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Fauna of the Middle Little Sioux River and Comparison with Upper and Lower Regions

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SYNOPSIS: A species list of macroscopic animals is compiled for the middle portion of the Little Sioux River, Iowa. These are tabulated along with published data from regions of the river above and below. The Little Sioux meanders throughout a valley of largely agricultural landscape; it has a relatively high silt load. Chemical differences are not great; some effects of municipal effluent are noted. The number of species is relatively constant (in the 40-60 range); numbers in the uppermost, intermittent stretches and the lowermost, channelized segment are lower (30-40). Only about 20% of the species are ubiquitous; trends of diversity and distribution are noted in the invertebrates and fishes.

INDEX DESCRIPTORS: fauna, Middle Little Sioux River; Iowa species list.

The purpose of this paper is to put the fauna of the entire Little Sioux River, Iowa on record. Observations on the fauna of the middle section made in the summer of 1971 may now be compared with those above and below reported by Bovbjerg *et al.* (1970), Krohn (1970), and Hansen (1971). This report and those cited are not exhaustive, but they are assembled here as a baseline so that future studies may use them for comparison.

The Little Sioux River is the largest Iowa tributary to the Missouri River. The middle region of the river in Clay, Buena Vista, O'Brien, and Cherokee Counties is meandering and silt-laden. The cities of Spencer and Cherokee dispose sewage effluent into the river. Other communities in the study area which also contribute to the effluent load are: Milford, Gillett Grove, Sioux Rapids, Linn Grove, and Petersen. The principal use of the river valley is agricultural, primarily cattle pasture.

The river bed is mostly sand and gravel. There are occasional short reaches of cobble, where the river cuts through glacial drift. In pools, or in the slack water of back eddies, silt is precipitated, often to a depth of several decimeters. The stream flow is sluggish, with an average gradient of 2.1 feet per mile (Pedersen and Lohnes, 1963). The river channel is highly convoluted, with banks of rich bottomland soil. In many areas, where livestock have broken the river bank, over-grazing further contributes to the silt load of the stream.

The area of investigation extended approximately 160 km, from 12 km northwest of Spencer, to 8 km south of Cherokee (Figure 1). Above Spencer, the river meanders southeasterly through a broad, flat, flood plain. Between Spencer and Gillett Grove, the flood plain narrows. At Sioux Rapids, the river turns to a west-northwesterly course, extending across the upper portion of Buena Vista County. At Petersen, the valley is at its narrowest, about 1 km in width. West of Petersen, the valley opens again. In the southeastern corner of O'Brien County, the river assumes a southwesterly course which is maintained until it reaches the Missouri River.

Station #1 was established at US Highway 18 northwest of Spencer; #2 was at the bridge of Clay County road M 50 southeast of Spencer; #3 was at a vacated bridge in Petersen that would be an extension of Clay County M 27. Station #4 was located at the bridge of Cherokee County road C 25 north of Cherokee, and #5 was located at an unnamed Cherokee County road approximately 8 km south of Cherokee. The locations were chosen to be both above and below population centers. Both Cherokee (pop. 7,300) and Spencer (pop. 10,300) have packing plants for the slaughter of large animals. The Spencer packing plant was closed from January 18, 1971, through September 7, 1971, the time of this study; therefore, the river was free of effluents from this plant.

PROCEDURE

The study area was first traversed by canoe and the five stations were established. Collections were made during the daytime in July and August, 1971; each station was visited nine times. Collections were made by hand, using wire screens, dip nets, and minnow seines. Bottom samples were collected by shovel, screening, and hand sorting. Only macroscopic organisms were identified. Identification of invertebrates was done with keys in Pennak (1953) and Ward and Whipple (1966). The fishes were keyed using Harlan and Speaker (1956) and Eddy (1957). The mollusks were identified by Dr. H. vander Schalie, Museum of Zoology, University of Michigan. Replicate water samples were collected from the stations and analyzed for some chemical and physical properties. A Hach Portable Engineer's Laboratory (Model DR-ED) was used to make the following tests: dissolved oxygen (O_2) (Winkler Method Hach Chemical Co.), Nitrate Nitrogen (N) (Cadmium Reduction Method), Phosphate (PO_4) Ortho (Stannaver Method), pH (Colorimetric Method, using a wide range pH indicator solution). Turbidity was measured in Jackson units (JTU). The work was done at the Iowa Lakeside Laboratory.

OBSERVATIONS

The water analyses were done to reveal any gross differences from the values reported in previous years in the sectors of the river above and below. No such differences emerged. Mean oxygen readings for the five stations were: 10.9, 9.3, 10.3, 10.5, and 9.0 ppm (range: 5.8 - 13.2). Mean CO_2 readings were: 3.6, 4.8, 4.3, 5.4, and 5.0 ppm (range: 1.0 - 9.0). Mean nitrate readings were: 0.6, 1.4, 0.4, 0.5,

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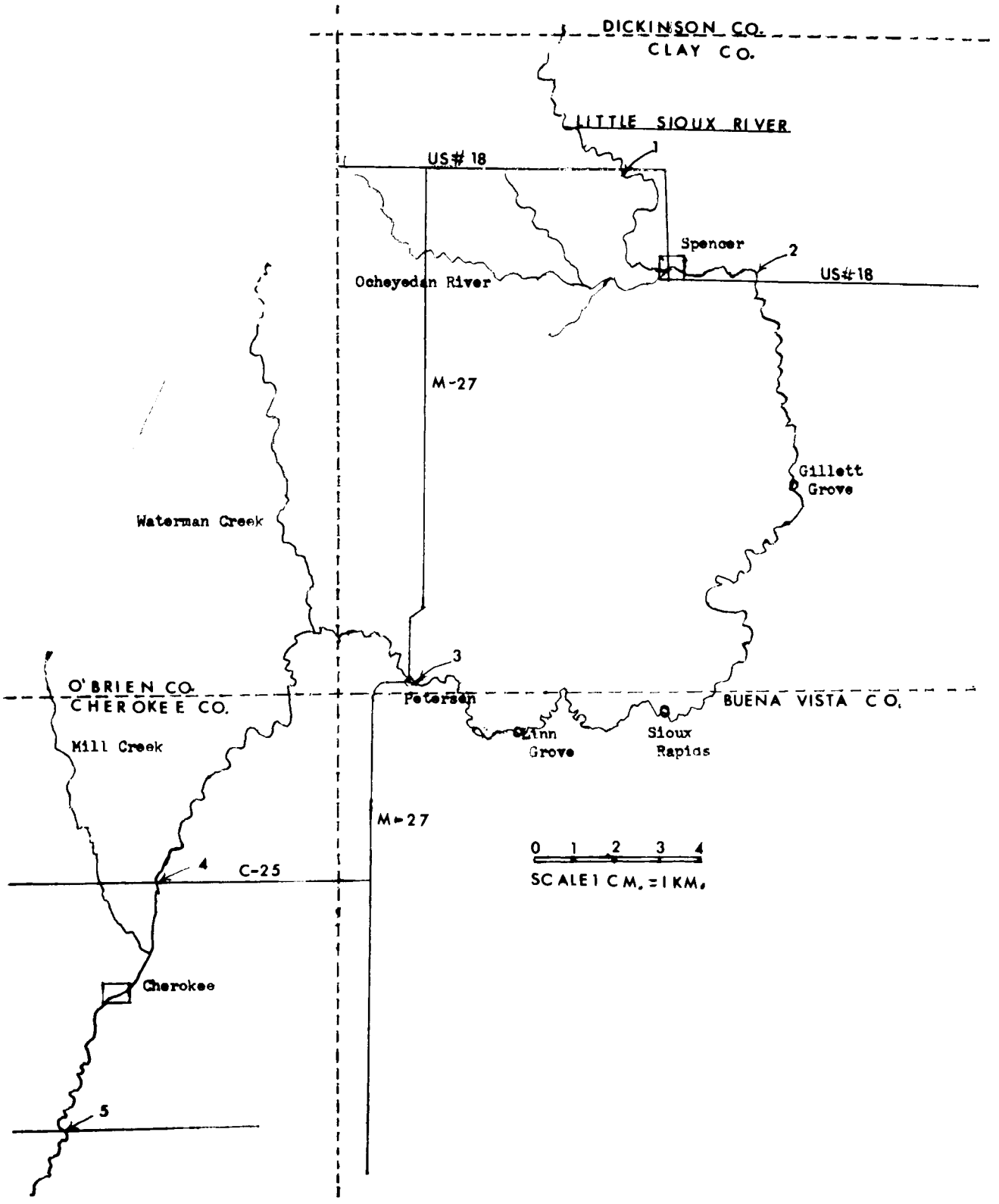

Figure 1. The middle segment of the Little Sioux River; stations numbered 1-5.

and 0.5 ppm (range: 0.1 - 5.0). The pH values were very consistent with a mean of all stations of 8.3 (range: 7.6 - 8.7). The orthophosphate means were: 0.2, 0.4, 0.3, 0.3, and 0.4 ppm (range: 0.1 - 1.3). Mean turbidities were 102, 109, 120, 133, and 151 JTU (range: 47 - 350). During the period of study none of these values was a stress for the fauna of a river such as this.

Table 1 tabulates the macro-fauna of this study flanked by the data from the upper and lower stretches of the river as reported (with their permission) by Bovbjerg *et al.* (1970) and Hansen (1971). The associated vertebrate fauna of the valley was noted but not recorded in the faunal list (beaver, muskrat, mink, mallards, blue-winged teal, wood duck, blue and green herons, belted kingfishers, horned owls, frogs and toads).

TABLE 1. SPECIES LISTS FROM 14 STATIONS OF THE ENTIRE LITTLE SIOUX RIVER; UPPER SEGMENT (BOVBJERG, ET AL., 1970), MIDDLE SEGMENT (THIS STUDY), AND LOWER SEGMENT (HANSEN, 1971)

Stations:	Upper					Middle					Lower			
	1	2	3	4	5	1	2	3	4	5	1	2	3	4
PORIFERS														
Spongilidae (unident.)		x	x											
BRYOZOA														
Plumatella repens	x	x	x	x	x	x	x	x	x	x				
PLATYHELMINTHES														
Planariidae														
Dugesia tigrinum			x		x	x	x	x	x	x				
ANNELIDIA														
Enchytraeidae														
Enchytraeus sp.	x				x									
Erpobdellidae														
Dina fervida	x													
Dina sp.						x								
Erpobdella punctata	x	x	x	x	x									
Erpobdella sp.						x	x							
Glossiphoniidae														
Glossiphonia sp.							x							
Helobdella stagnalis		x												
Placobdella rugosa		x		x										
Placobdella montifera		x			x									
Placobdella parasitica						x	x							
Oligochaeta (unident.)														x
NEMATOMORPHA														
Gordioidea (unident.)							x							
MOLLUSCA														
Ancylidae														
Ferrissia sp.		x	x	x	x	x								
Physidae														
Physa gyrina	x	x	x	x	x	x								
Planorbidae														
Helisoma campanulata	x	x												
Planorbula sp.	x													
Lymnaeidae														
Stagnicola reflexa	x													
Sphaeriidae														
Sphaerium sp.				x		x	x	x	x	x				
Unionidae														
Amblema costata						x			x	x				
Amblema sp.				x	x									
Anodonta grandis	x	x			x	x		x	x	x				
Lampsilis ventricosa						x	x	x	x	x				
Lasmigona complanata	x	x			x	x	x	x	x	x				
Leptodea fragilis									x	x				
Leptodea laevissima						x	x		x	x				
Ligumia recta latissima						x		x	x	x				
Quadrula quadrula					x	x		x	x	x				
Acinonaias sp.				x										

Stations:	Upper					Middle					Lower			
	1	2	3	4	5	1	2	3	4	5	1	2	3	4
ARTHROPODA														
Arachnida														
Acaridiae														
Acaria sp.										x				
Crustacea														
Branchiura														
Argulus sp.														x
Astacidae														
Orconectes immunis	x	x												
Orconectes virilis		x	x	x	x	x	x	x	x	x				
Isopoda (unident.)														x
Talitridae														
Hyalella azteca	x	x	x	x	x	x					x	x		
Insecta														
Coleoptera														
Gyrinidae														
Dineutes sp.	x		x		x	x	x	x	x	x				
Hydrophilidae (unident.)													x	
Hydrobius sp.						x								
Tropisternus sp.	x	x				x			x					
Tropisternus sp. #2						x								
Helophorus sp.						x								
Dytiscidae (unident.)												x		x
Laccophilus sp.	x					x								
Suphisellus sp.					x									
Noteridae														
Notomicrus sp.								x						
Notomicrus sp. #2						x								
Haliplidae (unident.)													x	x
Peltodytes sp.	x													
Elmidae														
Ancyronyx sp.				x										
Dryopidae (unident.)											x	x	x	x
Pelonomus sp.	x													
Diptera														
Stratiomyidae														
Eulalia sp.										x				
Chironomidae (unident.)											x	x	x	x
Chironomus sp. ?		x				x	x	x	x	x				
Coelotanypus sp. ?				x	x									
Cryptochironomus sp. ?	x	x	x	x	x									
Pentaneura sp. ?				x	x	x	x	x	x	x				
Polypedilum sp. ?	x			x	x									
Procladius sp. ?		x												
Pseudochironomus sp.	x	x	x			x								
Tanytarsus sp. ?				x	x									
Simuliidae (unident.)											x	x	x	x
Simulium vittatum	x	x	x	x	x									

Stations:	Upper					Middle					Lower			
	1	2	3	4	5	1	2	3	4	5	1	2	3	4
Simulium sp.						x	x	x	x	x				
Culicidae (unident.)														x
Dolichopodidae (unident.)											x		x	
Rhagionidae (unident.)													x	
Tipulidae (unident.)												x	x	
Ephemeroptera														
Baetidae														
Ameletus sp.				x	x									
Baetis sp.			x	x	x			x	x		x	x	x	x
Caenis sp.				x	x	x	x				x	x	x	x
Callibaetis sp.			x	x	x									
Isonychia sp.				x		x	x	x	x					
Trycorythodes sp.		x												
Ephemeridae														
Ephoron sp.		x	x	x					x			x	x	x
Hexagenia sp.						x	x							x
Penatagenia											x			
Heptageniidae														
Cinygma sp.						x			x	x				
Heptagenia sp.						x	x							
Stenonema sp.	x	x	x	x	x		x		x	x	x	x	x	x
Polymitarcidae														
Campsurus sp.									x	x				
Hemiptera														
Belostomatidae														
Lethocerus sp.							x							
Corixidae (unident.)											x	x	x	x
Palmacorixa sp.	x	x	x	x	x									
Sigara sp.						x								
Gerridae														
Gerris sp.	x	x		x	x	x								
Metrobates hesperius						x			x	x				
Notonectidae														
Notonecta undulata						x		x	x	x				
Notonecta sp.	x													
Veliidae														
Rhagovelia sp.						x	x	x	x	x				
Odonata														
Aeschnidae														
Aeschna sp.	x	x		x										
Coenagrionidae														
Ischnura sp.		x		x	x									
Gomphidae														
Gomphus sp.						x	x		x	x				
Dromogomphus sp.							x			x				
Plecoptera														
Perlidae														
Perlesta sp.			x			x								
Trichoptera														
Hydropsychidae														
Hydropsyche simulans						x	x	x	x	x				
Hydropsyche sp.	x	x	x	x	x						x	x	x	x
Cheumatopsyche sp. #1						x	x	x	x	x	x	x	x	x
Cheumatopsyche sp. #2							x			x				
Hydroptilidae														
Mayatrichia sp.								x	x	x				
Leptoceridae														
Athripsodes sp.											x	x	x	x
Molannidae														
Molanna sp.						x								
Psychomyiidae														
Neureclipsis sp.														x
Psychomyia sp.														x
CHORDATA														
Pisces														
Catostomidae														
Catostomus commersoni	x	x	x	x		x		x	x		x	x	x	x
Carpiodes carpio						x	x	x	x	x	x	x	x	x
Carpiodes cyprinus						x	x	x	x	x	x	x	x	x
Carpiodes sp.	x	x	x	x										
Ictiobus cyprinellus						x	x							
Moxostoma auriolum						x	x	x	x	x				
Moxostoma macrolepidotum														x
Centrarchidae														
Lepomis cyanellus	x		x	x			x				x	x	x	x
Lepomis humilis	x		x								x	x	x	x
Lepomis macrochirus				x						x	x	x	x	
Micropterus dolomieui									x	x	x			
Micropterus salmoides	x						x		x	x	x		x	
Pomoxis annularis			x			x	x	x	x	x		x		x
Pomoxis nigromaculatus	x		x	x										
Cyprinidae														
Campostoma anomalum						x		x		x				
Cyprinus carpio	x	x		x	x	x	x	x	x	x	x	x	x	x
Chrosomus erythrogaster			x											
Dionda nubilia		x	x	x	x									
Hybognathus hankinsoni			x	x	x	x	x	x	x	x	x	x	x	x
Hybognathus nuchalis									x	x				
Hybopsis gracilis									x	x	x	x	x	
Hybopsis storeriana											x		x	
Notemigonus crysoleucus		x												
Notropis cornutus					x	x	x	x	x	x	x			
Notropis dorsalis						x	x	x	x	x	x	x	x	
Notropis lutrensis				x	x	x	x	x	x	x	x	x	x	x
Notropis roseus		x	x											
Notropis stramineus	x		x	x		x	x	x	x	x	x	x	x	x
Notropis volucellus		x	x											
Pimephales notatus		x			x	x	x	x			x	x	x	
Pimephales promelas		x			x	x	x	x	x	x	x	x	x	x
Semotilus atromaculatus	x	x	x			x	x	x	x	x	x	x		x
Esocidae														
Esox lucius	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gasterosteidae														
Eucalia inconstans		x												
Ictaluridae														
Ictalurus melas	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ictalurus nebulosus					x									
Ictalurus punctatus						x	x	x	x	x	x	x	x	x
Noturus flavus		x	x	x	x	x	x	x	x	x	x	x	x	x
Percidae														
Etheostoma exile		x	x		x									
Etheostoma nigrum	x	x	x	x	x	x	x	x	x					
Perca flavescens		x		x										
Stizostedion vitreum			x	x	x		x				x	x	x	

Stations:	Upper					Middle					Lower			
	1	2	3	4	5	1	2	3	4	5	1	2	3	4
Sciaenidae														
Aplodinotus grunniens					x	x							x	x
Reptilia														
Chelydrae														
Chelydra serpentina			x			x	x	x						
Trionychidae														
Trionyx sp.						x	x							
Species totals	31	50	35	46	52	67	51	40	53	52	39	35	39	37
Average species number			(43)					(53)					(37)	

DISCUSSION

This study attempts to fill the gap between two previous studies, up and downstream. The most meaningful discussion is of comparisons and trends. There are inherent difficulties in comparing these data published in four papers by six authors; the work was done in different years; different collecting techniques were used, and the chemical parameters analyzed varied somewhat. Hopefully, future students of this river will augment these data and note longterm faunal changes. Particularly valuable would be simultaneous data collection for the entire stream using identical analytical techniques.

The Little Sioux is a silt-laden river, with no gross pollution. But the middle region was, on the average, twice as turbid as Hansen (1971) reported for the lower Little Sioux River; however, data on turbidity should be obtained simultaneously to be valid. Bovbjerg *et al.* (1970) reported an increase in turbidity from headwaters to Milford, but even the headwaters are characteristically turbid unless stream flow is so low that water is entirely contained in the gravel stream bed; it may then become quite clear. Within this study, where turbidity data are comparable, there was also a steady downstream increase; this probably is the case for the entire stream.

Comparison of the chemical parameters of the upper Little Sioux River (Krohn, 1970) with the middle region reveals little difference, except for consistently lower nitrate levels in the middle regions. Nitrate and phosphate levels in the middle region peaked below the major population center of Spencer.

Local residents stated that there had been some oxygen depletion of the river below Spencer, but this was not detected during the study period. It should be noted that the Spencer packing plant was not in operation during the study. There are no comparable chemical data for the lower one-third of the river.

The potentials for critical chemical stress on the biota are the effluents from a few municipalities and the Spring runoff in row-crop and feedlot agricultural regions as noted by Krohn (1970).

The fauna of the Little Sioux River appear to be characteristic for a turbid river of this region with these substratum and flow features.

Throughout the entire river, species numbers per station remain relatively constant. There are probably two areas which do show significant differences. The intermittent headwaters are low in species numbers, 31 species at station #1; and the channelized, mud-bottomed lower stations with 35-39 species. The smaller number in the lower reaches are in part due to certain taxa not being reported, e.g., crayfish and mollusks (Hansen, personal communication). For the major portion of the river, species numbers per station are in the 40-60 range.

Species composition changes are more prominent than species number changes. Only 25 of 148 species were found throughout the length of the river, eight of these being invertebrates. There are some trends in distribution of the invertebrates; these are discussed below in a taxonomic sequence.

Sponges were collected only in the headwaters. The bryozoan *Plumatella repens* was at every station to below Cherokee, and may be downstream as well although not reported. The same may be said for the flatworm *Dugesia tigrinum*. The seven species of free living leeches were restricted to the upper part of the river, above Spencer. This distribution correlates positively with the distribution of snails, also not found below Spencer. Tubificids are conspicuously missing throughout.

The mussels require specific search and are also very spotty in distribution; data on these animals are therefore difficult to interpret. The mussels appear to be most numerous in number of species and in density in the middle reaches where gravel bars produce good sites for mussel beds. Mussels are sensitive to organic pollution; there was evidence of a major kill below Spencer. Living mussels could be found above and within the city limits of Spencer; only empty shells were present below the city to about 6 km downstream. Here the shells of living mussels measured less than 5 cm in length, indicating recent establishment.

Of the two species of crayfish present, *Orconectes virilis* is the typical permanent stream species, probably extending down to the mouth. The pond species *O. immunis* is reported in the intermittent headwaters (Bovbjerg *et al.* 1970; Bovbjerg 1970). The amphipod *Hyallela azteca* was ubiquitous and is probably present in slack water regions of the lower stretches, though not reported. Hansen (1971) reported collecting isopods on artificial substrates at one station in the channelized portion of the river. They were found nowhere else.

Interpreting the data on insect distribution is particularly difficult because so few taxonomic determinations can be trusted; most were keyed only to genus and some only to family.

Simulids and chironomids were densely present throughout, though taxonomic problems are apparent here. The beetles are not a conspicuous element of the fauna. Of the 14 species reported, only the gyrinid *Dineutes sp.* was ubiquitous in backwaters; the others showed little pattern.

Four mayfly genera were found throughout: *Baetis, Caenis, Ephoron,* and *Stenonema.* Found only in the upper stations were *Ameletus, Callibaetis,* and *Trycorythodes.* The odonata display a specific pattern. The damselfly genus *Ischnura* and dragonfly *Aeschna* were restricted to the headwaters. The middle stretch had two species of gomphid dragonflies only. None were reported by Hansen (1971). Stoneflies are numerous in the brooks feeding the upper stretches of the river. They were not reported for the river by Bovbjerg *et al.* (1970), but have been collected at their station #3 since that time. They were not present below Spencer. Of the caddis flies, hydropsychids were found

throughout, often in great numbers. Curiously, three genera were not found in the upper or central stretches of the river, (*Athripsodes, Neureclipsis* and *Psychomyia*) but these were in the lower stretch.

The best collected and identified group in each of the studies was the fishes. Three species were found not previously reported for the Little Sioux River. Bovbjerg *et al.* (1970) lists *Dionda nubila* and *Notropis roseus;* neither having been reported in western Iowa (Harlan and Speaker, 1956). These could be dubious records. Hansen lists *Moxostoma macrolepidotum,* the Eastern redhorse, a species of the Atlantic Coastal Plain south of the St. Lawrence drainage, and found particularly in streams of the Chesapeake Bay area, Eddy (1957) Whitaker (1958). This fish may have been what we recorded as *Moxostoma aureolum,* the northern redhorse, which is commonly found throughout the middle region.

Almost half the species of fishes (17/40) were found in all three regions of the river. This attests to the rather consistent character of the river. The most ubiquitous were the carp, carpsuckers, suckers, brassy minnow, sand shiner, creek chub, black bullhead, northern pike, stone cat, and walleyes.

Seven species, excluding the questionable Ozark minnow and northern weed shiner, were reported only from the upper stretches: golden shiner, northern mimic shiner, redbellied dace, brook stickleback, brown bullhead, yellow perch, and Iowa darter.

Four species are reported in the study as being found in the middle region, but not in the upper or lower. One of them, the bigmouth buffalo, probably escaped from the Iowa Great Lakes outlet. The others, northern redhorse, silvery minnow and smallmouth bass, could well be present through most of the river, but were not collected in the other studies. There is nothing unique about the middle stretch of river to indicate there would be different fish in that area.

Silver chub and shorthead redhorse (*Moxostoma macrolepidotum*) (sic) were reported by Hansen (1971) for the lower region; these were not reported upstream. The distribution of the freshwater drum is curious; it is located at both the mouth of the river and just above Spencer. These specimens may represent emigrations from the Missouri River and the Iowa Great Lakes regions.

Other than fish, very few vertebrates were seen in the middle stretches of the river. Both snapping and soft-shelled turtles were seen. Conspicuously absent were painted turtles and aquatic snakes. Fish-eating birds were rare. Only three herons and two kingfishers were seen on the river during the study period. Snakes and fish-eating birds, so much more common in Eastern Iowa, are sight feeders and may be poorly adapted to feeding in these turbid waters.

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