Journal of the Iowa Academy of Science: JIAS

Volume 95 | Number | Article 8

1988

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Jour. Iowa Acad. Sci. 95(2):60-65, 1988

Benthic Macroinvertebrate Habitat Associations of the Channelized Middle Missouri River[1]

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Benthic macroinvertebrates associated with navigation structures (dikes, dike pools, revetted banks) and abandoned channels on the Missouri River at the Iowa-Nebraska border were sampled in June, August, and October 1983 to determine the invertebrate community structure of these habitats. Invertebrate densities were greatest in the abandoned channel habitat (to over 13,000/m^2), while diversities were greatest in the dike and revetment habitats. Greater habitat diversity contributed to greater organism diversity in the dike and revetment habitats while sediment homogeneity and stability presumably contributed to greater organism densities in the abandoned channel habitat. Dike pools had turbulent eddy currents, which constantly stirred bottom sediments and provided a marginal habitat for invertebrate colonization. Burrowing aquatic worms, midges, and mayflies characterized abandoned channels, whereas dikes and revetments were dominated by clinging caddisflies, mayflies, and *Hydra,* although worms and midges were associated with interstitial sediments. Dike pools were depauperate areas dominated by immature worms.

INDEX DESCRIPTORS: Aquatic fauna, benthos, invertebrates, Missouri River

Channelization and dam construction on the Missouri River have resulted in a shorter, narrower channel with reduced fluctuations in flow rates (Funk and Robinson 1974, Hallberg et al. 1979). Other modifications include dikes, built perpendicular to the water flow, that cut off side channels, contract channel width, and prevent bank erosion on the inside of the channel; revetments constructed on the outside of river bends parallel to the flow, that maintain channel alignment and stabilize banks; and the formation of abandoned channels that are essentially lentic habitats connected to the main channel, at least during high river discharge. Although there are few abandoned channels, most of the river shoreline supports either dike fields or revetments. Thus, the Missouri River is greatly modified by control structures from Sioux City, Iowa, to its confluence with the Mississippi River.

Before impoundment, flooding typically occurred twice a year in the river valley. Spring flooding resulted from snow-melt runoff from the Plains, whereas a "June rise" was associated with melting snow in the mountains and rain in the prairie states (Russell 1965). Impoundments now moderate the flow and contain the river within its banks to a great extent (Hallberg et al. 1979). Upstream impoundments also have reduced the high turbidities characteristic of the river preceding their construction (Berner 1951, Neel et al. 1963, Todd and Bender 1982, Kallemeyn and Novotny 1977).

Because there is so little information available on the biological communities of this modified river, this study was designed to assess macroinvertebrate communities associated with dike, revetted bank, and abandoned channel habitats on a segment of the Missouri River bordered by Iowa and Nebraska. The purpose was to provide baseline information on the river and to make comparisons with similar habitats farther downstream. Methods used were the same as those used by the U.S. Army Engineer Waterways Experiment Station (WES) in their earlier studies on the lower Mississippi River.

STUDY AREA

This study was conducted on the Missouri River between river miles 661 and 678 near Onawa, Iowa. Two dike fields (DF) were chosen for study, one between river miles 676.5 and 678 on the west bank (DF1) and the other between river miles 670 and 673 on the east bank (DF2). DF1 consisted of 10 stonefill dikes and associated pools, with the field about 1.6 km long. DF2 consisted of 19 stonefill dikes along 3.5 km of river. Detailed maps of the sample sites are available in Atchison et al. (1986).

The dikes extended into the river various distances (4-10 m) because of the extensive filling in with sediment around them, and all had portions extending above the surface of the water. The stone fill was composed of crushed limestone ranging in size from about 5 to 50 cm in diameter.

The dike pools varied in size, depth, and water velocity. Mean current velocity ranged from 0.2 to 1.3 m/sec. Dike pools had large eddies, with near-shore currents running contrary to the direction of the main channel flow. The dike pool at DF1 was 3 to 4 m deep while depths at DF2 ranged from 5 to 10 m. Sediments were composed primarily of sand, although fine silt occasionally was found near shore, and gravel could be found in the deepest areas.

Two revetted banks (RV) were studied, with RV1 extending about 2.3 km along the east bank across from DF1 and RV2 extending about 3.5 km along the west bank across from DF2. The revetments were constructed of crushed limestone ranging in size from about 25 to 100 cm. Mean current velocity along these revetments ranged from about 1.5 to 2.9 m/sec. However, currents within the rocky habitat actually sampled were minimal. Sampling depths were about 60 cm.

Two abandoned channel habitats (AC) also were sampled, one near river mile 671 (AC1) and the other near river mile 661 (AC2). AC1 and AC2 were shallow habitats (0.5 to 3.0 m), with sediments composed of mud and with no measurable current.

SAMPLING METHODS

Water temperature, pH, dissolved oxygen, specific conductance, and redox potential were measured at two stations in each habitat by using a Hydrolab in situ water analysis system. Profiles, consisting of readings at the surface, middepth and just above the bottom, were taken at each station where depth exceeded 0.9 m (3 ft); otherwise, only surface measurements were taken. The instruments were calibrated before sampling, and all habitats were measured on the same day, once immediately after dawn and again just before dusk. This sampling procedure was carried out the first and last days of each monthly collecting period. Water transparency was measured with a Secchi disk, and water samples for turbidity from the surface and the

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[1]Journal Paper No. J-12638 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa. Project 2465. Financed by a contract with the U.S. Army Corps of Engineers and the Iowa Cooperative Fishery Research Unit. The Unit is jointly supported by Iowa State University, the Iowa Department of Natural Resources, and the U.S. Fish and Wildlife Service.

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bottom were collected at each of the two stations in each habitat where water-quality variables were measured. Turbidity samples were immediately chilled, and after they were returned to the shore, turbidity was measured to the nearest 1 NTU with a Hach Turbidimeter (Model 2100A).

At the same times and places that water quality samples were taken, current velocity and direction were measured with an Endeco ducted impeller current meter. Profiles (surface, middepth, and just above the bottom) were taken at each station where the depth exceeded 0.9 m. The current meter was calibrated before sampling

Table 1. Mean values for water temperature, dissolved oxygen, pH, redox potential, turbidity, specific conductance, Secchi disk depth, and current velocity measured at the surface (SS), middepth (MD), and near the bottom (BS).

Month Site		Temp. (C)	Dis. Oxygen (mg/1)	pH	Redox Pot. (mv)	Turb. (NTU)	Spec. Cond. (μmho/cm)	Secchi Depth (m)	Current Vel. (m/sec)
June 1983									
Site AC1	SS	22.0	11.3	8.3	304	21.5	996	0.34	
	MD	21.5	10.3	8.3	297		998		
	BS	20.6	8.7	8.2	299		1001		
Site AC2	SS	23.4	10.0	8.2	300	17.0	1161	0.30	
Site DF1	SS	17.8	9.9	8.4	294	15.5	1013	0.28	0.85
	MD	17.8	9.5	8.2	273		1000		
	BS	17.8	9.5	8.3	275		1000		
Site DF2	SS	17.8	9.7	8.4	293	16.5	1038	0.27	1.30
	MD	18.0	9.6	8.4	275		1033		
	BS	18.0	9.6	8.4	275	17.0	1033		
Site RV1	SS	17.8	9.7	8.4	295	16.5	1069	0.26	1.59
	MD	18.0	9.9	8.2	350		1050		
	BS	18.0	10.2	8.2	350		1050		
Site RV2	SS	17.8	9.7	8.4	296	22.0	1082	0.26	1.55
	MD	17.8	9.4	8.3	272		1117		
	BS	17.8	9.4	8.4	275		1117		
August 1983									
Site AC1	SS	28.5	7.5	7.7	190	17.3	805	0.28	
	MD	28.1	4.2	7.4	193		810		
	BS	28.1	4.2	7.4	194	19.7	811		
Site AC2	SS	27.5	8.4	7.8	212	24.8	854	0.27	
Site DF1	SS	27.2	7.8	8.1	174	16.3	852	0.36	0.60
	MD	27.3	6.9	8.0	172		854		
	BS	27.3	6.8	8.0	172	16.2	854		
Site DF2	SS	27.1	7.7	8.1	196	19.3	852	0.36	0.38
	MD	27.2	7.4	8.1	194		853		
	BS	27.2	7.3	8.1	193	20.3	854		
Site RV1	SS	27.3	7.7	8.1	174	15.9	853	0.39	2.23
	MD	27.3	7.3	8.1	174		853		
	BS	27.3	7.2	8.1	174	16.4	854		
Site RV2	SS	27.2	7.8	8.1	196	17.7	852	0.38	2.86
	MD	27.3	7.4	8.0	190		853		
	BS	27.3	7.3	8.1	190	17.0	853		
October 1983									
Site AC1	SS	15.2	9.1	8.0	197	11.1	758	0.36	
	MD	15.4	8.2	8.0	201		760		
	BS	15.3	7.9	7.9	202	20.5	760		
Site AC2	SS	14.3	9.7	8.3	172	20.5	738	0.21	
Site DF1	SS	16.3	8.3	8.1	200	16.0	788	0.34	0.20
	MD	16.2	8.1	8.1	189		790		
	BS	16.2	8.1	8.1	188	17.2	790		
Site DF2	SS	16.3	8.5	8.1	208	17.3	789	0.33	0.48
	MD	16.3	8.2	8.1	202		789		
	BS	16.2	8.2	8.1	201	16.6	789		
Site RV1	SS	16.3	8.6	8.1	206	16.7	788	0.33	
	MD	16.3	8.4	8.1	205		789		
	BS	16.3	8.3	8.1	204	17.7	789		
Site RV2	SS	16.2	8.6	8.1	206	17.4	788	0.32	1.45
	MD	16.2	8.5	8.1	206	13.0	788		
	BS	16.2	8.3	8.1	204	17.1	788		

Table 2. Macroinvertebrates identified from Missouri River benthic samples.

NON-INSECTS	INSECTS	Leptophlebiidae
Acaria	Diptera	Leptophlebiidae immature
Amphipoda	Ceratopogonidae	*Paralepthophlebia*
Talitridae	Chaoboridae	Siphlonuridae
Hyalella azteca	*Chaoborus*	*Isonychia*
Bryozoa	Chironomidae	
Hirudinea	Chironomidae pupae	Hemiptera
Erpobdellidae	*Chironomus*	Corixidae immature
Erpodella	*Coelotanypus*	Odonata
Piscicolidae	*Cricotopus*	Coenagrionidae
Hydroida	*Cryptochironomus*	*Ischnura*
Hydridae	*Dicrotendipes*	*Nehalennia*
Hydra	*Glyptotendipes*	Corduliidae
Isopoda	*Hydrobaenus*	*Neurocordulia*
Ascellidae	*Larsia*	Gomphidae
Asellus	*Nanocladius*	*Gomphus*
Nematoda	*Natarsia*	Libellulidae
Oligochaeta	*Orthocladius*	*Ladona*
Naididae	*Parachironomus*	
Dero digitata	*Polypedilum*	Plecoptera
Pristina osborni	*Procladius*	Plecoptera immature
Tubificidae	*Rheotanytarsus*	Perlidae
Branchiura sowerbyi	*Robackia*	*Acroneuria*
Ilyodrilus templetoni	*Tanypus*	Perlodidae
Limnodrilus	*Tanytarsus*	*Isoperla*
L. cervix	*Thienemannimyia* group	
L. clapoaredianus	*Thienemanniella*	Trichoptera
L. hoffmeisteri	Empididae	Hydropsychidae immature
L. maumeensis	pupae	*Cheumatopsyche*
L. profundicola	*Hemrodromia*	*Hydropsyche*
L. udekemianus	Simuliidae	*Potamyia*
Tubificidae + cs (capilliform setae)	Ephemeroptera	Hydroptilidae
Tubificidae-cs	Baetidae	*Hydroptila*
Pelecypoda	Baetidae immature	*Ochotrichia*
Sphaeridae	*Baetis*	Leptoceridae
Sphaerium	Caenidae	*Ceraclea*
Pulmonata	*Branchycercus*	*Nectopsyche*
Physidae	*Caenis*	Polycentropidae
Physa	Ephemeridae	*Neureclipsis*
Planorbidae	*Hexagenia*	
Planorbula	Heptageniidae	
	Heptageniidae immature	
Tricladida	*Anepeorus*	
Planariidae	*Heptagenia*	
Dugesia	*Stenonema*	
Phagocata	*Stenacron*	

efforts.

Grain size of sediments, taken in conjunction with benthic macroinvertebrate samples from each habitat, were visually classified. The categories included: gravel; coarse sand; medium sand; fine sand; mud and fine sand; mud and coarse sand; silt; mud; mud and silt; mud and clay; clay; and clay and fine sand.

Invertebrates were sampled during three periods: 3-7 June, 8-12 August, and 6-9 October, 1983. Two dike structures in each of the two dike fields were selected for invertebrate sampling. An upstream and downstream station located near the middle of the selected dikes was sampled by using a square quadrat 0.5 m on a side with attached mesh bag (0.5-mm mesh opening). The sampler was positioned at a depth of about 60 cm; rocks within the square frame were removed to a depth of 27 cm, placed into a large metal tub, carefully brushed to remove clinging organisms, and discarded. The resulting material, along with materials captured in the bag net, were sieved and preserved. A similar sampling technique was used to collect invertebrates along the two revetted banks. Four stations along each revetted bank were sampled.

Four stations within each of four dike pools were sampled with a petite Ponar grab sampler (15.2 × 15.2 cm). The same dredge was used to sample invertebrates in the two abandoned channels using four equally spaced stations on each of four transects.

Benthic samples were sieved in the field through 0.5-mm mesh sieves and preserved in 10% buffered formalin. In the laboratory, samples were transferred to 70% ethanol and rose bengal solution for at least 48 h before sorting. Samples were later rinsed in tap water and sorted using Circline magnifying lamps (3X power). Oligochaetes and midges were mounted on microscope slides and identified under magnification to 1000X. All other invertebrates were identified with a stereomicroscopre to 100X. A reference collection of all taxa was maintained, and identification was to the lowest practical taxon (genus and species where possible).

RESULTS

General Physical and Chemical Variables

Average values for water temperature, dissolved oxygen, pH, redox potential, turbidity, specific conductance, Secchi depth, and current velocity for the various sites, depths, and months (Table 1) confirm previous observations on the Missouri River. First, the water is always turbid; turbidity measurements were usually greater than 15 NTU, and the maximum Secchi disk reading was only 0.39 m. Second, the Missouri River has high current velocities. In August average velocities were 2.23 and 2.86 m/sec near the two revetted bank stations. Velocities were 2.23 and 2.86 m/sec near the two revetted bank stations. Velocities were lower in the more protected dike fields, and the abandoned channels had no measurable currents. Dike fields and revetted bank sites were part of a well-mixed system, as shown by the almost uniform values for average temperature, dissolved oxygen, pH, redox potential, specific conductance, and turbidity. The abandoned channels were similar to the main river, but had some small differences. In June and August the specific conductance values in the abandoned channels were slightly lower than those in the other two habitats, indicating a difference in dissolved solids content. There was also some vertical chemical stratification, as shown by the dissolved oxygen measurements at site AC1 during August while site AC2 (0.5 m) was not stratified.

Bottom substrates differed among the four habitats. In the lentic abandoned channels, 81% of the samples were mud, and 13% were mud and clay. Coarse sand with mud made up another 4%. In the dike pools where currents were greater, coarser substrates were more important. Fine sand dominated in 60% of the samples. Coarse sand made up 18%; mud with fine sand 5%; silt 5%; mud 4%; and various mixtures of clay, silt, fine sand, and gravel made up an additional 5%. The samples from dikes and revetments were dominated by large rocks with various amounts of fine interstitial sediments.

Invertebrate Habitat Associations

Eighty-five taxa of aquatic invertebrates (Table 2) were identified in the four habitats sampled during the three sampling periods, a total of 192 quadrat and 48 Ponar dredge samples. A complete listing of the data are available in the report by Atchison et al. (1986). The invertebrate habitat associations were similar to those found by other researchers (Russell 1965, Morris et al. 1968, McMahon et al. 1972, Burress et al. 1982). Those taxa having average densities greater than 100 organisms/m^2 for each habitat are listed in Table 3. Table 4 lists the five most abundant taxa at each location for each monthly sampling period. The results of an analysis of variance test of total invertebrate densities in each location and month are presented in Table 5.

Abandoned Channel Habitats

The greatest densities of organisms were found in the abandoned channel habitats. The shallower site, AC2, consistently had greater densities of organisms than the deeper site. This might be related to the lower dissolved oxygen values sometimes found at site AC1. Although only 43 different taxa were found, this habitat had the greatest number of taxa with densities of 100/m^2 or greater (11). Oligochaetes and midges were most important in this habitat, while Beckett et at. (1983) found a dominance of *Chaoborus* in similar habitats on the lower Mississippi River.

Dike Pool Habitats

Current velocities within the dike pools were variable. June current velocity averages in DF1 and DF2 were 0.85 and 1.30 m/sec respectively. In August they were 0.60 and 0.38 m/sec and in October 0.20 and 0.48 m/sec. The interdike pools, characterized by turbulent eddy currents, distributed sediments unevenly across the bottom areas. Total densities of organisms in the interdike pools were always less than in the abandoned channels but usually were not significantly different from those in the other habitats. This was the only habitat in which any samples contained no organisms. In DF1, 10 of 48 had no invertebrates present. Like the abandoned channels, there was only one taxon (Tubificidae-cs) with an average density exceeding 100/m^2. None of the other habitats had so few abundant taxa. Presumably, the combination of higher current velocities and unstable sand subtrates produces an environment less favorable for benthic organisms.

Twenty-nine samples in fine sand and 10 in coarse sand contained the most abundant taxa, all members of the Tubificidae. Sixteen samples in fine sand and 4 in coarse sand had no organisms. Chi square tests showed that these ratios are not different than would be expected on the basis of a random distribution between the two sediment types. There were 14 different taxa ranked in the five most abundant taxa found in the two locations over the three sampling periods.

Dike Structure Habitats

The dike structure samples contained significant fine interstitial sediments, providing an additional habitat component. Although current velocities were not measured near the dike faces, the sampling sites were protected from all but minor currents, as evidenced by the deposition of fine sediments on rocky surfaces. Total numbers of organisms found in this habitat also were lower than those found in

Table 3. Taxa sampled in the four habitats whose average densities exceeded 100 organisms/m^2

Taxa	Number per square meter
Abandoned Channels	
Tubificidae-cs	4962
Dero digitata	1032
Pristina osborni	752
Tanypus	678
Chaoborus	506
Coelotanypus	304
Chironomus	235
Branchiura sowerbyi	189
Limnodrilus cervix	149
Ceratopogonidae	135
Limnodrilus maumeensis	112
Dike Pools	
Tubificidae-cs	736
Dike Structures	
Hydra	980
Hydropsychidae Imm.	219
Stenonema	214
Potamyia	185
Dero digitata	141
Caenis	132
Isonychia	130
Heptageniidae Imm.	112
Tubificidae-cs	111
Revetments	
Hydra	567
Dero digitata	189
Stenonema	124
Potamyia	111
Isonychia	107

Table 4. The five most abundant taxa found at each location for each monthly sampling period and their densities in organisms/m^2.

Location	June		August		October	
	Taxa	*Density*	*Taxa*	*Density*	*Taxa*	*Density*
AC1	*Dero digitata*	2271	Tubificidae-cs	3590	Tubificidae-cs	3501
	Tubificidae-cs	503	*Chaoborus*	1846	*Pristina osborni*	2414
	Chironomus	458	*Dero digitata*	1163	*Dero digitata*	1041
	Tanypus	312	*Pristina osborni*	1047	*Chaoborus*	773
	Pristina osborni	180	*Tanypus*	697	*Chironomus*	525
AC2	Tubificidae-cs	3385	Tubificidae-cs	9701	Tubificidae-cs	9093
	Tanypus	1811	*Tanypus*	1211	*Coelotanypus*	1141
	Dero digitata	705	*Dero digitata*	536	*Limnodrilus maumeensis*	538
	Limnodrilus cervix	393	*Branchiura sowerbyi*	425	*Dero digitata*	476
	Pristina osborni	245	*Coelotanypus*	291	*Pristina osborni*	366
DF1	Tubificidae-cs	129	Tubificidae-cs	430	Tubificidae-cs	1849
	Polypedilum	49	*Limnodrilus cervix*	49	*Dero digitata*	283
	Tanypus	27	*Robackia*	35	*Robackia*	14
	Paracladopelma	24	*Hexagenia*	24	Ceratopogonidae	14
	Cryptochironomus	19	*Branchycercus*	14	*Cryptochironomus*	11
DF2	Tubificidae-cs	97	Tubificidae-cs	928	Tubificidae-cs	983
	Hydropsyche	27	*Limnodrilus cervix*	162	*Dero digitata*	24
	Cryptochironomus sp.	14	*Robackia*	30	*Pristina osborni*	19
	Dero digitata	11	*Hydra*	22	*Ilyodrilus templetoni*	16
	Limnodrilus cervix	11	Hydropsychidae Imm.	16	*Robackia*	8
DFA	*Hydra*	1936	*Hydra*	611	*Dugesia*	110
	Isonychia	228	*Hydropsyche*	606	*Potamyia*	80
	Stenonema	206	*Caenis*	434	*Thienemannimyia* group	68
	Hydropsyche	121	*Potamyia*	386	Hydropsychidae Imm.	56
	Heptageniidae Imm.	111	*Stenonema*	198	*Tanytarsus*	41
DFB	*Hydra*	3331	Hydropsychidae Imm.	506	*Dero digitata*	596
	Stenonema	591	*Potamyia*	405	Tubificidae-cs	308
	Isonychia	436	*Caenis*	334	*Stenonema*	109
	Heptageniidae Imm.	278	Tubificidae-cs	183	*Ochtrotrichia*	91
	Orthocladius	242	*Neureclipsis*	159	*Nanocladius*	70
RV1	*Hydra*	359	*Caenis*	102	*Dero digitata*	882
	Orthocladius	252	Tubificidae-cs	78	*Stenonema*	157
	Heptageniidae Imm.	206	*Stenonema*	76	Tubificidae-cs	138
	Stenonema	191	*Branchiura sowerbyi*	68	*Branchiura sowerbyi*	106
	Potamyia	177	Hydropsychidae Imm.	26	*Pristina osborni*	53
RV2	*Hydra*	3040	*Potamyia*	382	Tubificidae-cs	103
	Isonychia	459	Hydropsychidae Imm.	325	*Dugesia*	85
	Heptageniidae Imm.	347	*Caenis*	152	*Stenonema*	70
	Orthocladius	202	*Dugesia*	89	*Dero digitata*	55
	Stenonema	168	*Neureclipsis*	71	Hydropsychidae Imm.	35

the abandoned channels but were comparable to those found in the dike pools and revetments (Table 5). There were no consistent differences between densities found on the upstream (DFA) and downstream (DFB) faces of the dikes.

The most taxa (N = 75) were collected in the dike structures. There were nine taxa with average densities greater than 100/m^2, making this habitat second only to the abandoned channels in this measure. Some of the most important invertebrate groups included *Hydra*, which peaked in June, caddisflies (*Hydropsyche, Potamyia*), and mayflies (*Stenonema*).

Both the dike and revetment habitats had the largest numbers of taxa found in comparison with the sediment substrates, although the densities were less than those found in the abandoned channels. This is consistent with the findings of Burress et al. (1982) on the Missouri River in North Dakota. On the other hand Mathis et al. (1981) found that the dike structures on the Lower Mississippi River had greater organism densities than did the abandoned channels. In another study on the Lower Mississippi River, Mathis et al. (1982) found that organism densities on dike structures were on the order of 100,000/m^2. These values are much larger than ours, which ranged from about 1000 to 4000 organisms/m^2. There may be differences in basic primary productivity between these stretches of river, or perhaps the combination of high current and high turbidity found in the Missouri River is unfavorable for the development of the dike structure macroinvertebrate communities.

Revetment Habitats

Although water velocities were rapid alongside the revetments, microhabitat velocities among the rocks were barely perceptible. The total organisms' densities in the revetments were always lower than those in the abandoned channels and were generally similar to those in the other habitats (dike field pools and pools). Diversity was high,

Table 5. Analysis of variance statistics for the effects of sampling (7,72 d.f.) on invertebrate group mean densities (organisms/m^2) and Duncan's multiple range test of significance. Groups with the same letter are not significantly different.

Month	F	P	N	Mean	Location	Group
June	9.09	0.0001	16	7214	AC2	A
			4	5848	DFB	A
			16	4176	AC1	AB
			4	4003	RV2	AB
			4	3476	DFA	ABC
			4	2070	RV1	BC
			16	328	DF1	C
			16	248	DF2	C
August	25.82	0.0001	16	13331	AC2	A
			16	9682	AC1	A
			4	2774	DFA	B
			4	2152	DFB	B
			4	1394	RV2	B
			16	1192	DF2	B
			16	613	DF1	B
			4	466	RV1	B
October	11.76	0.0001	16	12624	AC2	A
			16	9585	AC1	A
			16	2177	DF1	B
			4	1746	RV1	B
			4	1719	DFB	B
			16	1058	DF2	B
			4	691	RV2	B
			4	676	DFA	B

with 64 different taxa found, although only five taxa had average densities exceeding 100/m^2. Fifteen different taxa were found in the lists of the five most abundant taxa for each of the two locations and three sampling periods. *Hydra* dominated this habitat in June, although caddisflies (*Potamyia*), mayflies (*Stenonema, Isonychia*), and worms (*Dero digitata*) became important during other periods.

Comparisons Among Habitats

There were a number of differences in the taxa found in the different habitats. Of the dipterans, *Chironomus, Coelotanypus, Procladius, Tanypus,* Ceratopogonidae, and *Chaoborus* were found predominantly in the abandoned channel habitats. Chironomidae pupae, *Nanocladius, Orthocladius, Tanytarsus,* members of the *Thienemannimyia* group, and *Thienemiella* were found almost exclusively in the large rock structures of the dikes and revetments. The midge, *Robackia,* was found almost entirely in the dike pools. Trichopterans were found almost exclusively in the large rock habitats, as were plecopterans. The Ephemeroptera were most frequently collected in the dikes and revetments with the exception of representatives of the sprawler and burrower genera *Caenis* and *Hexagenia* that were found in the habitats with softer sediments as well. Most oligochaete taxa were abundant in fine sediments of the abandoned channels; but *Dero digitata* was generally found in all habitats and immature Tubificidae were often quite abundant in all habitats. The flatworm *Dugesia sp.* was most abundant in those same habitats in June. Other taxa had densities too low to generalize on their distributions.

ACKNOWLEDGEMENTS

We acknowledge the field and laboratory assistance from Kenneth Kortge, Thomas Robertson, Mark Sandheinrich, and Burt Shephard. Ralph Brinkhurst and Rex Bingham confirmed our identification of oligochaetes. Funds were provided by the Environmental and Water Quality Operational Studies Program sponsored by the Office, Chief of Engineers, and managed by the U.S. Army Engineer Waterways Experiment Station.

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