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UPPER MISSISSIPPI RIVER WING DAM NOTCHING:
THE PRE-NOTCHING FISH STUDY

By

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Wisconsin Cooperative Fishery Research Unit

A Thesis

submitted in partial fulfillment of the

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ABSTRACT

Six wing dams and an adjacent side channel in Pool 13 of the Upper Mississippi River were studied in June, August, and October 1978, and June 1979 in the initial phase (pre-notching) of a project to determine the effects of wing dam notching on fish and aquatic community characteristics. Three wing dams were notched in June 1979.

Fifty two species of fish were caught in the study area with hoop nets, electrofishing gear, and a small-mesh seine. Thirty eight fish species were caught on or near wing dams. Electrofishing provided the widest variety of fish species and hoop netting provided the least. Electrofishing and hoop net catches were influenced by river stage or discharge.

Species composition of the catches changed more dramatically from sampling month to month than between kinds of habitat. Fish were caught in greatest numbers and diversity throughout the study area in August. Centrarchids, especially bluegill, and cyprinids, especially emerald shiners, were most abundant in August. Freshwater drum dominated catches in late October. Electrofishing catch rates and fish species diversity were highest in the side channel, followed by main channel border shorelines, and emergent wing dams. The composition of electrofishing catches from the side channel, main channel border shorelines, and emergent wing dams were generally similar.

Smallmouth buffalo were most important in hoop net catches near wing dams, and channel catfish, in side channel hoop nets. No bluegill, black crappie, or sauger older than age IV, and only one freshwater drum older than IV were caught in the study area.

Discharge varied from month to month and year to year. Water temperature and dissolved oxygen concentration were nearly uniform with depth and among sampling sites each month. Height of wing dams and their position with respect to an upstream bend in the river and to other wing dams influenced current velocity in the study area. Current sweeping over submerged wing dams and over emergent wing dams during high river stages helps prevent sediment accretion between them.

ACKNOWLEDGEMENTS

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INTRODUCTION

Wing dams are low structures of brush and rock rubble that extend from the river bank into the main channel. Wing dams, also commonly referred to as wing dikes and spur dikes, divert water to the main channel, especially during periods of low flow, reducing the need for dredging. A major problem associated with wing dams has been sediment accretion in slack water areas between wing dams and adjacent backwaters causing loss of fish habitat (Funk and Robinson 1974). Currently, little information exists concerning the use of wing dams by fish and fish food organisms although wing dams are preferred fishing spots of many anglers.

Thousands of wing dams were built in the Upper Mississippi River by the U.S. Army Corps of Engineers to help maintain the 4.5 and 6 foot navigation channels authorized by Congress in 1890 and 1907. Construction of wing dams between 1890 and 1930 caused a slight decrease in the width of the Upper Mississippi River (Simons et al. 1975). Lateral wing dams closed off old channels, constricted low flows, and helped prevent the river from returning to another alignment. A permanent rise in water level caused by construction of a series of 29 locks and dams between 1930 and 1940 submerged many of the wing dams in the Upper Mississippi River.

In 1977, the Army Corps of Engineers submitted plans to GREAT II (Great River Environmental Action Team), the organization charged with developing an environmentally sound river management plan, for repair of wing dams in Pools 13 and 19. The fish and wildlife work group of GREAT II proposed that notches be constructed in the wing dams to help reduce sedimentation between them. Notching has been used extensively on the Missouri River in an attempt to restore slack water fish habitat by allowing flow into the area immediately below wing dams (Kallemeyn and Novotny 1976; Jennings 1979; Reynolds 1978; Dieffenbach 1980). The effects of notching have been variable because some notches have permitted scouring of sediments below wing dams and others have not. Much of the variation in success has been attributed to the height and location of notches in wing dams and to location of the wing dam in the flow field (Jennings 1979; Simons et al. 1974). Nonetheless, notching has created additional slack water habitat and increased habitat diversity for fish in channelized portions of the Missouri River (Kallemeyn and Novotny 1976; Jennings 1979).

This study was the initial phase of a project to determine the effects of wing dam notching on aquatic community characteristics in a wing dam field in Pool 13 of the Upper Mississippi River. Six wing dams and an adjacent side channel were studied in June, August, and October 1978, and June 1979. Three of the wing dams were notched in June 1979.

Objectives for this portion of the project were to describe physical characteristics of the study area, to determine fish species composition and relative abundance of fish at wing dams and in habitats associated with wing dams, and to identify factors such as time of year and habitat differences that may influence variations in relative abundance of fish. In conjunction with this fish study, benthic macroinvertebrates and sediments were investigated by Thomas Hall of the Wisconsin Cooperative Fishery Research Unit (Hall 1980). The post-notching study is presently being conducted by Scott Corley from the Wisconsin Cooperative Fishery Research Unit, and is scheduled to be completed in Fall 1980.

STUDY AREA

The study area encompassed wing dams 25, 26, 28, 29, 30, 31, and an unnamed side channel between river mile 547.4 and 548.6 in the upper end of Pool 13 of the Upper Mississippi River adjacent to Carroll County, Illinois (Figure 1). Pool 13, created by construction of Lock and Dam 13 north of Fulton, Illinois, in 1939, is 55 kilometers long and 178 meters above sea level. Pool 13 has 29,103 acres of surface water at flat pool stage, of which 7,276 acres are main channel. Almost 95 percent of the shoreline in Pool 13 is under federal control.

Bedrock in the area of the pool consists of Galena dolomite and Maquoketa shale from the Ordovician age. Depth to bedrock ranges from 9 to 46 meters. There are no glacial deposits in the northern area of Pool 13, but glacial deposits in the southern area of the pool are of the Illinoian and Kansan stages. Floodplain soils are silt-clay deposited 1 to 6 meters deep overlying sand. Pool 13 drains an area of 221,445 square kilometers. Approximately 1,415,232 metric tons of sediment enters Pool 13 annually. The river bed consists of sand with lesser amounts of silt-clay, gravel, and boulders (U.S. Army Corps of Engineers 1974).

River mile 548 is the major recurrent dredging site in Pool 13. About 892,335 cubic meters of sediments were dredged from the main channel between 1945 and 1975 (U.S.

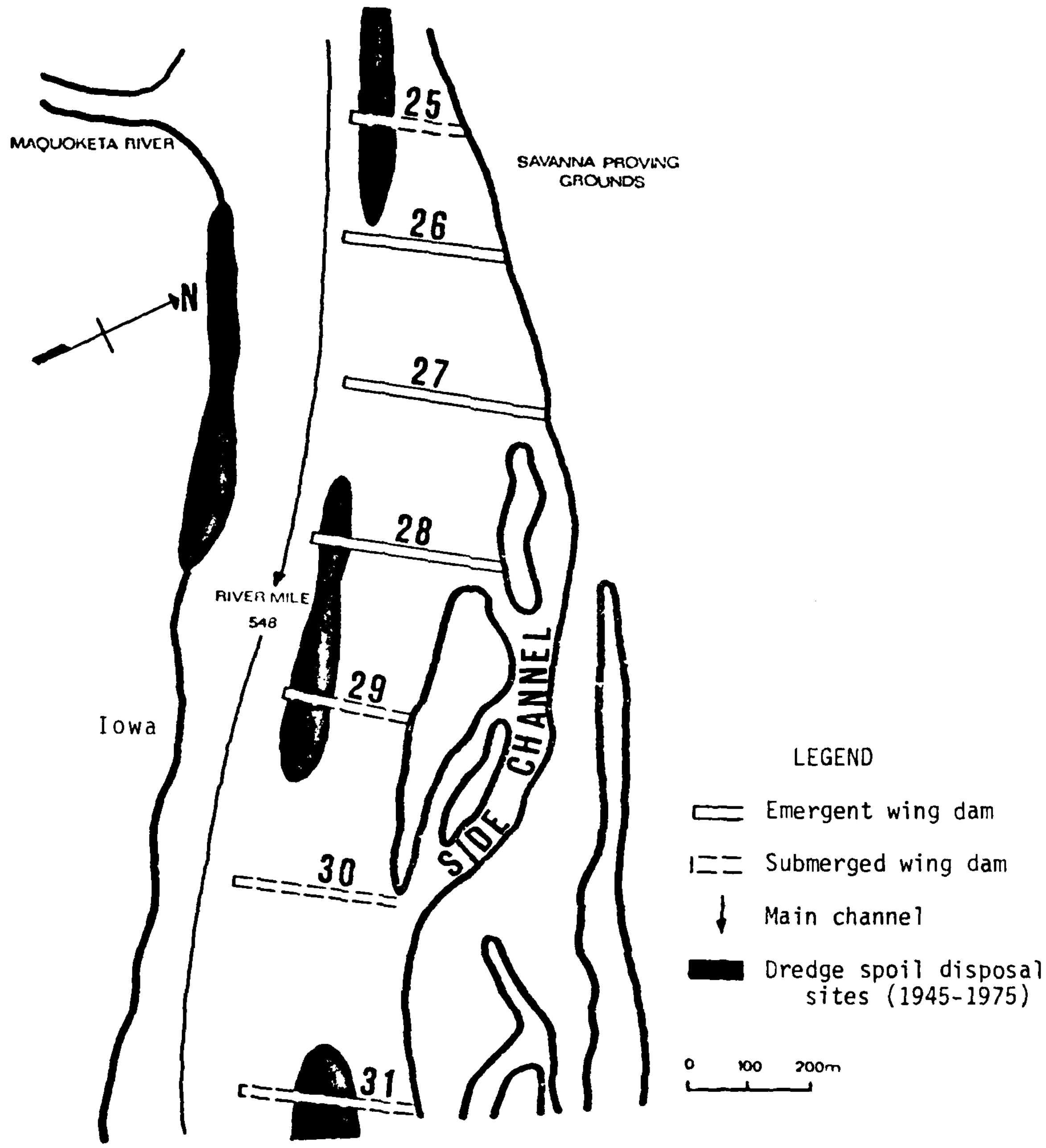


FIGURE 1. Wing dams 25, 26, 28, 29, 30, 31, and an adjacent side channel in Pool 13 of the Upper Mississippi River.

Army Corps of Engineers 1974). Some of the dredge spoil was placed between wing dams 24 and 26, 27 and 29, and at wing dam 31 (Figure 1).

Two classes of Upper Mississippi River aquatic habitat, main channel border and side channel, were present. These areas were similar to habitats defined by the Upper Mississippi River Conservation Committee (Nord 1971).

Main Channel Border

The main channel border was the zone between the 2.74 meter (9 foot) navigation channel and islands or the Illinois river bank. All of the wing dams were in this area. The navigation channel edge of this zone was marked by buoys and was adjacent to the distal ends of the wing dams. Substrate of the main channel border was primarily sand and no rooted aquatic vegetation was found growing there.

Side Channel

Side channels are departures from the main channel border area which have current during normal river stages. Some current was always present in the side channel at mile 548. The bottom consisted primarily of sand, but silt and clay were also present in varying amounts. Numerous fallen trees provided cover for fish along side channel shorelines.

The wing dams near mile 548 extended into the river as much as 300 meters from the Illinois bank. For the purposes of this study, wing dams were classified as submerged or emergent. Submerged wing dams remained under water during periods of low flow. Wing dams 25, 29, 30, and 31 were submerged wing dams. Emergent wing dams were tall enough to breach the water surface during low flow conditions although they were submerged when the river was high in June 1978 and 1979. Wing dams 26 and 28 were emergent. Wing dam 28 was the tallest, only rarely being completely under water. Wing dam 26 was emergent only during August and October 1978. Notches were constructed in wing dams 25, 26, and 28 in June 1979. The notch in wing dam 25 was to be 46 meters wide and centered 84 meters from the Illinois bank. The notch in wing dam 26 was also to be 46 meters wide, but centered 99 meters from the Illinois bank. The notch in 28 was to be constructed 91 meters wide and centered at 61 meters from the island. All notches were to be 1.5 meters deep. Because notching had not been completed by the end of my sampling in June, 1979, the actual dimensions were not measured.

METHODS

Fish Capture

Fish were caught with the aid of electrofishing gear (alternating current), hoop nets, and small-mesh seines. A boom shocker, described by Novotny and Priegel (1974), was operated at 7-9 amperes with 230 volts or 9-11 amperes with 320 volts. Three transects were established on wing dam 25 and four transects on the remaining five wing dams for electrofishing (Figures 2-4). Transects, which were perpendicular to and crossed each wing dam, were located between the following distances from the Illinois bank:

Wing dam 25 - (1) shoreline (2) between 60 and 105 meters (3) between 150 and 200 meters.

Wing dam 26 - (1) shoreline (2) between 75 and 120 meters (3) between 165 and 210 meters (4) between 260 and 300 meters.

Wing dam 28 - (1) shoreline (2) between 30 and 75 meters (3) between 120 and 165 meters (4) between 240 and 290 meters.

Wing dam 29 - (1) shoreline (2) between 75 and 105 meters (3) between 135 and 180 meters (4) between 230 and 275 meters.

Wing dam 30 - (1) shoreline (2) between 75 and 105 meters (3) between 135 and 185 meters (4) between 230 and 275 meters.

Wing dam 31 - (1) shoreline (2) between 75 and 105 meters (3) between 135 and 180 meters (4) between 230 and 275 meters.

Distances from the bank were measured with the aid of a Rangematic distance finder. Transects were marked with

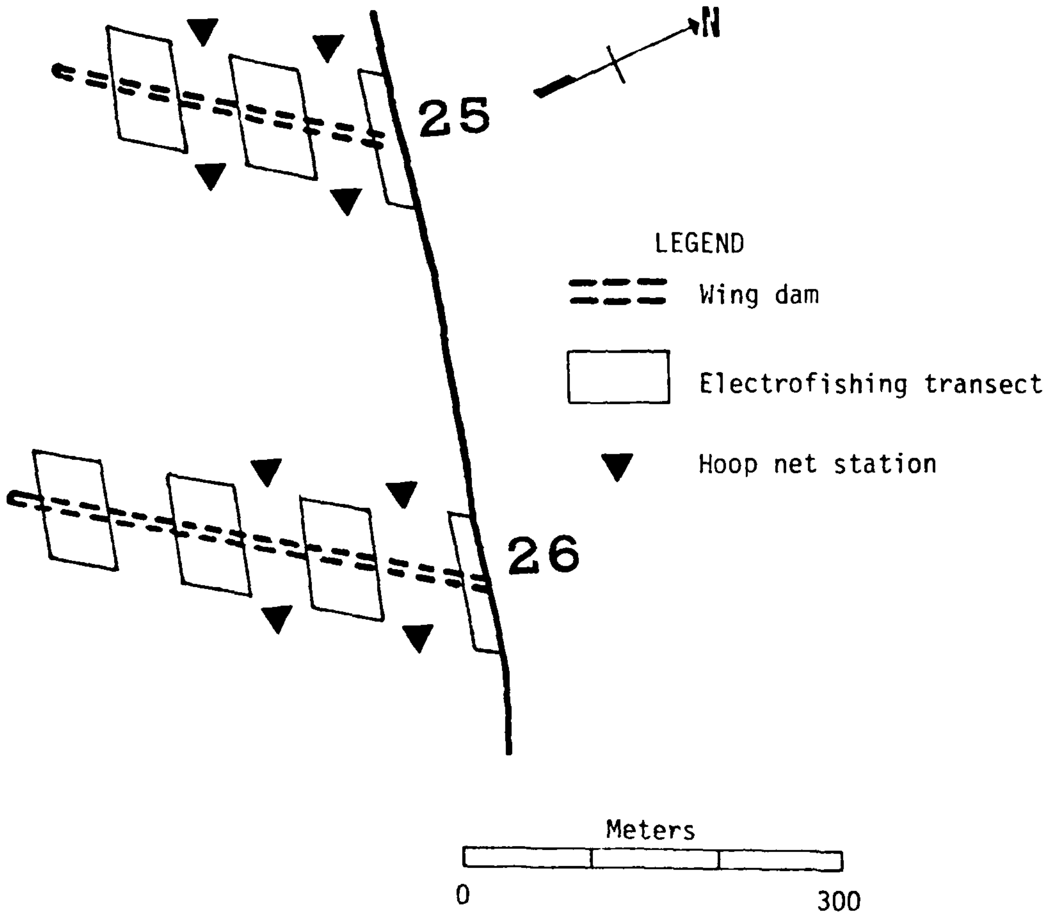


FIGURE 2. Electrofishing transects and hoop net stations for wing dams 25 and 26, Pool 13, Upper Mississippi River.

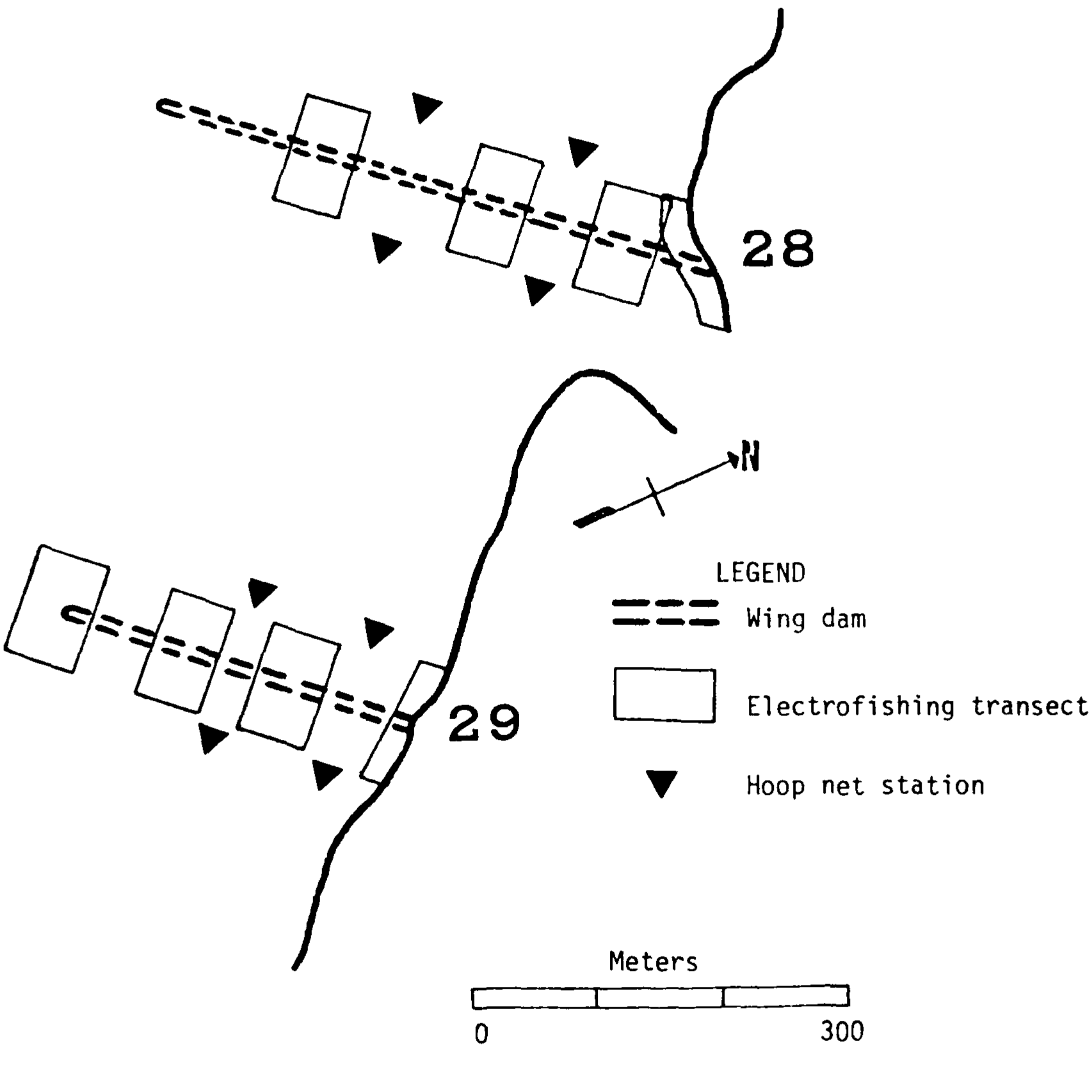


FIGURE 3. Electrofishing transects and hoop net stations for wing dams 28 and 29, Pool 13, Upper Mississippi River.

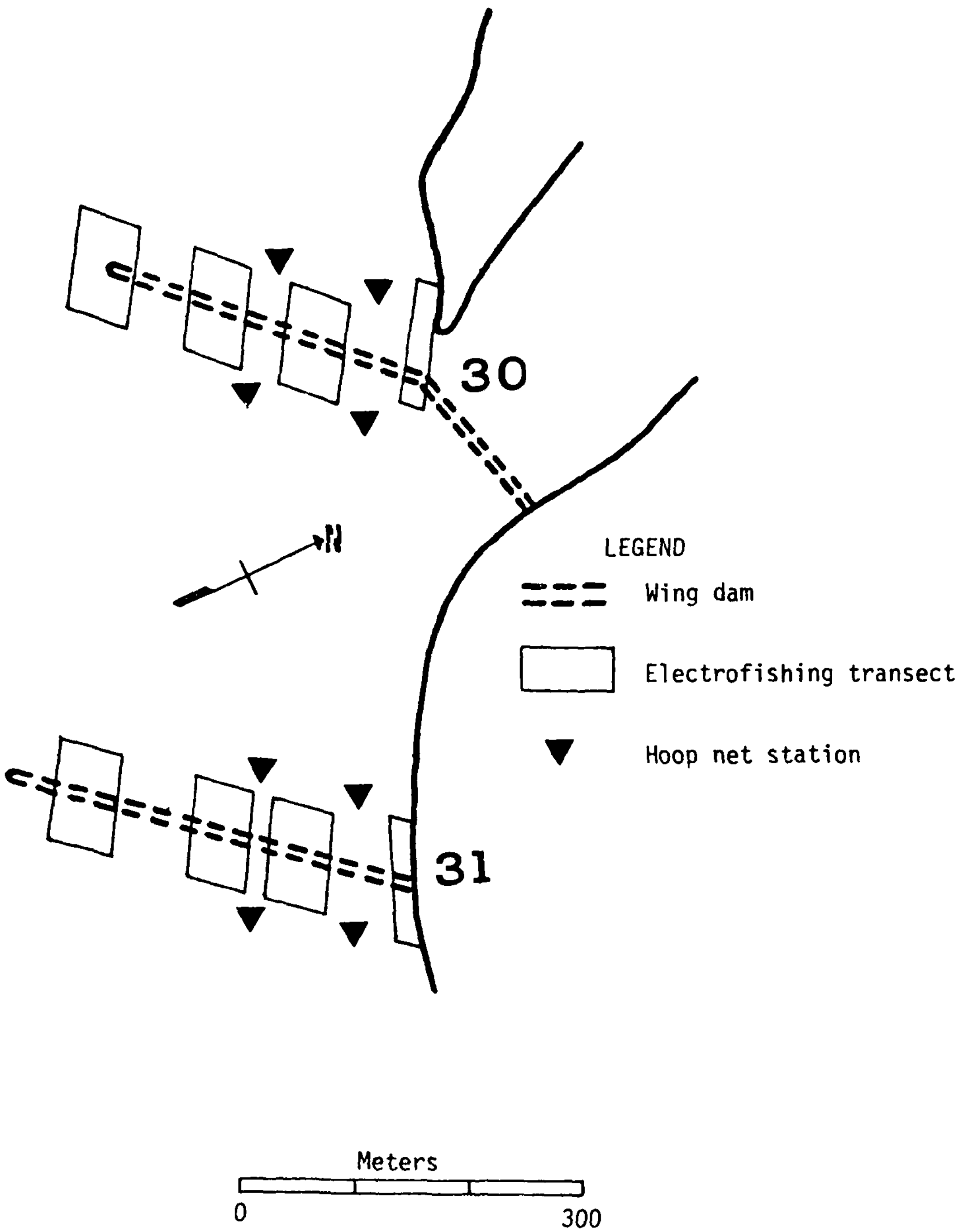


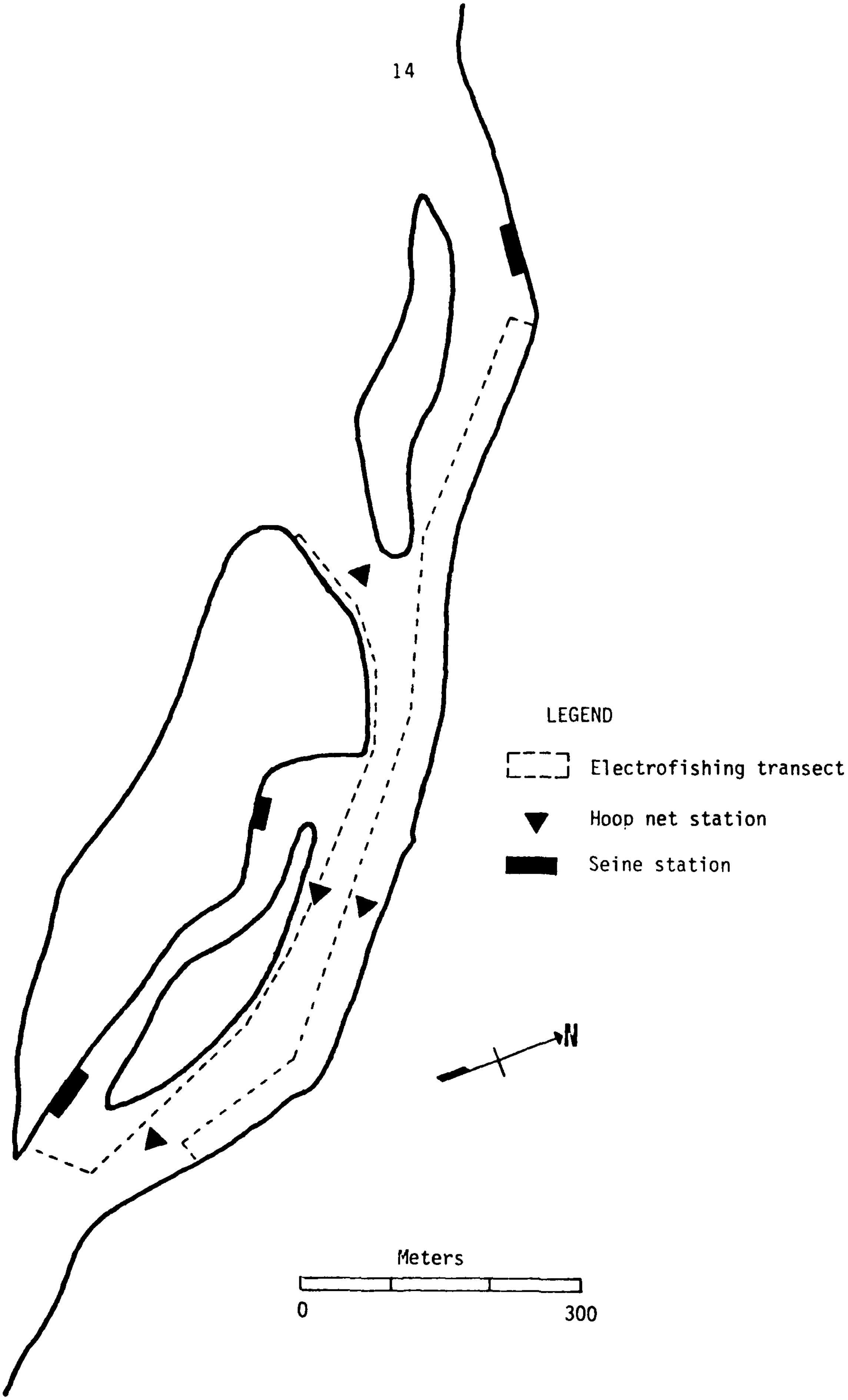
FIGURE 4. Electrofishing transects and hoop net stations for wing dams 30 and 31, Pool 13, Upper Mississippi River.

buoys. Shoreline transec xtended approximately 50 meters upstream and downstream from the wing dams, and the other transects extended about 40 meters above and below each wing dam. The effort at transects on emergent wing dams 26 and 28 was concentrated along the rock rubble sides of the wing dams. Also, two shoreline transects were fished along each bank of the side channel (Figure 5). About 800 meters along the island and 1000 meters along the Illinois bank were electrofished.

Each transect was fished twice at night with 72 hours between efforts. Shocking effort was usually 30 minutes per transect. Effort was reduced to 15 minutes over submerged wing dams if no fish were being captured. A catch boat downstream (Hubley 1963a) was used to pick up fish missed by the netting crew in the shocker boat.

Two hoop nets (Greenbank 1946; Starrett and Barnickol 1955) were set above, and two below each wing dam (Figures 2-4). Nets were placed at about 1/4 and 1/2 of the distance to the distal ends of the dams. Nets downstream from the wing dams were staked to the river bed within 20 meters of the dam and were allowed to trail downstream with the net opening downstream. Upstream nets were staked so that the net was less than 20 meters upstream from the wing dam. One hoop net was set at the upstream end of the side channel, two were in the central portion, and another in the downstream end of the side channel (Figure 5). Nets were

FIGURE 5. Electrofishing transects, hoop net stations, and seine stations in the side channel at river mile 548, Pool 13, Upper Mississippi River.


14
LEGEND
Electrofishing transect
Hoop net station
Seine station
N
Meters
0
300

approximately 800, 400, and 70 meters from the lower end of the side channel. Hoop nets were 0.76 meters (2.5 feet) in diameter with 2.5 cm (1 inch) bar mesh. Each net contained seven hoops and had two throats, one attached to each of the second and fourth hoops. Most nets were fished unbaited for two consecutive days then baited with soybean cake (Mayhew 1973) for 2 days. Due to difficulties in retrieving the nets, eight nets in June and one net in October 1978 were fished longer than 2 days. Roughly 2 kg of soybean cake was used in each baited net.

Four shoreline seine hauls were made in the side channel at night during each sampling month. Two hauls were made on a beach at the northeast end of the side channel, one from a beach at the southwest end and one from a backwater in the central side channel (Figure 5). A 0.6 cm (.25 inch) mesh bag seine, 10 meters (32 feet) long was used in August and October 1978 and June 1979. In June 1978, a 6 meter (20 feet) long 0.6 cm mesh straight seine was used. Seine hauls were 9 to 18 meters in length.

Total length (Hile 1948) and weight measurements to the nearest millimeter and to the nearest 2 or 10 grams, depending on the scale used, were obtained for most fish. Minnows and other small fish were preserved for positive identification in a laboratory. No weights were obtained for preserved fish and no length measurements were obtained for 622 emerald shiners shocked in the side channel in August. Lengths and weights of fish with deformed or damaged bodies were not used in computing length-weight relationships or mean, range, and standard deviation of length or weight.

Fish were marked with three fin clips to determine if movement was occurring within the study area and to enable me to evaluate the extent to which we were recapturing fish. Fish captured and released at wing dams 25, 26, and 28 were marked with left ventral fin clips. Fish from wing dams 29, 30, and 31 were given right ventral fin clips. The top of the caudal fin was clipped from fish captured in the side channel. Minnows and gizzard shad were not marked.

Age, Growth, Mortality Estimates

Scale samples from bluegill, black crappie, freshwater drum and sauger were taken from the left side of the fish beneath the tip of the folded pectoral fin. Impressions of the scales were make on 0.75 mm thick acetate slides (Smith 1954). Scale impressions were magnified 40 times on a microprojector (Van Oosten et al. 1934) for age determination. One scale from each fish was selected for measurement to each annulus and to the anterior margin of the scale. Measurements were made along the centermost radius beginning at the middle of the focus (Hile 1941).

Ages were assigned and scales measured by two workers independently. A third person aged the scales if the first two disagreed (Carlander 1961). The sample was discarded if none were in agreement. Additionally, ages were assigned to channel catfish caught in this study on the basis of length-frequency distributions for each age class that were provided to me by John Pitlo, Bellevue Fishery Research Station, Iowa Conservation Commission. Using similar hoop nets, Pitlo collected channel catfish during the summer of 1978 in Pool 13 and determined their ages by microprojection of pectoral spine cross-sections (Sneed 1950; Marzolf 1955; Muncy 1959).

GM functional regressions were calculated to describe body length versus scale radius relationships (Ricker 1973). Lengths of fish with deformed or damaged bodies were not used in computing the body-scale relationship. Mortality or survival rates were estimated from catch curves (Ricker 1975).

Hydrographic Relief

Three hydrographic relief transects were established on each wing dam. Transects were perpendicular to and crossed each wing dam. The 61 meter (200 feet) long transects were located at the following distances from the Illinois bank:

Wing dam 25 - 90, 150, and 215 meters.
Wing dam 26 - 105, 170, and 260 meters.
Wing dam 28 - 60, 120, and 245 meters.
Wing dams 29, 30, and 31 - 60, 140, and 215 meters.

Three hydrographic relief transects also were located in the lower, central, and upper ends of the side channel. Transects were approximately 70, 400, and 800 meters from the lower end of the side channel. Side channel transects were perpendicular to the current and ran the full width of the channel. Depths from a Vexilar sonar depth finder were recorded at 5 second intervals while a boat moved at a constant speed upstream along each wing dam transect or across the side channel transects (Lind 1979). No hydrographic relief information was obtained at wing dam 26 in June 1979 because the Army Corps of Engineers was notching that wing dam.

Water Temperature, Dissolved Oxygen, and Current Velocity

Water temperature (^{o}C) and dissolved oxygen concentration (mg l^{-1}) were determined with an air-calibrated oxygen-temperature probe (Yellow Springs Instrument Company, model 54A) at each meter of the water column at six stations for each wing dam. Stations were at each end of the hydrographic relief transects. Water temperature and dissolved oxygen were determined at four stations on each relief transect in the side channel. Stations in the side channel were equidistant along each transect. Calibration of the oxygen-temperature probe was verified with a laboratory grade mercury thermometer for water temperature and modified Winkler tests for dissolved oxygen (APHA 1975; EPA 1979).

Surface and subsurface velocity was measured at each of these stations with a cable suspended Price current meter, model F584 (Welch 1948). Velocity was usually recorded at 0, 0.2, 0.6 of the depth and at the bottom. In depths less than one meter, velocity was recorded only at the surface, bottom, or at 0.5 of the depth. Calibration of the current meter was checked by comparing the velocity determined with the current meter with that of an orange traveling a measured distance at the water surface in a given time (Stalnaker and Arnette 1976).

Staff Gauge and Discharge

Hourly staff gauge measurements for the tailwaters of Lock and Dam 12 were obtained from U.S. Army Corps of Engineer personnel at the lock and dam. Mean monthly discharges for Lock and Dam 12 were courteously provided to me by the Rock Island District Corps of Engineers.

RESULTS AND DISCUSSION

Species Captured

Fifty two species of fish were caught with hoop nets, electrofishing gear, and small-mesh seines (Table 1 and Appendices A-L).

Rasmussen (1979), in the most comprehensive recent review of the distribution and relative abundance of fish in the Upper Mississippi River, listed 70 species as possible inhabitants of Pool 13. Shorthead redhorse, regarded by Rasmussen as not being generally distributed in Pool 13, were abundant at mile 548. Eleven rock bass and 14 silver redhorse, considered rare in Pool 13 by Rasmussen, were encountered in the study area. Three trout-perch were caught with small-mesh seines in June and August of 1978; there are no previous records of trout-perch in Pool 13. The trout-perch were caught between 10:00 and 12:00 PM along shallow sand beaches in the side channel. Trout-perch are generally found above Pool 10, but have been reported as far south as Pool 18 (Smith et al. 1971).

Species Group Composition

Grouping fish species into categories to provide a simpler view of the fish community was useful for comparing catches in various habitats, and may be helpful for

TABLE 1. Total number and weight of each fish species caught in June, August, and October 1978 and June 1979 with hoop nets, electrofishing gear, and small-mesh seines. Common and scientific nomenclature follows the American Fisheries Society check list (Bailey 1970).

Common name	Scientific name	Number captured	Weight (grams)
Shovelnose sturgeon	*Scaphirhynchus platorynchus*	2	1257
Paddlefish	*Polyodon spathula*	1	690
Longnose gar	*Lepisosteus osseus*	59	25,757
Shortnose gar	*Lepisosteus platostomus*	7	4120
Bowfin	*Amia calva*	1	266
Gizzard shad	*Dorosoma cepedianum*	28	1073
Mooneye	*Hiodon tergisus*	16	2315
Northern pike	*Esox lucius*	2	2960
Carp	*Cyprinus carpio*	308	417,593
Silvery minnow	*Hybognathus nuchalis*	19	-
Speckled chub	*Hybopsis aestivalis*	1	-
Silver chub	*Hybopsis storeriana*	115	362
Emerald shiner	*Notropis atherinoides*	1309	-
River shiner	*Notropis blennius*	229	-
Spottail shiner	*Notropis hudsonius*	13	-
Spotfin shiner	*Notropis spilopterus*	21	-
Fathead minnow	*Pimephales promelas*	1	-
Bullhead minnow	*Pimephales vigilax*	93	-
River carpsucker	*Carpiodes carpio*	59	34,237
Quillback	*Carpiodes cyprinus*	124	37,504
Highfin carpsucker	*Carpiodes velifer*	22	3863
Smallmouth buffalo	*Ictiobus bubalus*	325	168,338

TABLE 1 (continued)

Common name	Scientific name	Number captured	Weight (grams)
Bigmouth buffalo	*Ictiobus cyprinellus*	16	20,021
Black buffalo	*Ictiobus niger*	3	3505
Spotted sucker	*Minytrema melanops*	2	601
Silver redhorse	*Moxostoma anisurum*	14	14,712
Golden redhorse	*Moxostoma erythrurum*	22	4948
Shorthead redhorse	*Moxostoma macrolepidotum*	192	61,530
Black bullhead	*Ictalurus melas*	12	1505
Yellow bullhead	*Ictalurus natalus*	1	142
Channel catfish	*Ictalurus punctatus*	492	76,693
Stonecat	*Noturus flavus*	2	112
Tadpole madtom	*Noturus gyrinus*	28	-
Flathead catfish	*Pylodictus olivaris*	63	22,101
Trout-perch	*Percopsis omiscomaycus*	3	-
Brook silverside	*Labidesthes sicculus*	6	-
White bass	*Morone chrysops*	42	2875
Rock bass	*Ambloplites rupestris*	11	1034
Pumpkinseed	*Lepomis gibbosus*	1	92
Orangespotted sunfish	*Lepomis humilis*	89	195
Bluegill	*Lepomis macrochirus*	628[a]	24,771
Smallmouth bass	*Micropterus dolomieui*	8	1848
Largemouth bass	*Micropterus salmoides*	62	9601
White crappie	*Pomoxis annularis*	72	6041
Black crappie	*Pomoxis nigromaculatus*	170	9094
Johnny darter	*Etheostoma nigrum*	1	-

TABLE 1 (continued)

Common name	Scientific name	Number captured	Weight (grams)
Yellow perch	*Perca flavescens*	1	98
Logperch	*Percina caprodes*	26	-
River darter	*Percina shumardi*	7	-
Sauger	*Stizostedion canadense*	270	26,089
Walleye	*Stizostedion vitreum*	52	9790
Freshwater drum	*Aplodinotus grunniens*	629[b]	53,984
	Grand total	5680	1,051,717

[a] Includes an estimated 132 young-of-the-year bluegill caught in August.

[b] Includes an estimated 227 young-of-the-year freshwater drum caught in October.

comparing the pre-notching and post-notching fish communities. Christenson (1965) and Ellis (1978) grouped fish species from the Upper Mississippi River into six categories: game fish, panfish, catfish, predatory rough fish, forage fish, and rough fish. Game fish encountered in this study were walleye, sauger, largemouth and smallmouth bass, and northern pike. Panfish (eight species) included white bass, yellow perch, and the remaining centrarchids. Catfish (five species) included all ictalurids except tadpole madtoms. Bowfin, longnose gar, and shortnose gar were considered predatory rough fish. Forage fish (16 species) were gizzard shad, tadpole madtoms, trout-perch, brook silverside, minnows, and darters. The remaining 15 species were classified as rough fish.

Forage and rough fish comprised 60% of the species found in the study area. Rough fish were the most important component of the catches, averaging 44% of the numbers and 78% of the weight in each month (Tables 2-5). The relatively high percentages of panfish and forage fish in August compared to June and October were caused by the abundance of bluegill and emerald shiners in August.

Schramm and Lewis (1974) grouped Mississippi River fishes according to their food habits in four categories based on diets primarily of plankton, benthos, benthos and fish, or fish. Although food habits of many Mississippi River fish species change with life history stage, time of

TABLE 2. Total numbers of game fish, panfish, catfish, predatory rough fish, forage fish, and rough fish in the catch for each month.

	Category						
Date	Game fish	Panfish	Catfish	Predatory rough fish	Forage	Rough fish	Total
Jun 1978	71	63	94	22	107	280	637
Aug 1978	168	850	162	19	1633	423	3255
Oct 1978	124	71	262	2	123	749	1331
Jun 1979	31	31	51	24	37	286	460
Total	394	1015	569	67	1900	1738	5683

TABLE 3. Total weight (grams) of game fish, panfish, catfish, predatory rough fish, forage fish, and rough fish in the catch for each month.

	Category						
Date	Game fish	Panfish	Catfish	Predatory rough fish	Forage	Rough fish	Total
Jun 1978	8267	3221	21,037	10,652	514	106,209	149,900
Aug 1978	18,652	35,179	29,459	7466	359	199,416	290,531
Oct 1978	17,977	3956	40,570	1150	498	339,335	403,486
Jun 1979	5392	1948	9345	10,875	64	180,280	207,904
Total	50,288	44,304	100,411	30,143	1435	825,240	1051,821

TABLE 4. Percent of game fish, panfish, catfish, predatory rough fish, forage fish, and rough fish in the total catch by number for each month.

Month	Category					
	Game fish	Panfish	Catfish	Predatory rough fish	Forage	Rough fish
Jun 1978	11.1	9.9	14.8	3.5	16.8	44.0
Aug 1978	5.2	26.1	5.0	0.6	50.2	13.0
Oct 1978	9.3	5.3	19.7	0.2	9.2	56.3
Jun 1979	6.7	6.7	11.1	5.2	8.0	62.2

TABLE 5. Percent of game fish, panfish, catfish, predatory rough fish, forage fish, and rough fish in the total catch by weight (grams) for each month.

Month	Category					
	Game fish	Panfish	Catfish	Predatory rough fish	Forage	Rough fish
Jun 1978	5.5	2.1	14.0	7.1	0.3	70.9
Aug 1978	6.4	12.1	10.1	2.6	0.1	68.6
Oct 1978	4.5	1.0	10.1	0.3	0.1	84.1
Jun 1979	2.6	0.9	4.5	5.2	0.0	86.7

year, and food availability (Merz 1974; Bailey and Harrison 1945; Jude 1968; Nelson 1968; Ranthum 1969; Bur 1976; and Wynes 1976), benthic invertebrates apparently were an important food source in the study area. Fishes with diets primarily of benthos according to Schramm and Lewis (1974) were 51% of the catches by number and 81% of the catches by weight for all gear combined. Benthos feeding fishes were shovelnose sturgeon, mooneye, silver chub, spotfin shiner, river shiner, speckled chub, carp, yellow and black bullheads, stonecat, tadpole madtom, brook silverside, trout-perch, orangespotted sunfish, bluegill, pumpkinseed, johnny darter, logperch, river darter, freshwater drum and catostomids.

Balon (1975) and Muncy et al. (1979) proposed systems for grouping fish based on their reproductive strategies or niches. I assigned species from this study to Balon's "reproductive guilds" according to their spawning habits and early life history and development (Table 6) although I had limited knowledge of the reproductive habits of carpsuckers, buffalos, and shovelnose sturgeon. Balon's original classification scheme was used whenever there was confusion about the spawning habits of a species. For example, Pflieger (1965) reported that the spotfin shiner deposits eggs in loose bark or in crevices of logs and tree roots, which suggests that they are brood hiders rather than open substrate spawners as proposed by Balon

TABLE 6. Reproductive guilds (Balon 1975) of fish species from river mile 548, Pool 13, of the Upper Mississippi River.

Reproductive guilds
A. Nonguarders
A. 1. Open substratum spawners
A. 1. 1. Pelagophils - Emerald Shiner, Freshwater Drum, Speckled Chub.
A. 1. 2. Litho-pelagophils - Gizzard Shad, Mooneye, Paddlefish.
A. 1. 3. Lithophils - River Shiner, Spotted Sucker, Golden Redhorse, Silver Redhorse, Shorthead Redhorse, Trout-perch, Sauger, Walleye, Shovelnose Sturgeon.
A. 1. 4. Phyto-Lithophils - Silvery Minnow, Silver Chub, Spotfin Shiner, Brook Silversides, White Bass, Yellow perch.
A. 1. 5. Phytophils - Carp, Longnose Gar, Northern Pike, Bigmouth Buffalo, Shortnose Gar, Smallmouth Buffalo, Black Buffalo.
A. 1. 6. Psammophils - Spottail Shiner, Quillback, Log Perch, River Carpsucker, Highfin Carpsucker.
A. 2. Brood Hiders
A. 2. 1. Lithophils - River Darter.
B. Guarders
B. 1. Substratum choosers
B. 1. 2. Phytophils - White Crappie
B. 2. Nest spawners
B. 2. 1. Lithophils - Flathead Catfish, Black Bullhead, Smallmouth Bass, Rockbass, Bluegill, Orangespotted Sunfish.
B. 2. 2. Phytophils - Bowfin, Black Crappie, Largemouth Bass.
B. 2. 5. Speleophils - Channel Catfish, Yellow Bullhead, Stonecat, Tadpole Madtom, Johnny Darter.
B. 2. 6. Polyphils - Pumpkinseed, Fathead minnow, Bullhead minnow.

(1975). Walleye spawn over rock and gravel (Johnson 1961; Niemuth et al. 1972) but also in flooded marshes (Priegel 1970) suggesting flexibility in their reproductive habits.

The river and its associated backwaters, coupled with seasonal flooding, provides a diverse array of reproductive opportunities. The number of guilds found in the study area was similar to the number reported for Canada (Balon 1975). Fourteen guilds represent all of the freshwater fishes of Canada. Twelve of these reproductive guilds were encountered at river mile 548 (Table 6). Guilds from the study area differed in their preferred spawning sites, reproductive behavior, and early life history and development.

Open substrate spawners exhibit no parental care. Among them pelagophils (A.1.1) scatter non-adhesive eggs in open water. The eggs of pelagophils are buoyant, and the larvae, strongly phototropic. Lithophils (A.1.3) deposit eggs on rock or gravel substrates where the embryos develop, scatter, and hide. Phytophils (A.1.5) lay adhesive eggs in live or dead aquatic or flooded terrestrial plants. The larvae have no photophobic response as is found in lithophils. Other open substrate spawners were litho-pelagophils (A.1.2), which deposit eggs over rocks but their larvae are pelagic, phyto-lithophils (A.1.4), which deposit eggs on submerged plants, logs, rocks, or gravel, and psammophils (A.1.2), which scatter eggs over sandy bottoms. The only brood hiding fish encountered were lithophils (A.2.1) which hide eggs but do not guard them.

Among the guarders, phytophils (B.1.2) scatter eggs or attach them to submerged plants where they are cared for by the male parent. Nest spawners exhibit parental care and choose substrates of rock or gravel for nests (B.2.1 lithophils), or soft mud for nests of plant matter (B.2.2 phytophils), or cavities or undersurfaces of stones for nesting (B.2.5 speleophils). Polyphils (B.2.6) use a variety of substrates and materials for nests.

Some guilds were more important than others in the catches of all three gears combined. Most guilds included open substrate spawners, followed by nest spawners (Tables 6-7). The largest number of species, nine, occurred in the non-guarding lithophil guild (A.1.3). The greatest number of fish caught by all gear in all sampling periods combined were open water spawners (A.1.1 pelagophils, Table 7). Substantial changes in the importance of a guild may indicate the manner in which notching influences the fish community if reproductive habitats are changed.

Influence of Time of Year and Discharge on Catches

Time of Year

Species composition of catches for each month were similar, especially the species mainly comprising the biomass. Carp and smallmouth buffalo were major components of the biomass; they were consistently the most important

TABLE 7. Percent of each of Balon's reproductive guilds in the catch by number for each month, and all months combined.

Reproductive guild	June 1978	August 1978	October 1978	June 1979	All months combined
A.1.1.	17.3	42.9	30.1	7.4	34.1
A.1.2.	0.5	0.8	1.0	0.4	0.8
A.1.3.	29.5	8.8	15.9	21.4	13.8
A.1.4.	1.7	4.1	3.8	2.4	3.6
A.1.5.	15.1	6.3	20.7	31.4	12.7
A.1.6.	6.6	2.4	3.7	16.6	4.3
A.2.1.	0.0	0.2	0.2	0.0	0.1
B.1.2.	2.2	1.5	0.4	0.7	1.3
B.2.1.	8.5	20.8	3.1	8.3	14.3
B.2.2.	3.6	5.6	1.1	2.8	4.1
B.2.5.	11.0	5.2	19.5	6.6	9.3
B.2.6.	4.1	1.5	0.6	2.0	1.6

two species by weight in electrofishing, hoop net, and seine catches combined in every month (Table 8). Shorthead redhorse were also important in the catch by weight each month. Freshwater drum ranked in the most important five species by number every month. Channel catfish were most abundant in hoop net catches during all three months of 1978, comprising 27 to 58% of the catch, but smallmouth buffalo dominated June 1979 hoop net catches and were 40% by number of the catch (Table 9). Smallmouth buffalo were most important by weight in the hoop nets every month, comprising 24 to 55% of the catch.

Notwithstanding these consistencies, numbers of various species in the catches changed dramatically from month to month because of variation in numbers of cyprinids, especially emerald shiners; centrarchids, especially bluegill; and freshwater drum (Table 10). Percentages by number and weight of game fish, panfish, catfish, predatory rough fish, forage fish, and rough fish in each month (Tables 4-5) were significantly different (Chi-square = 37.2 to 129.6; 12 to 15 d.f.; p=.025), even when the effect of 1123 schooling emerald shiners caught in August was removed.

The emerald shiner and bluegill dominated numbers caught in all gears combined in August 1978, comprising 57% of the catch. A total of 823 emerald shiner were caught over sand bars in the side channel on August 13 (Appendix B). Another aggregation of 300 emerald shiners was captured along the shallow sand beach adjacent to wing dam 31 on August 16.

TABLE 8. Most important five species by number and weight (grams) in electrofishing, hoop net, and seine catches combined for each month.

Rank	June 1978		August 1978		October 1978		June 1979	
					Number			
1	100	Freshwater Drum	1268	Emerald Shiner	370	Freshwater Drum	74	Smallmouth Buffalo
2	66	Channel Catfish	579	Bluegill	256	Channel Catfish	45	Carp
3	58	River Shiner	142	Channel Catfish	144	Smallmouth Buffalo	43	Quillback
4	55	Sauger	130	Black Crappie	126	Carp	43	Shorthead Redhorse
5	50	Shorthead Redhorse	127	Freshwater Drum	93	Sauger	32	Freshwater Drum
					Weight (grams)			
1	46595	Carp	109835	Carp	196960	Carp	64203	Carp
2	15863	Smallmouth Buffalo	39143	Smallmouth Buffalo	68205	Smallmouth Buffalo	45127	Smallmouth Buffalo
3	15651	Shorthead Redhorse	22551	Bluegill	39148	Channel Catfish	20051	Shorthead Redhorse
4	10571	Channel Catfish	22051	Channel Catfish	32934	Freshwater Drum	17272	Quillback
5	10362	Flathead Catfish	12110	Shorthead Redhorse	13718	Shorthead Redhorse	15284	River Carpsucker

TABLE 9. Most important five species by number and weight (grams) in hoop net catches in each month.

Rank	June 1978		August 1978		October 1978		June 1979	
				Number				
1	62	Channel Catfish	108	Channel Catfish	247	Channel Catfish	53	Smallmouth Buffalo
2	36	Freshwater Drum	68	Bluegill	136	Smallmouth Buffalo	21	Channel Catfish
3	27	Flathead Catfish	66	Smallmouth Buffalo	15	Freshwater Drum	14	Freshwater Drum
4	16	Smallmouth Buffalo	59	Black Crappie	6	Shorthead Redhorse	12	Black Bullhead
5	7	Carp	37	White Crappie	6	Sauger	11	Carp
				Weight (grams)				
1	11366	Smallmouth Buffalo	35684	Smallmouth Buffalo	64583	Smallmouth Buffalo	34834	Smallmouth Buffalo
2	10362	Flathead Catfish	18882	Channel Catfish	37093	Channel Catfish	21320	Carp
3	8387	Channel Catfish	6663	Carp	3507	Shorthead Redhorse	3466	Channel Catfish
4	7792	Carp	6371	Bluegill	2618	Freshwater Drum	2660	River Carpsucker
5	6502	Freshwater Drum	6325	Flathead Catfish	2400	River Carpsucker	2634	Freshwater Drum

TABLE 10. Number of emerald shiners, bluegill, freshwater drum, centrarchids other than bluegill, and cyprinids other than carp and emerald shiners caught by all gears combined in each month.

Species	Number of Fish			
	June 1978	August 1978	October 1978	June 1979
Emerald Shiner	10	1268	29	2
Bluegill	18	579	25	6
Freshwater Drum	100	127	370	32
Centrarchids other than Bluegill	46	311	31	25
Cyprinids other than Carp and Emerald Shiners	94	284	78	34

Schools of emerald shiner were shocked in 0.3 meters of water or less. Cyprinids other than emerald shiner and carp were also more abundant in August than other months. Almost 48% of the number of fish caught in August were minnows, whereas minnows were only 8 to 14% of catches in other months. Carp were abundant in all months.

Centrarchids, caught in all gears, were most abundant in August (Table 10). The 584 centrarchids shocked in August comprised 24% of the electrofishing catch. Only 24 to 44 centrarchids (5 to 14% of the catch) were caught by shocking in the other months. Largemouth bass, black crappie, and bluegill, three of the most abundant centrarchids, were found at emergent wing dams primarily in August (Table 11). In hoop net catches, 3, 164, 5, and 1 centrarchids were caught in June, August, and October 1978 and June 1979 (Tables 12-15). Centrarchids were present in hoop nets at all submerged wing dams in August, but not in other months. Bluegill, white crappie and black crappie were 41% of the August hoop net catch and only 1 to 2% of hoop net catches for other months. Similarly, Dunham and Bertram (1972) caught more centrarchids in mid-summer (July) than May by electrofishing, hoop netting, trap netting, and gill netting in Pools 12 and 13.

Bluegill abundance may have been related to high water temperatures but did not appear to be closely related to river stage. Bluegill were shocked on emergent wing dams almost exclusively in August when the water temperature was

TABLE 11. Fish caught by electrofishing at emergent wing dams 26 and 28 in June, August, and October 1978.

Species	Number of Fish		
	June	August	October
Mooneye	1	5	1
Carp	3	38	27
Silver Chub	2	3	5
Emerald Shiner	3	64	2
River Shiner	1	12	3
Quillback	1	4	4
Shorthead Redhorse	16	25	18
Sauger	2	19	17
Walleye	2	5	5
Freshwater Drum	5	22	161
Channel Catfish	0	10	3
Flathead Catfish	0	2	1
White Bass	0	5	5
Bluegill	0	160	1
Smallmouth Bass	0	3	3
White Crappie	0	4	1
Northern Logperch	0	11	1
River Darter	0	3	1
Shortnose Gar	2	0	0
Gizzard Shad	1	0	1
Spottail Shiner	0	2	0
Spotfin Shiner	0	2	0
Bullhead Minnow	1	4	0
River Carpsucker	0	1	0
Highfin Carpsucker	0	0	1
Rock Bass	2	2	0
Pumpkinseed	0	1	0
Orangespotted Sunfish	0	1	0
Largemouth Bass	0	15	0
Black Crappie	0	11	0

TABLE 12. Numbers of various fish species in baited (b) and unbaited (u) hoop nets at wing dam 25, 26, 28, 29, 30, 31, and the side channel (June 1978).

Species	25		26		28		29		30		31		Side Channel		Total
	u	b	u	b	u	b	u	b	u	b	u	b	u	b	
Shovelnose Sturgeon	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Carp	0	1	0	4	0	1	0	0	0	0	0	1	0	0	7
Silver Chub	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Channel Catfish	5	1	1	12	1	6	0	0	0	7	0	6	6	17	62
Flathead Catfish	2	2	4	1	1	0	2	3	2	1	6	1	1	1	27
Stonecat	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Smallmouth Buffalo	1	4	1	3	0	5	0	2	0	0	0	0	0	0	16
Shorthead Redhorse	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
White Crappie	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Black Crappie	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2
Sauger	1	0	0	0	0	3	0	0	0	0	1	0	0	0	5
Freshwater Drum	8	3	11	2	2	2	3	2	0	0	0	0	2	1	36

TABLE 13. Numbers of various fish species in baited (b) and unbaited (u) hoop nets at wing dams 25 26, 28, 29, 30, 31, and the side channel (August 1978).

Species	25 u	25 b	26 u	26 b	28 u	28 b	29 u	29 b	30 u	30 b	31 u	31 b	Side channel u	Side channel b	Total
Longnose Gar	1	0	0	0	1	0	2	0	0	0	0	0	1	0	5
Shortnose Gar	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Carp	0	1	0	0	0	1	0	3	0	1	0	8	0	0	14
Channel Catfish	0	12	0	0	0	6	0	29	1	4	1	17	1	37	108
Flathead Catfish	2	0	0	0	2	1	2	0	1	2	3	1	1	0	15
Smallmouth Buffalo	0	13	0	1	0	11	0	22	2	5	0	9	0	3	66
Shorthead Redhorse	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
White Bass	0	0	0	0	0	0	1	0	0	0	0	2	0	0	3
Bluegill	0	4	1	1	10	12	0	4	0	0	2	0	13	21	68
White Crappie	4	7	4	1	8	4	1	1	0	0	1	0	4	2	37
Black Crappie	13	0	12	0	10	8	3	0	0	1	2	1	7	2	59
Sauger	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Freshwater Drum	6	0	0	0	1	3	1	2	5	0	0	0	0	1	19

TABLE 14. Numbers of various fish species in baited (b) and unbaited (u) hoop nets at wing dam 25, 26, 28, 30, 31, and the side channel (October 1978).

Species	25 u	25 b	26 u	26 b	28 u	28 b	29 u	29 b	30 u	30 b	31 u	31 b	Side Channel u	Side Channel b	Total
Longnose Gar	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Gizzard Shad	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Carp	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
Channel Catfish	3	11	1	4	1	3	0	0	0	7	0	32	5	180	247
Flathead Catfish	0	0	0	0	0	0	1	1	0	0	1	1	0	0	4
River Carpsucker	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
Smallmouth Buffalo	1	21	0	17	1	42	0	31	0	3	2	6	3	9	136
Silver Redhorse	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Shorthead Redhorse	0	0	1	0	0	0	0	0	0	0	1	1	3	0	6
Bluegill	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Black Crappie	0	0	1	0	1	2	0	0	0	0	0	0	0	0	4
Sauger	1	0	1	0	0	0	1	0	0	0	0	0	2	1	6
Walleye	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2
Freshwater Drum	5	1	4	1	1	0	0	0	0	0	0	0	1	2	15

TABLE 15. Numbers of various fish species captured in baited (b) and unbaited (u) hoop nets at wing dams 25, 26, 28, 29, 30, 31, and the side channel (June 1979).

Species	25 u	25 b	26 u	26 b	28 u	28 b	29 u	29 b	30 u	30 b	31 u	31 b	Side Channel u	Side Channel b	Total
Shovelnose Sturgeon	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Longnose Gar	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Carp	0	0	0	0	0	1	0	2	0	0	1	0	1	6	11
Silver Chub	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Channel Catfish	2	3	5	1	0	3	3	0	3	1	0	0	0	0	21
Flathead Catfish	0	1	2	0	0	0	0	0	2	1	1	1	1	0	9
Black Bullhead	3	3	4	0	0	0	0	0	0	0	0	0	0	2	12
River Carpsucker	0	1	0	0	0	0	0	0	0	0	2	0	0	0	3
Smallmouth Buffalo	0	12	1	19	0	7	0	6	1	0	0	4	1	2	53
Golden Redhorse	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Snorthead Redhorse	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2
Sunfish Hybrid	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Yellow Perch	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Sauger	1	0	0	0	1	0	0	0	0	1	0	0	0	0	3
Freshwater Drum	1	7	1	0	0	1	0	0	0	0	0	0	0	2	14

25^{o}C and river stage was 1.5 to 1.8 meters. No bluegill were shocked on emergent wing dikes in June when water temperatures were 21^{o} to 23^{o}C and river stages were greater than 2.2 meters, and only one bluegill was shocked in October when the water was 13^{o}C and river stage was 1.4 to 2.0 meters. In October, bluegill may have moved to deeper water for the winter (Scott and Crossman 1973). Most of the bluegill were one and two years old.

Freshwater drum replaced bluegill in late October as the most abundant species at emergent wing dams and main channel border shorelines. Drum were 61.5% of the electrofishing catch by number over emergent wing dams and 39.7% of catches along main channel border shorelines. Most of the drum were caught October 20 to 21 when the water temperature was 13^{o}C and river stage was 1.4 meters and steady. Schools of freshwater drum were not found October 6 to 10 when the river stage was 1.9 to 2.0 meters and water temperature 13^{o} to 14^{o}C. Most of the freshwater drum were young-of-the-year and one year old fish. These schools or aggregations of a species, ie. freshwater drum, bluegill, and emerald shiners, should be considered when comparing pre- and post-notching conditions.

Discharge

Electrofishing catches were strongly influenced by river stage or discharge. Few fish were caught on wing dams during high flow conditions; for example only three fish were caught at wing dams 26 and 28 during June 1979 when water stages were high (average 2.83 meters) and those dams were submerged. Shocking was most effective on emergent dams during river stages less than 2.13 meters (Table 16). Four hundred thirty four and 262 fish were caught at emergent wing dams in August and October when low flow conditions existed. The region between emergent wing dams may have also been more attractive to fish normally associated with slack water habitats during low flows. The wing dams reduced current velocities in these areas during low flows.

Low water transparency, strong water currents, and the depths of submerged wing dams made shocking ineffective over submerged wing dams in every month. Only 24 fish were caught by electrofishing over submerged dams 25, 29, 30, and 31 during all four months (Table 17). Current velocity as high as 96 cm sec^{-1} hindered netting of shocked fish. Secchi disc transparency was never greater than 0.46 meters and was usually only 0.30 meters, making it difficult to see fish. The maximum effective depth for capturing fish was probably less than 0.6 meters since fish were rarely seen below that depth. Submerged wing dams were generally deeper than 1.5 meters.

Hoop net catch rates appeared to be negatively related to discharge (Table 18). Regression of the mean catch rate for hoop netting in each month with the mean monthly discharge yielded a correlation coefficient of -0.934.

TABLE 16. Average electrofishing catch rates for transects at emergent wing dams 26 and 28 during high (greater than 2.74 m) and low (less than 2.13 m) river stages.

	Average electrofishing catch rate (number of fish/30 min.)	
Month	High stage	Low stage
June 1978	0.7	6.7
August 1978		36.2
October 1978		21.8
June 1979	0.3	

TABLE 17. Fish caught by electrofishing at submerged wing dams 25, 29, 30, and 31 during all four months.

Species	Number captured
Longnose gar	2
Shortnose gar	1
Mooneye	2
Emerald shiner	3
Quillback	2
Smallmouth buffalo	1
Bigmouth buffalo	6
Shorthead redhorse	4
Channel catfish	1
Walleye	1
Freshwater drum	1

TABLE 18. Mean monthly discharge (m^3 sec^{-1}) and hoop net catch rates (number of fish/net day) for each month.

Date	Discharge	Catch rate
June 1978	1790	1.3
August 1978	1290	3.4
October 1978	1130	3.8
June 1979	2280	1.2

With natural log transformations of discharge and catch rates, a significant correlation coefficient (95% level) of -0.960 was obtained. A linear relationship does not have to be assumed when log transformations are used.

August Catches

Fish were most diverse throughout the study area in August. Forty two fish species were encountered in August, and 40, 38, and 35 species in October and June 1978, and June 1979. Significantly more species (paired t-test; 6 d.f.; p=.025) were caught throughout the study area by hoop netting and electrofishing combined in August than in any other month (Table 19). Dunham (1971) caught the greatest variety of species in August when electrofishing below navigation dams 12 through 26 on the Upper Mississippi River. Numbers of fish species found in most habitats in the study area were also greatest in August. More fish species (paired t-tests; 5 d.f.; p=.025) were present along main channel border shoreline electrofishing transects in August than in other months (Table 20). The greatest diversity of fish on emergent wing dam transects, 27 species, occurred in August (Table 21). The number of species seined in the side channel ranged from a high of 28 in August to 14 in June 1979.

Fish appeared to be most abundant in the study area in August. Total numbers of fish caught in the study area in August were 3255 versus 1331, 637, and 460 caught in October,

TABLE 19. Number of species caught by hoop netting and electrofishing on or near each wing dam and in the side channel.

Site	Number of species caught June 1978	August 1978	October 1978	June 1979	Row Mean
Wing dam 25	12	16	10	18	14.0
Wing dam 26	19	27	20	16	20.5[b,c,d]
Wing dam 28	24	31	24	18	24.3[d,e,f]
Wing dam 29	15	21	12	10	14.5[b,e]
Wing dam 30	14	20	13	10	14.3[c,f]
Wing dam 31	8	21	16	16	15.3
Side channel	21	26	25	20	23.0
Column mean	16.1	23.1[a]	17.1	15.4	17.9

[a]August values were significantly higher than other months (paired t-tests; 5 d.f.; p=.025).

[b,c,d,e,f]Values marked with the same superscript were significantly different (paired t-tests; 3 d.f.; p=.025).

TABLE 20. Number of fish species caught at main channel border shoreline electrofishing transects in each month.

Wing dam (shoreline transects)	Number of species caught June 1978	August 1978	October 1978	June 1979	Row mean
25	9	12	9	13	10.8[b]
26	13	19	14	14	15.0[b,c]
28	15	23	12	14	16.0[d,e]
29	12	16	10	8	11.5[c,d]
30	11	18	9	7	11.3[e]
31	5	16	13	13	11.8
Column mean	10.8	17.3[a]	11.2	11.5	12.7

[a]August values were significantly higher than other months (paired t-tests; 5 d.f.; p=.025)

[b,c,d,e]Values marked with the same superscript were significantly different (paired t-tests; 3 d.f.; p=.025).

TABLE 21. Number of species caught on emergent wing dam electrofishing transects in June, August, and October 1978.

	Number of species caught			
Transect	June	August	October	Row mean
Wing dam 26				
Inside transect	4	12	8	8.0[d]
Middle transect	6	17	8	10.3[e]
Outside transect	0	10	5	5.0[d,e]
Wing dam 28				
Inside transect	0	21	11	10.7
Middle transect	11	14	11	12.0
Outside transect	3	12	6	7.0
Column mean	4.0[a,b]	14.3[a,c]	8.2[b,c]	8.8

[a,b,c,d,e]Values marked with the same superscript were significantly different (paired t-tests; 5 and 2 d.f.; p=.025).

June 1978, and June 1979 respectively. Fish were generally more abundant at electrofishing and seining study sites in August than in other months. With the exception of the shoreline transect at wing dam 28, catch rates at each electrofishing transect were highest in August, followed by October and June (Appendices A-D). At wing dam 28, more fish were caught in October than August because of schooling freshwater drum. Seine hauls netted 87 to 114 fish per haul in August, and 12 to 48 fish in June 1978. Only 2 to 12 fish per haul were seined in October and June 1979.

Influence of Site or Habitat on the Catch

Differences from sample month to sample month in species composition of the catches appeared to be greater than differences between habitats. Differences between habitats in percent by number or weight of game fish, panfish, catfish, predatory rough fish, forage fish, and rough fish were primarily due to variation in catches of three species: emerald shiner, smallmouth buffalo, and channel catfish. Differences with time, mentioned previously, were caused by many species.

Electrofishing catches allowed comparison of fish populations in three kinds of habitat: emergent wing dams, main channel border shorelines, and side channel shorelines. All three habitats had low current and were shallow enough to be susceptible to the boom shocker. The major difference between the three habitats was the amount and kind of cover for fish. Emergent wing dams were entirely rock rip-rap with no fallen trees or emergent willows. Some rock rip-rap was found along main channel border shorelines adjacent to wing dams 25, 26, and 28, and a few fallen trees and emergent willows were present, but stretches of relatively barren sand were predominant. Fallen trees and emergent willows were most plentiful in the side channel, which also offered access to back water areas.

The composition of electrofishing catches was remarkably similar for the side channel, main channel border shorelines, and emergent wing dams. Percent by weight of game fish, panfish, catfish, rough fish, forage fish, and predatory rough fish were similar for each habitat (Table 22). The greatest difference between habitats was only 4.5% in predatory rough fish. Rough fish comprised most of the biomass in all three habitats. Percent by number of each fish category varied somewhat between habitats because of large schools of emerald shiners, totalling 1123 fish, that were present in the side channel and along the shoreline of wing dam 31 in August (Table 23 and Appendix B). When I removed the effect of the emerald shiners, there was no significant difference (Chi-square = 6.7; 10 d.f.; p=.025) between habitats in the percent by number of each category (Table 24).

Although most species were found in all three habitats

TABLE 22. Percent by weight of fish categories in side channel, main channel border shoreline, and emergent wing dam electrofishing catches for all four months combined.

Category	Percent by weight: Side channel	Main channel border shorelines	Emergent wing dams
Game fish	5.6	6.6	6.7
Panfish	2.9	4.2	5.6
Catfish	1.8	1.1	1.8
Predatory rough fish	5.1	3.8	0.6
Forage fish	0.1	0.2	0.3
Rough fish	84.5	84.1	85.0
Totals	100	100	100

TABLE 23. Percent by number of fish categories in side channel, main channel border shoreline, and emergent wing dam electrofishing catches for all four months combined.

Category	Percent by number: Side channel	Main channel border shorelines	Emergent wing dams
Game fish	5.6	11.4	9.6
Panfish	11.4	17.6	26.2
Catfish	0.9	1.0	2.3
Predatory rough fish	1.7	1.7	0.3
Forage fish	60.8	33.4	16.5
Rough fish	19.5	35.0	45.1
Totals	100	100	100

TABLE 24. Percent by number of fish categories in side channel, main channel border shoreline, and emergent wing dam electrofishing catches for all four months combined. The influence of emerald shiner schools in the side channel and at the shoreline by wing dam 31 in August has been removed.

	Percent by number		
Category	Side channel	Main channel border shorelines	Emergent wing dams
Game fish	12.8	13.8	9.6
Panfish	26.4	21.4	26.2
Catfish	2.0	1.2	2.3
Predatory rough fish	3.9	2.0	0.3
Forage fish	10.3	19.1	16.5
Rough fish	44.5	42.6	45.1
Totals	100	100	100

electrofished, some species were more important in certain habitats. Twenty three fish species were found in all three habitats, and carp were consistently important in number or weight in all (Tables 25-27). Quillback were important along main channel border shorelines. They ranked in the top three species by number or weight in border shoreline catches each month (Table 26). Shorthead redhorse were prominent in emergent wing dam catches, consistently ranking in the top three species by number or weight in each month's catch (Table 27).

Fish were most diverse and most abundant in the side channel. Significantly more fish species were caught per unit of effort in the side channel than along main channel border shorelines or emergent wing dams in each month (paired t-tests; 3 d.f.; p=.025). Electrofishing catch rates in the side channel were highest in each month, followed by main channel border shorelines and emergent wing dams (Tables 25-27), but the differences were not significant because of variability introduced by the large schools of emerald shiner in August. When the effect of the emerald shiners was removed, the differences in catches per effort between habitats were significant (paired t-tests; 3 d.f.; p=.025). In contrast, Bertrand and Miller (1973) found average side channel electrofishing catch rates were lower than catch rates at main channel border habitats in Pools 12 and 13 of the Upper Mississippi

TABLE 25. Side channel electrofishing catches for each month.

Catch and rank		June 1978	August 1978	October 1978	June 1979
Number of species/hour		9.5	12.5	12.5	9.5
Total number of fish captured		102	1098	163	93
Catch rate (fish/hour)		51.0	549.0	81.5	46.5
Rank (number)	1	Shorthead redhorse	Emerald shiner	Carp	River carpsucker
	2	Sauger	Bluegill	Sauger	Carp
	3	Carp	Carp	Freshwater drum	Smallmouth buffalo
Rank (weight)	1	Carp	Carp	Carp	Carp
	2	Shorthead redhorse	Largemouth bass	Freshwater drum	River carpsucker
	3	Longnose gar	Smallmouth buffalo	Sauger	Smallmouth buffalo

TABLE 26. Main channel border shoreline electrofishing catches for each month.

Catch and rank		June 1978	August 1978	October 1978	June 1979
Number of species captured/hour		4.3	5.7	4.8	4.5
Total number of fish captured		144	909	423	189
Catch rate (fish/hour)		24.0	151.5	70.5	31.5
Rank (number)	1	Sauger	Emerald shiner	Freshwater drum	Quillback
	2	Quillback	Bluegill	Carp	Carp
	3	Freshwater drum	River shiner	Sauger	Shorthead redhorse
Rank (weight)	1	Carp	Carp	Carp	Carp
	2	Longnose gar	Bluegill	Freshwater drum	Shorthead redhorse
	3	Freshwater drum	Quillback	Quillback	Quillback

TABLE 27. Emergent wing dam electrofishing catches for each month.

Catch and rank		June 1978	August 1978	October 1978	June 1979
Number of species captured/hour		2.5	4.7	3.5	0.5
Total number of fish captured		44	434	262	3
Catch rate (fish/hour)		7.3	72.3	43.7	0.5
Rank (number)	1	Shorthead redhorse	Bluegill	Freshwater drum	Shorthead redhorse[a]
	2	Freshwater drum	Emerald shiner	Carp	Quillback[a]
	3	Carp	Carp	Shorthead redhorse	Shortnose gar[a]
Rank (weight)	1	Shorthead redhorse	Carp	Carp	Shorthead redhorse
	2	Carp	Bluegill	Freshwater drum	Quillback
	3	Shortnose gar	Shorthead redhorse	Shorthead redhorse	Shortnose gar

River. Bertrand speculated that the average catch rate in the main channel border would have been lower but he was not able to sample the main channel border in May. Extra-channel habitats are likely to offer increased fish abundance and production of fish food organisms (Schramm and Lewis 1974; Eggleton 1939; Kallemeyn and Novotny 1977; Jennings 1979; and Groen and Schmulbach 1978).

Cover and water depth along main channel border shorelines probably affected catches. Wing dams 26 and 28 had more rip-rap, stumps, and logs along the channel border shorelines than the other wing dikes. More species were often caught (Table 20) and catch rates were usually higher (Table 28) along the shoreline at those two wing dams than at the others. Catch rates were also relatively high at the shoreline near wing dam 31. Fish may have been more vulnerable to electrofishing at the shoreline near wing dam 31 because of the shallowness of that shoreline compared to the others.

Hoop nets sampled two habitats: main channel border areas adjacent to wing dams, and the side channel. Hoop nets fished on the bottom in 1.5 to 5.0 meters of water where boom shocking was ineffective. Current was generally lower in the side channel than the main channel border although current velocity was low near emergent wing dams 26 and 28 during low river stages (Appendix II).

Species composition of hoop net catches in the side

TABLE 28. Catch per unit effort (number of fish/hour) at main channel border shoreline electrofishing transects in each month.

Wing dam (shoreline transects)	Number of fish/hour June 1978	August 1978	October 1978	June 1979	Row mean
25	23	59	41	31	38.5
26	32	171	87	40	82.5
28	42	108	146	41	84.3
29	27	74	41	23	41.3
30	22	52	20	9	25.8
31	14	146[a]	90	52	75.5
Column mean	26.7	101.7	70.8	32.7	58.0

[a]The influence of a large catch of 300 emerald shiners has been removed by subtracting the emerald shiners from the catch at wing dam 31 (page 52).

channel and main channel border were similar in all but catfish and rough fish categories (Table 29). Channel catfish were more than twice as important in the side channel than in the main channel border, comprising 71% of the number and 54% of the weight of side channel hoop net catches, but only 25% of the number and 12% of the weight in the main channel border. Smallmouth buffalo were more important in the main channel border. Buffalo were 33% of the number and 53% of the weight in the channel border versus 5% of the number and 12% of the weight in the side channel.

Fish abundance was not different between side channel and main channel border hoop nets. Although the average catch rate for baited and unbaited nets in all months combined was 1.9 fish per day near the wing dams and 5.2 fish per day in the side channel, these catch rates were not significantly different (Table 30). Kallemeyn and Novotny (1977) also found no difference in hoop net catch per unit effort between side channels and main channel borders in channelized portions of the Missouri River.

However, as in electrofishing catches, significantly more species were caught per unit of effort in side channel hoop nets than in main channel border nets (Table 31). Twenty three species were netted near wing dams versus thirteen species in the side channel, but about six times as much fishing took place near the wing dams. Hoop net

TABLE 29. Percent by number and weight of fish categories in side channel and main channel border hoop net catches for all four months combined.

	Percent number		Percent weight	
Species category	Side channel	Main channel border	Side channel	Main channel border
Game fish	1.16	1.67	1.17	1.78
Panfish	14.16	16.61	6.17	4.24
Catfish	72.84	32.69	55.38	20.19
Predatory rough fish	0.29	1.03	0.78	1.46
Forage fish	0.29	0.39	0.06	0.08
Rough fish	11.27	47.62	36.44	72.24
Totals	100.0	100.0	100.0	100.0

TABLE 30. Mean catch rates for baited and unbaited hoop nets in the side channel and near the wing dams each month.

Habitat	Catch rate (number of fish/day) June 1978	August 1978	October 1978	June 1979	Row mean
Baited nets					
Side channel	2.5	8.3	22.1	1.3	8.55[a]
Wing dam	1.6	3.9	3.9	1.6	2.75[a]
Unbaited nets					
Side channel	1.3	3.3	1.5	0.4	1.63[b]
Wing dam	0.9	2.2	0.7	0.7	1.13[b]
Column mean	1.58	4.43	7.05	1.00	3.52

[a,b]Each pair of values marked with the same superscript were not significantly different (paired t-tests; 3 d.f.; p=.025).

TABLE 31. Number of species caught per day in baited and unbaited hoop nets in the side channel and near the wing dams each month.

Habitat	Number of species caught/day June 1978	August 1978	October 1978	June 1979	Row mean
Baited nets					
Side channel	.50	.75	.57	.53	.59[a]
Wing dam	.21	.18	.21	.21	.20[a]
Unbaited nets					
Side channel	.50	.74	.61	.36	.55[b]
Wing dam	.11	.24	.22	.27	.21[b]
Column mean	.33	.48	.40	.34	.39

[a,b]Each pair of values marked with the same superscript were significantly different (paired t-tests; 3 d.f.; p=.025).

catches appeared to be similar at both submerged and emergent wing dams (Tables 12-15).

Fish Use of Emergent Wing Dams

Electrofishing catches of fish on emergent wing dams 26 and 28 during June, August, and October 1978 yielded the best information obtained about fish use of wing dams. During these months, river stages were low enough to make the boom shocker effective for catching fish along the exposed rock rubble of the wing dams. As many as 434 fish were shocked in shallow water along the rock rubble sides of emergent dikes in one sampling month.

One third of the fish species encountered by shocking on emergent wing dams, mooneye, carp, silver chub, emerald shiner, river shiner, quillback, shorthead redhorse, sauger, walleye, and freshwater drum, were present in every sampling month of 1978 (Table 11). Channel catfish, flathead catfish, logperch, river darter, white bass, bluegill, smallmouth bass, and white crappie were caught along the wing dams only during low river stages (less than 2.1 meters). A total of 38 fish species were caught at emergent and submerged wing dams by shocking and hoop netting in all sampling months (Tables 11-15).

Fish appeared to be equally abundant and diverse at emergent wing dam transects except the outside transects. Fewer fish and fish species were usually caught at the outside transect of wing dams 26 and 28 in each month although the difference was significant only at wing dam 26 (Tables 2, 32). At wing dam 26 less rock rubble was exposed and susceptible to electrofishing at the outside transect than at other transects. Wing dam 26 dropped off into deep water abruptly in the outside transect. All other emergent wing dam transects did not differ significantly from each other in catch per effort or number of species caught (paired t-tests; 2 d.f.; $p=.025$).

No consistent trends were seen in the distribution of most fish species laterally along emergent wing dams. Carp, quillback, shorthead redhorse, sauger, and walleye showed no consistent increase or decrease in abundance from inside to outside transects at emergent wing dams 26 and 28 (Table 33). The distribution of bluegill between inside, middle, and outside transects was similar at wing dams 26 and 28 in August (Figures 6-7). Bluegill were least abundant at outside transects in August, the only month they were abundant. Thiel (1977) found that bluegill were more abundant on vegetated than on unvegetated wing dams in the Mississippi River near LaCrosse, Wisconsin. Freshwater drum showed a decline in abundance between the middle and outside transects in October (Figures 8-9).

Aquatic invertebrates on the wing dams may play a role in attracting fish to wing dams (Jennings 1979). Since much of the river bottom is relatively unproductive sand,

TABLE 32. Number of fish caught per hour on emergent wing dam electrofishing transects in June, August, and October 1978.

Transect	Catch rate (fish/hour)			
	June 1978	August 1978	October 1978	Row mean
Wing dam 26				
Inside transect	6	55	46	35.7[d]
Middle transect	10	67	63	46.7[e]
Outside transect	0	31	21	17.3[d,e]
Wing dam 28				
Inside transect	0	112	74	62.0
Middle transect	25	113	35	57.7
Outside transect	3	56	23	27.3
Column mean	7.3[a,b]	72.3[a,c]	43.7[b,c]	41.1

[a,b,c,d,e]Each pair of values marked with the same superscript were significantly different (paired t-tests; 2 and 5 d.f.; p= .025 and .05).

TABLE 33. Electrofishing catch rates for carp, quillback, shorthead redhorse, sauger, and walleye at emergent wing dam transects in June, August, and October 1978.

	Catch rate (no. fish/hour)					
	Wing dam 26			Wing dam 28		
Species and month	Inside	Middle	Outside	Inside	Middle	Outside
Carp						
June	0	2	0	0	0	1
August	6	1	0	0	12	19
October	3	13	1	0	3	9
Quillback						
June	0	0	0	0	1	0
August	0	1	0	1	2	0
October	0	3	0	1	0	0
Shorthead redhorse						
June	3	4	0	0	9	0
August	2	2	6	12	0	3
October	5	0	2	9	2	0
Sauger						
June	0	0	0	0	2	0
August	5	2	3	5	3	1
October	1	4	1	5	2	5
Walleye						
June	0	1	0	0	0	1
August	0	1	0	2	0	2
October	1	1	1	1	1	0

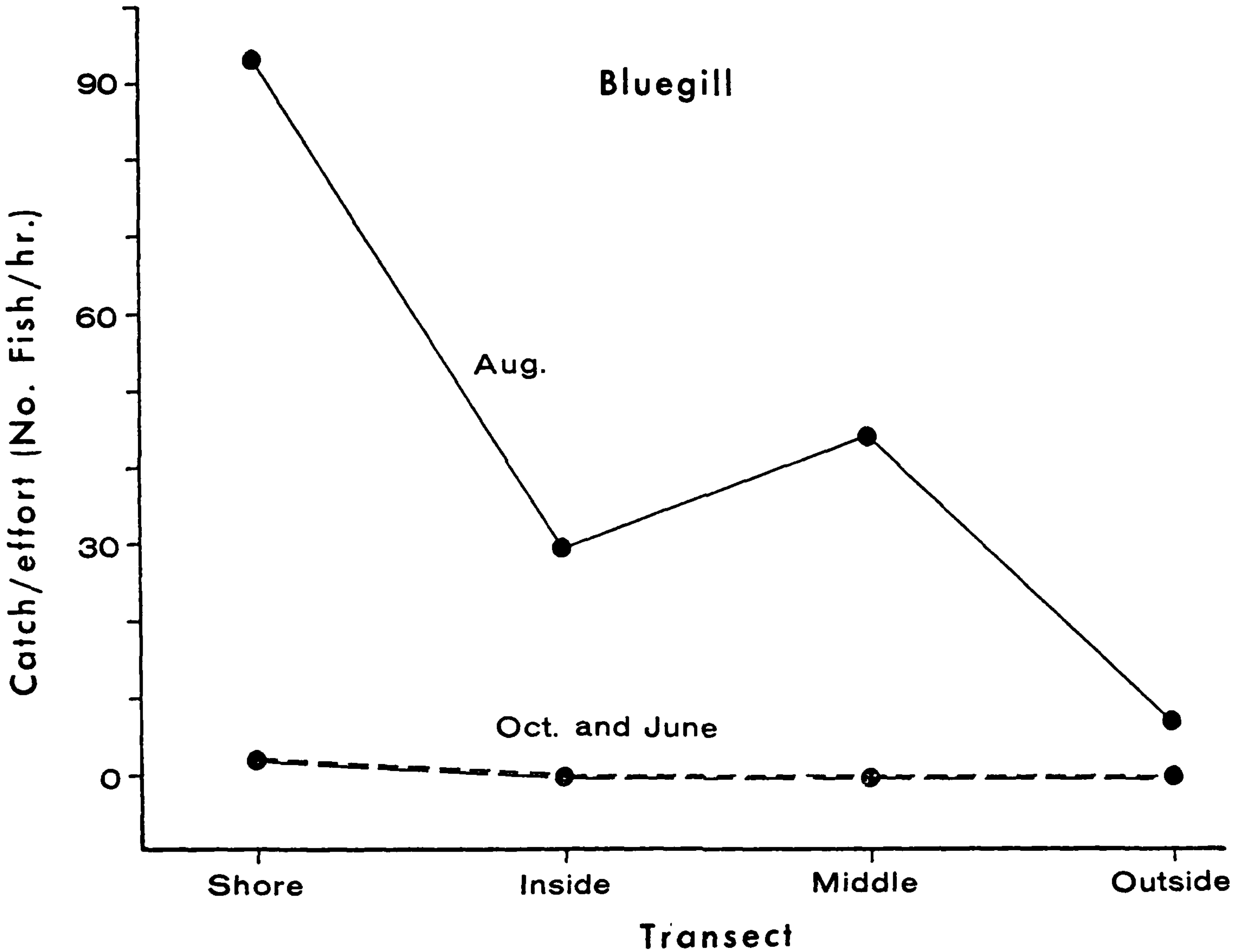


FIGURE 6. Bluegill distribution along emergent wing dam 26 in June, August, and October 1978.

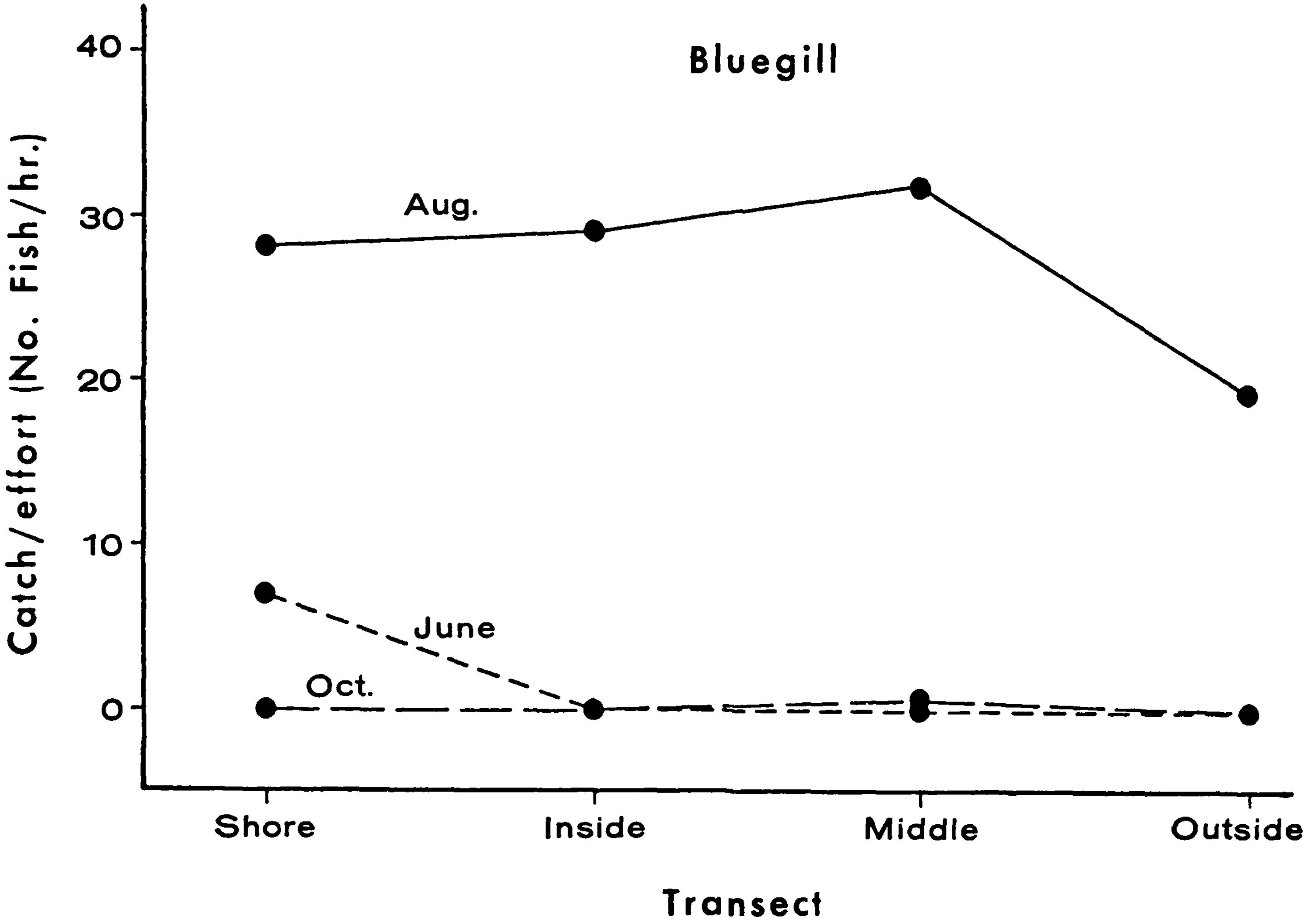


FIGURE 7. Bluegill distribution along emergent wing dam 28 in June, August, and October 1978.

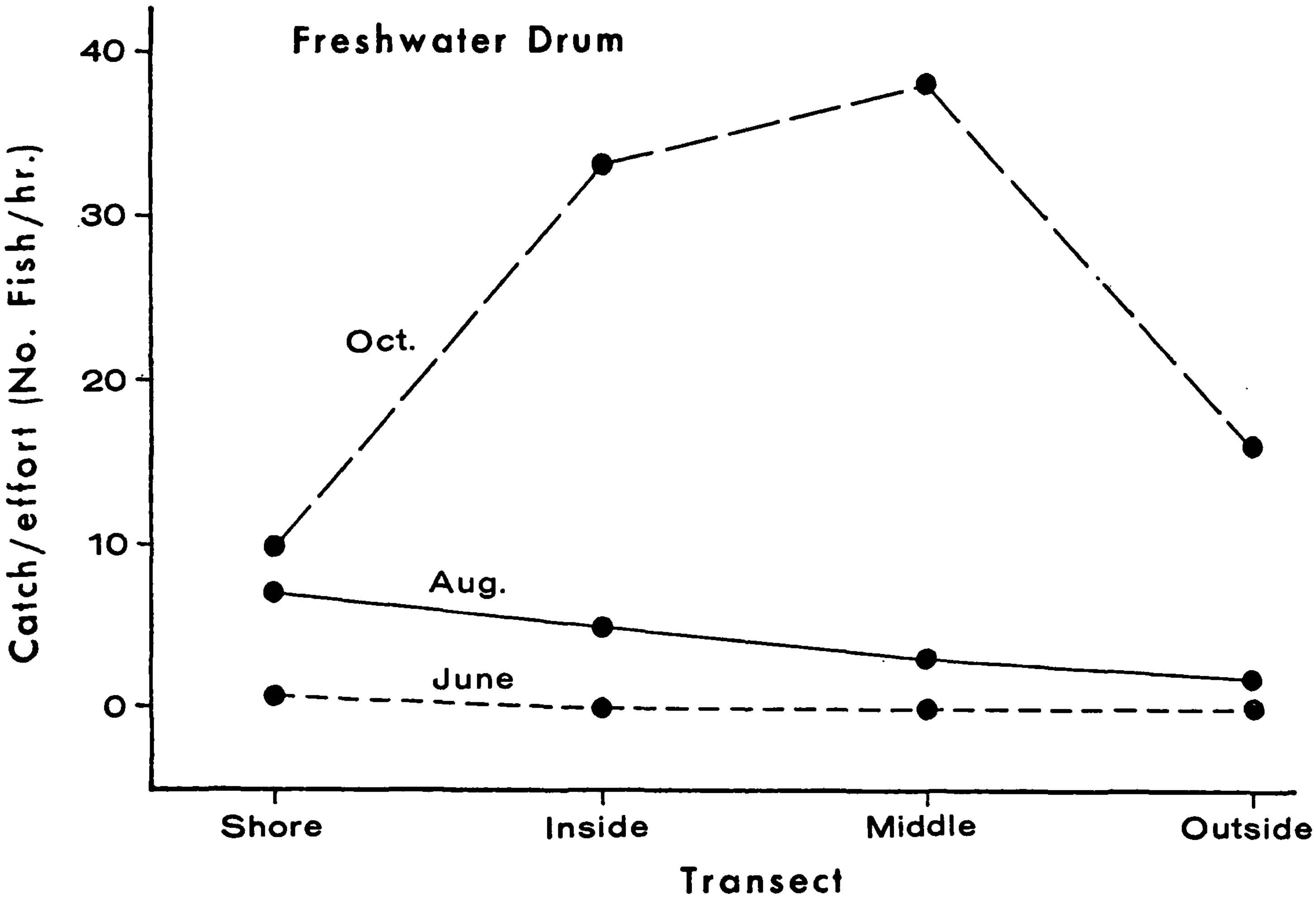


FIGURE 8. Freshwater drum distribution along emergent wing dam 26 in June, August, and October 1978.

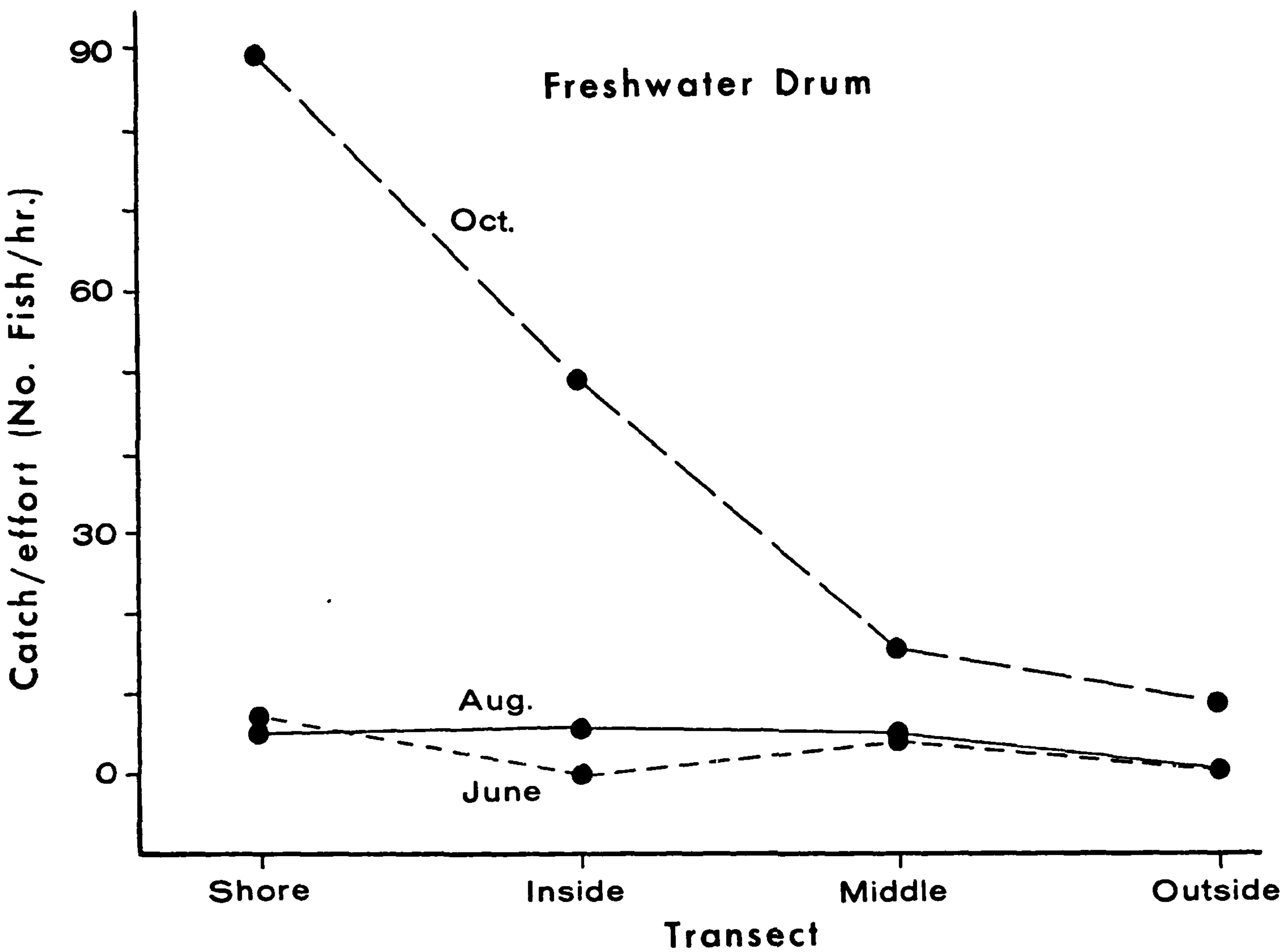


FIGURE 9. Freshwater drum distribution along emergent wing dam 28 in June, August, and October 1978.

the wing dams may provide important substrate for production of fish food organisms in the main channel border. Caddis flies (*Potamyia flava*, *Cheumatopsyche* sp., and *Hydropsyche orris*) and *Hyalella* were abundant on the wing dams. Caddis flies and other invertebrates colonized artificial substrates (Hester and Dendy 1962; Jacobi 1971) on the wing dams at densities up to 80,000 per square meter (Hall 1980). Hoopes (1960) and Carlander et al. (1959) considered *Potamyia flava* to be an important fish food but suggested negligible use of *Cheumatopsyche campyla* and *Hydropsyche orris* by Mississippi River fishes. Bur (1976) also reported use of caddis flies, especially *Potamyia flava*, by Mississippi River fishes. Jude (1968) reported that *Potamyia flava* was important in fish diets in late July and August in the Mississippi River. Large *Hexagenia*, because of emergence (Carlander et al. 1967), are less available to fish during this part of the summer. In August, bluegill may have been feeding at the wing dams (Thiel 1977). Most of the bluegill caught were one or two years old and 100 to 180 mm long (Appendix M). Wynes (1976) found that Mississippi River bluegill in this size range ate trichopterans and *Hyalella*. Most freshwater drum were young-of-the-year (average 136 mm), but there were also many of ages one and two (Appendix P). Ranthum (1969) found *Potamyia* to be important in the diet of drum less than 152 mm.

Wing dikes add to the diversity of cover types found in the main channel border and may provide important cover or shelter from current if substantial sediment accretion between dams has not occurred. Sedimentation had not yet destroyed fish habitat by filling in areas between the wing dams (see Hydrographic Relief section). Numerous studies (Hickman 1975; Marzolf 1978; Johnson and Stein 1979; Minckley and Deacon 1959; and Kallemeyn and Novotny 1977) have shown the benefits of diverse cover for fish in streams or have indicated that fish in both lotic and lentic aquatic environments are attracted to shelter. I found darters, minnows, and small flathead and channel catfishes nestled among rocks and gravel on the dams (Appendices A-C). Current velocity at emergent wing dams was low during low flow conditions in August and October. Ranthum (1969) suggested that bluegill from the Upper Mississippi River prefer areas with little flow. A potentially detrimental impact of notching to fish may be the removal of 45 to 90 meters of wing dam which provides both shelter from current and substrate for aquatic macroinvertebrates.

Fish Marking Results and Movement

Individual fish were not caught repeatedly by my fishing efforts. Fin clips were applied to 3154 fish in the study area, and only 25 fish or 0.79% were recaptured. Recaptures included 7 carp, 5 bluegill, 3 flathead catfish, 2 each of quillback, channel catfish, and freshwater drum, and 1 each of golden redhorse, shorthead redhorse, black crappie, and sauger.

Some movement of fish was evident within the study area. Five fish, 20% of the recaptures, were recaught in parts of the study area other than the site where they were originally captured and released. Four of the five fish had left the side channel and moved out to the main channel border area. Species which had moved were flathead catfish, channel catfish, quillback, and golden redhorse. Dramatic monthly changes in species composition at the various sites also indicated that fish movement was occurring (Tables 10-11, 25-27). Tagging studies of fish in the Upper Mississippi River, including those of Bahr (1977), Christenson (1952), Ellis (1978), Finke (1964), Gengerke (1977, 1978), Helms (1973), Hubley (1961, 1963a, 1963b), Iowa Conservationist (1959), and Schoumacher (1965) have indicated considerable upstream, downstream, and local movements of fish.

Gear Selectivity

Gear Efficiency

Electrofishing provided the widest variety of fish species and hoop netting provided the least variety. Shocking, seining, and hoop netting caught 44, 37, and 23 species, respectively, in all months combined (Tables 34-36). Bowfin, northern pike, yellow bullhead, black buffalo,

TABLE 34. Summary of lengths (mm) and weights (g) of all fish species caught by electrofishing in all sampling months.

Species	Length Mean	Length Range Min.	Length Range Max.	Length S.D.	Length Sample Size	Weight Mean	Weight Range Min.	Weight Range Max.	Weight S.D.	Weight Sample Size
Longnose Gar	587.4	222.	831.	123.04	47	425.9	16.	1215.	247.19	47
Shortnose Gar	576.5	520.	662.	50.17	6	593.3	485.	750.	113.56	6
Bowfin	288.0	288.	288.	0.00	1	266.0	266.	266.	0.00	1
Gizzard Shad	129.8	68.	330.	56.66	27	42.8	4.	320.	71.42	23
Mooneye	233.9	34.	310.	72.02	15	165.4	29.	302.	82.32	14
Northern Pike	626.0	574.	678.	73.54	2	1480.0	1200.	1760.	395.98	2
Carp	452.6	218.	744.	72.33	272	1394.8	160.	5380.	628.43	271
Silvery Minnow	59.8	40.	70.	10.73	12	0.0	-	0.	0.00	0
Silver Chub	89.8	36.	169.	40.02	36	31.3	24.	40.	5.32	6
Emerald Shiner	43.1	15.	99.	9.62	653	0.0	-	0.	0.00	0
River Shiner	59.2	30.	86.	9.50	138	0.0	-	0.	0.00	0
Spottail Shiner	51.8	46.	55.	3.56	5	0.0	-	0.	0.00	0
Spotfin Shiner	59.1	45.	72.	6.40	20	0.0	-	0.	0.00	0
Bullhead Minnow	52.9	38.	72.	7.82	41	0.0	-	0.	0.00	0
Channel Catfish	262.2	79.	555.	94.66	37	239.1	6.	1850.	349.42	37
Flathead Catfish	229.4	84.	371.	102.89	8	194.4	6.	580.	189.42	8
Stonecat	91.0	91.	91.	0.00	1	8.0	8.	8.	0.00	1
Yellow Bullhead	215.0	215.	215.	0.00	1	142.0	142.	142.	0.00	1
Logperch	65.0	56.	100.	11.64	15	0.0	-	0.	0.00	0
River Darter	61.2	49.	73.	10.01	5	0.0	-	0.	0.00	0
Sauger	218.2	101.	480.	50.61	230	91.2	6.	1200.	110.65	229
Walleye	274.4	178.	455.	63.81	45	197.6	41.	830.	169.30	45
River Carpsucker	325.2	156.	431.	70.32	54	540.3	52.	1100.	299.07	54
Highfin Carpsucker	232.8	138.	305.	43.12	20	192.6	62.	440.	100.71	19
Quillback	273.1	124.	434.	67.59	122	305.9	25.	1125.	200.14	121
Bigmouth Buffalo	400.0	249.	601.	131.83	14	1424.8	255.	3500.	1233.26	14
Smallmouth Buffalo	291.1	125.	500.	70.97	53	412.7	29.	1400.	249.24	53
Black Buffalo	477.0	476.	478.	1.41	2	1615.0	1615.	1670.	77.78	2
Silver Redhorse	427.8	350.	578.	60.02	12	1059.3	502.	2300.	467.97	12
Golden Redhorse	252.5	156.	412.	81.84	17	264.0	42.	850.	267.38	17
Shorthead Redhorse	276.9	98.	492.	91.86	173	314.6	9.	1390.	287.33	172
Spotted Sucker	293.0	293.	293.	0.00	1	317.0	317.	317.	0.00	1
White Bass	158.5	63.	314.	69.49	32	83.6	6.	375.	100.84	29
Rock Bass	169.8	152.	199.	17.40	9	114.9	78.	169.	34.58	9
Pumkinseed	149.0	149.	149.	0.00	1	92.0	92.	92.	0.00	1
Orangespotted Sunfish	67.5	52.	92.	7.13	46	6.1	2.	19.	3.31	32
Bluegill	107.9	27.	203.	36.49	465	45.1	1.	236.	37.10	402
Smallmouth Bass	238.4	160.	362.	69.96	8	231.0	52.	670.	215.85	8
Largemouth Bass	195.4	58.	352.	74.95	60	160.0	1.	700.	164.02	60
White Crappie	182.7	100.	240.	35.95	22	100.0	22.	200.	46.20	20
Black Crappie	145.9	55.	241.	36.53	83	60.1	2.	218.	43.68	78
Freshwater Drum	168.4	52.	398.	54.82	465	83.1	2.	920.	93.33	458
Brook Silversides	63.5	59.	68.	6.36	2	0.0	-	0.	0.00	0
Paddlefish	604.0	604.	604.	0.00	1	690.0	690.	690.	0.00	1

TABLE 35. Summary of lengths (mm) and weights (g) of all fish species caught by hoop netting in all sampling months.

	Length					Weight				
		Range			Sample		Range			Sample
Species	Mean	Min.	Max.	S.D.	Size	Mean	Min.	Max.	S.D.	Size
Longnose Gar	628.0	599.	673.	22.32	8	474.4	406.	580.	56.98	8
Shortnose Gar	552.0	552.	552.	0.00	1	560.0	560.	560.	0.00	1
Gizzard Shad	210.0	210.	210.	0.00	1	88.0	88.	88.	0.00	1
Carp	403.8	203.	640.	113.56	34	1085.1	142.	3400.	837.53	34
Silver Chub	184.3	171.	196.	12.58	3	58.0	40.	70.	15.87	3
Channel Catfish	265.4	79.	421.	35.94	438	155.3	10.	720.	68.87	435
Flathead Catfish	311.7	187.	493.	68.35	55	373.6	74.	1620.	283.47	55
Stonecat	217.0	217.	217.	0.00	1	104.4	104.	104.	0.00	1
Sauger	342.1	188.	471.	67.36	15	363.7	190.	930.	201.70	14
Walleye	279.0	271.	287.	11.31	2	178.5	147.	210.	44.55	2
River Carpsucker	408.4	360.	440.	31.19	5	1012.0	660.	1340.	280.21	5
Smallmouth Buffalo	325.4	209.	483.	41.57	268	542.0	116.	1850.	222.58	268
Silver Redhorse	551.0	551.	551.	0.00	1	2000.0	2000.	2000.	0.00	1
Golden Redhorse	321.0	321.	321.	0.00	1	370.0	370.	370.	0.00	1
Shorthead Redhorse	360.7	292.	452.	53.60	11	572.3	278.	1210.	282.20	11
White Bass	228.7	197.	262.	32.53	3	152.7	90.	236.	75.16	3
Bluegill	153.7	105.	201.	24.39	68	94.0	28.	183.	41.32	68
White Crappie	190.7	131.	262.	35.58	39	103.5	28.	256.	66.99	39
Black Crappie	151.6	114.	233.	29.62	65	62.0	26.	204.	43.42	65
Freshwater Drum	235.2	124.	388.	49.29	83	183.6	4.	900.	131.99	83
Shovelnose Sturgeon	645.0	638.	652.	9.90	2	628.5	407.	850.	313.25	2
Yellow Perch	188.0	188.	188.	0.00	1	98.0	98.	98.	0.00	1
Black Bullhead	192.5	159.	285.	43.15	12	125.4	69.	364.	82.42	12

TABLE 36. Summary of lengths (mm) and weights (g) of all fish species caught by seining in all sampling months.

Species	Length					Weight				
	Mean	Range Min.	Range Max.	S.D.	Sample Size	Mean	Range Min.	Range Max.	S.D.	Sample Size
Longnose Gar	605.0	605.	605.	0.00	1	600.0	600.	600.	0.00	1
Mooneye	38.0	38.	38.	0.00	1	0.0	-	0.	0.00	0
Carp	411.0	411.	411.	0.00	1	940.0	940.	940.	0.00	1
Silvery Minnow	46.1	42.	53.	3.93	7	0.0	-	0.	0.00	0
Silver Chub	46.0	30.	91.	8.77	75	0.0	-	0.	0.00	0
Speckled Chub	31.0	31.	31.	0.00	1	0.0	-	0.	0.00	0
Emerald Shiner	47.9	29.	66.	11.94	34	0.0	-	0.	0.00	0
River Shiner	46.9	26.	73.	9.27	90	0.0	-	0.	0.00	0
Spottail Shiner	45.6	40.	55.	4.98	8	0.0	-	0.	0.00	0
Spotfin Shiner	49.0	49.	49.	0.00	1	0.0	-	0.	0.00	0
Bullhead Minnow	47.4	23.	67.	8.83	52	0.0	-	0.	0.00	0
Fathead Minnow	47.0	47.	47.	0.00	1	0.0	-	0.	0.00	0
Channel Catfish	61.3	36.	162.	35.99	16	20.0	20.	20.	0.00	1
Tadpole Madtom	39.5	31.	68.	9.42	28	0.0	-	0.	0.00	0
Logperch	58.0	49.	83.	9.30	11	0.0	-	0.	0.00	0
River Darter	41.0	38.	44.	4.24	2	0.0	-	0.	0.00	0
Sauger	165.8	30.	293.	71.16	25	0.0	-	0.	0.00	0
Walleye	272.0	190.	396.	77.40	5	540.0	540.	540.	0.00	1
Highfin Carpsucker	227.0	227.	227.	0.00	1	0.0	-	0.	0.00	0
Quillback	37.0	37.	37.	0.00	1	0.0	-	0.	0.00	0
Bigmouth Buffalo	172.5	172.	173.	0.71	2	74.0	74.	74.	0.00	1
Smallmouth Buffalo	225.0	225.	225.	0.00	1	0.0	-	0.	0.00	0
Silver Redhorse	198.0	198.	198.	0.00	1	0.0	-	0.	0.00	0
Golden Redhorse	208.5	186.	248.	27.26	4	90.0	90.	90.	0.00	1
Shorthead Redhorse	259.6	154.	382.	90.46	5	520.0	520.	520.	0.00	1
Spotted Sucker	280.0	280.	280.	0.00	1	284.0	284.	284.	0.00	1
Trout-perch	39.7	34.	50.	8.96	3	0.0	-	0.	0.00	0
White Bass	127.0	31.	290.	85.13	7	0.0	-	0.	0.00	0
Rock Bass	98.5	26.	171.	102.53	2	0.0	-	0.	0.00	0
Orangespotted Sunfish	61.3	24.	90.	14.91	43	0.0	-	0.	0.00	0
Bluegill	54.4	23.	170.	36.86	94	94.0	94.	94.	0.00	1
Largemouth Bass	126.5	66.	187.	85.56	2	0.0	-	0.	0.00	0
White Crappie	82.5	24.	249.	88.20	11	89.0	89.	89.	0.00	1
Black Crappie	87.1	26.	223.	56.31	22	146.5	117.	176.	41.72	2
Freshwater Drum	48.3	14.	322.	40.32	79	500.0	500.	500.	0.00	1
Brook Silverside	42.3	35.	59.	11.41	4	0.0	-	0.	0.00	0
Johnny Darter	47.0	47.	47.	0.00	1	0.0	-	0.	0.00	0

smallmouth bass, a pumpkinseed, and a paddlefish were caught only with the shocker. Shovelnose sturgeon, black bullheads, and a yellow perch were found in hoop nets but not in other gear. Johnny darter, trout-perch, tadpole madtoms, a fathead minnow, and speckled chub were only caught with the seine.

The amount of effort used with each gear influenced month to month variation in number of species caught by each gear. Seining showed the greatest variation with time in number of species caught during each sampling month. Electrofishing yielded 30 to 38 species each sampling month, hoop netting captured 12 to 15 species, and seining, 14 to 28 species (Appendices A-L). Different amounts of effort for each gear can affect comparisons between different gears (Funk 1958). Greater variation in number of species seined each month was expected because much less effort was expended seining than shocking or hoop netting. Only four or five short seine hauls were made each sampling month compared to 19.5 hours of shocking and about 112 net days of hoop netting.

Bluegill and freshwater drum were vulnerable to all gears but the other species which were most susceptible to each gear differed. Emerald shiners, followed by bluegill and freshwater drum, carp, sauger, and shorthead redhorse were caught in greatest numbers electrofishing (Table 34). Bertram and Dunham (1972) felt the effectiveness of A.C. shocking was excellent for collecting carp and bluegill, good for freshwater drum, but only fair for sauger in the Upper Mississippi River. Channel catfish and smallmouth buffalo were most vulnerable to hoop netting but freshwater drum, bluegill, and black crappie were also important in hoop net catches (Table 35). Funk (1958) found hoop nets to be effective for catching channel catfish. Bluegill ranked fourth in abundance in hoop net catches even though they may be adept at escaping from hoop nets (Hansen 1944). Bluegill, river shiners, freshwater drum, silver chubs, and bullhead minnows were most abundant in seine hauls (Table 36). Reynolds and Simpson (1978) found that small seines were effective for catching bluegill.

Large variations in catch success were evident in all three gears. Electrofishing catch rates were extremely variable, ranging from 0 to 924 fish per 30 minute transect. Hoop net catch rates ranged from 0 to 44.2 fish per net day. The largest hoop net catch was 135 fish from one baited hoop net that fished for three days in the side channel. Seining netted 2 to 114 fish per haul. Time of year, river stage, and site differences probably influenced these variations through their effects on water conditions during sampling and on fish behavior (Lagler 1978; Pope et al. 1975; Vincent 1971).

Baited Versus Unbaited Hoop Nets

Hoop nets have been baited with soybean cake and cheese (Mayhew 1973; Harrison 1954) and cottonseed oil cake (Carter 1954) to increase catches of commercial fish. Mayhew (1973) found that cheese bait increased catch success for channel catfish, and soybean cake increased catch success for carp in the Des Moines River, Iowa.

In this study, hoop nets baited with soybean cake caught significantly more fish (paired t-tests; 23 and 27 d.f.; p=.025) than unbaited nets in each month of 1978. Average catch rates for all four months combined were 3.67 fish per net day in baited nets and 1.20 fish per net day in unbaited nets. These rates compare favorably with the 2.4 fish per net day reported by Starrett and Barnickol (1955) for the Mississippi River, and 1.2 fish per day reported by Carter (1954) for Kentucky Lake.

The month when the catch rate was highest differed between baited nets and unbaited nets (Figure 10). Catches in unbaited nets were greatest in August because of the number of centrarchids caught (Table 13). Highest catches in baited nets occurred in October because of large catches of channel catfish and smallmouth buffalo. Hoop net catch rates were similar in June of 1978 and 1979; 0.9 and 0.7 fish per day in unbaited nets and 1.6 and 1.6 fish per net day in baited nets.

Baited and unbaited nets differed in the species for which they were most selective, and in the number of

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UPPER MISSISSIPPI RIVER WING DAM NOTCHING: THE PRE-NOTCHING FIS--ETC(U)
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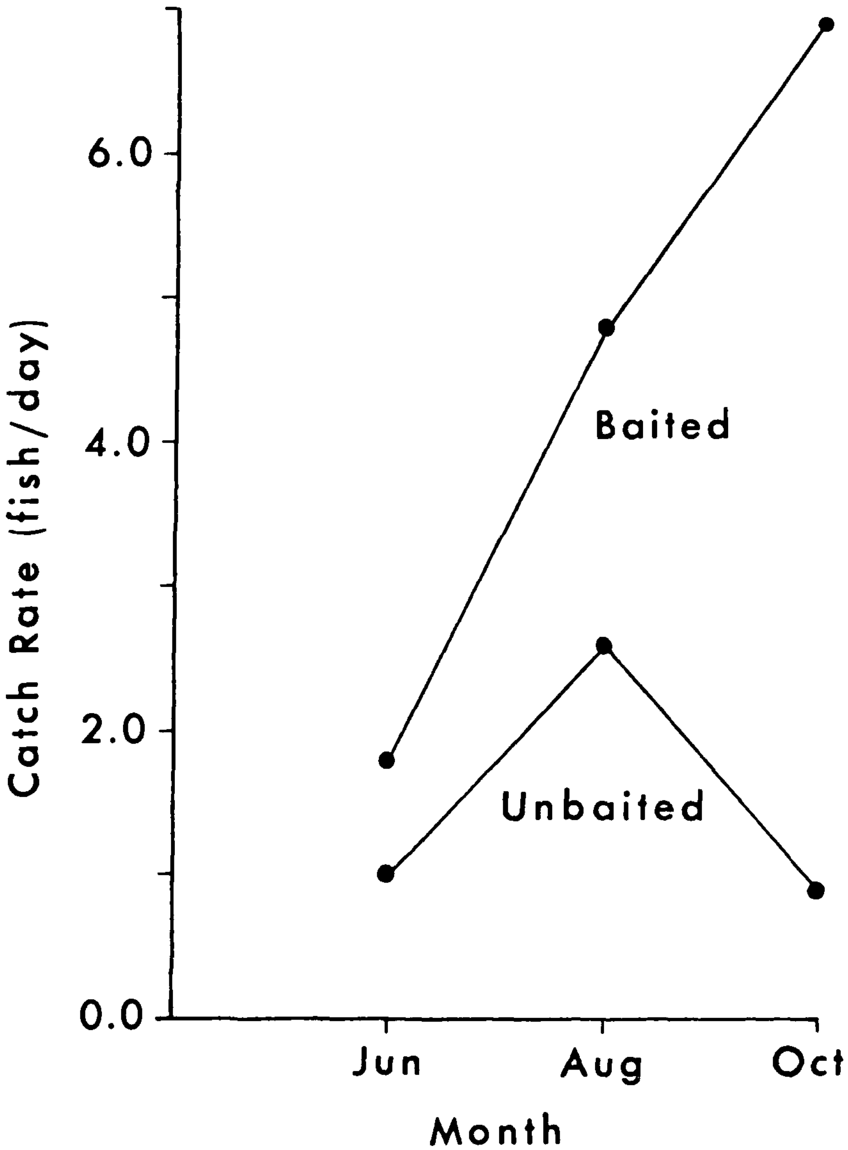

FIGURE 10. Average catch rates for baited and unbaited hoop nets in June, August, and October 1978.

species they caught. Significantly more channel catfish, smallmouth buffalo, carp, and bluegill (Chi-square; 1 d.f.; p=.05) were caught by baited nets than by unbaited nets (Table 37). Unbaited nets caught more flathead catfish, freshwater drum, and black crappie than baited nets (Chi-square; 1 d.f.; p=.05). Twenty one species of fish were caught in unbaited nets versus 16 in baited hoop nets. Longnose gar, shortnose gar, gizzard shad, silver redhorse, golden redhorse, shorthead redhorse, and yellow perch were caught in unbaited nets but not in baited nets (Tables 12-15). Stonecat and silver chub were captured in baited nets but not in unbaited nets.

The additional cost of baiting nets with soybean cake was greater than recent market values for most commercial fish. I estimated the cost of baiting hoop nets with 2 kg of soybean cake per net to be about 54¢ per net day. Since baiting resulted in an additional catch of 2.47 fish or 0.87 kg per net day over unbaited nets, baiting cost 22¢ per additional fish or 62¢ per kg (28¢ per lb.). Gengerke and Beck (1978) reported market values (¢ per lb.) for fish in Iowa of: carp, 7; buffalo, 22; freshwater drum, 16; channel and flathead catfish, 52; bullheads, 18; and carpsuckers and redhorse, 5. Catch rates (kg per net day) for legal size channel and flathead catfish (300 mm or longer) were actually higher in unbaited than baited nets. One commercial fisherman in Pool 13 stopped baiting his nets because he could not justify the cost. However,

TABLE 37. Total numbers of fish of various species caught in baited and unbaited nets in all four months.

Species	Number of fish	
	Unbaited hoop nets	Baited hoop nets
Carp	2	32
Smallmouth buffalo	14	257
Channel catfish	39	399
Flathead catfish	37	18
Bluegill	26	43
Black crappie	50	15
Freshwater drum	52	30

baiting may cost experienced commercial fishermen less than it did us because they are more efficient fishermen, and they buy large quantities of soybean at discounted rates. Soybean cake for this study cost $15.20 per 36 kg (80 lb.) sack.

Size Selection of Gear

Eighteen fish species were chosen to compare gear size selection: walleye, sauger, logperch, freshwater drum, channel catfish, flathead catfish, tadpole madtom, smallmouth buffalo, quillback, shorthead redhorse, carp, emerald shiner, river shiner, bullhead minnow, bluegill, black crappie, white crappie, and largemouth bass. These species represent a large proportion of the numbers, biomass, and families of fish caught in the study area. The most important sport and commercial fishes are represented.

Electrofishing was the least size selective of the three fishing gears. The widest range of sizes of fish, 15 mm (emerald shiner) to 831 mm (longnose gar) in total length, was caught electrofishing (Table 34). Lagler (1978) stated that electrofishing is one of the least selective active fishing methods. Hoop nets caught fish from 79 mm (channel catfish) to 673 mm (longnose gar) in total length (Table 35). Fish from 14 mm (freshwater drum) to 605 mm (longnose gar) were seined (Table 36). Compared to electrofishing, hoop netting was more effective for catching large individuals and seining was more effective for catching small fish (Tables 38-42). Average lengths of fish of all species caught in each gear were 64 mm for seining, 179 mm for electrofishing, and 273 mm for hoop netting. Two exceptions to this general pattern were found: the mean length of carp was greater in electrofishing catches than in hoop nets and the average length of emerald shiners was smaller in electrofishing catches than seine hauls. No explanation for these two exceptions were apparent.

Average sizes of smallmouth buffalo, freshwater drum, channel catfish, flathead catfish, bluegill, black crappie, and white crappie were similar to those found by Starrett and Barnickol (1955) in hoop nets of similar mesh size in the Mississippi River. Mean lengths found by Starrett and Barnickol usually differed by less than 50 mm from mean lengths found in this study. Carp were an exception. The average length of carp caught in hoop nets during this study was 150 mm shorter than those caught by Starrett and Barnickol. The smaller size of carp in this study may have been the result of some combination of increased fishing pressure on carp since the 1950's, differences in sample sizes, or differences in year class strength of carp between the 1950's and 1978. Since commercial fishing pressure on carp in Pool 13 has increased over the past 25 years (Rasmussen 1979), large carp may now be less abun-

TABLE 38. Length frequency distributions of bluegill, black crappie, white crappie, and largemouth bass captured by A.C. electrofishing, hoop netting, and seining in all four months.

Length	Bluegill			Black crappie			White crappie			Largemouth bass	
range (mm)	AC	Hoop net	Seine	AC	Hoop net	Seine	AC	Hoop net	Seine	AC	Seine
21-40	24		62			3			7		
41-60	38		11	1		7			1	1	
61-80	20			4		4				2	1
81-100	94		1	2			1			15	
101-120	134	9	14	3	1	1	2			6	
121-140	79	13	2	36	34	4		2		5	
141-160	30	13	3	15	14	1		4		2	
161-180	38	29	1	10	5		7	14		10	
181-200	7	3		3	5	1	6	8	1	5	1
201-220	1	1		7	3		2	2	1	3	
221-240				1	3	1	4	3		2	
241-260				1				2	1	1	
261-280								4		1	
281-300										2	
301-320										2	
321-340										2	
341-360										1	
Mean length	107.9	153.7	54.4	145.9	151.6	87.1	182.7	190.7	82.5	195.4	126.5
Stand. dev.	36.49	24.49	36.86	36.53	29.62	56.31	35.95	35.58	88.20	74.95	85.56
Sample size	465	68	94	83	65	22	22	39	11	60	2

TABLE 39. Length frequency distributions of walleye, sauger, and freshwater drum captured by A.C. electrofishing, hoop netting, and seining in all four months.

Length	Walleye			Sauger			Freshwater drum		
range(mm)	AC	Hoop net	Seine	AC	Hoop net	Seine	AC	Hoop net	Seine
0-20									10
21-40						1			31
41-60						2	2		15
61-80							16		14
81-100						2	21		7
101-120				8		2	26		
121-140				5		3	78	2	1
141-160				7		2	121	5	
161-180	3			27		3	64	4	
181-200	1		1	30	1		17	8	
201-220	3			45		4	25	11	
221-240	7		1	46		3	35	13	
241-260	10			30		1	27	14	
261-280	5		2	15		1	14	15	
281-300	5			8	2	1	11	3	
301-320	1			5	3		5	6	
321-340	2				2		2		1
341-360	2			1	2			1	
361-380	2	1			3				
381-400	2	1	1		1		1	1	
401-420	1			1					
421-440									
441-460	1			1					
461-480				1	1				
Mean length	274.4	279.0	272.0	218.2	342.1	165.8	168.4	235.2	48.3
Stand. dev.	63.81	11.31	77.40	50.61	67.36	71.16	54.82	49.29	40.32
Sample size	45	2	5	230	15	25	465	83	79

TABLE 40. Length frequency distributions of channel catfish, flathead catfish, and tadpole madtoms captured by A.C. electrofishing, hoop netting, and seining in all four months.

Length range (mm)	Channel catfish AC	Channel catfish Hoop net	Channel catfish Seine	Flathead catfish AC	Flathead catfish Hoop net	Tadpole madtom Seine
21-40			3			18
41-60			9			8
61-80	1	1	2			2
81-100				2		
101-120	2	1				
121-140			1			
141-160	2	1				
161-180	3		1			
181-200	2	3		1	2	
201-220	2	27			3	
221-240	1	82			4	
241-260	3	78		1	3	
261-280	5	100		1	8	
281-300	6	86		1	5	
301-320	2	35		1	6	
321-340	3	15			8	
341-360	1	5			6	
361-380	1	2		1	2	
381-400		1			2	
401-420					2	
421-440		1			3	
441-460						
461-480	1					
481-500					1	
501-520						
521-540						
541-560	1					
Mean length	262.2	265.4	61.3	229.4	311.7	39.5
Stand. dev.	94.66	35.94	35.99	102.89	68.35	9.42
Sample size	37	438	16	8	55	28

TABLE 41. Length frequency distributions of carp, smallmouth buffalo, quillback, and shorthead redhorse captured by A.C. electrofishing, hoop netting, and seining in all four months.

Length	Carp			Smallmouth buffalo			Quillback	Shorthead redhorse		
range (mm)	AC	Hoop net	Seine	AC	Hoop net	Seine	AC	AC	Hoop net	Seine
1-50										
51-100								1		
101-150				3			4	11		
151-200				2			18	26		1
201-250	3	1		8	2	1	18	34		2
251-300	9	2		15	75		31	45	1	
301-350	17	14		16	128		41	9	4	1
351-400	15			7	51		8	26	3	1
401-450	83	2	1	1	9		2	20	2	
451-500	90	7		1				3	1	
501-550	33	4								
551-600	19	2			3					
601-650	2	2								
651-700										
701-750	1									
Mean length	452.6	403.8	411.0	291.1	325.4	225.0	273.1	276.9	360.7	259.6
Stand. dev.	72.33	113.56	0.0	70.97	41.57	0.0	67.59	91.86	53.60	90.46
Sample size	272	34	1	53	268	1	122	173	11	5

TABLE 42. Length frequency distributions of emerald shiners, river shiners, bullhead minnows, and logperch captured by A.C. electrofishing and seining in all four months.

Length range (mm)	Emerald shiner		River shiner		Bullhead minnow		Logperch	
	AC	Seine	AC	Seine	AC	Seine	AC	Seine
11-15	1							
16-20								
21-25	1					1		
26-30	2	3	1	2		2		
31-35	70	7	3	8		3		
36-40	240		5	8	2	4		
41-45	191	8	5	20	6	6		
46-50	63	3	11	24	7	15		1
51-55	20	3	14	16	13	14		5
56-60	16	2	27	6	7	6	7	2
61-65	20	2	34	3	3		2	2
66-70	14	6	29	1	2	1	3	
71-75	4		7	2	1		2	
76-80	3		1					
81-85	6							1
86-90			1					
91-95								
96-100	2						1	
Mean length	43.1	47.9	51.2	46.9	52.9	47.4	65.0	58.0
Stand. dev.	9.62	11.94	9.50	9.27	7.82	8.83	11.64	9.30
Sample size	653	34	138	90	41	52	15	11

dant. Sample sizes were greater for all species in this study than those of Starrett and Barnickol. Variation in year class strength can result in a difference in mean size of fish in catches; whether such a difference occurred for carp in these two studies is not known.

Length-weight Relationships

G.M. functional regressions describing length-weight relationships ($\ln W = \ln a + b \ln TL$) were calculated for each fish species for which 20 or more individuals were caught in each sampling month (Tables 43-45). Ricker (1973) explained that G.M. functional regressions are more suitable than ordinary predictive regressions for describing the length-weight relationship.

In this study, coefficients of least squares length-weight regressions were similar to coefficients reported in the literature. Slopes and intercepts of regression lines were average compared to ranges found in Carlander (1969, 1977) for carp, river carpsucker, smallmouth buffalo, shorthead redhorse, channel catfish, flathead catfish, bluegill, largemouth bass, and white and black crappie. Slopes and intercepts in this study also resembled coefficients of regressions reported by Greenbank (1950), Andersen (1972), Meyer (1962), Buchholz (1957), Wynes (1976), Carter (1968), Vasey (1967), Eberley (1975), and Bur (1976) for carp, shorthead redhorse, river carp-

TABLE 43. Length-weight relationships and correlation coefficients (r) for carp, river carpsucker, quillback, smallmouth buffalo, and shorthead redhorse in Pool 13, Upper Mississippi River.

Species	Number of fish	Least squares regression	r	GM functional regression
Carp **				
June 1978	38	ln W = -9.80 + 2.77 ln TL	.993	ln W = -9.93 + 2.79 ln TL
August 1978	99	ln W = -9.96 + 2.79 ln TL	.993	ln W = -10.05 + 2.81 ln TL
October 1978	125	ln W = -10.18 + 2.84 ln TL	.968	ln W = -10.75 + 2.94 ln TL
June 1979	44	ln W = -9.20 + 2.68 ln TL	.978	ln W = -9.57 + 2.74 ln TL
River Carpsucker				
June 1979	25	ln W = -10.80 + 2.94 ln TL	.978	ln W = -11.18 + 3.00 ln TL
Quillback				
June 1978	29	ln W = -10.72 + 2.90 ln TL	.995	ln W = -10.80 + 2.91 ln TL
August 1978	25	ln W = -10.80 + 2.91 ln TL	.996	ln W = -10.84 + 2.92 ln TL
October 1978	25	ln W = -11.33 + 3.01 ln TL	.995	ln W = -11.44 + 3.03 ln TL
June 1979	42	ln W = -11.22 + 2.99 ln TL	.987	ln W = -11.44 + 3.03 ln TL
All months combined	121	ln W = -10.96 + 2.94 ln TL	.994	ln W = -11.05 + 2.96 ln TL
Smallmouth Buffalo **				
June 1978	30	ln W = -10.09 + 2.81 ln TL	.975	ln W = -10.50 + 2.88 ln TL
August 1978	75	ln W = -9.80 + 2.77 ln TL	.961	ln W = -10.42 + 2.88 ln TL
October 1978	144	ln W = -10.63 + 2.91 ln TL	.976	ln W = -11.01 + 2.98 ln TL
June 1979	71	ln W = -10.96 + 2.98 ln TL	.971	ln W = -11.47 + 3.06 ln TL
Shorthead Redhorse **				
June 1978	50	ln W = -10.88 + 2.89 ln TL	.998	ln W = -10.89 + 2.90 ln TL
August 1978	52	ln W = -11.38 + 3.00 ln TL	.995	ln W = -11.47 + 3.01 ln TL
October 1978	42	ln W = -12.00 + 3.11 ln TL	.997	ln W = -12.08 + 3.12 ln TL
June 1979	39	ln W = -10.18 + 2.79 ln TL	.961	ln W = -10.84 + 2.90 ln TL

* Significant difference between monthly least squares regressions at 95% confidence level.
** Significant difference between monthly least squares regressions at 99% confidence level.

TABLE 44. Length-weight relationships and correlation coefficients (r) for channel catfish, flathead catfish, bluegill, largemouth bass, white crappie, and black crappie in Pool 13, Upper Mississippi River.

Species	Number of fish	Least squares regression	r	GM functional regression
Channel Catfish *				
June 1978	66	$\ln W = -12.17 + 3.08 \ln TL$	.982	$\ln W = -12.50 + 3.14 \ln TL$
August 1978	125	$\ln W = -11.41 + 2.94 \ln TL$	.983	$\ln W = -11.68 + 2.99 \ln TL$
October 1978	254	$\ln W = -12.26 + 3.09 \ln TL$	.982	$\ln W = -12.57 + 3.15 \ln TL$
June 1979	28	$\ln W = -12.38 + 3.12 \ln TL$	.953	$\ln W = -13.24 + 3.28 \ln TL$
Flathead Catfish *				
June 1978	27	$\ln W = -13.98 + 3.44 \ln TL$	.986	$\ln W = -14.27 + 3.49 \ln TL$
August 1978	20	$\ln W = -11.34 + 2.97 \ln TL$	.983	$\ln W = -11.63 + 3.02 \ln TL$
Bluegill **				
August 1978	422	$\ln W = -11.42 + 3.15 \ln TL$	.985	$\ln W = -11.64 + 3.20 \ln TL$
October 1978	24	$\ln W = -10.30 + 2.92 \ln TL$	.993	$\ln W = -10.41 + 2.94 \ln TL$
Largemouth Bass				
August 1978	48	$\ln W = -11.30 + 3.03 \ln TL$	.996	$\ln W = -11.35 + 3.04 \ln TL$
White Crappie				
August 1978	50	$\ln W = -12.22 + 3.19 \ln TL$	.992	$\ln W = -12.35 + 3.22 \ln TL$
Black Crappie				
August 1978	111	$\ln W = -12.38 + 3.26 \ln TL$	.974	$\ln W = -12.80 + 3.35 \ln TL$

* Significant difference between monthly least squares regressions at 95% confidence level.
** Significant difference between monthly least squares regressions at 99% confidence level.

TABLE 45. Length-weight relationships and correlation coefficients (r) for sauger, walleye, and freshwater drum in Pool 13, Upper Mississippi River.

Species	Number of fish	Least squares regression	r	GM functional regression
Sauger				
June 1978	50	ln W = -12.51 + 3.12 ln TL	.988	ln W = -12.71 + 3.16 ln TL
August 1978	82	ln W = -11.90 + 3.01 ln TL	.979	ln W = -12.26 + 3.07 ln TL
October 1978	88	ln W = -13.02 + 3.22 ln TL	.996	ln W = -13.09 + 3.23 ln TL
June 1979	23	ln W = -11.55 + 2.95 ln TL	.967	ln W = -12.09 + 3.05 ln TL
All months combined	243	ln W = -12.26 + 3.08 ln TL	.983	ln W = -12.54 + 3.13 ln TL
Walleye				
October 1978	22	ln W = -12.97 + 3.22 ln TL	.991	ln W = -13.13 + 3.25 ln TL
Freshwater Drum *				
June 1978	61	ln W = -11.35 + 3.01 ln TL	.990	ln W = -11.51 + 3.04 ln TL
August 1978	87	ln W = -12.05 + 3.13 ln TL	.983	ln W = -12.30 + 3.18 ln TL
October 1978	363	ln W = -11.96 + 3.13 ln TL	.989	ln W = -12.14 + 3.16 ln TL
June 1979	31	ln W = -12.22 + 3.18 ln TL	.996	ln W = -12.29 + 3.19 ln TL

* Significant difference between monthly least squares regressions at 95% confidence level.
** Significant difference between monthly least squares regressions at 99% confidence level.

sucker, bluegill, largemouth bass, white and black crappie, sauger, and walleye in the Upper Mississippi and Des Moines Rivers.

Differences between monthly length-weight regressions for each species were tested by analysis of covariance (LeCren 1951; Li 1969) with adjusted mean intercepts. Carp, smallmouth buffalo, shorthead redhorse, channel catfish, flathead catfish, bluegill, and freshwater drum length-weight relationships changed significantly ($p=.025$) from sampling month to month but quillback and sauger length-weight relationships did not seem to change (Tables 43-45). Carp and shorthead redhorse conditions were lowest in June, shortly after spawning, and increased from June to August to October during the growing season. Channel catfish and flathead catfish condition decreased between June and August, possibly because spawning occurred. Small sample sizes may also have contributed to monthly differences in length-weight relationships since no biological reasons were apparent for changes in smallmouth buffalo, bluegill, and freshwater drum condition.

Age and Growth

Bluegill, black crappie, sauger, freshwater drum, and channel catfish were species selected for age and growth analysis because of their abundance at emergent wing dams or importance to commercial and sport fisheries.

Freshwater drum and bluegill were chosen because of their abundance in emergent wing dam catches during August and October. Sauger, bluegill, and black crappie have been the most important game fish and panfish in the sport fishery (Greenbank 1950b; Fleener 1975; Wright 1970; Ackerman 1976). Channel catfish and freshwater drum are important components of both commercial and sport fisheries (Rasmussen 1979; Fleener 1975; Barnickol and Starrett 1951).

The areas that I sampled contained primarily young fish of the five selected species. Age I and II bluegill, age I black crappie, age I sauger, and age 0, I, and II freshwater drum were abundant in pre-notching catches (Tables 46-49, Appendices M-P). Age II and III channel catfish were also estimated to be abundant in the catches (Table 50). No bluegill, black crappie, or sauger older than age IV, and only one freshwater drum and channel catfish older than IV were caught. Similarly, Jergens and Childers (1959) reported no sauger older than age IV in a sample of 267 sauger from Pools 13, 14, 15, and 19. Christenson and Smith (1965) found few fish older than five years of age in three Upper Mississippi River back waters. Heavy commercial fishing pressure may be removing a substantial proportion of older channel catfish from the river (Gengerke and Beck 1978; Helms 1975; Schoumacher 1965). Other investigators (Butler and Smith 1949; Vasey

TABLE 46. Growth rates and backcalculated mean lengths (mm) at each annulus for bluegill in Pool 13, Upper Mississippi River.

Year class	Sample size	Calculated mean length at each annulus 1	2	3	4
1977	130	66.0			
1976	88	57.5	129.0		
1975	5	52.9	118.1	162.5	
1974	3	40.9	94.1	131.9	167.0
Column means		54.3	113.7	147.2	167.0
Stand. dev.		10.5	17.8	21.6	0.0
Increment		54.3	59.4	33.4	19.8
Weighted means		62.1	127.3	151.0	167.0
Stand. dev.		5.0	6.5	15.8	0.1
Increment		62.1	65.2	23.7	16.0
		$\bar{G}$ =2.3126	0.5492	0.3245[a]	
		G_x=2.1562	0.7435	0.0886[b]	
		G=2.6005	0.0261	0.7607[c]	

[a] $\bar{G}$ is the mean growth rate based on column means.
[b] G_x is the population growth rate based on growth from one year class to the next.
[c] G is the true growth rate based on growth between the last two calculated mean lengths for each year class.

TABLE 47. Growth rates and backcalculated mean lengths (mm) at each annulus for black crappie in Pool 13, Upper Mississippi River.

Year class	Sample size	Calculated mean length at each annulus 1	2	3	4
1977	84	95.1			
1976	12	81.5	152.5		
1975	8	66.0	131.7	181.3	
1974	2	46.0	100.3	158.3	187.9
Column means		72.1	128.1	169.8	187.9
Stand. dev.		21.1	26.3	16.2	0.0
Increment		72.1	56.0	41.6	18.1
Weighted means		90.4	140.2	176.7	187.9
Stand. dev.		10.5	16.3	9.7	0.2
Increment		90.4	49.7	36.5	11.2
		$\bar{G}$ =1.3236	0.6991	0.1853[a]	
		G_x=1.4260	0.5226	0.1078[b]	
		G =1.8909	0.9651	0.5171[c]	

[a] $\bar{G}$ is the mean growth rate based on column means.
[b] G_x is the population growth rate based on growth from one year class to the next.
[c] G is the true growth rate based on growth between the last two calculated mean lengths for each year class.

TABLE 48. Growth rates and backcalculated mean lengths (mm) at each annulus for sauger in Pool 13, Upper Mississippi River.

Year class	Sample size	Calculated mean length at each annulus 1	2	3	4
1977	125	163.9			
1976	24	148.3	240.0		
1975	7	141.9	264.3	332.4	
1974	1	144.0	224.6	258.5	281.8
Column means		149.5	243.0	295.4	281.8
Stand. dev.		9.9	20.0	52.3	0.0
Increment		149.5	93.4	52.5	-13.6
Weighted means		160.4	244.9	323.2	281.8
Stand. dev.		7.0	10.8	26.1	281.8
Increment		160.4	84.4	78.3	-41.3
		$\bar{G}$ =1.3527	0.8874	-.4377[a]	
		G_x=1.2202	1.0411	-.5279[b]	
		G=1.5409	0.7337	0.2762[c]	

[a] $\bar{G}$ is the mean growth rate based on column means.
[b] G_x is the population growth rate based on growth from one year class to the next.
[c] G is the true growth rate based on growth between the last two calculated mean lengths for each year class.

TABLE 49. Growth rates and backcalculated mean lengths (mm) at each annulus for freshwater drum in Pool 13, Upper Mississippi River.

Year class	Sample size	Calculated mean length at each annulus 1	2	3	4	5	6
1977	90	145.5					
1976	63	120.3	211.2				
1975	12	117.7	194.0	245.2			
1974	4	120.7	190.4	262.7	301.5		
1972	1	160.5	123.5	278.8	315.7	344.6	363.0
Column means		132.9	206.8	262.3	308.6	344.6	363.0
Stand. dev.		19.1	18.8	16.8	10.0	0.0	0.0
Increment		132.9	73.8	55.5	46.3	36.0	18.4
Weighted means		133.7	207.8	251.3	304.4	344.6	363.0
Stand. dev.		12.9	7.8	10.4	6.3	344.6	363.0
Increment		133.7	74.1	43.5	53.1	40.2	18.4
		$\bar{G}$ =1.3974	0.6018	0.6068	0.3934	0.1649[a]	
		G_x=1.1801	0.4730	0.6551	0.0000	0.0000[b]	
		G =1.7823	0.7417	0.4363	0.0000	0.1649[c]	

[a]$\bar{G}$ is the mean growth rate based on column means.
[b]G_x is the population growth rate based on growth from one year class to the next.
[c]G is the true growth rate based on growth between the last two calculated mean lengths for each year class.

TABLE 50. Length-frequency distributions of channel catfish from this study assigned to various year classes on the basis of age and length-frequency information collected by John Pitlo, Iowa Conservation Commission. Channel catfish from my study were caught in June, August, and October 1978.

Length range (mm)	Number of fish	1977	1976	Year class 1975	1974	1973
106-130	1	1				
131-155	1	1				
156-180	0					
181-205	7	5	2			
206-230	64	17	45	2		
231-255	98		87	11		
256-280	121		47	74		
281-305	95			90	5	
306-330	36			31	5	
331-355	8			3	5	
356-380	4				4	
381-405	1				1	
406-430	1					1
Total number in each year class	437	24	181	211	20	1
Mean length of each year class (mm)		206	243	285	332	418

1967; Carter 1968) have reported finding more older age classes of freshwater drum and sauger in catches from the Upper Mississippi River.

The small number of scale samples that I was unable to age did not affect the conclusion that fish older than age IV were generally absent in the catches. Scale samples from 3 bluegill, 3 black crappie, 2 sauger, and 1 freshwater drum were discarded because of disagreement between workers over the number of annuli present. Only one of these fish, a sauger, may have been older than IV years old. Totals of 234 bluegill, 108 black crappie, 174 sauger, and 335 freshwater drum were aged from scale samples. Six scale samples were not aged because scale regeneration was apparent.

Length-frequency distributions (Weatherley 1972; Everhart et al. 1975) and the work of other investigators (Sprugel 1954; Carlander 1950; Erickson 1952; Regier 1962; Butler and Smith 1949) supported the validity of the scale method for aging bluegill, black crappie, sauger, and freshwater drum. The first two peaks in length-frequency histograms for bluegill, black crappie, and sauger (Figures 11-12) corresponded to modal length ranges for ages 0 and I (Appendices M-O). Growth of young-of-the-year freshwater drum from June to August to October 1978 was also evident in length-frequency histograms (Figure 13). Because scale samples were taken throughout the 1978 growing season,

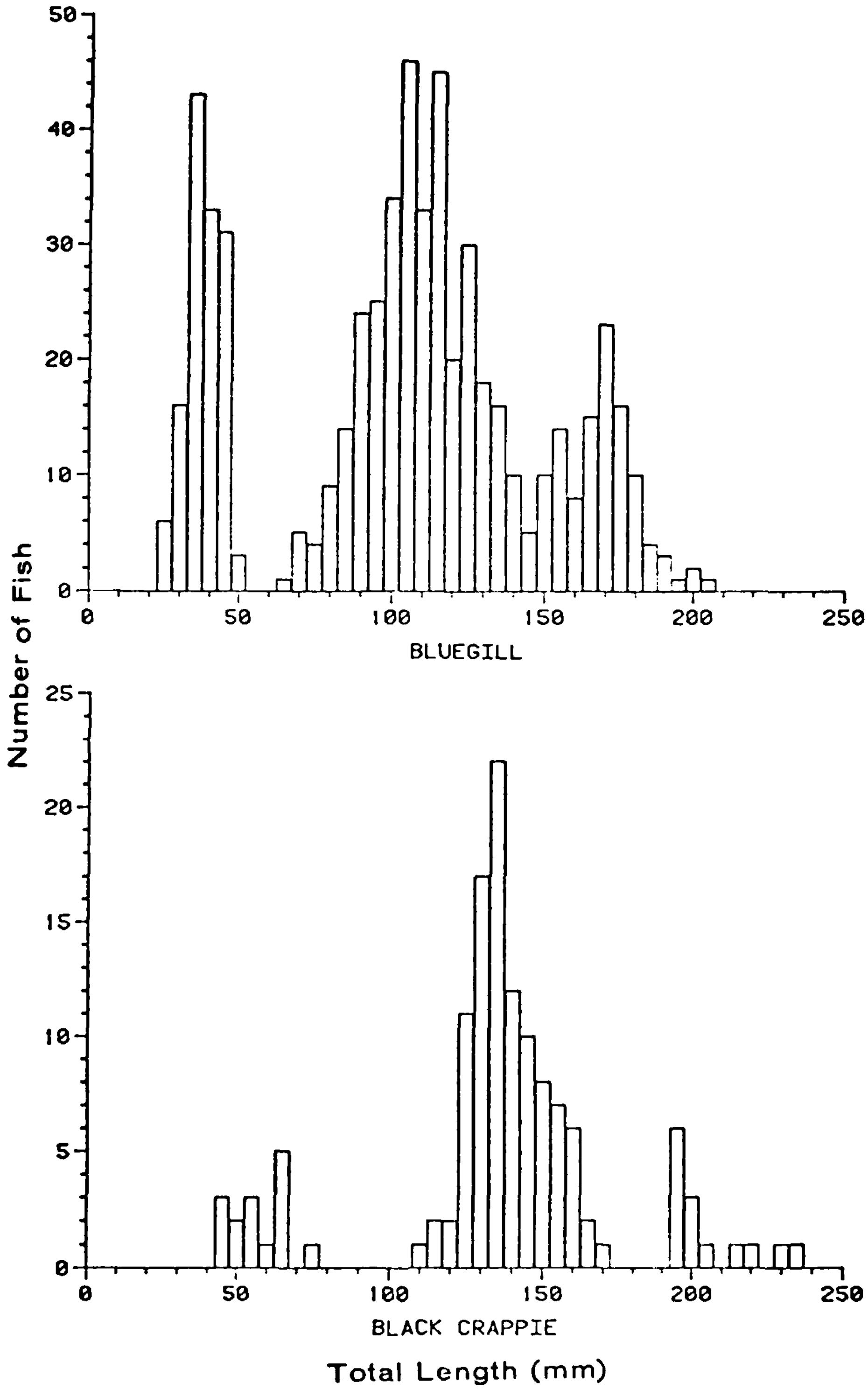

FIGURE 11. Length-frequency histograms for bluegill and black crappie caught in August 1978.

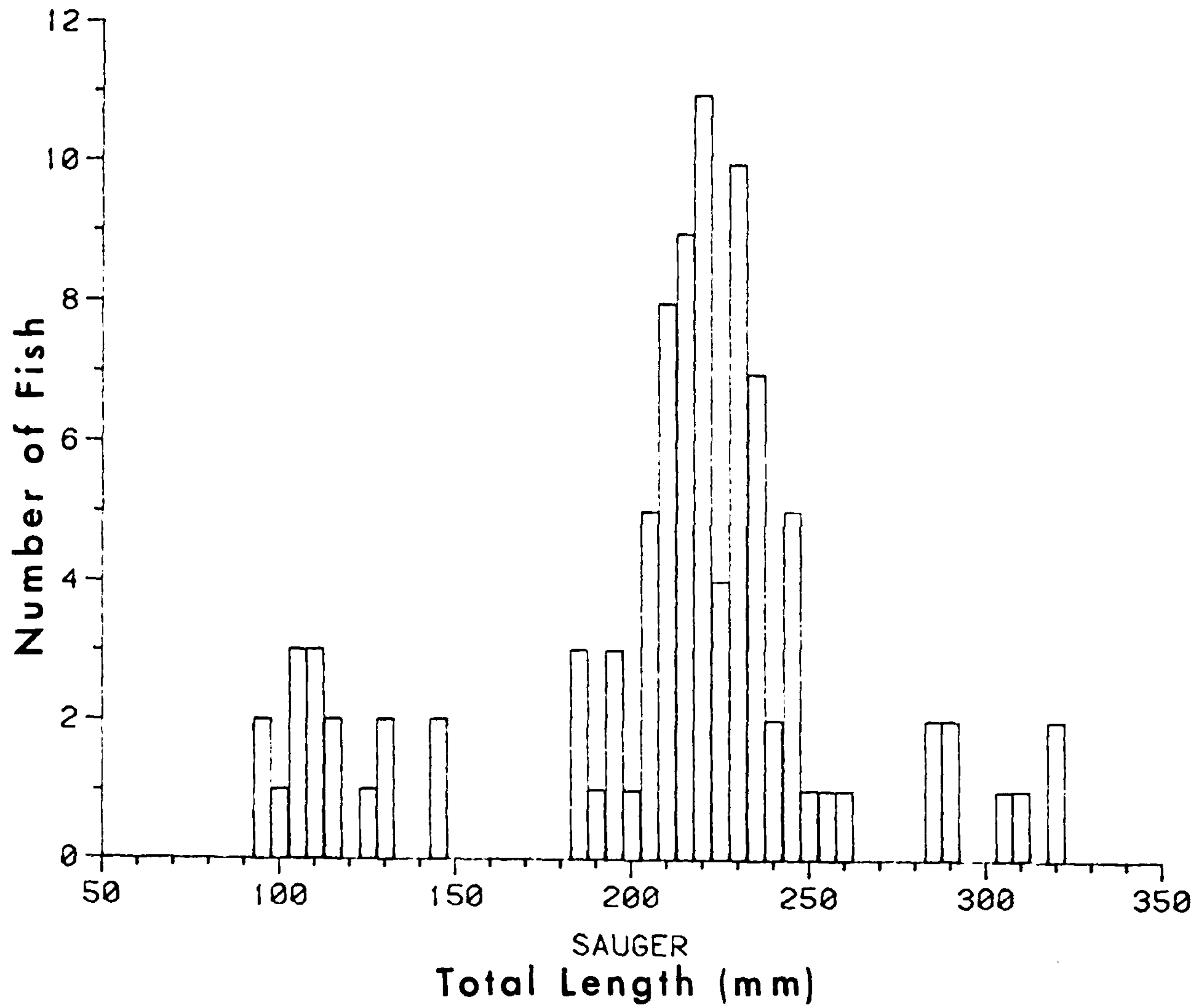

FIGURE 12. Length-frequency histogram for sauger caught in August 1978.

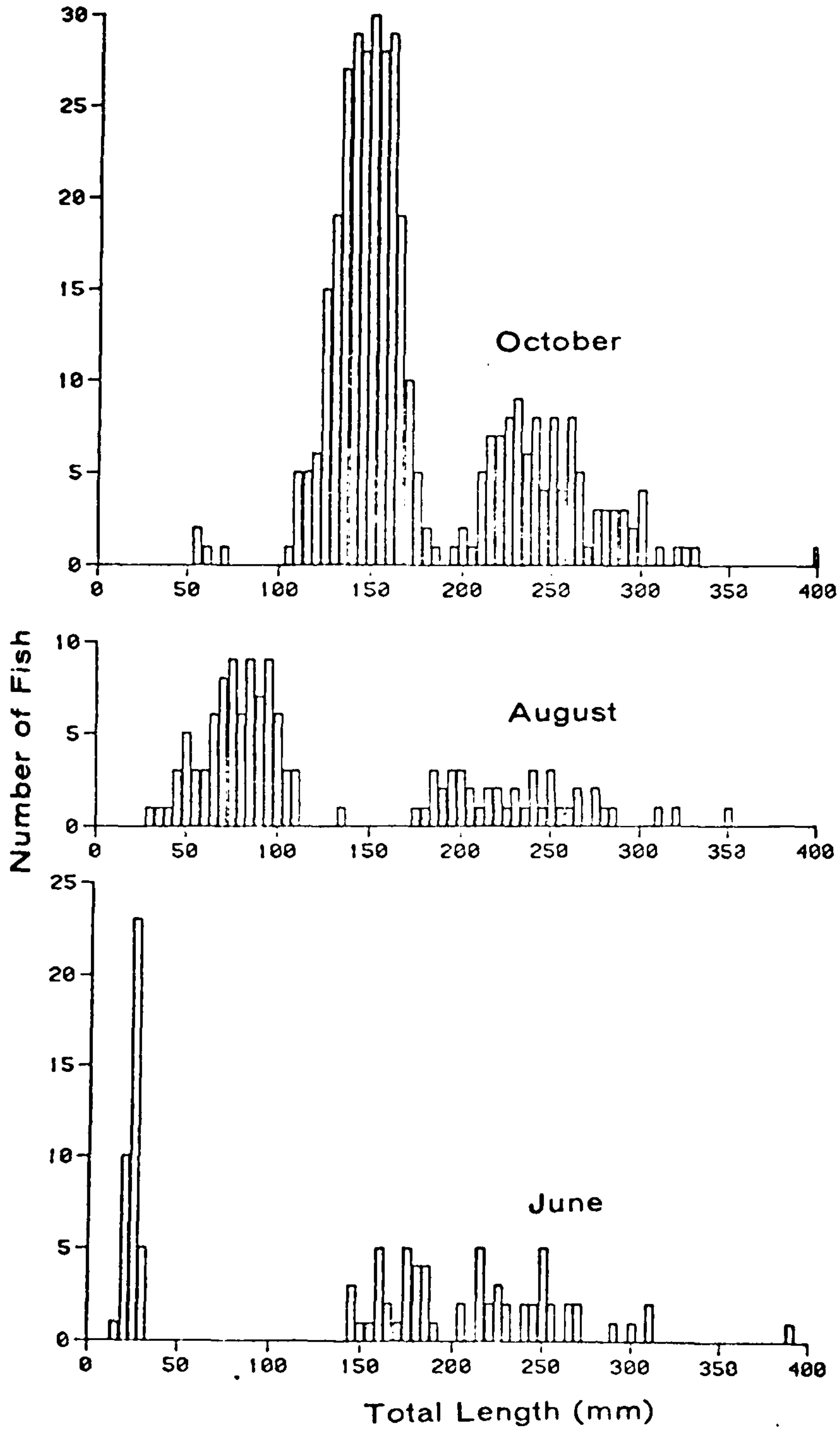

FIGURE 13. Length-frequency histograms for freshwater drum caught in June, August, and October 1978.

length-frequency distribution by year class showed much overlap of older year classes.

Growth of the youngest age group may have been overestimated because of gear selection. Sampling methods tend to catch the fastest growing or earliest hatching individuals in younger age groups (Carlander 1974). Most of the fish aged were caught electrofishing, and electrofishing tended to select for intermediate sized fish. Lee's phenomenon was evident in bluegill and black crappie backcalculated lengths since backcalculated mean lengths at each annulus were consistently smaller with increasing age of the fish from which scales were collected (Tables 46-47). Biased sampling or size selective mortality or both (Ricker 1969; Bagenal and Tesch 1978) were the most likely causes of Lee's phenomenon in this study.

Bluegill, black crappie, sauger, and freshwater drum grew more slowly beyond age II than those species in several other studies on the Upper Mississippi River (Christenson and Smith 1965; Butler and Smith 1949; Vasey 1967; Jergens and Childers 1959; and Carter 1968). In contrast, bluegill growth to age III was greater than found by Wynes (1976) for bluegill in the Mississippi River near LaCrosse, Wisconsin. Bluegill grew slightly faster than average for Ohio, Indiana, Illinois, and Iowa waters combined, and black crappie grew slower than average for northern waters (Carlander 1977).

Body-scale relationships appeared to be linear. The following G.M. functional regressions represented the body-scale relationships:

bluegill	TL = 18.283 + .985 SL,
black crappie	TL = 25.544 + 1.075 SL,
sauger	TL = 40.153 + 2.120 SL,
freshwater drum	TL = 23.714 + 1.315 SL.

Correlation coefficients (r) for the body-scale regressions were .977 for bluegill, .964 for black crappie, .973 for sauger, and for freshwater drum, .982.

Mortality

Annual mortality rates calculated from the slopes of catch curves (Ricker 1975) ranged from 62 to 82%. Total annual mortality was 82% for bluegill af ages II through IV, 69% for black crappie of ages I through IV, 79% for sauger from age I to IV, and 62% for freshwater drum of ages I to VI caught hoop netting and shocking (Appendices Q-T). Bluegill, black crappie, and freshwater drum mortality rates were within the ranges of mortalities listed by Carlander (1977), and Butler (1965) for freshwater drum in the Upper Mississippi River. Ricker (1949) found annual mortality rates of 26 to 60% for unexploited sauger populations, and Hackney and Holbrook (1978) estimated sauger annual mortality rate to be 88% in seven Tennessee and Cumberland River impoundments. Hoop netting and shocking catches were combined to include fish from both shallow and deep water habitats for mortality estimates. Age groups used to calculate mortality were susceptible to both gears.

Discharge

Discharge is a dominant factor in any river environment; it influences river stage (depth), current velocity, sediment loading, turbidity, and erosion (Leopold 1962; Hynes 1970; Beaumont 1975; Simons et al. 1975; Maddock 1972) as well as catches of fish (Table 18) and aquatic benthic macroinvertebrate populations (Hall 1980). Discharge in Pool 13 varied from month to month and year to year. Monthly mean discharges throughout 1978 and early 1979 fluctuated widely with the lowest discharges occurring during winter (Table 51). Annual mean discharges from 1970 through 1979 ranged from 770 to 1855 m^3 sec^{-1}. Although the 1978 annual mean discharge was similar to the average for the decade, 1320 and 1355 m^3 sec^{-1}, respectively, the pattern during 1978 was not typical. The maximum discharge occurred in July instead of earlier in spring. The 1740 m^3 sec^{-1} annual mean discharge for 1979 was considerably higher than average for the past ten years.

Hydrographic Relief

No substantial accumulation of sediments in the main

TABLE 51. Mean monthly discharges from Lock and Dam No. 12 during 1978 and early 1979 (courtesy of the Rock Island District Corps of Engineers).

Month	Mean monthly discharge	
	$m^3\ sec^{-1}$	$ft^3\ sec^{-1}$
1978		
January	920	32,400
February	680	24,100
March	990	34,900
April	2620	92,500
May	1670	58,800
June	1790	63,200
July	2670	94,200
August	1290	45,400
September	1780	63,000
October	1130	39,900
November	910	32,100
December	710	25,100
1979		
January	620	22,000
February	680	24,000
March	1870	66,000
April	3860	136,300
May	3840	135,700
June	2280	80,500
July	1840	65,000

channel border between 1976 and 1979 was evident. Although depths varied according to river stage, my comparison of depths found throughout the main channel border with soundings recorded on a 1976 Army Corps of Engineers' map of the study area revealed no accumulation of sediments. Current passing over submerged dams and over emergent dams during river stages higher than 2.1 m must have helped prevent sedimentation in the main channel border area between wing dams. Submerged wing dams and emergent wing dams during high flows were similar to sills in the Missouri River (Wolfender 1980) because current swept over the dams. Sediment build up does not occur below sills.

Deep scour holes were not apparent immediately downstream from submerged wing dams although they were present at the distal ends of emergent wing dams 26 and 28. The maximum depth recorded, 11.7 m, was found in the outside transect at wing dam 28.

Depth near the tallest wing dams was shallower than near submerged dams. Depth near submerged wing dams was usually greater than 2.6 m (Appendix W). The river bed between emergent wing dams 26 and 28 was often only about 1.5 m under water.

Portions of some wing dams had either eroded away or had been covered with sand. Examples were the inside transects at wing dams 25 and 29 (Appendix V), which we were only able to locate by a combination of techniques including "feeling" the substrate for rocks with a grappling hook and sonar depth observations. In most of the other hydrographic relief figures (Apendices U-X), the crest of the wing dam is visible as a small peak or mound near the center of each figure. The peaks appear small because the scale was small, and transects were 67 m long but the wing dams were seldom taller than 2.2 m.

The depth of the wing dams under water (Appendices U-X) fluctuated with river stage. River stages ranged from 2.9 to 3.0 meters in June 1978, 2.3 to 2.6 meters in August, 1.9 to 2.2 meters in October, and 2.9 to 3.1 meters in June 1979 during periods when depths were recorded along hydrographic relief transects. Current swept over all of the wing dams when the river was higher than 2.1 meters. The crests of wing dams 26 and 28, the tallest wing dams, were a minimum of 0.9 meters below the water surface in June 1979 but emerged as much as 0.5 meters in October. Submerged wing dams 25, 29, 30, and 31 were never closer than 1.1 meters to the water surface.

Although hydrographic relief transects were difficult to duplicate precisely, I believe the bottom relief figures (Appendices U-X) provide an adequate picture of bottom contours in the study area. Transects were difficult to duplicate because of limitation of accuracy of the range finder in measuring distances from shore. Range finder measurements varied an average of 1.4 meters at distances of 64 and 110 meters, resulting in 1.3 to 2.2% error.

Since the wing dams were as much as 300 meters long and the notches as wide as 90 meters, measurement errors of a few meters should not lead to false conclusions concerning the effects of notching.

Water Temperature and Dissolved Oxygen

Water temperature and dissolved oxygen concentrations were similar from site to site and from top to bottom in the water column in each sampling month (Appendices Y-FF). The maximum temperature difference found between sites in a sampling month was 1.9^{o}C in August. Temperatures varied less than 1^{o}C in the water column. The maximum difference in oxygen concentration usually was less than 1.5 mg l^{-1}. Water in a river channel rarely stratifies because of turbulence (Welcomme 1979).

Water temperature and dissolved oxygen concentration followed normal seasonal fluctuations (Figure 14) that have been described for the Mississippi River (Dorris et al. 1963). Temperatures ranged from 15.1^{o}C in October to 24^{o}C in August and dissolved oxygen levels ranged from a low of 5.2 mg l^{-1} in June 1978 to 8.5 mg l^{-1} in October. Dissolved oxygen concentration was lowest in June of both years because of high water temperature and possibly also, turbidity from high discharges. Secchi disc transparency was as low as 0.1 m in June 1978. Delfino (1977) and Hynes (1970) related low oxygen levels to high temperature

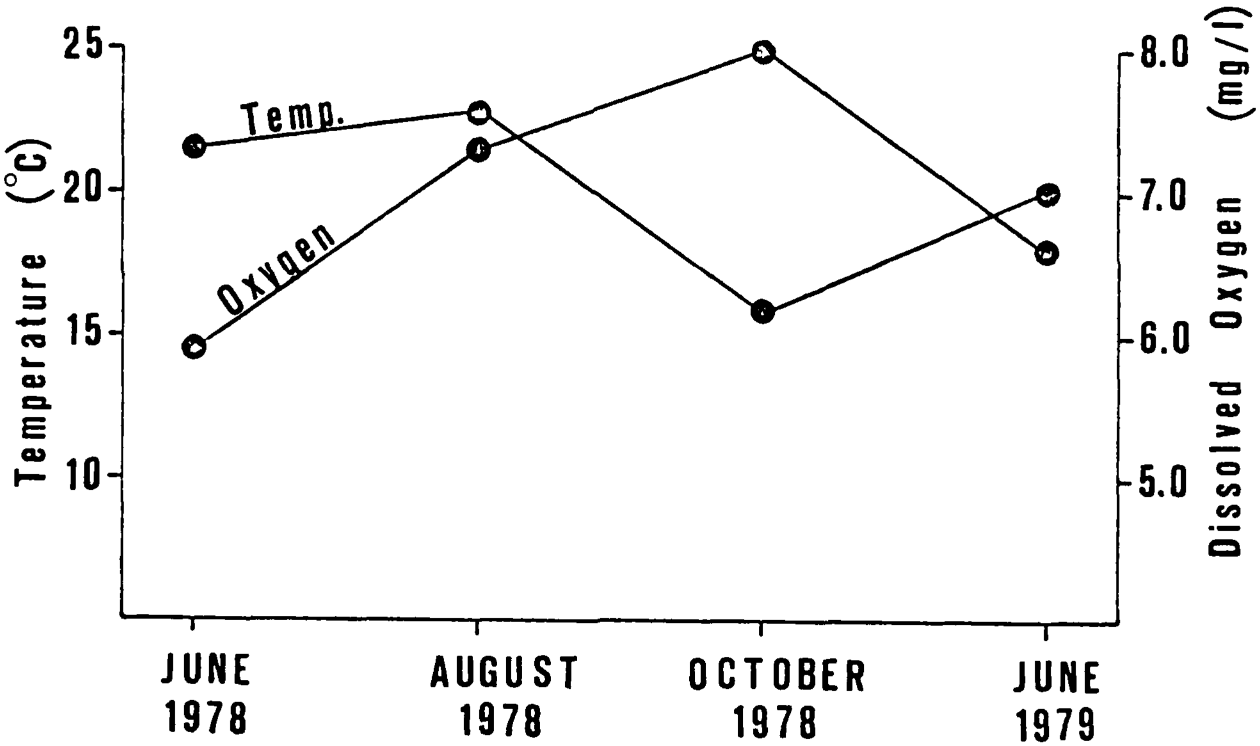

FIGURE 14. Mean water temperatures and dissolved oxygen concentrations in each month.

and large amounts of suspended sediments and biological oxygen demand during high spring discharges. Dissolved oxygen levels increased during low discharges in August and October. Dorris et al. (1963) reported that low stream discharge in the Mississippi River was accompanied by increased levels of oxygen and photosynthetic production.

Since dissolved oxygen concentrations were greater than 5.0 mg l^{-1}, it appeared that oxygen levels were adequate for fish (EPA 1973, Whitmore et al. 1960). However, dissolved oxygen concentration was not measured at night when levels might have been lower.

Current Velocity

Current velocity varied according to river stage. Current velocities along hydrographic relief transects in the side channel ranged from 0 to 77 cm sec^{-1} and in the main channel border near the wing dams, from 5 to 96 cm sec^{-1} (Appendices GG-JJ). Mean velocities (Leopold et al. 1964) at each wing dam and in the side channel (Table 52) were significantly higher in June of both years, when water level was highest, than in August or October (paired t-tests; 5 and 6 d.f.; $p=.025$). Mean velocity was also significantly higher in August than in October, when the water level was lowest. Mean wing dam and side channel velocities were significantly correlated ($p=.05$; $r=.986$ and $.984$) with river stage (Appendix HH). Natural

TABLE 52. Mean (at 0.6 of depth) and standard deviation (SD) of current velocities measured at each wing dam and the side channel in each month.

Site	Velocity ($cm\ sec^{-1}$)							
	June 1978		August 1978		October 1978		June 1979	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Wing dam 25	61	11	33	6	32	13	51	12
Wing dam 26	54	23	31	13	18	4	-	-
Wing dam 28	42	7	30	8	20	16	39	9
Wing dam 29	64	17	51	15	38	13	54	15
Wing dam 30	68	9	61	6	47	11	67	8
Wing dam 31	66	7	59	7	47	9	66	11
Side channel	43	16	37	14	23	11	45	9

log transformations of mean wing dam and side channel velocities were also significantly correlated with natural log transformations of river stage (p=.05; r=.992 and .980).

Height of wing dams and their position with respect to an upstream bend in the river and to other wing dams influenced current velocity in the study area. Mean velocity was slowest at emergent wing dams and below a bend which deflected the thalweg away from the upper end of the study area. Velocity at emergent wing dams 26 and 28 (Table 52) was significantly lower than at the submerged dams (paired t-tests; 3 and 2 d.f.; p=.025 and .05). Velocity was also significantly higher (paired t-tests; 3 d.f.; p=.025) at submerged dams 30 and 31 at the lower end of the study area than at submerged wing dams 25 and 29 (Figure 1). Velocity at wing dam 25 was lower because the dam was located immediately below the bend, and velocity at wing dam 29 was reduced by emergent wing dam 28. In the side channel, current velocity increased from upstream to downstream.

No immediate effect of notching on current velocity in June 1979 was apparent. Although discharge was greater in June 1979 than June 1978, current velocities throughout the water column near the notch in wing dam 28 were slower in 1979 than 1978 (Appendices GG-JJ).

Current velocity generally decreased from top to bottom in the water column (Appendices GG-JJ). Leopold et al.

(1964) and Hynes (1970) stated that velocity decreases logrithmically with increasing depth. In this study, highest velocity was usually near the surface and the lowest, near the river bed. Exceptions to these generalizations may have been caused by turbulence from the wing dams interrupting flow.

Bottom velocity in the main channel border was usually sufficient to transport fine sediment. Fine sand, between .06 and .25 mm in diameter (Cummins 1962), was only present in small amounts in the study area (Hall 1980) because bottom velocity often exceeded the 20 to 30 cm sec^{-1}, which is necessary to move fine sand (Hynes 1970). Bottom velocity at submerged wing dams was generally strong enough to move sand during both high and low river stages. Some of the bottom velocities recorded at emergent wing dams during high river stages were strong enough to move even coarse sand, but at low stages would allow deposition of sand. Patches of silt and clay were also present in the study area because compacted clay is less readily carried off than sand (Hynes 1970).

Bottom velocity in the side channel was usually sufficient to move fine sand up to .25 mm in diameter, and during higher river stages it was often sufficient to move coarse sand up to 1 mm diameter. Mean bottom velocity in the side channel ranged from 28 to 43 cm sec^{-1} in the three sampling months other than October. During periods of higher discharge (Table 51) bottom velocity was usually within the 30 to 70 cm sec^{-1} range which is necessary to move coarse sand. Bottom velocity in the side channel in October (Appendix II), which ranged from 0 to 43 cm sec^{-1}, was often slow enough to allow deposition of fine sand.

Notching could help prevent sand deposition during low flow periods such as October if it increased bottom velocity in the side channel above the critical levels. However, notching would have the opposite effect if it increased the amount of sediment entering the side channel without increasing bottom velocity above critical levels. Unsuitable upstream openings to side channels, including wing dam notches, can increase sedimentation rates in side channels and other backwater areas (Simons et al. 1974, 1975; Ackerman et al. 1977).

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APPENDIX A

Electrofishing catches for each transect during June, 1978. Shocking efforts are expressed in minutes and fish weights in grams.

APPENDIX A

Wing dam 25: Shoreline transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	1.0	360.	4.80	4.35
CARP	4	4.0	4340.	57.89	17.39
SAUGER	3	3.0	114.	1.52	13.04
QUILLBACK	5	5.0	1122.	14.97	21.74
SMALLMOUTH BUFFALO	1	1.0	130.	1.73	4.35
SHORTHEAD REDHORSE	2	2.0	1090.	14.54	8.70
LARGEMOUTH BASS	2	2.0	103.	1.37	8.70
BLACK CRAPPIE	2	2.0	39.	0.52	8.70
FRESHWATER DRUM	3	3.0	199.	2.65	13.04
TOTALS	23	23.0	7497	100.00	100.00

Wing dam 25: 60-105 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
EMERALD SHINER	1	1.0	0.	0.00	100.00
TOTALS	1	1.0	0	0.00	100.00

Wing dam 25: 150-200 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	1.0	480.	100.00	100.00
TOTALS	1	1.0	480	100.00	100.00

APPENDIX A (continued)

Wing dam 26: Shoreline transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	2	2.0	1845.	17.12	6.25
SHORT NOSE GAR	1	1.0	560.	5.20	3.13
CARP	2	2.0	3645.	33.82	6.25
SAUGER	4	4.0	526.	4.88	12.50
HIGHFIN CARPSUCKER	1	1.0	137.	1.27	3.13
QUILLBACK	7	7.0	2092.	19.41	21.88
SMALLMOUTH BUFFALO	1	1.0	720.	6.68	3.13
SHORTHEAD REDHORSE	3	3.0	555.	5.15	9.38
BLUEGILL	2	2.0	73.	0.68	6.25
LARGEMOUTH BASS	1	1.0	249.	2.31	3.13
WHITE CRAPPIE	3	3.0	245.	2.27	9.38
BLACK CRAPPIE	4	4.0	87.	0.81	12.50
FRESHWATER DRUM	1	1.0	45.	0.42	3.13
TOTALS	32	32.0	10779	100.00	100.00

Wing dam 26: 75-120 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SHORT NOSE GAR	1	1.0	485.	22.38	16.67
SILVER CHUB	1	1.0	30.	1.38	16.67
EMERALD SHINER	1	1.0	0.	0.00	16.67
SHORTHEAD REDHORSE	3	3.0	1652.	76.23	50.00
TOTALS	6	6.0	2167	100.00	100.00

APPENDIX A (continued)

Wing dam 26: 165-210 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SHORT NOSE GAR	1	1.0	545.	8.91	10.00
GIZZARD SHAD	1	1.0	320.	5.23	10.00
CARP	2	2.0	3040.	49.71	20.00
WALLEYE	1	1.0	45.	0.74	10.00
SMALLMOUTH BUFFALO	1	1.0	342.	5.59	10.00
SHORTHEAD REDHORSE	4	4.0	1824.	29.82	40.00
TOTALS	10	10.0	6116	100.00	100.00

Wing dam 26: 260-300 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX A (continued)

Wing dam 28: Shoreline transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	2	2.0	785.	5.70	4.76
CARP	7	7.0	9475.	68.78	16.67
SPOTFIN SHINER	1	1.0	0.	0.00	2.38
BULLHEAD MINNOW	1	1.0	0.	0.00	2.38
SAUGER	3	3.0	129.	0.94	7.14
RIVER CARPSUCKER	1	1.0	155.	1.13	2.38
SILVER REDHORSE	1	1.0	1085.	7.88	2.38
GOLDEN REDHORSE	1	1.0	185.	1.34	2.38
SHORTHEAD REDHORSE	3	3.0	264.	1.92	7.14
ROCK BASS	2	2.0	169.	1.23	4.76
BLUEGILL	7	7.0	227.	1.65	16.67
SMALLMOUTH BASS	1	1.0	52.	0.38	2.38
WHITE CRAPPIE	1	1.0	66.	0.48	2.38
BLACK CRAPPIE	4	4.0	400.	2.90	9.52
FRESHWATER DRUM	7	7.0	783.	5.68	16.67
TOTALS	42	42.0	13775	100.00	100.00

Wing dam 28: 30-75 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX A (continued)

Wing dam 28: 120-165 meters.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	1.0	155.	7.99	4.00
SILVER CHUB	1	1.0	24.	1.24	4.00
EMERALD SHINER	2	2.0	0.	0.00	8.00
RIVER SHINER	1	1.0	0.	0.00	4.00
BULLHEAD MINNOW	1	1.0	0.	0.00	4.00
SAUGER	2	2.0	82.	4.23	8.00
QUILLBACK	1	1.0	55.	2.84	4.00
SMALLMOUTH BUFFALO	1	1.0	29.	1.50	4.00
SHORTHEAD REDHORSE	9	9.0	1114.	57.45	36.00
ROCK BASS	2	2.0	205.	10.57	8.00
FRESHWATER DRUM	4	4.0	275.	14.18	16.00
TOTALS	25	25.0	1939	100.00	100.00

Wing dam 28: 240-290 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	1.0	1130.	76.71	33.33
WALLEYE	1	1.0	282.	19.14	33.33
FRESHWATER DRUM	1	1.0	61.	4.14	33.33
TOTALS	3	3.0	1473	100.00	100.00

APPENDIX A (continued)

Wing dam 29: Shoreline transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	2	2.0	895.	15.30	7.41
CARP	1	1.0	865.	14.79	3.70
SAUGER	8	8.0	475.	8.12	29.63
WALLEYE	1	1.0	48.	0.82	3.70
RIVER CARPSUCKER	3	3.0	1830.	31.29	11.11
QUILLBACK	2	2.0	784.	13.41	7.41
BIGMOUTH BUFFALO	1	1.0	256.	4.38	3.70
SMALLMOUTH BUFFALO	1	1.0	50.	0.85	3.70
SHORTHEAD REDHORSE	2	2.0	289.	4.94	7.41
BLUEGILL	2	2.0	130.	2.22	7.41
BLACK CRAPPIE	1	1.0	34.	0.58	3.70
FRESHWATER DRUM	3	3.0	192.	3.28	11.11
TOTALS	27	27.0	5848	100.00	100.00

Wing dam 29: 75-105 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
EMERALD SHINER	1	1.0	0.	0.00	100.00
TOTALS	1	1.0	0	0.00	100.00

Wing dam 29: 135-180 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
EMERALD SHINER	1	1.0	0.	0.00	100.00
TOTALS	1	1.0	0	0.00	100.00

Wing dam 29: 230-275 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX A (continued)

Wing dam 30: Shoreline transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SILVER CHUB	2	2.0	30.	1.69	9.09
RIVER SHINER	2	2.0	0.	0.00	9.09
CHANNEL CATFISH	1	1.0	14.	0.79	4.55
SAUGER	7	7.0	291.	16.39	31.82
QUILLBACK	1	1.0	384.	21.62	4.55
SMALLMOUTH BUFFALO	2	2.0	118.	6.64	9.09
SHORTHEAD REDHORSE	2	2.0	545.	30.69	9.09
WHITE BASS	1	1.0	73.	4.11	4.55
BLUEGILL	2	2.0	57.	3.21	9.09
LARGEMOUTH BASS	1	1.0	52.	2.93	4.55
FRESHWATER DRUM	1	1.0	212.	11.94	4.55
TOTALS	22	22.0	1776	100.00	100.00

Wing dam 30: 75-105 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 30: 135-180 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 30: 230-275 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX A (continued)

Wing dam 31: Shoreline transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	1.0	220.	10.87	7.14
SAUGER	4	4.0	142.	7.02	28.57
WALLEYE	2	2.0	116.	5.73	14.29
QUILLBACK	5	5.0	480.	23.73	35.71
SHORTHEAD REDHORSE	2	2.0	1065.	52.64	14.29
TOTALS	14	14.0	2023	100.00	100.00

Wing dam 31: 75-105 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 31: 135-180 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 31: 230-275 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX A (continued)

Side Channel: Right bank.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	2	2.0	692.	4.26	3.28
CARP	3	3.0	3601.	22.16	4.92
CHANNEL CATFISH	1	1.0	300.	1.85	1.64
SAUGER	12	12.0	591.	3.64	19.67
WALLEYE	3	3.0	908.	5.59	4.92
RIVER CARPSUCKER	3	3.0	680.	4.18	4.92
QUILLBACK	6	6.0	1304.	8.02	9.84
SMALLMOUTH BUFFALO	2	2.0	1100.	6.77	3.28
SILVER REDHORSE	2	2.0	1495.	9.20	3.28
GOLDEN REDHORSE	3	3.0	242.	1.49	4.92
SHORTHEAD REDHORSE	16	16.0	4773.	29.37	26.23
WHITE BASS	1	1.0	70.	0.43	1.64
BLUEGILL	3	3.0	125.	0.77	4.92
WHITE CRAPPIE	1	1.0	100.	0.62	1.64
FRESHWATER DRUM	3	3.0	271.	1.67	4.92
TOTALS	61	61.0	16252	100.00	100.00

Side Channel: Left bank.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	7	7.0	3035.	11.83	17.07
SHORT NOSE GAR	1	1.0	750.	2.92	2.44
CARP	9	9.0	10257.	39.99	21.95
CHANNEL CATFISH	1	1.0	1850.	7.21	2.44
SAUGER	2	2.0	138.	0.54	4.88
WALLEYE	1	1.0	420.	1.64	2.44
RIVER CARPSUCKER	4	4.0	2658.	10.36	9.76
QUILLBACK	2	2.0	787.	3.07	4.88
SMALLMOUTH BUFFALO	5	5.0	1458.	5.68	12.20
BLACK BUFFALO	1	1.0	1670.	6.51	2.44
SILVER REDHORSE	1	1.0	600.	2.34	2.44
SHORTHEAD REDHORSE	2	2.0	1240.	4.83	4.88
SPOTTED SUCKER	1	1.0	317.	1.24	2.44
BLUEGILL	1	1.0	92.	0.36	2.44
BLACK CRAPPIE	1	1.0	144.	0.56	2.44
FRESHWATER DRUM	2	2.0	232.	0.90	4.88
TOTALS	41	41.0	25648	100.00	100.00

APPENDIX B

Electrofishing catches for each transect during August, 1978. Shocking efforts are expressed in minutes and weights in grams.

APPENDIX B

DATE(S): 80978, 81278, — Wing dam 25: Shoreline transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
BOWFIN	1	1.0	266.	3.95	1.69
CARP	1	1.0	530.	7.87	1.69
EMERALD SHINER	1	1.0	0.	0.00	1.69
SAUGER	7	7.0	334.	4.96	11.86
HIGHFIN CARPSUCKER	5	5.0	1187.	17.63	8.47
QUILLBACK	8	8.0	2239.	33.25	13.56
ORANGE SPOTTED SUNFISH	2	2.0	11.	0.16	3.39
BLUEGILL	17	17.0	1316.	19.55	28.81
LARGEMOUTH BASS	1	1.0	1.	0.01	1.69
WHITE CRAPPIE	1	1.0	110.	1.63	1.69
BLACK CRAPPIE	7	7.0	540.	8.02	11.86
FRESHWATER DRUM	8	8.0	199.	2.96	13.56
TOTALS	59	59.0	6733	100.00	100.00

DATE(S): 81078, 81478, — Wing dam 25: 60-105 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	2.0	394.	100.00	100.00
TOTALS	1	2.0	394	100.00	100.00

DATE(S): 81478, 81078, — Wing dam 25: 150-200 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX B (continued)

DATE(S): 81078, 81778, Wing dam 26: Shoreline transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
GIZZARD SHAD	1	1.0	5.	0.05	0.58
MOONEYE	1	1.0	245.	2.22	0.58
NORTHERN PIKE	1	1.0	1760.	15.98	0.58
CARP	1	1.0	463.	4.20	0.58
EMERALD SHINER	4	4.0	0.	0.00	2.34
SPOTFIN SHINER	11	11.0	0.	0.00	6.43
BULLHEAD MINNOW	1	1.0	0.	0.00	0.58
CHANNEL CATFISH	1	1.0	200.	1.82	0.58
FLATHEAD CATFISH	1	1.0	580.	5.26	0.58
N. LOGPERCH	1	1.0	0.	0.00	0.58
SAUGER	16	16.0	1691.	15.35	9.36
WALLEYE	1	1.0	443.	4.02	0.58
RIVER CARPSUCKER	1	1.0	286.	2.60	0.58
ORANGE SPOTTED SUNFISH	10	10.0	51.	0.46	5.85
BLUEGILL	93	93.0	3371.	30.60	54.39
LARGEMOUTH BASS	10	10.0	1188.	10.78	5.85
WHITE CRAPPIE	1	1.0	196.	1.78	0.58
BLACK CRAPPIE	9	9.0	497.	4.51	5.26
FRESHWATER DRUM	7	7.0	41.	0.37	4.09
TOTALS	171	171.0	11017	100.00	100.00

DATE(S): 81778, 81178, Wing dam 26: 75-120 meter transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	1.0	195.	2.36	1.82
CARP	6	6.0	5540.	66.93	10.91
SILVER CHUB	1	1.0	34.	0.41	1.82
EMERALD SHINER	1	1.0	0.	0.00	1.82
SPOTFIN SHINER	2	2.0	0.	0.00	3.64
N. LOGPERCH	1	1.0	0.	0.00	1.82
SAUGER	5	5.0	429.	5.18	9.09
SHORTHEAD REDHORSE	2	2.0	354.	4.28	3.64
BLUEGILL	29	29.0	1130.	13.65	52.73
LARGEMOUTH BASS	1	1.0	112.	1.35	1.82
BLACK CRAPPIE	1	1.0	81.	0.98	1.82
FRESHWATER DRUM	5	5.0	402.	4.86	9.09
TOTALS	55	55.0	8277	100.00	100.00

APPENDIX B (continued)

DATE(S): 81878, 81178, Wing dam 26: 165-210 meter transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	1.0	166.	3.77	1.49
CARP	1	1.0	1180.	26.80	1.49
CHANNEL CATFISH	1	1.0	34.	0.77	1.49
N. LOGPERCH	1	1.0	0.	0.00	1.49
RIVER DARTER	1	1.0	0.	0.00	1.49
SAUGER	2	2.0	123.	2.79	2.99
WALLEYE	1	1.0	134.	3.04	1.49
QUILLBACK	1	1.0	114.	2.59	1.49
SHORTHEAD REDHORSE	2	2.0	322.	7.31	2.99
WHITE BASS	2	2.0	14.	0.32	2.99
ROCK BASS	1	1.0	121.	2.75	1.49
PUMPKINSEED	1	1.0	92.	2.09	1.49
BLUEGILL	44	44.0	1492.	33.89	65.67
LARGEMOUTH BASS	1	1.0	142.	3.23	1.49
WHITE CRAPPIE	2	2.0	144.	3.27	2.99
BLACK CRAPPIE	2	2.0	96.	2.18	2.99
FRESHWATER DRUM	3	3.0	229.	5.20	4.48
TOTALS	67	67.0	4403	100.00	100.00

DATE(S): 81178, 81778, Wing dam 26: 260-300 meter transect.
TOTAL EFFORT : 45.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	1.3	56.	2.42	3.23
EMERALD SHINER	2	2.7	0.	0.00	6.45
CHANNEL CATFISH	2	2.7	68.	2.94	6.45
N. LOGPERCH	3	4.0	0.	0.00	9.68
RIVER DARTER	2	2.7	0.	0.00	6.45
SAUGER	3	4.0	284.	12.26	9.68
SHORTHEAD REDHORSE	6	8.0	1052.	45.42	19.35
BLUEGILL	7	9.3	489.	21.11	22.58
BLACK CRAPPIE	3	4.0	193.	8.33	9.68
FRESHWATER DRUM	2	2.7	174.	7.51	6.45
TOTALS	31	41.3	2316	100.00	100.00

APPENDIX B (continued)

DATE(S): 81678, 81278, Wing dam 28: Shoreline transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	1.0	16.	0.14	0.93
GIZZARD SHAD	1	1.0	15.	0.13	0.93
CARP	4	4.0	6340.	54.54	3.70
EMERALD SHINER	12	12.0	0.	0.00	11.11
RIVER SHINER	10	10.0	0.	0.00	9.26
SPOTTAIL SHINER	2	2.0	0.	0.00	1.85
SPOTFIN SHINER	2	2.0	0.	0.00	1.85
BULLHEAD MINNOW	8	8.0	0.	0.00	7.41
CHANNEL CATFISH	2	2.0	224.	1.93	1.85
SAUGER	3	3.0	173.	1.49	2.78
RIVER CARPSUCKER	1	1.0	152.	1.31	0.93
HIGHFIN CARPSUCKER	1	1.0	0.	0.00	0.93
QUILLBACK	2	2.0	161.	1.39	1.85
BLACK BUFFALO	1	1.0	1560.	13.42	0.93
GOLDEN REDHORSE	1	1.0	246.	2.12	0.93
SHORTHEAD REDHORSE	1	1.0	61.	0.52	0.93
WHITE BASS	1	1.0	0.	0.00	0.93
ORANGE SPOTTED SUNFISH	6	6.0	33.	0.28	5.56
BLUEGILL	28	28.0	1090.	9.38	25.93
LARGEMOUTH BASS	6	6.0	991.	8.53	5.56
WHITE CRAPPIE	1	1.0	76.	0.65	0.93
BLACK CRAPPIE	9	9.0	308.	2.65	8.33
FRESHWATER DRUM	5	5.0	178.	1.53	4.63
TOTALS	108	108.0	11624	100.00	100.00

DATE(S): 81178, 81778, Wing dam 28: 30-75 meter transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	1.0	302.	3.45	0.89
SILVER CHUB	1	1.0	30.	0.34	0.89
EMERALD SHINER	15	15.0	0.	0.00	13.39
RIVER SHINER	10	10.0	0.	0.00	8.93
SPOTTAIL SHINER	1	1.0	0.	0.00	0.89
BULLHEAD MINNOW	4	4.0	0.	0.00	3.57
CHANNEL CATFISH	7	7.0	1866.	21.33	6.25
FLATHEAD CATFISH	2	2.0	77.	0.88	1.79
N. LOGPERCH	3	3.0	0.	0.00	2.68
SAUGER	5	5.0	650.	7.43	4.46
WALLEYE	2	2.0	268.	3.06	1.79
RIVER CARPSUCKER	1	1.0	115.	1.31	0.89
QUILLBACK	1	1.0	432.	4.94	0.89
SHORTHEAD REDHORSE	12	12.0	2420.	27.66	10.71
WHITE BASS	1	1.0	7.	0.08	0.89
BLUEGILL	29	29.0	1050.	12.00	25.89
SMALLMOUTH BASS	2	2.0	404.	4.62	1.79
LARGEMOUTH BASS	4	4.0	650.	7.43	3.57
WHITE CRAPPIE	2	2.0	138.	1.58	1.79
BLACK CRAPPIE	3	3.0	144.	1.65	2.68
FRESHWATER DRUM	6	6.0	197.	2.25	5.36
TOTALS	112	112.0	8750	100.00	100.00

APPENDIX B (continued)

DATE(S): 81078, 81778, Wing dam 28: 120-165 meters.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	1.0	128.	0.66	0.88
CARP	12	12.0	15980.	82.26	10.62
EMERALD SHINER	45	45.0	0.	0.00	39.82
RIVER SHINER	1	1.0	0.	0.00	0.88
SPOTTAIL SHINER	1	1.0	0.	0.00	0.88
N. LOGPERCH	3	3.0	0.	0.00	2.65
SAUGER	3	3.0	257.	1.32	2.65
QUILLBACK	2	2.0	724.	3.73	1.77
WHITE BASS	2	2.0	235.	1.21	1.77
BLUEGILL	32	32.0	1350.	6.95	28.32
SMALLMOUTH BASS	1	1.0	111.	0.57	0.88
LARGEMOUTH BASS	3	3.0	197.	1.01	2.65
BLACK CRAPPIE	2	2.0	105.	0.54	1.77
FRESHWATER DRUM	5	5.0	339.	1.75	4.42
TOTALS	113	113.0	19426	100.00	100.00

DATE(S): 81078, 81778, Wing dam 28: 240-290 meters transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	19	19.0	24705.	91.50	33.93
SILVER CHUB	1	1.0	40.	0.15	1.79
EMERALD SHINER	1	1.0	0.	0.00	1.79
RIVER SHINER	1	1.0	0.	0.00	1.79
SAUGER	1	1.0	74.	0.27	1.79
WALLEYE	2	2.0	217.	0.80	3.57
SHORTHEAD REDHORSE	3	3.0	526.	1.95	5.36
ROCK BASS	1	1.0	128.	0.47	1.79
ORANGE SPOTTED SUNFISH	1	1.0	7.	0.03	1.79
BLUEGILL	19	19.0	577.	2.14	33.93
LARGEMOUTH BASS	6	6.0	633.	2.34	10.71
FRESHWATER DRUM	1	1.0	94.	0.35	1.79
TOTALS	56	56.0	27001	100.00	100.00

APPENDIX B (continued)

DATE(S): 81378, 81678, Wing dam 29: Shoreline transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	3	3.0	4430.	47.34	4.05
SILVER CHUB	1	1.0	0.	0.00	1.35
EMERALD SHINER	6	6.0	0.	0.00	8.11
SPOTTAIL SHINER	1	1.0	0.	0.00	1.35
BULLHEAD MINNOW	3	3.0	0.	0.00	4.05
FLATHEAD CATFISH	1	1.0	240.	2.56	1.35
N. LOGPERCH	1	1.0	0.	0.00	1.35
SAUGER	10	10.0	653.	6.98	13.51
BIGMOUTH BUFFALO	1	1.0	1030.	11.01	1.35
SMALLMOUTH BUFFALO	2	2.0	630.	6.73	2.70
BLACK BUFFALO	1	1.0	275.	2.94	1.35
WHITE BASS	1	1.0	6.	0.06	1.35
BLUEGILL	29	29.0	1397.	14.93	39.19
LARGEMOUTH BASS	3	3.0	493.	5.27	4.05
BLACK CRAPPIE	7	7.0	174.	1.86	9.46
FRESHWATER DRUM	4	4.0	30.	0.32	5.41
TOTALS	74	74.0	9358	100.00	100.00

DATE(S): 81678, 81378, Wing dam 29: 75-105 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
BIGMOUTH BUFFALO	1	2.0	1720.	100.00	100.00
TOTALS	1	2.0	1720	100.00	100.00

DATE(S): 81378, 81678, Wing dam 29: 135-180 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
WALLEYE	1	2.0	650.	100.00	100.00
TOTALS	1	2.0	650	100.00	100.00

DATE(S): 81378, 81678, Wing dam 29: 230-275 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
BIGMOUTH BUFFALO	2	4.0	4500.	100.00	100.00
TOTALS	2	4.0	4500	100.00	100.00

APPENDIX B (continued)

DATE(S): 81378, 81778, Wing dam 30: Shoreline transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	1.0	148.	1.41	1.92
GIZZARD SHAD	1	1.0	18.	0.17	1.92
CARP	2	2.0	1240.	11.82	3.85
SILVER CHUB	2	2.0	0.	0.00	3.85
EMERALD SHINER	3	3.0	0.	0.00	5.77
RIVER SHINER	9	9.0	0.	0.00	17.31
CHANNEL CATFISH	2	2.0	306.	2.92	3.85
FLATHEAD CATFISH	1	1.0	186.	1.77	1.92
SAUGER	3	3.0	100.	0.95	5.77
WALLEYE	1	1.0	66.	0.63	1.92
QUILLBACK	3	3.0	1942.	18.51	5.77
SILVER REDHORSE	2	2.0	1312.	12.51	3.85
GOLDEN REDHORSE	3	3.0	1084.	10.33	5.77
SHORTHEAD REDHORSE	9	9.0	3605.	34.36	17.31
WHITE BASS	3	3.0	304.	2.90	5.77
BLUEGILL	1	1.0	14.	0.13	1.92
BLACK CRAPPIE	1	1.0	0.	0.00	1.92
FRESHWATER DRUM	5	5.0	166.	1.58	9.62
TOTALS	52	52.0	10491	100.00	100.00

DATE(S): 81478, 81678, Wing dam 30: 75-105 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SHORTHEAD REDHORSE	1	2.0	820.	100.00	100.00
TOTALS	1	2.0	820	100.00	100.00

DATE(S): 81478, 81678, Wing dam 30: 135-180 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
BIGMOUTH BUFFALO	1	2.0	3500.	100.00	100.00
TOTALS	1	2.0	3500	100.00	100.00

DATE(S): 81478, 81678, Wing dam 30: 230-275 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX B (continued)

DATE(S): 81478, 81678, Wing dam 31: Shoreline transect
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	2	2.0	902.	17.85	0.45
GIZZARD SHAD	18	18.0	217.	4.29	4.04
CARP	1	1.0	370.	7.32	0.22
SILVER CHUB	6	6.0	0.	0.00	1.35
EMERALD SHINER	319	319.0	0.	0.00	71.52
RIVER SHINER	46	46.0	0.	0.00	10.31
BULLHEAD MINNOW	5	5.0	0.	0.00	1.12
SAUGER	16	16.0	998.	19.75	3.59
WALLEYE	6	6.0	585.	11.58	1.35
HIGHFIN CARPSUCKER	2	2.0	288.	5.70	0.45
QUILLBACK	5	5.0	948.	18.76	1.12
SHORTHEAD REDHORSE	3	3.0	304.	6.02	0.67
BLUEGILL	5	5.0	129.	2.55	1.12
WHITE CRAPPIE	1	1.0	82.	1.62	0.22
BLACK CRAPPIE	2	2.0	175.	3.46	0.45
FRESHWATER DRUM	9	9.0	55.	1.09	2.02
TOTALS	446	446.0	5053	100.00	100.00

DATE(S): 81478, 81678, Wing dam 31: 75-105 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SHORTHEAD REDHORSE	1	2.0	790.	100.00	100.00
TOTALS	1	2.0	790	100.00	100.00

DATE(S): 81478, 81678, Wing dam 31: 135-180 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

DATE(S): 81478, 81678, Wing dam 31: 230-275 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
BIGMOUTH BUFFALO	1	2.0	3360.	100.00	100.00
TOTALS	1	2.0	3360	100.00	100.00

APPENDIX B (continued)

ELECTROFISHING

Side Channel
DATE(S): 81378, 80978, 80878,
TOTAL EFFORT : 120.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	6	3.0	2061.	3.47	0.55
CARP	34	17.0	41454.	69.76	3.10
SILVERY MINNOW	5	2.5	0.	0.00	0.46
SILVER CHUB	5	2.5	0.	0.00	0.46
EMERALD SHINER	833	416.5	0.	0.00	75.87
RIVER SHINER	12	6.0	0.	0.00	1.09
SPOTFIN SHINER	1	0.5	0.	0.00	0.09
BULLHEAD MINNOW	8	4.0	0.	0.00	0.73
CHANNEL CATFISH	4	2.0	471.	0.79	0.36
N. LOGPERCH	1	0.5	0.	0.00	0.09
SAUGER	9	4.5	545.	0.92	0.82
WALLEYE	1	0.5	126.	0.21	0.09
RIVER CARPSUCKER	3	1.5	1540.	2.59	0.27
HIGHFIN CARPSUCKER	1	0.5	62.	0.10	0.09
QUILLBACK	4	2.0	151.	0.25	0.36
BIGMOUTH BUFFALO	2	1.0	669.	1.13	0.18
SMALLMOUTH BUFFALO	7	3.5	2829.	4.76	0.64
GOLDEN REDHORSE	1	0.5	60.	0.10	0.09
SHORTHEAD REDHORSE	11	5.5	1228.	2.07	1.00
ORANGESPOTTED SUNFISH	23	11.5	50.	0.08	2.09
BLUEGILL	86	43.0	2775.	4.67	7.83
LARGEMOUTH BASS	14	7.0	2952.	4.97	1.28
WHITE CARPPIE	4	2.0	521.	0.88	0.36
BLACK CRAPPIE	10	5.0	434.	0.73	0.91
FRESHWATER DRUM	13	6.5	1492.	2.51	1.18
TOTALS	1098	549.0	59420.	100.00	100.00

APPENDIX C

Electrofishing catches for each transect during October, 1978. Shocking efforts are expressed in minutes and fish weights in grams.

DATE(S): 101078,102278, Wing dam 25: Shoreline transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	7	7.0	11220.	76.72	17.07
YELLOW BULLHEAD	1	1.0	142.	0.97	2.44
SAUGER	4	4.0	470.	3.21	9.76
WALLEYE	3	3.0	417.	2.85	7.32
RIVER CARPSUCKER	1	1.0	520.	3.56	2.44
SMALLMOUTH BUFFALO	1	1.0	138.	0.94	2.44
WHITE BASS	4	4.0	119.	0.81	9.76
FRESHWATER DRUM	19	19.0	1599.	10.93	46.34
BROOK SILVERSIDES	1	1.0	0.	0.00	2.44
TOTALS	41	41.0	14625	100.00	100.00

DATE(S): 101078,102278, Wing dam 25: 60-105 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	1	2.0	290.	17.16	50.00
SMALLMOUTH BUFFALO	1	2.0	1400.	82.84	50.00
TOTALS	2	4.0	1690	100.00	100.00

DATE(S): 101078,102178, Wing dam 25: 150-200 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX C (continued)

DATE(S): 101078,102178,

Wing dam 26: Shoreline transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	17	17.0	25490.	74.04	19.54
SILVER CHUB	1	1.0	0.	0.00	1.15
EMERALD SHINER	6	6.0	0.	0.00	6.90
SAUGER	23	23.0	2472.	7.19	26.44
RIVER CARPSUCKER	4	4.0	2250.	6.54	4.60
HIGHFIN CARPSUCKER	1	1.0	147.	0.43	1.15
QUILLBACK	10	10.0	2892.	8.40	11.49
SHORTHEAD REDHORSE	1	1.0	232.	0.67	1.15
WHITE BASS	6	6.0	151.	0.44	6.90
BLUEGILL	2	2.0	55.	0.16	2.30
LARGEMOUTH BASS	1	1.0	151.	0.44	1.15
WHITE CRAPPIE	3	3.0	225.	0.65	3.45
BLACK CRAPPIE	2	2.0	31.	0.09	2.30
FRESHWATER DRUM	10	10.0	330.	0.96	11.49
TOTALS	87	87.0	34426	100.00	100.00

DATE(S): 100678,102178,

Wing dam 26: 75-120 meter transect.

TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	1.0	250.	2.78	2.17
CARP	3	3.0	4600.	51.18	6.52
N. LOGPERCH	1	1.0	0.	0.00	2.17
SAUGER	1	1.0	54.	0.60	2.17
WALLEYE	1	1.0	172.	1.91	2.17
SHORTHEAD REDHORSE	5	5.0	740.	8.23	10.87
SMALLMOUTH BASS	1	1.0	390.	4.34	2.17
FRESHWATER DRUM	33	33.0	2782.	30.95	71.74
TOTALS	46	46.0	8988	100.00	100.00

APPENDIX C (continued)

Wing dam 26: 165-210 meter transect

DATE(S): 100778,102178,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
GIZZARD SHAD	1	1.0	4.	0.01	1.59
CARP	13	13.0	24650.	78.98	20.63
SAUGER	4	4.0	435.	1.39	6.35
WALLEYE	1	1.0	110.	0.35	1.59
QUILLBACK	3	3.0	806.	2.56	4.76
WHITE BASS	2	2.0	489.	1.57	3.17
SMALLMOUTH BASS	1	1.0	670.	2.15	1.59
FRESHWATER DRUM	38	38.0	4048.	12.97	60.32
TOTALS	63	63.0	31212	100.00	100.00

Wing dam 26: 260-300 meter transect.

DATE(S): 100778,102178,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	1.0	2540.	29.03	4.76
SAUGER	1	1.0	141.	1.61	4.76
WALLEYE	1	1.0	830.	9.49	4.76
SHORTHEAD REDHORSE	2	2.0	1840.	21.03	9.52
FRESHWATER DRUM	16	16.0	3399.	38.85	76.19
TOTALS	21	21.0	8750	100.00	100.00

APPENDIX C (continued)

Wing dam 28: Shoreline transect.

DATE(S): 101078,102178.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	32	32.0	49260.	86.11	21.92
EMERALD SHINER	4	4.0	0.	0.00	2.74
BULLHEAD MINNOW	1	1.0	0.	0.00	0.68
RIVER DARTER	1	1.0	0.	0.00	0.68
SAUGER	5	5.0	339.	0.59	3.42
WALLEYE	5	5.0	664.	1.16	3.42
RIVER CARPSUCKER	5	5.0	2280.	3.99	3.42
HIGHFIN CARPSUCKER	1	1.0	212.	0.37	0.68
QUILLBACK	1	1.0	70.	0.12	0.68
BIGMOUTH BUFFALO	1	1.0	455.	0.80	0.68
WHITE BASS	1	1.0	18.	0.03	0.68
FRESHWATER DRUM	89	89.0	3910.	6.83	60.96
TOTALS	146	146.0	57238	100.00	100.00

Wing dam 28: 30-75 meter transect.

DATE(S): 101078,102078.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SILVER CHUB	2	2.0	0.	0.00	2.70
EMERALD SHINER	1	1.0	0.	0.00	1.35
CHANNEL CATFISH	3	3.0	899.	8.43	4.05
FLATHEAD CATFISH	1	1.0	6.	0.06	1.35
STONECAT	1	1.0	8.	0.07	1.35
RIVER DARTER	1	1.0	0.	0.00	1.35
SAUGER	5	5.0	666.	6.24	6.76
WALLEYE	1	1.0	360.	3.37	1.35
QUILLBACK	1	1.0	380.	3.56	1.35
SHORTHEAD REDHORSE	9	9.0	2275.	21.33	12.16
FRESHWATER DRUM	49	49.0	6073.	56.93	66.22
TOTALS	74	74.0	10667	100.00	100.00

APPENDIX C (continued)

Wing dam 28: 120-165 meter transect.

DATE(S): 101078,102078,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	3	3.0	4620.	63.06	8.57
SILVER CHUB	3	3.0	0.	0.00	8.57
RIVER SHINER	3	3.0	0.	0.00	8.57
SAUGER	2	2.0	987.	13.47	5.71
WALLEYE	1	1.0	470.	6.42	2.86
HIGHFIN CARPSUCKER	1	1.0	132.	1.80	2.86
SHORTHEAD REDHORSE	2	2.0	128.	1.75	5.71
WHITE BASS	2	2.0	200.	2.73	5.71
BLUEGILL	1	1.0	32.	0.44	2.86
WHITE CRAPPIE	1	1.0	99.	1.35	2.86
FRESHWATER DRUM	16	16.0	658.	8.98	45.71
TOTALS	35	35.0	7326	100.00	100.00

Wing dam 28: 240-290 meter transect.

DATE(S): 101078,102078,
TOTAL EFFORT : 45.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	7	9.3	11810.	89.96	30.43
EMERALD SHINER	1	1.3	0.	0.00	4.35
SAUGER	4	5.3	350.	2.67	17.39
WHITE BASS	1	1.3	375.	2.86	4.35
SMALLMOUTH BASS	1	1.3	100.	0.76	4.35
FRESHWATER DRUM	9	12.0	493.	3.76	39.13
TOTALS	23	30.7	13128	100.00	100.00

APPENDIX C (continued)

Wing dam 29: Shoreline transect.

DATE(S): 100678,102178.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	5	5.0	8140.	65.80	12.20
EMERALD SHINER	4	4.0	0.	0.00	9.76
BULLHEAD MINNOW	1	1.0	0.	0.00	2.44
SAUGER	3	3.0	268.	2.17	7.32
RIVER CARPSUCKER	1	1.0	252.	2.04	2.44
QUILLBACK	2	2.0	805.	6.51	4.88
SMALLMOUTH BUFFALO	1	1.0	380.	3.07	2.44
SHORTHEAD REDHORSE	3	3.0	856.	6.92	7.32
WHITE BASS	1	1.0	238.	1.92	2.44
FRESHWATER DRUM	20	20.0	1432.	11.58	48.78
TOTALS	41	41.0	12371	100.00	100.00

Wing dam 29: 75-105 meter transect.

DATE(S): 100678,102178.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 29: 135-180 meter transect.

DATE(S): 100678,102178.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
FRESHWATER DRUM	1	2.0	510.	100.00	100.00
TOTALS	1	2.0	510	100.00	100.00

Wing dam 29: 230-275 meter transect.

DATE(S): 100678,102178.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
BIGMOUTH BUFFALO	1	2.0	2900.	100.00	100.00
TOTALS	1	2.0	2900	100.00	100.00

APPENDIX C (continued)

DATE(S): 100678,102178.
TOTAL EFFORT : 60.

Wing dam 30: Shoreline transect.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	1.0	72.	1.34	5.00
EMERALD SHINER	1	1.0	0.	0.00	5.00
SAUGER	2	2.0	414.	7.71	10.00
WALLEYE	1	1.0	390.	7.27	5.00
QUILLBACK	3	3.0	978.	18.22	15.00
SMALLMOUTH BUFFALO	1	1.0	190.	3.54	5.00
GOLDEN REDHORSE	1	1.0	283.	5.27	5.00
SHORTHEAD REDHORSE	6	6.0	2398.	44.68	30.00
FRESHWATER DRUM	4	4.0	642.	11.96	20.00
TOTALS	20	20.0	5367	100.00	100.00

DATE(S): 100678,102178.
TOTAL EFFORT : 30.

Wing dam 30: 75-105 meter transect.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SHORTHEAD REDHORSE	1	2.0	534.	100.00	100.00
TOTALS	1	2.0	534	100.00	100.00

DATE(S): 100678,102178.
TOTAL EFFORT : 30.

Wing dam 30: 135-180 meter transect.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

DATE(S): 100678,102178.
TOTAL EFFORT : 30.

Wing dam 30: 230-275 meter transect.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX C (continued)

DATE(S): 100678,102178. Wing dam 31: Shoreline transect.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
GIZZARD SHAD	2	2.0	179.	3.15	2.22
MOONEYE	2	2.0	459.	8.09	2.22
CARP	1	1.0	2360.	41.59	1.11
SILVERY MINNOW	7	7.0	0.	0.00	7.78
SILVER CHUB	1	1.0	0.	0.00	1.11
EMERALD SHINER	5	5.0	0.	0.00	5.56
RIVER SHINER	37	37.0	0.	0.00	41.11
CHANNEL CATFISH	1	1.0	134.	2.36	1.11
SAUGER	4	4.0	405.	7.14	4.44
QUILLBACK	2	2.0	156.	2.75	2.22
WHITE BASS	1	1.0	42.	0.74	1.11
FRESHWATER DRUM	26	26.0	1250.	22.03	28.89
PADDLE FISH	1	1.0	690.	12.16	1.11
TOTALS	90	90.0	5675	100.00	100.00

DATE(S): 100678,102178. Wing dam 31: 75-105 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	2.0	29.	100.00	100.00
TOTALS	1	2.0	29	100.00	100.00

DATE(S): 100678,102178. Wing dam 31: 135-180 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

DATE(S): 100678,102178. Wing dam 31: 230-275 meter transect.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX C (continued)

Side channel: Left bank.

DATE(S): 100478-101178.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
GIZZARD SHAD	1	1.0	73.	0.13	1.16
CARP	33	33.0	47530.	83.31	38.37
EMERALD SHINER	2	2.0	0.	0.00	2.33
SAUGER	11	11.0	1113.	1.95	12.79
WALLEYE	2	2.0	372.	0.65	2.33
RIVER CARPSUCKER	4	4.0	3835.	6.72	4.65
HIGHFIN CARPSUCKER	1	1.0	142.	0.25	1.16
BIGMOUTH BUFFALO	2	2.0	1073.	1.88	2.33
SMALLMOUTH BUFFALO	3	3.0	1309.	2.29	3.49
WHITE BASS	1	1.0	26.	0.05	1.16
ROCK BASS	2	2.0	247.	0.43	2.33
ORANGE SPOTTED SUNFISH	2	2.0	14.	0.02	2.33
BLUEGILL	11	11.0	425.	0.74	12.79
LARGEMOUTH BASS	1	1.0	208.	0.36	1.16
BLACK CRAPPIE	3	3.0	214.	0.38	3.49
FRESHWATER DRUM	6	6.0	469.	0.82	6.98
BROOK SILVERSIDES	1	1.0	0.	0.00	1.16
TOTALS	86	86.0	57050	100.00	100.00

Side channel: Right bank.

DATE(S): 100478-101178.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SHORT NOSE GAR	1	1.0	720.	5.59	1.30
GIZZARD SHAD	1	1.0	154.	1.20	1.30
MOONEYE	1	1.0	88.	0.68	1.30
CARP	2	2.0	3440.	26.72	2.60
SILVER CHUB	7	7.0	0.	0.00	9.09
EMERALD SHINER	2	2.0	0.	0.00	2.60
BULLHEAD MINNOW	2	2.0	0.	0.00	2.60
CHANNEL CATFISH	4	4.0	732.	5.69	5.19
SAUGER	13	13.0	1571.	12.20	16.88
WALLEYE	4	4.0	750.	5.83	5.19
QUILLBACK	3	3.0	426.	3.31	3.90
SMALLMOUTH BUFFALO	1	1.0	205.	1.59	1.30
GOLDEN REDHORSE	3	3.0	394.	3.06	3.90
SHORTHEAD REDHORSE	7	7.0	1208.	9.38	9.09
BLUEGILL	9	9.0	343.	2.66	11.69
LARGEMOUTH BASS	2	2.0	255.	1.98	2.60
BLACK CRAPPIE	1	1.0	68.	0.53	1.30
FRESHWATER DRUM	14	14.0	2519.	19.57	18.18
TOTALS	77	77.0	12873	100.00	100.00

APPENDIX D

Electrofishing catches for each transect during June 1979. Shocking efforts are expressed in minutes and fish weights in grams.

APPENDIX D

Wing dam 25: Shoreline transect.

DATE(S): 61579, 62179,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	2	2.0	1254.	9.72	6.45
CARP	3	3.0	4150.	32.17	9.68
SILVER CHUB	1	1.0	0.	0.00	3.23
RIVER SHINER	6	6.0	0.	0.00	19.35
BULLHEAD MINNOW	2	2.0	0.	0.00	6.45
SAUGER	3	3.0	1314.	10.19	9.68
HIGHFIN CARPSUCKER	1	1.0	204.	1.58	3.23
QUILLBACK	6	6.0	2797.	21.68	19.35
SMALLMOUTH BUFFALO	1	1.0	650.	5.04	3.23
SILVER REDHORSE	1	1.0	1230.	9.53	3.23
GOLDEN REDHORSE	1	1.0	850.	6.59	3.23
SHORTHEAD REDHORSE	3	3.0	395.	3.06	9.68
FRESHWATER DRUM	1	1.0	57.	0.44	3.23
TOTALS	31	31.0	12901	100.00	100.00

Wing dam 25: 60-105 meter transect.

SITE(S):
DATE(S): 61579, 62179,
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
MOONEYE	1	2.0	170.	100.00	100.00
TOTALS	1	2.0	170	100.00	100.00

Wing dam 25: 150-200 meter transect.

SITE(S):
DATE(S): 62179, 61579,
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX D (continued)

Wing dam 26: Shoreline transect.

DATE(S): 61579, 62179,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	2	2.0	845.	4.32	5.00
CARP	5	5.0	5540.	28.31	12.50
RIVER SHINER	1	1.0	0.	0.00	2.50
CHANNEL CATFISH	2	2.0	508.	2.59	5.00
SAUGER	4	4.0	167.	0.85	10.00
RIVER CARPSUCKER	1	1.0	460.	2.35	2.50
HIGHFIN CARPSUCKER	1	1.0	361.	1.84	2.50
QUILLBACK	2	2.0	726.	3.71	5.00
SMALLMOUTH BUFFALO	3	3.0	1052.	5.37	7.50
SILVER REDHORSE	3	3.0	4600.	23.49	7.50
GOLDEN REDHORSE	2	2.0	444.	2.27	5.00
SHORTHEAD REDHORSE	9	9.0	4309.	22.00	22.50
BLACK CRAPPIE	3	3.0	360.	1.84	7.50
FRESHWATER DRUM	2	2.0	109.	0.55	5.00
TOTALS	40	40.0	19579	100.00	100.00

Wing dam 26: 75-120 meter transect.

DATE(S): 61679, 62179,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 26: 165-210 meter transect.

DATE(S): 61579, 62179,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 26: 260-300 meter transect.

DATE(S): 61679, 62179,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX D (continued)

Wing dam 28: Shoreline transect.

DATE(S): 61579, 62079,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	2	2.0	560.	2.02	4.88
MOONEYE	1	1.0	0.	0.00	2.44
CARP	6	6.0	12830.	46.39	14.63
CHANNEL CATFISH	3	3.0	684.	2.47	7.32
RIVER CARPSUCKER	1	1.0	522.	1.89	2.44
QUILLBACK	6	6.0	2976.	10.76	14.63
SMALLMOUTH BUFFALO	3	3.0	1534.	5.55	7.32
SILVER REDHORSE	2	2.0	2390.	8.64	4.88
SHORTHEAD REDHORSE	11	11.0	5096.	18.43	26.83
ROCK BASS	1	1.0	164.	0.59	2.44
BLUEGILL	1	1.0	76.	0.28	2.44
SMALLMOUTH BASS	1	1.0	121.	0.44	2.44
LARGEMOUTH BASS	1	1.0	485.	1.75	2.44
FRESHWATER DRUM	2	2.0	218.	0.79	4.88
TOTALS	41	41.0	27661	100.00	100.00

Wing dam 28: 30-75 meter transect.

DATE(S): 61579, 62079,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SHORTNOSE GAR	1	1.0	500.	100.00	100.00
TOTALS	1	1.0	500	100.00	100.00

Wing dam 28: 120-165 meter transect.

DATE(S): 61579, 62079,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 28: 240-290 meter transect.

DATE(S): 61579, 62079,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
QUILLBACK	1	1.0	850.	48.57	50.00
SHORTHEAD REDHORSE	1	1.0	900.	51.43	50.00
TOTALS	2	2.0	1750	100.00	100.00

APPENDIX D (continued)

Wing dam 29: Shoreline transect.

DATE(S): 61979, 61479,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	4	4.0	1518.	14.30	17.39
CARP	4	4.0	2572.	24.23	17.39
RIVER CARPSUCKER	4	4.0	2136.	20.12	17.39
QUILLBACK	3	3.0	1644.	15.49	13.04
SMALLMOUTH BUFFALO	3	3.0	1474.	13.88	13.04
SHORTHEAD REDHORSE	1	1.0	1000.	9.42	4.35
BLACK CRAPPIE	2	2.0	150.	1.41	8.70
FRESHWATER DRUM	2	2.0	122.	1.15	8.70
TOTALS	23	23.0	10616	100.00	100.00

Wing dam 29: 75-105 meter transect.

DATE(S): 61379, 61479,
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 29: 135-180 meter transect.

DATE(S): 61379, 61479,
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER

Wing dam 29: 230-275 meter transect.

DATE(S): 61379, 61479,
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX D (continued)

Wing dam 31: Shoreline transect.

DATE(S): 61479, 61779.
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	3	3.0	1444.	10.37	5.77
CARP	3	3.0	2124.	15.25	5.77
SILVER CHUB	1	1.0	0.	0.00	1.92
EMERALD SHINER	1	1.0	0.	0.00	1.92
SAUGER	8	8.0	423.	3.04	15.38
HIGHFIN CARPSUCKER	1	1.0	105.	0.75	1.92
QUILLBACK	17	17.0	4644.	33.35	32.69
GOLDEN REDHORSE	1	1.0	700.	5.03	1.92
SHORTHEAD REDHORSE	10	10.0	3744.	26.89	19.23
WHITE BASS	1	1.0	50.	0.36	1.92
BLUEGILL	2	2.0	140.	1.01	3.85
WHITE CRAPPIE	1	1.0	101.	0.73	1.92
FRESHWATER DRUM	3	3.0	451.	3.24	5.77
TOTALS	52	52.0	13925	100.00	100.00

Wing dam 31: 75-105 meter transect.

DATE(S): 61779, 61379.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 31: 135-180 meter transect.

DATE(S): 61779, 61379.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

Wing dam 31: 230-275 meter transect.

DATE(S): 61779, 61379.
TOTAL EFFORT : 30.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
TOTALS	0	0.0	0	0.00	0.00

APPENDIX D (continued)

Side channel: Right bank.

DATE(S): 61379, 61479,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	3	3.0	1495.	5.33	5.36
CARP	8	8.0	10411.	37.07	14.29
CHANNEL CATFISH	1	1.0	95.	0.34	1.79
FLATHEAD CATFISH	1	1.0	305.	1.09	1.79
SAUGER	3	3.0	272.	0.97	5.36
RIVER CARPSUCKER	13	13.0	7139.	25.42	23.21
HIGHFIN CARPSUCKER	3	3.0	682.	2.43	5.36
QUILLBACK	6	6.0	2212.	7.88	10.71
BIGMOUTH BUFFALO	1	1.0	484.	1.72	1.79
SMALLMOUTH BUFFALO	2	2.0	945.	3.36	3.57
SHORTHEAD REDHORSE	5	5.0	2785.	9.93	8.93
ORANGESPOTTED SUNFISH	1	1.0	19.	0.07	1.79
BLUEGILL	2	2.0	206.	0.74	3.57
WHITE CRAPPIE	1	1.0	0.	0.00	1.79
BLACK CRAPPIE	1	1.0	96.	0.34	1.79
FRESHWATER DRUM	5	5.0	927.	3.30	8.93
TOTALS	56	56.0	28084	100.00	100.00

Side channel: Left bank.

DATE(S): 61779, 61479,
TOTAL EFFORT : 60.

SPECIE	NBR OF FISH	FISH/HOUR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	5	5.0	2504.	16.15	13.51
CARP	4	4.0	4660.	30.05	10.81
SPOTFIN SHINER	3	3.0	0.	0.00	8.11
BULLHEAD MINNOW	4	4.0	0.	0.00	10.81
CHANNEL CATFISH	1	1.0	170.	1.10	2.70
RIVER CARPSUCKER	3	3.0	2367.	15.26	8.11
SMALLMOUTH BUFFALO	9	9.0	4638.	29.91	24.32
ORANGESPOTTED SUNFISH	1	1.0	10.	0.06	2.70
BLUEGILL	1	1.0	52.	0.34	2.70
LARGEMOUTH BASS	2	2.0	738.	4.76	5.41
BLACK CRAPPIE	3	3.0	318.	2.05	8.11
FRESHWATER DRUM	1	1.0	52.	0.34	2.70
TOTALS	37	37.0	15509	100.00	100.00

APPENDIX E

Hoop net catches for each wing dam and the side channel during June, 1978. Weight is expressed in grams.

APPENDIX E

SITE(S): 25
DATE(S): 60778,

TOTAL HOURS SET: 288.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	5	0.4	457.	15.48	29.41
FLATHEAD CATFISH	2	0.2	504.	17.07	11.76
SAUGER	1	0.1	191.	6.47	5.88
SMALLMOUTH BUFFALO	1	0.1	500.	16.94	5.88
FRESHWATER DRUM	8	0.7	1300.	44.04	47.06
TOTALS	17	1.4	2952	100.00	100.00

HOOPNETTING

SITE(S): 26
DATE(S): 60878, 60978, 61178, 60678,

TOTAL HOURS SET: 432.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	1	0.1	106.	1.60	5.88
FLATHEAD CATFISH	4	0.2	3668.	55.48	23.53
SMALLMOUTH BUFFALO	1	0.1	1085.	16.41	5.88
FRESHWATER DRUM	11	0.6	1752.	26.50	64.71
TOTALS	17	0.9	6611	100.00	100.00

HOOPNETTING

SITE(S): 28
DATE(S): 60678, 60878,

TOTAL HOURS SET: 144.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	1	0.2	96.	12.15	16.67
FLATHEAD CATFISH	1	0.2	230.	29.11	16.67
WHITE CRAPPIE	1	0.2	79.	10.00	16.67
BLACK CRAPPIE	1	0.2	162.	20.51	16.67
FRESHWATER DRUM	2	0.3	223.	28.23	33.33
TOTALS	6	1.0	790	100.00	100.00

APPENDIX E (continued)

HOOPNETTING

SITE(S): 29
DATE(S): 60678.

TOTAL HOURS SET: 208.50 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
FLATHEAD CATFISH	2	0.2	670.	35.06	40.00
FRESHWATER DRUM	3	0.3	1241.	64.94	60.00
TOTALS	5	0.6	1911	100.00	100.00

HOOPNETTING

SITE(S): 30
DATE(S): 61178.

TOTAL HOURS SET: 288.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
FLATHEAD CATFISH	2	0.2	436.	100.00	100.00
TOTALS	2	0.2	436	100.00	100.00

HOOPNETTING

SITE(S): 31
DATE(S): 60978. 60778.

TOTAL HOURS SET: 144.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
FLATHEAD CATFISH	6	1.0	2368.	84.63	85.71
SAUGER	1	0.2	430.	15.37	14.29
TOTALS	7	1.2	2798	100.00	100.00

APPENDIX E (continued)

HOOPNETTING

SITE(S): 25
DATE(S): 60978,

TOTAL HOURS SET: 192.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	505.	10.88	9.09
CHANNEL CATFISH	1	0.1	132.	2.84	9.09
FLATHEAD CATFISH	2	0.3	458.	9.87	18.18
SMALLMOUTH BUFFALO	4	0.5	2985.	64.33	36.36
FRESHWATER DRUM	3	0.4	560.	12.07	27.27
TOTALS	11	1.4	4640	100.00	100.00

HOOPNETTING

SITE(S): 26
DATE(S): 61078, 61178, 61378, 60878,

TOTAL HOURS SET: 192.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	4	0.5	5835.	58.19	18.18
CHANNEL CATFISH	12	1.5	1677.	16.72	54.55
FLATHEAD CATFISH	1	0.1	280.	2.79	4.55
SMALLMOUTH BUFFALO	3	0.4	1855.	18.50	13.64
FRESHWATER DRUM	2	0.3	380.	3.79	9.09
TOTALS	22	2.8	10027	100.00	100.00

HOOPNETTING

SITE(S): 28
DATE(S): 62278, 60878, 61078,

TOTAL HOURS SET: 192.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	142.	2.46	5.56
CHANNEL CATFISH	6	0.8	1374.	23.85	33.33
SAUGER	3	0.4	1143.	19.84	16.67
SMALLMOUTH BUFFALO	5	0.6	2621.	45.49	27.78
BLACK CRAPPIE	1	0.1	168.	2.92	5.56
FRESHWATER DRUM	2	0.3	314.	5.45	11.11
TOTALS	18	2.3	5762	100.00	100.00

HOOPNETTING

SITE(S): 29
DATE(S): 60878,

TOTAL HOURS SET: 192.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SILVER CHUB	1	0.1	70.	1.99	12.50
FLATHEAD CATFISH	3	0.4	672.	19.07	37.50
SMALLMOUTH BUFFALO	2	0.3	2320.	65.83	25.00
FRESHWATER DRUM	2	0.3	462.	13.11	25.00
TOTALS	8	1.0	3524	100.00	100.00

HOOPNETTING

SITE(S): 30
DATE(S): 62278,

TOTAL HOURS SET: 192.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	7	0.9	769.	51.40	70.00
FLATHEAD CATFISH	1	0.1	216.	14.44	10.00
STONECAT	1	0.1	104.	6.95	10.00
SHOVELNOSE STURGEON	1	0.1	407.	27.21	10.00
TOTALS	10	1.3	1496	100.00	100.00

HOOPNETTING

SITE(S): 31
DATE(S): 62278, 60978, 61178,

TOTAL HOURS SET: 192.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	1310.	51.88	12.50
CHANNEL CATFISH	6	0.8	895.	35.45	75.00
FLATHEAD CATFISH	1	0.1	320.	12.67	12.50
TOTALS	8	1.0	2525	100.00	100.00

APPENDIX E (continued)

HOOPNETTING

DATE(S): 60778. Side channel

TOTAL HOURS SET: 192.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	6	0.8	652.	36.67	60.00
FLATHEAD CATFISH	1	0.1	200.	11.25	10.00
SHORTHEAD REDHORSE	1	0.1	720.	40.49	10.00
FRESHWATER DRUM	2	0.3	206.	11.59	20.00
TOTALS	10	1.3	1778	100.00	100.00

HOOPNETTING

DATE(S): 60978. Side channel

TOTAL HOURS SET: 192.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SILVER CHUB	1	0.1	40.	1.50	5.00
CHANNEL CATFISH	17	2.1	2229.	83.39	85.00
FLATHEAD CATFISH	1	0.1	340.	12.72	5.00
FRESHWATER DRUM	1	0.1	64.	2.39	5.00
TOTALS	20	2.5	2673	100.00	100.00

APPENDIX F

Hoop net catches for each wing dam and the side channel in August, 1978. Fish weights are expressed in grams.

SITE(S): 25
DATE(S): 80778. 80978.

TOTAL HOURS SET: 191.50 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	0.1	480.	13.78	3.70
FLATHEAD CATFISH	2	0.3	1040.	29.86	7.41
SAUGER	1	0.1	218.	6.26	3.70
WHITE CRAPPIE	4	0.5	306.	8.79	14.81
BLACK CRAPPIE	13	1.6	661.	18.98	48.15
FRESHWATER DRUM	6	0.8	778.	22.34	22.22
TOTALS	27	3.4	3483	100.00	100.00

HOOPNETTING

SITE(S): 26
DATE(S): 80778.

TOTAL HOURS SET: 192.62 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
BLUEGILL	1	0.1	120.	8.11	5.88
WHITE CRAPPIE	4	0.5	558.	37.70	23.53
BLACK CRAPPIE	12	1.5	802.	54.19	70.59
TOTALS	17	2.1	1480	100.00	100.00

HOOPNETTING

SITE(S): 28
DATE(S): 80778. 80978.

TOTAL HOURS SET: 194.36 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	0.1	580.	20.27	3.13
FLATHEAD CATFISH	2	0.2	149.	5.21	6.25
BLUEGILL	10	1.2	993.	34.70	31.25
WHITE CRAPPIE	8	1.0	546.	19.08	25.00
BLACK CRAPPIE	10	1.2	404.	14.12	31.25
FRESHWATER DRUM	1	0.1	190.	6.64	3.13
TOTALS	32	4.0	2862	100.00	100.00

APPENDIX F (continued)

SITE(S): 29
DATE(S): 61378.

TOTAL HOURS SET: 199.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	2	0.2	944.	24.65	18.18
SHORT NOSE GAR	1	0.1	560.	14.62	9.09
FLATHEAD CATFISH	2	0.2	1110.	28.98	18.18
WHITE BASS	1	0.1	132.	3.45	9.09
WHITE CRAPPIE	1	0.1	248.	6.48	9.09
BLACK CRAPPIE	3	0.4	236.	6.16	27.27
FRESHWATER DRUM	1	0.1	600.	15.67	9.09
TOTALS	11	1.3	3830	100.00	100.00

HOOPNETTING

SITE(S): 30
DATE(S): 80778.

TOTAL HOURS SET: 200.47 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	1	0.1	100.	3.99	11.11
FLATHEAD CATFISH	1	0.1	85.	3.39	11.11
SMALLMOUTH BUFFALO	2	0.2	1630.	65.07	22.22
FRESHWATER DRUM	5	0.6	690.	27.54	55.56
TOTALS	9	1.1	2505	100.00	100.00

HOOPNETTING

SITE(S): 31
DATE(S): 80778.

TOTAL HOURS SET: 205.03 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	1	0.1	94.	3.29	9.09
FLATHEAD CATFISH	3	0.4	1645.	57.52	27.27
SHORTHEAD REDHORSE	2	0.2	628.	21.96	18.18
BLUEGILL	2	0.2	216.	7.55	18.18
WHITE CRAPPIE	1	0.1	78.	2.73	9.09
BLACK CRAPPIE	2	0.2	199.	6.96	18.18
TOTALS	11	1.3	2860	100.00	100.00

HOOPNETTING APPENDIX F (continued)

SITE(S): 25
DATE(S): 81178.

TOTAL HOURS SET: 203.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	480.	4.63	2.70
CHANNEL CATFISH	12	1.4	2119.	20.42	32.43
SMALLMOUTH BUFFALO	13	1.5	6519.	62.83	35.14
BLUEGILL	4	0.5	479.	4.62	10.81
WHITE CRAPPIE	7	0.8	778.	7.50	18.92
TOTALS	37	4.4	10375	100.00	100.00

HOOPNETTING

SITE(S): 26
DATE(S): 81678.

TOTAL HOURS SET: 214.33 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SMALLMOUTH BUFFALO	1	0.1	570.	62.16	33.33
BLUEGILL	1	0.1	103.	11.23	33.33
WHITE CRAPPIE	1	0.1	244.	26.61	33.33
TOTALS	3	0.3	917	100.00	100.00

HOOPNETTING

SITE(S): 28
DATE(S): 81179.

TOTAL HOURS SET: 199.20 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	450.	4.72	2.17
CHANNEL CATFISH	6	0.7	1016.	10.66	13.04
FLATHEAD CATFISH	1	0.1	520.	5.45	2.17
SMALLMOUTH BUFFALO	11	1.3	5368.	56.30	23.91
BLUEGILL	12	1.4	856.	8.98	26.09
WHITE CRAPPIE	4	0.5	426.	4.47	8.70
BLACK CRAPPIE	8	1.0	312.	3.27	17.39
FRESHWATER DRUM	3	0.4	587.	6.16	6.52
TOTALS	46	5.5	9535	100.00	100.00

HOOPNETTING APPENDIX F (continued)

SITE(S): 29
DATE(S): 81578,

TOTAL HOURS SET: 203.25 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	3	0.4	2128.	10.58	4.92
CHANNEL CATFISH	29	3.4	5480.	27.23	47.54
SMALLMOUTH BUFFALO	22	2.6	11363.	56.47	36.07
BLUEGILL	4	0.5	598.	2.97	6.56
WHITE CRAPPIE	1	0.1	155.	0.77	1.64
FRESHWATER DRUM	2	0.2	398.	1.98	3.28
TOTALS	61	7.2	20122	100.00	100.00

HOOPNETTING

SITE(S): 30
DATE(S): 81178,

TOTAL HOURS SET: 204.50 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	315.	6.16	7.69
CHANNEL CATFISH	4	0.5	524.	10.24	30.77
FLATHEAD CATFISH	2	0.2	738.	14.42	15.38
SMALLMOUTH BUFFALO	5	0.6	3503.	68.46	38.46
BLACK CRAPPIE	1	0.1	37.	0.72	7.69
TOTALS	13	1.5	5117	100.00	100.00

HOOPNETTING

SITE(S): 31
DATE(S): 81178.

TOTAL HOURS SET: 204.17 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	8	0.9	3290.	24.39	21.05
CHANNEL CATFISH	17	2.0	3649.	27.05	44.74
FLATHEAD CATFISH	1	0.1	855.	6.34	2.63
SMALLMOUTH BUFFALO	9	1.1	5330.	39.52	23.68
WHITE BASS	2	0.2	326.	2.42	5.26
BLACK CRAPPIE	1	0.1	38.	0.28	2.63
TOTALS	38	4.5	13488	100.00	100.00

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APPENDIX F (continued)

HOOPNETTING

DATE(S): 81178. Side channel

TOTAL HOURS SET: 193.50 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	0.1	515.	20.82	3.70
CHANNEL CATFISH	1	0.1	112.	4.53	3.70
FLATHEAD CATFISH	1	0.1	183.	7.40	3.70
BLUEGILL	13	1.6	1007.	40.70	48.15
WHITE CRAPPIE	4	0.5	209.	8.45	14.81
BLACK CRAPPIE	7	0.9	448.	18.11	25.93
TOTALS	27	3.3	2474	100.00	100.00

HOOPNETTING

DATE(S): 81578. Side channel

TOTAL HOURS SET: 191.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	37	4.6	5788.	58.82	56.06
SMALLMOUTH BUFFALO	3	0.4	1401.	14.24	4.55
BLUEGILL	21	2.6	1999.	20.32	31.82
WHITE CRAPPIE	2	0.3	160.	1.63	3.03
BLACK CRAPPIE	2	0.3	252.	2.56	3.03
FRESHWATER DRUM	1	0.1	240.	2.44	1.52
TOTALS	66	8.3	9840	100.00	100.00

APPENDIX G

Hoop net catches for each wing dam and the side channel in October, 1978. Fish weights are expressed in grams.

APPENDIX G (continued)

Wing dam 25

TOTAL HOURS SET: 206.67 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	3	0.3	446.	19.98	30.00
SAUGER	1	0.1	380.	17.03	10.00
SMALLMOUTH BUFFALO	1	0.1	550.	24.64	10.00
FRESHWATER DRUM	5	0.6	856.	38.35	50.00
TOTALS	10	1.2	2232	100.00	100.00

Wing dam 26

TOTAL HOURS SET: 181.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	1	0.1	76.	4.19	12.50
SAUGER	1	0.1	226.	12.44	12.50
SHORTHEAD REDHORSE	1	0.1	640.	35.24	12.50
BLACK CRAPPIE	1	0.1	48.	2.64	12.50
FRESHWATER DRUM	4	0.5	826.	45.48	50.00
TOTALS	8	1.1	1816	100.00	100.00

Wing dam 28

TOTAL HOURS SET: 181.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONG NOSE GAR	1	0.1	430.	41.59	20.00
CHANNEL CATFISH	1	0.1	26.	2.51	20.00
SMALLMOUTH BUFFALO	1	0.1	365.	35.30	20.00
BLACK CRAPPIE	1	0.1	76.	7.35	20.00
FRESHWATER DRUM	1	0.1	137.	13.25	20.00
TOTALS	5	0.7	1034	100.00	100.00

APPENDIX G (continued)

Wing dam 29

TOTAL HOURS SET: 181.58 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
FLATHEAD CATFISH	1	0.1	510.	72.65	50.00
SAUGER	1	0.1	192.	27.35	50.00
TOTALS	2	0.3	702	100.00	100.00

Wing dam 30

TOTAL HOURS SET: 182.75 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SILVER REDHORSE	1	0.1	2000.	100.00	100.00
TOTALS	1	0.1	2000	100.00	100.00

Wing dam 31

TOTAL HOURS SET: 182.67 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
GIZZARD SHAD	1	0.1	88.	3.78	20.00
FLATHEAD CATFISH	1	0.1	108.	4.64	20.00
SMALLMOUTH BUFFALO	2	0.3	1550.	66.64	40.00
SHORTHEAD REDHORSE	1	0.1	580.	24.94	20.00
TOTALS	5	0.7	2326	100.00	100.00

APPENDIX G (continued)

Wing dam 25

TOTAL HOURS SET: 188.33 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	11	1.4	1618.	13.96	32.35
RIVER CARPSUCKER	1	0.1	1060.	9.14	2.94
SMALLMOUTH BUFFALO	21	2.7	8760.	75.57	61.76
FRESHWATER DRUM	1	0.1	154.	1.33	2.94
TOTALS	34	4.3	11592	100.00	100.00

Wing dam 26

TOTAL HOURS SET: 193.58 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	4	0.5	788.	9.66	18.18
SMALLMOUTH BUFFALO	17	2.1	7152.	87.70	77.27
FRESHWATER DRUM	1	0.1	215.	2.64	4.55
TOTALS	22	2.7	8155	100.00	100.00

Wing dam 28

TOTAL HOURS SET: 193.33 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	3	0.4	400.	2.25	6.38
SMALLMOUTH BUFFALO	42	5.2	17226.	96.69	89.36
BLACK CRAPPIE	2	0.2	190.	1.07	4.26
TOTALS	47	5.8	17816	100.00	100.00

APPENDIX G (continued)

Wing dam 29

TOTAL HOURS SET: 192.08 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
FLATHEAD CATFISH	1	0.1	490.	2.36	3.03
RIVER CARPSUCKER	1	0.1	1340.	6.46	3.03
SMALLMOUTH BUFFALO	31	3.9	18907.	91.18	93.94
TOTALS	33	4.1	20737	100.00	100.00

Wing dam 30

TOTAL HOURS SET: 196.25 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	620.	15.34	7.69
CHANNEL CATFISH	7	0.9	1252.	30.98	53.85
WALLEYE	1	0.1	210.	5.20	7.69
SMALLMOUTH BUFFALO	3	0.4	1870.	46.28	23.08
BLUEGILL	1	0.1	89.	2.20	7.69
TOTALS	13	1.6	4041	100.00	100.00

Wing dam 31

TOTAL HOURS SET: 197.92 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	32	3.9	5615.	60.01	80.00
FLATHEAD CATFISH	1	0.1	300.	3.21	2.50
SMALLMOUTH BUFFALO	6	0.7	2232.	23.85	15.00
SHORTHEAD REDHORSE	1	0.1	1210.	12.93	2.50
TOTALS	40	4.9	9357	100.00	100.00

APPENDIX G (continued)

Side channel

TOTAL HOURS SET: 236.17 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	5	0.5	588.	13.61	33.33
SAUGER	2	0.2	631.	14.60	13.33
WALLEYE	1	0.1	147.	3.40	6.67
SMALLMOUTH BUFFALO	3	0.3	1832.	42.40	20.00
SHORTHEAD REDHORSE	3	0.3	1077.	24.92	20.00
FRESHWATER DRUM	1	0.1	46.	1.06	6.67
TOTALS	15	1.5	4321	100.00	100.00

Side channel

TOTAL HOURS SET: 209.50 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	500.	1.59	0.52
CHANNEL CATFISH	180	20.6	26284.	83.43	93.26
SAUGER	1	0.1	197.	0.63	0.52
SMALLMOUTH BUFFALO	9	1.0	4139.	13.14	4.66
FRESHWATER DRUM	2	0.2	384.	1.22	1.04
TOTALS	193	22.1	31504	100.00	100.00

APPENDIX H

Hoop net catches for each wing dam and the side channel in June, 1979. Fish weights are expressed in grams.

APPENDIX H

Wing dam 25

DATE(S): 61079.

TOTAL HOURS SET: 191.67 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
LONGNOSE GAR	1	0.1	406.	18.12	11.11
CHANNEL CATFISH	2	0.3	240.	10.71	22.22
SAUGER	1	0.1	422.	18.83	11.11
SHORTHEAD REDHORSE	1	0.1	590.	26.33	11.11
FRESHWATER DRUM	1	0.1	264.	11.78	11.11
BLACK BULLHEAD	3	0.4	319.	14.23	33.33
TOTALS	9	1.1	2241	100.00	100.00

Wing dam 26

DATE(S): 61079.

TOTAL HOURS SET: 192.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	5	0.6	898.	34.29	35.71
FLATHEAD CATFISH	2	0.3	546.	20.85	14.29
SMALLMOUTH BUFFALO	1	0.1	434.	16.57	7.14
FRESHWATER DRUM	2	0.3	312.	11.91	14.29
BLACK BULLHEAD	4	0.5	429.	16.38	28.57
TOTALS	14	1.8	2619	100.00	100.00

Wing dam 28

DATE(S): 61079.

TOTAL HOURS SET: 192.33 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SAUGER	1	0.1	329.	25.76	33.33
SHOVELNOSE STURGEON	1	0.1	850.	66.56	33.33
YELLOW PERCH	1	0.1	98.	7.67	33.33
TOTALS	3	0.4	1277	100.00	100.00

APPENDIX H (continued)

Wing dam 29

DATE(S): 61079.

TOTAL HOURS SET: 193.00 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	3	0.4	596.	61.70	75.00
GOLDEN REDHORSE	1	0.1	370.	38.30	25.00
TOTALS	4	0.5	966	100.00	100.00

Wing dam 30

SITE(S):
DATE(S): 61079.

TOTAL HOURS SET: 191.67 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	3	0.4	730.	40.47	50.00
FLATHEAD CATFISH	2	0.3	244.	13.53	33.33
SMALLMOUTH BUFFALO	1	0.1	830.	46.01	16.67
TOTALS	6	0.8	1804	100.00	100.00

DATE(S): 61479. 61279. 61079. Wing dam 31

TOTAL HOURS SET: 196.42 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	2570.	44.27	20.00
FLATHEAD CATFISH	1	0.1	385.	6.63	20.00
RIVER CARPSUCKER	2	0.2	2000.	34.45	40.00
SHORTHEAD REDHORSE	1	0.1	850.	14.64	20.00
TOTALS	5	0.6	5805	100.00	100.00

APPENDIX H (continued)

DATE(S): 61279, Wing dam 25

TOTAL HOURS SET: 190.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	3	0.4	468.	4.76	11.11
FLATHEAD CATFISH	1	0.1	390.	3.97	3.70
RIVER CARPSUCKER	1	0.1	600.	6.72	3.70
SMALLMOUTH BUFFALO	12	1.5	6747.	68.66	44.44
FRESHWATER DRUM	7	0.9	993.	10.16	25.93
BLACK BULLHEAD	3	0.4	564.	5.74	11.11
TOTALS	27	3.4	9827	100.00	100.00

DATE(S): 61779, Wing dam 26

TOTAL HOURS SET: 192.67 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	1	0.1	104.	0.88	4.76
SMALLMOUTH BUFFALO	19	2.4	11630.	98.51	90.48
FRESHWATER DRUM	1	0.1	72.	0.61	4.76
TOTALS	21	2.6	11806	100.00	100.00

DATE(S): 61279, Wing dam 28

TOTAL HOURS SET: 180.47 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	2450.	26.93	8.33
CHANNEL CATFISH	3	0.4	292.	3.21	25.00
SMALLMOUTH BUFFALO	7	0.9	5993.	65.86	58.33
FRESHWATER DRUM	1	0.1	364.	4.00	8.33
TOTALS	12	1.6	9099	100.00	100.00

APPENDIX H (continued)

Wing dam 29

DATE(S): 61279,

TOTAL HOURS SET: 186.75 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	2	0.3	4200.	44.46	25.00
SMALLMOUTH BUFFALO	6	0.8	5246.	55.54	75.00
TOTALS	8	1.0	9446	100.00	100.00

Wing dam 30

DATE(S): 61279,

TOTAL HOURS SET: 185.70 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CHANNEL CATFISH	1	0.1	138.	10.99	25.00
FLATHEAD CATFISH	1	0.1	84.	6.69	25.00
SAUGER	1	0.1	930.	74.04	25.00
UNKNOWN	1	0.1	104.	8.28	25.00
TOTALS	4	0.5	1256	100.00	100.00

Wing dam 31

DATE(S): 61679, 61479, 61279,

TOTAL HOURS SET: 196.00 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
SILVER CHUB	1	0.1	64.	1.70	16.67
FLATHEAD CATFISH	1	0.1	600.	15.94	16.67
SMALLMOUTH BUFFALO	4	0.5	3100.	82.36	66.67
TOTALS	6	0.7	3764	100.00	100.00

APPENDIX H (continued)

DATE(S): 61079. Side channel

TOTAL HOURS SET: 199.67 UNBAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	1	0.1	1200.	72.46	33.33
FLATHEAD CATFISH	1	0.1	202.	12.20	33.33
SMALLMOUTH BUFFALO	1	0.1	254.	15.34	33.33
TOTALS	3	0.4	1656	100.00	100.00

DATE(S): 61279. Side channel

TOTAL HOURS SET: 179.67 BAITED

SPECIE	NBR OF FISH	FISH/24 HR	TOTAL WEIGHT	PCT OF GRAND TOTAL WEIGHT	PCT OF GRAND TOTAL NUMBER
CARP	6	0.8	10900.	88.50	50.00
SMALLMOUTH BUFFALO	2	0.3	600.	4.87	16.67
FRESHWATER DRUM	2	0.3	624.	5.07	16.67
BLACK BULLHEAD	2	0.3	193.	1.57	16.67
TOTALS	12	1.6	12317	100.00	100.00

APPENDIX I

June 1978 seine catches in the side channel.

Species	Number of fish	Percent of grand total number
Mooneye	1	0.62
Emerald shiner	4	2.47
River shiner	55	33.95
Bullhead minnow	26	16.05
Fathead minnow	1	0.62
Channel catfish	1	0.62
Sauger	5	3.09
Walleye	1	0.62
Quillback	1	0.62
Bigmouth buffalo	2	1.23
Golden redhorse	2	1.23
Shorthead redhorse	1	0.62
Spotted sucker	1	0.62
Trout-perch	2	1.23
White bass	2	1.23
Orangespotted sunfish	4	2.47
Bluegill	1	0.62
White crappie	8	4.94
Black crappie	5	3.09
Freshwater drum	39	24.07
Totals	162	100.0

APPENDIX J

August 1978 seine catches in the side channel.

Species	Number of fish	Percent of grand total number
Longnose gar	1	0.25
Carp	1	0.25
Silvery minnow	7	1.72
Silver chub	70	17.24
Emerald shiner	26	6.40
River shiner	22	5.42
Spottail shiner	7	1.72
Bullhead minnow	19	4.68
Channel catfish	15	3.69
Tadpole madtom	26	6.40
Logperch	9	2.22
River darter	2	0.49
Sauger	12	2.96
Walleye	2	0.49
Highfin carpsucker	1	0.25
Smallmouth buffalo	1	0.25
Golden redhorse	2	0.49
Shorthead redhorse	1	0.25
Trout-perch	1	0.25
White bass	1	0.25
Rock bass	1	0.25
Orangespotted sunfish	31	7.64
Bluegill	92	22.66
Largemouth bass	2	0.49
White crappie	1	0.25
Black crappie	15	3.69
Freshwater drum	35	8.62
Brook silverside	3	0.74
Totals	406	100.0

APPENDIX K

October 1978 seine catches in the side channel.

Species	Number of fish	Percent of grand total number
Silver chub	4	8.51
Speckled chub	1	2.13
Emerald shiner	3	6.38
River shiner	4	8.51
Bullhead minnow	4	8.51
Tadpole madtom	1	2.13
Logperch	2	4.26
Sauger	5	10.64
Walleye	2	4.26
Silver redhorse	1	2.13
Shorthead redhorse	3	6.38
White bass	3	6.38
Orangespotted sunfish	4	8.51
Bluegill	1	2.13
White crappie	1	2.13
Black crappie	1	2.13
Freshwater drum	5	10.64
Brook silverside	1	2.13
Johnny darter	1	2.13
Totals	47	100.0

APPENDIX L

June 1979 seine catches in the side channel.

Species	Number of fish	Percent of grand total number
Silver chub	1	3.33
Emerald shiner	1	3.33
River shiner	9	30.00
Spottail shiner	1	3.33
Spotfin shiner	1	3.33
Bullhead minnow	3	10.00
Tadpole madtom	1	3.33
Sauger	3	10.00
White bass	1	3.33
Rock bass	1	3.33
Orangespotted sunfish	4	13.33
White crappie	1	3.33
Black crappie	1	3.33
Small unknown suckers	2	6.67
Totals	30	100.0

APPENDIX M

Length-frequency distributions of each year class of bluegill caught in Pool 13.

Length range (mm)	Year class 1978	1977	1976	1975	1974
41-60	3				
61-80	2	4			
81-100	3	36	3		
101-120		49	6		
121-140		35	16		
141-160		5	21	1	
161-180		1	38	2	2
181-200			3	2	1
201-220			1		
Totals	8	130	88	5	3

APPENDIX N

Length-frequency distributions of each year class of black crappie caught in Pool 13.

Length range (mm)	Year class 1978	1977	1976	1975	1974
61-80	1				
81-100		1			
101-120		3			
121-140		54	1		
141-160		19	2		
161-180		6	1		
181-200		1	6	2	2
201-220			2	3	
221-240			1	3	
Totals	1	84	13	8	2

APPENDIX O

Length-frequency distributions of each year class of sauger caught in Pool 13.

Length range (mm)	Year class 1978	1977	1976	1975	1974
101-120	4				
121-140	5				
141-160	2				
161-180	2	18	1		
181-200	3	19			
201-220		28			
221-240		30	3		
241-260		19	3		
261-280		10	5		
281-300		1	4	1	
301-320			5	1	1
321-340			1	1	
341-360				1	
361-380			2	1	
381-400					
401-420				1	
421-440					
441-460				1	
Totals	16	125	24	7	1

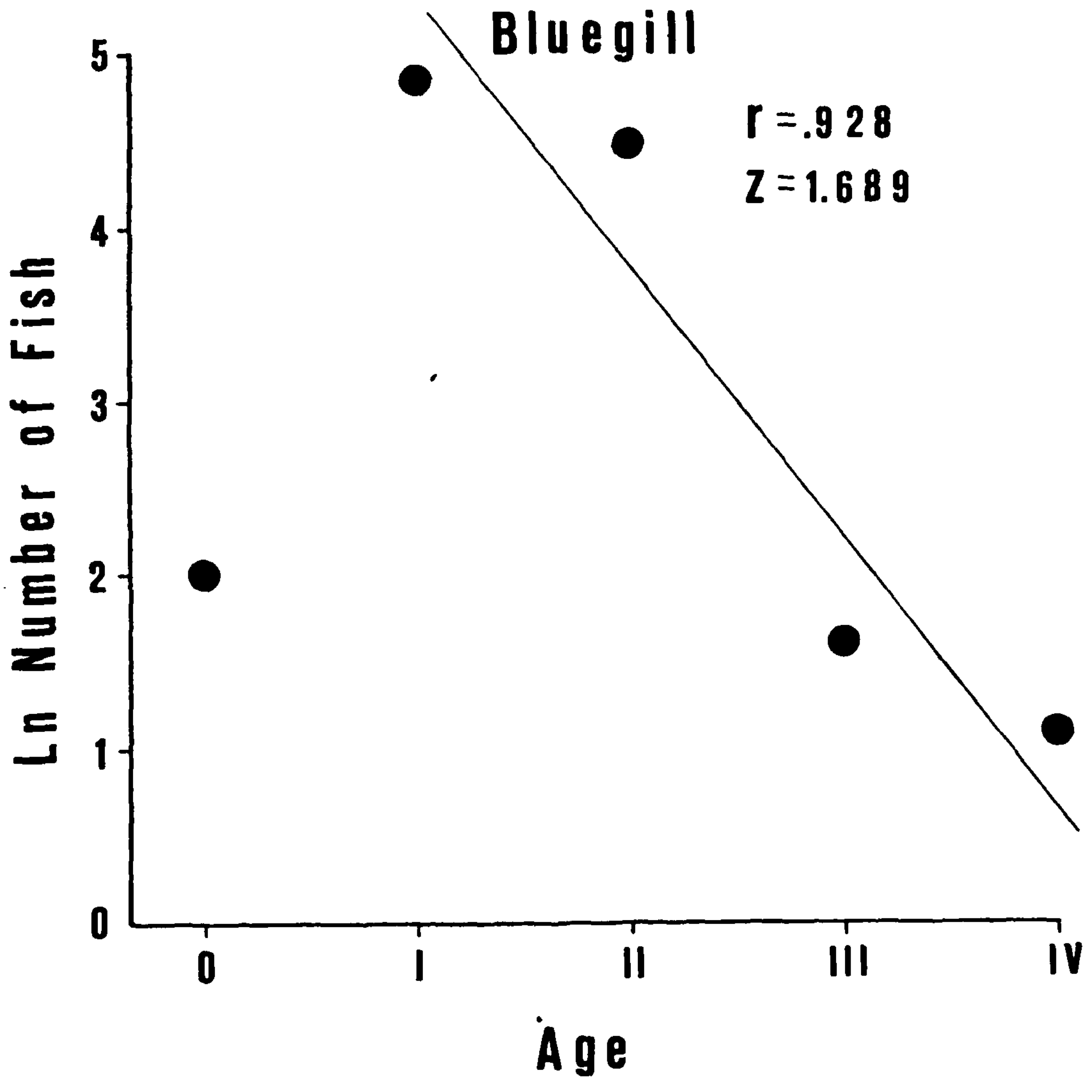
APPENDIX P

Length-frequency distributions of each year class of freshwater drum caught in Pool 13.

Length range (mm)	Year class 1978	1977	1976	1975	1974	1973	1972
41-60	1						
61-80	7						
81-100	14						
101-120	13						
121-140	49						
141-160	55	11	1				
161-180	25	13					
181-200	1	15	2				
201-220		24	6	1			
221-240		20	12				
241-260		7	20	2			
261-280			15	4			
281-300			5	2			
301-320			2	2	2		
321-340				1	1		
341-360					1		
361-380							
381-400							1
Totals	165	90	63	12	4	0	1

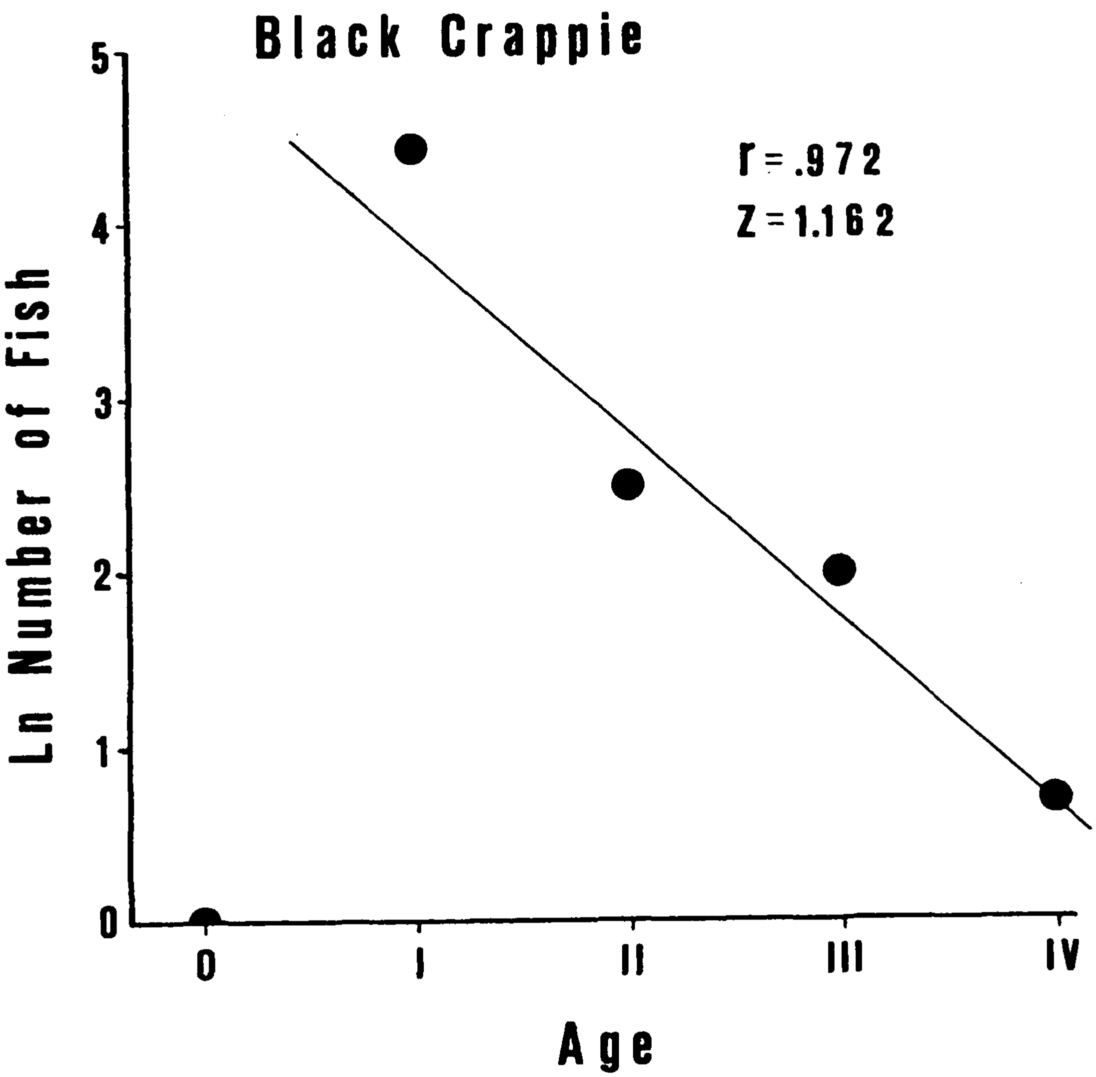
APPENDIX Q

Catch curve, correlation coefficient (r), and instantaneous rate of total mortality (Z) for bluegill of ages II through IV.



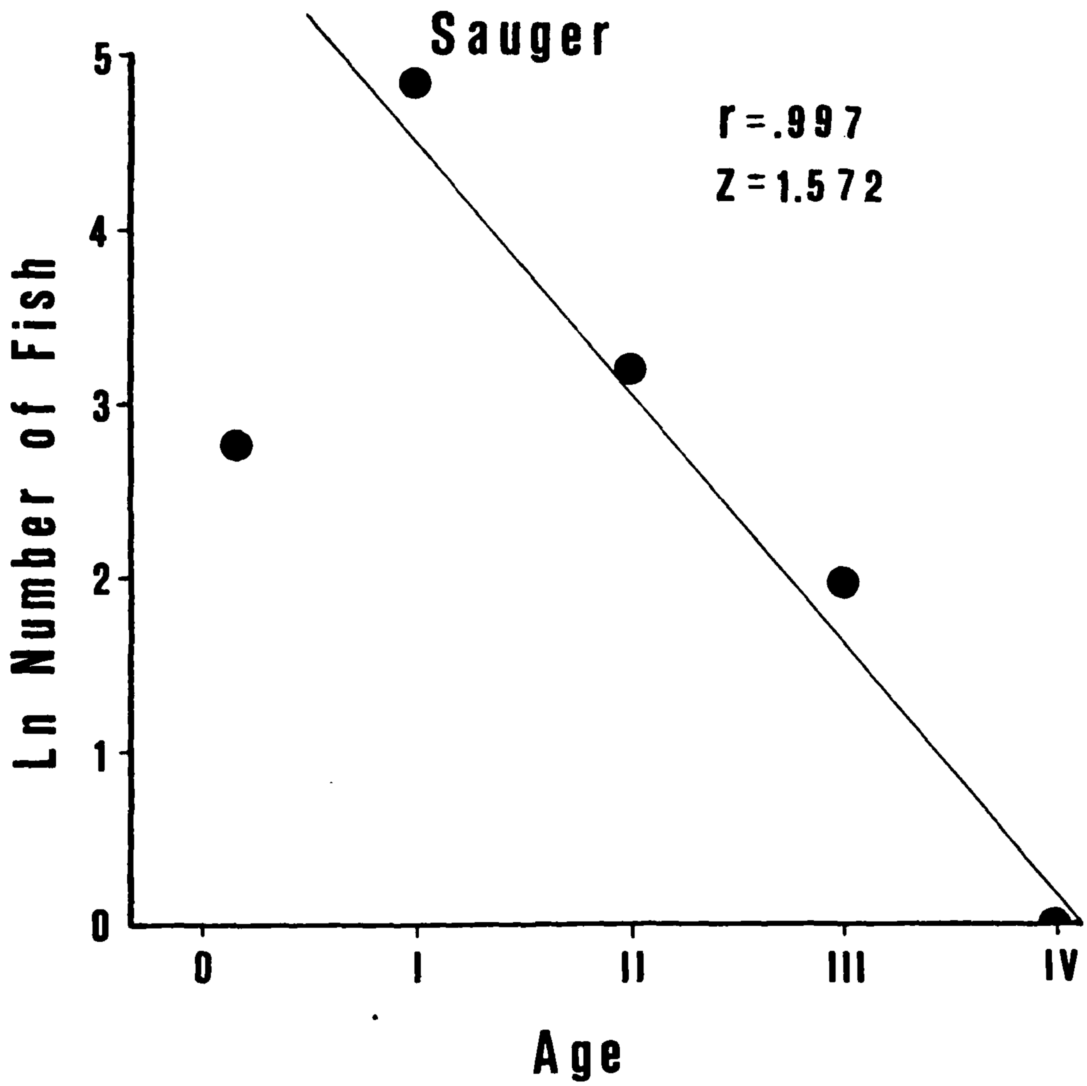
APPENDIX R

Catch curve, correlation coefficient (r), and instantaneous rate of total mortality (Z) for black crappie of ages I through IV.



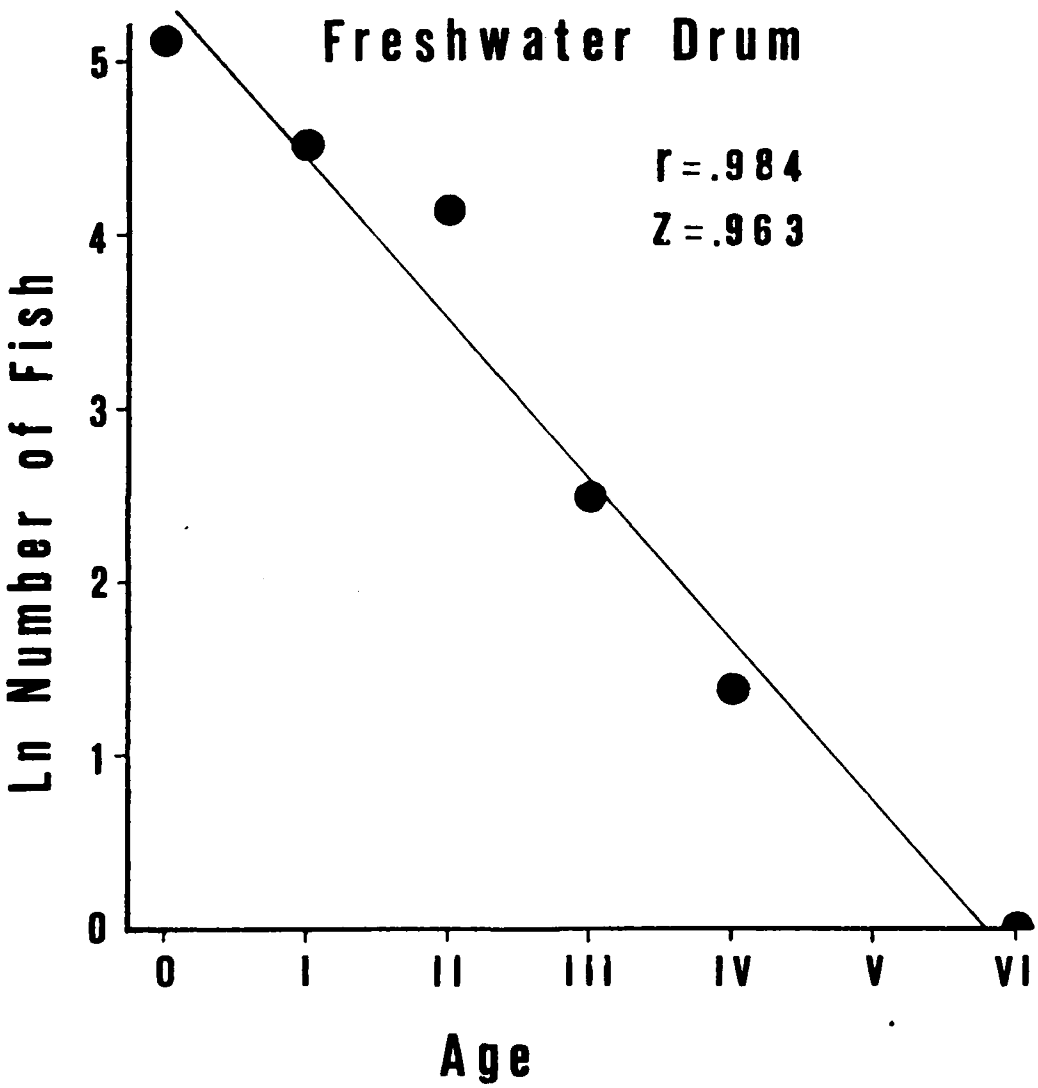
APPENDIX S

Catch curve, correlation coefficient (r), and instantaneous rate of total mortality (Z) for sauger of ages I through IV.



APPENDIX T

Catch curve, correlation coefficient (r), and instantaneous rate of total mortality (Z) for freshwater drum of ages I through VI.

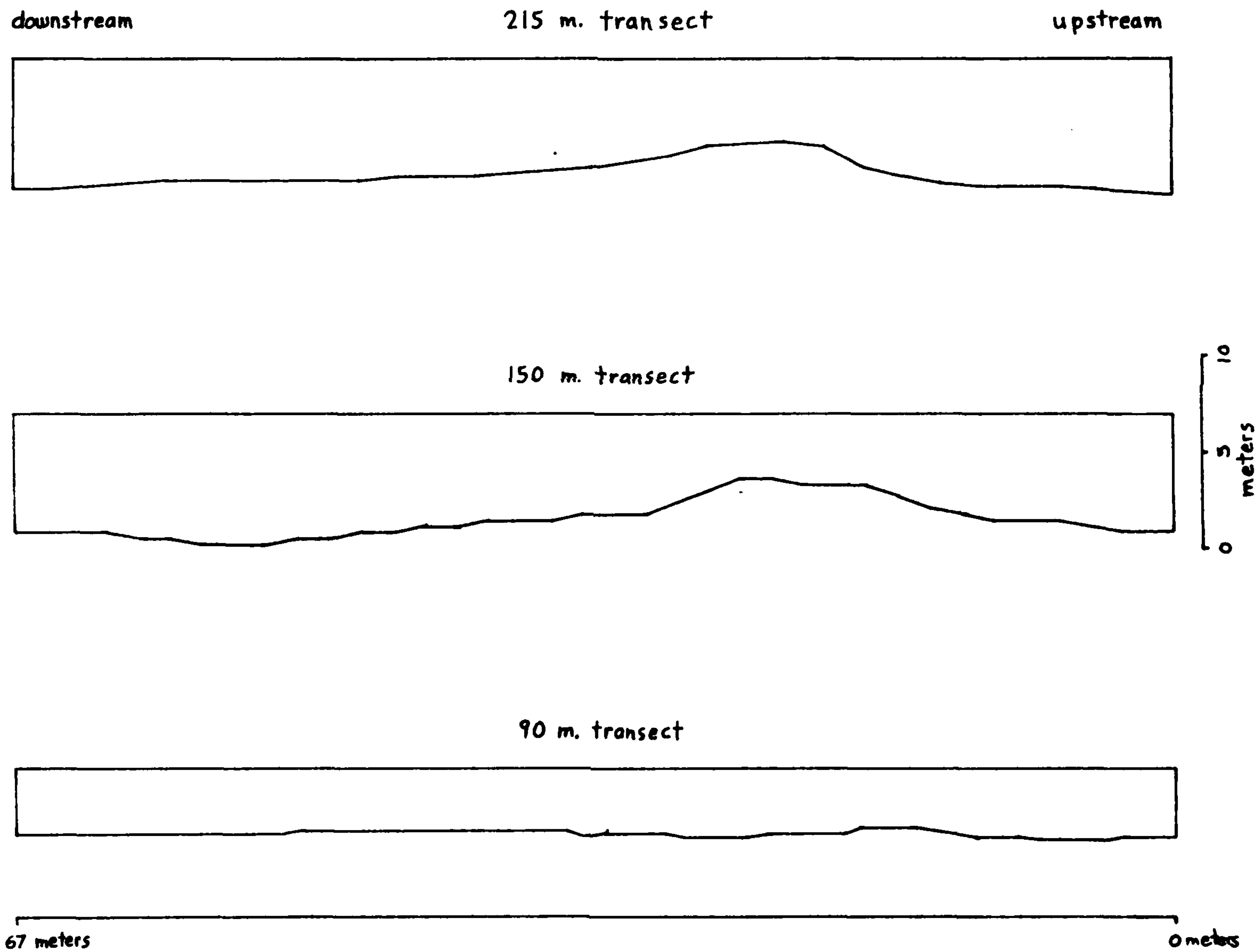


APPENDIX U

Hydrographic relief transects for each wing dam and the side channel in June, 1978.

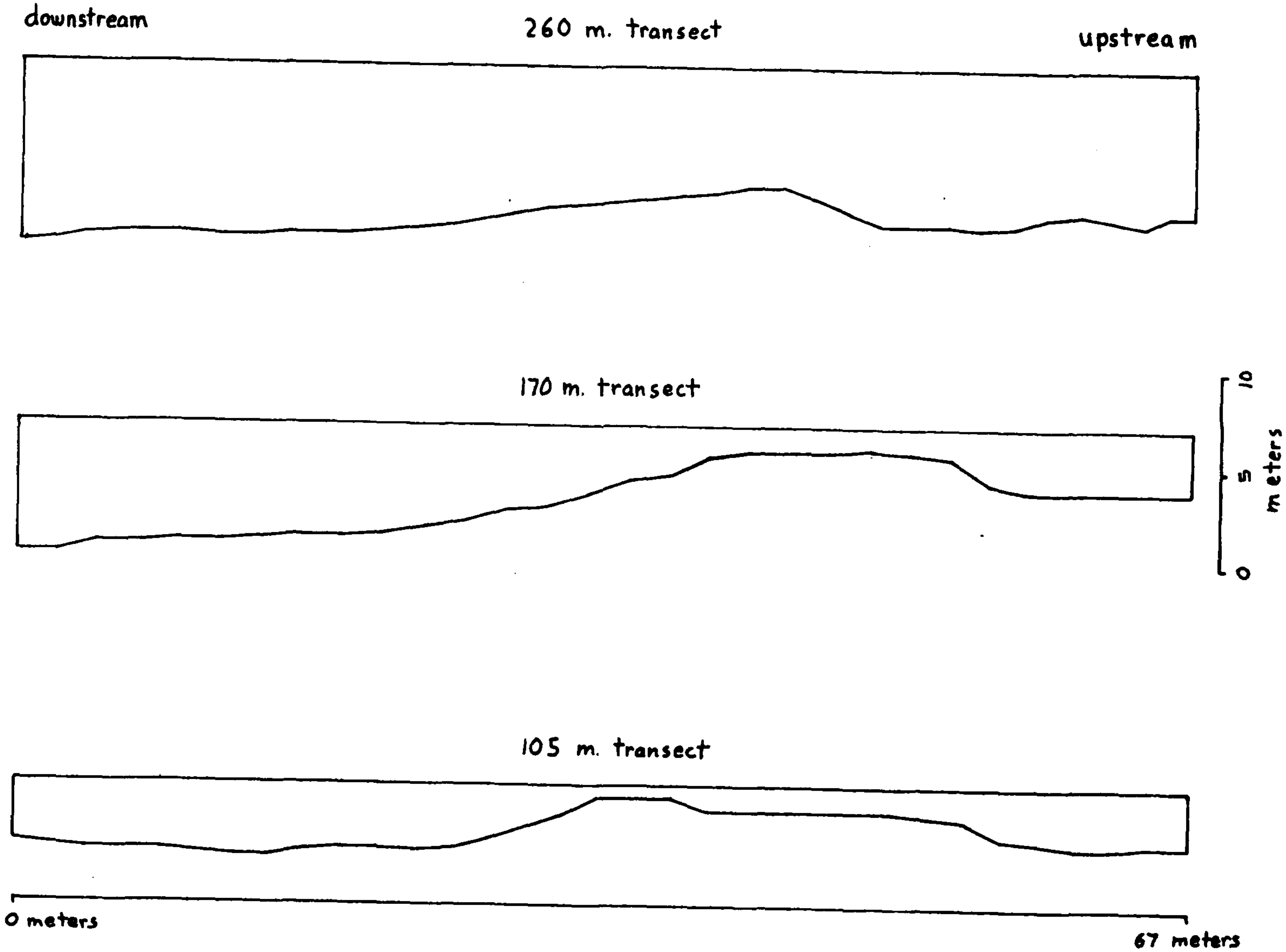
APPENDIX U

Wing Dam 25



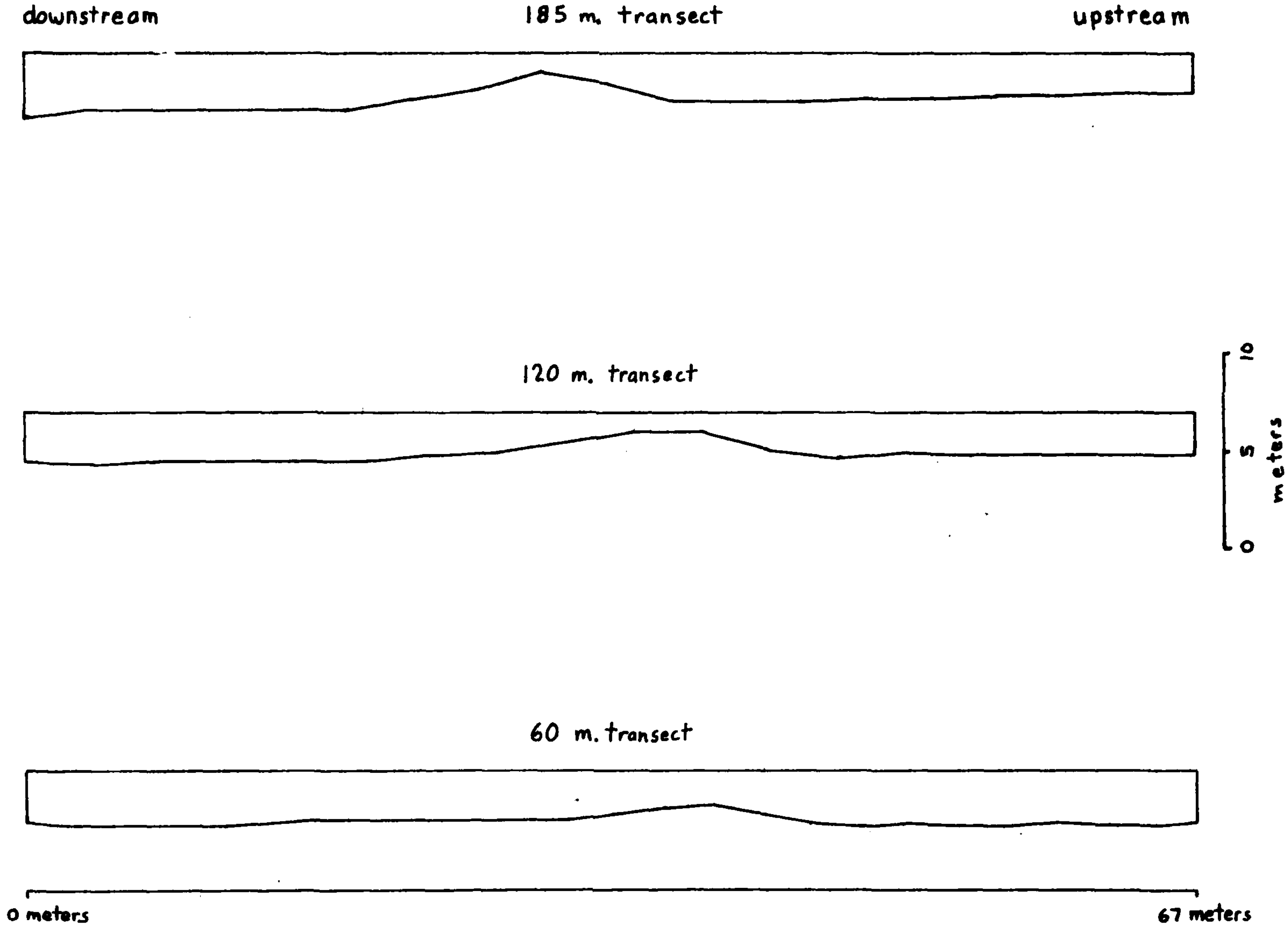
APPENDIX U (continued)

Wing Dam 26

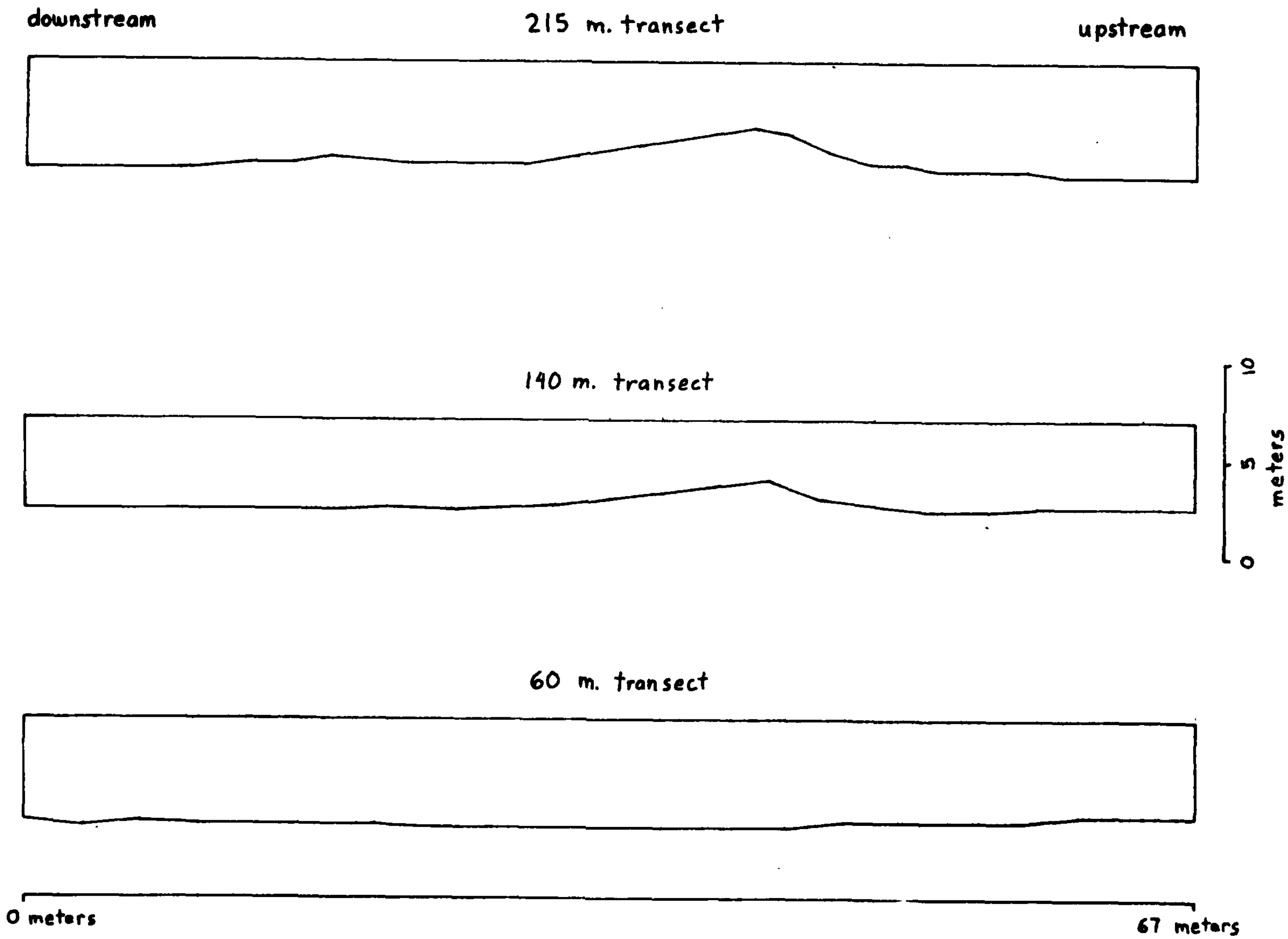


APPENDIX U (continued)

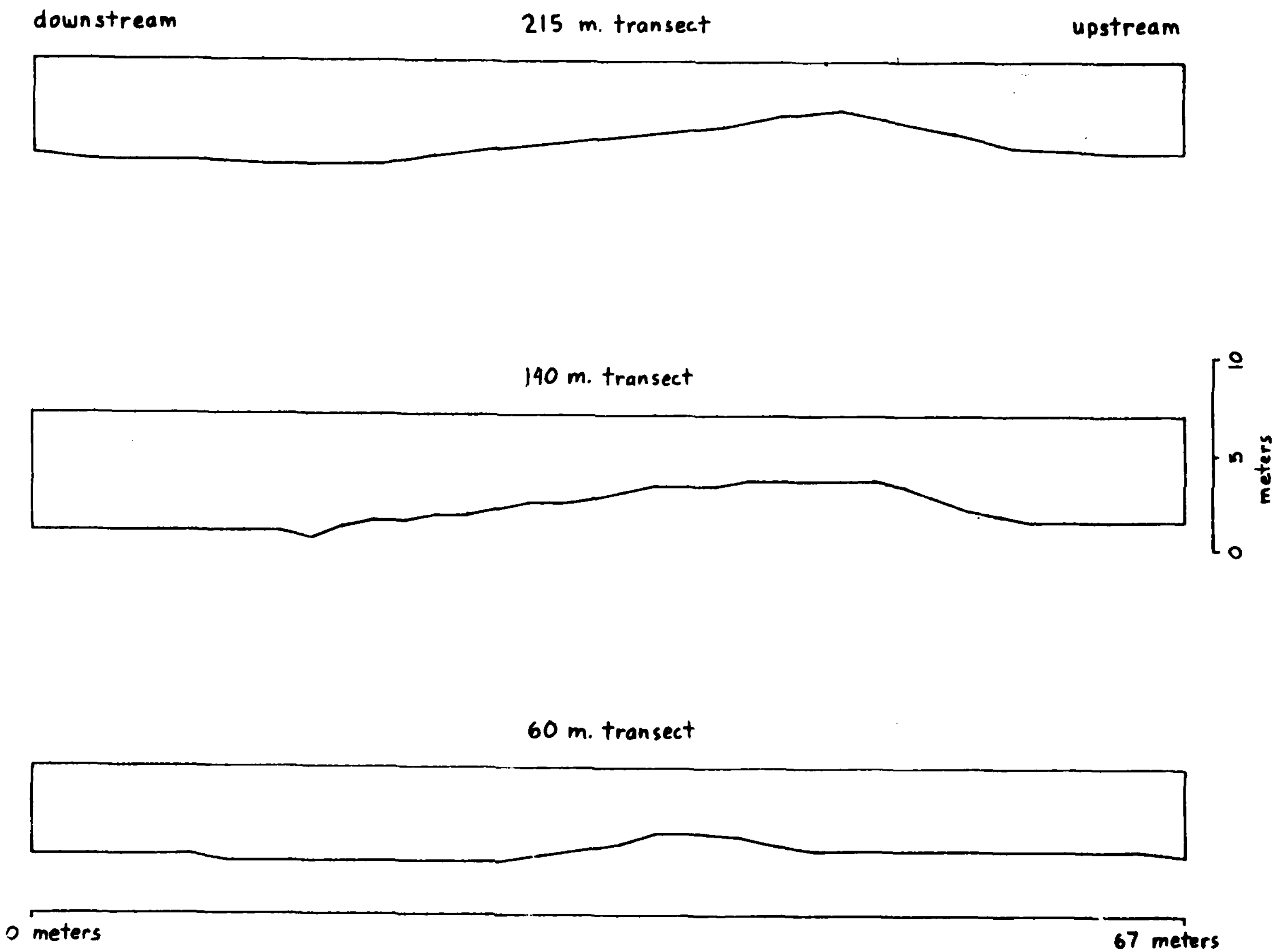
Wing Dam 28



APPENDIX U (continued)
Wing Dam 29

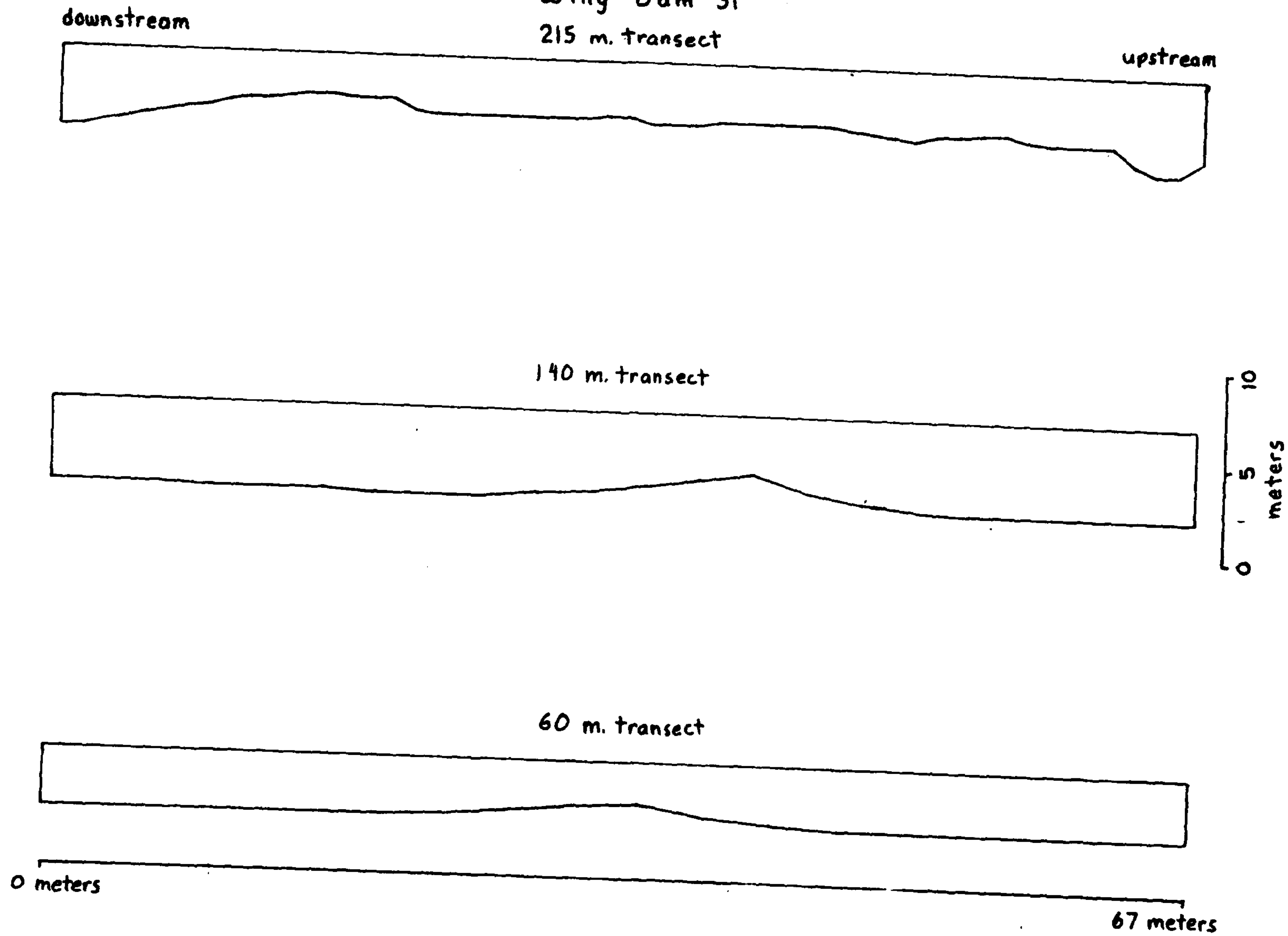


APPENDIX U (continued)
Wing Dam 30

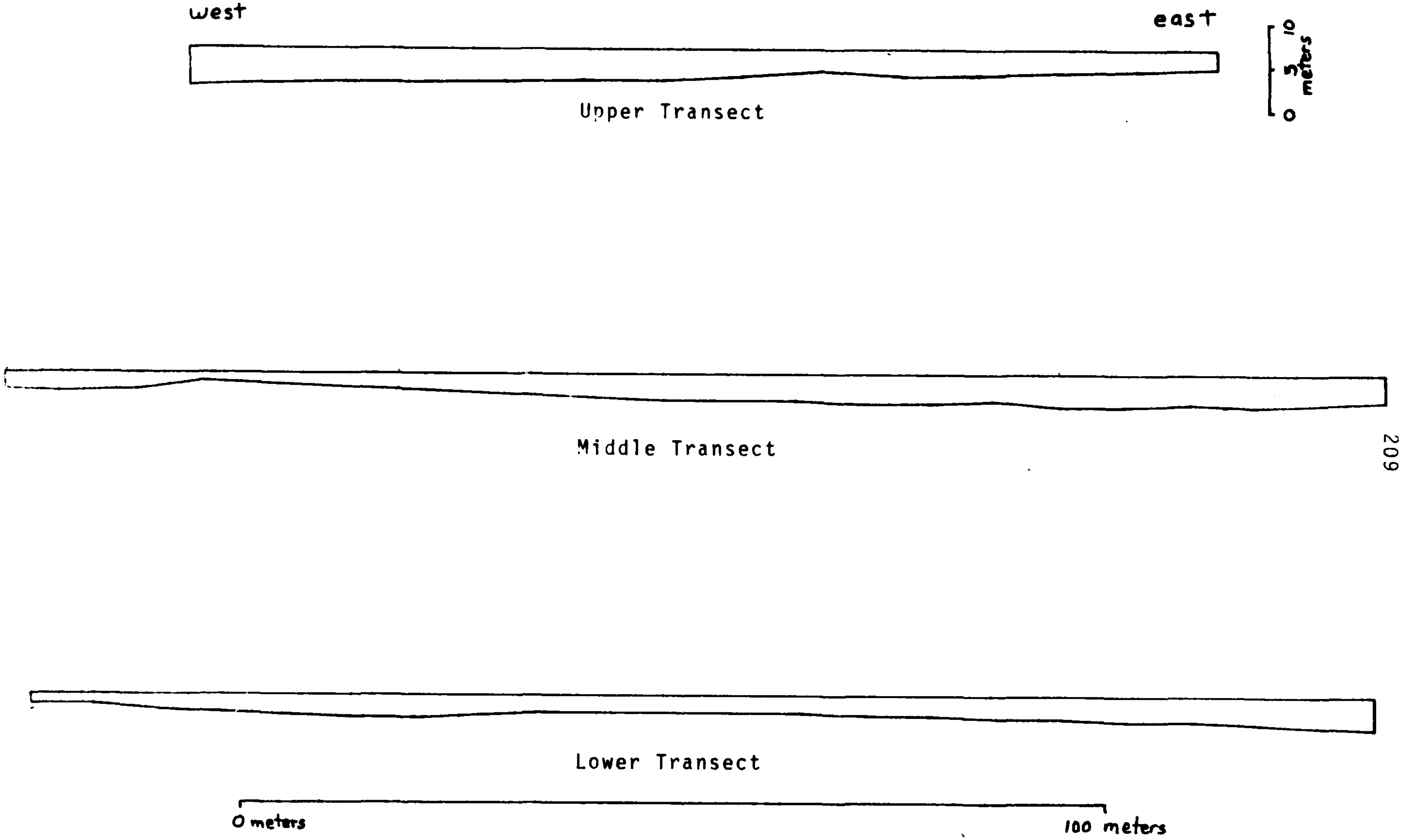


APPENDIX U (continued)

Wing Dam 31



APPENDIX U (continued)

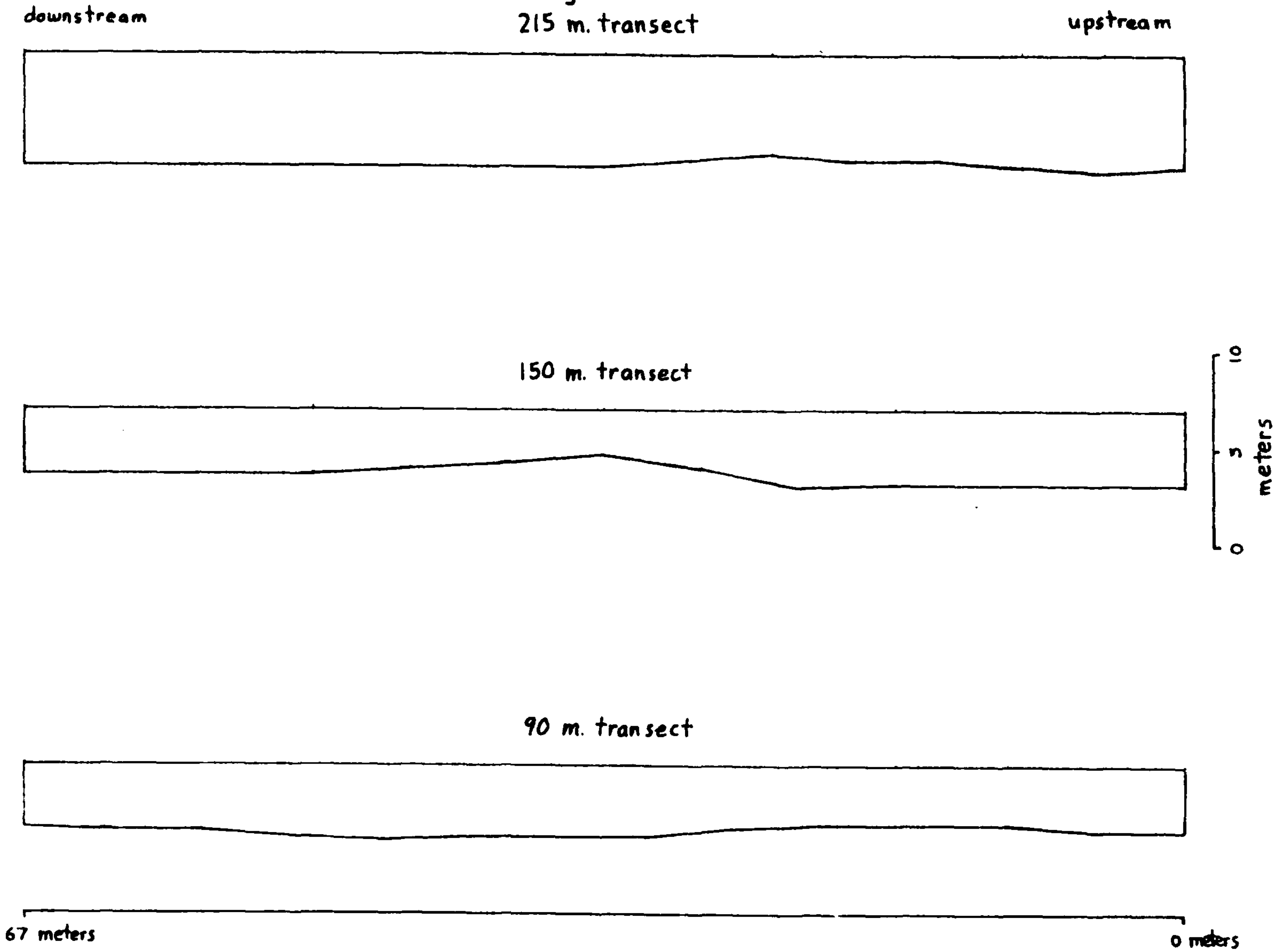


APPENDIX V

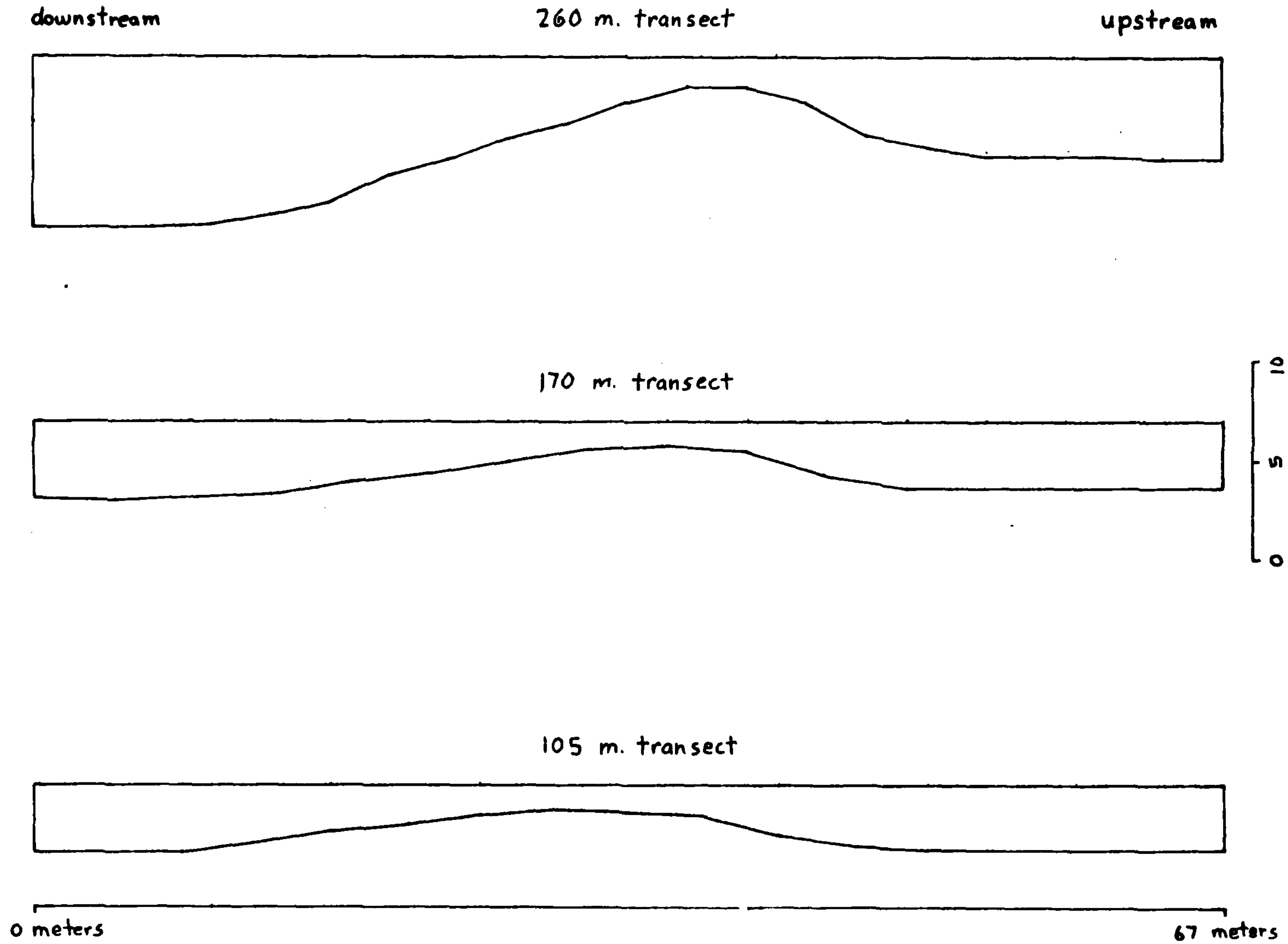
Hydrographic relief transects for each wing dam and the side channel in August, 1978.

APPENDIX V

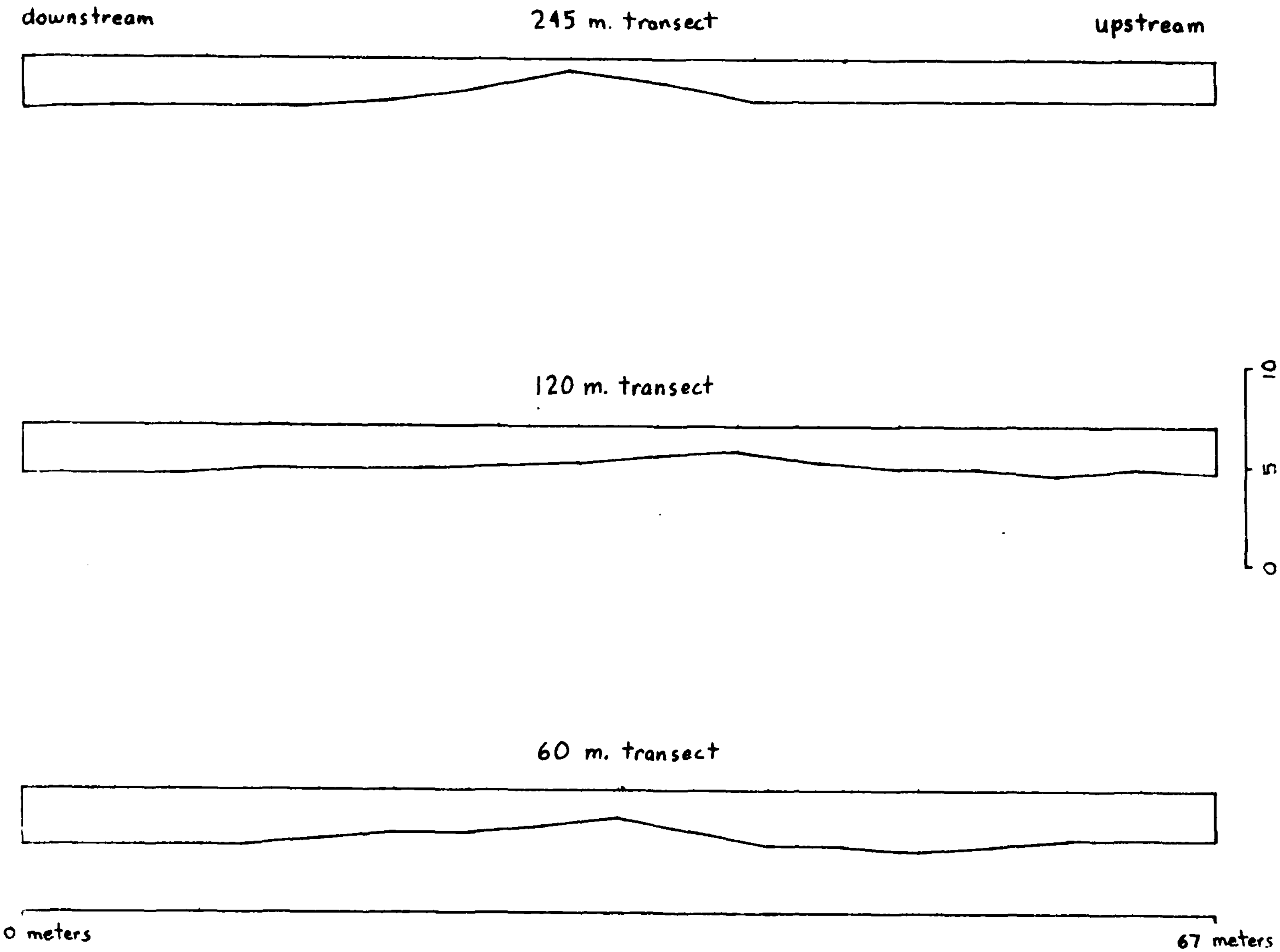
Wing Dam 25



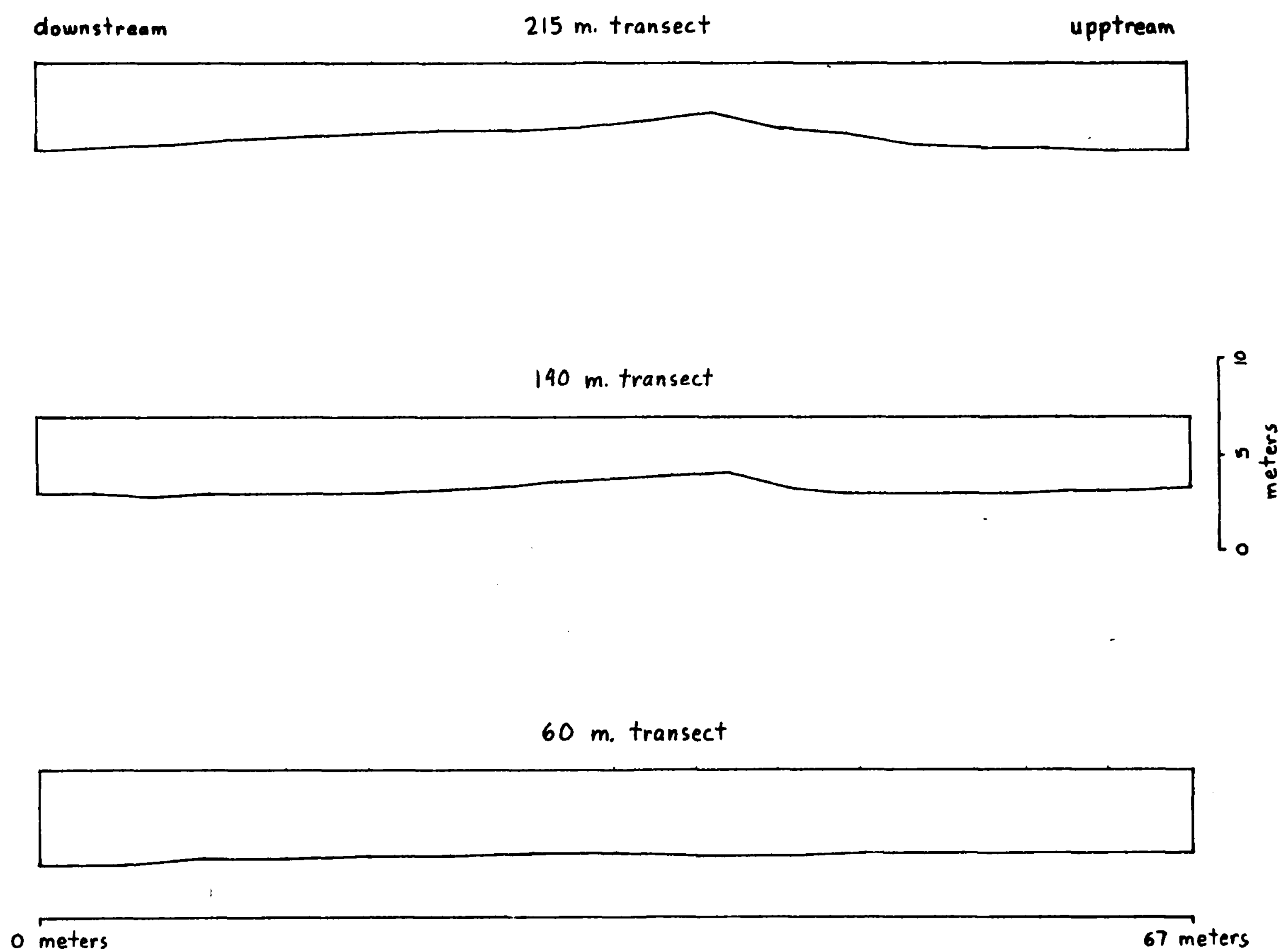
APPENDIX V (continued)
Wing Dam 26



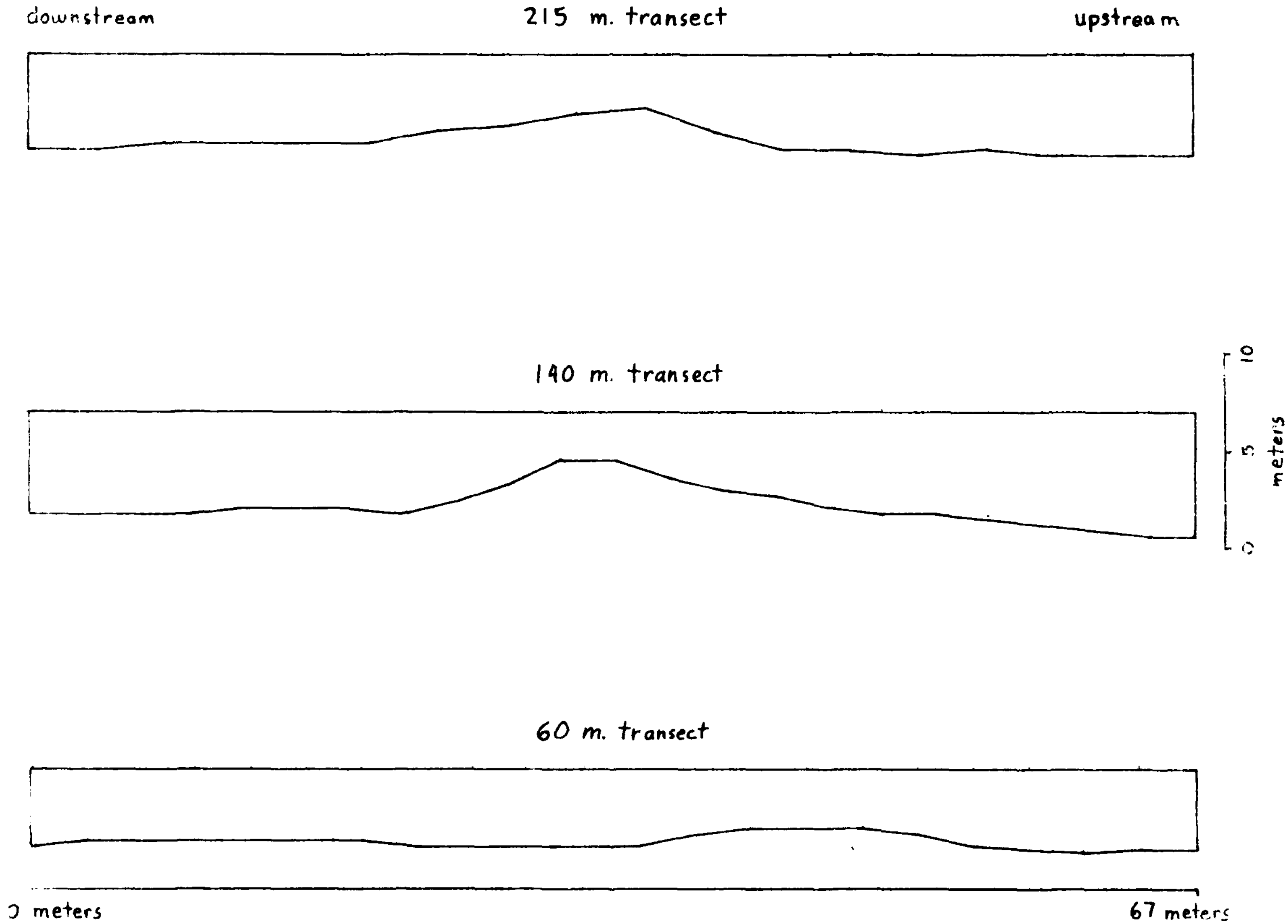
APPENDIX V (continued)
Wing Dam 28



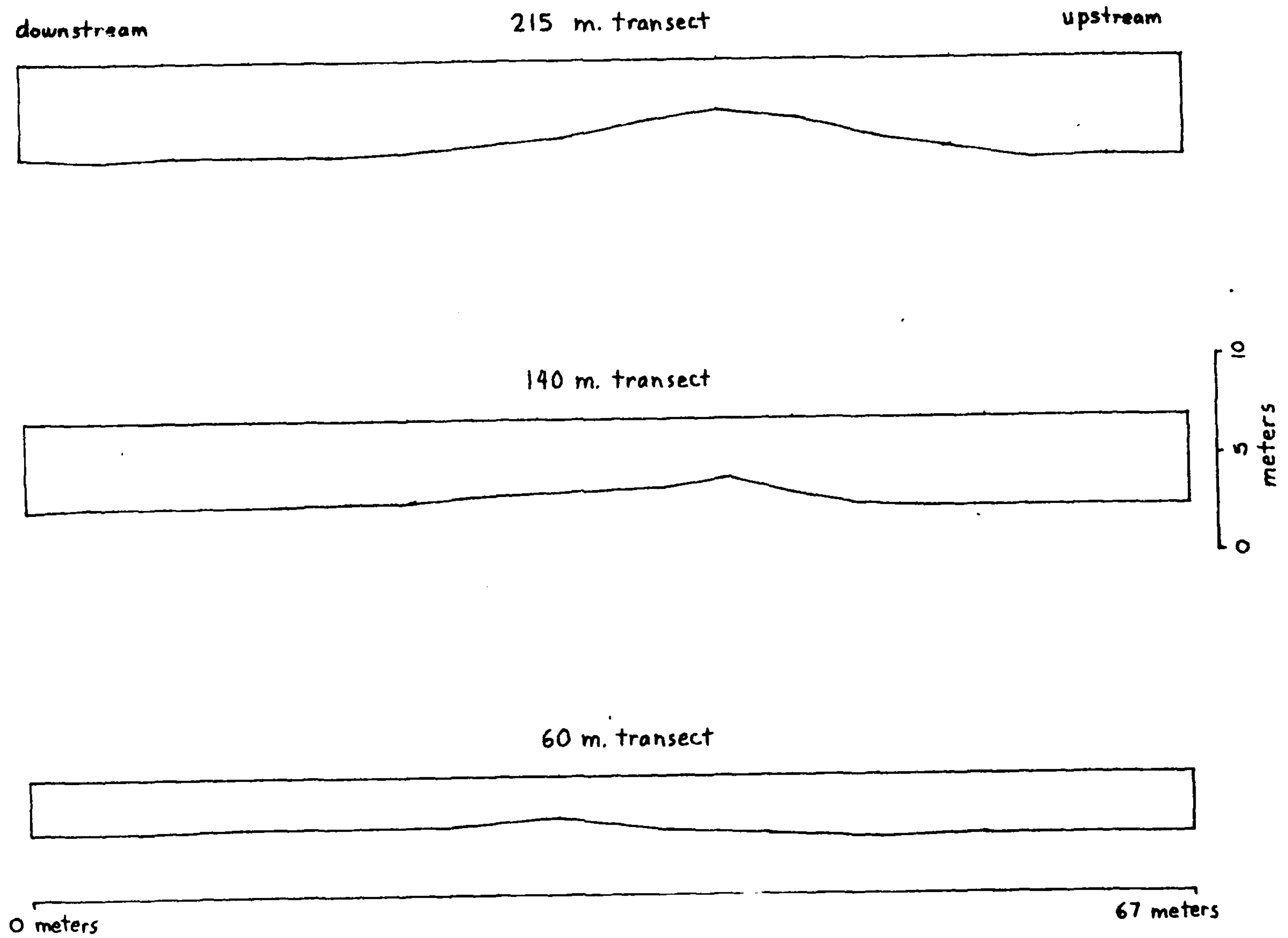
APPENDIX V (continued)
Wing Dam 29



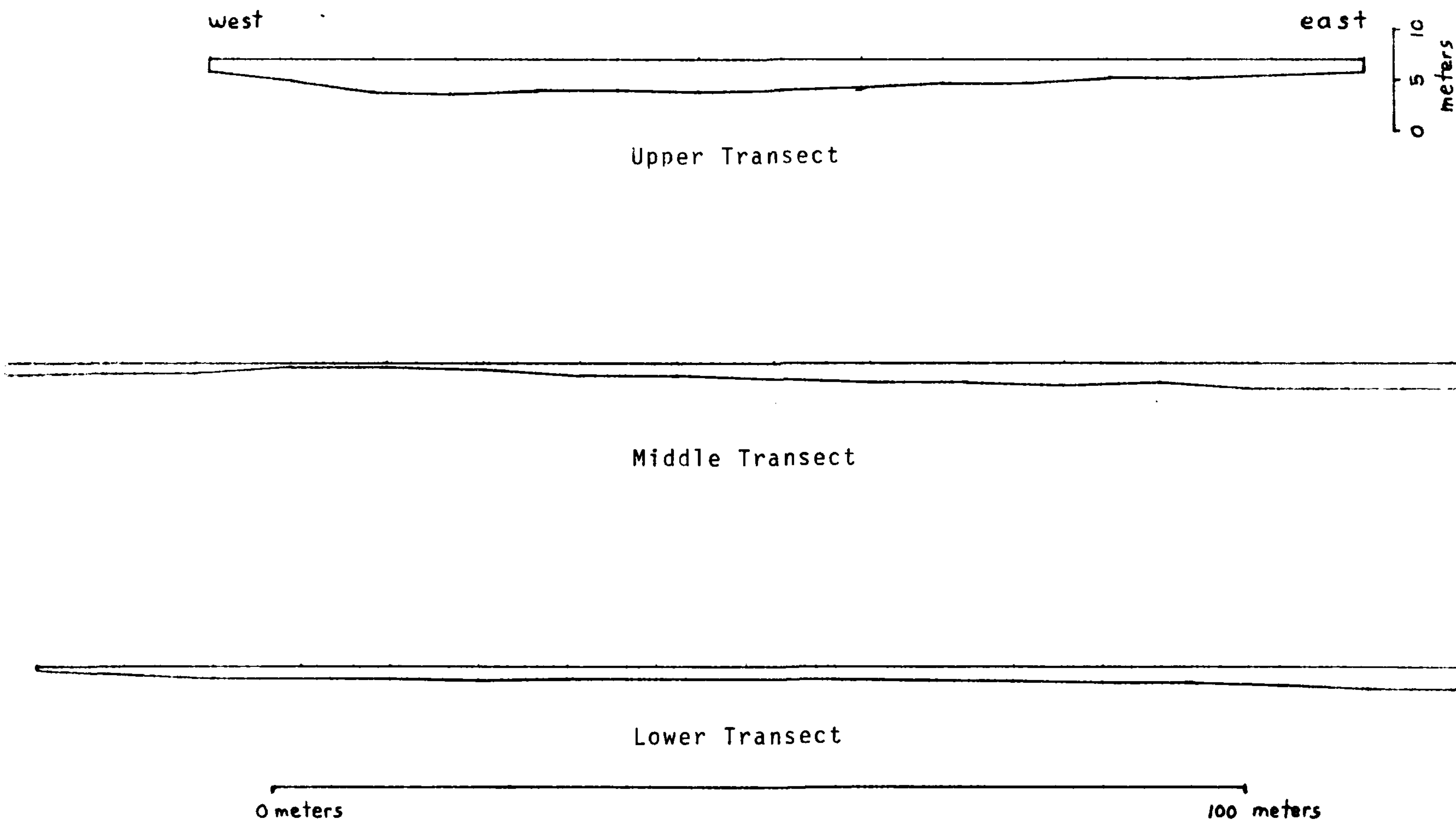
APPENDIX V (continued)
Wing Dam 30



APPENDIX V (continued)
Wing Dam 31



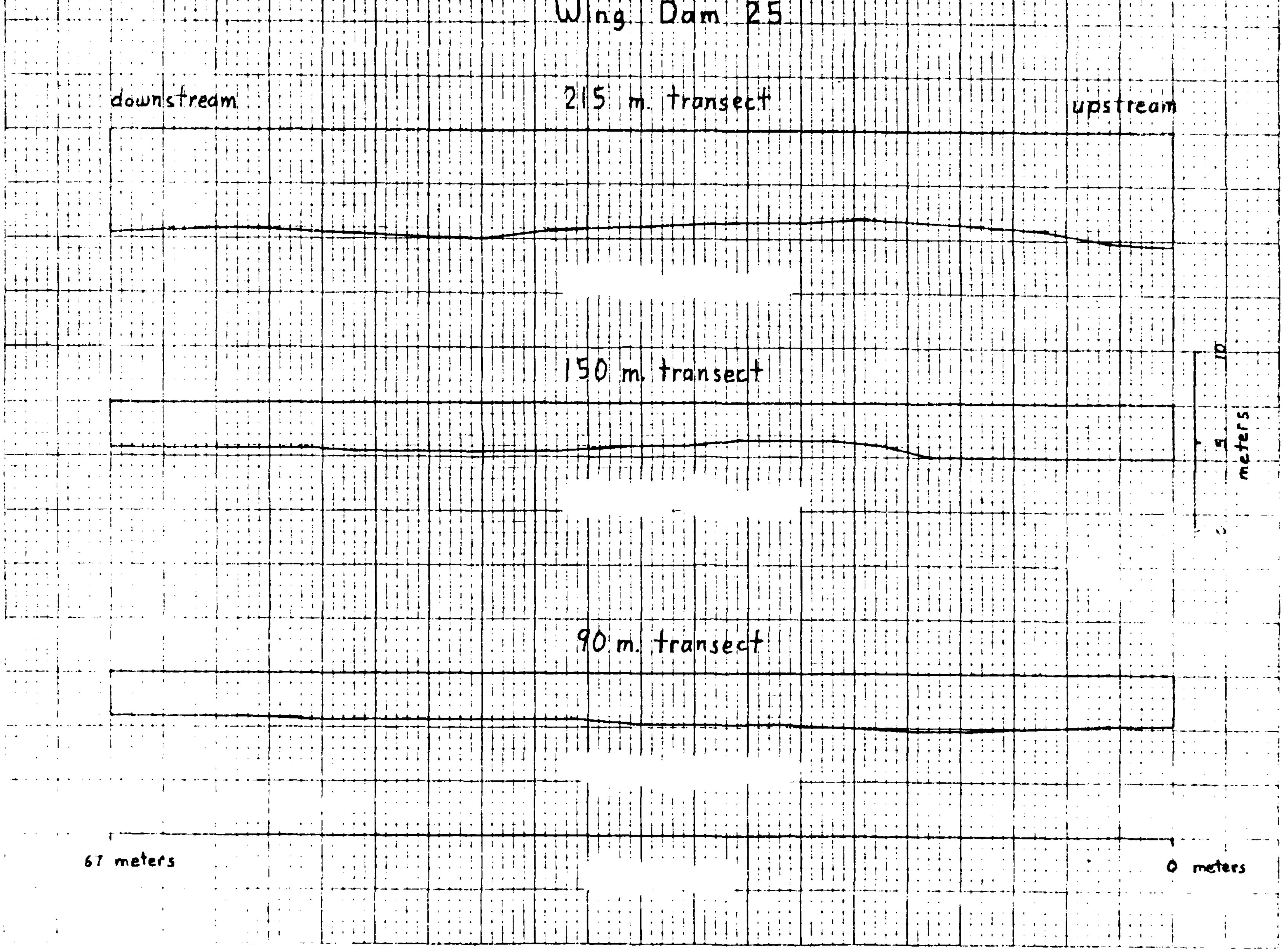
APPENDIX V (continued)



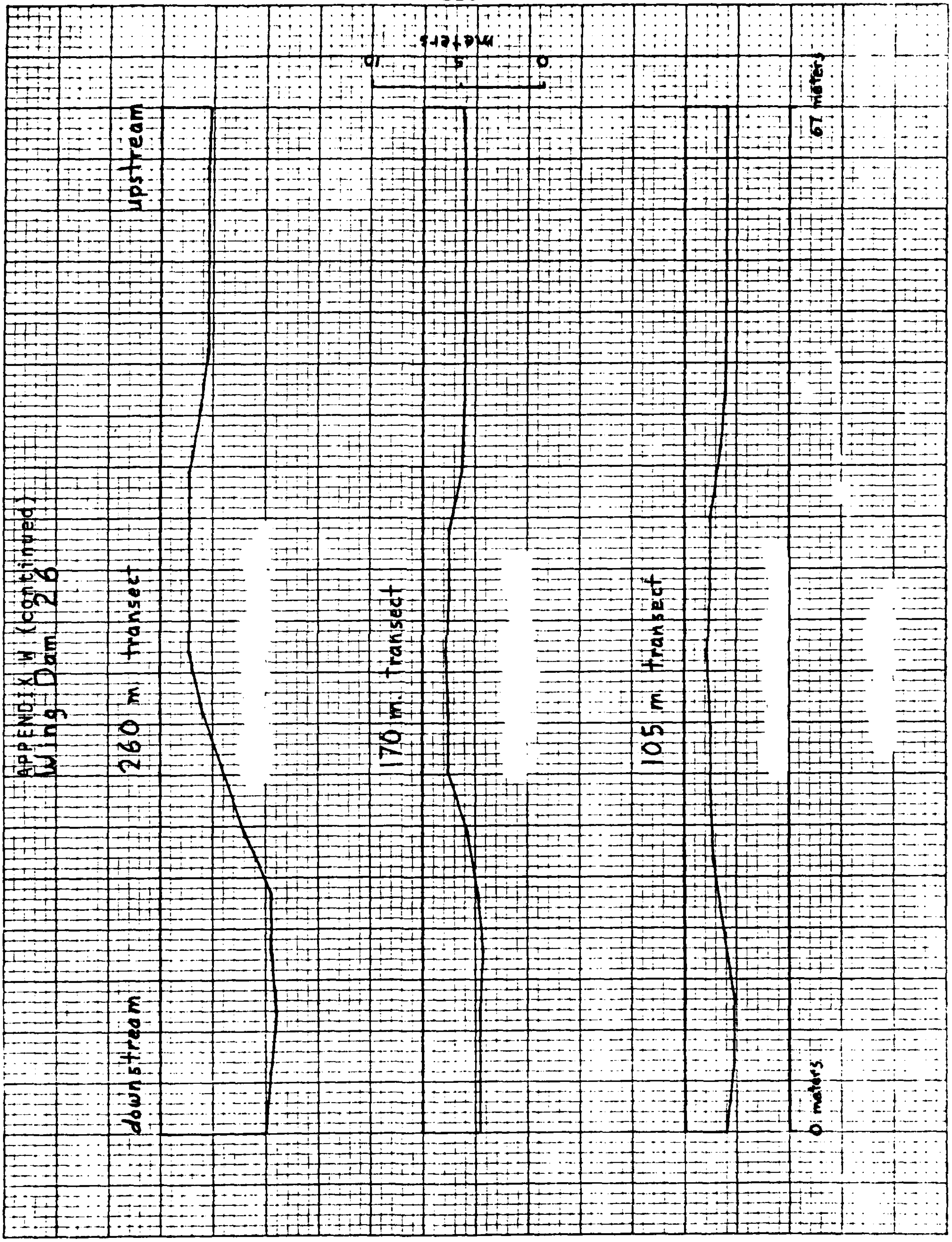
APPENDIX W

Hydrographic relief transects for each wing dam and the side channel in October, 1978.

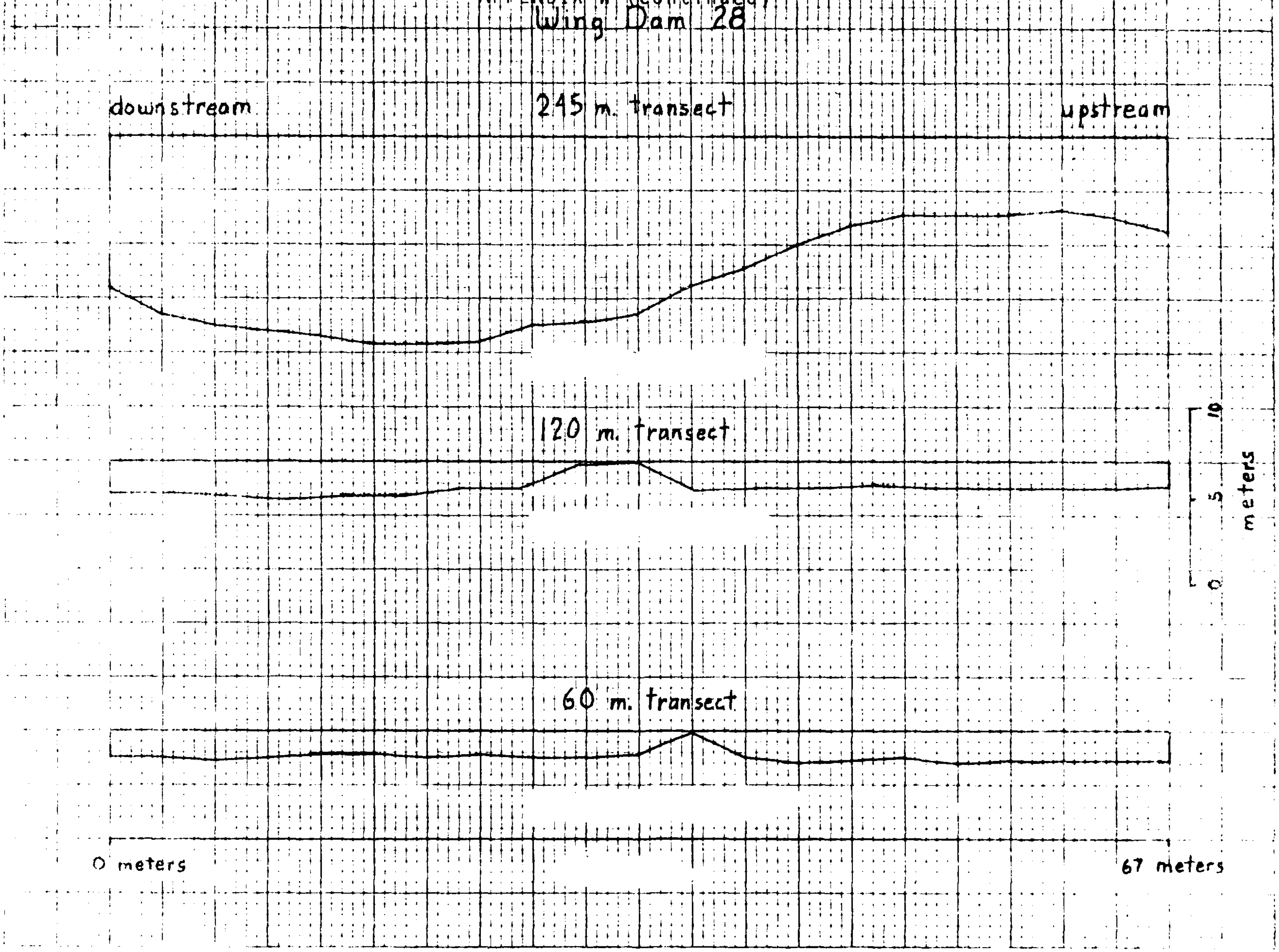
APPENDIX W



Wing Dam 25
downstream
215 m. transect
upstream
150 m. transect
10
5
0
meters
90 m. transect
67 meters
0 meters

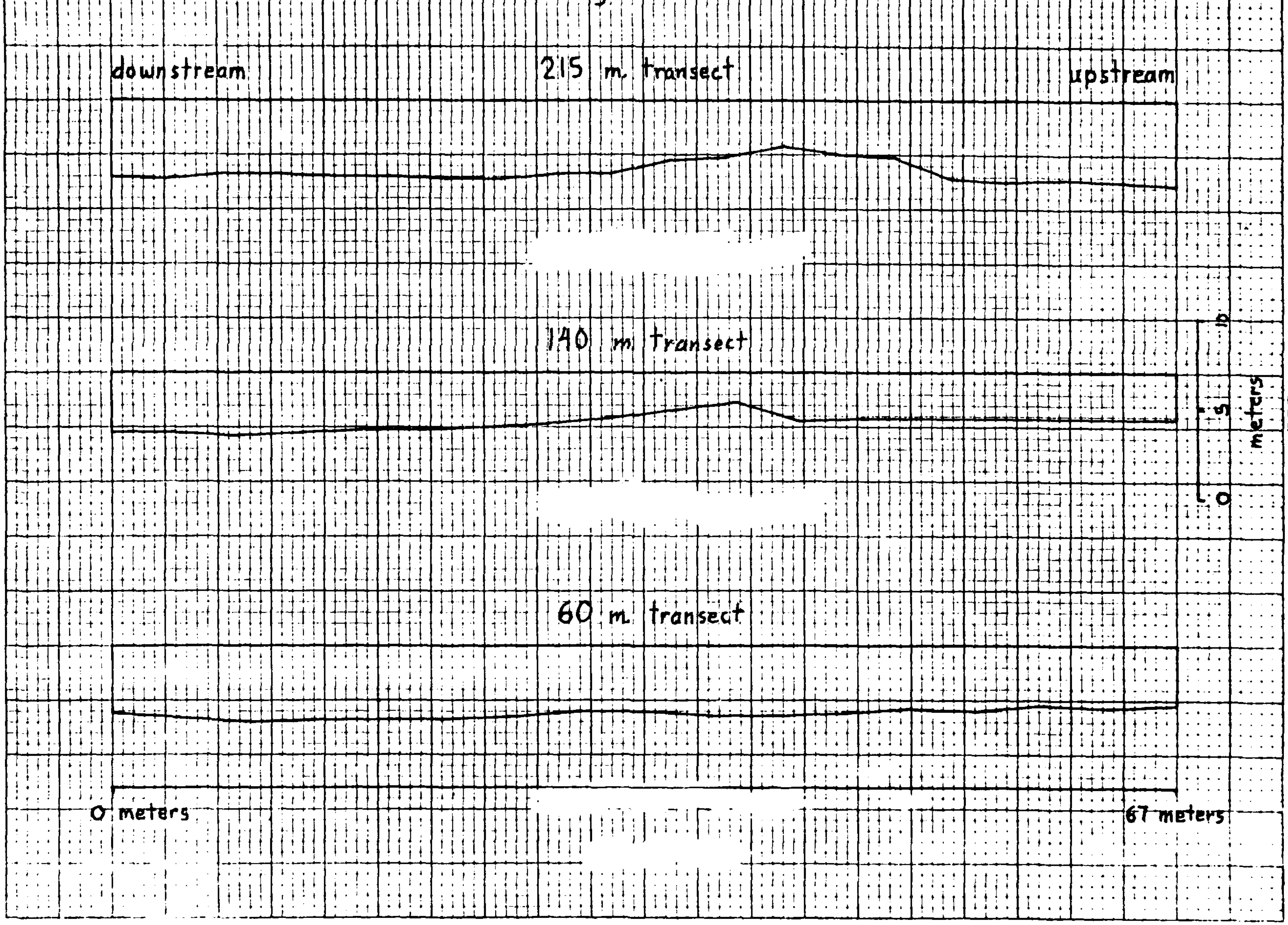

APPENDIX W (continued)
Wing Dam 26
260 m. transect
170 m. transect
105 m. transect
downstream
upstream
meters
10
5
0
67 meters
0 meters

APPENDIX W (continued)

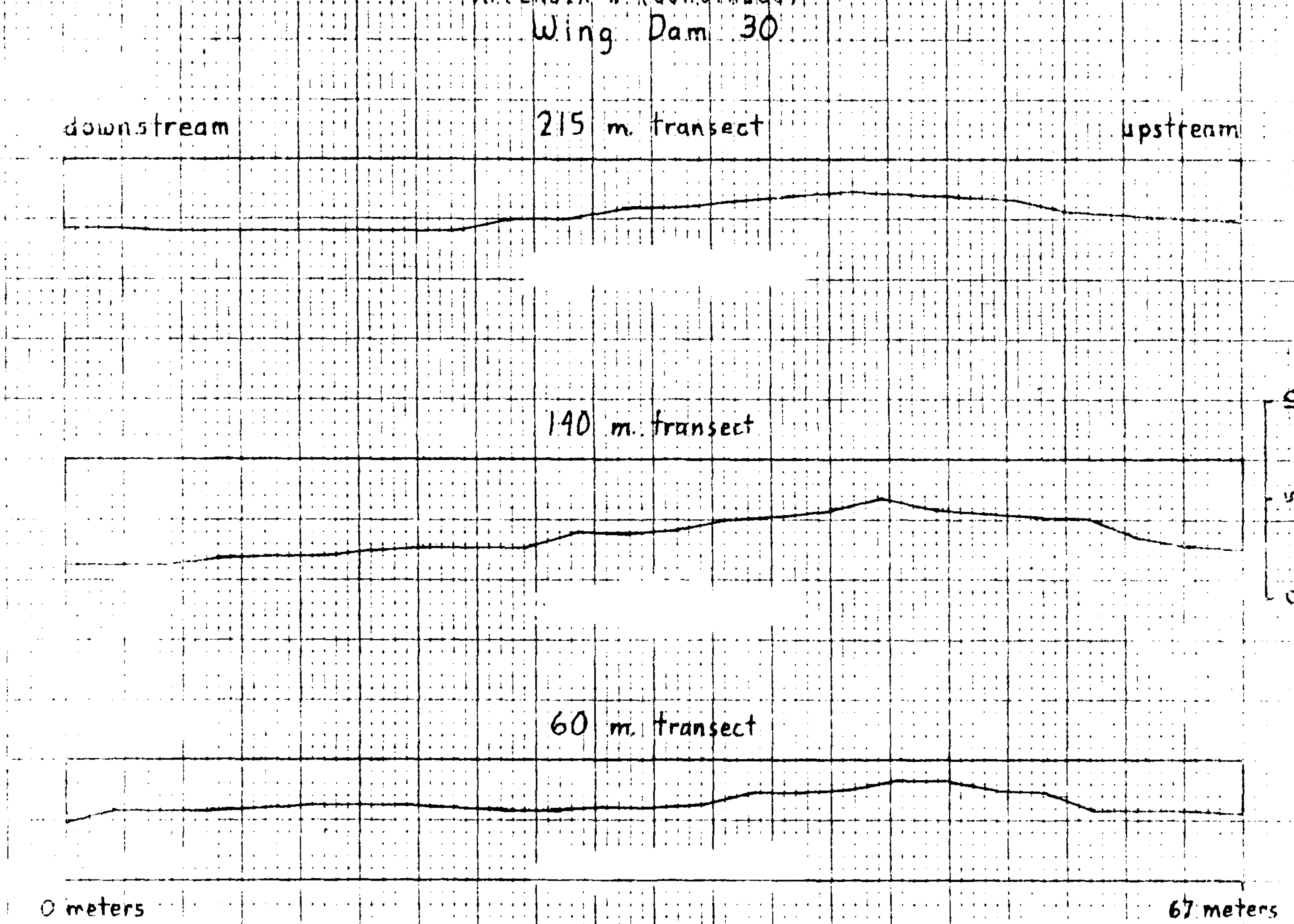


APPENDIX W (continued)

Wing Dam 29

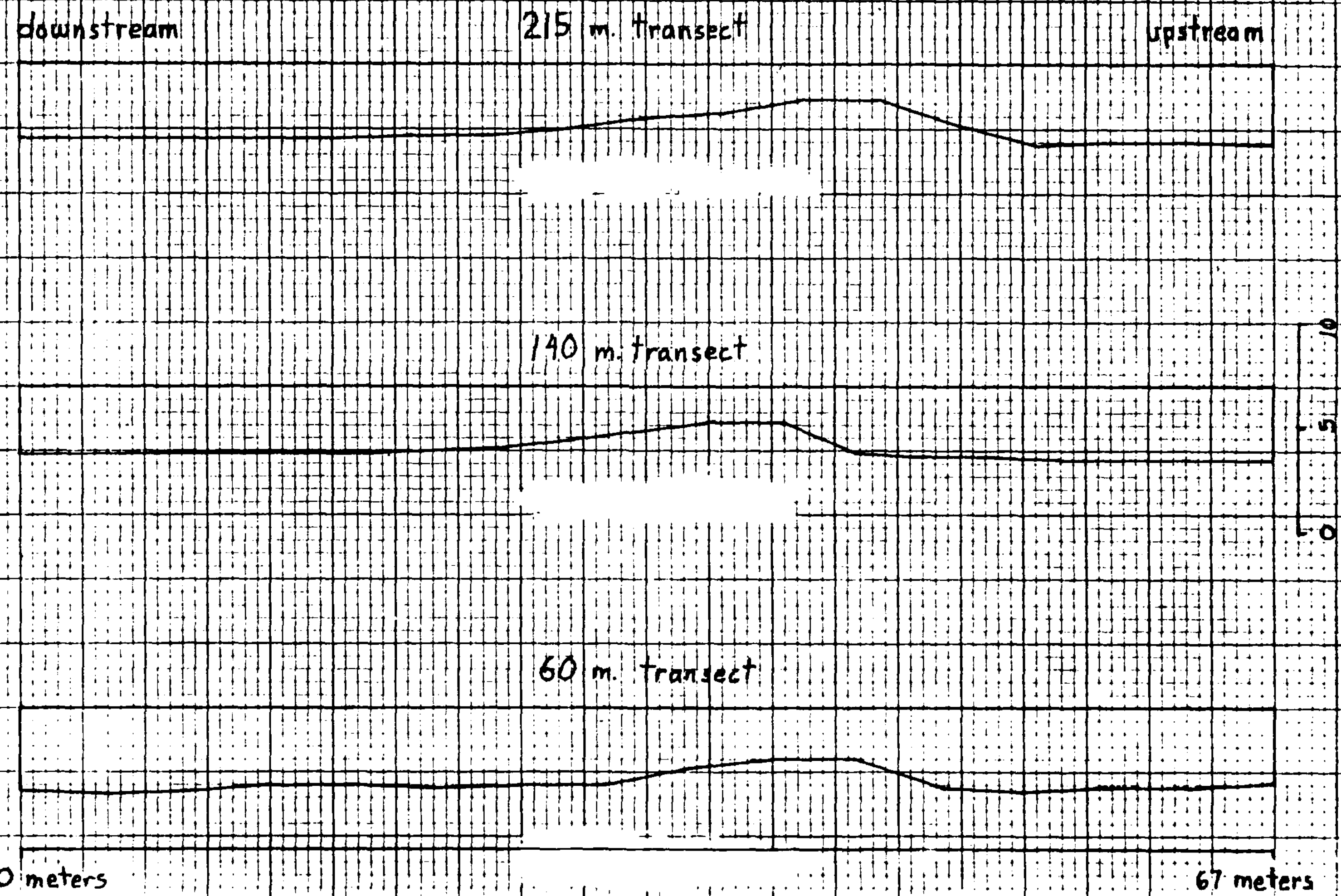


APPENDIX W (continued)

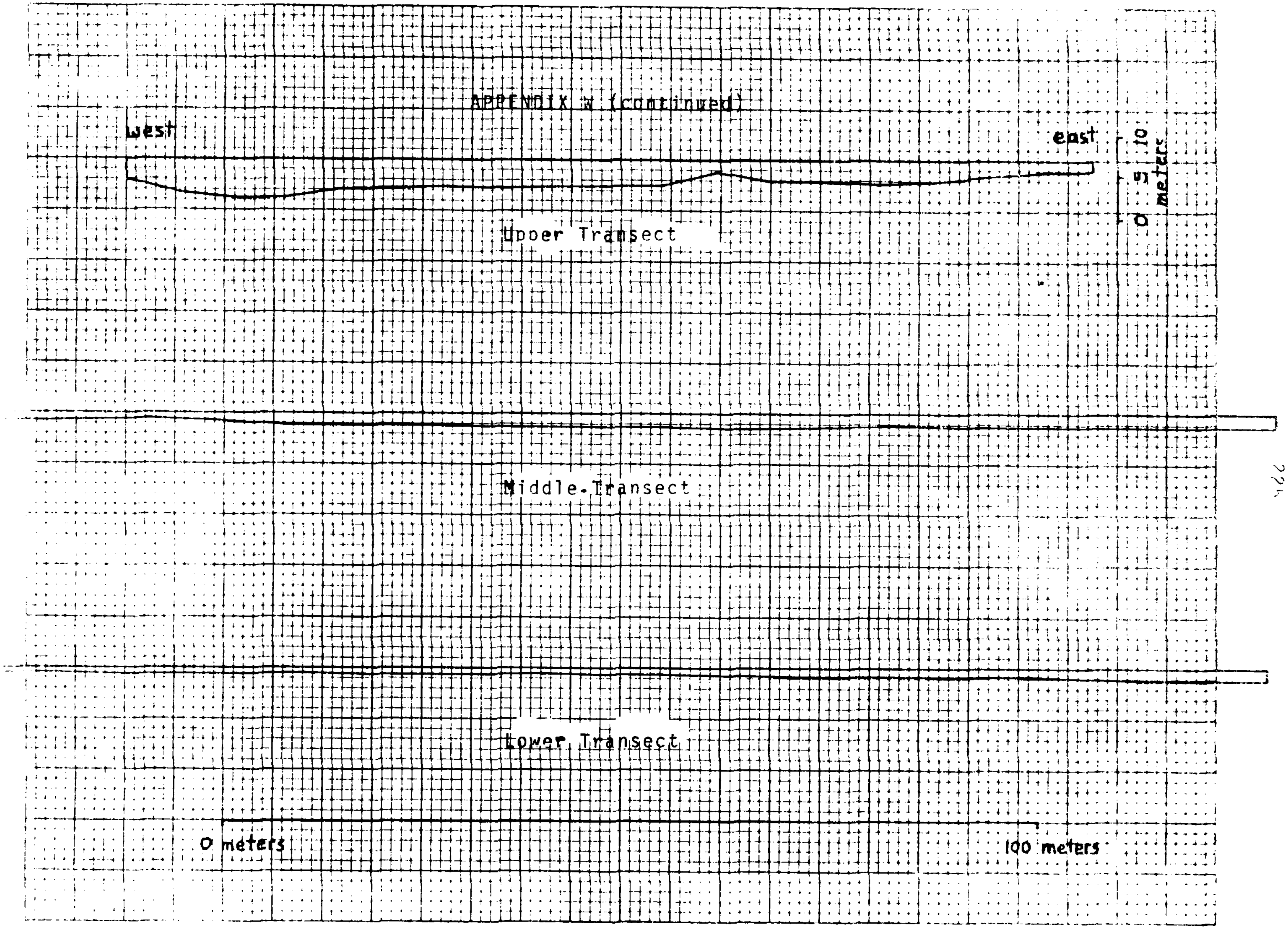


APPENDIX W (continued)

Wing Dam 31



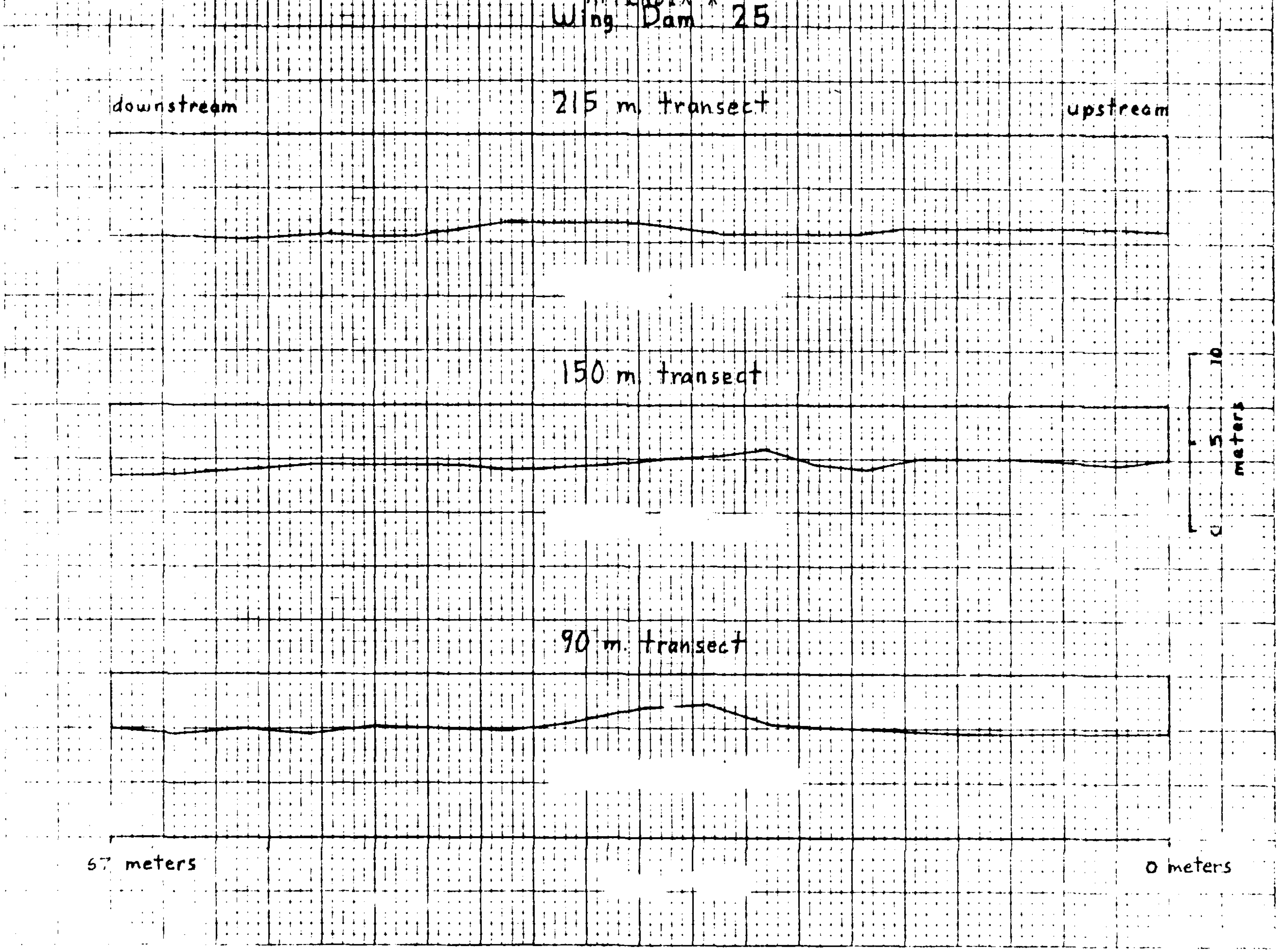
APPENDIX W (continued)



APPENDIX X

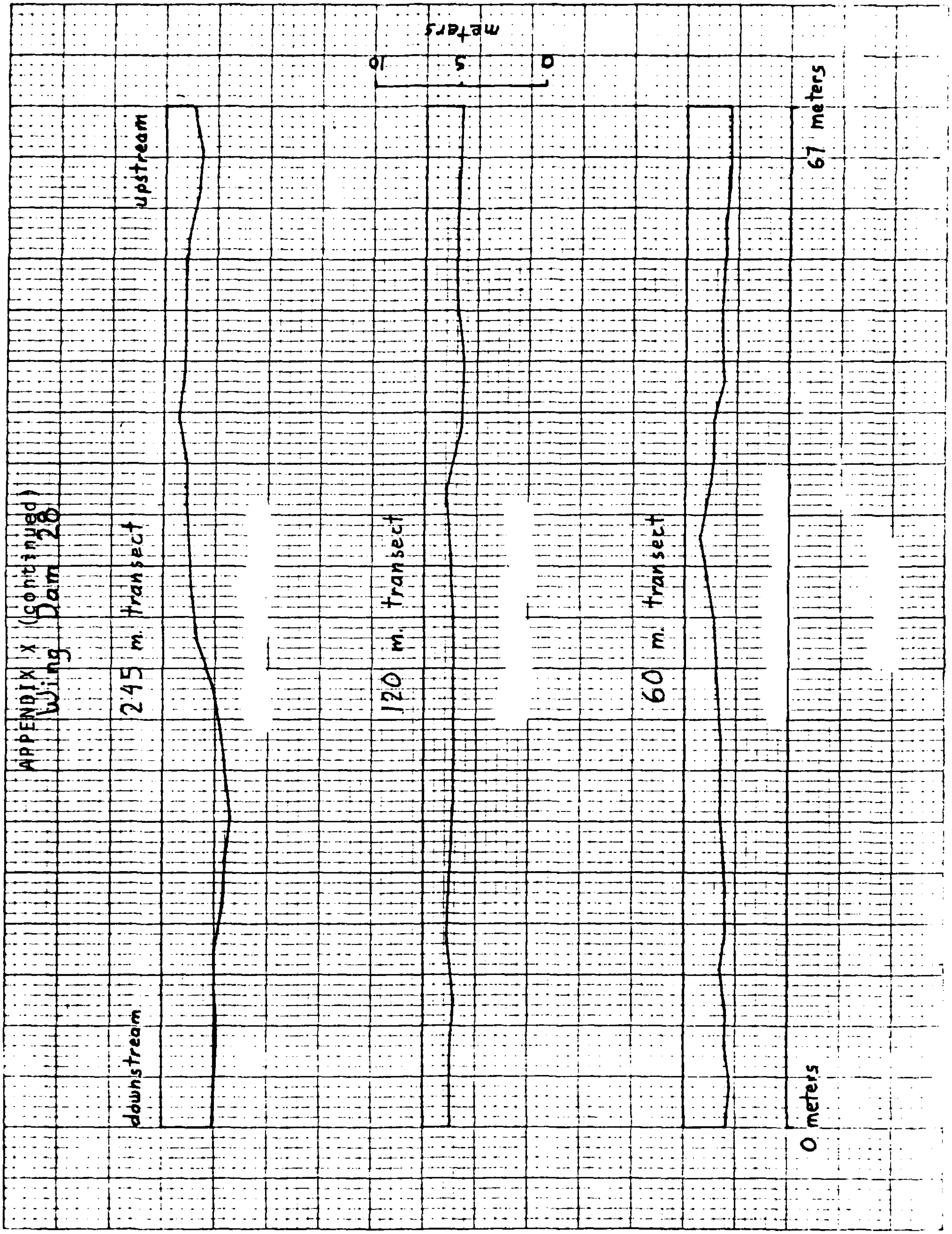
Hydrographic relief transects for each wing dam and the side channel in June, 1979.

APPENDIX X



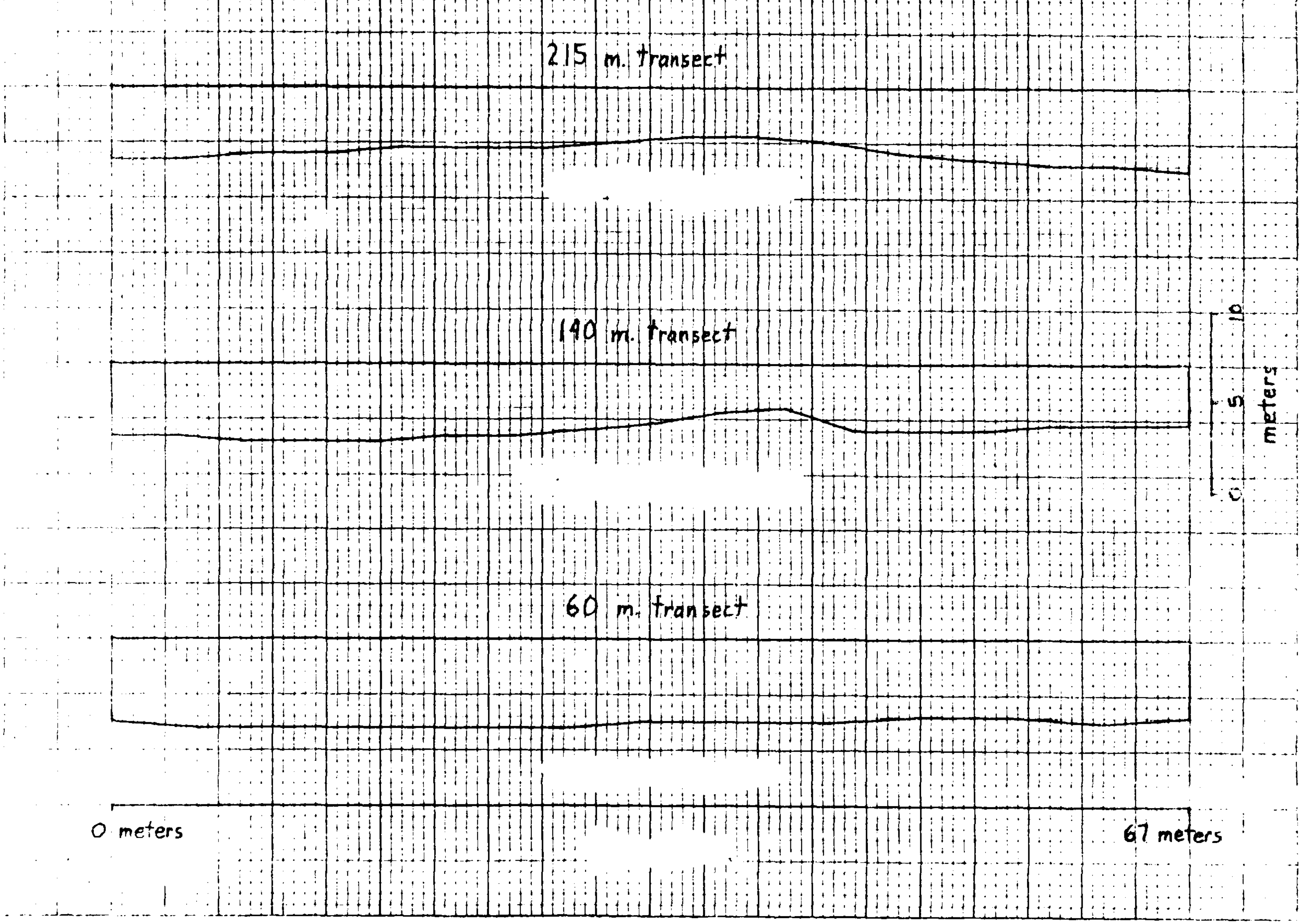
Wing Dam 25
downstream
215 m. transect
upstream
150 m. transect
90 m. transect
meters
0
5
10
57 meters
0 meters

APPENDIX X (continued)
Wing Dam 28

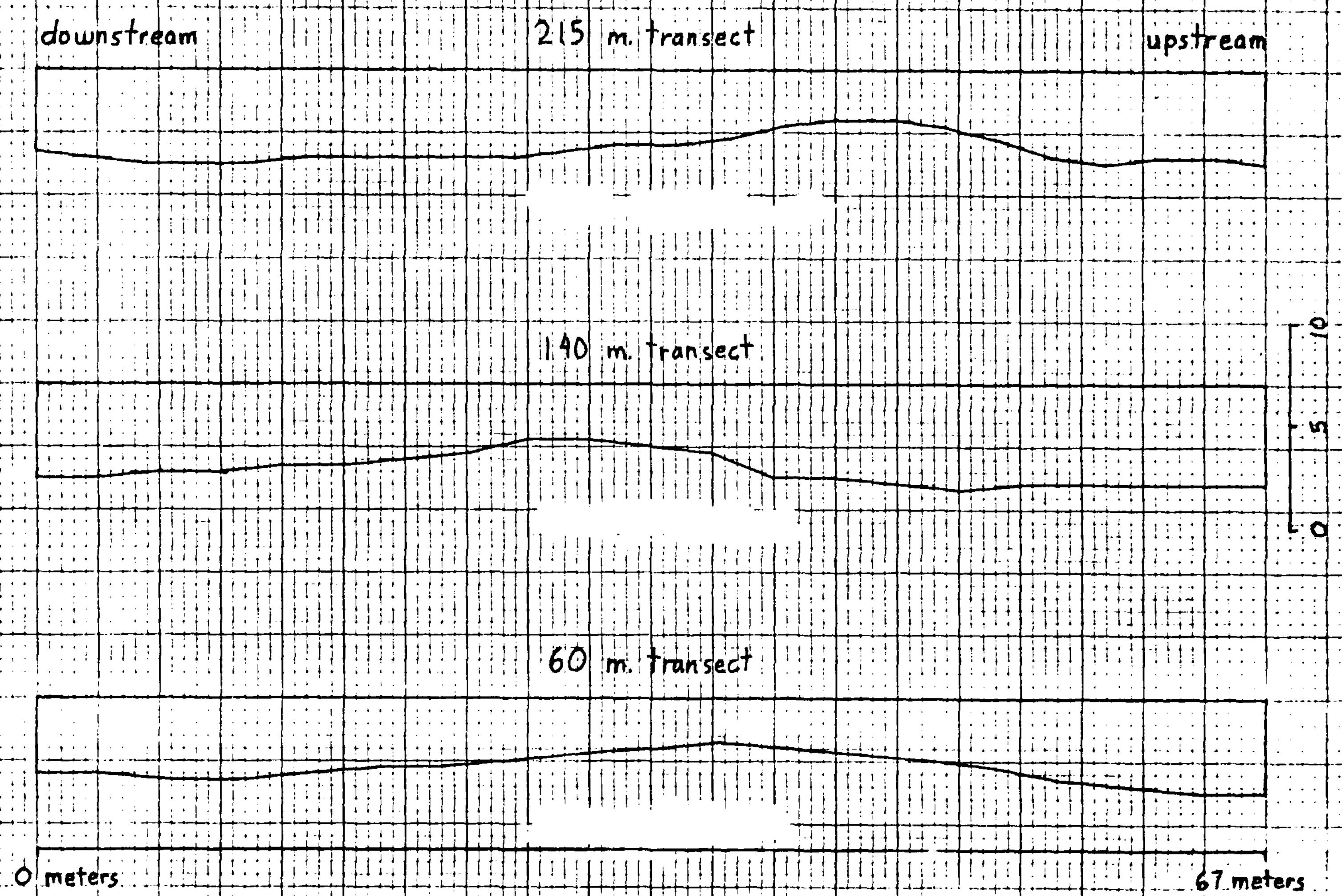


APPENDIX X (continued)

Wing Dam 29

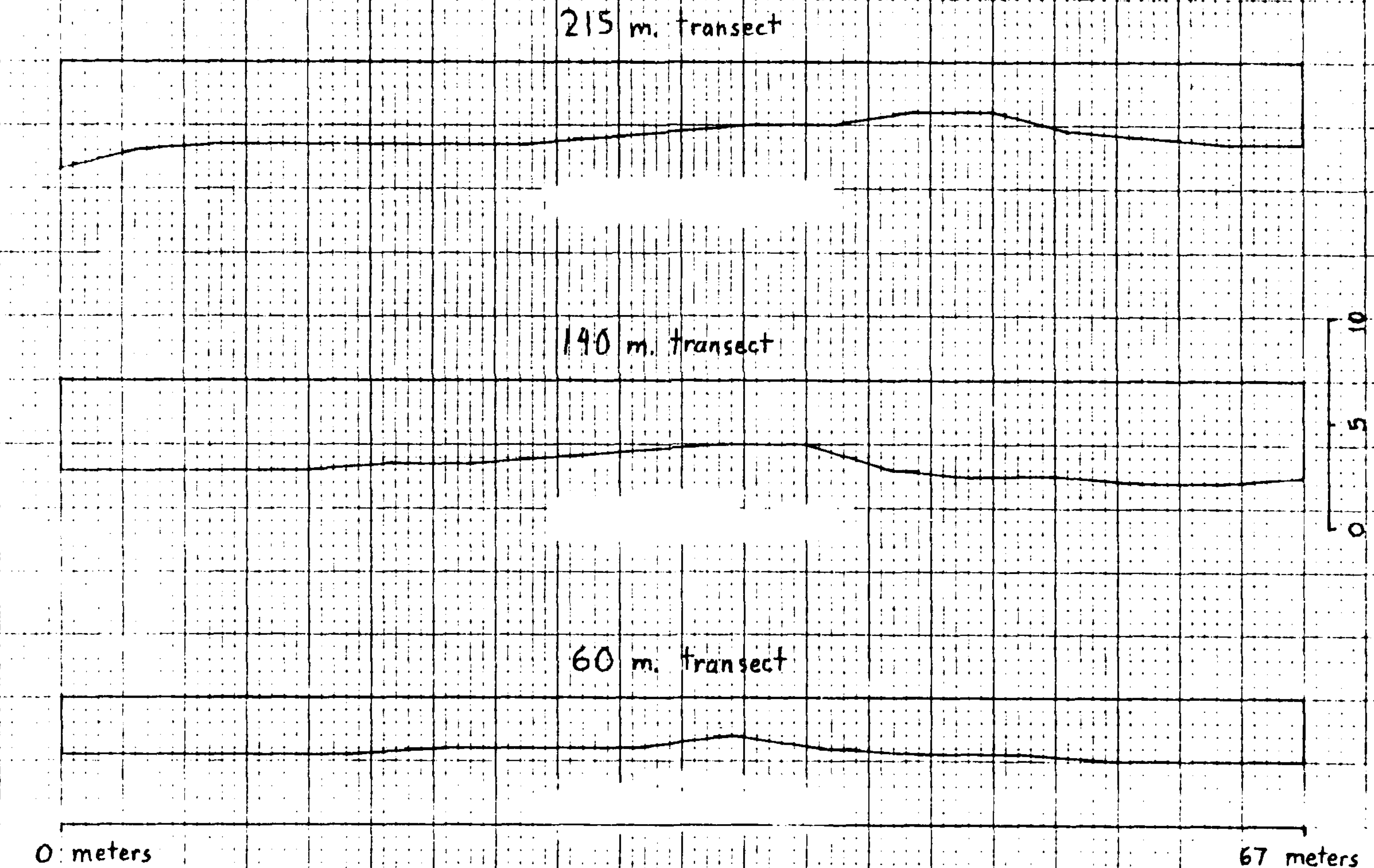


APPENDIX X (continued)
Wing Dam 30

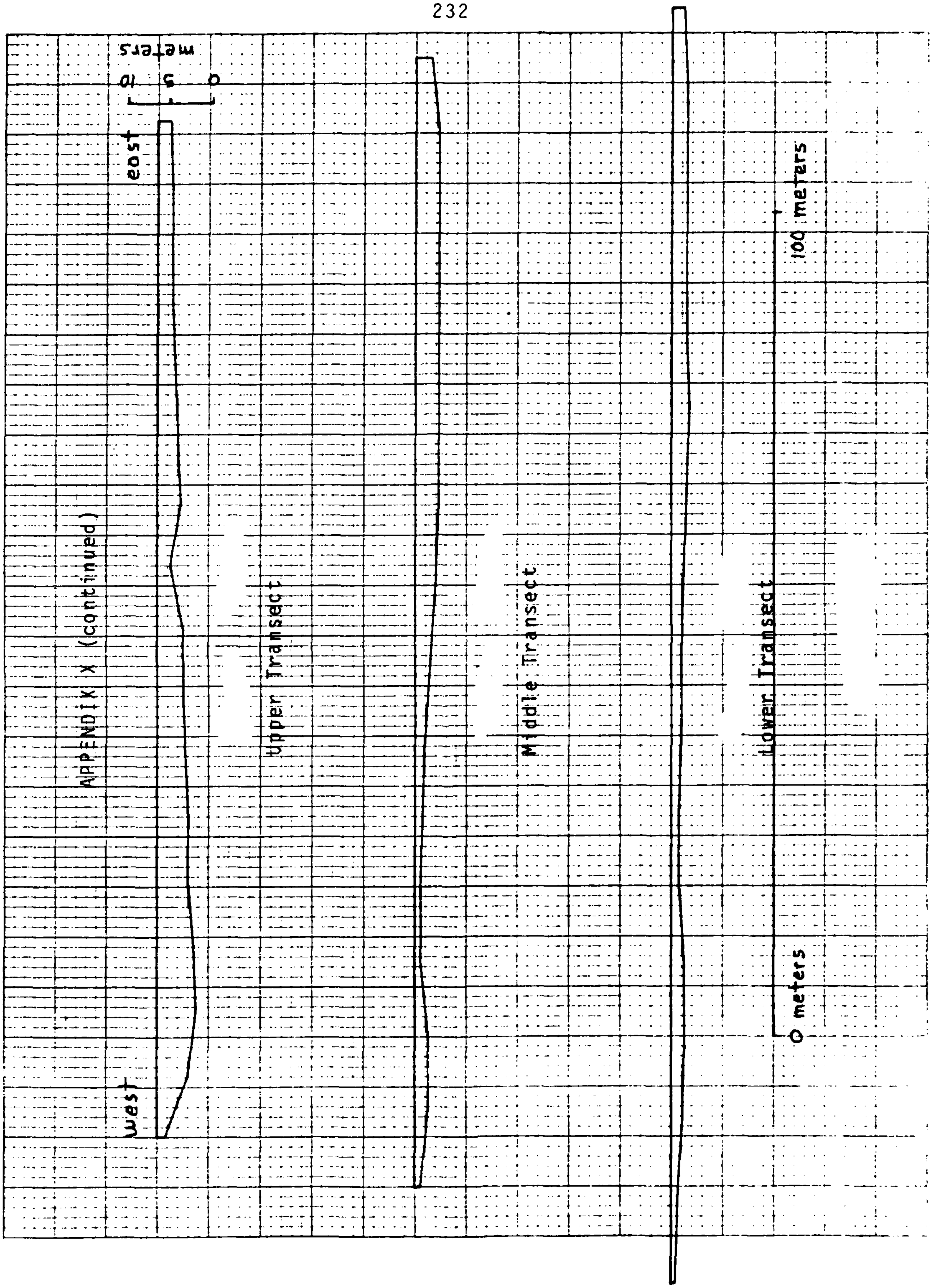


APPENDIX X (continued)

Wing Dam 31



APPENDIX X (continued)



APPENDIX Y

Mean, range, and standard deviation (SD) of water temperature and dissolved oxygen concentrations measured at each wing dam and the side channel in June 1978.

Site	Temperature (^{o}C)				Dissolved oxygen (mg l^{-1})			
		Range				Range		
	Mean	Min.	Max.	SD	Mean	Min.	Max.	SD
25	21.6	21.3	21.8	.181	5.8	5.2	6.3	.318
26	21.8	21.8	21.9	.031	6.0	5.6	6.2	.211
28	21.4	21.1	21.8	.173	5.7	5.3	6.1	.223
29	21.7	21.3	21.8	.120	6.1	5.6	6.6	.120
30	21.6	21.3	22.0	.236	6.1	5.8	6.4	.145
31	21.5	21.3	21.8	.173	6.1	5.5	6.4	.173
Side channel	21.8	21.7	21.9	.066	5.7	5.2	6.2	.254

APPENDIX Z

Mean, range, and standard deviation (SD), of water temperature and dissolved oxygen concentrations measured at each wing dam and the side channel in August, 1978.

	Temperature (°C)				Dissolved oxygen (mg l^{-1})			
		Range				Range		
Site	Mean	Min.	Max.	SD	Mean	Min.	Max.	SD
25	23.6	23.2	24.0	.282	7.7	7.5	8.0	.132
26	23.0	22.9	23.1	.042	7.4	7.0	7.7	.189
28	22.7	22.7	22.9	.076	7.3	7.1	7.7	.171
29	22.8	22.5	23.0	.198	7.1	6.9	7.4	.128
30	22.1	21.9	22.3	.117	7.4	7.1	7.6	.126
31	22.2	22.0	23.0	.230	6.7	6.5	7.2	.136
Side channel	23.2	23.0	23.4	.111	7.3	7.0	7.5	.104

APPENDIX AA

[illegible] range, and standard deviation (SD), of water temperature and dissolved oxygen [illegible]ntrations measured at each wing dam and the side channel in October, 1978.

Site	Temperature (^{o}C)				Dissolved oxygen (mg l^{-1})			
		Range				Range		
	Mean	Min.	Max.	SD	Mean	Min.	Max.	SD
25	16.0	15.9	16.1	.041	7.8	7.4	8.1	.224
[illegible]	16.0	15.9	16.0	.033	7.6	7.4	7.8	.111
28	15.7	15.5	16.0	.127	8.1	7.8	8.2	.135
[illegible]	15.6	15.4	15.8	.133	8.2	8.0	8.4	.116
30	15.6	15.1	15.9	.244	8.2	8.0	8.5	.121
[illegible]	15.7	15.5	16.0	.162	8.3	8.1	8.5	.121
Side channel	15.8	15.5	15.9	.106	8.0	7.6	8.4	.215

APPENDIX BB

Mean, range, and standard deviation (SD), of water temperature and dissolved oxygen concentrations measured at each wing dam and the side channel in June, 1979.

	Temperature (^{o}C)				Dissolved oxygen ($mg\ l^{-1}$)			
		Range				Range		
Site	Mean	Min.	Max.	SD	Mean	Min.	Max.	SD
25	20.0	20.0	20.0	.0	7.1	5.8	7.8	.791
28	20.2	20.0	21.0	.388	7.1	6.6	7.5	.289
29	20.1	20.0	20.5	.231	6.4	6.1	6.7	.205
30	20.0	20.0	20.0	.0	6.7	6.4	7.0	.215
31	20.2	20.0	21.0	.323	6.4	5.6	7.0	.418
Side channel	20.6	20.0	21.0	.221	5.6	5.3	5.9	.160

APPENDIX CC

Water temperature (^{o}C, and dissolved oxygen concentration (mg l^{-1}) measured throughout the water column at stations on the hydrographic relief transects in June, 1978.

APPENDIX CC

Wing Dam 25

Transect 215 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.9	21.7
1	5.9	21.8
2	5.9	21.8
3	6.0	21.8
4	6.0	21.8
5	6.1	21.8
6	6.3	21.8
6.5	6.1	21.8

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.0	21.8
1	6.0	21.8
2	6.0	21.8
3	6.1	21.8
4	6.1	21.8
5	6.1	21.8
6	6.1	21.8
6.5	6.1	21.8

Transect 150 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.8	21.8
1	5.6	21.8
2	5.6	21.7
3	5.6	21.7
4	5.6	21.7
5	5.6	21.7
6	5.6	21.7

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.9	21.6
1	5.6	21.6
2	5.9	21.5
3	5.9	21.5
4	6.0	21.5
5	6.0	21.5
6	6.0	21.5

Transect 90 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.5	21.5
1	5.2	21.4
2	5.2	21.3
3	5.3	21.3
4	5.3	21.3

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.4	21.6
1	5.3	21.5
2	5.3	21.4
3	5.3	21.3
3.5	5.3	21.3

Wing Dam 26

Transect 260 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.2	21.8
1	6.2	21.8
2	6.2	21.8
3	6.2	21.8
4	6.2	21.8
5	6.2	21.8
6	6.2	21.8
6.5	6.2	21.8

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.2	21.8
1	6.2	21.8
2	6.2	21.8
3	6.2	21.8
4	6.2	21.8
5	6.2	21.8
6	6.2	21.8
6.5	6.2	21.8

Transect 170 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.8	21.8
1	5.8	21.8
2	5.9	21.8
3	5.9	21.8
3.8	5.8	21.8

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.9	21.8
1	5.9	21.8
2	5.9	21.8
3	6.0	21.8
4	6.0	21.8
5	5.9	21.8
6	5.7	21.8
6.7	5.9	21.8

Transect 105 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.7	21.9
1	5.6	21.9
2	5.6	21.9
3	5.7	21.9
3.5	5.8	21.9

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.7	21.8
1	5.7	21.8
2	5.9	21.8
3	5.8	21.8
4	5.8	21.8

Wing Dam 28

Transect 185 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.6	21.8
1	5.5	21.3
2	5.3	21.3
2.1	5.6	21.3

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.0	21.3
1	6.0	21.5
2	5.8	21.5
2.8	5.8	21.5

Transect 120 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.5	21.5
1	5.5	21.5
1.9	5.6	21.5

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.4	21.3
1	5.6	21.3
2	5.6	21.3
2.8	5.6	21.3

Transect 60 m

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.1	21.7
1	5.9	21.2
2	5.8	21.2
2.8	5.9	21.1

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.0	21.3
1	6.0	21.2
2	5.5	21.2
2.8	5.7	21.2

APPENDIX CC (continued)

Wing Dam 29

Transect 215 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.0	21.8
1	6.2	21.8
2	6.2	21.8
3	6.6	21.8
4	6.6	21.8
5	6.6	21.8

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.4	21.8
1	6.4	21.8
2	6.4	21.8
3	6.6	21.8
4	6.4	21.8
5	6.5	21.8

Transect 140 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.2	21.8
1	6.1	21.8
2	5.9	21.8
3	5.9	21.8
4	5.8	21.8
4.5	5.8	21.8

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.4	21.8
1	6.4	21.8
2	6.0	21.8
3	6.0	21.8
4	6.0	21.8
5	6.0	21.8

Transect 60 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.0	21.3
1	6.1	21.7
2	5.9	21.6
3	5.7	21.6
4	5.7	21.6
4.5	5.8	21.6

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.0	21.6
1	5.8	21.6
2	5.6	21.6
3	5.6	21.6
4	5.6	21.6
5	5.6	21.5

Wing Dam 30

Transect 215 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.4	21.5
1	6.3	21.3
2	6.3	21.3
3	6.3	21.3
4	6.2	21.3
5	6.2	21.3
5.5	6.2	21.3

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.35	21.5
1	6.3	21.4
2	6.2	21.4
3	6.2	21.4
4	6.2	21.3
5	6.1	21.3
6	6.1	21.3
6.5	6.0	21.3

Transect 140 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.0	21.8
1	5.9	21.8
2	5.9	21.8
3	6.0	21.8
4	6.0	21.8
5	6.0	21.8
5.5	6.1	21.9

Depth (meters)	D.O. (ppm)	Temp (°C)
0	5.8	21.8
1	6.0	21.9
2	6.1	21.9
3	6.3	21.9
4	6.2	21.9
5	6.2	21.9
6	6.2	22.0

Transect 60 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.4	21.6
1	6.2	21.6
2	6.0	21.6
3	6.0	21.6
4	6.0	21.6
4.5	6.0	21.6

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.1	21.8
1	6.0	21.8
2	6.1	21.8
3	6.0	21.8
4	6.0	21.8
5	6.0	21.8

Wing Dam 31

Transect 215 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.3	21.5
1	6.15	21.4
2	6.2	21.4
3	6.2	21.4
4	6.2	21.4
5	6.2	21.4

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.35	21.5
1	6.3	21.4
2	6.2	21.4
3	6.2	21.4
4	6.2	21.3
5	6.1	21.3
6	6.1	21.3
6.5	6.1	21.3

Transect 140 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.2	21.5
1	6.1	21.5
2	6.1	21.5
3	6.1	21.5
4	6.1	21.5
5	6.1	21.5

Depth (meters)	D.O. (ppm)	Temp (°C)
0	6.3	21.5
1	6.1	21.5
2	6.1	21.5
3	6.1	21.5
4	6.1	21.5
5	6.1	21.5

Transect 60 m

Depth (meters)	D.O. (ppm)	Temp (°C)
0	5.5	21.8
1	5.6	21.8
2	5.6	21.8
2.9	5.6	21.8

Depth (meters)	D.O. (ppm)	Temp (°C)
0	5.8	21.8
1	5.8	21.8
2	5.8	21.8
3	5.8	21.8
3.4	5.8	21.8

APPENDIX CC (continued)

Transect	Station 4 Depth (meters)	Station 4 Temp (°C)	Station 4 D.O. (ppm)	Station 3 Depth (meters)	Station 3 Temp. (°C)	Station 3 D.O. (ppm)	Station 2 Depth (meters)	Station 2 Temp (°C)	Station 2 D.O. (ppm)	Station 1 Depth (meters)	Station 1 Temp. (°C)	Station 1 D.O. (ppm)
Upper Chute Transect	0	21.9	6.2	0	21.9	5.5	0	21.9	5.2	0	21.9	5.5
	1	21.9	6.1	1	21.9	5.5	1	21.9	5.3	1	21.9	5.5
	2	21.9	6.1	2	21.9	5.5	2	21.9	5.2	2	21.9	5.5
	3	21.9	6.1	3	21.9	5.5				2.4	21.9	5.5
	4	21.9	6.1									
Middle Chute Transect	0	21.8	5.9	0	21.7	5.4	0	21.8	5.7	0	21.8	5.4
	1	21.8	5.6	1	21.8	5.4	1	21.8	5.5	1	21.8	5.6
				1.8	21.8	5.4	2	21.8	5.6	2	21.8	5.6
										3	21.8	5.6
Lower Chute Transect	0	21.8	5.9	0	21.8	5.8	0	21.8	5.8	0	21.8	5.8
	1	21.7	5.9	0.8	21.7	5.7	1	21.8	5.8	1	21.8	5.85
	1.7	21.7	5.8							2	21.8	5.7
										2.7	21.8	5.7

APPENDIX DD

Water temperature (^{o}C) and dissolved oxygen concentration (mg l^{-1}) measured throughout the water column at stations on the hydrographic relief transects in August, 1978.

APPENDIX DD

Wing Dam 25

700 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	23.5
1	7.6	23.5
2	7.5	23.5
3	7.7	23.5
4	7.6	23.2
5	7.6	23.2

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	23.5
1	7.7	23.5
2	7.7	23.5
3	7.7	23.5
4	7.7	23.2
5	7.7	23.2

500 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.9	23.5
1	7.9	23.5
2	7.8	23.5
3	7.7	23.5

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.9	24.0
1	7.6	23.9
2	7.6	23.5
2.7	7.6	23.5

300 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.0	24.0
1	7.5	24.0
2	7.8	24.0
2.7	7.8	24.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	24.0
1	8.0	24.0
2	7.8	23.9
2.8	7.8	23.9

Wing Dam 26

850 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.5	23.0
1	7.3	23.0
2	7.5	23.0
3	7.4	23.0
4	7.3	23.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.6	23.0
1	7.5	23.0
2	7.2	22.9
3	7.2	22.9
4	7.2	22.9
5	7.3	23.0
6	7.3	22.9

550 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	23.0
1	7.0	23.0
2	7.4	23.0
2.5	7.4	23.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.3	23.0
1	7.0	23.0
2	7.1	23.0
2.8	7.1	23.0

350 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	23.0
1	7.5	23.1
2	7.3	23.0
2.5	7.3	23.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.6	23.0
1	7.5	23.0
2	7.5	23.0
3	7.4	23.0

Wing Dam 28

800 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.5	22.9
1	7.2	22.9
1.3	7.2	22.9

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.5	22.7
1	7.1	22.7
2	7.1	22.7

400 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	22.8
1	7.4	22.8
1.8	7.3	22.7

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.6	22.8
1	7.4	22.8
2	7.3	22.7

200 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.6	22.8
1	7.3	22.7
1.8	7.3	22.7

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.4	22.8
1	7.3	22.7
2	7.2	22.7
2.3	7.2	22.7

APPENDIX DD (continued)

Wing Dam 29

700 ft. Transect (above)

Depth (meters)	D.O. (ppm)	Temp (°C)
0	7.4	22.7
1	7.1	22.7
2	7.0	22.7
3	7.0	22.7
4	7.1	22.7

700 ft. Transect (below)

0	7.3	22.9
1	7.2	22.5
2	7.1	22.5
3	7.1	22.5
4	7.1	22.5

450 ft. Transect (above)

Depth (meters)	D.O. (ppm)	Temp (°C)
0	7.3	22.9
1	7.2	22.9
2	7.1	22.8
3	7.1	22.8

450 ft. Transect (below)

0	7.2	22.7
1	7.1	22.5
2	7.0	22.5
3	7.0	22.5
3.5	7.0	22.5

200 ft. Transect (above)

Depth (meters)	D.O. (ppm)	Temp (°C)
0	7.2	23.0
1	6.9	23.0
2	6.9	23.0
3	6.9	23.0
3.5	7.1	23.0

200 ft. Transect (below)

0	7.3	23.0
1	7.2	22.9
2	7.3	22.9
3	7.0	23.0
4	7.1	23.0
4.3	7.1	22.9

Wing Dam 30

700 ft. Transect (above)

0	7.6	22.0
1	7.3	22.0
2	7.3	21.9
3	7.2	21.9
4	7.2	21.9
4.3	7.2	21.9

700 ft. Transect (below)

0	7.6	22.1
1	7.4	22.1
2	7.4	22.1
3	7.3	22.0
4	7.3	22.0

450 ft. Transect (above)

0	7.6	22.1
1	7.4	22.1
2	7.4	22.1
3	7.4	22.1
4	7.3	22.1
4.5	7.3	22.0

450 ft. Transect (below)

0	7.6	22.1
1	7.4	22.1
2	7.4	22.1
3	7.3	22.1
4	7.3	22.1
5	7.1	22.0

200 ft. Transect (above)

0	7.6	22.3
1	7.4	22.3
2	7.4	22.2
3	7.3	22.2
3.3	7.3	22.2

200 ft. Transect (below)

0	7.4	22.3
1	7.4	22.3
2	7.4	22.2
3	7.3	22.2
3.5	7.3	22.2

Wing Dam 31

700 ft. Transect (above)

0	6.7	22.0
1	6.7	22.0
2	6.7	22.0
3	6.6	22.0
4	6.6	22.0
4.3	6.6	22.0

700 ft. Transect (below)

0	6.9	22.1
1	6.9	22.0
2	6.7	22.0
3	6.7	22.0
4	6.7	22.0
4.4	6.7	22.0

450 ft. Transect (above)

0	6.9	22.2
1	6.7	22.1
2	6.7	22.1
3	6.7	22.1
4	6.7	22.0
4.3	6.7	22.1

450 ft. Transect (below)

0	7.2	22.5
1	6.9	22.3
2	6.9	22.1
3	6.8	22.2
4	6.8	22.2

200 ft. Transect (above)

0	6.6	22.5
1	6.6	22.5
2	6.5	22.5

200 ft. Transect (below)

0	6.8	23.0
1	6.8	22.8
2	6.8	22.8
2.3	6.8	22.8

APPENDIX DD (continued)

	West											East
Transect	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)
upper chute transect	0	23.2	7.4	0	23.3	7.1	0	23.3	7.3	0	23.4	7.2
	1	23.2	7.4	1	23.2	7.2	0.6	23.3	7.5	1	23.4	7.2
	2	23.2	7.4	2	23.2	7.2	1.2	23.3	7.4	1.7	23.4	7.0
	3	23.2	7.4	2.8	23.2	7.0						
	3.4	23.2	7.3									
middle chute transect	0	23.0	7.3	0	23.2	7.3	0	23.2	7.3	0	23.2	7.3
	0.5	23.0	7.2	0.3	23.2	7.3	1	23.2	7.2	1	23.2	7.2
	1.1	23.0	7.2				2	23.2	7.2	2	23.2	7.3
							2.3	23.2	7.2	2.4	23.2	7.2
lower chute transect	0	23.0	7.3	0	23.2	7.3	0	23.2	7.3	0	23.0	7.4
	0.9	23.0	7.3	0.8	23.2	7.2	0.5	23.2	7.2	1	23.0	7.3
							1.0	23.2	7.2	1.6	23.0	7.3

APPENDIX EE

Water temperature (^{o}C) and dissolved oxygen concentration ($mg\ l^{-1}$) measured throughout the water column at stations on the hydrographic relief transects in October, 1978.

APPENDIX EE

Wing Dam 25

700 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.8	16.0
1	7.8	16.0
2	7.8	16.0
3	7.9	16.0
4	7.9	16.0
5	8.0	16.0
6	7.9	16.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.0	16.0
1	8.0	15.9
2	8.0	16.0
3	8.0	15.9
4	8.1	16.0
5	8.1	16.0
6	8.1	16.0

500 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	16.0
1	7.7	16.0
2	7.7	16.0
3	7.7	16.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	16.0
1	7.5	16.0
2	7.7	16.0
3	7.7	16.0

300 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	16.0
1	7.4	16.0
2	7.5	16.0
2.9	7.5	16.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.5	16.0
1	7.4	16.0
2	7.5	16.1
2.3	7.4	16.1

Wing Dam 26

850 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	16.0
1	7.6	16.0
2	7.6	16.0
3	7.6	16.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	16.0
1	7.6	16.0
2	7.6	16.0
3	7.6	16.0
4	7.7	15.9
5	7.8	16.0

550 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.8	16.0
1	7.6	15.9
2	7.6	16.0
2.5	7.5	16.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.7	15.9
1	7.4	16.0
2	7.6	16.0
2.5	7.5	16.0

350 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.6	16.0
1	7.5	16.0
2	7.4	16.0
2.3	7.4	16.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.8	16.0
1	7.6	16.0
2	7.6	16.0
2.5	7.6	16.0

Wing Dam 28

800 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.3	15.7
1	8.2	15.6
2	8.2	15.5
3	8.2	15.5
4	8.2	15.5
4.8	8.2	15.5

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.0	15.7
1	8.0	15.7
2	7.9	15.7
3	7.9	15.7
4	7.8	15.7
5	7.9	15.7
6	7.9	15.7
6.5	8.0	15.7

400 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.1	15.7
0.5	7.8	15.6

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.1	15.6
1	8.1	15.5
1.4	8.1	15.5

200 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.0	16.0
1	8.0	15.8
1.4	8.0	15.8

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.2	15.8
1	8.1	15.8
1.4	8.0	15.7

APPENDIX EE (continued)

Wing Dam 29

700 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.0	15.6
1	8.2	15.5
2	8.4	15.5
3	8.3	15.5
3.5	8.4	15.5

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.2	15.5
1	8.1	15.5
2	8.1	15.5
3	8.4	15.4
3.5	8.3	15.4

450 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.4	15.7
1	8.3	15.7
2	8.2	15.6
2.5	8.3	15.6

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.3	15.5
1	8.2	15.5
2	8.2	15.5
3	8.3	15.5
3.5	8.2	15.5

200 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.0	15.8
1	8.1	15.8
2	8.1	15.8
3	8.1	15.8
3.4	8.1	15.8

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.2	15.8
1	8.1	15.7
2	8.1	15.7
3	8.2	15.7
3.6	8.2	15.7

Wing Dam 30

700 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.3	15.8
1	8.2	15.7
2	8.3	15.6
3	8.3	15.6
3.4	8.3	15.6

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.2	15.7
1	8.2	15.8
2	8.2	15.7
3	8.2	15.7
3.6	8.3	15.8

450 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.0	15.8
1	8.0	15.9
2	8.1	15.9
3	8.3	15.9
4	8.4	15.8

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.2	15.9
1	8.2	15.8
2	8.1	15.9
3	8.3	15.8
4	8.4	15.8
4.8	8.5	15.8

200 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.2	15.6
1	8.2	15.3
2	8.2	15.3
2.5	8.2	15.4

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.1	15.2
1	8.0	15.2
2	8.1	15.3
2.4	8.1	15.1

Wing Dam 31

700 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.2	15.5
1	8.1	15.6
2	8.1	15.6
3	8.2	15.5
4	8.2	15.7
4.2	8.3	15.7

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.4	15.5
1	8.2	15.5
2	8.2	15.6
3	8.2	15.7
3.7	8.2	15.6

450 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.3	15.6
1	8.2	15.7
2	8.2	15.7
3	8.2	15.7
3.6	8.2	15.6

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.4	15.7
1	8.3	15.8
2	8.3	15.7
3	8.3	15.8
3.5	8.3	15.7

200 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.5	16.0
1	8.4	16.0
2	8.4	16.0
2.3	8.4	16.0

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	8.5	15.9
1	8.4	15.9
2	8.5	15.9
2.4	8.5	15.9

APPENDIX EE (continued)

West — East

Upper Chute Transect

Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)
0	15.5	7.7	0	7.9	7.9	0	15.8	8.3	0	15.9	8.1
1	15.7	7.9	1	15.8	7.9	1	15.8	8.1	1.1	15.9	7.9
2	15.7	7.8	2	15.8	7.7						
3	15.7	7.8	2.4	15.8	7.7						
3.5	15.6	8.0									

Middle Chute Transect

Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)
0.1	15.8	8.0	0	15.8	8.2	0	15.8	8.1	0	15.9	8.2
			1	15.9	7.6	1	15.9	7.9	1	15.9	8.1
			1.2	15.9	7.7	1.5	15.9	7.9	1.5	15.9	8.1

Lower Chute Transect

Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)
0	15.8	8.2	0.1	15.8	8.3	0	15.9	8.3	0	15.9	8.4
0.5	15.8	8.1				0.5	15.9	8.2	1	15.9	8.2
									1.2	15.9	8.2

APPENDIX FF

Water temperature (^{o}C) and dissolved oxygen concentration ($mg\ l^{-1}$) measured throughout the water column at stations on the hydrographic relief transects in June, 1979.

APPENDIX FF

Wing Dam 25

700 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.8	20
1	7.7	20
2	7.7	20
3	7.7	20
4	7.7	20
5	7.6	20
6	7.6	20
6.4	7.6	20

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.8	20
1	7.6	20
2	7.7	20
3	7.7	20
4	7.6	20
5	7.7	20
6	7.7	20
6.5	7.7	20

500 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.0	20
1	7.2	20
2	7.3	20
3	7.2	20
3.7	7.1	20

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.3	20
1	7.3	20
2	7.3	20
3	7.2	20
4	7.2	20
4.2	7.2	20

300 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.9	20
1	5.9	20
2	5.9	20
3	5.8	20
3.5	5.9	20

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.9	20
1	5.8	20
2	5.9	20
3.1	6.1	20

Wing Dam 28

800 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.5	21
1	7.4	20
2	7.4	21
2.2	7.4	21

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.4	20
1	7.2	20
2	7.5	20
2.9	7.4	20

400 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.0	21
1	7.1	20
2	7.0	20
2.3	7.1	20

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.2	20
1	7.0	20
1.7	7.0	20

200 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.8	20
1	6.7	20
2	6.6	20
2.8	7.0	20

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.9	20
1	6.9	20
2	6.9	20
2.8	6.9	20

Wing Dam 29

700 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.6	20
1	6.6	20
2	6.6	20
3	6.6	20
4	6.7	20
4.7	6.7	20

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.6	20
1	6.6	20
2	6.7	20
3	6.7	20
4	6.7	20

450 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.4	21
1	6.5	21
2	6.4	20
3	6.4	20
3.5	6.4	20

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.5	20
1	6.6	20
2	6.5	20
3	6.6	20
4	6.6	20
4.5	6.5	20

200 ft. Transect

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.3	21
1	6.1	20
2	6.2	20
3	6.3	21
4	6.3	21
4.5	6.3	21

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.1	20
1	6.1	20
2	6.1	21
3	6.1	21
4	6.2	21
5	6.2	21

APPENDIX FF (continued)

Wing Dam 30

Transect 700 ft — above the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.0	20
1.0	6.9	20
2.0	7.0	20
3.0	7.0	20
4.0	7.0	20
5.0	7.0	20

Transect 700 ft — below the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.9	20
1.0	6.9	20
2.0	6.9	20
3.0	6.9	20
4.0	7.0	20
4.7	7.0	20

Transect 450 ft — above the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.7	20
1.0	6.6	20
2.0	6.6	20
3.0	6.6	20
4.0	6.8	20
5.0	6.8	20

Transect 450 ft — below the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.6	20
1.0	6.5	20
2.0	6.5	20
3.0	6.6	20
4.0	6.7	20
5.0	6.8	20

Transect 200 ft — above the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.6	20
1.0	6.4	20
2.0	6.4	20
3.0	6.4	20
4.0	6.4	20
4.5	6.4	20

Transect 200 ft — below the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.6	20
1.0	6.5	20
2.0	6.5	20
3.0	6.5	20
3.8	6.5	20

Wing Dam 31

Transect 700 ft — above the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	7.0	20
1.0	6.9	20
2.0	6.9	20
3.0	6.9	20
4.0	6.8	20
4.5	6.7	20

Transect 700 ft — below the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.8	20
1.0	6.8	20
2.0	6.8	20
3.0	6.9	20
4.0	6.9	20
5.0	6.9	20
5.5	6.9	20

Transect 450 ft — above the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.6	20
1.0	6.6	20
2.0	6.6	20
3.0	6.6	20
4.0	6.6	20
5.0	6.6	20
5.5	6.6	20

Transect 450 ft — below the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.4	20
1.0	6.4	20
2.0	6.3	20
3.0	6.3	20
4.0	6.4	20
5.0	6.4	20

Transect 200 ft — above the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	6.1	21
1.0	5.6	21
2.0	5.7	21
3.0	5.8	21
3.5	5.8	21

Transect 200 ft — below the wing dam line

Depth (meters)	D.O. (ppm)	Temp. (°C)
0	5.9	21
1.0	5.9	21
2.0	5.9	21
3.0	5.9	21
3.5	5.9	21

APPENDIX FF (continued)

West → East

Transect	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)	Depth (meters)	Temp. (°C)	D.O. (ppm)
Upper Chute Transect	0	21	5.5	0	21	5.5	0	21	5.4	0	21	5.3
	1.0	21	5.5	1.0	21	5.5	1.0	21	5.3	1.0	21	5.3
	2.0	21	5.6	2.0	21	5.4	2.0	21	5.4	2.0	21	5.3
	3.0	21	5.5	3.0	21	5.5	3.0	21	5.5	2.6	21	5.3
	4.0	21	5.7	4.0	21	5.5	4.0	21	5.5			
	4.5	21	5.8									
Middle Chute Transect	0	21	5.8	0	20	5.7	0	21	5.7	0	21	5.6
	0.5	21	5.6	0.8	20	5.6	1.0	21	5.7	1.0	21	5.5
							2.0	21	5.7	2.0	21	5.5
							2.5	21	5.7	3.0	21	5.6
Lower Chute Transect	0	21	5.7	0	21	5.7	0	21	5.9	0	21	5.8
	1.0	21	5.8	1.0	21	5.7	1.0	21	5.9	1.0	21	5.5
	1.5	21	5.7	1.2	21	5.7	1.2	21	5.6	2.0	21	5.6

APPENDIX GG

Current velocity (m sec^{-1}) measured at each station on the hydrographic relief transects in June, 1978.

APPENDIX GG

Wing Dam 25
300 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.57	0	.44
0.8	.49	0.7	.56
2.4	.48	2.1	.51
4.0	.28	2.8	.38
		3.5	.27

Wing Dam 25
500 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.54	0	.77
1.2	.56	1.2	.72
3.6	.54	3.6	.72
6	.36	6	.53

Wing Dam 25
700 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.86	0	.84
1.3	.80	1.3	.75
3.9	.71	3.9	.68
5.2	.66	5.2	.72
6.5	.67	6.5	.60

Wing Dam 26
350 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.53	0	.49
0.7	.51	0.8	.50
2.1	.48	2.4	.38
3.5	.34	4.0	.40

Wing Dam 26
550 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.49	0	.35
0.8	.45	1.3	.33
2.4	.43	3.9	.32
3.8	.34	6.7	.16

Wing Dam 26
850 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.82	0	.91
1.3	.80	1.3	.96
3.9	.74	3.9	.90
6.5	.70	6.5	.86

Wing Dam 28
200 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.54	0	.63
0.6	.54	0.6	.63
1.7	.48	1.7	.53
2.8	.39	2.8	.34

Wing Dam 28
400 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.48	0	.34
0.4	.46	0.6	.36
1.1	.43	1.7	.35
1.9	.35	2.8	.20

APPENDIX GG (continued)

Wing Dam 28
600 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.37	0	.40
0.4	.43	0.6	.32
1.3	.37	1.7	.37
2.2	.25	2.8	.25

Wing Dam 29
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.49	0	.66
0.9	.43	1.0	.56
2.7	.43	3.0	.47
4.5	.33	5.0	.38

Wing Dam 29
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.62	0	.80
0.9	.67	1.0	.84
2.7	.60	3.0	.72
4.5	.55	5.0	.43

Wing Dam 29
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.72	0	.86
1.0	.71	1.0	.84
3.0	.71	3.0	.88
5.0	.48	5.0	.62

Wing Dam 30
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.82	0	.74
0.9	.84	1.0	.60
2.7	.72	3.0	.64
4.5	.44	5.0	.46

Wing Dam 30
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.79	0	.77
1.1	.75	1.2	.77
3.3	.67	3.6	.60
5.5	.49	6.0	.50

Wing Dam 30
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.92	0	.93
1.1	.88	1.3	.88
3.3	.84	3.9	.61
5.5	.52	6.5	.52

Wing Dam 31
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.74	0	.83
0.6	.70	0.7	.74
1.8	.65	2.0	.72
2.9	.47	3.4	.52

APPENDIX GG (continued)

Wing Dam 31
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.76	0	.88
1.0	.75	1.0	.84
3.0	.72	3.0	.56
5.0	.47	5.0	.43

Wing Dam 31
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.77	0	.81
1.0	.80	1.3	.78
3.0	.70	3.9	.59
5.0	.43	6.5	.43

Upper Chute transect

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0.5	.51	0.5	.23	0.6	.17	0.8	.50
1.4	.46	1.4	.35	1.8	.13	2.4	.48

Central Chute transect

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0.6	.50	0.4	.60	0.4	.53	0.2	.19
1.8	.43	1.3	.54	1.1	.49	0.6	.27

Lower Chute transect

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0.5	.77	0.2	.64	0.4	.23	0.3	.47
1.6	.68	0.7	.62			1.0	.42

APPENDIX HH

Current velocity (m sec^{-1}) measured at each station on the hydrographic relief transects in August, 1978.

APPENDIX HH

Wing Dam 25
300 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.29	0	.34
0.6	.30	0.6	.37
1.8	.33	1.8	.30
2.7	.21	2.8	.22

Wing Dam 25
500 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.32	0	.34
0.6	.32	0.6	.35
1.8	.29	1.8	.26
3.0	.19	2.7	.20

Wing Dam 25
700 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.43	0	.50
1	.46	1	.52
3	.38	3	.43
5	.28	5	.26

Wing Dam 26
350 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.31	0	.60
0.5	.31	0.6	.37
1.5	.30	1.8	.19
2.5	.20	3.0	.21

Wing Dam 26
550 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.27	0	.23
0.5	.28	0.6	.19
1.5	.25	1.7	.46
2.5	.21	2.8	.17

Wing Dam 26
850 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.49	0	.23
0.8	.43	1.6	.16
2.4	.47	5.8	.20
4.0	.26		

Wing Dam 28
200 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.33	0	.40
0.4	.33	0.5	.40
1.1	.29	1.4	.42
1.8	.24	2.3	.29

Wing Dam 28
400 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.37	0	.44
0.4	.37	0.4	.48
1.1	.30	1.2	.36
1.8	.18	2.0	.26

APPENDIX HH (continued)

Wing Dam 28
800 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.23	0	.24
0.3	.23	0.4	.20
0.8	.22	1.2	.22
1.3	.16	2.0	.18

Wing Dam 29
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.19	0	.41
0.7	.18	0.9	.37
2.1	.26	2.6	.41
3.5	.20	4.3	.29

Wing Dam 29
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.59	0	.84
0.6	.61	0.7	.64
1.2	.62	2.1	.64
3.0	.49	3.5	.49

Wing Dam 29
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.61	0	.84
0.8	.51	0.8	.72
2.4	.50	2.4	.64
4.0	.38	4.0	.33

Wing Dam 30
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.53	0	.72
0.7	.61	0.7	.70
2.0	.55	2.1	.60
3.3	.48	3.5	.37

Wing Dam 30
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.72	0	.64
0.9	.68	1	.60
2.7	.62	3	.54
4.5	.49	5	.18

Wing Dam 30
700 ft transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
[illegible]	.77	0	.80
[illegible]	[illegible]	0.8	.79
[illegible]	[illegible]	2.4	.70
[illegible]	[illegible]	4.0	.50

Wing Dam 31
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.59	0	.70
0.4	.58	0.5	.70
1.2	.48	1.4	.63
2.0	.37	2.3	.46

APPENDIX HH (continued)

Wing Dam 31
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.65	0	.77
0.9	.65	0.8	.79
2.6	.59	2.4	.65
4.3	.43	4.0	.43

Wing Dam 31
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.68	0	.79
0.9	.61	0.9	.77
2.6	.55	2.6	.65
4.3	.43	4.4	.39

Upper Chute transect

east — west

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0	.38	0	.43	0	.16	0	.29
0.3	.34	0.6	.52	0.6	.17	0.7	.31
1.0	.32	1.2	.27	1.7	.05	2.0	.32
1.7	.25			2.8	.05	3.4	.23

Central Chute transect

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0	.44	0	.43	0	.33	0	.25
0.5	.36	0.5	.44	0.3	.33	0.5	.26
1.4	.37	1.4	.45			1.1	.22
2.4	.19	2.3	.27				

Lower Chute transect

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0	.64	0	.58	0	.37	0	.50
0.3	.60	0.5	.50	0.4	.37	0.2	.44
1.0	.60	1.0	.42	0.8	.30	0.5	.40
1.6	.40					0.9	.40

APPENDIX II

Current velocity (m sec^{-1}) measured at each station on the hydrographic relief transects in October, 1978.

APPENDIX II

Wing Dam 25
300 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.28	0	.26
0.6	.21	0.5	.28
1.8	.19	1.5	.26
2.9	.17	2.3	.21

Wing Dam 25
500 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.26	0	.21
0.6	.28	0.6	.26
1.8	.19	1.8	.32
3.0	.17	3.0	.28

Wing Dam 25
700 ft. Transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.48	0	.59
1.3	.48	1.2	.61
3.9	.48	3.6	.48
6.0	.17	6.0	.30

Wing Dam 26
350 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.24	0	.19
0.5	.24	0.5	.15
1.5	.17	1.5	.21
2.3	.13	2.5	.13

Wing Dam 26
550 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.21	0	.15
0.5	.19	0.7	.13
1.5	.21	2.1	.21
2.5	.08	3.5	.10

Wing Dam 26
850 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.19	0	.21
0.5	.19	1.0	.17
1.5	.13	3.0	.13
2.7	.09	5.0	.13

Wing Dam 28
200 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.11	0	.27
0.3	.11	0.3	.24
0.9	.14	0.9	.16
1.4	.07	1.4	.08

Wing Dam 28
400 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.19	0	.19
0.1	.17	0.3	.21
0.3	.15	0.9	.15
0.5	.17	1.4	.13

APPENDIX II (continued)

Wing Dam 28
800 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.61	0	.17
1.0	.59	1.3	.15
3.0	.52	3.9	.05
4.8	.50	6.5	.11

Wing Dam 29
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.32	0	.46
0.7	.30	0.7	.48
2.1	.13	2.1	.41
3.4	.24	3.6	.30

Wing Dam 29
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.54	0	.50
0.5	.48	0.7	.57
1.5	.52	2.1	.43
2.5	.39	3.5	.32

Wing Dam 29
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.41	0	.48
0.7	.39	0.7	.46
2.1	.39	2.1	.37
3.5	.41	3.6	.37

Wing Dam 30
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.54	0	.52
0.5	.59	0.5	.54
1.5	.57	1.5	.48
2.5	.39	2.4	.43

Wing Dam 30
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.52	0	.52
0.8	.54	1.0	.43
2.4	.43	3.0	.32
4.0	.28	4.8	.32

Wing Dam 30
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.68	0	.83
0.7	.68	0.7	.61
2.1	.61	2.1	.43
3.4	.32	3.6	.37

Wing Dam 31
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.50	0	.52
0.5	.52	0.5	.54
1.5	.32	1.5	.46
2.3	.35	2.4	.41

APPENDIX II (continued)

Wing Dam 31
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.61	0	.61
0.7	.59	0.7	.65
2.1	.50	2.1	.59
3.6	.39	3.5	.50

Wing Dam 31
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.59	0	.41
0.8	.59	0.7	.52
2.4	.48	2.1	.48
4.2	.39	3.7	.28

Upper Chute transect

east — west

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0	.19	0	.35	0	.19	0	.13
0.6	.13	0.6	.28	0.5	.06	0.7	.15
1.1	.17	1.0	.28	1.5	.06	2.1	.13
				2.4	0	3.5	.06

Central Chute transect

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0	.24	0	.35	0	.19		
0.3	.28	0.3	.35	0.2	.17	0.1	.21
0.9	.17	0.9	.32	0.6	.17		
1.5	.24	1.5	.30	1.2	.19		

Lower Chute transect

Station 1		Station 2		Station 3		Station 4	
Depth	Velocity	Depth	Velocity	Depth	Velocity	Depth	Velocity
0	.54	0	.37			0	.39
0.2	.54	0.3	.32	0.1	.28	0.3	.24
0.7	.46						
1.2	.43						

APPENDIX JJ

Current velocity (m sec^{-1}) measured at each station on the hydrographic relief transects in June, 1979.

APPENDIX JJ

Wing Dam 25
300 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.41	0	.48
0.7	.41	0.6	.46
2.1	.37	1.8	.43
2.8	.28	2.4	.35
3.5	.28	3.1	.32

Wing Dam 25
500 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.50	0	.59
0.7	.46	0.8	.46
2.1	.46	2.4	.46
2.8	.41	3.2	.26
3.7	.26	4.2	.32

Wing Dam 25
700 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.79	0	.72
1.3	.74	1.3	.72
3.9	.68	3.9	.63
5.2	.68	5.2	.61
6.4	.50	6.5	.54

Wing Dam 28
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.52	0	.39
0.6	.50	0.6	.43
1.8	.43	1.8	.39
2.4	.37	2.4	.32
2.8	.28	2.8	.24

Wing Dam 28
400 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.50	0	.61
0.4	.48	0.4	.59
1.2	.46	1.2	.50
1.6	.39	1.7	.48
2.3	.32		

Wing Dam 28
800 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.43	0	.32
0.4	.32	0.6	.32
1.3	.30	1.8	.28
1.7	.28	2.4	.21
2.2	.26	2.9	.09

Wing Dam 29
200 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.46	0	.50
0.9	.43	1.0	.48
2.7	.41	3.0	.48
3.6	.35	4.0	.43
4.5	.28	5.0	.39

Wing Dam 29
450 ft. transect

Upstream		Downstream	
Depth	Velocity	Depth	Velocity
0	.43	0	.81
0.7	.46	0.9	.74
2.1	.37	2.7	.63
2.8	.28	3.6	.54
3.5	.28	4.5	.37

APPENDIX JJ (continued)

Wing Dam 29
700 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.83	0	.83
0.9	.79	0.8	.79
2.8	.74	2.4	.63
3.8	.61	3.6	.43
4.7	.37	4.0	.30

Wing Dam 30
200 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.70	0	.85
0.9	.59	0.8	.83
2.7	.61	2.3	.70
3.6	.61	3.0	.61
4.5	.37	3.8	.50

Wing Dam 30
450 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.61	0	.94
1.0	.59	1.0	.90
3.0	.61	3.0	.81
4.0	.54	4.0	.70
5.0	.28	5.0	.50

Wing Dam 30
700 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.85	0	.96
1.0	.76	0.9	.83
3.0	.70	2.8	.61
4.0	.68	3.8	.61
5.0	.46	4.7	.46

Wing Dam 31
200 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.70	0	.74
0.7	.68	0.7	.79
2.1	.65	2.1	.61
2.8	.61	2.8	.37
3.5	.46	3.5	.37

Wing Dam 31
450 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.83	0	.94
1.1	.68	1.0	.79
3.3	.65	3.0	.83
4.4	.52	4.0	.70
5.5	.50	5.0	.57

Wing Dam 31
700 ft. transect

Upstream Depth	Upstream Velocity	Downstream Depth	Downstream Velocity
0	.83	0	.92
0.9	.85	1.1	.92
2.7	.74	3.3	.50
3.6	.79	4.4	.37
4.5	.28	5.5	.35

APPENDIX JJ (continued)

Upper Chute Transect

east | west

Station 1 Depth	Station 1 Velocity	Station 2 Depth	Station 2 Velocity	Station 3 Depth	Station 3 Velocity	Station 4 Depth	Station 4 Velocity
0	.48	0	.39	0	.43	0	.52
1.5	.39	2.4	.28	2.4	.39	2.7	.57
2.6	.17	4.0	.26	4.0	.26	4.5	.41

Central Chute Transect

Station 1 Depth	Station 1 Velocity	Station 2 Depth	Station 2 Velocity	Station 3 Depth	Station 3 Velocity	Station 4 Depth	Station 4 Velocity
0	.43	0	.57	0	.52	0	.52
1.8	.39	1.5	.57	0.8	.43	0.5	.52
3.0	.21	2.5	.28				

Lower Chute Transect

Station 1 Depth	Station 1 Velocity	Station 2 Depth	Station 2 Velocity	Station 3 Depth	Station 3 Velocity	Station 4 Depth	Station 4 Velocity
0	.70	0	.68	0	.43	0	.39
1.2	.52	0.8	.52	0.8	.43	1.0	.43
2.0	.52	1.2	.39	1.2	.30	1.5	.35

APPENDIX KK

Mean current velocity (at 0.6 depth) and staff gauge for the wing dams and side channel in June, August, and October 1978, and June 1979.

Date	Staff guage (meters)	Mean wing dam velocity (cm sec^{-1})	Mean side channel velocity (cm sec^{-1})
1978			
June	3.0	59	43
August	2.5	44	37
October	2.0	34	23
1979			
June	3.0	55	45