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A Survey of the Benthic Macroinvertebrates of the Big Spring Basin, Iowa

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Benthic macroinvertebrates were collected in the Big Spring Basin, located in northeastern Iowa, from May through October 1988. The purpose of the study was to develop baseline information on the benthic organisms present in the basin. A total of 167 taxa including seven species of leeches, five genera of snails, three genera of clams, one crayfish genus and over 150 taxa of aquatic insects were identified with the majority of the organisms having been reported in Iowa previously. Benthic organisms not usually encountered in Iowa include the planarian, *Cura formanii*; the isopod, *Lirceus*; the beetles, *Enochrus, Hydrophilus,* and *Ilybius*; the chironomids, *Diamesa* and *Prodiamesa*; the mayfly, *Stenacron candidum*; the damselfly, *Archilestes grandis*; the dragonfly, *Aeshna tuberculifera*; the stonefly, *Claassenia* and the caddisfly, *Helicopsyche borealis*. The variety and distribution of benthic organisms within the Big Spring Basin reflect the numerous habitats in the various stream segments. Many of the benthic organisms collected, especially those not reported before, are known to prefer clear, cold water streams such as those found in the Big Spring Basin. The continued existence of this aquatic life is dependent upon, at a minimum, maintaining current water quality conditions in the basin.
INDEX DESCRIPTORS: Benthic Macroinvertebrates, Big Spring Basin, Cold Water Streams, Water Quality.

The northeast corner of Iowa is a region of the state bypassed by the last continental glacier, and is marked by the deep dissection of streams whose valleys are entrenched into Paleozoic-aged bedrock. The area is referred to as the Paleozoic Plateau (Hallberg, et. al., 1984a) and exhibits greater topographic relief than other areas of Iowa. The Plateau is known for the extensive bedrock exposure and bedrock control of the landscape. This topography, and its resultant groundwater flow, produces the many cool spring-fed streams containing unique assemblages of plants and animals not found elsewhere in Iowa. Locally, where limestones and other carbonate rocks dominate, some karst topography has formed, exhibiting a network of sinkholes, caves and large springs. The Big Spring Basin is located in northeastern Clayton County (Fig. 1) in the heart of the karst topography. An extensive data base for the Big Spring Basin has been developed defining the hydrogeology, soils and land utilization in the basin (Hallberg, et. al., 1984a; Hallberg, et. al., 1984b; Libra, et. al., 1986). Comprehensive water quality studies of the basin have been conducted since 1980 (see Hallberg, et. al. 1983 and 1985). These water quality studies have been directed at assessing the impact of non-point source pollution (mainly bacteria, nitrogen and pesticide loadings) on both surface and groundwater in the basin. As a result, a great deal of data have been acquired on the water chemistry in the basin while little is known of the aquatic biology of this unique area. The purpose of this study was, therefore, to sample and identify the macroinvertebrates inhabiting the waters in the Big Spring Basin.

MATERIALS AND METHODS

The Big Spring Basin is comprised of several creeks (Deer Creek, Unnamed Creek, Howard Creek, Roberts Creek and Silver Creek) with a drainage of approximately 267 square kilometers in addition to the Turkey River. Each stream had at least one macroinvertebrate sampling location.

Benthic samples were collected from each site (Fig. 1) monthly from May 1988 thru October 1988. Where possible, macroinvertebrate sampling sites were selected to coincide with already established water sampling locations. Because of the lack of precipitation, the low stream flow in late summer prevented benthic sampling at certain locations. Two springs, Big Spring and St. Olaf Spring, were also sampled for aquatic macroinvertebrates. Samples from Big Spring were obtained from sediment collection buckets and artificial substrates placed into the mouth of the spring for 4 to 6 weeks. St. Olaf Spring samples were collected over a 30-yard reach downstream from the spring mouth. All stream habitats (pools and riffles) and substrates (gravel, mud, sand, stream edge vegetation, etc.) were sampled in an effort to collect all fauna present. Substrate sampling utilized kick nets, Surber samplers, hand picking and Hester-Dendy artificial substrates. All samples were preserved in a 70% ethanol solution and returned to the laboratory where the macroinvertebrates were identified to the lowest practical taxon. Sources used in identification were Brown (1976), Bryce and Hobart (1972), Burch (1982), Burks (1953), Edmunds et.al. (1976), Frison (1942), Hobbs (1976), Holsinger (1976), Kenk (1976), Klemm (1982), Lewis (1974), Mason (1973), Needham and Westfall (1955), Phillips (1980), Ross (1944), Schuster and Etnier (1978), Williams (1976), Merritt and Cummins (1984), Pennak (1978), Wiggins (1977), and Simpson and Bode (1979).

RESULTS AND DISCUSSION

The results of the study will be discussed by major taxonomic groups and locations where they were collected. A summary of all the benthic organisms collected in the Big Spring Basin is presented in Table 1. Because of the variety of collection methods utilized, a semi-quantitative code has been used in the table to indicate the total numbers of organisms present. A list of organisms and water chemistry data collected for each sampling site and sampling date is available from the University of Iowa Hygienic Laboratory as Report #88-9 (1989).

Two major groups of annelids (worms and leeches) were collected in the Big Spring Basin. The tubificids (worms) were found at one site on Roberts Creek and at six sites on Silver Creek. A large number of tubificids were collected at Site 27 on Silver Creek. This location was downstream from a point source discharge with a high organic waste loading (creamery waste). The only other organism collected at Site 27 throughout the study was the chironomid, *Chironomus*. Both of these organisms thrive in waters with high levels of organic enrichment.

Several species of leeches (Hirudinea) were collected at many sites throughout the basin. *Helobdella triserialis, Placobdella ornata* and *Mooreobdella fervida* were the leeches collected most frequently. All of the leeches identified are considered common and widely distributed throughout North America (Klemm, 1982). *Placobdella ornata* and two species of *Erpobdella* have been reported from the nearby Upper Iowa River Basin (Meierhoff and Prill, 1981).

One freshwater planarian, *Cura formanii* known to inhabit cool streams in the eastern half of North America (Kenk, 1976), was collected from Unnamed Creek, Silver Creek and Roberts Creek. *Cura formanii* was collected from Roberts Creek and Silver Creek during late summer and fall (August, September and October) while it was collected every month at Sampling Sites 4, 5 and 6 located on the upper reaches of Unnamed Creek. Interestingly, *C. formanii* was not collected at the most downstream site (Site 3) on Unnamed Creek. In order to have the large populations (100-200 per 0.1 square

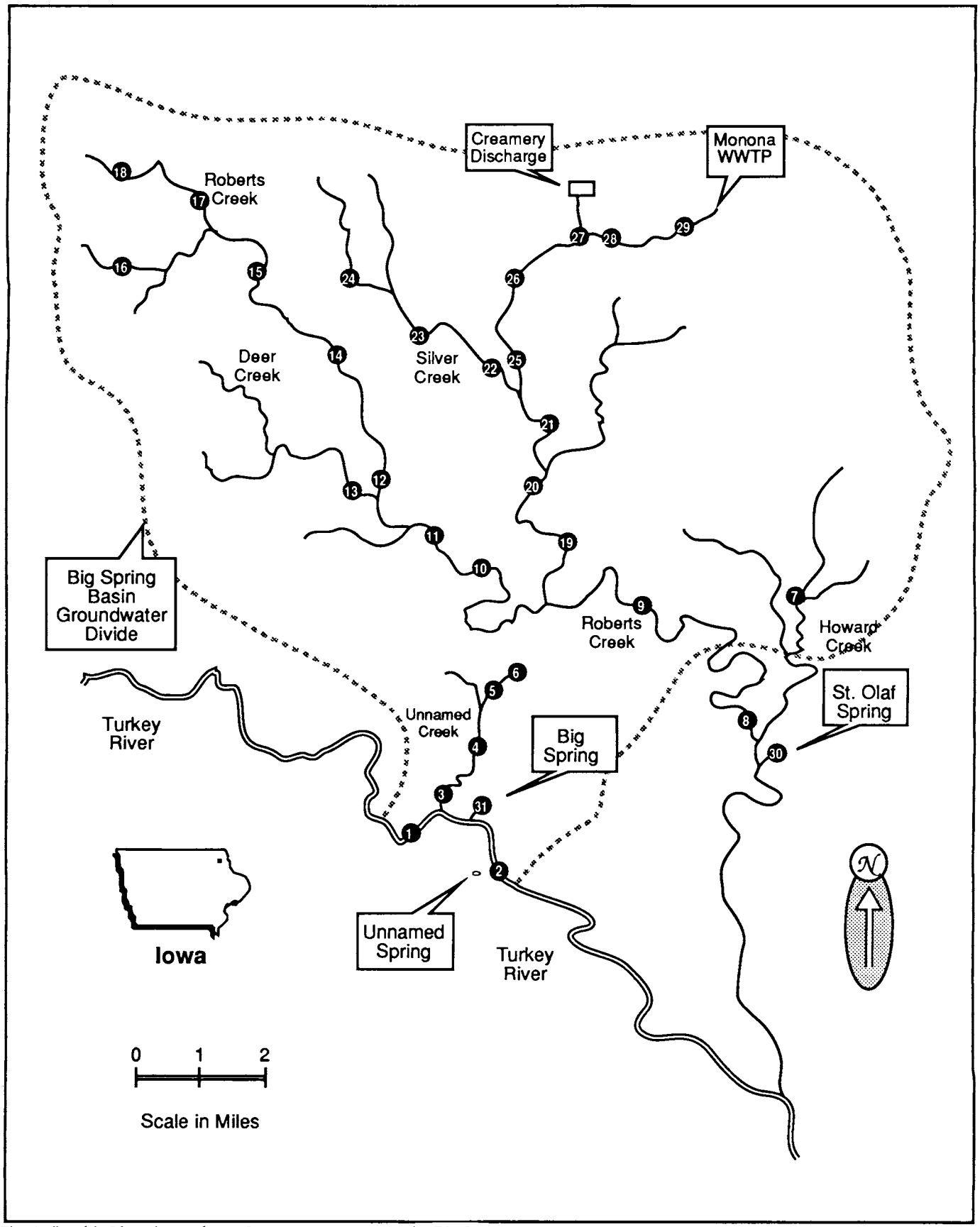

Fig. 1. Benthic Macroinvertebrate Sampling Locations in the Big Spring Basin

Table 1. Aquatic Macroinvertebrates Collected from the Big Spring Basin May thru October 1988.

	TR	UNC	HC	RC	DC	SC	SO	BS[a]
Annelida								
Oligochaeta								
Haplotaxida								
Tubificidae	-	-	-	C	-	A	-	-
Hirudinea								
Rhynchobdellida								
Glossiphoniidae								
Glossiphonia complanata Linnaeus	-	R	-	-	-	-	-	R
Helobdella elongata Castle	-	-	-	-	-	R	-	-
Helobdella stagnalis Linnaeus	-	-	-	-	-	R	-	-
Helobdella triserialis E. Blanchard	-	R	U	U	U	C	-	-
Placobdella ornata Verrill	R	-	-	U	R	R	-	-
Pharyngobdellida								
Erpobdellidae								
Mooreobdella fervida Verrill	R	U	-	U	U	C	-	-
Mooreobdella microstoma Moore	-	-	-	R	-	U	-	-
Platyhelminthes								
Turbellaria								
Tricladida								
Planariidae								
Cura formanii	-	A	-	C	-	C	-	-
Molluska								
Gastropoda								
Basommatophora								
Ancylidae								
Ferrissia sp.	-	-	-	R	-	-	-	-
Lymnaeidae								
Lymnaea sp.	R	R	-	U	-	U	-	-
Planorbidae								
Gyraulus sp.	-	-	-	R	-	R	-	-
Helisoma sp.	-	-	-	-	-	R	-	-
Physidae								
Physa sp.	C	C	C	C	C	C	U	U
Pelecypoda								
Heterodonta								
Sphaeriidae								
Musculium sp.	-	-	-	R	-	-	-	-
Pisidium sp.	R	U	U	U	-	U	-	-
Sphaerium sp.	-	U	R	U	U	C	-	-
Eulamellibranchia								
Unionidae	U	-	-	-	-	-	-	-
Arthropoda								
Crustacea								
Amphipoda								
Gammaridae								
Gammarus pseudolimnaeus Bousfield	-	-	-	-	-	-	C	C
Talitridae								
Hyalella azteca Saussure	-	-	-	C	C	C	-	-
Decapoda								
Astacidae	C	C	C	C	-	C	-	-
Orconectes sp.	-	-	-	C	-	-	-	-
Orconectes rusticus Girard	-	-	-	-	-	C	-	-
Isopoda								
Asellidae								
Lirceus sp.	-	-	-	-	-	-	R	-
Insecta								
Coleoptera								
Dryopidae								
Helichus sp.	U	C	-	C	-	U	-	-
Dytiscidae								
Agabus sp.	-	R	R	U	-	C	U	U
Dytiscus sp.	-	-	-	U	-	-	-	-
Hydaticus sp.	-	-	-	U	R	U	-	-

Table 1. (Con't)

	TR	UNC	HC	RC	DC	SC	SO	BS[a]
Hydroporus sp.	-	R	-	-	R	U	-	-
Ilybius sp.	-	-	-	-	-	U	-	-
Laccophilus sp.	-	R	-	C	C	C	-	-
Uvarus sp.	-	R	-	R	-	-	-	-
Elmidae								
Dubiraphia sp.	-	U	-	-	-	C	-	-
Stenelmis sp.	C	C	U	C	C	C	U	-
Gyrinidae								
Dineutus sp.	U	-	-	U	-	U	-	-
Gyrinus sp.	-	-	-	U	-	-	-	-
Haliplidae								
Peltodytes sp.	U	U	-	C	U	C	-	-
Hydrophilidae								
Berosus sp.	-	-	-	R	-	-	-	-
Enochrus sp.	-	-	-	R	-	-	-	-
Helophorus sp.	R	-	-	-	-	-	-	-
Hydrobius sp.	R	-	-	-	-	-	-	-
Hydrophilus sp.	-	-	-	-	-	U	-	-
Tropisternus sp.	U	U	-	C	U	C	-	-
Scirtidae								
Cyphon sp.	-	-	-	R	-	-	-	-
Scirtes sp.	-	-	-	R	-	R	-	-
Staphylinidae								
Stenus sp.	R	-	-	-	-	-	-	-
Diptera								
Chironomidae (Chironomini)								
Chironomus sp. Meigen	-	-	-	A	-	A	-	-
Cryptochironomus sp. Kieffer	-	-	-	U	U	C	-	-
Dicrotendipes sp. Kieffer	-	-	-	-	-	U	-	R
Glyptotendipes sp. Kieffer	U	-	-	-	-	U	-	-
Microtendipes pedellus	U	-	-	U	-	-	-	-
Parachironomus sp. Lenz	U	-	-	C	-	-	-	-
Paralauterborniella nigrohalteralis	-	-	-	U	-	-	-	-
Paratendipes sp. Kieffer	-	-	-	U	-	-	-	R
Phaenopsectra sp. Kieffer	-	-	-	-	-	-	-	U
Polypedilum fallax	U	U	-	U	-	U	-	-
Polypedilum sp. Kieffer	U	-	-	C	U	U	-	U
Stictochironomus sp. Kieffer	-	-	-	U	-	-	-	R
Tribelos sp. Townes	-	U	-	-	-	-	-	-
Chironomidae (Diamesinae)								
Diamesa sp. Meigen	-	C	-	C	U	-	U	-
Chironomidae (Orthocladiinae)								
Brillia sp. Kieffer	-	-	-	-	R	-	-	-
Cricotopus bicinctus	-	-	-	-	-	R	-	-
Cricotopus sp.	-	-	-	U	-	-	-	-
Cricotopus trifasciata	U	U	-	U	-	-	-	-
Orthocladius sp. Thienemann	-	-	-	C	-	U	R	R
Rheocricotopus sp. Thienemann & Harnisch	-	-	-	-	-	U	-	-
Chironomidae (Prodiamesinae)								
Prodiamesa sp. Kieffer	-	-	-	-	-	-	R	-
Chironomidae (Tanypodinae)								
Ablabesmyia sp. Johannsen	-	-	-	-	-	R	-	-
Conchapelopia/Thienemannimyia gr.	U	U	-	C	U	U	-	-
Procladius sp. Skuse	-	-	-	U	R	R	-	-
Psectrotanypus sp. Kieffer	-	C	-	U	-	U	-	-
Tanypus sp. Meigen	-	U	-	U	-	U	-	-
Zavrelimyia sp. Fittkau	-	-	U	U	-	-	-	-
Chironomidae (Tanytarsini)								
Micropsectra sp. Kieffer	-	-	-	-	-	U	-	R
Rheotanytarsus sp. Bause	-	-	-	U	-	U	-	-
Tanytarsus sp. vanderWulp	-	-	-	-	-	-	-	R

Table 1. (Con't)

	TR	UNC	HC	RC	DC	SC	SO	BS[a]
Athericidae								
Atherix sp. Meigen	C	-	-	U	-	-	-	-
Ceratopogonidae								
Palpomyia sp.	-	-	-	-	-	U	-	-
Culicidae								
Aedes sp.	-	-	-	-	-	U	-	-
Anopheles sp.	U	U	U	U	U	U	-	-
Culex sp.	-	-	-	C	-	C	-	-
Dixidae								
Dixella sp. Dyar and Shannon	-	-	U	R	-	-	-	-
Dolichopodidae								
Rhaphium sp.	-	-	-	-	-	U	-	-
Empididae								
Hemerodromia Meigen	-	-	-	-	-	-	R	-
Muscidae	-	-	-	U	-	-	-	-
Ptychopteridae								
Pytchoptera sp. Meigen	-	U	-	-	-	-	-	
Simuliidae								
Simulium sp. Latreille	C	C	U	C	-	C	U	-
Stegopterna sp. Enderlein	-	-	R	-	-	-	-	-
Stratiomyidae								
Odontmyia sp.	-	-	-	R	-	-	-	-
Oxycera sp. Meigen	-	R	-	-	-	-	-	-
Stratiomys sp. Geoffroy	-	-	-	-	-	U	-	-
Tabanidae								
Chrysops sp. Miegen	-	-	-	U	-	U	-	-
Tabanus sp. Linnaeus	-	U	-	-	-	U	-	-
Tipulidae	-	-	-	U	-	-	-	-
Dicranota sp.	-	-	-	-	-	-	R	-
Tipula sp.	-	U	-	U	-	U	R	-
Ephemeroptera								
Baetidae								
Baetis sp.	C	C	U	C	C	C	-	-
Baetis brunneicolor	U	C	-	C	-	C	C	-
Baetis intercalaris	-	C	-	C	-	C	-	-
Callibaetis sp.	-	C	U	C	C	C	-	-
Baetiscidae								
Baetisca sp.	U	-	-	-	-	-	-	-
Caenidae								
Caenis sp.	U	U	U	C	-	C	-	-
Ephemerellidae								
Ephemerella sp.	C	-	-	-	-	-	-	-
Ephemeridae								
Hexagenia limbata	-	-	-	U	-	-	-	-
Heptageniidae								
Heptagenia diabasia	-	-	-	U	-	R	-	-
Stenacron sp.	-	-	-	U	-	-	-	-
Stenacron candidum	-	-	-	R	-	-	-	-
Stenacron interpunctatum	C	C	U	C	-	C	-	-
Stenonema sp.	C	-	-	-	-	-	-	-
Stenonema neopotellum	C	-	-	-	-	-	-	-
Stenonema pulchellum	C	-	-	-	-	-	-	-
Stenonema vicarium	-	C	-	-	-	-	-	-
Leptophlebiidae								
Leptophlebia sp.	U	-	-	-	-	-	-	-
Oligoneuriidae								
Isonychia sp.	C	-	-	U	-	-	-	-
Polymitarcyidae								
Ephoron sp.	R	-	-	-	-	-	-	-
Potamanthidae								
Potamanthus sp.	C	-	-	-	-	-	-	-

Table 1 (Con't)

	TR	UNC	HC	RC	DC	SC	SO	BS[a]
Tricorythidae								
Tricorythodes sp.	C	-	-	R	-	-	-	-
Hemiptera								
Belostomatidae	-	-	-	C	-	-	-	-
Belostoma sp. Latreille	-	U	-	C	U	C	-	-
Corixidae	C	-	-	C	-	C	-	-
Hesperocorixa sp. Kirkaldy	U	U	U	C	C	C	-	-
Palmacorixa sp. Abbott	R	-	-	C	-	C	-	-
Gerridae	-	-	-	C	-	-	-	-
Gerris sp. Fabricius	-	U	C	C	C	C	-	-
Limnoporus sp. Stal	-	-	-	-	-	U	-	-
Metrobates sp. Uhler	-	-	U	C	-	-	-	-
Trepobates sp. Uhler	R	U	-	C	-	C	-	-
Mesoveliidae								
Mesovelia sp.	-	-	-	C	-	C	-	-
Nepidae								
Ranatra sp. Fabricius	-	R	-	U	-	U	-	-
Notonectidae								
Buenoa sp. Kirkaldy	-	-	-	C	-	-	-	-
Notonecta sp. Linnaeus	-	-	-	U	R	C	-	-
Veliidae								
Microvelia sp. Westwood	-	U	-	U	-	U	-	-
Rhagovelia sp. Mayr	-	-	-	U	-	-	-	-
Megaloptera								
Corydalidae								
Corydalus sp. Latreille	R	R	-	C	-	-	-	-
Sialidae								
Sialis sp. Latreille	-	U	-	C	U	C	-	-
Odonata (Anisoptera)								
Aeshnidae								
Aeshna sp.	-	U	U	U	C	U	-	-
Aeshna tuberculifera	-	-	-	-	-	U	-	-
Anax sp.	-	-	-	R	-	-	-	-
Boyeria sp.	-	-	-	-	-	U	-	-
Boyeria vinosa Say	-	-	-	-	-	U	-	-
Gomphidae								
Gomphus sp.	U	-	-	-	-	-	-	-
Libellulidae								
Libellula sp.	-	U	-	U	-	C	-	-
Plathemis sp.	-	-	-	U	-	-	-	-
Plathemis lydia Drury	-	-	-	U	-	C	-	-
Odonata (Zygoptera)								
Calopterygidae								
Calopteryx sp.	U	C	C	C	U	C	R	-
Hetaerina sp.	C	U	-	C	-	U	-	-
Lestidae								
Archilestes grandis	-	-	-	-	-	U	-	-
Coenagrionidae	-	-	-	C	-	-	-	-
Amphiagrion sp.	-	-	-	-	-	C	-	
Argia sp.	C	U	-	C	-	C	-	-
Coenagrion sp.	-	-	-	C	U	C	-	-
Enallagma sp.	C	C	R	C	C	C	-	
Ischnura sp.	-	-	-	C	-	R	-	
Plecoptera								
Perlidae								
Claassenia sp. Wu	C	-	-	-	-	-	-	-
Perlinella sp. Banks	R	-	-	-	-	-	-	-
Phasganophora sp. Klapalek	-	R	-	-	-	-	-	-
Perlodidae								
Isoperla sp. Banks	U	-	-	-	-	-	-	-

Table 1 (Con't)

	TR	UNC	HC	RC	DC	SC	SO	BS[a]
Pteronarcyidae								
Pteronarcys sp. Newman	C	-	-	-	-	-	-	-
Trichoptera								
Glossosomatidae								
Glossosoma sp.	-	-	-	-	-	-	U	-
Helicopsychidae								
Helicopsyche borealis	U	C	-	U	-	-	-	-
Hydropsychidae								
Cheumatopsyche sp.	C	U	-	C	-	U	-	-
Hydropsyche betteni[b]	-	C	-	U	C	C	-	-
Hydropsyche simulans[b]	U	-	-	-	-	U	-	-
Symphitopsyche sp.[b]	-	-	-	U	-	-	-	-
Symphitopsyche bifida[b]	C	U	-	C	-	R	-	-
Symphitopsyche morosa[b]	C	-	-	C	-	R	-	-
Symphitopsyche riola[b]	-	U	-	R	-	-	-	-
Symphitopsyche slossonae[b]	-	R	-	C	C	C	C	-
Hydroptilidae								
Hydroptila sp.	-	-	-	R	-	-	-	-
Limnephilidae								
Anabolia sp.	-	R	-	-	-	-	-	-
Philopotamidae								
Chimarra sp.	-	R	-	R	-	-	-	-
Total Number	58	61	22	111	32	95	16	12

[a]TR = Turkey River; UNC = Unnamed Creek; HC = Howard Creek; RC = Roberts Creek; DC = Deer Creek; SC = Silver Creek; SO = St. Olaf Spring; BS = Big Spring

[b]Schuster and Etnier, 1978

A = Abundant (>30)
C = Common (11-30)
U = Uncommon (4-10)
R = Rare (1-3)

meter) of *C. formanii* observed at Sites 5 and 6, a substantial food source must have been available. Planaria food usually consists of living, dead or crushed animal matter. While a source of this type of food was not apparent, a relatively large number of dairy cattle were located in and around Sampling Site 5 and may have contributed to the planaria food source. The upper reach of Unnamed Creek was so nutrient-enriched by cattle waste that benthic diversity was greatly reduced and the stream was choked with long tresses of attached filamentous algae.

Mollusks (snails and clams) in the Big Spring Basin were represented by six families and eight genera. The snail *Physa* was collected from all streams and both springs while the clams, *Pisidium* and *Sphaerium,* were collected in five of the six streams. Roberts Creek was the only collection site for *Ferrissia* (snail) and *Musculium* (clam) and their occurrence may be related to the large number of sampling sites (10) located on Roberts Creek. Four of the genera collected *(Ferrissia, Helisoma, Physa,* and *Musculium)* have also been recorded from the Upper Iowa River Basin (Meierhoff and Prill, 1981). All of the mollusks collected are considered widely distributed throughout North America (Burch, 1982).

Two amphipods, *Gammarus pseudolimnaeus* and *Hyalella azteca* were collected in the Big Spring Basin. *Gammarus pseudolimnaeus* was only collected from the springs (St. Olaf and Big Spring) while *H. azteca* was collected from many sites on Roberts Creek, Deer Creek and Silver Creek. Both organisms are widely distributed and common in unpolluted clear waters (Pennak, 1978).

The crayfish is the most abundant freshwater decapod and belongs to the family Astacidae. Crayfish were collected from all Big Spring Basin stream segments except Deer Creek and the two springs. Most of the crayfish collected were immature forms which made species identification impossible. One genus, *Orconectes* and one species, *O. rusticus,* were identified from Roberts Creek and Silver Creek respectively. This genus is common and has been found in northeast Iowa previously (Phillips, 1980; Prill, et. al., 1982).

Only one Isopod, *Lirceus,* was collected during the study and it was collected only from the St. Olaf Spring. Although the isopod, *Asellus intermedium,* has been collected from the Upper Iowa River (Meierhoff and Prill, 1981; USEPA, 1979) no previous collection record for *Lirceus,* in Iowa, has been found.

Eight families of aquatic beetles representing 22 genera were collected in the Big Spring Basin. Fourteen of these genera have been reported in northeast Iowa by other authors (Prill and Meierhoff, 1979; Meierhoff and Prill, 1980; Meierhoff, et. al., 1981; Prill, et. al., 1982; USEPA, 1979).

In the beetle family Dryopidae (the long-toed water beetles) only one genus, *Helichus,* according to Merritt and Cummins (1984) is common and widespread. *Helichus* was found at many locations (Turkey River, Unnamed Creek, Roberts Creek and Silver Creek) in the basin. It is interesting to note that the adults of *Helichus* are aquatic while the larvae are terrestrial (a condition that is unique among the aquatic insects).

Seven genera of the family Dytiscidae, or predaceous diving beetles, were found during the study. At least one genus of Dytiscidae was collected from each of the various streams and springs within the study area. All of the genera collected are considered to be widespread except for *Ilybius* which is considered to be an eastern North American genus (Merritt and Cummins, 1984).

Two genera of riffle beetles (family Elmidae) were collected in the basin. Although the genera, *Stenelmis* and *Dubiraphia,* are listed as being common and widespread, both organisms require habitats containing high concentrations of dissolved oxygen (Merritt and Cummins, 1984). *Stenelmis* was found throughout most of the Big

Spring Basin while *Dubiraphia* was found only in Roberts Creek and the Unnamed Creek.

The whirligig beetles (family Gyrinidae) are an interesting family in that they have divided eyes that allow them to see both above and below the surface of the water simultaneously. The two genera found during this study were *Dineutus* and *Gyrinus*. The Turkey River, Roberts Creek and Silver Creek were all home for *Dineutus* while *Gyrinus* was found only in Roberts Creek.

One genus *(Peltodytes)* of the family Haliplidae (crawling water beetles) was collected during the study. This beetle was found at many sampling sites throughout the Big Spring Basin (with the exception of Howard Creek and the two springs that were sampled). *Peltodytes* is a widespread genus and has been previously reported in northeastern Iowa.

The insect family Hydrophilidae (water scavenger beetles) are probably the second most commonly encountered aquatic beetles in the midwest (State Biological Survey of Kansas, 1981). Six genera *(Berosus, Enochrus, Helophorus, Hydrobius, Hydrophilus* and *Tropisternus)* were collected. The most common and widespread genus of Hydrophilidae in the basin was *Tropisternus* which was collected at many sampling sites. All of the genera, except for *Enochrus* and *Hydrophilus*, have been reported for northeastern Iowa.

Although the larvae of the insect family Scirtidae, or marsh beetles, are aquatic, the adults are short-lived terrestrial species. Two genera *(Cyphon* and *Scirtes)* were taken at a few stations in Roberts Creek and Silver Creek. A previous EPA study also reported finding *Cyphon* present in the Turkey River (USEPA, 1979).

According to Merritt and Cummins (1984), the Staphylinidae or rove beetles, are one of the largest and most poorly known families of Coleoptera. They are found chiefly in the damp littoral zones of fresh and saline waters, but few are truly aquatic. The genus *Stenus* was the only rove beetle collected. Although Merritt and Cummins (1984) indicates *Stenus* as being widespread in distribution, it was only found in the Turkey River.

Thirteen families of dipterans representing 48 taxa were collected throughout the Big Spring Basin. The family Chironomidae was represented by 27 genera. Almost all the chironomids collected are considered widespread in distribution and most have been collected in northeast Iowa before. Two genera of chironomids, *Diamesa* and *Prodiamesa*, identified are generally found in clean, cold, fast streams (Simpson and Bode, 1979) and have not been reported before in northeast Iowa. The relatively large numbers of *Chironomus* observed on the upper reaches of the East Fork Silver Creek (Sites 25, 26, 27, 28) may be related to poor water quality. A water sample collected at Site 26 on 22 June 1988 contained an ammonia nitrogen level of 4.6 mg/L and a BOD of 220 mg/L. Ferrington and Crisp (unpublished data, 1989) have correlated dense populations of *Chironomus riparius* pupal exuviae with elevated levels of ammonia nitrogen and biochemical oxygen demand (BOD). The only macroinvertebrates collected at Site 26 during June were tubificids and the dipteran, *Chironomus*, reflecting the poor water quality. Both the chironomids and the twelve remaining dipteran families were collected from many locations throughout the basin. The majority of the diptera taxa have been reported before from the Upper Iowa and Turkey Rivers (USEPA, 1979).

During the study 11 Ephemeroptera families representing 14 different genera of mayflies were collected in the Big Spring Basin. Representatives of the Baetidae and Heptageniidae families were found at the majority of the sampling sites. Other families, for example, the Ephemerellidae and Ephemeridae, were found only in the Turkey River and Roberts Creek, respectively. The most frequently collected mayflies were *Baetis brunneicolor, Callibaetis* and *Stenacron interpunctatum*. The species *Stenacron candidum* requires cool temperatures (Lewis, 1974), and was found at only one sampling site on Roberts Creek while *Stenacron interpunctatum* and *Stenonema vicarium* were collected at several sampling sites located within the Big Spring Basin. Except for *S. candidum*, all of the mayflies collected during this study have previously been identified in northeastern Iowa.

Seven families (representing 13 genera) of aquatic or semi-aquatic Hemiptera ("true bugs") were collected in the Big Spring Basin. The most frequently collected organisms were the giant water bug *(Belostoma)*, the water boatmen *(Hesperocorixa)* the water striders *(Gerris* and *Trepobates)* and the back swimmer *(Notonecta)*. Other less frequently collected hemipterans include an additional genus of the water boatmen *(Palmacorixa)*, various genera of the water treader *(Mesovelia)*, the water scorpion *(Ranatra)*, back swimmer *(Buenoa)*, broad-shouldered water striders *(Microvelia, Rhagovelia)* and water striders *(Limnoporus, Metrobates)*. All of the genera of the insect order Hemiptera found during this study are listed as being either wide spread in their North American distribution or as being found in the midwest (State Biological Survey of Kansas, 1981). Several of these genera *(Belostoma, Metrobates, Rhagovelia,* and *Gerris)* have also been previously reported in northeastern Iowa.

Two genera of the insect order Megaloptera were found in the Big Spring Basin. Alderflies *(Sialis)* were more frequently collected than dobsonflies *(Corydalus)*. *Sialis* was collected from Unnamed Creek, Roberts Creek, Deer Creek and Silver Creek, while *Corydalus* was collected from the Turkey River, Unnamed Creek and Roberts Creek. Both of these genera are widespread in their North American distribution.

Three families of dragonflies (Aeshnidae, Gomphidae, and Libellulidae) representing six genera were collected from all stream segments. No dragonflies were collected from either the St. Olaf Spring or Big Spring sites. The most frequently collected genera of dragonflies were *Aeshna, Boyeria, Libellula* and *Plathemis*. All of the dragonfly genera found during this study are widespread in their distribution and known to occur in the midwest. With the exception of *Aeshna tuberculifera*, all of these dragonflies have been previously found in Iowa.

Three families of damselflies (Calopterygidae, Lestidae and Coenagrionidae) representing eight genera were collected in the basin. *Calopteryx* was the most widespread genus collected being found in all streams segments and from the St. Olaf Spring. Other frequently collected genera of damselflies were *Hetaerina, Argia* and *Enallagma*. It is interesting to note that all eight genera of damselflies were present in Silver Creek. Also noteworthy was the collection of *Archilestes grandis* from several locations in Silver Creek. Although some authors (Merritt and Cummins, 1984) list the geographical distribution of *A. grandis* as western North America, it has been reported as being present in the midwest (State Biological Survey of Kansas, 1981), *Archilestes grandis* has not been reported in Iowa previously. The remaining damselflies found during this study are reported either as being widespread in their North American distribution or are known to occur in the midwestern United States.

Five genera of stoneflies (Plecoptera) were found during this study. Four genera *(Claassenia, Perlinella, Isoperla* and *Pteronarcys)* were collected from the Turkey River while the stonefly *Phasganophora* was obtained from a single site (3) on Unnamed Creek. Site 3 was located near the mouth of Unnamed Creek and only a short distance from the Turkey River. Although stoneflies are known to be habitat and stream specific, it seems unusual not to have collected stonefly nymphs on any other stream segments. With the exception of *Claassenia* all of the other stonefly genera collected have been reported in Iowa.

Representatives of the Trichoptera order were collected from all stream segments except Howard Creek and the Big Spring itself. Six families representing 8 genera were collected. The most frequently collected caddisflies belong to the family Hydropsychidae and were *Cheumatopsyche, Hydropsyche betteni, Symphitopsyche bifida, Symphitopsyche morosa* and *Symphitopsyche slossonae*. Several caddisflies collected in the basin are not commonly found anywhere else in Iowa. In

particular, *Glossosoma* and *Helicopsyche borealis* are unique to northeast Iowa. *Glossosoma* prefers clean, cold streams and was only collected from the St. Olaf spring segment. *Helicopsyche borealis,* although able to withstand wide temperature variations (Wiggins, 1977), has not been reported in Iowa before.

SUMMARY

A wide variety of aquatic invertebrates were collected from the streams and springs in the Big Spring Basin. Although the majority of the organisms identified are distributed throughout Iowa, several are limited to northeast Iowa. The clear cold water requirements of these organisms restrict their distribution to this area. In addition, we believe some of the aquatic insects, i.e., *Glossosoma* and *Prodisameia,* collected may represent geographical isolates. If these were to be removed by an environmental perturbation their repopulation would be in doubt. The impact that anthropogenic effects (creamery waste and cattle in the stream) can have on aquatic macroinvertebrate diversity was demonstrated on two stream segments in the basin. The continued existence of aquatic life in the Big Spring Basin is dependent, at a minimum, on maintaining current water quality and habitat conditions.

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