In 1978 S.B. Peck and J.J. Lewis presented the first comprehensive list of subterranean invertebrates in Illinois. This list was the result of fieldwork done by Peck from 1966-1968, and Lewis from 1972-1976. In 1976 Lewis’ work for the Illinois Natural Areas Inventory recommended several caves from the western Illinois “sinkhole plain karst” (SHPK) for conservation. This eventually became a reality with the creation of Fogelpole Cave and Stemler Cave nature preserves, the Armin Krueger Speleological Preserve, and Illinois Caverns State Natural Area. Despite these efforts, progressive urbanization of the SHPK due to the proximity of St. Louis, Missouri, was having an increasing impact on the caves and subterranean fauna of the area. With the growth in human population, groundwater contamination had become a growing reality, leading to several projects to define the kinds, sources and spatial relationships of groundwater contamination in the western Illinois karst (Panno et al. 1996, 1997, 1998, 1999; Taylor et al. 2000). Extensive dye tracing was also conducted to delineate the recharge areas of springs in the area (Aley & Aley 1998; Aley et al. 1999).

Much attention was drawn to the SHPK by the listing of the Illinois cave amphipod, _Gammarus acherondytes_, as an endangered species. Webb’s (1995) report on the status of this unique amphipod, the only troglobitic species of _Gammarus_ currently described in North America, became the foundation for its listing in 1998. We suspected that some other troglobitic species were present, but yet undetected in the area, and that others known to be present were more widespread than had been demonstrated, possibly including _Gammarus acherondytes_. In 1998 The Nature Conservancy initiated a bioinventory project to gather more data on the status of cave invertebrates in Monroe and St. Clair counties (Lewis et al. 1999). The goal of this paper is to present the results of this bioinventory to support cave and karst conservation efforts in Illinois.

**PROJECT AREA**

The SHPK (Fig. 1) consists of an area of the Salem Plateau section of the Ozark Plateau physiographic province isolated through dissection by the Mississippi River, which left this island of karst east of the river (Willman et al. 1975). In St. Clair and Monroe counties, just southeast of St. Louis, a well developed karst is present with three somewhat distinct sub-units. These are the: (1) Columbia, (2) Waterloo, and (3) Renault karst areas.

The Columbia karst is the most isolated, with the separation visible on topographic maps as a swath of land devoid of sinkholes. This area coincides with the Waterloo-Dupo Anticline. Stemler Cave as well as dozens of smaller caves occur in this area just to the northeast of Columbia.

The Waterloo karst area includes the Pautler Cave System (includes the recently connected Pautler and Danes caves, with 8.3 kilometers of mapped passage) that resurges via Icebox...
CONSERVATION FOCUSED INVENTORY OF SUBTERRANEAN INVERTEBRATES OF THE SOUTHWESTERN ILLINOIS KARST

Cave at the Camp Vandeventer boy scout camp. The Renault karst area encompasses Fogelpole Cave (the longest cave known in Illinois with 24 kilometers of passages mapped), Krueger-Dry Run/Spider/Kelly Spring Cave System (8 kilometers), and Illinois Caverns (8.6 kilometers). Several of these sites were discussed by Bretz and Harris (1961).

FIELD WORK: METHODS

The following list presents collection records from a total of 71 sites, including 39 caves, 20 springs, 5 wells, 4 karst windows and 3 drain tiles (approximate locations are provided in Figure 1). The sampling was conducted between 20 June 1998 and 7 July 1999. The sites were sampled as appropriate using hand collecting, limburger cheese-baited pitfall traps, Berlese extraction of leaf litter, plankton netting of aquatic habitats, and placement of shrimp-baited jar traps in deep water habitats. The collected material was deposited in the institutional collections of the taxonomists identifying the specimens.

ANNOTATED LIST OF FAUNA

For each species the following list provides scientific name and author, ecological classification, common name for species of conservation interest (obligate subterranean species or species of high global rarity), localities and a suggested state and global rank of rarity (S and G-ranks, respectively). The basis for these ranks is the number of sites from which the species is known (Table 2). The definition of element (species) occurrence must be determined for each animal since barriers to dispersal differ from species to species. Thus, for *Ergodesmus remingtoni*, three sites that are physically separated to human entry (e.g., Danes, Pautler & Icebox caves) are easily connect-

Figure 1. Key to Sampling Locations in the Sinkhole Plain:

1 Couchs Cave; 2 Jacobs Cave; 3 Wannabe Karst Window Cave; 4 Salt peter Cave; 5 Wandas Waterfall Cave; 6 Juelfs Cave; 7 Fogelpole Cave; 8 Myrons Misery Cave and Bat Sump Cave; 11 Collier Spring and Karst Window; 12 Frees Well; 13 Walsh Seep; 14 Walsh Spring; 15 Walsh Cave; 16 Kelly Spring Cave (Dual Pit); 17 Illinois Caverns; 18 Spider Cave; 19 Metter Cave; 20 Madonnaille Cave; 21 Vöelker Well; 22 Belle Fontaine; 23 Danes Cave, Danes Annex Cave, and Dirks Cave; 26 Cedar Ridge Cave; 27 Rose Hole; 28 Pautler Cave; 29 Wednesday Cave; 30 Frog Cave; 31 Trout Hollow Spring; 32 Bicklein Cave; 33-38 Camp Vandeventer karst window, Camp Vandeventer Cave = Ice Box Cave, Camp Vandeventer Spring, Connecting Crevice Cave, Hidden Hand Cave, Little Cave, and Fountain Creek pump-well; 40 Antler Cave; 41 Two Row Cave and Antler Cave; 42 Bat Love Cave; 43 Andy's Run Cave; 44 Maya Spring; 45 Schipps Well; 46 Terry Spring; 47 Haney Spring; 48 Browns Cave II; 49 Dashed Hopes Pit; 50-52 Stemler well, Stemler Cave, Stemler Cave (Harres Pit); 53 Spring Valley Spring; 54 WH Spring and Karst Window; 55 Falling Springs; 56 Sparrow Spring; 57 Imbs Station Road Spring; 58 Pipe Spring; 59 Cement Hollow Spring; 60 drain tile.

Note: a bold number corresponds to multiple sampling locations on the figure.
ed by the millipedes and thus considered a single element occurrence. After occurrences are determined the rank can be modified accordingly if the biotic potential (frequency of reproduction, number of offspring, life span) of the species is particularly high or low. Another common reason for modification of a ranking occurs with analysis of threats, such as loss of known populations due to environmental degradation (e.g., *Gammarus acherondytes*). Animals like the Illinois cave amphipod, with a very restricted range, are more sensitive to localized threats and are afforded a lower ranking. For a few species endemic to the southwestern Illinois karst all of the known sites are listed and the S/G ranks are apparent. For the other more widespread taxa listed, the rank was suggested based on the opinion of the taxonomists identifying the material (including their knowledge of unpublished records) and published sources. In the final analysis ranking remains somewhat subjective and conservation oriented agencies typically develop criteria for ranking based on criteria beyond the scope of this paper. A detailed discussion of ranking criteria is presented by Stein et al. (2000).

After the S/G rank a brief narrative is given to present range or occurrence information for each species and citations as deemed appropriate. G5 species are so widespread as to require no further information. Important sources by which S/G ranks could be evaluated were the Illinois cave bioinventories of Peck and Lewis (1978) and Webb et al. (1994). Also used were the checklists for cave faunas of Kentucky (Barr 1967), Indiana (Lewis 1983, 1998), Missouri (Gardner 1986), and the Driftless area (Peck & Christiansen 1990). In the interest of conservation of space a telegraphic style has been used in many cases to convey habitat and range information. Much of the information on species of lesser conservation interest has been placed in Table 3.

### Table 1. The ecological classification of cavernicoles as defined by Barr (1963, 1968) and Peck and Lewis (1978):

<table>
<thead>
<tr>
<th>Classification</th>
<th>Abbreviation</th>
<th>Brief definition</th>
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<tbody>
<tr>
<td>troglobite</td>
<td>TB</td>
<td>obligate cavernicoles, live/reproduce only in caves</td>
</tr>
<tr>
<td>troglophile</td>
<td>TP</td>
<td>facultative cavernicoles, may live/reproduce in caves</td>
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<tr>
<td>trogloxene</td>
<td>TX</td>
<td>cave &quot;visitors&quot;, must leave the cave at some point in life cycle</td>
</tr>
<tr>
<td>accidental</td>
<td>AC</td>
<td>enter caves only by accident</td>
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<tr>
<td>edaphobite</td>
<td>ED</td>
<td>soil inhabitant that may occur in caves</td>
</tr>
<tr>
<td>phreatobite</td>
<td>PB</td>
<td>groundwater animal that may occur in caves</td>
</tr>
<tr>
<td>parasite/commensal</td>
<td>PS</td>
<td>an organism that lives obligately in/on another</td>
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</table>

### Table 2. Element occurrence criteria for assigning state and global rarity rankings

<table>
<thead>
<tr>
<th>Rank</th>
<th>Criteria</th>
<th>Description</th>
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<tbody>
<tr>
<td>S1 – G1</td>
<td>&lt;5 localities in Illinois / globally</td>
<td>critically imperiled</td>
</tr>
<tr>
<td>S2 – G2</td>
<td>6-20 localities in Illinois / globally</td>
<td>imperiled</td>
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<tr>
<td>S3 – G3</td>
<td>21-100 localities in Illinois / globally</td>
<td>vulnerable</td>
</tr>
<tr>
<td>S4 – G4</td>
<td>&gt;100 localities in Illinois / globally</td>
<td>apparently secure</td>
</tr>
<tr>
<td>S5 – G5</td>
<td>widespread and common from many localities</td>
<td>secure</td>
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<tr>
<td>SE</td>
<td>exotic (introduced) species</td>
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</tbody>
</table>

3.

### PHYLUM PLATYHELMINTHES

**CLASS TURBELLARIA**

**ORDER TRICLADIDA**

*Sphalloplana hubrichti* (Hyman) TB Hubricht’s cave flatworm

**FAMILY KENKIIDAE**

**PHYLUM MOLLUSCA**

**CLASS GASTROPODA**

**ORDER NEOTAENIOGLOSSA**

*Fontigens antroecetes* (Hubricht) TB Eastern Ozark cave snail

**ORDER MESOGASTROPODA**

*Pomatiopsis lapidaria* (Say) TX

**ORDER BASOMMATOPHORA**

**FAMILY CARYCHIIDAE**

*Carychium mexicanum* Pilsbry TX Southern thorn snail

**FAMILY POMATIOPSIDAE**

*Pomatiopsis lapidaria* (Say) TX

**ST. CLAIR CO.**


**ORDER MESOASTROPODA**

**FAMILY POMATIOPSIDAE**

*Pomatiopsis lapidaria* (Say) TX

**ST. CLAIR CO.**

**S/G-rank: S1/G1;** Hershler et al. (1990) from St. Louis Cavern (type-locality), Cliff Cave, St. Louis Co. and 7 caves in Perry Co., Missouri. Of the Perry Co. sites, only three cave systems are actually involved and two of the sites (Mertz and Schindler caves) are synonyms. The continued presence of the snail in Cliff Cave, in suburban St. Louis is unknown. The population in the type-locality remains extant, but is threatened by pollution from septic systems in subdivisions surrounding St. Clair Cave.

**ORDER MESOGASTROPODA**

**FAMILY POMATIOPSIDAE**

*Pomatiopsis lapidaria* (Say) TX

**ST. CLAIR CO.**


**ORDER BASOMMATOPHORA**

**FAMILY CARYCHIIDAE**

*Carychium mexicanum* Pilsbry TX Southern thorn snail

**ST. CLAIR CO.**

**S/G-rank: S1/G4;** Moist litter of entrance pits, the first Illinois record and a significant range extension; otherwise occurs in the gulf coast states and eastern Mexico (Hubricht 1985).
### Table 3.
Localities for species of lesser conservation interest.

<p>| Order               | Family          | Taxon                                | Ecological Classification | Rank | County       | County       | County       | County       | County       | County       | County       | County       |
|---------------------|-----------------|--------------------------------------|---------------------------|------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| <strong>PHYLM PLATHYHELMINTHES</strong> |                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| CLASS TUBEBULARIA   |                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| TRICLADIA          | PLANARIIDAE     | Phagocata gracilis (Haideman)        | TX/TP                     | S5/G5|              |              |              |              |              |              |              |              |
| <strong>PHYLM MOLLUSCA</strong>  |                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| PULMONATA           | PHYSIDAE        | Physella sp. (weat halot)            | TP/TPB                    | ?    | L            | L            | L            |              |              |              |              |              |
| MESOGASTROPODA     | POMATOPSIDAE    | Pomatopyxis spiculosa (Say)          | TX                         | S5/G5|              |              |              |              |              |              |              |              |
| BANOMMATOPHORA     | CARYIIDAE       | Carychiodes leei (Lea)               | TX                         | S5/G5|              |              |              |              |              |              |              |              |
| STYLOMATOPHORA     | PUPILLIDAE      | Pseudosulida variabilis (Adams)      | TX                         | S5/G5|              |              |              |              |              |              |              |              |
| ISPUMINATA          | GASTROPODA      | Gastroscopia armifera (Say)          | TX                         | S5/G5|              |              |              |              |              |              |              |              |
| HELICIDAE           | HELICIDAE       | Helicostoma sp. (Pisby)              | TX                         | S4/G4|              |              |              |              |              |              |              |              |
| LIMACIDAE           | LIMACIDAE       | Columbella sp. (Muller)              | TX                         | S5/G5|              |              |              |              |              |              |              |              |
| ZONITIDAE           | ZONITIDAE       | Zonitoides sp. (Say)                 | TX                         | S5/G5|              |              |              |              |              |              |              |              |
| POLYGYREIDAE        | POLYGYREIDAE    | Polycelidae sp. (Say)                | TP                         | S5/G5| L            | L            |              |              |              |              |              |              |
| MICROGHYRA         | MICROGHYRA      | Mesodon clausus (Say)                | TX                         | S5/G5|              |              |              |              |              |              |              |              |
| TROCHIIDAE          | TROCHIIDAE      | Tylotrochus sp. (Kiefer)             | TX                         | S5/G5|              |              |              |              |              |              |              |              |
| <strong>PHYLM ARTHIPODOA</strong>|                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| CLASS CRUSTACEA     |                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| EUACIENCEA          |                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| SUBORDER CICLOPODA  |                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| CYCLOPIDA          | Acanthocyclops brevispinus (Herrick) | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Acanthocyclops robustus (Sars)       | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Acanthocyclops vermis (Fischier)     | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Acanthocyclops littoralis Petkovskii | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Eucyclops elegis (Koch)               | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Macroscyllus albidus (Jurine)         | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Mesocypris edeni (Forbes)             | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Microscyllus bembiculatus (Liljeborg) | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Orthocyclops modestus (Herrick)      | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYCLOPIDAE         | Tropocyclops prasinus mexicanus Kiefer | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| <strong>SUBORDER HARPACTOCDOA</strong> |             |                                      |                           |      |              |              |              |              |              |              |              |              |
| CANTHOCAMPIDAE     | Attelopus nordskoldi (Liljeborg)      | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| ISOPODA            |                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| <strong>SUBORDER ONISOPODA</strong> |             |                                      |                           |      |              |              |              |              |              |              |              |              |
| AMARILIIDAE        | Armatilum nascim. Buddle-Land         | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYLINDRIDA         | Cylindroscylops conifer (Deevey)      | TX/TP                      | S5/G5| L            |              |              |              |              |              |              |              |              |
| CYLINDRIDA         | Haplotothamnus dolius Buddle-Lande     | TX/TP                      | S5/G5| L            |              |              |              |              |              |              |              |              |
| <strong>SUBORDER ASELLOTA</strong> |             |                                      |                           |      |              |              |              |              |              |              |              |              |
| ASELLIDAE          | Caecidotea brevicauda (Forbes)        | TP/TP                      | S4/G5| L            | L            | L            | L            | L            |              |              |              |              |
| AMPHIPODA          | CRANGONIDAE     | Crangonon forbesi Hutchins &amp; Mackin | TP                         | S4/G5| L            | L            | L            | L            |              |              |              |              |
| GAMMARIDAE         | Gammarus pseudonicolai Mackinfield    | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| ARACHNIDA          |                 |                                      |                           |      |              |              |              |              |              |              |              |              |
| PSEUDOSCLORIDAE    | NEBESIDAE       | Microbranum parvulum (Banks)         | TX                         | S5/G3| L            |              |              |              |              |              |              |              |
| ARANEAE            | IXODIDAE        | Dermacentor variabilis (Say)         | PS                         | S5/G3| L            |              |              |              |              |              |              |              |
| AGELINIDAE         | Tegenaria domestica (Clerck)           | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| Linyphiidae        | Bathyphantes pallida (Banks)           | TX/TP                      | S4/G5| L            |              |              |              |              |              |              |              |              |
| Linyphiidae        | Centromerus corniger (O.P.-Cambridge)  | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| Linyphiidae        | Eperigone maculata (Banks)             | TX/TP                      | S5/G5| L            |              |              |              |              |              |              |              |              |
| Linyphiidae        | Eperigone tridentata (Evers)           | TX                         | S5/G3| L            |              |              |              |              |              |              |              |              |
| Linyphiidae        | Linyphia (Nirntae) radiata (Walckenaer) | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| Lycosidae          | Pirata sedenarius Montgomery           | TX                         | S5/G3| L            | L            |              |              |              |              |              |              |              |
| Lycosidae          | Scytodes concinnata (Hentz)            | TX                         | S4/G4| L            |              |              |              |              |              |              |              |              |
| Lycosidae          | Sycites subtilis Evers (Say)           | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| Nebraska            | Edmonella pallida Evers (Say)          | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| Nebraska            | Plocas phalamgoides Foulds (Say)       | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |
| Nebraska            | Dolomedes scriptus Hentz (Say)         | TX                         | S4/G5| L            |              |              |              |              |              |              |              |              |
| Nebraska            | Meta ovalis (Gerttsch)                  | TX/TP                      | S5/G5| L            |              |              |              |              |              |              |              |              |
| Nebraska            | Tetragnatha aestrata (Hentz)            | TX                         | S4/G4| L            |              |              |              |              |              |              |              |              |
| Nebraska            | Achniargesus ocellatus (Hentz)          | TX                         | S5/G5| L            |              |              |              |              |              |              |              |              |</p>
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**Table 3 (cont.)**

Localities for species of lesser conservation interest.

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CONSERVATION FOCUSED INVENTORY OF SUBTERRANEAN INVERTEBRATES OF THE SOUTHWESTERN ILLINOIS KARST

Carychi um nannodes Clapp TX File thorn snail
Monroe Co.: Metter Cave.
S/G-rank: S1/G4; Only Illinois record; otherwise of Appalachian distribution (Hubricht 1985).

Carychi um riparium Hubricht TX Floodplain thorn snail
Monroe Co.: Danes Annex, Dirks, Fogelpole, Frog, Metter and Pautler caves; St. Clair Co.: Dashed Hopes Pit.
S/G-rank: S2/G3; Only Illinois records. Moist leaf litter of sinkhole floors, pits, and the twilight zone of these caves.
ORDER STYLOMMATOPHORA
FAMILY PUPILLIDAE
Gastrocopta abbreviata (S terki) TX Plains maggletooth snail
Monroe Co.: Fogelpole Cave; St. Clair Co.: Stemler Cave.
S/G-rank: S2/G3; Calciphile from over a dozen states in the central U.S. from the gulf coastal area to Wisconsin and North Dakota, including three sites in Illinois (Hubricht 1985).

Gastrocopta similis (S terki) TX
Monroe Co.: Rose Hole; St. Clair Co.: Stemler Cave.

FAMILY STROBILOPSISIDAE
Strobilops affinis Pilsbry TX Eightfold pinecone snail
St. Clair Co.: Stemler Cave.
S/G-rank: S2/G3; Leaf litter, Massachusetts west to Illinois and eastern Missouri, but known from relatively few localities (Hubricht 1985).

FAMILY PHILOMYCIDAE
Philomyxus togatus (Gould) TX Toga mantleslug
Monroe Co.: Cedar Ridge Cave.
S/G-rank: S1/G4; Only known Illinois population and a large range extension of this Appalachian species, unknown from the intervening area of Indiana and western Ohio (Hubricht 1985).

FAMILY HELICODISCIDAE
Helicodiscus notius notius H ubricht TX Tight coil snail
Monroe Co.: Fogelpole Cave.
S/G-rank: S2/G4; Leaf litter on hillsides and ravines, common trogloxene, many sites in the southeastern U.S., including southwestern Illinois (Hubricht 1985); reported by Gardner (1986) from six Missouri caves.

Helicodiscus undescribed species TP/ TX Undescribed terrestrial snail
Monroe Co.: Bat Love and Pautler cave, Rose Hole; St. Clair Co.: Stemler Cave.
S/G-rank: S1/G1; Resembles a hypertrophied Helicodiscus parallellus (Say), related to H. eidenmanni, a facultative cavernicole in Texas (Hubricht 1985, Grimm in litt. 1999).

FAMILY ZONITIDAE
Glypha nina latelbricola Hubricht TX Stone glyph snail
St. Clair Co.: Stemler Cave.
S/G-rank: S1/G2; Only Illinois record, the only published record is from northeastern Alabama (Hubricht 1985); Lewis (1998) found the snail in a cave in Orange County, Indiana.

Glypha nina luticola Hubricht TX Furrowed glyph snail
Monroe Co.: Metter, Pautler and Wednesday caves; St. Clair Co.: Dashed Hopes Pit, Stemler Cave.

Paravitrea undescribed species TX Undescribed terrestrial snail
St. Clair Co.: Stemler Cave.
S/G-rank: S1/G1; Only known locality for this undescribed species.

Paravitrea undescribed species TX Undescribed terrestrial snail
Monroe Co.: Wednesday Cave.
S/G-rank: S1/G1; Only known locality for this undescribed species, which is distinct from the above species from Stemler Cave.

Vestrisiens intertextus (B inny) TX Pyramid done snail
Monroe Co.: Danes Annex Cave.
S/G-rank: S1/G4; Only known Illinois record, a significant range extension to the west, mostly occurs in a band paralleling the Appalachians and extending south to Louisiana, frequently found in acidic habitats (Hubricht 1985).

Zonitoides nitidus (M uller) TX
Monroe Co.: Dirks, Pautler and Wednesday caves.
S/G-rank: S2/G5; Holartic, reported from the northern tier of counties in Illinois (Hubricht 1985).

FAMILY POLYGYRIDAE
Xolotrema denotata (Ferrussac) TX Velvet wedge snail
Monroe Co.: Danes Cave.
S/G-rank: S1/G4; Appalachians, west to three reported sites in southeastern Illinois (counties along the Wabash River), west to eastern Arkansas; previously unknown from other parts of Illinois (Hubricht 1985).

PHYLUM ARTHROPODA
CLASS CRUSTACEA
ORDER AMPHIPODA

FAMILY CRANGONYCTIDAE
Bactrurus brachycaudus Hubricht & Mackin TB Eastern Ozark cave amphipod
Monroe Co.: Fogelpole, Icebox, Juelfs, Pautler, Terry Spring and unnamed near Warburg caves, Illinois Caverns (Peck & Lewis 1978), Andys Run, Antler, Danes, Frog and Jacobs caves, Rose Hole, near Valmeyer, Walsh Seep, St. Clair Co.: Stemler Cave and spring near Falling Spring (Peck & Lewis 1978), Dashed Hopes Pit Cave, Cement Hollow, Imbs Station Road and pipe spring (Cement Hollow) springs, Chipps Well.


Stygobromus subtilis (H ubricht) TB/PB Western Illinois groundwater amphipod
Monroe Co.: Saltipeter Cave (Peck & Lewis 1978).
S/G-rank: S2/G2; Found in drip pools in Saltipeter Cave, otherwise reported from eight caves and seeps in Illinois, one cave in Missouri (Peck & Lewis 1978).

FAMILY GAMMARIDAE
Gammarras acheronphyes Hubricht & Mackin TB Illinois cave amphipod

S/G-rank: S1/G1; Endemic to the karst of Monroe and St. Clair counties, previously known populations were summarized by Webb et al. (1998), now known extant in six drainage conduits: (1) Fogelpole, (2) Illinois Caverns, (3) Krueger-Dry Run (including Spider Cave), (4) Pautler/Danes/Rose Hole, (5) Frog Cave, (6) Annbriar (Wednesday Cave and possibly Cedar Ridge Cave). In addition to the 10 cave populations in these six drainages, a single specimen was taken in Madisonville Cave (in 1986), but a collection from the cave in 1995 failed to demonstrate its presence (Webb 1995). A collection in Stemler Cave likewise failed to demonstrate its presence (Webb 1995). The amphipod was not found in Stemler Cave during sampling for this project nor in community censusing in the main stream passage.

Gammarras minus Say TX
Monroe Co.: Andys Run, Juelfs and Madisonville caves (Webb 1995).
This species was reported by Chamberlin and Ivie (1940) only from the type-locality in New York (Millidge 1987). The S/G-ranks are probably inflated since the range is wide. Reported by Chamberlin and Ivie (1940) from about 20 localities in Illinois, eastern Missouri, southern Wisconsin, eastern Iowa and southern Minnesota (Shear 1971). Surface populations were reported in the northern part of the range, in the southern part of its range limited almost, or entirely, to caves. At Metter and Danes Annex caves the millipeds were taken from sinkhole floors (i.e., sheltered epigean habitat).

Antriadesmus argentea (Hoffman 1999), a synonym of Chaetaspis argentea (Hoffman 1999), from Pautler Cave. Additional females were taken in the above caves during this project. The original collection was identified by Dr. N. Causey from females, but the cave lies within the range of Chaetaspis albus (Hoffman 1999) and a male specimen will be necessary to determine the identity of the species. Chaetaspis contains three troglobitic (or perhaps edaphic) species from Tennessee and Kentucky, with a fourth being described from Tumbling Creek Cave, Missouri (Lewis in progress 2002a).

ORDER CHORDEUMATIDA
FAMILY CONOTYLLIDAE
Austrotylus sp. (Loomis) SP Eastern Ozark cave milliped

Monroe Co.: Pautler Cave (Peck & Lewis 1978), Danes Cave, Rose Hole. S/G-rank: S1/G1; Peck and Lewis (1978) reported juveniles of an undescribed species of Antriadesmus, a synonym of Chaetaspis (Hoffman 1999), from Pautler Cave. Additional females were taken in the above caves during this project. The original collection was identified by Dr. N. Causey from females, but the cave lies within the range of Chaetaspis albus (Hoffman 1999) and a male specimen will be necessary to determine the identity of the species. Chaetaspis contains three troglobitic (or perhaps edaphic) species from Tennessee and Kentucky, with a fourth being described from Tumbling Creek Cave, Missouri (Lewis in progress 2002a).

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FAMILY CONOTYLLIDAE
Pseudosinella undescribed species near argentea TB Undescribed cave springtail

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Onychiurus reluctus are either troglobitic or edaphic, are very uncommon, fragile, and usually represented in collections by very few specimens.

**FAMILY ONYCHIURIDAE**

Onychiurus reluctus Christiansen TP Glistening springtail

Monroe Co.: Bat Sump, Fogelpole, Hidden Hand and Saltpeter caves; St. Clair Co.: Stemler Cave.

*S/G-rank: S3/G3; Widespread in caves, few reports of surface populations (Christiansen 1982), reported from about two dozen caves in Missouri (Gardner 1986) and several in Indiana (Lewis 1998).*

**Onychiurus** undescribed species TB Undescribed cave springtail

Monroe Co.: Bat Love, Fogelpole, Frog and Icebox caves.

*S/G-rank: S1/G1; Known only from these caves. This genus contains numerous undescribed species (Christiansen, in litt. 2000).*

**FAMILY SMINTHURIDAE**

Arrhopalites carolynae Christiansen & Bellinger TB Carolyn’s cave springtail

Monroe Co.: Hidden Hand and Saltpeter caves.

*S/G-rank: S1/G2; Only Illinois records, known from seven caves in Virginia (Christiansen & Bellinger 1996b, 1998d) and one in Indiana (Lewis 2002b in progress).*

**Arrhopalites** undescribed species TB Undescribed cave springtail

Monroe Co.: Frog, Hidden Hand, Jacobs, Madonnaville and Pautler caves, Rose Hole.

*S/G-rank: S2/G2; Riparian habitats, known only from the above caves.*

**Arrhopalites atro Cavernicola** Christiansen & Bellinger TB Black Medusa cave springtail

Monroe Co.: Bicklein, Danes and Fogelpole caves.

*S/G-rank: S1/G2; Known from 5 caves in southern Indiana (Lewis 1998, Christiansen & Bellinger 1998d). The morphology of the specimens from Illinois is slightly different, tentatively regarded as geographic variation (Christiansen, pers. comm. 2000).*

**Arrhopalites hirtus** Christiansen & Bellinger TB ED Hairy cave springtail

Monroe Co.: Fogelpole and Little caves.

*S/G-rank: S1/G2; Christiansen (1966) from a drain tile in Union Co., Illinois, as well as caves in Iowa, Wisconsin and Ohio.*

**Arrhopalites lewisi** Christiansen & Bellinger TB Lewis’ cave springtail

Monroe Co.: Icebox Cave.

*S/G-rank: S1/G2; Only Illinois record, known from caves in southern Indiana (Lewis 1998, Christiansen & Bellinger 1998d).*

**Arrhopalites whitesidei Jacot TP Whiteside’s springtail**

Monroe Co.: Saltpeter Cave (Peck & Lewis 1978).

*S/G-rank: S1/G2; Caves in the eastern U.S., including 5 Missouri counties (Gardner 1986, Christiansen 1966).*

**FAMILY TOMOCERIDAE**

Tomocerus (Lethemurus) missus Mills TB Relict cave springtail

Monroe Co.: Illinois Caverns (Peck & Lewis 1978), Bat Love and Pautler caves, Rose Hole; St. Clair Co.: Stemler Cave.

*S/G-rank: S2/G2; Christiansen (1964) speculated that this species may be the last remnant of a group that was otherwise known only from Japan. Previously known from Illinois Caverns and Brainard Cave (type-locality) in Illinois, three caves in Indiana (Lewis 1998), single caves in Virginia and Tennessee, plus caves in Colorado. Even in areas collected rather thoroughly, like Missouri (Gardner 1986) or Indiana (Lewis 1998, 2002b) the species occurs sporadically. Christiansen (in litt. 1999) believes it is quite likely that two or more species are involved.*

**ORDER DIPLURA**

**FAMILY CAMPOIDEIDAE**

Eumescosoma sp. TB Undescribed cave dipluran

Monroe Co.: Horsethief, Icebox Madonnaville caves (Peck & Lewis 1978), Bat Sump, Bicklein, Danes, Fogelpole, Frog, Jacobs and Pautler caves, Rose Hole; St. Clair County: Browns II and Stemler caves.

*S/G-rank: S2/G3; Known only from the above localities and six populations in caves of Jefferson, St. Genevieve and Perry counties in Missouri.*

Eumescosoma sp. TB Undescribed cave dipluran

Monroe Co.: Bat Love Cave.

*S/G-rank: S1/G1; This species appears related to, but morphologically distinct, from the Eumescosoma listed above (Ferguson, in litt. 1999).*

Haplocampa sp. TB Undescribed cave dipluran

Monroe Co.: Illinois Caverns (Peck & Lewis 1978), Bicklein, Fogelpole, Jacobs, Pautler and Spider caves, St. Clair Co.: Stemler Cave.

*S/G-rank: S2/G2; Reported previously in Illinois only from Illinois Caverns (Peck & Lewis 1978), is conspecific with populations in Crawford and Washington counties, Missouri (Ferguson, in litt 1999).*

**ORDER ORTHOPTERA**

**FAMILY GYLLACRIDIDAE**

Ceuthophilus elegans Hubbell TX

Monroe Co.: Fogelpole Cave, Illinois Caverns (Peck & Lewis 1978), Bicklein, Cedar Ridge, Couchs, Danes, Jacobs, Juelfs, Kelly Spring, Madonnaville, Pautler, Spider, Two Row, Wandas Waterfall and Wednesday caves, Rose Hole; St. Clair Co.: Stemler Cave.

*S/G-rank: S3/G4; Common in the caves of this area and of the Ceuthophilus found in Monroe/St. Clair county caves, this is the species that occurs the deepest in the caves; a prairie species reported by Hubbell (1936) from about 20 sites, six in Illinois.*

**Ceuthophilus scelus** Scudder TX Secluded camel cricket

Monroe Co.: Krueger-Dry Run Cave (Peck & Lewis 1978).

*S/G-rank: S1/G2; One of two eastern Rhadine, also known from caves in Alabama and Florida (Barr, in litt 2000).*

**FAMILY LEIODIDAE**

Ptomaphagus cavernicola Schwartz TP

Monroe Co.: Bat Love, Cedar Ridge, Fogelpole, Icebox, Jacobs, Little, Pautler, Two Row and Wandas Waterfall caves; St. Clair County: Stemler Cave.

*S/G-rank: S2/G4; Only Illinois records of this widespread troglobiphilic species, previously unknown from the state. Known almost entirely from caves, two surface collections exist; known from Mexico north to the Ozarks, then east to Florida (Peck 1973). Gardner (1986) reported from over 50 Missouri caves.*

**FAMILY STAPHYLINIDAE**

Tychobius hybinioides (Brendel) TP Cave-loving ant beetle

Monroe Co.: Pautler Cave.

*S/G-rank: S1/G3-G4; Illinois to New England, but sporadic; three of the five known species of Tychobius are troglotites (Chandler 1997). *

**Theodotes fossulatus** (Brendel) TX Grooved ant beetle

St. Clair Co.: Dashed Hopes Pit.

*S/G-rank: S3/G3; Leaf litter on the pit floor.*

Alessarcha lucifuga (Casey) TP Cavernicolous rove beetle

Monroe Co.: Frog Cave; St. Clair Co.: Stemler Cave.

*S/G-rank: S1/G3-G4; Previously known in Illinois from Burton Cave, Adams Co. (Peck & Lewis 1978). Recorded only from caves and animals burrows; largely Appalachian from southern Pennsylvania to northern Alabama (Klimaszewski & Peck 1986). Lewis (1998) found it in several southern Indiana caves.*

**ORDER DIPTERA**

**FAMILY SPHECOERIDAE**

Spelobia tenellurum (Aldrich) TB


*S/G-rank: S4/G5; One cave in Illinois by Peck and Lewis (1978), but the unidentified Leptocera sp. reported from 20+ caves therein was probably this
PROBLEMATIC SPECIES

Stygobromus subtilis and are known only from the Columbia karst, of the SHPK, within the project area. Although found outside (1984) found this species to be identical to described from Fogelpole Cave (Barr 1963), however Peck (1984) found this species to be identical to Eperigone indicabilis. Of the 71 sites visited, 39 produced at least one species of significance. For conservation purposes, all sites were rank-ordered by the number of global and state rare species present, as well as the number of troglobites. This produced a prioritized list for conservation purposes, e.g., acquisition of property (Table 4). Fogelpole and Stemler caves had the highest number of globally rare species with 18 and 16, respectively. The Pautler Cave System (combined Danes, Pautler, Camp Vandeventer caves and Rose Hole) had 20 globally and state rare species.

Twenty-four taxa thought to be obligate subterranean species were found. The highest number of troglobites found in a single cave was 14 at Fogelpole, although the Pautler Cave System was found to be inhabited by 16 troglobites. The zoo-geographic and evolutionary scenario proposed by Peck and Lewis (1978) remains unchanged by the data presented here. With the discovery of Caecidotea packardi in southeastern Missouri (Lewis & Bowman 1981), all aquatic troglobites known from the SHPK except Gammarus acherondytes are known from southeastern Missouri. The isolation of the karst subunits of the SHPK is illustrated by the endemism of Mundocthonius cavernicolus to the Renault karst, and by Chaetaspis undescribed species and Eumesocampa undescribed species to the Waterloo karst. Although found outside of the SHPK, within the project area Fontigens antroecetes is known only from the Columbus karst, Ergodesmus remingtoni and Arrhopalites lewisi from the Waterloo karst, and Stygobromus subtilis and Oncopodura iowae from the Renault karst.

RESULTS

Forty one species of global rarity are reported from the SHPK, of which 12 were G1, 14 G2 and 15 G3. Of these, 20 were reported by Peck and Lewis (1978), and Webb et al. (1998) added Eperigone indicabilis. Of the 71 sites visited, 39 produced at least one species of significance. For conservation purposes, all sites were rank-ordered by the number of global and state rare species present, as well as the number of troglobites. This produced a prioritized list for conservation purposes, e.g., acquisition of property (Table 4). Fogelpole and Stemler caves had the highest number of globally rare species with 18 and 16, respectively. The Pautler Cave System (combined Danes, Pautler, Camp Vandeventer caves and Rose Hole) had 20 globally and state rare species.

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Table 4. Sites in the SHPK rank-ordered by the number of globally rare species and number of troglobites present

<table>
<thead>
<tr>
<th>Site</th>
<th>Globally Rare Species</th>
<th>Troglobites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fogelpole Cave</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Stemler Cave</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Pautler Cave</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Rose Hole</td>
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<td>10</td>
</tr>
<tr>
<td>Frog Cave</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Illinois Caverns</td>
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<td>9</td>
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<tr>
<td>Danes Cave</td>
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<td>9</td>
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<tr>
<td>Jacobs Cave</td>
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<td>8</td>
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<tr>
<td>Salt peter Cave</td>
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<td>5</td>
</tr>
<tr>
<td>Spider Cave</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Madonnville Cave</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Camp Vandeventer Cave</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Bat Love Cave</td>
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<td>5</td>
</tr>
<tr>
<td>Hidden Hand Cave</td>
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<tr>
<td>Bicklein Cave</td>
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<td>5</td>
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<td>Wednesday Cave</td>
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<tr>
<td>Bat Sump Cave</td>
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<td>5</td>
</tr>
<tr>
<td>Juel's Cave</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Wandas Waterfall Cave</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

DISCUSSION

The presence of a millipede of the genus Scoterpes in Illinois was reported by Shear (1969) from an unspecifed site in western Illinois, speculated by Peck and Lewis (1978) to be Illinois Caverns. Neither Peck and Lewis (1978), Webb et al. (1994), nor this survey demonstrated the presence of Scoterpes in Illinois. Shear (in litt. 1999) was unable to provide further information on a locality and has seen no specimens of Scoterpes from Illinois. We have not included Scoterpes in the species list as we have been unable to verify its presence.

The troglobitic leiodid Potomaphagus nicholasi was described from Fogelpole Cave (Barr 1963), however Peck (1984) found this species to be identical to P. hirtus from the Mammoth Cave area of central Kentucky. The collector had been collecting in Mammoth Cave prior to visiting Fogelpole cave and the possibility of a mislabeled specimen from Kentucky was suggested (Peck & Lewis 1978). Due to the inability to rediscover Ptomophagus nicholasi in any Illinois cave, the unlikely dispersal event needed to explain the presence of a P. hirtus-like population in Illinois, and the possibility of labeling error, Peck (1984) suggested that the species in fact never existed and P. nicholasi was synonymized with P. hirtus.

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STATUS OF GAMMARUS ACHERONDYTES

This species was previously recorded from six caves, to which we add six new sites (see species account), including those in the Annbriar and Frog Spring groundwater systems where the amphipod was not formerly known to occur. At present, the largest known population of G. acherondytes is known from Frog Cave (Lewis 2002c in progress). Pautler Cave had been reported as physically closed and the status of the amphipod was unknown (Webb 1995). In 1999 we found the cave to be open and G. acherondytes present. Preliminary findings (Lewis 2002c in progress) indicate that the second largest known population of G. acherondytes occurs in Pautler Cave. Identical to the finding of Webb (1995), we were unable to demonstrate the presence of Gammarus acherondytes in Stemler Cave, where the species was previously known to occur (Peck & Lewis 1978). We were furthermore unable to find G. acherondytes in any other site in the Columbus karst subunit. In Illinois Caverns G. acherondytes is present in the main entrance passage but disappears downstream (Lewis 2000b). The disappearance of the amphipod correlates with a decrease in the diversity of the invertebrate community and the appearance of filamentous biofilms on rocks in the stream (Lewis 2000b).

Gammarus acherondytes was found to have a wider habitat preference than found by Webb et al. (1998), that is, gravel riffle habitat of large streams such as in Illinois Caverns and Fogelpole Cave. We found the amphipod in similar habitat in Illinois Caverns.
Spider and Frog caves, as well as in narrow headwater streamlets (less than 30 cm across) in Rose Hole and Wednesday Cave. In the latter, G. acherondytes was taken from a scoured rimstone pool with a bare limestone substrate containing only a couple of cobbles. The amphipod also accepts pool habitats (Lewis 2000b, 2002c in progress).

ACKNOWLEDGMENTS

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We would like to thank the Illinois Speleological Survey for cave location information. In particular, Dr. Steve Taylor was of great assistance in providing cave locations. We would like to thank Salisa T. Rafail for volunteering her services to The Nature Conservancy to work as a field assistant during this project. The Illinois Department of Natural Resources kindly facilitated permits to collect in state nature preserves and parks.

ADDITIONAL

As this paper was being sent to press new collections of Gammarus acherondytes were made in the following Monroe County localities: Snow White Cave (Dual Spring groundwater basin), Rick’s Pit (Luhr Spring groundwater basin), Reverse Stream, Jason’s Surprise and Triple Delight caves (Annibriar Spring groundwater basin). The first two sites represent the presence of the amphipod in previously unknown drainage basins.

The milliped Ergodemos remingtoni was also found in Jason’s Surprise Cave.

REFERENCES


