations were based on the catch from dike fields and an oxbow lake. The dike fields included Seven Oaks, Island 86, and Leota. Lake Lee was the site chosen as the oxbow lake. Because of the proximity of Seven Oaks and Island 86 Dike Fields, they were sampled on the same dates (2-4 August 1978) and are treated as one site for the purpose of gear comparisons. The catch from Lake Lee and from the Leota Dike Field are treated separately. Lake Lee was sampled 5-7 June 1978, and fish were captured at the Leota Dike Field 31 July-2 August 1978. Species lists were prepared for each habitat and methods thought to indicate gear efficiency and selectivity were calculated for each gear and species.

Habitat Comparison

Fish community

38. Fish were collected during the pilot study to describe the communities and compare diversity and abundance in the different habitats associated with the study area. Fish communities in each habitat were determined by the species of fish caught with all usable gear types over the duration of the pilot study. Assessments of the degree of similarity of fish communities among habitats and within each habitat type were based on species composition and frequency of capture of individual species. Comparison of the frequency of capture of individual species

among habitats was facilitated by ranking each species in order of decreasing numbers collected (1 = greatest number collected) by all gears at all times and comparing the five most frequently collected species (ranked 1-5) in one habitat with the ranks of the same five species in another habitat. Although similarity coefficients and nonparametric rank statistics are useful for this type of comparison, different sampling efforts and gears were used in the different habitats. Species ranked 1-5 in each habitat were compared to the ranks of the species in other habitats to give a general, qualitative indication of similarity of fish communities.

Abundance

39. Catch per unit of effort (C/f) was used as an index of abundance of fish in a habitat. Comparisons of C/f were made among habitats and within a habitat type over time. All mean C/f values are the number of fish caught divided by the number of units of effort catching one or more fish for that gear. The C/f by gill nets, trammel nets, hoop nets, and slat traps is equivalent to catch per net night. The C/f with seines is catch per seine haul with a haul being approximately 100 ft in length. The C/f with electroshocking is based on catch per 5-min transect. Only one trawl was conducted, and it was not timed nor was the distance measured. Units of effort in a habitat by gear type are presented in Table 1.

Mayersville, prerevetment and postrevetment

40. Monthly sampling was initiated on 17 April 1978 at the 12 permanent stations along the riverbank. Each station was sampled with 2-ft and 3-ft hoop nets. The 2-ft nets were always set in more shallow water near the riverbank; deeper water was sampled with the 3-ft nets. Nets were set parallel to shore and to each other for two consecutive nights and fished daily in the mornings.

41. Fish from all samples were weighed, measured, and counted. Scales or spines were collected from selected species for further age and growth analyses. Also, sex and state of gonadal development were determined for the fish from which scales or spines were removed.

42. At each station where a fish collection was made, water depth and surface measurements of dissolved oxygen (D.O.), temperature, and water velocity were taken. Depth was measured to the nearest 1 ft with Techsonic Industries Model Super Sixty depth sounder. A YSI (Yellow Springs Instrument Company) oxygen-temperature meter or a Hydrolab water analyzer was used to measure D.O. to the nearest 0.1 mg/ℓ and temperature to the 0.1 degree Celsius. Water velocity was measured to the nearest 1 cm/sec with a Marsh-McBirney Model 210 electromagnetic water current meter.

PART IV: RESULTS AND DISCUSSION

43. During the pilot study, 66 species of fish representing 17 families were collected (Table 2). A total of 9562 fish, weighing 4979.3 lb, were captured. Gizzard shad were by far the most numerically abundant (33.1 percent of the total) and the most abundant by weight (17.1 percent of the total biomass). Three other species comprised at least 5 percent of the numeric catch; river carpsucker (9.1 percent), freshwater drum (8.8 percent), and Mississippi silverside (5.9 percent). Carp ranked ninth in numerical abundance (2.5 percent of the total) but second in weight (16.2 percent of the total biomass). River carpsucker and freshwater drum comprised 13.6 and 9.7 percent of the total weight, respectively.

Gear Evaluation

44. The results of the gear evaluation conducted in the Seven Oak and Island 86 Dike Fields are summarized in Table 3. The data indicate that the seine captured a wider diversity of fish species than any other gear used. Overall 31 species were taken with the seine. In terms of frequency of occurrence, the seine was the most effective collecting device for 15 of the 44 species captured at these sites with all gears. However, length frequency data indicate that practically all fish captured by seining were less than 100 mm in total length (Figure 3). Most species captured were small cyprinids, clupeids, and young-of-the-year centrarchids. It appears that the seine is highly efficient in capturing these groups of fishes. Noticeably absent from the catch were several species of commercially important catfish.

45. The electroshocker was the next most efficient sampling gear used in the Seven Oaks and Island 86 Dike Fields. Seventeen species of fish were collected from the site with the electroshocker, which was the most effective device in capturing six species.

46. The number of species captured by 2-ft and 3-ft hoop nets were 16 and 15, respectively. Only seven species were collected using 4-ft

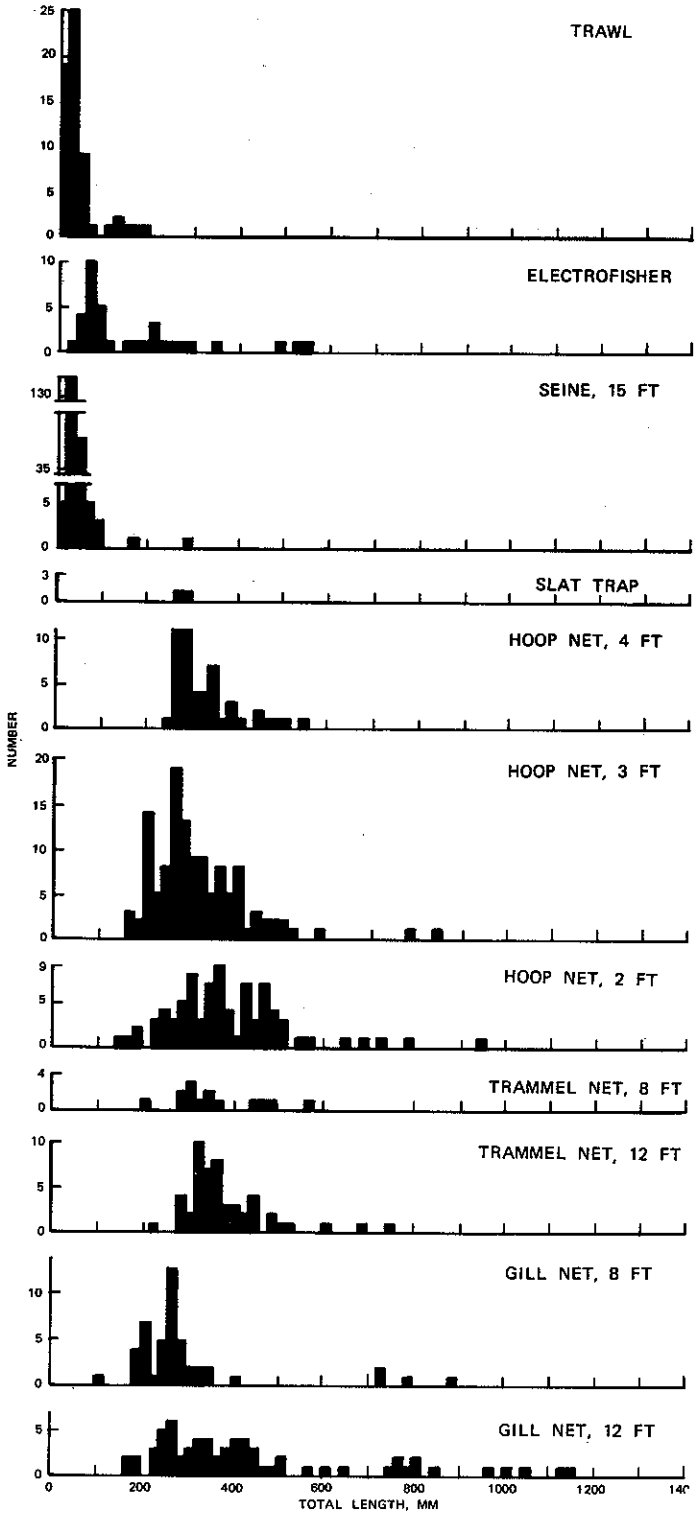

Figure 3. Length-frequency distribution of total catches with various collecting devices on 2-4 August 1978 from Seven Oaks and Island 86 Dike Fields

hoop nets. Frequency of occurrence data (Table 3) indicate that the 2-ft hoop nets were more effective in capturing four species (bowfin, eel, bigmouth buffalo, and spotted sucker) than any other gear. Even though the 4-ft nets captured only seven species, three of these (river carpsucker, quillback carpsucker, and freshwater drum) were most vulnerable to that gear. Interestingly, species common to the three sizes of hoop nets showed little difference in their average total lengths (Table 4). However, the 2-ft and 3-ft nets were more efficient in capturing a greater size range of fish (Figure 3). Lengths of fish captured with 2- and 3-ft nets ranged from 120 to 960 mm, but lengths of fish collected with 4-ft nets ranged between 240 and 560 mm.

47. Little difference in species composition existed in the combined catch using experimental gill nets and trammel nets. Fourteen fish species were taken with the two sizes of gill nets, and 13 species were captured with trammel nets. More species were captured with 12-ft nets than with 8-ft nets (Table 3).

48. Twelve-foot gill nets captured more gizzard shad than other gears evaluated at the site (Table 3). Eight-foot gill nets were most efficient in capturing three species--longnose gar, shortnose gar, and threadfin shad. Skipjack herring and striped bass were most vulnerable to capture with the 12-ft trammel net; carp and bluegill were most effectively caught with 8-ft trammel nets. Experimental gill nets captured fish with a greater range in total length than did trammel nets (Figure 3). However, the mean total lengths of fish common to gill and trammel nets were similar.

49. The trawl was highly selective in capturing bottom-dwelling fish, as expected (Table 3). Most fish captured with the trawl were young-of-the-year catfish and freshwater drum (Tables 3 and 4, Figure 3). Slat traps captured only one species, the flathead catfish.

50. Results of gear evaluations conducted in the Leota Dike Field are presented in Table 5. Gill nets, hoop nets, a seine, and the electroshocker were the gears used in association with the Leota Dike Field. The data indicate similar trends to the trends indicated by data from the Seven Oaks and Island 86 Dike Fields. The 15-ft seine

captured the highest number of species (27). The seine was the most efficient collecting device for 17 of the 27 species collected from the Leota Dike Field (Table 5). Species captured included cyprinids, clupeids, and young-of-the-year centrarchids. Comparison of a plot of the length frequency of the catch and the frequency of occurrence data indicates that the seine is highly selective for the above three groups (Figure 4).

51. Species composition, frequency of occurrence, and length distribution of the catch with 2- and 3-ft hoop nets were only slightly different. Seven species were collected with 2-ft nets, and 6 with 3-ft nets. Each size net was selective for three species each. Eel, channel catfish, and bluegill were captured most efficiently with 2-ft nets; 3-ft nets exhibited a slight selective preference for river carpsucker, flathead catfish, and freshwater drum. Length distribution of the catch with 2-ft nets was greater than the catch with 3-ft nets.

52. Little difference in species composition and length distribution existed between the two sizes of gill nets. Sixteen species were collected with the two sizes of gill nets; 15 with the 8-ft nets, 12 with the 12-ft nets. Frequency of occurrence of species common to both sizes of nets were very similar (Table 5). The 12-ft gill net was more efficient than any other gear in collecting shortnose gar. Skipjack herring, highfin carpsucker, smallmouth buffalo, redear sunfish, white crappie, and black crappie were more effectively captured with 8-ft gill nets. Length-frequency distribution of the catch of both sizes of nets were similar (Figure 4).

53. Comparative results for gill nets, trammel nets, and hoop nets for the Lake Lee sampling site are presented in Table 6. Gill nets and trammel nets were set so that fish were collected from either surface or bottom strata. Twenty-four species overall were collected with all gear types.

54. The number of species captured with 2-ft and 4-ft hoop nets were 2 and 8, respectively. The frequency of occurrence data and length-frequency distribution of the catch (Figure 5) indicate that 4-ft nets are a much more effective collecting device in standing water than are 2-ft hoop nets.

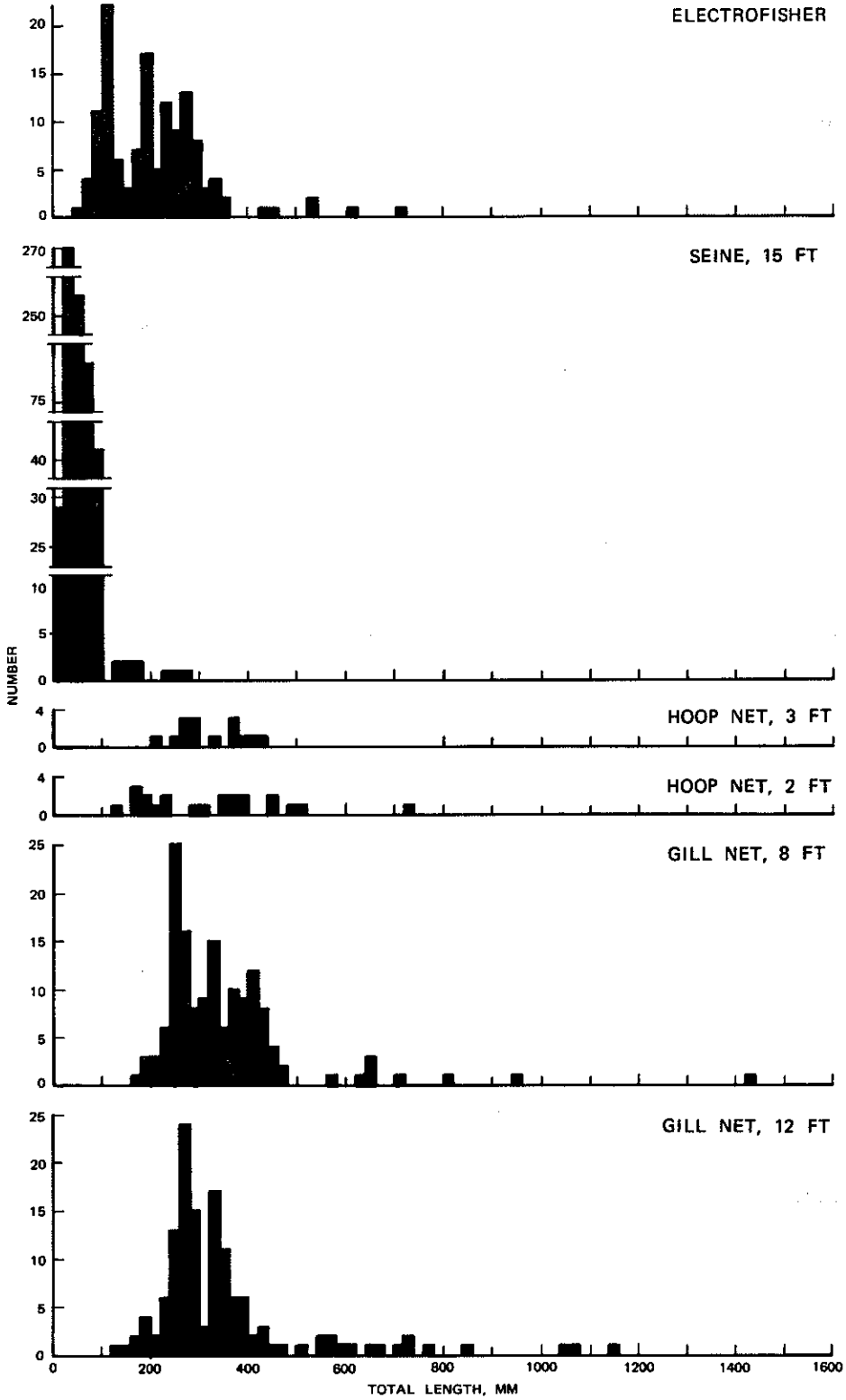

Figure 4. Length-frequency distribution of total catches with various collecting devices on 31 July-2 August 1978 from Leota Dike Field

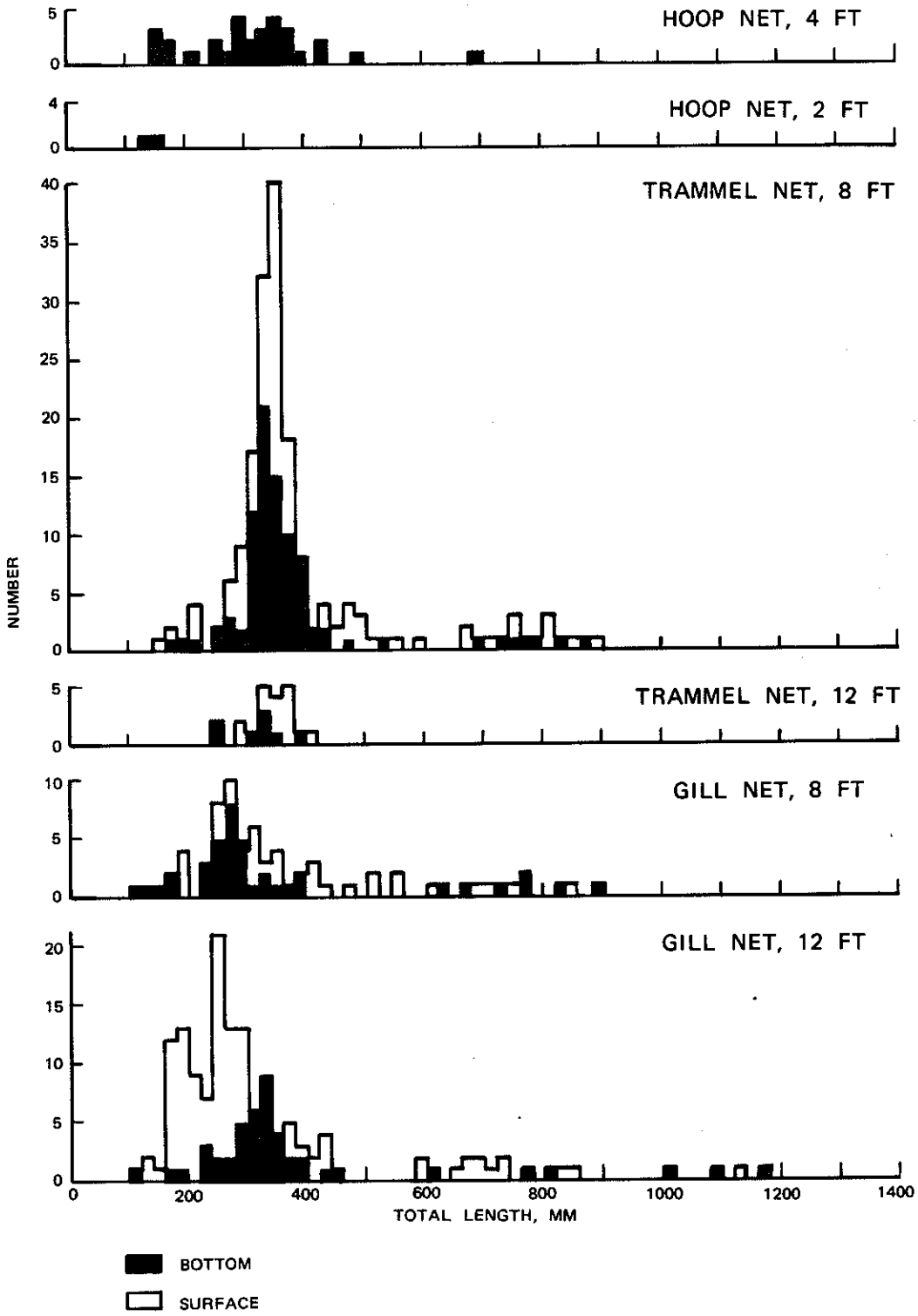

Figure 5. Length-frequency distribution of total catches with various collecting devices on 5-7 June 1978 from Lake Lee

55. Species composition differed only slightly in the combined catch of experimental gill and trammel nets. Eighteen species were taken with the two sizes of gill nets, and sixteen species were captured with trammel nets. More species were captured with 8-ft nets than with 12-ft nets (Table 6). This is the converse of findings in the Seven Oaks and Island 86 Dike Fields.

56. Skipjack herring, threadfin shad, blue catfish, and sauger were more efficiently captured with 12-ft gill nets than with other sizes of gill or trammel nets. Eight-foot gill nets were most selective for spotted gar, longnose gar, quillback carpsucker, smallmouth buffalo, and largemouth bass than the other types of gear used at Lake Lee. The 8-ft trammel nets were most effective in capturing five species. They were shortnose gar, bowfin, carp, highfin carpsucker, and bigmouth buffalo. The length-frequency distributions of gill and trammel net catches are similar, with the exception of the catch from the 12-ft trammel nets (Figure 5), which indicated a size selectivity for fishes between 340 and 420 mm in length.

57. It is interesting to note that the catch from surface-set nets was greater for all gill and trammel nets than the catch from bottom-set nets. However, species composition of surface- and bottom-set nets differed little.

58. It is readily apparent that no single gear satisfactorily samples all sizes and species of fish, regardless of habitat type. Also, the methods used to evaluate gear efficiency and selectivity were strictly qualitative and subjective procedures.

59. Based on results of the pilot study, seines, gill nets, hoop nets, and electroshocking were selected as gears to collect juvenile and adult fishes for the remaining portion of the field studies. The plankton net was selected to collect larval fishes.

60. Seines were found to be a variable gear for estimating the diversity of fish in shoreline habitats. Many species of minnows and shiners, which are a major component of the forage base, were collected only with seines. Also collected were young-of-the-year centrarchids, a recreationally important group of fish. The primary advantage of a

seine is that it may be used in areas not easily worked by other gears. If the seine is used carefully, samples of fish are usually in good condition and may be returned to the river after data has been recorded.

61. Gill nets were selected because they more effectively captured a greater number of species with a greater range in length distribution than did trammel nets. Also, fish can be removed from gill nets much more quickly than from trammel nets. This allows more nets to be deployed without additional manpower requirements. A disadvantage is that fish are usually injured when removed from the gill nets and cannot be returned to the water alive.

62. Hoop nets are an invaluable gear for riverine fisheries work, even though they are species-selective. These nets can be deployed in a variety of habitats, exhibiting wide ranges of current, depth, and substrate. The fish, when removed from the net, are generally uninjured and may be returned to the water.

63. Even though the electroshocker was not used extensively during the pilot study, it will be frequently used during the field studies. The electroshocker is very effective in rivers with waters of low to moderate conductivity, especially when operated in the DC mode. The electroshocker is very effective in capturing a majority of species present with little harm to the fish.

64. Report 6 presents the reasons for selecting plankton nets to conduct the larval fish studies.

Habitat Comparison

Fish communities by habitat

65. Habitats are discussed in order of decreasing fish community diversity. For example, a greater diversity of fish was collected from dike fields, which are discussed first. The least number of species was collected from the inundated floodplain, which is discussed last.

66. Dike field. Dike fields are diverse habitats that contain standing and flowing water with a wide variety of substrates such as mud, sand, gravel, stone riprap, and vegetation. Of all habitats sampled,

dike fields had the most diverse fish community. The 55 species collected in dike fields included 10 species unique to this habitat (Table 7). Present were the stoneroller, the cypress minnow, pugnose minnow, spotfin shiner, steelcolor shiner, creek chub, black buffalo, blackstripe topminnow, longear sunfish, and spotted bass. Gizzard shad, Mississippi silverside, threadfin shad, black crappie, and freshwater drum were the five most frequently collected species (Table 8).

67. Because of the physical diversity of the Lower Cracraft, Island 86, Leota, Seven Oaks, and Walnut Point Dike Fields, it was possible to efficiently use a wide variety of gear. Seven species of fish were collected with hoop nets in the Lower Cracraft Dike Field (Table 7). Freshwater drum was the only species frequently captured. The Island 86 Dike Field was sampled with gill nets, trammel nets, hoop nets, slat traps, and seines. Of the 41 species collected, black crappie was the most frequently captured. Gizzard shad, Mississippi silverside, brook silverside, and emerald shiner, all collected in large numbers, were the second through fifth most frequently collected species. Blackstripe topminnow and spotted bass were collected only at the Island 86 Dike Field. Forty-five species were collected in the Leota Dike Field with gill nets, hoop nets, seines, and electroshocking. The five most frequently collected species, in decreasing order, were gizzard shad, threadfin shad, Mississippi silverside, river shiner, and river carpsucker (Table 8). Cypress minnow, pugnose minnow, spotfin shiner, steelcolor shiner, creek chub, and black buffalo were unique to Leota Dike Field. Seven Oaks Dike Field was sampled with gill nets, hoop nets, slat traps, electroshocking, and trawling. Twenty-one species of fish were collected (Table 7). The five most frequently collected species, in decreasing order, were freshwater drum, gizzard shad, blue catfish, flathead catfish, and river carpsucker (Table 8). Stoneroller and longear sunfish were caught only in Seven Oaks. At Walnut Point Dike Field, 11 species were collected with hoop nets (Table 7). Because of the limited effort with these gears, relatively few individuals were caught. The 17 freshwater drum collected constituted the most frequently collected species. The next most frequently collected species included channel

catfish, flathead catfish, gizzard shad, shortnose gar, and white crappie.

68. Sandbar. Although areas of standing and flowing water with different substrates were present, diversity of habitat was considerably less here than in dike fields. Also, the variety of gears used and the number of samples collected was reduced when compared to the effort in the dike fields.

69. Thirty-nine different species of fish were collected with gill nets, hoop nets, and seines (Table 7). Two species, the bluntnose darter and the speckled chub, were captured only from this habitat. The five most frequently collected species, in decreasing order, were gizzard shad, Mississippi silverside, river shiner, freshwater drum, and river carpsucker (Table 8). Sandbar areas at Kentucky Bend Bar and Lakeport Towhead comprised this habitat. Twenty-three species of fish were captured with gill nets, hoop nets, and a seine at Kentucky Bend Bar (Table 7). Freshwater drum, gizzard shad, Mississippi silverside, channel catfish, and shortnose gar were the five most frequently collected species (Table 8). At Lakeport Towhead, 36 species were collected with hoop nets and seines (Table 7). Gizzard shad and Mississippi silverside, collected in almost identical numbers, were the first and second most frequently collected species, respectively (Table 8). River shiner, also collected in large numbers, was the third most frequently collected species; river carpsucker and white bass were the fourth and fifth most frequently collected species, respectively. Bluntnose darter and speckled chub were collected only at the sandbar areas at Lakeport Towhead.

70. The high diversity is largely attributable to fish collected from shallow shoreline water with seines. Considerably more species were collected at the more extensively seined Lakeport Towhead. Relative to the number of species caught with the same gear in other habitats, high numbers of species were collected with hoop nets. Only moderate numbers of species were collected with gill nets. However, this gear was only fished for two net-nights.

71. Abandoned channel. The third highest diversity of fish was

collected in abandoned river channels (Types I and II). The high diversity in the abandoned channels is significant because only gill nets, trammel nets, hoop nets, and slat traps were fished; almost all fish were caught in the web nets. Of the gears used, 8-ft gill nets caught the greatest number of species in the abandoned channels. Also, more species of fish were caught with 8-ft gill nets in the abandoned channels than were caught in the other habitats with this gear.

72. Abandoned channels (Types I and II) were treated as the same habitat and included Matthews Bend, Carolina Chute, and Moon Chute. Thirty-one species of fish were collected from the sites in this habitat type (Table 7). Of these species, two were collected only from this habitat--brown bullhead and warmouth. Gizzard shad was the most frequently collected fish, followed by river carpsucker, freshwater drum, carp, and shortnose gar (Table 8). In Matthews Bend, 26 species of fish were collected (Table 7). Gizzard shad was, by far, the most frequently collected species (Table 8). River carpsucker, freshwater drum, carp, and blue catfish were the second through fifth most frequently collected species. Twenty-five species were collected from Moon Chute (Table 7). The five most frequently collected species, in decreasing order, were gizzard shad, river carpsucker, freshwater drum, shortnose gar, and carp (Table 8). Brown bullhead and warmouth were collected only in Moon Chute. Only 12 different species were captured in Carolina Chute (Table 7). As in Matthews Bend and Moon Chute, gizzard shad and river carpsucker were the first and second most frequently collected species, respectively. Carp and bowfin were the third and fourth most frequently collected species. Blue catfish and freshwater drum, collected in equal numbers, were next in frequency of collection (Table 8).

73. Temporary secondary channel. Fish were collected with hoop nets and seines in Kentucky Bar Chute, the only example of the temporary secondary channel. Twenty-eight different species were collected (Table 7). No unique species was collected in this habitat. Mississippi silverside was the most frequently collected species (Table 8). River shiner, gizzard shad, white bass, and threadfin shad were the second through fifth most frequently collected species.

74. Of the 28 species captured, 20 were captured with a 15-ft seine and an additional four species were collected with a 25-ft seine. The high diversity of species of fish in Kentucky Bend Chute, despite the limited habitat diversity and sampling effort, attests to the importance of the shallow water along the shoreline as fish habitat. High diversity collections with seines at dike fields and sandbars support this conclusion.

75. Oxbow lake. Twenty-seven species of fish were captured in Lake Lee. No species was unique to the oxbow lake. Relative frequency of the species collected in this habitat are shown in Table 8. Gizzard shad was the most frequently collected species. River carpsucker, freshwater drum, channel catfish, and white crappie were the second through fifth most frequently collected species.

76. Revetted bank. Hoop nets and electroshocking were the only fish-capture devices that could be deployed in the swiftly flowing waters along the revetted banks. These gears caught a total of 18 different species (Table 7). No species unique to revetted banks was captured. Freshwater drum was the most abundant species in this habitat type, followed by channel catfish, gizzard shad, flathead catfish, and blue catfish (Table 8). Data for the revetted bank habitats were collected from five locations. At Cracraft Revetment, only one carp and one freshwater drum were caught in four net-nights of effort with 2-ft hoop nets. Hoop nets fished at Lakeport Revetment caught few individuals of six species (Table 7). Channel catfish was the most frequently collected species; the five flathead catfish, three blue catfish, two carp, and two smallmouth buffalo comprised the second through fifth most frequently collected species (Table 8). Mayersville Revetment was extensively sampled with 2- and 3-ft hoop nets, and several samples were collected with 4-ft hoop nets and electroshocking. Sixteen species were collected at Mayersville Revetment (Table 7). Freshwater drum was the most frequently collected species, and gizzard shad, flathead catfish, blue catfish, and skipjack herring were the second through fifth, respectively, most frequently collected species (Table 8). Limited effort with 2- and 3-ft hoop nets collected eight species of fish at Sunnyside Revetment.

Only channel catfish, the most frequently collected species, was collected in appreciable numbers. The three blue catfish and two flathead catfish, two longnose gar, and two smallmouth buffalo were the next most frequently collected species. Fourteen species were collected at Walnut Point-Kentucky Bend Revetment with hoop nets. Freshwater drum was the most frequently collected species, followed by gizzard shad. The third and fourth most frequently collected fish--carp and flathead catfish--were collected in equal numbers. Channel catfish was the fifth most frequently collected species.

77. Natural bank. Hoop nets and electroshocking were used to sample fish along natural banks. These gears caught 19 different species (Table 7). No species was unique to natural banks. Freshwater drum were caught most frequently. Flathead catfish, carp, gizzard shad, and blue catfish were the second through fifth most numerically abundant in the catch (Table 8). Three areas comprised the natural bank habitat. At Anconia Natural Bank, eight species were caught with hoop nets (Table 7). The few fish caught were collected in similar numbers. Freshwater drum were most frequently collected; channel catfish and carp were the second and third most frequently collected species (Table 8). Fourth, fifth, and sixth most frequently collected were almost equal numbers of blue catfish, flathead catfish, and river carpsucker. The limited sampling effort with hoop nets during only April collected few individuals of four species at Island 88 Natural Bank (Table 7). Carp was the most frequently collected species, followed by flathead catfish, freshwater drum, and white crappie (Table 8). At the Mayersville Natural Bank, 18 species were collected during extensive sampling with 2- and 3-ft hoop nets and limited sampling with 4-ft hoop nets and electroshocking (Table 7). Freshwater drum was the most frequently collected species. Flathead catfish, carp, gizzard shad, and blue catfish were the second through fifth most frequently collected species (Table 8).

78. The sixth and seventh greatest numbers of species were collected at the revetted bank and natural bank habitats, respectively. The number of species collected in these two habitats was similar, as was expected because of the similarity of the two habitats, the use of the same

gears, the similar time of sampling, and the geographical promixity of the revetted bank and natural bank areas. The lower diversity of the fish communities in these habitats, compared to the diversity found in other habitats, is associated with the limited habitat diversity and the types of gear that could be fished in these areas.

79. Borrow pit. Only one borrow pit was sampled during the pilot study. The borrow pit habitat is very similar to the other standing-water habitats, except that the borrow pit is smaller and not generally confluent with the river. Sampling was conducted with gill nets and a seine. Thirteen species of fish were collected (Table 7). Of the few fish caught, river shiner was the most abundant species, followed by an equal number of spotted gar and bowfin.

80. Permanent secondary channel. Sampling with trammel nets and hoop nets in American Cutoff yielded 12 species of fish (Table 7). No species of fish unique to this habitat was collected. Freshwater drum, carp, flathead catfish, channel catfish, and shovelnose sturgeon, in decreasing order, were the four most frequently collected species (Table 8).

81. Fewer species were collected in American Cutoff than at the natural banks and the revetted banks. The permanent secondary channel, natural bank, and revetted bank habitats are similar because most of the samples in American Cutoff were collected with hoop nets along steep bank areas. The lower diversity in the permanent secondary channel was, therefore, unexpected. Further, the low diversity is surprising because some sampling in American Cutoff was conducted with trammel nets in a slow-flowing water (part of the chute which connects Lake Lee with the river at American Cutoff).

82. Inundated floodplain. The inundated floodplain was sampled in only one location with trammel nets and gill nets. Only two carp were captured in the limited sampling effort.

Habitat selection

83. Based on results of the pilot study, dike fields, revetted banks, natural banks, and abandoned channels were selected as habitats to be studied during the remainder of the field studies. Dike fields

and revetted banks were chosen because of their ubiquity in the Mississippi River ecosystem and their influence on the physical characteristics of the river. Abandoned channels and natural banks were chosen so that results obtained from habitats directly influenced by Corps of Engineer (CE) structures could be related to similar areas that are not directly influenced by a dike or a revetted bank. Other habitats were not selected because of their similarity to one of the four habitats chosen (natural sandbar and dike field shoreline) or because of their importance only during high river stages (borrow pits and inundated floodplain).

Temporal changes in species composition

84. All habitats exhibited temporal changes in the number of species collected or in the species composition of the community. In standing-water habitats (oxbow lake and abandoned channels), the number of species collected with gill and trammel nets was higher during June than in April or May, except for the catch with 8-ft trammel nets. The higher diversity of the catch during May than in June with 8-ft trammel nets resulted from fishing this gear in Carolina Chute and Moon Chute during May but only in Moon Chute during June. Shovelnose sturgeon was the only species caught in the standing-water habitats with gill and trammel nets during April and May that was not caught in June. Several species were typical to the more diverse community in June. Paddlefish, black bullhead, yellow bullhead, brown bullhead, largemouth bass, and sauger were collected in the standing-water only in June. Shortnose gar and bluegills were more frequently collected during June.

85. In the flowing-water habitats (natural banks, revetted banks, and dike fields), hoop net sampling indicated the community was more diverse during April-June than July-October. With the higher diversity early in the year, several species were collected in the flowing-water habitats only during spring or spring to summer. Sauger were collected only in April. Since this species was collected in the standing-water habitats only during June, the April occurrence in flowing water may be related to spawning habits of this species. Spotted suckers were

collected only during April-May. Gizzard shad and carp were collected only during April-August and April-July, respectively.

86. No consistent temporal trends in diversity of the fish community were apparent in the seinable habitats. In the sandbar habitat, diversity was much higher during August than in June; however, the seining effort was also much greater in August. Diversity in the temporary secondary channel was similar in June and August, despite the higher seining effort in August. June and August diversities were similar in the dike field habitat; however, the representative areas that were seined (Island 86 and Leota Dike Fields) differed considerably. At the Island 86 Dike Field, a similar effort with the 15-ft seine in June and August resulted in much higher diversity during June. At the Leota Dike Field, diversity and seining effort were both higher during August than in June. Seining with the 25-ft seine was conducted only during June at Island 86 and Leota Dike Fields. Approximately the same number of samples were collected in both dike fields. The number of species and the species composition with the 25-ft seine at the Island 86 Dike Field approximated the corresponding figures with the 15-ft seine in June, which substantiates the higher diversity during June in this dike field. The number of species collected with the 25-ft seine during June at the Leota Dike Field was greater than the number of species collected with the 15-ft seine at this time. Further, all species collected with the 15-ft seine were also collected with the 25-ft seine. This suggests that, although diversity may have been higher during August at Leota Dike Field, the difference in the diversities between June and August were due, at least in part, to the higher seining effort during August.

87. Inspection of the inshore fish community across all riverine habitats where seining was conducted does indicate differences in community composition between June and August. Mooneye, ribbon shiner, bigmouth buffalo, and sauger were frequent during June but were not collected during August. Single specimens of speckled chub and blackstripe topminnow were collected during June. Silver chub, spotfin shiner, and highfin carpsucker were frequent during August but were not present in the June seine samples. Limited numbers of taillight shiner, steelcolor

shiner, and black buffalo were collected only during August. Threadfin shad were common during August and rare during June.

Generalized fish communities

88. Based on species composition and relative numerical frequency of species collected, three generalized fish communities can be recognized. There is a diverse standing-water community typified by the fish collected in the abandoned channels and oxbow lake. Shortnose gar, gizzard shad, carp, river carpsucker, channel catfish, white crappie, and freshwater drum are numerically dominant; paddlefish, spotted gar, black bullhead, yellow bullhead, and brown bullhead are unique to the standing-water community. The standing-water community, except for its unique species, also occurred in dike fields, primarily in the slack-water areas. The borrow pit is also a standing-water habitat but, based on the low diversity collected (albeit with limited sampling), may represent a unique community.

89. A flowing-water community is typified by the moderately diverse communities along natural and revetted banks. Gizzard shad, carp, blue catfish, channel catfish, flathead catfish, and freshwater drum are numerically dominant; shovelnose sturgeon, goldeye, mooneye, and spotted sucker are rather unique in this flowing-water community. This community also occurred in the dike field, sandbar, temporary secondary channel, and permanent secondary channel habitats.

90. Another community consists of the inshore fish. This a diverse community of fish seined in the shallow, shore-water interface habitats of dike fields, natural sandbars, and temporary secondary channels. Frequently collected inshore species included the various Notropis spp., bullhead minnow, river carpsucker, buffalo, brook silverside, Mississippi silverside, white bass, striped bass, and young-of-the-year sunfish.

Abundance

91. C/f data can be used to indicate numerical abundance of fish. Comparative abundance of fish in habitats containing standing water is based on C/f with gill and trammel nets. Although sampling with 8-ft gill nets indicated greatest abundance of fish in standing-water areas of

the sandbar and dike field habitats, the abandoned channel and oxbow lake habitats show, in general, the greatest abundance of fish when collections with all web nets are considered (Table 9). The high C/f in standing-water habitats is largely due to consistently high numbers of gizzard shad and freshwater drum and frequently high numbers of river carpsucker, spotted gar, shortnose gar, and white crappie caught with web nets. Where comparisons were possible, temporal comparisons of catch with web nets in Matthews Bend, Carolina Chute, Moon Chute, and Lake Lee indicated fish were generally more abundant during June than in April or May (Tables 10, 11, 12, 13, and 14). The increased abundance in June resulted from increased numbers of species collected and increased catches of freshwater drum, river carpsucker, spotted gar, shortnose gar, white crappie, bluegill, gizzard shad, smallmouth buffalo, and paddlefish at this time. The catch of carp, however, was lower in June than in April and May. Because temporal variations in C/f with web nets existed in the abandoned channel and oxbow lake habitats, comparisons of habitats representing the abandoned channels must be based on monthly sampling. Hence, only C/f obtained with the same gear in the same month can be used to compare abundance between habitats. C/f with 8-ft trammel nets indicated similar abundance in Carolina Chute and Moon Chute in May and in Matthews Bend, Moon Chute, and Lake Lee in June (Table 10). Abundance of fish, based on C/f with 8-ft gill nets, was similar in Matthews Bend, Moon Chute, and Lake Lee in June, but in May the abundance in Caroline Chute was much lower in the Lake Lee than in Matthews Bend (Table 11).

92. C/f with hoop nets indicated the abundance of fish in flowing-water habitats was greatest in Lake Lee and American Cutoff. These high abundance estimates for Lake Lee were due to large catches of channel catfish in hoop nets set in the chute connecting Lake Lee with the river. Generally, similar numerical abundances of fish were collected among natural bank, revetted bank, dike field, natural sandbar, and temporary secondary channel habitats. Temporal trends in abundance differed among habitats. Along revetted banks and, to a greater extent, in natural banks, fish were most abundant in July based on C/f for 2- and 3-ft hoop

nets (Tables 15 and 16). The greater abundance in July along natural banks was due to increased catches of freshwater drum, gizzard shad, river carpsucker, blue catfish, and carp, but the greater abundance in July at the revetted banks was due to increased catches of freshwater drum, smallmouth buffalo, and flathead catfish. It is important to note that the increased catch was, in general, due to slightly greater C/f of many species in a rather constant community, rather than large increases in a few species or large increases in the number of species collected. In dike fields, hoop net sampling indicated greatest abundance in April, followed by fluctuating but decreasing C/f (Tables 15, 16, and 17). The greater abundance of fish during April in the dike fields coincided with increased numbers of species collected with hoop nets, greatly increased catches of carp with 2-ft hoop nets and freshwater drum with 3-ft hoop nets, and slight increases in catch of most of the species collected in the dike fields from April-August. This temporal trend in abundance of individual species was shown in most dike fields.

93. Highest mean C/f of all hoop net samples was obtained with 4-ft hoop nets in Lake Lee (Table 17). High C/f values with 4-ft hoop nets were also found in the dike fields. C/f was highly variable in the natural banks and revetted banks. No fish were caught in two net-nights with 4-ft hoop nets in the inundated floodplain.

94. Temporal variation in fish abundance also occurred within the habitats comprising the natural bank, revetted bank, and dike field habitats. Comparison of C/f with 2-ft hoop nets by month among the natural banks indicated similar abundances of fish at Anconia, Island 88, and Mayersville during April. C/f was similar at Anconia and Mayersville during April and June (Table 15). Comparisons of C/f with 3-ft hoop nets suggests similar abundance of fish at Island 88 and Mayersville Natural Banks during April and greater abundances at Mayersville than at Anconia during June (Table 16). Monthly C/f with 2- and 3-ft hoop nets were compared among revetted bank habitats. C/f with 2-ft hoop nets during April suggests highest abundance at Walnut Point-Kentucky Bend Revetment, intermediate abundance at Mayersville Revetment, and low abundance at Cracraft Revetment (Table 15). C/f with 2-ft hoop nets

during June indicated greater abundance at Lakeport Revetment than at Mayersville Revetment and similar abundance at Mayersville and Walnut Point-Kentucky Bend Revetments during August. C/f with 3-ft hoop nets indicated that fish were more abundant at Walnut Point-Kentucky Bend Revetment than at Mayersville Revetment during April and May, that fish occurred in similar abundance at Lakeport and Mayersville Revetments during June, and that fish were more abundant at Mayersville Revetment than at Walnut Point-Kentucky Bend Revetment during August (Table 16). These limited comparisons suggest that fish were more abundant at Walnut Point-Kentucky Bend Revetment than at the other revetted bank habitats sampled.

95. Comparison of abundances of fish between dike fields is hampered by discrepancies between C/f with 2-ft hoop nets versus C/f with 3-ft hoop nets. C/f with 2-ft hoop nets indicates that abundance was high and similar at Island 86 and Seven Oaks Dike Fields and low (zero catch) at Lower Cracraft Dike Field during April. The abundance of fish was similar at Island 86 and Seven Oaks Dike Fields during May, at Leota and Lower Cracraft Dike Fields during June, and at Island 86 and Leota Dike Fields in August (Table 15). C/f with 3-ft hoop nets indicated similar abundance at Lower Cracraft and Island 86 Dike Fields during April, at Island 86 and Seven Oaks Dike Fields in May, and at Lower Cracraft and Walnut Point Dike Fields during June (Table 16). Greatest relative abundance of fish in the dike fields occurred at Island 86 during April, Island 86 and Seven Oaks during May, and Leota Dike Field during August.

96. Inshore fish were more abundant in Kentucky Bend Bar Chute based on C/f over time with 15-ft seines in June and August and 25-ft seines in June (Tables 18 and 19). The highest abundance in this habitat coincided with large catches of gizzard shad with 15-ft seines and of river shiner and white bass with 25-ft seines. In Kentucky Bend Bar Chute the variation in C/f was lower for the catch with the 15-ft than with the 25-ft seine, despite the fact that samples were collected with the 15-ft seine during two months and in only one month with the 25-ft seine. However, only two samples were taken with the 25-ft seine and

C/f for each sample differed widely. The inshore fishes in the secondary channel were more abundant during August than in June. The greater abundance in August resulted largely from very large catches of gizzard shad and Mississippi silverside.

97. Mean C/f for all samples with 15- and 25-ft seines in the dike fields was intermediate between that for secondary channels and sandbars. The higher abundance in dike fields than at sandbars is, in part, associated with higher C/f of young-of-the-year black crappie, brook silverside, Mississippi silverside, emerald shiner, silvery minnow, and threadfin shad with the 15-ft seine and higher C/f of young-of-the-year largemouth bass, striped bass, and white bass, river shiner, and silvery minnow and higher diversities with the 25-ft seine in the dike fields. The abundance of fish collected with 15-ft seines in dike fields was higher during June than in August. Greater abundances of young-of-the-year black crappie, brook silverside, and silvery minnow in June are counterbalanced by the increased abundance of emerald shiners, gizzard shad, and threadfin shad during August. The lower abundance in August was partly a function of the more extensive seining effort in that month. The reader is reminded that C/f with a single gear type in a habitat is the total catch of all individuals pooled over species divided by the number of units of effort with the gear in which that species was collected. Therefore, it is reasonable that C/f at two or more different times (or in different habitats) can differ due to different sampling efforts even though the total number of individuals caught and the number of species are the same. Conversely, C/f pooled over species between habitats or time periods can be similar or equal despite differences in the number of species and the C/f of individual species when the sampling effort is unequal. The influence of sample size on C/f is particularly apparent for seine samples due to the wide variation in total number of individuals and number of individuals of a species collected with seines.

98. Comparisons by month of C/f with seines in the dike fields indicates fish were more abundant at Island 86 Dike Field than at Leota Dike Field during June and August. The greater abundance at Island 86 Dike Field during June resulted from collection of more species and the

greater abundance of silvery minnow, Mississippi silverside, and young-of-the-year black crappie in this habitat. The sampling effort was similar at Island 86 and Leota Dike Fields in June. The greater abundance at Island 86 in August, despite the greater diversity at Leota, resulted from the large catch of emerald shiner and a much lower sampling effort at Island 86 Dike Field.

99. In the sandbar habitats, abundance of inshore fish was similar in June and August. The similar abundance over time resulted from more extensive sampling with seines during August. Abundance in individual natural sandbar habitats, based only on C/f with 15-ft seines during August, indicates greater abundance of fish at Lakeport Towhead. This greater abundance, despite more extensive sampling, resulted from the greater diversity and moderate numbers of individuals of most species collected; whereas, the limited sampling effort at Kentucky Bend Bar caught very few individuals of only a few species.

100. Low and highly variable C/f values were obtained with slat traps fished in dike fields and abandoned channels (Table 20). Electroshocking was conducted in dike fields and along natural and revetted banks. C/f was highly variable in all three areas (Table 21). Trawling was attempted only once, and based on C/f relative to other years, was successful in the dike fields (Table 9).

Mayersville, prerevetment and postrevetment

101. Monthly water temperature from the Mayersville area indicated that no unusual thermal conditions occurred during the study. Maximum temperatures occurred in August, and minimum temperatures were in December. Monthly temperatures rarely varied more than one degree among station groupings and between the shallow and deep sets at a station. The general trend was that temperatures recorded from the shallowwater sets were slightly lower than temperatures at the deepwater sets. Also, temperatures from stations located along the old revetment (stations 12-15) were slightly cooler than those recorded at the other stations. However, analysis of variance indicates that no statistically significant differences in temperatures were evident among station groupings or

between the shallowwater and deepwater sets at a particular station (Table 22).

102. Dissolved oxygen determinations indicated a normal tendency toward winter maximum and summer minimum values. The inner, more shallow sets at a station had only slightly higher D.O. values than did the deeper sets. The difference, however, was not significant (Table 22). Also, no significant differences of D.O. values occurred among the stations when grouped by bank type.

103. Monthly current measurements indicated that velocity was significantly less at stations along the old ACM revetment at both the shallow and deep sets than at other stations grouped by bank type (Table 22). The data also demonstrates that currents along the shallow inshore sets were less than, but not significantly different from, the deepwater sets at each sampling station.

104. Mean depths at each net set were fairly consistent throughout the study period. Depths of shallow sets were approximately 6 ft, and depth of the deepwater sets were generally 12 ft. Water depth of the deep sets associated with the old revetment at stations 12-15 was slightly less, and significantly different from, the deep sets at stations 1-4 and 5-8 (Table 22).

105. Hoop net catches varied considerably during the nine-month study along the Mayersville Revetment. Total catches ranged from zero in numerous net sets to over 16 fish captured at station 2 on 11 July. Greatest catches occurred during June and July as river stage decreased and water temperatures were increasing. Catches were consistently low from September-December. Some possible explanations for such low hoop net catches include the following: (a) a steady low water river stage during September and October; (b) decreased activity of fish caused by falling water temperatures; and (c) disturbance of the area when revetment was placed on 24 August along the riverbank at stations 5-8 or by upper bank grading that continued through December.

106. Total catches were generally greatest along the natural bank at stations 1-4 and 5-8 (prior to 24 August) and lowest at stations 12-15 located downstream on the old revetment. Total catch along the

new revetment (stations 5-8) after 24 August was approximately the same as that at natural bank stations and slightly better than catches on the old revetment. The low catches along the revetted bank (stations 12-15) could reflect a difference in fish abundance that may be governed by local variations in bank material and water currents. Eddy currents along the revetted bank (stations 12-15) were consistently present, certainly causing some nets to fish improperly.

107. Eighteen species of fishes were collected on the monthly trips, 16 from the natural bank (stations 1-4) and 14 each from the natural or revetted bank (stations 5-8) and the old revetted bank (stations 12-15).

108. During the nine-month evaluation period, four species of fish comprised over 75.5 percent of the total catch. Freshwater drum was by far the most abundant species, representing 42.4 percent of the total fish catch (Table 23). Flathead catfish, gizzard shad, and carp followed in abundance and comprised 13.9, 10.9, and 8.3 percent of the total catch, respectively.

109. During the months prior to the revetment placement, freshwater drum was the most abundant species (32.7 percent of the catch) collected. Following in abundance were the flathead catfish (9.8 percent of the catch), carp (7.8 percent), and blue catfish (3.3 percent). After the revetment placement in August, the freshwater drum was again the most abundant component of the catch, comprising 9.7 percent of the catch. Gizzard shad (8.9 percent of the catch), flathead catfish (4.1 percent), and blue catfish (3.4 percent) followed in abundance.

110. Mean C/f was used to compare relative abundance of fishes captured from the three types of riverbank at Mayersville. The data indicate that fishes were generally more abundant at natural bank stations (1-4) than at other station groupings (Figure 6). Analysis of variance among station groupings by month indicates that C/f was not significantly different ($\alpha = 0.05$) except during June and August. In June, C/f on the natural bank (stations 1-4) was greater than, and significantly different from, C/f at stations 5-8 and 12-15. In October, C/f along the old revetted banks (stations 12-15) was zero and was

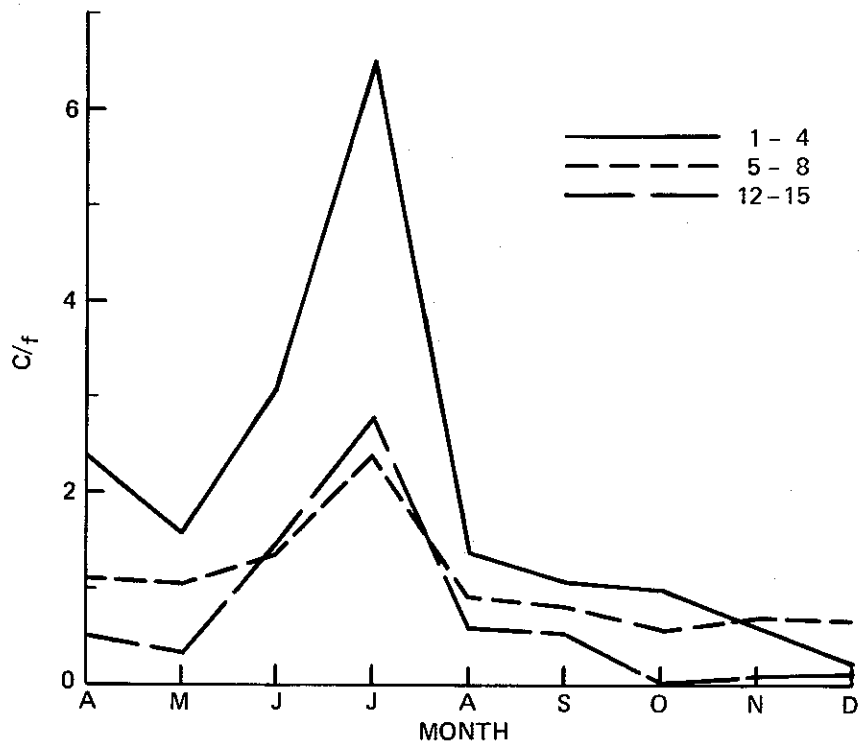

Figure 6. Mean catch per effort (C/f) of hoop nets grouped by bank type (1-4 = natural bank; 5-8 = natural to revetted bank; 12-15 = old revetment)

significantly different from C/f at stations 1-4 and 5-8.

111. C/f was generally greater in 3-ft nets fished in deeper water than in the 2 ft nets set in more shallow water. However, analysis of variance of C/f between the two gears indicated no significant difference in mean C/f of the two sizes of hoop nets.

112. During this evaluation study, no major differences in water quality or the measured fish parameters were documented among the three types of riverbank (old revetment, new revetment, and natural bank). This is not to say that differences were not present, but that the hoop nets used to document the relationship among the banks should have been supplemented with additional gear types. However, apparently fishes responded and recovered quite rapidly from bank perturbation caused by the placement of the ACM revetment.

PART V: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

113. The amount of data generated during the pilot study ensured the best estimate of habitat-by-habitat diversity and abundance of fishes and facilitated refinement of sampling methodology. In addition, the pilot study revealed several important findings useful to the development of an appropriate plan of study for future investigation of dikes and reveted banks.

114. The diversity of sampling gears used adequately represented the fish fauna of most habitats. Seines were found to be a very valuable gear for estimating the diversity and abundance of fish in shoreline habitats. However, seines were not usable in several habitats, and the fish diversity in those areas could be underestimated. Hoop nets and electroshocking were effective along natural banks, revetted banks, dike fields, and other areas with flowing water. Gill nets were more effective than trammel nets in slack-water areas of the study reach. Trawling was an effective technique in dike fields and areas with unobstructed bottoms.

115. Overall, 66 species of fish were collected with gill nets, trammel nets, hoop nets, trawls, seines, slat traps, and electroshocking. The dike fields were the most diverse habitat type, where 55 species of fish were collected. The following habitats are listed in descending order according to their species diversity: natural sandbar (39 species), abandoned channel (31 species), temporary secondary channel (28 species), oxbow lake (27 species), revetted bank (18 species), natural bank (19 species), bottow pit (13 species), permanent secondary channel (12 species), and inundated floodplain (1 species). Ten species of fish were collected in dike fields only and nowhere else. Other habitats with unique species were the sandbar (2 unique species) and the abandoned channel (2 unique species).

116. Based on species composition and relative numerical frequency, three recognizable fish communities occur in the Lower Mississippi River. They are (a) the standing-water community, (b) the flowing-water

community, and (c) the shallow shoreline community.

117. Two community types exhibited temporal changes in species composition. Species composition in the standing-water community was greatest in June; whereas, the flowing-water community was more diverse during April-June. The shallow shoreline community showed no temporal trend in species composition.

118. Several habitats were represented at two or more locations. Fish communities in three abandoned channels were similar, as were the communities associated with three natural banks. The fish communities at Mayersville and Walnut Point-Kentucky Bend Revetment were similar. Limited sampling effort at three other revetted banks suggested the fish communities were similar to Mayersville and Walnut Point-Kentucky Bend Revetments. Fish communities in five dike fields were similar, based on hoop net catches. Leota and Island 86 Dike Fields were seined, and the catches were similar. The fish communities at two sandbars were not similar. Whenever possible, the same habitat type should be sampled at two or more locations to determine variance and comparability.

119. Numerical catch per unit of effort (C/f) was used as an index of abundance. For most gear types in most habitats, C/f was highly variable. C/f varied over time, between habitats, within sites within a habitat, and between samples within a habitat. Also, equal units of effort could be standardized to allow more meaningful comparisons of diversity and relative abundance. Considering the wide variations in C/f, the standing-water fish community was most abundant in abandoned channels and the oxbow lake. C/f in flowing water was highest in the chute connecting Lake Lee with the river. The flowing-water fish community was collected in similar abundance from the natural bank, revetted bank, dike field, sandbar, and temporary secondary channel habitats, with the temporary secondary channel habitat exhibiting the greatest abundance.

120. Abandoned channels, oxbow lakes, revetted banks, natural banks, dike fields, and sandbars appear very important to the fishery of the river based on diversity and abundance. Dike fields are especially interesting because of the diversity of habitats within a dike field.

Standing-water, flowing-water, and inshore fish communities are well represented in dike fields.

Recommendations

121. Based on results of the pilot study, the following recommendations are made:

a. When the choice of gear is limited because of manpower or equipment constraints, seines, electroshocking, gill nets, and hoop nets should be used in riverine systems. Not only do these gears collect representative samples of the fish community, but they can also be deployed in a range of physical conditions.

b. The number of habitats studied should be limited to dike fields, revetted banks, natural banks, and abandoned channels. Dike fields and revetted banks should be studied because of their common occurrence in the river and their influence on the physical characteristics of the river. Studies of natural banks and abandoned channels are necessary so that results of the dike field and revetment studies can be related to habitats not directly influenced by CE structures.

c. The same habitat type should be sampled at two or more different locations to determine variance and comparability of physical and biological parameters.

d. The number of samples taken with a particular gear in any given habitat should be increased to reduce the variation in C/f values.

e. Because of considerable temporal variation in species composition and abundance of fish communities in the different habitats, sampling should be conducted throughout the year.

f. Before beginning a major field study, a pilot study should be conducted to familiarize field personnel with the physical characteristics of a study area, the fish species associated with the different habitats, and adequate sampling methods for the different fish communities.

Table 1

Units of Effort for Sampling Juvenile and Adult Fish with Various Gear Types in Different Habitats in the Lower Mississippi River (River Mile 500 to 530), April-October 1978

Habitat	Month	Gear Type: 8-ft Gill Net	12-ft Gill Net	8-ft Trammel Net	12-ft Trammel Net	2-ft Hoop Net	3-ft Hoop Net	4-ft Hoop Net	Minnow Trap	Slat Trap	15-ft Seine	25-ft Seine	Electroshocker	Trawl
Abandoned channel (Type I), Matthews Bend	4	4		2		4	2	4		10				
	5													
	6	4	4	4										
	7													
	8													
	9													
	10													
Abandoned channel (Type II), Carolina Chute	4													
	5	6		2	4									
	6													
	7													
	8													
	9													
	10													
Abandoned channel (Type II), Moon Chute	4													
	5	4	3	4	2									
	6	4		2										
	7													
	8													
	9													
	10													
Oxbow lake, Lake Lee	4	4		4		6	2	4		6				
	5													
	6	4	8	8	3	6	4	7						
	7													
	8													
	9													
	10													

(Continued)

Table 1 (Continued)

Habitat	Month	8-ft Gill Net	12-ft Gill Net	8-ft Trammel Net	12-ft Trammel Net	2-ft Hoop Net	3-ft Hoop Net	4-ft Hoop Net	Minnow Trap	Slat Trap	15-ft Seine	25-ft Seine	Electroshocker	Trawl
		Gear Type												
Natural bank, Mayersville	4					20	9	9						
	5					44	44							
	6					16	16							
	7					14	13							
	8					8	8						2	
	9					8	8						1	
	10					8	8							
Natural bank, Island 88	4					4	4	2						
	5													
	6													
	7													
	8													
	9													
	10													
Natural bank, Anconia	4					2		2						
	5													
	6					8	7							
	7													
	8													
	9													
	10													
Revetted bank, Mayersville	4					2	2							
	5					15	15							
	6					8	8							
	7					8	8	2						
	8					16	16	1				4		
	9					16	16					5		
	10					16	14							
Revetted bank, Cracraft	4													
	5													
	6					4								
	7													
	8													
	9													
	10													

(Continued)

Table 1 (Continued)

Habitat	Month	8-ft Gill Net	12-ft Gill Net	8-ft Trammel Net	12-ft Trammel Net	2-ft Hoop Net	3-ft Hoop Net	4-ft Hoop Net	Minnow Trap	Slat Trap	15-ft Seine	25-ft Seine	Electroshocker	Trawl
		Gear Type												
Revetted bank, Walnut Point-Kentucky Bend	4					7	3	2	4					
	5					10	6	4						
	6													
	7													
	8					8	8	2						
	9													
	10													
Revetted bank, Lakeport	4													
	5													
	6					6	6							
	7													
	8													
	9													
	10													
Revetted bank, Sunnyside	4													
	5													
	6					8	8							
	7													
	8													
	9													
	10													
Dike field, Lower Cracraft	4					4	1							
	5													
	6					8	7	2						
	7													
	8													
	9													
	10													
Dike field, Leota	4													
	5													
	6					16	16	3			5	7		
	7	4	6			24	8				32		24	
	8					4	4							
	9													
	10													

(Continued)

Table 1 (Continued)

Habitat	Month	Gear Type: 8-ft Gill Net	12-ft Gill Net	8-ft Trammel Net	12-ft Trammel Net	2-ft Hoop Net	3-ft Hoop Net	4-ft Hoop Net	Minnow Trap	Slat Trap	15-ft Seine	25-ft Seine	Electroshocker	Trawl
Dike field, Island 86	4				2	4	4	2		4				
	5	2		2	2	10	6	4		7				
	6										7	5		
	7													
	8		2			24	8			10				
	9													
	10													
Dike field, Seven Oaks	4					2	1							
	5					10	6	6		8				
	6													
	7													
	8		4			10	8					15		1
	9													
	10													
Dike field, Walnut Point	4							2						
	5													
	6					5	2	3						
	7													
	8													
	9													
	10													
Sandbar, Kentucky Bend Bar	4					2								
	5													
	6					4	4							
	7													
	8	2								8				
	9													
	10													
Sandbar, Lakeport Towhead	4													
	5													
	6					16	15			3	2			
	7													
	8									24				
	9													
	10													

(Continued)

Table 1 (Concluded)

Habitat	Month	Gear Type: 8-ft Gill Net	12-ft Gill Net	8-ft Trammel Net	12-ft Trammel Net	2-ft Hoop Net	3-ft Hoop Net	4-ft Hoop Net	Minnow Trap	Slat Trap	15-ft Seine	25-ft Seine	Electroshocker	Trawl
Permanent secondary channel, American Cutoff	4			2	1	1								
	5													
	6					13	12							
	7													
	8													
	9													
	10													
Temporary secondary channel, Kentucky Bend Chute	4													
	5													
	6					4	4				2	2		
	7										8			
	8													
	9													
	10													
Inundated floodplain	4			2		2		2						
	5													
	6													
	7													
	8													
	9													
	10													
Borrow pit	4													
	5													
	6	2								4				
	7													
	8													
	9													
	10													

Table 2

Families and Species of Fish Captured During the Pilot Study, April-December 1978

Acipenseridae - sturgeons

Shovelnose sturgeon (Scaphirhynchus platorynchus)

Polyodontidae - paddlefishes

Paddlefish (Polyodon spathula)

Lepisosteidae - gars

Spotted gar (Lepisosteus oculatus)
Longnose gar (Lepisosteus osseus)
Shortnose gar (Lepisosteus platostomus)

Amiidae - bowfins

Bowfin (Amia calva)

Anguillidae - freshwater eels

American eel (Anguilla rostrata)

Clupeidae - herrings

Skipjack herring (Alosa chrysochloris)
Gizzard shad (Dorosoma cepedianum)
Threadfin shad (Dorosoma petenense)

Hiodontidae - mooneyes

Goldeye (Hiodon alosoides)
Mooneye (Hiodon tergisus)

Cyprinidae - minnows and carps

Stoneroller (Campostoma anomalum)
Goldfish (Carassius auratus)
Carp (Cyprinus carpio)

(Continued)

Table 2 (Continued)

Cyprinidae - minnows and carps (Continued)

Cypress minnow (Hybognathus hayi)
Silvery minnow (Hybognathus nuchalis)
Speckled chub (Hybopsis aestivalis)
Silver chub (Hybopsis storeriana)
Emerald shiner (Notropis atherinoides)
River shiner (Notropis blennius)
Pugnose minnow (Notropis emiliae)
Ribbon shiner (Notropis fumeus)
Red shiner (Notropis lutrensis)
Taillight shiner (Notropis maculatus)
Silverband shiner (Notropis shumardi)
Spotfin shiner (Notropis spiloterus)
Weed shiner (Notropis texanus)
Redfin shiner (Notropis umbratilis)
Blacktail shiner (Notropis venustus)
Mimic shiner (Notropis volucellus)
Steelcolor shiner (Notropis whipplei)
Bullhead minnow (Pimephales vigilax)
Creek chub (Semotilus atromaculatus)

Catostomidae - suckers

River carpsucker (Carpiodes carpio)
Quillback (Carpiodes cyprinus)
Highfin carpsucker (Carpiodes velifer)
Blue sucker (Cycleptus elongatus)
Smallmouth buffalo (Ictiobus bubalus)
Bigmouth buffalo (Ictiobus cyprinellus)
Black buffalo (Ictiobus niger)
Spotted sucker (Minytrema melanops)

(Continued)

Table 2 (Continued)

Ictaluridae - freshwater catfishes

- Blue catfish (Ictalurus furcatus)
- Black bullhead (Ictalurus melas)
- Yellow bullhead (Ictalurus natalis)
- Brown bullhead (Ictalurus nebulosus)
- Channel catfish (Ictalurus punctatus)
- Flathead catfish (Pylodictis olivaris)

Cyprinodontidae - killifishes

- Blackstripe topminnow (Fundulus notatus)

Poeciliidae - livebearers

- Mosquitofish (Gambusia affinis)

Atherinidae - silversides

- Brook silverside (Labidesthes sicculus)
- Mississippi silverside (Menidia audens)

Percichthyidae - temperate basses

- White bass (Morone chrysops)
- Striped bass (Morone saxatilis)

Centrarchidae - sunfishes

- Warmouth (Lepomis gulosus)
- Orangespotted sunfish (Lepomis humulis)
- Bluegill (Lepomis macrochirus)
- Longear sunfish (Lepomis megalotis)
- Redear sunfish (Lepomis microlophus)
- Spotted sunfish (Lepomis punctatus)
- Largemouth bass (Micropterus salmoides)
- White crappie (Pomoxis annularis)
- Black crappie (Pomoxis nigromaculatus)

(Continued)

Table 2 (Concluded)

Percidae - perches

Bluntnose darter (Etheostoma chlorosomum)

Sauger (Stizostedion canadense)

Sciaenidae - drums

Freshwater drum (Aplodinotus grunniens)

Table 3

Frequency of Occurrence of Species Captured with Various Collecting Devices on 2-4 August 1978 from Seven Oaks and Island 86 Dike Fields

Species	Gear*										
	EG12	EG8	T122	T82	HN2	HN3	HN4	ST	S15	TRWL	ES
Shovelnose sturgeon				14.3							
Longnose gar	14.3	22.2			1.2	3.1					
Shortnose gar	5.7	22.2	4.7		3.5						2.8
Bowfin					1.2						
American eel					1.2						
Skipjack herring	2.9		9.5		1.2				4.8		
Gizzard shad	11.4	22.2	9.5	14.3	9.4	9.4	5.0		6.8		22.2
Threadfin shad		11.1				1.6			1.9		
Goldeye									1.0		
Stoneroller											2.8
Goldfish									1.0		
Carp	2.9		9.5	14.3	7.0	9.4	10.0				5.6
Silvery minnow									1.9		

(Continued)

* EG12, Experimental gill net, 12 ft deep.
EG8, Experimental gill net, 8 ft deep.
T122, Trammel net, 12 ft deep, 2-in. inner panel.
T82, Trammel net, 8 ft deep, 2-in. inner panel.
HN2, Hoop net, 2-ft diameter.
HN3, Hoop net, 3-ft diameter.
HN4, Hoop Net, 4-ft diameter.
ST, Slat trap.
S15, Seine, 15 ft long.
TRWL, Trawl.
ES, Electroshocker.

Table 3 (Continued)

Species	Gear										
	EG12	EG8	T122	T82	HN2	HN3	HN4	ST	S15	TRWL	ES
Silver chub									1.0		
Pugnose minnow											
Emerald shiner									2.9		
River shiner									11.6		2.8
Ribbon shiner									1.0		
Red shiner									1.9		2.8
Redfin shiner									1.0		
Blacktail shiner									1.0		2.8
Mimic shiner									1.0		
Bullhead minnow									1.0		
River carpsucker	8.6		19.0		7.0	7.8	20.0		3.9		2.8
Quillback carpsucker							5.0		1.0		
Smallmouth buffalo	8.6					1.6			1.0		14.3
Bigmouth buffalo					1.2				1.0		
Spotted sucker					2.4	1.6					
Blue catfish	17.1		4.7	14.3	2.4	7.8	10.0			20.0	16.7
Channel catfish	5.7		4.7		5.9	4.7	5.0			20.0	5.6
Flathead catfish	5.7	11.1	4.7		9.4	12.5		10.5		20.0	2.8
Blackstripe topminnow									1.0		
Mosquitofish									2.9		

(Continued)

Table 3 (Concluded)

Species	Gear										
	EG12	EG8	T122	T82	HN2	HN3	HN4	ST	S15	TRWL	ES
Brook silversides									6.8		
Mississippi silversides									9.7		
White bass	2.7								4.8		2.8
Striped bass			4.7								
Bluegill				14.3		1.7			2.0		5.6
Longear sunfish									2.0		5.6
Largemouth bass						1.5			1.9		
White crappie	5.7		9.5	14.3	16.7	4.7			2.9	20.0	5.6
Black crappie									5.8		
Sauger					1.2	1.6			2.9		
Freshwater drum	8.6	11.1	9.5	14.3	7.0	14.0	30.0		1.0	20.0	2.8

Table 4

Mean Length (mm) of Species Captured with Various Collecting Devices on 2-4 August 1978 from Seven Oaks and Island 86 Dike Fields

Species	Gear*										
	EG12	EG8	T122	T82	HN2	HN3	HN4	ST	S15	TRWL	ES
Shovelnose sturgeon				573							
Longnose gar	931	838			955	826					
Shortnose gar	713	725	750		685						551
Bowfin					640						
American eel					728						
Skipjack herring	254		431		302				59		
Gizzard shad	303	263	354	328	293	275	280		86		186
Threadfin shad		148				173			41		
Goldeye									56		
Stoneroller											81
Goldfish											
Carp	436		490	478	457	495	513				502
Silvery minnow											

(Continued)

* EG12, Experimental gill net, 12 ft deep.
EG8, Experimental gill net, 8 ft deep.
T122, Trammel net, 12 ft deep, 2-in. inner panel.
T82, Trammel net, 8 ft deep, 2-in. inner panel.
HN2, Hoop net, 2-ft diameter.
HN3, Hoop net, 3-ft diameter.
HN4, Hoop net, 4-ft diameter.
ST, Slat trap.
S15, Seine, 15 ft long.
TRWL, Trawl.
ES, Electroshocker.

Table 4 (Continued)

Species	Gear										
	EG12	EG8	T122	T82	HN2	HN3	HN4	ST	S15	TRWL	ES
Silver chub									40		
Pugnose minnow											
Emerald shiner									31		
River shiner											52
Ribbon shiner											
Red shiner											58
Redfin shiner											38
Blacktail shiner											83
Mimic shiner									24		
Bullhead minnow									48		
River carpsucker	356		354		347	315	353				247
Quillback carpsucker							344				
Smallmouth buffalo	409					409					
Bigmouth buffalo					444						
Spotted sucker					377	370					
Blue catfish	445		518	450	265	305	440			48	69
Channel catfish	425		432		356	305	354			35	64
Flathead catfish	524	337	447		378	407		280		177	227
Blackstripe topminnow											
Mosquitofish											

(Continued)

Table 4 (Concluded)

Species	Gear										
	EG12	EG8	T122	T82	HN2	HN3	HN4	ST	S15	TRWL	ES
Brook silversides									45		
Mississippi silversides									43		
White bass	393								84		353
Striped bass			324								
Bluegill				208		212					99
Longear sunfish											31
Largemouth bass						380					
White crappie	240		304	286	316	246				112	221
Black crappie											
Sauger					360	302					
Freshwater drum	246	296	313	316	269	274	300			31	200

Table 5

Frequency of Occurrence of Species Captured with Various Collecting Devices on 31 July-2 August 1978 From Leota Dike Field

Species	Gear*					
	EG12	EG8	HN2	HN3	S15	ES
Longnose gar	5.7	5.9				2.4
Shortnose gar	8.5	5.9				
American eel			5.9			
Skipjack herring	8.5	8.8			3.3	
Gizzard shad	17.1	8.8	17.6	15.4	5.9	36.6
Threadfin shad					17.6	4.8
Goldeye					1.6	2.4
Carp						7.3
Silvery minnow					5.9	
Silver chub					0.8	
Emerald shiner					3.3	
River shiner					12.6	2.4
Red shiner					0.8	
Taillight shiner					0.8	
Silverband shiner					4.2	
Spotfin shiner					0.8	
Steelcolor shiner					1.6	
Redfin shiner					0.8	
Blacktail shiner					4.2	
Mimic shiner					0.8	
River carpsucker	11.4	11.7		23.1	4.2	4.8

(Continued)

* EG12, Experimental gill net, 12 ft deep.
EG8, Experimental gill net, 8 ft deep.
HN2, Hoop net, 2-ft diameter.
HN3, Hoop net, 3-ft diameter.
S15, Seine, 15 ft long.
ES, Electroshocker.

Table 5 (Concluded)

Species	Gear					
	EG12	EG8	HN2	HN3	S15	ES
Quillback carpsucker					1.6	
Highfin carpsucker	2.8	8.8			0.8	
Smallmouth buffalo		8.8		7.7		
Black buffalo					0.8	
Blue catfish	11.4	5.9	17.6			19.5
Channel catfish	5.7	5.9	17.6	7.7		4.8
Flathead catfish	5.7	5.9	23.5	30.8		4.8
Brook silversides					1.6	
White bass					0.8	2.4
Striped bass	2.8	2.9			0.8	
Bluegill			11.7		3.3	
Redear sunfish		2.9				
Largemouth bass					1.6	
White crappie		5.9			3.3	4.8
Black crappie		2.9			1.6	
Sauger	5.7	5.9				
Freshwater drum	14.3		5.9	15.4		2.4

Table 6

Frequency of Occurrence of Species Captured with Various Collecting Devices on 5-7 June 1978 from Lake Lee

Species	Gear*					
	EG12	EG8	T122	T82	HN2	HN4
Paddlefish	7.4		12.5	3.4		
Spotted gar	1.8	3.3		1.7		
Longnose gar	5.5	10.0				
Shortnose gar	5.5	10.0		10.3		8.3
Bowfin				5.2		
Skipjack herring	11.1	6.6				
Gizzard shad	12.9	13.3	37.5	13.8		
Threadfin shad	3.7	3.3				
Carp	3.7	3.3		10.3		
River carpsucker	12.9	10.0	12.5	13.8		16.6
Quillback carpsucker	1.8	3.3				
Highfin carpsucker				1.7		
Smallmouth buffalo	3.7	6.6		5.2		
Bigmouth buffalo				1.7		
Blue catfish	5.5			1.7		
Yellow catfish		3.3	12.5			
Channel catfish	3.7	6.6		1.7		16.6
White bass						8.3
Bluegill				6.9		8.3
Redear sunfish					25.0	8.3
Largemouth bass		6.6				
White crappie	7.4		12.5	8.6	25.0	8.3
Sauger	1.8					
Freshwater drum	11.1	13.3	12.5	12.5		16.6

* EG12, Experimental gill net, 12 ft deep.
EG8, Experimental gill net, 8 ft deep.
T122, Trammel net, 12 ft deep, 2-in. inner panel.
T82, Trammel net, 8 ft deep, 2-in. inner panel.
HN2, Hoop net, 2-ft diameter.
HN4, Hoop net, 4-ft diameter.

Table 7

Numbers of Fish Captured with All Usable Gear Types from Different Habitats in the Lower Mississippi River, April-December 1978

Species	Abandoned Channel			Oxbow Lake	Natural Bank			Revetted Bank				
	Matthews Bend	Moon Chute	Carolina Chute	(Lake Lee)	Anconia	Island 88	Mayersville	Cracraft	Lakeport	Mayersville	Sunnyside	Walnut Point-Kentucky Bend
Shovelnose sturgeon	1						4			1		
Paddlefish	2	2		20								
Spotted gar	3	16		3								
Longnose gar	1	1		13						2	2	
Shortnose gar	12	41	3	30			14			1		1
Bowfin	6	10	9	3								
American eel				1			6					1
Skipjack herring	22	1		35			3			12		1
Gizzard shad	586	379	48	764	1		37			32	1	19
Threadfin shad		5		7								
Goldeye	2		1				3					
Mooneye							2			4		
Stoneroller												
Goldfish										2		
Carp	20	30	11	17	5	7	42	1	2	10		11
Cypress minnow												
Silvery minnow												
Speckled chub												
Silver chub												
Emerald shiner												
River shiner												
Pugnose minnow												
Ribbon shiner												
Red shiner												
Taillight shiner												
Silverband shiner												
Spotfin shiner												
Weed shiner												
Redfin shiner												
Blacktail shiner												
Mimic shiner												
Steelcolor shiner												
Bullhead minnow												
Creek chub												
River carpsucker	210	135	18	267	3		16			5		7
Quillback	2	3		2			2					
Highfin carpsucker	1			1								

(Continued)

Table 7 (Continued)

Species	Abandoned Channel			Oxbow Lake	Natural Bank			Revetted Bank				
	Matthews Bend	Moon Chute	Carolina Chute	(Lake Lee)	Anconia	Island 88	Mayersville	Cracraft	Lakeport	Mayersville	Sunnyside	Walnut Point-Kentucky Bend
Blue sucker				1							1	1
Smallmouth buffalo	3	2	2	14			3		2	11	2	3
Bigmouth buffalo	2	2	1	11			4					
Black buffalo												
Spotted sucker					2							
Blue catfish	18	11	8	7	3		24		3	17	3	3
Black bullhead	1	1										
Yellow bullhead		1		2								
Brown bullhead		1										
Channel catfish	15	24	2	56	6		8		21	3	21	8
Flathead catfish	4	1	2	2	3	3	61		5	27	2	11
Blackstripe topminnow												
Mosquitofish												
Brook silverside												
Mississippi silverside												
White bass	1			2			3					1
Striped bass	7											
Warmouth		3										
Orangespotted sunfish												
Bluegill	11	17		5						2		
Longear sunfish												
Redear sunfish		2		6								
Spotted bass												
Largemouth bass	2	3		2								
White crappie	14	29		36		1	5			1		1
Black crappie												
Bluntnose darter												
Sauger	2	1		1								
Freshwater drum	90	66	8	104	7	1	192	1	1	71	1	24
Total Individuals	1038	787	113	1412	30	12	429	2	34	201	33	92
Total Species	26	26	12	27	8	4	18	2	6	16	8	14

(Continued)

Table 7 (Continued)

Species	Dike Field					Sandbar		Permanent Secondary Channel (American Cutoff)	Temporary Secondary Channel (Kentucky Bend Bar)	Inundated Floodplain	Borrow Pit
	Lower Cracraft	Island 86	Leota	Seven Oaks	Walnut Point	Kentucky Bend Bar	Lakeport Towhead				
Shovelnose sturgeon		1				1		7			
Paddlefish											6
Spotted gar											
Longnose gar		8	11	7		3		2			
Shortnose gar		5	13	5	4	14	1				6
Bowfin		1									
American eel			1	1				1			
Skipjack herring		14	24			2	1	1	12		
Gizzard shad	1	140	936	64	4	31	94	2	98		
Threadfin shad		22	67			2	8		34		
Goldeye		2	16				2				
Mooneye			9						4		
Stoneroller				1							
Goldfish		3									
Carp	2	22	10	16	2	2	3	19	1	2	1
Cypress minnow			1								
Silvery minnow		49	17				12				
Speckled chub							2				
Silver chub		1	1				14		2		
Emerald shiner		89	37			1	18		4		
River shiner		72	108	1		3	85		101		10
Pugnose minnow		2									
Ribbon shiner		1	1			1					
Red shiner		8	16	3			1				
Taillight shiner			1								2
Silverband shiner			8			2	13		2		
Spotfin shiner			6								
Weed shiner			4				1				1
Redfin shiner		11	1				1				
Blacktail shiner		4	30	3		2	3		9		
Mimic shiner		9	4			1	10		1		
Steelcolor shiner			2								
Bullhead minnow		6	1			1	10		3		
Creek chub			1								
River carpsucker	6	33	100	18	3	9	26	2	9		
Quillback		4	3	1		1	1				
Highfin carpsucker			9				1				

(Continued)

Table 7 (Concluded)

Species	Dike Field					Sandbar		Permanent Secondary Channel (American Cutoff)	Temporary Secondary Channel (Kentucky Bend Bar)	Inundated Floodplain	Borrow Pit
	Lower Cracraft	Island 86	Leota	Seven Oaks	Walnut Point	Kentucky Bend Bar	Lakeport Towhead				
Blue sucker											
Smallmouth buffalo		4	12	4		1	2	1			
Bigmouth buffalo		5					1				
Black buffalo			1								
Spotted sucker		3		2							
Blue catfish		20	29	29	2	3	19	6	1		
Black bullhead											2
Yellow bullhead											
Brown bullhead											
Channel catfish	1	12	16	17	5	14	9	7	1		
Flathead catfish	1	12	24	21	5	4	8	13	8		
Blackstripe topminnow		1									
Mosquitofish		9	8				1		3		6
Brook silverside		111	19				1		5		1
Mississippi silverside		136	163			25	93		146		
White bass	1	62	32	2	1		21		37		
Striped bass		1	34				1		3		
Warmouth											
Orangespotted sunfish									1		3
Bluegill		8	12	3	2				2		2
Longear sunfish				1							
Redear sunfish			1								
Spotted bass		1									
Largemouth bass		22	2				1		1		3
White crappie		33	15	6	4	5	12		2		1
Black crappie		258	27				3		12		
Bluntnose darter							2				
Sauger									7		
Freshwater drum	15	59	32	83	17	32	13	23	1		
Total Individuals	27	1264	1865	288	51	160	494	84	510	2	44
Total Species	7	41	45	21	11	23	36	12	28	1	13

Table 8

Species of Fish Captured with All Usable Gear Types from Different Habitats in the Lower Mississippi River

April-December 1978, Ranked in Order of Decreasing Abundance (1 = Greatest Number Collected)*

Species	Abandoned Channel			Oxbow Lake	Natural Bank			Revetted Bank				
	Matthews Bend	Moon Chute	Carolina Chute	(Lake Lee)	Anconia	Island 88	Mayersville	Cracraft	Lakeport	Mayersville	Sunnyside	Walnut Point-Kentucky Bend
Shovelnose sturgeon	15						11			12		
Paddlefish	14	14		8								
Spotted gar	13	9		16								
Longnose gar	15	15		11						11	3	
Shortnose gar	8	4	6	7			7			12		7
Bowfin	12	11	4	16								
American eel				18			9					7
Skipjack herring	3	15		6			12			5		7
Gizzard shad	1	1	1	1	6		4			2	4	2
Threadfin shad		12		13								
Goldeye	14		8				12					
Mooneye							13			9		
Stoneroller												
Goldfish										11		
Carp	4	5	3	9	3	1	3	1	4	7		3
Cypress minnow												
Silvery minnow												
Speckled chub												
Silver chub												
Emerald shiner												
River shiner												
Pugnose minnow												
Ribbon shiner												
Red shiner												
Taillight shiner												
Silverband shiner												
Spotfin shiner												
Weed shiner												
Redfin shiner												
Blacktail shiner												
Mimic shiner												
Steelcolor shiner												
Bullhead minnow												
Creek chub												

(Continued)

* Species with equal abundance have the same numeric value.

Table 8 (Concluded)

Species	Dike Field					Sandbar		Permanent Secondary Channel (American Cutoff)	Temporary Secondary Channel (Kentucky Bend Bar)	Inundated Floodplain	Borrow Pit
	Lower Cracraft	Island 86	Leota	Seven Oaks	Walnut Point	Kentucky Bend Bar	Lakeport Towhead				
Bigmouth buffalo		19					21				
Black buffalo			28								
Spotted sucker		22		13							
Blue catfish		11	10	3	5	8	6	5	16		
Black bullhead											8
Yellow bullhead											
Brown bullhead											
Channel catfish	4	14	15	6	2	4	12	4	16		
Flathead catfish	4	14	12	4	2	7	13	3	9		
Blackstripe topminnow		25							14		
Mosquitofish		16	22				21				2
Brook silverside		4	13				21		11		5
Mississippi silverside		3	3			3	2		1		
White bass	4	7	8	13	6		5		4		
Striped bass		25	7				21		14		
Warmouth											
Orangespotted sunfish									16		3
Bluegill		17	18	12	5				15		4
Longear sunfish				14							
Redear sunfish											
Spotted bass		25									
Largemouth bass		10	27				21		16		3
White crappie		9	16	9	3	6	10		15		5
Black crappie		1	11				14		6		
Bluntnose darter							20				
Sauger									10		
Freshwater drum	1	8	8	1	1	1	9	1	16		

Table 9

Mean Catch per Unit Effort ($\bar{X}$) and Coefficient of Variation (CV) by Gear Type in Different Habitats in the Lower Mississippi River, April-December 1978

Habitat Type		Gear Type											
		8-ft Gill Net	12-ft Gill Net	8-ft Trammel Net	12-ft Trammel Net	2-ft Hoop Net	3-ft Hoop Net	4-ft Hoop Net	Slat Trap	Electro-shocker	15-ft Seine	25-ft Seine	Trawl
Abandoned channel	$\bar{X}$	26.77	74.57	45.57	18.50	0.25	0.00	0.56	0.20				
	CV	99.7	65.9	80.24	65.2	200.0	0	66.7	210.8				
Oxbow lake	$\bar{X}$	22.62	63.00	47.17	19.00	2.33	0.00	6.91	0.00				
	CV	124.5	95.7	94.0	137.1	242.0	0	140.8	0				
Natural bank	$\bar{X}$					1.21	1.91	1.00					
	CV					112.7	89.1	141.4					
Revetted bank	$\bar{X}$					1.07	1.88	2.10		7.25			
	CV					145.2	142.6	120.6		104.6			
Dike field	$\bar{X}$	38.50	17.17	7.00	12.75	1.04	2.72	4.27	0.11	19.44	34.39	33.25	60.00
	CV	67.4	79.3	80.8	58.1	238.0	217.5	147.7	299.5	221.9	133.3	105.2	0
Sandbar	$\bar{X}$	50.5				0.73	2.05				15.34	32.5	
	CV	32.2				135.4	124.2				110.0	84.9	
Permanent secondary channel	$\bar{X}$			8.00	1.00	1.93	3.17						
	CV			141.4	0	92.0	122.6						
Temporary secondary channel	$\bar{X}$					1.00	2.00				41.00	73.00	
	CV					81.6	108.0				68.8	100.8	
Inundated flood-plain	$\bar{X}$			1.00		0.00		0.00					
	CV			141.4		0		0					
Borrow pit	$\bar{X}$	8.50									6.75		
	CV	25.0									55.9		

Table 10

Average Number of Fish Caught per Net-Night with 8-ft-Deep, 2-in. Inner Panel Trammel Net in Different Habitats in the Lower Mississippi River, April-June 1978

Species	Abandoned Channel: Type I, Matthews Bend Apr	Abandoned Channel: Type I, Matthews Bend Jun	Abandoned Channel: Type II, All Habitats May	Abandoned Channel: Type II, All Habitats Jun	Abandoned Channel: Type II, Carolina Chute May	Abandoned Channel: Type II, Moon Chute May	Abandoned Channel: Type II, Moon Chute Jun	Oxbow Lake, Lake Lee Apr	Oxbow Lake, Lake Lee Jun	Dike Field, Island 86 May	Permanent Secondary Channel, American Cutoff Apr	Inundated Floodplain Apr
Shovelnose sturgeon										1.0	6.0	
Paddlefish		1.0		1.0			1.0		13.0			
Spotted gar									1.0			
Longnose gar											1.0	
Shortnose gar		2.0	1.5	3.0		1.5	3.0		2.2			
Bowfin		4.0	3.0	3.0	4.0	2.5	3.0		1.0			
Skipjack herring								4.0			1.0	
Gizzard shad	1.0	39.5	20.0	29.0	21.0	19.5	29.0	10.0	52.0	6.0	2.0	
Goldeye			1.0		1.0							
Carp		2.5	4.3	5.0	4.0	5.0	4.0	2.0	2.5	2.0	1.0	2.0
River carpsucker		85.0	13.3	49.0	11.0	49.0	11.0	3.0	54.2		2.0	
Quillback			1.5									
Highfin carpsucker		1.0						1.0	1.0			
Smallmouth buffalo		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.7			
Bigmouth buffalo		1.0	1.0	1.0	1.0	1.0	1.0	4.5	1.0			
Blue catfish		1.0	3.0		3.0		3.0	1.0	1.0	1.0	2.0	
Black bullhead		1.0		1.0		1.0						
Channel catfish	3.0	1.0	3.5	2.0		2.0			1.0		1.0	
Flathead catfish		1.0	1.5		2.0		2.0					
White bass		1.0							1.0			
Striped bass		2.5										
Bluegill		5.0	2.0	10.0	10.0				1.3	1.0		
White crappie		6.5	2.0	17.0		17.0		1.0	7.3	1.0		
Freshwater drum		10.5	2.3	36.0	5.0	36.0	5.0	1.0	8.8	2.0		
Mean	2.0	80.0	26.2	79.0	79.8	26.0	79.0	8.5	66.5	7.0	8.0	1.0
Total number of species	2	18	15	13	10	11	13	10	16	7	8	1

Table 11

Average Number of Fish Caught per Net-Night with 8-ft-Deep Experimental Gill Nets in Different Habitats in the Lower Mississippi River, April-August 1978

Species	Abandoned Channel							Oxbow Lake, Lake Lee		Dike Field		Sandbar, Kentucky Bend Bar	Borrow Pit
	Type I, Matthews Bend		Type II, All Habitats		Type II, Carolina Chute	Type II, Moon Chute				Leota	Island 86		
	Apr	Jun	May	Jun	May	May	Jun	Apr	Jun	Jul	May	Aug	Jun
Shovelnose sturgeon	1.0												
Paddlefish				1.0			1.0						3.0
Spotted gar	1.0	1.0	1.0	7.0		1.0	7.0		1.0				
Longnose gar	1.0			1.0			1.0	1.0	2.5	5.0	2.0		
Shortnose gar		3.0	6.7	8.0	3.0	18.5	8.0		4.0	2.0	2.0	7.0	
Bowfin	1.0	1.0	1.0	1.0		1.0	1.0						3.0
Skipjack herring		2.0	1.0					1.0	4.5	2.5		1.0	
Gizzard shad	14.0	68.5	44.0	19.0	2.0	65.0	19.0	1.0	53.0	43.5	39.0		
Threadfin shad			1.5			1.5			2.0		2.0		
Goldeye		1.0											
Carp	3.0	1.0	3.7		1.0	5.0			1.0	1.0			1.0
River carpsucker	1.0	4.0	2.5	20.0		2.5	20.0		6.0	25.0		4.0	
Quillback	1.0								1.0			1.0	
Highfin carpsucker										3.0			
Smallmouth buffalo		1.0		1.0			1.0		5.0	4.0			
Bigmouth buffalo		1.0				1.0		1.0					
Blue catfish	3.0	1.5	2.5	3.0	1.7	2.5	3.0	1.0		1.0		1.0	
Black bullhead													2.0
Yellow bullhead				1.0			1.0		1.0				
Brown bullhead				1.0			1.0						
Channel catfish		2.5	1.7	5.0	2.0	1.5	5.0	1.0	2.0	3.0		6.0	
Flathead catfish										3.0	1.0	15.5	
Striped bass										1.0			
Warmouth				3.0			3.0						
Bluegill		1.0		2.5			2.5						1.0
Redear sunfish				2.0			2.0			1.0			
Largemouth bass	1.0	1.0		1.5			1.5		2.0				1.0
White crappie	1.0		1.0	6.0		1.0	6.0			2.0		2.5	
Black crappie										1.0			
Sauger		2.0		1.0			1.0			2.0			
Freshwater drum	1.0	21.0	1.0	11.0	1.0	1.0	11.0		9.5		1.0	14.0	
Mean	8.0	48.0	19.6	42.5	2.3	45.5	42.5	1.8	43.5	46.0	23.5	50.5	8.5
Total number of species	12	16	12	19	6	12	19	6	14	16	6	9	6

Table 12

Average Number of Fish Caught per Net-Night with 12-ft-Deep Experimental Gill Nets in Different Habitats in the Lower Mississippi River, May-August 1978

Species	Abandoned Channel Type I, Matthews Bend Jun	Channel Type II, Moon Chute May	Oxbow Lake, Lake Lee Jun	Dike Field All Habitats Jul	Dike Field All Habitats Aug	Dike Field Leota Jul	Dike Field Island 86′ Aug	Dike Field Seven Oaks Aug
Paddlefish	1.0		2.0					
Spotted gar	1.0		1.0					
Longnose gar			3.5	4.0	3.3	7.0	3.0	3.5
Shortnose gar	4.0	1.0	3.5	4.5	3.0	4.5		3.0
Skipjack herring	10.0		7.0	3.5	1.0	3.5	1.0	
Gizzard shad	142.0	94.0	96.2	22.3	7.0	22.3	2.0	9.5
Threadfin shad		2.0	5.0					
Goldeye	1.0							
Carp	3.5	3.0	4.0		1.0			1.0
River carpsucker	15.0	1.0	4.5	9.5	1.0	9.5	1.0	1.0
Quillback	1.0		1.0	1.0		1.0		
Highfin carpsucker				1.0		1.0		
Smallmouth buffalo			2.0		1.0		1.0	1.0
Bigmouth buffalo	1.0							
Blue catfish	5.0	2.0	1.5	4.3	3.3	4.3	2.0	4.0
Channel catfish	1.7	2.0	1.0	5.0	1.0	5.0	1.0	1.0
Flathead catfish			11.3	1.0	1.0	1.0		1.0
White bass					1.0			1.0
Striped bass	2.0			1.0		1.0		
White crappie			2.3		2.0			2.0
Sauger			1.0	1.5		1.5		
Freshwater drum	23.0	4.0		3.0	3.5	3.0	1.0	6.0
Mean	103.2	36.3	63.0	23.3	11.0	23.3	6.0	13.5
Total number of species	14	8	16	13	13	13	8	12

Table 13

Average Number of Fish Caught per Net-Night with 12-ft-Deep, 2-in. Inner Panel Trammel Nets by Month in Different Habitats in the Lower Mississippi River, April-June 1978

Species	Abandoned Channel			Oxbow Lake, Lake Lee	Dike Field, Island 86		Permanent Secondary Channel, American Cutoff
	Type II, All Habitats May	Type II, Carolina Chute May	Type II, Moon Chute May	Jun	Apr	May	Apr
Paddlefish				1.0			
Shortnose gar					1.0		
Bowfin	2.5	2.5					
Skipjack herring					3.0		
Gizzard shad	24.7	12.5	49.0	23.0		17.0	
Carp	3.0	3.0	3.0			4.0	1.0
River carpsucker	6.0	3.5	11.0	7.0	7.0	4.0	
Smallmouth buffalo	1.0	1.0					
Blue catfish	1.0		1.0		1.0		
Yellow bullhead				1.0			
Channel catfish						2.0	
Flathead catfish						1.0	
Striped bass						1.0	
White crappie				1.0	1.0	3.0	
Sauger	1.0		1.0				
Freshwater drum		2.0	2.0	1.0		4.0	
Mean	18.5	11.5	32.5	19.0	6.5	19.0	1.0
Total number of species	7	6	6	6	5	8	1

Table 14

Average Number of Fish Caught per Net-Night with 8-ft-Deep, 3-in. Inner Panel Trammel Net during April 1978 in the Permanent Secondary Channel at River Mile 525 to 528.5 in the Lower Mississippi River

Species	Apr
Carp	1.0
Blue catfish	1.0
Mean	2.0
Total number of species	2

Table 15

Average Number of Fish Caught per Net-Night with 2-ft-Diameter, 1-in.-Mesh Hoop Nets in Different Habitats in the Lower Mississippi River, April-October 1978

Species	Abandoned Channel Type I, Matthews Bend, Apr	Oxbow Lake, Lake Lee		Natural Bank									
				Mayersville							Island 88	Anconia	
		Apr	Jun	Apr	May	Jun	Jul	Aug	Sep	Oct	Apr	Apr	Jun
Shovelnose sturgeon										1.0			
Longnose gar													
Shortnose gar			1.0	4.5	2.0		2.0						
Bowfin													
American eel			1.0	1.0		1.0				1.0			
Skipjack herring	1.0												
Gizzard shad				1.0	3.0								
Carp				1.0	1.4	1.0	2.7				1.0	1.0	2.0
River carpsucker		1.0		1.0	1.0							1.0	
Blue sucker													
Smallmouth buffalo													
Bigmouth buffalo													
Spotted sucker												2.0	
Blue catfish					1.7	1.0	2.0		1.0				
Channel catfish			19.0		1.0								1.5
Flathead catfish				1.0	2.2	2.3	2.0			1.0			
White bass							2.0	2.0					
Bluegill													
Redear sunfish			1.0										
White crappie			1.0	2.0							1.0		
Sauger													
Freshwater drum		3.0		1.5	1.5	2.8	3.7	1.2	3.0	3.0	1.0		3.0
Mean	0.2	0.7	4.0	1.3	0.7	1.7	2.9	0.8	1.4	0.8	0.8	1.5	1.4
Total number of species	1	2	5	8	8	5	6	2	2	4	3	3	3

(Continued)

Table 15 (Continued)

Species	Revetted Bank												
	Mayersville							Cracraft	Walnut Point-Kentucky Bend			Lake Port	Sunnyside
	Apr	May	Jun	Jul	Aug	Sep	Oct	Jun	Apr	May	Aug	Jun	Jun
Shovelnose sturgeon													
Longnose gar													1.0
Shortnose gar										1.0			
Bowfin										1.0			
American eel													
Skipjack herring									1.0				
Gizzard shad									3.0	1.3			1.0
Carp		1.0	1.0							1.5			
River carpsucker	1.0								2.5				
Blue sucker											1.0		
Smallmouth buffalo												1.0	
Bigmouth buffalo													
Spotted sucker													
Blue catfish				2.0					1.0			2.0	
Channel catfish						1.0				1.0		3.0	3.0
Flathead catfish	1.0	1.0	1.0	2.0	1.3	1.0				1.5	1.0	1.0	2.0
White bass													
Bluegill						2.0							
Redear sunfish													
White crappie													
Sauger													
Freshwater drum		1.0	2.0	2.5	1.0	1.3	1.3		1.0	1.4		1.0	
Mean	1.0	0.2	0.6	1.8	0.5	0.5	0.2	0.0	2.1	2.3	0.5	2.3	1.2
Total number of species	2	3	3	3	2	4	1	0	5	7	2	5	4

(Continued)

Table 15 (Concluded)

Species	Dike Field											Sandbar			Permanent Secondary Channel, American Cutoff	Temporary Secondary Channel, Kentucky Bend Chute	Inundated Floodplain
	Lower Cracraft	Leota			Island 86			Seven Oaks			Walnut Point	Kentucky Bend Bar		Lakeport Towhead			
	Jun	Jun	Jul	Aug	Apr	May	Aug	Apr	May	Aug	Jun	Apr	Jun	Jun	Jun	Jun	Apr
Shovelnose sturgeon													1.0				
Longnose gar							1.0						1.5		1.0		
Shortnose gar					1.0		1.0		1.0		1.0						
Bowfin					1.0												
American eel			1.0						1.0						1.0		
Skipjack herring					1.0												
Gizzard shad			1.5	1.0	3.0		1.0	2.0	1.0					1.0			
Carp	1.0	1.3			12.0	1.0		6.0	1.0		1.5			1.0	1.2		
River carpsucker	1.0				4.0	2.0	1.0	3.0	1.0			1.0					
Blue sucker																	
Smallmouth buffalo																	
Bigmouth buffalo					1.0												
Spotted sucker					2.0			2.0									
Blue catfish			1.0	1.0		1.0	1.0						2.0		1.0	1.0	
Channel catfish					3.0	1.0	1.5	1.0			1.5		1.0		1.0	1.0	
Flathead catfish		1.0	1.0			1.0			1.0	1.0	2.0			2.0	2.2	1.0	
White bass		1.0	2.7														
Bluegill			3.0								1.0						
Redear sunfish																	
White crappie					1.0		1.0										
Sauger								1.0									
Freshwater drum		1.0	1.0		2.0	1.0		1.0	1.5	1.0			1.0	1.0	2.7	1.0	
Mean	0.2	0.4	0.8	0.8	7.8	0.8	0.8	8.0	1.0	0.2	1.8	0.5	2.2	0.4	2.1	1.0	0.0
Total number of species	2	4	7	2	11	6	7	7	7	2	5	1	5	4	7	4	0

Table 16

Average Number of Fish Caught per Net-Night with 3-ft-Diameter, 1-in.-Mesh Hoop Nets in Different Habitats in the Lower Mississippi River, April-October 1978

Species	Abandoned Channel Type I, Matthews Bend, Apr	Oxbow Lake, Lake Lee		Natural Bank								
				Mayersville							Island 88	Anconia
		Apr	Jun	Apr	May	Jun	Jul	Aug	Sep	Oct	Apr	Jun
Shovelnose sturgeon				1.0						2.0		
Longnose gar												
Shortnose gar				1.0								
American eel				1.0					1.0			
Gizzard shad					1.0		4.0	1.0				
Threadfin shad												
Goldfish											6.0	1.0
Carp				1.5	2.4	1.0	2.0					
River carpsucker					1.5	1.0	3.0	2.0		1.0		
Quillback				1.0								
Blue sucker												
Smallmouth buffalo						1.0		1.0		1.0		
Bigmouth buffalo							2.0					
Spotted sucker												1.5
Blue catfish				1.0	1.8	1.0	2.0	1.0	1.5	1.5		1.5
Channel catfish					3.0							3.0
Flathead catfish				3.0	1.9	1.0	2.0	1.0			2.0	3.0
White bass												
Bluegill												
Largemouth bass												
White crappie				1.0								
Sauger												
Freshwater drum				2.0	3.3	5.0	8.3	2.0	1.5	1.5	1.0	1.0
Mean	0.0	0.0	0.0	2.1	1.5	2.8	5.4	2.0	0.7	1.2	2.2	1.7
Total number of species	0	0	0	9	7	6	7	6	3	5	3	6

(Continued)

Table 16 (Continued)

Species	Revetted Bank												Dike Field											
	Mayersville							Walnut Point-Kentucky Bend			Lake Port	Sunny-side	Lower Cracraft		Leota			Island 86			Seven Oaks			Walnut Point
	Apr	May	Jun	Jul	Aug	Sep	Oct	Apr	May	Aug	Jun	Jun	Apr	Jun	Jun	Jul	Aug	Apr	May	Aug	Apr	May	Aug	Jun
Shovelnose sturgeon																								
Longnose gar												1.0			1.0				2.0					
Shortnose gar						1.0																		
American eel																								
Gizzard shad					1.0			4.0	1.3					1.0		3.0	1.0	1.0	1.0			1.3		
Threadfin shad																			1.0					
Goldfish						1.0			1.0															
Carp		1.0	2.0	1.5							1.0		1.0		1.0			1.0	2.0			1.5		
River carpsucker		1.0	1.0				2.0		2.0				5.0		1.0	1.5		6.0	1.0			1.0		
Quillback																								
Blue sucker												1.0												
Smallmouth buffalo		1.0		4.0		1.0			3.0		1.0	2.0			1.0	1.0							1.0	
Bigmouth buffalo																								
Spotted sucker																		1.0						
Blue catfish				2.0	3.0	1.0	2.0		1.0		1.0	1.5			1.0			2.0	5.5			1.0		
Channel catfish				1.0					1.5	1.0	6.0		1.0		1.0		1.0	1.0				4.0		
Flathead catfish			1.7	1.0	1.0	1.3	1.0		1.3		2.0	15.0		1.0	1.3	1.0	1.0	2.0		1.0		3.7	1.0	
White bass													1.0											
Bluegill															2.0			2.0						
Largemouth bass																		1.0						
White crappie			1.0												4.0			6.0		1.0				
Sauger																		2.0						
Freshwater drum		1.5	2.2	4.5	1.7	1.0	1.0		2.8			1.0	5.0	2.5	4.3	3.0		20.0	3.0			1.0	2.0	
Mean	0.0	0.4	2.4	3.9	1.1	0.9	0.4	2.2	4.8	0.1	3.3	2.9	13.0	1.7	1.9	1.2	1.2	16.5	3.7	0.2	0.0	4.3	0.7	0.0
Total Number of species	0	4	5	6	4	6	4	1	8	1	5	6	5	3	10	5	3	12	7	2	0	7	3	0

(Continued)

Table 16 (Concluded)

Species	Sandbar		Permanent Secondary Channel, American Cutoff	Temporary Secondary Channel, Kentucky Bend Chute
	Kentucky Bend Bar Jun	Lakeport Towhead Jun	Jun	Jun
Shovelnose sturgeon			1.0	
Longnose gar				
Shortnose gar		1.0		
American eel				
Gizzard shad		1.0		
Threadfin shad				
Goldfish				
Carp	1.0	1.0	2.0	
River carpsucker		2.0		1.0
Quillback				
Blue sucker				
Smallmouth buffalo		1.0	1.0	
Bigmouth buffalo		1.0		
Spotted sucker				
Blue catfish		1.0	1.0	
Channel catfish		1.0	1.6	
Flathead catfish	2.0	2.0	1.3	2.3
White bass				
Bluegill				
Largemouth bass				
White crappie		1.5		
Sauger				
Freshwater drum	1.5	2.7	3.8	
Mean	2.2	2.0	3.2	2.0
Total number of species	3	11	7	2

Table 17

Average Number of Fish Caught per Net-Night with 4-ft Diameter, 1.5-in.-Mesh Hoop Nets by Month in Different Habitats in the Lower Misissippi River, April-August 1978

Species	Abandoned Channel Type I, Matthews Bend	Oxbow Lake, Lake Lee		Natural Bank			Revetted Bank					Dike Field							Inundated Floodplain
				Mayers-ville	Island 88	Anconia	Mayers-ville		Walnut Point-Kentucky Bend			Lower Cra-craft	Leota	Island 86		Seven Oaks	Walnut Point		
	Apr	Apr	Jun	Apr	Apr	Apr	Jul	Aug	Apr	May	Aug	Jun	Jun	Apr	May	May	Apr	Jun	Apr
Shortnose gar			2.0															3.0	
Gizzard shad			3.5	3.0						1.0				1.0				4.0	
Carp				1.5		1.0	1.0			2.0						1.5	1.0	1.0	
River carpsucker	1.0		2.2	1.0		2.0							4.0		1.0	4.5	1.0	2.0	
Quillback				1.0												1.0			
Smallmouth buffalo	1.0						4.0						1.0						
Bigmouth buffalo				2.0															
Spotted sucker						1.0													
Blue catfish			1.0											1.0		1.0	1.0	1.0	
Channel catfish			10.3				1.0			2.0	1.0					1.0		2.0	
Flathead catfish			1.0	1.0			1.0			1.0								3.0	
White bass			1.0															1.0	
Bluegill			1.0															1.0	
Redear sunfish			5.0																
White crappie			2.0															2.0	
Freshwater drum	1.0	3.3	2.0				4.0			1.7					3.0	9.3	3.0	7.0	
Mean	0.8	0.2	10.7	1.9	0.0	2.0	5.5	0.0	0.0	3.2	0.5	0.0	1.7	1.0	1.0	7.2	3.0	11.3	0.0
Total number of species	2	1	11	6	0	3	5	0	0	5	1	0	2	2	2	6	4	11	0

Table 18

Average Number of Fish Caught per Seine-Haul with 15-ft-long, 1/8-in.-Mesh Seine in Different Habitats in the Lower Mississippi River, June and August 1978

Species	Dike Field				Sandbar			Temporary Secondary Channel,		
	Leota		Island 86		Kentucky Bend Bar	Lakeport Towhead		Kentucky Bend Chute		Borrow Pit
	Jun	Aug	Jun	Aug	Aug	Jun	Aug	Jun	Aug	Aug
Skipjack herring		3.0	1.0	2.0	1.0		1.0		4.0	
Gizzard shad		16.0	5.4	5.0			8.8		46.5	
Threadfin shad		12.5		9.5	2.0		1.1		8.5	
Goldeye	4.0	1.0		1.0			1.0			
Mooneye	3.0							4.0		
Goldfish		2.0	3.0							
Silvery minnow		1.0	14.5				6.0			
Speckled chub						1.0				
Silver chub		1.0		1.0			1.8		2.0	
Emerald shiner		9.2	4.0	42.5	1.0		3.6		2.0	
River shiner	2.7	3.5	7.8	1.6	1.5		3.9	4.0	1.8	10.0
Ribbon shiner			1.0		1.0	10.0				
Red shiner	2.5	1.0	3.0				1.0			
Taillight shiner		1.0								2.0
Silverband shiner		1.6			2.0	12.0	1.0	2.0		
Spotfin shiner		6.0								
Weed shiner							1.0			1.0
Redfin shiner		1.0		11.0						
Blacktail shiner	1.7	3.2	1.0					4.0		
Mimic shiner	1.0	3.0		9.0	1.0		5.0		1.0	
Steelcolor shiner		1.0								
Bullhead minnow	1.0			2.0	1.0		2.5		1.0	
River carpsucker		3.8	1.0				3.7		5.0	
Quillback	1.0	1.0	3.0				1.0			
Highfin carpsucker							1.0			
Smallmouth buffalo			2.0							
Bigmouth buffalo			1.0							
Black buffalo		1.0								
Blue catfish					1.0		6.0			
Channel catfish							2.0			
Blackstripe topminnow			1.0							
Mosquitofish	2.0		2.7				1.0	1.0	1.0	6.0
Brook silverside		9.5	20.8	2.5			1.0	4.0	1.0	1.0
Mississippi silverside		9.6	9.0	13.9	5.0		4.6	1.0	18.1	
White bass	4.7	1.0	5.5	1.0		8.0	1.0	8.0		
Striped bass	3.0	1.0					1.0	3.0		
Orangespotted sunfish		1.5								3.0
Bluegill			1.5						1.0	1.0
Largemouth bass		1.0	1.5					1.0		2.0
White crappie	1.0	1.2	5.0			1.0				1.0
Black crappie	3.5	1.5	29.8			2.0	1.0	4.0		
Bluntnose darter							2.0			
Sauger	1.0		2.3					1.0		
Freshwater drum		1.0	2.0				1.5			
Mean	39.8	26.3	72.0	31.1	5.2	14.3	18.3	35.0	42.5	6.8
Total number of species	14	29	24	13	10	6	26	12	13	9

Table 19

Average Number of Fish Caught per Seine-Haul with 25-ft-Long, 3/8-in.-Mesh Seine in Different Habitats in the Lower Mississippi River, June 1978

Species	Dike Field		Sandbar, Lakeport Towhead	Temporary Secondary Channel, Kentucky Bend Chute
	Leota Jun	Island 86 Jun	Jun	Jun
Gizzard shad	3.0	9.3	12.0	5.0
Threadfin shad	1.0			
Goldeye	1.0	1.0		
Carp				1.0
Cypress minnow	1.0			
Silvery minnow	10.0	10.0		
Speckled chub			1.0	
River shiner	8.0	15.0	9.0	43.0
Pugnose minnow		2.0		
Ribbon shiner	1.0			
Red shiner	3.3	2.0		
Weed shiner	4.0			
Redfin shiner			1.0	
Blacktail shiner	1.5	1.5	3.0	2.5
Bullhead minnow		2.0		2.0
Creek chub	1.0			
River carpsucker		2.0		3.0
Quillback		1.0		
Smallmouth buffalo		1.0	1.0	
Bigmouth buffalo		3.0		
Mosquitofish	4.0	1.0		
Brook silverside		2.0		
Mississippi silverside		2.0		
White bass	4.0	13.0	12.0	29.0
Striped bass	12.5			
Orangespotted sunfish				1.0
Bluegill	1.0	2.0		1.0
Spotted bass		1.0		
Largemouth bass		9.0	1.0	
White crappie	1.0	3.0	8.0	2.0
Black crappie	3.0	15.8		2.0
Sauger	2.0	1.0		6.0
Freshwater drum	1.0			
Mean	21.3	50.0	32.5	73.0
Total number of species	19	22	9	12

Table 20

Average Number of Fish Caught per Night with Slat Traps by Month in Different Habitats in the Lower Mississippi River, April-May 1978

Species	Abandoned Channel (Type I), Matthews Bend Apr	Oxbow Lake, Lake Lee Apr	Dike Field Island 86 Apr	Dike Field Island 86 May	Dike Field Seven Oaks May
Blue catfish	1.0				
Flathead catfish				1.0	1.0
Freshwater drum	1.0				
Mean	0.2	0.0	0.0	0.1	0.1
Total number of species	2	0	0	1	1

Table 21

Average Number of Fish Caught per Electroshocking Transect in Different Habitats in the Lower Mississippi River during August-September 1978

Species	Natural Bank Mayersville Aug	Natural Bank Mayersville Sep	Revetted Bank Mayersville Aug	Revetted Bank Mayersville Sep	Dike Field Leota Aug	Dike Field Seven Oaks Aug
Longnose gar			1.0		1.0	
Shortnose gar						1.0
Skipjack herring	1.0	2.0		4.0		
Gizzard shad	4.0	18.0	6.0	6.5	43.8	4.8
Threadfin shad					1.5	
Goldeye	1.0	2.0			1.0	
Mooneye		2.0		2.0		
Stoneroller						1.0
Goldfish				1.0		
Carp			1.0		1.3	1.0
River shiner					1.0	1.0
Red shiner						3.0
Blacktail shiner						3.0
River carpsucker					1.5	1.0
Smallmouth buffalo						1.0
Blue catfish				1.0	1.1	1.2
Channel catfish					1.0	1.0
Flathead catfish	2.0		1.0		1.0	2.0
White bass					1.0	1.0
Bluegill						1.5
Longear sunfish						1.0
White crappie					1.0	1.5
Sauger			1.0			
Freshwater drum					1.0	1.0
Mean	21.0	24.0	6.0	6.2	28.6	4.7
Total number of species	4	4	5	5	13	17

Table 22

Summary of Mean Catch per Effort (C/f), Current Velocity, Dissolved Oxygen (D.O.), Temperature, and Depth by Station Group and Type of Gear Used, April-December 1978, Mayersville, Mississippi

Station Group	Gear*	C/f	Velocity cm/sec	D.O. mg/ℓ	Temperature °C	Depth m
1-4	HN2	0.60**	39	7.8	19.9	2.1
	HN3	0.74	55	7.7	20.6	4.4
5-8	HN2	0.45**	33	7.8	19.9	2.1
	HN3	0.58	47	7.7	20.2	4.2
12-15	HN2	0.28**	18*	7.7	19.7	2.0
	HN3	0.41**	23*	7.6	20.1	3.4**

* HN2, Hoop net, 2-ft diameter; HN3, Hoop net, 3-ft diameter.

** Indicates a significant difference ($\alpha = 0.05$) when compared to the mean values obtained for the same gear type.

Table 23

Frequency of Occurrence (percent) of Fish Captured with Hoop Nets at Sampling Stations 1-4, 5-8, and 12-15

Species	Station Group 1-4 B*	1-4 A	5-8 B	5-8 A	12-15 B	12-15 A	Total
Shovelnose sturgeon	0.2	0.9			0.2		1.3
Shortnose gar	0.5		1.7			0.2	2.4
American eel	0.2	0.6	0.2	0.2		0.2	1.4
Gizzard shad	1.4	3.7	0.6	3.5		1.7	10.9
Goldfish						0.3	0.3
Carp	4.0		2.4	0.5	1.4		8.3
Rivercarp sucker	1.7	0.5	0.2	0.6	0.5		3.5
Quillback	0.2		0.2				0.4
Smallmouth buffalo	0.2	0.5		0.6	1.4		2.7
Bigmouth buffalo	0.6						0.6
Blue catfish	1.1	1.3	1.1	1.6	1.1	0.5	6.7
Channel catfish	0.9			0.6	0.3		1.8
Flathead catfish	4.5	1.7	3.2	1.6	2.1	0.8	13.9
White bass	0.3	0.2					0.5
Bluegill				0.2		0.3	0.5
White crappie	0.6		0.2		0.2		1.0
Sauger		0.2		0.6			0.8
Freshwater drum	17.7	4.9	7.5	3.4	7.5	1.4	42.4
TOTAL	34.1	14.5	17.3	13.4	14.7	5.4	99.4

* B = before revetment and A = after revetment placement at stations 5-8.

APPENDIX A: DETAILED MAPS OF THE STUDY AREA SHOWING SAMPLING STATIONS IN EACH OF THE HABITATS

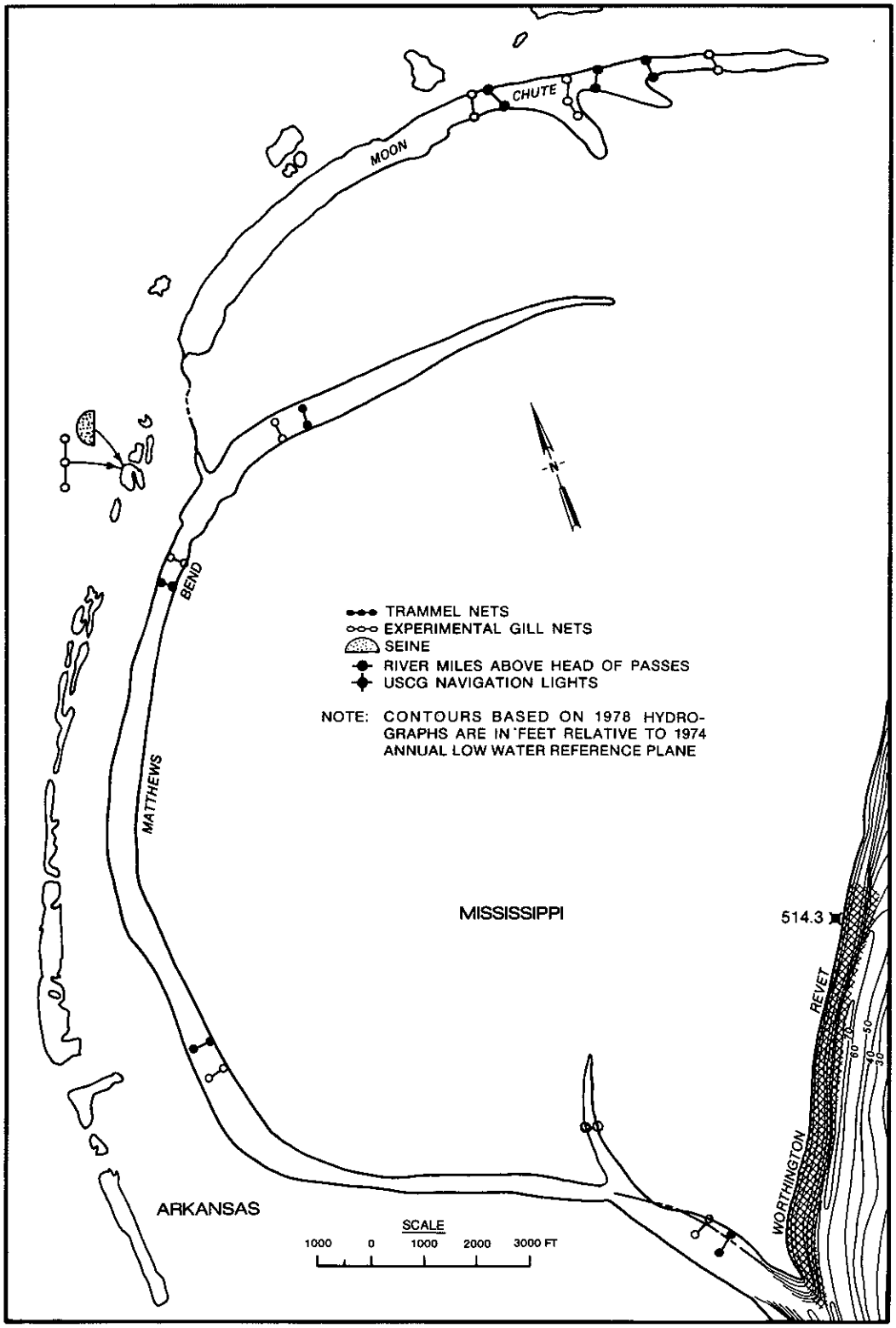

Figure A1. Sampling stations at Moon Chute, Matthews Bend, and borrow pit

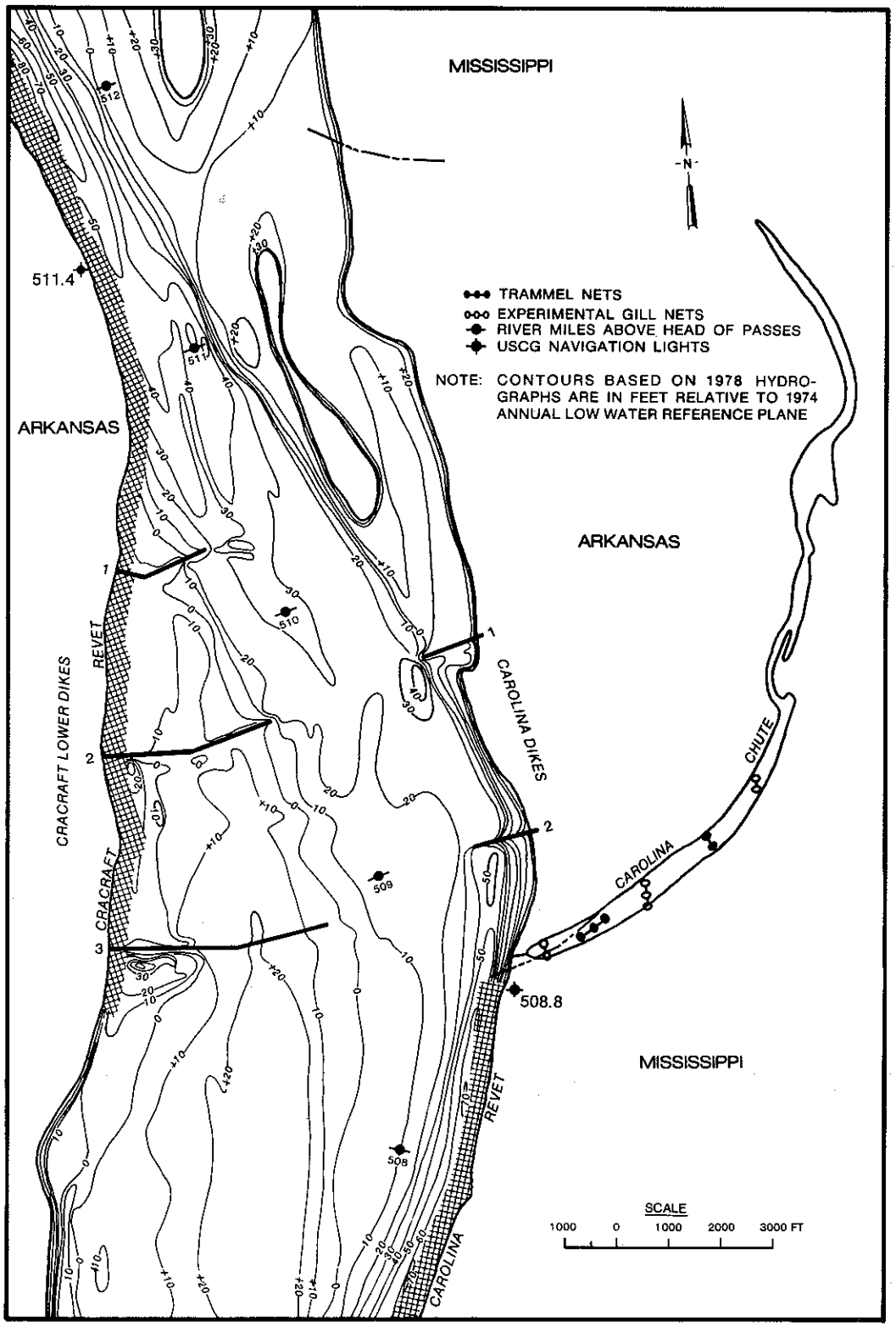

Figure A2. Sampling stations at Carolina Chute

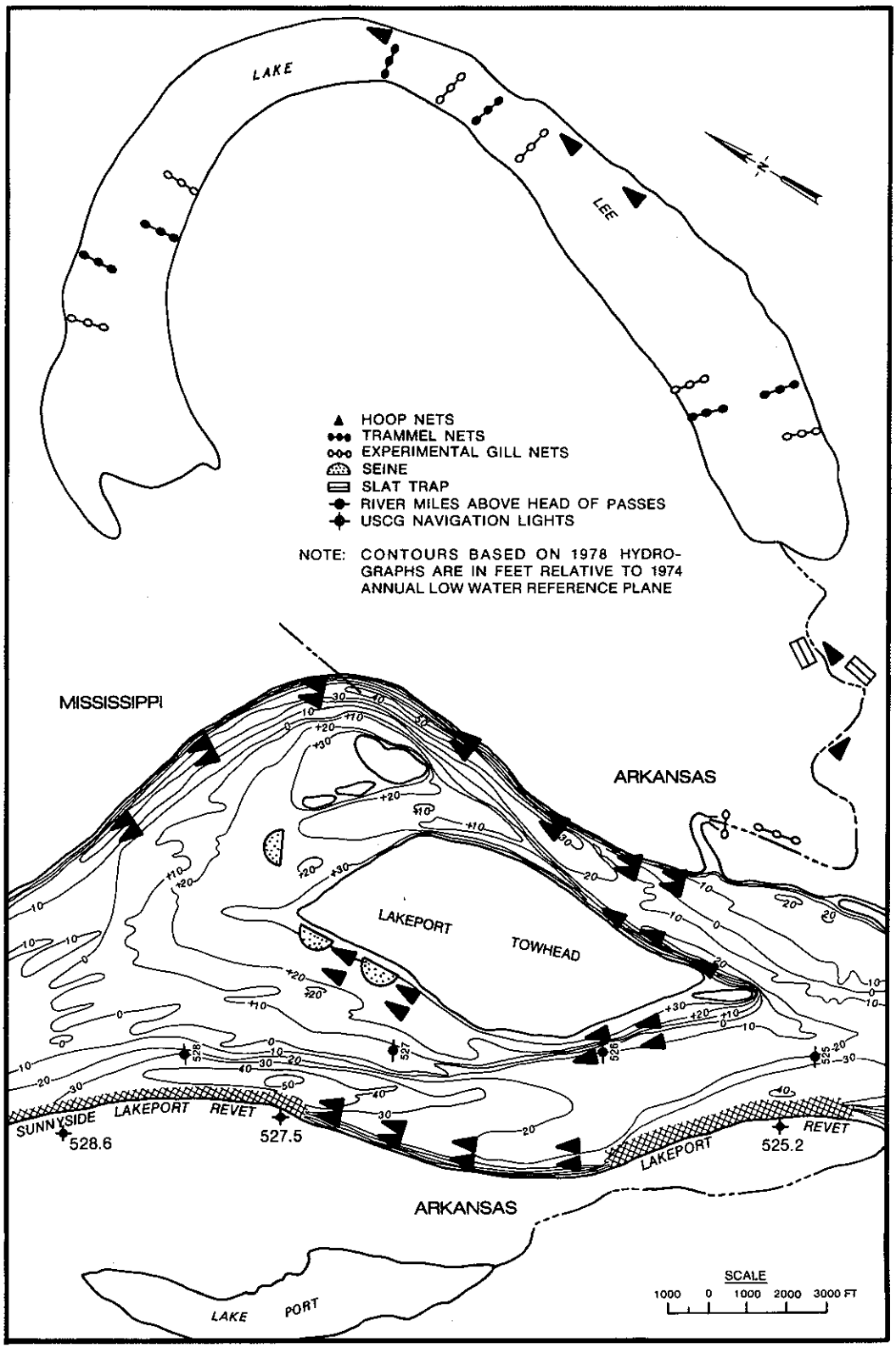

Figure A3. Sampling stations at Lake Lee, American Cutoff, Lakeport Towhead, and natural bank at Anconia light

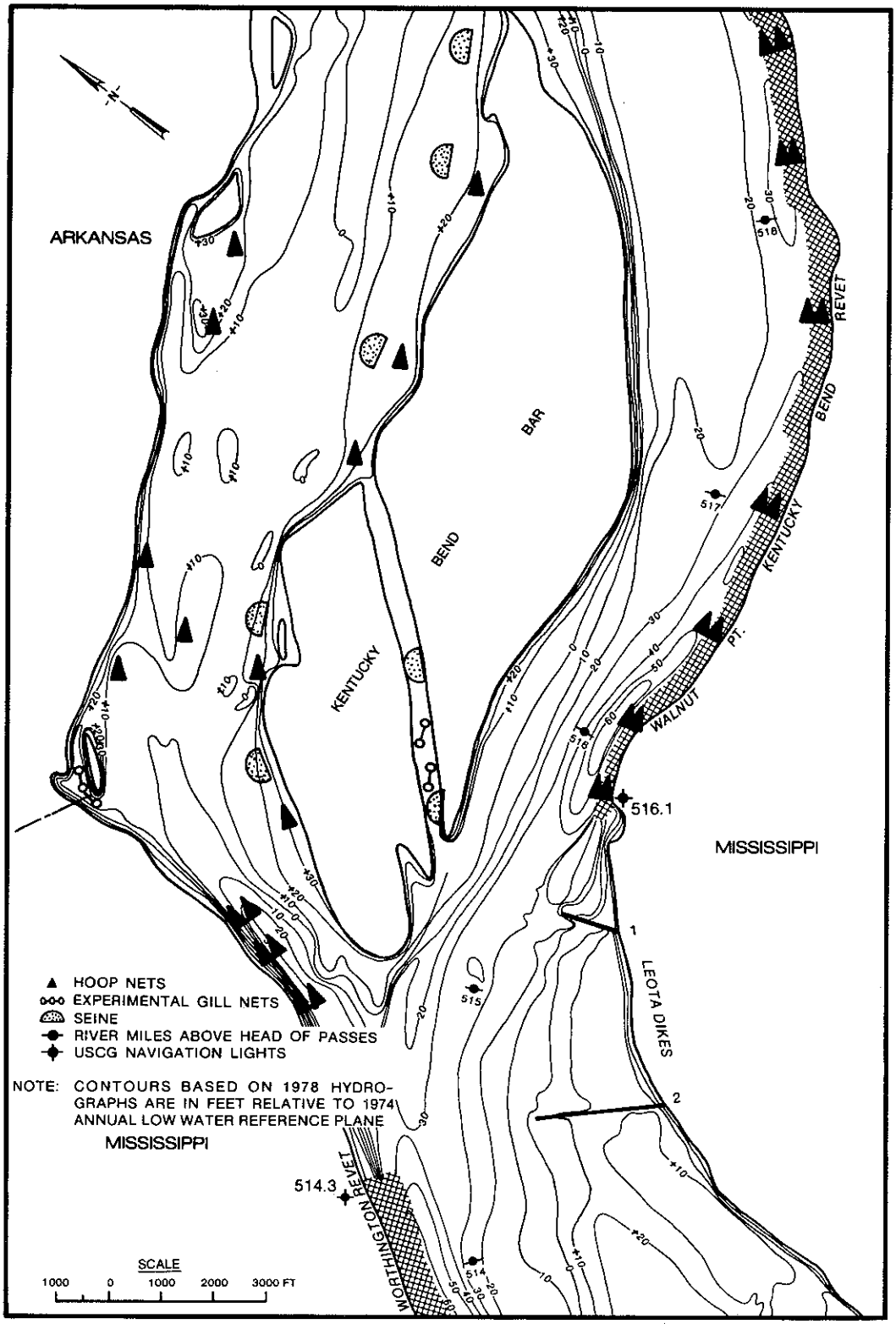

Figure A4. Sampling stations at temporary secondary channel, Kentucky Bend Bar, and Walnut Point-Kentucky Bend revetment

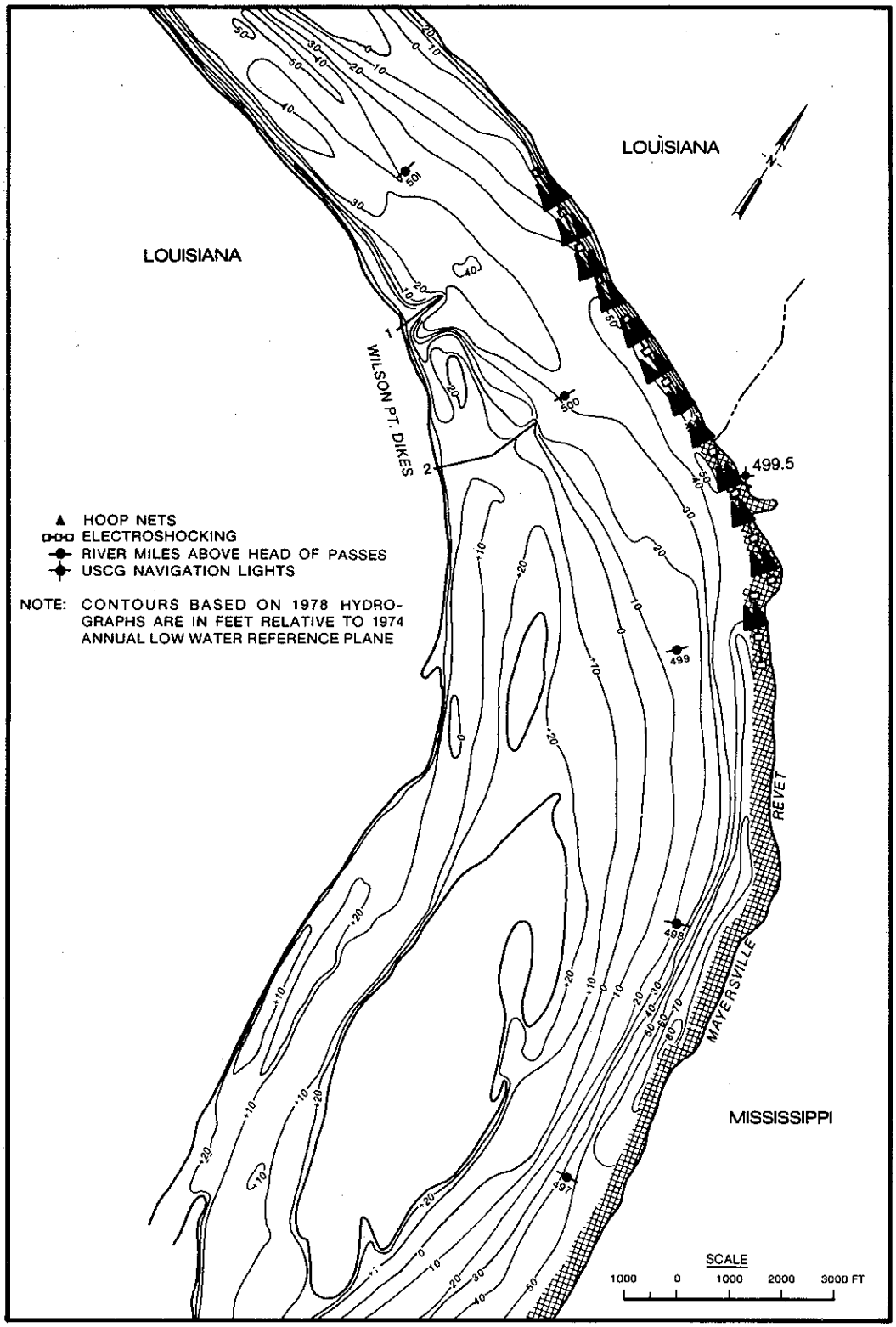

Figure A5. Sampling stations at natural and revetted bank at Mayersville, Mississippi

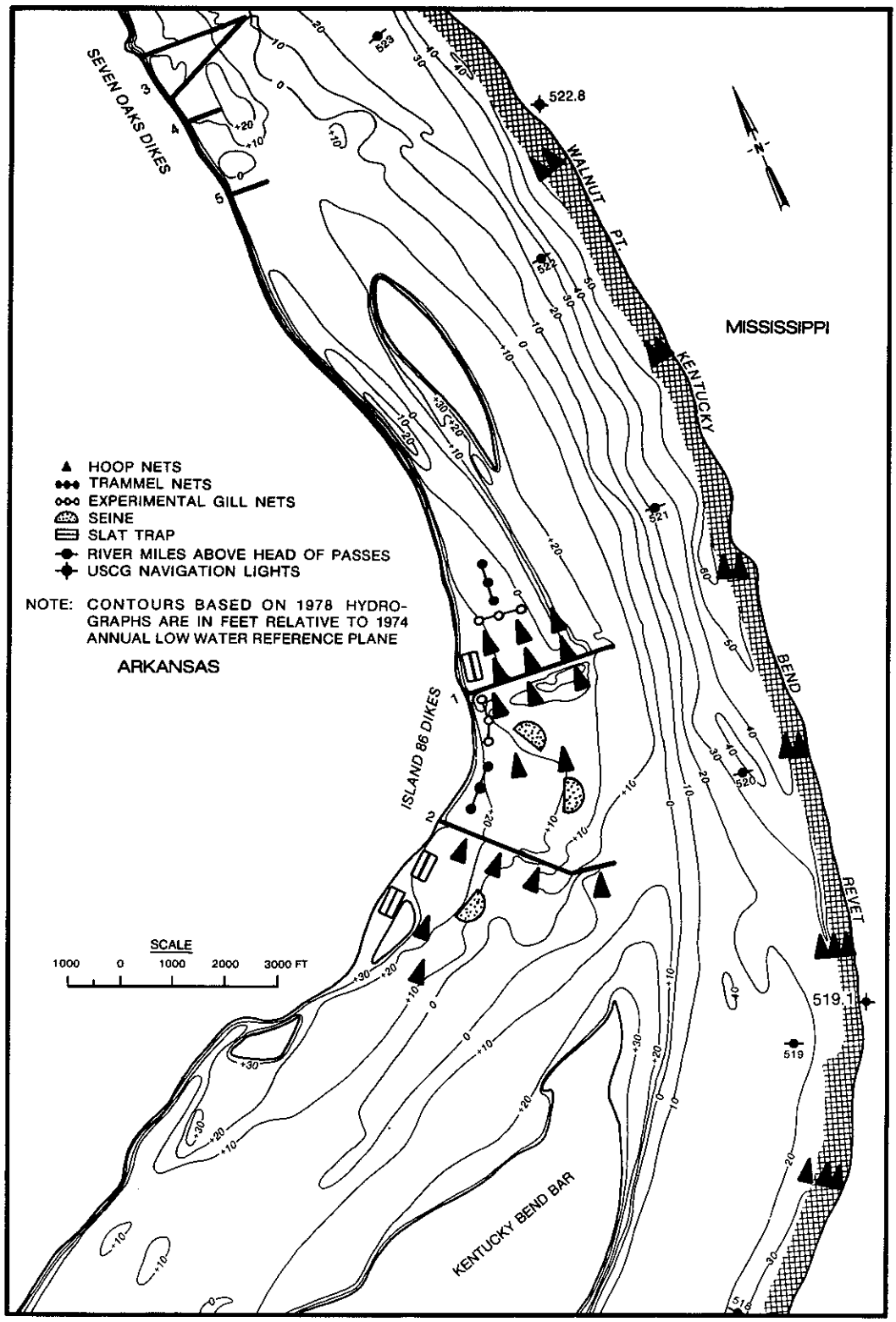

Figure A6. Sampling stations at Island 86 Dike Field and Walnut Point-Kentucky Bend revetment

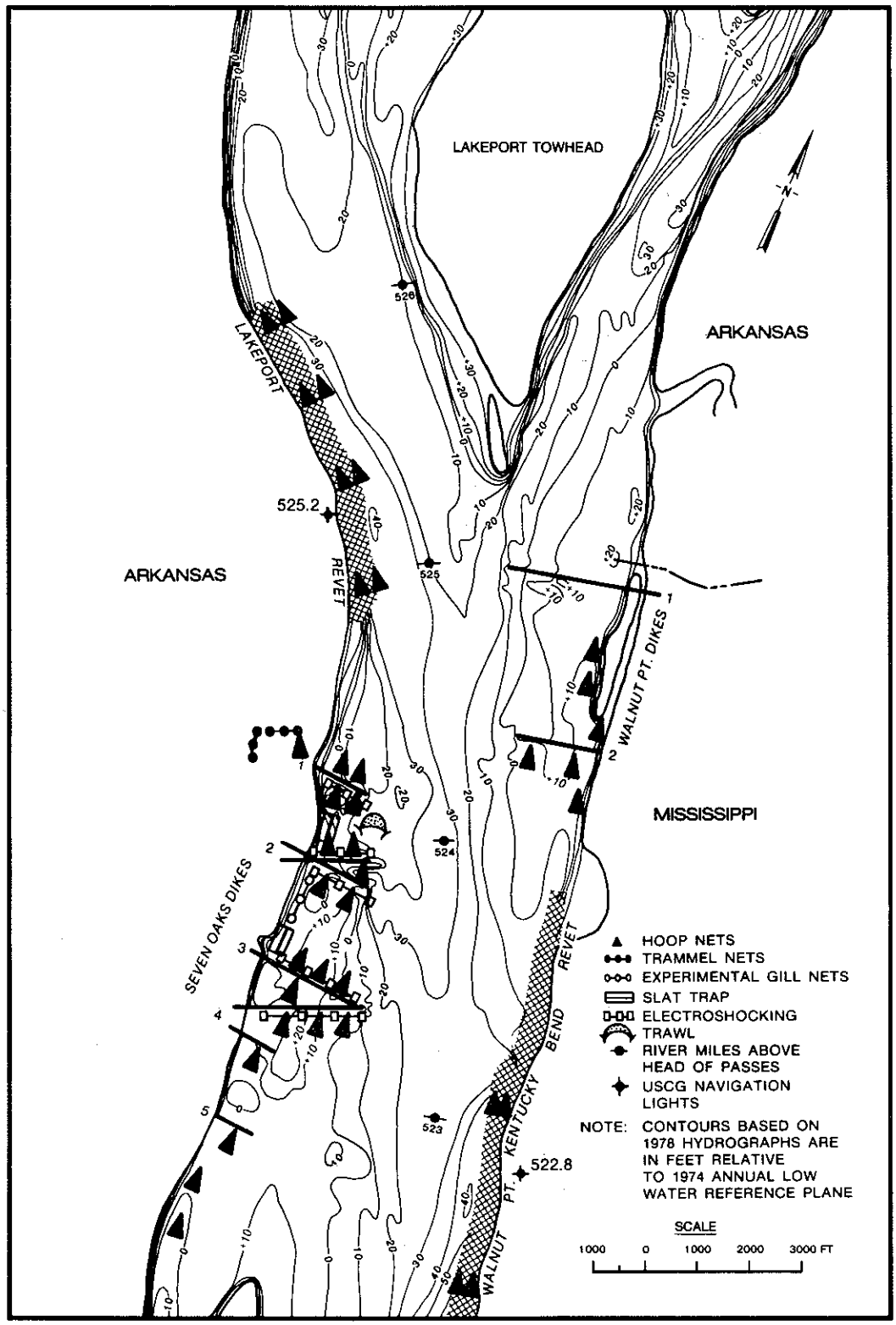

Figure A7. Sampling stations at Lakeport Revetment, inundated floodplain, Seven Oaks and Walnut Point Dike Fields, and Walnut Point-Kentucky Bend Revetment

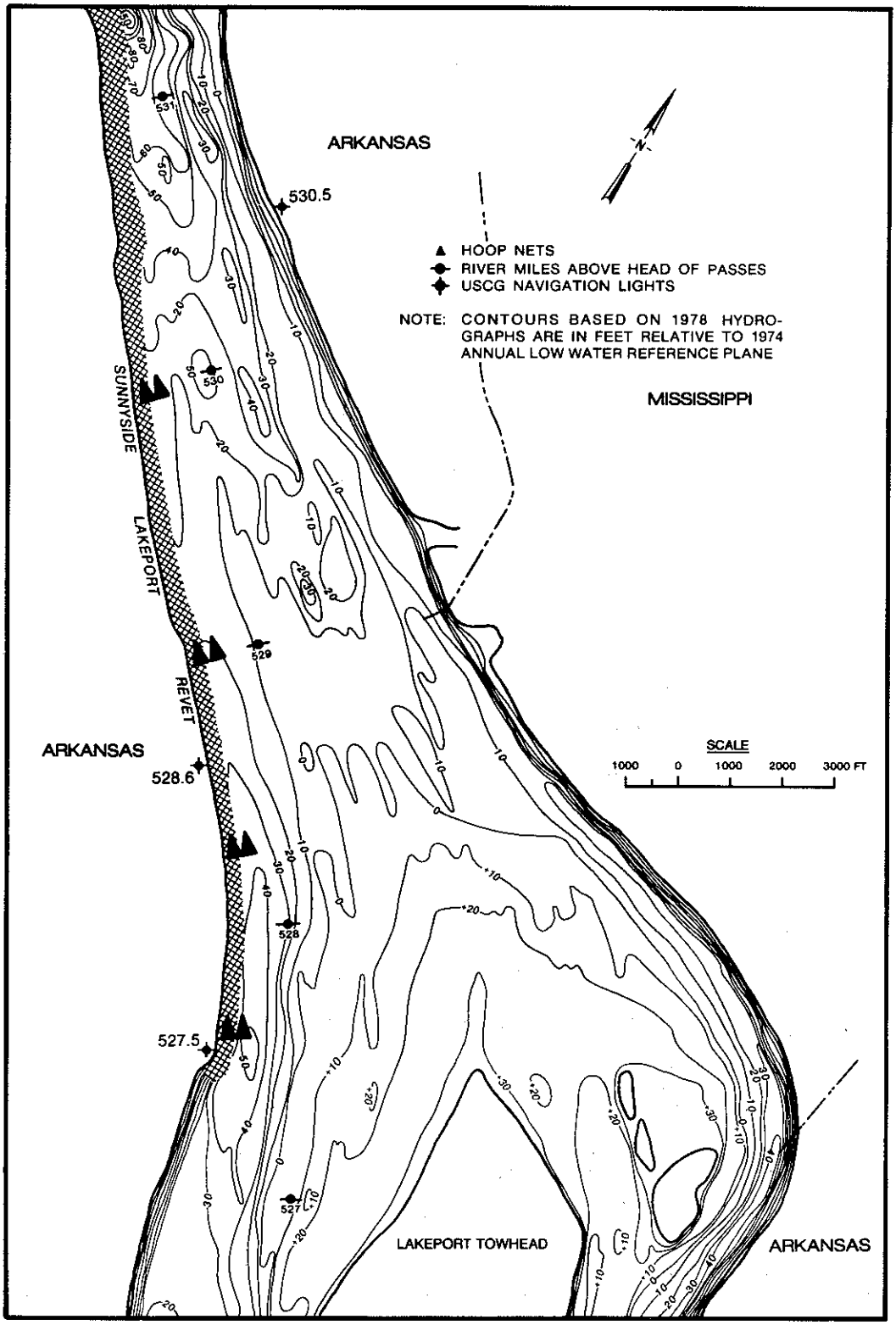

Figure A8. Sampling stations at Sunnyside-Lakeport Revetment

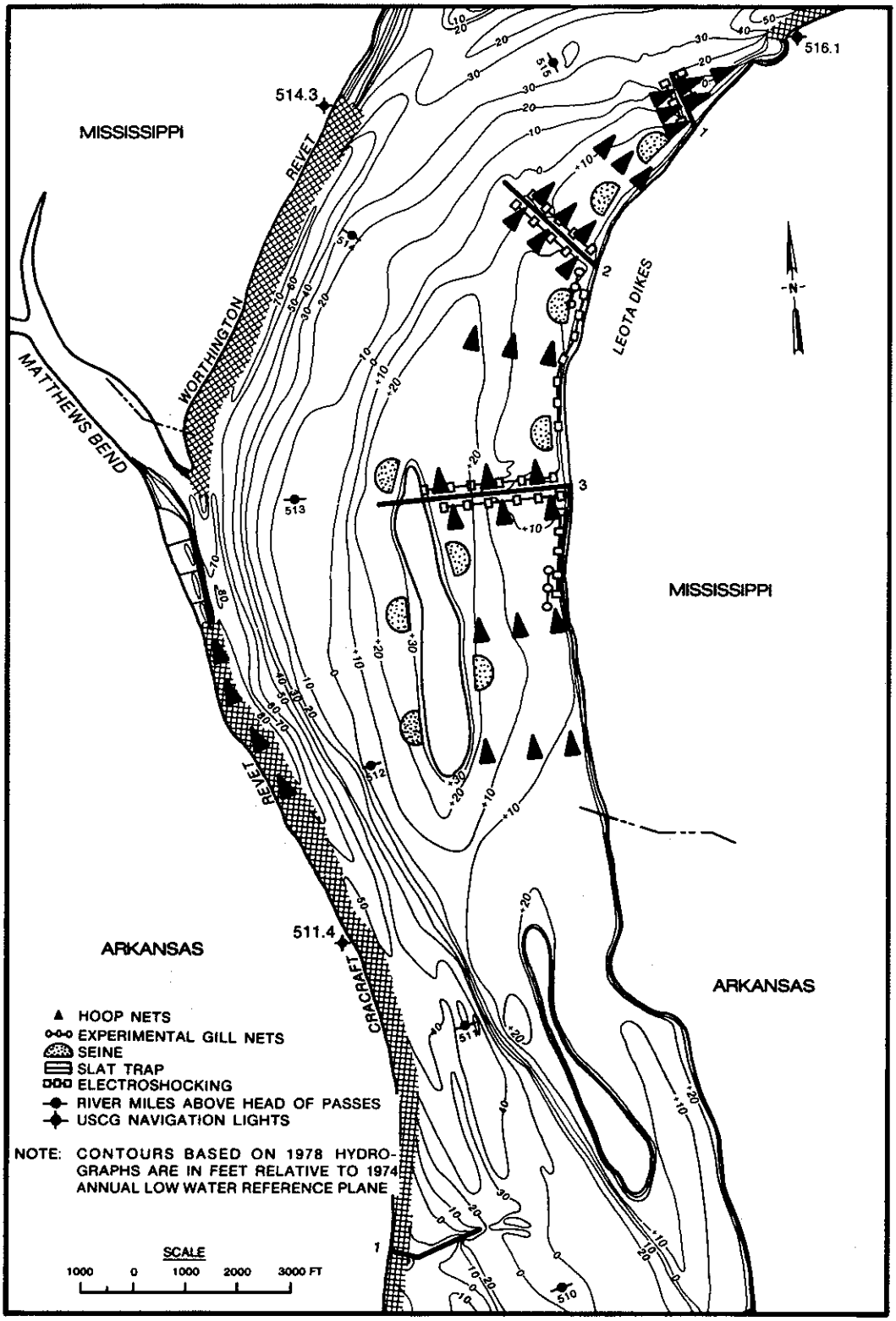

Figure A9. Sampling stations at Leota Dike Field and Cracraft Revetment

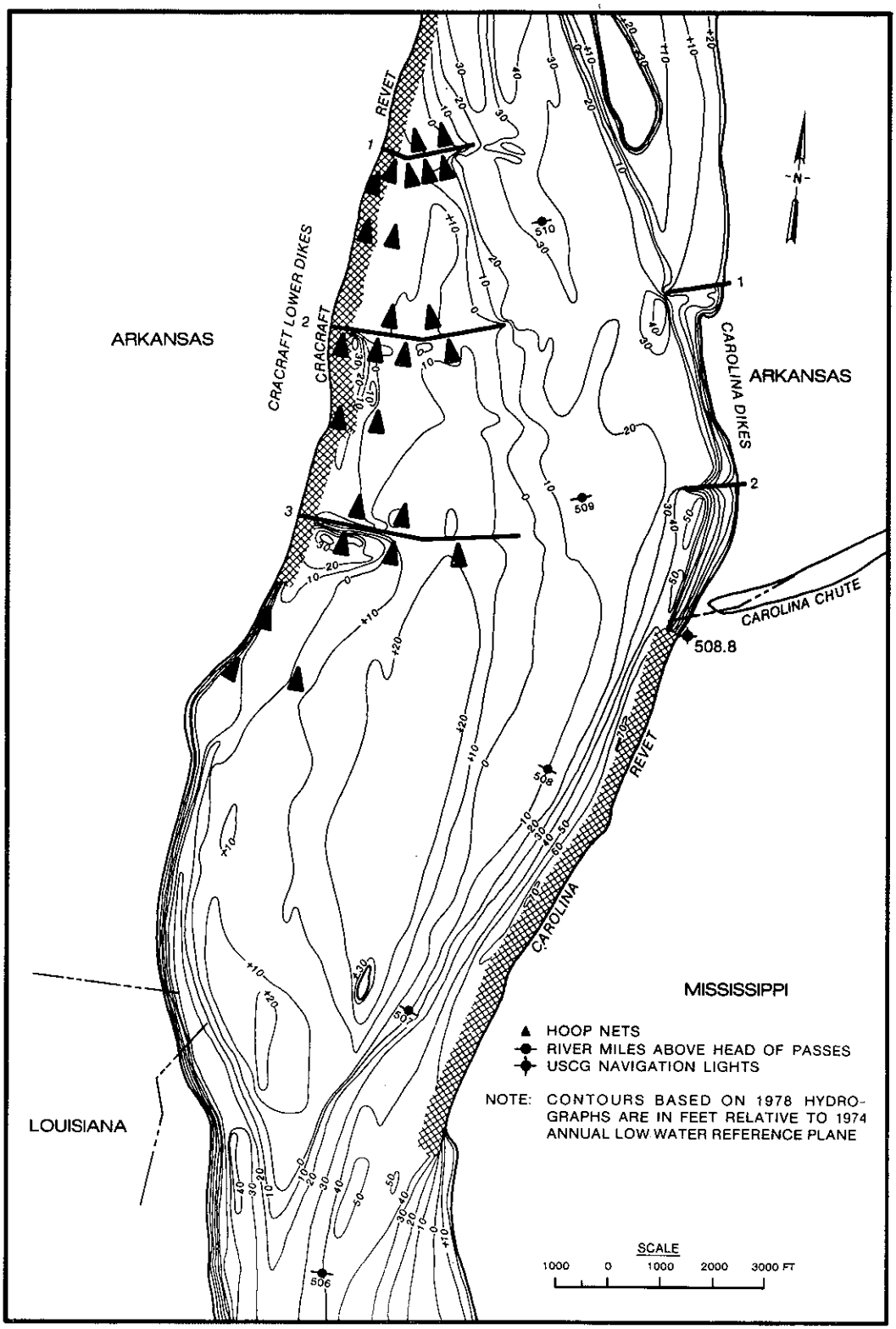

Figure A10. Sampling station at Cracraft Dike Field

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Aquatic habitat studies on the Lower Mississippi River, river mile 480 to 530 : Report 5 : fish studies--pilot report / by C.H. Pennington ... [et al.] (Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station.) -- Vicksburg, Miss. : The Station, [1981.]
101 p. in various pagings : ill. ; 27 cm. -- (Miscellaneous paper / U.S. Army Engineer Waterways Experiment Station ; E-80-1, Report 5.)
Cover title.
"May 1981."
"Prepared for Office, Chief of Engineers, U.S. Army, under EWQOS Work Unit VIIB."
"Available from National Technical Information Service, Springfield, Va. 22161."

1. Aquatic ecology. 2. Environmental impact analysis. 3. Fishes. 4. Mississippi River. 5. Sampling. I. Pennington, C.H. II. United States. Army. Corps of Engineers, Office of the Chief of Engineers.

Aquatic habitat studies on the Lower Mississippi : ... 1981. (Card 2)

III. United States. Army Engineer Waterways Experiment Station. Environmental Laboratory. IV. Title V. Series: Miscellaneous paper (United States. Army Engineer Waterways Experiment Station) ; E-80-1, Report 5.
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