THE BIOLOGICAL RESOURCES OF ILLINOIS CAVES AND OTHER SUBTERRANEAN ENVIRONMENTS

Determination of the Diversity, Distribution, and Status of the Subterranean Faunas of Illinois Caves and How These Faunas are Related to Groundwater Quality

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TECHNICAL REPORT 1993 (8)
ILLINOIS NATURAL HISTORY SURVEY
CENTER FOR BIODIVERSITY

Prepared for:

The Environmental Protection Trust Fund Commission

and

Illinois Department of
Energy and Natural Resources
Office of Research and Planning
325 W. Adams, Room 300
Springfield, IL 62704-1892

Jim Edgar, Governor
State of Illinois

John Moore, Director
Illinois Department of Energy
and Natural Resources

ACKNOWLEDGEMENTS

Funding for this project was provided through Grant EPTF23 from the Environmental Protection Trust Fund Commission, administered by the Department of Energy and Natural Resources (ENR). Our thanks to Doug Wagner and Harry Hendrickson (ENR) for their assistance. Other agencies that contributed financial support include the Shawnee National Forest (SNF) and the Illinois Department of Transportation (IDOT). Many thanks to Mike Spanel (SNF) and Rich Nowack (IDOT) for their assistance. Several agencies cooperated in other ways; we are grateful to: Illinois Department of Conservation (IDOC); Joan Bade of the Monroe-Randolph Bi-County Health Department; Russell Graham and Jim Oliver, Illinois State Museum (ISM); Dr. J. E. McPherson, Zoology Department, Southern Illinois University at Carbondale (SIUC). Further contributions were made by the National Speleological Society, Little Egypt and Mark Twain Grottoes of the National Speleological Society, and the Missouri Speleological Survey.

This report is built upon the contributions of many people for whom we are eternally grateful. Most important among these are landowners (too numerous to mention) who allowed us access to their caves or permission to cross their land. Cavers who have helped us with field work at various times include Aaron Addison, Charles Albert, Don Bittle, Kent Buckles, Don Coons, Amy Driskell, Justin Lassy, John Lloyd, Dave Mahon, Philip Moss, Myron Mugele, Carl Pierce, Jim Rodemaker, Brian Schaffner, Mark Stamborski, Terri Treacy, and Father Paul Wightman. Other individuals that provided assistance with field work included Ed Anderson (IDOC), Randy Nyboer (IDOC), Bill Handel, Illinois Natural History Survey (INHS), Ken Barker (Mine Reclamation) and Armin Kreuger.

Many other people assisted us in various ways, and we are grateful for their help. Philip Moss, Don Paquette (National Cave Rescue Commission) and others provided useful safety training. Mark J. Wetzel for the loan of an oxygen meter. Sue Wood (INHS) analyzed water samples during 1992. John Meister and John Hicks provided laboratory space for water analysis at SIUC Pollution Control and Shirley Irland (Irland Laboratories, Metropolis, IL) analyzed water samples during 1993. Discussions with Mary Ann Ryan, Steve Varsa (SIUC Pollution Control), and Anna Maxwell-Dennis, Illinois Basin Environmental, Inc. (Carbondale) aided us in our understanding of karst geology, hydrology and water quality. Bill Elliot, Texas Memorial Museum (Austin, TX) provided the results of a literature search. Drs. Horton Hobbs III (Wittenberg University, Springfield, OH), David Culver (Department of Biology, American University, Washington, D. C.), Brooks M. Burr, Donald R. Tindall, J. E. McPherson, Joseph A. Beatty, George Feldhamer (SIUC), and David Ashley (Western Missouri University, MO) provided helpful discussions and advice. Diane Wood (SIUC) aided in initial sorting of macroinvertebrate specimens, and Holly McIlrath (SNF) assisted in data entry.

We would like to sincerely thank those individuals that identified the various terrestrial and aquatic organisms: Dr. J. A. Beatty, Department of Zoology, SIUC (Arachnida); M. A. Harris, Center For Biodiversity, INHS (Ephemeroptera, Plecoptera, Trichoptera); J. A. Krejca (Mammalia: Chiroptera); Dr. L. M. Page, Center For Biodiversity, INHS (Amphipoda and Decapoda);

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EXECUTIVE SUMMARY

This report presents the results of a two year study examining the biota and groundwater of Illinois caves. Ninety eight caves, mines, pits, and springs were examined in 13 counties throughout four karst regions of Illinois. Extensive faunal inventories were conducted at each site, water samples were collected from 55 sites and aquatic cave invertebrates from 5 sites were chemically analyzed.

Over 5,900 invertebrate specimens, representing 4 phyla, 11 classes, and at least 32 orders, have been sorted and entered into a database. The specimens are now being identified by cooperating systematists. The state endangered amphipod *Crangonyx anomalus* was collected at a second spring in Pope County, Illinois. The state endangered species *Gammarus acherondytes* was collected in Fogelpole Cave in 1992 but was not collected in 1993 in any of the five caves for which it had been previously reported. An additional cave locality for this species was identified from Oliver and Graham material (Illinois State Museum).

Vertebrate specimens in caves were dominated by salamanders and bats. Seven species of salamanders were collected, although no state or federally threatened or endangered species were observed. Seven species of bats were observed in Illinois caves. The federally endangered species *Myotis grisescens* and *M. sodalis* were observed in one and six caves, respectively. The state endangered species *Myotis austroriparius* was observed in two caves.

Nitrates were detected in the 31 water samples tested and one spring and one cave stream in Monroe County exceeded the Illinois Pollution Control Boards Maximum Contamination Level of 10 mg/L.

Mercury levels from 9-658 parts per billion were detected in specimens of amphipods and isopods from one spring and four cave streams although mercury was not detected in any of the water samples tested.

Pesticides (o,p-DDE, p,p'-DDE, and Dieldrin were detected in each of the three samples of isopods and amphipods as well as in several water samples. No Atrazine was detected in any water samples.

Preliminary results of chemical analyses show some interesting trends, but no cases of severe chemical contamination. Correlations between water quality and the cave biota await the specific identifications of organisms collected.

CHAPTER 1: INTRODUCTION

Approximately 40,000 caves are known in the United States (Holsinger 1988), with 391 of these in Illinois (Oliver and Graham 1988; present study) (Figure 1). Unlike most natural features, caves are difficult to conceptualize, and only through intensive study can we begin to understand the subterranean routes that carry groundwater which we rely on as a source of drinking water, and which is home to unique and very specialized organisms.

Caves in Illinois are restricted to limited areas because of past glaciations. The limestone and dolomite in the northeastern part of the state have undergone multiple glaciations which have destroyed or filled any caves that may have been there (Peck and Lewis 1978). The majority of Illinois caves are located in four karst regions (Figure 2) where exposed limestones occur along the western and southern edges of the state. Illinois caves are formed in Paleozoic limestones, ages ranging from Ordovician to Mississippian.

The very existence of caves makes them worthy of protection as any other natural phenomenon would be. The relative rarity of caves in Illinois and their particular vulnerability to damage from human activities warrants special consideration and study. Illinois caves contain many unusual resources not found in other environments. One feature unique to caves is their fragile speleothems (secondary carbonate deposits, stalactites, stalagmites). Illinois is known to harbor some exceptionally rare speleothems formed as a result of the mineral deposits in the Driftless Area of northwestern Illinois (Peck 1978).

Cave life, in particular troglobitic (obligate cave inhabitants) organisms, is another unique resource found underground and nowhere else. These organisms are particularly vulnerable to habitat perturbations caused by human activity, because they are often rare organisms in a habitat that is itself rare (Chapman 1987). There are about 1,200 troglobites known in North America (Holsinger 1988), and many more remain undescribed. Peck and Lewis (1978) reported 18 troglobitic invertebrates from Illinois, about 10 of which are considered endemic. Of the many species of organisms inhabiting Illinois caves, 10 are threatened or endangered at the state and or federal level (Herkert 1992). Many other cave inhabiting organisms may also warrant such status. Unfortunately, it is difficult to determine the conservation status of invertebrate species, and since we generally lack extensive ecological data concerning the environmental requirements of the species, development of management recommendations is severely hampered (Howarth 1981, 1983; Pugsley 1981).

The biological resources supported within caves are fragile and often poorly understood. Because of the unique subterranean environment, cave adapted organisms are highly specialized and have evolved narrow tolerances that make them particularly susceptible to disturbance. The environment that has influenced the behavioral adaptations, morphology, physiology and evolution of these unique creatures can be a harsh environment for the human researcher, and this has delayed the accumulation of knowledge about this ecosystem. The absence of light, near-constant temperatures, high relative humidity, and minimal energy input are some of the properties of the cave environment (Gardner 1991). The narrow tolerances of cavernicoles (animals dwelling in caves) makes them far more sensitive to changes than similar epigean (surface dwelling) species (Field 1989).

THE CAVE ENVIRONMENT

Caves are ecologically divided into four zones: the entrance, twilight, middle (or transition) and dark zones (Poulson and White 1969). The properties of these environments, (available light, temperature and its constancy, relative humidity, proximity to surface openings, etc.) are the basis of their definitions and also have a strong impact on the kinds of organisms that are found in and utilize each different zone.

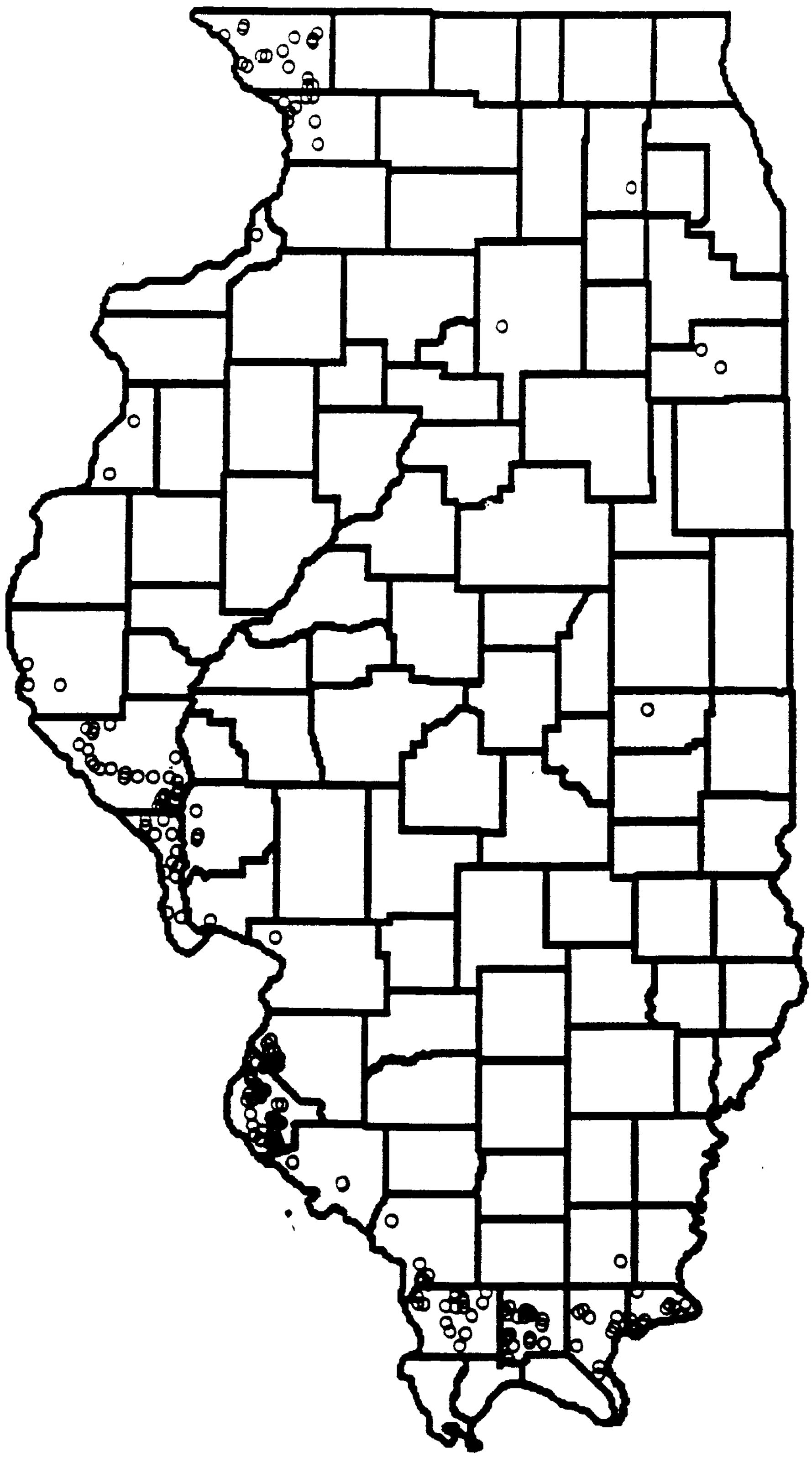

Figure 1. Distribution of caves in Illinois. Only caves with fairly precise locations are shown.

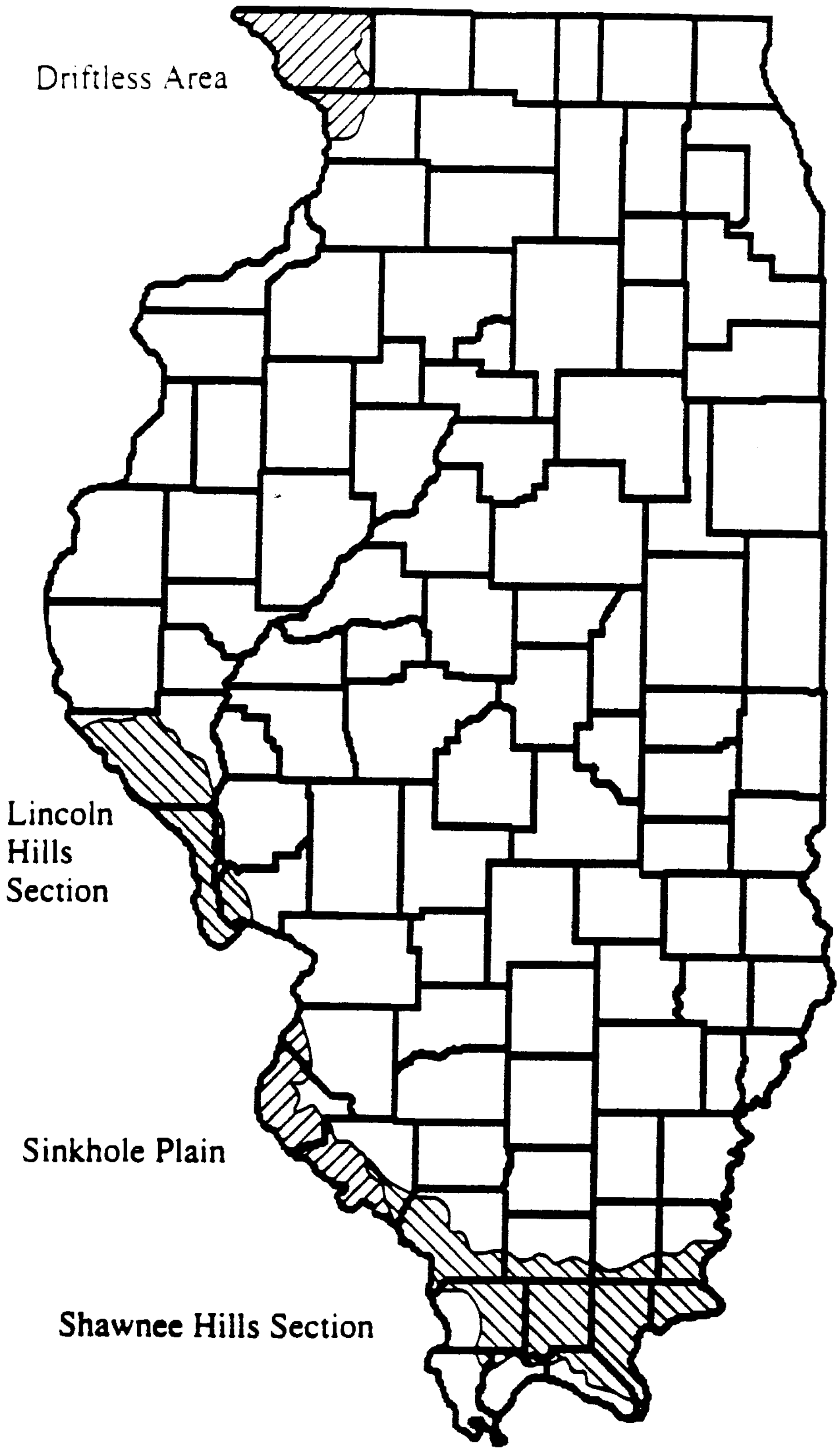

Figure 2. The four karst regions of Illinois.

The **Entrance Zone** is that part of the cave immediately associated with the surface environment. Light, temperature, and relative humidity fluctuations are similar to those in surrounding surface habitats. The fauna of the entrance zone is often similar to that of moist shaded bluffs.

The **Twilight Zone** extends from the entrance zone to where vision is no longer possible with the unaided human eye. Temperature and relative humidity fluctuate, but the environment is usually damp and cool. The entrance and twilight zones have the largest and most diverse assemblage of animals of any of the cave zones.

The **Middle Zone** (Transition) is completely dark, but temperature and relative humidity still fluctuate somewhat on a seasonal basis.

The **Dark Zone** is devoid of light, and temperature and relative humidity are nearly constant. The dark zone temperature in Illinois caves is generally in the range of 13 to 15 $^{\circ}C$. Relative humidity in the dark zone is usually near the saturation point, and animals found here (excluding bats and cave crickets) are capable of completing their entire life cycles without leaving the cave.

Since the differences between the middle zone and the dark zone are difficult to determine on a single visit to a cave, the two zones were combined for the purposes of this study, and are collectively referred to as the dark zone.

The cave environment affects the behavior, development, and evolution of the organisms living there. The absence of light, near-constant temperatures and relative humidity all influence the animals found in caves and their positions within the cave (distance from the entrance). The general cave climate varies little when compared to variations in surface climates. The cave environment is cool and relative relative humidity is usually high (80% or more), therefore, evaporation rates are very low. Cave life is typically associated with areas where the relative humidity approaches the saturation level (Culver 1982). Air currents in caves are normal events and can have drastic affects on the temperature and relative humidity within the cave. The temperature in the dark zone of a cave generally approximates the average yearly surface temperature. This is more true for larger caves (such as Mammoth Cave, Kentucky, where temperatures only fluctuate over a 0.3 $^{\circ}C$ range in remote parts of the cave (Barr and Kuehne 1971) than for smaller caves (Juberthie 1969). A typical cave might have temperature fluctuations of several degrees through much of the passage (Culver 1982), with much greater fluctuations in the entrance zone and, to a lesser degree, in the twilight zone.

CLASSIFICATION OF CAVERNICOLES

Cavernicolous animals, or animals dwelling in caves, are ecologically classified with respect to their degree of adaptation to the cave environment and with respect to the degree they are restricted to the cave environment. The most widely accepted system stems from the work of Barr (1963, 1968), which has been detailed in a number of other studies (Holsinger and Culver 1988; Peck and Lewis 1978), and is used in this study:

Accidentals. These organisms enter caves by accident and exist there only temporarily (they either leave or die). Accidentals may be washed into caves in floods, or they may wander or fall into caves.

Trogloxenes. Trogloxenes frequent caves and other moist cool habitats outside of caves. They must return to the surface (or at least the cave entrance) to forage.

Troglophiles. These organisms can complete their entire life cycles within a cave, but they may also be found in similar epigean habitats (deep down in surface leaf debris; in crawl spaces beneath buildings; inside wet rotting logs; in bluffs; and in and around springs). The cave salamander (*Eurycea lucifuga* Rafinesque) and the spring cavefish (*Forbesicthys agassizi* (Putnam)) are two troglophilic vertebrates found in Illinois.

Troglobites. Troglobites are obligate cave inhabitants. They usually display morphological specializations such as the loss of pigment, reduction or loss of eyes, and attenuation of the body and appendages. Troglobites often exhibit a number of physiological specializations that distinguish them from their sister taxa in epigean environments. Metabolic rates are generally lower, olfactory, vibratory and tactile senses are typically modified and well developed, movements often appear slower and more deliberate, and reproductive strategies tend towards the production of fewer and larger eggs and young. Reproduction is often closely attuned to seasonal availability of food, as might be brought in by flooding (Ginet 1960). No troglobitic vertebrates are known from Illinois.

Other special terms are used to classify cavernicoles occupying particular types of habitats. **Edaphobites** are found in deep soil and sometimes in caves. **Phreatobites** (or **Stygobionts**) occur both in caves and in other groundwater.

Many organisms are referred to as **epigean** animals. These organisms are usually restricted to living on the surface. When found in caves they are termed accidentals. **Hypogean** organisms are animals that live below ground. This includes troglophiles, troglobites, phreatobites and edaphobites.

Communities of cave dwelling organisms are not comprised wholly of troglobites. Only 20 to 30% of the faunal assemblages of most North American caves are comprised of troglobitic species. The largest percentages of the total cave fauna are troglophiles and trogloxenes.

CAVE COMMUNITIES

Because of the total absence of light, cave communities generally lack energy capturing primary producers (plants), and thus cave communities are decomposer communities, depending on other sources of energy. The primary source of food for cave life is organic debris, especially flood debris (Howarth 1983). This organic debris is often broken down by microorganisms (bacteria and fungi) (Barr 1968; Culver 1982), and these microorganisms are an important food item for many cavernicoles (Dickson and Kirk 1976). A second source of energy, and an important one in Illinois caves, is fecal material (Poulson 1978) from raccoons, bats, cave crickets and other animals that go above ground to forage. Another important food source are the accidentals--these organisms are sometimes overlooked in cave studies, but they make an important contribution to the diets of cave predators and scavengers (Howarth 1983, Smith 1980).

Just as with other ecosystems, human disturbance affects cave ecosystems. As a result of changes we make on the surface, we unknowingly alter the cave environment, destroying unique and valuable organisms before we even know of their existence. Unfortunately the public perception of caves and the organisms that inhabit them often has little relevance to the facts (Foster 1992) and often the public cares little about the conservation and protection of groundwater, caves, and cave life. It is not at all uncommon to find sinkholes filled with trash, serving as a "natural garbage can" for locals. The caves that many non- conservation minded people visit are permanently damaged with graffiti, trash, broken speleothems and fires. Over 61% of the Illinois caves inventoried by the Illinois State Museum (Oliver and Graham 1988) displayed one or more of these forms of human disturbance.

Arthropoda: Diplopoda. Insecta: Collembola: Entomobryidae. Diptera: Heleomyzidae. Sciaridae. Hymenoptera: Formicidae. Orthoptera: Gryllacridae: *Ceuthophilus* sp. Trichoptera.
Mollusca: Gastrpoda.
Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga.*

Current Status: This cave is fairly pristine and not affected by human visitation. However, the practice of dumping garbage in sinkholes constitutes a real threat to this cave and it's biota.

Procyon Cave, [Unnamed Cave]

Johnson County. Site #272.

This cave is located in a draw on the side of a wooded hill below a pasture and a house. The hillside is currently being logged. Nearly all of the cave was examined on March 6, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is a collapse area, 4 feet by 8 feet, under a fallen tree that leads down from surface drainage. In the twilight zone a small cave stream is intersected. The bottom of the cave stream is covered with a black encrusting layer that is easily broken. This encrusting layer is up to 1 inch thick. A few names are scratched or smoked onto the walls and ceiling of the cave. Much of the passage is 12 feet high by 8 feet wide. Upstream, the cave becomes about 1 foot wide. There is probably less than 300 feet of passage in this cave.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978) Their locality was "unnamed cave at White Hill" in Johnson County, Illinois, which is probably, but not for sure, the same as our Procyon Cave. This could be checked by comparing the general site location given in Peck and Lewis' Figures.
PlatyhelminthesP Turbellaria: Tricladida.
Annelida: Oligochaeta.
Arthropoda: Arachnida: Acari. Araneae: Dictynidae: *Cicurina brevis*. Linyphiidae: *Bathyphates pallida, Centromerus latidens, Linyphia radiata.* Liocranidae: *Scotinella redempta.* Lycosidae: *Pirata* sp. Pisauridae: *Dolomedes* sp. Tetragnathidae: *Meta americana.* Malacostraca: Isopoda: Asellidae: *Caecidotea* sp. 2. Opiliones. Amphipoda: Crangonyctidae: *Crangonyx minor, Crangonyx* sp.*packardi* group). Chilopoda: Geophilomorpha. Lithobiomorpha. Diploda. Insecta: Collembola. Diplura: Japygidae.Diptera: Phoridae: *Megaselia cavernicola..* Stratiomyiidae/ Homoptera: Cicadellidae. Lepidoptera. Orthopterha: Gryllacrididae: *Ceuthophilus* sp. Siphonaptera. Thysanura.
Mollusca: Gastropoda.
Amphibia: Caudata: Plethodontidae: *Eurycea longicauda longicauda, Eurycea lucifuga, Plethodon glutinosis.*

Current Status: Quarrying on a nearby hill may threaten this cave and other karst in the area. Ongoing logging around the entrance to the cave may result in increased sediment deposition in the cave stream, thus threatening the aquatic cave community.

Sink-Joint Cave

Johnson County. Site #617.

This cave is located on a wooded hillside about 40-50 feet above a nearby valley. Adjacent to the woods are farm fields. Nearly a complete examination was conducted on June 15, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is 9 feet high by 4 feet wide with bedrock walls and ceiling and a gravel/breakdown floor. The entrance is on the side of the bottom of a large sinkhole 40 feet long, 15 feet wide, and 15 feet deep. A small trickle of water flows from the entrance and quickly sinks down into the gravel in the bottom of the sink. The sink and cave are developed along a northeasterly trending joint. The passage consists of limestone bedrock walls and ceiling developed along a joint. The cave stream is 1-5 inches deep and the passage is enterable for 25 feet, where it then becomes too low. No vandalism or human debris was observed. The presence of a typical limestone cave fauna suggests that the subterranean system here is considerably more extensive than the portion that is humanly enterable.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Acari: Ixodidae. Araneae. Malacostraca: Amphipoda: Gammaridae. Decapoda: Cambaridae: *Cambarus tenebrosus*. Insecta: Coleoptera: Carabidae. Collembola: Entomobryidae. Diptera: Culicidae; Heleomyzidae; Mycetophilidae; Sciaridae; Tipulidae. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Mollusca: Gastropoda.

Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga*,.

Current Status: This small cave is relatively free from human impact. It is possible that farming chemicals and topsoil from agricultural fields could wash into the cave upstream of the enterable passage.

Teal's Cave. [Teal Cave]

Johnson County. Site #16.

This cave is located on a wooded hillside beneath pasture and a farm pond. A rural residential area lies below the cave. The entire cave was examined and mapped on May 20, 1993 by J. K. Krejca and S. J. Taylor. The north entrance to this cave is a sinkhole entrance 4 feet by 5 feet on the side of a hill. It goes nearly straight down for a short distance. Rock is exposed on about half of the entrance wall, the remainder of the wall being soil. The south entrance, about 80 feet away, is a small entrance on the same hillside, 2 feet by 3.5 feet. It drops straight down into the cave. From the north entrance, one can go down into a small room, almost completely filled by a large breakdown block. On the south side of the room is a small opening through which one can look down over a large pit that is more accessible through the south entrance. The floor of this passage is dry limestone breakdown.

From the south entrance, the passage drops down into an irregular passage with a rubble and breakdown floor which trends towards the north with two side passages leading out towards the surface of the hill. At some points, the passage is 20 feet high. After about 100 feet, the passage nearly terminates in a low breakdown filled room, but a small opening on one side leads to the top of a joint controlled pit, 30 feet deep. Some areas of the pit walls are decorated with large popcorn. From the bottom of the pit, passages lead off to the east and west. The western end leads upwards and ends in breakdown near the level of the top of the pit. To the east, a high upper lead with considerable popcorn runs about 50 feet to a dead end. At the bottom of the eastern end of the joint is a low water crawl. This passage contains a cave stream, though there was only a small rivulet of water at the time of our visit. The passage becomes too small to be humanly enterable here. Little evidence of human visitation was observed in the cave. The total surveyed length is 366 feet, and 52 feet deep.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978).

associated with a cave entrance. Habitat disturbance and possible groundwater degradation are threats to this population (Herkert 1992).

The bat family Vespertilionidae (Chiroptera) is perhaps the best known taxon in Illinois which contains endangered species found in caves. The southeastern bat *Myotis austroriparius* (Rhoads) and Rafinesque's big-eared bat *Plectous rafinesquii* Lesson are state endangered and the gray bat *M. grisescens* Howell and the Indiana bat *M. sodalis* Miller and Allen are federally and state endangered (Herkert 1992). Bat populations are particularly sensitive to visitation by scientists and cavers (Mohr 1972) as well as to insecticide poisoning (Reidinger 1972).

ENDEMIC CAVE INVERTEBRATES IN ILLINOIS

More than 200 invertebrate species are known to inhabit caves and groundwater habitats in Illinois, and several of these are endemic troglobites. In addition, there are a number of other specimens which may ultimately turn out to be endemic troglobites that remain either undescribed or unidentified.

Caecidotea lesliei Lewis and Bowman (Isopoda: Asellidae) is Illinois' only endemic isopod (Lewis and Bowman 1981; Henry *et al.* 1986) and has been collected only from a single drain tile in McDonough County. *Stygobromus lucifugus* (Hay 1882) (Amphipoda: Crangonyctidae) is known only from groundwater in Knox County (Holsinger 1986), and *Gammarus acherondytes* (Amphipoda: Gammaridae) is found in caves in the Sinkhole Plain (Herkert 1992; Holsinger 1986; Peck and Lewis 1978; Stock 1986, Webb 1993). Peck and Lewis (1978) list an undescribed or unidentified *Crangonyx* and two undescribed or unidentified *Stygobromus* species, which may also be state endemics, but are not listed as such in Holsinger (1986). Herkert (1992) lists *Crangonyx anomalus* Hubricht as an endemic, but the species is also known from Kentucky, Ohio, and Indiana (J. R. Holsinger, personal communication 1992).

Two species of troglobitic carabid beetles are endemic to Illinois. *Pseudanophthalmus illinoisensis* Barr and Peck is known from one cave in Hardin County. *Ptomaphagus nicholasi* Barr is known from one cave in Monroe County (Peck and Lewis 1978), but may actually be a mislabeled specimen from another state.

Among the remaining endemic troglobites are three millipedes: *Ergodesmus remingtoni* (Hoffman) (Polydesmida: Xytodesmidae) is known from caves in the Lincoln Hills and Sinkhole Plain; unidentified immatures of the genus *Antriadesmus* (Polydesmida: Trichopolydesmidae) may be troglobitic endemics, but the genus is known from surrounding states; and an undescribed troglobitic *Pseudotremia* (Chordeumida: Cleidogonidae) (Peck and Lewis 1978) from a cave in the Shawnee Hills.

Christiansen (1982) notes that there are a number of undescribed springtail species of the genus *Pseudosinella* (Collembola: Entomobryiidae), but does not discuss any species of the genus from Illinois besides the widespread *Pseudosinella aera* Christiansen and Bellinger, known from surface samples in Illinois. Peck and Lewis (1978) report a possibly troglobitic, unidentified or undescribed *Pseudosinella* sp. from a cave in Johnson County which may be an endemic.

Ferguson (1981) reported that dipluran species identical or very similar to *Tricampa rileyi* or *T. remingtoni* are known from three caves in Illinois. Therefore, these diplurans, reported as "*Metriocampa* sp." by Peck and Lewis (1978) may or may not be endemic troglobites.

GROUNDWATER
THE ROLE OF CAVES AND KARST AQUIFERS IN GROUNDWATER

Caves are extremely important to Illinois residents because of the groundwater they contain. Fifty percent of the nation's population and 95% of the rural population depend on groundwater as a source of drinking water (Moore 1988; Helling 1986; Collins and Johnson 1988). The pollution of this water is increasingly becoming a concern, as almost half of the reported water carried disease outbreaks each year in the U.S. result from the consumption of contaminated groundwater (Gerba 1988). Caves function as conduits for underground water flow, and the water associated with them often serves as a drinking water source for people living in karst areas. In Illinois' Sinkhole Plain, which has a higher concentration of caves than any other area in the state, many cities use wells that tap into karst aquifers as their source of drinking water (Joan Bade, personal communication 1992).

Aquifers in karst terranes are exceptionally sensitive and have a higher potential for contamination than do other aquifers (Field 1989; Helling 1986). Three of the unique characteristics that make karst aquifers particularly vulnerable to contamination (discrete conduits, turbulent flow, and unique and varied recharge) are discussed below.

Discrete conduits carry much of the water in karst areas. Similar to surface streams, these tend to be convergent in their upper reaches, which gives them the potential to concentrate contaminants (Field 1989). These conduits can sometimes be divergent in the lower reaches, and dye tracing has shown that water from one source may come out of as many as 20 different springs (Quinlan 1982; Palmer 1986). Generally there is one easy route that the water follows, but during a flood, water may reach into upper fossil passages and flow to different springs. This can spread contamination and complicate the understanding of the hydrology.

Turbulent flow does not allow for the filtration that is generally associated with groundwater, and this type of flow is much more rapid than the flow of diffuse groundwater. Therefore, karst aquifers have the potential to spread contaminants over great distances very quickly (Quinlan and Ewars 1985; Smart and Hobbs 1986). Sensitivity to quick flooding after a rain creates high concentrations of contaminants that create brief, but hazardous water quality problems (Hallberg *et al.* 1985). According to Field (1989), downgradient wells, springs and sinkholes can be contaminated within a few hours of a chemical spill or rain, and this allows little time for adequate warning to those who rely on the water.

The recharging of a karst aquifer is varied and unique. Most commonly associated with karst terranes are sinkholes. Sinkholes provide little or no filtration or attenuation of contaminants, allowing them to be directly injected into the groundwater (Field 1989). Sediments, disease causing bacteria, viruses and chemicals travel directly into the aquifer without the filtration through surface materials associated with non- karst regions (Mitchem *et al.* 1988).

Although not as commonly addressed, another means of recharge is from the soil and epikarst zone. It is a misconception that because of the rapid conduit flow of cave systems they will flush themselves clean of contaminants in a short period of time. In the epikarst zone contaminants amass during dry periods to be recharged later (Field 1989; Hobbs and Smart 1986; Smart and Friederich 1987; Williams 1985). In a study of a karst aquifer by Alexander *et al.* (1987), dye injected on a ridge top took as long as seven months to appear at a downgradient site. Pollutants can also infect upper level passages when contaminated water travels down vertical shafts and walls before reaching stream level. Kurtz and Parizek (1986) described another type of contaminant storage where a sort of "bathtub ring" of chemical contamination was left on the walls of Lost River Cave System, Kentucky, after a flood pulse receded. Regardless of whether or not there are conduit features, chemicals with certain physiochemical properties will be temporarily stored on substrates (Field 1989), and these substrates are often important microhabitats for subterranean organisms. Yet another manner of recharge is slow seepage (similar to that in non-karst regions) which can affect the aquifer in more traditional ways (Field 1989). In some cases, seepage through soil and glacial deposits constitutes the greatest contributor of nitrate and pesticides in the groundwater, in spite of the presence of karst terrane (Libra *et al.* 1986).

STATE AND FEDERAL REGULATIONS

This study is of relevance to a variety of state and federal laws that pertain to groundwater quality and the subterranean fauna. Maximum contaminant levels set for drinking water supplies in the Safe Drinking Water Act of 1974 (LaMoreaux 1989; Moore 1988) were tested for. The Federal Insecticide, Fungicide, and Rodenticide Act (1974) addresses pesticides (LaMoreaux 1989; Moore 1988) which were also tested for in this study. This study is also monitoring water quality in accordance with the Clean Water Act of 1972 that calls for state funding for groundwater management and water quality programs (LaMoreaux 1989; Moore 1988). Under Sections 303 and 304 of this act, states are required to develop biological criteria for the protection of aquatic communities (Baker 1992). The Federal Endangered Species Act calls for research and protection of federal endangered species, several of which are known to inhabit Illinois caves. In addition, there has recently been a federal upgrading of the priority for protection of the Sinkhole Plain karst region.

State regulations that this study is applicable to include the 1972 Illinois Endangered Species Protection Act which calls for research on state threatened and endangered species in an effort to stop the extirpation of species from the state. A number of such species inhabit Illinois caves (Herkert 1992). The biological information collected in this study also applies to the Illinois Cave Protection Act of 1985 which calls for specific protection of Illinois caves. Under the National Cave Resources Protection Act the U. S. Fish and Wildlife Service created an inter-state/Region 3 committee (in May 1990) in order to:

- -Identify rare species within the six states represented (Illinois included)
- -Identify research needs (especially status surveys on numerous poorly understood species) and specialists for specific faunal groups
- -Discuss current projects involving cave invertebrates
- -Establish future goals

A report by the Environmental and Energy Study Institute (1986) determined that groundwater contamination is a national problem and recommends federal support to states to aid in making decisions that would prevent contamination (Moore 1988). The management recommendations made in this study as a result of water quality analyses will fulfill this recommendation. The Illinois Groundwater Protection Act mandates that state and federal resource management agencies are to work together to protect Illinois water supplies. This project presents the results of the collaboration of many government organizations, including: INHS, ISM, IDOC, USFS, and IDOT. Base line data collected in this study will assist the Illinois Environmental Protection Agency and the Illinois Pollution Control Board in their statutory and regulatory responsibilities as well as augment the groundwater classification developed under Section 8(a) of the 1989 Groundwater Protection Act.

Cave water fits well into the definition of Class I groundwater as given in the code (Illinois Pollution Control Board 1991, Part 620, pg 10): "Included are all groundwaters that are located 10 feet or more below the land surface and that, by any one of several tests, produce groundwater in quantities sufficient to sustain a potable use." In almost all cases cave water is below 10 feet (usually more than 20 feet) from the surface and at a number of sites a pipe coming out of the entrance of a cave or a well drilled into cave passage provides drinking water for rural households. Also in cases where potable use is not demonstrated, the potential for potable use often can be demonstrated. It has also been suggested that cave water should be considered for Class III (Illinois Pollution Control Board 1991, Part 620) status since the water usually contains a unique, vulnerable, and extremely sensitive cave adapted community, often including species on the state threatened and endangered species list.

Since no binding decision is currently available on this matter, we treat cave water as Class I groundwater. This is the category cave water seems to fit best, even though it is evident that cave water could fit into several categories. Currently, a binding decision classifying cave water would require a thorough hydrogeological analysis on a site by site basis. Such an analysis is not the focus of this study. Because people are drinking cave water and cave water contains particularly sensitive communities of invertebrates, it makes sense to apply the more stringent standards of Class I. In the future, it would be appropriate to have cave water designated, through petitioning of the Pollution Control Board, as Class III (Special Resource) groundwater because of the communities of unique and sensitive organisms which cave water supports and because cave and spring waters are so commonly used as sources of drinking water.

MATERIALS AND METHODS
CAVING SAFETY

As a precautionary measure, the field team was immunized against rabies using human diploid cell vaccine (Dreesen *et al.* 1982). Standard caving equipment was used, as outlined in Rea (1987). Additional safety training was obtained through the National Cave Rescue Commission. Specialized gear (wetsuits, ropes and vertical gear, and cable ladders) was used as conditions dictated, and vertical techniques followed standard methods outlined in Padgett and Smith (1987). A call down list was developed and appropriate persons notified of the time, destination and expected duration of each visit before each cave trip.

CAVE LOCATIONS

Many cave locations were acquired from the Illinois State Museum study (Oliver and Graham 1988), and other locations came from organized cavers, other government agencies, landowners, and discoveries made in the course of field work. All of the locations and associated information were entered into a computer database (Appendix A).

BIOLOGICAL EQUIPMENT AND TECHNIQUES
FIELD COLLECTION TECHNIQUES AND EQUIPMENT

Collecting techniques followed standard methods (Cooper and Poulson 1968; Gardner 1984). Permits for collecting invertebrates (Illinois Department of Conservation Scientific Permit No. W-92.0048) and collecting and releasing vertebrates and collecting fish (except spring cavefish) (Illinois Department of Conservation Scientific Permit No. W-92.0049) were obtained. Nearly all vertebrates were sight identified.

Invertebrate specimens were collected using aspirators, small paint brushes, Berlese funnel (for leaf litter samples and rodent nest material), dipnets, a baster, and by hand. Specimens were placed in glass vials with neoprene stoppers. The vials were filled half full with 80% ethyl alcohol (except for earthworms and flatworms which were placed in a vial without alcohol) and contained a paper tag bearing a vial number. Larger specimens were placed in bigger jars or nalgene bottles containing alcohol and a vial number. In order to collect the epizoites of crayfish, (Branchiobdellids, Entocytherids, Harpactacoids) the crayfish were collected by hand and dispatched in separate containers of alcohol which were then shaken vigorously to help remove the epizoites. The containers were shaken again before identification in the laboratory where the settled residue as well as the crayfish body were examined for epizoites.

Vials, jars and assorted collecting equipment were carried in a modified tackle box in the caves. A metal clipboard with a pencil and two kinds of field forms (Appendix B) was also carried into the caves. Information recorded on the field forms included: 1.) general location information (state, county, quadrangle, township, range, quartersections, UTM coordinates, outside temperatures and weather, cave name and ownership/access information), 2.) general cave descriptions (entrance(s), passages, use and impact, speleothems, hazards), 3.) specific habitat information (cave zone, temperatures, spatial, general substrate, microhabitat, species associations, population levels).

Though many recent studies have divided the caves into entrance, twilight, middle and dark zones, we have, for convenience, lumped the middle and dark zones, since the distinction between these zones (constant temperature versus variable temperature) is impossible to determine on a single visit. Where possible, we entered caves far enough that it is highly likely we were collecting in the dark zone (in the narrower definition).

Our operational definition of the cave zones depended on available light (or amount that would be available on a reasonably sunny day). If small organisms (such as Collembola) could easily be seen and collected without the aid of a headlamp, the collection was from the entrance zone. If light was still visible from the entrance, but a headlamp aided in the collection of small organisms, then the collection was from the twilight zone. If no light was visible from the entrance (or would not be visible on a reasonably sunny day) then the collection was from the dark zone.

There are numerous definitions of what a cave is, and all ultimately fail under some circumstances. All features which we collected from and called caves had humanly enterable passage that extended for more than 20 feet and usually had a dark zone.

Careful attention was given to population levels when collecting. If something appeared to be a troglobite with very low population levels, only one specimen was collected. In areas where organisms were extremely abundant (such as some populations of amphipods, isopods, and heleomyzid flies), approximately 10 specimens were collected to increase the likelihood of getting at least one specimen of each sex (often an adult of only one of the sexes can be used in specific identifications). In some cases, samples seem deceptively large: One crayfish was collected, but that one individual crayfish yielded 256 epizoitic organisms when it was examined under a microscope in the laboratory. This one specimen thus represents about 1/12th of all of our sorted material, and the epizoites of the eight crayfish examined thus far combine to represent over 1/6th of our total collections!

LABORATORY CURATION TECHNIQUES

All specimens besides earthworms and flatworms were stored in 80% ethyl alcohol. Earthworms were stored in 5% formalin for a day, then in 80% ethyl alcohol. Flatworms were fixed with a quick rinse in 15% nitric acid followed immediately by several rinses in 80% ethyl alcohol and final storage in 80% ethyl alcohol. All specimens were stored in glass vials with neoprene stoppers or, for larger specimens (such as crayfish), in miscellaneous larger jars.

After preliminary sorting, each organism received a unique specimen number. Organisms collected from the same microhabitat and apparently of the same species were placed together in a vial with a locality label and a determination label indicating the most specific taxon to which the organism(s) belonged and the specimen and field vial number.

Specimens have been sent to systematists who have agreed to identify specific groups of organisms. Identified material will be deposited in the INHS collection except when retained by the specialists.

All of the above information pertaining to each specimen is entered into the organism database (Appendix C) as the material is sorted. The database program can cross-reference any of the fields which are given in the organism database with those in the cave database (Appendix A) to provide very complete information about each specimen. Using these capabilities, appropriate details about the cave and microhabitat can be printed out and shipped to taxonomic specialists, further increasing the value of the material collected.

WATER QUALITY PARAMETERS AND EQUIPMENT

A number of water quality parameters were measured. Many were used because they are commonly accepted measurements that give a general overview of the water's characteristics and suitability for life. Other parameters have been measured in past studies and were recommended by some of the many people we spoke to regarding water quality and were also within our budget. In addition, most of the parameters measured have a maximum contaminant level (MCL) within the Class I groundwater standards (Illinois Pollution Control Board 1991).

Air and water temperatures were, when possible, taken outside the cave, in the entrance zone, in the twilight zone, and in the dark zone.

In the field, dissolved oxygen was measured with a Yellow Springs Instruments Co. Model 51A meter and pH with a Cole Parmer Model 05941-20 meter.

Water samples (1 liter) were collected from caves and springs in brown glass containers and packed on ice or refrigerated until analyzed. Water analysis involved cation and anion analyses, and a pesticide/PCB test. Water analysis was performed by the Illinois Natural History Survey Analytical Chemistry Laboratory during 1992 and by Irland Laboratories, Metropolis, Illinois during 1993. Total cation analysis (1992) used Inductively Coupled Plasma - Atomic Emmision Spectroscopy (ICP-AES) which measured: aluminum, arsenic, boron, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, mercury, potassium, magnesium, manganese, molybdenum, sodium, nickel, phosphorus, lead, antimony, selenium, silicon, tin, vanadium, and zinc. Anion analysis (1992) used a DIONEX Ion Chromatograph which measured: fluoride, bromide, chloride, nitrate, nitrite, phosphate, and sulfate. Pesticide and polychlorinated biphenols (PCB) analysis (1992) used a gas chromatograph and measured: Aldrin, Dieldrin, Heptachlor, Heptachlor epoxide, o,p-DDE, p,p'- DDE, o,p-DDD, DDT, and Aroclor 1254. If there were no peaks in this initial test, no additional standards were run. If peaks were present, they were compared to appropriate standards to determine concentration. If specific peaks did not match the initial standards then a variety of procedures were followed to determine the pesticide/PCB present and its concentration. Cation levels in certain cave amphipods and isopods were analyzed (1992) using Inductively Coupled Plasma - Atomic Emmision Spectroscopy. These analyses measured the same cations analysed in water samples. Pesticides and PCB analysis (1992) on invertebrates uses a gas chromatograph and tested for the same pesticides and PCB as in water samples. Laboratory analysis of alkalinity titrations, *p*H, total, suspended, and dissolved solids were performed at the SIUC Department of Pollution Control Laboratory utilizing methods outlined in Standard Methods (Franson 1989).

CAVE MAPPING

Several small caves were surveyed utilizing a Sisteco "SightMaster - ClinoMaster" combination compass and clinometer and a 100 foot tape. Cave mapping followed Thomson and Taylor (1991).

RESULTS

The focus of this study was a faunal inventory of Illinois caves along with the collection of baseline water quality data. Table 1 summarizes the sampling done in 1992 and 1993. Figure 3 shows the counties in which collections were taken. Results of specific sampling types will be presented separately.

Table 1. Caves and subterranean habitats (N=99) sampled during 119 site visits in 1992-1993. Column 1: W= Water Sample. F= Field water quality analysis. Column. 2: R= Biological inventory. Column 3: Cave Map (A= mapped during this study, B= memory sketch during this study, C= not mapped during this study but map known to exist). Column 4: Invertebrates collected for chemical analysis (A= Amphipods, B= Amphipods and Isopods). Sample dates are given after cave name.

SITE ID #	SITE NAME	Collecting Date	Data Collected 1	2	3	4
		Karst Region: Driftless Area				
	Carroll County:					
542	Babe's Cave	05/27/92		R	A	
77	Bat Cave	05/29/92		R	A	
541	Nadig Spring	05/27/92	W, F	R		
540	Raccoon Den Cave	05/27/92		R		
547	Sand Boil Spring	05/28/92	W			
539	Skeeter Spring	05/28/92		R		
545	Sorrel Horse Camp Spring	05/27/92	F	R		
	Jo Daviess County:					
543	Jean's Cave	05/28/92		R	A	
202	Kevern's Cavern	05/26/92		R		
544	Kopper's Crevice	05/28/92		R	A	
256	Tree Root Pit	05/28/92		R		
		Karst Region: Lincoln Hills				
	Adams County:					
657	Bobtail Salamander Cave	05/27/93		R		
659	Unnamed Cave Spring Fall Creek	06/03/93	W, F			
658	Weed Cave	05/27/93		R		
	Calhoun County:					
134	Madison Creek Spring Cave	06/02/93	W, F	R		
		06/03/93				
117	McNabb Hollow Cave Spring	05/16/92	F	R	A	
	Greene County:					
626	Crinoid Cave	08/21/92		R	A	
	Pike County:					
408	Cedar Cave	08/22/92		R	A	
627	Cloven Hoof Cave	08/22/92		R	A	
378	Boat Ramp Cave	05/15/92		R	A	
69	Lost Creek Cave	05/15/92	F	R		
387	Lower Lost Creek Cave	05/26/93	W, F	R		
		06/03/93				
655	Lucky Calf Spring	06/03/93	W, F	R		
278	Slick Crawl Cave	05/27/93	W, F	R	A	
		06/03/93				
		08/20/93				

Table 1 (Continued)

SITE ID #	SITE NAME	Collecting Date	Data Collected 1	2	3	4
		Karst Region: Other				
Kane County:						
421	Devil's Den Cave	04/20/92		R		
La Salle County:						
242	Mathiesen Park Cave	08/20/92	R	C		
243	Skeleton Cave	08/20/92		R		
274	Blackball Mine North	08/20/92		R	C	
275	Blackball Mine South	08/20/92	F	R	C	
		Karst Region: Shawnee Hills				
Alexander County:						
432	Silica Mine No. 42	06/29/93		R		
Hardin County:						
248	Crystal Cave	04/17/93		R	B	
444	Mine No. 69	04/17/93		R		
Jackson County:						
18	Ava Cave	10/20/92	F	R	C	
	Ava Spring	10/20/92	W, F			
147	Toothless Cave	03/04/92		R		
537	Stearn's Cave	05/24/92	F	R	C	
Johnson County:						
216	Cedar Bluff Cave	04/29/92		R	A	
224	Jug Spring Cave	04/30/92	W, F	R	C	A
1	Mason Cave #1	05/21/93		R		
2	Mason Cave #2	05/21/93		R		
645	Mason Cave #3	05/21/93		R		
646	Mason Spring	05/21/93	W	R		
644	Pipistrellus Pit Cave	05/21/93		R	B	
272	Procyon Cave	03/06/92	F	R		
617	Sink-Joint Cave	06/15/93		R		
16	Teal's Cave	05/20/93		R	A	
Pope County:						
279	Big Grand Pierre Creek Cave	04/14/92		R		
390	Brasher Cave	10/23/93		R		
394	Lackey Cave	10/23/93		R		
283	Simmon's Creek Cave #2	04/15/92		R		
546	Spring at Simmon's Creek	04/15/92	F	R		
284	Tube Cave	04/18/93		R		
Pulaski County:						
678	Boiling Spring	10/24/93	W	R		
Randolph County:						
639	Indian Cave	04/09/93 09/06/93	W, F	R	A	
Saline County:						
14	Equality Cave	10/22/93		R	C	

Table 1 (Continued)

SITE ID #	SITE NAME	Collecting Date	Data Collected 1	2	3	4
	Union County:					
470	Apis Annex	05/08/92		R	A	
679	Barefoot Cave Spring	10/24/93	W	R		
167	Graig Cave #4	08/25/93		R		
12	Guthrie Cave	04/30/92	W, F	R	C	A
451	Honeycomb Hole	05/08/92		R	A	
175	Migrant Camp Cave	08/25/93		R		
19	Rich's Cave	05/07/92	F	R	C	
10	Saratoga Cave	03/02/92	F	R	C	
677	Shilly-Shally Cave	10/05/93	W	R	C	
	Karst Region: Sinkhole Plain					
	Monroe County:					
637	Auctioneer Cave	09/04/92	W, F	R		
303	Cave Spring #1	09/03/92	F	R		
555	Cave near Collier Spring	09/04/92	F	R		
551	Collier Spring	06/30/92 07/02/92	W, F			
309	Couch Cave	09/03/92	F	R	C	
33	County Line Cave	09/04/93 09/06/93	W, F	R		
671	Dulcet Waterfall Cave	06/24/93		R	A	
640	Erwin Vogt Spring	09/28/92	W, F	R		A
52	Fogelpole Cave	02/24/92 07/01/92 09/29/92 08/28/93	W, F	R	C	B
27	Fults Saltpeter Cave	03/26/92		R		
29	Illinois Caverns	02/24/92 08/30/93	W, F	R	C	
556	Indian Hole	07/02/92	W, F	R?		
25	Kelly Spring Cave	08/21/93 09/05/93	W	R	C	
57	Kreuger Dry-Run Cave	04/03/92 08/29/93	F	R	C	
636	Paw Paw Pit	09/03/93		R	A	
674	Quirky Quarry Spring	09/06/93	W, F	R		
350	Running Spring Cave	06/26/93 06/30/93	W, F	R		
354	Shelter Dome Cave	11/19/93		R	B	
672	Shivery Slither Cave	09/05/93 09/06/93	W, F	R		
355	Slippery Dell Cave	06/23/93		R		
363	Terry Spring Cave	05/06/92	F	R		
424	Unnamed Spring	08/21/93	W			
369	Wanda's Waterfall Cave	04/03/92 08/21/93	W, F	R	C	

Table 1 (Continued)

SITE ID #	SITE NAME	Collecting Date	Data Collected 1	2	3	4
670	Weeping Buddha Cave	06/23/93		R		
663	Weird Wall Cave	06/26/93		R		
St. Clair County:						
661	A Little Pit More Cave	06/22/93		R		
667	Charles' Cave	06/25/93		R		
635	Cossile Fast Pit	08/18/92		R	A	
660	Dieciseis Tigrinum Pit	06/22/93		R		
666	Drainage Cave	06/25/93 06/30/93	W	R		
669	Misplias Cave	06/26/93		R		
668	Puppies, Eggs & Apples Spring	06/24/93		R		
34	Sparrow Spring Cave	09/29/92	W, F	R		
36	Spring Valley Cave	06/22/93 06/30/93	W, F	R		
35	Stemler Cave	06/25/93 06/30/93 10/10/93	W, F	R	C	

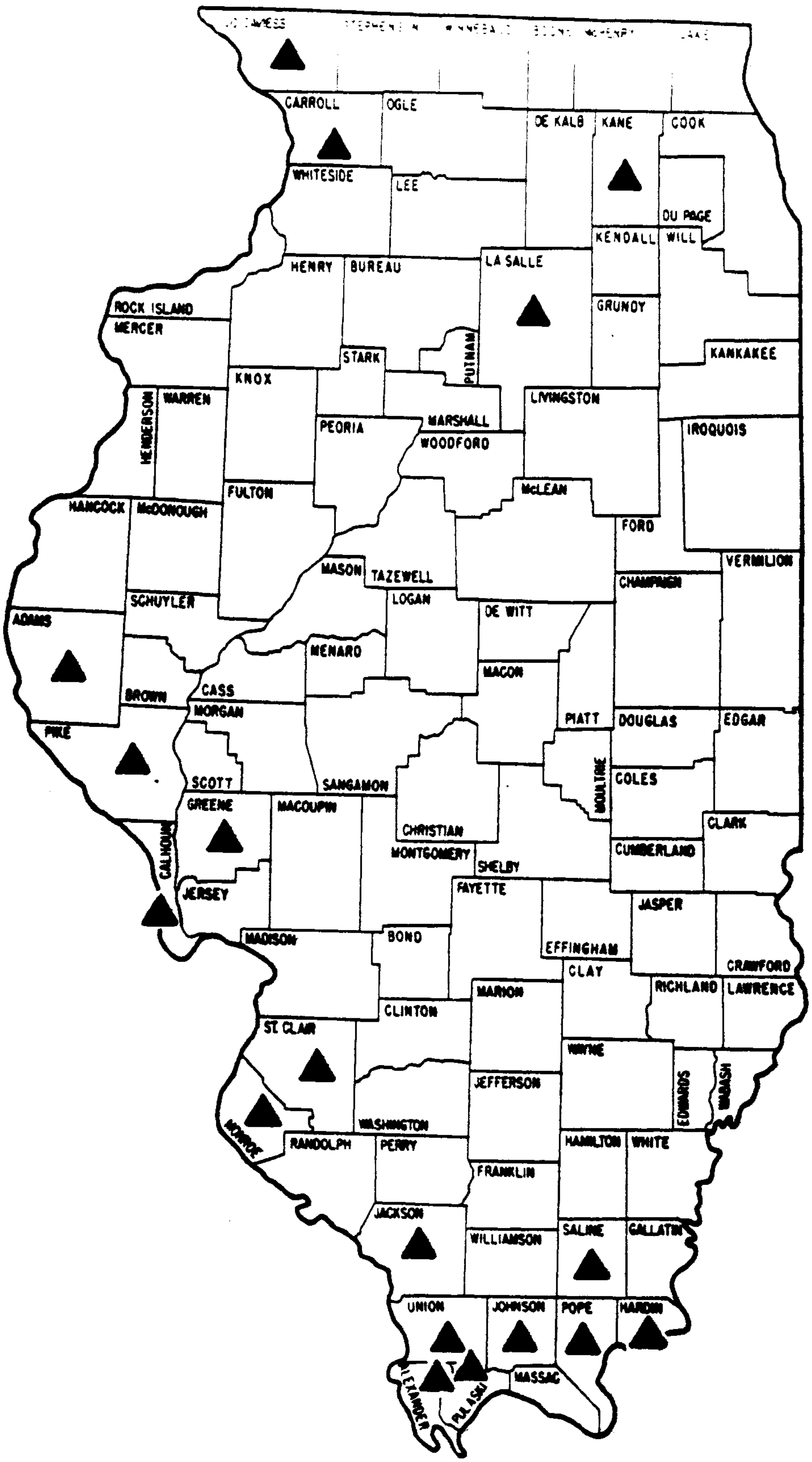

Figure 3. Counties sampled in the 1992 - 1993 cave inventory.

DATABASES

Though not strictly dealing with biological resources in Illinois caves, the construction of a detailed database of Illinois cave locations was a major, and critical, part of this study. For future work on the biota of Illinois caves to progress, accurate locations of caves must be available. At present, the database contains over 600 records, each with representing a different cave (or at least different cave entrance), spring, mine, rockshelter or other related feature. The individual records contain the most precise (and most accurate) location available to us. As sites were visited, location data could often be refined. Information on the owner of the feature, access to the feature, karst region, descriptions of cave passage entered, vandalism, etc. are all contained in separate fields in the database. This database is currently the largest available collection of data on Illinois caves. The structure of the database is given in Appendix A.

BIOLOGICAL RESULTS

Five thousand, eight hundred and ten specimens of invertebrates have been sorted to the lowest convenient taxon and includes specimens from Oliver and Graham's study (1988) and from the collections of J. D. Garner (Illinois Department of Conservation). These latter two collections did not have cave zone of microhabitat information. Much of the material which has passed through the preliminary sorting still awaits identification by systematists. Because of this, most taxa will not be treated at the species level, but at the lowest taxa to which they could be reasonably sorted. In some cases, particular groups within an order were relatively easy to identify, and these groups (spiders, amphipods, and heleomyzid flies) are given specific attention. All discussions refer only to the sorted material except where specific reference is made to specimens in samples yet to be sorted. Mixed in with the material which we have collected during the past year are the specimens from the Illinois State Museum study (Oliver and Graham 1988) and some material collected by Jim Garner (IDOC). The specimens from these latter two collections generally lack data on cave zones and microhabitat data. Because of this, our numbers of specimens may vary significantly depending on how the data is being examined. For example, though we have 183 spiders (Araneae), only 113 specimens have information on cave zone (entrance, twilight, or dark) and 110 specimens have information on microhabitat.

Four phyla of invertebrates are represented in the samples: Annelida (10.8%, 311 specimens), Arthropoda (85.6%, 2471 specimens), Mollusca (2.2%, 64 specimens) and Platyhelminthes (1.4%, 40 specimens). These represent a wide variety of organisms, both those normally associated with caves (troglobites, troglophiles, and trogloxenes) and accidentals. Nearly every available microhabitat in the caves yielded a few organisms. With the exception of a few mites, and the branchiobdellids, entocytherids and harpacticoids, microscopic organisms were generally not collected. Bacteria and fungi, which are important components of the subterranean communities (Caumartin 1963), were not investigated.

The classification of the taxa collected or observed in the sites examined in this study, in addition to those taxa referred to these sites in other publications, is given in Table 2. The five phyla collected show different trends in the number of specimens collected from each cave zone (Table 3). These differences will be addressed separately with each phylum.

Table 2. The classification of the taxa known to occur in the sites examined in this study. Ecological Classification: AC= accidental. ED= edaphobite. PB= phreatobite. TB = troglobite. TP= troglophile. TX= trogloxene.

Platyhelminthes:
Turbellaria: Tricladida

Kenkiidae
Sphalloplana hubrichti (Hyman), TB.
Planariidae
Phagocata gracilis (Haldeman), TP.

Annelida
Oligochaeta: Haplotaxida

Acanthrodrilidae
Diplocardia singularis Ude, ED.
Diplocardia sp., ED.

Lumbricidae
Allolobophora trapezoides (Duges), ED
Dendrobaena rubida (Savigny), ED, TP.

Arthropoda: Chelicerata
Arachnida: Acari:

Eupodidae
Linopodes sp., TP.
Galumnidae
Galumna sp., TP.
Laelapidae
Hypoaspis nr. *angusta* Karg, TP
Hypoaspis nr. *subterranea* (Willmann), TP
Hypoaspis, sp. 3, TP.
Phthiracaridae
Steganacarus sp., TP.
Rhagidiidae
Rhagidia sp., TP?
Uropodidae
Discourella nr. *dubiosa* (Schweizer), TP.
Veigaiaidae
Genus and species undetermined, TP.

Arachnida: Araneae:

Agelenidae
Agelenopsis pennsylvanica (C. L. Koch)
Calymmaria cavicola (Banks), TP.
Coras sp.
Tegenaria domestica (Clerck)
Anyphaenidae
Wulfila satabundus (Hentz)
Araneidae
Leucauge venusta (Walckenaer)
Mangora placida (Hentz)

Table 2 (Continued)

Dictynidae
Cicurina arcata Chamberlin and Ivie
Cicurina brevis (Emerton)
Cicurina cavealis Crosby and Bishop, TP.
Cicurina pallida Keyserlingg
Cicurina sp.
Gnaphosidae
Drassyllus fallens (Chamberlin)
Drassylus sp.
Linyphiidae
Bathyphantes alboventris (Banks), TP.
Bathyphantes pallida (Banks)
Ceratinopsis sp.?
Centromerus cornupalpis (Cambridge)
Centromerus latidens (Emerton)
Erigone autumnalis Emerton
Eperigone indicabilis ? Crosby and Bishop
Eperigone maculata (Banks)
Eperigone tridentata (Emerton)
Islandiana flaveola (Banks)
Islandiana new species
Lepthyphantes leprosus (Ohlert)
Lepthyphantes sabulosa (Keyserling)
Lepthypantes sp.
Linyphia radiata
[*Neriene radiata*] (Walckenaer)
Meioneta unimaculata (Banks)
Phanetta subterranea (Emerton), TB.
Porrhoma emertoni ? (=*incertae*)
Porrhomma sp.
Sciastes terrestris
Liocranidae
Scotinella redempta (Gertsch)
Lycosidae
Pardosa sp.
Pirata sedentarius Montgomery
Pirata sp.
Schizocosa ocreata (Hentz), TX.
Schizocosa sp.
Trochosa sp.
Mysmenidae
Maymena ambita (Barrows)
Nesticidae
Eidmanella pallida (Emerton)
Pholcidae
Pholcus phalangioides (Fuesslin)

Pisauridae

Dolomedes scriptus Hentz
Dolomedes tenebrosus Hentz
Dolomedes sp., TX.
Pisaurina mira (Walckenaer)

Salticidae

Metaphidippus protervus (Walckenaer)
Habrocestum parvalum (Banks)
Phidippus sp.

Tetragnathidae

Meta americana
Meta menardi (Latreille), TP.
Tetragnatha sp.

Theridiidae

Achaearanea rupicola (Emerton)
Achaearanea tepidariorum (Koch)
Robertus frontatus
Theridion sp.

Theridiosomaticae

Theridiosoma gemmosum (Koch)

Thomisidae

Philodromas vulgaris (Hentz)
Xysticus sp.

Arachnida:Opiliones

Ischyropsalidae

Sabacon caricolens
Sabacon sp., TX.

Arachnida: Pseudoscorpionida

Chthoniidae

Mundochthonius cavernicolus Muchmore, TB.

Arthropoda: Mandibulata
Malacostraca: Amphipoda

Gammaridae

Gammarus acherondytes (Hubricht and Mackin), TB.
Gammarus minus Say, TP;
Gammarus troglophilus (Hubricht and Mackin), TP.

Crangonyctidae

Bactrurus brachycaudus Hubricht and Mackin, TB
Bactrurus mucronatus (Forbes), PB
Crangonyx forbesi Hubricht and Mackin, TP
Crangonyx packardi group, TB
Stygobromus subtilis (Hubricht), TB or PB

Malacostraca: Decapoda

Cambaridae

Cambarus sp., TP.

Table 2 (Continued)

Malacostraca: Isopoda

Asellidae
Caecidotea brevicauda (Forbes), TP
Caecidotea packardi Mackin and Hubricht, TB.
Caecidotea sp. 1, TB.
Caecidotea sp. 2, TB.
Ligidium elrodii (Packard), TX
Lirceus fontinalis Rafinesque, TX.

Chilopoda: Lithobiomorpha

Lithobiidae
Nadabius sp., TP?

Diplopoda: Chordeumida

Conotylidae
Austrotyla specus (Loomis), TP.
Tingupidae
Tingupa pallida Loomis, TP.
Trichopetalidae
Scoterpes sp., TB

Diplopoda: Julida

Nemasomatidae
Zosteractis interminata Loomis, TB.

Diplopoda: Polydesmida

Nearctodesmidae
Ergodesmus remingtoni (Hoffman), TB.
Polydesmidae
Pseudopolydesmus sp., TP.

Diplopoda: Spirostreptida

Cambalidae
Cambala minor (Bollman), TP.

Insecta: Collembola

Entomobryidae
Pseudosinella argentea complex sp. 1, TB
Sinella cavernarum (Packard), TP.
Isotomidae
Folsomia candida Willem, TP;.
Isotoma (Desoria) notabilis Schafter, TP.
Onychiuridae
Onychiurus sp., TX/TP.
Tomoceridae
Tomocerus flavescens (Tullberg), TP.
Tomocerus missus Mills, TB.
Sminthuridae
Arrhopalites whitesidei Jacot, TP.

Table 2 (Continued)

Insecta: Coleoptera

Carabidae

Atranus pubescens (DeJean), TP
Bembidion texanum Chaudoir, TP
Patrobus longicornis Say, TX?.
Evarthrus sodalis colossus Leconte, AC.
Platynus tenuicollis (LeConte), TP.
Pterostichus (Euferonia) coracinus Say, AC.
Tachyura incurva (Say), AC.

Cryptophagidae

Cryptophagus valens Casey, AC.

Leiodidae

Catops gratiosus Blanchard, TP.
Ptomaphagus nicholasi Barr, TB

Pselaphidae

Batrisodes rossi Park, TP.
Staphylinidae: *Atheta* sp., TP
Emplenota lucifuga Casey, TP
Homoeotarsus (*Gastrolobium*) sp., AC.
Lesteva pallipes LeConte, TP.
Oxytelus exiggus Erichson, AC.
Quedius erythrogaster Mannerheim, TP.
Quedius spelaeus Horn, TP.
Rimulincola divalis Sanderson, TP.

Insecta: Diplura

Campodeidae

Eumesocampa sp., TB.
Haplocampa sp., TB.
Metriocampa (*Tricampa*) sp., TB.

Insecta: Diptera

Culicidae

Anopheles punctipennis (Say), TX.
Anopheles quadrimaculatus Say, TX.
Culex pipiens Linnaeus, TX.
Culex sp., TX.

Heleomyzidae: *Aecothea specus* (Aldrich), TX.
Amoebaleria defessa (Osten Sacken), TX.
Amoebaleria sackeni Garrett, TX.
Heleomyza brachypterna (Loew), TX.

Mycetophilidae

Macrocera nobilis
Orfelia sp., TX.

Phoridae

Megaselia cavernicola (Brues), TP.

Psychodidae

Psychoda umbricola Quate, TX.
Undetermined genera and species, TP?

Table 2 (Continued)

Sciarida
Lycoriella sp., TX
Undetermined genera and species, TP.

Sphaeroceridae
Leptocera tenebrarum Aldrich, TP.
Leptocera sp., TP.

Tipulidae
Gnophomyia tristissima (Osten Sacken), TX.

Insecta: Ephemeroptera

Family Heptageniidae
Stenonema femoratum (Say), TX.

Insecta: Lepidoptera

Noctuidae
Scoliopteryx libatrix (Linnaeus), TX.

Insecta: Orthoptera

Gryllacrididae
Ceuthophilus elegans Hubbell, TX.
Ceuthophilus gracilipes (Haldeman), TX.
Ceuthophilus williamsoni Hubbell, TX.
Ceuthophilus sp., TX.

Insecta: Plecoptera

Family Leuctridae
Zealeuctra narfi Ricker and Ross, AC.

Family Nemouridae
Nemoura trispinosa Frison

Insecta: Trichoptera

Mollusca
Gastropoda: Stylommatophora:

Hydrobiidae
Fontigens antroecetes (Hubricht), TB. This cave is the type locality for this snail.

Physidae: *Physa halei* Lea, TP or TB?.

Polygyridae: *Triodopsis vulgatus* (Pilsbry), TP?

Chordata

Osteichthyes: Perciformes (Nelson 1984)

Centrarchidae
Lepomis cyanellus Green Sunfish, AC

Table 2 (Continued)

Osteichthyes: Scorpaeniformes (Nelson 1984)

Cottidae
Cottus carolinae Mottled Sculpin, AC/TX?

Osteichthyes: Siluriformes (Nelson 1984)

Ictaluridae
Ameiurus melas ? Black Bullhead. AC.

Amphibia: Leptospondyli
Caudata (Smith 1961)

Ambystomatidae
Ambystoma tigrinum Tiger Salamander, TX?
Plethodontidae
Eurycea sp. Larvae, TX/TP
Eurycea l. longicauda Longtail Salamander, TX/TP
Eurycea l. melanopleura Dark-sided Salamander, TP
Eurycea lucifuga Cave Salamander, TP
Plethodon dorsalis Zigzag Salamander, AC
Plethodon glutinosis Slimy Salamander, TP

Amphibia: Apsidospondyli
Anura (Smith 1961)

Unidentified Frog Frog, AC
Unidentified Toad Toad, AC
Bufonidae
Bufo americanus American Toad, AC
Hylidae
Pseudacris triseriata Western Chorus Frog, AC
Ranidae
Rana sp Uniidentified Frog, AC
Rana catesbeiana Bullfrog, AC
Rana palustris Pickerel Frog, TX

Reptilia
Anapsida: Testudines (Smith 1961)

Testudinidae
Terrapene carolina Eastern Box Turtle, AC

Aves
(Gill 1989)

Columbiformes

Columbidae
Columba livia Rock Dove, TX

Falconiformes

Cathartidae
Cathartes aura Turkey Vulture, TX

Table 2 (Continued)

Passeriformes

Tyrannidae
Sayornis phoebe Eastern Phoebe, TX
Icteridae
Molothrus ater Cowbird, AC?

Strigiformes

Unidentified Owl, AC

Mammalia
(Vaughan 1985)

Unidentified mammal Mammal, ?

Artiodactyla

Bovidae
Bos taurus Domestic Cow, AC
Cervidae
Odocoileus virginianus White-tailed Deer, AC
Suidae
Sus scrofa Domestic Pig, AC

Carnivora

Canidae
Unidentified Canid, AC
Canis familiaris Domestic Dog, AC
Urocyon cinereoargenteu Gray Fox, AC/TX?
Felidae
Felis domestica Domestic Cat, AC
Mustelidae
Mephitis mephitis Striped Skunk, AC/TX?
Procyonidae
Procyon lotor Raccoon, TX

Chiroptera

Vespertilionidae
Unidentified Bat Bat, TX
Myotis sp. Unidentified Myotis, TX
Myotis austroriparius Southeastern Bat, TX
Myotis lucifugus Little Brown Bat, TX
Myotis sodalis Indiana Bat, TX
Myotis grisescens Gray Bat, TX
Myotis keenii Keen's Bat, TX
Eptesicus fuscus Big Brown Bat, TX
Pipistrellus subflavus Eastern Pipistrelle, TX

Lagomorpha

Leporidae
Unidentified Rabbit Rabbit, AC

Table 2 (Continued)

Marsupialia

Didelphidae

Didelphis virginiana Virginia Opossum, AC

Rodentia

Unidentified small rodent Small rodent, AC/TX

Castoridae

Castor canadensis Beaver, AC/TX

Muridae

Unidentified mouse Mouse, AC

Peromyscus maniculatus Deer Mouse, AC/TX

Microtus sp. Vole, AC

Sciuridae

Tamias striatus Eastern Chipmunk, AC

Marmota monax Woodchuck, AC

Table 3. Percentages of different taxa found in each cave zone during 1992 and 1993 faunal surveys. Numbers based only on taxa for which cave zone data was available.

Taxon	N	Cave Zone Entrance	Twilight	Dark
Platyhelminthes	68	72.1	5.9	22.1
Annelida	451	7.5	37.9	54.5
Arthropoda	4147	43.0	32.4	24.6
Crustacea	1299	35.6	32.6	31.9
Arachnida	779	48.5	43.3	8.2
Acari	223	20.2	66.8	13.0
Araneae	491	58.5	34.4	7.1
Opiliones	61	73.8	26.2	0.0
Pseudoscorpiones	4	25.0	75.0	0.0
Amphipoda	562	54.1	9.6	36.3
Copepoda	74	0.0	91.9	8.1
Decapoda	15	46.7	20.0	33.3
Isopoda	298	44.3	28.9	26.8
Ostracoda	350	5.4	60.6	34.0
Chilopoda	26	42.3	53.8	3.8
Diplopoda	107	60.7	28.0	11.2
Insecta	1936	44.8	27.8	27.3
Coleoptera	456	39.0	38.0	23.0
Collembola	553	45.6	35.8	18.6
Diptera	1009	28.0	46.0	26.0
Heteroptera	50	66.0	32.0	2.0
Homoptera	36	83.3	16.7	0.0
Hymenoptera	85	74.0	26.0	0.0
Orthoptera	87	13.0	77.0	10.0
Siphonaptera	40	0.0	0.0	100.0
Trichoptera	21	66.7	28.5	4.8
Other Orders	11	63.6	18.2	18.2
Mollusca	46	58.7	21.7	19.6

Phylum PLATYHELMINTHES
Class TURBELLARIA
Order TRICLADIDA

A number of white flatworms, many of which are likely to be members of the troglobitic genus *Sphalloplana*, were collected from pools and riffles in the dark zone. Brown specimens, some of which are probably troglophiles or trogloxenes of the genus *Phagocata*, were collected from all cave zones. Nearly all flatworms were associated with rocks, gravel or rubble substrates in cave streams.

Peck and Lewis (1978) reported: *Sphalloplana hubrichti* (Hyman) (Kenkiidae) from Happy Hollow Spring, Jackson Count; Coonrod, Fults Creek, Fogelpole caves and Illinois Caverns, Monroe County; Stemler [Oerter] Cave, St. Clair County; and Rich's Cave, Union County. Record of unidentifiable material that are probably this species are: Kreuger Dry-Run Cave, Monroe County; and Cricket Cave, Union County. *Phagocata gracilis* (Haldeman) (Planariidae) from a spring near Lamb, Hardin County; Fountain Bluff Spring numbers 1 and 2, Jackson County; Case Spring Cave, Jug Spring Cave, and Will Thomas Spring Cave, Johnson County; Fults Creek Cave and Horsethief Cave, Monroe County; Elm Spring, Guthrie Cave and Rich's Cave, Union County. In southern Illinois, this species is common in most springs and many caves (Jenio 1972; Kenk 1970, 1972).

Phylum NEMATOMORPHA

A single nematomorphan was collected from a drip pool in the entrance of Stemler Cave.

Phylum ANNELIDA
Class HIRUDINIDA
Subclass BRANCHIOBDELLIDA

The family Branchiobdellidae has affinities with both the Oligocheata and the Hirudinea, and has been taxonomically difficult to place. Often, the family is treated within the Oligochaeta. More recently, some authors have treated the group as a separate class within the Annelida (Brinkhurst and Jamieson 1972).

Branchiobdellids are tiny epizoitic worms which are fairly common on crayfish but are seldom collected. While some branchiobdellids are only commensals (Keller 1992), others are probably parasitic (Grabda and Wierzbicka 1969; Holt 1963). Our collections (Table 4) represent the first records for this taxon from Illinois caves. Since most, if not all of the crayfish in our collections are probably troglophiles, the branchiobdellids might be classified as troglophiles as well (Hamilton- Smith 1971). Associated with the branchiobdellids on some of the crayfish were entocytherid ostracods and harpacticoid copepods. Data on the taxa of crayfish epizoites will be summarized under the treatment of the decapod family Cambaridae.

Specimens were taken from crayfish collected in both pools and riffles. Holsinger and Culver (1988) report five genera of branchiobdellids collected from the troglophilic crayfish *Cambarus bartoni* taken in caves in Virginia and Tennessee.

Class HIRUDINIDA
Subclass HIRUDINEA

Six leeches were examined, two collected in a gravel and rubble bottomed stream riffle in the dark zone of one cave.

Peck and Lewis (1978) reported *Dina* (*Mooreobdella*) *microstoma* (Moore) (Erpobdellidae) from Mystery Cave, Perry County. This species is probably a troglophile, since Klemm (1972)

Table 4. Number of epizoites collected from ten crayfish (*Cambarus tenebrosus, Cambarus diogenes* and *Orconectes vriilis*) collected in Illinois caves. Cave Zones: E= Entrance. T= Twilight. D= Dark.

Species	Cave	Zone	ANNELIDA Branchiobdellidae	COPEPODA Harpacticoida	OSTRACODA Entocytheridae
C. tenebrosus	Saratoga Cave	E	1	0	19
C. tenebrosus	Saratoga Cave	E	0	0	0
C. tenebrosus	Jug Spring Cave	E	0	0	0
C. diogenes	Rich's Cave	E	11	0	0
C. tenebrosus	Jug Spring Cave	T	105	1	80
C. tenebrosus	Jug Spring Cave	T	58	65	133
C. tenebrosus	Sink Joint Cave	T	0	0	0
C. diogenes	Guthrie Cave	D	0	0	48
O. virilis	Kreuger-Dry Run Cave	D	0	0	0
O. virilis	Kreuger-Dry Run	D	113	0	0
Total			288	66	280

reported its primary food as crustaceans and aquatic insects. Thus our specimens are thus likely to be either troglophiles or accidentals.

Class OLIGOCHAETA
Order HAPLOTAXIDA

Forty six worms were examined, primarily edaphobites from moist organic debris in the entrance or twilight zone. Most of the earthworms found in caves in the United States are accidentals (Gates 1959).

Among the material yet to be identified are some tubificids (Order Tubificida) from County Line, Fogelpole, and Slippery Dell caves (Monroe County). Kathman and Brinkhurst (1984) found several species of tubificids in samples taken from Tennessee and Kentucky caves, and Holsinger (1966) observed *Tubifex tubifex* (Müller) in cave pools containing sewage. He also suggested that flatworms eat tubificid worms. Our Fogelpole specimens were associated with flatworms in an odiferous pool of stagnant water. Poulson (1992) suggests that tubificids may be useful indicator species for water polluted with sewage. Our specimens are the first tubificids reported from Illinois caves.

Peck and Lewis (1978) reported: *Diplocardia singularis* Ude (Acanthrodrilidae) from Guthrie Cave, Union County. *Diplocardia* sp. from Brown's Hole, Hardin County; Camp Vandeventer Cave, Monroe Cave; and Lost Creek Cave, Pike County. *Komarekiona eatoni* Gates (Komarekionidae) from Brown's Hole, Hardin County. *Allolobophora trapezoides* (Duges) (Lumbricidae) from cave north of Cave-in-Rock, Hardin County; and Mason Cave #1, Johnson County. *Bimastos heimburgeri* Smith and *B. longicinctus* Smith and Gittens from Brown's Hole, Hardin County. *Dendrobaena rubida* (Savigny) from Brown's Hole, Layoff Cave and cave north of Cave-in-Rock, Hardin County; Will Thomas Spring Cave, Johnson County; and Illinois Caverns, Monroe County. *Eisenoides carolinensis* (Michaelsen) from Brown's Hole, Hardin County. *Lumbricus rubellus* Hoffmeister, Griffith Cave, Hardin county; and Will Thomas Spring Cave, Johnson County. *Octolasion tyrtaeum* (Savigny) from Layoff Cave, Hardin County.

Phylum ARTHROPODA

The arthropods are the most abundant and diverse phylum occupying Illinois caves. Five classes and 5,215 arthropods were examined, constituting 88.8% of the invertebrates collected and represented in our samples as follows: Insecta (2739 specimens), Malacostraca (1189 specimens), Chelicerata (654 specimens), Maxillopoda (360 specimens), Myriapoda (199 specimens). Arthropods were common throughout the caves, but the largest numbers and greatest diversity was found in the entrance zone (Table 3), where the diversity was greatly influenced by accidentals.

Subphylum CHELICERIFORMES
Class CHELICERATA
Subclass ARACHNIDA

Four orders and 654 specimens were examined, constituting 12.8% of the arthropods. The Arachnida comprise the second most abundant class of terrestrial arthropods in the caves. For those specimens with cave zone data (N=779), 48.5% were collected in the entrance zone, 43.3% in the twilight zone, and 8.2% in the dark zone. Many of the species are accidentals or trogloxenes in the entrance and twilight zones (Table 3), but a few species are troglophiles and troglobites.

Order ACARI [ACARINA]

Two hundred and forty two specimens were examined, constituting 37.1% of the Arachnida collected. This order is much more abundant in the caves than our collections might indicate, but the tiny size of most mites makes them easy to overlook. For those specimens with cave zone data (N=223), 20.2% were collected in the entrance zone, 66.8% in the twilight zone, and 13.0% in the dark zone. Most of the specimens were collected from organic debris (41.0%) or animal feces (24.6%) in the entrance or twilight zone (Table 3) and are probably either accidentals or trogloxenes. Among our unsorted material are a number of specimens from raccoon feces in the dark zone. Some of our material from feces appears to include troglophilic mites of the family Rhagiidae. This family is fairly common in North American caves (Holsinger 1965; Holsinger 1982; Holsinger and Culver 1988; Peck 1980). Peck and Christiansen (1990) report undetermined Rhagiidae from Smiths Park Cave (Carroll County), and Peck and Lewis (1978) reported: *Linopodes* sp. (Eupodidae), *Galumna* sp. (Galumnidae), *Hypoaspis* nr. *angusta* Karg, *H.* nr. *subterranea* (Willmann) (Laelapidae), *Steganacarus* sp. (Phthiracaridae), *Discourella* nr. *dubiosa* (Schweizer), and an undetermined genus and species of Veigaiaidae from Illinois Caverns, Monroe County; and *Rhagidia* sp. (Rhagidiidae) from Saltpeter Cave, Monroe County. Peck and Christiansen (1990) reported an undetermined Rhagiidae from Smiths Park Cave (Carroll County). The tick (*Dermacentor variabilis* (Say)) from a dry bedrock wall is clearly an accidental and may have come into the cave on ta raccoon.

Order ARANEAE

Seventeen families and 61 taxa have been identified from the 411 spiders sorted so far. Spiders constituted 62.9% of the the Arachnida collected with 58.5% of these collected in the entrance zone, 34.4% from the twilight zone and 7.1 % in the dark (Table 3). For those specimens where microhabitat data was available, 55.0% of the spiders were collected from moist or dry walls and ceiling of caves, 42.9% from leaf litter, and the remaining 2.1% off of racoons, racoon feces, and gravel. The most obvious and frequently encountered spider, *Meta americana*, is a troglophile typically found on bedrock walls and ceilings in the entrance and twilight zone. This species has only recently (Marusik and Koponen 1992) been recognized as separate from the european *Meta menardi* and is found in cave entrances and other similar habitats throughout most of the eastern United States (Holsinger and Culver 1988; Peck and Christiansen 1990; Peck and Lewis 1978). Some of the species from the entrance zone, such as the Salticidae (jumping spiders) are clearly accidentals. Spiders were uncommon in the dark zone (Table 3), but some specimens in the unsorted material from the dark zone have reduced pigment and are likely to be troglobites.

The habitat in which spiders were most abundant was organic debris (52.7%). Thirty-one percent of the spiders collected were specimens from moist or dry bedrock walls and ceilings, and most of these were *Meta americana* (Tetragnathidae).

Peck and Lewis (1978) reported: *Calymmaria cavicola* (Banks) (Agelenidae) from Layoff Cave, Hardin County and Tela Cave, Johnson County; *Circurina cavealis* Crosby and Bishop from Salpeter Cave, Monroe County; *C. pallida* Keyserling, from Burton Cave, Adams County, Bat Cave, Union County, and Cave Spring Cave, Union County; and *Coras lamellosus* (Keyserling) from Degognia Cave, Jackson County, and an undescribed species of this genus occurs in Jug Spring cave, Johnson County. *Meta americana* [as *M. menardi* (Latreille)] (Araneidae) from Griffith Cave, Hardin County, Illinois Caverns, Monroe County, Bat Cave, Cave No. 1, Degognia, and Giant City Sandstone caves, Jackson County, Will Thomas Spring, and Mason No. 1 and No. 2 caves, Johnson County, Equality Cave, Saline County, Cave Spring, Guthrie, Rich's, Saratoga, and Sensemeyer caves, Union County. *Dictyna* sp. (Dictynidae) from Frieze Cave, from stomach of *Eurycea lucifuga* salamander (Pope County). *Zelotes* sp. (Gnaphosidae) from Cave Spring Cave, dry entrance, Union County. *Bathyphantes albiventris* (Banks) (Linyphiidae) from Jug Spring Cave, Johnson County; *B. pallidus* (Banks) from Firestone Creek Cave, Johnson County, *Centromerus cornupalpis* (O. P. Cambridge) from Layoff Cave, Hardin County; *C. latidens* (Emerton) from Degognia Cave, Jackson County, Firestone Creek Cave, Johnson county, unnamed cave north of Cave-in-Rock, Hardin County; *Eperigone antraea* (Crosby) from Sensemeyer Cave, Union County; *E. eschatologica* Crosby from Cave-In-Rock Cave, Hardin County; *Phanetta subterranea* (Emerton) from Cave Spring Cave, Hardin County, Devils Backbone Cave, Jackson County, Firestone Creek and Will Thomas Spring caves, Johnson County, Camp Vandeventer, Fults Creek, Horsethief, and Terry Spring caves, and Illinois Caverns, Monroe County, Equality Cave, Saline County, Sensemeyer Cave, Union County; *Porrhoma* sp. from Dry-Run Cave, Monroe County. *Pardosa* sp. (Lycosidae) from Cave-in-Rock Cave, Hardin County; *Pirata* sp., from Ava Cave, Jackson County, *Schizocosa ocreata* Hentz from Illinois Caverns, Monroe County; *Trochosa avara* Keyserling from Camp Vandeventer Cave, Monroe County. *Nesticus pallidus* Emerton (Nesticidae) from Cave-in-Rock, Cave Spring, and Layoff caves, Hardin County. *Pholcus phalangoides* Fuesslin (Pholcidae) from Cave-in-Rock, Hardin County and cave one mile northwest of Alton, Madison County. *Dolomedes vittatus* Walckenaer (Pisauridae) from Will Thomas Spring Cave, Johnson County; *Dolomedes* sp., from unnamed cave at White Hill, Johnson County. *Metaphidippus exiguus* (Banks) (Salticidae) from Cave-in-Rock Cave, Hardin County. *Maymena ambita* (Barrows) (Symphytognathidae) from Salpeter cave, Monroe County. *Archaeranea tepidariorum* (Koch) from Cave-in-Rock, cave near Cave-in-Rock, and Layoff caves in Hardin County; and *Steatoda triangulosa* (Walckenaer) from Cave-in-Rock Cave, Hardin County.

Order OPILIONES [PHALANGIDA]

Sixty one specimens of opilionids were collected, 73.8% from the entrance zone and 26.2% from the twilight zone (Table 3). All specimens are probably trogloxenes or accidentals. Specimens were found on moist and dry leaf litter, logs, moss, and liverworts (52.5%) or on dry bedrock walls, ceilings, and rubble (47.5%). Peck (1980) noted that the genus *Leiobunum* is common in cave entrances in the United States. Many of our sorted and unsorted opilionids are first records for this order in the caves from which they were collected.

Peck and Lewis (1978) reported: *Vonones* sp. (Cosmetidae) from Firestone Creek Cave, Johnson County. *Sabacon* sp. (Ischyropsalidae) from Jug spring Cave, Johnson County.

Order PSEUDOSCORPIONES

The eight specimens in the sorted material are probably both trogloxenes or accidentals. Specimens were collected from moist and dry leaf litter and moist racoon feces in the entrance and twilight zones. Peck and Lewis (1978) reported *Mundochthonus cavernicolous* Muchmore, a troglobite from Fults Saltpeter Cave (Monroe County) and a troglophilic or troglobitic species of *Apochthonius* from Brown's Hole (Hardin County).

Phylum ARTHROPODA
Subphylum CRUSTACEA
Class MALACOSTRACA
Subclass EUMALACOSTRACA

Seven order of Malacostraca were collected during this study, which constituted 30.3% of the arthropods collected. The Malacostraca are the dominant aquatic arthropod in Illinois caves. The few terrestrial crustaceans found were isopods which are primarily accidentals or trogloxenes in cave entrances and twilight zones.

Order AMPHIPODA

Two families, nine species, and 698 specimens of amphipods were examined during this study, constituting 45.1% of the Malacostraca collected. Amphipods make up an important and large component of aquatic cave communities. For those specimens with cave zone data (N=562), 54.1% were collected in the entrance zone, 9.6% in the twilight zone, and 36.3% in the dark zone. They were collected on a wide variety of microhabitats in stream pools and riffles, although silt, clay, and sand bottomed habitats yielded the fewest specimens. Many of the amphipods collected are troglobites, but troglophiles, trogloxenes and accidentals are also significant components of our samples.

Among the taxa known from Illinois caves are three species of *Crangonyx* (Crangonyctidae) which are state endangered (see comments under threatened and endangered amphipods in the introduction), and one state threatened and one state endangered *Gammarus* species (Gammaridae) (Herkert 1992). In addition, the state endangered *Stygobromus iowae* Hubricht (Crangonyctidae) is known only from a flooded shaft on mine timbers on an algific slope in Jo Daviess County, Illinois and two caves and a spring in Iowa (Holsinger 1986, Herkert 1992, Peck and Christiansen 1990).

Family Crangonyctidae

Bactrurus brachycaudus is a large, subterranean species found in cave streams, springs, and seeps (Holsinger 1976).

Three specimens were collected by Oliver and Graham (1988) from two caves in Illinois (Ava Cave, Elmo Cave) and this species constituted 0.6% of the identified amphipods. No cave zone or microhabitat data was available on these specimens

Bactrurus mucronatus is a rather common, widely distributed interstitial species. This species is common in the outlets of drains in the glaciated areas of the middle-weser United States and is occasionally found in wells and caves. In Illinois it was collected in two caves (Equality Cave, Gallatin County; Bobtail Salamander Cave, Adam County) and a mine (Blackball Mine South, La Salle County).

Ten specimens were collected and this species constituted 2.0% of the identified amphipods. For those specimens with cave zone data (N=8), 100% were collected in the dark zone. For those specimens from springs and cave streams with microhabitat data (N=8), 50% were collected in submerged leaf litter, 37.5% from wet bedrock walls, and 12.5% from a stream riffle.

Crangonyx anomalus is a large, unique species, easily distinguished from all other members of the genus by the sexually mature males being larger than sexually mature females (Holsinger 1976) This species inhabits two springs in southeastern Illinois. The second locality for this species in Illinois was discovered during this study. A single specimen was collected from stream gravel in a spring near Simmon's Creek, Pope County, Illinois.

Crangonyx forbesi is a rather large, somewhat variable species that is common in cave streams, springs, and occasionally small surface streams and ponds. It is commonly associated with *Gammarus troglophilus* and occasionally with *G. acherondytes* and *Bactrurus brachycaudus* in cave streams of southern Illinois. This species is about as common in springs as it is in caves and does not show an appreciable loss of pigment or eye structure when it occurs in caves (Holsinger 1976).

Eight specimens were collected and this species constituted 1.6% of the identified amphipods. For those specimens with cave zone and microhabitat data (N=8), all were collected in the dark zone in gravel bottom springs and cave streams.

Crangonyx minor inhabits a variety of aquatic habitats, including small streams (temporary and permanent), sloughs, ditches, drains, springs, and ponds. It appears to be more common in small streams than in other habitats (Holsinger 1976). During this study, *C. minor* was collected from the dark zone of Procyon Cave.

One hundred and fifty eight specimens were collected and this species constituted 31.3% of the identified amphipods. For those specimens with cave zone data (N=142), 86.7% were collected in the entrance zone, 1.3% in the twilight zone, and 12.0% in the dark zone. For those specimens from springs and cave streams with microhabitat data (N=148), 57.4% from under rocks, 30.4% from gravel riffles, and 12.2% from sand bottomed streams.

Family Gammaridae

Gammarus acherondytes is a rare, troglobitic amphipod, previously recorded from five subterranean streams in Monroe and Saint Clair counties, Illinois (Bousfield 1958; Cole 1970a, 1970b; Holsinger 1972; Hubricht and Mackin 1940; Nicholas 1960; Page 1974; Peck and Lewis 1977, Webb 1993). Twenty one specimens were collected and this species constituted 4.4% of the identified amphipods. It is associated with *G. troglophilus* Hubricht and Mackin (1940) from which it may be distinguished by its smaller size, light gray-blue color, small eyes, the absence of sensory organs on the second antenna, and by the larger fasciles of setae on the outer margin of the outer ramus of the third uropod (Hubricht and Mackin 1940).

Gammarus acherondytes was described in 1940 from Illinois Caverns, Monroe County and Stemler Cave, Saint Clair County, Illinois. Specimens were collected from Stemler Cave in 1965

(J. R. Holsinger, personal communication) and specimens were collected from Illinois Caverns in 1974 (INHS Collections). Holsinger (1976) reported it as being in four caves in Monroe County but did not specify which caves. Then Peck and Lewis (1977) reported it from Fogelpole Cave, Kreuger Dry-Run Cave, Illinois Caverns and Pautler Cave in Monroe County. These four caves are the four caves referred to in Holsinger (1976) (J. R. Holsinger, personal communication).

Twenty one specimens, 4.2% of the identified amphipods, were collected in Illinois Caverns on February 24, 1992. For those specimens with cave zone data (N=20), 10% were collected the twilight zone and 90% from the dark zone. For those specimens with microhabitat data (N=20), 30% were collected under rubble in a stream and 70% were collected under rocks in a gravel stream. No specimens of *G. acherondytes* were collected in any of the caves during 1993 although a single specimen was identified by Dr. L. M. Page from amphipods collected in Madonnaville Cave, Monroe County, July 3, 1986 during the cave study of Oliver and Graham (1988). This is a new locality for this species.

Gammarus minus is a widely distributed troglophilic amphipod in springs and cave streams, especially in areas with limestone and dolomitic bedrock (Holsinger 1976). This species displays considerable morphological variation and currently four geographical types have been designated with one type occurring in the post Kansan region, including western Illinois and Northeastern Missouri and another for the Pine Hills region of southern Illinois where the population here was designated as the subspecies *Gammarus minus pinicollis* Cole (Cole 1970, Holsinger 1976). One hundred and fifty eight specimens were collected and this species constituted 31.3% of the identified amphipods. For those specimens with cave zone data (N=142), 86.7% were collected in the entrance zone, 1.3% in the twilight zone, and 12.0% in the dark zone. For those specimens from springs and cave streams with microhabitat data (N=148), 57.4% from under rocks, 30.4% from gravel riffles, and 12.2% from sand bottomed streams.

Peck and Lewis (1978) reported *G. minus* from a spring four miles south southwest of Ursa and Burton Spring near Quincy, Adams County, McNabb Hollow Cave Spring and Orchard Spring at Hardin, Calhoun County, spring in Kaskaskia Experiment Forest, Hardin County, Clear Spring in Shawnee National Forest, and Degognia Cave and seep near Degognia, Jackson County, Chautaqua Spring and spring in Pere Marquette State park, Jersey County, Will Thomas spring Cave, Johnson County, Croxville Cave Spring and spring 5 miles west of Pearl, Pike County, Allied Chemical Quarry Spring at Prairie du Rocher, Randolph County, Falling Spring, St. Clair County, spring near Cricket Cave and Roaring and Elm springs, Union County.

Gammarus pseudolimnaeus is a widely distributed troglophilic species of amphipod in springs and sometimes in cave streams (Holsinger 1976). In springs and cave streams in Illinois this species occurs syntopically with *G. minus* and *G. troglophilus*. Forty one specimens were collected and this species constituted 8.1% of the identified amphipods. For those specimens with cave zone data (N=20), 95% were collected in the entrance zone and 5% in the twilight zone. For those specimens from springs and cave streams with microhabitat data (N=38), 23.7% were collected from under rocks, 28.9% from gravel riffles, 21.1% from sand bottomed streams, and 26.3% from silt bottomed streams.

Peck and Lewis (1978) reported *G. pseudolimnaeus* from a spring 5 miles southwest of Ursa, and Burton Spring, Siloam Springs, Brown County, Orchard Spring at Hardin, Calhoun County, sandstone seep at Pounds Hollow, Gallatin County, Old Settler's Spring, 4 miles south of Millview, Greene County, Cave Spring Cave and Round Springs, Hardin County, cave no. 1 and Hickman Cave, Fountain Bluff sandstone seep springs no. 1 and no. 2, Happy Hollow Spring, and sandstone seep near Degognia, Jackson County, Chautauqua Spring, Jersey County, Casey Spring, Johnson County, spring in spring Dell, LaSalle County, spring 2 miles north of Fountain Gap, Monroe County, spring at Allied Chemical Quarry at Prairie du Rocher and spring 2 miles northeast of Rockwood, Falling Spring, St. Clair County, spring near Cricket Cave, and elm, Roaring, and Triple springs, Union County.

Gammarus troglophilus (Hubricht and Mackin) is a large amphipod common in cave streams and springs in southwestern Illinois (Holsinger 1976). It occurs syntopically with *G. acherondytes*, *G. minus*, and *G. pseudolimneus*. Illinois Caverns, Monroe County, Illinois is the type locality for this species. Two hundred and twenty four specimens were collected and this species constituted 44.4% of the identified amphipods. For those specimens with cave zone data (N=192), 47.9% were collected in the entrance zone, 20.8% in the twilight zone, and 31.3% in the dark zone. For those specimens from springs and cave streams with microhabitat data (N=173), 51.0% were collected from under rocks, 31.8% from gravel riffles, 6.9% from sand bottomed streams, and 10.4% from submerged leaf litter.

Peck and Lewis (1978) reported *G. troglophilus* from Madison Creek and McNabb Hollow caves, Calhoun County, Ava, cave no. 1, Degognia, and Hickman Caves and spring no. 1 and no. 2 at Hickman Cave, spring at Clear Spring Picnic area, and Mt. Pleasant Spring, Jackson County, Jug Spring Cave, Johnson County, Cave 2 miles north of Fountain Gap, and Camp Vandeventer, Kreuger Dry-Run, Fogelpole, Kreuger Dry-Run, Fults Creek, Horsethief, Madonnaville, Pautler, Terry, and Wilde's (2 miles east of Columbia) caves, and Illinois Caverns, Falling Spring and Stemler caves, St. Clair County, at spring and dry entrances of cave Spring Cave, and Cricket, Guthrie, Rich's, Saratoga, and Sensemeyer caves, and Elm and Triple springs, Union County.

Peck and Lewis (1978) also reported: *Bactrurus brachycaudus* Hubricht and Mackin (Crangonyctidae) from Orchard Spring at Hardin, Calhoun County, spring 2.5 miles south of Hillview, spring 3 miles north of Eldred, Green County, Giant City seeps, Jackson County, Belknap and Firestone Creek caves, Johnson County, Camp Vandeventer, Fogelpole, Fults Creek and Terry Spring caves, small cave near Wartburg, seep near Valmeyer, and Illinois Caverns, Monroe County, Stemler's Cave and small spring near Falling Spring, St. Clair County, Croxville and Twin Culvert caves, and a small spring near Pearl, Pike County, seep 2.5 miles northeast Aldridge, Union County. *Bactrurus mucronatus* (Forbes) from Equality Cave, Saline County and a variety of drains around the state. *Crangonyx forbesi* Hubricht and Mackin from Orchard Spring near Hardin, seeps nea Salt spring, Gallatin county, spring near Lamb, Hardin County, Cave no. 1, Fountain Bluff spring no. 1 and no. 2, Giant City seeps, Happy Hollow spring, sandstone seep near Degognia, Hickman Cave, and spring no. 1 and no. 2 across from Hickman Cave, Jackson County, spring near Grafton, Jersey County, Firestone Creek Cave, Johnson county, Camp Vandeventer, Kreuger Dry-Run, Fogelpole, Kreuger Dry-Run Horsethief, Pautler, Terry Spring, and Wilde's caves, and Illinois Caverns, Monroe County, Lost Creek Cave, Pike county, spring 2 miles northeast of Rockwood, Randolph County, Stemler cave, St. Clair County. *Crangonyx* sp. *packardi* group from Griffith, Layoff, and cave Spring caves, and a spring north of Illinois Iron Furnace, Hardin County, Firestone Creek Cave and Spring, and an unnamed cave at White Hill, Johnson County, Croxville Cave, Pike County, Equality Cave, Saline County, Cricket and Sensemeyer caves, Union County. *Stygobromus lucifugus* (Hay) from a well near Abingdon, Know County. *Stygobromus subtilis* (Hubricht) Burton Cave, Adams County, Saltpeter Cave, Bat Cave and sandstone seep near Bat Cave Sink, Monroe County, Pomona and Giant City seeps, Jackson County, small seep, Jersey County, small sandstone seep, Union County. *Stygobromus* sp. 1 from Jackson's Sandstone Cave, Hardin County. *Stygobromus* sp. 2 from Dixon Springs, Pope County. *Synurella dentata* (Hubricht) from Firestone Creek Cave and Spring, Johnson county, Spring near Herod, Pope County.

Order ISOPODA

Four families (Armadillidiidae, Asellidae, Ligiidae, Porcellionidae) and 476 specimens of isopods were examined during this study, constituting 30.7% of the Malacostraca. Isopods make up an important and large component of aquatic cave communities (Asellidae) as well as a portion of the terrestrial fauna (Armadillidiidae, Ligiidae, Porcellionidae) For those specimens with cave zone data (N=298), 44.3% were collected in the entrance zone, 28.9% in the twilight zone, and 26.8% in the dark zone.

Though generally less abundant than amphipods in Illinois caves, the aquatic isopods are a major and often conspicuous element of aquatic cave communities. Lisowski (1979) noted *Asellus brevicauda* Forbes densities of up to 4000 individuals per m^2. *Caecidotea* contains several troglobitic species found in Illinois caves. The state endangered (Herkert 1992) phreatobite *Caecidotea lesliei*, known only from a drain tile in McDonough County (Henry *et al.* 1986; Lewis and Bowman 1981), is perhaps the rarest isopod species in the state. Other subterranean species, such as *Caecidotea bicrenata* which ranges from southern Illinois (*Caecidotea b. whitei*) to northern Alabama (*Caecidotea b. bicrenata*) (Lewis 1982), are more widespread.

Caecidotea intermedius, a troglophile, and other species of *Caecidotea* and *Lirceus* are also found in Illinois cave streams, where they are at times abundant.

For those specimens of aquatic isopods with cave zone data (N=164), 44.2% were collected in the entrance zone, 17.1% in the twilight zone, and 42.7% in the dark zone.

Aquatic isopods were found in a variety of microhabitats, but mainly from rock/rubble or gravel stream riffles (Table 5). The general distribution of aquatic isopods in the different microhabitats is comparable to that of the amphipods, though isopods were found to be less abundant in most stream pool microhabitats (Table 5).

For those specimens of terrestrial isopods with cave zone data (N=133), 48.9% were collected in the entrance zone, 43.6% in the twilight zone, and 7.5% in the dark zone. This terrestrial fauna includes primarily accidentals of the families Armadillidiidae and Porcellionidae from the entrance and twilight zones. For those terrestrial isopods with microhabitat data (N=135), 55.6% were collected from leaf litter/woody debris/moss, 18.5% from rubble, 14.1% from bedrock walls and ceilings, 3.7% from dry feces, 3.7% from under a racoon, 3.0% from floor soil, and 1.5% from a deermouse nest.

Ligidium elrodii (Packard) (=*Ligidium longicaudatum*), a fast moving semiaquatic/terrestrial species, was found in moist organic debris, rubble and gravel in entrance and twilight zones of several caves. This species is a trogloxene or troglophile. Most populations are comprised of parthenogenetic females (J. A. Beatty, personal communication 1992). This species is fairly common in caves across the eastern United States (Schultz 1970).

Peck and Stewart (1978) reported: *Caecidotea* sp. no. 1 (Asellidae) from Cricket, Roaring Spring, and Sensemeyer caves, Union county. The species from Cricket Cave was erroneously reported by Fleming (1972) as *A. alabamensis*; *Caecidotea* sp. no. 2 from an unnamed cave at white Hill, Johnson County; Caecidotea sp. no. 3, from stream from pumphouse at Dixon Springs State Park, Pope County; *Caecidotea brevicauda* (Forbes) from McNabb Hollow Cave, Calhoun County, Cave Spring Cave, spring near Lamb, and Round Spring, Hardin County, Ava and Degognia Cave and Cave No. 1, springs no. 1 and no. 2 across from Hickman Cave, sandstone seep near Degognia, sandstone seep 1.5 mi southwest of Pomona, and Mt. Pleasant Spring, Jackson County, spring near Grafton, Jersey County, Firestone Creek Cave and Spring, Johnson County, Camp Vandeventer, Fogelpole, Kreuger Dry-Run, Horsethief, Madonnaville, Pautler, and Terry Spring caves and Illinois Caverns, Monroe County, Lost Creek Cave, Pike County, Bell Smith Springs, Pope County, spring at Allied Chemical Quarry in Prairie du Rocher, spring two miles northeast of Rockwood, Randolph County, Falling Spring and Stemler caves, St. Clair County, and Cave Spring, Saratoga, and Union Point caves, Union County. *Caecidotea kendeighi*

Table 5. Microhabitats from which amphipods and aquatic isopods were collected. Values are percentages.

Habitats	Aquatic Isopoda	Amphipoda
Stream Pools	N=118	N=262
Bedrock Bottom	14.4	10.7
Rubble Bottom	30.0	35.9
Gravel Bottom	21.2	23.2
Sand/Silt/Clay Bottom	11.9	24.0
Organic Debris	24.6	6.1
Flowing Stream	N=122	N=348
Bedrock Bottom	0.0	0.9
Rubble Bottom	45.1	56.9
Gravel Bottom	50.0	35.6
Sand/Silt/Clay Bottom	4.1	2.9
Organic Debris	0.8	3.7

(Steeves and Seidenberg) from drainage ditch three miles north of Mayview, Champaign County. *Caecidotea packardi* Mackin and Hubricht from Burton Cave, pumpwell south of Quincy, Adams County, Fogelpole, Kreuger Dry-Run, Fults Creek, Horsethief, Pautler, Terry Spring caves and Illinois Caverns, Monroe County, Croxville Cave, Pike county, Falling Spring Cave, small cave two miles north of Fountain Gap, and Stemler cave, St. Clair County. Caecidotea spatulata (Mackin and Hubricht) from swales one mile south of Falling Spring, St. Clair County. *Caecidotea stygia* Packard from Cave spring, Griffith, and Layoff caves, Hardin County. *Caecidotea tridentata* from drain outlet, LaSalle County. *Caecidotea* spp. from Quincy Cave, Coe Spring, and Peter's Spring, Adams County. Madison Creek Cave, Calhoun County. Teal Cave, Johnson County, Kreuger Dry-Run Cave, Monroe County. *Lirceus fontanalis* Rafinesque from Round Spring, Hardin County, Illinois Caverns, Monroe County. *Armadillidium vultgare* (Latreille) (Armadillidiidae) from cave-in-Rock Cave, Hardin County. *Ligidium elrodii elrodii* (Packard) (Ligiidae), from Brown's Hole and Layoff caves, Hardin County, Will Thomas Spring Cave, Johnson County, Cave Spring Cave (dry entrance), Union County. *Cyclisticus convexus* (De Geer) (Porcellionidae) from Buron Cave, Adams County. *Miktoniscus* sp (Trichoniscidae) from Brown's Hole, Hardin County.

Order DECAPODA

Family Cambaridae. Three species and 15 specimens of crayfish were examined during this study, constituting 1.0% of the Malacostraca. For those specimens of crayfish with cave zone data (N=15), 46.7% were collected in the entrance zone, 20.0% in the twilight zone, and 33.3% in the dark zone.

No troglobitic crayfish occur in Illinois. Of the three species collected from caves, only *Cambarus tenebrosus* appears to be troglophilic. Crayfish were increasingly uncommon as we progressed deeper into the caves, and all specimens were collected from perennial cave streams. Peck and Lewis (1978) report four species of troglophilic *Cambarus* from Illinois caves in Hardin and Pike counties.

Though the majority of the crayfish are from the entrance zone, the specimens from the twilight and dark zones tended to carry a greater number of epizoites (Table 4). While it is possible that this trend is a quirk of small sample size, it may be that the crayfish deeper in the caves were under some physiological stress, possibly making them more suitable for epizoite colonization.

Peck and Lewis (1978) reported: *Cambarus laevis* Faxon (Cambaridae) from Cave Spring Cave, Hardin County; *C. ornatus* Rhoades, from Layoff Cave, Hardin County; *C. tenebrosus* Hay from Griffith Cave, Hardin County; and *Cambarus* sp. probably *diogenes* section from Lost Creek Cave, Pike County.

Subclass COPEPODA
Order Harpacticoida

Seventy two specimens of copepods were examined during this study, constituting 4.6% of the Malacostraca.

Harpacticoid copepods are not generally thought of as epizoites, but instead are free living bottom dwellers or are found in interstitial habitats. While we collected one specimen from a more typical habitat (the bottom of a cave stream) which might be a naturally occurring subterranean species, 66 specimens were collected off of crayfish. These latter specimens may have been browsing on the epifauna of the crayfish exoskeleton, but certainly they could not be considered accidentals given the large numbers found on one crayfish specimen (*Cambarus tenebrosus*) (Table 4). Therefore, we consider the vast majority of our specimens of harpacticoids to be epizoites until further evidence becomes available. Associated with the harpacticoid copepods on some of the crayfish were entocytherid ostracods and branchiobdellids. Data on the taxa of crayfish epizoites will be summarized under the treatment of the decapod family Cambaridae.

Our specimens constitute the first record of harpacticoids from Illinois caves, although Yeatman (1964) described *Cyclops clandestinus* Yeatman, a phreatobitic cyclopoid copepod, from a drainage tile emptying into Jordan Creek, Vermilion County, Illinois.

Order Calanoida

Calanoid copepods are planktonic. Five specimens were collected from a stream riffle in the dark zone of a cave.

Order Cyclopoida

Peck and Stewart (1978) reported: *Cyclops clandestinus* Yeatman (Cyclopidae) from a drain tile, Vermilion County.

Subclass OSTRACODA

Family Entocytheridae. Two hundred and eighty eight specimens of ostracods were examined during this study, constituting 18.6% of the Malacostraca. Tables 4 gives the number of specimens collected from the various species of crayfish in each of the cave zones.

This family of unusual ectocommensals of crayfish and other freshwater crustaceans has not previously been reported from Illinois caves. No other ostracods are known from Illinois caves. However, entocytherids on crayfish in caves has been reported for other midwestern states, and the family Entocytheridae is represented by more than 146 species in North America (Hobbs 1975). Entocytheridae have been reported in caves in several states surrounding Illinois, including Kentucky, Indiana, and Missouri (Hobbs 1975). Holsinger and Culver (1988) reported *Cambarus bartoni* as a common troglophile in Virginia, and since Hobbs (1975) indicated that a species of entocytherid that is commensal on *C. bartoni* is present in West Virginia and Virginia caves, they predict that entocytherids should be found in Virginia and eastern Tennessee caves.

Walton and Hobbs (1971) reported an average of 119 entocytherids on epigean populations of *Cambarus bartoni*. The troglophile *Cambarus laevis* (Faxon) was found to carry up to 83 entocytherids per individual (average 29.7) in a study of 36 host crayfish (Hobbs 1975). In the same study, the troglobitic crayfish *Orconectes inermis inermis* carried up to 54 entocytherids (average 19.5), based on a sample of 27 crayfish. The maximum number of entocytherids on any one crayfish in our material is 133 (Table 4), which seems more similar in numbers to the epigean sample of Walton and Hobbs (1971). Associated with the entocytherid ostracods on some of the crayfish were harpacticoid copepods and branchiobdellids. Data on the taxa of crayfish epizoites will be summarized under the treatment of the decapod family Cambaridae.

Phylum ARTHROPODA
Subphyllum Uniramia
Class MYRIAPODA
Subclass CHILOPODA

Four orders (Geophilomorpha, Lithobiomorpha, Scolopendromorpha, Scutigeromorpha) and 33 specimens of chilopods were sorted from caves. For those specimens with cave zone data (N=26), 42.3% were collected in the entrance zone, 53.8% in the twilight zone, and 3.8% in the dark zone. Centipedes were the most uncommon of the four classes of arthropods encountered in Illinois caves and there are few records of centipedes from caves (Holsinger and Culver 1988). Our records are largely accidentals or trogloxenes from the entrance and twilight zones (Table 3). One species of *Scutigeromorpha* was collected from three different caves having very dry bluff entrances exposed through much of the day to sunlight.

For those specimens where microhabitat data was available, 52% were collected in organic debris and most of the remaining 48% from under rocks and rubble. All of our specimens are first records of centipedes from the caves in which they were collected. The order Geophilomorpha had not previously been collected from Illinois caves.

Order Lithobiomorpha. Peck and Lewis (1978) reported: *Nadabius* sp. (Lithobiidae) from Layoff Cave, Hardin County, Salpeter Cave, Monroe County, and an undetermined genus and species from Firestone Creek Cave, Johnson County.

Order Scutigeromorpha. Peck and Lewis (1978) reported: *Scutigera* sp. probably *coleoptrata* (Linnaeus) (Scutigeridae) from Cave-in-Rock Cave and the deepest part of Layoff Cave, Hardin County.

Subclass DIPLOPODA

One hundred and sixty six specimens of millipedes were examined during this study, constituting 3.2% of the Arthropoda. For those specimens of millipedes with cave zone data (N=107), 60.7% were collected in the entrance zone, 28.0% in the twilight zone, and 11.2% in the dark zone.

Millipedes were collected from a variety of microhabitats, but primarily from wet leaf litter woody debris and organic debris (61.2%). Many of the specimens from the dark zone are probably troglophilic or troglobitic species in the order Chordeumida. One species of polydesmid millipede reported by Peck and Lewis (1978) is an endemic troglobite and another polydesmid and a chordeumid millipede reported on in their study may be endemics as well.

Order POLYDESMIDA

Peck and Lewis (1978) reported: *Semionellus placidus* ? (Wood) (Xystodesmidae) from Rich's Cave, Union County. *Ergodesmus remingtoni* (Hoffman) (Nearctodesmidae) from Burton Cave, Adams County, Brainard Cave, Jersey County, Pautler Cave, Monroe County, Lost Creek and Twin Culvert caves, Pike County. *Pseudopolydesmus pinetorum* (Bollman) (Polydesmidae) from Will Thomas Spring Cave, Johnson County; *Pseudopolydesmus* sp., from McNabb Hollow Cave, Calhoun County, Ava Cave, Jackson County, cave north of cave-in-Rock, Hardin County. *Antriadesmus* sp. (Trichopolydesmidae) from Pautler Cave, Monroe County. *Cleidogona unita* Causey (Cleidogonidae) from Brown's Hole, Hardin County, Will Thomas Spring Cave, Johnson County; *Pseudotremia* sp. from Cave Spring Cave, Hardin county. *Austrotyla specus* (Loomis) (Contylidae) from Goose Hollow Cave, Henderson County, Ava Cave, Jackson County, cave one mile northwest of alton, in gut of Eurycea longicauda salamander, Madison County, Camp Vandeventer, Dry-Run, and Horsethief caves, and Illinois Caverns, Monroe County, Stemler Cave, St. Clair County, Equality cave, Saline County, Saratoga and Sensemeyer caves , Union County. *Scoterpes* sp. (Trichopetalidae) from Illinois Caverns?, Monroe County. *Tingupa pallida* Loomis (Tingupidae) from Ava Cave, Jackson County, Teal and Will Thomas Spring caves, Johnson County, Twin Culvert Cave, Pike County.

Order JULIDA

Peck and Lewis (1978) reported: *Zosteractis interminata* Loomis (Nemasomatidae) from Lost Creek Cave, Pike County.

Order SPIROBOLIDA.

Peck and Lewis (1978) reported: *Narceus* sp. (Spirobolidae) from Will Thomas Spring Cave, Johnson County.

Order SPIROSTREPDIDA

Peck and Lewis (1978) reported: *Cambala minor* (Bollman) (Cambalidae) from Salpeter Cave, Monroe County, Layoff Cave, Hardin County, and Union Point cave, Union County.

Order CALLIPODIDA

Peck and Lewis (1978) reported: *Abacion* sp. (Schizopetalidae) from Croxville and Twin culvert caves, Pike County.

Class INSECTA

Insects are the largest and most diverse group of organisms examined during this study and are the dominant group in the Illinois cave fauna. Nineteen orders and 2,739 specimens were examined during this study, constituting 46.6% of all invertebrates and 53.6% of the arthropods. For those specimens of insects with cave zone data (N=1936), 44.8% were collected in the entrance zone, 27.8% in the twilight zone, and 27.3% in the dark zone, with nine to eleven orders being found in each cave zone (Table 3). The Diptera, Coleoptera, and Collembola far outnumber the other orders of insects examined.

While the amphipods and isopods are the dominant aquatic cave invertebrate groups, the insects dominate the terrestrial fauna. The few aquatic insects collected are mainly accidentals or trogloxenes. Microhabitats utilized by the cave inhabiting insects are diverse and will be treated separately under each order.

Order DIPTERA

Thirteen families and 1,112 flies were collected during this study, constituting 40.6% of the insects collected. For those specimens of flies with cave zone data (N=1009), 28.0% were collected in the entrance zone, 46.0% in the twilight zone, and 26.0% in the dark zone.

Among the Diptera, heleomyzid flies (trogloxenes), overwintering mosquitoes (Culicidae) (trogloxenes) and the monorail worm, *Macrocera nobilis* (Mycetophilidae) are among the most apparent and easily identified taxa, but a wide assortment of flies were found. Some, such as the Bibionidae, Cecidomyiidae, Sciaridae, Stratiomyidae and Syrphidae are clearly accidentals or trogloxenes. Others, such as Chironomidae, Culicidae, Dixidae and Psychodidae are aquatic.

Dry and wet bedrock walls and ceiling, and dry and wet leaf litter, woody debris, feces, and organic debris were the dominant microhabitats from which Diptera were most frequently collected. Specimens from the dry and wet bedrock walls and ceiling were generally heleomyzid flies which regularly inhabit twilight and dark zones of caves (Busacca 1975). *Macrocera nobilis* was generally collected in the larval stage from webs where the predatory larvae primarily use other dipterans as a food source (Peck and Russell 1976).

Family Bibionidae. The single specimen collected in the entrance zone is probably an accidental, however, the larvae of March Flies are known to feed on decaying organic debris.

Family Calliphoridae. Peck and Lewis (1978) reported Calliphora *vicina* from Cave-in-Rock, Hardin County.

Family Cecidomyiidae. The single specimen collected in the entrance zone is probably an accidental. Most species are generally gall makers, although the larvae of some species are known to feed on decaying organic debris.

Family Chironomidae. Twelve specimens were examined, constituting 3.6% of the identified Diptera. For those non-biting midges with cave zone data (N=12), 25.0% were collected in the entrance zone, 16.7% in the twilight zone, and 58.3% in the dark zone. The non-biting midges are primarily aquatic and the larvae were collected from all cave zones generally from submerged rock surfaces or in gravel riffles.

Peck and Lewis (1978) reported *Conchapelopia* sp. from Berome Moore Cave, Perry County. *Orthocladius* sp. from Cave-in-Rock, Hardin County. *Trichocladius* sp. from Brown's Hole, Hardin County.

Family Culicidae. Sixty eight specimens were examined, constituting 14.9% of the identified Diptera. For those mosquitoes with cave zone data (N=45), 28.9% were collected in the entrance zone, 66.7% in the twilight zone, and 4.4% in the dark zone.

In the cave environment, mosquitoes are both terrestrial and aquatic. Adults, *Anopheles* sp. and *Culex pipiens* Linnaeus, were collected on the bedrock walls and ceiling in the entrance and twilight zones. These adult mosquitoes often utilize caves as overwinter habitats The larvae were collected from pools and around rocks in slow flowing streams and were found in all cave zones.

Peck and Lewis (1978) reported *Anopheles punctipennis* (Say) from McNabb Hollow Cave, Calhoun County, Twin Culvert Cave, Pine County, and Equality Cave, Saline County. *Culex pipiens* from McNabb Hollow Cave, Calhoun County, Goose Hollow Cave, Henderson County, Illinois Caverns, Saltpeter and Terry Spring caves, Monroe County, and Twin Culvert Cave, Pike County. *Culex* sp. from Goose Hollow Cave, Henderson County, Saltpeter and Terry Spring caves, Monroe County, and Equality Cave, Saline County.

Family Dixidae. Two specimen were examined, and the one collected in the entrance zone should be considered as a trogloxene. The larvae are aquatic and often collected in wet leaf litter.

Family Heleomyzidae. One hundred and seventy two heleomyzid flies were examined, constituting 37.6% of the identified Diptera. For those heleomyzid flies with cave zone data (N=146), 5.5% were collected in the entrance zone, 57.5% in the twilight zone, and 37.0% in the dark zone. For those heleomyzid flies with microhabitat data (N=146), 91.8% were collected from dry or moist bedrock walls and ceiling, 6.2% were collected from dry or wet leaf litter or organic debris, and 2.1% were collected on dry feces. Heleomyzid flies are the dominant Diptera in the terrestrial cave environment.

Peck and Lewis (1978) reported *Aecothea specus* (Aldrich) from Burton Cave, Adams County, Jug Spring Cave, Johnson County, Illinois Caverns, Monroe County, Frieze Cave, Pope County, Falling Spring Cave, St. Clair County, and Cricket and Sensemeyer caves, Union County. *Amoebaleria defess* (Osten Sacken) from Layoff Cave, Hardin County, Jug Spring Cave, Johnson County, Illinois Caverns and Saltpeter Cave, Monroe County, Equality Cave, Saline County, Guthrie, Cricket, Sensemeyer and Saratoga caves, Union County. *Amoebaleria sackeni* Garrett from Equality Cave, Saline County. *Heleomyza brachypterna* (Loew) from Horsethief (in gut of *Eurycea lucifuga* salamander), Saltpeter, and Terry Spring (in gut of *Plethodon glutinosus* salamander) caves, Equality Cave, Saline County, and Saratoga, Cricket, and Sensemeyer caves, Union County.

Family Muscidae. Peck and Lewis (1978) reported *Fannia* sp. from Cave-in-Rock, Hardin County.

Family Mycetophilidae. Seventy two fungus gnats were examined, constituting 15.6% of the identified Diptera. For those fungus gnats with cave zone data (N=68), 39.7% were collected in the entrance zone, 44.1% in the twilight zone, and 16.2% in the dark zone. For those fungus gnats with microhabitat data (N=67), 56.7% were collected from dry or moist bedrock walls and ceiling, 32.8% were collected from dry or wet leaf litter or organic debris, and 4.8% were collected on dry feces.

Macrocera nobilis was generally collected in the larval stage from webs where the predatory larvae use primarily other dipterans as a food source (Peck and Russell 1976).

Peck and Lewis (1978) reported *Exechia* sp. 6 from Sensemeyer Cave, Union County. *Exechia* sp. from Cave No. 1, Jackson County. *Orfelia* sp. from Brown's Hole, Hardin County, Firestone Creek Cave, Johnson County, Equality Cave, Saline County, and Cricket Cave, Union County. *Rymosia trinagularis* Shaw from Cave No. 1, Jackson County. *Rymosia* sp. A from Equality Cave, Saline County. *Rymosia* sp. from Frieze Cave, Pope County.

Family Phoridae. Peck and Lewis (1978) reported *Megaselia cavernicola* (Brues) from Burton Cave, Adams County, McNabb Hollow Cave, Calhoun County, Cave-in-Rock and Brown's Hole, Hardin County, Firestone Creek and Teal caves, and unnamed cave at White Hill, Johnson County, Fogelpole and Horsethief caves and Illinois caverns, Monroe County, and Guthrie Cave, Union County.

Family Psychodidae. Thirty two moth flies were examined, constituting 7.0% of the identified Diptera. For those moth flies with cave zone data (N=30), 26.7% were collected in the entrance zone, 56.7% in the twilight zone, and 16.7% in the dark zone. For those adult moth flies with microhabitat data (N=29), 55.6% were collected from dry or moist bedrock walls and ceiling, 24.1% were collected from dry or wet leaf litter or organic debris, and 20.7% were collected on dry feces.

Family Scatopsidae. Peck and Lewis (1978) reported *Scatopse notata* (LeConte) from Cave-in-Rock, Hardin County.

Family Sciaridae. The three specimens of dark-winged fungus gnats examined were collected in the cave entrance and twilight zones and should be considered as accidentals, although the larvae do feed on fungus and decaying organic debris.

Peck and Lewis (1978) reported *Bradysia* sp. from Brown's Hole, Hardin County.*Corynoptera* sp. from Frieze Cave, Pope County. *Corynoptera* nr. *subtrivalis* (Pettey) from Layoff Cave, Hardin County. *Lycoriella* sp. from Teal cave, Johnson County.

Family Sphaeroceridae. Twenty eight small dung flies were examined, constituting 6.1% of the identified Diptera. For those small dung flies with cave zone data (N=28), 57.1% were collected in the entrance zone and 42.9% in the twilight zone. No specimens were collected in the dark zone. For those small dung flies with microhabitat data (N=28), 82.1% were collected from moist bedrock walls and 17.9% were collected from dry rubble on the floor. Small dung flies occur often in cave environments in association with *Procyon lotor* feces.

Peck and Lewis (1978) reported *Leptocera tenebrarum* Aldrich from Teal cave, Johnson County. *Leptocera* sp. from Burton Cave, Adams County, McNabb Hollow Cave, Calhoun County, Cave-in-Rock, Brown's Hole, Layoff and Cave Spring caves, Hardin County, Goose Hollow Cave, Henderson County, Cave No. 1, Jackson County, Jug Spring, Firestone Creek and Belknap caves, Johnson County, Camp Vandeventer, Fogelpole and Horsethief caves, and Illinois caverns, Monroe County, Frieze Cave, Pope county, Equality Cave, Saline county, Falling Spring and Stemler caves, St. Clair County, Cricket, Saratoga, and Sensemeyer caves, Union County.

Family Stratiomyidae. Two specimens of soldier flies were examined and collected from the cave entrance zone. Both specimens should be considered as accidentals, although the larvae of some species are aquatic or inhabit decaying organic debris.

Family Syrphidae. The single hover fly examined was collected from the cave entrance and should be considered as an accidental, possibly attracted to the colored helmet of a caver.

Family Tipulidae. Sixty three crane flies were examined, constituting 13.8% of the identified Diptera. For those crane flies with cave zone data (N=62), 82.3% were collected in the entrance zone and 17.7% in the twilight zone. No specimens were collected in the dark zone. For those crane flies with microhabitat data (N=62), 90.3% were collected from moist bedrock walls and 9.7% were collected from wet leaf litter.

Peck and Lewis (1978) reported *Gnophomyia tristissima* (Osten Sacken) from Illinois Caverns, Monroe County.

Family Trichoceridae. Peck and Lewis (1978) reported *Trichocera regelationis* (Linnaeus) from Griffith Cave, Hardin County. *Trichocera* sp. from Twin Culvert Cave, Pike County.

Order COLLEMBOLA

Two families and 639 collembolans were examined during this study, constituting 23.3% of the insects. For those collembolans with cave zone data (N=553), 45.6% were collected in the entrance zone, 35.8% in the twilight zone, and 18.6% in the dark zone. Collembola were found in a wide variety of microhabitats and for those collembolans with microhabitat data (N=556), 46.8% were collected from dry or wet leaf litter, 18.9% from dry or wet woody debris, 9.2% from dry or wet walls, ceilings or floors, 8.8% from dry or wet rubble, 7.5% from feces, 6.8% from a mouse hair ball, and 2.0% from fungus.

Christiansen (1982) has investigated the zoogeographic relationships of cave Collembola east of the Great Plains, and associates the Illinois fauna (exclusive of the Driftless Area) with the "Non-glaciated, non-heartland" cave faunas of Missouri and northern Arkansas. In addition, some species from the eastern Shawnee Hills show affinities with the western Kentucky fauna.

Family Entomobryidae. Peck and Lewis (1978) reported *Lepidocyrtus* sp. from Cave-in-Rock and cave north of Cave-in-Rock, Hardin County and Frieze Cave, Pope county. *Pseudosinella* sp. 1 from Brown's Hole and cave Spring Cave, Hardin County, Saltpeter Cave, Monroe County. *Pseudosinella* sp. 2 from Firestone Creek Cave, Johnson County. *Sinella cavernarum* (Packard) from Brown's Hole and Cave Spring Cave, Hardin County, Firestone Creek Cave, Johnson County, Equality Cave, Saline County. *Sinella auita* Christiansen from Firestone Creek Cave, Johnson County. *Entomobrya intermedia* Brook from Cave-in-Rock, Hardin County.

Family Hypogastruridae. Peck and Lewis (1978) reported *Hypogastrura denticulata* complex from Firestone Creek and Will Thomas Spring caves, Johnson County. *Hypogastrura matura* Folsom from cave north of Cave-in-Rock, Hardin County. *Hypogastrura notha* (MacNamara) from cave north of Cave-in-Rock, Hardin County. *Schafferia* (*Typhlogastrura*) sp. from Firestone Creek Cave, Johnson County.

Family Isotomidae. Peck and Lewis (1978) reported *Folsomia candida* Willem from Cave No. 1, Jackson County, Illinois Caverns, Monroe County, and Cricket Cave, Union County. *Folsomia elongata* MacGillivray from Layoff Cave, Hardin County. *Folsomia nivalis* (Packard) from Frieze Cave, Pope County. *Folsomia prima* Mills from cave north of Cave-in-Rock, Hardin County. *Folsomia* sp. from Brown's Hole, Hardin County. *Isotoma andrei* Mills from Frieze Cave, Pope County. *Isotoma gelida* Folsom from Cave-in-Rock, Hardin County. *Isotoma trispinata* MacGillivray from Cave Spring Cave, Union County. *Isotoma* (*Desoria*) from Blackball Mine, LaSalle County. *Isotoma* (*Desoria*) sp. from Cave-in-Rock, Hardin County, Degognia and Devil's Backbone caves, Jackson County, and Frieze Cave, Pope County.

Family Neanuridae. Peck and Lewis (1978) reported *Neanura persimilis* Mills from cave north of Cave-in-Rock, Hardin County. *Neanura pseudoquadrioculata* (Stach) from cave north of Cave-in-Rock, Hardin County. *Pseudachorutes saxatilis* MacNamara from cave north of Cave-in-Rock, Hardin County and Devil's Backbone Cave, Jackson County. *Pseudachorutes* sp. G. from Frieze cave, Pope County.

Family Onychiuridae. Peck and Lewis (1978) reported *Onychiurus* sp. from Teal Cave, Johnson County, and Cave Spring Cave, Union County. *Onychiurus* sp. C from Brown's Hole, Hardin County. *Tullbergia clavata* Mills from cave north of Cave-in-Rock, Hardin County.

Family Sminthuridae. Peck and Lewis (1978) reported *Arrhopalites clarus* Christiansen from Mystery Cave, Perry County. *Arrhopalites hirtus* Christiansen from Twin Culvert Cave, Pike County. *Arrhopalites pygmaeus* Wankel from Brown's Hole and Layoff Cave, Hardin County, and Firestone Creek and Will Thomas Spring caves, Johnson County. *Arrhopalites whitesidei* Jacot from Saltpeter Cave, Monroe County.*Ptenothrix atra* Linnaeus from Firestone Creek cave, Johnson County. *Sminthurides* sp. 1 from Brown's Hole and Cave-in-Rock, , Hardin County, and Frieze Cave, Pope County. *Sminthurides malmgreni* Tullberg from Cave-in-Rock, Hardin County.

Family Tomoceridae. Peck and Lewis (1978) reported *Tomocerus bidentatus* Folsom from Frieze Cave, Pope County and Sensemeyer Cave, Union County. *Tomocerus flavescens* (Tullberg) from Burton Cave, Adams County, Cave-in-Rock and Brown's Hole, Hardin County, Cave No. 1, Devil's Backbone Cave, Jackson County, Teal Cave, Johnson County, Camp Vandeventer Cave and Illinois Caverns, Monroe County, and Stemler and Falling Spring caves, St. Clair County. *Tomocerus missus* Mills from Brainard Cave, Jersey County, Illinois Caverns, Monroe County.

Order COLEOPTERA

Twenty one families and 535 beetles were collected during this study, constituting 20.5% of the insects. For those specimens of beetles with cave zone data (N=456), 39.0% were collected in the entrance zone, 38.0% in the twilight zone, and 23.0% in the dark zone.

Beetles constitute a diverse and often conspicuous component of the terrestrial cave community. They occupy a wide assortment of microhabitats but for those terrestrial beetles with microhabitat data (N=453), 30.9% were collected on dry or wet leaf litter, 21.2% on dry or wet rubble, 18.8% from feces or guano, 15% from dry moss, 4.2% from dry or wet woody vegetation, 4.2% from dry or wet walls and ceilings, 4% from dry or wet floors, and 1.8% from organic debris. Carabidae and Staphylinidae are the dominant families of beetle collected in Illinois caves.

The Illinois fauna is already known to include a troglobitic beetle from Cave Spring Cave (Hardin County) (Barr and Peck 1965; Peck and Lewis 1978) and another from Fogelpole Cave (Peck 1973, Peck and Lewis 1978), though the latter specimen may have been mislabeled as being from Illinois (Peck and Lewis 1978).

Several accidentals of the families Elmidae, Gyrinidae, and Haliplidae were collected from the dark zone. These specimens probably washed in from a surface stream. The family Gyrinidae has previously been reported from caves in other parts of the world (Guignot 1955), but not from Illinois.

Family Cantharidae. A single specimen of a soldier beetle was collected in the entrance zone of a cave. This specimen is probably an accidental as soldier beetles are usually found on flowers.

Family Carabidae. Ground beetles are the second most diverse and abundant beetles in Illinois caves. Ninety four specimens were examined, constituting 20.7% of the identified Coleoptera. For those ground beetles with cave zone data (N=64), 48.4% were collected in the entrance zone, 29.7% in the twilight zone, and 21.9% in the dark zone. For those ground beetles with microhabitat data (N=63), 50.8% were collected from dry or wet leaf litter, 14.3% from bedrock rubble, 12.7% from woody debris,.11.1% from clay or silt floors, 9.5% from dry or wet bedrock walls and ceilings, and 1.6% from feces.

Peck and Lewis (1978) reported *Atranus pubescens* (DeJean) from Cave-in-Rock and Layoff Cave, Hardin County, Will Thomas Spring Cave, Johnson County, and Illinois Caverns, Monroe County. *Bembidion lacunarium* Zimmerman from Burton Cave, Adams County, Cave-in-Rock, Hardin County, and Horsethief Cave, Monroe County. *Bembidion texanum* Chaudoir from Ava Cave, Jackson County, Cave-in-Rock, Hardin County, Camp Vandeventer, Horsethief, and Fogelpole caves, Monroe County, and Saratoga Cave, Union County. *Bembidion* (*Amerizus*) *wingatea* Bland from Burton Cave, Adams County. *Bembidion* (*Furcacampa*) sp. from Cave Spring Cave, Hardin County. *Chalaenius aestivus* (Say) from Cave-in-Rock, Hardin County. *Evarthrus sodalis colossus* Leconte from Illinois Caverns, Monroe County. *Evarthrus fucatus* Freitag from Brown's Hole, Hardin County. *Patrobus longicornis* Say from Fogelpole Cave, Monroe County. *Platynus tenuicollis* (LeConte) from Cave Spring Cave, Hardin County, Ava Cave, Jackson County, Will Thomas Spring Cave, Johnson County, Kreuger Dry-Run, Fogelpole, and Horsethief caves, and Illinois Caverns, Monroe County. *Pseudanophthalmus illinoisensis* Barr and Peck from Cave Spring Cave, Hardin County. *Pterostichus* (*Euferonia*) *coracinus* Say from Illinois Caverns, Monroe County. *Rhadine larvalis* LeConte from Falling Spring Cave, St. Clair County. *Tachyura incurva* (Say) from Fogelpole Cave, Monroe County. *Tachys* sp. from Cave-in-Rock, Hardin County.

Family Cerambycidae. Two specimen of a long-horned-wood boring beetle was examined, one collected in the twilight zone of a cave. This specimen is probably an accidental as long-horned-wood boring beetles feed on flowers and the immature stages bore in wood. It is possible that this specimen emerged from logs washed into the twilight zone of the cave.

Family Chrysomelidae. Eight specimens of leaf beetles were examined, five collected from the entrance zone. These specimens are probably accidentals as flea beetles principally forage on flowers and foliage.

Family Cryptophagidae. Peck and Lewis (1978) reported *Cryptophagus valens* Casey from Teal Cave, Johnson County.

Family Cucujidae. Peck and Lewis (1978) reported *Cathartus* sp. from Cave-in-Rock, Hardin County.

Family Curculionidae. Three specimens of snout beetles (weevils) were examined, one collected in the cave entrance zone and two in the twilight zone. These specimens are probably accidentals as snout beetles bore holes in fruit, nuts, and other plant tissues.

Family Dytiscidae. Seven specimens of predaceous diving beetles were examined, one collected in the twilight zone and three in the dark zone. These specimens are probably accidentals, washed in from surface runoff. Although predaceous diving beetles are aquatic, no species are considered troglophiles or troglobites.

Family Elateridae. Three specimens of click beetles were examined, one collected in the cave entrance zone and one in the dark zone. These specimens are probably accidentals as click beetles are phytophagous and occur on flowers, under bark, or on vegetation.

Family Elmidae. One specimen of riffle beetle was examined, collected from the dark zone of a cave. Their is a possibility that this riffle beetle may be a troglophile as they generally occur on stones and debris in stream riffles.

Family Gyrinnidae. Two specimens of whirligig beetles were examined, collected in the dark zone of a cave. These are probably accidentals, washed into the cave with surface runoff. Both larvae and adults are predaceous. The adults feed chiefly on insects that fall on the surface of the water.

Family Haliplidae. Two specimens of crawling water beetles were examined, collected from a pool in the dark zone of a cave. Although these beetles are aquatic, they are probably accidentals, washed into the cave with surface runoff. Adults are common in ponds. Both adults and larvae feed chiefly on algae and other plant materials.

Family Histeridae. Six specimens hister beetles were examined, one collected in a cave twilight zone and two in the dark zone. These beetles are usually found in or near decaying organic matter such as dung, fungi, and carrion and the two specimens from the dark zone were collected from racoon feces.

Peck and Lewis (1978) reported *Hister* sp. from Firestone Creek Cave, Johnson County.

Family Hydrophilidae. One specimens of water scavenger beetle was examined, collected from a wet log in the dark zone of a cave. Although water scavenger beetles are aquatic, this specimen is probably an accidental, washed into the cave with surface runoff. Adults are scavengers, common in ponds and quiet pools.

Family Leiodidae. Six specimens of round fungus beetles were examined, two were collected from feces and four from leaf litter in the dark zone of a cave. These beetles occur in fungi, under bark, in decaying wood or other vegetation. It is possible that these beetles are troglophiles.

Peck and Lewis (1978) reported *Catops gratiosus* Blanchard from Cave-in-Rock, Hardin County and Equality Cave, Saline County. *Ptomaphagus nicholasi* Barr from Fogelpole Cave, Monroe County.

Family Leptinidae. Eleven specimens of mammal-nest beetles were examined, one collected in the twilight zone of a cave and six from the dark zone. Specimens were collected from racoon feces, a mouse hair ball, leaf litter and woody debris. These beetles are thought to feed on eggs and young of mites and other small arthropods found in mammal nests. Their association with a cave environment may be related to the use of a cave by racoons.

Family Noteridae. A single specimen of burrowing water beetle was collected from a sump pool in the dark zone of a cave. Its occurrence in the cave is probably accidental, washed into the cave from surface runoff as the larvae of this beetle burrow into the mud around the base of aquatic macrophytes.

Family Passalidae. One specimen of *Odontotaenius disjunctus* (Illiger) was collected from moist leaf litter in the entrance of a cave. This specimen is probably an accidental as bessbugs are somewhat social, and their colonies occur in galleries in decaying logs.

Family Pselaphidae. Two specimens of short-winged mold beetles were collected from wet leaf litter and under a rock in the twilight zone. This is a large family of beetles and the adults are found under stones or logs, in rotting wood, or in moss. The occurrence of these two specimens in the twilight zone is probably accidental.

Peck and Lewis (1978) reported *Batrisodes rossi* Park from Teal Cave, Johnson County.

Family Pyrochroidae. One specimen of fire-colored beetle was collected from a spring. It occurrence in probably accidental as the adults are generally found on foliage and flower, or under bark. The larvae occur under the bark of dead trees.

Family Scarabaeidae. Eight specimens of scarab beetles were examined, one collected in the cave entrance zone, four in the twilight zone, and two in the dark zone. Specimens were collected from racoon feces, moist leaf litter and from a dry dirt floor. This is a large family of beetles which varies considerably in habits. Many are dung feeders, or feed on decomposing plant materials, carrion, and the like; some live in the nests or burrows of vertebrates; a few feed on fungi; and many feed on plant materials.

Family Staphylinidae. This is a very large family of beetles and is the dominant family of beetles in Illinois caves. Two hundred and eighty eight rove beetles were examined, constituting 63.4% of the identified Coleoptera. For those rove beetles with cave zone data (N=250), 42.4% were collected in the entrance zone, 37.2% in the twilight zone, and 20.4% in the dark zone. For those rove beetles with microhabitat data (N=258), 26.4% were collected from dry moss on a ledge, 24% from dry or wet leaf litter, 14.7% from rubble, 14% from wet rocks and gravel in a stream riffle, 12.4% from feces and guano, 3.1% from wet organic debris, 1.9% from dry or wet woody debris, 1.9% from moist clay floors, and 1.6% from bedrock walls and ceilings.

Peck and Lewis (1978) reported *Acheta* sp no. 1 from Brown's Hole, Hardin County and Firestone Creek and Teal caves, Johnson County. *Acheta* sp. no. 3 from Cave-in-Rock, cave north of Cave-in-Rock, and Brown's Hole, Hardin County. *Acheta* sp. from Cave Spring and Griffiths caves, Hardin County, Ava Cave, Jackson County, Camp Vandebenter, Fogelpole, Horsethief, and Saltpeter caves, and Illinois Caverns, Monroe County. *Deinopsis* sp. from Brown's Hole, Hardin County. *Emplenota lucifuga* Casey from Burton Cave, Adams County, and Teal Cave, Johnson County. *Erichsonius nanus* Horn from Brown's Hole, Hardin County. *Geodromicus brunneus* (Say) from Layoff Cave, Hardin County. *Homoeotarsus bicolor* (Gravenhorst) from Cave-in-Rock, Hardin County. *Homoeotarsus* (*Gastrolobium*) sp. from Fogelpole Cave, Monroe County. *Lesteva pallipes* LeConte from Brown's Hole, Layoff Cave, and cave north of Cave-in-Rock, Hardin County, Jug Spring and Belknap caves, Johnson county, and Frieze Cave, Pope County. *Myllaena* sp. from Brown's Hole, Hardin County and Frieze Cave, Pope County. *Neobisnius paederoides* LeConte from cave north of Cave-in-Rock, Hardin County. *Oxytelus exiggus* Erichson from Illinois Caverns, Monroe County. *Philonthus micropthalmus* Horn from Brown's Hole, Hardin County. *Philonthus* sp. from Cave-in-Rock, Hardin County, and Belknap Cave, Johnson County. *Quedius erythrogaster* Mannerheim from Burton Cave, Adams County, McNabb Hollow Cave, Calhoun County, Cave-in-Rock, Hardin County, Brainerd Cave, Jersey County, Firestone Creek, Teal, and Will Thomas Spring caves, Johnson County, Camp Vandebenter, Horsethief, Fogelpole, and Saltpeter caves, and Illinois caverns, Monroe County, and Twin Culvert and Lost Creek caves, Pike County. *Quedius fulgidus* (Fabricius) from Burton Cave, Adams County, Cave-in-Rock, Hardin County, and Cricket and Sensemeyer caves, Union County. *Quedius spelaeus* Horn from Illinois caverns, Monroe County, and Lost Creek Cave, Pike County. *Quedius* sp. from Goose Hollow Cave, Henderson County, and Kreuger Dry-Run Cave, Monroe County. *Rimulincola divalis* Sanderson from Horsethief Cave, Monroe County, and Lost Creek Cave, Pike County. *Scopaeus* sp. from Horsethief Cave, Monroe County. *Tachyporus maculipennis* LeConte from Cave-in-Rock, Hardin County.

Family Tenebrionidae. Six specimens of darkling beetles were examined, collected from dry feces in the twilight zone of a cave. This is a very large family of beetles with extremely varied habits.

Order ORTHOPTERA

Four families and 120 crickets and grasshoppers were examined, constituting 4.4% of the insects collected. For those crickets and grasshoppers with cave zone data (N=87), 13.0% were collected in the entrance zone, 77.0 in the twilight zone, and 10.0% in the dark zone. For those crickets and grasshoppers with microhabitat data (N=85), 81.2% were collected from dry or wet walls and ceilings and 11.8% from dry or wet leaf litter. The remaining specimens were collected from bat guano, woody debris, breakdown rubble, and the cave floor.

The scattered specimens of Acrididae, Gryllidae, and Tetrigidae are accidentals, mainly from the entrance zone. The remaining specimens are all cave crickets (Gryllacrididae) of the genus *Ceuthophilus*. These insects are among the largest and most conspicuous of the cave invertebrate fauna. *Ceuthophilus* spp. leave caves to forage on the forest floor and then return to the caves, where their fecal material provides a source of energy for the cave ecosystem. Holsinger and Culver (1988) note that *Ceuthophilus* species are common troglophiles near cave entrances in Tennessee and Virginia. The genus is found in caves across most of the United States (Peck 1980).

Family Gryllacrididae. Peck and Lewis (1978) reported *Ceuthophilus elegans* Hubbell from Firestone Creek Cave, Johnson County, Fogelpole Cave and Illinois Caverns, Monroe County, and Rich's Cave, Union County. *Ceuthophilus gracilipes* (Haldeman) from Cave Spring and Layoff caves, Hardin County, Frieze Cave, Pope County, Equality Cave, Saline county, and Guthrie Cave, Union County. *Ceuthophilus seclusus* Scudder from Kreuger Dry-Run Cave, Monroe County. *Ceuthophilus williamsoni* Hubbell from Burton Cave?, Adams County, Madison Creek and McNabb Hollow caves, Calhoun County, Goose Hollow Cave, Henderson County, Layoff Cave?, Hardin County, Ava Cave, Jackson County, Will Thomas Spring cave, Johnson County, Lost Creek and Twin Culvert caves, Pike County, Equality Cave, Saline County, and Saratoga and Guthrie caves, Union County. *Ceuthophilus* sp. from Brown's Hole, Hardin County, Cave No. 1, and Giant City Cave, Jackson County, Mason No. 1 and No. 2, Jug Spring, Thapsis, Persimmon Pit, Firestone Creek and Teal caves, Johnson County, and Guthrie cave, Union County. *Tachycines asynamorous* Adelung from Cave-in-Rock, Hardin County.

Order HYMENOPTERA

Three families of Hymenoptera and 99 specimens were examined, constituting 3.6% of the insects collected. Of the identified Hymenoptera (N=88), 96.6% were ants (Formicidae), 2.3% ichneumonid wasps (Ichneumonidae), and 1.1% sphecid wasps (Sphecidae). For those Hymenoptera with cave zone data (N=85), 74.0% were collected in the entrance zone and 26.0% in the twilight zone.

Ants are primarily foragers and their occurrence in caves is generally accidental, though the impact of ants foraging in caves may be significant (Elliot 1992). The two ichneumonid wasps and the one sphecid wasp are clearly accidentals. Peck and Christiansen (1990) record three families of wasps (accidentals) from caves in Iowa. Our Hymenoptera are the first record of this order recorded from Illinois caves.

Order HETEROPTERA

Seven families of Heteroptera or true bugs and 58 specimens were examined, constituting 2.1% of the insects.

Family Aradidae. A single fungus bug was collected from a dry bedrock wall in the twilight zone. The occurrence of fungus bugs in caves is accidental the specimen collected is of interest, as it was found in a spider web, and there are few records of predation on this family. These bugs are usually found under loose bark or in crevices of dead and decaying trees. They feed on the sap of fungi or the moisture in bark or decaying wood.

Family Corixidae. A single water-boatman was collected from a pool in the dark zone of a cave. Although aquatic, this specimen is probably an accidental, washed into the cave from surface runoff.

Family Cydnidae. A single specimen on *Sehirus cinctus* was collected from moist breakdown rubble in the entrance of a cave. This specimens is an accidental.

Family Gerridae. Sixteen specimens of *Gerris* spp. were examined during this study. For those waterstriders with cave zone data (N=14), 71.2% were collected in the entrance zone and 28.6 in the twilight zone. No specimens were collected in the dark zone of a cave. For those waterstrider with microhabitat data (N=16), 56.3% were collected from the surface of a pool, 37.5% from a gravel riffle, and 6.2% from wet leaf litter. While this family is an accidental, it is not uncommon in cave entrances with emerging streams.

Family Pentatomidae. The single specimen was collected from the surface of a spring. This is an obvious accidental as stinkbug are primarily phytophagous.

Family Reduviidae. A single specimens of *Melanolestes*, an accidental, was collected from the dirt floor of a cave entrance.

Family Rhopalidae. Four specimens of *Boisea trivittatus* (Say), an accidental, were collected from wet wood and rocks in the twilight zone of a cave.

Family Veliidae. Thirty four specimens of veliids were examined from caves and springs. For those veliids with cave zone data (N=27), 74.1% were collected in the entrance zone and 25.9% in the twilight zone. No specimens of veliids were collected in the dark zone. For those veliids with microhabitat data (N=34), 94.1% were collected from the surface of pools, the remaining specimens were collected from a wet log and moist organic debris. Our specimens of Veliidae are nearly all *Microvelia americana* (Uhler) a common inhabitant of shaded clear rocky streams. *Microvelia albonotata* Champion is known from caves in Florida (Drake and Hussey 1955). Heteroptera have not been reported from Illinois caves.

Order TRICHOPTERA

Forty eight specimens of caddisflies were examined, constituting 1.8% of the identified insects. For those caddisflies with cave zone data (N=21), 66.7% were collected in the entrance zone, 28.5% in the twilight zone, and 4.8% in the dark zone. The few adults that were collected were resting on dry bedrock walls. The aquatic larvae were collected from a gravel riffle and a single specimen from a sand bottomed stream. Previous faunal surveys of Illinois caves have not reported trichopterans from Illinois caves.

Order SIPHONAPTERA

Forty specimens of fleas were examined, constituting 1.5% of the identified insects. These larval fleas were extracted, using a Berlese funnel, from part of a rodent nest found in a dark zone of a cave. While the nest was active and the fleas seemed to be well established, application of the terms trogloxene or troglophile may be questionable. Hamilton-Smith (1971) has discussed some of the problems associated with the ecological classification of parasites. Three different flea species known to be found on rodents are recorded by Peck and Christiansen (1990) from Iowa caves, but our specimens are the first fleas recorded from Illinois caves.

Order HOMOPTERA

Six families of leafhoppers and 37 specimens were examined, constituting 1.4% of the identified insects. Homoptera have not previously been reported from Illinois caves.

Family Aphididae. A single specimen of aphid, an accidental, was collected from leaf litter at the entrance to a cave.

Family Cercopidae. Two specimens of spittlebugs, accidentals, were collected from moist leaf litter or dry bedrock walls in the entrance (1) and twilight (1) zones of caves.

Family Cicadellidae. Thirty one specimens of leafhoppers, possibly trogloxenes, were collected from leaf litter, woody debris, bedrock walls, and breakdown rubble in the entrance (27) and twilight (4) zones of caves. These specimens appear similar to the epigean leaf litter fauna.

Family Flatidae. A single flatid, an accidental, was collected from the dry bedrock wall at the entrance to a cave.

Family Fulgoridae. A single fulgorid, an accidental, was collected from moist walls in the entrance to a cave.

Family Membracidae. A single membracid, an accidental, was collected from the twilight zone of a cave.

Order LEPIDOPTERA

Fifteen specimens of moths were examined during this study. The distinctive trogloxene *Scoliopteryx libatrix* (Linnaeus) was seen in a number of caves, where it overwinters in the adult stage. It is holarctic in distribution and well known from Illinois caves.

Family Noctuidae. Peck and Lewis (1978) reported *Scoliopteryx libatrix* from Layoff and Jackson's Sandstone caves, Giant City Cave, Jackson County, Mason No. 1 and Will Thomas Spring caves, Johnson County, and Guthrie Cave, Union County.

Order PLECOPTERA

Two families and seven specimens of stoneflies were examined during this study.

Family Leuctridae. One female of *Zealeuctra narfi* Ricker and Ross, an accidental, was collected from Cave Spring Cave, Union County, Illinois. This species is known from only three other localities in Illinois. This is the first record of a stonefly from a cave in Illinois.

Family Nemouridae. Six specimens of *Nemoura trispinosa* Frison were collected from under rocks in a gravel riffle in two springs in Carroll County. Previously, this species was only known from springs in Trout Park [Elgin Botanical Gardens], Elgin, Illinois.

Order DIPLURA

Two families and seven specimens of diplurans were examined. For those diplurans with cave zone data (N=7), two were collected in the entrance zone and five in the dark zone.

Family Campodeidae. Four specimens were collected from moist wood (2) and moist clay (2) in the entrance (2) and the dark (2) zones of caves.

Peck and Lewis (1978) and Ferguson (1981) report three genera of troglobitic campodeids from Illinois. *Eumesocampa* sp. from Camp Vandeventer Cave, Horsethief Cave, and Madonnaville Cave, Monroe County; Lost Creek Cave and Twin Culvert Cave, Pike County; and Sensemeyeer Cave, Union County. *Haplocampa* sp. from Illinois Caverns, Monroe County. *Metriocampa* [=*Tricampa*] from Burton Cave, Adams County; Brown's Hole, Hardin County; and Equality Cave, Saline County.

Family Japygidae. A single specimen, probably a troglobite, was collected from under a moist rock on a gravel and mud floor in the dark zone of a cave, and is new to the state's fauna.

Peck and Lewis (1978) reported an undetermined genus and species, an accidental, collected in leaf litter from the entrance of Degognia Cave, Jackson County, Illinois.

Order THYSANURA

Six specimens of silverfish, accidentals or trogloxenes, were examined. Two specimens were collected on leaf litter in the entrance zone to a cave.

Family Machilidae. Peck and Lewis (1978) reported *Machilus* sp. from Layoff, Griffith, and Jackson Sandstone caves, Hardin County.

Order PSOCOPTERA

Five specimens of psocopterans were examined, three from the entrance and two from the twilight zones of caves. Specimens were collected from dry racoon feces (2), wet leaf litter (1), and dry and moist bedrock walls (2).

Peck and Christiansen (1990) report a troglophilic *Psocoptera* from an Iowa cave, but none have previously been reported from Illinois caves.

Order EPHEMEROPTERA

Five specimens of mayflies were examined, two specimens from Nadig Spring, two specimens from Kreuger Dry-Run Cave, and one specimen from Ava Cave.

Family Heptageniidae. Two nymphs of *Stenonema femoratum* (Say), trogloxenes, were collected from gravel in a stream riffle in the dark zone of Kreuger Dry-Run Cave. This is the first record of a mayfly from cave in Illinois.

Order NEUROPTERA

Family Myrmeleontidae. Two larvae of ant lions, trogloxenes, were collected from the dry floor in the entrance zone of a cave.

Order BLATTARIA

Two specimens of cockroaches were examined.

Family Blattidae. A single specimen, an accidental, was collected from dry leaf litter under a deermouse nest in the twilight zone of a cave.

Phylum MOLLUSCA

Two classes and 100 specimens of snails and clams were examined, constituting 1.7% of the invertebrates.

Class BIVALVIA

Three clams, probably accidentals, were collected from a gravel bottom stream pool in the dark zone of a cave. Hubricht (1941) reports *Musculium* sp. (Heterondonta: Sphaeriidae) reproducing in Illinois Caverns (Monroe County), and Peck and Lewis (1978) reported Musculium *transversum* (Say) from Berome Moore Cave (Perry County, Missouri).

Class GASTROPODA

Ninety seven of snails were examined. Twenty two specimens of aquatic Gastropoda were collected from rubble or gravel bottomed stream riffles. For those aquatic snails with cave zone data (N=22), 18.2% were collected in the entrance zone, 50% from the twilight zone, and 31.8% from the dark zone. Some of these may be troglobitic.

For those terrestrial snails with cave zone data (N=62), 75.6% were collected from the entrance zone, 17.7% from the twilight zone, and 9.7% from the dark zone. For those terrestrial snails with microhabitat data (N=54), 81.5% were collected from leaf litter and woody debris. The remaining specimens were collected from under rocks, from bedrock walls and ceilings, and from moist clay floors. Most of our terrestrial gastropods are accidentals or trogloxenes.

Order CTENOBRANCHIATA

Peck and Lewis (1978) reported: *Fongigens antroecetes* (Hubricht) (Hydrobiidae) from Stemler Cave, St. Clair County.

Order PULMONATA

Peck and Lewis (1978) reported: *Physa halei* Lea (Physidae) from Camp Vandeventer and Fogelpole caves, and Illinois Caverns, Monroe County.

Order STYLOMMATOPHORA

Peck and Lewis (1978) reported: *Mesodon inflectus* (Say) (Polygyridae) from Layoff Cave, Hardin County; *Triodopsis fosteri* (F. C. Baker), Cricket Cave, Union County; *T. vulgatus* (Pilsbry) from Guthrie Cave, Union County. *Zonitoides arboreus* (Say) (Zonitidae) from Firestone Creek Cave, Johnson County.

VERTEBRATES

The vertebrates observed in Illinois caves in 1992 and 1993 are listed in Table 6 and a summary of the evidence which indicates vertebrate activity is given in Table 7. A wide variety of vertebrates, including accidentals, trogloxenes, and troglophiles, were seen in caves throughout the state.

Three species of fish (*Lepomis cyanellus*, *Ameiurus melas* ?, *Cottus carolinae*)were observed and both taxa were reported from Illinois caves by Oliver and Graham (1988). A catfish was clearly an accidental. Such large organisms introduced into a cave stream can add large quantities of energy into cave communities. Krejca and Taylor have seen dead catfish in caves in southeastern Missouri covered with amphipods and isopods. Sculpins are not uncommon in midwestern caves and at times they may be abundant.

Of the five species of salamanders observed in caves, three were accidentals or trogloxenes. *Eurycea lucifuga* and *Plethodon glutinosis* are troglophiles. *Eurycea lucifuga* was very common in caves in the Shawnee Hills, and less so in the Sinkhole Plain, which constitutes the northwestern limit of the species' range in Illinois. *Plethodon glutinosis*, the slimy salamander, sometimes lays its eggs in caves (Mohr and Poulson 1966), and is fairly common in moist organic debris in entrance zones of caves in the Shawnee Hills. No salamanders were found in caves of the Lincoln Hills or Driftless Area, though they have been reported from the Lincoln Hills (Oliver and Graham 1988).

Frogs and toads were mainly accidentals, but *Rana palustris* is not uncommon in caves in Illinois and Missouri. Oliver and Graham (1988) report the green frog, *Rana clamitans*, as the most common ranid in Illinois caves, but no specimens of that species were observed in caves during this study.

A variety of birds were associated with the entrance and twilight zones of caves. Rock doves were observed nesting in entrance zones of two caves with large bluff entrances, and rock doves were noted by Oliver and Graham (1988) to frequent rockshelters and bluffs. A turkey vulture with a single egg was encountered in the twilight zone of a Shawnee Hills cave, but a later visit to the cave before the nestling should have fledged yielded only a few feathers and shell fragments, suggesting that rearing had been unsuccessful (predation?). While eastern phoebe nests were fairly common in moist shaded cave entrances in all karst regions except the Driftless Area (Table 7), sightings of the birds were uncommon, and some nests were observed to contain cowbird eggs rather than (or in addition to) phoebe eggs. Oliver and Graham (1988) report considerably less evidence of phoebe activity than is evident from the data presented here (Tables 6, 7).

Bats were observed in caves in all karst regions. Six species were observed with the eastern pipistrelle being the most frequently encountered species (Table 6). Data on bats in this study corroborates the findings of Oliver and Graham (1988).

Raccoons were not commonly seen in caves (Table 6), but evidence of their activities was extremely common (Table 7). Raccoon feces were a common collecting site for invertebrates, especially flies, and raccoon feces probably play an important roles in the energy input into Illinois caves.

Table 6. Vertebrates observed in caves during 1992 and 1993 by karst region, cave*, cave zone** and entrance type***.

	KARST REGION			
	Shawnee Hills	Sinkhole Plain	Lincoln Hills	Driftless Area	Other
Osteichthyes			278 D		
Ameiurus melas ?		57 D			
Unidentified Catfish	10 D				
Lepomis cyanellus		670 A			
Cottus carolinae		52 D			
Amphibia					
Ambystoma tigrinum	167 D	660 B			
		52 D			
Eurycea sp. (larva)	19 A	35 D	278 D		
	10 D	52 D			
	18 D	369 D			
	12 T	363 D			
	537 T	637 D			
		29 T			
		309 T			
Eurycea l. longicauda	678 A	29 T			
	639 B	309 T			
	272 E	555 T			
	283 E				
Eurycea l. melanopleura			657 F		
			278 F		
Eurycea lucifuga	216 B	363 T			
	272 B				
	639 B				
	644 C				
	19 D				
	390 D				
	1 E				
	16 F				
	283 F				
	617 F				
	175 T				
	451 T				
	470 T				
	677 T				
Plethodon dorsalis	284 B	660 B			
	283 E	57 E			
	390 F				

Table 6 (continued)

	KARST REGION				
	Shawnee Hills	Sinkhole Plain	Lincoln Hills	Driftless Area	Other
Plethodon glutinosis	10 B		278 D		
	16 D				
	284 D				
	639 D				
	272 E				
	279 E				
	283 E				
Unidentified Frog		672 E			
Unidentified Toad		355 D			
Bufo americanus			69 D		
Pseudacris triseriata	283 E	660 D			
Rana sp.	167 D	33 D			
	639 D	35 D			
		666 T			
		670 D			
Rana catesbeiana		660 D			
		670 D			
		369 E			
Rana palustris	639 D	52 D			
		363 D			
		670 D			
		25 T			
Reptilia					
Terrapene carolina	470 E				
Aves					
Columba livia		27 E			242 E
Cathartes aura	1 T				
	216 T				
Hatchling (Cowbird or Eastern Phoebe)			378 E		
Sayornis phoebe	283 E	670 E			
	639 E				
Sayornis phoebe egg			378 E		
Molothrus ater egg in *Sayornis phoebe* nest		52 E	378 E		
Mammalia					
Unidentified rodent		272 D		278 E	
Peromyscus maniculatus		543 F			
Unidentified Bat	1 D	636 D			
	283 F	309 T			
Myotis sp.	14 D				
Myotis austroriparius	390 T				
	444 T				
Myotis lucifugus	19 T			202 D	275 D
		544 D			

Table 6 (continued)

	KARST REGION								
	Shawnee Hills		Sinkhole Plain		Lincoln Hills		Driftless Area		Other
Myotis sodalis	147	A	52	D					
	390	B							
	432	B							
	283	T							
	444	T							
Myotis grisescens	147	T							
Myotis keenii	283	T			278	B			
Eptesicus fuscus	12	T							
	19	T							
	147	T							
Pipistrellus subflavus	19	A	27	B	278	B	544	D	
	12	B	29	B	627	E	542	T	
	16	B	350	D	387	F			
	279	B	369	E					
	639	B	672	E					
	18	D							
	646	D							
	2	T							
	248	T							
	283	T							
	284	T							
Procyon lotor							540	T	

*Numbers are site identification numbers, refer to Table 1 for cave names and counties.

**Coding for Zones in which animals were seen: A=Entrance, Dark and Twilight; B=Twilight and Dark; C=Entrance and Dark; D=Dark; E=Entrance; F=Entrance and Twilight; T=Twilight.

***Entrance Type: P=Pit Entrance, I=Intermediate (may constitute a barier for exit of some animals from cave), S=Spring, or spring type cave entrance (not including cases where water resurges at a location away from humanly enterable entrance), N=Other non-pit entrance.

Table 7. Evidence of vertebrate activity found in caves in 1992 and 1993, by karst region, cave*, type of evidence** and entrance type***.

	KARST REGION				
	Shawnee Hills	Sinkhole Plain	Lincoln Hills	Driftless Area	Other
Osteichthyes					
Lepomis cyanellus		670 D P			
Reptilia					
Terrapene carolina	1 B I				
	16 D P				
	283 B P				
Aves					
Columba livia		27 R N			
Sayornis phoebe	432 N N	670 N P	387 N S		
	444 N N	309 N N	117 N N		
	639 N S	52 N N	378 N N		
	157 N P				
	677 N S				
	272 N I				
	279 N I				
	283 N P				
	12 N N				
Owl			626 P N		
Mammalia					
Unidentified mammal	1 O I		134 B S		
	2 O N		278 B S		
	645 G N				
	644 I N				
	390 O I				
Didelphis virginiana	644 B N				
	677 B S				
	272 B I				
Unidentified rodent	432 B N		627 B N	77 B P	
	283 B P				
Castor canadensis	394 W S				
Unidentified Mouse		52 N N			
Peromyscus maniculatus				543 N N	
Microtus sp.			69 D P		
Tamias striatus		636 B P			
Marmota monax	645 B N				
Unidentified Rabbit					274 B N
Bos taurus		33 B S	655 F S		
			627 B N		
Odocoileus virginianus	16 B P				
	678 A S				
Sus scrofa	644 B N				

Table 7 (continued)

		KARST REGION			
	Shawnee Hills	Sinkhole Plain	Lincoln Hills	Driftless Area	Other
Unidentified Bat	432 J N		387 B S	544 F N	
	444 F N		278 F S		
	1 F I				
	645 F N				
	390 F I				
	677 F S				
	147 J N				
	283 F P				
Myotis lucifugus		354 B N			275 F N
Myotis sodalis	147 F N				
Pipistrellus subflavus	12 B N				
Unidentified Canid		672 A I			
Canis familiaris	283 B P		627 B N		
Urocyon cinereoargenteus		645 B N			
Felis domestica	645 D N				
Mephitis mephitis	645 O N				
Procyon lotor	1 F I	663 F N	387 C S	542 J P	275 O N
	2 K N	33 A S	626 T N	540 F N	
	645 F N	637 F N	408 F N	202 H N	
	644 C N	369 F I	627 F N	256 B P	
	679 A S				
	677 F S				
	537 F N				
	216 S N				
	272 F I				
	19 F N				
	10 C N				

*Numbers (reading down) are cave identification numbers, refer to Table 1 for cave names and counties.

**Coding for types of evidence of vertebrate activity: A=tracks; B=bones (generally a skull for identification); C=tracks and feces; D=dead body; F=feces; G=Feces and very strong odor; H=hair; I=hair and very strong odor; J=bones and feces; K=bones, tracks and feces; N=nest; O=very strong odor; P=pellet (owl); Q=feces and dead body; R=feathers and droppings; S=bones and scratch marks on walls; T=bones, feces and tracks; W=Wood with tooth marks (beaver).

***Entrance Type: P=Pit Entrance, I=Intermediate, N=Non-pit entrance, S=Spring.

In caves where there was evidence of vertebrate activity, there is a distinct correlation between the presence of bones, hair and dead bodies and the type of cave entrance (Table 7). Similarly, in caves where vertebrates were seen, there is a correlation between the presence or absence of terrestrial accidental vertebrates and the type of cave entrance (Table 7). In both cases, our data suggests that pit entrance type caves function as a natural trap for some vertebrate animals, and in caves with a pit entrance, these animals probably serve as an important source of energy for the cave system

CHEMICAL ANALYSIS AND WATER QUALITY RESULTS

The chemical analysis of water samples and invertebrates are summarized in Table 8 and detailed results are given in Tables 9-18.

Specific conductivity was only obtained for two caves because we were unable to keep the necessary equipment. Fogelpole Cave (24 February 1992) had a specific conductivity of 475 mS/cm, and Illinois Caverns (24 Feb 1992) had a specific conductivity of 418mS/cm.

Suspended and dissolved solids were calculated for Stearn's Cave (Jackson County). These values were 2.6 mg/L and 284.4 mg/L respectively. For seven caves total solids, pH, and alkalinity are given in Table 10.

Table 8. Water analysis from collecting sites in 1992-1993. *= Analysis Completed. .= No Data. a= Data unreliable.

AI: Amphipods and/or Isopods for Chemical Analaysis
PH: pH (field)
DO: Dissolved Oxygen (field)O
CN: Conductivity/Total Dissolved Solids (field)
TP: Temperature (field)
PP: Pesticides - Polychlorinated Biphenols
NI: Nitrates
TM: Trace Metals
AN: Anions
PT: Lab Analysis — pH, Alkalinty, Total Solids

KARST REGIONS	AI	PH	DO	CN	TP	PP	NI	TM	AN	PT	
Tables Showing Actual Data	10-11		12	12		12	15		13	14	16
Driftless Area											
Carroll County											
Nadig Spring	*	*	*	*	.	.	*	.	.	*	
Sand Boil Spring	*	*	*	*	*	.	*	.	.	*	
Sorrel Horse Camp Spring	*	*	*	*	.	*	*	*	*	*	
Lincoln Hills											
Adams County											
Bobtail Salamander Cave	*	*	*	*	.	*	*	*	*	*	
Cave Spring-Fall Creek	*	*	a	.	.	.	.	*	*	*	
Calhoun County											
McNabb Hollow	*	.	.	*	.	*	*	*	*	.	
Madison Creek Spring Cave	*	*	.	.	.	*	*	*	*	*	
Madison Creek Spring Cave	*	*	a	.	.	.	.	*	*	*	
Pike County											
Lost Creek Cave	*	*	*	*	.	*	*	*	*	.	
Lower Lost Creek Cave											
05/26/93	*	*	*	*	.	*	*	*	*	.	
06/03/93	*	*	a	.	.	.	.	*	*	*	
Lucky Calf Spring	*	*	a	.	.	.	.	*	*	*	
Slick Crawl Cave											
05/27/93	*	*	*	*	.	*	*	*	*	*	
06/03/93	*	*	a	.	.	.	.	*	*	*	
Shawnee Hills											
Hardin County											
Mine No. 69	*	*	*	*	.	*	*	*	*	*	
Jackson County											
Ava Cave	*	.	.	*	.	.	*	.	.	*	
Ava Spring	*	.	.	*	.	*	*	*	*	*	
Stearn's Cave	*	*	*	*	.	*	*	*	*	.	

Table 8 (Continued)

AI — Amphipods and/or Isopods for Chemical Analysis
PH — pH (field)
DO — Dissolved Oxygen (field)O
CN — Conductivity/Total Dissolved Solids (field)
TP — Temperature (field)
PP — Pesticides - Polychlorinated Biphenols
NI — Nitrates
TM — Trace Metals
AN — Anions
PT — Lab Analysis: pH, Alkalinty, Total Solids

KARST REGIONS	AI	PH	DO	CN	TP	PP	NI	TM	AN	PT	
Johnson County											
Jug Spring Cave	.	.	.	*	.	.	*	.	.	.	
Mason Spring	*	*	*	*	.	.	*	*	*	*	
Procyon Cave	*	*	*	*	.	*	*	*	*	*	
Pope County											
Lackey Cave	*	*	*	*	.	*	*	*	*	*	
Pulaski County											
Boiling Spring	*	*	*	*	.	.	.	*	*	*	
Randolph County											
Indian Cave 04/09/93	*	.	*	*	.	*	*	*	*	*	
09/06/93	*	*	*	*	*	.	.	*	*	*	
Union County											
Barefood Cave Spring	*	*	*	*	.	.	.	*	*	*	
Guthrie Cave	.	.	.	*	.	.	*	.	.	.	
Rich's Cave	*	.	.	*	.	*	*	*	*	.	
Saratoga Cave	*	*	*	*	.	*	*	*	*	*	
Shilly Shally Cave	*	*	*	*	.	.	.	*	*	*	
Sinkhole Plain											
Monroe County											
Auctioneer Cave	*	.	.	*	.	.	*	.	.	*	
Unnamed Cave near Collier Spr.		*	*	*	*	.	*	*	*	*	*
Cave Spring #1	*	.	.	*	.	*	*	*	*	*	
Collier Spring 06/30/92	*	*	*	*	*	.	*	.	.	*	
07/02/92	*	.	.	*	.	.	*	.	.	*	
Couch Cave	*	.	.	*	.	*	*	*	*	*	
County Line Cave											
09/04/93	*	*	*	*	.	*	*	*	*	*	
09/06/93	*	*	*	*	*	.	.	*	*	*	
Dulcet Waterfall Cave	*	*	*	*	.	*	*	*	*	*	
Erwin Vogt Spring	.	.	*	*	.	.	*	.	.	*	

Table 8 (Continued)

AI = Amphipods and/or Isopods for Chemical Analaysis
PH = pH (field)
DO = Dissolved Oxygen (field)O
CN = Conductivity/Total Dissolved Solids (field)
TP = Temperature (field)
PP = Pesticides - Polychlorinated Biphenols
NI = Nitrates
TM = Trace Metals
AN = Anions
PT = Lab Analysis pH Alkalinty Total Solids

KARST REGIONS	AI	PH	DO	CN	TP	PP	NI	TM	AN	PT	
Fogelpole Cave											
02/24/92	.	*	.	*	.	.	*	.	.	*	
07/01/92	*	.	.	*	.	*	*	*	*	*	
09/29/92	*	*	*	*	*	.	*	.	.	*	
08/28/93	*	*	*	*	*	*	*	*	*	*	
Illinois Caverns											
02/24/92	*	*	.	*	.	.	*	.	.	*	
08/30/93	*	*	*	*`	.	*	*	*	*	*	
Indian Hole	*	.	*	*	.	.	*	.	.	*	
Kelly Spring Cave											
08/21/93	*	*	*	*	*	.	.	*	*	*	
09/05/93	*	*	*	*	.	*	*	*	*	*	
Kreuger Dry Run Cave											
04/03/92	*	.	*	*	.	*	*	*	*	*	
08/29/93	*	*	*	*	.	*	*	*	*	*	
Quirky Quarry Spring	*	*	*	*	.	.	.	*	*	*	
Running Spring Cave											
06/26/93	*	*	*	*	.	*	*	*	*	*	
06/30/93	*	*	a	.	.	.	.	*	*	*	
Shivery Slithery Cave											
09/05/93	*	*	*	*	.	*	*	*	*	*	
09/06/93	*	*	*	*	*	.	.	*	*	*	
Slippery Dell Cave	*	*	*	*	.	*	*	*	*	*	
Terry Spring Cave	*	.	.	*	.	*	*	*	*	.	
Unamed Spring #424	*	*	*	*	*	.	.	*	*	*	
Wanda's Waterfall Cave											
04/03/92	*	.	*	*	.	*	*	*	*	*	
08/21/93	*	*	*	*	*	.	.	*	*	*	
Weeping Buddha Cave	*	*	*	*	.	*	*	*	*	*	
St. Claire County											
Charles' Cave	*	*	*	*	.	*	*	*	*	*	
Drainage Cave 06/25/93	*	*	*	*	.	*	*	*	*	*	
06/30/93	*	*	*	*	*	.	.	*	*	*	
Misplias Cave	*	*	*	*	.	*	*	*	*	*	
Puppies, Eggs & Apples Spring		*	*	*	*	.	*	*	*	*	*

Table 8 (Continued)

AI = Amphipods and/or Isopods for Chemical Analaysis; PH = pH (field); DO = Dissolved Oxygen (field)O; CN = Conductivity/Total Dissolved Solids (field); TP = Temperature (field); PP = Pesticides - Polychlorinated Biphenols; NI = Nitrates; TM = Trace Metals; AN = Anions; PT = Lab Analysis pH Alkalinty Total Solids

KARST REGIONS	AI	PH	DO	CN	TP	PP	NI	TM	AN	PT
Sparrow Spring Cave	*	.	.	*	.	.	*	.	.	*
Spring Valley Cave										
06/22/93	*	*	*	*	.	*	*	*	*	*
06/30/93	*	*	a	.	.	.	.	*	*	*
Stemmler Cave										
06/25/93	*	*	*	*	.	*	*	*	*	*
10/10/93	*	*	*	*	.	*	*	*	*	*
Other										
LaSalle County										
Blackball Mine South	*	.	.	*	.	*	*	*	*	*

Table 9. Field analysis of air and water temperatures (^{o}C), *p*H, dissolved oxygen (mg/L) and conductivity (mg/L of $CaC0_3$) for sites visited in 1992 and 1993. OUT=outside, ENT=entrance zone, TWI=twilight zone, DRK=dark zone. PCB LIMITS= Illinois Pollution Control Board Limits for Class I Groundwater (Illinois Pollution Control Board 1991).

	AIR TEMP				WATER TEMP						
SITE	OUT	ENT	TWI	DRK	OUT	ENT	TWI	DRK	*p*H	D.O.	Cond.
Driftless Area											
Carroll County:											
Babe's Cave	17	16	13	12	-	-	-	-	-	-	-
Bat Cave	17	15.5	15	-	-	-	-	-	-	-	-
Nadig Spring	19	-	-	-	-	11.5					
Raccoon Den Cave	17	15	13	12	-	-	-	-	-	-	-
Sand Boil Spring	19	-	-	-	-	-	-	-	-	-	-
Skeeter Spring	19	-	-	-	-	-	-	-	-	-	-
Sorrel Horse Camp Spring	19	-	-	-	-	10.5	-	-	-	-	-
Jo Daviess County:											
Jean's Cave	19	17	15	-	-	-	-	-	-	-	-
Kevern's Cavern	-	-	12.5		13						
Kopper's Cave	15	13	12	11	-	-	-	-	-	-	-
Tree Root Cave	15	14	16	-	-	-	-	-	-	-	-
Lincoln Hills											
Adams County											
Bobtail Salamander cave	18	16.5	15	13	13	12	12	12	-	-	-
Cave Spring-Fall Creek	20	-	-	-	12.8	12.3	-	-	-	11.2	268
Weed Cave	-	18	16	14.5	-	-	-	-	-	-	-
Calhoun County:											
Madison Creek Spring Cave 06/02/93	20.5	19	16	-	13	12.5	12.5	12	-	3.9	415
Madison Creek Spring Cave 06/02/93	-	-	-	-	-	12.2	-	-	-	10.8	420
McNabb Hollow Cave Spring	26	21.5	14	-	13	13	13	-	7.8	-	-
	-	-	-	-	-	-	-	-	-	10.6	-
Greene County:											
Crinoid Cave	28	24	18	19	-	-	-	-	-	-	-
Pike County:											
Cedar Cave	29	26	19	-	-	-	-	-	-	-	-
Cloven Hoof Cave	29	26	14.5	13	-	-	-	-	-	-	-
Boat Ramp Cave	21.5	16	14.5	-	-	-	-	-	-	-	-
Lost Creek Cave	21.5	-	16	16	-	-	-	14	-	-	-
Lower Lost Creek Cave	22	17.5	13.5	-	-	11.8	11	-	-	11.6	267
Lucky Calf Spring	19	-	-	-	10.6	-	-	-	-	11.8	291
Slick Crawl Cave	-	20.5	16	-	-	11.8	-	-	-	10.7	280
Other											
Kane County:											
A Little Pit More Cave	28	18	12	-	-	-	-	-	-	-	-
Charles' Cave	-	-	-	-	-	-	14	13	-	-	-
Devil's Den Cave	22.5	-	-	-	-	-	-	-	-	-	-

Table 9 (Continued)

	AIR TEMP				WATER TEMP						
SITE	OUT	ENT	TWI	DRK	OUT	ENT	TWI	DRK	pH	D.O.	Cond.
Dieciseis Tigrinum Pit	28	22	-	13	-	-	-	-	-	-	-
Drainage Cave	-	-	-	-	-	-	18	-	-	-	-
Misplias Cave	-	17	14	-	-	-	13	-	-	-	-
Pups, Eggs & Apples Spring	23.5	-	-	-	-	14	-	-	-	-	-
Spring Valley Cave 06/22/93	26	22	-	-	14	14	13.5	-	-	-	-
06/30/93	-	-	-	-	-	13.9	-	-	-	14.7	286
Stemler Cave 06/25/93	-	19	16	-	-	17	17	17	-	-	-
06/30.93	-	-	-	-	-	14.1	-	-	-	11.2	311
10/10/93	-	-	-	11.5	-	-	-	13	-	-	-
La Salle County:											
*Mathisen Park Cave	18	18	17	-	-	-	-	-	-	-	-
*Skeleton Cave	-	18	-	-	-	-	-	-	-	-	-
*Blackball Mine No. 20	-	14	11	-	-	-	-	-	-	-	-
	13	10	11	-	-	-	-	10.5	8.1	13.7	-
Shawnee Hills											
Alexander County											
Silica Mine No. 42	27.5	14	14	9	-	-	-	-	-	-	-
Hardin County											
Crystal Cave	-	10	8.5	-	-	-	-	-	-	-	-
Mine No. 69	-	14	13.5	14	-	-	-	13	-	-	-
Jackson County:											
Ava Cave	10	10	11	12	-	-	-	12	8.2	13.4	-
Ava Spring	-	-	-	-	12	-	-	-	7.6	11.2	-
Toothless Cave	25.5	-	-	-	-	-	-	-	-	-	-
Stearn's Cave	13.5	11.5	12	14	-	-	11.5	11.5	-	-	-
Johnson County:											
Cedar Bluff Cave	14	13	12	11.5	-	-	-	-	-	-	-
Jug Spring Cave	21	12	12	12	13	13	13	13	8.4	10.6	-
Mason Cave #1	15	13	11.5	11	-	-	-	-	-	-	-
Mason Cave #2	15	14	12	12	-	-	-	-	-	-	-
Mason Cave #3	15	13	11	10.5	-	-	-	-	-	-	-
Mason Spring	12	-	-	-	13	-	-	-	-	-	-
Pip Pit Cave	19	14.5	13	11.5	-	-	-	-	-	-	-
Procyon Cave	23	12	11.5	12	-	-	12.5	11.5	-	-	-
Teal's Cave	15	15	11.5	-	-	-	-	-	-	-	-
Pope County:											
Big Grand Pierre Creek Cave	29	24	21.5	16	-	-	-	-	-	-	-
Brasher Cave	15.5	14	14	-	-	-	-	-	-	-	-
Lackey Cave	17	-	-	-	13	-	-	-	-	-	-
Simmon Creek Cave #2	32.5	13.5	12	-	-	-	-	-	-	-	-
Spring at Simmon Creek	32.5	-	-	-	-	-	-	-	-	-	-
Tube Cave	20	16	15	-	-	-	-	-	-	-	-
Pulaski County											
Boiling Spring	16.5	-	-	-	13.5	-	-	-	-	-	-
Randolph County											
Indian cave	16	14.5	13	-	11	11	11	-	7.4	-	-

Table 9 (Continued)

SITE	AIR TEMP OUT	ENT	TWI	DRK	WATER TEMP OUT	ENT	TWI	DRK	pH	D.O.	Cond.
Saline County											
Equality Cave	13.5	12.5	11.5	12.5	-	-	-	-	-	-	-
Union County:											
Apis Annex	23	13	13	-	-	-	-	-	-	-	-
Barefoot Cave Spring	19.5	-	-	-	13.5	13.5	13.5	-	-	-	-
Craig Cave #4	31	20	16	16	-	-	-	-	-	-	-
Guthrie Cave	23	14	11.5	-	13.5	13.5	13.5	-	8.8	14.4	-
Honeycomb Hole	23.5	16.5	13	13	-	-	-	-	-	-	-
Migrant Camp Cave	30.5	20	18	-	-	-	-	-	-	-	-
Rich's Cave	19	14.5	10	11	-	12.5	12.5	12.5	8.9	12.2	-
Saratoga Cave	15	13	13.5	13.5	13.5	14	14	14	-	-	-
Shilly Shally Cave	18.5	17.5	14	13.5	13.5	13.5	13	13	-	-	-
Sinkhole Plain											
Monroe County:											
Auctioneer Cave	20	22	18	14.5	15	15	15	13	8.1	10.5	-
Cave Spring #1	23	-	-	-	14	-	-	-	7.4	9.2	-
Cave near Collier	26	21	8	16	16	16	14	14	-	-	-
Collier Spring	-	-	-	-	15	13.5	-	-	7.5	11.4	-
Couch Cave	28	22	19	-	13.5	-	13.5	-	7.1	9.8	-
County Line Cave	22	18.5	14	13	19.5	-	13	13	-	-	-
Dulcet Waterfall Cave	22.5	-	17	-	-	-	19	-	-	-	-
*Erwin Vogt Spring	19	19	-	-	-	14	14	-	7.1	-	-
*Fogelpole Cave 02/24/92	18	-	-	10	-	-	12	-	-	10.6	-
*Fogelpole Cave 07/01/92	18	14	10.5	12	-	-	-	13	7.9	10.5	-
*Fults Saltpeter Cave	15.5	15.5	14	14	-	-	-	-	-	-	-
*Illinois Caverns	18	13	13.5	14	-	-	14	14	-	10.3	-
Illinois Caverns	-	-	-	-	-	-	-	14.5	-	-	-
Kelly Spring cave	24	21	18	16	-	-	16	-	-	-	-
Kreuger Dry Run Cave 04/03/92	10	10	8.5	11.5	-	7	11	11	8.6	-	-
	-	-	-	-	-	-	-	18.5	-	-	-
08/29/93	-	-	-	-	-	-	-	14.5	-	-	-
Paw Paw Pit	23		-	10	-	-	-	-	-	-	-
Running Spring Cave 06/26/93	27	16	16	15	-	-	13.5	13.5	-	-	-
06/30/93	-	-	-	-	-	18.7	-	-	-	10.5	129
Shivery Slithery Cave	-	17	-	-	-	-	-	13	-	-	-
Slippery Dell Cave	23.5	22	18	17.5	-	20	20	18	-	-	-
*Terry Spring Cave	21	16	13	14	16	14	3.5	14	8.0	11.3	-
*Virgil Brandt Cave	12.5	11.5	12	13	-	13.5	13	13	8.4	-	-
Weeping Budha Cave	22	21	20	20	-	21	21	21	-	-	-
Wierd Wall Cave	27	19	17.5	15	-	-	-	-	-	-	-
St. Clair County:											
Cossle Fast Pit	28	15	14	12	-	-	-	-	-	-	-
Sparrow Spring Cave	19	19	13	13	-	-	-	-	7.3	11.7	-
MEAN									8.0		
RANGE									7.1-8.9		
PCB LIMITS									6.5-9.0		

Table 10. Total dissolved solids, pH (as determined by laboratory titration) and alkalinity for seven caves sampled in 1992. PCB LIMITS = Pollution Control Board Limits for Class I Groundwater (Illinois Pollution Control Board 1991).

SITE	DATE	pH	Alkalinity mg/L $CaCO_3$)	Total Solids (mg/L)
LINCOLN HILLS				
Calhoun County				
McNabb Hollow	5/16/92	7.25	377	470
Pike County				
Lost Creek Cave	5/15/92	6.7	266	384
SHAWNEE HILLS				
Jackson County				
Stearn's Cave	5/24/92	6.95	148.5	287
Johnson County				
Jug Spring Cave	4/30/92	7.8	116.0	114
Union County				
Guthrie Cave	4/30/92	8.2	217.8	317
Rich's Cave	5/07/92	8.2	159.5	177
SINKHOLE PLAIN				
Monroe County				
Terry Spring Cave	5/06/92	7.65	333.8	400
Range:		6.7-8.2	116.0-377	114-470
Average:		7.54	231.1	307
PCB LIMITS		6.5-9.0	--	1200*

* Pollution Control Board Limits are for total dissolved solids, but our data is total solids (total solids=total dissolved solids + total suspended solids).

Table 11. Anion analysis for water samples from collecting sitesin 1992. Values in milligrams/liter. <DL = below detection limit. MEAN = average value for all samples above detection limit. MAX = maximum value for trace metal in all samples. PCB MCL = Pollution Control Board Maximum Contaminant Level for Class I groundwater (Illinois Pollution Control Board 1991).

KARST REGION	DETECTION	SINKHOLE PLAIN									DRIFTLESS			SHAWNEE		PCB		
ANION	LIMIT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	MEAN	MAX	MCL
Bromide	(0.01)	0.025	0.035	0.069	<DL	0.056	<DL	0.042	0.054	0.064	<DL	<DL	<DL	<DL	0.064	0.051	0.069	--
Chloride	(0.01)	8.90	9.48	11.7	14.7	10.58	17.9	7.29	23.9	22.2	5.49	3.38	2.36	7.00	14.10	11.36	23.9	200
Fluoride	(0.01)	0.225	0.235	0.273	0.248	0.347	0.096	0.366	0.342	0.371	0.198	0.130	0.173	0.141	0.331	0.248	0.371	4.0
Soluble Ortho-Phosphate	(0.005)	0.205	0.202	0.019	<DL	<DL	<DL	<DL	<DL	0.097	<DL	<DL	<DL	<DL	0.123	0.129	0.205	--
Sulfate	(0.01)	22.1	23.2	40.9	61.3	30.8	28.0	20.6	38.0	65.3	25.8	27.1	23.0	72.3	96.2	41.0	96.2	400
Nitrite Nitrogen	(0.005)	0.028	0.029	0.006	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.021	0.029	--
Nitrate Nitrogen	(0.005)	2.84	2.92	2.95	4.14	2.09	5.89	2.71	3.31	2.46	2.78	1.29	0.124	0.964	0.594	2.50	5.89	10

*A=Collier Spring, Monroe County (6/30/92), B=Collier Spring, Monroe County (7/02/92), C=Indian Hole, Monroe County (7/02/92), D=Fogelpole Cave, Monroe County (2/24/92), E=Fogelpole Cave, Monroe County (9/29/92), F=Illinois Caverns, Monroe County (2/24/92), G=Auctioneer Cave, Monroe County (9/28/92), H=Erwin Vogt Spring, Monroe County (9/28/92), I=Sparrow Spring Cave, St. Clair County (9/28/92), J=Nadig Spring, Carroll County (5/27/92), K=Sand Boil Spring, Carroll County (5/28/92), L=Jug Spring Cave, Johnson County (4/30/92), M=Guthrie Cave, Union County (4/30/92), N=Ava Cave, Jackson County (10/20/92).

Table 12. Nitrate Nitrogen (N-NO_3) levels (mg/L) in water samples from collecting sites in 1992 and 1993. PCBMCL= Illinois Pollution Control Board Maximum Contamination Level. *= Nitrate test not done on this water sample.

	Karst Region: Driftless Area
Carroll County	
Nadig Spring	2.78
Sand Boil Spring	1.29
Region Average:	2.035
Region Range:	1.29-2.78
	Karst Region: Lincoln Hills
Adams County	
Unnamed Cave Spring-Falls Creek	1.91
Calhoun County	
Madison Creek Spring Cave	1.73
Pike County	
Lower Lost Creek Cave	2.31
Lucky Calf Spring	1.40
Slick Crawl Cave	2.01
Region Average:	1.872
Region Range:	1.40-2.31
	Karst Region: Shawnee Hills
Jackson County	
Ava Cave	0.59
Johnson County	
Jug Spring Cave	0.12
Mason Spring	*
Pulaski County	
Boiling Spring	1.40
Randolph County	
Indian Cave	0.94
Union County	
Barefoot Cave Spring	1.03
Guthrie Cave	0.96
Shilly-Shally cave	0.89
Region Average:	0.85
Region Range:	0.89-1.40
	Karst Region: Sinkhole Plain
Monroe County	
Auctioneer Cave	2.71
Collier Spring (06/30/92)	2.84
Collier Spring (07/30/92)	2.92
County Line Cave	0.80
Erwin Vogt Spring	3.31
Fogelpole Cave (02/24/92	4.14
Fogelpole Cave (09/29/92)	2.09
Illinois Caverns	5.89

Table 12 (Continued)

Indian Hole	2.95
Kelly spring Cave	9.75
Quirky Quarry Spring	3.30
Running Spring	1.02
Shivery Slithery Cave	11.17
Unnamed Spring #424	11.45
Wanda's Waterfall Cave	4.51
St. Clair County	
Drainage Cave	5.22
Sparrow Spring Cave	2.46
Spring Valley Cave	6.25
Stemler Cave	5.40
Region Average:	4.641
Region Range:	0.80-11.45
Overall Average:	3.259
Overall Range:	0.80-11.45
PCBMCL	10.00

Table 13. Trace metals and mercury analysis in water samples from collecting sites in 1992. Values in parts per million, except Hg is in parts per billion. <DL = below detection limit. MEAN = average value for all samples above detection limit. MAX = maximum value for trace metal in all samples. PCBMCL = Illinois Pollution Control Board Maximum Contaminant Level for Class I Groundwater (Illinois Pollution Control Board 1991).

TRACE METAL	DETEC-TION LIMIT	SITES: SINKHOLE PLAIN A	B	C	D	E	F	G	H	I	DRIFTLESS J	K	SHAWNEE L	M	N	MEAN	MAX	PCB MCL
Al	0.045	0.119	0.118	0.212	<DL	0.248	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.344	0.208	0.344	--
As	0.030	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	0.05
B	0.005	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	2
Ba	0.001	0.140	0.142	0.138	0.096	0.113	0.088	0.084	0.070	0.120	0.074	0.039	0.043	0.073	0.072	0.092	0.142	2
Be	0.001	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	--
Ca	0.004	92.3	94.9	93.9	95.4	79.6	92.1	96.8	103.0	108.0	77.6	66.7	39.4	95.2	49.9	84.6	108.	--
Cd	0.002	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	0.005
Co	0.002	<DL	<DL	<DL	<DL	<DL	<DL	0.005	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.005	0.005	1
Cr	0.007	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	0.1
Cu	0.004	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.009	<DL	<DL	<DL	<DL	0.009	0.009	0.65
Fe	0.025	0.140	0.148	0.237	0.165	0.290	0.026	<DL	0.192	0.100	<DL	<DL	<DL	0.052	0.242	0.159	0.290	5
K	0.629		1.87	1.53	2.01	<DL	1.72	<DL	<DL	1.53	2.52	0.940	<DL	<DL	<DL	2.02	1.77	2.52
--																		
Mg	0.003	12.7	13.1	16.2	16.2	13.0	10.7	13.3	8.11	20.4	34.2	31.5	4.29	10.0	17.4	15.8	34.2	--
Mn	0.009	0.032	0.049	0.045	0.019	0.029	0.014	<DL	0.059	0.058	<DL	<DL	0.052	<DL	<DL	0.040	0.059	0.15
Mo	0.006	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	--
Na	1.34	15.7	14.2	30.8	29.6	18.8	18.8	21.9	17.1	30.1	4.14	2.56	6.72	12.9	16.3	17.1	30.8	--
Ni	0.008	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	0.1
P	0.062	0.180	0.212	<DL	<DL	0.079	<DL	<DL	<DL	0.089	0.090	<DL	<DL	<DL	0.182	0.139	0.212	--
Pb	0.015	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	0.0075
Sb	0.013	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	--
Se	0.031	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	0.05
Si	0.011	9.36	9.61	8.20	9.44	8.22	10.6	14.9	10.9	11.1	11.1	8.83	7.38	10.5	11.0	10.1	14.9	--
Sn	0.033	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	--
V	0.007	<DL	DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	--
Zn	0.007	<DL	<DL	<DL	<DL	<DL	<DL	DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	5
Hg	0.050	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	--	--	0.002

SITES: A=Collier Spring, Monroe County (6/30/92), B=Collier Spring, Monroe County (7/02/92), C=Indian Hole, Monroe County (7/02/92), D=Fogelpole Cave, Monroe County (2/24/92), E=Fogelpole Cave, Monroe County (9/29/92), F=Illinois Caverns, Monroe County (2/24/92), G=Auctioneer Cave, Monroe County (9/28/92), H=Erwin Vogt Spring, Monroe County (9/28/92), I=Sparrow Spring Cave, St. Clair County (9/28/92), J=Nadig Spring, Carroll County (5/27/92), K=Sand Boil Spring, Carroll County (5/28/92), L=Jug Spring Cave, Johnson County (4/30/92), M=Guthrie Cave, Union County (4/30/92), N=Ava Cave, Jackson County (10/20/92).

Table 14. Trace metals and mercury analysis in invertebrate samples from collecting sites in 1992. Values in parts per million, Hg in parts per billion. Analysis based on dry weights of samples. Detection limits given in parentheses after each trace metal.

	ISOPODA	------------------------AMPHIPODA-------------------------			
TRACE METAL	A *	B*	C*	D*	E*
Al (11.2)	2720.	400.	2000.	1390.	760.
As (7.5)	<DL	<DL	<DL	<DL	<DL
B (1.25)	26.7	14.4	<DL	20.0	10.3
Ba (.250)	212.	136.	130.	170.	187.
Be (.250)	<DL	<DL	<DL	<DL	<DL
Ca (1.00)	123000.	98000.	104000.	109000.	112000.
Cd (.500)	6.67	<DL	<DL	<DL	<DL
Co (.500)	0.988	<DL	<DL	<DL	<DL
Cr (1.75)	4.20	7.22	3.47	<DL	<DL
Cu (1.00)	161.	67.4	71.0	40.0	74.0
Fe (6.25)	1940.	320.	1960.	805.	543.
K (157.)	7530.	6120.	6820.	5050.	5970.
Mg (.750)	1350.	1800.	2020.	1600.	1960.
Mn (2.25)	123.	29.7	783.	360.	192.
Mo (1.50)	<DL	<DL	<DL	<DL	<DL
Na (335.)	6620.	4190.	11000.	10400.	8700.
Ni (2.00)	3.95	<DL	4.16	5.50	5.33
P (15.5)	6760.	7290.	7430.	7850.	8300.
Pb (3.75)	<DL	<DL	<DL	<DL	<DL
Sb (3.25)	<DL	<DL	<DL	<DL	<DL
Se (7.75)	<DL	<DL	<DL	<DL	<DL
Si (2.75)	<DL	<DL	<DL**	61.0	62.4
Sn (8.25)	<DL	<DL	<DL	<DL	<DL
Zn (1.75)	95.3	63.8	154.	82.5	75.7
Hg (5.00)	327.	658.	37.0	9.13	16.4

*A=Fogelpole Cave, Monroe County (2/24/92), B=Fogelpole Cave, Monroe County (2/24/92), C=Erwin Vogt Spring (9/28/92), D=Jug Spring Cave, Johnson County (4/30/92), E=Guthrie Cave, Union County (4/30/92). * *= Undissolved silicate residue present in digested sample.

Table 15. Trace metals and mercury analysis of invertebrate and water samples collected from Fogelpole Cave, February 24, 1992. Values in mg/l, except Hg is in parts per billion. Analysis based on dry weights of samples.

TRACE METAL	DETECTION LIMIT FOR CRUSTACEA	ISOPODA	AMPHIPODA	FOGELPOLE CAVE WATER	DETECTION LIMIT FOR WATER
Al	11.2	2720.	400.	<DL	0.045
As	7.5	<DL	<DL	<DL	0.030
B	1.25	26.7	14.4	<DL	0.005
Ba	0.250	212.	136.	0.096	0.001
Be	0.250	<DL	<DL	<DL	0.001
Ca	1.00	123000.	98000.	95.4	0.004
Cd	0.500	6.67	<DL	<DL	0.002
Co	0.500	0.988	<DL	<DL	0.002
Cr	1.75	4.20	7.22	<DL	0.007
Cu	1.00	161.	67.4	<DL	0.004
Fe	6.25	1940.	320.	0.165	0.025
K	157.	7530.	6120.	<DL	0.629
Mg	0.750	1350.	1800.	16.2	0.003
Mn	2.25	123.	29.7	0.019	0.009
Mo	1.50	<DL	<DL	<DL	0.006
Na	335.	6620.	4190.	29.6	1.34
Ni	2.00	3.95	<DL	<DL	0.008
P	15.5	6760.	7290.	<DL	0.062
Pb	3.75	<DL	<DL	<DL	0.015
Sb	3.25	<DL	<DL	<DL	0.013
Se	7.75	<DL	<DL	<DL	0.031
Si	2.75	<DL	<DL	9.44	0.011
Sn	8.25	<DL	<DL	<DL	0.033
V	1.75	<DL	<DL	<DL	0.007
Zn	1.75	95.3	63.8	<DL	0.007
Hg	5.00	327.	658.	<DL	0.050

Table 16. Rank order relationship of relative concentrations of trace metals detected in amphipod, isopod and water samples from Fogelpole Cave, Monroe County, 24 February 1992 visit. 1=highest concentration, 2=next highest, 6=lowest concentration. See Table 15 for actual concentrations of chemicals.

Trace Metals	Water	Amphipoda	Isopoda
Ca	1	1	1
Na	2	2	2
Mg	3	3	4
Fe	4	4	3
Ba	5	5	5
Mn	6	6	6

Table 17. Analysis of pesticides and polychlorinated biphenols in water samples from collecting sites in 1992. Values are in milligrams/liter. <DL = below detection limit (0.0000001 mg/l). Aldrin, Heptachlor, Heptachlor epoxide, DDT, Aroclor 1254 and PCB's were not detected in any of the water samples.

	Pesticides			
SITE	o,p-DDE	p,p'-DDE	o,p-DDD	Dieldrin
	DRIFTLESS AREA			
Carroll County				
Nadig Spring 5/27/92	<DL	<DL	<DL	0.0000001
Sand Boil Spring 5/28/02	<DL	<DL	<DL	0.0000001
	SHAWNEE HILLS			
Jackson County				
Ava Cave 10/20/92	<DL	<DL	<DL	<DL
Johnson County				
Jug Spring Cave 4/30/92	0.00000085	0.00000063	0.00000037	<DL
Union County				
Guthrie Cave 4/30/92	0.00000157	0.00000143	0.00000129	<DL
	SINKHOLE PLAIN			
Monroe County				
Auctioneer Cave 9/28/92	<DL	<DL	<DL	<DL
Collier Spring 6/30/92	<DL	<DL	<DL	<DL
Collier Spring 7/02/92	<DL	<DL	<DL	<DL
Erwin Vogt Spring 9/28/92	<DL	<DL	<DL	<DL
Fogelpole Cave 2/24/92	<DL	<DL	<DL	<DL
Fogelpole Cave 9/29/92	<DL	<DL	<DL	<DL
Illinois Caverns 2/24/92	<DL	<DL	<DL	<DL
Indian Hole 7/02/92	<DL	<DL	<DL	<DL
St. Clair County				
Sparrow Spring Cave 9/28/92	<DL	<DL	<DL	<DL

Table 18. Pesticide and polychlorinated biphenols analyses of invertebrate samples from collecting sites in 1992. Values are in parts per million. <DL = below detection limit (0.0001 ppm). Aldrin, Heptachlor, Heptachlor epoxide, DDT, and Aroclor 1254 and polychlorinated biphenols were not detected in any of the invertebrate samples.

	o,p-DDE	p,p'-DDE	o,p-DDD	Dieldrin
		Amphipoda		
Shawnee Hills:				
Union County				
Guthrie Cave 04/30/92	0.0166	0.0147	0.0130	0.000184
Sinkhole Plain:				
Monroe County				
Erwin Vogt Spring 09/28/92 0.00352		<DL	<DL	<DL
		Isopoda		
Sinkhole Plain:				
Monroe County				
Fogelpole Cave 2/24	0.0305	0.00152	<DL	0.0163

SITE DESCRIPTIONS

The following descriptions of the caves, mines and springs examined during this study pull together all of the information available on each site.

The species name of the terrestrial or aquatic organisms collected or observed in the various sites is followed by an ecological classification and a coding for the zone in which the species was collected or observed

Ecological Classification: AC=accidental; ED= edaphobite; PB= phreatobite; TB = troglobite; TP=troglophile; TX=trogloxene.

Coding for Zones: A=Entrance, Dark and Twilight; B=Twilight and Dark; C=Entrance and Dark; D=Dark; E=Entrance; F=Entrance and Twilight; T=Twilight.

KARST REGION
Driftless Area

Babe's Cave

Carroll County. Site #542.

This cave is located beneath a rugged, heavily wooded hilltop. Some nearby land has been cleared for livestock pasture. The entire cave was examined and mapped on May 27 1992 by G. Gardner, J. K. Krejca, and S. J. Taylor (The Crawlway Courier, 1992, 26(2):46). The entrance to the cave is an opening 4 feet high by 4 feet wide in a sinkhole near the top of the hill. The entrance walls are moss covered bedrock. Beyond the entrance a passage drops straight down 10 feet to a joint controlled cavern 1-4 feet wide and up to 20 feet high. The floor is dry clay and rubble. No speleothems, water, or the remains of human visitation were observed. This cave is less than 100 feet long.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed or observed during this study:

Annelida: Oligochaeta.

Arthropoda: Arachnida: Acari. Araneae: Linyphiidae: *Bathyphantes pallida*, *Meioneta unimaculata*. Theridiidae: *Achaearanea tepidariorum*. Thomisidae: *Xysticas* sp. Opiliones. Malacostraca: Isopoda: Porcellionidae. Diplopoda. Insecta: Coleoptera: Chrysomelidae, Histeridae, Scarabaeidae, Staphylinidae. Collembola. Diptera: Heleomyzidae. Mycetophilidae: *Macrocera* sp. Psychodidae. Tipulidae. Homoptera: Cicadellidae. Hymentoptera: Formicidae. Lepidoptera. Orthoptera: Acrididae. Gryllacrididae: *Ceuthophilus* sp. Trichoptera.

Mammalia: Chiroptera: Vespertilionidae: *Pipistrellus subflavus*.

Current Status: The presence of an animal trap and raccoon bones in the vicinity of cave suggests some prior animal trapping near the cave entrance but there is no evidence of human visitation to the cave.

Bat Cave

Carroll County. Site #77.

This cave is located beneath a wooded hillside alongside a well utilized nature trail. A fairly complete examination and mapping of the cave on May 29 1992 was done by E. Anderson, J. K. Krejca and S. J. Taylor. The entrance is 4 feet high by 5 feet wide with a locked gate set in cement. Beyond the entrance a passage drops down 45 feet through a narrow, elongate joint to the top of a debris cone. This passage continues downwards over the rubble and breakdown. This passage is 1-4 feet wide and often the height of the ceiling could not be determined. No speleothems, water, or the remains of human visitation were observed. This cave is 87 feet deep and the total surveyed length was 189 feet.

Physical and chemical analysis: Air temperatures analysis Table 9.

Fauna: From Peck and Christiansen (1990) and Peck and Lewis (1978):
Annelida: *Dendrobaena rubida* .
Arthropoda: Arachnida: Araneae: Linyphiidae: *Phanetta subterranea, Porrhoma* sp.; Tetragnathidae: *Meta americana*. Malacostraca: Isopoda. Insecta: Coleoptera: Carabidae; Curculionidae. Collembola: *Tomocerus flavescens*. Coleoptera: *Quedius spelaeus*. Diptera: Culicidae:*Culex pipiens*.; Heleomyzidae; Phoridae: *Megaselia cavernicola* . Hymenoptera: Formicidae; Sphecidae.

Current Status: Some debris (beer cans, old gate, flashlight, etc,) has been dropped in the cave, but some was carried in by previous visitors. The cave and the cave fauna are threatened by human visitation and the debris dropped into the cave, even though this cave is protected as part of a nature preserve.

Nadig Spring

Carroll County. Site #541.

This spring is located at the bottom of a wooded hill near a rural home, was examined on May 27 1992 by G. Gardner, J. K. Krejca and S. J. Taylor. The spring resurges from the base of a hill and is 3-4 feet wide, 1-3 inches deep, with a gravel and rock substrate.

Physical and chemical analysis: Air and water temperatures Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Pesticide and polychlorinated biphenol analysis of water Table 17.

Fauna: Taxa collected or observed during this study:
Arthropoda: Isopoda: Asellidae. Malacostraca: Gammaridae: *Gammarus pseudolimneaus*. Insecta: Coleoptera: Carabidae. Dytiscidae. Ephemeroptera. Plecoptera: Nemouridae: *Nemoura trispinosa*. Trichoptera.

Current Status: This spring shows no evidence of domestic use, although it is situated near to a rural home.

Raccoon Den Cave

Carroll County. Site #540.

This cave is located beneath a rugged, heavily wooded area near the top of a hill. Some land nearby has been cleared for livestock pasture. The entire cave was examined on May 27 1992 by G. Gardner, J. K. Krejca and S. J. Taylor. The entrance is 2.5 feet high by 2.5 feet wide with bedrock walls and ceiling. Beyond the entrance a passage trending to the north was formed along an enlarged joint about 3 feet high with a breakdown floor covered with leaf litter and soil. No speleothems, water, or the remains of human visitation were observed. The cave is approximately 50 feet long.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Acari. Araneae: Linyphiidae: *Bathyphantes pallida*, *Linyphia radiata*.; Theridiidae: *Achaearenea tepidariorum*. Opiliones. Pseudoscorpiones. Malacostraca: Isopoda. Insecta: Coleoptera: Histeridae. Scarabaeidae. Staphylinidae. Diptera. Hymenopera: Formicidae. Orthopera: Gryllacrididae: *Ceuthophilus* sp.

Mammalia: Carnivora: Procyonidae: *Procyon lotor*.

Current Status: Probably because of the small size of this cave it has received little or no human visitation.

Sand Boil Spring

Carroll County. Site #547.

This spring is located in the bottom of a narrow valley in the upper reaches of a marshy area. Immediately below the spring is a man made pond and a rural home. This spring was examined on May 28 1992 by G. Gardner, J. K. Krejca and S. J. Taylor. The spring head resurges through a sand boil about 3 inches deep and 3 feet in diameter on the side of a hill. The spring brook flows a short distance into a fishing pond.

Physical and chemical analysis: Air temperature Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Pesticide and polychlorinated biphenol analysis of water Table 17.

Current Status: This spring is currently utilized by the landowner to fill a fishing pond.

Skeeter Spring

Carroll County. Site #539.

This spring is located at the base of a wooded hillside in the vicinity of a pasture and was examined on May 28 1992 by J. K. Krejca and S. J. Taylor. The spring brook is 1-3 feet wide and 1-3 inches deep with a gravel and clay substrate.

Physical and chemical analysis: Air temperature Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Amphipoda: Gammaridae: *Gammarus pseudolimnaeus*. Isopoda. Insecta: Coleoptera: Staphylinidae. Trichoptera.

Mollusca: Gastropoda: Basommatophora: Physidae: *Physa* sp.

Current Status: The spring has previously been used for watering livestock, but in recent years has not been used. It is possible that a lake will be built in this area which may innundate the spring.

Sorrel Horse Camp Spring

Carroll County. Site #545.

This spring is located in a wooded area and was examined on May 27 1992 by G. Gardner, J. K. Krejca and S. J. Taylor. Near the spring was a small building, possibly a well house, that was fairly new and locked, although there was no evidence that it had been used. The spring head resurges from the base of a wooded hill. The spring brook was 2.5 feet wide and 1-3 inches deep with a gravel substrate and flowed into a tributary of Rush Creek.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Current Status: In the past it appears that some domestic use was made of the water in this spring.

Jean's Cave

Jo Daviess County. Site #543.

This cave is located beneath a wooded hillside. The land on top of the hill has been cleared for a housing development. The entire cave was examined and mapped on May 28 1992 by G. Gardner, J. K. Krejca and S. J. Taylor. The entrance is located in a small sinkhole between the roots of two trees in a dense stand of bushes. The entrance is 2.5 feet high by 1.5 feet wide. Beyond the entrance the passage consistis of one enlarged joint 34 feet long. The first part of this passage is a rubble slope followed by passage approximately 10 feet long by 6-8 feet high. The passage height then decreases as the floor rises to pinch off as a sediment filled plug. The passage has bedrock walls and ceiling with a clay and rock floor.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Acari. Araneae: Nesticidae: *Eidmanella pallida*, *Nesticus pallidus*. Theridiidae: *Achaearanea tepidariorum*. Opiliones. Chilopoda: Lithobimorpha. Malacostraca: Isopoda. Insecta: Blattaria. Coleoptera: Letinidae, Staphylinidae. Collembola. Diptera: Mycetophilidae: *Macrocera nobilis*. Collembola. Homoptera: Cercopidae, Membracidae. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Mollusca: Gastropoda.

Mammalia: Rodentia: Muridae: *Peromyscus maniculatus*.

Current Status: This cave showed no evidence of human visitation, although the hillside above the cave is slated for development, with lots already laid out. The potential of increased human activity in the future is likely to have a profound negative effect on this cave.

Kevern's Cavern

Jo Daviess County. Site #202.

This cave is located in a partially wooded sinkhole near a pulloff on major road. Approximately 50 feet of this cave was examined on May 28, 1992 by J. K. Krejca and S. J. Taylor before an 8-10 feet dropoff was encountered that had old ropes hanging into it. No map was made of this cave. The entrance to this cave is a wooden box 3.5 feet high by 5 feet wide with a wooden trapdoor on top. Wooden walls of the entrance shored up the surrounding rubble in the sinkhole and allowed access to the passage beyond. Beyond the entrance the passage is joint controlled, 10-20 feet high and about 2-4 feet wide. The passage walls and ceiling are limestone bedrock and the floor is clay and rubble. The passage trends downwards at a 30-50 degree angle for approximately 50 feet to a pit 15 feet deep where the examination ended. There is probably not much passage beyond this point. There was some water dripping into the cave, but no cave stream or pools were observed. Some human debris (old ropes, beer cans, plastic and styrofoam cups) was observed and some graffitti was observed on the cave walls.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Acari. Araneae: Linyphiidae: *Bathyphantes pallida, Porrhomma* sp.; Nesticidae: *Nesticus pallidus*. Malacostraca: Asellidae. Insecta: Coleoptera: Staphylinidae. Collembola. Diptera: Heleomyzidae; Mycetophilidae: *Macrocera* sp.; Psychodidae. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Mammalia: Carnivora: Procyonidae: *Procyon lotor*. Chiroptera; Vespertilionidae: *Myotis lucifugus*.

Current Status: While the cave entrance is fairly difficult to find, the presence of human debris and graffitti indicates that this cave will continue to be threatened by human visitation. The cave also lies near an area visited by many people.

Kopper's Crevice

Jo Daviess. Site #544.

This cave is located high on a heavily wooded hillside. The entire cave was examined and mapped on May 28, 1992 by G. Gardner, J. K. Krejca, S. J. Taylor and G. Gardner. The entrance is a crevice in the bottom of the sinkhole, 3-4 feet high by 4 feet wide, with some exposed rock above the entrance. Beyond the entrance the passage heads downwards as a rubble slope 1-4 feet wide, joint controlled, and with bedrock walls. The ceiling averaged 20-30 feet high. The cave extends for about 150 feet with one small side passage. The walls and ceiling are wet and dripping, but no cave stream or pooled water was observed. Some speleothems, flowstone and popcorn, were observed. No human debris or vandalism was observed.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Annelida: Oligochaeta.

Arthropoda: Arachnida: Acari. Araneae: Araneidae: *Leucauge venusta*. Linyphiidae: *Bathyphantes pallida,* possibly *Eperigone maculata, Porrhoma emertoni* (=incerta). Lycosidae: *Schizpcosa* sp. Tetragnathidae: *Meta americana*. Opiliones. Malacostraca: Isopoda. Insecta: Carabidae, Leiodidae, Pselaphidae, Staphylinidae. Diptera: Heleomyzidae; Mycetophilidae; Psychodidae; Tipulidae. Homptera: Cercopidae. Hymenoptera: Formicidae.

Mollusca: Gastropoda.

Mammalia: Chiroptera: Vespertilionidae: *Myotis lucifugus, Pipistrellus subflavus*.

Current Status: The cave is currently in pristine condition, but the land above the cave is slated for residential development. The small size of this cave, its fragile speleothems, and its utilization as a bat roost make it particularly threatened by the impending residential development.

Tree Root Pit

Jo Daviess County. Site #256.

This pit is located high on a heavily wooded hillside and was examined on May 28, 1992 by G. Gardner, J. K. Krejca, S. J. Taylor. No map was made The entrance to this pit is a small hole, 2 feet high by 4 feet wide, at the base of a tree. The pit is 18 feet deep, joint controlled, with fractured bedrock (limestone) and clay walls and a rubble floor. A small, unentrable (by humans) joint extends off the bottom of pit. In the winter, a steam is said to rise out of the pit.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Annelida: Oligochaeta.

Arthropoda: Arachnida: Acari. Araneae: Linyphiidae: *Linyphia radiata, Meionata animaculata*. Tetragnathidae: *Meta americana*. Theridiidae: *Achaearanea rupicola*. Opiliones. Insecta: Coleoptera: Staphylinidae. collembola. Diptera: Mycetophilidae; Psychodidae; Tipulidae. Hymenoptera: Formicidae.

Mollusca: Gastropoda.

Mammalia: Carnivora: Procyonidae: *Procyon lotor*.

Current Status: This pit is a relatively minor subterranean feature, but could be threatened by future residential development in the area.

KARST REGION
Lincoln Hills

Bobtail Salamander Cave

Adams County. Site #657.

This cave is located at the base of a hill in a heavily wooded area. On May 27, 1992 about 100 feet of passage was explored by M. Deason, J. K. Krejca, D. Mahon, and S. J. Taylor. No map was made. The cave continued as a small but enterable passage. The entrance is about 4 feet high by 4 feet wide, through which a spring flowed. The spring brook flows a short distance before joining a surface stream. Beyond the entrance the passage was 1.5-3.0 feet high by 3 feet wide. The walls and ceiling are limestone and the floor consisted of a cave stream about 1.5 feet wide and 4 inches deep with a sand and gravel substrate. A few small stalactites were observed in the cave. No human debris or vandalism was observed. The cave is probably several hundred feet in length.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Isopoda. Amphipoda: Crangonyctidae: *Bactrurus mucronatus*; Gammaridae: *Gammarus minus*. Insecta: Coleoptera: Carabidae; Staphylinidae. Diptera: Dixidae; Heleomyzidae; Sphaeroceridae; Tipulidae.

Amphibia: Caudata: Plethodontidae: *Eurycea longicauda melanopleura*.

Current Status: This little cave seems relatively untouched by humans. Because exploration requires crawling, often on one's belly, the cave is not likely to be heavily impacted by human visitation since the land above the cave does not appear to be suitable for farming, and the cave is fairly far from areas currently being developed, the cave will probably remain in good condition for quite some time.

Unnamed Cave Spring

Adams County. Site #659.

This cave spring is located on the side of a creek at the bottom of a limestone bluff. The entrance was examined on June 3, 1992 by J. K. Krejca and S. J. Taylor. No map was made. The entrance is a spring that had been dammed up. Two pipes extended out of the dam indicatind that the cave spring was used as a water source at one time. Beyond the entrance the passage is small, joint controlled and could be observed extending back 15 feet to a turn. The quantity of water issuing from the cave entrance suggested that the current entrance was a piracy route and that a larger passage exists further inside the cave.

Physical and chemical analysis: Air and water temperatures, conductivity, and dissolved oxygen analysis Table 9.

Current Status: While the area around Unnamed Cave Spring is frequently visited, the dam at the entrance to the cave makes it appear unenterable, thus protecting the cave from visitation. Runoff from a highway above the cave is a potential source for contamination to the cave stream.

Weed Cave

Adams County. Site #658.

The cave is located on the side of a creek along the bottom of a bluff. The entire cave was examined on May 27, 1992 by M. Deason, J. K. Krejca, D. and W. Mahon, and S. J. Taylor. No map was made. The entrance is a narrow joint with water seeping out at the base. Three to four feet above the water is an opening about 3 feet high by 1.5 feet wide. The entire joint is about 10 feet high, but not all of the joint is enterable. Beyond the entrance the passage is a narrow joint about 20 feet long which terminates in clay fill. The passage is very dry. Crinoid fossils are abundant as well as some small calcite crystals and a small amount of drapery, all in mediocre condition. A small amount of spray paint and human debris was observed.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Arachnida: Araneae. Opiliones: Phalangidae. Amphipoda: Gammaridae: *Gammarus minus*, *Gammarus pseudolimnaeus*. Isopoda. Diplopoda. Insecta: Dixidae; Psychodidae.

Mollusca: Gastropoda.

Current Status: This small cave is occasionally entered but contains little of interest to the casual visitor. Already moderately vandalized, this cave will probably continue to see a small amount of detrimental human visitation.

Madison Creek Spring Cave. [Madison Creek Cave (Peck and Lewis 1978)]

Calhoun County. Site #134.

The cave is located at the base of a wooded hillside next to a surface stream. Farmland above the cave which may drain into the cave. About 200 feet of the cave was examined on June 2, 1992 by J. K. Krejca and S. J. Taylor, and enterable passage continues on. No map was made. The entrance has a cave stream flowing out of it. The entrance was developed along a joint and was 8 feet high by 4 feet wide. There were no rock outcrop above the entrance. Much of the passage is about 2 feet high by 2 feet wide and developed along joints. Where joints intersect, the ceiling height briefly rises to 3-6 feet. In the areas with taller passage, some flowstone was observed. A cave stream occupies the entire floor of the passage and averages about 1 feet deep, with a gravel, breakdown, and bedrock substrate, all covered with considerable quantities of silt, possibly as a result of farming activities on the land above. Bretz and Harris (1961) discuss the geology of this cave and surrounding area. The cave spring was previously utilized as a water source for humans. A few old names are scratched in walls at the entrance area, but otherwise little vandalism was observed.

Physical and chemical analysis: Air and water temperatures, conductivity, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978).

Arthropoda: Arachnida: Araneae. Malacostraca: Isopoda: Asellidae: *Caecidotea* spp. Amphipoda: Gammaridae: *Gammarus troglophilus*,. Chilopoda. Insecta: Coleoptera: Staphylinidae. Diptera: Chironomidae. Sphaeroceridae. Tipulidae. Orthoptera: Gryllacrididae: *Ceuthophilus williamsoni*.

Current Status: Though the location of Madison Creek Spring Cave is well known, it has suffered little damage from humans other than as a result of farming activities. The small wet passage is probably unappealing to casual visitors. Continued problems with siltation constitute a serious threat to the aquatic fauna of this cave.

McNabb Hollow Cave Spring. [McNabb Hollow Cave (Peck and Lewis 1978)]

Calhoun County. Site #117.

This cave is located at the base of a low wooded hill surrounded by farmland in a large valley. The entire cave was examined and mapped on May 16, 1992 by J. K. Krejca and S. J. Taylor. The entrance is about 4 feet high by 20 feet wide with about 10 feet of exposed rock above the entrance. A fairly large cave stream flows out of the entrance and pools up behind a small man-made dam with a pipe that currently carrys water elsewhere. The entrance area is fenced by the landowner to keep livestock out of the pool. Beyond the entrance the passage is 1-2.5 feet high. An enlarged joint leads up to a small dome with a few small formations. A cave stream forms the passage floor with a breakdown and cobble substrate. This stream soon divides into three smaller streams which become too low to be humanly enterable. Total surveyed length is 57 feet. Bretz and Harris (1961) report several other large springs in the area that have no enterable passage.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9. Total dissolved solids, *p*H and alkalinity analysis Table 10.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978):

Annelida: Oligochaeta.

Arthropoda: Arachnida: Acari. Araneae: Agelenidae: *Coras* sp. Linyphiidae: possibly *Bathyphantes pallida*.; Lycosidae: *Pirata sedentarius*.. Tetragnathidae: *Tetragnatha* sp. Theridiidae: *Achaearanea tepidariorum*. Opiliones. Malacostraca: Isopoda: Asellidae: *Caecidotea brevicauda*,. Amphipoda: Asellidae: *Asellus* sp. Porcellionidae. Gammaridae: *Gammarus minus*, *Gammarus troglophilus*. Diplopoda: Polydesmida: Polydesmidae: *Pseudopolydesmus* sp. Insecta: Coleoptera: Carabidae. Staphylinidae: *Quedius erythrogaster*. Collembola. Diptera: Culicidae: *Anopheles punctipennis*, *Culex pipiens*. Heleomyzidae. Mycetophylidae: *Macrocera nobilis*. Phoridae: *Megaselia cavernicola*. Psychodidae: Undetermined genera and species; Sphaeroceridae: *Leptocera* sp. Tipulidae. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthophilus williamsoni*. Trichoptera.

Mollusca: Gastropoda.

Current Status: During the examination of this cave it was not clear whether or not the cave spring was still being used as a water source. The livestock in the area may have a negative impact on the cave water, but the cave does not suffer from human visitation.

Crinoid Cave

Greene County. Site #626.

This cave is located beneath a wooded area in a limestone bluff overlooking farmland. One hundred and eleven feet of this cave was examined and mapped on August 21, 1992 by J. K. Krejca and S. J. Taylor. The entrance faces west and is 15-20 feet high by 4-10 feet wide. Beyond the entrance the passage is joint controlled, dusty dry, and mostly walking height. The floor was dirt and rubble. The main passage trended upwards towards the back of the cave, which became somewhat smaller. A side passage, developed along a parallel joint, lead up to nearly the top of the bluff as a small, dry crawlway. No water or human debris or vandalism was observed.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae: Agelinidae: *Coras* sp.; Linyphiidae: *Linyphia radiata*; Theridiidae: *Achaearanea tepidariorum*. Malacostraca: Isopoda. Insecta: Coleoptera: Curculionidae. Diptera: Culicidae: *Anopheles punctipennis*, *Culex* sp. Homoptera: Flatidae. Hymenoptera. Neuroptera: Myrmeleontidae.

Current Status: Although this cave is located fairly close to a road, it did not appear to have received much human visitation. There appeared to be very little negative impact as a result of human visitation or farming activities.

Boat Ramp Cave

Pike County. Site #378.

This cave is located two-third of the way up a high bluff at the top of a talus slope overlooking a river. The bluff above cave was wooded and below the cave was a highway and some rural housing. The entire cave was examined and mapped on May 15, 1992 by J. K. Krejca and S. J. Taylor. The entrance was 6 feet high by 1-3 feet wide, developed along a joint. Beyond the entrance a narrow passage, 4-6 feet high lead to a dome room about 10 feet in diameter and 60 feet high. The floor was dry breakdown and rubble. A few names had been scratched in the walls and a broken bottle was found on the floor. No water was observed. Speleothems observed included flowstone, popcorn, and fluted walls, none of which were in particularly good condition. Total horizontal length surveyed was 21 feet.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study: Some fur, feathers and bones were found on the floor of the dome room.

Arthropoda: Arachnida: Araneae: Agelenidae: *Tegenaria domestica*; Linyphiidae: *Linyphia radiata*; Salticidae: *Phidippus* sp.; Theridiidae: *Achaearanea tepidariorum*. Malacostraca: Isopoda: Armadillidiidae: *Armadillidium nasatum*; Porcellionidae. Chilopoda: Geophilomorpha; Lithobiomorpha; Scutigeromorpha. Diploda. Insecta: Coleoptera: Carabidae; Pselaphidae; Scarabaeide; staphylinidae; Tenebrionidae. Collembola. Diptera: Mycetophilidae; Tipulidae. Homoptera: Aphididae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Mollusca: Gastropoda.

Aves: Passeriformes: Icteridae: *Molothrus ater* egg in *Sayornis phoebe* nest.

Current Status: The cave, while somewhat impacted by previous human visitors, was in reasonable condition and not likely to be heavily impacted in the near future.

Cedar Cave

Pike County. Site #408.

This cave was located 20-30 feet up the side of a bluff overlooking a small stream. Intensive farming was observed above and below the cave, including both livestock (cattle and pigs) and crops. The entire cave was examined and mapped on August 22, 1992 by J. K. Krejca and S. J. Taylor. The entrance was 7 feet high by 10 feet wide with a large breakdown block in front of the entrance. Beyond the entrance the cave consisted of two main rooms with a low lead into the back of the cave which quickly became too small for human entry. The cave was formed in limestone with a dirt floor. No water was observed although some spray paint and human debris was observed, and local children apparently frequented the cave. No speleothems were observed. Total surveyed length was 60 feet.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae: Theridiidae: *Achaearanea tepidariorum*.

Mammalia: Carnivora: Procyonidae: *Procyon lotor*.

Current Status: The cave is in rather poor condition, but probably will not suffer any more damage than has already been done.

Cloven Hoof Cave

Pike County. Site #627.

This cave was located 20-30 feet up the side of bluff overlooking small stream. Intensive farming was observed above and below the cave, including both livestock (cattle and pigs) and crops. The entire cave was examined and mapped on August 22, 1992 by J. K. Krejca and S. J. Taylor. The entrance consisted of a small, dry, joint controlled crawlway in the side of a bluff. Beyond the entrance, the passage consisted of a short crawlway which lead to a wide, low room and a small upper room developed along the same joint as the entrance. The floor of the cave was dusty dry with breakdown blocks and dirt. Much of the cave was less than 2 feet in height. No speleothems, water, or evidence of human visitation was observed. Total surveyed length is 70 feet.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae: Linyphiidae: *Linyphia* (*Neriene*) *radiata*; Lycosidae: *Pardosa* sp.; Theridiidae: *Achaearanea tepidariorum*. Malacostraca: Isopoda. Insecta: Coleoptera: Staphylinidae. Collembola. Diptera: Culicidae; Heleomyzidae; Mycetophilidae; Tipulidae. Lepidoptera. Orthoptera: Gryllacrididae: *Ceuthophilus* sp. Psocoptera. Siphonaptera.

Mollusca: Gastropoda.

Mammalia: Chiroptera; Vespertilionidae: *Pipistrellus subflavus*. Carnivora: Procyonidae: *Procyon lotor*.

Current Status: This cave was too small to attract human visitation and, since it was dry it probable will not be heavily affected by farming activities in the area.

Lost Creek Cave. [Pearl Cave].

Pike County. Site #69.

This cave is located in a sinkhole on an upland plateau that drains hundreds of acres of farmland. Immediately around the entrance is a pasture containing cattle, and further away, but still in the drainage leading to the cave, are various crops. At least one farmhouse is located within the drainage basin as well. The majority of the enterable passage was examined on May 15, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance has been modified by a farmer so that water will not pool up and form a lake. Two old metal wheels from farm machinery form a door just above ground level. The spokes of the wheels allow water to pass into the cave, while larger debris is kept out. Below the wheels are several sections of drain tile, about 30 inches in diameter, leading straight down about 25 feet. The passage at the bottom of the drain tiles consisted of two rooms up to 10 feet high by 20 feet wide. Flood debris on the ceiling and huge piles of organic debris on the sides of the passage indicated that the cave regularly floods to the ceiling. The odor of cow feces and decaying flesh was quite noticeable. Considerable topsoil and debris from crops was observed in the cave. A very small stream trickled through one of the rooms and contained sediment which appeared rusty in color. An earlier report (Bretz and Harris 1961) indicated considerably more passage (4000 feet) being observed than either we or Oliver and Graham (1988) were able to find. We estimated that less than 100 feet of enterable passage existed. No speleothems were observed and there was no evidence of human visitation. This cave is hydrologically connected to Lower Lost Creek Cave (Site #387), which is half a mile away and 140 feet lower than Lost Creek Cave. Bretz and Harris (1961) discuss the geology of this cave and surrounding area, noting that the cave passage probably predates the Pleistocene, and surface water from the surrounding prairie found its way into the cave after Illinoian time.

Physical and chemical analysis: Air and water temperatures Table 9. Total dissolved solids, *p*H and alkalinity analysis Table 10.

Fauna: Taxa collected or observed during this study and Peck and Lewis (1978)

Annelida: Clitellata: Oligochaeta: Acanthrodrilidae: *Diplocardia* sp.

Arthropoda: Malacostraca: Arachnida: Araneae: Linyphiidae: *Eperigone tridentata*. Isopoda: Asellidae: *Caecidotea brevicauda*. Amphipoda: Crangonyctidae: *Crangonyx forbesi*. Decapoda: Cambaridae: *Cambarus* sp., probably *diogenes*. Diplopoda: Polydesmida: Nearctodesmidae: *Ergodesmus remingtoni*. Julida: Nemasomatidae: *Zosteractis interminata*. Insecta: Coleoptera: Carabidae. Dytiscidae. Staphylinidae: *Atheta* sp., *Quedius erythrogaster*, *Quedius spelaeus*, *Rimulincola divalis*. Collembola. Diplura: Campodeidae: *Eumesocampa* sp. Diptera: Psychodidae: Undetermined genera and species. Orthoptera: Gryllacrididae: *Ceuthophilus williamsoni*.

Mollusca: Gastropoda.

Amphibia: Anura: Bufonidae: *Bufo americanus*.
Mammalia: Chiroptera: Vespertilionidae: *Pipistrellus subflavus*.

Current Status: This cave is heavily impacted by the farming activities in the large drainage area which goes underground via this cave's entrance. In addition to sediment and fecal material, it is likely that any chemicals utilized on the crops in the surrounding fields are transported into this cave. Biologically, the cave is virtually dead except for accidentals which get washed in. Controlling the problems of farmland runoff going into the cave would be very difficult. Creating a large woodland buffer around the entrance, into which no livestock was allowed, would improve the situation somewhat.

Lower Lost Creek Cave

Pike County. Site #387.

This cave is located low on a hillside near a stream. The land above the cave is extensively farmed, with both livestock and crops. Lower Lost Creek Cave is thought to be the resurgence of Lost Creek Cave (Site #69). Approximately 300 feet of passage was examined on May 26, 1993 and June 3, 1993 by J. K. Krejca and S. J. Taylor. No map was made. The entrance was 3 feet high by 10 feet wide with 15 feet of exposed rock above it. A cave stream flowed out of the entrance and down a rubble slope before joining a surface stream. According to a nearby landowner, water completely fills the entrance and comes out with considerable force after heavy rains. The passage was rather rounded and about one sixth to one third full of water. The stream substrate was silt throughout all passages entered, except for the gravel substrate at the entrance area. Water levels rose to 3 feet where our examination ended. A few small stalactites and soda straws, in good condition, were observed.

Physical and chemical analysis: Air and water temperature, conductivity, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study:
Platyhelminthes: Turbellaria.
Annelida: Hirudinida: Hirudinea.
Arthropoda: Arachnida: Opiliones: Phalangidae. Malacostraca: Isopoda. Amphipoda: Gammaridae: *Gammarus minus*. Insecta: Coleoptera: Staphylinidae. Diptera. Hymenotpera: Formicidae.
Mollusca: Gastropoda.

Current Status: The impacts of farming discussed under Lost Creek Cave (Site #69) are relevant here, since the two caves are apparently hydrologically connected. Because of the water conditions, the cave apparently is not often visited and it is unlikely to be seriously affected by human visitation in the future.

Lucky Calf Spring

Pike County. Site #655.

This spring is located at the base of wooded hillside alongside a cow pasture. This spring was examined on June 3, 1993 by J. K. Krejca and S. J. Taylor. A large collapse of a limestone outcrop suggested that there may be a cave entrance buried under the rubble. The limestone outcrop is about 20 feet above the spring. The spring brook is about 6 feet wide by 2 inches deep. The spring is utilized as a water source for cattle. This spring may be hydrologically related to Lost Creek Cave (Site #69).

Physical and chemical analysis: Air and water temperatures, conductivity, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study:
Platyhelminthes: Tricladida: Turbellaria.
Arthropoda: Malacostraca: Isopoda. Amphipoda: Gammaridae: *Gammarus minus*. Insecta: Trichoptera.

Current Status: This spring was heavily trampled by livestock, and the impacts of farming discussed under Lost Creek Cave (Site #69) may be relevant here as the spring may possibly be the resurgence for that cave.

Slick Crawl Cave. [Unnamed Cave #278]

Pike County. Site #278.

This cave is located at the base of a hill in a heavily wooded area. Farmland lies below the entrance. Over 1000 feet of the principal passage was examined and mapped on May 27, 1993, by M. Deason, J. K. Krejca, D. and W. Mahon, and S. J. Taylor; on June 3, 1993, by J. K. Krejca and S. J. Taylor; and on August 20, 1993 by J. K. Krejca, D. Mahon, and S. J. Taylor; with two small leads left unexamined. The entrance is a joint controlled opening on a quarried rockface. The entrance is about 8 feet high by 5 feet wide. A cave stream flows as a spring a few feet from the cave entrance and flows a short distance before entering a surface stream. The passage is about 4 feet wide, beginning as a hands and knees crawl over wet sticky clay. Several sections of canyon passage were encountered with 4-6 feet of air over pooled water in excess of 6 feet deep (exact depth not determined). After several hundred feet, the pools of water are replaced with a flowing cave stream interspersed with crawling and walking on wet sticky clay. Speleothems, especially soda straws, are abundant and in near pristine condition in the first half of the explored passage. The cave showed little evidence of human visitation.

Physical and chemical analysis: Air and water temperatures, conductivity, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Amphipoda: Gammaridae: *Gammarus minus*. Isopoda. Insecta: Coleoptera: Staphylinidae. Diptera: Bibionidae; Heleomyzidae; Psychodidae; Sphaeroceridae; Tipulidae.

Osteichthyes observed.

Amphibia: Caudata: Plethodontidae: *Eurycea longicauda melanopleura, Eurycea* sp., *Plethodon glutinosis*.

Mammalia: Chiroptera: Vespertilionidae: *Myotis keenii, Pipistrellus subflavus.*

Current Status: This is one of the few cave found to be in near pristine condition.

KARST REGION
Other

Devil's Den Cave

Kane County. Site #421.

This cave is located on the bank of a river in a small park that is surrounded by urban development. The entire cave was examined on April 20, 1992 by J. K. Krejca. The cave has been mapped by the Windy City Grotto. Two entrances that are 5 feet apart join a very short distance into the cave. The larger, northernmost entrance is 4 feet high by 3.5 feet wide, the second entrance is 1.5 feet tall by 2-4 feet wide. A small amount of exposed bedrock is around the entrances. The passage averages 4 feet high by 3.5 feet wide with walls and ceiling of bedrock. The floor is dirt and trash. No water or speleothems were observed. Total length of cave is less than 100 feet.

Physical and chemical analysis: Air temperature Table 9.

Fauna: Taxa collected or observed during this study:

Annelida: Oligochaeta.

Arthropoda: Arachnida: Araneae: Pholcidae: *Pholcus phalangioides*. Pseudoscorpiones. Malacostraca: Isopoda: Armadillidiidae: *Armadillidium* sp.; Porcellionidae. Chilopoda: Geophilomorpha; Lithobiomorpha. Diplopoda. Insecta: Coleoptera: carabidae. Collembola. Diplura: Campodeidae. Diptera: Mycetophilidae. Hymenoptera: Formicidae.

Current Status: Signs clearly mark the way to this cave, and the litter distributed on the cave floor are the result of frequent human visitation.

Blackball Mine North and Blackball Mine South [=Zimmerman Mine]

La Salle County. Site #274 and 275.

These two mines are located in a wooded limestone hills on the side of valley in close proximity to a town. A partial examination of these two mines was conducted on May 15, 1992 by D. Coons, J. K. Krejca and S. J. Taylor. Maps are currently in progress by D. Coons and G. Garner. All entrances are manmade, generally 4-6 feet high, in limestone bedrock. Most passages are rectangular and 6-10 feet high with limestone walls and ceilings and a soil or breakdown floor. Several pools of water were encountered and a natural enlarged joint was intersected by the mine passage. The passage was mazy, with a series of parallel passages intersected by another series of parallel passages perpendicular to the first. There is an upper and a lower level to the mine, both accessible via surface entrances and connected to one another by vertical shafts. Remains of the old mining operation are strewn about, including some railroad rails, rotting cross ties, and other machinery. Much of this debris is from the late 1800's. The mining began around 1825-1830 and ended about 1870. The limestone in the area was used to make hydrolic cement. Some later modifications were made to the mine in an attempt to turn it into a commercial mushroom farm, and some of the remains of this, including some mounds of earth that were apparently mushroom beds, can still be observed. More recent visitation by humans was evident by the remains of beer cans, spray paint, and other debris. Some speleothems were observed, primarily small sodastraws and some tiny rimstone dams. These had to have formed since the mine was excavated in the 1800's.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study and by Peck and Lewis (1978)

Arthropoda: Arachnida: Acari. Araneae: Linyphiidae: *Islandiana flaveola*, *Islandiana* new species, *Lepthyphantes leprosus*; Theridiidae: *Achaearanea tepidariorum*. Opiliones. Malacostraca: Isopoda. Amphipoda: Crangronyctidae: *Bactrurus mucronatus;* Gammaridae: *Gammarus troglophilus*. Chilopoda: Scutigeromorpha. Insecta: Coleoptera: Carabidae; Curculionidae. Collembola: Isotomidae: *Isotoma (Desoria) notabilis*. Diptera: Culicidae: *Anopheles punctipennis*, *A. quadrimaculatus* ; Heleomyzidae. Mycetophilidae. Heteroptera: Rhopalidae: *Boisea trivittatus*. Homoptera: Cicadellidae. Hymenoptera: Formicidae. Lepidoptera: Lymantriidae. Othoptera: Gryllidae.

Current Status: The two Blackball Mines are currently protected as a Nature Preserve but the unwanted effects of human visitation are still evident.

Mathiessen Park Cave

La Salle County. Site #242.

This rockshelter cave is a sandstone erosional feature at base of a waterfall in Mathiessen Park. The cave is surrounded by heavily used park trails and some woods. The cave has been surveyed by D. Coons and P. Kambesis. It was also examined on August 20, 1992 by D. Coon, J. K. Krejca and S. J. Taylor. No map is available. This cave has three entrances, each about 10 feet high by 10 feet wide. The passage is joint controlled, 4-10 feet high by 3-15 feet wide. Most of the passage walls, ceiling and floor are wet sandstone, with some organic debris on the floor. The passage is about 50 feet long. No speleothems or water were observed.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae: Theridiidae: *Achaearanea tepidariorum*, *Theridion* sp. Insecta: Diptera. Heteroptera: Gerridae: *Gerris remigis*. Veliidae: *Microvelia americana*.

Aves: Columbiformes: Columbidae: *Columba livia*.

Current Status: This rockshelter cave is heavily utilized by park visitors.

Skeleton Cave

La Salle County. Site #243.

This rockshelter cave is located some 15 feet up on the side of a sandstone bluff. The entire rockshelter cave was examined on August 20, 1992 by J. K. Krejca and S. J. Taylor. No map was made. This rockshelter is 15-20 high by 15 feet wide, extending back into bluff about 20 feet. No speleothems or water was observed.

Physical and chemical analysis: Air temperature Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae: Theridiidae: *Achaearanea tepidariorum*. Insecta: Coleoptera: Cerambycidae. Diptera: Culicidae: *Culex* sp. Psocoptera.

Current Status: This simple rockshelter cave shows little disturbance by the regular human visitation it receives.

KARST REGION
Shawnee Hills

Silica Mine No. 42

Alexander County. Site #432.

This mine is located on a wooded hillside well away from any development. A partial examination of this mine was conducted on June 29, 1993 by J. K. Krejca and S. J. Taylor. No map was made. The mine entrance is 6-8 feet high by 15 feet wide with a talus slope below the entrance. The passage is about 20 feet high by 20 feet wide, with large piles of mine tailings and assorted rubble on the floor. The walls and ceiling are of very white silica. The passage is very mazy and slopes down at an angle. As a result, the mine was created on several levels. No water was observed past the twilight zone, and there was surprisingly little graffiti or human debris, suggesting the mine is not commonly visited. No speleothems were observed. Over a mile of passage likely exists in this mine.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Opiliones: Phalangidae. Diplopoda. Insecta: Lepidoptera.
Mammalia: Chiroptera: Vespertilionidae: *Myotis sodalis*.

Current Status: This mine appears to be fairly free from human disturbance.

Crystal Cave

Hardin County. Site #248.

This cave is located on a wooded hillside surrounded by abandoned and operating mines. A partial examination was conducted on April 17, 1993 by J. K. Krejca, J. Lassy, and S. J. Taylor. No map was made. The cave entrance was a mine that intersected the cave passage. The mined entrance is 20 feet high by 35 feet wide. From the entrance, the natural cave can be followed to the left as a walking height passage up a breakdown pile that leads to a breakdown choke in less than 50 feet. The cave can also be followed directly forward as a bellycrawl 1.5 feet high by 6 feet wide that intersects a cave stream. This small stream cannot be followed in either direction as the passage becomes humanly unenterable.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Insecta: Orthoptera: Gryllacrididae: *Ceuthophilus* sp.
Mammalia: Chiroptera: Vespertilionidae: *Pipistrellus subflavus*.

Current Status: This small cave receives little human visitation, and the major threat is that it will be blasted closed by the nearby miners.

Mine No. 69

Hardin County. Site #444.

This mine is located on a wooded hillside, surrounded by abandoned and active mines. A partial examination of this mine was conducted on April 17, 1993 by J. K. Krejca and J. Lassy. No map was made. The mine entrance is 10 feet high by 10 feet wide. The passage is 19 feet high by 10 feet wide with a breakdown floor that is sometimes unstable. There are occasional pools and small streams. There is more than 300 feet of passage.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Mammalia: Chiroptera: Vespertilionidae: *Myotis austroriparius*, *Myotis sodalis*.

Current Status: This mine has observed little human visitation. The main threat is that the miners will blast it closed, which would destroy the bat habitat this mine offers.

Ava Cave

Jackson County. Site #18.

This cave is located beneath a wooded hill with some crop fields interspersed. Part of the drainage is adjacent to a public road. The majority of the cave was examined on October 20, 1992 by H. Henderson, J. K. Krejca, S. J. Taylor, D. Wagner. Bretz and Harris (1961) partially mapped this cave, as have T. Treacy and J. Rodemaker. A survey of this cave is in progress by S. J. Taylor and J. K. Krejca. The main entrance, next to a public road, is in a small sinkhole into which flows some water after it rains. An upstream entrance is in a large sinkhole and has a sinking stream which enters to become the cave stream. There is usually at least a small amount of water in the sinking stream. A third entrance, downslope of the other two, is located in a small sink on a wooded hillside. The spring resurgence to the cave system, located on a nearby creek, may possibly constitute a fourth entrance, but it appears to be blocked by breakdown. From the main entrance, one enters a mazy area with several intersecting passages. Clay floored crawlways give way to larger passages, 6-8 feet high, where the cave stream is encountered. Upstream from the main entrance the cave passage follows the cave stream, with only a few minor side passages that run only for a short distance. Towards this upstream entrance the passage is only 1-2 feet high by 6-8 feet wide with a considerable amount of water. Downstream from the main entrance, one can remain in a mazy passage and generally stay in a dry clay floored upper level which ultimately leads to the downstream entrance, or go down into the perennial stream where a low, 1-2 feet high, wet passage leads towards the spring. This cave, has over a mile of passage. Bretz and Harris (1961) noted that the cave is developed in Kinkaid Limestone, and they discuss other geological features of the cave. Harris and Allen (1952) give a more detailed discussion of the geology of this cave. Much of the passage contains graffiti and assorted human debris. The few speleothems observed are broken. Humans have generally left the passage close to the upstream entrance undisturbed, but the mazy area between the main and downstream entrances is heavily vandalized.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Pesticide and polychlorinated biphenol analysis of water Table 17.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978):

Annelidae: Oligochaeta.

Arthropoda: Arachnida: Araneae: Linyphiide: *Centromerus latidens*, *Eperigone maculata*, *Lepthyphantes sabulosa*. Lycosidae: *Pirata* sp. Pisauridae: *Pisaurina mira*. Tetragnathidae: *Meta americana*. Malacostraca: Isopoda: Asellidae: *Caecidotea brevicauda*. Amphipoda: Crangronyctidae: *Bactrurus brachycaudus*; Gammaridae: *Gammarus troglophilus*. Diplopoda: Polydesmida: Polydesmidae: *Pseudopolydesmus* sp. Chordeumida: Conotylidae: *Austrotyla specus*; Tingupidae: *Tingupa pallida*. Insecta: Coleoptera: Carabidae: *Bembidion texanum*, *Platynus tenuicollis*. Dytiscidae. Staphylinidae: *Atheta* sp. Collembola: Sminthuridae.

Diptera: Culicidae: *Anopheles punctipennis*. Heleomyzidae. Mycetophilidae: *Macrocera nobilis*. Tipulidae. Ephemeroptera. Orthoptera: Gryllacrididae: *Ceuthophilus williamsoni*.
Mollusca: Gastropoda.
Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga, Eurycea* sp.
Mammalia: Chiroptera: Vespertilionidae: *Pipistrellus subflavus*.

Current Status: This cave continues to be threatened by excessive human visitation. The croplands above the cave probably drains into Ava Cave, and is a potential source of agricultural contaminants.

Stearn's Cave

Jackson County. Site #537.

This cave is located low on the side of a wooded hill. The land above the cave contains many small sinkholes and some logging has been done in the cave's drainage basin. The majority of the cave was examined on May 24, 1992 by J. K. Krejca and S. J. Taylor. No map was made. A small spring opening, 2 feet high by 3 feet wide, with the spring water emerging below the cave entrance in rubble. Most of the passage is 2.5-4 feet high by 1.5-2.5 wide with bedrock walls and ceiling. Some flowstone and draperies were observed. The joint controlled passage leads upstream to a "T" junction. The cave stream is 2 inches to 2 feet wide and very shallow. Turning left, the passage ends at a dome. Turning right, the passage becomes less than 1 foot high with 4 inches of water, but appears to continue. Some evidence of flooding was observed in the cave. The small amount of garbage observed in the cave probably washed in through sinkholes. There is probably over 1000 feet of passage in this cave.

Physical and chemical analysis: Air and water temperatures and dissolved oxygen analysis Table 9. Total dissolved solids, *p*H and alkalinity analysis Table 10.

Fauna: Taxa collected or observed during this study:
Platyhelminthes: Turbellaria: Tricladida.
Arthropoda: Arachnida: Acari. Araneae: Agelenidae: *Agelenopsis pennsylvanica*. Linyphiidae: *Centromerus latidens, Lepthyphantes sabulosa*. Liocranidae: *Scatinella redempta*. Tetragnathidae: *Meta americana*. Opiliones. Malacostraca: Amphipoda: Gammaridae: *Gammarus minus, Gammarus troglophilus*. Insecta; Coleoptera: Staphylinidae. Collembola. Diptera: Heleomyzidae; Tipulidae. Orthoptera: Gryllacrididae: *Ceuthophilus* Sp.
Amphibia: Caudata: Plethodontidae: *Eurycea* sp.

Current Status: This cave is in fairly good condition.

Toothless Cave. [Bat Cave]

Jackson County. Site #147.

This cave lies beneath a mixture of woodlands and rural housing. The entire cave was examined on March 4, 1992 by G. Gardner, J. K. Krejca, M. Spanel, and S. J. Taylor. No map was made. The entrance to this cave is an obscure opening in a wooded area. The entrance room is 4-6 feet high and about 60 feet in diameter with a dry dirt and breakdown floor. At the back of the entrance room is a 6-8 feet dropoff and a large ceiling joint. Below the dropoff is a lower level room about 30 feet wide, 15 feet long and 2-6 feet high. At one edge of this room is a small hole that leads down to a little room at a lower level. Most of the cave is dry, but a small seep of water was observed along one edge of the first room. Bretz and Harris (1961) discuss the geology of this cave and surrounding area. A few small speleothems were observed in the back of the cave. Some trash and graffitti was observed near the entrance. There is less than 200 feet of passage in this cave.

Physical and chemical analysis: Air water temperature Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978)
Arthropoda: Malacostraca: Amphipoda: Crangonyctidae: *Stygobromus subtilis*. This is the type locality of this species. Arachnida: Araneae: Agelenidae: *Circurina pallida*. Linyphiidae:

Porrhoma sp. (=incerta). Tetragnathidae *Meta americana, Meta menardi*. Insecta: Coleoptera: Staphylinide. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.
Mammalia: Chiroptera: Vespertilionidae: *Myotis sodalis, Myotis grisescens, Eptesicus fuscus*.

Current Status: This cave has been subjected to a little vandalism in the past, but since it is relatively difficult to find, it seems to be fairly free from further damage.

Cedar Bluff Cave [Cedar Grove Cave]

Johnson County. Site #216.

This cave is located about half way up a wooded hillside which has scattered limestone outcrops. The cave was examined on April 29, 1992 by S. J. Taylor, J. K. Krejca, and partially mapped by D. Bittle, J. K. Krejca, and E. Rodemaker. A soil slope leads down through a small hole beneath a 4 feet high limestone outcrop to a dry, joint controlled passage about 1.5 feet high. Passage: The entrance passage shortly intersects a perpendicular joint, where the passage opens up to the left to an enlarged mazy area. A short distance down this passage two small pits occur on the left. The second of these pits contains some dripping water and moist limestone walls. Most of the cave passage consists of maze-like crawlways, mostly 2-4 feet high with dusty dry floors and numerous broken formations. Towards the back of the cave, one passage leads off to the west much farther than the rest of the cave. The speleothems in this passage are in better condition and some dripping water and wet mud was encountered. The front part of the cave is well known and often visited by locals. The cave is marred by a little bit of trash, graffitti and the broken speleothems (mostly stalactites). Total surveyed length is 1,010 feet.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae: Dictynidae: *Cicurina pallida*. Linyphiidae: *Eperigone maculata, Linyphia radiata*. Tetragnathidae: *Meta americana*. Opiliones. Insecta: Coleoptera: Elateridae; Staphylinidae. Diptera: Heleomyzidae; Mycetophilidae; Tipulidae. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthopilus* sp.
Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga*.
Aves: Falconiformes: Cathartidae: *Cathartes aura*.

Current Status: This cave receives regular visitation by humans, but still remains relatively free from major human impacts. Since it is a dry cave, most activity from above the cave (residential development and farming) has little impact.

Jug Spring Cave

Johnson County. Site #224.

This cave is located at the base of a wooded hillside near a stream, and just downstream of an impoundment. A partial examination was conducted on April 30, 1992 by J. K. Krejca and S. J. Taylor. P. Moss has mapped this cave. The entrance is a spring with a small cement dam causing the water to be pooled to a depth of about 1 foot. The entrance is developed along a joint in the limestone and is about 3 feet high by 2.5 feet wide. There is an outcrop of limestone above the entrance. The passage is joint controlled, about 3-4 feet high with 0.5-2 feet of water. Further upstream the passage gets very low, less than one foot in places. No speleothems were observed. Total surveyed length is 2157 feet.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9. Total dissolved solids, *p*H and alkalinity analysis Table 10. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Trace metals and mercury analysis on isopod and amphipod invertebrates Table 14. Pesticide and polychlorinated biphenol analysis of water Table 17.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978).
Platyhelminthes: Turbellaria: Tricladida: Planariidae: *Phagocata gracilis*.
Annelida: Hirudinida: Branchiobdellida.

Arthropoda: Arachnida: Acari. Phalangida: Ischyropsalidae: *Sabacaon* sp. Araneae: Agelenidae: *Coras* sp. Linyphiidae: *Bathyphantes alboventris* . Opiliones. Malacostraca: Amphipoda: Gammaridae: *Gammarus minus, Gammarus troglophilus.* Decapoda: Cambaridae: *Cambarus tenebrosus.* Copepoda: Harpacticoida. Insecta: Coleoptera: Staphylinidae: *Lesteva pallipes.* Collembola. Diptera: Heleomyzidae: *Aecothea specus, Amoebaleria defessa.* Mycetophylidae. Sphaeroceridae: *Leptocera* sp. Tipulidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp Current Status: Though the entrance to this cave is heavily visited, the cave itself receives very little human visitation because of the low ceiling and very wet passage. In the drainage above the cave are some farms and wooded areas. Our water quality analysis indicates that the farming activities on the overlying drainage appears to be having a negative impact on the cave stream.

Mason Cave #1

Johnson County. Site #1.

This cave is located high on a wooded hillside beneath farmland and rural residential areas. A partial examination was conducted on May 21, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is in a sinkhole in a wooded area, 5 feet high by 5 feet wide, with exposed bedrock above it. The passage begins fairly large, 6-12 feet high by 6-10 feet wide and is well decorated, though some speleothems are broken. No cave stream was observed, but some pools of water were encountered. Some evidence of human visitation (graffiti) and a strong animal smell was evident. This cave and Mason Cave #3 might actually be just one cave, but we did not enter far enough to find the connection if it exists. There is less than 300 feet of passage in this cave.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978).

Annelida: Clitellata: Oligochaeta: Lumbricidae: *Allolobophora trapezoides.*

Arthropoda: Arachnida: Acari. Araneae: Tetragnathidae: *Meta americana, Meta menardi.* Diplopoda. Insecta: Coleoptera: Leptinidae. Scarabaeidae. Collembola: Entomobryidae. Diptera: culicidae: *Culex* sp. Hompptera: Cicadellidae. Lepidoptera: Noctuidae: *Scoliopteryx libatrix.* Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga.*

Aves: Falconiformes: Cathartidae: *Cathartes aura.*

Mammalia: Chiroptera: Vespertilionidae: Unidentified bat.

Current Status: This cave has received a fair amount of human visitation in the past. Further damage from humans and the possible negative impacts from farming are potential threats.

Mason Cave #2

Johnson County. Site #2.

This cave is located high on a wooded hillside beneath farmland and rural residential areas. A partial examination was conducted on May 21, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is 4 feet high by 10 feet wide with 2 feet of exposed bedrock above. Just inside the entrance is a rusted old vat that was used (according to the landowner) as part of a still during prohibition. The passage is generally smaller than the other two Mason Caves, mainly about 4 feet high with a clay floor. There is some evidence that people have visited the cave, and a strong animal smell was evident. The passage is probably more than 300 feet in length.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978):

Arthropoda: Arachnida: Acari: Ixodidae: *Dermacentor variabilis.* Araneae: Tetragnathidae: *Meta americana, Meta menardi.* Opiliones. Insecta: Coleoptera: Staphylinidae. Collembola: Entomobryidae. Diptera: Culicidae: *Culex* sp. Heleomyzidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Mollusca: Gastropoda.

Mammalia: Chiroptera: Vesptertilionidae: *Pipistrellus subflavus.*

Current Status: Further damage from humans and the possible negative impacts from farming are potential threats.

Mason Cave #3

Johnson County. Site #645.

This cave is located high on a wooded hillside beneath farmland and rural residential areas. A partial examination was conducted on May 21, 1992 by J. K. Krejca and S. J. Taylor. No map is available. This cave has the smallest entrance of the three Mason caves, about 2 feet high by 5 feet wide, with very little exposed rock around entrance. The passage is rather mazy, with slippery rocks and loose breakdown on the floor. At one time the cave was very well decorated, but most of the formations have been broken. Some graffiti, names, and arrows were observed. This cave may be connected to Mason Cave #1, but we did not explore enough passage to determine whether or not this is true. Like the other Mason caves, there was a strong animal oder evident. More than 300 feet of passage is in this cave.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Fauna: Taxa collected or observed during this study.

Arthropoda: Arachnida: Araneae. Opiliones: Phalangidae. Diplopoda. Insecta: Carabidae. Leptinidae. Staphylinidae. Collembola: Entomobryidae. Diptera.

Current Status: Further damage from humans and the possible negative impacts from farming are potential threats.

Mason Spring

Johnson County. Site #646.

This spring originates at the base of a wooded hillside. An examination of this spring was conducted on May 21, 1992 by J. K. Krejca and S. J. Taylor. The spring brook is 1.5 feet wide and 4 inches deep with a rubble, gravel and silt substrate. A pumphouse, 5 feet long by 5 feet wide, was built over the spring and is currently used as a water source.

Physical and chemical analysis: Air and water temperature, *p*H, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Isopoda. Amphipoda: Crangonyctidae: *Crangonyx forbesi*. Decapoda: Cambaridae: *Cambarus tenebrosus*. Insecta: Coleoptera: Dyhtiscidae.

Current Status: This spring drains a karst area which includes woods, farmland and rural houses. Farming and domestic waste are potential threats to this aquifer.

Pipistrellus Pit Cave

Johnson County. Site #644.

This cave is located in a large wooded sinkhole complex on top of hill. A partial examination was conducted on May 21, 1992 by J. K. Krejca and S. J. Taylor. Mapped by S. J. Taylor. The entrance is a hole 2 feet high by 4 feet wide, on the side of a sinkhole which drops down about 1 foot to a low passage. There is about 2 feet of exposed limestone above the entrance. The passage begins about 1 foot high with a breakdown floor. Soon it branches and becomes 2-3 feet high with clay and breakdown on the floor. One branch was followed through two of the constrictions to an end, where unentrable small cracks in the floor lead downwards. The other branch led to a blind pit 15 feet deep with water dripping into it. The passage continues beyond this to another smaller pit. The walls and ceiling are bedrock, and several small formations in good condition were observed. No evidence of prior human visitation was observed, but some garbage dumped into the sinkhole had washed into the cave. Aside from a few drips, no water was observed. Total surveyed length was 185 feet.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Diplopoda. Insecta: Collembola: Entomobryidae. Diptera: Heleomyzidae. Sciaridae. Hymenoptera: Formicidae. Orthoptera: Gryllacridae: *Ceuthophilus* sp. Trichoptera.
Mollusca: Gastrpoda.
Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga.*

Current Status: This cave is fairly pristine and not affected by human visitation. However, the practice of dumping garbage in sinkholes constitutes a real threat to this cave and it's biota.

Procyon Cave, [Unnamed Cave]

Johnson County. Site #272.

This cave is located in a draw on the side of a wooded hill below a pasture and a house. The hillside is currently being logged. Nearly all of the cave was examined on March 6, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is a collapse area, 4 feet by 8 feet, under a fallen tree that leads down from surface drainage. In the twilight zone a small cave stream is intersected. The bottom of the cave stream is covered with a black encrusting layer that is easily broken. This encrusting layer is up to 1 inch thick. A few names are scratched or smoked onto the walls and ceiling of the cave. Much of the passage is 12 feet high by 8 feet wide. Upstream, the cave becomes about 1 foot wide. There is probably less than 300 feet of passage in this cave.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978) Their locality was "unnamed cave at White Hill" in Johnson County, Illinois, which is probably, but not for sure, the same as our Procyon Cave. This could be checked by comparing the general site location given in Peck and Lewis' Figures.

PlatyhelminthesP Turbellaria: Tricladida.
Annelida: Oligochaeta.
Arthropoda: Arachnida: Acari. Araneae: Dictynidae: *Cicurina brevis*. Linyphiidae: *Bathyphates pallida, Centromerus latidens, Linyphia radiata.* Liocranidae: *Scotinella redempta.* Lycosidae: *Pirata* sp. Pisauridae: *Dolomedes* sp. Tetragnathidae: *Meta americana.* Malacostraca: Isopoda: Asellidae: *Caecidotea* sp. 2. Opiliones. Amphipoda: Crangonyctidae: *Crangonyx minor, Crangonyx* sp.*packardi* group). Chilopoda: Geophilomorpha. Lithobiomorpha. Diploda. Insecta: Collembola. Diplura: Japygidae.Diptera: Phoridae: *Megaselia cavernicola*.. Stratiomyiidae/ Homoptera: Cicadellidae. Lepidoptera. Orthopterha: Gryllacrididae: *Ceuthophilus* sp. Siphonaptera. Thysanura.
Mollusca: Gastropoda.
Amphibia: Caudata: Plethodontidae: *Eurycea longicauda longicauda, Eurycea lucifuga, Plethodon glutinosis.*

Current Status: Quarrying on a nearby hill may threaten this cave and other karst in the area. Ongoing logging around the entrance to the cave may result in increased sediment deposition in the cave stream, thus threatening the aquatic cave community.

Sink-Joint Cave

Johnson County. Site #617.

This cave is located on a wooded hillside about 40-50 feet above a nearby valley. Adjacent to the woods are farm fields. Nearly a complete examination was conducted on June 15, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is 9 feet high by 4 feet wide with bedrock walls and ceiling and a gravel/breakdown floor. The entrance is on the side of the bottom of a large sinkhole 40 feet long, 15 feet wide, and 15 feet deep. A small trickle of water flows from the entrance and quickly sinks down into the gravel in the bottom of the sink. The sink and cave are developed along a northeasterly trending joint. The passage consists of limestone bedrock walls and ceiling developed along a joint. The cave stream is 1-5 inches deep and the passage is enterable for 25 feet, where it then becomes too low. No vandalism or human debris was observed. The presence of a typical limestone cave fauna suggests that the subterranean system here is considerably more extensive than the portion that is humanly enterable.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Acari: Ixodidae. Araneae. Malacostraca: Amphipoda: Gammaridae. Decapoda: Cambaridae: *Cambarus tenebrosus*. Insecta: Coleoptera: Carabidae. Collembola: Entomobryidae. Diptera: Culicidae; Heleomyzidae; Mycetophilidae; Sciaridae; Tipulidae. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Mollusca: Gastropoda.

Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga*,.

Current Status: This small cave is relatively free from human impact. It is possible that farming chemicals and topsoil from agricultural fields could wash into the cave upstream of the enterable passage.

Teal's Cave. [Teal Cave]

Johnson County. Site #16.

This cave is located on a wooded hillside beneath pasture and a farm pond. A rural residential area lies below the cave. The entire cave was examined and mapped on May 20, 1993 by J. K. Krejca and S. J. Taylor. The north entrance to this cave is a sinkhole entrance 4 feet by 5 feet on the side of a hill. It goes nearly straight down for a short distance. Rock is exposed on about half of the entrance wall, the remainder of the wall being soil. The south entrance, about 80 feet away, is a small entrance on the same hillside, 2 feet by 3.5 feet. It drops straight down into the cave. From the north entrance, one can go down into a small room, almost completely filled by a large breakdown block. On the south side of the room is a small opening through which one can look down over a large pit that is more accessible through the south entrance. The floor of this passage is dry limestone breakdown.

From the south entrance, the passage drops down into an irregular passage with a rubble and breakdown floor which trends towards the north with two side passages leading out towards the surface of the hill. At some points, the passage is 20 feet high. After about 100 feet, the passage nearly terminates in a low breakdown filled room, but a small opening on one side leads to the top of a joint controlled pit, 30 feet deep. Some areas of the pit walls are decorated with large popcorn. From the bottom of the pit, passages lead off to the east and west. The western end leads upwards and ends in breakdown near the level of the top of the pit. To the east, a high upper lead with considerable popcorn runs about 50 feet to a dead end. At the bottom of the eastern end of the joint is a low water crawl. This passage contains a cave stream, though there was only a small rivulet of water at the time of our visit. The passage becomes too small to be humanly enterable here. Little evidence of human visitation was observed in the cave. The total surveyed length is 366 feet, and 52 feet deep.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978).

Arthropoda: Arachnida: Araneae: Agelenidae: *Calymmaria cavicola*. Malacostraca: Isopoda: Asellidae: *Caecidotea* spp. Diplopoda: Chordeumida: Tingupidae: *Tingupa pallida*. Insecta: Coleoptera: Carabidae; Pselaphidae: *Batrisodes rossi*. Staphylinidae: *Atheta* sp. 1, *Emplenota lucifuga*, *Quedius erythrogaster*. Cryptophagidae: *Cryptophagus valens*. Collembola: Onychiuridae: *Onychiurus* sp. Tomoceridae: *Tomocerus flavescens*. Diptera: Cecidomyiidae; Heleomyzidae; Mycetophilidae; Sciaridae: *Lycoriella* sp. Phoridae: *Megaselia cavernicola*.; Sphaeroceridae: *Leptocera tenebrarum*; Tipulidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Amphibia: Caudata; Plethodontidae: *Eurycea lucifuga*, *Plethodon glutinosis*.

Mammalia: Chiroptera: Vesptertilionidae: *Pipistrellus subflavus*.

Current Status: This cave is in fairly good condition and does not appear to be particularly threatened by human activities. Farmland on the overlying hill and future residential development could constitute potential threats in the future.

Big Grand Pierre Creek Cave. [Vaughn Cave]

Pope County. Site #279.

This cave is located at the top of a hill in a secondary growth wooded area. The entire cave was examined on April 14, 1992 by G. Gardner, J. K. Krejca and S. J. Taylor. No map is available. The entrance is a small hole at the base of a tree. A climb 7 feet down leads into this small sandstone cave. The cave is composed of four small rooms, none larger than 10 feet in diameter and 4 feet high. At the end of the lowest room is a slit where one can see down about 10 feet. The floor consists of sandstone breakdown blocks, and the walls and ceiling are fractured sandstone. No water was observed in the cave. The total length is less than 100 feet.

It is possible that the collapsed sandstone here is indicative of underlying limestone cavities.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Annelida: Oligochaeta.

Arthropoda: Arachnida: Acari. Araneae: Linyphiidae: *Centromerus latidens*. Lycosidae: *Pirata* sp. Salticidae. Opiliones. Insecta: Coleoptera: Carabidae; Elateridae; Leptinidae; Staphyinidae. Collembola: Sminthuridae. Diptera: Heleomyzidae; Mycetophilidae: *Macrocera nobilus*; Psychodidae: *Psychoda umbricola*; Tipulidae. Homoptera: Cicadellidae; Fulgoroidea. Othoptera: Gryllacrididae: *Ceuthophilus* sp.

Amphibia: Caudata: Plethodontidae; *Plethodon glutinosis*.

Mammalia: Chiroptera: Vesptertilionidae: *Pipistrellus subflavus*.

Current Status: This small cave is well known locally but of little interest. No graffitti was observed and the cave seems to be biologically stable.

Brasher Cave

Pope County. Site #390.

This cave is located at the top of a hillside in a wooded area. The entire cave was examined on October 23, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is a sinkhole/moderate pit in sandstone, 4 feet high by 7 feet wide. The passage is 5-15 feet high by 10-20 feet wide with sandstone walls and ceiling and slopes gradually downwards for about 100 feet, ending in a low depression at the back wall. Some large breakdown blocks, covered with graffitti, are found in the passage. No speleothems or water were observed. Beer cans, a shotgun shell, and other human debris was observed.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Opiliones: Phalangidae. Diplopoda. Insecta: Collembola: Entomobryidae. Diptera: Culicidae. Homoptera: Cicadellidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga*, *Plethodon dorsalis*.
Mammalia: Chiroptera: Vespertilionidae: *Myotis austroriparius*, *Myotis sodalis*.
Current Status: This cave is threatened by excessive human visitation.

Lackey Cave

Pope County. Site #394.

This cave and spring is located at the base of a wooded hill. On top of hill are some crop fields. The entire cave was examined on October 23, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is 1-2 feet high by 8 feet wide with water up to 1.5 feet deep. The entrable passage extends back about 6 feet to where the ceiling becomes too low. The spring brook joins a surface creek after 20 feet. There is 10 feet of exposed limestone above the spring entrance. According to the landowner, there was an enterable cave here many years ago. However, the water level has risen and it is now only a spring.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Isopoda. Amphipoda: Gammaridae: *Gammarus pseudolimnaeus*.. Insecta: Coleoptera: Staphylinidae. Diptera: Culiciidae. Heteroptera: Gerridae: *Gerris* sp.; Veliidae: *Microvelia* sp.

Mammalia: Rodentia: Castoridae: *Castor canadensis*.

Current Status: Agricultural chemicals and topsoil runoff from the farms above this spring may have a negative impact on the subterranean community here.

Simmons Creek Cave No. 2

Site #283. Pope County.

This cave is located on a wooded hillside. The cave was partially examined on April 15, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is a slitlike opening 8 feet long by 1-4 feet wide that leads down into a pit 20 feet deep. The bottom of the pit is a large debris cone with three passages leading off. One of these passages leads downwards through several small pits with fluted walls and a clay floor to a blind room about 5 feet high. The second passage leads down to a narrow canyon passage formed by a series of connected pits with sharp fluted limestone walls, breakdown ceiling and clay and breakdown floors. This series of pits continues for at least 75 feet. The third passage leads down to a room with fluted walls and a series of connected pits continuing beyond. No water was observed. The cave is over 300 feet long.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Annelida: Oligochaeta.

Arthropoda: Arachnida: Linyphiidae: *Centromerus latidens*, *Eperigone maculata*. Liocranidae: *Scotinella redempta*. Lycosidae: *Pirata* sp. Salticidae: *Metaphidippus protervus*. Opiliones. Malacostraca: Isopoda: Ligiidae: *Ligidium longicaudatum*. Chilopoda: Lithobiomorpha. Diplopoda. Insecta: Coleoptera: Carabidae; Passalidae: *Odontotaenius disjunctus* ; Staphylinidae. Diptera. Hymenoptera. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.; Gryllidae; Tetrigidae.

Mollusca: Gastropoda.

Amphibia: Caudata: Plethodontidae: *Eurycea longicauda longicauda*, *Eurycea lucifuga*, *Plethodon dorsalis*, *Plethodon glutinosis*. Anura: Hylidae: *Pseudacris triseriata*.

Aves: Tyrannidae: *Sayornis phoebe*.

Mammalia: Chiroptera: Vespertilionidae: *Myotis sodalis*, *Myotis keenii*, *Pipistrellus subflavus*.

Current Status: This cave is in near pristine condition, though it has been visited by humans before. Garbage dumped in a nearby sinkhole is the only obvious threat to the cave and it's biota.

Spring Near Simmons Creek Cave

Pope County. Site #546.

This spring is located at the base of talus slope beneath a bluff. Land above is wooded. It was examined on April 15, 1992 by J. K. Krejca and S. J. Taylor. The spring brook is 2-4 inches deep and 1 feet wide with gravel, mud and organic substrate.

Physical and chemical analysis: Air temperature Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Amphipoda: Crangonyctidae: *Crangonyx anomalus*. Decapoda: Cambaridae: *Fallicambarus fodiens*. Isopoda: Asellidae.

Current Status: This spring appears to be in good condition and is not currently threatened by human activities.

Tube Cave

Site #284. Pope County.

This cave is located high on a wooded hillside among large blocks of sandstone. The cave was partially examined on April 18, 1993 by J. K. Krejca, J. Lassy, and S. J. Taylor. No map is available. The entrance is a hole 2 feet by 3 feet between two large sandstone boulders. The passage is initially in sandstone but leads down into a limestone cave room 8-12 feet in diameter with two side passages. One passage was a dry joint controlled tube 1-3 feet high by up to 4 feet wide with a narrow channel in the floor. After about 50 feet and several turns a small blind pit, 8 feet deep was encountered. The passage continues high beyond the pit, where a small pool of water, 1.5 feet by 3 feet, was observed. The second passage was not explored. No cave stream was observed. Some graffitti and beer cans were observed, mainly in the first room. A few small speleothems were observed that were in fairly good condition. The cave is probably less than 500 feet long.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida. Diploda. Insecta: Coleoptera: Cantharidae. Diptera: Mycetophilidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Amphibia: Caudata: Plethodontidae: *Plethodon dorsalis* ; *Plethodon glutinosis*.

Mammalia: Chiroptera: Vespertilionidae: *Pipistrellus subflavus*.

Current Status: This cave and its biota are threatened by excessive human visitation.

Boiling Spring

Site #678. Pulaski County.

This spring is located at the base of a wooded hillside. Land above the spring is rural residential. It was examined on October 24, 1993 by J. K. Krejca and S. J. Taylor. The spring is at the base of a very large maple tree. No exposed rock above the spring. Some gravel, all of which is sandstone, is observed in the spring. The substrate is gravel, sand and organic debris. In addition to flowing out from the hill, water also wells up through the sand in small "boils" along the first 25 feet of the spring brook. The brook is 5 feet wide and 1-6 inches deep. Numerous deer tracks in the area suggest that this is a regular watering hole for the deer.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Platyhelminthes: Turbellaria: Tricladida.

Arthropoda: Malacostraca: Amphipoda: Gammaridae: *Gammarus minus*, *Gammarus troglophilus*. Insecta: Coleoptera: Cerambycidae. Heteroptera: Gerridae; Veliidae: *Microvelia* sp.

Amphibia: Caudata: Plethodontidae: *Eurycea longicauda longicauda*.

Current Status: The aquifer for this spring could be threatened if there is any leakage from the sewer systems in the residential area above the spring.

Indian Cave

Site #639. Randolph County.

This cave is located in a secondary growth hardwood forest, with farmland and some rural homes above the cave. About 1000 feet of passage was examined on April 9, 1993 by D. Bittle, J. K. Krejca, and S. J. Taylor and on September 6, 1993 by J. K. Krejca, S. J. Taylor and D. Bittle, but an additional 300-500 feet of enterable passage may exist. There is the possibility of a second entrance in the left fork, based on the quantity of sediment in the cave stream and conversations with the landowner. A partial line plot has been made by J. K. Krejca, S. J. Taylor and D. Bittle. The entrance to this cave is a spring located on a hillside. The entrance is 7 feet high by 3 feet wide, enlarged by exfoliation. The spring issuing from the cave is fairly large and flows year round. The passage begins as a walking passage in 1-2 feet of water, with some large pools up to 3 feet deep. Soon the passage becomes a stoopwalk and eventually a crawl in shallow water. Then the passage forks. The right fork was mapped for some distance. The left fork, which appears to be slightly larger and carried more silt, was not examined. Very few small speleothems were observed, but they were in good condition. Some graffitti was observed, mainly in the front part of the cave.

Physical and chemical analysis: Air and water temperatures and *p*H analysis Table 9.

Fauna: Taxa collected or observed during this study:

Amphibia: Caudata: Plethodontidae: *Eurycea longicauda longicauda*, *Eurycea lucifuga*, *Plethodon glutinosis*. Anura: Ranidae: *Rana palustris*, *Rana* sp.

Mammalia: Chiroptera: Vespertilionidae: *Pipistrellus subflavus*.

Aves: Passeriformes: Tyrannidae: *Sayornis phoebe*.

Current Status: The cave stream and its' fauna are threatened by sedimentation due to farming activities above the cave. Some graffitti damage by human visitation appears to be continuing.

Equality Cave. [Cave Hill Cave]

Saline County. Site #14.

This cave is located high on a wooded hillside. The cave was partially examined on October 22, 1993 by J. K. Krejca and S. J. Taylor. A partial map is known to exist. The entrance is in a small sinkhole high on the side of the hill. The opening is about 4 feet by 3 feet and leads down a moderately steep rubble and garbage slope into the cave. The crawl at the entrance opens almost immediately into a standing height passage. The cave is unique to all of Illinois in that it is very mazy and noticeably tilted, formed along 3 or 4 joint sets, two of which are parallel to the 10-15 degree dip and strike of the Kinkaid limestone that the cave is in (Bretz 1942, Bretz and Harris 1961). Most of the passage is 10-15 feet high by 4-6 feet wide, narrowing from the top to bottom. Based on an earlier partial survey of this cave, there are at least 2 miles, possibly 3 miles of passage in the cave. In some places the cave contains pools of water, and in one area we observed a cave stream bed that was nearly dry. It is possible that further in this streambed develops into a flowing cave stream. Harris and Allen (1952) note some flowstone formations. Bretz (1942) and Bretz and Harris (1961) note other geological features that make this cave unique.

Piles of debris can be observed for hundreds of feet along the trail leading up to this well known cave. Around the entrance there is considerable garbage and spray paint on rocks. Inside of the cave are hundreds of strings used by casual visitors to avoid getting lost (Note: this is NOT an acceptable technique!). The graffitti on the walls of the cave is very extensive and extends well back into the cave, probably throughout the whole cave. Various cans and bottles from alcoholic beverages, assorted items of clothing, food, batteries, flashlights, broken glass, etc, are scattered throughout the cave, and these constitute a real hazard to safe negotiation of the passages.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978)

Arthropoda: Arachnida: Araneae: Linyphiidae: *Phanetta subterranea*. Tetragnathidae: *Meta menardi*. Malacostraca: Amphipoda: Crangonyctidae: *Bactrurus mucronatus*, *Crangonyx* *packardi* group. Diplopoda: Chordeumida: Conotylidae: *Austrotyla specus*. Insecta: Coleoptera: Leiodidae: *Catops gratiosus*. Staphylinidae: *Atheta* sp. Collembola: Entomobryidae: *Sinella cavernarum*. Diplura: Campodeidae: *Metriocampa* sp. Diptera: Culicidae: *Anopheles punctipennis*, *Culex* sp.;Heleomyzidae: *Amoebaleria defessa*, *Amoebaleria sackeni*, *Heleomyza brachypterna* ; Mycetophilidae: *Orfelia* sp., *Rymosia* sp.; Sphaeroceridae: *Leptocera* sp. Orthoptera: Gryllacrididae: *Ceuthophilus gracilipes*, *Ceuthophilus williamsoni*.

Mammalia: Chiroptera: Vespertilionidae: *Myotis* sp.

Current Status: This cave is the best Illinois example of what happens to a cave when its location becomes well known. Equality Cave has numerous easy and interesting walking passage, but unfortunately the remains of human visitation are extensive. Unless visitation to this cave is controlled, continued degradation of this cave will occur.

Apis Annex

Union County. Site #470.

This cave is located high on a wooded hillside. The entire cave was examined and mapped on May 8, 1992 by J. K. Krejca and S. J. Taylor. The entrance is a narrow pit in a slight depression. There are three openings about 2 feet or less in diameter. The entrance opens into a small joint controlled passage about 63 feet long with rubble, breakdown and soil on the floor. No speleothems or water were observed.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Annelida: Oligochaeta.

Arthropoda: Arachnida: Araneae: Linyphiidae: *Erigone autumnalis*. Lycosidae: *Pirata* sp. Opiliones. Malacostraca: Isopoda: Ligiidae: *Ligidium longicaudatum*. Insecta: Coleoptera: Staphylinidae. Collembola: Sminthuridae. Diptera: Mycetophilidae. Homptera: cicadellidae. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga*.

Reptilia: Testudines: Emydidae: *Terrapene carolina*.

Current Status: The area around the entrance is currently being logged. Logging and farming constitute threats to this cave and its' biota.

Barefoot Cave Spring

Union County. Site #679.

This cave and spring is located at the base of a very low wooded hill below pastures. The entire cave was examined on October 24, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is about 3-4 feet high by 8 feet wide with 5 feet of limestone outcropping above it. A cave stream, 4 feet wide and 6 inch deep, flows out the entrance to this cave. Twenty feet downstream from the entrance, water boils up from a second spring. A pvc pipe with hardware cloth extends about 5 feet into the cave spring and is currently used as a backup water source by the landowner. About 30 feet downstream from the spring head is a concrete dam and a small springhouse, neither of which are currently being used. The passage leads back about 20 feet to a breakdown collapse where water comes out through the breakdown. The passage height began about 3 feet high and ended in the back about 1.5 feet high. The walls and ceiling are bedrock and the stream passage has a sediment and breakdown substrate.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Amphipoda: Gammaridae: *Gammarus pseudolimnaeus*. Insecta: Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Current Status: This cave spring appears to be in fairly good condition. Human activities have somewhat modified the entrance, but have not seriously damaged the cave or its' biota.

Graig Cave #4

Union County. Site #167.

This cave is located in a cow pasture. The entire cave was examined on August 25, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is in a large sinkhole which is almost completely filled with tires. The entrance is about 3 feet in diameter. The passage is 3 feet by 5 feet and leads nearly straight down 35 feet to rubble, breakdown and mud fill. The walls are fluted limestone, and the cave appears to take in some water during heavy rains. Some resolutioned calcite formations were observed. No water was observed in the cave.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Insecta: Coleoptera.

Amphibia: Caudata: Ambystomatidae: *Abystoma tigrinum*. Anura: Ranidae: *Rana* sp.

Current Status: This cave is threatened both by the dumping of tires and other debris in the sinkhole in which it is located and by the waste generated by the cattle in the same field. Several other caves in the same area are now extinct, filled completely with tires and other debris.

Guthrie Cave. [Ephgrave Cave]

Union County. Site #12.

This cave is located at the base of wooded hillside with pasture, cropland, and a rural residential area above in the cave drainage basin. The entire cave was examined on April 30, 1992 by J. K. Krejca and S. J. Taylor. Mapped by J. K. Krejca, 1993. The entrance is 4 feet high by 6 feet wide with about 10 feet of exposed limestone above it. A cave stream, about 4 feet wide, 1-6 inches deep with a gravel and breakdown substrate flows out through the entrance. The entrance passage continues at a height of 4 feet for about 20 feet, and then opens into a room with ceiling heights about 7 feet. Here the floor has several large and many small breakdown blocks. The passage continues for 2 miles, mostly 3-5 feet high, but with some passage 20 feet high and some passage, especially in the upstream ends of the cave, less than 1 foot high. Most of the passage carries a cave stream with a gravel and breakdown substrate, 1-3 inches deep, up to 1.5 feet deep in places. There are several upper level passages which are dry and clay floored. Three main branches are encountered heading up stream, and each of these branches branch again several times before becoming too low to be humanly enterable. Harris and Allen (1952) and Bretz and Harris (1961) noted that the cave is formed in the Mississippian Kinkaid formation capped by sandstone, and they discuss other geological features of the cave and surrounding area.

A few formations were observed in the cave, but they are relatively small. Much of the graffitti that used to be found in the cave has been cleaned off by the local caving club.

Physical and chemical analysis: Air and water temperatures, pH, and dissolved oxygen analysis Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Total dissolved solids, pH and alkalinity analysis Table 12. Trace metals and mercury analysis of water Table 13. Trace metals and mercury analysis on isopods and amphipod invertebrates Table 14. Pesticide and polychlorinated biphenol analysis of water Table 17. Pesticide and polychlorinated biphenol analysis of isopod and amphipod invertebrates Table 18.

Fauna: Taxa collected or observed during this stud and from Peck and Lewis (1978).

Platyhelminthes: Turbellaria: Tricladida: Planariidae: *Phagocata gracilis*.

Annelida: Clitellata: Oligochaeta: Acanthrodrilidae: *Diplocardia singularis*. Hirudinida: Branchiobdellida.

Arthropoda: Arachnida: Araneae: Tetragnathidae: *Meta americana*., *Meta menardi* Opiliones. Malacostraca: Isopoda: Asellidae: *Asellus* sp.; Ligiidae: *Ligidium longicaudatum*. Amphipoda: Gammaridae: *Gammarus minus*, *Gammarus pseudolimnaeus*, *Gammarus troglophilus*. Decapoda: Cambaridae: *Cambarus diogenes*. Ostracoda: Entocytheridae. Diplopoda. Insecta: Coleoptera: Carabidae; Staphylinidae. Diplura: Campodidae. Diptera: Heleomyzidae:

Amoebaleria defessa.; Mycetophilidae; Phoridae: *Megaselia cavernicola.*; Tipulidae. Heteroptera: Gerridae: *Gerris remigis*; Veliidae: *Microvelia americana*. Orthoptera: Gryllacrididae: *Ceuthophilus gracilipes*, *Ceuthophilus williamsoni*, *Ceuthophilus* sp. Lepidoptera: Noctuidae: *Scoliopteryx libatrix*. Trichoptera.
Mollusca: Gastropoda: Stylommatophora: Polygyridae: *Triodopsis vulgatus*.
Amphibia: Caudata: Plethodontidae: *Eurycea* sp.
Mammalia: Chiroptera: Vespterilionidae: *Eptesicus fuscus*, *Pipistrellus subflavus*.

Current Status: This cave could become threatened by excessive human visitation, and more graffitti will probably show up in the future. Crop fields and rural residential sites drain directly down into the cave, and these constitute a very real threat to the water quality and aquatic cave community.

Honeycomb Hole

Union County. Site #451.

This cave is located high on a wooded hillside which is currently being logged. The entire cave was examined and mapped on October 23, 1993 by J. K. Krejca and S. J. Taylor. The entrance is an opening three feet in diameter in a small depression which leads down to the entrance pit. The entrance pit is an extremely small joint, less than 10 inches wide, leading down to a joint controlled passage heading into the hill. The passage is relatively tall and narrow with a clay floor. No speleothems or water were observed. Total surveyed length is 56 feet.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:
Arthropoda: Arachnida: Acari: Ixodidae. Malacostraca: Isopoda: Ligiidae: *Ligidium longicaudatum*. Insecta: Coleoptera: Staphylinidae. Collebola. Diptera: Heleomyzidae; Mycetophylidae: *Macrocera nobilis*. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.
Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga*.

Current Status: The land above this cave is currently being logged. This logging and the farming elsewhere above the cave constitute the primary threats to this cave and its biota.

Migrant Camp Cave

Union County. Site #175.

This cave is located on a low wooded hillside. A heavily used trail leads from a nearby migrant orchard worker camp to the entrance of the cave. The entire cave was examined on October 23, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is a 15 feet by 4 feet hole leading down through sandstone. A drop of 6 feet leads into a sandstone room about 30 feet in diameter with a rubble floor. No passages lead off from this room. The sandstone forming this cave lies just above a limestone layer, and it is possible that this cave was formed through collapse into an underlying cavity in the limestone. A considerable amount of garbage was strewn about the cave. No speleothems or water were observed.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:
Arthropoda: Arachnida: Araneae. Insecta: Coleoptera: Carabidae. collembola: Entomobryidae. Diptera: Heleomyzidae. Tipulidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.
Amphibia: Caudata: Pletodontidae: *Eurycea lucifuga*.

Current Status: This small sandstone cave is heavily visited by humans as evidenced by the amount of debris strewn around the cave. Though the cave lacks water and no real cave community exists here, the presence of a cave salamander in this sandstone cave suggests that the cave drains down into a limestone cavern. Human garbage and sewage constitute a future threat to the underlying karst drainage.

Rich's Cave. [Hunsaker's Cave]

Union County. Site #19.

This cave is located at the base of a large wooded hill. Some homes and a road are located on the hill above the cave. The cave was partially examined on May 7, 1992 by J. K. Krejca and S. J. Taylor. Mapped by Bretz and Harris (1961), Harris and Allen (1952, lineplot) and J. Rodemaker. The entrance is an opening in the limestone 9 feet high by 8 feet wide, with several feet of exposed rock above the entrance. A stream, 4 feet wide and 4 inches deep with a rubble, gravel and sand substrate, flows out through the main entrance. The passage begins 6-7 feet high with a cave stream covering the floor. The passage becomes lower, 2-3 feet high with water about 6 inches deep before expanding again into a larger passage 6 feet high at a second entrance. This second entrance is a sinkhole entrance. The passage beyond this second entrance continues as a low crawl. Approximately 1000 feet of passage has been surveyed. Harris and Allen (1952) and Bretz and Harris (1961) noted that the cave is developed in Kinkaid limestone of Mississippian age that is capped by Pennsylvanian sandstone, and they discuss other geological features of the cave and surrounding area. Nearby Cobden Cave may drain into Rich's Cave (Bretz and Harris 1961).

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9. Total dissolved solids, *p*H and alkalinity analysis Table 10.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978)

Platyhelminthes: Turbellaria: Tricladida: Kenkiidae: *Sphalloplana hubricht*. Planariidae: *Phagocata gracilis*.

Annelida: Hirudinida: Branchiobdellida.

Arthropoda: Arachnida: Acari. Araneae: Tetragnathidae: *Meta americana*, *Meta menardi*. Opiliones. Malacostraca: Isopoda: Asellidae: *Asellus* sp. Ligiidae: *Ligidium longicaudatum*. Amphipoda: Gammaridae: *Gammarus minus*, *Gammarus troglophilus*. Decapoda: Cambaridae: *Cambarus diogenes*. Diplopoda: Polydesmida: Xystodesmidae: *Semionellus placidus* ? Insecta: Coleoptera: Carabidae; Chrysomelidae; Scarabaeidae; Staphylinidae. Collembola: Entomobryidae. Diptera: Culicidae: *Anopheles punctipennis*, *Culex* sp.; Heleomyzidae; Psychodidae; Tipulidae. Lepidaoptera. Orthoptera: Gryllacrididae: *Ceuthophilus elegans*. Psocoptera. Trichoptera.

Mollusca: Gastropoda.

Amphibia: Anura: Ranidae: *Rana palustris*. Caudata: Plethodontidae: *Eurycea longicauda longicauda*, *Eurycea lucifuga*, *Eurycea* sp.

Mammalia: Chiroptera: Vespertilionidae: *Myotis lucifugus*, *Eptesicus fuscus*, *Pipistrellus subflavus*.

Current Status: This cave is in fairly good condition. The cave is fairly well known and is threatened by excessive human visitation.

Saratoga Cave

Union County. Site #10.

This cave is located at the base of a wooded hillside with rural homes and a horse pasture above the cave. The entire cave was examined on March 2, 1992 by J. K. Krejca and S. J. Taylor. A map is known to exist. The entrance is a spring entrance four feet high by 2 feet wide with about 1 foot of pooled water on the floor and a small outcrop of rock above the entrance. The spring water flows a short distance from the cave to join a surface stream. The passage is joint controlled, about 2-4 feet high by 1-3 feet wide through which runs a cave stream 0.5-8 inches deep with a gravel and sediment substrate. After several hundred feet, the cave ends where the ceiling drops down too low to be humanly enterable. Bretz and Harris (1961) discuss the geology of this cave and surrounding area. No speleothems were observed.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978).

Annelida: Hirudinida: Branchiobdellida. Oligochaeta.

Arthropoda: Arachnida: Acari. Araneae: Lycosidae: *Pirata* sp. Pisauridae: *Dolomedes scriptus*. Tetragnathidae: *Meta americana*, *Meta menardi*. Malacostraca: Amphipoda: Gammaridae: *Gammarus minus*, *Gammarus troglophilus*. Decapoda: Cambaridae: *Cambarus tenebrosus*. Isopoda: Asellidae: *Caecidotea brevicauda* ; Ligiidae: *Ligidium longicaudatum*. Ostracoda: Entocytheridae. Diplopoda: Polydesmida: Conotylidae: *Austrotyla specus*. Insecta: Coleoptera: Carabidae: *Bembidion texanum* ; Chrysomelidae. Diptera: Culicidae: *Anopheles punctipennis*, *Culex* sp. Heleomyzidae: *Amoebaleria defessa*, *Heleomyza brachypterna*. Sphaeroceridae: *Leptocera* sp. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthophilus williamsoni*. Orthoptera: Gryllacrididae: *Ceuthophilus williamsoni*.

Osteichthyes: Ictaluridae: unidentified catfish.

Amphibia: Caudata: Plethodontidae: *Eurycea* sp., *Plethodon glutinosis*.

Current Status: The aquatic cave community here is seriously threatened by the land use practices utilized above the cave.

Shilly-Shally Cave

Union County. Site #677.

This cave is located half way up a hillside with small woodlots interspersed with pastures. Almost all of the cave was examined on October 5, 1993 by J. K. Krejca and S. J. Taylor. Mapped by S. J. Taylor, 1992. The entrance is 5 feet high by 4 feet wide with about 10 feet of exposed rock above it. A cave stream, 2 feet wide and 1 inch deep, flows from the entrance. The passage becomes 4 feet high with limestone walls and ceiling. A cave stream, 1 inch deep, with a gravel and breakdown substrate covers the floor. The passage is highly joint controlled and divides into two passages, each about 2 feet high. The left passage continues on with a small cave stream and its breakdown and gravel substrate, to become very low after several turns. The right passage is cobble floored with less water and becomes very small after turning deeper into the hill. Each branch has a dome, and a few small formations were observed. The total length of the cave is about 300 feet.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Platyhelminthes: Turbellaria.

Arthropoda: Arachnida: Araneae. Opiliones: Phalangidae. Malacostraca: Amphipoda: Gammaridae: *Gammarus minus*, *Gammarus troglophilus*. Isopoda. Insecta: Diptera: Culicidae; Tipuliade. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.

Mollusca: Gastropoda.

Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga*.

Current Status: This cave is in fairly pristine condition. Changes in land usage above the cave could threaten the aquatic cave community here.

Auctioneer Cave

Monroe County. Site #637.

The cave is located high on the side of a valley below an upland sinkhole plain which has rural homes and agricultural fields. The entire cave was examined on September 4, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is 3.5 feet high by about 20 feet wide with 2 feet of exposed limestone above the entrance. A cave stream 10 feet wide and 1 inch deep flows out of the entrance over a sloping waterfall 8 feet high. This spring brook flows for several hundred feet through a wooded valley before joining a surface stream. Most of the passage is 3-4 feet high by 4-6 feet wide. A cave stream averaging 2 to 6 inches deep but reaching 4 feet deep, with a gravel or bedrock substrate covers the floor. The passage continues for about 1000 feet and ends in a flowstone plug with water percolating out beneath the plug. A few formations, stalactites and soda straws, were observed. Their was little evidence of human visitation except for a few wax drippings and a few string being left in the cave.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Pesticide and polychlorinated biphenol analysis of water Table 17.

Fauna: Taxa collected or observed during this study:

Platyhelminthes: Turbellaria: Tricladida.

Arthropoda: Malacostraca: Amphipoda: Gammaridae: *Gammarus troglophilus*. Isopoda. Arachnida: Acari. Araneae: Theridiidae: *Achaearanea rupicola*. Insecta: Coleoptera: Carabidae, Staphylinidae. Collembola. Diptera: Heleomyzidae, Mycetophilidae. Heteroptera Gerridae. Hymenoptera: Formicidae.

Amphibia: Caudata: Plethodontidae: *Eurycea* sp.

Current Status: This cave is potentially threatened by sedimentation and the use of agricultural chemicals on the crops above the cave.

Cave Spring #1

Monroe County. Site #303.

This spring is located at the base of a valley below an upland sinkhole plain which has agricultural fields. It was examined on September 3, 1992 by J. K. Krejca and S. J. Taylor. This spring originates from an enlarged joint in the limestone, some 10-15 feet above and 40 feet away from a surface stream. The spring is about 1 feet in diameter and completely filled with pooled water. Several feet below the spring the water trickles out through the rubble as a small brook 1 foot wide and 1-3 inches deep with a gravel and rubble substrate.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Amphipoda: Gammaridae: *Gammarus troglophilus*.

Current Status: This spring seems to be in fairly good condition, though it may be threatened by agricultural chemicals applied to the crops in the upland area it drains.

Unnamed Cave near Collier Spring

Monroe County. Site #555.

This cave is located half way up the side of a small hill below a residential area. The cave was partially examined on September 4, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is 2.5 feet high by 4 feet wide with 3 feet of exposed rock above the entrance. A small cave stream flows out of the entrance into a little pond. The flow was barely a trickle, but the landowner reported that the flow was much higher after a heavy rain. Most of the passage is 1-2 feet high by 1-2 feet wide, with bedrock walls and ceiling. A cave stream about 1.5 inch deep covers the floor. The cave turns several times and continues very low. Quite a bit of garbage has been washed into the cave from upstream. No speleothems were observed and there was no evidence of human visitation. There is probably less than 300 feet of passage here.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae: Lycosidae: *Pirata sedentarius*. Theridiosomatidae: *Theridiosoma gemmosum*. Opiliones. Malacostraca: Isopoda. Diplopoda. Insecta: Diptera: Culicidae. Heteroptera: Veliidae: *Microvelia americana*. Orthoptera: Gryllidae.

Amphibia: Caudata: Plethodontidae: *Eurycea longicauda longicauda*.

Current Status: This small cave is clearly threatened by the practice of dumping garbage in a sinkhole at the upstream end of the cave. In addition, the caves' aquatic life is potentially threatened by sewage leaks from the residential area above the cave.

Collier Spring. [Big Spring]

Monroe County. Site #551.

This spring is located in a bottomland wooded area surrounded by cropland. It was examined on June 30, 1992 and July 2, 1992 by J. K. Krejca and S. J. Taylor. Collier Spring is a large spring, about 15 feet by 20 feet across with a stream issuing from it that is 7 feet wide and 2-3 inches deep. There is a stone wall built up around the spring. The spring brook flows a short distance to join a major surface stream. Collier Spring is apparently the major resurgence of Fogelpole Cave, with the nearby Indian Hole being a secondary resurgence.

Physical and chemical analysis: Water temperatures, *p*H, and dissolved oxygen analysis Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Pesticide and polychlorinated biphenol analysis of water Table 17.

Current Status: If in fact this spring is the primary resurgence of Fogelpole cave, it is threatened by a number of factors associated with human activities, such as chemical input, sedimentation, and eutrophication.

Couch Cave. [Couch's Cave]

Monroe County. Site #309.

This cave is located on a wooded hillside just up the valley from a manmade pond. The cave was partially examined on September 3, 1992 by J. K. Krejca and S. J. Taylor. A map is known to exist. The entrance is 8 feet by 12 feet wide on the side of a valley with many breakdown blocks around the entrance. The breakdown and small brook from the cave continue a short distance down to a stream in the valley. The cave stream is temporarily lost in the entrance breakdown, but can be observed again in the twilight zone. The passage is 10 feet high by 4 feet wide with a pooled cave stream covering the floor that quickly becomes deep. This passage shows signs of flooding, and has some flowstone formations in good conditions. Fretz (1983) reported that the surveyed length as of September 1981 was 4,356 feet.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study: Fretz (1983) reports on mammoth and other fossil remains deep in this cave. Windy City Grotto and the Field Museum of Chicago paleontologists were working there. A possible new species of mammoth, in addition to giant sloth, deer, and elk bones were found. Results of Carbon 14 testing showed a mastodon bone to be 31,860 years old.

Arthropoda: Arachnida: Araneae: Araneidae: *Leucauge venusta*. Tetragnathidae: *Meta americana*. Malacostraca: Amphipoda: Gammaridae: *Gammarus troglophilus*. Diplopoda. Insecta: Diptera: Culicidae: *Culex* sp.; Heleomyzidae; Mycetophilidae. Heteroptera: Reduviidae: *Melanolestes picipes*. Hymenoptera:

Mollusca: Gastropoda.
Mammalia: Chiroptera: Vespertilionidae: Unidentified bat.

Current Status: This cave is in fairly good condition, with the exception of a little human debris that appears to have been washed in from sinkholes above. Very few of the formations have been broken, and the cave appears to have received little to no human visitation recently. Threats to this cave include increased sinkhole dumping and the potential for increased human visitation.

County Line Cave

Monroe County. Site #33.

This cave is located in a wooded draw surrounded by houses, roads and farmland. The cave was partially examined on September 4, 1993 and September 6, 1993 by J. K. Krejca, M. Stanboski and S. J. Taylor. No map is available. The wet weather spring entrance is 2.5 feet high by 5 feet wide with a silt and breakdown floor. After a short entrance passage about 2.5 feet high by 6 feet wide, a "T" junction is encountered, with passages leading off to the left and right. The left passage was not explored very far and is somewhat lower, 1.5-2 feet high with a silt and breakdown floor and scattered pools of water. The right passage was followed for several hundred feet, where it continued 2-4 feet high by 8 feet wide with the floor thickly covered with silt and pools of water up to several feet deep were encountered in several spots. A few stalactites were observed along joints and a little spray paint was observed in one place. The cave smells of sewage. Local children occasionally visit the cave. Recent organic debris on the ceiling suggested that the cave regularly floods to the ceiling. There is probably over 500 feet of passage here.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Annelida: Hirudinea. Oligocaheta: Haplotaxida: Tubificidae.
Arthropoda: Arachnida: Araneae. Opiliones: Phalangidae. Malacostraca: Amphipoda: Crangonyctidae: *Crangonyx forbesi*. Gammaridae: *Gammarus troglophilus*. Chilopoda. Diplopoda. Insecta: Coleoptera: Carabidae; Staphylinidae. Collembola: entomobryidae. Diptera: Heleomyzidae.
Amphibia: Anura: Ranidae: *Rana* sp.

Current Status: This cave is clearly impacted by sedimentation, probably from farming on the overlying land. In addition, it appeared that sewage enters the cave - possibly from residential development in the area. The cave is rather unpleasant and is therefore not particularly threatened by excessive human visitation.

Dulcet Waterfall Cave

Monroe County. Site #671.

This cave is located at the base of a hill next to a well maintained and heavily visited mowed area and adjacent to a small woodlot. The entire cave was examined and mapped on June 24, 1993 by J. K. Krejca and S. J. Taylor. The cave entrance is in an area of exposed bedrock in an intermittent sinking stream. The stream bed is about 10 feet wide near the entrance of the cave. Where the water has cut down into the bedrock, there are three openings leading down into the entrance pit area. Two of the surface openings lead straight down about 4 feet to the lip of a pit. The third entrance is a short crawl, approximately 10 feet to the lip of the pit. The pit is 33 feet deep, belling out slightly at the bottom. The bottom of the pit is in a room about 10 feet in diameter with a breakdown floor. High on one wall is a small passage with water flowing out into the pit room. This passage was not explored. Along the opposite wall is a lower lead that receives water from the pit entrance and the high lead on the wall. This lower passage drops down a few feet to a stream crawlway. One can continue downstream here at least 100 feet in a passage about 3 feet in diameter with a gravel bottomed stream. Our exploration of this passage was not complete. This cave is probably hydrologically related to the nearby Slippery Dell Cave (Site #355) and Weeping Buddha Cave (Site #670). There is probably over 300 feet of passage here.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Isopoda. Insecta: Coleoptera: Carabidae; Dytiscidae.

Current Status: This cave is potentially threatened by chemicals used to maintain the large mowed area nearby.

Erwin Vogt Spring

Monroe County. Site #640.

This spring is located high on an upland area surrounded by agricultural fields and some urban development. It was examined on September 28, 1992 by J. K. Krejca and S. J. Taylor. The spring resurgence has rock walls about 6 feet high on either side and cement slabs over the rock walls, forming an artificial passage that extends back about 25 feet to the spring outflow. The spring outflow stream is 3 feet wide and 2 inches deep. The spring was used as a water source many years ago, and more recently (but not observedly) as a water source for bathwater. In the past, a nearby country club dumped sewage in a sinkhole, and the waste is said by the landowner to have come out of the ground at this spring.

Physical and chemical analysis: Trace metals and mercury analysis on isopods and amphipod invertebrates Table 16. Air and water temperature and *p*H analysis Table 9. Trace metals and mercury analysis Table 13. Anion analysis Table 11. Pesticide and polychlorinated biphenol analysis of water Table 19. Pesticide and polychlorinated biphenol analysis of invertebrates Table 20.

Fauna: Taxa collected or observed during this study:

Platyhelminthes: Turbellaria: Tricladida.

Arthropoda: Malacostraca: Amphipoda: Gammaridae: *Gammarus minus, Gammarus troglophilus.* Decapoda: Cambaridae: *Cambarus diogenes, Orconectes virilis.* Insecta: Heteroptera: Gerridae: *Aquarius* sp.

Current Status: Farming and urban development pose potential threats to the water quality and subterranean biota of the karst groundwater which feeds this spring.

Fogelpole Cave. [Lemonade Cave]

Monroe County. Site #52.

This cave passes under a large area of upland karst which contains considerable farmland (crops and livestock), rural dwellings, and several small communities. Throughout the area are small woodlots containing sinkholes that receive runnoff from fields, residential land, roads, etc. The cave was partially examined on February 24, 1992 by J. Krejca and S. J. Taylor, on July 1, 1992 by G. Gardner, J. K. Krejca, and S. J. Taylor, on September 19, 1992, and August 28, 1993 by J. K. Krejca and S. J. Taylor. Partially mapped by Bretz and Harris (1961) though a more complete map is known to exist. There are several entrances to this cave, but only one was utilized in the course of this study. This entrance is located in a very large, deep, wooded sinkhole surrounded by cropland. In the bottom of the sinkhole are two entrances, both with large iron gates used to control access. Only one of these two entrances was used. There is a rock outcrop above the entrance. The entrance is about 6 feet high by 20 feet wide. A total of seven entrances are known: Fogelpole or Main (2 openings), Lemonade (2 openings), Northwest Entrance, Twin Pits Entrance, and Southeast Entrance. The passage near the entrance has a dry breakdown floor and a low ceiling 4 feet high. The passage width is variable (5-15 feet). Soon, the ceiling height rises to about 8 feet over a bedrock floor, and, about 50 feet from the entrance, the floor drops 10 feet, continuing on with a mixed gravel and breakdown floor interspersed with small pools of water. The ceiling height here is about 20 feet. Walls are limestone bedrock. This passage takes in some water during rains, but no flowing water was observed during any of our visits. After 1100-1200 feet, the entrance passage joins the main cave stream of Fogelpole Cave. The passage over the main cave stream is 30 feet high by about 40 feet wide, with the stream 10-20 feet wide and 1-4 or more feet deep. Here, there are three directions to continue. Upstream there are two passages, the stream passage continues up as a deep pool, and a smaller passage leads up a clay slope. Downstream the main trunk continues as a single passage. Both upstream and downstream of this area there are several side passages, and the cave is in excess of 13 miles long. The main cave stream is characterized by deep pools, shallow riffles, raceways, etc. Large gravel bars and breakdown blocks are found along the shorelines of the main stream. A wide variety of other habitats are found in the cave. A few speleothems in good condition were observed. Some garbage was found in the cave stream, probably washed in from sinkholes. Very little graffitti was observed.

According to Frasz (1983), the general dip of the limestone to the east accounts for Fogelpole's general eastward flow. Fogelpole is known to resurge at Collier Spring (Site #551), and Indian Hole (Site #556) may be another resurgence. Bretz and Harris (1961) discuss geological features of the cave and surrounding area.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Trace metals and mercury analysis on isopod and amphipod invertebrates Table 14. Trace metals and mercury analysis on isopod and amphipod invertebrates and water Table 15. Pesticide and polychlorinated biphenol analysis of water Table 17.

Fauna: Taxa collected or observed during this study:and from Peck and Lewis (1978).

Platyhelminthes: Turbellaria: Tricladida: Kenkiidae: *Sphalloplana hubrichti.*

Annelida: Oligochaeta: Tubificida: Tubificidae.

Arthropoda: Arachnida: Araneae: Linyphiidae: *Lepthyphantes* sp., *Phanetta subterranea.* Lycosidae: *Pirata sedentarias*, *Pirata* sp., *Schizocosa ocreata.* Tetragnathidae: *Meta americana.* Opiliones. Malacostraca: Isopoda: Asellidae: *Caecidotea brevicauda*, *Caecidotea packard.* Amphipoda: Crangonyctidae: *Bactrurus brachycaudus*, *Crangonyx forbesi.* Gammaridae: *Gammarus acherondytes*, *Gammarus troglophilus.* Copepoda: Calanoida. Chilopoda: Scolopendromorpha. Diplopoda. Insecta: Coleoptera: Carabidae: *Bembidion texanum*, *Patrobus longicornis*, *Platynus tenuicollis*, *Tachyura incurva.* Leiodidae: *Ptomaphagus nicholasi.* Fogelpole Cave is the type locality. Peck and Lewis (1978) note that "extensive searching and trapping at Fogelpole and other western Illinois caves has not yielded a second specimen, and that this may be a mislabelled specimen of *P. hirtus* from Kentucky." Staphylinidae: *Atheta* sp., *Homoeotarsus (Gastrolobium)* sp., *Quedius erythrogaster.* Collembola. Diptera: Chironomidae; Heleomyzidae; Phoridae: *Megaselia cavernicola.* Sphaeroceridae: *Leptocera* sp. Sciaridae: Undetermined genera and species. Homoptera: Cicadellidae.Orthoptera: Gryllacrididae: *Ceuthophilus elegans.*

Mollusca: Gastropoda: Pulmonata: Physidae: *Physa halei.*

Osteichthyes: Cottidae: *Cottus carolinae.*

Amphibia: Caudata: Ambystomatidae: *Ambystoma tigrinum.* Plethodontidae: *Eurycea* sp. Anura: Ranidae: *Rana palustris.*

Aves: Passeriformes: Icteridae: *Molothrus ater* egg in *Sayornis phoebe* nest.

Mammalia: Chiroptera: Vespertilionidae: *Myotis sodalis.*

Frasz (1983) mentions a bat population study that revealed a number of bat species, including *Myotis sodalis*, and a possible *Myotis grisescens* habitat.

Current Status: This large and unique cave is threatened by human development and agricultural practices. Most of the other entrances to this cave are protected by unfriendly landowners or unpleasant passage, and the main entrance is gated. Thus, human visitation is not a major threat to the cave and its life.

Fults-Saltpeter Cave. [Saltpeter Cave; Fults Cave]

Monroe County. Site #27.

This cave is located at the top of a talus slope and at the base of a large bluff overlooking the Mississippi floodplain. Land above this cave is mainly woodlots and agricultural land. Below the entrance is additional agricultural land and a paved road. The entire cave was examined on March 26, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance is a large opening in limestone bedrock, some 10 feet high by 15-20 feet wide. The entrance passage leads back about 75 feet before branching into two passages. The floor of this passage is bedrock nearest the entrance, becoming clay further back. No water was observed. A few small formations in poor condition were observed. The walls of the entrance passage are heavily covered with spray paint graffitti, and assorted garbage, beer cans, broken glass, etc., were observed. The remains of a recent campfire can usually be found at the entrance. Both passages are fairly large with clay floors and eventually end in clay fill. The left passage has a blind pit 25 feet deep, about 50 feet from the end of the passage. The bottom of the pit has a small amount of water, considerable clay, and large quantities of garbage. Bretz and Harris (1961) discussed the geological features of the cave and surrounding area. Total cave length is approximately 400 feet.

Physical and chemical analysis: Air water temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978).

Arthropoda: Arachnida: Araneae: Agelenidae: *Circurina cavealis*, *Tegenaria domestica*. Phocidae: *Pholcus phalangioides*. Symphytognathidae: *Maymena ambita*. Pseudoscorpionida: Chthoniidae: *Mundochthonius cavernicolous*. Malacostraca: Amphipoda: Crangonyctidae: *Stygobromus subtilis*. Acarina: Rhagidiidae: *Rhagidia* sp. Chilopoda: Lithobiomorpha: Lithobiidae: *Nadabius* sp. Scutigeromorpha. Diplopoda: Spirostreptida: Cambalidae: *Cambala minor*. Insecta: Collembola: Entomobryidae: *Pseudosinella argentea* complex sp. 1. Sminthuridae: *Arrhopalites whitesidei*. Coleoptera: Staphylinidae: *Atheta* sp., *Quedius erythrogaster*. Diptera: Culicidae: *Culex pipiens*, *Culex* sp.; Heleomyzidae: *Amoebaleria defessa*, *Heleomyza brachypterna* ; Mycetophilidae: *Macrocera nobilis*. Homoptera: Cicadellidae. Orthoptera: Gryllacrididae: *Ceuthopilus* sp.

Aves: Columbiformes: Columbidae: *Columba livia*.

Mammalia: Chiroptera: Vespertilionidae: *Pipistrellus subflavus*.

Current Status: This cave receives considerable human visitation because of its large size and close proximity to a road. The cave is not without scenic value, and if access could be somewhat controlled it may be possible to partially restore the cave to a more natural state. Agricultural activities do not affect this cave because there is virtually no water here and the cave is not utilized by bats.

Illinois Caverns. [Burkesville Cave/Caverns; Eckert's Cave/Cavern; Egyptian Caverns; Illinois Grand Cavern; Illinois Mammoth Cave; Little Mammoth Cave; Morrison's Cave/Cavern].

Monroe County. Site #29.

This cave passes under an area of upland karst which contains considerable farmland (crops and livestock) and rural dwellings. Throughout the area are small woodlots containing sinkholes that receive runnoff from fields, residential land, roads, etc. The cave was partially examined on February 24, 1992, and August 30, 1993 by J. K. Krejca and S. J. Taylor. A map is available on site, although a more detailed version is known to exist. The main entrance is located in a moderate sized wooded sinkhole which has been modified to allow easy access to the cave and to control access. A wooden board walk leads from a parking area to the entrance sink, where cement stairs with stainless steel railings lead down though a joint controlled opening. A gate near the base of the stairs can be locked to control access. The other known entrance is called the McCarthy entrance. Passage: This cave contains a variety of passages, varying from small upper dry crawlways to mainstream borehole 20 feet high by 20 feet wide. The cave has 5.5 miles of mapped passages (Frasz 1983) and carries a significant amount of water. In an attempt to commercialize this cave, several stone and steel walkways, stairways, and ladders were placed in the first part of the cave (primarily from the entrance steps downstream to the main passage). The passages show evidence of flooding, and often has a lot of surface organic debris such as large logs and leaves. Frasz (1983) notes that the general eastward dip of the limestone accounts for the cave's east-trending drainage. The cave is developed in St. Louis limestone, and is known to resurge at Walsh Spring. Bretz and Harris (1961) discussed the geological features of the cave and surrounding area.

Physical and chemical analysis: Air and water temperatures and dissolved oxygen analysis Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Pesticide and polychlorinated biphenol analysis of water Table 17.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978)

Platyhelminthes: Turbellaria: Tricladida: Kenkiidae: *Sphalloplana hubrichti*. Illinois Caverns and Kohm's Cave (Sainte Genevieve County, Missouri) are the type localities (Hyman, 1945; Kenk 1972, 1977).
Annelida: Clitellata: Oligochaeta: Lumbricidae: *Dendrobaena rubida.*
Arthropoda: Arachnida: Acari: Eupodidae: *Linopodes* sp. Galumnidae: *Galumna* sp. Laelapidae: *Hypoaspis*, near *angusta*, *Hypoaspis*, near *subterranea*, *Hypoaspis* sp. 3. Phthiracaridae: *Steganacarus* sp. Uropodidae: *Discourella*, near *dubiosa*. Veigaiaidae: genus and species undetermined. Araneae: Anyphaenidae. Dictynidae: *Cicurina arcata*. Gnaphosidae: *Drassylus* sp. Linyphiidae: *Centromerus cornupalpis*, *Centromerus latidens*, *Eperigone indicabilis*; *Eperigone tridentata*, *Linyphia radiata*; *Phanetta subterranea*, TB. Lycosidae: *Pirata* sp., *Schizocosa ocreata*, TX; *Schizocosa* sp. Pisauridae: *Dolomedes scriptus*, *Dolomedes* sp. Tetragnathidae: *Meta americana*; *Meta menardi*. Pseudoscorpiones. Malacostraca: Isopoda: Asellidae: *Caecidotea brevicauda*, *Caecidotea packardi* (Illinois Caverns is the type locality), *Lirceus fontinalis* Rafinesque. Amphipoda: Crangonyctidae: *Bactrurus brachycaudus*, *Crangonyx forbesi*. Gammaridae: *Gammarus acherondytes* (Illinois Caverns is the type locality), *Gammarus troglophilus* (Illinois Caverns is the type locality). Copepoda: Harpacticoida. Diplopoda: Chordeumida: Conotylidae: *Austrotyla specus*. Trichopetalidae: *Scoterpes* sp. NOTE: this record is given as "Monroe County: Illinois Caverns?" in Peck and Lewis (1978), this specimen is from Monroe County and may be from Illinois Caverns. Insecta: Collembola: Isotomidae: *Folsomia candida*. Tomoceridae: *Tomocerus flavescens*, *Tomocerus missus*. Diplura: Campodeidae: *Haplocampa* sp. Orthoptera: Gryllacrididae: *Ceuthophilus elegans*. Coleoptera: Carabidae: *Atranus pubescens*, *Evarthrus sodalis colossus*, *Platynus tenuicollis*, *Pterostichus (Euferonia) coracinus*. Chrysomelidae. Staphylinidae: *Atheta* sp., *Oxytelus exiggus*, *Quedius erythrogaster*, *Quedius spelaeus*. Diptera: Chironomidae. Culicidae: *Culex pipiens*. Heleomyzidae: *Aecothea specus*, *Amoebaleria defessa*. Phoridae: *Megaselia cavernicola*. Sciaridae: undetermined genera and species. Sphaeroceridae: *Leptocera* sp. Syrphidae. Tipulidae: *Gnophomyia tristissima*. Hymenoptera: Formicidae. Orthoptera: Gryllacrididae: *Ceuthophilus* sp.
Mollusca: Gastropoda: Pulmonata: Physidae: *Physa halei*.
Amphibia: Caudata: Plethodontidae: *Eurycea longicauda longicauda*, *Eurycea* sp.
Mammalia: Chiroptera: Vespertilionidae; *Pipistrellus subflavus*.

Current Status: Access is controlled by the Illinois Department of Conservation by means of an entrance gate, and Armin Krueger is the steward of the cave. Anyone may visit the cave during the daytime hours it is open, providing they sign a liability release. Due to the heavy visitation it has received in the past and still receives today, many of the would-be impressive speleothems are broken, and vandalism on the walls and human debris in the cave is not uncommon. The cave is also likely affected by input of sediment and chemicals from the farmland that drains into the cave.

Indian Hole

Monroe County. Site #556.

This spring is a small tributary on the edge of a wooded stream. Farmland lies beyond the strip of woods that the stream is in. It was examined on July 2, 1992 by J. K. Krejca and S. J. Taylor. The spring emanates from a triangular shaped joint in the bedrock that forms a tributary to a creek. The water was murky, and the depth at the spring was not measured. This may be a resurgence of Fogelpole, as is the nearby Collier Spring that is located on the other side of the surface creek.

Physical and chemical analysis: Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Pesticide and polychlorinated biphenol analysis of water Table 17.

Current Status: The spring does not appear to be used by humans or livestock, though the water quality is probably affected by the agricultural activities updrainage of the spring.

Kelly Spring Cave

Monroe County. Site #25.

The spring entrance is located on a wooded hillside, with the spring draining immediately into a creek. Dual Pit entrance is located in a wooded sinkhole. Both of the wooded areas are surrounded by farmland. The cave was partially examined on August 21, 1993 and September 5, 1993 by J. K. Krejca, S. J. Taylor, and M. Stamborski. A map is known to exist. The spring entrance is 3 feet high by 6 feet wide and partially filled with pooled water. At the entrance is a natural bedrock bridge about 3 feet above normal stream level. The Dual Pit entrance consists of two holes in the bedrock each 4 feet in diameter at the bottom of a sinkhole. These two openings at the Dual Pit entrance join to form the 20 feet entrance drop. The cave was not entered from the spring entrance. The Dual Pit has a sizeable breakdown floored passage at the bottom of the pit that leads downward to a tight crawl. The crawl was choked with wood, rocks, and foam with a strong chemical smell. This passage has been mapped to connect with the Kelly Spring entrance, but we did not dig beyond this choke. Bretz and Harris (1961) discussed the geological features of the cave and surrounding area. No speleothems were observed in this part of the cave, though there were some bedrock pendants and fluted walls in good condition. The Kelly Spring Cave spring entrance resurges water from Krueger Dry-Run Cave (Site #57) and Spider Cave, a tributary to Krueger Dry-Run Cave. From this entrance, a passage can be followed upstream to within a few feet of Big Sink, a feature that separates Kelly Spring Cave from the Krueger Dry-Run Cave system (Frasz 1983).

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Opiliones. Malacostraca: Isopoda. Amphipoda: Gammaridae: *Gammarus troglophilus*. Diplopoda. Insecta: Blattaria. Coleoptera: Chrysomelidae, Dytiscidae, Staphylinidae. Collembola: Entomobryidae.

Amphibia: Anura: Ranidae: *Rana palustris*.

Current Status: From the Dual Pit entrance, the cave appears to receive heavy chemical input resulting in an abundance of foam and strong chemical smell. The owner of the pit entrance, who is also the steward of Illinois Caverns, allows access, though it does not appear that the cave receives much human visitation.

Krueger Dry-Run Cave. [Dry-Run Cave; Fruth Cave; Fruth's Spider Cave;
Fruth's Spider Pit; Half-Mile Cave; Kreuger Cave
Monroe County. Site #57.

The two main entrances are located in adjacent wooded sinkholes surrounded by farmland. Pig Pen entrance is in a wooded sinkhole that is heavily used by cattle, and is also surrounded by farmland. The cave was partially examined on March 3, 1992 and August 29, 1993 by J. K. Krejca and S. J. Taylor. This cave contains four miles of mapped passages (Frasz 1983). The two main entrances (Main Entrance and Middle Entrance, also known as O'Leary School Entrance) are in large sinkholes, some 40 feet in diameter, with holes 3 feet high in the bottom. One entrance is more frequently used than the other because they both join together, yet one of them has a section of deep water and low air that must be passed before the main cave can be reached. The Pig Pen entrance is a joint 2 feet wide by 4 feet long in the bottom of a sinkhole that can be climbed down into. To reach the main stream from this entrance, a series of tight spots must be maneuvered through. The eight known entrances, from upstream to downstream: Half-Mile Cave, Fruth Cave (=Fruth's Spider, or Fruth's Spider Pit Cave), Dry-Run Creek, Dry-Run Pit (=Dry-Run Cave), Pig Pen, Main Entrance (=Main Entrance and Middle Entrance, or O'Leary School Entrance), and Big Sink (=O'Leary Spring Entrance). Also Spider Cave is a hydrological tributary to Krueger Dry-Run Cave, though they are not humanly connected (Frasz 1983). This is a fairly large cave that trends eastward due to the dip in the St. Louis limestone that the cave is formed in (Frasz 1983). It offers a variety of passage types, from bellycrawls to a stream passage 10 feet high by 20 feet wide. The stream is 5 to 15 feet wide and up to 6 feet deep in places, generally with a gravel, sand, or silt substrate. There is evidence that the cave frequently floods to the ceiling, probably accounting for the relative scarcity of some terrestrial organisms. There are several areas with large speleothems that are in reasonably good condition.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978). Included below are specimens collected from what Peck and Lewis (1978) refer to as: "Dry-Run Cave" and "Fruth's Spider Cave". These are now known to be part of Krueger Dry-Run Cave.
Platyhelminthes: Turbellaria: Tricladida: Kenkiidae: *Sphalloplana hubrichti.*
Annelida: Hirudinida: Branchiobdellida. Oligochaeta.
Arthropoda: Arachnida: Araneae: Linyphiidae: *Porrhoma* sp., *Sciastes terrestris* ?. Lycosidae: *Pirata* sp.; *Schizocosa* sp. Malacostraca: Isopoda: Asellidae: *Caecidotea brevicauda, Caecidotea packardi, Caecidotea* spp. Amphipoda: Crangonyctidae: *Crangonyx forbesi.* Gammaridae: *Gammarus acherondytes, Gammarus troglophilus.* Decapoda: Cambaridae: *Orconectes virilis.* Ostracoda: Entocytheridae. Chilopoda: Geophilomorpha. Diplopoda: Chordeumida: Conotylidae: *Austrotyla specus.* Insecta: Coleoptera: Carabidae: *Platynus tenuicollis.* Elmidae. Gyrinidae. Staphylinidae: *Quedius* sp. Peck and Lewis (1978) noted that these specimens could not be determined but probably belong to *Q. spelaeus.* Collembola. Diptera: Chironomidae. Ephemeroptera: Heptageniidae: *Stenonema femoratur.* Heteroptera: Corixidae. Veliidae: *Microvelia americana.* Homoptera: Cicadellidae. Lepidoptera. Orthoptera: Gryllacrididae: *Ceuthophilus seclusus.* Trichoptera.
Mollusca: Gastropoda.
Osteichthyes: Ictaluridae: *Ameiurus melas* ?
Amphibia: Caudata: Plethodontidae: *Plethodon dorsalis.*

Current Status: There is some scattered human debris that is probably washed in from sinkholes, but there is very little vandalism. Some broken glass and drips of wax that suggest humans do frequent this fairly well known site, but these are in small amounts. Most likely the frequent flooding keeps the cave "clean" of this debris. Just as the other caves in this county, the biggest threat to this cave is likely to be from the agricultural practices that dominate its drainage basin.

Paw Paw Pit

Monroe County. Site #636.

This cave is located in a small sinkhole high on a wooded hillside. The entire cave was examined on September 3, 1993 by J. K. Krejca and S. J. Taylor. Mapped by J. K. Krejca and S. J. Taylor (1992 Crawlway Courier 26(3)). The entrance is a joint opening 10 feet long by 2 feet wide in the bottom of shallow sinkhole. One must rappel 70 feet down this narrow joint to reach the cave. The bottom of the entrance drop is a blind room about 30 feet long by 20 feet wide with a ceiling 20 feet high. The floor is a talus slope with a considerable amount of breakdown. There are a variety of speleothems, and those out of the rockfall zone of the entrance are in pristine condition. Although there is no water in the bottom of the pit, the cave is located directly above Cave Spring #1 (Site #303) and is likely to be related to the spring.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:
Arthropoda: Arachnida: Araneae: Pisauridae: *Dolomedes tenebrosus.* Insecta: Coleoptera: Carabidae. Leiodidae. Staphylinidae. Collembola. Diptera. Hymenoptera.
Mammalia: Chiroptera: Vespertilionidae: Unidentified bat.

Current Status: Because this is not a large stream carrying cave, it is probably not affected by the runnoff from nearby farming. The cave that is likely below this pit and connected to the spring below the pit, however, is probably affected by these things. Potential threats include clearing the wooded hillside that the small pit cave is in for development, and human visitation.

Quirky Quarry Spring

Monroe County. Site #674.

This spring emerges high on wooded hillside adjacent to a quarry. It was examined on September 6, 1993 by J. K. Krejca and S. J. Taylor. The spring outflow is 1-2 feet wide and 1-3 inch deep with a gravel and rubble substrate. Several feet downstream there is a small waterfall, and the water continues down a steep slope to join water from other seeps along the base of the quarry.

Fauna: Taxa collected or observed during this study:
Arthropoda: Malacostraca: Isopoda. Amphipoda: Crangonyctidae: *Crangonyx forbesi.*

Current Status: The hills around the quarry are criss-crossed with four wheel drive trails and littered with human debris, suggesting the type of visitation this site receives. A smaller path leads up to the spring itself. The water is probably affected by the chemicals and sediment that runs off of the farmland into sinkholes above this site. This spring and the seeps along the quarry "bluff" have observed about as much physical damage as possible because of the quarrying.

Running Spring Cave

Monroe County. Site #350.

This cave is located on the side of a wooded hillside that is surrounded by farm and pasture. The cave was partially examined on June 26, 1993 by J. K. Krejca, M. Maple, C. Pierce, and S. J. Taylor and on June 30, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave is a spring entrance 4 feet high by 3 feet wide, with 3 feet of exposed rock above the entrance. The water at the entrance is 1-4 feet wide and up to 6 inches deep. Beyond the entrance a passage 3 feet high by 4 feet extends about 40 feet with pooled water up to 1 foot deep covering the floor, then the ceiling becomes very low and it appears to sump. Some small speleothems in good condition were observed.

Physical and chemical analysis: Air and water temperatures, conductivity, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study:
Arthropoda: Malacostraca: Amphipoda: Gammaridae. Isopodidae. Insecta: Diptera: Heleomyzidae; Mycetophylidae.
Mammalia: Chiroptera: Vespertilionidae: *Pipistrellus subflavus.*

Current Status: The sediment in the stream suggests that the cave receives runoff from nearby farms, and this is probably the cave's worst threat. It appears to receive little (if any) visitation by humans, probably because of its wet nature.

Shelter Dome Cave

Monroe County. Site #354.

This cave is located at the base of a bluff and at the top of a talus slope. The entire cave was examined on October 23, 1993 by J. K. Krejca and S. J. Taylor. A memory sketch has been made by S. J. Taylor and J. K. Krejca. The entrance is an opening 20 feet high by 20 feet wide opening at the base of the bluff. The entrance room has the appearance of a rockshelter 8-10 feet high by 8 feet wide extending into the hillside about 20 feet. The rear of this room is on a raised shelf, about 5 feet above the ground. At the rear of this shelf the room ends in clay fill, where the ceiling and floor join. Considerable quantities of graffitti, beer cans and other garbage was evident.

Three feet out from the shelf and 8 feet above the ground at the junction of the ceiling and the wall is a small opening in a joint that leads upwards into a dome room 4 feet in diameter and 60 feet high. Some railroad spikes have been driven into the wall on one side, extending about 10 feet high on the wall. Some flowstone in fair condition can be observed in the dome. No water was observed in the cave. The floor is sandy clay and breakdown and the walls and ceiling are limestone bedrock.

Fauna: Taxa collected or observed during this study:
Arthropoda: Arachnida: Araneae. Insecta: Coleoptera: Carabidae. Dipera: Culicidae. Heteroptera: Cydnidae: *Sehirus cinctus cinctus.*
Mammalia: Chiroptera: Vespertilionidae.

Current Status: This cave receives considerable visitation by humans, but little additional damage can be done to the cave other than increase the quantities of spray paint. As no water is found in the cave, other human activities (development, farming) are likely to have little or no impact on this cave.

Shivery Slither Cave

Monroe County. Site #672

This cave is located in a fairly large section of woods that is surrounded by farmland. The entire cave was examined on September 5, 1993 by J. K. Krejca, M. Stamborski, and S. J. Taylor, and on September 6, 1993 by J. K. Krejca and S. J. Taylor. No map is available. This cave has a sinkhole entrance, 10 feet long by 5 feet wide, with a small surface stream running into it. About 5 feet under the dripline the cave stream joins the surface stream. The cave stream can not be followed upstream because of breakdown collapse, but it continues downstream as a breakdown floored bellycrawl in water, 1-2 feet high by 4 feet wide with a fairly steep gradient. The stream is 2 feet wide by 3-8 inches deep, and continues further downstream as a low crawl. The passage entered has some resolutioned flowstone and a small stalactite, both in good condition. Below the cave is a spring (Site #673) along a sinking stream (Site #676) which may be the resurgence of this cave.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Isopoda.

Amphibia: Anura: Hylidae: *Pseudacaris* sp.

Mammalia: Chiroptera: Vesptertilionidae: *Pipistrellus subflavus*.

Current Status: The water is probably affected by the chemicals and sedimentation of the farming in the area, though the wooded areas that most of the nearby sinkholes are likely to provide a buffer. The cave has little threat of being seriously visited by humans, as its passage is small and wet.

Slippery Dell Cave

Monroe County. Site #355.

This cave is located in a wooded sink surrounded by farm and recreational land. The entire cave was examined on June 23, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave consists of a large sinking stream entrance (streambed 10 feet wide) that funnels down to an entrance 10 feet high by 4 feet wide. There are large boulders, 3-4 feet in diameter, in the stream bed that is otherwise bare bedrock, suggesting that this entrance receives a lot of water during heavy rains. There was just a trickle of water at time of our visit. The passage consists of a short initial section 15 feet high by 4 feet wide with bedrock walls and ceiling and a breakdown and cobble floor. A small trickle of water flows from the entrance. In this section large logs could be observed that were wedged up at the ceiling, showing how high the water level sometimes gets. Shortly the passage becomes a cobble crawlway 2-3 feet high by 10 feet wide descending steeply at first, then leveling off. The cave ends as a terminal sump 3 feet high by 4 feet wide . Here the walls and ceiling are bedrock, and the floor has a considerable amount of debris. On our visit, the pooled sump had foam on it (as well as on the walls, indicating that the water was higher), and occasionally bubbled gas. The water was stagnant and smelly with no visibility. Total length of this cave is about 100 to 200 feet. No speleothems were observed. This cave is probably related to the nearby Dulcet Waterfall Cave (Site #671) and Weeping Buddha Cave (Site #670).

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Platyhelminthes: Turbellaria.

Annelida: Oligochaeta: Tubificida: Tubificidae.

Arthropoda: Arachnida: Acari: Ixodidae. Araneae. Malacostraca: Isopoda. Insecta: Coleoptera: Dytiscidae; Helipidae; Noteridae; Staphylinidae. Collembola: entomobryidae. Diptera: Chironomidae; Culicidae; Heleomyzidae; Psychodidae; Sciaridae; Tipulidae. Heteroptera: Gerridae: *Gerris* sp.

Mollusca: Gastropoda.

Current Status: The quality of the water at the sump, combined with the presence of certain fauna (tubificids and midge larvae), suggests that the cave receives significant chemical and sewage input. The cave has already suffered badly from these things, and the only other possible threat could be human visitation.

Terry Spring Cave. [Fountain Gap Cave; Long Slash Cave].

Monroe County. Site #363.

This cave is located in a bluff along the Mississippi floodplain. The cave was partially examined on May 6, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave is a spring entrance 2 feet high by 5 feet wide with a small waterfall. The walls, ceiling, and floor of the entrance are bedrock. The bedrock and breakdown around the entrance is heavily spray painted and littered. The passage is fairly constant, 2-3 feet high by 4 feet wide, with the stream pooled and occupying half of the floor, the other half being mud bank. Bretz and Harris (1961) discuss the geology of this cave and surrounding area. Some 500 feet were examined and the passage continued much the same. There were a few small stalactites, as well as evidence of total flooding.

Physical and chemical analysis: Air and water temperatures, *p*H, and dissolved oxygen analysis Table 9. Total dissolved solids, *p*H and alkalinity analysis Table 10.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978):

Platyhelminthes: Turbellaria: Tricladida.

Arthropoda: Arachnida: Araneae: Agelenidae: *Tegenaria domestica*. Linyphiidae: *Phanetta subterranea*. Theridiidae: *Achaearanea tepidariorum*. Malacostraca: Isopoda: Asellidae: *Asella* sp.; *Caecidotea brevicauda*, *Caecidotea packardi*. Amphipoda: Crangonyctidae: *Bactrurus brachycaudus*, *Crangonyx forbesi*. Insecta: Coleoptera: Staphylinidae. Diptera: Culicidae: *Culex pipiens*, *Culex* sp.; Chironomidae; Heleomyzidae: *Heleomyza brachypterna* ; Mycetophilidae; Psychodidae; Stratiomnyiidae; Tipulidae. Heteroptera: Aradidae: *Aradus* sp. Trichoptera.

Amphibia: Caudata: Plethodontidae: *Eurycea lucifuga*, *Eurycea* sp. Anura: Ranidae: *Rana palustris*.

Current Status: Though the entrance is heavily vandalized, the cave appears to be infrequently visited by humans possibly because of the small wet passage it has. The water and streambed have considerable sediment, suggesting input from farms on the land above.

Unnamed Spring

Monroe County. Site #424.

This spring is located on a wooded hillside near houses and road with farmland nearby. It was examined on August 21, 1993 by J. K. Krejca and S. J. Taylor. It is a small gravel bottomed spring that drains into a roadside creek.

Current Status: According to owner this spring runs all year, and used to be used for drinking water. The water is probably threatened by the farmland upgradient of the spring.

Wanda's Waterfall Cave. [Virgil Brandt Cave].

Site #86. Monroe County.

This cave is located in a small woodlot with several sinkholes. Nearby are rural homes and farmland. The cave was partially examined on March 3, 1992 and August 21, 1993 by J. K. Krejca and S. J. Taylor. A map is known to exist. The entrance is a sinkhole about 4 feet high by 3 feet wide. Twenty feet from the top of the sinkhole is the floor of the cave. Running water can be heard from the entrance. Immediately at the bottom of the entrance the cave stream is joined. At this point the passage both downstream and upstream is 6 feet high by 4 feet wide. About 20 feet upstream the passage becomes a 2-3 feet high crawl in water, similar to the downstream passage 75 to 100 feet from the entrance. The cave is fairly extensive, with three known entrances and over 1300 feet of mapped passage so far. The few speleothems observed were in good condition.

Fauna: Taxa collected or observed during this study:

Platyhelminthes: Turbellaria: Tricladida.

Annelida: Oligochaeta.

Arthropoda: Arachnida: Acari. Linyphiidae: *Centromerus latidens*, *Eperigone maculata*, *Eperigone tridentata*. Lycosidae: *Pirata* sp. Tetragnathidae: *Meta americana*. Malacostraca: Amphipoda: Crangonyctidae: *Crangonyx forbesi*. Gammaridae: *Gammarus troglophilus*. Isopoda. Diplopoda. Insecta: Coleoptera: Carabidae; Histeridae; Staphylinidae. Collembola: Sminthuridae. Diptera; Mycetophilidae: *Macrocera nobilis* ; Psychodidae; Tiulidae. Homptera: Cicadellidae. Lepidoptera; Orthoptera: Gryllacrididae: *Ceuthophilus* sp. Thysanura.

Current Status: The cave is being mapped by organized cavers, and appears in good condition. No graffitti, and very little trash, probably washed in from sinkholes, was observed. The water is probably affected by sedimentation and chemicals from agriculture, and sewage effluents from housing developments are a potential threat.

Weeping Buddha Cave

Monroe County. Site #670.

This cave is located in a wooded sinkhole bordered by a recreational area. The cave was partially examined on June 23, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave consists of a large sinkhole, about 40 feet in diameter and 25 feet deep, with a sinking stream flowing into it. There is a considerable amount of large organic debris, including big logs and brush, washed into the entrance. The entrance is 10 to 20 feet high and 6 feet wide. The passage consists of a short section, less than 20 feet long, of the entrance joint 10-20 feet high, which then leads to a 15 feet drop into a pit 25 feet deep by 15 feet in diameter . The surface stream makes a small waterfall at the drop into the pit. There is a 3 feet wide by 1-1.5 feet high crawlway leading off of the bottom of the pit. It had 0.5-1 feet of stagnant water with a film on the surface and that smelled heavily of organic decay. After 30-40 feet the crawl continued, with the passage character remaining the same, and no air flow. The stagnant air and water suggests a sump. There is evidence of extreme flooding, as logs and tires were jammed up at the ceiling of the entrance. Some flowstone in good condition was observed. This cave is probably hydrologically related to the nearby Slippery Dell Cave (Site #355) and Dulcet Waterfall Cave (Site #671)

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Insecta: Coleoptera: Carabidae; Hydrophilidae; Staphylinidae. Heteroptera: Veliidae: *Microvelia*. Odonata: Libellulidae.

Mollusca: Gastropoda.

Osteichthyes: Centrarchidae: *Lepomis cyanellus*.

Amphibia: Anura: Ranidae: *Rana catesbeiana*, *Rana palustris*, *Rana* sp.

Aves: Passeriformes: Tyrannidae: *Sayornis phoebe*.

Current Status: The cave appears to receive little human visitation. The main threat is the quality of the water that drains into this cave. It was taking in a lot of organics on our visit, and it also contained such things as a 55 gallon drum half buried in the sediment bottomed stream. There was also an oily film on the surface of the water. Many small sunfish (*Lepomis* sp.) had been washed in and were rotting in the stagnant water. This cave has been negatively affected by humans, and the major threat is continued input of sediment, organics, and chemicals.

Weird Wall Cave

Monroe County. Site #663.

This cave is located on a wooded hillside surrounded by farm and pasture land. The entire cave was examined on June 26, 1993 by J. K. Krejca, M. Mugele, C. Pierce and S. J. Taylor. No map is available. The entrance is a hole 3 feet in diameter hole at the bottom of a sinkhole. Eight feet of exposed rock are above the entrance The passage is about 4 feet in diameter with bedrock walls and ceiling and a dry silt floor. The bedrock walls had an interesting "swiss cheese" form, probably due to varying degrees of solubility of the limestone. No water was observed. The cave is less than 50 feet long and had some speleothems that were in good condition.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Opiliones: Phalangidae. Insecta: Coleoptera. Collembola: Entomobryidae. Diptera: Heleomyzidae; Myctophilidae. Homoptera: Cicadellidae. Hymenoptera; Formicidae.

Current Status: Because of its small size the cave does not appear to receive much human visitation. As a dry cave it presumably suffers little from agriculture activities above it. Possible threats are clearing of the wooded hillside that the cave is in, or vandalism by humans.

A Little Pit More Cave

Saint Clair County. Site #661.

Located in a wooded area with many sinkholes. The wooded area is surrounded by farmland. The cave was partially examined on June 22, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave is a hole 2 feet in diameter near the bottom of a large sinkhole. There is soil all around the entrance, 3 feet down bedrock is reached. The entrance is a small pit 10 feet deep. Judging by the soil around the entrance, and by the other sinkholes in the area, the entrance is probably quite transient. A climbdown 10 feet long leads into the joint that makes the cave. The passage is 5-9 feet high by 2-4 feet wide and has bedrock walls and a bedrock and breakdown ceiling with a breakdown floor. Judging from the breakdown ceiling, the cave is probably fairly unstable. No water was observed. No speleothems were observed, though the fluted walls looked to be in pristine condition and there was an abundance of fossil crinoid stems in the walls. The cave is approximately 30 feet long.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Opiliones: Phalangidae. Insecta: Collembola: Entombryidae. Diptera: Heleomyzidae.

Current Status: The cave receives little human visitation and since it is a dry cave presumably it is not affected by agricultural activities above it. The entrance and the cave itself are unstable, due to a large amount of soil and breakdown, and the cave may naturally disappear. Potential threats include deforestation and development of the area the cave is in.

Charles' Cave

Saint Clair County. Site #667.

This cave is located in a wooded area with numerous sinkholes surrounded by farmland. The entire cave was examined on June 25, 1993 by C. Albert, J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave is a hole 3 feet by 4 feet in the bottom of a sinkhole that leads straight down about 20 feet. The entrance was dug open by the landowner, and possibly clogs up regularly. The passage is 2-5 feet high by 5 feet wide with a small gravel bottomed stream, 1 foot wide and 1 inch deep. The speleothems observed were in pristine condition. The cave is about 30 feet long.

Physical and chemical analysis: Water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Malacostraca: Isopoda. Amphipoda: Gammaridae. Insecta: Coleoptera: Carabidae.

Current Status: The cave receives little visitation by the landowner, and no graffitti or human debris was observed. The cave may receive some sediment or chemical input from nearby farmland. The entrance is probably a transient feature, and has potential to close up.

Cossile Fast Pit

Saint Clair County. Site #635.

This pit is located in a wooded area with numerous sinkholes that is surrounded by farmland. The cave was partially examined on August 18, 1992 by J. K. Krejca and S. J. Taylor. Mapped by S. J. Taylor and J. K. Krejca (1992, Crawlway Courier 26(3)). The entrance to this pit is 5 feet in diameter at the bottom of a sinkhole. The entrance has several large breakdown blocks in it that must be navigated through to get down the pit. All of the other sinks in this area were plugged with debris (natural and human debris), indicating that this entrance may also end up clogged. This small pit winds downward about 40 feet to where a pool of water is reached. There is no discernable flow in the water. Though it was not entered, a very low and wet passage could be observed that continued at the pool level. No speleothems were observed, but the fluted walls of the pit were in excellent condition.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Annelida: Oligochaeta.

Arthropoda: Arachnida: Araneae: Araneidae: *Leucauge venusta*. Linyphiidae: *Bathyphantes pallida*, *Ceratinopsis* ? sp., Lycosidae: *Pardosa* sp., *Pirata sedentarius*. Pisauridae: *Dolomedes tenebrosus*. Opiliones. Insecta: Collembola. Diptera: Mycetophilidae: *Macrocera nobilis*. Hymenoptera: Formicidae. Psocoptera.

Current Status: This pit does not appear to be used by humans, though it has a serious threat of being clogged with sediment from farms as the neighboring sinkholes are.

Dieciseis Tigrinum Pit

Saint Clair County. Site #660.

This pit is located in a wooded area with numerous sinkholes that is surrounded by farmland. The entire cave was examined on June 25, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this pit is a joint entrance 3 feet long by 2 feet wide in the side of a sinkhole. About 4 feet under the dripline a narrow opening is reached, and once through this squeeze the passage continues to angle steeply downward along the joint as a narrow pit. The "floor" of this drop is extremely sticky clay. The pit is about 60 feet deep, and the passage extends a total of 30 feet. At the bottom of the pit is a small puddle, and the water drains downward from this through the breakdown floor. No actual stream passage could be reached. There were a few small speleothems in pristine condition.

Physical and chemical analysis: Air temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Insecta: Coleoptera: Carabidae. Diptera: Culicidae.

Amphibia: Caudata: Ambystomatidae: *Ambystoma tigrinum*. Plethodontidae: *Plethodon dorsalis*. Anura: Hylidae: *Pseudacris triseriata*. Ranidae: *Rana catesbeiana*.

Current Status: The pit appears to receive no human visitation. It is in very good condition. Threats include deforestation of the land the pit is on, and input such as sediment and chemicals from nearby farmland.

Drainage Cave

Saint Clair County. Site #666.

This cave is located in a wooded area with several sinkholes surrounded by farm and pasture land. The entire cave was examined on June 30, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave is a hole 4 feet in diameter at the bottom of a complex of sinkholes. The entrance sometimes becomes clogged with debris, and the landowner digs it open. The passage extends straight down 20 feet from the entrance. At this point there is a small talus slope that leads to 15-20 feet of passage. This short passage intersects an underground stream about 10 feet from the bottom of the entrance. There is only 3 feet of stream exposed. It is a 1.5 feet wide and up to 1 feet deep raceway that sumps at both ends. There was also a small rivulet coming from the bedrock wall that feeds into the raceway. Beyond the raceway a crawl 5 feet long leads to a room 5 feet in diameter and 10 feet high that is the end of the cave. The total length is about 30 feet.

Physical and chemical analysis: Water temperature Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Malacostraca: Isopoda. Amphipoda: Gammaridae. Insecta: Collembola: Entomobryidae. Diptera. Hymenoptera: Formicidae.

Amphibia: Anura: *Rana* sp.

Current Status: The cave receives little human visitation. The entrance has shown the potential to clog up, and is a transient feature. The biggest threat is from sedimentation and chemicals from farmlands that likely drain into the cave stream.

Misplias Cave

Saint Clair County. Site #669.

This cave is located beneath a wooded sinkhole surrounded by farmland. The entire cave was examined on June 26, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave is a hole 2 feet by 3 feet leading off from the bottom of a sinkhole with 15 feet of exposed rock above the entrance. About 5 feet of crawlway opens into a room 15 feet long, 5 feet wide, by 8 feet high. Water drips from the ceiling and small pools are formed on the gravel and breakdown floor. This water flows into an unenterable hole at the far end of the room. Some broken stalactites were observed. The total length of the cave was 20 feet.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Arachnida: Araneae. Malacostraca: Isopoda. Insecta: Heleomyzidae.

Current Status: The cave receives visits by the landowner and his family which may account for the broken stalactites. There is not much more damage (besides spray paint) that could be done in this very small cave. Corn cobs in the cave are evidence that the nearby farming runoff gets into the cave, providing the most serious threat from sedimentation and chemicals.

Puppies, Eggs & Apples Spring

Saint Clair County. Site #668.

This spring is located in a pasture surrounded by farmland and was visited on 24 June 1993 by J. K. Krejca and S. J. Taylor. This spring has a brick cistern built up around it, 5 feet in diameter and 18 feet deep according to landowners, and the spring actually resurges 25 feet downstream of the cistern. The spring is silt bottomed and seems fairly unsuitable for life. The cistern is pumped for irrigation and animals.

Physical and chemical analysis: Air and water temperatures Table 9.

Fauna: Taxa collected or observed during this study:

Arthropoda: Insecta: Heteroptera: Veliidae: *Microvelia* sp.

Current Status: The spring has been dramatically tampered with, and barely continues to exist. Threats are the continued input of pasture and farmland runoff that it probably receives.

Sparrow Spring Cave

Saint Clair County. Site #34.

This cave is located in back backyard of a rural homeowner. The area is surrounded by farmfields. Only the entrance to this cave was examined on September 29, 1992 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave is a spring entrance 12 feet wide on a hillside. Pooled water is more than one foot deep, with 2 feet of air over the water at the dripline. Eight feet into the cave a 3-4 inch diameter pipe could be observed coming in through the ceiling and entering the water. Immediately above this on the surface is a pumphouse.

Physical and chemical analysis: Air temperatures Table 9. Anion analysis Table 11. Trace metals and mercury analysis of water Table 13. Pesticide and polychlorinated biphenol analysis of water Table 17.

Fauna: Taxa collected or observed during this study:

Arthropoda: Malacostraca: Amphipoda: Gammaridae: *Gammarus pseudolimnaeus*. Insectca: Heteroptera: Gerridae: *Gerris* sp.; Veliidae: *Microvelia americana*.

Current Status: Probably not visited by humans often. This cave likely receives sediment and chemicals from the surrounding farmland. It is not known whether the cave water is being used for drinking water.

Spring Valley Cave

Saint Clair County. Site #36.

This cave is located on a wooded hillside surrounded by farmland. The entire cave was examined on June 22, 1993 and June 30, 1993 by J. K. Krejca and S. J. Taylor. No map is available. The entrance to this cave is a spring entrance 4 feet in diameter with 2 feet of exposed rock above the entrance. The passage continues the same size as the entrance for 20 feet. There the ceiling collapsed, and the stream continues with no roof. Also at this point there is a manmade dam with pipes emerging from it. According to the landowner this was used for drinking water and to fill up a swimming pool. From this point the stream can be followed another 20 feet (upstream, with no roof) to where it resurges from impassable breakdown. A little bit of popcorn was observed, and what little cave there was was in good condition.

Physical and chemical analysis: Air and water temperatures, conductivity, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study:

Platyhelminthes: Turbellaria.

Arthropoda: Arachnida: Araneae. Malacostraca: Isopoda.

Current Status: The cave is no longer used for drinking water, and probably sees little human visitation. The stream appears to be in good condition, but is likely to receive sediment and chemicals from farmland that drains into the cave.

Stemler Cave. [Oerter Cave; also spelled: Stemmler Cave]

Saint Clair County. Site #35.

This cave is located in a wooded sinkhole surrounded by farmland. The cave was partially examined on June 25, 1993, June 30, 1993, and October 10, 1993 by J. K. Krejca and S. J. Taylor. A map is known to exist. The entrance to this cave is a sinkhole entrance 40 feet long by 10 feet wide that drops vertically 15 feet to a breakdown covered floor. A large stream 5-10 feet wide and up to 3 feet deep can be observed at the entrance. Harris Pit is a second entrance to this cave. About 30 feet upstream the passage sumps. Downstream the passage continues 3-10 feet high by 5-20 feet wide. This is a large cave, and though we did not explore much of it, it probably has a variety of passage sizes and types. Speleothems that were observed were in excellent condition. On 25 June 25, 1993 a strong sewage odor could be smelled 20 feet away from the entrance. There were heaps of foam 4 feet in diameter, and the water was murky. Subsequent visits proved that this was not the "norm" for this cave.

Physical and chemical analysis: Air and water temperatures, conductivity, and dissolved oxygen analysis Table 9.

Fauna: Taxa collected or observed during this study and from Peck and Lewis (1978)

Platyhelminthes: Turbellaria: Tricladida: Kenkiidae: *Sphalloplana hubrichti*
Arthropoda: Malacostraca: Isopoda: Asellidae: *Caecidotea brevicauda*, *Caecidotea packardi*. Amphipoda: Crangonyctidae: *Bactrurus brachycaudus*, *Crangonyx forbesi*. Gammaridae: *Gammarus acherondytes*, *Gammarus minus*, *Gammarus troglophilus*. Diplopoda: Chordeumida: Conotylidae: *Austrotyla specus*. Insecta: Collembola: Tomoceridae: *Tomocerus flavescens*. Diptera: Sphaeroceridae: *Leptocera* sp.
Mollusca: Bivalvia. Gastropoda: Ctenobranchiata: Hydrobiidae: *Fontigens antroecetes*. Stemler Cave is the type locality.
Amphibia: Caudata: Plethodontidae: *Eurycea* sp. Anura: Ranidae: *Rana* sp.

Current Status: This cave receives some human visitation and remains in good condition. It is evident that the cave periodically receives sewage and sediment, particularly during floods. Threats to this cave include continued input of sediment, fecal material, and chemicals.

MANAGEMENT RECOMMENDATIONS AND DISCUSSION

CHEMICAL ANALYSIS AND WATER QUALITY

Water quality monitoring in karst areas is extremely complex and requires specialized equipment and much labor to achieve a thorough understanding. Our data are important as they serve as a beginning for background monitoring in Illinois karst areas. All of the sites for which some level of water quality data was recorded were springs or cave streams. These are the most efficient and reliable places to monitor for background contaminants in karst terranes (Quinlan 1988, Quinlan and Ewars 1984). When possible (27/40 times), water sampling was done at cave springs (often the entrance to a cave) rather than in the caves at a spot along the cave stream. Springs represent water from the entire karst drainage basin, whereas a single spot in a dendritic cave system would be less likely represent the water from the entire system.

There are many factors that could affect the parameters that were measured. In this study, water was not sampled at a specific time or frequency. Flood pulses, which may come hours or days after a rain or meltwater event, cause levels of contaminants to become transiently higher (Field 1989, Libra *et al.* 1986), up to 10,000 times higher than before the event (Quinlan and Alexander 1987). Farming activity such as application of pesticides and fertilizers, and tilling can also affect contaminant levels. Therefore, results from this study should be interpreted as background spot checks with the understanding that in order to obtain a complete picture of the water quality, much more extensive field work needs to be done.

PHYSICAL AND CHEMICAL ANALYSIS

Temperatures, *p*H, dissolved oxygen, and conductivity were taken at many sites (Table 8), but sometimes conditions in the field (a cave without water) or other considerations (problems with meters, broken thermometer, etc.) resulted in some parameters not being measured.

Cave temperatures are an important physical parameter of the cave environment, as obligate cave-dwelling organisms can be extremely sensitive to relatively small fluctuations. Juberthie (1969) reported that a certain cave-limited beetle was only found at sites with low minute to minute changes in temperature. Temperature also serves as a major factor in site selection for bats (Barbour and Davis 1969; Hill and Smith 1984).

As dark zone cave temperatures generally represent the mean yearly surface temperatures (Culver 1982), an increase in dark zone air temperature may be expected moving north to south through the state. The mean dark air temperature of sites sampled in the north half of the Illinois (including karst regions Driftless Area and "Other") in this study was 11.7 ^{o}C, and in the south half of the state (Lincoln Hills, Sinkhole Plain, and Shawnee Hills karst regions--see Figure 2) was 13.6 ^{o}C. This correlates well with the expected variation in dark zone cave temperatures across the state. However, many of the dark zone temperature values deviate significantly from this trend, and generally do so as a result of particular properties unique to the particular cave.

Such properties may include entrance orientation, passage configuration, and air flow patterns. Also to be considered is that the depth of penetration into the caves examined varied. In many instances traversing far beyond the twilight/dark zone barrier was easily possible, but in some caves the dark zone could barely be reached. The dark zone temperature values obtained from deep within a cave are more stable and truly representative of the mean yearly values of the area than values obtained just beyond the twilight zone (Juberthie 1969).

Values for *p*H (obtained using a meter in the field) ranged from 7.1 to 8.9 (Table 9), which is slightly more basic than typical surface stream values. This more basic pH is expected from water travelling through limestone conduits (Sweeting 1973, Poulson and White 1969). The pH may also be affected by the quantity and type of organic debris available. This is clearly demonstrated in Ava Cave, where the *p*H value for a bedrock bottomed stream pool was 8.2, but at the resurgence of the cave (Ava Spring), where the water from the cave percolates through rubble and organic debris for approximately 10-15 feet before (upstream of) it is accessible, the pH was 7.6. The most likely explanation of these results is that the *p*H decreased due to percolation through surface organic debris. Particular care should be taken when sampling at spring resurgences to avoid inaccurate assessment of groundwater parameters as a result of percolation through surface debris. None of our values exceeded Illinois Groundwater Quality Standards for Class I groundwater (Illinois Pollution Control Board 1991) (Table 9).

Dissolved oxygen levels ranged from 3.9 ppm to 14.7 ppm (Table 9). Holsinger (1966) reports that in a Virginia cave polluted by septic tank leakage, pools with less than 3 ppm of oxygen still supported cave isopods and planarians. However, such extremely low values are clearly not sufficient to support healthy communities of cave invertebrates.

The specific conductivity levels ranged from 129-429 mg/L $CaCO_3$ (Table 9). The values fall within the range of values collected by Muck and Newman (1992) in their evaluation of streams in Minnesota.

ANALYSIS OF TOTAL SOLIDS, pH (by titration), ALKALINITY

The pH values obtained in the laboratory from titrations (Table 10) are all less than the values recorded in the field (with a meter) for the same water (Table 9). The difference in values could be accounted for by the two techniques using different pH buffer solutions for calibration. It is also possible that the *p*H of the samples was actually reduced during the holding period for samples. None of our values exceeded Illinois Groundwater Quality Standards for Class I groundwater (Illinois Pollution Control Board 1991).

Alkalinity values were high (Table 10), as would be expected flowing through a calcium carbonate rock (Sweeting 1973). The high alkalinity, ranging from 116 mg/L to 377 mg/L $CaCO_3$, reflects the water's high acid-neutralizing capacity. Alkalinity is important in determining the suitability of water for irrigation, since alkalinity values in relation to alkaline earth metal concentrations are significant (Franson 1989).

Total solids values ranged from 114 mg/L to 470 mg/L in our water samples, well below the maximum level allowed Illinois Groundwater Quality Standards for Class I groundwater (Illinois Pollution Control Board 1991) (Table 10). A limit of 500 mg/L of dissolved solids is desirable for drinking water (Franson 1989), and from our values of total solids, it is evident that the waters tested did not exceed that limit. Crawford (1984) measured total dissolved solids values high enough to be considered pollutants from urban storm water runoff that were draining into a cave system.

ANALYSIS OF ANIONS

None of the anion levèls analyzed in water samples (N=14) during 1992 exceeded Illinois Groundwater Quality Standards for Class I groundwater (Illinois Pollution Control Board 1991) (Table 11). Nitrite nitrogen was detected in only in three samples at two sites (Collier Spring 30 June, Collier Spring 2 July, Indian Hole 2 July). This similarity may be a result of actual hydrological connections (see trace metal discussion) or possibly seasonal fluctuations. Another trend that shows up in the samples analyzed to date is that all of the nitrate-nitrogen levels for the Sinkhole Plain are higher than levels in the other two karst regions. With one exception (Ava Cave), the same is true for chloride. The differences in concentrations between geographic regions may represent differences in land use practices or geology.

Nitrates in particular are of concern because as their use for fertilizing increases, so does their level in drinking water supplies (Hallberg 1986; Thompson *et al.* 1986). They have been found in groundwater in other states with major agricultural land-use areas such as Iowa and Wisconsin (Libra et al. 1986, Thompson et al. 1986, Contant 1986). Nielsen and Lee (1987) found nitrate levels greater than 10 mg/L in 25% of wells analyzed in agricultural counties primarily located in the corn belt (Illinois included). Levels exceeding 10 mg/L have also been found in drinking water wells (US EPA 1990). For 1993 water samples (N=34), nitrate nitrogen levels exceeded Illinois Groundwater Quality Standards for Class I groundwater (Illinois Pollution Control Board 1991) (Table 12) in Shivery Slithery Cave and an unnamed spring #424 in Monroe County.

ANALYSIS OF TRACE METALS OF WATER

None of the values for trace metals in water samples (N=14) collected from Illinois caves and springs exceeded the Illinois Groundwater Quality Standards for Class I groundwater (Illinois Pollution Control Board 1991) (Table 13). Many studies have found trace metals in water that affects humans and aquatic life, and a likely source of metals from non point-source pollution is from mining areas and urban runoff (Crawford 1984). The EPA performed a comprehensive study of urban runoff and concluded that Cu, Pb, and Zn were a notable threat to aquatic life as these parameters exceeded criteria for the protection of aquatic life in over half of the collected samples (US EPA 1983). Crawford (1984) found urban storm water runoff flowing into a cave surpassing Cr, Pb, and Fe concentrations for surface water criteria.

In some cases, our data reveals similarities among values for trace metals at different sites and at the same site on different dates. Sites A, B, and C (Table 13) are from Collier Spring on 30 June, Collier Spring on 2 July, and Indian Hole on 2 July. Collier Spring is the main resurgence of Fogelpole Cave (White 1973), and Indian Hole is a smaller spring allegedly also a resurgence of the Monroe County cave. It is interesting that the values for the two Collier Spring samples are more similar to one another than either of them are to Indian Hole. Further discussion of similarities between Collier Spring and Indian Hole can be found in the anion discussion below.

Levels of calcium are expected to be high in limestone areas, and the values we found for calcium and magnesium (Table 13) exceeded the range for both elements in cave water given by Poulson and White (1969). Sweeting (1973) also compared the values of these two constituents from limestone vs. sandstone waters.

INVERTEBRATE CHEMICAL ANALYSIS

Amphipods and isopods were used for invertebrate chemical analysis as they are the most abundant aquatic organisms in Illinois caves, lessening the impact of sampling on the cave communities, and making it possible to collect the required weight of organisms to run an analytical sample on. Sampling was only carried out in caves with particularly large populations of these invertebrates. Since the laboratory tests are expensive, testing was also limited by financial restrictions.

TRACE METALS IN INVERTEBRATES

Trace metal tests were run on the five isopod and amphipod invertebrate samples (Table 14). After digestion of the single isopod sample, there was some sand-like residue that may have skewed the results, increasing the values of some of the elements such as aluminum, iron, and manganese that are present in this sample. In the four amphipod samples, the four trace metals (looking only at those that were above detection limits in both the amphipod samples and their corresponding water samples) that were in the highest concentration were also the trace metals with the highest concentration in the water samples collected at the same time and site. Ca, Na, Mg, and Ba, in order of concentration, were the top four constituents (Tables 18).

The correlation between levels of trace metals in the water with levels in invertebrates is most apparent in the Fogelpole Cave samples (Table 15), where six out of seven of the trace metals detected in the water sample were also found in the invertebrates, with only one parameter, silicon, below detectable limit in both of the invertebrate samples. Comparing the values detected in both the Fogelpole water sample and the invertebrate sample taken at the same time, there is an apparent relationship in their relative concentrations (Table 16). The rank order of the concentrations of the chemicals present in detectable quantities in both the water and the invertebrate samples taken on the same day at the same site is almost identical. The incongruency of the iron and magnesium levels in the isopod sample may be a result of higher iron concentrations from the sediment in the digest discussed earlier.

The trace metals data also suggests that isopods may concentrate higher levels of metals than amphipods, but our data is very limited. Eighty-one percent of the chemicals were in higher concentrations in isopods than in the amphipods (Table 14).

PESTICIDES AND PCB'S IN INVERTEBRATES

Pesticides were found in all three of the invertebrate samples analyzed (Table 18). Due to insufficient quantity of amphipods collected, the sample from Fogelpole Cave could not be analyzed, and the Jug Spring Cave data is unavailable. DDE and DDD, persistent breakdown products of DDT, showed up in Guthrie Cave amphipods and the Fogelpole Cave isopods. DDT is no longer in use, and the existence of DDE and DDD in these invertebrates probably reflects historical usage of DDT in the drainage basin of these caves. Dieldrin, the persistent breakdown product of Aldrin, was detected in amphipods from Guthrie Cave and Erwin Vogt Spring. Since Aldrin is no longer for sale in Illinois, our data probably reflect historical agricultural practices, when use of this chemical was widespread. These data demonstrate some of the long term detrimental effects that agricultural chemicals can have on cave ecosystems.

Our data also suggests that not only are the invertebrate samples revealing historic usage of chemicals, but that they can do so in cases where water sample analysis does not detect chemicals. The water sample taken at the same time as the invertebrate sample in Guthrie Cave contained DDD and DDE, while the water sample from Fogelpole Cave did not have detectable levels of DDD and DDE (Table 15). In addition, while Dieldrin was detected in all three invertebrate samples, it was not detected in any of the corresponding water samples (Tables 17). This strongly supports the idea that cave invertebrates accumulate these toxins, and thus serve as indicators of past and present contamination, while the water only reflects contamination levels at the moment of sampling (Field 1989; Libra *et al.* 1986; Quinlan and Alexander 1987). At each of the three sites where invertebrates were analyzed for pesticides, there is ongoing agricultural land use in the drainage basin of the cave, and this was probably the source of contamination.

Toxicity of substances to troglobites may be quite different than the responses of their epigean relatives, making results of chemical analysis difficult to interpret. Due to their narrow environmental adaptations, troglobitic species may be hypersensitive to changes not detectable by standard toxicity tests (increased organic input, sedimentation, flow rate changes) and they may actually be more resistant in the short run to toxic substances (trace metals) than epigean species because of their slowed metabolism (Poulson 1991). In the case of two Tennessee aquatic isopods, the epigean species was found to be more sensitive to cadmium, zinc and total residual chlorine than its hypogean counterpart (Bosnak 1984, Bosnak and Morgan 1981). Mayer and Elersieck (1986) reports that pulses of pesticides characteristic of karst springs could have major impacts on biota such as the amphipod *Gammarus pseudolimnaeus* (a species found in Illinois groundwater) that are highly susceptible to pesticides.

PESTICIDES AND POLYCHLORINATED BIPHENOLS

Pesticides have been found in four of the fourteen water samples analyzed (Table 19). Besides the pesticides in water samples discussed above (under Invertebrate Pesticides and PCB's), DDD, DDE and Dieldrin were found in water samples from Jug Spring Cave, Nadig Spring, and Sand Boil Spring but no invertebrate samples are available from these sites. The presence of pesticides in groundwater is a valid concern, and karst regions in particular offer higher potential for groundwater contamination (Helling 1986). Pesticides have been found in groundwater in neighboring farming states such as Iowa and Wisconsin (Contant 1986; Hallberg 1986; Libra *et al.* 1986). Williams *et al.* (1988) reports that 46 pesticides from 26 states have been detected in groundwater. None of the water samples tested (Table 19) contained detectable levels of PCB's.

BIOLOGICAL DISCUSSION

The majority of the discussion of individual taxa is treated under those taxa in the results. Since our biological results are rather preliminary at present, as most invertebrate taxa have not yet been identified by specialists, detailed analysis of the specific organisms found in the course of this study, and comparisons with other studies (, Peck and Lewis [1978] and Peck and Christiansen [1990]), must wait until such identifications become available.

The most significant vertebrate find of this study was a colony of federally endangered *Myotis sodalis* in a cave in southern Illinois. The cave harbored 3714 Indiana bats at the time the cave was visited in the summer of 1992. Because of the nature of the cave, the best management plan would be to leave the cave alone. Drawing any attention to the cave, including unnecessary discussion of its existence with other government agencies or private individuals, can only lead to unnecessary attempts to visit the cave which will in turn draw undesirable attention to the cave and the bats within it. Because locals know about the cave, as is evidenced by a small amount of human debris and a fire ring, no more attention of any sort (gate, signs, visiting the cave, discussing the cave and colony) should be given to this site. The entrance is already well hidden and is on private land, and a sign or gate would only make the cave entrance more obvious. McGregor (1992) notes that gates often do more damage to bat colonies than vandals do, and we feel that this holds true for the recently found bat colony. The cave location should be kept confidential and necessary visits to the cave (bat counts, mapping) should be held at the absolute minimum level possible.

MANAGEMENT RECOMMENDATIONS FOR ILLINOIS CAVES AND KARST REGIONS

1) EDUCATION:

In order to protect the karst ecosystems, it is necessary to educate the current and future landowners and land users about the vulnerability and uniqueness of caves and the karst terrane. In Illinois, major threats to the subterranean communities and groundwater in the karst areas are the agricultural land use practices (Hallberg 1986). Providing farmers with information about preventing groundwater contamination from pesticides, fertilizers, livestock, and improperly placed or constructed wells (Foster 1989) is a wise beginning to slowing water contamination problems at the source and protecting subterranean communities. Some specific recommendations to include among the guidelines for farming in karst regions are:

-Restrict the amount of tilling to control sedimentation, a major water pollutant in Illinois (Walker 1985).

-Control fertilizer and pesticide application, as drinking water sources of both municipalities and private individuals in agricultural areas commonly exhibit pollutant concentrations above the Maximum Contaminant Limit for public drinking water due to the conventional usage of agricultural chemicals (Hallberg 1986). These high levels of pollutants have a detrimental effect not only on the people who drink the water, but also on the cavernicoles which live in the water.

-Leave a natural wooded buffer around sinkholes and other recharge areas since contaminant levels in groundwater under forest, unfertilized pastures, meadows and grasslands are orders of magnitude less than in areas under fertilized crops and areas under intensive animal production (Hallberg 1986).

Setting up educational programs to teach school children and their parents about the flow of groundwater in karst terranes promotes a better understanding of the consequences of water contamination and should be a particularly effective long term method of protecting subterranean communities and karst aquifer water quality. Basic concepts about sinkhole recharge in relation to the water most wells are tapped into can be easily demonstrated by posters made available by government agencies such as the Virginia Cave Board, Department of Conservation and Recreation: "What Goes Down Must Come Up." Providing school teachers with information packets about caves and groundwater is another method to educate the public. Such information is currently available from the American Cave Conservation Association (Foster 1992).

2) DEFINITION OF KARST AQUIFERS:

To better understand and manage subterranean communities and karst groundwater and to avoid potentially dangerous threats to the environment and human health, it is necessary to map aquifers and define their recharge and discharge areas (Moore 1988). Cave mapping and dye tracing can be used to facilitate karst aquifer definition and to pinpoint sources of pollution (Poulson 1992).

To define karst aquifers it is necessary to document the nature and locations of the many karst features that exist in an area. This can be done quite inexpensively through coordination with organized cavers (generally members of the National Speleological Society and its chapters), who may be willing to lend cave location information, provide help with field work (cave mapping), to even providing an escort to difficult to find cave entrances. Mullins (1992) recommends the integration of caver volunteers into cave management plans. Another method for obtaining information about caves and karst features is to solicit the help of landowners, who often know locations of springs, sinks, or caves on their land.

Defining karst aquifers requires knowledge of the flow of water, cave mapping, dye tracing, and water table mapping - all of these being necessary elements of a well thought out management plan for protecting subterranean life and groundwater quality in karst areas (Field 1989, Palmer 1986, Quinlan 1982, White 1988). Cave maps are useful management and monitoring tools as well as accurate descriptions of routes of enterable subterranean conduit flow. Cave maps can be obtained or created through agreements with organized cavers (Taylor 1992), who are a source of volunteer labor that is often overlooked. Dye tracing in karst can be used to determine routes of conduit flow through areas people cannot reach. Water table mapping helps determine the characteristics of diffuse flow contributing to the aquifer.

3) THOROUGH ASSESSMENT AND MONITORING OF WATER QUALITY:

Much additional data is needed to determine the quality of the water we rely on and its future. The public alarm regarding the quality of the groundwater is rightfully growing. Contamination of ground water has been reported in every state and has resulted in the closing of over 2,800 public and private wells (Moore 1988). Understanding the status of Illinois subterranean communities and the quality of the groundwater they live in will require more thorough analysis than the backround sampling carried out in the present study, as well as sensible long term monitoring plans (Moore 1988). Sampling and monitoring should be carried out according to the recommendations given by karst hydrogeology experts (Field 1988, Poulson 1992, Quinlan 1988, Quinlan and Alexander 1987, Quinlan and Ewers 1985, 1986). An economical option to more expensive chemical testing involves developing an index of biotic integrity for aquatic cave communities (Poulson 1992). Aquatic cavernicole populations will fluctuate in response to changes in water quality. Changes which might otherwise go undetected, such as pulses of agricultural chemicals, can be detected by observing changes in cave communities (Crunkilton 1982). Populations of some aquatic cavernicoles, such as amphipods, are quite susceptible to pesticides (Mayer and Ellersieck 1986), and since they are slow to recolonize after local extinctions (Gooch and Glazier 1991, Muck and Newman 1992) they are excellent organisms for detecting previous pesticide contamination.

Monitoring water quality means paying special attention to diffuse and point-source pollution. Potential sources of point source pollution, such as spills and agricultural and urban runoff, cause many serious problems for groundwater and subterranean life (Crawford 1984, 1988, Crunkilton 1982, Hoenstine et al. 1987, Niederpruem 1992, Quinlan 1988). Though point-source problems are significant and need to be addressed, non point-source pollution from agricultural activities (pesticides and fertilizers) poses the most immediate and visible threat to the degradation of ground water quality and the cave environment (Contant 1986, Hallberg 1986, Thompson et al. 1986). Another thing to consider is that the sinkhole nature of karst terrane focus contaminants that are traditionally considered non- point (such as pesticides and fertilizers) by funneling them into the groundwater.

In addition to nitrates and other agricultural chemicals, sedimentation in groundwater is a serious problem (Dysart 1985, Walker 1985) and the conduits formed by cave streams form natural traps for sediments (Palmer 1984). In turn, these sediments can transform a rubble or bedrock bottom cave stream into a sediment bottom stream, drastically changing the structure of the aquatic cave community (Culver 1982, Dickson and Kirk 1976, Poulson 1991).

Contamination of wells in karst areas by sewage and other organics (from septic tanks, sewer lines, and livestock) is common (Aley 1984), with over half of the reported waterborne disease outbreaks each year in the U.S. resulting from the consumption water from contaminated wells (Gerba 1988). Well construction problems also contribute to contamination of drinking water (Hallberg 1986, Contant 1986).

LITERATURE CITED

Aley, T. 1984. Ground-water tracing in water pollution studies. National Speleological Society Bulletin 46:17-20.

Alexander, E. C., Jr., M. A. Davis and J. Dalgleish. 1987. Dye tracing through thick unsaturated zones. Proceedings of the 5th International Symposium on Underground Water Tracing, Athens. pp.

Baker, L. A. 1992. Introduction to nonpoint source pollution in the United States and prospects for wetland use. Ecological Engineering 1(1/2):1-26.

Barbour, R. W and W. H. Davis. 1969. Bats of America. University Press of Kentucky, Lexington, Kentucky. 286 pp.

Barr, T. C., Jr. 1963. Ecological classification of cavernicoles. Cave Notes 5:9-12.

Barr, T. C., Jr. 1968. Cave ecology and the evolution of troglobites. Evolutionary Biology 2:35-102.

Barr, T. C., Jr. and R. A. Kuehne. 1971. Ecological studies in the Mammoth Cave ecosystems of Kentucky. II. The ecosystem. Annales de Speleologie 26:47-96.

Barr, T. C., Jr. and S. B. Peck. 1965. Discovery of *Pseudanophthalmus* (Coleoptera: Carabidae) in southern Illinois. American Midland Naturalist 76:519-522.

Borror, D. J., C. A. Triplehorn and N. F. Johnson. 1989. An Introduction to the study of Insects. Saunders College Publishing, Philadelphia. 875 pp.

Bosnak, A. D. 1984. Comparison of acute toxicity between epigean and hypogean isopods (Asellidae) to Cadmium, Zinc, and total residual Chlorine. National Speleological Society Bulletin 46:19. [Abstract].

Bosnak, A. D. and E. L. Morgon. 1981. Acute toxicity of Cadmium, Zinc, and total residual Chlorine to epigean and hypogean isopods (Asellidae). National Speleological Society Bulletin 43:12-18.

Brinkhurst, R. O. and B. G. M. Jamieson. 1972. Aquatic Oligochaeta of the World. Toronto University Press, Toronto, Ontario. 860 pp.

Bretz, J. H. 1938. Caves in the Galena formation. The Journal of Geology. 46:828-841.

Bretz, J. H. 1942. Vadose and phreatic features of limestone caverns. The Journal of Geology 50(6, Part II):675-811.

Bretz, J. H. and S. E. Harris, Jr. 1961. Caves of Illinois. Illinois State Geological Survey, Report of Investigations 215:1-87.

Brusca, R. C. and G. J. Brusca. 1990. Invertebrates. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts. 922pp.

Busacca, J. 1975. Distribution and biology of *Amoebaleria defessa* (Osten Sacken) and *Heleomyza brachypterna* [*sic*] (Loew) (Diptera: Heleomyzidae) in an Indiana Cave. National Speleological Society Bulletin 37(1):5-8.

Caumartin, V.. 1963. Review of the microbiology of underground environments. National Speleological Society Bulletin 25:1-14.

Chapman, P. 1987. Extinction faces the world's cave creatures. Bulletin of the International Union for the Conservation of Nature, Special Report 18(7):13-14.

Christiansen, K. 1982. Zoogeography of cave Collembola east of the Great Plains. National Speleological Society Bulletin 44:32-41.

Christiansen, K. and M. Bullion. 1978. An evolutionary and ecological analysis of the terrestrial arthropods of caves in the Central Pyrenees. National Speleological Society Bulletin 40:103-117.

Contant, C. K. 1986. Ground water protection in agricultural midwestern states: a comparative analysis of programs and policies. Pages 115-133. *In*: Proceedings of the Agricultural Impacts on Ground Water - A Conference, Omaha, Nebraska. National Water Well Association, Dublin, Ohio. 685 pp.

Cooper, J. E. and T. L. Poulson. 1968. A guide for biological collecting in caves. National Speleological Society News 26:127-138.

Collins, A. G. and A. I. Johnson. 1988. Overview. Pages 1-4. *In*: D. M. Neilsen and A. I. Johnson (eds.). Ground-Water Contamination: Field Methods. American Society for Testing and Materials, Special Technical Publication, Philadelphia, Pennsylvania. 963:1-491.

Craig, J. L. 1977. Invertebrate faunas of caves to be inundated by the Meramec Park Lake in eastern Missouri. National Speleological Society Bulletin 39:81-89.

Crawford, N. C. 1984. Sinkhole flooding associated with urban development upon karst terrain: Bowling Green, Kentucky. Pages 283-292. *In*: B. F. Beck (ed.). Sinkholes: Their Geology, Engineering and Environmental Impact. Proceedings of the First Multidisciplinary Conference on Sinkholes, Orlando, Florida. A. A. Balkema, Rotterdam, Netherlands. 429 pp.

Crawford, N. C. 1988. Karst ground water contamination from leaking underground storage tanks: Prevention, monitoring techniques, emergency response procedures, and aquifer restoration. Pages 213-226. *In*: Proceedings of the Second Conference on Environmental Problems in Karst Terranes and Their Solutions, Nashville, Tennessee. National Water Well Association, Dublin, Ohio. 441pp.

Crunkilton, R.. 1982. Bitter harvest. Missouri Conservationist 43:4-7.

Culver, D. C. 1982. Cave Life: Evolution and Ecology. Harvard University Press, Cambridge, Massachusetts. 185 pp.

Decu, V. G. 1984. A review of the terrestrial cavernicolous fauna of Romania. National Speleological Society Bulletin 45:86-97.

Dickson, G. W. and P. W. Kirk, Jr. 1976. Distribution of heterotrophic microorganisms in relation to detritivores in Virginia caves [with supplemental bibliography on cave mycology and microbiology]. Pages 205-226. *In*: B. C. Parker and M. K. Roane (eds.). The Distributional History of the Biota of the Southern Appalachians. Part IV. Algae and Fungi. University Press of Virginia. 416pp.

Drake, C. J. and R. F. Hussey. 1955. Concerning the genus *Microvelia* Westwood, with descriptions of two new species and a checklist of the American forms (Hemiptera: Veliidae). Florida Entomologist 38:95-115.

Dreesen, D. W., J. W. Sumner, J. Brown and D. T. Kemp. 1982. Intradermal use of human diploid cell vaccine for preexposure rabies immunizations. Journal of the American Veterinary Medical Association 181(12):1519-1523.

Dysart, B. C., III. 1985. Perspectives on nonpoint source pollution control: a conservation view. Pages 16-18. *In*: Perspectives in Nonpoint Source Pollution. Office of Water Regulations and Standards, United States Environmental Protection Agency, Washington, D.C. EPA 440/5-85-001.

Elliot, W. R. 1992. The Imported Red Fire Ant in Texas caves. 1992 National Speleological Society Convention. Grayhound Press, Plainfield, Indiana. Page 41. [Abstract]

Ferguson, L. M. 1981. Cave Diplura of the United States. Pages 11-12. In : B. F. Beck (ed.). Proceedings of the Eighth International Congress of Speleology, July 18-24, 1981. Volum 1. 400 pp.

Field, M. S. 1988. U. S. Environmental Protection Agency's Strategy for Ground Water Quality Monitoring at Hazardous Waste Land Disposal Facilities Located in Karst Terranes. Pages 1006-1011. *In* Karst Hydrogeology and Karst Environment Protection. IAH Twenty First Congress, 10-15 October 1988 , Guilin, China. 2 Volumes, 1261pp.

Field, M. S. 1989. The Vulnerability of Karst Aquifers to Chemical Contamination. Pages 130-142. *In*: Proceedings of the International Conference on Recent Advances in Ground-Water Hydrology. J. E. Moore, A. A. Zaporozec, S. C. Csallany and T. C. Varney (eds.). American Institute of Hydrology, Minneapolis, Minnesota. 602 pp.

Fischer, J. A., R. W. Greene, R. S. Ottoson and T. C. Graham. 1987. Planning and design in karst terrain. Pages 323-329. *In*: B. F. Beck and W. L. Wilson (eds.). Karst Hydrogeology: Engineering and Environmental Applications. Proceedings of the Second Multidisciplinary Conference on Sinkholes and the Environmental Impacts of Karst, Orlando, Florida. A. A. Balkema, Rotterdam, Netherlands. 429 pp.

Foster, D. G. 1992. Caves, Karst, and America's Schools. *In*: Abstracts of the Nineteenth Annual Natural Areas Conference, Bloomingtion, Indiana.

Foster, S. S. D. 1989. Diffuse Pollution of Ground Water by Agriculture- Lessons Learned and Future Prospects. Pages 185-194. *In*: Proceedings of the International Conference on Recent Advances in Ground-Water Hydrology. J. E. Moore, A. A. Zaporozec, S. C. Csallany, and T. C. Varney (eds.). American Institute of Hydrology, Minneapolis, Minnesota. 602 pp.

Franson, M. A. H. (Managing Editor). 1989. Standard Methods for the Examination of Water and Wastewater, 17th edition. American Public Health Association, American Water Works Association, Water Pollution Control Federation. American Public Health Association, Washington, D. C. pp.

Frasz, G. B. 1983. The land and the caves. National Speleological Society News. February. 72-76.

Gardner, J. E. 1984. An Introduction to the Inventory and Evaluation of Biological Cave Resources. 1984 National Cave Management Symposium, Rolla, Missouri. pp.

Gardner, J. E. 1986. Invertebrate fauna from Missouri caves and springs. Natural History. Series No. 3. Missouri Department of Conservation. 72 pp.

Gardner, J. E. 1991. Illinois Caves: A Unique Resource. Illinois Natural History Survey Bulletin 34(4):447-452.

Gates, G. E. 1959. Earthworms of North American caves. National Speleological Society Bulletin 21:77-84.

Gerba, C. P. 1988. Methods for virus sampling and analysis of ground water. Pages 343-348. *In*: D. M. Neilsen and A. I. Johnson (eds.). Ground-Water Contamination: Field Methods. American Society for Testing and Materials Special Technical Publication, Philadelphia, Pennsylvania. 963: 1-491.

Gill, F. B. 1989. Ornithology. W. H. Freeman and Company, New York. 660 pp.

Ginet, R. 1960. Ecologie, ethologie et biologie de *Niphargus* (Amphipodes Gammarides hypoges). Annales de Speleologie 15:1-254.

Gooch, J. C. and D. S. Glazier. 1991. Temporal and spatial patterns in mid-Appalachian springs. Memoirs of the Entomological Society of Canada 155:29-49.

Grabda, E. and J. Wierzbicka. 1969. The problem of parasitism of the species of the genus *Branchiobdella* Odier 1823. Polish Archives of Hydrobiology 16:93-104.

Guignot, F. 1955. Speologia africana. Dytiscidae et Gyrinidae captures dans les grottes de Guinee. Bulletin de l'Institut française d'Afrique Noire, Series A. 17:856-858.

Hallberg, G. R. 1986. Overview of agricultural chemicals in groundwater. Pages 1-63. *In*: Proceedings of Agricultural Impacts on Ground Water-A Conference, Omaha, Nebraska. National Water Well Association, Dublin, Ohio. 685 pp.

Hallberg, G. R., R. D. Libra and B. E. Hoyer. 1985. Nonpoint source contamination of ground water in karst-carbonate aquifers in Iowa. Pages 109-114. *In*: Perspectives in Nonpoint Source Pollution. Office of Water Regulations and Standards. U.S. Environmental Protection Agency, Washington, D.C. EPA 440/5-85-001.

Hamilton-Smith, E.. 1971. The classification of cavernicoles. National Speleological Society Bulletin 33:63-66.

Harris, S. E., Jr., and B. D. Allen. 1952. Caves of the Kinkaid limestone near Cobden, Illinois. Transactions of the Illinois Academy of Science 45:196-207.

Helling, C. S. 1986. Agricultural pesticides and ground water quality. Pages 161-175. *In*: Proceedings Agricultural Impacts on Ground Water -A- Conference, Omaha, Nebraska. National Water Well Association, Dublin, Ohio. 685 pp.

Henry, J.-P., J. J. Lewis and G. Magniez. 1986. Isopoda: Asellota: Aselloidea, Gnathostenetroidea, Stenetroidea. Pages 434-464. *In*: L. Botosaneanu (ed.). Stygofauna Mundi: a faunistic, distributional, and ecological synthesis of the world fauna inhabiting subterranean waters (including the marine interstitial). E. J. Brill, Leiden. 740 pp.

Herkert, J. R. (ed.) 1992. Endangered and Threatened Species of Illinois: Status and Distribution, Volume 2 - Animals. Illinois Endangered Species Protection Board, Springfield, Illinois. 142 pp.

Hill, J. E. and J. D. Smith. 1984. Bats: a Natural History. University of Texas Press, Austin. 243 pp.

Hobbs, H. H. III. 1975. Distribution of Indiana cavernicolous crayfishes and their ectocommensal ostracods. International Journal of Speleology 7:273-302.
Hobbs, S. L. and P. L. Smart. 1986. Characterization of carbonate aquifers: a conceptual base. Ninth International Congress of Speleology, Barcelona. Communications :43- 46.
Hoenstine, R. W., E. Lane, S. M. Spencer and T. O'Carroll. 1987. A landfill site in a karst environment, Madison County, Florida - A case study. Pages 253-258. *In*: B. F. Beck and W. L. Wilson (eds.). Karst Hydrogeology: Engineering and Environmental Applications. Proceedings of the Second Multidisciplinary Conference on Sinkholes and the Environmental Impacts of Karst, Orlando, Florida. A. A. Balkema, Rotterdam, Netherlands. 429 pp.
Holsinger, J. R. 1963. Annotated checklist of the macroscopic troglobites of Virginia with notes on their geographic distribution. National Speleological Society Bulletin 25:23-36.
Holsinger, J. R. 1965. Free living mites (Acarina) in caves of the eastern United States. National Speleological Society Bulletin 27:47-54.
Holsinger, J. R. 1966. A preliminary study of the effects of organic pollution of Banners Corner Cave, Virginia. International Journal of Speleology 2:75-89.
Holsinger, J. R. 1982. A preliminary report on the cave fauna of Burnsville Cove, Virginia. National Speleological Society Bulletin 44:98-101.
Holsinger, J. R. 1986. Holarctic crangonyctid amphipods. Pages 535-549 *In*: L. Botosaneanu (ed.). Stygofauna Mundi: a faunistic, distributional, and ecological synthesis of the world fauna inhabiting subterranean waters (including the marine interstitial). E. J. Brill, Leiden. 740 pp.
Holsinger, J R. 1988. Troglobites: The evolution of cave-dwelling organisms. American Scientist 76:147-153.
Holsinger, J. R. and D.C. Culver. 1988. The invertebrate cave fauna of Virginia and part of eastern Tennessee, zoogeography and ecology. Brimleyana 14:1-162.
Holsinger, J. R. and S. B. Peck. 1971. The invertebrate cave fauna of Georgia. National Speleological Society Bulletin 33:23-44.
Holt, P. C. 1963. A new branchiobdellid (Branchiobdellidae: Cambarincola). Journal of the Tennessee Academy of Sciences 38:97-100.
Howarth, F. 1981. The conservation of cave invertebrates. Pages 57-64. *In*: J. E. Mylroie (ed.). Proceedings of the First International Cave Management Symposium. Murray State University Press, Murray, Kentucky. pp.
Howarth, F. G. 1983. Ecology of cave arthropods. Annual Review of Entomology 28:365-389.
Hubricht, L. 1941. The cave Mollusca of the Ozark Region. Nautilus 54:111-112.
Illinois Pollution Control Board. 1990. 35 IL. Adm. Code 302. Implementing Section 13 and authorized by Section 27 of the Environmental Protection Act (Ill. Rev. Stat. 1987, ch 111 1/2 pars. 1013 and 1027).
Illinois Pollution Control Board. 1991. 35 IL. Adm. Code 620. Implemented and authorized by Section 8 of the Illinois Groundwater Protection Act (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 7451 et seq.).
Jenio, F. Jr. 1972. The *Gammarus* of Elm Spring, Union Co., Illinois (Amphipoda, Gammaridae). Unpublished Dissertation, Department of Zoology, Southern Illinois University at Carbondale. 181 pp.
Juberthie, C. 1969. Relations entre le climat, le microclimat et les *Aphaenops cerberus* dans la grotte de Sainte-Catherine (Ariege). Annales de Speleologie 24:75-104.
Kathman, R. D. and R. O. Brinkhurst. 1984. Some benthic invertebrates from Tennessee and Kentucky caves. Journal of the Tennessee Academy of Science 59:19-21.
Keller, T. A. 1992. The effect of the branchiobdellid annelid *Cambarincola fallax* on the growth rate and condition of the crayfish *Orconectes rusticus*. Journal of Freshwater Ecology 7(2):165-171.
Kenk, R. 1970. Freshwater triclads (Turbellaria) of North America. IV. The polypharyngeal species of *Phagocata*. Smithsonian Contributions in Zoology 80:1-17.
Kenk, R. 1972. Freshwater planarians (Turbellaria) of North America. Biota of freshwater Ecosystems, U.S. Environmental Protection Agency. Identification Manual No. 1. 81 pp.

Klemm, D. J. 1972. The leeches (Annelida, Hirudinea) of Michigan. Michigan Academy of Science 4:405-444.

Kochanov, W. E. 1988. The Inventory of Sinkholes and Related Karst Features in the Commonwealth of Pennsylvania, U.S.A. Pages 1163-1168. *In*: Karst Hydrogeology and Karst Environment Protection. IAH Twenty First Congress, 10-15 October 1988, Guilin, China. 2 Volumes, 1261pp.

Kurtz, D. A. and R. R. Parizek. 1986. Complexity of contaminant dispersal in a karst geological system. Pages 256-281. In: Evaluation of Pesticides in Groundwater, Symposium. Proceedings of the 189th Meeting of the Chemical Society, Miami Beach, Florida. Chemical Society, Washington, D. C. 573pp.

LaMoreaux, P. E. 1989. Legal Problems in Karst Terranes. Pages 453-457. *In*: Proceedings of the International Conference on Recent Advances in Ground-Water Hydrology. J. E. Moore, A. A. Zaporozec, S. C. Csallany and T. C. Varney (eds.). American Institute of Hydrology, Minneapolis, Minnesota. 602 pp.

Lewis, J. J. 1974. The invertebrate fauna of Mystery Cave, Perry County, Missouri. Missouri Speleology 14:1-19.

Lewis, J. J. 1982. Systematics of the troglobitic *Caecidotea* (Crustacea: Isopoda: Asellidae) of the Southern Interior Low Plateaus. Brimleyana 8:65-74.

Lewis, J. J. 1983. The obligatory subterranean invertebrates of glaciated southwestern Indiana. National Speleological Society Bulletin 35:34-40.

Lewis, J. J. and T. E. Bowman. 1981. The subterranean asellids (*Caecidotea*) of Illinois (Crustacea: Isopoda: Asellidae). Smithsonian Contributions to Zoology 335:1-66.

Liang, C. 1970. The soil microfungi of Burton Cave, Adams County, Illinois. Masters thesis, Western Illinois University, Macomb, Illinois. 45 pp.

Libra, R. D., G. R. Hallberg, B. E. Hoyer and L. G.Johnson. 1986. Agricultural impacts on ground water quality: The Big Spring basin study, Iowa. Pages 253-273. *In* Proceedings of the Agricultural Impacts on Ground Water - A Conference, Omaha, Nebraska. National Water Well Association, Dublin, Ohio. 685 pp.

Lisowski, E. A. 1979. Variation in body color and eye pigmentation of *Asellus brevicauda* Forbes (Isopoda: Asellidae) in a southern Illinois cave stream. National Speleological Society Bulletin 41:11-14.

Marusik, Y. M. and S. Kiponen. 1992. A review of Meta (Araneae, Tetragnathidae) with descriptions of two new species. Journal of Arachnology 20:137-143.

Mayer, F. L. and M. R. Ellersieck. 1986. Manual for acute toxicity: interpretation and database for 410 chemicals and 66 species of freshwater organisms. Resource Publication 160, USDA, Fish and Wildlife Service, Washington, D.C. 506pp.

McGregor, J. 1992. Bat Protection in Caves. *In*: Abstracts of the 19th Annual Natural Areas Conference, Bloomingtion, Indiana. p. 48.

Mitchem, P. S., G. R. Hallberg, B. E. Hoyer and R. D. Libra. 1988. Ground-water contamination and land management in the karst area of northeastern Iowa. Pages 442-458. *In*: D. M. Neilsen and A. I. Johnson (eds.). Ground-Water Contamination: Field Methods, American Society for Testing and Materials Special Technical Publication, Philadelphia, Pennsylvania. 963:1-491.

Moeschler, P., C. Romain and I. Muller. 1988. Microcrustaceans as Bioindicators in Karstic Aquifers: A Case Study in the Jura (Neuchatel, Switzerland). Pages 948-953 *In*: Karst Hydrogeology and Karst Environment Protection. IAH Twenty First Congress, 10-15 October 1988, Guilin, China. 2 Volumes, 1261pp.

Mohr, E. 1972. The status of threaten species of cave-dwelling bats. National Speleological Society Bulletin 34:33-47.

Mohr, C. E. and T. L. Poulson. 1966. The Life of the Cave. McGraw-Hill, New York, New York. 232 pp.

Moore, J E. 1988. Ground-Water Protection in the United States. Pages 1059-1063. *In*: Karst Hydrogeology and Karst Environment Protection. IAH Twenty First Congress, 10-15 October 1988 , Guilin, China. 2 Volumes, 1261pp.

Muck, J. A., and R. M. Newman. 1992. The Distribution of Amphipods in Southeastern Minnesota and Their Relation to Water Quality and Land Use. Journal of the Iowa Academy of Science 99(1):34-39.

Mullins, L. H. 1992. Cave Management by Prescription. *In*: Abstracts of the 19th Annual Natural Areas Conference, Bloomingtion, Indiana. p. 37.

Nelson, J. S. 1984. Fishes of the world. John Wiley & sons, New York. 2nd. edition. 523 pp.

Niederpruem, K.. 1992. "Big fuss being made over a little fish." Indianapolis Star, Indianapolis, Indiana. Sunday, August 23, 1992.

Nielsen, E. G.,and L. K. Lee. 1987. The magnitude and costs of groundwater contamination from agricultural chemicals: a national perspective. AGES870318. National Resources Economics Division, Economic Research Service, USDA, Washington, D.C. 54pp.

Northup, D. E. 1992. Biological Resources of Lechuguilla Cave: Is Protection Possible During Active Exploration?. *In:* Abstracts of the 19th Annual Natural Areas Conference, Bloomingtion, Indiana. p. 48.

Oliver, J. S. and R. W. Graham. 1988. Preliminary Inventory of Natural Resources in Select Caves in Illinois. Illinois State Museum, Springfield, Illinois. viii + 115 pp.

Padgett, A. and B. Smith. 1987. On Rope. North American vertical rope techniques. National Speleological Society, Huntsville, Alabama. 341 pp.

Palmer, A. N. 1984. Geomorphic interpretation of karst features. Pages 173-209. *In*: R. G. LaFleur (ed.). Groundwater as a geomorphic agent. Allen and Unwin, Boston, Massachusetts. 390pp.

Palmer, A. N. 1986. Prediction of contaminant paths in karst aquifers. Pages 32-53. *In*: Proceedings of the First Conference on Environmental Problems in Karst Terranes and Their Solutions, Bowling Green, Kentucky. National Water Well Association, Dublin, Ohio. pp..

Peck, S. B. 1973. A systematic revision and the evolutionary biology of the *Ptomophagus* (Adelops) beetles of North America (Coleoptera, Leiodidae; Catopinae), with emphasis on the cave-inhabiting species. Bulletin of the Museum of Comparative Zoology 145:26-162.

Peck, S. B. 1978. Stalactites and helictites of Marcasite, Galena, and Sphalerite in Illinois and Wisconsin. National Speleological Society Bulletin 41:27-30.

Peck, S. B. 1980. Climatic change and the evolution of cave invertebrates in the Grand Canyon, Arizona. National Speleological Society Bulletin 42:53-60.

Peck, S. B. 1988. A review of the cave fauna of Canada, and the composition and ecology of the invertebrate fauna of caves and mines in Ontario. Canadian Journal of Zoology 66:1197-1213.

Peck, S. B. and K. Christiansen. 1990. Evolution and zoogeography of the invertebrate cave faunas of the Driftless Area of the Upper Mississippi River Valley of Iowa, Minnesota, Wisconsin, and Illinois, U.S.A. Canadian Journal of Zoology 68:73-88.

Peck, S. B. and J. Kukalova-Peck. 1981. The subterranean fauna and conservation of Mona Island (Puerto Rico): A Caribbean karst environment. National Speleological Society Bulletin 43:59-68.

Peck, S. B. and J. J. Lewis. 1978. Zoogeography and evolution of the subterranean invertebrate fauna of Illinois and southeastern Missouri. National Speleological Society Bulletin 40:39-63.

Peck S. B. and D. R. Russell. 1976. Life history of the fungus gnat *Macrocera nobilis* in American caves (Diptera: Mycetophilidae). The Canadian Entomologist 108:1235-1241.

Poulson, T. L. 1978. Community organization. Pages 41-45. S. G. Wells (ed.). *In* Cave Research Foundation Annual Report. Yellow Springs, Ohio. pp.

Poulson, T. L. 1991. Assessing groundwater quality in caves using indices of biological integrity. Pages 495-511. *In*: Proceedings of the Third Conference on Hydrology, Ecology, Monitoring and Management of Groundwater in Karst Terranes, December 4-6, 1991, Nashville, Tennessee. pp.

Poulson, T. L. 1992. Detecting Anthropogenic Pollution in Aquatic Cave Communities. *In*: Abstracts of the 19th Annual Natural Areas Conference, Bloomingtion, Indiana. p. 48.

Poulson, T. L. and W. B. White. 1969. The cave environment. Science 165:971-981.

Pugsley, C. 1981. Management of a biological resource-Waitomo Glowworm Cave, New Zealand. Pages 489-492. *In*: B. F. Beck (ed.). Proceedings of the 8th International Congress on Speleology, Bowling Green, Kentucky, Vols 1 & 2. 820 pp.

Quinlan, James F. 1982. Groundwater Basin Delineation with Dye- Tracing, Potentiometric Surface Mapping, and Cave Mapping, Mammoth Cave Region, Kentucky, U.S.A. Beitrage Zur Biologie Der Schweiz - Hydrologie 28:177-189.

Quinlan, J. F. 1988. Protocol for reliable monitoring of groundwater quality in karst terranes. Pages 888-893. *In*: Y. Daoxian and X. Chaofan (eds.). Karst Hydrogeology and Karst Environmental Protection. Proceedings of the Twenty First Congress of the International Association of Hydrogeologists, Guilin, China. Geological Publishing House, Beijing, China. 705pp.

Quinlan, J. F. and E. C. Alexander. 1987. How often should samples be taken at relevant locations for reliable monitoring of pollutants from an agricultural, waste disposal, or spill site in a karst terrane? A first approximation. Pages 277-286. *In*: B. F. Beck and W. L. Wilson (eds.). Karst Hydrogeology: Engineering and Environmental Applications. Proceedings of the Second Multidisciplinary Conference on Sinkholes and the Environmental Impacts of Karst, Orlando, Florida. A. A. Balkema, Rotterdam, Netherlands. 429 pp.

Quinlan, J. F. and R. O. Ewers. 1984. Springs are more efficient and reliable than wells for monitoring ground water quality in most limestone terrains - a consequence of transport processes occurring in conduits. Pages 146-148. *In*: Proceedings of the Second International Conference on Ground-water Quality Research, Tulsa, Oklahoma. 222pp.

Quinlan, J. F. and R. O. Ewers. 1985. Ground water flow in limestone terranes: strategy, rationale and procedure for reliable, efficient monitoring of ground water quality in karst areas. Pages 197-234. *In*: Proceedings of the Fifth National Symposium and Exposition on Aquifer Restoration and Ground Water Monitoring, Columbus, Ohio. National Water Well Association, Worthington, Ohio. 750pp.

Quinlan, J. F. and R. O. Ewers. 1986. Reliable monitoring in karst terranes: it can be done, but not by an EPA-approved method. Ground Water Monitoring Review 6:4-6.

Rea, T. (ed.). 1987. Caving Basics. (Revised Edition). National Speleological Society, Huntsville, Alabama. 128 pp.

Reidinger, R. F., Jr. 1972. Factors influencing Arizona bat population levels. Ph.D. Dissertation, Arizona State University, Tucson, Arizona. 172 pp.

Reynolds, J.. 1959. A preliminary study of the ecology of some Benton County caves. Missouri Speleology 1:3-7.

Schultz, G. A. 1970. Descriptions of new subspecies of *Ligidium elrodii* (Packard) comb. nov. with notes on other isopod crustaceans from caves in North America. American Midland Naturalist 84:36-45.

Smart, P. L. and H. Friederich. 1987. Water movement and storage in the unsaturated zone of a Carboniferous limestone aquifer, Mendip Hills, England. Pages 59-87. *In*: Environmental Problems in Karst Terranes and Their Solution (Bowling Green, Kentucky), Proceedings. National Water Well Association, Dublin, Ohio. 525pp.

Smart, P. L. and S. L. Hobbs. 1986. Characterization of carbonate aquifers: a conceptual base. Pages 1-14. *In*: Proceedings of the First Conference on Environmental Problems in Karst Terranes and Their Solutions, Bowling Green, Kentucky. National Water Well Association, Dublin, Ohio. 441pp.

Smith, G. B. 1980. Biospeleology. Pages 121-129. *In*: J. M. James and H. J. Dyson (eds.). Caves and Karst of the Muller Range, Newton, NSW, Australia. A. T. Sutton. 150 pp.

Smith, P. W. 1961. The Amphibians and Reptiles of Illinois. Illinois Natural History Survey Bulletin 28(1):1-298.

Stock, J. H. 1986. Amphipoda: Gammarid Grouping (Gammaridae *S. Str. sensu* Bousfield). Pages 497-503. *In*: L. Botosaneanu (ed.). Stygofauna Mundi: a faunistic, distributional, and ecological synthesis of the world fauna inhabiting subterranean waters (including the marine interstitial). E. J. Brill, Leiden. 740 pp.

Steeves, H. R., III and A. J. Seidenberg. 1971. A new species of troglobitic Asellid from Illinois. American Midland Naturalist 85:231-234.
Sweeting, M. M. 1973. Karst Landforms. Columbia University Press, New York, New York. 362pp.
Taylor, S.. 1992. Southern Illinois Cavers Reach Two Agreements with Government Agencies in 1991. Crawlway Courier 26(1):10-11.
Thompson, C. A., R. D. Libra and G. R. Hallberg. 1986. Water quality related to ag-chemicals in alluvial aquifers in Iowa. Pages 224-242. *In* Proceedings of the Agricultural Impacts on Ground Water - A Conference, Omaha, Nebraska. National Water Well Association, Dublin, Ohio. 685 pp.
Thomson, K. C. and R. L. Taylor. 1991. The Art of Cave Mapping. Missouri Speleology 31(1-4):1-182.
U.S Environmental Protection Agency. 1983. Results of the Nationwide Urban Runoff Program, Volume 1 - Final Report. WH-554. Water Planning Division, US EPA, Washington, D.C. 200pp.
U. S Environmental Protection Agency. 1990. National pesticide survey: project summary.. USEPA, Washington, D.C. 11pp.
Vaughan, T. A. 1985. Mammalogy. Saunders College Publishing, Philadelphia. 3rd. edition. 576 pp.
Vineyard, J. D. 1992. Catalog of the caves of Missouri. Missouri Speleological Survey, Rolla, MO. pp.
Walker, R. D. 1985. Agricultural nonpoint source pollution in the Midwest. Pages 497-498. *In*: Perspectives in Nonpoint Source Pollution. Office of Water Regulations and Standards, USEPA, Washington, D.C. EPA 440/5-85-001.
Walton, M. and H. H. Hobbs, Jr. 1971. The distribution of certain entocytherid ostracods on their crayfish hosts. Proceedings of the Academy of Natural Sciences, Philadelphia 123:87-103.
Webb, D. W. 1993. Status survey for a cave amphipod, *Gammarus acherondytes*, Hubricht and Mackin (Crustacea: Amphipoda) in southern Illinois. Technical Report, Center for Biodiversity, Illinois Natural History Survey 1993(9):1-7.
Welbourn, W. C.. 1978. Biology of Ogle Cave with a list of the cave fauna of Slaughter Canyon. National Speleological Society Bulletin 40:27-34.
White, J.. 1991. Estimated potential ranges of endangered and threatened invertebrate animals in Illinois, excluding mussels. Unpublished report submitted to the Illinois Department of Conservation, Springfield. 11 pp. + appendix.
White, J. 1973. Preservation of Fogelpole Cave, Monroe County, Illinois. Unpublished report submitted to the Illinois Nature Preserves Commission, 49th INPC, Item 21. 10 pp.
White, W. B. 1988. Geomorphology and Hydrology of Karst Terrains. Oxford University Press, New York, New York. 464 pp.
Williams, P. W. 1985. Subcutaneous hydrology and the development of doline and cockpit karst. Zeitschrift fur Geomorphologie 29:463-482.
Williams, W. M., P. W. Holdren, D. W. Parson and M. N. Lorber. 1988. Pesticides in ground water data base: 1988 interim report. Office of Pesticide Programs, USEPA, Washington, D.C. One volume, various pagings.
Xiang, S., J. Chen, W. L.Wilson and B. F Beck. 1989. Sinkholes as a Consequence of Ground-Water Development in Karst Regions. Pages 160-173. J. E. Moore, A. A. Zaporozec, S. C. Csallany and T. C. Varney (eds.). *In*: Proceedings of the International Conference on Recent Advances in Ground-Water Hydrology, Tampa, Florida. American Institute of Hydrology, Minneapolis, Minnesota. 602 pp.
Yeatman, H. C. 1964. New cavernicolous cyclopoid copepod from Tennessee and Illinois. Journal of the Tennessee Academy of Science 39:95-98.

APPENDICES

Appendix A: Structure of the Cave Database.

Structure for database: C:CAVES.dbf

Field	Field Name	Type	Width	Dec
1	CAVENAME	Character	30	
2	CAVEID	Numeric	3	

A unique identification number for each cave/spring/etc. Different entrances to the same cave receive the same ID number. Magnitude of number is of no significance (i.e. Cave number 628 is not the 628th cave in the state.)

3 STATE Character 2
4 COUNTY Character 15
5 QUADRANGLE Character 15
Name of USGS 7.5 minute topographic quadrangle map on which cave is located.
6 TOWNSHIP Character 4
7 RANGE Character 4
8 QUARTERSEC Character 20
Quartersections of location of cave, from smallest (on left) to largest (on right).
9 SECTION Numeric 2
10 UTMEAST Character 7
Universal Transverse Mercatur location (in meters).
11 UTMNORTH Character 8
Universal Transverse Mercatur location (in meters).
12 LOCATION . Character 60
Verbal description of location.
13 OWNERACCES Character 38
Name of owner and information on access to cave.
14 OWNERINFO Memo 10
Address, Phone number or other information pertaining to owner.
15 GATE Logical 1
True if cave is gated (gates on roads to cave not included).
16 PERMIT Logical 1
True if a permit is required to visit the cave.
17 MAP Character 35
If there is a map of the cave, the location where it may be found.
18 ENTRANCE Character 15
Type of entrance: HILLSIDE, SINKHOLE, BLUFF, OTHER
19 ENTDISCRIP Memo 10
Verbal description of entrance area.
20 PASDISCRIP Memo 10
Verbal description of passages entered.
21 USEIMPACT Memo 10
Verbal description of use and impact of cave.
22 SPELEOTHEM Memo 10
Verbal description of the speleothems present in the passages entered.
23 HAZARDS Memo 10
Particular hazards in the cave.
24 COMMENTS Memo 10
General comments about the cave.
25 FEATURETYP Character 10
Type of feature: CAVE, SPRING, MINE, ROCKSHELTER, OTHER.
26 CAVEVISIT Logical 1
True if visited in the course of this study.

Appendix A (continued)

27 PRIORITY Numeric 1

Our ranking of how important it is for us to visit this site. Based on significance of cave, ownership, whether it has already been collected from before, quality of cave location, etc.

28 KARSTREGN Character 15

Karst region: SHAWNEE HILLS, SINKHOLE PLAIN, LINCOLN HILLS, DRIFTLESS AREA, OTHER.

29 PECKNLEWIS Numeric 1

1 if reported on in paper by Peck and Lewis (1978).

30 PECKNCHRIS Numeric 1

1 if reported on in paper by Peck and Christiansen (1990).

31 JIMGARNER Numeric 1

1 if collected by Jim Garner.

32 ISM Numeric 1

1 if collected by Illinois State Museum (Oliver and Graham 1988).

33 STEVENJEAN Numeric 1

1 if collected during present study.

34 OTHERCOLL Numeric 1

1 if collected by others or reported in another study (generally accompanied by some explanation in COMMENTS field).

** Total ** 364

Appendix B

CAVE DATA FORM

CAVE NAME_______________CAVE ID #_____COUNTY_____________

QUADRANGLE_____________________TWP__________RNG____________
(7.5' 15')

ENTRANCE____

DATE_____________WATER SAMPLE (Y : N) LOCATION______________

TIME IN__________OUT__________ UTM___________E ____________N

RESEARCHERS____

OWNERSHIP/ACCESS____

GATE (Y : N) PERMIT NEEDED (Y : N) MAP______________________

ENTRANCE__________________SINKHOLE - HILLSIDE - BLUFF - OTHER

OUTSIDE AIR TEMP__________ H_20 TEMP_________ ^{0}C *p*H_________

OUTSIDE WEATHER CONDITIONS_________________________________

ENTRANCE DESCRIPTION:

DESCRIPTION OF PASSAGES ENTERED:

DESCRIPTION OF USE AND IMPACT:

DESCRIPTION OF SPELEOTHEMS/CONDTIONS:

GENERAL COMMENTS:

MAJOR HAZARDS:

Appendix C: Structure of the Organism Database.

Structure for database: C:ORGANISM.dbf

Field	Field Name	Type	Width	Dec
1	CAVENAME	Character	30	
2	CAVEID	Numeric	3	

A unique identification number for each cave/spring/etc. Different entrances to the same cave receive the same ID number. Magnitude of number is of no significance (i.e. Cave number 628 is not the 628th cave in the state.)

Field	Field Name	Type	Width	Dec
3	STATE	Character	2	
4	COUNTY	Character	15	
5	DATE	Date	8	

Collection date.

6 VIALNUMBER Numeric 2

Field vial number which specimen was collected into.

7 SPECNUMBER Numeric 6

Unique identification number for each specimen.

Field	Field Name	Type	Width	Dec
8	PHYLUM	Character	25	
9	CLASS	Character	25	
10	ORDER	Character	25	
11	FAMILY	Character	25	
12	GENUS	Character	25	
13	SPECIES	Character	25	

This field actually contains the specific epithet, not the whole species name (genus + specific epithet).

14 LIFESTAGE Character 15

Larva, Nymph, Pupa, Adult, etc.

15 HAB_ASSOC1 Character 80

Detailed information on the microhabitat in which specimen was collected.

16 HAB_ASSOC2 Character 80

Same as HAB_ASSOC1, used as needed.

17 CAVEZONE Character 8

Entrance, Twilight, Dark (Dark actually = Middle Zone + Dark Zone).

18 ZONEAIR Numeric 4 1

Air temperature in degrees celsius for the zone in which the specimen was collected.

19 ZONEWATER Numeric 4 1

Water temperature in degrees celsius for the zone in which the specimen was collected.

20 SURFWEATH Character 50

Outside weather conditions at time of cave visit.

21 SENTTO Character 30

Person or institution to which specimens were sent for specific determination.

22 IDENTBY Character 30

Person making the most specific determination thus far for the specimen.

23 CURRENTLOC Character 30

Current location of the specimen (, INHS, specialists collection, etc.)

24 GENCOMMENT Character 80

General comments.

** Total ** 628