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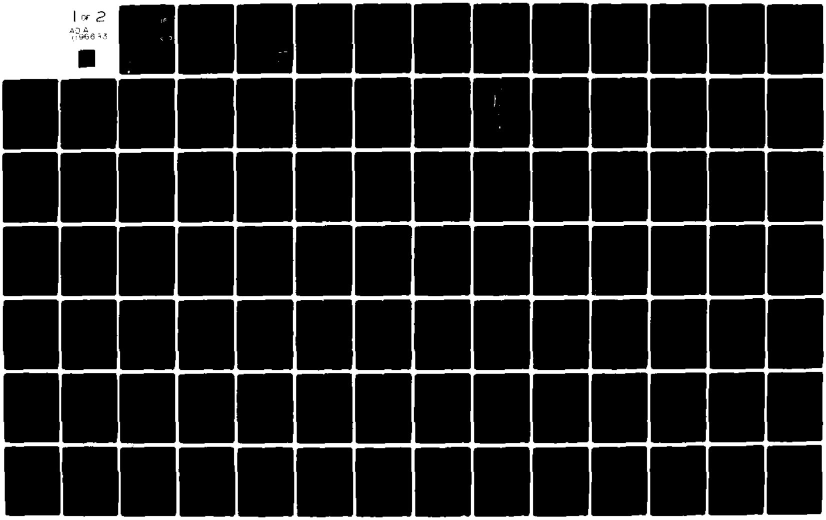

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LEVEL II

INFLUENCE OF WING DAM NOTCHING ON AQUATIC MACROINVERTEBRATES IN POOL 13, UPPER MISSISSIPPI RIVER: THE PRENOTCHING STUDY

by

Thomas J. Hall

Wisconsin Cooperative Fishery Research Unit

A Thesis
submitted in partial fulfillment of the
requirements for the degree
MASTER OF SCIENCE

College of Natural Resources

UNIVERSITY OF WISCONSIN
Stevens Point, Wisconsin

May 1980

CORRECTIONS/ERRORS - HALL THESIS

Page

8 At the end of the first paragraph add: "Their locations were marked with floats."
Cross out: "with a grapple hook on" in the first sentence of the next paragraph and put "between" in.

39 Forty-nine percent...

40 station 26-6-7...

65 station 26-6-7...

165 , biomass (g)/m^2
Oligochaeta

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ABSTRACT

Benthic and colonizing macroinvertebrates and physicochemical characteristics were studied at six wing dams and an adjacent side channel in Pool 13 of the Upper Mississippi River in June, August, September through October 1978, and June 1979 in the prenotching phase of a project to determine the effects of wing dam notching on aquatic macroinvertebrates. Three wing dams were notched in May through June 1979. Water temperature and dissolved oxygen concentration were uniform with depth in each sampling period but varied among periods. Current velocity varied with sampling period because staff gauge, i.e. discharge, varied with time. Current velocity decreased with depth. The substrate was mainly medium sand because bottom current velocities ranged from 22 to 43 cm/s during 1978.

Fifty-six taxa of macroinvertebrates were collected with a Ponar grab sampler in 1978. Oligochaeta, the most abundant class, comprised 51% of benthic invertebrate density. *Hexagenia bilineata* (Say), *Hexagenia limbata* (Serville), and early instars of *Hexagenia* spp. made up 64% of the benthic biomass. Hydropsychid caddisflies dominated the macroinvertebrate aufwuchs on basket and multiple-plate samplers, which were placed on wing dams. Basket samplers were colonized by significantly greater macroinvertebrate numbers, biomass, and number of taxa than multiple-plate samplers.

Total benthic invertebrate, oligochaete, *Hexagenia* spp., and chironomid density, and biomass and number of benthic taxa each were positively, significantly related to percent silt-clay in the substrate. All of these macroinvertebrate categories were negatively, significantly related to percent sand in the substrate. Although gravel substrate was rare, the highest benthic invertebrate density, biomass, and number of taxa occurred in gravel. Wing dam 25, on the inside of a river bend in an area of reduced current, had significantly greater benthic density and biomass than for other wing dams because of greater silt-clay deposits there. Wing dam 28 had the lowest benthic density, biomass, and number of taxa and the greatest percentage of sand. Benthic density, biomass, and number of taxa were significantly greater at stations above wing dams than below because percentages of silt-clay were greater above than below.

Besides substrate, discharge and time of year in relation to invertebrate life cycles affected benthic invertebrate populations. Benthic invertebrates decreased in August 1978 and June 1979 partly because of peak discharges in the month before the decrease and partly because of insect emergence.

The wing dams were islands of rock in a sea of sand. Basket samplers collected 26.5 times more macroinvertebrate numbers and 14.3 times more biomass than the Ponar grab sampler ~~in September~~ 1978. These differences were related to habitat, i.e. basket samplers collected invertebrates from a lotic-erosional habitat, and the Ponar grab sampler sampled a lotic-depositional habitat.

ACKNOWLEDGEMENTS

The study was supported by funds and materials from the Great River Environmental Action Team II and the Wisconsin Cooperative Fishery Research Unit, University of Wisconsin, Stevens Point.

My thanks go to colleagues, Rod Pierce, Scott Corley, Dr. William LeGrande, and other members of the Wisconsin Cooperative Fishery Research Unit, who spent many hours in the field collecting data. I would also like to thank Tom Gengerke and John Pitlo of the Iowa Conservation Commission for their cooperation and assistance.

I am particularly grateful to my advisor, Dr. Daniel Coble, who gave supervision and advice on all phases of the project and critically evaluated the manuscript, and to Dr. Henry Booke for helping solve equipment problems and examining the manuscript. I am indebted to Dr. Edward Stern for confirming my bivalve mollusk identification and examining the manuscript, as well as to Dr. Jack Heaton and Dr. Stan Szczytko for examining the manuscript. I also express appreciation to Dr. Frederick Hilpert and Tom Zeisler for their help with statistical procedures and programming, and to Dr. James Bowles and Gene Tubbs for giving information on sediment analyses and equipment.

Finally, none of this would have been possible without the continual interest, support, and love by my wife, Janette. I dedicate my thesis to my late parents, Mr. and Mrs. Irving T. Hall, for their love and support throughout my education.

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INTRODUCTION

The U.S. Army Corps of Engineers submitted plans on June 30, 1977 to the Great River Environmental Action Team II (GREAT II) for repair of wing dams in Pools 13 and 19. The Fish and Wildlife Management Work Group of GREAT II proposed the construction of notches in some of the wing dams to help alleviate the detrimental effects of accreted sediments between wing dams. They proposed that a notch be constructed in wing dams 25, 26, and 28 (Figure 1). Wing dikes have been notched in the Missouri River to reduce accreted sediments between the dikes and in backwater areas (Kallemeyn and Novotny 1977, Reynolds 1978, Jennings 1979, Dieffenbach 1980).

The objectives of this study were to compare species composition, density, and biomass of aquatic macroinvertebrates and measure physicochemical characteristics at the wing dams and side channel before notching. This study was half of the prenotching phase of the investigation. In the other half, fish populations at the wing dams and in the side channel and physicochemical characteristics at hydrographic relief transect stations were investigated by Rod Pierce (1980), another student in the Wisconsin Cooperative Fishery Research Unit.

The post-notching study is scheduled to be completed in the fall of 1980 by Scott Corley of the Wisconsin Cooperative Fishery Research Unit.

Structures for directing current and reducing erosion in large rivers for the benefit of navigation have included revetments, pile dikes, and wing dikes. Revetments are constructed to stabilize river banks from erosion. Wing dikes, which are often referred to as wing dams on the Upper Mississippi River and as wing dikes on the Missouri River, have been constructed to deflect current towards the center of the main channel to help reduce the need for recurrent dredging and to maintain a navigation channel.

Slack water areas often have developed behind wing dams, resulting in accretion of sediments between them and in adjacent backwaters because most wing dams were built in areas of natural deposition. Such sediment deposition results in loss of invertebrate and fishery habitat (Funk and Robinson 1974, Simons et al. 1975).

Although little is known of effects of wing dam notching on aquatic communities, it has been learned that wing dam height, location of notches in dams, discharge, and location of the dam in relation to the thalweg of a river affects the degree to which sediments are scoured (Simons et al. 1974, Reynolds 1978, Jennings 1979).

STUDY AREA

Pool 13 of the Upper Mississippi River extends from Bellevue, Iowa, 55 kilometers south to 2.4 kilometers north of Fulton, Illinois. The northern end of the pool is 2.6 kilometers wide and gradually widens to 4.8 kilometers. The pool is formed by Lock and Dam 13 at kilometer 841 (river mile 522.5), which was placed in operation by the U.S. Army Corps of Engineers on May 13, 1939. At Lock and Dam 13, the pool is maintained at an elevation of 178 meters above sea level (flat pool) creating a 2.7-meter pool for navigation. At flat pool, there are 11,778 hectares of water surface of which 2,945 hectares (25%) are classified as channel. Of the 814 kilometers of shoreline of the pool, 94% is federally owned (U.S. Army Corps of Engineers 1974).

The 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. The 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 riverbed consists of sand with lesser amounts of silt-clay, gravel, and boulders (U.S. Army Corps of Engineers 1974).

The study area (Figure 1) included wing dams 25, 26, 28, 29, 30, and 31 between river kilometers 880.7 and 882.7 (river miles 547.4 and 548.6) and an unnamed side channel between river kilometers 880.9 and 881.9 (river miles 547.5 to 548.1). The Illinois bank was primarily open with scattered trees, whereas the islands, shorelines of the side channel, and the Iowa bank were more densely covered river bottom woodlands.

Study sites in the river channel were within an area approximately 38 meters upstream and downstream of the base of each wing dam. The study sites included main channel border (the zone between the 2.7-meter channel and the main river bank or islands) and side channel (all departures from the main channel in which there is current during normal river stages) (Rasmussen 1979).

River kilometers 878.5 to 883.0 (river miles 546.0 to 548.8) are classified by the U.S. Army Corps of Engineers (1974) as a recurrent dredging area. This area has been dredged 13 times since 1945 with 1,373,293 cubic meters of dredge spoil having been removed. Areas of past dredge spoil disposal are between the wing dams in the study area and on the Iowa bank (Figure 1). The Maquoketa River, which enters Pool 13 opposite the study area, introduces approximately 417,312 metric tons of sediments to Pool 13 annually (U.S. Army Corps of Engineers 1974).

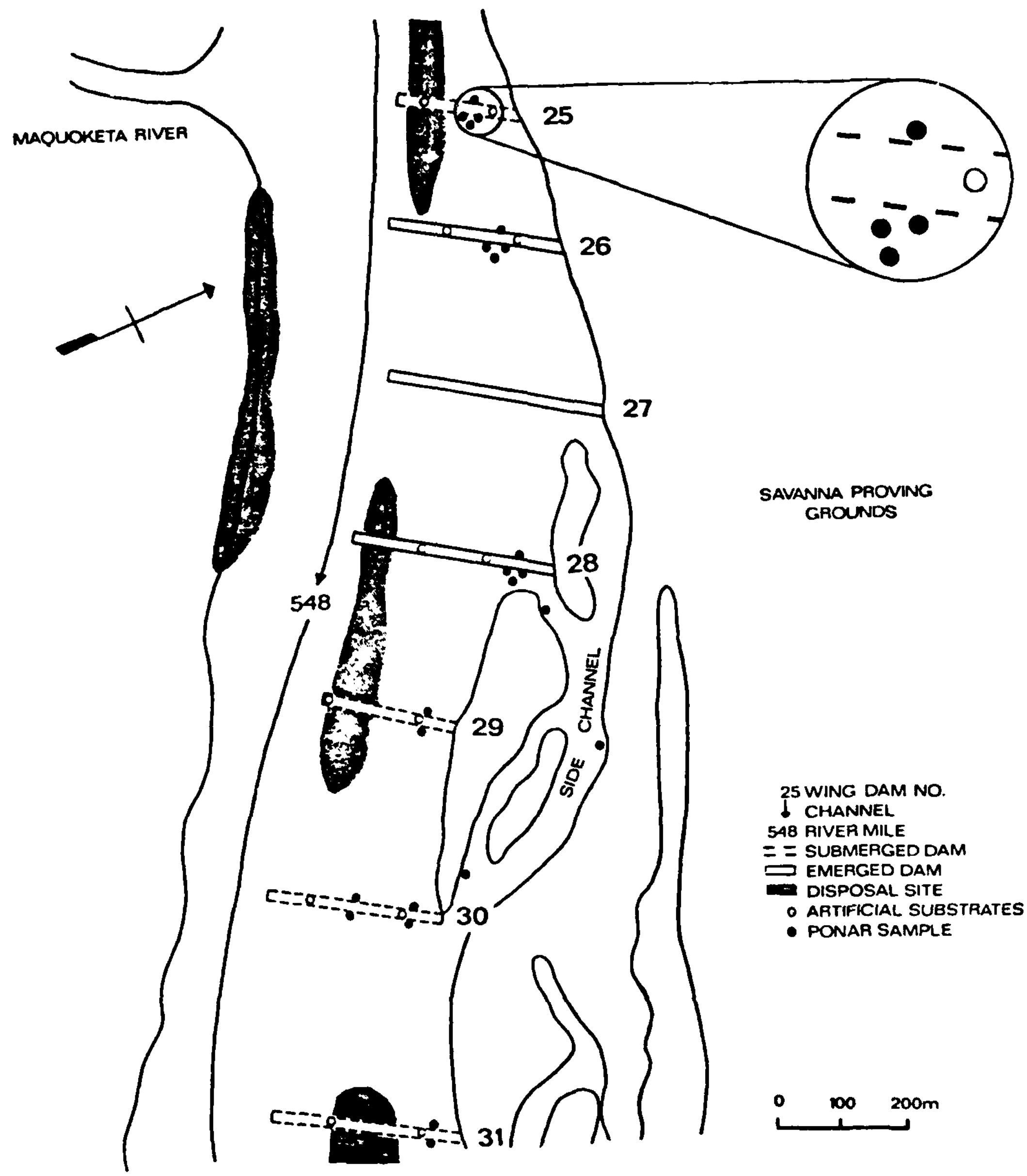

Figure 1. The study area showing the wing dams, side channel, past dredge disposal areas, Ponar sample sites, and artificial substrate sample sites. The study area is eight miles south of Bellevue, Iowa (U.S. Army Corps of Engineers 1974).

METHODS AND MATERIALS

Aquatic Macroinvertebrates

Benthic invertebrates were collected with a 252-cm^2 Ponar grab sampler on June 12, 17, 18, 20, 21; August 2-4; September 29-30, 1978; and June 5-6, 1979. Three replicate samples were taken at four sites near each wing dam and at three sites in the adjacent side channel. Sites at wing dams 25, 26, and 28 were located as follows: one site was 8 m upstream of the dams' base at the center of the proposed notch (Figure 1, Table 1). When the proximal end of the wing dam (Illinois bank) was considered to be 0° and the distal end (channel) 180°, the remaining sites radiated downstream from the center of the proposed notch at 45°-8 m, 135°-23 m, and 90°-38 m from the base of the dam (Figure 1). Sites at wing dams 29, 30, and 31 were located 8 m upstream and downstream from the base of the dam at locations 61 and 152 m from the Illinois bank (Figure 1).

Distances for transects along each dam were measured with a Rangematic range finder. Accuracy of the range finder varied from 2.2% (1.4 m) at 64 m to 1.3% (1.4 m) at 110 m.

Three Ponar grab sites in the side channel were as follows: 15 m from the west bank at river mile 548.0, 15 m from the east bank at river mile 547.8, and 15 m from the west bank at river mile 547.6 (Figure 1).

Artificial substrates included four cylindrical metal

Table 1. Proposed notches for wing dams 25, 26, and 28, Pool 13, Upper Mississippi River (refer to Figure 1 for locations).

Wing dam	Center of notch from IL bank	Depth	Width
	meters		
25	84	1.5	46
26	99	1.5	46
28	61	1.5	91

baskets with concrete spheres (Mason et al. 1967, Jacobi 1971) and four multiple-plate substrates (Hester and Dendy 1962). The artificial substrates were set August 17, 1978 at each wing dam and left for six to eight weeks to allow for optimum colonization of macroinvertebrates (Mason et al. 1973). Two basket samplers and two multiple-plate samplers were located on each of two transects (Figure 1, Table 2), with one basket and one multiple-plate sampler on the upstream and on the downstream side of the wing dam, both equidistant between the base and crown. Baskets were 28 x 18 cm, and spheres were 7.5 cm in diameter. The multiple-plate substrates were made from 2-mm tempered hardboard (masonite), with eight alternate layers of 7.5-cm squares and seven 2.5-cm squares attached to an 8-cm ring bolt. The artificial substrates were tied to a 4190 x 1-cm nylon rope that was anchored upstream from the dam by a 122 x 1.3-cm steel reinforcing rod driven into the bottom.

Artificial substrates were retrieved with a grapple hook on September 28, October 3, 12, 1978. Sixty-five percent (28) of the artificial substrates were recovered. A washtub was placed below each sampler before it was removed from the water to prevent the loss of organisms (Bull 1968, Hilsenhoff 1969, Mason et al. 1973). The substrates were dismantled in washtubs and scrubbed to remove invertebrates. Only those organisms on the spheres were used in the quantitative analysis.

Table 2. Locations of artificial substrate transects (meters from Illinois bank), Pool 13, Upper Mississippi River (refer to Figure 1 for locations).

Wing dam	Transect Inside	Transect Outside
25	64	152
26	79	183
28	105	213
29	61	213
30	61	213
31	61	213

Organisms attached to the wire basket, debris, or vegetation were discarded.

All samples were sieved through a U.S. No. 35 (0.50 mm) screened wash-bucket and placed in plastic bags containing five percent formalin (Lind 1974). In the laboratory, invertebrates were sorted from debris, subsampled (Cummins 1975: section 8.23, Elliot 1977: section 8.3) (Appendix A, B, and C), identified, and counted. Identification was facilitated by use of taxonomic keys of Ross (1944), Burks (1953), Fremling (1960a, 1960b), Gooch (1967), Parmalee (1967), Burch (1972, 1973), Lewis (1974), Hilsenhoff (1975), McCafferty (1975), Edmunds et al. (1976), Wiggins (1978a), Merritt and Cummins (1978), Pennak (1978), and Schuster et al. (1978). Oligochaetes were too fragmented in screening to be identified further than class; numbers were estimated by counting prostomiums.

Invertebrate biomass was calculated from organism length (Hynes and Coleman 1968) for all but Oligochaeta, Zygoptera, and Unionidae. Hynes and Coleman (1968) assumed invertebrates to be cylinders in which volume increased by the cube of the length and with a specific gravity of 1.05. Weights for invertebrates with lengths equal to five diameters were 3.298×10^{-5}g times the length cubed; Chironomidae and Ceratopogonidae with lengths equal to 7.5 diameters were 1.393×10^{-5}g times the length cubed; and Gastropoda and Sphaeriidae, which were considered spheres, were 4.398×10^{-3}g times the radius cubed.

Unionidae, with and without shell, and Zygoptera were soaked in water for 30 minutes, blotted dry, and weighed on a Mettler H54 balance to the nearest 0.001 g. Oligochaeta were soaked for 30 minutes in water, centrifuged at 650 rpm for three minutes (Howmiller 1972, Stanford 1973), and weighed to the nearest 0.001 g.

Physicochemical Characteristics

Water temperature, dissolved oxygen concentration, and current velocity were measured, and sediments were collected at each sampling site at the time of the benthic invertebrate samples. Water temperature and dissolved oxygen concentration were determined at each meter of the water column with a YSI Model 54 Oxygen Meter. The oxygen meter was air-calibrated and checked against a Hach kit at the beginning of each sampling day. Current velocity was recorded at the water surface; at 0.2, 0.6, and 0.8 X depth; and 10 cm from the bottom with a cable-suspended Price Current Meter (Hynes 1970).

One sediment sample was collected with a 252-cm^2 Ponar grab at each benthos sampling site. Sediments were analyzed for particle size by the procedure of Ingram (1971) and divided into 10 particle size fractions based on the modified Wentworth Scale (Wentworth 1922, Cummins 1962). No attempt was made to separate fine sediments into silt and clay.

Statistical Analyses

Large variation is usually encountered in sampling benthic populations, and small samples are often statistically inaccurate because distribution of macroinvertebrates is usually contagious (Mottley et al. 1938; Needham and Usinger 1958, cited by Resh 1979; Allen 1959; Taylor 1965; Egglishaw 1969; Sugimoto 1969; Cummins 1975; DeMarch 1976; Elliot 1977; Minshall and Minshall 1977; Taylor et al. 1978; Resh 1979; Downing 1979). Parametric statistical methods should be applied to invertebrate data only if the data are normally distributed, the variance of the sample is independent of the mean, and the components of variance are additive (Elliot 1977).

I fitted log-log regressions of variances on means for benthos samples to find out if the variances were independent of the means. If they were not, I used a transformation based on the slope of the regression line (Taylor's Power Law) on invertebrate replicate counts or biomass (Downing 1979). Transformations that removed correlation between variances and means often normalize frequency distributions and ensure that the components of variance are additive (Bartlett 1947; Anscombe 1948; Quenouille 1950; Tukey 1957, 1968; Bliss and Owen 1958; Taylor 1961; Healy and Taylor 1962; Box and Cox 1964; Southwood 1966; Snedecor and Cochran 1967; Thöni 1967; Zar 1974; Cummins 1975; Elliot 1977; Downing 1979).

Parametric statistics were used on the transformed counts or biomass. The arithmetic means of the transformed data plus an adjustment factor were transformed back to the original scale giving derived means (Quenouille 1950, Elliot 1977). Quenouille (1950) stated that derived means are usually in good agreement with means obtained by direct averaging, and that differences in derived means and arithmetic means can be considered adjustments that eliminate effects of extreme observations.

Cummins (1975), Elliot (1977), Resh (1979), and Downing (1979) felt that a tolerable error for bottom samples was a percentage error of precision of 20% calculated as $(SE)(100)/\bar{X}=20\%$. I calculated the sample size required for a 20% error for mean total invertebrate counts and biomass collected with a Ponar grab and artificial substrates (Cummins 1975: section 8.222, Elliot 1977: section 8.22). Data were pooled during analysis to reduce the large variation associated with invertebrate sampling. The percentage error for mean total invertebrate counts was approximately 20% (Appendix D and E). Whenever my transformations did not remove the correlation between the variances and means, or whenever the percentage error was greater than 20%, I used nonparametric statistics (Conover 1971, Elliot 1977, Downing 1979).

Guidelines of Sutcliffe (1979) were used for measurements of quantitative data.

Appendices F, G, H, I, J, and K are copies of computer printouts.

Hydrographic Relief Sediments

One sediment sample was collected with a 252-cm^2 Ponar grab from six sites at each wing dam. Sites at the wing dams were located 30 m upstream and downstream from the base of the dam at the following locations from the Illinois bank:

Wing dam 25 - 91, 152, and 213 m

Wing dam 26 - 107, 168, and 259 m

Wing dam 28 - 61, 122, and 244 m

Wing dams 29, 30, and 31 - 61, 137, and 213 m.

Sediments were analyzed for particle size by the procedure of Ingram (1971). No attempt was made to separate fine sediments into silt and clay.

Data on current velocity, depth, dissolved oxygen concentration, hydrographic relief, and temperature for the hydrographic relief transects, as opposed to the benthos sampling sites, are in Pierce (1980).

RESULTS AND DISCUSSION

Physicochemical Characteristics of Benthos Stations

Discharge

The mean yearly discharge for 1979 was the second highest discharge recorded in the past decade, whereas the discharge for 1978 was slightly below average (Appendix L). Monthly discharges in 1978 were erratic with three peaks occurring (Appendix M), similar to discharge found in the Mississippi River by Dorris and Copeland (1963). The maximum monthly discharge in 1978 occurred in July, and in 1979, in April and May (Appendix M). The maximum monthly discharge for July 1978 was atypical because the maximum normally occurs in spring (Dorris and Copeland 1963; Hynes 1970; Fremling et al. 1978, 1979). The mean monthly discharge for May 1979 was 131% greater than in May 1978 (Appendix M). These differences in discharge between years should be considered in any comparisons of the environment through time. Leopold (1962), Leopold et al. (1964), Hynes (1970), Maddock (1972), Beaumont (1975), and Simons et al. (1975) concluded that discharge was the most important factor influencing biological, and physicochemical factors of a stream.

Current Velocity

Current velocity varied with depth, sampling location, and sampling period. The range of current velocities from bottom to surface was 8 to 105 cm/s during the study (Appendix F-1 to F-4). Current velocities became progressively smaller with increasing depth (Figure 2). Hubault (1927, cited by Hynes 1970) and Ambühl (1959, 1961, 1962; cited by Hynes 1970) reported this aspect of flow with reference to benthic animals.

Bottom current velocity increased downstream from wing dams 25 to 31 in 1978 (Table 3). Current velocities were significantly greater for downstream wing dams (29, 30, and 31) than upstream wing dams (25, 26, and 28) and the side channel in 1978 (Appendix N) because the upstream wing dams were located on the inside of a river bend.

There was no difference in bottom current velocity above and below the wing dams (Table 3). Wing dams 26 and 28 were partly emergent in 1978, but current velocities were not lower at emergent dams than at submergent wing dam 25 (Table 3).

Mean current velocity varied with sampling period because staff gauge readings, i.e. discharge, varied with time. As staff gauge readings decreased in 1978, mean current velocity decreased (Table 4).

Substrate

Bottom current velocity determined particle size in the study area. Median particle size (0.25-0.50 mm) for the side channel and wing dams was in the medium to coarse sand range (Figure 3, Appendix G). Einsele (1960, cited by Hynes 1970) stated that bottom velocities of 20 to 40 cm/s would produce sandy substrates. Mean bottom current velocities for the benthos sites varied from 22 to 43 cm/s

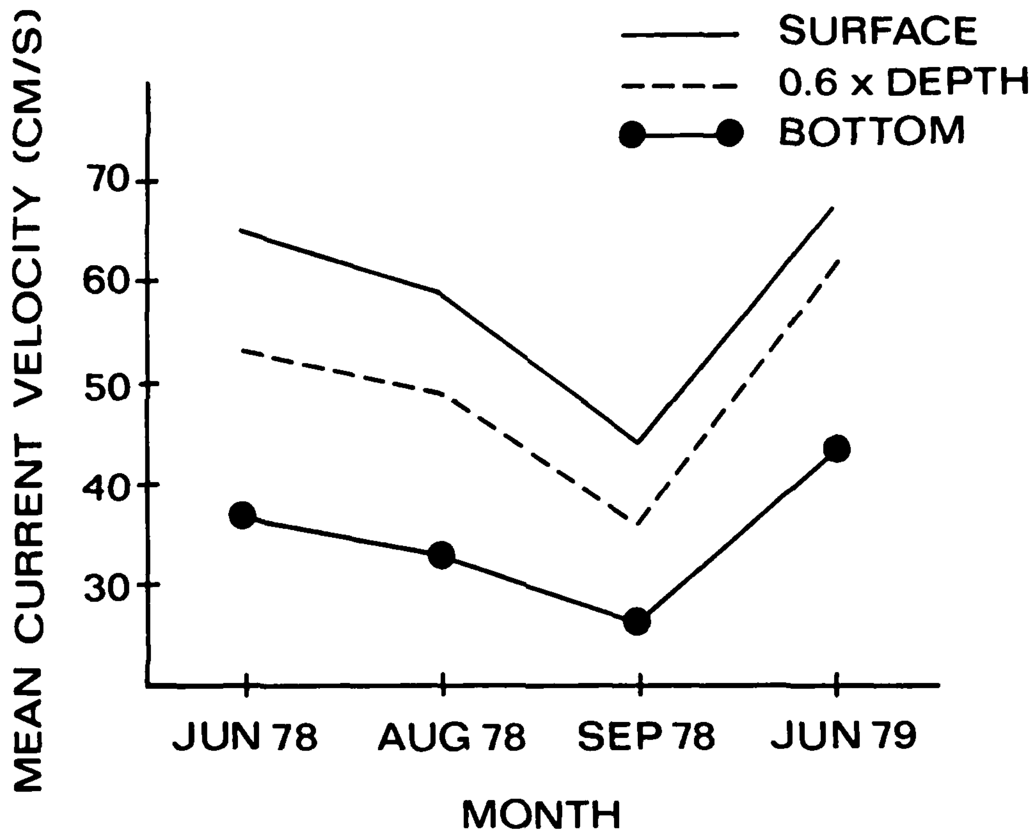

Figure 2. Mean current velocity recorded at the surface, 0.6 of the depth, and the bottom at benthos sites for June, August, September 1978, and June 1979, Pool 13, Upper Mississippi River.

Table 3. Bottom current velocity (cm/s) at benthos stations in the side channel, wing dams, and stations upstream and downstream of the wing dams, Pool 13, Upper Mississippi River, 1978 (refer to Figure 1 for locations). Means and standard deviations for velocities upstream and downstream of the wing dams were calculated for stations located nearest to the Illinois bank. Station 30-6-7 in August 1978 was eliminated because of an erroneous velocity value (Appendix F-2).

Site	Mean	SD	n
Side channel	25[a]	10	9
Wing dam 25	22[a]	9	12
Wing dam 26	22[a]	11	12
Wing dam 28	28[a]	9	12
Wing dam 29	40[b]	12	12
Wing dam 30	39[b]	10	11
Wing dam 31	43[b]	5	12
Upstream	32	12	18
Downstream	29	12	18

[a,b]Significantly different (Appendix N).

Table 4. Current velocity (cm/s) at 0.6 of the depth at benthos stations (refer to Figure 1 for locations) and staff gauge readings (m) at Lock and Dam 12, Pool 13, Upper Mississippi River, 1978. Staff gauge readings were obtained from the U.S. Army Corps of Engineers, Lock and Dam 12, Bellevue, Iowa.

		Current velocity		Staff gauge	
Month	n	Mean	SD	Mean	SD
June 1978	27	54	12	2.81	0.33
August 1978	27	48	15	2.62	0.10
September 1978	27	38	14	2.24	0.10
June 1979	23	62	17	3.08	0.10

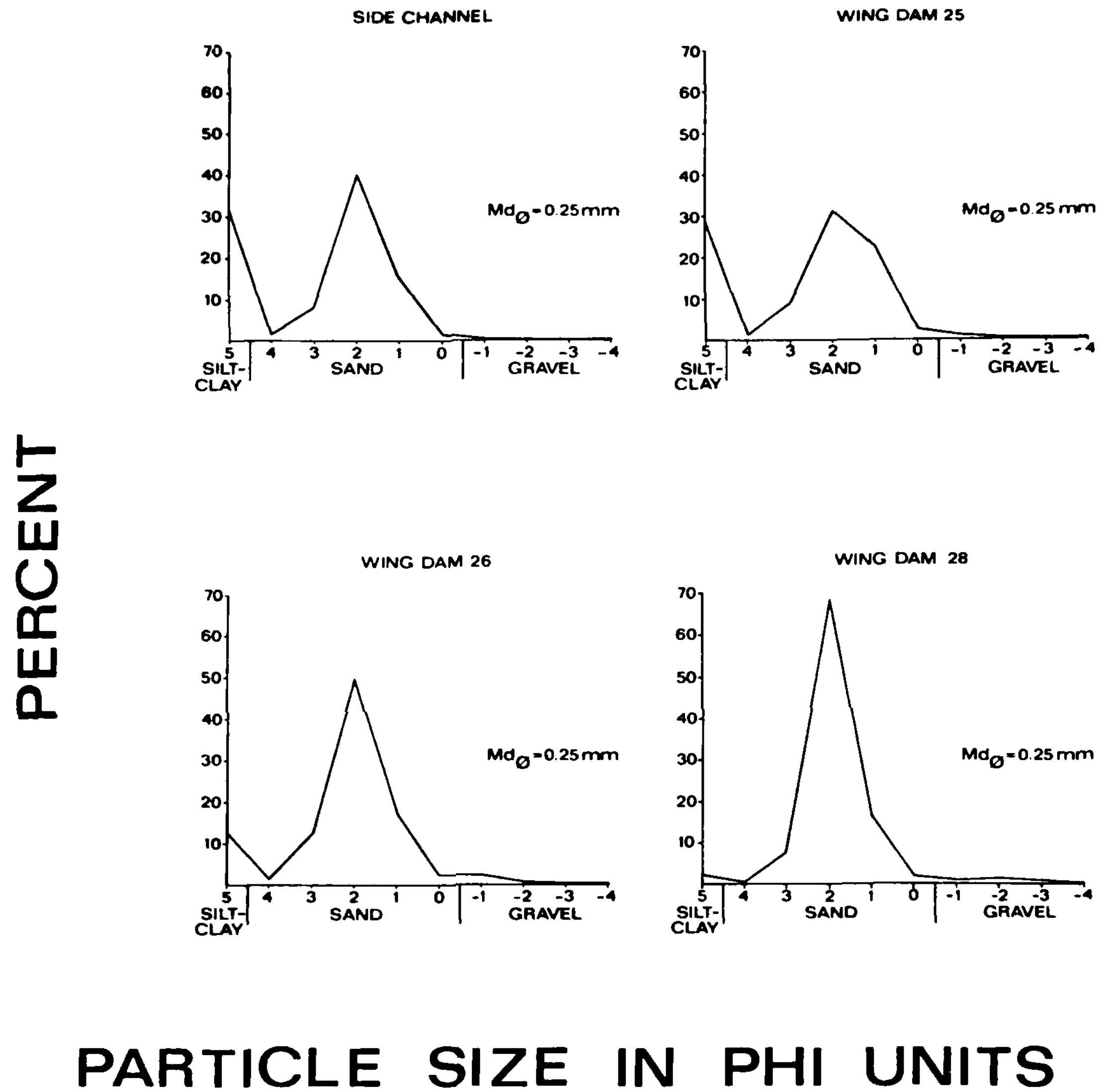

Figure 3. Percent mean particle size (Phi units) from benthos stations in the side channel and wing dams, Pool 13, Upper Mississippi River, 1978. Phi units, defined as the negative log to the base 2 of particle size diameter (mm), convert the geometric Wentworth classification in which each size category is twice the preceding one, into an arithmetic one with equal class intervals, i.e. 0.063 mm = 4; 0.125 mm = 3; 0.25 mm = 2; 0.50 mm = 1; 1.00 mm = 0; 2.00 mm = -1; 4.00 mm = -2; 8.00 mm = -3; and 16 mm = -4 phi units. Silt-clay, which was less than 0.063 mm, was considered to be 5 phi units. Md_{ϕ} = median particle size (mm).

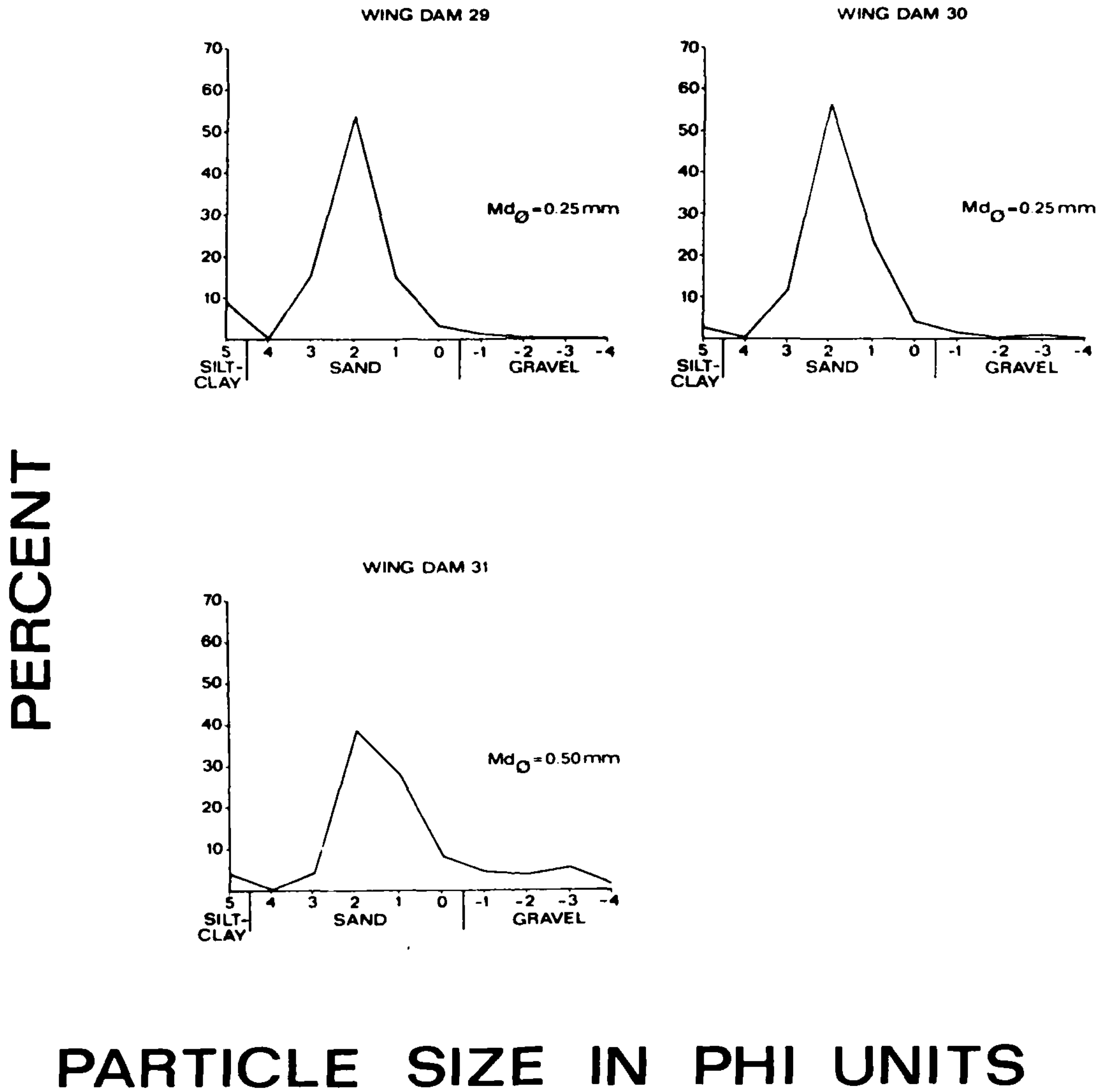

Figure 3. (continued)

in the 1978 samples (Table 3).

There was only a small amount of fine sand in the study area in 1978 (Figure 3) because bottom current velocities were equal to or greater than 20 to 30 cm/s (Table 3), the velocities required to transport fine sands (Schmitz 1961, Hynes 1970). Percentages of gravel and sand increased from upstream to downstream and percentages of silt-clay were less downstream (wing dams 28 to 31) than upstream (wing dams 25 to 26) in the study area (Figure 3) because current velocities increased from upstream to downstream (Table 3). However, percentages of silt-clay were higher than for very fine sands (Figure 3). Hynes (1970) stated that the packing coefficient of sediments complicates current velocity-sediment particle size dynamics. Current velocities of 30 to 50 cm/s would be required to transport sandy clay (Schmitz 1961, Hynes 1970).

Bottom current velocities and sediment composition for the side channel were similar to those for wing dams 25 and 26 in 1978 (Figure 3, Table 3).

Several investigators have found substrate composition to depend on current velocity (Butcher 1927, 1933; Nielson 1950; Schmitz 1961; Hynes 1970). Nielson (1950) and Leopold et al. (1964) stated that increasing current velocity picks up, or rolls sediment particles of increasing size along the bed, and that these are carried downstream.

Dissolved Oxygen and Temperature

There was little range in dissolved oxygen concentration and temperature from bottom to the surface within a sampling period, but both varied greatly between sampling periods (Appendix F-1 to F-4). Hynes (1970) and Welcomme (1979) stated that because of turbulence, water in a river channel rarely stratifies. Mean dissolved oxygen concentrations varied from 4.7 to 8.6 mg/l and mean temperatures varied from 16.0 to 23.3°C during the study (Appendix F-1 to F-4). Dissolved oxygen concentrations and temperatures were comparable to those reported by Dorris and Copeland (1963) and Schramm and Lewis (1974) for the Mississippi River.

Davis (1975) stated that insufficient evidence exists to formulate definite dissolved oxygen criteria for aquatic invertebrate communities, but a reasonable basis was to follow recommendations for fish populations. Doudoroff and Shumway (1967) and Bennett (1970) recommended a minimum dissolved oxygen level of 5 mg/l for good mixed warmwater fish populations. Dissolved oxygen concentrations probably were not limiting to benthic invertebrates during the study. However, dissolved oxygen levels were not measured just before dawn when levels might have been lower.

Benthos

Influence of Substrate on Benthos

Substrate composition was an important influence on benthic invertebrate density, biomass, and number of taxa in the study area. Total invertebrate, Oligochaeta, *Hexagenia* spp., and Chironomidae density and biomass were positively, significantly related to percent silt-clay in substrates in 1978 (Appendix O). Total invertebrate taxa were also positively, significantly related to percent silt-clay (Appendix O). All of these macroinvertebrate categories were negatively, significantly related to percent sand in substrates (Appendix O). Total invertebrate, Oligochaeta, and Hexagenia spp. were negatively, significantly related to bottom current velocity (Appendix O). However, high proportions of gravel (over 30%) were found at two sites at wing dam 31 in September 1978 (31-5-7 and 31-5-8), and the greatest invertebrate density, biomass, and number of taxa in the entire study were found then (Appendix G and H-3).

Wene (1940) stated that the addition of silt to sand increased the food content (detritus) available to macroinvertebrates. Results of this investigation confirmed the conclusions of others that sand is a poor substrate for benthic invertebrates (Gersbacher 1937; Tarzwell 1937a; Denham 1938; Murray 1938; Pennak and Van Gerpen 1947; Sprules 1947; O'Connel and Campbell 1953; Cordone and Kelly 1961; Leonard 1962; Chutter 1969; Hynes 1970; Leudtke and Brusven 1976; Fremling et al. 1978, 1979; Schmal and Sanders 1978). If notching increases the percentage of sand in the substrate, it would adversely affect bottom-dwelling macroinvertebrates in the study area.

Site Differences

Benthic density, biomass, and number of taxa varied among sites according to the differences in substrate composition. Wing dam 25, on the inside of a river bend in an area of reduced current velocity, was an area of deposition (Table 3).

Benthic density and biomass were significantly greater for wing dam 25 than for other wing dams because of the greater silt-clay deposits there (Figure 3, Table 5, Appendix P). Also the number of taxa was greatest at wing dam 25 and significantly greater there than at wing dams 28, 29, 30, and 31 (Table 5, Appendix P). The average proportion of silt-clay in the side channel was similar to that of wing dam 25 (Figure 3), but there was more variation from site to site in the side channel. The second highest density and number of taxa occurred in the side channel (Table 5). Wing dam 28 had the lowest benthic density, biomass, and number of taxa and the greatest percentage of sand (Figure 3, Table 5). Swift current over soft substrates has been related to low numbers and taxa of benthic animals (Richardson 1921, Briggs 1948, Berner 1951, Milkulski 1961, Hynes 1970). Leudtke and Brusven (1976) believed that the combination of exposure to strong current and instability of sand grains was responsible for restricting recolonization by invertebrates.

Mean benthic density, biomass, and number of taxa was significantly greater at stations above the wing dams than below (Table 5, Appendix P). These differences were probably caused by differences in substrate. Percentages of silt-clay were 33% greater for stations above than below the wing dams (Appendix G).

Influence of Discharge and Season on Benthos

Discharge and time of year in relation to invertebrate life cycles affected benthic invertebrate density, biomass, and number of taxa in the study area. Benthic populations

Table 5. Benthic invertebrate density and biomass (g) per m^2 and number of taxa collected with a 252-cm^2 Ponar grab from the side channel, wing dams, and from stations upstream and downstream of the wing dams, Pool 13, Upper Mississippi River, 1978 (refer to Figure 1 for locations). Means and standard deviations for stations upstream and downstream of the wing dams were calculated for stations nearest to the Illinois bank.

Site	Density			Biomass			Taxa		
	Mean	SD	n	Mean	SD	n	Mean	SD	n
Side channel	942	1139	27	6.18	11.03	27	6.3	4.3	9
Wing dam 25	1767	1256	36	34.20	44.67	36	7.2	3.5	12
Wing dam 26	833	1080	36	12.46	40.02	36	4.6	2.8	12
Wing dam 28	212	331	36	0.61	1.47	36	2.8	1.7	12
Wing dam 29	670	1910	36	6.42	25.68	36	4.2	2.2	12
Wing dam 30	305	413	36	1.63	4.60	36	3.0	2.1	12
Wing dam 31	224	380	30	3.14	13.25	30	3.8	1.5	10
Upstream	877	953	51	21.13	49.52	51	5.3	3.7	17
Downstream	745	1877	51	9.33	23.08	51	3.9	2.5	17

Table 6. Benthic invertebrate density and biomass (g) per m^2 and number of taxa collected with a 252-cm^2 Ponar grab in June, August, September 1978, and June 1979, Pool 13, Upper Mississippi River (refer to Figure 1 for locations).

Taxa	Density				Biomass			Taxa		
	n	Mean	SD	Derived mean[a]	n	Mean	SD	n	Mean	SD
June 1978	81	903	1520	908	81	19.78	43.77	27	5.2	2.9
August 1978	81	476[b]	921	480	81	1.23[b]	4.40	27	2.8[b]	1.7
September 1978	75	757	1010	761	75	7.35	15.60	25	5.6	3.5
June 1979	69	663	722	666	69	3.05	6.96	23	3.9	1.9

[a] Derived means are arithmetic means of transformed counts plus an adjustment factor, which is then transformed back to the original scale (Quenouille 1950, Elliot 1977).

[b] August values were significantly lower than those in other months (Appendix Q).

decreased significantly from June to August 1978 (Table 6, Appendix Q). The peak annual discharge that occurred in July 1978 probably caused part of the decrease by: 1) reducing percentages of productive substrate (silt-clay), 2) dislodging invertebrates and moving them downstream, and 3) stimulating hyporheic or lateral movement of invertebrates to avoid being dislodged (Tarzwell 1937b; Allen 1951, 1959). Benthos stations in June 1978 had 18% silt-clay substrates, and in August, 7% (Appendix G).

Part of the decline in benthic populations from June to August 1978 was probably related to emergence of insects with bivoltine life cycles and the inefficiency of the sampling gear to collect the eggs and early instars of the invertebrates. Chironomidae should emerge in late July and in August (Fremling 1960b, Coffman 1978). However, *Hexagenia* sp., a univoltine insect, should have been abundant in August 1978 because the adults emerge every 6 to 11 days and lay eggs from mid-June to mid-August, with peak emergences and egg-laying occurring from late June to mid-July. The eggs hatch in 10 to 12 days, and several broods of nymphs should have molted several times by August (Fremling 1960a, 1964b, 1967, 1968; Thomforde and Fremling 1968; Edmunds et al. 1976). The virtual absence of *Hexagenia* nymphs in August 1978 (Appendix H-2) was probably caused by the high discharge in July 1978.

High discharge in April and May 1979 probably also decreased benthic populations from September 1978 to June 1979, although these differences were not significant

(Table 6, Appendix Q). Benthic biomass should have been much higher in June 1979 than September 1978; maximum biomass occurs in the spring in most streams (Hynes 1970). Hexagenia nymphs should have been abundant during the early June sampling, but they were virtually absent (Appendix H-4).

The decrease in benthic populations from September 1978 to June 1979 may have been caused by: 1) dislodgement of invertebrates, and 2) hyporheic or lateral movements. Adequate silt-clay substrate for Hexagenia colonization was present in spring. Silt-clay increased in the study area from 12% in September 1978 to 24% in June 1979 (Appendix G). Perhaps there had been insufficient time for recolonization of Hexagenia nymphs in the study area following the high discharge in April and May, and perhaps the silt-clay had only recently been deposited in the study area.

Oligochaetes, ceratopogonids, and chironomids have been found to be the first benthic colonizers following floods. In this study, oligochaetes and chironomids were numerically the dominant taxa in August 1978 and June 1979 after flooding, and ceratopogonids were also abundant in June 1979 (Appendix H-2 and H-4). Gersbacher (1937) found that chironomids and ceratopogonids were the first colonizers of Illinois streams denuded by floods, and that with deposition of silt-clay, Hexagenia sp. and Sphaerium sp. were the principal colonizers. Moffet (1936) reported that after complete removal of invertebrates in South Willow Creek, Utah, by flooding, chironomids dominated the invertebrate fauna during the recovery stages. In the River Endrick in Scotland, Maitland

(1964, cited by Hynes 1970) reported that winter flooding reduced the invertebrate fauna in sandy areas, and that substrate burrowers, such as chironomids and tubificids, managed to survive the winter. Hynes (1970) stated that invertebrates with short life cycles, such as chironomids, may dominate the fauna following high discharges.

Taxonomic Composition

With data from stations 31-5-7 and 31-5-8 in September 1978 eliminated, the classes Oligochaeta and Pelecypoda and the orders Ephemeroptera, Trichoptera, and Diptera were the dominant benthic invertebrates in the study area in 1978 (Table 7, Appendix H-1 to H-3). Those stations were eliminated because they had such atypically high chironomid and trichopteran densities and gravel (Appendix G and H-3) that their inclusion would indicate that chironomids and trichopterans dominated the benthos in the study area, whereas they did not. The remaining less common taxa of benthic invertebrates comprised less than 0.3% of total numbers and less than 6.7% of the total biomass. These groups included: Turbellaria, Nematoda, Hirudinea, Isopoda, Amphipoda, Hydracarina, Plecoptera, Odonata, Megaloptera, Lepidoptera, Coleoptera, and Gastropoda.

Oligochaeta, the most abundant class in 1978, comprised 50.8% of the benthic invertebrate density and 3.4% of the biomass (Appendix H-1 to H-3).

Ephemeroptera dominated benthic biomass in 1978, representing 21.2% of the density and 65.0% of the biomass (Appendix H-1 to H-3). The greatest ephemeropteran biomass

Table 7. List of macroinvertebrate taxa collected with a 252-cm^2 Ponar grab sampler and artificial substrates from Pool 13, Upper Mississippi River (X = present).

Taxa	Ponar grab sampler				Basket sampler	Multiple-plate sampler
	Jun 1978	Aug 1978	Sep 1978	Jun 1979	Sep 1978	Sep 1978
Platyhelminthes						
Turbellaria			X		X	
Tricladida			X		X	X
Nematoda			X			
Annelida						
Oligochaeta	X	X	X	X	X	X
Hirudinea						
Rhynchobdellida						
Glossiphoniidae			X			
Helobdella sp.			X			
Placobdella sp.	X					X
Arthropoda						
Crustacea						
Isopoda						
Asellidae						
Asellus sp.	X				X	X
Amphipoda						
Gammaridae						

Table 7. (continued)

Taxa	Ponar grab sampler				Basket sampler	Multiple-plate sampler
	Jun 1978	Aug 1978	Sep 1978	Jun 1979	Sep 1978	Sep 1978
Gammarus sp.						X
Talitridae						
Hyallela azteca (Saussure)	X	X	X	X	X	X
Arachnoidea						
Hydracarina[a]	X					
Insecta						
Plecoptera						
Perlidae						
Perlesta placida (Hagen)	X					
Ephemeroptera						
Baetidae			X		X	
Baetis sp.		X	X		X	X
Baetiscidae						
Baetisca sp.				X		
Caenidae			X			X
Brachycercus sp.	X	X	X			
Caenis sp.	X		X		X	X
Ephemeridae						
Hexagenia spp.	X	X	X	X	X	X

Table 7. (continued)

Taxa	Ponar grab sampler				Basket sampler	Multiple-plate sampler
	Jun 1978	Aug 1978	Sep 1978	Jun 1979	Sep 1978	Sep 1978
H. bilineata (Say)	X	X	X	X		
H. limbata (Serville)	X			X		
Heptageniidae						
Stenacron sp.					X	
Stenonema sp.			X		X	X
Leptophlebiidae						
Paraleptophlebia sp.				X		
Polymitarcidae						
Ephoron album (Say)	X					
Odonata						
Gomphidae						
Dromogomphus sp.			X			
Gomphus sp.				X	X	
Ophiogomphus sp.	X					
Libellulidae						
Pantala sp.					X	
Coenagrionidae					X	X
Anomalagrion hastatum (Say)			X			
Argia sp.					X	

Table 7. (continued)

Taxa	Ponar grab sampler				Basket sampler	Multiple-plate sampler
	Jun 1978	Aug 1978	Sep 1978	Jun 1979	Sep 1978	Sep 1978
Ischnura sp.					X	
Hemiptera						
Pleidae						
Neoplea striola (Fieber)					X	
Megaloptera						
Sialidae						
Sialis sp.		X			X	
Trichoptera	X	X				
Hydropsychidae (early instars)			X	X	X	X
Cheumatopsyche sp.	X	X	X		X	X
Hydropsyche sp.			X		X	X
H. orris Ross			X		X	X
Potamyia flava (Hagen)	X	X	X	X	X	X
Leptoceridae						
Oecetis sp.	X		X	X		
Polycentropodidae					X	
Neureclipsis sp.			X		X	X
Lepidoptera						
Pyralidae						

Table 7. (continued)

Taxa	Ponar grab sampler				Basket sampler	Multiple-plate sampler
	Jun 1978	Aug 1978	Sep 1978	Jun 1979	Sep 1978	Sep 1978
<u>Acentropus</u> sp.			X			
Coleoptera						
Elmidae						X
<u>Dubiraphia</u> sp.				X		
<u>Stenelmis</u> sp.	X		X	X	X	
Diptera						
Ceratopogonidae	X	X	X	X		
Chironomidae	X	X	X	X	X	X
Culicidae	X		X	X		
Chaoboridae						
<u>Chaoborus</u> sp.			X		X	
Empididae			X			
Muscidae	X					
Stratiomyidae			X			
Mollusca						
Gastropoda						
Basommatophora						
Lymnaeidae						
<u>Lymnaea</u> sp.	X					

Table 7. (continued)

Taxa	Ponar grab sampler Jun 1978	Ponar grab sampler Aug 1978	Ponar grab sampler Sep 1978	Ponar grab sampler Jun 1979	Basket sampler Sep 1978	Multiple-plate sampler Sep 1978
Physidae						
Physa sp.					X	
Pelecypoda						
Heterodonta						
Corbiculidae						
Corbicula manilensis (Philippi)			X			
Sphaeriidae						
Pisidium sp.	X	X	X			
Sphaerium sp.	X	X	X	X		
Schizodonta						
Unionidae			X		X	X
Fusconaia flava (Rafinesque)	X					
Lasmigona compressa (Lea)	X	X				
Leptodea fragilis (Rafinesque)	X	X			X	
Obliquaria reflexa Rafinesque	X					
Obovaria olivaria (Rafinesque)	X	X				
Number of taxa	30	17	37	17	31	21

[a]"Hydracarina" is not a specific taxonomic term, but a term of convenience (Pennak 1978). It is an aggregation of families in the suborder Trombidiformes.

obtained was 122.47 g/m^2 for Hexagenia spp. in June 1978 (Appendix H-1). Hexagenia spp. comprised 86.6% of the ephemeropteran density and 98.7% of the biomass. Of the Hexagenia nymphs greater than 16 mm in length (Gooch 1967), 55.1% were H. limbata (Serville) and 44.9% were H. bilineata (Say). A caenid mayfly, Brachycercus sp., comprised 12.6% of the ephemeropteran density and 0.9% of the biomass. The remaining ephemeropterans consisted of Baetis sp., Baetidae (early instars), Ephoron album (Say), Paraleptophlebia sp., and Stenonema sp. These taxa represented 0.6% of the ephemeropteran density and 0.4% of the biomass in 1978.

Trichoptera comprised 7.6% of benthic invertebrate density and 0.9% of the biomass (Appendix H-1 to H-3). The largest trichopteran density found was 31,810/m^2 in September 1978, of which 18,438/m^2 were Potamyia flava (Hagen) (Appendix H-3). The most abundant trichopteran was Potamyia flava, which accounted for 31.5% of the trichopteran density and 36.6% of the biomass. Cheumatopsyche sp. made up 25.9% of the trichopteran density and 42.7% of the biomass. Other trichopterans included: Hydropsychidae (early instars), Hydropsyche sp., H. orris Ross, Neureclipsis sp., and Oecetis sp. Together, they represented 42.6% of the trichopteran density and 20.7% of the biomass in 1978.

Diptera comprised 17.9% of benthic invertebrate density and 4.1% of the biomass in 1978 (Appendix H-1 to H-3). Chironomidae was the most abundant dipteran family, comprising 89.9% of the dipteran density and 81.3% of biomass. Ceratopogonidae represented 6.6% of dipteran density and 17.6% of the biomass. The remaining dipteran families, which included Culicidae, Empididae, and Stratiomyidae, comprised 3.5% of the density and 1.1% of the dipteran biomass in 1978.

The class Pelecypoda was represented by two families, Sphaeriidae and Unionidae. These bivalve mollusks comprised 2.2% of benthic invertebrate density and 19.9% of the biomass in 1978 (Appendix H-1 to H-3). Sphaerium sp. represented 73.3% of bivalve density and 17.8% of the biomass. Pisidium sp., another sphaeriid, represented 20.0% of the density and 1.0% of the bivalve biomass. The family Unionidae comprised 6.7% of bivalve density and 81.2% of the biomass in 1978. Species within the family included: Fusconaia flava (Rafinesque), Lasmigona compressa (Lea), Leptodea fragilis (Rafinesque), Obliquaria reflexa Rafinesque, and Obovaria olivaria (Rafinesque). Lasmigona compressa, which is a small stream species, has rarely been collected in the Upper Mississippi River (Van der Shalie and Van der Shalie 1950, Perry 1979).

The invertebrates found in this study were similar to those found by others in the Mississippi River (Wiebe 1927; Johnson 1929; Johnson and Munger 1930; Van der Shalie and Van der Shalie 1950; Dorris 1958; Fremling 1960a, 1960b, 1964a, 1964b, 1967, 1968, 1970, 1973; Hoopes 1960; Dorris and Copeland 1962; Christenson and Smith 1965; Carlander et al. 1967; Thomforde and Fremling 1967; Wenke 1967; Carlson 1968; Gale 1971, 1973, 1975, 1976, 1977; Merz 1974; Schramm et al. 1974; Rogers 1976; Coon et al. 1977; Fuller 1978;

ERT/Ecological Consultants, Inc. 1979; Fremling et al. 1979; Lewis 1979; Perry 1979).

Macroinvertebrate Aufwuchs

Organisms other than aquatic macrophytes that live attached to substrate have been referred to as aufwuchs (Ruttner 1963). I studied only the macroinvertebrate aufwuchs that colonized artificial substrates placed on wing dams.

Comparison of Stations

Macroinvertebrate aufwuchs populations were similar at various locations in the study area in September 1978. There was no significant difference in macroinvertebrate numbers, biomass, or number of taxa collected on artificial substrates at upstream versus downstream stations or stations near the Illinois bank versus stations near the main channel (Table 8). Invertebrate aufwuchs populations were not compared among wing dams because of insufficient sample size (Table 8).

Comparison of Samplers

Basket samplers were colonized by significantly greater macroinvertebrate numbers, biomass, and number of taxa than multiple-plate samplers (Table 8). Basket samplers had three times more individuals and 2.6 times more biomass than multiple-plate samplers (Table 8). Thirty-one taxa were collected from basket samplers and 21 from multiple-plate samplers (Table 7). Forty-seven percent of the taxa collected by both samplers were common to both (Table 7).

Density was slightly more variable from basket samplers than from multiple-plate samplers; the percentage error of

Table 8. Total invertebrate density and biomass (g) per m^2 and number of taxa for basket samplers and multiple-plate samplers from the wing dams, Pool 13, Upper Mississippi River, September 28, October 3, 12 1978 (refer to Figure 1 for locations). Artificial substrates from station 29-6-7 were eliminated because they were embedded in mud (Appendix I and J).

Sampler	Density			Biomass		Taxa	
	n	Mean	SD	Mean	SD	Mean	SD
Basket sampler							
Study area	13	20029[a]	14103	104.96[b]	68.04	11.7[c]	3.8
Stations upstream of wing dams	5	18838	14189	99.02	75.17	12.6	5.1
Stations downstream of wing dams	8	20774	14976	108.67	68.31	11.1	2.9
Stations near IL bank	8	18023	12805	93.89	66.24	11.6	4.8
Stations near main channel	5	23240	16994	122.66	74.65	11.8	1.6
Wing dam 25	4[d]	11425	4668	77.23	44.66	14.8	1.5
Wing dam 26	3	20037	9840	130.80	44.79	13.3	3.2
Wing dam 28	1	7867	-	36.39	-	11.0	-
Wing dam 29	2	13808	13444	51.21	32.07	10.5	3.5
Wing dam 30	3	39696	11516	174.77	84.68	7.0	3.0
Multiple-plate sampler							
Study area	13	6739[a]	4485	39.83[b]	26.37	10.6[c]	2.7
Stations upstream of wing dams	5	7592	5249	43.80	30.51	12.0	2.7
Stations downstream of wing dams	8	6206	4230	37.34	25.33	9.8	2.5
Stations near IL bank	8	6851	4717	39.52	28.08	11.0	3.3
Stations near main channel	5	6561	4620	40.33	26.56	10.0	1.6

Table 8. (continued)

Sampler	n	Density Mean	Density SD	Biomass Mean	Biomass SD	Taxa Mean	Taxa SD
Wing dam 25	4[d]	3578	2566	25.70	21.98	12.5	2.1
Wing dam 26	3	12122	2822	75.95	14.20	8.3	0.6
Wing dam 28	1	10746	-	50.11	-	11.0	-
Wing dam 29	2	1985	2129	13.95	16.00	11.5	6.4
Wing dam 30	3	7405	2413	36.37	4.41	9.7	0.6

[a] Basket sampler density was significantly greater than multiple-plate density (Wilcoxon paired-sample test: $T = 6$, $n = 13$, $p<0.01$).

[b] Basket sampler biomass was significantly greater than multiple-plate biomass (Wilcoxon paired-sample test: $T = 6$, $n = 13$, $p<0.01$).

[c] Basket sampler taxa was significantly greater than multiple-plate taxa (Wilcoxon paired-sample test: $T = 15$, $n = 13$, $p<0.05$).

[d] Invertebrate aufwuchs populations were not compared among wing dams because of insufficient sample size, e.g. Mann-Whitney tests would require a minimum of four samples for each wing dam (Zar 1974).

precision for density was 19.9% for basket samplers and 18.8% for multiple-plate samplers (Appendix E). The number of samplers required for a percentage error of precision of 20%, a tolerable error for invertebrate samples (Cummins 1975, Elliot 1977), was 12 for basket samplers and 11 for multiple-plate samplers (Appendix E).

Variability of biomass estimates was approximately equal in both samplers; the percentage error of precision for biomass was 18.3% for basket samplers and 18.7% for multiple-plate samplers (Table 8). Eleven basket samplers and 11 multiple-plate samplers would be required for a percentage error of precision of 20% for biomass estimates (Table 8).

The percentage error of precision for invertebrate taxa collected by basket samplers was 9.0%, and for multiple-plate samplers, 7.1% (Table 8). Only two basket samplers and two multiple-plate samplers would be required for a percentage error of precision of 20% for invertebrate taxa collected by each sampler (Table 8). Dickson et al. (1971) found that four baskets filled with limestone were required to estimate the true mean number of taxa with a percentage error of precision of 25%.

The high level of precision obtained for number of taxa did not allow statistical comparisons among wing dams, however. Even with an acceptable level of precision, I could not find a transformation for the data that would make the variance independent of the mean. Therefore, parametric statistics should not be used for analysis of the data (Downing 1979). The number of samples was also insufficient for nonparametric statistical comparisons among wing dams (Zar 1974) (Table 8).

I recommend basket samplers over multiple-plate samplers on the basis of these data. The small loss in precision of basket samplers compared to multiple-plate samplers (1.1% for numbers and 1.9% for taxa) should be more than compensated by the greater numbers, biomass, and number of taxa collected by basket samplers. Basket samplers with cement spheres probably provide more stability, sheltered and variety of crevices, available living space, and areas of reduced current velocity than multiple-plate samplers.

Fullner (1971) preferred multiple-plate samplers to basket samplers because multiple-plate samplers are light, easily installed and serviced, and the materials and construction are simple. However, opponents of multiple-plate samplers have contended that the hardboard (masonite) used to construct them often warps or swells in water and nearly closes the space available for habitation (Mason et al. 1973). Proponents of basket samplers have favored their stability in large bodies of water and thought that the rough texture of the substrate used to fill the baskets provided more niches for colonization and that it more closely approximated natural substrate (Mason et al. 1973).

In this study, the cement spheres in the basket samplers were more like the substrate of the wing dams than the hardboard of the multiple-plate samplers. They were somewhat smaller but similar in surface roughness to the rock of the wing dams; they represented a cobble substrate, whereas the wing dams were constructed of cobbles and boulders.

Taxonomic Composition

Hydropsychidae (Trichoptera) dominated the macroinvertebrate aufwuchs in both samplers. Hydropsychid caddisflies made up 91.1 and 87.7% of the total numbers and 86.4 and 91.3% of the total biomass in basket and multiple-plate samplers, respectively (Appendix I and J).

Potamyia flava was the most important colonizer of basket samplers, constituting 34.5% of the total numbers and 37.8% of the biomass (Appendix I). However, high density and biomass of *Potamyia flava* on wing dam 30 greatly increased these estimates. *Cheumatopsyche* sp. was the dominant colonizer on 63% of the basket samplers (Appendix I). *Cheumatopsyche* sp., *Hydropsyche* sp., Hydropsychidae (early instars), and Hydropsychidae pupae comprised 21.8, 17.6, 15.8, and 1.3%, respectively of the total numbers and 31.3, 13.2, 2.0, and 2.0%, respectively of total biomass collected by basket samplers (Appendix I). *Cheumatopsyche* sp. was the primary colonizer of multiple-plate samplers, constituting 35.1% of the numbers and 43.4% of the biomass, but *Potamyia flava* was the principal colonizer on wing dam 30 (Appendix J). Fremling (1960b) reported that *Potamyia flava* favored rocks in sandy, silt-free areas of the river bottom where current is strong. Wing dam 30 fulfilled these requirements, whereas the other wing dams had lower current velocity and higher percentages of silt-clay (Figure 3, Table 3). The remaining hydropsychid caddisflies colonizing multiple-plate samplers were Potamyia flava, Hydropsyche sp., Hydropsychidae (early instars), and Hydropsychidae pupae, each comprising 23.0, 20.8, 6.7, and 2.1%, respectively of total numbers and 26.8, 15.8, 1.0, and 4.3%, respectively of the biomass (Appendix J). Density and biomass of the remaining taxa on artificial substrates was minor (Appendix I and J). Dominance of artificial substrates by a few taxa has been common in artificial substrate sampling of large rivers (Mason et al. 1973).

Macroinvertebrate Habitat

Wing dams in the study area were islands of rocks in a sea of sand, which were colonized by epilithic organisms, especially Hydropsychidae. Habitats sampled by the Ponar grab and basket samplers were different. The Ponar grab sampled a lotic-depositional habitat composed mainly of sand containing a fauna of collector-gatherers that were adapted for burrowing, e.g. Oligochaeta, Ephemeridae, and Chironomidae, or sprawling, e.g. Caenidae (Moon 1939, Coffman 1978, Edmunds et al. 1978, Pennak 1978). Basket samplers represented a lotic-erosional habitat composed of rock (wing dams), with a fauna of collector-filterers that were adapted for clinging, e.g. Hydropsychidae (Moon 1939; Wiggins 1978a, 1978b).

In September 1978, the only month that artificial substrates were present, the basket samplers collected 26.5 times more macrc invertebrate numbers and 14.3 times more biomass than the Ponar grab (Table 6 and 8). The Ponar grab collected 37 taxa, and the basket sampler collected 31 taxa (Table 7); however, 81 replicate grabs were taken in September and only 14 basket samplers were recovered then. Forty-two percent of the taxa collected in September 1978 were common to both (Table 7). Mikulski (1961) stated that rock or rubble added to sandy areas served as concentration points for colonization by lithophilic animals. Wene and Wickliff (1940) showed experimently that the addition of rubble to sandy areas increased invertebrate density by a factor of 3 and 5.

Hydrographic Relief Sediments

As at benthos sites, bottom current velocity determined particle size distribution at hydrographic relief sites (see Physicochemical Characteristics of Benthos Stations). Sediment curves at hydrographic relief sites (Figure 4) were similar to those at benthos sites (Figure 3). Median particle size (0.25 mm) for the hydrographic relief sites at the wing dams corresponded to medium sand (Figure 4). Einsele (1960, cited by Hynes 1970) stated that bottom current velocities of 20 to 40 cm/s would produce sandy substrates. Mean bottom current velocities for hydrographic relief sites varied from 23 to 42 cm/s in the 1978 samples (Table 9).

Bottom current velocity increased from inside to outside hydrographic relief transects, but the differences

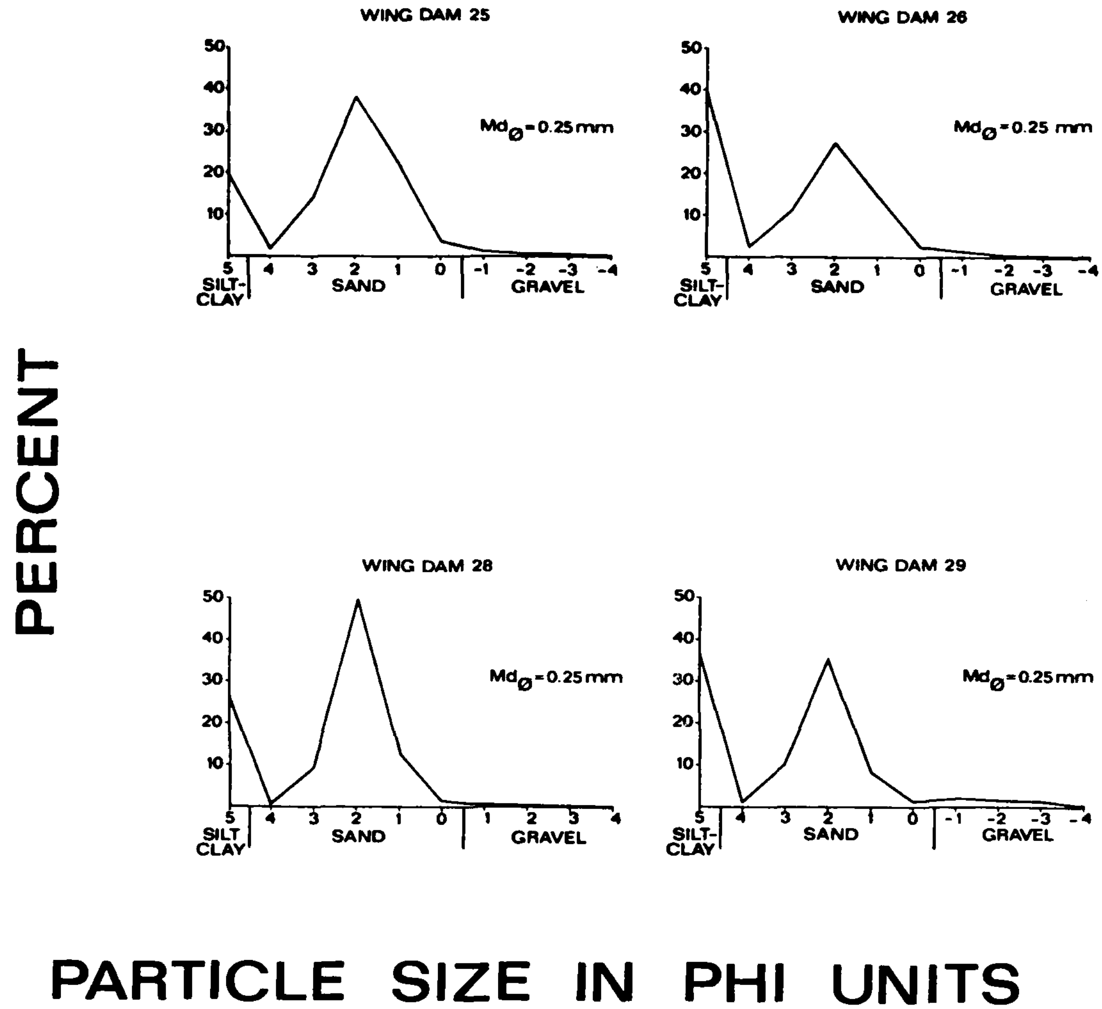

Figure 4. Percent mean particle size (Phi units) from hydrographic relief stations at the wing dams, Pool 13, Upper Mississippi River, 1978. Phi units, defined as the negative log to the base 2 of particle size diameter (mm), convert the geometric Wentworth classification in which each size category is twice the preceding one, into an arithmetic one with equal class intervals, i.e. 0.063 mm = 4; 0.125 mm = 3; 0.25 mm = 2; 0.50 mm = 1; 1.00 mm = 0; 2.00 mm = -1; 4.00 mm = -2; 8.00 mm = -3; and 16 mm = -4 phi units. Silt-clay, which was less than 0.063 mm, was considered to be 5 phi units. Md_{ϕ} = median particle size (mm).

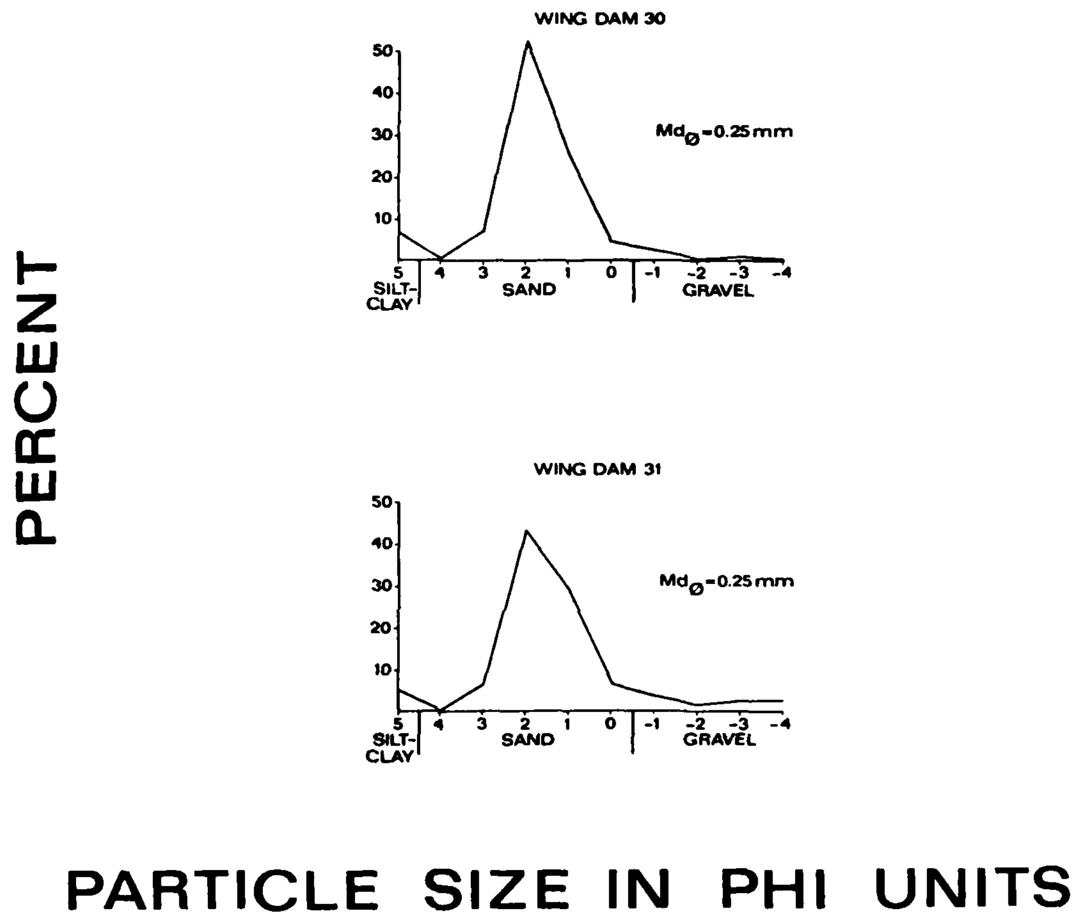

Figure 4. (continued)

Table 9. Bottom current velocity (cm/s) at hydrographic relief stations of the wing dams, Pool 13, Upper Mississippi River, 1978. Means and standard deviations were calculated from the data of Pierce (1980).

Site	Mean	SD	n
Wing dam 25	30	15	18
Wing dam 26	26	21	18
Wing dam 28	23	11	18
Wing dam 29	39	11	18
Wing dam 30	42	10	18
Wing dam 31	42	6	18
Inside transect	31	12	36
Middle transect	32	14	36
Outside transect	38	18	36
Above wing dams	34	15	54
Below wing dams	34	15	54

were not significant (Table 9). There were greater silt-clay deposits at the middle hydrographic relief transects than other transects, but these differences were not significant; the inside transect had 19.9% silt-clay, the middle transect 26.5% silt-clay, and the outside transect 19.7% silt-clay (Appendix K).

There was no difference in bottom current velocity above and below the wing dams (Table 9). This result might be unexpected because some reduction in bottom current velocity downstream of the dam might be presumed. The reason that no difference was found may be that the sampling stations, on the ends of the transects (see METHODS AND MATERIALS), were 30 m from the wing dams. There was more silt-clay deposited above than below the wing dams, but the differences were not significant; upstream stations had 26.5% silt-clay, and downstream stations had 17.2% silt-clay (Appendix K).

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Appendix A. Subsample counts for large catches of invertebrates collected with a 252-cm^2 Ponar grab, September 29, 1978, Pool 13, Upper Mississippi River (refer to Figure 1 for locations). The counts were found to be random when tested for a poisson distribution (Cummins 1975: section 8.23, Elliot 1977: section 8.3).

Wing dam	Sample site[a]	Orientation to wing dam[b]	Replicate	Water volume (ml)		Counts of no. of organisms
				Total	Subsample	
31	5	7	1	4000	200	38, 35, 19, 28, 28
31	5	7	2	10000	200	8, 21, 22, 12, 13
31	5	8	1	4000	200	18, 21, 32, 18, 27
31	5	8	2	4000	200	28, 16, 23, 30, 25
31	5	8	2	4000	200	40, 26, 36, 24, 40

[a]Sample site 5 = inside transect.
[b]Orientation to wing dam 7 = upstream and 8 = downstream.

Appendix B. Subsample counts for large catches of invertebrates collected with basket samplers, September 28, October 3, 12, 1978, Pool 13, Upper Mississippi River (refer to Figure 1 for locations). The counts were found to be random when tested for a poisson distribution (Cummins 1975: section 8.23, Elliot 1977: section 8.3).

Wing dam[a]	Sample site[b]	Orientation to wing dam[c]	Water volume (ml)		Counts of no. of organisms
			Total	Subsample	
25	5	7	10000	200	30, 27, 31, 23, 27
25	5	8	10000	200	25, 25, 23, 28, 28
25	6	7	10000	200	43, 40, 34, 37, 40
25	6	8	14000	100	24, 22, 18, 31, 17
26	5	7	12000	200	30, 22, 29, 23, 30
26	5	8	14000	100	38, 43, 29, 24, 40
26	6	7	4000	400	15, 14, 25, 16, 10, 15
26	6	8	14000	100	36, 35, 44, 45, 46
28	6	8	10000	200	22, 28, 39, 32, 23
29	5	7	14000	100	27, 34, 29, 28, 35
29	5	8	10000	200	25, 14, 23, 15, 19
30	5	7	14000	50	25, 34, 23, 28, 23
30	5	8	14000	100	39, 27, 34, 31, 38
30	6	8	16000	50	29, 22, 30, 27, 20

[a] Wing dam 25, 26, 28, 29, or 30.
[b] Sample site 5 = inside transect and 6 = outside transect.
[c] Orientation to wing dam 7 = upstream and 8 = downstream.

Appendix C. Subsample counts for large catches of invertebrates collected with multiple-plate samplers, September 28, October 3, 12, 1978, Pool 13, Upper Mississippi River (refer to Figure 1 for locations). The counts were found to be random when tested for a poisson distribution (Cummins 1975: section 8.23, Elliot 1977: section 8.3).

Wing dam[a]	Sample site[b]	Orientation to wing dam[c]	Water volume (ml) Total	Water volume (ml) Subsample	Counts of no. of organisms
25	5	7	4000	200	21, 27, 23, 16, 25
25	5	8	4000	400	26, 20, 30, 21, 16
25	6	7	4000	300	33, 23, 31, 24, 32
25	6	8	4000	300	21, 19, 20, 15, 21
26	5	7	10000	200	25, 24, 27, 40, 23
26	5	8	10000	200	27, 21, 16, 19, 15
26	6	8	12000	200	26, 21, 24, 16, 17
28	6	8	10000	200	26, 24, 20, 16, 16
29	5	7	8000	400	24, 16, 20, 22, 12
30	5	7	8000	200	26, 23, 23, 28, 16
30	5	8	8000	200	26, 25, 16, 18, 20
30	6	8	8000	200	17, 26, 17, 21, 16

[a]Wing dam 25, 26, 28, 29, or 30.
[b]Sample site 5 = inside transect and 6 = outside transect.
[c]Orientation to wing dam 7 = upstream and 8 = downstream.

Appendix D. Percentage error (D)[a] for mean total invertebrate numbers per m^2 collected with a 252-cm^2 Ponar grab, Pool 13, Upper Mississippi River, assuming a negative binomial distribution (Cummins 1975: section 8.222, Elliot 1977: section 8.22). Stations 31-5-7 and 31-5-8 in September 1978 were eliminated because of atypically high chironomid and trichopteran densities and gravel (Appendix G and H-3). Those data were also eliminated in Table 5 and 6 and Appendix O, P, and Q. Four stations at wing dam 26 were not sampled in June 1979 because the U.S. Army Corps of Engineers were notching the dam. These four stations were also eliminated in Table 4 and 6 and Appendix Q.

Date or location	n	Mean	SD	k[b]	D[a]	No. of samples required for D = 20%
June 1978	81	903	1520	0.34	19.0	71
August 1978	81	476	921	0.25	22.0	94
September 1978	75	757	1010	0.55	15.6	45
June 1979	69	663	722	0.83	13.2	30

[a]D is the percentage error expressed as (SE)(100)/$\bar{X}$.
[b]K from the negative binomial distribution was estimated from total invertebrates counts.

Appendix E. Percentage error (D)[a] for mean total invertebrate counts per m^2 collected with basket samplers and multiple-plate samplers, September 28, October 3, 12, 1978, Pool 13, Upper Mississippi River, assuming a negative binomial distribution (Cummins 1975: section 8.222, Elliot 1977: section 8.22). Artificial substrates for station 29-6-7 were eliminated because they were embedded in mud (Appendix I and J). Those data were also eliminated from Table 8.

Sampler	n	Mean	SD	k^b	D^a	No. of samples required for D = 20%
Basket	13	20029	14103	1.94	19.9	12
Multiple-plate	13	6739	4485	2.18	18.8	11

[a]D is the percentage error expressed as $(SE)(100)/\bar{X}$.
[b]K from the negative binomial distribution was estimated from total invertebrates counts.

APPENDIX F-1. TEMPERATURE, DISSOLVED OXYGEN, VELOCITY AND DEPTH AT BENTHIC INVERTEBRATE STUDY SITES, JUNE 12, 17, 18, 20, 21, 1978, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	TEMPERATURE (C)4/	DISSOLVED OXYGEN (MG/L)4/	VELOCITY (M/S) SURFACE	MEAN 5/	MEAN 6/	BOTTOM 7/	DEPTH (M)	UMRCC HABITAT CLASSIFICATION
7			22.0 (22.0-22.0)	6.1 (5.9-6.4)	0.52	0.43	0.48	0.34	4.5	SIDE CHANNEL
10			22.1 (22.0-22.3)	6.2 (6.1-6.3)	0.45	0.49	0.45	0.24	3.5	SIDE CHANNEL
11			22.0 (21.8-22.3)	5.9 (5.7-6.1)	0.20	0.20	0.19	0.09	1.3	SIDE CHANNEL
25	1	7	21.1 (21.0-21.3)	5.1 (5.0-5.3)	0.50	0.46	0.46	0.32	4.0	CHANNEL BORDER
25	2	8	21.0 (21.0-21.0)	4.9 (4.8-4.9)	0.45	0.42	0.44	0.26	3.8	CHANNEL BORDER
25	3	8	21.1 (21.0-21.3)	5.0 (5.0-5.2)	0.56	0.50	0.47	0.40	3.5	CHANNEL BORDER
25	4	8	21.0 (21.0-21.0)	5.4 (5.4-5.5)	0.54	0.50	0.49	0.33	3.4	CHANNEL BORDER
26	1	7	21.8 (21.8-21.9)	4.9 (4.9-4.9)	0.50	0.47	0.48	0.30	3.5	CHANNEL BORDER
26	2	8	21.9 (21.9-21.9)	4.9 (4.9-5.0)	0.60	0.55	0.51	0.29	3.3	CHANNEL BORDER
26	3	8	21.9 (21.8-21.9)	5.0 (4.9-5.2)	0.51	0.43	0.42	0.43	3.5	CHANNEL BORDER
26	4	3	21.8 (21.7-21.8)	4.9 (4.9-5.0)	0.48	0.34	0.40	0.35	3.7	CHANNEL BORDER
28	1	7	21.7 (21.6-21.8)	4.5 (4.3-4.7)	0.53	0.49	0.52	0.43	2.7	CHANNEL BORDER
28	2	5	21.6 (21.5-21.8)	4.8 (4.6-4.9)	0.66	0.54	0.39	0.14	2.3	CHANNEL BORDER
28	3	5	21.7 (21.5-21.8)	4.8 (4.4-4.9)	0.68	0.59	0.60	0.42	2.5	CHANNEL BORDER

APPENDIX F-1. CONTINUED.
TEMPERATURE, DISSOLVED OXYGEN, VELOCITY AND DEPTH AT BENTHIC INVERTEBRATE STUDY SITES, JUNE 12, 17, 18, 20, 21, 1973, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	TEMPERATURE (C) 4/	DISSOLVED OXYGEN (MG/L) 4/	VELOCITY (M/S) SURFACE	MEAN 5/	MEAN 6/	BOTTOM 7/	DEPTH (M)	UMRCC HABITAT CLASSIFICATION
28	4	5	21.9 (21.[illegible]-21.9)	5.0 (4.[illegible]- 5.[illegible])	0.64	0.56	0.57	0.35	2.5	CHANNEL BORDER
29	5	7	21.8 (21.[illegible]-21.8)	4.7 (4.7- 4.7)	0.55	0.57	0.54	0.39	4.2	CHANNEL BORDER
29	5	8	21.9 (21.[illegible]-22.0)	4.8 (4.7- 5.0)	0.65	0.58	0.57	0.41	5.0	CHANNEL BORDER
29	6	7	21.3 (21.3-21.[illegible])	4.9 (4.9- 5.1)	0.93	0.71	0.73	0.65	5.0	CHANNEL BORDER
29	6	8	21.2 (21.2-21.[illegible])	4.8 (4.7- 5.0)	0.71	0.60	0.61	0.41	4.5	CHANNEL BORDER
30	5	7	21.0 (21.0-21.0)	6.2 (6.0- 6.6)	0.77	0.67	0.68	0.43	4.8	CHANNEL BORDER
30	5	8	21.1 (21.0-21.2)	6.2 (6.0- 6.6)	0.82	0.67	0.66	0.38	4.5	CHANNEL BORDER
30	6	7	21.0 (21.[illegible]-21.[illegible])	6.2 (6.1- 6.4)	0.86	0.67	0.71	0.64	5.5	CHANNEL BORDER
30	6	8	21.0 (20.[illegible]-21.[illegible])	7.5 (7.[illegible]- 7.6)	0.86	0.62	0.61	0.24	5.0	CHANNEL BORDER
31	5	7	21.0 (21.0-21.0)	7.6 (7.5- 7.6)	0.77	0.58	0.59	0.52	2.0	CHANNEL BORDER
31	5	8	21.3 (21.[illegible]-21.3)	8.6 (8.[illegible]- 8.7)	0.70	0.67	0.61	0.42	2.5	CHANNEL BORDER
31	6	7	21.7 (21.[illegible]-21.[illegible])	7.0 (6.0- 8.3)	0.71	0.62	0.00	0.49	4.5	CHANNEL BORDER
31	6	8	22.1 (22.0-22.1)	7.0 ([illegible].2- [illegible].5)	0.82	0.62	0.00	0.43	4.2	CHANNEL BORDER

1/ WING DAM 25, 26, 27, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.
4/ MEAN AND RANGE FOR TEMPERATURE AND DISSOLVED OXYGEN TAKEN FROM SURFACE, AT EVERY METER, AND BOTTOM.
5/ MEAN VELOCITY = VELOCITY AT 0.6 OF THE DEPTH.
6/ MEAN VELOCITY = VELOCITY AT 0.2 OF THE DEPTH + VELOCITY AT 0.8 OF THE DEPTH DIVIDED BY 2.
7/ BOTTOM VELOCITY = VELOCITY AT 10 CM FROM THE SUBSTRATE SURFACE.

APPENDIX F-2. TEMPERATURE, DISSOLVED OXYGEN, VELOCITY AND DEPTH AT BENTHIC INVERTEBRATE STUDY SITES, AUGUST 2-4, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	TEMPERATURE (C) 4/	DISSOLVED OXYGEN (MG/L) 4/	VELOCITY (M/S) SURFACE	VELOCITY (M/S) MEAN 5/	VELOCITY (M/S) MEAN 6/	VELOCITY (M/S) BOTTOM 7/	DEPTH (M)	UMRCC HABITAT CLASSIFICATION
9			23.0 (23.0-23.0)	7.1 (7.0- 7.1)	0.35	0.31	0.33	0.24	4.6	SIDE CHANNEL
10			23.0 (23.0-23.0)	7.0 (7.0- 7.1)	0.46	0.35	0.36	0.25	2.4	SIDE CHANNEL
11			23.0 (23.0-23.0)	7.3 (7.3- 7.3)	0.50	0.40	0.42	0.40	2.9	SIDE CHANNEL
25	1	7	22.5 (22.5-22.5)	[illegible] (6.3- [illegible])	0.39	0.37	0.37	0.22	2.7	CHANNEL BORDER
25	2	8	22.6 (22.5-22.7)	[illegible] (6.4- 6.6)	0.42	0.37	0.36	0.10	2.1	CHANNEL BORDER
25	3	8	22.6 (22.5-23.0)	6.6 (6.5- 6.7)	0.39	0.33	0.33	0.19	3.4	CHANNEL BORDER
25	4	8	22.5 (22.5-22.5)	6.8 (6.5- 6.9)	0.38	0.35	0.33	0.23	3.0	CHANNEL BORDER
26	1	7	23.0 (23.0-23.0)	5.4 (4.3- 5.9)	0.40	0.29	0.35	0.24	2.8	CHANNEL BORDER
26	2	8	22.3 (22.2-22.5)	6.8 (6.7- 7.0)	0.53	0.15	0.00	0.13	3.5	CHANNEL BORDER
26	3	8	22.5 (22.5-22.5)	6.8 (6.7- 6.9)	0.47	0.30	0.36	0.25	3.6	CHANNEL BORDER
26	4	9	22.5 (22.5-22.5)	5.8 (5.7- 5.9)	0.40	0.27	0.35	0.24	3.1	CHANNEL BORDER
28	1	7	23.0 (23.0-23.0)	6.1 (5.9- 6.3)	0.42	0.39	0.30	0.21	2.9	CHANNEL BORDER
28	2	8	23.0 (23.0-23.0)	6.2 (5.9- 6.5)	0.60	0.52	0.44	0.24	2.5	CHANNEL BORDER
28	3	8	23.0 (23.0-23.0)	6.0 (5.6- 6.5)	0.48	0.39	0.39	0.32	2.3	CHANNEL BORDER

APPENDIX F-2. CONTINUED.

TEMPERATURE, DISSOLVED OXYGEN, VELOCITY AND DEPTH AT BENTHIC INVERTEBRATE STUDY SITES, AUGUST 2-4, 1979, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	TEMPERATURE (C) 4/	DISSOLVED OXYGEN (MG/L) 4/	VELOCITY (M/S) SURFACE	MEAN 5/	MEAN 6/	BOTTOM 7/	DEPTH (M)	UMRCC HABITAT CLASSIFICATION
29	4	8	23.0 (23.0-23.0)	[illegible] (5.3- 6.3)	0.53	0.34	0.38	0.26	2.3	CHANNEL BORDER
29	5	7	23.0 (23.0-23.0)	6.3 (6.0- 6.4)	0.55	0.51	0.52	0.44	3.5	CHANNEL BORDER
29	5	[illegible]	23.0 (23.0-23.0)	6.2 (5.7- 6.5)	0.68	0.56	0.60	0.35	3.3	CHANNEL BORDER
29	6	7	23.0 (23.0-23.0)	6.2 (5.3- 6.5)	0.77	0.68	0.65	0.50	3.8	CHANNEL BORDER
29	6	8	23.0 (23.0-23.0)	6.3 (5.7- 6.9)	0.72	0.62	0.59	0.51	4.0	CHANNEL BORDER
30	5	7	23.0 (23.0-23.0)	[illegible] (5.4- 6.4)	0.76	0.70	0.67	0.42	3.4	CHANNEL BORDER
30	5	6	23.0 (23.0-23.0)	6.0 (5.5- 6.4)	0.30	0.56	0.60	0.40	3.5	CHANNEL BORDER
30	5	7	22.9 (22.5-23.0)	6.2 (5.7- 6.4)	0.46	0.71	0.72	0.86	4.0	CHANNEL BORDER
30	5	9	22.5 (22.5-22.5)	5.9 (5.2- 6.4)	0.80	0.70	0.52	0.32	5.5	CHANNEL BORDER
31	5	7	23.2 (23.0-23.3)	6.3 (6.0- 6.4)	0.70	0.59	0.61	0.44	3.0	CHANNEL BORDER
31	5	8	23.3 (23.3-23.3)	6.3 (6.0- 6.5)	0.74	0.62	0.65	0.39	2.8	CHANNEL BORDER
31	6	7	23.0 (23.0-23.0)	6.2 (5.5- 6.7)	1.04	1.11	0.95	0.33	3.5	CHANNEL BORDER
31	6	8	23.0 (23.0-23.0)	6.2 (6.0- 6.5)	0.56	0.72	0.77	0.45	3.5	CHANNEL BORDER

1/ WING DAM 25, 26, 27, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.
4/ MEAN AND RANGE FOR TEMPERATURE AND DISSOLVED OXYGEN TAKEN FROM SURFACE, AT EVERY METER, AND BOTTOM.
5/ MEAN VELOCITY = VELOCITY AT 0.6 OF THE DEPTH.
6/ MEAN VELOCITY = VELOCITY AT 0.2 OF THE DEPTH + VELOCITY AT 0.8 OF THE DEPTH DIVIDED BY 2.
7/ BOTTOM VELOCITY = VELOCITY AT 10 CM FROM THE SUBSTRATE SURFACE.

APPENDIX F-3. TEMPERATURE, DISSOLVED OXYGEN, VELOCITY AND DEPTH AT BENTHIC INVERTEBRATE STUDY SITES, SEPTEMBER 29-30, 1979, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	TEMPERATURE (C) 4/	DISSOLVED OXYGEN (MG/L) 4/	VELOCITY (M/S) SURFACE	VELOCITY (M/S) MEAN 5/	VELOCITY (M/S) MEAN 6/	VELOCITY (M/S) BOTTOM 7/	DEPTH (M)	UMRCC HABITAT CLASSIFICATION
9			16.0 (16.0-16.0)	7.5 (7.4-7.5)	0.22	0.15	0.15	0.15	4.3	SIDE CHANNEL
10			16.0 (16.0-16.1)	7.3 (7.2-7.4)	0.37	0.32	0.34	0.30	1.5	SIDE CHANNEL
11			16.0 (15.9-16.0)	7.4 (7.3-7.4)	0.32	0.30	0.30	0.29	0.5	SIDE CHANNEL
25	1	7	16.0 (16.0-16.1)	7.4 (7.4-7.5)	0.30	0.25	0.26	0.15	3.0	CHANNEL BORDER
25	2	8	16.0 (16.0-16.0)	7.3 (7.3-7.4)	0.23	0.25	0.26	0.19	2.6	CHANNEL BORDER
25	3	8	16.1 (15.9-16.1)	7.4 (7.3-7.5)	0.30	0.24	0.24	0.15	2.5	CHANNEL BORDER
25	4	8	16.0 (16.0-16.0)	7.4 (7.3-7.4)	0.26	0.22	0.22	0.15	2.5	CHANNEL BORDER
26	1	7	16.0 (16.0-16.1)	7.3 (7.3-7.4)	0.25	0.19	0.20	0.10	2.4	CHANNEL BORDER
26	2	8	16.1 (16.0-16.1)	7.4 (7.2-7.7)	0.43	0.22	0.22	0.10	3.0	CHANNEL BORDER
25	3	8	16.0 (16.0-16.0)	7.6 (7.4-8.2)	0.35	0.15	0.25	0.12	2.8	CHANNEL BORDER
25	4	8	16.1 (16.1-16.1)	7.5 (7.3-7.9)	0.48	0.26	0.24	0.08	3.0	CHANNEL BORDER
28	1	7	16.3 (16.3-16.3)	7.5 (7.3-7.7)	0.32	0.30	0.29	0.22	1.9	CHANNEL BORDER
28	2	9	16.5 (16.3-16.7)	7.6 (7.5-7.7)	0.37	0.24	0.29	0.24	2.4	CHANNEL BORDER
28	3	8	16.3 (16.3-16.3)	7.6 (7.5-7.7)	0.37	0.39	0.34	0.24	2.0	CHANNEL BORDER

APPENDIX F-3. CONTINUED.

TEMPERATURE, DISSOLVED OXYGEN, VELOCITY AND DEPTH AT BENTHIC INVERTEBRATE STUDY SITES, SEPTEMBER 29-30, 1978. POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	TEMPERATURE (C) 4/	DISSOLVED OXYGEN (MG/L) 4/	VELOCITY (M/S) SURFACE	MEAN 5/	MEAN 6/	BOTTOM 7/	DEPTH (M)	UMRCC HABITAT CLASSIFICATION
29	4	6	16.3 (16.3-16.3)	7.9 (7.6- 7.9)	0.37	0.35	0.37	0.28	1.5	CHANNEL BORDER
29	5	7	16.6 (16.5-16.6)	7.7 (7.6- 7.8)	0.35	0.32	0.31	0.26	3.5	CHANNEL BORDER
29	5	8	16.6 (16.5-16.6)	7.7 (7.6- 7.8)	0.35	0.39	0.37	0.22	3.8	CHANNEL BORDER
29	6	7	16.3 (16.2-16.3)	7.8 (7.7- 7.9)	0.63	0.49	0.48	0.28	3.0	CHANNEL BORDER
29	5	6	16.3 (16.3-16.5)	7.8 (7.3- 7.9)	0.72	0.50	0.57	0.41	3.8	CHANNEL BORDER
30	5	7	16.2 (16.2-16.5)	7.8 (7.7- 7.8)	0.52	0.50	0.51	0.30	2.5	CHANNEL BORDER
30	5	8	16.2 (16.2-16.5)	7.5 (7.3- 7.8)	0.56	0.50	0.53	0.43	2.5	CHANNEL BORDER
30	5	7	16.1 (16.1-16.1)	7.7 (7.7- 7.8)	0.61	0.50	0.52	0.35	4.3	CHANNEL BORDER
30	6	8	16.2 (16.1-16.2)	7.8 (7.7- 7.8)	0.58	0.56	0.54	0.39	5.0	CHANNEL BORDER
31	5	7	16.5 (16.5-16.5)	7.7 (7.6- 7.7)	0.56	0.45	0.48	0.39	2.3	CHANNEL BORDER
31	5	8	16.6 (16.5-16.8)	7.6 (7.6- 7.6)	0.70	0.61	0.59	0.45	2.0	CHANNEL BORDER
31	6	7	16.2 (16.2-16.3)	7.9 (7.8- 7.9)	0.63	0.52	0.59	0.37	4.5	CHANNEL BORDER
31	5	8	16.2 (16.2-16.5)	7.9 (7.8- 8.0)	0.61	0.56	0.59	0.45	4.3	CHANNEL BORDER

1/ WING DAM 25, 26, 27, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M; 5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.
4/ MEAN AND RANGE FOR TEMPERATURE AND DISSOLVED OXYGEN TAKEN FROM SURFACE, AT EVERY METER, AND BOTTOM.
5/ MEAN VELOCITY = VELOCITY AT 0.6 OF THE DEPTH.
6/ MEAN VELOCITY = VELOCITY AT 0.2 OF THE DEPTH + VELOCITY AT 0.8 OF THE DEPTH DIVIDED BY 2.
7/ BOTTOM VELOCITY = VELOCITY AT 10 CM FROM THE SUBSTRATE SURFACE.

APPENDIX F-4. TEMPERATURE, DISSOLVED OXYGEN, VELOCITY AND DEPTH AT BENTHIC INVERTEBRATE STUDY SITES, JUNE 5-6, 1979, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	TEMPERATURE (C)4/	DISSOLVED OXYGEN (MG/L)4/	VELOCITY (M/S) SURFACE	MEAN 5/	MEAN 6/	BOTTOM 7/	DEPTH (M)	UMRCC HABITAT CLASSIFICATION
9			18.7 (18.5-19.0)	6.5 (6.4- 6.6)	0.46	0.39	0.42	0.25	5.2	SIDE CHANNEL
10			21.0 (20.3-20.0)	6.2 (6.0- 6.4)	0.45	0.37	0.41	0.35	2.8	SIDE CHANNEL
11			20.3 (20.0-21.0)	5.5 (5.4- 5.6)	0.24	0.41	0.00	0.24	1.6	SIDE CHANNEL
25	1	7	19.5 (19.5-19.5)	5.4 (5.3- 5.6)	0.45	0.45	0.47	0.28	3.7	CHANNEL BORDER
25	2	8	19.6 (19.5-20.0)	5.0 (5.5- 5.7)	0.46	0.48	0.49	0.37	3.5	CHANNEL BORDER
25	3	8	19.5 (19.0-20.0)	6.0 (5.9- 6.1)	0.49	0.46	0.47	0.35	3.2	CHANNEL BORDER
25	4	8	19.6 (19.5-20.0)	5.2 (6.2- 5.3)	0.50	0.46	0.44	0.35	3.4	CHANNEL BORDER
26 8/	1	7	0.0 (0.0- 0.0)	0.0 (0.0- 0.0)	0.00	0.00	0.00	0.00	0.0	CHANNEL BORDER
26 8/	2	8	0.0 (0.0- 0.0)	0.0 (0.0- 0.0)	0.00	0.00	0.00	0.00	0.0	CHANNEL BORDER
26 8/	3	8	0.0 (0.0- 0.0)	0.0 (0.0- 0.0)	0.00	0.00	0.00	0.00	0.0	CHANNEL BORDER
26 8/	4	8	0.0 (0.0- 0.0)	0.0 (0.0- 0.0)	0.00	0.00	0.00	0.00	0.0	CHANNEL BORDER
28	1	7	20.0 (20.0-20.0)	6.3 (5.7- 6.4)	0.59	0.52	0.54	0.37	3.0	CHANNEL BORDER
28	2	8	20.0 (20.0-20.0)	6.7 (6.6- 6.9)	0.63	0.46	0.54	0.76	3.0	CHANNEL BORDER
28	3	8	20.0 (20.0-20.0)	5.7 (5.6- 5.9)	0.68	0.57	0.58	0.54	2.5	CHANNEL BORDER

APPENDIX F-4. CONTINUED.

TEMPERATURE, DISSOLVED OXYGEN, VELOCITY AND DEPTH AT BENTHIC INVERTEBRATE STUDY SITES , JUNE 5-6, 1979, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	TEMPERATURE (C) 4/	DISSOLVED OXYGEN (MG/L) 4/	VELOCITY (M/S) SURFACE	VELOCITY (M/S) MEAN 5/	VELOCITY (M/S) MEAN 6/	VELOCITY (M/S) BOTTOM 7/	DEPTH (M)	UMRCC HABITAT CLASSIFICATION
29	4	8	20.0 (20.0-20.0)	6.9 (6.7- 7.0)	0.54	0.61	0.60	0.49	2.5	CHANNEL BORDER
29	5	7	20.0 (20.0-20.0)	7.3 (7.2- 7.5)	0.59	0.54	0.61	0.35	4.5	CHANNEL BORDER
29	5	8	20.0 (20.0-20.0)	7.4 (7.3- 7.4)	0.54	0.52	0.53	0.43	5.0	CHANNEL BORDER
29	6	7	20.0 (20.0-20.0)	7.7 (7.7- 7.7)	0.72	0.31	0.78	0.59	3.0	CHANNEL BORDER
29	6	8	20.0 (20.0-20.0)	7.7 (7.6- 7.9)	0.59	0.54	0.50	0.26	4.5	CHANNEL BORDER
30	5	7	20.0 (20.0-20.0)	7.2 (7.2- 7.3)	0.76	0.76	0.75	0.57	4.0	CHANNEL BORDER
30	5	8	20.0 (20.0-20.0)	7.4 (7.3- 7.5)	0.59	0.61	0.79	0.48	4.0	CHANNEL BORDER
30	6	7	20.0 (20.0-20.0)	7.8 (7.7- 7.8)	0.93	0.91	0.95	0.50	5.0	CHANNEL BORDER
30	6	8	20.0 (20.0-20.0)	7.9 (7.7- 7.9)	0.69	0.63	0.80	0.52	5.0	CHANNEL BORDER
31	5	7	20.0 (20.0-20.0)	7.1 (7.0- 7.2)	0.96	0.83	0.84	0.65	3.0	CHANNEL BORDER
31	5	8	20.0 (20.0-20.0)	6.9 (6.9- 6.9)	0.99	0.89	0.94	0.46	3.0	CHANNEL BORDER
31	6	7	20.0 (20.0-20.0)	7.3 (7.2- 7.5)	0.89	0.91	0.97	0.57	5.0	CHANNEL BORDER
31	6	8	20.0 (20.0-20.0)	7.0 (6.7- 7.3)	1.05	0.96	0.94	0.49	5.0	CHANNEL BORDER

1/ WING DAM 25, 26, 27, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.
4/ MEAN AND RANGE FOR TEMPERATURE AND DISSOLVED OXYGEN TAKEN FROM SURFACE, AT EVERY METER, AND BOTTOM.
5/ MEAN VELOCITY = VELOCITY AT 0.6 OF THE DEPTH.
6/ MEAN VELOCITY = VELOCITY AT 0.2 OF THE DEPTH + VELOCITY AT 0.8 OF THE DEPTH DIVIDED BY 2.
7/ BOTTOM VELOCITY = VELOCITY AT 10 CM FROM THE SUBSTRATE SURFACE.
8/ No Sample

APPENDIX G. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB, BENTHOS SITES, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

				PARTICLE SIZE (MM)									
				CLAY-SILT	SAND					GRAVEL			
WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	<.0625	.0625	.125	.25	.5	1.0	2.0	4.0	8.0	16.0
9			6-19-78	76.7	5.1	9.6	4.6	2.9	0.6	0.4	0.1	0.0	0.0
10			6-19-78	3.3	0.2	5.9	63.3	24.9	1.0	0.3	1.1	0.0	0.0
11			6-19-78	60.5	0.3	2.6	35.6	19.5	2.2	0.3	0.0	0.0	0.0
25	1	7	6-21-78	62.8	2.2	3.9	13.9	16.[illegible]	0.8	0.7	0.0	0.0	0.0
25	2	8	6-21-78	50.1	1.0	2.5	29.8	16.1	0.5	0.1	0.0	0.0	0.0
25	3	6	6-21-78	25.7	0.5	2.4	33.5	28.1	1.9	2.5	3.0	2.4	0.0
25	4	8	6-21-78	49.9	1.6	8.7	28.7	11.1	0.6	0.2	0.0	0.0	0.0
26	1	7	6-20-78	47.3	1.9	6.6	25.2	15.0	2.8	1.3	0.0	0.0	0.0
26	2	8	6-20-78	3.6	0.4	5.7	49.4	30.5	6.4	2.9	0.5	0.9	0.0
26	3	8	6-20-78	0.8	0.2	7.7	63.5	22.2	3.3	1.6	0.9	0.0	0.0
26	4	8	6-20-78	21.7	0.4	13.7	55.3	8.0	0.5	0.3	0.0	0.0	0.0
28	1	7	6-20-78	15.0	0.3	9.2	51.9	15.9	3.2	2.0	2.5	0.0	0.0
28	2	8	6-20-78	0.9	0.4	9.7	62.4	23.2	2.9	0.1	0.1	0.0	0.0
28	3	8	6-20-78	0.8	0.1	6.1	80.1	12.3	0.6	0.0	0.0	0.0	0.0
28	4	8	6-20-78	0.5	0.1	6.7	82.4	9.7	0.2	0.1	0.0	0.0	0.0
29	5	7	6-20-78	4.1	0.5	18.2	69.6	6.5	0.8	0.4	0.0	0.0	0.0
29	5	8	6-20-78	40.9	0.8	6.9	39.4	9.2	0.7	2.0	1.1	0.0	0.0
29	6	7	6-20-78	5.2	0.2	2.6	27.2	37.2	19.7	7.9	0.8	0.2	0.0
29	6	8	6-20-78	1.1	0.4	34.4	51.3	10.5	1.5	0.4	0.3	0.0	0.0
30	5	7	6-19-78	1.5	0.2	5.2	49.4	26.5	11.3	6.8	0.2	0.0	0.0

APPENDIX G. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB. BENTHOS SITES, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	SAND .0625	SAND .125	SAND .25	SAND .5	SAND 1.0	GRAVEL 2.0	GRAVEL 4.0	GRAVEL 8.0	GRAVEL 16.0
30	5	8	6-19-78	1.4	0.3	2.5	34.6	50.2	8.1	1.5	1.5	0.0	0.0
30	6	7	6-17-78	0.9	0.4	19.2	63.3	14.0	1.8	0.4	0.0	0.0	0.0
30	6	8	6-17-78	3.3	1.3	16.1	40.8	23.7	6.8	1.5	0.0	1.6	0.0
31	5	7	6-17-78	0.8	0.1	4.3	34.2	29.3	8.6	9.0	13.8	0.0	0.0
31	5	8	6-17-78	17.7	0.1	1.8	59.3	17.0	3.4	0.7	0.0	0.0	0.0
31	6	7	6-12-78	0.9	0.1	4.5	46.0	34.0	10.0	4.3	0.1	0.2	0.0
31	6	8	6-12-78	0.7	0.1	3.0	13.7	24.6	16.1	7.3	10.0	15.2	0.0
9			8- 4-78	73.8	1.6	15.1	7.7	1.6	0.2	0.1	0.0	0.0	0.0
10			8- 4-78	2.2	0.4	9.2	70.4	17.3	0.2	0.0	0.0	0.0	0.0
11			8- 4-78	1.7	0.4	5.1	47.0	35.2	8.5	2.1	0.0	0.0	0.0
25	1	7	8- 4-78	3.2	0.5	4.6	30.9	50.5	7.7	2.3	0.4	0.0	0.0
25	2	8	8- 4-78	9.2	0.9	12.6	48.5	29.8	0.1	0.0	0.0	0.0	0.0
25	3	8	8- 4-78	6.8	1.0	4.9	16.9	53.5	9.9	2.3	1.7	3.1	0.0
25	4	8	8- 4-78	3.5	0.2	18.8	63.0	9.4	0.5	0.3	0.3	0.0	0.0
26	1	7	8- 3-78	27.9	3.4	19.9	36.9	11.9	2.7	1.4	0.0	0.0	0.0
26	2	8	8- 3-78	2.0	0.5	12.3	33.4	25.6	4.3	16.1	2.0	2.7	0.0
26	3	8	8- 3-78	2.6	0.2	10.0	73.9	13.1	0.2	0.0	0.0	0.0	0.0
26	4	8	8- 3-78	1.5	0.5	34.8	55.6	6.3	0.5	0.3	0.0	0.0	0.0
28	1	7	8- 3-78	1.9	0.3	12.3	70.3	4.3	0.5	2.0	4.5	3.7	0.0
28	2	8	8- 3-78	0.7	0.2	5.9	57.3	26.2	4.0	2.6	3.2	0.0	0.0
28	3	8	8- 3-78	0.7	0.2	8.9	76.7	12.9	0.7	0.1	0.0	0.0	0.0

APPENDIX G. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB, BENTHOS SITES, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

				PARTICLE SIZE (MM)									
WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	SAND .0625	.125	.25	.5	1.0	GRAVEL 2.0	4.0	8.0	16.0
29	4	8	8- 3-78	1.3	0.3	12.1	66.6	10.1	0.2	3.0	5.3	1.1	0.0
29	5	7	8- 3-78	3.4	0.6	16.3	62.3	12.1	2.5	2.1	0.9	0.0	0.0
29	5	8	8- 3-78	1.8	0.2	14.9	58.9	17.4	4.0	2.6	0.3	0.0	0.0
29	6	7	8- 3-78	17.2	0.3	6.6	52.6	20.5	2.0	0.9	0.0	0.0	0.0
29	6	8	8- 3-78	0.7	0.1	9.2	64.7	22.9	2.1	0.3	0.1	0.0	0.0
30	5	7	8- 3-78	1.6	0.3	5.7	53.8	32.6	3.5	1.4	1.1	0.0	0.0
30	5	8	8- 3-78	2.6	0.2	3.7	59.9	29.3	3.3	1.1	0.3	0.0	0.0
30	6	7	8- 3-78	1.0	0.2	9.1	59.2	24.3	4.0	2.3	0.0	0.0	0.0
30	6	8	8- 3-78	0.9	0.4	15.3	69.8	13.3	0.2	0.0	0.0	0.0	0.0
31	5	7	8- 2-78	1.3	0.3	3.7	58.2	34.0	2.1	0.4	0.0	0.0	0.0
31	5	8	8- 2-78	16.1	1.4	7.4	27.9	18.5	2.9	2.3	0.7	18.4	4.4
31	6	7	8- 2-78	3.0	0.8	2.9	34.9	49.5	7.5	1.2	0.1	0.0	0.0
31	6	8	8- 2-78	0.3	0.0	2.5	40.9	41.7	11.3	3.1	0.2	0.0	0.0
9			9-30-78	41.5	2.0	15.2	31.7	9.5	0.2	0.0	0.0	0.0	0.0
10			9-30-78	1.9	0.2	4.3	76.0	16.9	0.2	0.0	0.0	0.0	0.0
11			9-30-78	44.2	6.0	4.7	31.7	11.7	1.4	0.2	0.0	0.0	0.0
25	1	7	9-30-78	15.4	1.1	10.6	36.9	15.4	4.0	3.1	1.9	6.3	5.3
25	2	8	9-30-78	42.1	1.4	4.9	24.2	23.3	2.4	0.4	0.3	0.0	1.0
25	3	8	9-30-78	43.9	3.1	12.6	16.0	13.3	4.6	5.1	1.4	0.0	0.0
25	4	8	9-30-78	29.2	3.5	23.5	39.9	4.5	0.3	0.1	0.0	0.0	0.0
26	1	7	9-30-78	41.4	5.3	19.3	19.8	7.6	4.3	1.9	0.0	0.0	0.0

APPENDIX 6. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB, BENTHOS SITES, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

				PARTICLE SIZE (MM)									
WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	SAND .0625	.125	.25	.5	1.0	GRAVEL 2.0	4.0	8.0	16.0
26	2	3	9-30-73	1.3	0.1	8.3	59.3	17.8	1.9	4.6	4.5	4.8	6.4
26	3	8	9-30-73	2.8	0.2	4.3	68.3	23.7	0.8	0.0	0.0	0.0	0.0
26	4	8	9-30-73	1.0	0.1	4.2	67.7	26.3	0.7	0.0	0.0	0.0	0.0
28	1	7	9-29-73	1.5	0.1	7.1	62.4	23.2	4.6	0.9	0.0	0.0	0.0
28	2	8	9-29-73	1.3	0.1	5.5	76.2	15.9	0.8	0.1	0.0	0.0	0.0
28	3	8	9-29-73	0.4	0.1	7.1	69.8	13.7	2.7	0.9	0.0	0.0	0.0
28	4	8	9-29-73	0.4	0.1	3.5	62.7	27.9	3.4	2.1	0.0	0.0	0.0
29	5	7	9-29-73	29.3	1.5	15.5	46.2	6.4	1.0	0.0	0.0	0.0	0.0
29	5	8	9-29-73	2.8	0.2	9.8	64.6	18.9	3.0	0.9	0.0	0.0	0.0
29	6	7	9-29-73	0.9	1.0	49.3	46.2	2.6	0.1	0.0	0.0	0.0	0.0
29	6	6	9-29-73	7.4	0.1	9.2	63.8	17.2	2.0	0.2	0.0	0.0	0.0
30	5	7	9-29-73	3.5	0.1	5.5	47.7	33.1	4.2	0.9	0.0	0.0	0.0
30	5	6	9-29-73	0.7	0.1	12.5	72.7	13.2	0.5	0.2	0.1	0.0	0.0
30	6	7	9-29-73	0.9	0.3	21.3	61.2	13.3	2.1	1.0	0.0	0.0	0.0
30	6	8	9-29-73	0.5	0.2	20.4	62.2	13.6	1.5	0.5	1.2	0.0	0.0
31	5	7	9-29-73	0.4	0.0	2.6	19.9	28.3	16.3	15.9	7.7	9.0	0.0
31	5	8	9-29-73	0.8	0.4	5.6	23.1	4.5	3.5	9.7	15.2	24.0	13.3
31	6	7	9-29-73	0.7	0.1	9.0	46.6	31.9	9.6	2.0	0.0	0.0	0.0
31	6	6	9-29-78	1.1	0.1	7.0	57.1	24.6	7.9	2.2	0.0	0.0	0.0
9			6- 6-79	9.8	0.6	10.8	52.5	9.5	2.0	4.0	0.7	0.0	0.0
10			6- 6-79	1.1	0.1	6.9	75.7	15.9	0.2	0.0	0.0	0.0	0.0

APPENDIX G. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB, BENTHOS SITES, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

					PARTICLE SIZE (MM)								
				CLAY-SILT	SAND					GRAVEL			
WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	<.0625	.0625	.125	.25	.5	1.0	2.0	4.0	8.0	16.0
11			6- 6-79	12.4	0.2	5.9	51.3	17.5	6.9	2.9	2.9	0.0	0.0
25	1	7	6- 6-79	67.8	1.5	5.6	16.6	5.6	2.6	0.2	0.0	0.0	0.0
25	2	9	6- 6-79	1.7	0.1	0.8	47.6	43.4	1.5	0.1	0.0	0.0	0.0
25	3	8	6- 6-79	27.9	0.1	4.3	13.2	38.4	9.1	1.3	0.2	0.0	0.0
25	4	8	6- 6-79	51.5	0.1	0.9	5.0	36.3	5.2	0.9	0.2	0.0	0.0
25[4/]	1	7	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25[4/]	2	8	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25[4/]	3	9	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25[4/]	4	8	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	1	7	6- 5-79	1.3	0.1	13.1	65.6	14.9	3.0	1.5	0.2	0.0	0.0
28	2	8	6- 5-79	39.9	0.2	8.0	34.6	15.2	1.7	0.4	0.1	0.0	0.0
28	3	8	6- 5-79	43.1	0.2	6.0	34.4	14.5	4.4	0.4	0.0	0.0	0.0
28	4	8	6- 5-79	1.0	0.1	9.4	55.0	13.4	3.6	1.8	0.3	0.4	0.0
29	5	7	6- 5-79	68.6	1.4	8.7	16.1	3.7	0.9	0.3	0.2	0.0	0.0
29	5	8	6- 5-79	9.3	0.2	10.7	51.4	15.8	7.1	4.3	1.3	0.0	0.0
29	6	7	6- 5-79	93.0	1.3	4.0	1.3	0.1	0.1	0.1	0.0	0.0	0.0
29	6	8	6- 5-79	1.2	0.6	27.7	54.3	14.4	1.8	0.2	0.0	0.0	0.0
30	5	7	6- 5-79	22.6	0.2	2.1	19.9	39.9	12.0	2.5	0.9	0.0	0.0
30	5	8	6- 5-79	1.9	0.2	1.3	18.4	22.8	8.8	5.3	4.2	6.0	31.1
30	6	7	6- 5-79	29.5	0.2	6.5	37.3	15.7	7.6	2.7	0.1	0.0	0.0
30	6	8	6- 5-79	1.6	0.2	5.9	50.3	33.0	7.1	1.5	0.4	0.0	0.0

APPENDIX G. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB. BENTHOS SITES, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	SAND .0625	SAND .125	SAND .25	SAND .5	SAND 1.0	GRAVEL 2.0	GRAVEL 4.0	GRAVEL 8.0	GRAVEL 16.0
31	5	7	6-5-79	37.2	0.3	1.3	15.6	15.0	6.3	2.6	2.6	4.5	14.3
31	5	8	6-5-79	2.1	0.4	1.0	15.2	44.3	26.6	9.6	1.2	0.6	0.0
31	6	7	6-5-79	23.3	0.2	5.0	34.4	15.5	6.2	5.0	1.9	3.6	0.0
32	6	8	6-5-79	1.3	0.1	2.2	31.3	44.4	14.7	5.6	0.4	0.0	0.0

1/ WING DAM 25, 26, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = INSIDE TRANSECT, 2 = MIDDLE TRANSECT, 3 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 4 = UPSTREAM AND 5 = DOWNSTREAM.
4/ No Sample

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INFLUENCE OF WING DAM NOTCHING ON AQUATIC MACROINVERTEBRATES IN--ETC(U)
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APPENDIX W-1.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 12, 17, 13, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
9			6-17-78	OLIGOCHAETA	1799	1590	159 - 3333	81.9	2.02	1.77	0.15 - 3.69	44.3
				BRACHYCERCUS SP.	93	92	40 - 198	4.2	0.91	0.97	0.09 - 1.99	20.0
				HEXAGENIA SP.	13	23	0 - 40	0.6	0.09	0.16	0.00 - 0.28	2.0
				CHEUMATOPSYCHE SP.	13	23	0 - 40	0.6	0.22	0.39	0.00 - 0.67	4.9
				STENELMIS SP.	13	23	0 - 40	0.6	0.05	0.09	0.00 - 0.16	1.2
				CERATOPOGONIDAE	13	23	0 - 40	0.6	0.09	0.15	0.00 - 0.25	2.0
				CHIRONOMIDAE	238	221	0 - 436	10.9	1.14	1.22	0.00 - 2.42	24.9
				CHIRONOMIDAE PUPAE	13	23	0 - 40	0.6	0.03	0.05	0.00 - 0.09	0.6
				TOTAL INVERTEBRATES	2196	1849	0 - 3949	100.0	4.56	3.27	0.00 - 6.94	100.0
10			6-15-78	OLIGOCHAETA	119	40	79 - 159	75.0	0.07	0.05	0.04 - 0.12	9.3
				EPHORON SP.	13	23	0 - 40	8.3	0.59	1.01	0.00 - 1.75	31.5

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
JUNE 13, 17, 18, 20, 21, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
10			6-13-78	CHIRONOMIDAE	13	23	0 - 40	8.3	0.07	0.11	0.00 - 0.20	9.3
				LYMNAEA SP.	13	23	0 - 40	8.3	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	159	79	0 - 238	100.0	0.71	1.17	0.00 - 2.06	100.0
11			6-13-78	OLIGOCHAETA	198	143	79 - 357	34.9	1.47	0.91	0.45 - 2.26	25.9
				HEXAGENIA SP.	106	100	0 - 198	19.6	3.51	3.38	0.00 - 6.75	61.9
				POTAMYIA FLAVA (HAGEN)	13	23	0 - 40	2.3	0.01	0.02	0.00 - 0.04	0.2
				CERATOPOGONIDAE	13	23	0 - 40	2.3	0.04	0.07	0.00 - 0.12	0.7
				CHIRONOMIDAE	225	160	79 - 397	39.5	0.63	0.29	0.40 - 0.95	11.2
				LYMNAEA SP.	13	23	0 - 40	2.3	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	569	333	0 - 952	100.0	5.66	4.22	0.00 - 9.36	100.0
25	1		6-21-78	OLIGOCHAETA	552	61	516 - 635	24.3	1.95	1.53	0.32 - 3.37	1.4

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES), JUNE 13, 17, 18, 20, 21, 1973, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	1	7	6-21-73	HYALELLA AZTECA (SAUSSURE)	13	23	0 - 40	0.6	0.05	0.09	0.00 - 0.16	0.0
				HYDRACARINA	13	23	0 - 40	0.6	0.00	0.00	0.00 - 0.00	0.0
				BRACHYCERCUS SP.	106	46	79 - 159	4.4	0.53	0.23	0.36 - 0.79	0.4
				CAENIS SP.	13	23	0 - 40	0.6	0.05	0.09	0.00 - 0.16	0.0
				HEXAGENIA SP.	701	196	476 - 833	29.3	122.47	58.98	83.72 - 190.34	92.0
				STENELMIS SP.	13	23	0 - 40	0.6	0.03	0.05	0.00 - 0.09	0.0
				CERATOPOGONIDAE	53	46	0 - 79	2.2	0.38	0.35	0.00 - 0.67	0.3
				CHIRONOMIDAE	833	221	635 - 1071	34.8	3.32	0.26	3.02 - 3.49	2.5
				CULICIDAE PUPAE	13	23	0 - 40	0.6	0.15	0.25	0.00 - 0.44	0.1
				MUSCIDAE	13	23	0 - 40	0.6	0.01	0.02	0.00 - 0.04	0.0
				SPHAERIUM SP. W/ SHELL	40	40	0 - 79	1.7	4.26	3.85	0.00 - 7.50	3.2

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 12, 17, 18, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	1	7	6-21-78	TOTAL INVERTEBRATES	2394	100	0 - 2500	100.0	133.11	69.00	0.00 - 201.93	100.0
25	2	8	6-21-78	OLIGOCHAETA	185	226	0 - 436	23.0	0.30	0.30	0.00 - 0.60	0.4
				BRACHYCERCUS SP.	26	23	0 - 40	3.3	0.11	0.09	0.00 - 0.16	0.2
				HEXAGENIA SP.	238	105	119 - 317	29.5	65.23	37.22	39.98 - 107.97	95.0
				OPHIOGOMPHUS SP.	13	23	0 - 40	1.6	0.22	0.39	0.00 - 0.67	0.3
				CERATOPOGONIDAE	40	40	0 - 79	4.9	0.22	0.32	0.00 - 0.60	0.3
				CHIRONOMIDAE	304	139	159 - 436	37.7	1.35	0.85	0.91 - 2.50	2.0
				TOTAL INVERTEBRATES	807	358	0 - 1151	100.0	67.97	36.40	0.00 - 109.72	100.0
25	3	8	6-21-78	OLIGOCHAETA	950	1011	193 - 2024	73.0	0.73	1.08	0.29 - 2.22	8.1
				BRACHYCERCUS SP.	119	105	40 - 238	10.1	0.39	0.47	0.04 - 0.91	3.2
				EPHORON SP.	13	23	0 - 40	1.1	0.44	0.76	0.00 - 1.31	3.6

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 12, 17, 18, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
25	3	8	5-21-78	HEXAGENIA SP.	40	69	8.15	14.11
					0 -	119	0.00 -	24.44
					3.4		67.1	
				OECETIS SP.	13	23	0.15	0.25
					0 -	40	0.00 -	0.44
					1.1		1.2	
				CERATOPOGONIDAE	13	23	0.07	0.11
					0 -	40	0.00 -	0.20
					1.1		0.5	
				CHIRONOMIDAE	93	63	0.21	0.20
					0 -	159	0.00 -	0.40
					7.9		1.7	
				SPHAERIUM SP. W/ SHELL	26	46	1.77	3.07
					0 -	79	0.00 -	5.32
					2.2		14.6	
				TOTAL INVERTEBRATES	1177	1352	12.14	20.00
					0 -	2738	0.00 -	35.24
					100.0		100.0	
25	4	8	5-21-78	OLIGOCHAETA	701	229	0.57	0.24
					436 -	833	0.44 -	0.81
					48.2		0.9	
				HYALLELA AZTECA (SAUSSURE)	13	23	0.03	0.05
					0 -	40	0.00 -	0.08
					0.9		0.0	
				BRACHYCERCUS SP.	40	69	0.11	0.18
					0 -	119	0.00 -	0.32
					2.7		0.1	
				HEXAGENIA SP.	397	238	69.69	29.32
					159 -	635	45.65 -	102.69
					27.3		96.7	
				STENELMIS SP.	13	23	0.09	0.16
					0 -	40	0.00 -	0.28
					0.9		0.1	

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
JUNE 13, 17, 19, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	4	8	6-[illegible]-78	CERATOPOGONIDAE	13	23	0 - 40	0.9	0.13	0.23	0.00 - 0.40	0.2
				CHIRONOMIDAE	255	121	159 - 397	18.2	1.31	0.95	0.36 - 2.38	1.5
				SPHAERIUM SP. W/ SHELL	13	23	0 - 40	0.9	0.03	0.09	0.00 - 0.16	0.1
				TOTAL INVERTEBRATES	1455	637	0 - 2063	100.0	72.05	25.94	0.00 - 104.24	100.0
26	1	7	6-2[illegible]-78	OLIGOCHAETA	1918	524	1349 - 2381	61.4	1.83	0.82	0.91 - 2.42	1.9
				HYALLELA AZTECA (SAUSSURE)	53	23	40 - 79	1.7	0.12	0.07	0.05 - 0.20	0.1
				BRACHYCERCUS SP.	106	83	40 - 198	3.4	0.42	0.33	0.15 - 0.79	0.4
				CAENIS SP.	13	23	0 - 40	0.4	0.03	0.05	0.00 - 0.09	0.0
				HEXAGENIA SP.	463	337	119 - 794	14.9	59.80	53.97	1.43 - 107.99	52.2
				OECETIS SP.	40	40	0 - 79	1.3	0.20	0.31	0.00 - 0.56	0.2
				TRICHOPTERA PUPAE	40	69	0 - 119	1.3	0.45	0.78	0.00 - 1.35	0.5

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
JUNE 12, 17, 18, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 1/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL	BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL
26	1	[illegible]	6-20-78	STENELMIS SP.	26 46 0 - 79 0.8	0.12 0.21 0.00 - 0.36 0.1
				CERATOPOGONIDAE	53 61 0 - 119 1.7	1.59 1.82 0.00 - 3.57 1.6
				CHIRONOMIDAE	394 264 79 - 556 12.3	4.06 3.99 0.35 - 9.29 4.2
				LYMNAEA SP.	13 23 0 - 40 0.4	0.09 0.16 0.00 - 0.28 0.1
				FUSCONAIA FLAVA (BARNES) W/ SHELL	13 23 0 - 40 0.4	42.99 74.46 0.00 - 128.96 44.7
				FUSCONAIA FLAVA (BARNES) W/O SHELL	13 23 0 - 40 0.4	27.49 47.61 0.00 - 82.46 28.5
				TOTAL INVERTEBRATES	3121 512 0 - 3690 100.0	96.21 90.99 0.00 - 157.25 100.0
26	2	8	6-20-78	OLIGOCHAETA	145 100 40 - 238 73.3	0.05 0.06 0.00 - 0.12 10.5
				CHIRONOMIDAE	26 46 0 - 79 13.3	0.05 0.09 0.00 - 0.15 10.5
				SPHAERIUM SP. W/ SHELL	26 23 0 - 40 13.3	0.40 0.34 0.00 - 0.60 75.9
				TOTAL INVERTEBRATES	198 159 0 - 357 100.0	0.50 0.45 0.00 - 0.97 100.0

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 12, 17, 18, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 1/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
26	3	8	6-20-78	OLIGOCHAETA	212 119 - 72.7	100 317	0.15 0.09 - 42.3	0.11 0.28
				CERATOPOGONIDAE	13 0 - 4.5	23 40	0.13 0.00 - 38.5	0.23 0.40
				CHIRONOMIDAE	66 0 - 22.7	115 198	0.07 0.00 - 19.2	0.11 0.20
				TOTAL INVERTEBRATES	291 0 - 100.0	196 516	0.34 0.00 - 100.0	0.23 0.45
26	4	8	6-20-78	OLIGOCHAETA	1534 1190 - 73.9	435 2024	1.93 1.23 - 52.7	0.63 2.46
				BRACHYCERCUS SP.	489 79 - 23.6	355 714	0.75 0.20 - 20.6	0.52 1.23
				CHIRONOMIDAE	53 40 - 2.5	23 79	0.98 0.12 - 26.7	1.49 2.70
				TOTAL INVERTEBRATES	2077 0 - 100.0	736 2778	3.66 0.00 - 100.0	0.40 4.13
28	1	•	6-20-78	OLIGOCHAETA	317 193 - 92.3	105 397	0.22 0.00 - 89.5	0.20 0.36
				BRACHYCERCUS SP.	26 0 - 7.7	46 79	0.03 0.00 - 10.5	0.05 0.09
				TOTAL INVERTEBRATES	344 0 - 100.0	139 476	0.25 0.00 - 100.0	0.22 0.40

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 16, 17, 18, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
23	2	8	6-20-78	OLIGOCHAETA	265	46	0.09	0.02
					233 -	317	0.08 -	0.12
					87.0		20.6	
				CHIRONOMIDAE	40	40	0.36	0.62
					0 -	79	0.00 -	1.07
					13.0		79.4	
				TOTAL INVERTEBRATES	304	61	0.45	0.61
					0 -	357	0.00 -	1.15
					100.0		100.0	
23	3	3	6-20-78	OLIGOCHAETA	145	63	0.30	0.46
					79 -	238	0.00 -	0.83
					61.1		54.8	
				CERATOPOGONIDAE	13	23	0.19	0.32
					0 -	40	0.00 -	0.56
					5.6		33.3	
				CHIRONOMIDAE	79	40	0.07	0.06
					40 -	119	0.00 -	0.12
					33.3		11.9	
				TOTAL INVERTEBRATES	238	119	0.56	0.83
					0 -	357	0.00 -	1.51
					100.0		100.0	
23	4	8	6-20-78	OLIGOCHAETA	119	69	0.13	0.02
					79 -	198	0.12 -	0.16
					50.0		7.8	
				BRACHYCERCUS SP.	13	23	0.09	0.16
					0 -	40	0.00 -	0.29
					5.6		5.5	
				TRICHOPTERA	13	23	0.00	0.00
					0 -	40	0.00 -	0.00
					5.6		0.0	
				POTAMYIA FLAVA (HAGEN)	79	137	0.08	0.14
					0 -	238	0.00 -	0.24
					33.3		4.7	

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 12, 17, 18, 20, 21, 1973,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL	BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL
28	4	8	5-20-73	LASMIGONA COMPRESSA (LEA) W/ SHELL	13 23 0 - 40 5.6	3.72 6.44 0.00 - 11.15 219.5
				LASMIGONA COMPRESSA (LEA) W/O SHELL	13 23 0 - 40 5.6	1.39 2.41 0.00 - 4.17 82.0
				TOTAL INVERTEBRATES	238 159 0 - 397 100.0	1.69 2.26 0.00 - 4.29 100.0
29	5	7	6-20-73	OLIGOCHAETA	767 389 357 - 1071 95.1	0.77 0.29 0.44 - 0.95 0.3
				CERATOPOGONIDAE	13 23 0 - 40 1.6	0.09 0.16 0.00 - 0.28 0.3
				CHIRONOMIDAE	13 23 0 - 40 1.6	0.04 0.07 0.00 - 0.12 0.1
				OBLIQUARIA REFLEXA RAFINESQUE W/ SHELL	13 23 0 - 40 1.6	44.04 76.29 0.00 - 132.13 132.6
				OBLIQUARIA REFLEXA RAFINESQUE W/O SHELL	13 23 0 - 40 1.6	32.31 55.97 0.00 - 96.94 97.3
				TOTAL INVERTEBRATES	807 421 0 - 1190 100.0	33.21 56.36 0.00 - 99.29 100.0
29	5	8	6-20-73	OLIGOCHAETA	3439 5919 40 - 10158 97.9	3.06 5.22 0.00 - 9.09 11.1
				ASELLUS SP.	53 92 0 - 159 1.4	0.05 0.09 0.00 - 0.16 0.2

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 12, 17, 18, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
29	5	8	6-20-78	HYALELLA AZTECA (SAUSSURE)	13	23	0.05	0.09
					0 -	40	0.00 -	0.15
					0.3		0.2	
				PERLESTA PLACIDA (HAGEN)	13	23	0.59	1.01
					0 -	40	0.00 -	1.75
					0.3		2.1	
				BRACHYCERCUS SP.	159	275	0.66	1.15
					0 -	476	0.00 -	1.98
					4.1		2.4	
				HEXAGENIA SP.	66	115	22.58	39.11
					0 -	199	0.00 -	67.73
					1.7		82.4	
				STENELMIS SP.	66	115	0.19	0.32
					0 -	198	0.00 -	0.56
					1.7		0.7	
				CHIRONOMIDAE	66	115	0.16	0.27
					0 -	198	0.00 -	0.48
					1.7		0.6	
				CHIRONOMIDAE PUPAE	40	69	0.08	0.14
					0 -	119	0.00 -	0.24
					1.0		0.3	
				TOTAL INVERTEBRATES	3915	6610	27.41	47.26
					0 -	11547	0.00 -	81.98
					100.0		100.0	
29	6	7	6-20-78	OLIGOCHAETA	79	69	0.04	0.07
					40 -	159	0.00 -	0.12
					24.0		5.5	
				ASELLUS SP.	13	23	0.05	0.09
					0 -	40	0.00 -	0.16
					4.0		7.3	
				HYALELLA AZTECA (SAUSSURE)	26	46	0.01	0.02
					0 -	79	0.00 -	0.04
					8.0		1.8	

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 17, 17, 19, 20, 21, 1975,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
29	4	7	6-20-75	CERATOPOGONIDAE	26	23	0 - 40	8.0	0.12	0.14	0.00 - 0.28	16.4
				CHIRONOMIDAE	185	139	40 - 317	56.0	0.53	0.30	0.09 - 0.83	59.2
				TOTAL INVERTEBRATES	331	92	0 - 436	100.0	0.73	0.44	0.00 - 1.07	100.0
29	6	8	6-20-75	OLIGOCHAETA	767	989	159 - 1766	72.5	0.41	0.71	0.00 - 1.23	41.9
				HYALLELA AZTECA (SAUSSURE)	251	369	0 - 675	23.8	0.45	0.65	0.00 - 1.19	45.9
				BRACHYCERCUS SP.	13	23	0 - 40	1.3	0.05	0.09	0.00 - 0.15	5.4
				CAENIS SP.	13	23	0 - 40	1.3	0.03	0.05	0.00 - 0.08	2.7
				CHIRONOMIDAE	13	23	0 - 40	1.3	0.04	0.07	0.00 - 0.12	4.1
				TOTAL INVERTEBRATES	1058	853	0 - 1905	100.0	0.98	0.79	0.00 - 1.55	100.0
30	5	7	6-20-75	OLIGOCHAETA	430	121	317 - 556	66.7	0.33	0.15	0.16 - 0.44	43.1
				CERATOPOGONIDAE	26	23	0 - 40	3.9	0.26	0.23	0.00 - 0.40	34.5

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 12, 17, 14, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
30	5	7	6-20-78	CHIRONOMIDAE	198	210	40 - 436	29.4	0.17	0.23	0.00 - 0.44	22.4
				TOTAL INVERTEBRATES	675	143	0 - 794	100.0	0.77	0.32	0.00 - 0.99	100.0
30	5	9	6-20-78	OLIGOCHAETA	13	23	0 - 40	12.5	0.00	0.00	0.00 - 0.00	0.0
				CHIRONOMIDAE	93	160	0 - 278	87.5	0.17	0.30	0.00 - 0.52	100.0
				TOTAL INVERTEBRATES	106	150	0 - 278	100.0	0.17	0.30	0.00 - 0.52	100.0
30	6	7	6-19-78	OLIGOCHAETA	344	139	198 - 476	96.3	0.22	0.13	0.00 - 0.32	94.4
				CHIRONOMIDAE	13	23	0 - 40	3.7	0.01	0.02	0.00 - 0.04	5.6
				TOTAL INVERTEBRATES	357	119	0 - 476	100.0	0.24	0.10	0.00 - 0.32	100.0
30	6	8	6-19-78	OLIGOCHAETA	291	23	278 - 317	32.8	0.29	0.30	0.12 - 0.63	2.2
				ASELLUS SP.	13	23	0 - 40	1.5	0.01	0.02	0.00 - 0.04	0.1
				HYALELLA AZTECA (SAUSSURE)	26	46	0 - 79	3.0	0.04	0.07	0.00 - 0.12	0.3

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES), JUNE 16, 17, 18, 20, 21, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS SD	BIOMASS RANGE	BIOMASS PERCENT OF TOTAL
30	6	3	6-1?-78	BRACHYCERCUS SP.	66	63	0 - 159	7.5	0.24	0.39	0.00 - 0.71	2.0
				EPHORON SP.	53	61	0 - 119	6.0	0.52	0.48	0.00 - 0.95	3.8
				CHEUMATOPSYCHE SP.	13	23	0 - 40	1.5	0.15	0.25	0.00 - 0.44	1.1
				CHIRONOMIDAE	331	333	119 - 714	37.3	2.87	3.43	0.08 - 6.71	21.3
				SPHAERIUM SP. W/ SHELL	93	[illegible]	40 - 19	10.4	9.31	9.25	0.15 - 15.19	69.2
				TOTAL INVERTEBRATES	886	607	0 - 1587	100.0	13.45	9.62	0.00 - 19.88	100.0
31	5	?	6-17-78	OLIGOCHAETA	119	119	0 - 238	31.0	0.00	0.00	0.00 - 0.00	0.0
				CHIRONOMIDAE	185	287	0 - 516	48.3	0.03	0.08	0.00 - 0.15	0.3
				CHIRONOMIDAE PUPAE	13	23	0 - 40	3.4	0.01	0.02	0.00 - 0.04	0.0
				PISIDIUM SP. W/ SHELL	13	23	0 - 40	3.4	0.05	0.09	0.00 - 0.16	0.2
				SPHAERIUM SP. W/ SHELL	40	69	0 - 119	10.3	3.84	6.64	0.00 - 11.51	13.7

APPENDIX M-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
JUNE 12, 17, 19, 20, 21, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
31	5	7	6-17-78	OBOVARIA OLIVARIA (RAFINESQUE) W/ SHELL	13	23	231.33	400.65
					0 -	40	0.00 -	694.00
					3.4		904.6	
				OBOVARIA OLIVARIA (RAFINESQUE) W/O SHELL	13	23	2 .07	41.69
					0 -	40	0.00 -	72.22
					3.4		95.3	
				TOTAL INVERTEBRATES	384	460	23.05	39.77
					0 -	913	0.00 -	72.30
					100.0		100.0	
31	5	8	6-17-78	OLIGOCHAETA	40	69	0.00	0.00
					0 -	119	0.00 -	0.00
					60.0		0.0	
				BRACHYCERCUS SP.	13	23	0.03	0.05
					0 -	40	0.00 -	0.09
					20.0		66.7	
				CHIRONOMIDAE	13	23	0.01	0.02
					0 -	40	0.00 -	0.04
					20.0		33.3	
				TOTAL INVERTEBRATES	66	46	0.04	0.04
					0 -	119	0.00 -	0.09
					100.0		100.0	
31	6	7	6-17-78	OLIGOCHAETA	26	45	0.00	0.00
					0 -	79	0.00 -	0.00
					66.7		0.0	
				CERATOPOGONIDAE	13	23	0.19	0.32
					0 -	40	0.00 -	0.56
					33.3		100.0	
				TOTAL INVERTEBRATES	40	40	0.19	0.32
					0 -	79	0.00 -	0.56
					100.0		100.0	
31	6	8	6- 7-78	OLIGOCHAETA	40	40	0.00	0.00
					0 -	79	0.00 -	0.00
					33.3		0.0	

APPENDIX H-1. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 16, 17, 18, 20, 21, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
31	6	8	6-17-78	PLACOBDELLA SP.	13	23	0.03	0.05
					0 -	40	0.00 -	0.08
					11.1		1.8	
				HYDRACARINA	13	23	0.01	0.02
					0 -	40	0.00 -	0.04
					11.1		0.9	
				CHEUMATOPSYCHE SP.	13	23	0.09	0.16
					0 -	40	0.00 -	0.28
					11.1		6.4	
				CHIRONOMIDAE	26	46	0.05	0.09
					0 -	79	0.00 -	0.16
					22.2		3.6	
				LEPTODEA FRAGILIS (RAFINESQUE) W/ SHELL	13	23	2.22	3.85
					0 -	40	0.00 -	6.67
					11.1		152.7	
				LEPTODEA FRAGILIS (RAFINESQUE) W/O SHELL	13	23	1.27	2.20
					0 -	40	0.00 -	3.81
					11.1		37.3	
				TOTAL INVERTEBRATES	119	105	1.45	2.25
					0 -	198	0.00 -	4.05
					100.0		100.0	

1/ WING DAM 25, 26, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.

APPENDIX H-2.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
AUGUST 2-4, 1973,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 1/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
9			8- 4-73	OLIGOCHAETA	1336	1097	0.52	0.47
					79 -	2103	0.00 -	0.91
					90.2		4.1	
				HEXAGENIA SP.	106	183	10.74	14.95
					0 -	317	0.00 -	32.42
					7.1		83.0	
				SIALIS SP.	13	23	0.05	0.09
					0 -	40	0.00 -	0.16
					0.9		0.4	
				CHIRONOMIDAE	26	23	0.93	1.56
					0 -	40	0.00 -	2.70
					1.9		7.4	
				TOTAL INVERTEBRATES	1481	1227	12.43	20.68
					0 -	2500	0.00 -	36.31
					100.0		100.0	
10			8- 4-73	OLIGOCHAETA	13	23	0.00	0.00
					0 -	40	0.00 -	0.00
					100.0		0.0	
				TOTAL INVERTEBRATES	13	23	0.00	0.00
					0 -	40	0.00 -	0.00
					100.0		0.0	
11			8- 4-73	OLIGOCHAETA	476	757	0.12	0.21
					0 -	1349	0.00 -	0.35
					46.9		3.3	
				TRICHOPTERA	13	23	0.00	0.00
					0 -	40	0.00 -	0.00
					1.3		0.0	
				CERATOPOGONIDAE	26	23	0.05	0.06
					0 -	40	0.00 -	0.12
					2.6		1.7	
				[illegible]	265	196	0.09	0.06
					40 -	397	0.04 -	0.16
					26.0		2.9	

APPENDIX H-2. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
AUGUST 3-4, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 1/	DATE	TAXON	NUMBER MEAN, SD		NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN, SD		BIOMASS RANGE	BIOMASS PERCENT OF TOTAL
11			8-4-78	PISIDIUM SP. W/ SHELL	132	196	0 - 357	13.0	0.99	1.59	0.00 - 2.32	31.5
				SPHAERIUM SP. W/ SHELL	93	61	40 - 159	9.1	0.57	0.36	0.16 - 0.79	18.1
				LEPTODEA FRAGILIS (RAFINESQUE) W/ SHELL	13	23	0 - 40	1.3	2.43	4.22	0.00 - 7.30	77.3
				LEPTODEA FRAGILIS (RAFINESQUE) W/O SHELL	13	23	0 - 40	1.3	1.32	2.29	0.00 - 3.97	42.0
				TOTAL INVERTEBRATES	1018	953	0 - 1865	100.0	3.15	2.10	0.00 - 4.92	100.0
25	1	*	8-4-78	OLIGOCHAETA	40	69	0 - 119	60.0	0.00	0.00	0.00 - 0.00	0.0
				CHIRONOMIDAE	26	46	0 - 79	40.0	0.01	0.02	0.00 - 0.04	100.0
				TOTAL INVERTEBRATES	56	61	0 - 119	100.0	0.01	0.02	0.00 - 0.04	100.0
25	2	4	8-4-78	OLIGOCHAETA	2576	2415	754 - 5277	94.5	1.67	1.31	0.15 - 2.46	34.6
				CHIRONOMIDAE	238	198	40 - 436	8.0	2.01	3.07	0.20 - 5.56	41.9
				CHIRONOMIDAE PUPAE	13	23	0 - 40	0.4	0.01	0.02	0.00 - 0.04	0.3

APPENDIX H-2. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
AUGUST 2-4, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	2	8	8- 4-78	SPHAERIUM SP. W/ SHELL	212	115	79 - 278	7.1	1.12	1.50	0.16 - 2.86	23.4
				TOTAL INVERTEBRATES	2989	2444	0 - 5793	100.0	4.81	3.71	0.00 - 9.17	100.0
25	3	8	8- 4-78	OLIGOCHAETA	1991	1331	557 - 2738	74.5	1.27	1.00	0.12 - 1.85	39.7
				BRACHYCERCUS SP.	26	46	0 - 79	1.0	0.03	0.05	0.00 - 0.09	0.8
				HEXAGENIA SP.	26	46	0 - 79	1.0	1.07	1.86	0.00 - 3.21	33.5
				POTAMYIA FLAVA (HAGEN)	159	241	0 - 436	6.3	0.16	0.21	0.00 - 0.40	5.0
				CHIRONOMIDAE	195	219	40 - 436	7.3	0.33	0.32	0.04 - 0.67	12.0
				CHIRONOMIDAE PUPAE	159	241	0 - 436	6.3	0.15	0.25	0.00 - 0.44	4.5
				SPHAERIUM SP. W/ SHELL	93	92	40 - 198	3.6	0.15	0.02	0.12 - 0.16	4.5
				TOTAL INVERTEBRATES	2540	653	0 - 2936	100.0	3.20	1.92	0.00 - 5.20	100.0
25	4	8	8- 4-78	OLIGOCHAETA	790	947	119 - 1965	93.7	0.55	0.87	0.00 - 1.59	93.6

APPENDIX H-2. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
AUGUST [illegible], 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS SD	BIOMASS RANGE	BIOMASS PERCENT OF TOTAL
25	4	5	4- 8-78	CHIRONOMIDAE	53	61	0 - 119	[illegible]	0.04	0.07	0.00 - 0.12	5.4
				TOTAL INVERTEBRATES	833	1006	0 - 1984	100.0	0.62	0.94	0.00 - 1.71	100.0
26	1	7	4- 8-78	OLIGOCHAETA	886	496	317 - 1230	94.4	0.69	0.47	0.15 - 1.03	49.5
				CHIRONOMIDAE	26	23	0 - 40	2.9	0.04	0.04	0.00 - 0.08	2.9
				SPHAERIUM SP. W/ SHELL	26	45	0 - 79	2.8	0.66	1.15	0.00 - 1.99	47.6
				TOTAL INVERTEBRATES	939	547	0 - 1349	100.0	1.39	1.52	0.00 - 3.10	100.0
26	2	3	3- 8-78	OLIGOCHAETA	40	69	0 - 119	60.0	0.00	0.00	0.00 - 0.00	0.0
				BRACHYCENTRUS SP.	13	23	0 - 40	20.0	0.03	0.05	0.00 - 0.09	65.7
				CERATOPOGONIDAE	13	23	0 - 40	20.0	0.01	0.02	0.00 - 0.04	33.3
				TOTAL INVERTEBRATES	66	83	0 - 159	100.0	0.04	0.04	0.00 - 0.08	100.0
26	3	3	4- 8-78	OLIGOCHAETA	106	121	0 - 238	22.2	0.04	0.04	0.00 - [illegible]	5.4

APPENDIX H-2. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
AUGUST 2-4, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 1/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
26	3	8	8- 3-78	BRACHYCERCUS SP.	13	23	0 - 40	2.8	0.03	0.05	0.00 - 0.08	3.6
				CHIRONOMIDAE	357	619	0 - 1071	75.0	0.67	1.17	0.00 - 2.02	91.1
				TOTAL INVERTEBRATES	476	525	0 - 1071	100.0	0.74	1.11	0.00 - 2.02	100.0
26	4	8	8- 4-78	OLIGOCHAETA	159	137	79 - 317	66.7	0.05	0.09	0.00 - 0.16	25.0
				BRACHYCERCUS SP.	13	23	0 - 40	5.6	0.03	0.05	0.00 - 0.08	12.5
				CERATOPOGONIDAE	13	23	0 - 40	5.6	0.09	0.16	0.00 - 0.28	43.8
				CHIRONOMIDAE	53	92	0 - 159	22.2	0.04	0.07	0.00 - 0.12	18.8
				TOTAL INVERTEBRATES	238	143	0 - 357	100.0	0.21	0.20	0.00 - 0.40	100.0
28	1	7	8- 3-78	OLIGOCHAETA	79	69	0 - 119	10.3	0.03	0.05	0.00 - 0.09	2.6
				BRACHYCERCUS SP.	26	23	0 - 40	3.4	0.03	0.02	0.00 - 0.04	2.6
				CHEUMATOPSYCHE SP.	622	943	0 - 1706	81.0	0.93	1.56	0.00 - 2.70	90.9

APPENDIX H-2. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
AUGUST 2-4, 1973,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
23	1	7	8- 3-73	POTAMYIA FLAVA (HAGEN)	13	23	0 -	1.7	[illegible]	0.00	0.00 -	0.0
				CHIRONOMIDAE	26	23	0 - 40	3.4	0.04	0.04	0.00 - 0.08	3.9
				TOTAL INVERTEBRATES	767	1020	0 - 1944	100.0	1.02	1.63	0.00 - 2.90	100.0
23	2	9	8- 3-73	OLIGOCHAETA	66	83	0 - 159	83.3	0.03	0.10	0.00 - 0.20	100.0
				CHIRONOMIDAE	13	23	0 - 40	16.7	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	79	79	0 - 159	100.0	0.08	0.10	0.00 - 0.20	100.0
23	3	9	8- 3-73	NONE	0	0	0 - 0	0.0	0.00	0.00	0.00 - 0.00	0.0
23	4	9	8- 3-73	CHEUMATOPSYCHE SP.	53	61	0 - 119	66.7	0.11	0.09	0.00 - 0.16	[illegible]
				CHIRONOMIDAE	13	23	0 - 40	16.7	0.01	0.02	0.00 - 0.04	3.3
				LASMIGONA COMPRESSA (LEA) W/ SHELL	13	23	0 - 40	16.7	1.10	1.90	0.00 - 3.29	275.7
				LASMIGONA COMPRESSA (LEA) W/O SHELL	13	23	0 - 40	16.7	[illegible]	0.49	0.00 - 0.93	70.0

APPENDIX H-2. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
AUGUST 2-4, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
28	4	6	8- 3-78	TOTAL INVERTEBRATES	79 0 - 100.0	105 198	0.40 0.00 - 100.0	0.56 1.03
28	5	7	8- 3-78	OLIGOCHAETA	198 0 - 88.2	162 357	0.24 0.03 - 27.3	0.04 0.08
				CERATOPOGONIDAE	13 0 - 5.9	23 40	0.09 0.03 - 63.6	0.15 0.28
				CHIRONOMIDAE	13 0 - 5.9	23 40	0.01 0.00 - 9.1	0.02 0.04
				TOTAL INVERTEBRATES	225 0 - 100.0	165 357	0.15 0.00 - 100.0	0.15 0.32
29	5	6	8- 3-78	CERATOPOGONIDAE	26 0 - 100.0	23 40	0.21 0.00 - 100.0	0.30 0.56
				TOTAL INVERTEBRATES	26 0 - 100.0	23 40	0.21 0.00 - 100.0	0.30 0.56
29	5	7	8- 3-78	OLIGOCHAETA	476 159 - 94.7	300 754	0.30 0.04 - 100.0	0.24 0.52
				HYALLELA AZTECA (SAUSSURE)	13 0 - 2.6	23 40	0.00 0.00 - 0.0	0.00 0.00
				CHEUMATOPSYCHE SP.	13 0 - 2.6	23 40	0.00 0.00 - 0.0	0.00 0.00
				TOTAL INVERTEBRATES	503 0 - 100.0	337 833	0.30 0.00 - 100.0	0.24 0.52

APPENDIX H-2. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
AUGUST 3-4, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
29	6	8	8- 3-78	OLIGOCHAETA	66	83	0 - 159	83.3	0.05	0.14	0.00 - 0.24	100.0
				CHIRONOMIDAE	13	23	0 - 40	16.7	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	79	105	0 - 198	100.0	0.08	0.14	0.00 - 0.24	100.0
33	5	7	8- 3-78	OLIGOCHAETA	40	69	0 - 119	42.9	0.00	0.00	0.00 - 0.00	0.0
				CHIRONOMIDAE	53	23	40 - 79	57.1	0.04	0.04	0.00 - 0.09	100.0
				TOTAL INVERTEBRATES	93	61	0 - 159	100.0	0.04	0.04	0.00 - 0.09	100.0
30	5	8	8- 3-78	OBOVARIA OLIVARIA (RAFINESQUE) W/ SHELL	13	23	0 - 40	100.0	29.23	50.63	0.00 - 87.69	712.9
				OBOVARIA OLIVARIA (RAFINESQUE) W/O SHELL	13	23	0 - 40	100.0	4.10	7.10	0.00 - 12.30	100.0
				TOTAL INVERTEBRATES	13	23	0 - 40	100.0	4.10	7.10	0.00 - 12.30	100.0
30	6	7	8- 3-78	BAETIS SP.	13	23	0 - 40	100.0	0.09	0.16	0.00 - 0.28	100.0
				TOTAL INVERTEBRATES	13	23	0 - 40	100.0	0.09	0.16	0.00 - 0.28	100.0

APPENDIX H-D. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
AUGUST 2-4, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM R SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
30	6	8	8- -78	POTAMYIA FLAVA (HAGEN)	13	23	0 - 40	100.0	0.01	0.02	0.00 - 0.04	100.0
				TOTAL INVERTEBRATES	13	23	0 - 40	100.0	0.01	0.02	0.00 - 0.04	100.0
31	5	7	8- -78	CHIRONOMIDAE	159	241	0 - 436	100.0	0.05	0.09	0.00 - 0.15	100.0
				TOTAL INVERTEBRATES	159	241	0 - 436	100.0	0.05	0.09	0.00 - 0.16	100.0
31	5	8	8- -78	OLIGOCHAETA	26	23	0 - 40	33.3	0.00	0.00	0.00 - 0.00	0.0
				BRACHYCENTRUS SP.	13	23	0 - 40	16.7	0.05	0.09	0.00 - 0.16	57.1
				CHEUMATOPSYCHE SP.	13	23	0 - 40	16.7	0.03	0.05	0.00 - 0.09	28.6
				CHIRONOMIDAE	26	23	0 - 40	33.3	0.01	0.02	0.00 - 0.04	14.3
				TOTAL INVERTEBRATES	79	40	0 - 119	100.0	0.09	0.13	0.00 - 0.24	100.0
31	6	7	8- -78	OLIGOCHAETA	13	23	0 - 40	12.5	0.00	0.00	0.00 - 0.00	0.0
				CHEUMATOPSYCHE SP.	13	23	0 - 40	12.5	0.00	0.00	0.00 - 0.00	0.0

APPENDIX H-2. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
AUGUST 2-4, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
31	5	7	8- [illegible]-78	CERATOPOGONIDAE	13	23	0.04	0.07
					0 -	40	0.00 -	0.12
					12.5		33.3	
				CHIRONOMIDAE	66	83	0.08	0.14
					0 -	159	0.00 -	0.24
					62.5		66.7	
				TOTAL INVERTEBRATES	106	61	0.12	0.12
					0 -	159	0.00 -	0.24
					100.0		100.0	
31	6	8	8- [illegible]-78	CHIRONOMIDAE	79	105	0.04	0.07
					0 -	198	0.00 -	0.12
					85.7		75.0	
				SPHAERIUM SP. W/ SHELL	13	23	0.01	0.02
					0 -	40	0.00 -	0.04
					14.3		25.0	
				TOTAL INVERTEBRATES	93	100	0.05	0.06
					0 -	198	0.00 -	0.12
					100.0		100.0	

1/ WING DAM 25, 26, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.

APPENDIX H-3.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
SEPTEMBER 29-30, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
9			9-29-79	TURBELLARIA	13	23	0 - 40	0.6	0.03	0.05	0.00 - 0.09	0.1
				NEMATODA	26	46	0 - 79	1.2	0.50	0.87	0.00 - 1.51	2.4
				TRICHLADIDA	13	23	0 - 40	0.6	0.05	0.09	0.00 - 0.16	0.3
				OLIGOCHAETA	661	512	233 - 1230	31.1	0.44	0.24	0.20 - 0.63	2.3
				HEXAGENIA SP.	939	737	436 - 1786	44.1	17.99	19.62	5.12 - 40.55	86.0
				DROMOGOMPHUS SP.	13	23	0 - 40	0.6	0.44	0.76	0.00 - 1.31	2.1
				ANOMALAGRION HASTATUM SAY	13	23	0 - 40	0.6	0.07	0.11	0.00 - 0.20	0.3
				CHEUMATOPSYCHE SP.	79	137	0 - 238	3.7	0.25	0.44	0.00 - 0.75	1.2
				HYDROPSYCHE SP.	13	23	0 - 40	0.6	0.05	0.09	0.00 - 0.16	0.3
				POTAMYIA FLAVA (HAGEN)	145	139	0 - 278	6.9	0.37	0.40	0.00 - 0.79	1.8
				NEURECLIPSIS SP.	40	69	0 - 119	1.9	0.24	0.41	0.00 - 0.71	1.1

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
SEPTEMBER 29-30, 1973.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL	BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL
9			9-30-73	OECETIS SP.	13 23 0 - 40 0.6	0.01 0.02 0.00 - 0.04 0.1
				ACENTROPUS SP.	13 23 0 - 40 0.6	0.03 0.05 0.00 - 0.09 0.1
				STENELMIS SP.	13 23 0 - 40 0.6	0.09 0.16 0.00 - 0.28 0.4
				CHIRONOMIDAE	106 61 40 - 159 5.0	0.23 0.21 0.12 - 0.52 1.1
				CHAOBORUS SP.	26 46 0 - 79 1.2	0.05 0.09 0.00 - 0.15 0.3
				TOTAL INVERTEBRATES	2129 1455 0 - 3770 100.0	20.91 21.72 0.07 - 45.93 100.0
10			9-30-73	OLIGOCHAETA	26 46 0 - 79 40.0	0.00 0.00 0.00 - 0.00 0.0
				HEXAGENIA SP.	13 23 0 - 40 20.0	0.15 0.25 0.00 - 0.44 91.7
				CHIRONOMIDAE	26 46 0 - 79 40.0	0.01 0.02 0.00 - 0.04 8.3
				TOTAL INVERTEBRATES	66 61 0 - 119 100.0	0.16 0.24 0.00 - 0.44 100.0
11			9-30-73	OLIGOCHAETA	276 79 194 - 357 36.2	0.19 0.14 0.04 - 0.32 2.4

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
SEPTEMBER 29-30, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
11			9-30-78	HEXAGENIA SP.	394	369	0 - 714	39.7	5.40	6.70	0.00 - 12.90	59.5
				CHEUMATOPSYCHE SP.	13	23	0 - 40	1.7	0.09	0.16	0.00 - 0.28	1.2
				CERATOPOGONIDAE	13	23	0 - 40	1.7	0.03	0.05	0.00 - 0.09	0.3
				CHIRONOMIDAE	79	105	0 - 198	10.3	0.04	0.07	0.00 - 0.12	0.5
				PISIDIUM SP. W/ SHELL	13	23	0 - 40	1.7	0.20	0.34	0.00 - 0.60	2.6
				SPHAERIUM SP. W/ SHELL	66	83	0 - 159	8.6	1.83	2.66	0.00 - 4.48	23.5
				UNIONIDAE (JUVENILE) W/ SHELL	13	23	0 - 40	1.7	0.24	0.41	0.00 - 0.71	3.1
				TOTAL INVERTEBRATES	767	567	0 - 1389	100.0	7.76	9.26	0.00 - 18.29	100.0
25	1	7	9-30-78	OLIGOCHAETA	344	183	238 - 556	25.7	0.25	0.05	0.20 - 0.29	3.1
				CAENIDAE	13	23	0 - 40	1.0	0.03	0.05	0.00 - 0.09	0.3
				BRACHYCERCUS SP.	13	23	0 - 40	1.0	0.03	0.05	0.00 - 0.09	0.3

APPENDIX [illegible], CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
SEPTEMBER 29-30, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	1	*	9-30-78	HEXAGENIA SP.	473	330	159 - 794	31.7	6.47	5.10	2.30 - 13.49	30.6
				ANOMALAGRION HASTATUM SAY	13	23	0 - 40	1.0	0.04	0.07	0.00 - 0.12	0.5
				HYDROPSYCHIDAE (EARLY INSTAR)	40	69	0 - 119	3.0	0.03	0.05	0.00 - 0.09	0.3
				CHEUMATOPSYCHE SP.	132	165	0 - 317	9.9	0.40	0.59	0.00 - 1.07	4.9
				HYDROPSYCHE SP.	13	23	0 - 40	1.0	0.05	0.09	0.00 - 0.16	0.7
				POTAMYIA FLAVA (HAGEN)	172	46	119 - 198	12.9	0.4[illegible]	0.22	0.16 - 0.60	4.9
				NEURECLIPSIS SP.	13	23	0 - 40	1.0	0.03	0.05	0.00 - 0.08	0.3
				CERATOPOGONIDAE	13	23	0 - 40	1.0	0.00	0.00	0.00 - 0.00	0.0
				CHIRONOMIDAE	119	69	79 - 198	8.9	0.21	0.17	0.08 - 0.40	2.6
				SPHAERIUM SP. W/ SHELL	26	23	0 - 40	2.0	0.11	0.09	0.00 - 0.16	1.3
				TOTAL INVERTEBRATES	1336	456	0 - 1786	100.0	8.06	5.55	0.00 - 14.44	100.0

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES), SEPTEMBER 29-30, 1978,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	2	3	9-30-78	TRICHLADIDA	13	23	0 - 40	0.5	0.07	0.11	0.00 - 0.20	0.2
				OLIGOCHAETA	503	385	79 - 933	19.3	0.33	0.30	0.00 - 0.60	1.2
				HEXAGENIA SP.	1402	219	1190 - 1627	53.8	25.33	5.94	21.19 - 32.14	93.2
				STENONEMA SP.	40	69	0 - 119	1.5	0.01	0.02	0.00 - 0.04	0.0
				CHEUMATOPSYCHE SP.	66	83	0 - 159	2.5	0.32	0.42	0.00 - 0.79	1.2
				POTAMYIA FLAVA (HAGEN)	397	587	0 - 1071	15.2	0.79	1.22	0.00 - 2.18	2.9
				CERATOPOGONIDAE	13	23	0 - 40	0.5	0.04	0.07	0.00 - 0.12	0.1
				CHIRONOMIDAE	132	61	79 - 198	5.1	0.20	0.17	0.09 - 0.40	0.7
				CHAOBORUS SP.	13	23	0 - 40	0.5	0.04	0.07	0.00 - 0.12	0.1
				SPHAERIUM SP. W/ SHELL	26	23	0 - 40	1.0	0.07	0.08	0.00 - 0.16	0.2
				TOTAL INVERTEBRATES	2606	1394	0 - 4127	100.0	27.18	5.43	0.00 - 33.29	100.0

APPENDIX A-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES), SEPTEMBER 29-30, 1979, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	3	3	9-30-79	OLIGOCHAETA	423	63	357 - 516	14.0	0.37	0.31	0.12 - 0.71	0.7
				HEXAGENIA SP.	2434	282	2182 - 2738	80.7	53.40	36.92	23.17 - 94.40	93.4
				POTAMYIA FLAVA (HAGEN)	53	92	0 - 159	1.8	0.03	0.05	0.00 - 0.08	0.0
				OECETIS SP.	13	23	0 - 40	0.4	0.03	0.05	0.00 - 0.09	0.0
				CHIRONOMIDAE	40	40	0 - 79	1.3	0.13	0.17	0.00 - 0.32	0.2
				CHAOBORUS SP.	26	23	0 - 40	0.9	0.04	0.07	0.00 - 0.12	0.1
				SPHAERIUM SP. W/ SHELL	26	23	0 - 40	0.9	0.25	0.31	0.00 - 0.60	0.5
				TOTAL INVERTEBRATES	3016	221	0 - 3254	100.0	54.23	36.81	0.00 - 95.31	100.0
25	4	3	9-30-79	OLIGOCHAETA	476	79	397 - 556	23.8	0.37	0.10	0.28 - 0.48	1.4
				NAIDIDAE	13	23	0 - 40	0.7	0.05	0.09	0.00 - 0.15	0.2
				BRACHYCERCUS SP.	13	23	0 - 40	0.7	0.01	0.02	0.00 - 0.04	0.0

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
SEPTEMBER 29-30, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, RANGE, PERCENT OF TOTAL	NUMBER SD	BIOMASS (G) MEAN, RANGE, PERCENT OF TOTAL	BIOMASS SD
25	6	[illegible]	9-30-78	HEXAGENIA SP.	1415	139	26.47	7.89
					1270 -	1548	15.09 -	33.73
					70.9		92.0	
				POTAMYIA FLAVA (HAGEN)	13	23	0.05	0.09
					0 -	40	0.00 -	0.16
					0.7		0.2	
				CERATOPOGONIDAE	13	23	0.00	0.00
					0 -	40	0.00 -	0.00
					0.7		0.0	
				CHIRONOMIDAE	53	61	0.05	0.06
					0 -	119	0.00 -	0.12
					2.6		0.2	
				TOTAL INVERTEBRATES	1997	219	27.01	7.79
					0 -	2222	0.00 -	34.12
					100.0		100.0	
26	1	[illegible]	9-30-78	OLIGOCHAETA	357	206	0.25	0.10
					239 -	595	0.16 -	0.36
					17.1		0.9	
				GLOSSIPHONIIDAE	13	23	0.05	0.09
					0 -	40	0.00 -	0.16
					0.6		0.2	
				HYALLELA AZTECA (SAUSSURE)	13	23	0.01	0.02
					0 -	40	0.00 -	0.04
					0.6		0.0	
				CAENIS SP.	13	23	0.03	0.05
					0 -	40	0.00 -	0.08
					0.6		0.1	
				HEXAGENIA SP.	1574	819	27.59	17.35
					635 -	2143	12.50 -	46.54
					75.3		93.2	
				CHIRONOMIDAE	93	23	0.16	0.07
					79 -	119	0.12 -	0.24
					4.4		0.6	

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
SEPTEMBER 29-30, 1973,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
26	1	7	9-30-73	SPHAERIUM SP. W/ SHELL	26	23	0 - 40	1.3	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	2090	924	0 - 2738	100.0	28.34	17.18	0.00 - 45.92	100.0
26	2	5	9-30-73	OLIGOCHAETA	106	23	79 - 119	72.7	0.04	0.07	0.00 - 0.12	7.0
				BRACHYCERCUS SP.	13	23	0 - 40	9.1	0.05	0.09	0.00 - 0.16	9.3
				PISIDIUM SP. W/ SHELL	13	23	0 - 40	9.1	0.01	0.02	0.00 - 0.04	2.3
				SPHAERIUM SP. W/ SHELL	13	23	0 - 40	9.1	0.46	0.80	0.00 - 1.39	81.4
				TOTAL INVERTEBRATES	145	46	0 - 198	100.0	0.57	0.85	0.00 - 1.55	100.0
26	3	5	9-30-73	TRICHLADIDA	26	46	0 - 79	12.5	0.12	0.21	0.00 - 0.36	32.1
				OLIGOCHAETA	26	46	0 - 79	12.5	0.00	0.00	0.00 - 0.00	0.0
				BRACHYCERCUS SP.	26	46	0 - 79	12.5	0.07	0.11	0.00 - 0.20	19.9
				HEXAGENIA SP.	13	23	0 - 40	6.2	0.05	0.09	0.00 - 0.16	14.3

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
SEPTEMBER 29-30, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
26	3	3	9-30-78	CHIRONOMIDAE	93	160	0 - 278	43.8	0.01	0.02	0.00 - 0.04	3.6
				SPHAERIUM SP. W/ SHELL	26	46	0 - 79	12.5	0.10	0.21	0.00 - 0.36	32.1
				UNIONIDAE (JUVENILES) W/ SHELL	13	23	0 - 40	6.2	0.09	0.16	0.00 - 0.28	25.0
				TOTAL INVERTEBRATES	212	270	0 - 516	100.0	0.37	0.51	0.00 - 0.95	100.0
26	4	4	9-30-78	OLIGOCHAETA	26	46	0 - 79	50.0	0.00	0.00	0.00 - 0.00	0.0
				CHIRONOMIDAE	13	23	0 - 40	25.0	0.00	0.00	0.00 - 0.00	0.0
				SPHAERIUM SP. W/ SHELL	13	23	0 - 40	25.0	1.57	2.73	0.00 - 4.72	100.0
				TOTAL INVERTEBRATES	53	61	0 - 119	100.0	1.57	2.73	0.00 - 4.72	100.0
28	1	7	9-29-78	OLIGOCHAETA	159	105	79 - 278	80.0	0.05	0.09	0.00 - 0.16	23.5
				BRACHYCERCUS SP.	13	23	0 - 40	6.7	0.03	0.05	0.00 - 0.09	11.9
				CHEUMATOPSYCHE SP.	13	23	0 - 40	6.7	0.09	0.16	0.00 - 0.28	41.2

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
SEPTEMBER 27-30, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	DIST. FROM WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
24	1	7	9-29-78	POTAMYIA FLAVA (HAGEN)	13	23	0 - 40	6.7	0.05	0.09	0.00 - 0.16	23.5
				TOTAL INVERTEBRATES	198	69	0 - 278	100.0	0.20	0.06	0.00 - 0.29	100.0
24	2	8	9-29-78	OLIGOCHAETA	40	69	0 - 119	50.0	0.03	0.05	0.00 - 0.08	23.6
				CAENIDAE (EARLY INSTAR)	13	23	0 - 40	16.7	0.03	0.05	0.00 - 0.08	23.6
				CERATOPOGONIDAE	13	23	0 - 40	16.7	0.04	0.07	0.00 - 0.12	42.9
				CHIRONOMIDAE	13	23	0 - 40	16.7	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	79	79	0 - 159	100.0	0.09	0.09	0.00 - 0.16	100.0
29	3	3	9-29-78	NONE	0	0	0 - 0	0.0	0.00	0.00	0.00 - 0.00	0.0
29	4	3	9-29-78	CERATOPOGONIDAE	26	46	0 - 79	13.3	0.05	0.09	0.00 - 0.16	2.0
				CHIRONOMIDAE	159	241	0 - 436	80.0	0.04	0.04	0.00 - 0.09	1.5
				CORBICULA MANILENSIS (PHILIPPI) W/ SHELL	13	23	0 - 40	6.7	2.50	4.33	0.00 - 7.50	96.4

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
SEPTEMBER 29-30, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
26	4	8	9-29-78	TOTAL INVERTEBRATES	198	275	0 - 516	100.0	2.59	4.25	0.00 - 7.50	100.0
29	5	7	9-29-78	OLIGOCHAETA	331	252	40 - 476	73.5	0.17	0.16	0.00 - 0.32	14.9
				BRACHYCERCUS SP.	13	23	0 - 40	2.9	0.03	0.05	0.00 - 0.09	2.9
				HEXAGENIA SP.	53	92	0 - 159	11.9	0.42	0.55	0.00 - 1.67	53.5
				CERATOPOGONIDAE	26	46	0 - 79	5.9	0.11	0.18	0.00 - 0.32	11.6
				PISIDIUM SP. W/ SHELL	26	46	0 - 79	5.9	0.12	0.21	0.00 - 0.36	13.0
				TOTAL INVERTEBRATES	450	356	0 - 675	100.0	0.91	0.89	0.00 - 1.79	100.0
27	5	8	9-29-78	OLIGOCHAETA	93	46	40 - 119	19.4	0.04	0.04	0.00 - 0.08	11.5
				HELOBDELLA SP.	13	23	0 - 40	2.9	0.05	0.09	0.00 - 0.16	15.4
				BRACHYCERCUS SP.	13	23	0 - 40	2.8	0.03	0.05	0.00 - 0.09	7.7
				CERATOPOGONIDAE	26	46	0 - 79	5.4	0.11	0.18	0.00 - 0.32	30.9

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS (PER SQUARE METER) OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES), SEPTEMBER 29-30, 1978, POOL 19, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	[illegible] STATION [illegible] WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
29	5	6	9-29-78	CHIRONOMIDAE	317 119 - 56.7	310 675	0.12 0.04 - 34.6	0.07 0.16
				EMPIDIDAE	13 0 - 2.4	23 40	0.00 0.00 - 0.0	0.00 0.00
				TOTAL INVERTEBRATES	476 0 - 100.0	286 794	0.34 0.00 - 100.0	0.29 0.67
29	6	7	9-29-78	BRACHYCERCUS SP.	13 0 - 50.0	23 40	0.03 0.00 - 10.5	0.05 0.08
				POTAMYIA FLAVA (HAGEN)	13 0 - 50.0	23 40	0.22 0.00 - 89.5	0.39 0.67
				TOTAL INVERTEBRATES	26 0 - 100.0	46 79	0.25 0.00 - 100.0	0.44 0.75
29	6	6	9-29-78	HEXAGENIA SP.	13 0 - 10.0	23 40	0.15 0.00 - 45.3	0.25 0.44
				CHEUMATOPSYCHE SP.	13 0 - 10.0	23 40	0.03 0.00 - 9.3	0.05 0.08
				CERATOPOGONIDAE	53 0 - 40.0	61 119	0.15 0.00 - 45.4	0.19 0.36
				CHIRONOMIDAE	40 0 - 30.0	40 79	0.00 0.00 - 0.0	0.00 0.00
				STRATIOMYIDAE (ADULT)	13 0 - 10.0	23 40	0.00 0.00 - 0.0	0.00 0.00

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
SEPTEMBER 29-30, 1973,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
29	6	8	9-29-73	TOTAL INVERTEBRATES	132 0 - 100.0	83 198	0.32 0.00 - 100.0	0.22 0.52
30	5	7	9-29-73	OLIGOCHAETA	13 0 - 1.7	23 40	0.00 0.00 - 0.0	0.00 0.00
				HYDROPSYCHIDAE (EARLY INSTAR)	13 0 - 1.7	23 40	0.00 0.00 - 0.0	0.00 0.00
				CHEUMATOPSYCHE SP.	13 0 - 1.7	23 40	0.05 0.00 - 17.4	0.09 0.16
				HYDROPSYCHE SP.	13 0 - 1.7	23 40	0.01 0.00 - 4.3	0.02 0.04
				CERATOPOGONIDAE	53 40 - 6.7	23 79	0.11 0.00 - 34.8	0.15 0.28
				CHIRONOMIDAE	588 516 - 86.7	179 873	0.13 0.12 - 43.5	0.02 0.16
				TOTAL INVERTEBRATES	794 0 - 100.0	102 992	0.30 0.00 - 100.0	0.13 0.40
30	5	3	9-29-73	CHEUMATOPSYCHE SP.	13 0 - 2.4	23 40	0.09 0.00 - 46.7	0.16 0.28
				CERATOPOGONIDAE	13 0 - 2.4	23 40	0.03 0.00 - 13.3	0.05 0.09
				CHIRONOMIDAE	516 0 - 95.1	859 1508	0.08 0.00 - 40.0	0.14 0.24

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES), SEPTEMBER 29-30, 1978, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
30	5	3	9-29-78	TOTAL INVERTEBRATES	542	936	0 - 1509	100.0	0.20	0.10	0.00 - 0.28	100.0
30	6	[illegible]	9-29-78	OLIGOCHAETA	13	23	0 - 40	10.0	0.00	0.00	0.00 - 0.00	0.0
				CHEUMATOPSYCHE SP.	13	23	0 - 40	10.0	0.03	0.05	0.00 - 0.08	50.0
				POTAMYIA FLAVA (HAGEN)	13	23	0 - 40	10.0	0.01	0.02	0.00 - 0.04	25.0
				CHIRONOMIDAE	93	83	0 - 159	70.0	0.01	0.02	0.00 - 0.04	25.0
				TOTAL INVERTEBRATES	132	61	0 - 198	100.0	0.05	0.06	0.00 - 0.12	100.0
30	6	3	9-29-78	CHEUMATOPSYCHE SP.	13	23	0 - 40	33.3	0.03	0.05	0.00 - 0.08	15.4
				HYDROPSYCHE SP.	13	23	0 - 40	33.3	0.15	0.25	0.00 - 0.44	84.6
				CHIRONOMIDAE	13	23	0 - 40	33.3	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	40	40	0 - 79	100.0	0.17	0.23	0.00 - 0.44	100.0
31	5	[illegible]	9-29-78	OLIGOCHAETA	251	188	40 - 397	0.7	0.00	0.00	0.00 - 0.00	0.0

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
SEPTEMBER 29-30, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
31	5	7	9-29-79	BAETIS SP.	13	23	0.04	0.07
					0 -	40	0.00 -	0.12
					0.0		0.1	
				BRACHYCERCUS SP.	132	229	0.26	0.46
					0 -	397	0.00 -	0.79
					0.3		0.4	
				HEXAGENIA SP.	53	92	0.90	1.56
					0 -	159	0.00 -	2.70
					0.1		1.2	
				STENONEMA SP.	53	92	0.00	0.00
					0 -	159	0.00 -	0.00
					0.1		0.0	
				TRICHOPTERA	635	1100	0.00	0.00
					0 -	1905	0.00 -	0.00
					1.7		0.0	
				HYDROPSYCHIDAE (EARLY INSTAR)	11970	6064	4.02	2.64
					6150 -	18253	1.90 -	6.99
					31.7		5.4	
				CHEUMATOPSYCHE SP.	476	825	2.43	4.22
					0 -	1428	0.00 -	7.30
					1.3		3.3	
				HYDROPSYCHE SP.	53	92	0.11	0.19
					0 -	159	0.00 -	0.32
					0.1		0.1	
				POTAMYIA FLAVA (HAGEN)	18438	16298	55.62	52.75
					3333 -	35712	9.83 -	113.33
					48.8		75.0	
				TRICHOPTERA PUPAE	238	210	2.67	2.34
					0 -	397	0.00 -	4.36
					0.6		3.6	
				STENELMIS SP.	53	92	0.00	0.00
					0 -	159	0.00 -	0.00
					0.1		0.0	

APPENDIX H-3. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
SEPTEMBER 29-30, 1978.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
31	5	7	9-29-78	CERATOPOGONIDAE	556	599	0 - 1190	1.5	2.73	3.53	0.00 - 6.75	3.7
				CHIRONOMIDAE	4312	4407	476 - 9126	11.4	2.57	2.44	0.32 - 5.16	3.5
				CHIRONOMIDAE PUPAE	135	200	0 - 397	0.5	0.19	0.20	0.00 - 0.40	0.2
				CULICIDAE PUPAE	53	92	0 - 159	0.1	0.11	0.13	0.00 - 0.32	0.1
				EMPIDIDAE	135	200	0 - 397	0.5	0.26	0.45	0.00 - 0.79	0.4
				PISIDIUM SP. W/ SHELL	145	219	0 - 397	0.4	2.19	3.28	0.00 - 5.95	2.9
				TOTAL INVERTEBRATES	37902	26488	0 - 62953	100.0	74.14	62.93	0.00 - 133.55	100.0
31	5	2	9-29-78	HYDROPSYCHIDAE (EARLY INSTAR)	5714	5197	0 - 10159	25.9	2.01	1.99	0.00 - 3.97	5.0
				CHEUMATOPSYCHE SP.	53	92	0 - 159	0.2	0.05	0.09	0.00 - 0.16	0.1
				HYDROPSYCHE SP.	4295	7266	0 - 12698	19.6	1.48	2.43	0.00 - 4.29	3.7
				POTAMYIA FLAVA (HAGEN)	11269	1680	9364 - 12539	51.1	33.17	5.95	25.51 - 37.62	82.9

APPENDIX H-3, CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES), SEPTEMBER 29-30, 1978, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
31	5	6	9-29-78	TRICOPTERA PUPAE	212	242	0 - 476	1.0	2.70	2.70	0.00 - 5.40	6.7
				CHIRONOMIDAE	370	242	159 - 635	1.7	0.53	0.19	0.32 - 0.63	1.3
				CHIRONOMIDAE PUPAE	106	183	0 - 317	0.5	0.11	0.18	0.00 - 0.32	0.3
				EMPIDIDAE	53	92	0 - 159	0.2	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	22052	2914	0 - 25395	100.0	40.05	2.95	0.00 - 42.85	100.0
31	6	7	9-29-78	BAETIDAE	13	23	0 - 40	2.1	0.09	0.16	0.00 - 0.28	15.2
				POTAMYIA FLAVA (HAGEN)	53	46	0 - 79	8.3	0.20	0.28	0.00 - 0.52	30.6
				CERATOPOGONIDAE	13	23	0 - 40	2.1	0.07	0.11	0.00 - 0.20	10.9
				CHIRONOMIDAE	542	905	0 - 1567	85.4	0.25	0.44	0.00 - 0.75	41.3
				CHIRONOMIDAE PUPAE	13	23	0 - 40	2.1	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	635	998	0 - 1786	100.0	0.61	0.66	0.00 - 1.31	100.0

APPENDIX H-I. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
SEPTEMBER 29-30, 197-.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
11	6	D	9-29-73	HYDROPSYCHIDAE (EARLY INSTAR)	13	23	0.00	0.00
					0 -	40	0.00 -	0.00
					2.4		0.0	
				TRICOPTERA PUPAE	13	23	0.15	0.25
					0 -	40	0.00 -	0.44
					2.4		15.6	
				CERATOPOGONIDAE	238	79	0.56	0.12
					159 -	317	0.44 -	0.67
					42.9		71.2	
				CHIRONOMIDAE	291	369	0.08	0.14
					40 -	714	0.00 -	0.24
					52.4		[illegible]	
				TOTAL INVERTEBRATES	556	379	0.78	0.10
					0 -	992	0.00 -	0.97
					100.0		100.0	

1/ WING DAM 25, 26, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.= 4.42M; 2 = 45 DEG.= 7.62M; 3 = 90 DEG.= 35.10M; 4 = 135 DEG.= 22.56M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM U = UPSTREAM AND D = DOWNSTREAM.

APPENDIX H-6.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
9			6- 5-79	OLIGOCHAETA	106	92	0 - 159	11.4	0.13	0.14	0.00 - 0.29	1.7
				POTAMYIA FLAVA (HAGEN)	463	233	198 - 635	50.0	3.90	2.46	1.07 - 5.48	49.9
				HYDROPSYCHIDAE PUPAE	159	119	40 - 278	17.1	2.63	1.93	0.67 - 4.52	33.7
				OECETIS SP.	13	23	0 - 40	1.4	0.09	0.15	0.00 - 0.29	1.2
				STENELMIS SP.	26	23	0 - 40	2.9	0.07	0.09	0.00 - 0.16	0.9
				CHIRONOMIDAE	145	160	0 - 317	15.7	0.56	0.83	0.00 - 1.51	7.1
				HAETIDEA SP.	13	23	0 - 40	1.4	0.44	0.76	0.00 - 1.31	5.6
				TOTAL INVERTEBRATES	926	495	0 - 1270	100.0	7.82	4.07	0.00 - 11.90	100.0
10			5- 5-79	OLIGOCHAETA	79	40	40 - 119	27.3	0.11	0.15	0.00 - 0.29	42.1
				CHIRONOMIDAE	212	128	119 - 357	72.7	0.15	0.12	0.04 - 0.28	57.9
				TOTAL INVERTEBRATES	291	160	0 - 476	100.0	0.25	0.11	0.00 - 0.32	100.0

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
JUNE 5-6, 1979.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
11			5-[illegible]-79	OLIGOCHAETA	569	581	40 - 1190	56.7	0.50	0.50	0.00 - 0.99	3.9
				HEXAGENIA SP.	119	173	0 - 317	13.8	10.73	19.55	0.00 - 32.14	84.0
				CHIRONOMIDAE	119	105	40 - 238	13.8	0.21	0.37	0.00 - 0.63	1.7
				SPHAERIUM SP. W/ SHELL	40	40	0 - 79	4.6	1.02	1.63	0.00 - 2.90	8.0
				BAETISCA SP.	13	23	0 - 40	1.5	0.32	0.55	0.00 - 0.95	2.5
				TOTAL INVERTEBRATES	860	578	0 - 1508	100.0	12.78	16.83	0.00 - 32.14	100.0
25	1	7	5-[illegible]-79	OLIGOCHAETA	185	219	40 - 436	20.9	0.28	0.26	0.00 - 0.52	16.0
				CERATOPOGONIDAE	79	69	0 - 119	9.0	0.37	0.34	0.00 - 0.67	21.4
				CHIRONOMIDAE	529	470	238 - 1071	59.7	0.60	0.41	0.32 - 1.07	34.4
				CHIRONOMIDAE PUPAE	56	83	0 - 159	7.5	0.03	0.05	0.00 - 0.09	1.5
				CULICIDAE PUPAE	13	23	0 - 40	1.5	0.00	0.00	0.00 - 0.00	0.0

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	1	7	6- 6-79	SPHAERIUM SP. W/ SHELL	13	23	0 - 40	1.5	0.46	0.80	0.00 - 1.39	26.7
				TOTAL INVERTEBRATES	886	815	0 - 1825	100.0	1.73	1.23	0.00 - 2.54	100.0
25	2	8	6- 6-79	OLIGOCHAETA	40	40	0 - 79	4.3	0.00	0.00	0.00 - 0.00	0.0
				HYDROPSYCHIDAE PUPAE	53	61	0 - 119	5.7	0.67	0.82	0.00 - 1.59	29.7
				CERATOPOGONIDAE	53	46	0 - 79	5.7	0.37	0.32	0.00 - 0.55	16.3
				CHIRONOMIDAE	727	615	278 - 1428	78.6	1.11	1.13	0.44 - 2.42	48.8
				CHIRONOMIDAE PUPAE	40	69	0 - 119	4.3	0.07	0.11	0.00 - 0.20	2.9
				SPHAERIUM SP. W/ SHELL	13	23	0 - 40	1.4	0.05	0.09	0.00 - 0.16	2.3
				TOTAL INVERTEBRATES	926	737	0 - 1746	100.0	2.27	1.62	0.00 - 3.61	100.0
25	3	5	6- 6-79	OLIGOCHAETA	26	46	0 - 79	4.3	0.00	0.00	0.00 - 0.00	0.0
				CHIRONOMIDAE	529	437	239 - 1032	95.7	0.54	0.53	0.16 - 1.15	100.0

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979.
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
25	3	4	6- 6-79	TOTAL INVERTEBRATES	556	483	0 - 1111	100.0	0.54	0.53	0.00 - 1.15	100.0
25	4	8	6- 6-79	OLIGOCHAETA	13	23	0 - 40	1.1	0.00	0.00	0.00 - 0.00	0.0
				CERATOPOGONIDAE	53	61	0 - 119	4.3	0.26	0.35	0.00 - 0.67	14.2
				CHIRONOMIDAE	1071	715	278 - 1667	88.0	1.40	1.07	0.20 - 2.26	75.2
				CHIRONOMIDAE PUPAE	13	23	0 - 40	1.1	0.00	0.00	0.00 - 0.00	0.0
				CULICIDAE PUPAE	53	23	40 - 79	4.3	0.00	0.00	0.00 - 0.00	0.0
				SPHAERIUM SP. W/ SHELL	13	23	0 - 40	1.1	0.20	0.34	0.00 - 0.60	10.6
				TOTAL INVERTEBRATES	1217	778	0 - 1944	100.0	1.86	1.61	0.00 - 3.53	100.0
25 4/	1	7	6- 6-79	NONE	0	0	0 - 0	0.0	0.00	0.00	0.00 - 0.00	0.0
25 4/	2	8	6- 6-79	NONE	0	0	0 - 0	0.0	0.00	0.00	0.00 - 0.00	0.0
25 4/	5	[illegible]	6- 6-79	NONE	0	0	0 - 0	0.0	0.00	0.00	0.00 - 0.00	0.0

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
28 4/	4	8	6-5-79	NONE	0	0	0 - 0	0.0	0.00	0.00	0.00 - 0.00	0.0
28	1	7	6-5-79	CHIRONOMIDAE	119	119	0 - 238	100.0	0.07	0.06	0.00 - 0.12	100.0
				TOTAL INVERTEBRATES	119	119	0 - 238	100.0	0.07	0.06	0.00 - 0.12	100.0
28	2	8	6-5-79	OLIGOCHAETA	40	40	0 - 79	9.7	0.00	0.00	0.00 - 0.00	0.0
				CERATOPOGONIDAE	93	23	79 - 119	22.6	0.39	0.35	0.00 - 0.67	69.0
				CHIRONOMIDAE	278	105	159 - 357	67.7	0.17	0.12	0.04 - 0.29	31.0
				TOTAL INVERTEBRATES	410	83	0 - 476	100.0	0.56	0.47	0.00 - 0.95	100.0
28	3	8	6-5-79	CERATOPOGONIDAE	26	46	0 - 79	4.3	0.11	0.19	0.00 - 0.32	16.7
				CHIRONOMIDAE	582	437	159 - 1032	95.7	0.53	0.50	0.09 - 1.07	83.3
				TOTAL INVERTEBRATES	608	478	0 - 1111	100.0	0.63	0.68	0.00 - 1.39	100.0
28	4	8	6-5-79	OLIGOCHAETA	13	23	0 - 40	5.9	0.00	0.00	0.00 - 0.00	0.0

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
23	4	6	5- [illegible]-79	CHIRONOMIDAE	212	160	119 - 397	94.1	0.05	0.02	0.04 - 0.08	100.0
				TOTAL INVERTEBRATES	225	183	0 - 436	100.0	0.05	0.02	0.00 - 0.08	100.0
29	5	7	5- [illegible]-79	OLIGOCHAETA	675	695	0 - 1389	89.5	1.26	1.36	0.00 - 2.70	8.7
				HEXAGENIA SP.	40	40	0 - 79	5.3	12.47	15.82	0.00 - 31.90	89.1
				GOMPHUS SP.	13	23	0 - 40	1.8	0.22	0.39	0.00 - 0.67	1.5
				CERATOPOGONIDAE	13	23	0 - 40	1.8	0.09	0.16	0.00 - 0.29	0.6
				CHIRONOMIDAE PUPAE	13	23	0 - 40	1.8	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	754	775	0 - 1548	100.0	14.44	17.32	0.00 - 33.65	100.0
29	5	3	6- [illegible]-79	OLIGOCHAETA	13	23	0 - 40	5.3	0.00	0.00	0.00 - 0.00	0.0
				CERATOPOGONIDAE	66	61	0 - 119	26.3	0.34	0.41	0.00 - 0.79	70.3
				CHIRONOMIDAE	172	179	0 - 357	68.4	0.13	0.16	0.00 - 0.32	29.7

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
29	5	8	6- 5-79	TOTAL INVERTEBRATES	251 0 - 100.0	226 436	[illegible] 0.00 - 100.0	0.46 0.91
29	6	7	6- 5-79	OLIGOCHAETA	[illegible] [illegible] - [illegible]	[illegible] [illegible]	[illegible] 3.5[illegible] - [illegible]	3.73 [illegible]
				HEXAGENIA SP.	[illegible] [illegible] - [illegible]	115 199	2.95 0.00 - 13.[illegible]	5.11 9.85
				GOMPHUS SP.	[illegible] [illegible] - 1.[illegible]	23 40	2.[illegible] 0.[illegible] - [illegible]	2.73 5.36
				CHIRONOMIDAE	[illegible] [illegible] - 33.9	[illegible] [illegible]	[illegible] 2.[illegible] - [illegible]	[illegible] 3.65
				CHIRONOMIDAE PUPAE	26 0 - 1.0	[illegible] 40	[illegible] 0.00 - 0.3	0.06 0.12
				SPHAERIUM SP. W/ SHELL	79 40 - 3.1	69 159	6.07 1.39 - 28.7	4.92 11.19
				PARALEPTOPHLEBIA SP.	13 0 - 0.5	23 40	0.09 0.00 - 0.4	0.16 0.28
				DUBIRAPHIA SP.	13 0 - 0.5	23 40	0.05 0.00 - 0.2	0.09 0.16
				TOTAL INVERTEBRATES	2526 0 - 100.0	1665 3849	21.19 0.00 - 100.0	3.22 25.17
29	6	8	6- 5-79	OLIGOCHAETA	26 0 - 10.0	46 79	0.00 0.00 - 0.0	0.00 0.00

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES).
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
29	6	3	6- 5-79	CERATOPOGONIDAE	13	23	0 - 40	5.0	0.14	0.32	0.00 - 0.56	60.9
				CHIRONOMIDAE	79	69	40 - 159	30.0	0.04	0.07	0.00 - 0.12	13.0
				CHIRONOMIDAE PUPAE	132	115	0 - 198	50.0	0.03	0.07	0.00 - 0.12	26.1
				CULICIDAE PUPAE	13	23	0 - 40	5.0	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	265	179	0 - 436	100.0	0.30	0.23	0.00 - 0.56	100.0
30	5	7	6- 5-79	OLIGOCHAETA	13	23	0 - 40	2.1	0.00	0.00	0.00 - 0.00	0.0
				CERATOPOGONIDAE	93	61	40 - 159	14.9	0.21	0.15	0.04 - 0.32	29.6
				CHIRONOMIDAE	516	221	278 - 714	83.0	0.50	0.26	0.24 - 0.75	70.4
				TOTAL INVERTEBRATES	622	233	0 - 794	100.0	0.71	0.39	0.00 - 1.03	100.0
30	5	8	6- 5-79	OLIGOCHAETA	265	458	0 - 794	45.5	0.03	0.05	0.00 - 0.09	4.0
				CERATOPOGONIDAE	53	61	0 - 119	9.1	0.30	0.43	0.00 - 0.79	46.0

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
30	5	5	6- 5-79	CHIRONOMIDAE	265	356	40 - 675	45.5	0.33	0.54	0.00 - 0.95	50.0
				TOTAL INVERTEBRATES	542	871	0 - 1567	100.0	0.65	1.01	0.00 - 1.93	100.0
30	6	7	6- 5-79	CERATOPOGONIDAE	40	40	0 - 79	14.3	0.11	0.10	0.00 - 0.20	28.6
				CHIRONOMIDAE	238	286	0 - 556	85.7	0.26	0.23	0.00 - 0.40	71.4
				TOTAL INVERTEBRATES	278	248	0 - 556	100.0	0.37	0.24	0.00 - 0.60	100.0
30	6	5	6- 5-79	CERATOPOGONIDAE	53	23	40 - 79	8.9	0.40	0.12	0.28 - 0.52	53.6
				CHIRONOMIDAE	542	905	0 - 1587	91.1	0.34	0.60	0.00 - 1.03	46.4
				TOTAL INVERTEBRATES	595	928	0 - 1567	100.0	0.74	0.70	0.00 - 1.55	100.0
31	5	7	5- 5-79	OLIGOCHAETA	13	23	0 - 40	8.3	0.00	0.00	0.00 - 0.00	0.0
				HYDROPSYCHIDAE (EARLY INSTAR)	13	23	0 - 40	8.3	0.00	0.00	0.00 - 0.00	0.0
				CERATOPOGONIDAE	40	69	0 - 119	25.0	0.30	0.53	0.00 - 0.91	92.0

APPENDIX H-4. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN	NUMBER SD	NUMBER RANGE	NUMBER PERCENT OF TOTAL	BIOMASS (G) MEAN	BIOMASS (G) SD	BIOMASS (G) RANGE	BIOMASS (G) PERCENT OF TOTAL
31	5	7	6- 5-79	CHIRONOMIDAE	79	40	40 - 119	50.0	0.03	0.02	0.00 - 0.04	3.3
				CHIRONOMIDAE PUPAE	13	23	0 - 40	8.3	0.00	0.00	0.00 - 0.00	0.0
				TOTAL INVERTEBRATES	159	137	0 - 317	100.0	0.33	0.54	0.00 - 0.95	100.0
31	5	5	6- 5-79	OLIGOCHAETA	40	0	40 - 40	2.6	0.00	0.00	0.00 - 0.00	0.0
				HYALLELA AZTECA (SAUSSURE)	66	115	0 - 198	4.4	0.03	0.14	0.00 - 0.24	6.3
				HYDROPSYCHIDAE (EARLY INSTAR)	172	179	0 - 357	11.4	0.09	0.10	0.00 - 0.20	7.3
				CERATOPOGONIDAE	40	40	0 - 79	2.6	0.09	0.13	0.00 - 0.26	7.3
				CHIRONOMIDAE	1190	516	675 - 1706	78.9	1.01	0.46	0.49 - 1.31	79.2
				TOTAL INVERTEBRATES	1508	735	0 - 2341	100.0	1.27	0.50	0.00 - 1.79	100.0
31	6	7	5- 5-79	OLIGOCHAETA	13	23	0 - 40	3.2	0.00	0.00	0.00 - 0.00	0.0
				CERATOPOGONIDAE	26	23	0 - 40	6.5	0.22	0.20	0.00 - 0.40	34.0

APPENDIX H-4, CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A PONAR GRAB (THREE REPLICATES),
JUNE 5-6, 1979,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER MEAN, SD RANGE PERCENT OF TOTAL		BIOMASS (G) MEAN, SD RANGE PERCENT OF TOTAL	
31	5	7	5- 5-79	CHIRONOMIDAE	370 199 - 90.3	160 516	0.44 0.29 - 55.0	0.14 0.56
				TOTAL INVERTEBRATES	410 0 - 100.0	160 556	0.66 0.00 - 100.0	0.13 0.93
31	6	8	5- 5-79	OLIGOCHAETA	66 0 - 25.0	83 159	11.89 0.00 - 97.2	20.57 35.63
				CERATOPOGONIDAE	40 0 - 15.0	69 119	0.26 0.00 - 2.2	0.46 0.79
				CHIRONOMIDAE	145 40 - 55.0	150 317	0.05 0.00 - 0.4	0.05 0.09
				CHIRONOMIDAE PUPAE	13 0 - 5.0	23 40	0.03 0.00 - 0.2	0.05 0.08
				TOTAL INVERTEBRATES	265 0 - 100.0	287 595	12.22 0.00 - 100.0	21.03 36.51

1/ WING DAM 25, 26, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 0 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.
4/ No Sample

APPENDIX I. NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
25	5	7	9-29-78	TURBELLARIA	57	0.7	0.17	0.3
				TRICHLADIDA	57	0.7	0.11	0.2
				HYALLELA AZTECA (SAUSSURE)	113	1.4	0.11	0.2
				CAENIS SP.	113	1.4	0.06	0.1
				HEXAGENIA SP.	57	0.7	0.62	1.2
				STENONEMA SP.	57	0.7	0.11	0.2
				ISCHNURA SP.	57	0.7	0.06	0.1
				COENAGRIONIDAE	57	0.7	0.79	1.5
				HYDROPSYCHIDAE (EARLY INSTAR)	340	4.1	0.17	0.3
				CHEUMATOPSYCHE SP.	5320	64.4	36.51	68.4
				HYDROPSYCHE SP.	340	4.1	1.58	3.0
				POTAMYIA FLAVA (HAGEN)	906	11.0	8.49	15.9
				HYDROPSYCHIDAE PUPAE	113	1.4	1.02	1.9
				NEURECLIPSIS SP.	396	4.8	3.40	5.4
				CHIRONOMIDAE	226	2.7	0.11	0.2
				PHYSA SP.	57	0.7	0.05	0.1
				TOTAL INVERTEBRATES	8264	100.0	53.37	100.0
25	5	6	9-25-78	TRICHLADIDA	57	0.7	0.34	0.7
				OLIGOCHAETA	113	1.4	0.00	0.0
				HEXAGENIA SP.	226	2.9	6.74	13.1

APPENDIX I. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
25	5	3	9-23-78	STENACRON SP.	113	1.4	1.02	2.0
				STENONEMA SP.	170	2.1	0.23	0.4
				ISCHNURA SP.	57	0.7	0.06	0.1
				NEOPLEA STRIOLA (FIEBER)	57	0.7	0.21	0.4
				HYDROPSYCHIDAE (EARLY INSTAR)	906	11.3	0.51	1.0
				CHEUMATOPSYCHE SP.	3566	44.4	27.96	54.6
				HYDROPSYCHE SP.	226	2.8	0.68	1.3
				POTAMYIA FLAVA (HAGEN)	1528	19.0	8.43	16.5
				HYDROPSYCHIDAE PUPAE	283	3.5	3.23	6.3
				POLYCENTROPODIDAE (EARLY INSTAR)	170	2.1	0.05	0.1
				NEURECLIPSIS SP.	340	4.2	1.42	2.8
				CHIRONOMIDAE	226	2.8	0.29	0.6
				UNIONIDAE (JUVENILE) W/ SHELL	57	0.7	3.68	7.2
				TOTAL INVERTEBRATES	8037	100.0	51.22	100.0
25	6	7	9-23-78	TRICLADIDA	170	1.5	0.34	0.6
				HYALELLA AZTECA (SAUSSURE)	57	0.5	0.06	0.1
				BAETIDAE	113	1.0	0.40	0.7
				STENONEMA SP.	283	2.5	0.40	0.7
				ISONYCHIA SP.	57	0.5	1.42	2.5
				HYDROPSYCHIDAE (EARLY INSTAR)	2490	22.1	1.55	2.8

APPENDIX I. (CONTINUED).
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
25	5	7	9-25-78	CHEUMATOPSYCHE SP.	4471	39.7	34.75	61.6
				HYDROPSYCHE SP.	340	3.0	2.49	4.4
				POTAMYIA FLAVA (HAGEN)	2207	19.6	12.06	21.4
				HYDROPSYCHIDAE PUPAE	57	0.5	0.61	1.1
				POLYCENTROPODIDAE (EARLY INSTAR)	283	2.5	0.34	0.6
				NEURECLIPSIS SP.	283	2.5	1.25	2.2
				CHIRONOMIDAE	453	4.0	0.74	1.3
				TOTAL INVERTEBRATES	11263	100.0	56.43	100.0
25	5	8	9-25-78	TRICLADIDA	317	1.9	0.63	0.5
				BAETIS SP.	317	1.9	0.63	0.5
				HEXAGENIA SP.	634	3.5	23.68	23.7
				STENACRON SP.	634	3.5	1.90	1.6
				STENONEMA SP.	634	3.5	0.79	0.7
				COENAGRIONIDAE	158	0.9	0.63	0.5
				HYDROPSYCHIDAE (EARLY INSTAR)	3011	16.7	1.59	1.3
				CHEUMATOPSYCHE SP.	4913	27.2	50.56	41.9
				HYDROPSYCHE SP.	1268	7.0	3.01	2.5
				POTAMYIA FLAVA (HAGEN)	5071	28.1	30.59	25.3
				HYDROPSYCHIDAE PUPAE	158	0.9	0.16	0.1
				CHIRONOMIDAE	634	3.5	1.74	1.4

APPENDIX I. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
25	6	8	9-23-73	CHIRONOMIDAE PUPAE	317	1.9	0.39	0.0
				LEPTODEA FRAGILIS (RAFINESQUE) W/ SHELL	11	0.1	23.26	19.2
				TOTAL INVERTEBRATES	18067	100.0	120.92	100.0
26	5	7	9-23-78	TRICLADIDA	204	2.1	0.4[illegible]	0.6
				HYALLELA AZTECA (SAUSSURE)	136	1.4	0.14	0.2
				BAETIS SP.	66	0.7	0.49	0.6
				CAENIS SP.	136	1.4	6.52	8.3
				STENONEMA SP.	136	1.4	0.14	0.2
				GOMPHUS SP.	68	0.7	6.19	7.9
				ISCHNURA SP.	68	0.7	0.41	0.5
				HYDROPSYCHIDAE (EARLY INSTAR)	883	9.3	0.34	0.4
				CHEUMATOPSYCHE SP.	2953	30.9	31.92	40.4
				HYDROPSYCHE SP.	2106	22.1	9.24	11.7
				POTAMYIA FLAVA (HAGEN)	1562	16.4	10.66	13.5
				HYDROPSYCHIDAE PUPAE	272	2.9	2.51	3.2
				POLYCENTROPODIDAE (EARLY INSTAR)	272	2.9	0.41	0.5
				NEURECLIPSIS SP.	272	2.9	8.22	10.4
				STENELMIS SP.	68	0.7	0.75	0.9
				CHIRONOMIDAE	340	3.6	0.48	0.6
				CHIRONOMIDAE PUPAE	68	0.7	0.07	0.1

APPENDIX I. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
26	5	F	9-25-78	TOTAL INVERTEBRATES	9509	100.0	74.92	100.0
26	5	B	9-23-78	TRICHLADIDA	158	0.7	0.16	0.1
				HYALLELA AZTECA (SAUSSURE)	158	0.7	0.16	0.1
				BAETIS SP.	475	2.2	2.06	1.4
				STENONEMA SP.	317	1.5	0.32	0.2
				HYDROPSYCHIDAE (EARLY INSTAR)	3328	15.4	1.90	1.3
				CHEUMATOPSYCHE SP.	1789	8.3	52.14	34.4
				HYDROPSYCHE SP.	7132	33.0	29.32	19.4
				POTAMYIA FLAVA (HAGEN)	6498	30.1	40.25	26.6
				HYDROPSYCHIDAE PUPAE	317	1.5	3.65	2.4
				POLYCENTROPODIDAE (EARLY INSTAR)	634	2.9	0.32	0.2
				NEURECLIPSIS SP.	634	2.9	19.49	12.9
				POLYCENTROPODIDAE PUPAE	158	0.7	1.74	1.2
				TOTAL INVERTEBRATES	21599	100.0	151.51	100.0
26	6	F	9-25-78	TRICHLADIDA	68	10.0	0.11	3.4
				BAETIDAE	11	1.7	0.04	1.2
				HEXAGENIA SP.	28	4.2	1.40	41.7
				COENAGRIONIDAE (EARLY INSTAR)	11	1.7	0.01	0.3
				HYDROPSYCHIDAE (EARLY INSTAR)	28	4.2	0.01	0.3
				CHEUMATOPSYCHE SP.	187	27.5	0.65	19.4

APPENDIX I. (CONTINUED).
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
26	5	7	9-24-78	HYDROPSYCHE SP.	125	18.3	0.40	11.8
				POTAMYIA FLAVA (HAGEN)	198	29.2	0.62	19.4
				NEURECLIPSIS SP.	11	1.7	0.10	3.0
				CHIRONOMIDAE	11	1.7	0.02	0.5
				TOTAL INVERTEBRATES	679	100.0	3.36	100.0
25	6	6	9-23-78	TRICLADIDA	634	2.2	1.74	1.1
				ASELLUS SP.	159	0.5	0.15	0.1
				BAETIS SP.	475	1.6	2.06	1.3
				STENONEMA SP.	158	0.5	0.16	0.1
				HYDROPSYCHIDAE (EARLY INSTAR)	1902	6.5	0.63	0.4
				CHEUMATOPSYCHE SP.	11569	39.9	74.60	46.1
				HYDROPSYCHE SP.	4437	15.3	19.13	11.9
				POTAMYIA FLAVA (HAGEN)	7766	26.9	47.07	29.0
				HYDROPSYCHIDAE PUPAE	317	1.1	2.22	1.4
				NEURECLIPSIS SP.	1109	3.8	13.47	8.3
				CHIRONOMIDAE	475	1.6	0.63	0.4
				TOTAL INVERTEBRATES	29002	100.0	162.13	100.0
2[illegible] 4/	5	7	9-23-78	NONE	0	0.0	0.00	0.0
2[illegible] 4/	5	8	9-23-78	NONE	0	0.0	0.00	0.0
2[illegible] 4/	6	7	9-24-78	NONE	0	0.0	0.00	0.0

APPENDIX I. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
29	6	3	9-28-78	TRICHLADIDA	113	1.4	0.11	0.3
				HYALLELA AZTECA (SAUSSURE)	226	2.9	0.11	0.3
				BAETIS SP.	226	2.9	0.35	2.3
				ISCHNURA SP.	57	0.7	0.57	1.6
				HYDROPSYCHIDAE (EARLY INSTAR)	453	5.8	0.28	0.8
				CHEUMATOPSYCHE SP.	3679	46.8	13.11	49.8
				HYDROPSYCHE SP.	566	7.2	1.87	5.1
				POTAMYIA FLAVA (HAGEN)	2094	26.6	9.79	26.9
				HYDROPSYCHIDAE PUPAE	57	0.7	0.40	1.1
				NEURECLIPSIS SP.	283	3.6	4.19	11.5
				CHIRONOMIDAE	113	1.4	0.11	0.3
				TOTAL INVERTEBRATES	7867	100.0	36.39	100.0
29	5	[illegible]	9-28-78	TRICHLADIDA	158	0.7	0.49	0.6
				HYALLELA AZTECA (SAUSSURE)	158	0.7	0.16	0.2
				BAETIS SP.	634	2.7	1.11	1.5
				CAENIS SP.	158	0.7	0.32	0.4
				STENONEMA SP.	317	1.4	0.05	0.1
				GOMPHUS SP.	11	0.0	6.07	8.2
				PANTALLA SP.	6	0.0	0.51	0.7
				HYDROPSYCHIDAE (EARLY INSTAR)	5398	23.1	1.90	2.6

APPENDIX I. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
29	5	7	9-25-73	CHEUMATOPSYCHE SP.	6022	25.8	27.73	37.6
				HYDROPSYCHE SP.	4754	20.4	14.42	19.5
				POTAMYIA FLAVA (HAGEN)	3804	16.3	16.80	22.8
				NEURECLIPSIS SP.	1109	4.8	3.93	5.4
				CHAOBORUS SP.	792	3.4	0.32	0.4
				TOTAL INVERTEBRATES	23314	100.0	73.62	100.0
29	5	8	9-23-73	HEXAGENIA SP.	57	1.3	0.40	1.4
				SIALIS SP.	57	1.3	3.23	11.3
				HYDROPSYCHIDAE (EARLY INSTAR)	113	2.6	0.11	0.4
				CHEUMATOPSYCHE SP.	1189	27.6	9.11	31.9
				HYDROPSYCHE SP.	1641	38.7	8.21	29.9
				POTAMYIA FLAVA (HAGEN)	1019	23.7	6.05	21.2
				HYDROPSYCHIDAE PUPAE	113	2.6	0.62	2.2
				POLYCENTROPODIDAE PUPAE	113	2.6	0.79	2.8
				TOTAL INVERTEBRATES	4302	100.0	28.53	100.0
29 4/	6	7	9-24-73	NONE	0	0.0	0.00	0.0
29 4/	6	9	9-24-73	NONE	0	0.0	0.00	0.0
30	5	7	10-12-73	HYDROPSYCHIDAE (EARLY INSTAR)	3170	7.6	1.90	0.8
				CHEUMATOPSYCHE SP.	3304	9.1	15.49	7.1
				HYDROPSYCHE SP.	13629	32.6	60.66	26.2

APPENDIX I. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
30	5	[illegible]	10-12-73	POTAMYIA FLAVA (HAGEN)	21236	50.8	152.77	65.8
				TOTAL INVERTEBRATES	41839	100.0	232.01	100.0
30	5	8	10-12-73	STENONEMA SP.	475	1.7	0.49	0.6
				HYDROPSYCHIDAE (EARLY INSTAR)	8716	32.0	7.43	9.6
				CHEUMATOPSYCHE SP.	1902	7.0	12.20	15.7
				HYDROPSYCHE SP.	3962	14.5	8.67	11.5
				POTAMYIA FLAVA (HAGEN)	11411	41.9	45.17	58.3
				NEURECLIPSIS SP.	158	0.5	1.11	1.4
				CHIRONOMIDAE	634	2.3	2.22	2.9
				TOTAL INVERTEBRATES	27259	100.0	77.50	100.0
30 4/	6	7	10- 3-73	NONE	0	0.0	0.00	0.0
30	6	8	10- 3-73	BAETIS SP.	362	0.7	1.45	0.7
				STENONEMA SP.	362	0.7	0.36	0.2
				ISCHNURA SP.	362	0.7	0.36	0.2
				HYDROPSYCHIDAE (EARLY INSTAR)	10505	21.0	9.05	4.2
				CHEUMATOPSYCHE SP.	5796	11.6	35.14	16.4
				HYDROPSYCHE SP.	5434	10.9	21.01	9.9
				POTAMYIA FLAVA (HAGEN)	24632	49.3	127.51	59.4
				HYDROPSYCHIDAE PUPAE	1811	3.6	13.40	6.2
				CHIRONOMIDAE	362	0.7	1.09	0.5

APPENDIX I. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A BASKET SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
30	6	8	10- 3-78	CHIRONOMIDAE PUPAE	362	0.7	5.43	2.5
				TOTAL INVERTEBRATES	49989	100.0	214.81	100.0
31 4/	5	7	9-23-78	NONE	0	0.0	0.00	0.0
31 4/	5	8	9-23-78	NONE	0	0.0	0.00	0.0
31 4/	6	7	9-23-78	NONE	0	0.0	0.00	0.0
31 4/	6	8	9-23-78	NONE	0	0.0	0.00	0.0

1/ WING DAM 25, 26, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.
4/ No Sample

APPENDIX J. NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER. POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
25	5	[illegible]	9-24-78	TRICHLADIDA	43	0.6	0.09	0.1
				OLIGOCHAETA	43	0.6	0.00	0.0
				PLACOBDELLA SP.	43	0.6	2.21	3.9
				CAENIS SP.	43	0.6	0.04	0.1
				HEXAGENIA SP.	128	1.7	2.81	4.9
				STENONEMA SP.	128	1.7	0.30	0.5
				HYDROPSYCHIDAE (EARLY INSTAR)	426	5.7	0.26	0.4
				CHEUMATOPSYCHE SP.	4767	64.4	43.28	75.8
				HYDROPSYCHE SP.	426	5.7	1.02	1.8
				POTAMYIA FLAVA (HAGEN)	1234	16.7	6.09	10.7
				NEURECLIPSIS SP.	43	0.6	0.47	0.8
				TRICOPTERA PUPAE	43	0.6	0.47	0.8
				CHIRONOMIDAE	43	0.6	0.04	0.1
				TOTAL INVERTEBRATES	7405	100.0	57.07	100.0
25	5	6	9-24-78	TRICLADIDA	85	3.6	0.23	2.0
				OLIGOCHAETA	21	0.9	0.00	0.0
				ASELLUS SP.	21	0.9	0.09	0.7
				BAETIS SP.	21	0.9	0.09	0.7
				[illegible]IDAE (EARLY INSTAR)	21	0.9	0.02	0.2
				HEXAGENIA SP.	106	4.5	1.51	12.9

APPENDIX J. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
25	5	8	9-24-73	STENONEMA SP.	192	8.1	0.49	4.1
				HYDROPSYCHIDAE (EARLY INSTAR)	404	17.1	0.19	1.6
				CHEUMATOPSYCHE SP.	702	29.7	4.60	38.5
				HYDROPSYCHE SP.	85	3.6	0.36	3.1
				POTAMYIA FLAVA (HAGEN)	511	21.6	3.15	26.6
				NEURECLIPSIS SP.	64	2.7	0.94	7.9
				ELMIDAE	21	0.9	0.02	0.2
				CHIRONOMIDAE	106	4.5	0.15	1.3
				UNIONIDAE (JUVENILE) W/ SHELL	21	0.9	0.11	0.9
				TOTAL INVERTEBRATES	2362	100.0	11.93	100.0
25	6	7	9-24-73	TRICHLADIDA	117	6.0	0.34	3.7
				OLIGOCHAETA	32	1.6	0.00	0.0
				HYALLELA AZTECA (SAUSSURE)	32	1.6	0.05	0.6
				BAETIS SP.	32	1.6	0.05	0.6
				CAENIS SP.	53	2.7	0.03	0.3
				HEXAGENIA SP.	117	6.0	0.96	10.2
				STENONEMA SP.	53	2.7	0.14	1.5
				HYDROPSYCHIDAE (EARLY INSTAR)	170	8.8	0.14	1.5
				HYDROPSYCHE SP.	511	26.4	1.77	19.3
				POTAMYIA FLAVA (HAGEN)	596	30.8	3.79	41.3

APPENDIX J. CONTINUED.
NUMBER AND G. MASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
25	6	7	9-23-73	HYDROPSYCHIDAE PUPAE	170	8.8	1.82	19.9
				NEURECLIPSIS SP.	53	2.7	0.09	0.9
				TOTAL INVERTEBRATES	1936	100.0	9.14	100.0
25	6	8	9-23-73	TRICLADIDA	32	1.2	0.00	0.0
				HYALELLA AZTECA (SAUSSURE)	117	4.5	0.17	0.7
				CAENIS SP.	53	2.1	0.05	0.2
				HEXAGENIA SP.	85	3.3	2.87	11.7
				STENONEMA SP.	32	1.2	0.03	0.1
				HYDROPSYCHIDAE (EARLY INSTAR)	255	9.9	0.22	0.9
				CHEUMATOPSYCHE SP.	904	35.0	9.86	40.1
				HYDROPSYCHE SP.	564	21.8	8.10	32.9
				POTAMYIA FLAVA (HAGEN)	511	19.8	3.18	12.9
				HYDROPSYCHIDAE PUPAE	32	1.2	0.12	0.5
				TOTAL INVERTEBRATES	2586	100.0	24.61	100.0
25	5	7	9-24-73	TRICLADIDA	958	6.4	1.23	1.4
				CAENIS SP.	106	0.7	0.11	0.1
				STENONEMA SP.	213	1.4	0.43	0.5
				COENAGRIONIDAE (EARLY INSTAR)	532	3.5	1.23	1.4
				HYDROPSYCHIDAE (EARLY INSTAR)	1064	7.1	1.17	1.3
				CHEUMATOPSYCHE SP.	3937	26.2	34.05	33.6

APPENDIX J. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
26	5	7	9-25-78	HYDROPSYCHE SP.	7022	46.8	34.05	38.6
				POTAMYIA FLAVA (HAGEN)	1064	7.1	13.41	15.2
				HYDROPSYCHIDAE PUPAE	106	0.7	2.55	2.9
				TOTAL INVERTEBRATES	15002	100.0	88.31	100.0
26	5	6	9-22-78	GAMMARUS SP.	106	1.1	0.11	0.2
				BAETIS SP.	106	1.1	0.43	0.7
				STENONEMA SP.	106	1.1	0.11	0.2
				HYDROPSYCHIDAE (EARLY INSTAR)	851	9.1	0.64	1.1
				CHEUMATOPSYCHE SP.	3192	34.1	18.51	30.6
				HYDROPSYCHE SP.	2234	23.9	8.30	13.7
				POTAMYIA FLAVA (HAGEN)	2660	28.4	29.79	49.3
				HYDROPSYCHIDAE PUPAE	106	1.1	2.55	4.2
				TOTAL INVERTEBRATES	9363	100.0	60.44	100.0
26	5	7	9-23-78	TRICHLADIDA	32	5.1	0.15	1.9
				ASELLUS SP.	11	1.7	0.02	0.3
				HYALLELA AZTECA (SAUSSURE)	32	5.1	0.04	0.5
				BAETIS SP.	11	1.7	0.02	0.3
				HEXAGENIA SP.	192	30.5	5.98	72.1
				STENONEMA SP.	11	1.7	0.01	0.1
				AESHNIDAE (EARLY INSTAR)	43	6.8	0.13	1.5

APPENDIX J. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
26	6	7	9-25-78	CHENACRIONIDAE	11	1.7	0.43	5.1
				SIALIS SP.	11	1.7	0.19	2.2
				HYDROPSYCHIDAE (EARLY INSTAR)	32	5.1	0.01	0.1
				CHEUMATOPSYCHE SP.	53	8.5	0.36	4.4
				HYDROPSYCHE SP.	53	8.5	0.17	2.1
				POTAMYIA FLAVA (HAGEN)	53	8.5	0.18	2.2
				HYDROPSYCHIDAE PUPAE	11	1.7	0.12	1.4
				NEURECLIPSIS SP.	53	8.5	0.36	4.4
				CHIRONOMIDAE	21	3.4	0.13	1.5
				TOTAL INVERTEBRATES	628	100.0	8.39	100.0
25	6	4	9-24-78	TRICLADIDA	255	2.1	0.51	0.6
				HEXAGENIA SP.	128	1.1	14.17	17.8
				STENONEMA SP.	383	3.2	0.51	0.6
				HYDROPSYCHIDAE (EARLY INSTAR)	383	3.2	0.13	0.2
				CHEUMATOPSYCHE SP.	6129	51.1	41.89	52.5
				HYDROPSYCHE SP.	2937	24.5	16.60	20.9
				POTAMYIA FLAVA (HAGEN)	1532	12.8	4.99	6.2
				CHIRONOMIDAE	255	2.1	1.02	1.3
				TOTAL INVERTEBRATES	12002	100.0	79.30	100.0
2 4/	5	7	9-25-78	NONE	0	0.0	0.00	0.0

APPENDIX J. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
24 4/	5	6	9-23-78	NONE	0	0.0	0.00	0.0
24 4/	6	7	9-25-78	NONE	0	0.0	0.00	0.0
24	6	5	9-24-78	TRICHLADIDA	106	1.0	0.11	0.2
				ASELLUS SP.	319	3.0	1.17	2.3
				HYALLELA AZTECA (SAUSSURE)	426	4.0	0.32	0.6
				STENONEMA SP.	638	5.9	0.32	0.6
				COENAGRIONIDAE	106	1.0	0.53	1.1
				HYDROPSYCHIDAE (EARLY INSTAR)	1064	9.9	1.06	2.1
				CHEUMATOPSYCHE SP.	5214	48.5	37.45	74.7
				HYDROPSYCHE SP.	106	1.0	1.17	2.3
				POTAMYIA FLAVA (HAGEN)	1702	15.8	5.75	11.5
				NEURECLIPSIS SP.	319	3.0	0.96	1.9
				CHIRONOMIDAE	745	6.9	1.28	2.5
				TOTAL INVERTEBRATES	10746	100.0	50.11	100.0
24	5	7	9-24-78	TRICHLADIDA	43	1.2	0.34	1.3
				ASELLUS SP.	43	1.2	0.06	0.2
				HYALLELA AZTECA (SAUSSURE)	43	1.2	0.09	0.3
				BAETIS SP.	170	4.9	0.60	2.4
				CAENIS SP.	85	2.4	0.17	0.7
				HEXAGENIA SP.	128	3.7	1.11	4.4

APPENDIX J. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER,
POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
29	5	7	9-24-76	STENONEMA SP.	95	2.4	0.13	0.5
				CHEUMATOPSYCHIDAE (EARLY INSTAR)	43	1.2	0.21	0.8
				HYDROPSYCHIDAE (EARLY INSTAR)	43	1.2	0.09	0.3
				CHEUMATOPSYCHE SP.	1575	45.1	14.51	57.4
				HYDROPSYCHE SP.	511	14.6	2.26	8.9
				POTAMYIA FLAVA (HAGEN)	383	11.0	3.11	12.3
				HYDROPSYCHIDAE PUPAE	213	6.1	2.43	9.6
				ELMIDAE	43	1.2	0.09	0.3
				CHIRONOMIDAE	43	1.2	0.13	0.5
				CHIRONOMIDAE PUPAE	43	1.2	0.01	0.0
				TOTAL INVERTEBRATES	3490	100.0	25.29	100.0
29	5	8	9-23-76	OLIGOCHAETA	11	2.2	0.00	0.0
				ASELLUS SP.	11	2.2	0.02	0.9
				HYDROPSYCHIDAE (EARLY INSTAR)	85	17.8	0.05	2.0
				CHEUMATOPSYCHE SP.	96	20.0	0.27	10.2
				HYDROPSYCHE SP.	160	33.3	1.64	62.5
				POTAMYIA FLAVA (HAGEN)	74	15.6	0.20	7.7
				HYDROPSYCHIDAE PUPAE	43	8.9	0.44	16.7
				TOTAL INVERTEBRATES	479	100.0	2.62	100.0
29 4/	6		9-25-76	NONE	0	0.0	0.00	0.0

APPENDIX J. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER, POOL 13, UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
2,4/	6	[illegible]	9-2[illegible]-75	NONE	0	0.0	0.00	0.0
30	5	[illegible]	10-12-78	TRICLADIDA	340	3.4	0.60	1.5
				OLIGOCHAETA	85	0.8	0.00	0.0
				STENONEMA SP.	85	0.8	0.09	0.2
				HYDROPSYCHIDAE (EARLY INSTAR)	511	5.0	0.17	0.4
				CHEUMATOPSYCHE SP.	1532	15.1	6.47	16.5
				HYDROPSYCHE SP.	2468	24.4	1.19	3.0
				POTAMYIA FLAVA (HAGEN)	4341	42.9	26.22	67.0
				HYDROPSYCHIDAE PUPAE	426	4.2	3.75	9.6
				ELMIDAE	85	0.8	0.17	0.4
				CHIRONOMIDAE	255	2.5	0.51	1.3
				TOTAL INVERTEBRATES	10129	100.0	39.16	100.0
30	5	[illegible]	10-12-78	OLIGOCHAETA	85	1.3	0.00	0.0
				STENONEMA SP.	426	6.5	0.43	1.2
				HYDROPSYCHIDAE (EARLY INSTAR)	255	3.9	0.17	0.5
				CHEUMATOPSYCHE SP.	2213	33.8	9.19	26.3
				HYDROPSYCHE SP.	596	9.1	2.21	6.3
				POTAMYIA FLAVA (HAGEN)	2468	37.7	14.13	40.4
				HYDROPSYCHIDAE PUPAE	255	3.9	4.34	12.4
				NEURECLIPSIS SP.	85	1.3	4.34	12.4

APPENDIX J. CONTINUED.
NUMBER AND BIOMASS PER SQUARE METER OF MACROINVERTEBRATES COLLECTED WITH A MULTIPLE-PLATE SAMPLER.
POOL 13. UPPER MISSISSIPPI RIVER (REFER TO FIGURE 1 FOR LOCATIONS).

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	TAXON	NUMBER	PERCENT OF TOTAL	BIOMASS (G)	PERCENT OF TOTAL
30	5	3	10-12-73	ELMIDAE	85	1.3	0.17	0.5
				CHIRONOMIDAE	85	1.3	0.00	0.0
				TOTAL INVERTEBRATES	6554	100.0	34.99	100.0
30	6	[illegible]	10- 3-73	NONE	0	0.0	0.00	0.0
30	6	3	10- 3-73	OLIGOCHAETA	85	1.5	0.00	0.0
				BAETIS SP.	85	1.5	0.34	0.9
				HYDROPSYCHIDAE (EARLY INSTAR)	340	6.2	0.60	1.5
				CHEUMATOPSYCHE SP.	511	9.2	4.77	12.3
				HYDROPSYCHE SP.	596	10.8	2.89	7.5
				POTAMYIA FLAVA (HAGEN)	3064	55.4	24.86	64.3
				HYDROPSYCHIDAE PUPAE	511	9.2	4.43	11.5
				ELMIDAE	85	1.5	0.60	1.5
				CHIRONOMIDAE	255	4.6	0.17	0.4
				TOTAL INVERTEBRATES	5533	100.0	38.64	100.0
31 4/	5	7	9-23-73	NONE	0	0.0	0.00	0.0
31 4/	5	8	9-23-73	NONE	0	0.0	0.00	0.0
31 4/	6	7	9-24-73	NONE	0	0.0	0.00	0.0
31 4/	6	8	9-24-73	NONE	0	0.0	0.00	0.0

1/ WING DAM 25, 26, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = 90 DEG.- 7.62M; 2 = 45 DEG.- 7.62M; 3 = 90 DEG.- 38.10M; 4 = 135 DEG.- 22.86M;
5 = INSIDE TRANSECT; 6 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 7 = UPSTREAM AND 8 = DOWNSTREAM.
4/ No Sample

APPENDIX K. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB. HYDROGRAPHIC RELIEF SITES, POOL 13, UPPER MISSISSIPPI RIVER.

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	PARTICLE SIZE (MM) SAND .0625	.125	.25	.5	1.0	GRAVEL 2.0	4.0	8.0	16.0
25	1	4	6-21-78	24.5	1.4	10.3	30.9	20.8	3.3	2.7	3.4	2.3	0.0
25	1	5	6-21-78	56.7	3.7	15.3	17.5	3.5	1.1	0.0	0.0	0.0	0.0
25	2	4	6-21-78	24.5	1.9	22.9	35.8	9.7	1.1	0.1	0.0	0.0	0.0
25	2	5	6-21-78	2.5	0.1	5.8	52.3	30.3	7.5	1.5	0.0	0.0	0.0
25	3	4	6-21-78	2.5	0.1	3.9	52.1	31.5	6.8	2.6	0.5	0.0	0.0
25	3	5	6-21-78	12.0	0.2	14.8	59.5	9.5	0.8	0.9	1.4	0.0	0.0
26	1	4	6-21-78	2.8	0.1	4.7	78.3	13.0	0.6	0.2	0.5	0.0	0.0
26	1	5	6-21-78	28.1	0.6	11.4	47.3	11.6	1.0	0.0	0.0	0.0	0.0
26	2	4	6-21-78	94.6	1.7	2.0	1.1	0.3	0.2	0.0	0.0	0.0	0.0
26	2	5	6-21-78	52.2	2.4	7.7	18.0	15.8	3.9	0.1	0.0	0.0	0.0
26	3	4	6-21-78	50.3	2.9	8.5	4.3	24.3	4.3	4.5	0.2	0.0	0.0
26	3	5	6-21-78	31.0	0.6	2.3	10.0	5.5	0.6	0.0	0.0	0.0	0.0
28	1	4	6-21-78	13.5	0.1	5.1	66.3	13.3	0.7	0.3	0.3	0.0	0.0
28	1	5	6-21-78	1.0	0.1	4.6	59.2	26.0	4.0	2.0	0.7	1.9	0.0
28	2	4	6-21-78	43.4	0.6	3.1	36.3	15.5	0.6	0.1	0.0	0.0	0.0
28	2	5	6-21-78	60.9	1.3	8.5	26.0	2.7	0.4	0.2	0.0	0.0	0.0
28	3	4	6-21-78	72.9	1.2	4.6	8.0	12.7	0.5	0.1	0.0	0.0	0.0
28	3	5	6-21-78	40.0	0.9	13.2	43.2	2.5	0.1	0.0	0.0	0.0	0.0
29	1	4	6-22-78	57.1	1.7	13.7	24.5	2.5	0.5	0.0	0.0	0.0	0.0
29	1	5	6-23-78	42.7	0.3	4.2	44.4	7.9	0.7	0.0	0.0	0.0	0.0

APPENDIX N. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (IN.RAM 1971) COLLECTED WITH A PONAR GRAB, HYDROGRAPHIC RELIEF SITES, POOL 13, UPPER MISSISSIPPI RIVER.

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	SAND .0625	SAND .125	SAND .25	SAND .5	SAND 1.0	GRAVEL 2.0	GRAVEL 4.0	GRAVEL 8.0	GRAVEL 16.0
29	2	4	6-23-78	82.5	2.2	5.4	7.7	1.8	0.4	0.0	0.0	0.0	0.0
29	2	5	6-23-78	2.9	0.1	8.4	65.5	20.9	1.9	0.4	0.0	0.0	0.0
29	3	4	6-23-78	93.4	1.2	1.1	3.2	1.1	0.1	0.0	0.0	0.0	0.0
29	3	5	6-23-78	14.4	0.3	7.6	37.7	20.5	2.0	2.7	3.9	10.9	0.0
30 4/	1	4	6-23-78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	1	5	6-23-78	4.4	0.2	1.0	16.5	39.2	26.6	11.0	1.1	0.0	0.0
30	2	4	6-23-78	3.1	0.2	8.1	58.9	22.3	5.4	1.9	0.2	0.0	0.0
30	2	5	6-23-78	3.5	0.1	6.5	65.5	19.7	2.8	1.5	0.1	0.0	0.0
30	3	4	6-23-78	2.8	0.2	4.2	73.4	18.2	0.7	0.2	0.2	0.0	0.0
30	3	5	6-23-78	2.9	0.1	2.5	66.0	26.9	1.3	0.5	0.0	0.0	0.0
31	1	4	6-23-78	3.0	0.3	2.1	23.0	34.6	5.5	10.9	2.2	6.5	12.0
31	1	5	6-23-78	21.2	0.2	4.0	55.3	15.6	2.5	0.3	0.0	0.0	0.0
31	2	4	6-23-78	3.0	0.1	3.1	29.5	46.4	12.8	3.5	0.3	1.3	0.0
31	2	5	6-23-78	3.1	0.3	2.4	22.0	51.4	15.5	4.2	1.1	0.0	0.0
31	3	4	6-23-78	2.3	1.2	6.9	60.7	26.9	1.8	0.3	0.0	0.0	0.0
31	3	5	6-23-78	2.5	0.2	12.3	73.2	10.8	0.4	0.2	0.2	0.0	0.0
25	1	4	8- 7-78	3.4	0.2	8.6	39.0	45.2	2.3	0.2	0.0	0.0	0.0
25	1	5	8- 7-78	2.3	0.4	16.0	49.9	28.1	2.5	0.2	0.0	0.0	0.0
25	2	4	8- 7-78	28.1	1.3	22.9	36.2	9.7	1.1	0.1	0.0	0.0	0.0
25	2	5	8- 7-78	13.7	2.1	12.7	52.9	8.4	0.2	0.0	0.0	0.0	0.0
25	3	4	8- 7-78	2.4	0.1	0.4	14.7	60.4	17.4	3.3	0.9	0.5	0.0

APPENDIX H. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB, HYDROGRAPHIC RELIEF SITES, POOL 13, UPPER MISSISSIPPI RIVER.

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	PARTICLE SIZE (MM) SAND .0625	.125	.25	.5	1.0	GRAVEL 2.0	4.0	8.0	16.0
25	1	5	6- 7-78	7.5	0.1	10.1	56.4	21.9	5.6	3.1	0.3	0.0	0.0
26	1	4	6- 5-78	57.2	3.7	15.1	17.6	4.7	2.6	0.7	0.0	0.0	0.0
26	1	5	6- 5-78	1.8	0.1	19.1	69.0	8.9	0.3	0.6	0.2	0.0	0.0
26	2	4	6- 5-78	75.9	3.4	13.1	2.0	5.2	0.2	0.7	0.0	0.0	0.0
26	2	5	6- 5-78	2.0	0.2	6.9	44.8	44.8	1.4	0.0	0.0	0.0	0.0
26	3	4	6- 5-78	3.2	0.5	14.8	54.4	25.1	1.5	0.0	0.0	0.0	0.0
26	3	5	6- 5-78	91.6	1.4	7.4	6.9	2.0	0.3	0.0	0.0	0.0	0.0
28	1	4	6- 5-78	2.8	0.1	5.2	70.8	19.5	1.5	0.1	0.0	0.0	0.0
28	1	5	6- 5-78	19.9	0.2	3.3	57.4	17.0	2.1	0.1	0.0	0.0	0.0
28	2	4	6- 5-78	1.1	0.7	7.2	70.5	16.2	3.4	1.5	0.0	0.0	0.0
28	2	5	6- 5-78	1.0	0.1	4.0	69.2	20.5	3.8	1.5	0.0	0.0	0.0
28	3	4	6- 5-78	2.2	0.3	8.7	71.9	16.7	0.3	0.0	0.0	0.0	0.0
28	3	5	6- 5-78	3.0	0.3	29.0	62.0	5.6	0.1	0.0	0.0	0.0	0.0
29 4/	1	4	6- 5-78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	1	5	6- 5-78	15.1	0.1	5.4	72.9	0.1	2.8	0.6	0.0	0.0	0.0
29	2	4	6- 5-78	35.0	1.1	5.8	6.7	0.9	0.2	0.7	0.0	0.0	0.0
29	2	5	6- 5-78	2.4	0.2	9.6	51.2	29.9	4.3	2.1	0.3	0.0	0.0
29	3	4	6- 5-78	62.4	0.6	3.3	19.2	9.5	2.4	2.3	0.2	0.0	0.0
29	3	5	6- 5-78	2.6	0.5	16.6	64.4	13.9	1.3	0.7	0.0	0.0	0.0
30	1	4	6- 5-78	1.7	0.1	3.7	53.3	37.0	3.2	1.0	0.1	0.0	0.0
30	1	5	6- 5-78	2.6	0.1	3.9	59.9	31.4	1.8	0.3	0.0	0.0	0.0

APPENDIX K. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB, HYDROGRAPHIC RELIEF SITES, POOL 13, UPPER MISSISSIPPI RIVER.

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	SAND .0625	SAND .125	SAND .25	SAND .5	SAND 1.0	GRAVEL 2.0	GRAVEL 4.0	GRAVEL 8.0	GRAVEL 16.0
30	2	4	8- 5-78	56.9	2.6	16.7	19.4	3.5	0.8	0.1	0.0	0.0	0.0
30	2	5	8- 5-78	1.5	0.5	34.1	54.3	6.7	0.5	0.3	0.0	0.8	1.2
30	3	4	8- 5-78	2.0	0.0	2.2	45.2	44.8	4.7	0.9	0.1	0.0	0.0
30	3	5	8- 5-78	7.9	0.1	1.9	70.0	23.6	1.0	0.3	0.3	0.0	0.0
31	1	4	8- 4-78	1.7	0.1	10.1	49.7	21.9	3.7	2.9	2.9	0.0	6.9
31	1	5	8- 4-78	2.5	0.0	7.2	57.4	24.8	4.6	2.4	1.2	0.0	0.0
31	2	4	8- 4-78	2.7	0.2	7.2	47.2	36.5	5.1	1.0	0.1	0.0	0.0
31	2	5	8- 4-78	2.5	0.1	5.9	64.9	23.6	1.3	1.0	0.7	0.0	0.0
31	3	4	8- 4-78	2.7	0.2	6.1	46.0	34.1	8.3	2.5	0.2	0.0	0.0
31	3	5	8- 4-78	2.5	0.1	1.7	38.0	49.3	7.1	1.2	0.2	0.0	0.0
25	1	4	9-30-78	24.6	1.4	10.2	30.9	20.8	3.3	2.7	3.4	2.9	0.0
25	1	5	9-30-78	1.6	0.9	4.5	41.1	49.1	2.6	0.2	0.0	0.0	0.0
25	2	4	9-30-78	39.9	4.8	21.3	30.3	3.1	0.2	0.1	0.0	0.0	0.0
25	2	5	9-30-78	13.7	2.1	12.7	62.9	8.4	0.2	0.0	0.0	0.0	0.0
25	3	4	9-30-78	0.4	0.2	2.9	26.1	59.2	6.4	2.2	2.6	0.0	0.0
25	3	5	9-30-78	2.5	0.1	10.1	56.4	21.9	5.7	3.1	0.3	0.0	0.0
26	1	4	9-30-78	43.4	2.3	12.9	26.9	11.9	1.8	0.8	0.0	0.0	0.0
25	1	5	9-30-78	4.6	0.3	17.6	69.9	10.5	0.6	0.3	0.0	0.0	0.0
26	2	4	9-30-78	34.1	5.7	7.9	1.7	0.3	0.2	0.1	0.0	0.0	0.0
26	2	5	9-30-78	10.4	0.5	11.1	67.0	10.6	0.2	0.1	0.0	0.0	0.0
25	3	4	9-30-78	58.8	9.2	14.6	14.6	2.5	0.2	0.1	0.0	0.0	0.0

APPENDIX K. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB, HYDROGRAPHIC RELIEF SITES, POOL 13, UPPER MISSISSIPPI RIVER.

				PARTICLE SIZE (MM)									
WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT <.0625	SAND .0625	.125	.25	.5	1.0	GRAVEL 2.0	4.0	8.0	16.0
26	3	5	9-30-78	5.8	0.0	9.8	45.0	34.0	3.2	0.1	0.0	0.0	0.0
28	1	4	10- 2-78	71.5	0.1	0.2	18.9	8.7	0.6	0.0	0.0	0.0	0.0
28	1	5	10- 2-78	75.2	0.0	0.1	7.6	16.0	0.8	0.3	0.0	0.0	0.0
28	2	4	10- 2-78	27.3	0.9	5.6	51.0	13.9	0.9	0.1	0.0	0.0	0.0
28	2	5	10- 2-78	20.0	0.7	20.9	56.6	1.9	0.1	0.0	0.0	0.0	0.0
28	3	4	10- 2-78	11.2	1.4	32.7	52.2	2.4	0.0	0.1	0.1	0.0	0.0
28	3	5	10- 2-78	21.1	2.0	15.3	47.5	12.0	0.4	0.1	0.0	0.0	0.0
29	1	4	10- 2-78	37.1	1.8	9.8	44.3	5.7	0.5	0.5	0.0	0.0	0.0
29	1	5	10- 2-78	24.9	1.5	10.6	44.0	9.9	3.8	3.9	1.1	1.0	0.0
29	2	4	10- 2-78	3.3	1.4	52.4	40.1	2.3	0.1	0.0	0.0	0.0	0.0
29	2	5	10- 2-78	91.9	4.0	1.7	1.5	0.5	0.2	0.0	0.0	0.0	0.0
29	3	4	10- 2-78	13.5	1.1	11.6	22.3	5.4	2.1	20.4	20.4	2.5	0.6
29	3	5	10- 2-78	4.6	0.3	4.6	59.7	14.7	2.1	2.6	2.9	8.9	0.0
30	1	4	10- 2-78	2.9	0.1	4.6	52.9	34.3	4.4	0.6	0.1	0.0	0.0
30	1	5	10- 2-78	1.2	0.0	2.2	65.3	28.4	2.0	0.6	0.2	0.0	0.0
30	2	4	10- 2-78	3.5	0.1	12.5	57.6	23.1	2.8	0.4	0.0	0.0	0.0
30	2	5	10- 2-78	2.3	0.2	10.4	55.5	10.8	0.8	2.6	4.6	10.5	2.3
30	3	4	10- 2-78	11.4	0.2	1.6	32.0	35.6	10.3	2.9	0.3	2.5	0.0
30	3	5	10- 2-78	5.3	0.1	3.3	51.8	33.4	5.1	0.8	0.2	0.0	0.0
31	1	4	10- 3-78	4.4	0.3	6.2	19.5	9.4	4.4	9.3	11.2	23.6	11.7
31 4/	1	5	10- 3-78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

APPENDIX K. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB, HYDROGRAPHIC RELIEF SITES, POOL 13, UPPER MISSISSIPPI RIVER.

WING DAM OR SIDE CHANNEL 1/	SAMPLE SITE 2/	ORIENTATION TO WING DAM 3/	DATE	CLAY-SILT < .0625	PARTICLE SIZE (MM) SAND .0625	.125	.25	.5	1.0	GRAVEL 2.0	4.0	8.0	16.0
31	2	4	10- 3-78	3.4	0.2	5.4	22.7	24.9	9.4	12.5	5.0	8.9	3.7
31	2	5	10- 3-78	3.0	0.1	6.3	48.0	36.3	5.5	0.9	0.0	0.0	0.0
31	3	4	10- 3-78	1.3	0.1	12.1	39.1	29.7	12.4	4.8	0.1	0.0	0.0
31	3	5	10- 3-78	24.3	0.2	6.2	36.9	27.5	6.7	6.1	1.2	0.9	0.0
25	1	4	5- 6-79	62.8	1.3	2.9	15.0	15.3	0.9	0.2	0.0	0.0	0.0
25	1	5	5- 6-79	1.0	0.1	2.3	34.2	52.1	7.7	2.3	0.2	0.0	0.0
25	2	4	5- 6-79	3.7	0.0	26.3	68.2	1.6	0.1	0.0	0.0	0.0	0.0
25	2	5	5- 6-79	8.0	0.4	8.2	77.4	5.5	0.2	0.7	0.1	0.0	0.0
25	3	4	5- 6-79	4.5	0.2	2.4	35.9	36.1	13.6	5.6	1.7	0.0	0.0
25	3	5	5- 6-79	10.2	0.5	12.8	57.3	16.5	1.2	1.0	0.0	0.0	0.0
26 4/	1	4	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26 4/	1	5	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26 4/	2	4	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26 4/	2	5	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26 4/	3	4	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26 4/	3	5	6- 6-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	1	4	6- 6-79	5.3	0.5	15.8	62.1	7.1	1.5	1.2	1.2	2.4	2.9
23	1	5	6- 6-79	6.5	0.1	6.4	65.1	15.3	2.2	1.1	0.3	0.0	0.0
23	2	4	6- 6-79	23.5	0.1	10.3	50.1	14.7	1.1	0.1	0.0	0.0	0.0
23	2	5	5- 6-79	7.0	0.1	3.0	62.4	24.0	2.4	0.7	0.0	0.0	0.0
23	3	4	6- 6-79	64.0	7.9	11.2	11.0	5.3	0.3	0.2	0.0	0.0	0.0

APPENDIX K. CONTINUED. PARTICLE SIZE FRACTIONS AS PERCENT TOTAL IN 100 GRAM SAMPLES (INGRAM 1971) COLLECTED WITH A PONAR GRAB. HYDROGRAPHIC RELIEF SITES, POOL 13, UPPER MISSISSIPPI RIVER.

					PARTICLE SIZE (MM)								
WING DAM OR	SAMPLE	ORIENTATION		CLAY-SILT	SAND					GRAVEL			
SIDE CHANNEL 1/	SITE 2/	TO WING DAM 3/	DATE	< .0625	.0625	.125	.25	.5	1.0	2.0	4.0	8.0	16.0
28	3	5	6- 6-79	47.0	0.7	14.3	33.1	4.1	0.3	0.3	0.0	0.0	0.0
29	1	4	6- 7-79	4.2	0.9	11.0	21.6	10.2	7.7	6.0	8.4	13.9	16.1
29	1	5	6- 7-79	2.7	0.5	10.9	33.9	24.4	19.0	6.5	2.1	0.0	0.0
29	2	4	6- 7-79	75.6	2.7	15.5	5.0	0.7	0.3	0.1	0.1	0.0	0.0
29	2	5	6- 7-79	21.8	0.9	22.5	46.0	7.7	0.6	0.3	0.2	0.0	0.0
29	3	4	6- 7-79	17.1	1.6	4.8	53.0	21.8	1.6	0.0	0.0	0.0	0.0
29	3	5	6- 7-79	26.0	0.3	7.5	57.9	3.5	2.6	0.8	0.2	0.0	0.0
30	1	4	6- 7-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	1	5	6- 7-79	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	2	4	6- 7-79	1.4	0.1	7.5	60.4	25.4	3.5	1.7	0.4	0.0	0.0
30	2	5	6- 7-79	0.7	0.1	4.5	57.7	30.1	5.5	1.1	0.3	0.0	0.0
30	3	4	6- 7-79	0.7	0.1	6.9	80.7	8.4	0.8	0.9	1.5	0.0	0.0
30	3	5	6- 7-79	17.1	0.3	2.8	58.4	16.2	4.0	0.7	0.5	0.0	0.0
31	1	4	6- 7-79	10.6	0.2	2.4	41.2	36.7	5.1	2.5	1.3	0.0	0.0
31	1	5	6- 7-79	55.3	0.9	7.0	22.4	12.1	1.4	0.4	0.2	0.0	0.0
31	2	4	6- 7-79	4.3	0.6	11.0	39.4	15.2	4.3	4.9	6.0	7.4	6.9
31	2	5	6- 7-79	4.2	0.2	0.6	27.9	13.7	49.3	4.0	0.0	0.0	0.0
31	3	4	6- 7-79	3.8	0.2	4.4	55.3	28.1	5.2	1.6	1.4	0.0	0.0
31	3	5	6- 7-79	25.0	0.2	7.5	48.6	15.8	1.9	0.7	0.0	0.2	0.0

1/ WING DAM 25, 26, 28, 29, 30, 31 OR SIDE CHANNEL 9 = UPSTREAM, 10 = MIDDLE, 11 = DOWNSTREAM.
2/ SAMPLE SITE 1 = INSIDE TRANSECT, 2 = MIDDLE TRANSECT, 3 = OUTSIDE TRANSECT.
3/ ORIENTATION TO WING DAM 4 = UPSTREAM AND 5 = DOWNSTREAM.
4/ No Sample

Appendix L. Mean yearly discharge in thousands entering Pool 13 from Lock and Dam 12, 1970-1979, Upper Mississippi River. Data were obtained from G.E. Johnson, Chief of Hydraulics, U.S. Army Corps of Engineers, Rock Island, Illinois.

Year	M^3/s	Ft^3/s
1970	1.1	38.9
1971	1.4	49.6
1972	1.7	58.9
1973	1.9	65.5
1974	1.3	46.4
1975	1.4	50.1
1976	0.9	33.2
1977	0.8	27.3
1978	1.3	46.7
1979	1.7	61.6
Mean	1.4	47.8

Appendix M. Mean monthly discharge in thousands entering Pool 13 from Lock and Dam 12, January 1978 to December 1979, Pool 13, Upper Mississippi River. Data were obtained from G.E. Johnson, Chief of Hydraulics, U.S. Army Corps of Engineers, Rock Island, Illinois.

	1978		1979	
	M^3/s	Ft^3/s	M^3/s	Ft^3/s
January	0.9	32.4	0.6	22.0
February	0.7	24.1	0.7	24.0
March	1.0	34.9	1.9	66.0
April	2.6	92.5	3.9	136.3
May	1.7	58.8	3.8	135.7
June	1.8	63.2	2.3	80.5
July	2.7	94.2	1.8	65.0
August	1.3	45.4	1.6	56.1
September	1.8	63.0	1.4	49.7
October	1.1	39.9	1.0	34.8
November	0.9	32.1	1.6	54.8
December	0.7	25.1	1.0	34.2

Appendix N. Results of Mann-Whitney tests of bottom current velocities (cm/s) at benthos stations in the side channel and wing dams and Wilcoxon paired-sample test of velocities at stations upstream and downstream of the wing dams, Pool 13, Upper Mississippi River, 1978 (refer to Figure 1 for locations). Only stations located nearest to the Illinois bank were used for comparison of velocities upstream vs. downstream of the wing dams. Station 30-6-7 in August 1978 was eliminated because of an erroneous velocity value (Appendix F-2).

Site		U	n_1, n_2
Side channel[a]	vs. wing dam 25	67.0	9, 12
[a]	vs. wing dam 26	63.0	9, 12
	vs. wing dam 28[a]	60.0	9, 12
	vs. wing dam 29[a]	91.5**	9, 12
	vs. wing dam 30[a]	85.0**	9, 11
	vs. wing dam 31[a]	103.0**	9, 12
Wing dam 25[a]	vs. wing dam 26	75.0	12, 12
	vs. wing dam 28[a]	105.5	12, 12
	vs. wing dam 29[a]	130.0**	12, 12
	vs. wing dam 30[a]	119.0**	12, 11
	vs. wing dam 31[a]	139.5**	12, 12
Wing dam 26	vs. wing dam 28[a]	93.0	12, 12
	vs. wing dam 29[a]	122.5**	12, 12
	vs. wing dam 30[a]	115.0*	12, 11
	vs. wing dam 31[a]	137.5**	12, 12
Wing dam 28	vs. wing dam 29[a]	112.5*	12, 12
	vs. wing dam 30[a]	105.5*	12, 11
	vs. wing dam 31[a]	133.0**	12, 12
Wing dam 29[a]	vs. wing dam 30	73.0	12, 11
	vs. wing dam 31[a]	87.5	12, 12
Wing dam 30	vs. wing dam 31[a]	94.5	11, 12
		T	n
Upstream vs. Downstream		49.0	18

[a]Larger U statistic of the pair (Zar 1974)
*$p < 0.05$
**$p < 0.01$

Appendix O. Spearman's rank correlation coefficients for factors affecting benthic invertebrate density, biomass, and number of taxa, 1978. Dependent variables were: density/m^2, biomass(g)m^2, and number of taxa. Independent variables were: % silt-clay, % sand, % gravel, median particle size, and bottom current velocity (cm/s). Only invertebrates with densities greater than 25 individuals/m^2 in 1978 were included in the analysis.

	% silt-clay	% sand	% gravel	Median particle size	Velocity
Total Invertebrates					
Density	0.557**	-0.485**	-0.085	-0.352**	-0.215
Biomass	0.578**	-0.538**	-0.018	-0.393**	-0.243*
Taxa	0.613**	-0.551**	0.063	-0.284*	-0.292*
Ologochaeta					
Density	0.657**	-0.515**	-0.053	-0.283*	-0.227*
Biomass	0.625**	-0.480**	-0.164	-0.390**	-0.224*
Hexagenia sp.					
Density	0.701**	-0.620**	-0.165	-0.528**	-0.362**
Biomass	0.706**	-0.625**	-0.173	-0.541**	-0.329**
Chironomidae					
Density	0.293**	-0.248*	-0.004	-0.074	-0.049
Biomass	0.502**	-0.441**	-0.002	-0.164	-0.144

*$p \leq 0.05$, 77 df

**$p \leq 0.01$, 77 df

Appendix P. Results of Mann-Whitney tests of benthic invertebrate density and biomass (g) per m^2 and number of taxa from the side channel and wing dams and Wilcoxon paired-sample tests of invertebrate density and biomass (g) per m^2 and number of taxa from stations upstream and downstream of the wing dams, Pool 13, Upper Mississippi River, 1978 (refer to Figure 1 for locations). Only stations located nearest to the Illinois bank were used for comparisons of density, biomass, and number of taxa.

Site		Density		Biomass		Taxa	
		d	n_1, n_2	d	n_1, n_2	U	n_1, n_2
Side channel	vs. wing dam 25	-2.92**	27, 36	-3.03**	27, 36	64.0	9, 12[a]
	vs. wing dam 26	0.27	27, 36	1.02	27, 36	72.5	9[a], 12
	vs. wing dam 28	2.69**	27, 36	2.99**	27, 36	86.5*	9[a], 12
	vs. wing dam 29	1.46	27, 36	2.24*	27, 36	71.0	9[a], 12
	vs. wing dam 30	2.59**	27, 36	2.74**	27, 36	84.5*	9[a], 12
	vs. wing dam 31	2.95**	27, 30	2.75**	27, 30	63.5	9[a], 10
Wing dam 25	vs. wing dam 26	3.53**	36, 36	3.74**	36, 36	103.5	12[a], 12
	vs. wing dam 28	5.92**	36, 36	5.55**	36, 36	124.0**	12[a], 12
	vs. wing dam 29	4.99**	36, 36	4.72**	36, 36	111.0*	12[a], 12
	vs. wing dam 30	5.61**	36, 36	5.30**	36, 36	121.0**	12[a], 12
	vs. wing dam 31	5.64**	36, 30	4.95**	36, 30	97.5*	12[a], 10
Wing dam 26	vs. wing dam 28	2.61**	36, 36	2.34*	36, 36	99.5	12[a], 12
	vs. wing dam 29	1.16	36, 36	1.23	36, 36	73.0	12[a], 12
	vs. wing dam 30	2.42*	36, 36	2.07*	36, 36	105.5	12[a], 12
	vs. wing dam 31	2.95**	36, 30	2.11*	36, 30	65.5	12[a], 10

Appendix P. (continued)

Site		Density		Biomass		Taxa	
		d	n_1, n_2	d	n_1, n_2	U	n_1, n_2
Wing dam 28	vs. wing dam 29	-1.85	36, 36	-1.70	36, 36	99.0	12, 12[a]
	vs. wing dam 30	-0.40	36, 36	-0.28	36, 36	75.0	12[a], 12
	vs. wing dam 31	0.58	36, 30	0.06	36, 30	79.0	12, 10[a]
Wing dam 29	vs. wing dam 30	1.23	36, 36	1.47	36, 36	97.5	12[a], 12
	vs. wing dam 31	1.92	36, 30	1.54	36, 30	64.5	12[a], 10
Wing dam 30	vs. wing dam 31	-2.00*	36, 30	0.21	36, 30	80.5	12, 10[a]
		T	n	T	n	T	n
Upstream vs. downstream		316**	51	377**	51	33*	17

[a]Larger statistic of the pair (Zar 1974)
*$p \leq 0.05$
**$p \leq 0.01$

Appendix Q. Results of t-tests of square-root mean total invertebrate density per m^2 and Mann-Whitney tests of total invertebrate biomass (g) per m^2 and number of taxa collected with a 252-cm^2 Ponar grab in June, August, September 1978, and June 1979, Pool 13, Upper Mississippi River (refer to Figure 1 for locations). Derived means (Quenouille 1950, Elliot 1977) for transformed counts are in Table 6.

	Density		Biomass		Taxa	
Months	t	df	d	n_1, n_2	d	n_1, n_2
June 1978 vs. August 1978	3.52**	160	5.16**	81, 81	3.24**	27, 27
vs. September 1978	1.09	154	1.53	81, 75	-0.47	27, 25
vs. June 1979	0.76	148	1.41	81, 69	1.46	27, 23
August 1978 vs. September 1978	-2.33*	154	-3.71**	81, 75	-3.59**	27, 25
vs. June 1979	-3.09**	148	-4.61**	81, 69	-2.05*	27, 23
September 1978 vs. June 1979	0.43	142	0.31	75, 69	1.85	25, 23

*$p \leq 0.05$

**$p \leq 0.01$