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A Preliminary faunal study of the upper Little Sioux River

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Abstract. Several stations of the Little Sioux River were sampled from the Minnesota headwaters to the confluence of Milford Creek. The river changes from intermittent, ponded headwaters to continuously flowing stretches with a concomitant shift in the fauna of increasing downstream diversity of species. While the study of only one summer is reported here, it is hoped that further studies on this and other rivers would be encouraged so that biologists will have a biotic baseline to follow future changes and hopefully to be the basis for suggested water quality control of the future.

The upper Little Sioux River, from its headwaters in Jackson County, Minnesota to the confluence with Milford Creek, has no significant urban pollution; it is nevertheless a stream with a normally heavy load of silt and it is subject to agricultural pollution. No formal studies have been made of this stretch of the river.

The purposes of the present study are these: 1. to present data for a bench mark; further studies may reveal changes in the fauna with changing environmental conditions (probably worsened but hopefully improved); 2. to act as a stimulus for more definitive studies of the biology, limnology, and geography of the basin; 3. to specifically compare the fauna of the headwaters with that downstream, which do receive effluent starting with Milford. This study must be considered as preliminary—the result of a few weeks during one summer, 1969. None of the authors is a taxonomic expert. This report is not one of specific ecological significance nor is it a review of the extensive literature on stream ecology.

THE BASIN OF THE UPPER LITTLE SIOUX RIVER

The river has its origin in Rost and Hunter townships of Jackson County, Minnesota, about 16 km north of the Iowa Border. It enters Iowa in Dickinson County and flows southerly. The "Iowa Lakes" region lies to the east of the river in this area.

The valley is of glacial origin; the Cary ice sheet of the Wisconsin deposited a Bemis moraine to the south and then an Altamont moraine to the west. The Little Sioux River flows south along the western border of the Altamont, through the Altamont and then through the Bemis just west of Milford (Salisbury and Knox, 1969).

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The present valley has, for these reasons of glacial history, three zones in the regions studied.

1. Upper reaches: normally intermittent above the Iowa border; wide valley, low and marshy; Altamont moraine to the east; low gradient, meandering brook, 2-3 m wide; bottom is silty gravel with few riffles; station I on east fork.
2. Second zone: normally continuously flowing except in extreme drought; 6-10 m wide; may become a trickle; valley continues to be wide, low, and marshy; Altamont moraine still to east; bottom gravel, with boulder—cobble riffles more numerous. Station II.

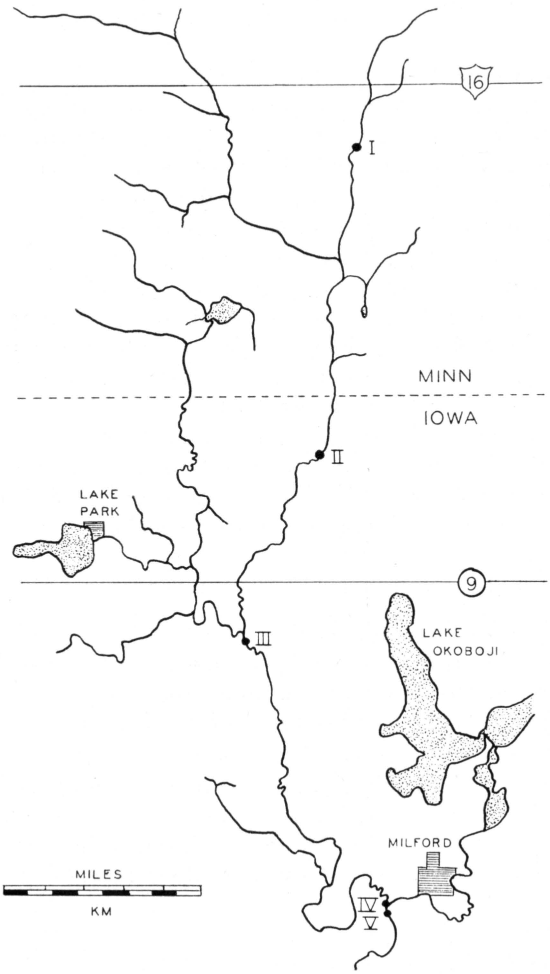

Figure 1. The upper Little Sioux River with stations designated by roman numerals.

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3. Third zone: west fork joins and the river cuts into and parallels the edge of the Altamont morain; banks steepen; current more rapid (by two or three times), 10-20 m wide; bottom alternating with gravel in pools and boulder—cobble riffles; river meanders in larger loops; station III. The river then flows tortuously between high, knobby Bemis moraine with a narrowed valley; water deepens and continues to flow rapidly; bottom continues to be gravel with numerous riffles; Finally, the river flows out into a wider flood plain at the confluence with Milford Creek, west of Milford; Station IV. State V is 200 M below confluence.

The potential pollution from Milford is high. A sewage treatment plant serves a very large summer resort population. In addition, gravel washings from commercial pits increase the silt load of Milford Creek by a factor of 50 (Ohl, 1963). During the summer of 1969, the water of the creek entering the river was a discrete orange band. Chemically, the water entering the river is no higher in nitrate than water above the sewage plant. The values cited by Ohl (1963) are 0.6 ppm, up to 3.7, and down to 0.5 at the confluence. Phosphates do not drop in this manner and do raise the levels in the river from time to time (Krohn, 1970).

In the entire stretch of the upper Little Sioux River, there is no appreciable difference in water chemistry, at least during the summer of 1969 with an unusual high rate of flow (Krohn, 1970). Ordinarily, the upper zone in Minnesota becomes stagnant in isolated pools. At such time the chemical picture is very different, with complete oxygen depletion each night. There is increase in turbidity downstream; from station I to III it increased from 55 to 130 ppm, and jumped to 190 ppm below Milford Creek at station V.

Procedure

The work was done from the Iowa Lakeside Laboratory during July-August of 1969. Each of the stations was visited repeatedly. Collections were made by hand, wire screen seines, minnow seines, and dip nets. Bottom samples were washed through wire screens and hand sorted. All parts of the station were sampled and the collections were terminated when no new species were found. The fish were collected after poisoning with 5% Rotenone insecticide. Two fine-mesh seines were stretched across the river downstream to insure as nearly a complete collection as possible.

Identification of the invertebrates was done with keys in Pennak (1953) and in Ward and Whipple (1959). The fish were keyed in Harlan and Speaker (1956), with assistance from the fisheries group at Iowa State University. Only macroscopic animals were collected; this excludes the protozoans, rotifers, copepods, cladocerans, ostracods, nematodes, and mites; these were seen of course, particularly in the slow headwaters.

The Fauna

The list of species by station in Table 1 is certainly incomplete; yet we did feel we had adequately sampled each station. Some trends are apparent.

Table 1. Fauna of the upper Little Sioux River by stations indicated in text. (Note: some large animals were associated with the river but not collected or recorded—beaver, muskrat, snapping turtles, frogs and toads.)

	I	II	III	IV	V
SPONGES					
Spongilidae		X	X		
BRYOZOANS					
Plumatella repens	X	X	X	X	X
Plumatella repens var. *appressa*			X	X	X
FLATWORMS					
Planariidae					
Dugesia tigrina			X		X
ANNELIDS					
Erpobdellidae					
Erpobdella punctata	X	X	X	X	X
Dina fervida	X				
Glossiphoniidae					
Helobdella stagnalis		X			
Placobdella rugosa		X		X	
Placobdella montifera		X			X
Enchytraeidae					
Enchytraeus sp.	X			X	
SNAILS					
Physidae					
Physa gyrina	X	X	X	X	X
Planorbidae					
Helisoma campanulata	X	X			
Planorbula sp.	X				
Lymnaeidae					
Stagnicola reflexa	X				
Ancylidae					
Ferrissia sp.		X	X	X	X
MUSSELS					
Unionidae					
Lasmigona complanata		X	X		X
Andodonta grandis		X	X		X
Amblema sp.				X	X
Quadrula quadrula					X
Acinonaias sp.			X	X	X
Sphaeriidae					
Sphaerium sp.				X	
CRUSTACEANS					
Talitridae					
Hyalella azteca	X	X	X	X	X
Astacidae					

Table 1, Cont.

	I	II	III	IV	V
Orconectes immunis	X	X			
Orconectes virilis		X	X	X	X
INSECTS					
DIPTERA					
Tendipedidae					
Tanytarsus sp.?				X	X
Pseudochironomus sp.?	X	X	X		
Chironomus sp.?		X			
Procladius sp.?		X			
Polypedilum sp.?	X			X	X
Cryptochironomus sp.?	X	X	X	X	X
Coelotanypus sp.?				X	X
Pentaneura sp.?					X
Simuliidae					
Simulium vittatum	X	X	X	X	X
EPHEMEROPTERA					
Heptageniidae					
Stenonema sp.	X	X	X	X	X
Ephemeridae					
Ephoron sp.		X	X	X	
Baetidae					
Caenis sp.				X	X
Callibaetis sp.					X
Baetis sp.			X	X	X
Trycorythodes sp.		X			
Isonychia sp.				X	
Ameletus sp.				X	X
TRICHOPTERA					
Hydropsychidae					
Hydropsyche sp.	X	X	X	X	X
ODONATA					
Aeschnidae					
Aeschna sp.	X	X		X	
Coenagrionidae					
Ischnura sp.		X		X	X
COLEOPTERA					
Gyrinidae					
Dineutes sp.	X		X		X
Dytiscidae					
Laccophilus sp.	X				
Suphisellus sp.					X
Hydrophilidae					
Tropisternus sp.	X	X			
Helophorus sp.	X				
Haliplidae					
Peltodytes sp.	X				
Elmidae					
Ancyronyx sp.				X	
Dryopidae					
Pelonomus sp.	X				
HEMIPTERA					
Gerridae					
Gerris sp.	X	X		X	X
Notonectidae					
Notonecta sp.	X				
Corixidae					
Palmacorixa sp.	X	X	X	X	X

Table 1, Cont.

	I	II	III	IV	V
FISHES					
Esocidae					
Esox lucius	X	X	X	X	X
Ictaluridae					
Ictalurus melas	X	X	X	X	X
Ictalurus nebulosus					X
Noturus flavus		X	X	X	X
Cyprinidae					
Cyprinus carpio	X	X		X	X
Chrosomus erythrogaster			X		
Notemigonus crysoleucus		X			
Hybognathus hankinsoni			X	X	X
Semotilus atromaculatus	X	X	X		
Dionda nubila		X	X	X	X
Pimephales notatus		X			X
Pimephales promelas		X			X
Notropus cornutus					X
Notropus delicosus		X		X	X
Notropus roseus		X	X		
Notropus volucellus		X	X		
Notropus lutrensis				X	X
Percidae					
Perca flavescens		X		X	
Etheostoma nigrum	X	X	X	X	X
Etheostoma exile		X	X		X
Stizostedion vitreum			X	X	X
Gasterosteidae					
Eucalia inconstans		X			
Catastomidae					
Catastomus commersoni		X	X	X	X
Carpiodes sp.		X	X	X	X
Centrarchidae					
Lepomis cyanellus		X		X	X
Lepomis humilis		X		X	
Lepomis salmoides s.		X			
Lepomis macrochirus					X
Pomoxis annularis				X	
Pomoxis nigromaculatus		X		X	X
Sciaenidae					
Aplodinotus grunniens					X
Species Total	31	50	35	46	52

The outstanding faunal shift is at the point where the stream is normally summer stagnant above and continuously flowing below. This upper fauna has a strong pond flavor, and in fact during most summers the stream becomes a series of ponds: the stream here flows slowly in a wide, marshy valley and is connected to numerous ponds. We found pond mollusks, crustaceans, and insects. Ten invertebrate species were found here and not below. The characteristic stream fauna is represented only by those widely tolerant forms able to extend into this stretch during periods of flow, *eg.* northern pike, black bullhead, carp, the amphipod *Hyalella azteca,* and snail *Physa gyrina.*

At station II (permanently flowing) the number of fish species jumps from 5 to 23. Mussels appear; and the stream crayfish *Orconectes virilis* replaces *Orconectes immunis* (Bovbjerg, 1970). Ancylid snails appear here and the usual stream insects greatly increase in density.

From station II downstream, there are no sharp faunal differences. At least during the summer of 1969, there were no consistent chemical differences either (Krohn, 1970).

At the time of the study, station IV above the confluence with Milford Creek and station V below, did not have a real difference in fauna. At this time of high flow, the potential for serious pollution was not realized.

In general, there was no obvious indication of pollution in the entire stretch of the river which was studied. There were no tubificid worms, for instance. Silt load may have been a factor in excluding stoneflies which are present in one small tributary. On the contrary, ancylid snails, caddis flies, black flies, and several mayflies are present in abundance, and the fish fauna appears to be relatively diverse and not one associated with heavy pollution.

Unreported observations from other years with low water indicate a very different array. Stream forms are exterminated in the ponded headwaters. When these regions resume flow, these same species move back. This could be readily done by insects whose larvae require moving water but whose adults can fly. Rapid swimmers, like the fish, could also quickly disperse upstream; local residents cited conspicuous upstream movements of carp and northern pike during the spring floods of 1969 which followed two dry years.

Conclusions

This report is preliminary. The summer was one of high water and as a result of volume and rapid flow the river was chemically dilute and tended to be rather uniform. The normally ponded upper stretches were flowing and aerated. Even so, the upper station could be characterized as having a pond fauna with stream elements introduced, those tolerant species from downstream.

In the regions of normally continuous flow, the fauna was relatively consistent but very different from the upper station. This was most marked in the fish fauna.

No distinct impact was seen from the potential pollution from Milford creek. Again, in this year, the flow in the creek was very high and the only really obvious polluton was the heavy silt load from commercial gravel washing.

The study was intended as a baseline for future work. The next period of low water should make for a significant comparison. Hopefully, students of specific groups would do a more complete work. Equally important are the groups omitted from this report, not only the animals but the algae and bacteria. To be of ecological importance, the fauna should be analyzed quantitatively; numbers reveal effects not seen in species lists.

If an entire region of a river basin were somehow managed, thus preventing any agricultural pollution, an answer might be obtained to an important question. Can a silted stream subjected to such pollution recover and support the biota it undoubtedly once had?

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