The Cave Fauna of the Garrison Chapel Karst Area: Part I, Wayne Cave

Weingartner’s cave flatworm
*Sphalloplana weingartneri*

Cave sheet-web spider
*Porrhomma cavernicola*

Final Report

Division of Nature Preserves
Indiana Department of Natural Resources
and
Indiana Karst Conservancy

23 December 2008

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INTRODUCTION

The Garrison Chapel Karst Area is located about 7 miles southwest of Bloomington, in Monroe County. It lies on the eastern boundary of the Crawford Upland, in an area of sandstone capped ridges and limestone floored valleys. In about five square miles that comprises this karst area (fig. 1) the Indiana Karst Conservancy (IKC) owns or manages several major caves. Wayne Cave, at 4.2 miles in length, is the longest cave in Monroe County and 9th largest in Indiana. Purchased by the IKC in 2003, the 20 acre preserve contains the entrance as well as part of the known passages in Wayne Cave. Nearby, a short cave called Tiparillo Hole, consists of about 30 feet of passage at the bottom of a sinkhole. Other sites managed by the IKC in the Garrison Chapel karst are Grotto, Shaft and Coon caves. The purpose of this report was to compile a list of the cave fauna of the Wayne Cave Preserve.

Some sampling has been conducted in caves at Garrison Chapel. The close proximity of Indiana University-Bloomington combined with the ease of entry into some of the caves has produced a few collections of a variety of invertebrates. The presence of Indiana bats has also focused attention on certain caves in the area.

Bollman (1889) reported the millipede Conotyla bollmani from Coon and Truett caves. Blatchley (1897) reported Crangonyx packardi, Caecidotea stygia, Meta ovalis, Sinella cavernarum and Amoebaleria defessa from Eller Cave. In his treatise on the fauna of Mayfield Cave, Banta (1907) summarized what was known from other Indiana caves, including Coon and Eller. Fleming (1972) listed the isopod Caecidotea stygia from Salamander Cave. Hobbs, Jr. and Barr (1972) reported the crayfish Orconectes inermis testii from Ellers, Salamander and Shaft caves, to which Hobbs, Jr. et. al (1977) added Brinegar, Buckner and Wayne Cave. In an unpublished dissertation Hobbs III (1973) reported the presence of the commensal entocytherid ostracods Sagittocythere barri (Buckner, Ellers, Salamander, Wayne caves), Donnaldsoncythere donnaldsonensis (Salamander Cave), Dactylocythere susanae (Salamander Cave) from the cave crayfish O. inermis testii. From the crayfish Cambarus laevis were Donnaldsoncythere donnaldsonensis (Buckner Cave), Dactylocythere susanae, Unacythere xania (Buckner, Wayne caves). Zhang & Holsinger (2003) reported the amphipod Crangonyx indianaensis from Buckner and Salamander caves, and Crangonyx packardi from Wayne and Salamander caves. In an unpublished manuscript, Barr (email 2008) reported the presence of the cave beetle Pseudanophthalmus shilohensis mayfieldensis from Buckners, Ellers, Grotto, Mayfields, Mays, Queen Blair, Reeves, Shaft, Salamander, Strong, Truett, and Wayne caves, along with an undescribed species of the leonae group of this genus from Wayne Cave.

By far the greatest attention has been given to the bats inhabiting the area. The federal endangered Indiana bat Myotis sodalis. Brack & Duffey (2007) reported the Indiana bat from the following sites (census numbers in parenthesis): Buckner Cave (49), Coon Cave (14,099), Grotto Cave (12,891), King Blair/Brinegar Cave (218). Salamander Cave is a historic site for this species, but the bats usually roost in an area prone to flooding. Other species present in these caves are the Little brown bat Myotis lucifugus,
Big brown bat *Eptesicus fuscus*, Eastern pipistrelle *Perimyotis subflavus* and Northern bat *Myotis septentrionalis*. Of these, Grotto Cave may have the largest winter population of Little brown bats in Indiana, with over 2,000 found during the last four censuses. Detailed records and historical data are presented by Brack & Duffey (2007).

**Figure 1.** Overlay of cave passages in Garrison Chapel karst area including Wayne Cave in center left of map (from NSS 73 Convention Guidebook).
METHODS & MATERIALS

Terrestrial sampling was performed by collecting manually, placing pitfall traps and Berlese extraction of litter. The pitfalls consisted of four ounce glass specimen jars filled with 70% isopropyl alcohol as a preservative and baited with limburger cheese. Leaf litter was taken from the entrances for Berlese extraction. Litter was placed in a Berlese funnel, with overhead light/heat extracting the invertebrates into a vial of 70% isopropyl alcohol. Pitfall residues were screened, then transferred into petri dishes for sorting of the fauna under a dissecting microscope. Aquatic sampling was also performed manually as well as dipping water from pools and straining it through a plankton net. Specimens of each taxon were placed in 3 or 4 dram vials of 70% ethyl alcohol and labeled with collection site, state, county, miles to nearest town, date and collector.

ACKNOWLEDGMENTS

This bioinventory was funded by the Indiana Department of Natural Resources, facilitated by Cloyce Hedge. Permission to conduct the field work on the property was granted by the Indiana Karst Conservancy (IKC). Assistance at Sullivan Cave was kindly provided by Keith Dunlap and David Everton. The following zoologists identified specimens: Dr. Thomas C. Barr (ground beetles), Dr. John Holsinger (amphipods), Dr. R.E. Lewis (fleas), Dr. Janet Reid (copepods) and Dr. Felipe N. Soto-Adames (springtails).

FAUNAL LIST

In the following list each species is placed within a hierarchical classification. For each species there is a scientific name, original author of the species, a descriptive common name and an ecological classification. Under each taxon the site where the collection was made, the habitat, and the range of the species is given. Range information not cited was taken from the works of Lewis et al. 1983-2007 and the NatureServe website (http://www.natureserve.org/).

The ecological classifications adhere to the following system:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troglobite</td>
<td>TB</td>
<td>terrestrial, morphologically adapted and restricted to caves, must feed and reproduce in the cave environment</td>
</tr>
<tr>
<td>Troglophile</td>
<td>TP</td>
<td>terrestrial, +/- morphologically adapted to caves, not restricted to caves, but can feed and reproduce in the cave environment</td>
</tr>
<tr>
<td>Trogloxene</td>
<td>TX</td>
<td>terrestrial, not usually morphologically adapted to caves, usually leaves the cave to either feed or reproduce</td>
</tr>
<tr>
<td>Stygobite</td>
<td>SB</td>
<td>aquatic, morphologically adapted and restricted to caves, must feed and reproduce in the cave environment</td>
</tr>
</tbody>
</table>
Stygophile  SP  aquatic, +/- morphologically adapted to caves, not restricted to caves, but can feed and reproduce in the cave environment

Stygoxene  SX  aquatic, not usually morphologically adapted to caves, usually leaves the cave to either feed or reproduce

Accidental  AC  fall or wash into caves with no demonstrable affiliation to the habitat

Accompanying each taxon identified to the species level is a S-rank and G-rank, or State rank of rarity and Global rank of rarity, according to the following system:

<table>
<thead>
<tr>
<th>State/Global Rank</th>
<th>Number of sites</th>
<th>Characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1/G1</td>
<td>1-5</td>
<td>critically imperiled</td>
</tr>
<tr>
<td>S2/G2</td>
<td>6-20</td>
<td>imperiled</td>
</tr>
<tr>
<td>S3/G3</td>
<td>21-100</td>
<td>vulnerable</td>
</tr>
<tr>
<td>S4/G4</td>
<td>100+</td>
<td>apparently secure</td>
</tr>
<tr>
<td>S5/G5</td>
<td></td>
<td>secure</td>
</tr>
<tr>
<td>SE</td>
<td></td>
<td>exotic, not native to the U.S.</td>
</tr>
</tbody>
</table>

**PHYLUM PLATYHELMINTHES**

**CLASS TURBELLARIA**

**ORDER TRICLADIDA**

**FAMILY KENKIIDAE**

*Sphalloplana weingartneri* Kenk SB S3/G3 Weingartner’s cave flatworm

  Locality: Wayne Cave  
  Habitat: pools  
  Range: endemic to southern Indiana

**PHYLUM ARTHROPODA**

**CLASS CRUSTACEA**

**ORDER EUCOPEPODA**

**FAMILY CYCLOPIDAE**

*Diacyclops crassicaudis brachycercus* (Kiefer) SP S5/G5 copepod

  Locality: Wayne Cave  
  Habitat: drip pools  
  Range: USA & Europe (Reid 2004)

**ORDER OSTRACODA**

**FAMILY ENTOCYTHERIDAE**

*Dactylocythere susanae* Hobbs SP/EC Susan’s S3/G4 crayfish ostracod

  Locality: Wayne Cave (Hobbs 1973)  
  Habitat: ectocommensal on crayfish  
  Range: Indiana & Kentucky (Hobbs Jr. et al. 1977)
Sagittocythere barri (Hart & Hobbs) SB/EC S3/G4 Barr’s crayfish ostracod
   Locality: Wayne Cave (Hobbs 1973)
   Habitat: ectocommensal on stygobitic crayfish
   Range: caves in Indiana, Kentucky, Tennessee, Alabama (Hobbs Jr. et al. 1977)

Uncinocythere xania (Hart & Hobbs) SP/EC S3/G4 crayfish ostracod
   Locality: Wayne Cave (Hobbs 1973)
   Habitat: ectocommensal on stygobitic crayfish
   Range: reported from Indiana & Missouri, poorly known (Hobbs Jr. et al. 1977)

ORDER ISOPODA

FAMILY ASELLIDAE
Caecidotea stygia Packard SB S5/G5 Northern cave isopod
   Locality: Wayne Cave
   Habitat: streams and pools
   Range: SW Ohio, Kentucky, northern Tennessee, southern Indiana, southern Illinois, eastern Missouri

FAMILY LIGIIDAE
Ligidium elrodi (Packard) TP/TX S4/G5 Elrod’s terrestrial isopod
   Locality: Tiparillo Hole
   Habitat: leaf litter
   Range: eastern U.S. (Jass & Klausmeier 2001)

FAMILY PORCELLIONIDAE
Trachelipus rathkei (Brandt) TX SE/G5 Rathke’s terrestrial isopod
   Locality: Wayne Cave
   Habitat: leaf litter
   Range: exotic, probably European in origin

FAMILY TRICHONISCIDAE
Haplophthalmus danicus Budde-lunde TP SE/G5 terrestrial isopod
   Locality: Wayne Cave
   Habitat: leaf litter
   Range: exotic, probably European in origin

Hyloniscus riparius Budde-Lund TX SE/G5 Riparian terrestrial isopod
   Locality: Wayne Cave
   Habitat: leaf litter
   Range: exotic, probably European in origin
ORDER AMPHIPODA

FAMILY CRANGONYCTIDAE
Crangonyx packardi Smith SB S4/G4 Packard’s groundwater amphipod
  Locality: Wayne Cave
  Habitat: pools, streams
  Range: Indiana to Kansas (Zhang & Holsinger, 2003)

ORDER DECAPODA

FAMILY CAMBARIDAE
Cambarus laevis Faxon SP S4/G4 Karst crayfish
  Locality: Wayne Cave
  Habitat: pools, streams
  Range: southern Illinois, Indiana, Ohio, Kentucky

Orconectes inermis testii Cope SB S2/G4 Northern cave crayfish
  Locality: Wayne Cave
  Habitat: pools, streams
  Range: Monroe County, Indiana

CLASS ARACHNIDA
ORDER ARANEAE

FAMILY AGELENIDAE
Cicurina pallida Keyserling TP S4/G5 Pallid funnel-web spider
  Locality: Wayne Cave
  Habitat: under stones, entrance room
  Range: eastern U.S.

FAMILY LINYPHIIDAE
Phanetta subterranea (Emerton) TB S5/G5 Subterranean sheet-web spider
  Locality: Tiparillo Hole, Wayne Cave
  Habitat: under stones, crevices
  Range: eastern U.S.

Porromma cavernicola (Keys) TB S2/G4 Cavernicolous sheet-web spider
  Locality: Wayne Cave
  Habitat: under stones
  Range: eastern U.S.

FAMILY PISAURIDAE
Dolomedes scriptus Hentz TX S4/G4 fishing spider
  Locality: Wayne Cave
Habitat: entrance ceiling
Range: eastern U.S.

CLASS DIPLOPODA
ORDER CHORDEUMATIDA

FAMILY CONOTYLIDAE
Conotyloa bollmani (McNeill) TB/TP S3-4/G3-4 Bollman’s cave millipede
Località: Tiparillo Hole, Wayne Cave
Habitat: under stones, boards, leaf litter
Range: southcentral Indiana karst

ORDER COLLEMBOLA

FAMILY ENTOMOBRYIDAE
Pseudosinella fonsa Christiansen TB S2/G2 Fountain cave springtail
Località: Tiparillo Hole
Habitat: under stones, leaf litter
Range: southcentral & southeastern Indiana karst, 1 cave in SW Ohio
(Christiansen & Bellinger 1998c)

Sinella cavernarum (Packard) TB S3/G4 Cavernicolous springtail
Località: Wayne Cave
Habitat: under stones
Range: eastern U.S., 1 endogean record (Christiansen & Bellinger 1998c)

FAMILY HYPOGASTRURIDAE
Ceratophysella denticulata group engadinensis vs. granulate TP
Località: Wayne Cave
Habitat: entrance leaf litter

Odontella rossi Christiansen & Bellinger TX S1/G1? Ross’ springtail
Località: Wayne Cave
Habitat: entrance leaf litter
Range: previously known from the type-locality in Pennsylvania (Christiansen & Bellinger 1998a)

Pseudochorutes aureofasciatus (Harvey) species complex TX S4/G5 springtail
Località: Wayne Cave
Habitat: entrance leaf litter
Range: United States & Canada (Christiansen & Bellinger 1998a)

FAMILY ISOTOMIDAE
Folsomia candida Willem TP S5/G5 White springtail
Località: Tiparillo Hole
Habitat: entrance leaf litter
Range: U.S. and southern Canada (Christiansen & Bellinger 1998b)

**Isotoma anglicana** Lubbock TX S?/G5 Anglican springtail
- Locality: Wayne Cave
- Habitat: entrance leaf litter
- Range: few Indiana collections, but temperate North America, Europe

**Isotoma (Desoria) near canadensis** Brown TX
- Locality: Wayne Cave
- Habitat: entrance leaf litter
- Range: species too poorly known to characterize range.

**Isotoma (Desoria) trispinata** MacGillivray TX
- Locality: Tiparillo Hole
- Habitat: entrance leaf litter
- Range: U.S. and eastern Canada (Christiansen & Bellinger 1998b)

**Isotoma (Desoria) undescribed species?** TX/TP
- Locality: Tiparillo Hole
- Habitat: entrance leaf litter
- Range: possibly conspecific with a taxon represented in material from a cave in Virginia (Soto email 2008)

**FAMILY TOMOCERIDAE**
**Tomocerus bidentatus** Folsom TP S4/G4 Two-toothed springtail
- Locality: Tiparillo Hole
- Habitat: leaf litter
- Range: eastern U.S. (Christiansen & Bellinger 1998c)

**Tomocerus elongatus** Maynard TX S4/G5 Elongate springtail
- Locality: Wayne Cave
- Habitat: entrance leaf litter
- Range: continental U.S. to Alaska (Christiansen & Bellinger 1998c)

**Tomocerus flavescens** (Tullberg) TP S5/G5 Golden springtail
- Locality: Tiparillo Hole
- Habitat: under stones, leaf litter
- Range: U.S., Canada, Alaska (Christiansen & Bellinger 1998c)

**FAMILY SMINTHRIDAE**
**Arrhopalites sp.** TB cave springtail
- Locality: Wayne Cave
- Habitat: dark zone mud banks next to pools
- Range: unknown

**Ptenothrix atra** Linnaeus TX S5/G5 Black springtail
Localities: Tiparillo Hole, Wayne Cave
Habitats: leaf litter, cave walls and ceilings; woodlands, riparian, under stones and on mudbanks
Ranges: cosmopolitan (Christiansen & Bellinger 1998d), northeastern U.S. (Hubbell 1936), known only from Wayne Cave (Barr, email 2008)

**ORDER ORTHOPTERA**

**FAMILY GRYLLACRIDIDAE**
Ceuthophilus brevipes Scudder TX S4/G4 cave cricket
- Localities: Tiparillo Hole, Wayne Cave
- Habitats: cave walls and ceilings; woodlands
- Ranges: northeastern U.S. (Hubbell 1936)

**ORDER COLEOPTERA**

**FAMILY CARABIDAE**
Pseudanophthalmus shilohensis mayfieldensis (Krekeler) TB S2/G2 Shiloh cave beetle
- Localities: Wayne Cave
- Habitats: riparian, under stones and on mudbanks
- Ranges: southcentral Indiana karst, Lawrence, Monroe, southeast Owen counties (Barr 2004).

Pseudanophthalmus undescribed species (leonae group) TB S1/G1 Wayne cave beetle
- Localities: Wayne Cave
- Habitats: riparian, under stones and on mudbanks
- Ranges: known only from Wayne Cave (Barr, email 2008)

**FAMILY STAPHYLINIDAE**
Aleochara lucifuga (Casey) TP S4/G4 Rove beetle
- Localities: Wayne Cave
- Habitats: riparian, under stones and on mudbanks
- Ranges: eastern U.S.

Quedius erythrogaster Mannerheim TX S5/G5 rove beetle
- Localities: Wayne Cave
- Habitats: leaf litter
- Ranges: eastern U.S.

**ORDER DIPTERA**

**FAMILY HELEOMYZIDAE**
Aecothea specus (Aldrich) TX S5/G5 heleomyzid fly
- Localities: Wayne Cave
- Habitats: moist walls, floor surfaces
- Ranges: eastern U.S.

**FAMILY MYCETOPHILIDAE**
Macrocera nobilis TP S4/G5 fungus gnat
Locality: Wayne Cave  
Habitat: larval webs under stones, crevices  
Range: eastern U.S.

**FAMILY PHORIDAE**  
*Megaselia cavernicola* Brues TP S5/G5 Cave hump-backed fly  
Locality: Tiparillo Hole, Wayne Cave  
Habitat: damp areas, mudbanks  
Range: eastern U.S.

**FAMILY SPHAEROGERIDAE**  
*Spelobia tenebrarum* (Aldrich) TB S5/G5 Cave dung fly  
Locality: Tiparillo Hole, Wayne Cave  
Habitat: raccoon dung, mudbanks, damp areas  
Range: eastern U.S.

**ORDER SIPHONAPTERA**

**FAMILY CTENOPHTHALMIDAE**  
*Epitedia wenmanni* (Rothschild) PS S5/G5 Wenmann’s flea  
Locality: Tiparillo Hole, Wayne Cave  
Habitat: ectoparasite of White footed mouse  
Range: eastern U.S.

**CLASS AMPHIBIA**  
**ORDER CAUDATA**

**FAMILY PLETHODONTIDAE**  
*Eurycea lucifuga* Rafinesque TP S5/G5 Cave salamander  
Locality: Wayne Cave  
Habitat: wall ledges, under stones, larvae in pools  
Range: east-central U.S.

**ORDER CHIROPTERA**

**FAMILY VESPERTILIONIDAE**  
*Myotis lucifugus* (LeConte) TX S5/G5 Little brown bat  
Locality: Wayne Cave  
Habitat: passage ceiling  
Range: North America south to Mexico

*Perimyotis subflavus* (Cuvier) TX S5/G5 Eastern pipistrelle  
Locality: Tiparillo Hole, Wayne Cave  
Habitat: wall ledges, under stones, larvae in pools  
Range: eastern U.S. & Canada
ORDER RODENTIA

FAMILY CRICETIDAE
Peromyscus leucopus (Rafinesque) TX S5/G5 White-footed mouse
   Locality: Wayne Cave
   Habitat: moist areas, primarily near entrance
   Range: U.S. & Canada, excluding Pacific states
DISCUSSION

A total of 47 taxa were recorded during the survey of the Wayne Cave Preserve. Of these, 14 were classified as obligate subterranean species:

- *Sphalloplana weingartneri* Weingartner’s cave flatworm
- *Sagittocythere barri* Barr’s crayfish ostracod
- *Caecidotea stygia* Northern cave isopod
- *Crangonyx packardi* Packard’s Groundwater amphipod
- *Orconectes inermis* Northern cave crayfish
- *Phanetta subterranea* Subterranean sheet-web spider
- *Porrhomma cavernicola* Cavernicolous sheet-web spider
- *Conotyla bollmani* Bollman’s cave millipede
- *Pseudosinella fonsa* Fountain cave springtail
- *Sinella cavernarum* Cavernicolous springtail
- *Arrhopalites sp.* cave springtail
- *Pseudanophthalmus shilohensis* Shiloh cave beetle
- *Pseudanophthalmus* undescribed species (leonae group) Wayne cave beetle
- *Spelobia tenebrarum* Cave dung fly

Compared to other cave systems sampled in Indiana, Wayne Cave ties for 5th place in the number of obligate subterranean species present:

<table>
<thead>
<tr>
<th>Cave</th>
<th>Obligate Subterranean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binkley Cave (Harrison Co.)</td>
<td>19</td>
</tr>
<tr>
<td>Wesley Chapel Gulf/Elrod Cave (Orange Co.)</td>
<td>18</td>
</tr>
<tr>
<td>Sullivan Cave (Lawrence Co.)</td>
<td>16</td>
</tr>
<tr>
<td>Marengo Cave (Crawford Co.)</td>
<td>15</td>
</tr>
<tr>
<td>Wyandotte Cave (Crawford Co.)</td>
<td>15</td>
</tr>
<tr>
<td>Wayne Cave (Monroe Co.)</td>
<td>14</td>
</tr>
<tr>
<td>Donnellson Cave (Lawrence Co.)</td>
<td>13</td>
</tr>
<tr>
<td>Blowing Hole (Harrison Co.)</td>
<td>12</td>
</tr>
<tr>
<td>Tucker Lake Spring Cave (Orange Co.)</td>
<td>12</td>
</tr>
<tr>
<td>Buddha-Christian Cave (Lawrence Co.)</td>
<td>11</td>
</tr>
<tr>
<td>Patton Cave (Monroe Co.)</td>
<td>11</td>
</tr>
<tr>
<td>Spring Springs Cave (Orange Co.)</td>
<td>11</td>
</tr>
<tr>
<td>Sibert’s Well Cave (Crawford Co.)</td>
<td>11</td>
</tr>
<tr>
<td>Black Medusa Cave (Harrison Co.)</td>
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<tr>
<td>Patton Cave (Monroe Co.)</td>
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<tr>
<td>Dillon Cave (Orange Co.)</td>
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</tr>
<tr>
<td>Hudelson Cavern (Orange Co.)</td>
<td>10</td>
</tr>
<tr>
<td>Linds Cave (Harrison Co.)</td>
<td>10</td>
</tr>
<tr>
<td>Murray Spring Cave (Orange Co.)</td>
<td>10</td>
</tr>
<tr>
<td>May Cave (Monroe Co.)</td>
<td>10</td>
</tr>
<tr>
<td>King/Bug Ear Cave (Lawrence Co.)</td>
<td>10</td>
</tr>
</tbody>
</table>
LITERATURE CITED


_____. and Salisa L. Lewis. 2006. Interstate 69 Evansville to Indianapolis Tier 2 Studies: Section 4 selected subterranean fauna. 42 pages.


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