The Subterranean Fauna of the Buddha Karst Preserve, Lawrence County, Indiana

Stream passage, Buddha Cave (photo by S. Fee)

Final Report

Division of Nature Preserves
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and
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INTRODUCTION

The purpose of this project was to inventory the subterranean fauna of the Buddha Karst Preserve. This preserve is comprised of 37 acres located less than a mile south of the small village of Buddha, or about five miles southwest of the larger town of Bedford. The area occupied by the preserve is isolated within the Mitchell Plain (Powell 1961), a karst plain, and is for all intents an island about 6 miles in length. The Preserve is about a mile north of the East Fork of White River, with the tributary Guthrie Creek to the north. Only a narrow isthmus 0.2 mile in width called the Devil's Backbone prevents the area from being a true island.

On 25 June 2001 the Indiana Karst Conservancy acquired the property, which could be characterized as rolling pastureland with small patches of deciduous forest. It is an excellent example of karst topography, with features present including sinkholes, sinkhole ponds and cave entrances. Buddha-Christian Cave is a subterranean drainage (figure 1) conduit receiving water from a wet-weather sinking stream via the Buddha Cave entrance. The cave has a mapped length of 3,119 feet (figure 2), consisting of a dry upper level and a lower stream passage accessible by a 25 foot pit. It is remarkable for its pristine condition, particularly the highly decorated stream passage. Under normal conditions exploration downstream is stopped by a stream sump, although in dry weather a through trip can be made and exited via the Christian Cave entrance (on private property). The cave stream surfaces as a series of springs below Christian Cave in an alcove about half a mile north of the East Fork of White River. A detailed description of Buddha-Christian Cave appears in Rea (1992).

Several other smaller caves are known on the Buddha Karst Preserve. The most noteworthy is Chase Cave. This cave occurs in a sinkhole west of the Buddha Cave entrance. A map is not available for Chase Cave, which after the entrance room consists of a stream crawlway. It seems likely that Chase Cave is a disjunct piece of the Buddha-Christian Cave system and that its water enters the larger cave at some point. Another cave on the property is Chase Pit, approximately 20 feet in depth that usually requires removal of wood and other debris and is rarely entered.

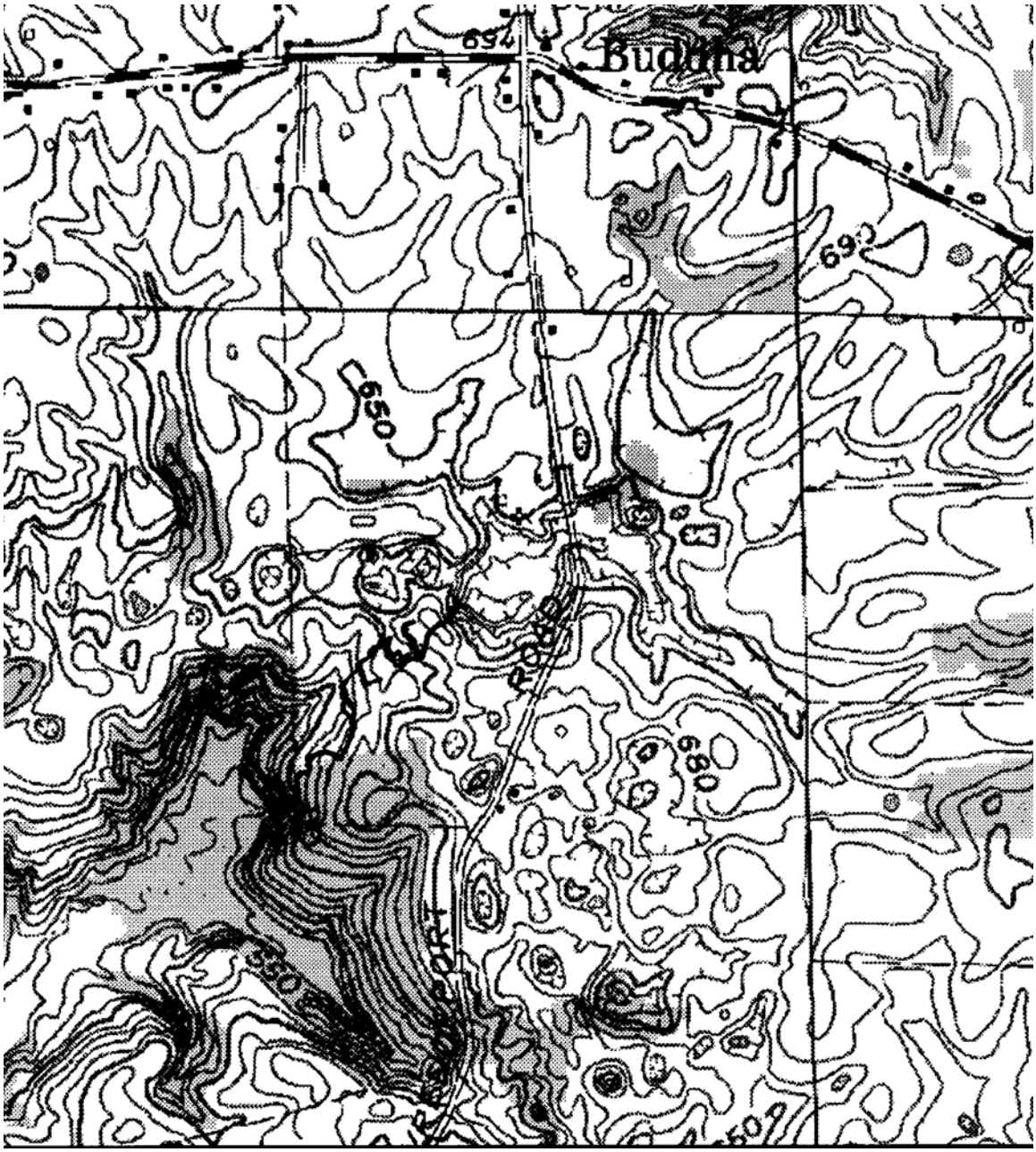

Figure 1. Topographic map showing the vicinity of the Buddha Karst Preserve. The approximate course of Buddha-Christian Cave is shown. The subterranean conduit drains the large sinkhole rimmed by the 650 foot contour (1/2 mile southwest of Buddha) and conducts the water to the spring alcove to the south.

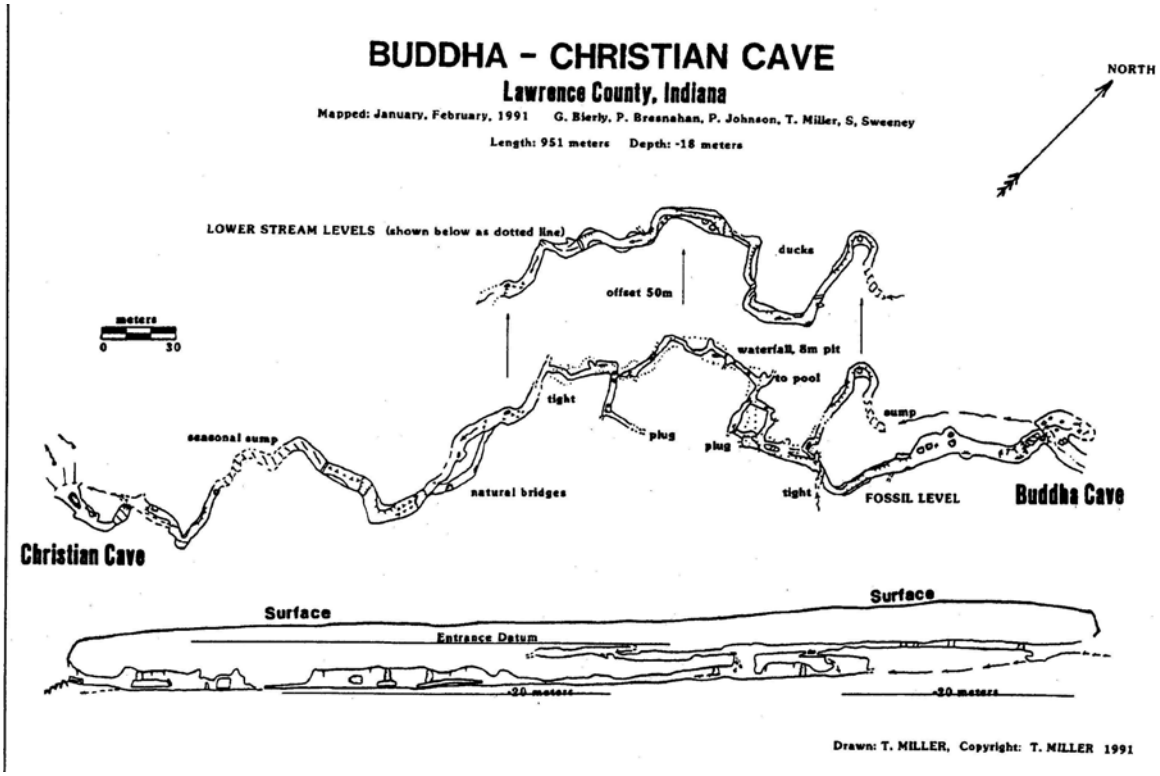

Figure 2. Map of Buddha-Christian Cave

METHODS & MATERIALS

Three sites were sampled during this project: (1) Buddha-Christian Cave, accessed via the Buddha Cave entrance and traversed to the downstream sump; (2) Chase Cave; (3) and a small, probably wet-weather spring on the southwestern edge of the preserve that is termed here the Buddha Preserve Spring (not to be confused with the spring from the main cave system that emerges below the Christian Cave entrance on private property).

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. Stream detritus and leaf litter was taken from the lower level of Buddha Cave for Berlese extraction. Litter taken 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. Specimens of each taxon were placed in 3 or 4 dram vials of 70% ethyl alcohol and labeled per cave of origin, state, county, miles to nearest town, date and collector.

Aquatic sampling was also performed manually. In addition, water was dipped from shallow pools in the upper level of Buddha Cave and strained through a plankton net. Water samples were then placed in a cooler and transported back to the laboratory where they were placed in petri dishes and examined for living fauna under a dissecting microscope.

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). Keith Dunlap (IKC) provided an overview of the property and suggestions for navigating the caves safely. Assistance with field work provided by Ronnie Burns and Tom Sollman is gratefully acknowledged. The following zoologists identified specimens: Dr. Felipe N. Soto-Adames, Dr. Thomas C. Barr, Dr. L. Denis Delorme, Dr. John Holsinger, Dr. Janet Reid and Dr. Douglas Zeppelini.

FAUNAL LIST

In the following list each species is placed within a Linnaean hierarchical classification. For each species there is a scientific name, original author of the species, a descriptive common name and an ecological classification. The ecological classifications adhere to the following system:

Classification	Abbreviation	Definition
Troglobite	TB	terrestrial, morphologically adapted and restricted to caves, must feed and reproduce in the cave environment
Troglophile	TP	terrestrial, +/- morphologically adapted to caves, not restricted to caves, but can feed and reproduce in the cave environment
Trogloxene	TX	terrestrial, not usually morphologically adapted to caves, usually leaves the cave to either feed or reproduce
Stygobite	SB	aquatic, morphologically adapted and restricted to caves, must feed and reproduce in the cave environment
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:

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

PHYLUM PLATYHELMINTHES
CLASS TURBELLARIA
ORDER TRICLADIDA

FAMILY KENKIIDAE

Sphalloplana weingartneri Kenk SB Weingartner's cave flatworm

Lawrence Co.: Buddha Cave

S3/G3; The type-locality of this species is the Donaldson Cave System, located about 5 miles to the south in Spring Mill State Park (Kenk 1970a). In Buddha Cave it was found under stones in the main cave stream. The species is endemic to southern Indiana, where it has been reported from caves in Clark, Crawford, Harrison, Jefferson, Jennings, Lawrence, Martin, Orange, Ripley and Washington counties (Lewis, 1983; 1996; 1998; Lewis & Rafail 2002; Lewis et al. 2004).

FAMILY PLANARIIDAE

Phagocata gracilis (Haldeman) SP Slender spring flatworm

Lawrence Co.: Buddha Cave, Buddha Preserve Seepspring

S5/G5; This flatworm is ubiquitous in springs of the Midwestern U.S. It is also common in cave streams and in some populations the worms are depigmented and nearly white in color. Hyman (1937) described the unpigmented Phagocata in Donaldson's Cave, Lawrence Co., Indiana as Phagocata subterranea which Kenk (1970b) synonymized with Phagocata gracilis.

PHYLUM MOLLUSCA
CLASS GASTROPODA
ORDER BASOMMATOPHORA

FAMILY CARYCHIIDAE

Carychium exile Lea TP carych

Lawrence Co.: Buddha Cave

G-rank: S5/G5; These tiny snails were fond in the dark zone of the cave on leaf litter. Itis species occurs across the eastern U.S. in leaves on wooded hillsides and talus slopes (Hubricht 1985).

FAMILY POLYGYRIDAE

Inflectarius inflectus (Say) TX Inflected three-toothed snail

Lawrence Co.: Buddha Cave

S5/G5; This is a common species that occurs in a variety of habitats throughout the southcentral U.S. (Hubricht, 1985). It is commonly found in caves. In Indiana, Lewis (1998, Lewis et. al 2004) reported it from caves in Crawford, Lawrence, Martin, Orange and Washington counties.

Mesodon appressus (Say) TX terrestrial snail

Lawrence Co.: Buddha Cave

G-rank: S4/G4; This species occurs in rocky areas and river bluffs and is primarily Appalachian in distribution (Hubricht 1985).

Triodopsis tridentata Say TX Common three-toothed snail

Lawrence Co.: Buddha Cave

S4/G5; Indiana is on the western edge of the range of the primarily Appalachian species, which usually occurs in upland woods in leaf litter, under logs or rocks (Hubricht, 1985).

PHYLUM ARTHROPODA

CLASS CRUSTACEA

ORDER EUCOPEPODA

FAMILY CYCLOPIDAE

Acanthocyclops robustus (Sars) SP Robust copepod

Lawrence Co.: Buddha Cave

S4/G4; This species was reported from numerous caves and springs in Harrison, Lawrence, Orange and Washington counties (Lewis 1998; Lewis et al. 2004). In Buddha Cave it was abundant in pools in the upper level passage.

Macrocyclops albidus (Jurine) SX White copepod

Lawrence Co.: Buddha Cave

S4/G4; This species was taken with the above copepod from pools in the upper level of Buddha Cave.

ORDER OSTRACODA

FAMILY CANDONIDAE

Pseudocandona jeanneli (Klie) SB Jeannel's groundwater ostracod

Lawrence Co.: Buddha Cave

G-rank: S1/G2; These tiny ostracods were taken from upper level pools. This species is known from several caves in southern Indiana, one cave on the Cumberland Escarpment in Pulaski County, Kentucky, and six caves along the Cumberland Escarpment in Tennessee (Lewis et. al 2004).

ORDER ISOPODA

FAMILY ASELLIDAE

Caecidotea stygia Packard SB Northern cave isopod

Lawrence Co.: Buddha Cave, Buddha Preserve Seepspring

S4/G5; This species was reported by Fleming (1972) from Buddha Cave, where it remains common in the cave stream, rimstone and drip pools. This isopod is ubiquitous in caves of the south-central Indiana karst. It is one of the most wide ranging subterranean members of the genus, recorded from southwestern Ohio, most of Kentucky, southern Illinois and a small area of eastern Missouri (Lewis & Bowman, 1981).

Caecidotea jordani (Eberly) SB Jordan's groundwater isopod

Lawrence Co.: Chase Cave

S1/G1; This species was described from a seepage stream in the basement of Jordan Hall (the biology building) at Indiana University, Bloomington (Eberly 1965). The isopods were once common there, but were subsequently extirpated by termiticide treatments on the building. The isopods were also taken from hyporheic/parafluvial habitats in gravels below and adjacent to the Blue River (Lewis 1998). In Chase Cave the isopods were found in a seep on a mudbank in the entrance room of the cave. The water drips into the cave from the epikarst, which is likely to be the true interstitial habitat of this species.

FAMILY PORCELLIONIDAE

Cylisticus convexus DeGeer TX Common convex pillbug

Lawrence Co.: Buddha Cave

SE/G5; This is a common exotic species that has been report in Indiana caves in Clark, Crawford, Harrison, Jefferson, Ripley and Washington counties (Lewis 1983, 1994, 1995, 1996, 1998; Lewis and Rafail Lewis & Rafail 2002; Lewis, Burns and Lewis 2004). It is usually found in drier habitats in caves, frequently around entrances under stones and debris.

Trachelipus rathkei (Brandt) TX Rathke's terrestrial isopod

Lawrence Co.: Buddha Cave, Chase Cave

SE/G5; This is an introduced European species. It is a common threshold trogloxene and was reported from caves in Clark, Crawford, Harrison, Jennings, Lawrence, Orange and Washington counties (Lewis, 1995; 1996; 1998; Lewis et al. 2004).

FAMILY TRICHONISCIDAE

Haplophthalmus danicus Budde-lunde TP terrestrial isopod

Lawrence Co.: Buddha Cave

SE/G5; This species was reported from caves in Clark, Crawford, Harrison, Lawrence, Orange and Washington counties (Lewis 1996; 1998, Lewis et al. 2004). It is an introduced European species that is widespread in the eastern U.S. (Hoffman 1999).

ORDER AMPHIPODA

FAMILY CRANGONYCTIDAE

Crangonyx packardi Smith SB Packard's Groundwater amphipod

Lawrence Co.: Buddha Cave, Chase Cave

S3/G4; These amphipods were taken in rimstone pools and under stones in the cave stream. Crangonyx packardi was first described from a well in Orleans, Orange Co., Indiana. The species is now known to occur from Indiana west to Kansas (Zhang & Holsinger, 2003).

Crangonyx indianensis Zhang & Holsinger SB/SP Indiana cave amphipod

Lawrence Co.: Buddha Preserve Seepspring

S3/G3; This species has been reported from caves and spring orifices in Clark, Crawford, Decatur, Harrison, Jefferson, Lawrence, Martin, Monroe, Orange, Owen and Washington counties, Indiana (Zhang & Holsinger, 2003). Although it is known exclusively from subterranean habitats, this amphipod is questionably stygobitic.

ORDER DECAPODA

FAMILY CAMBARIDAE

Cambarus laevis Faxon SP Karst crayfish

Lawrence Co.: Buddha Cave

S4/G4; This species occurs in caves of both the south-central and southeastern Indiana karst areas, where it has been reported from essentially every county with a cave containing a stream counties (Lewis, 1995; 1996; 1998; Lewis et al. 2004).

Orconectes inermis Cope SB Northern cave crayfish

Lawrence Co.: Buddha Cave

S3/G3; This crayfish occurs primarily in larger cave streams, where it is frequently found slowly wandering the substrate or under stones. It occurs from central Kentucky north to Owen County, Indiana (Hobbs and Barr, 1960).

CLASS ARACHNIDA
ORDER ARANEAE

FAMILY LINYPHIIDAE

Phanetta subterranea (Emerton) TB Subterranean sheet-web spider

Lawrence Co.: Buddha Cave, Chase Cave

S4/G5; In Buddha and Chase caves this tiny spider was taken from under stones, frequently in the company of its small silk egg cases. The species is ubiquitous in Indiana caves, where it has been found in nearly every cave sampled (Lewis 1983, 1994, 1995, 1996, 1997, 2001, Lewis et al. 2004). Originally described from Wyandotte Cave, Crawford Co., the species was redescribed by Millidge (1984) and reported from a range between Alabama and Pennsylvania, west to Indiana. Peck & Lewis (1978) reported this species from Illinois and Missouri.

FAMILY NESTICIDAE

Eidmannella pallida Emerton TP Pallid cave spider

Lawrence Co.: Chase Cave

G-rank: G5; This spider is widespread in North America, Central America and the West Indies. It has been introduced elsewhere, including Hawaii and England, and the a few records are known from South America. It has been recorded frequently from caves, where populations may become reduced in size and eyes reduced or absent (Gertsch 1984).

ORDER OPILIONES

FAMILY PHALANGIIDAE

Erebomaster flavescens (Cope) TP Golden cave harvestman

Lawrence Co.: Buddha Cave

S3/G3?; The taxonomic status of this species remains unclear. In Indiana it has been reported from caves in Crawford, Harrison, Orange and Washington counties (Lewis, 1998).

ORDER PSEUDOSCORPIONIDA

FAMILY CHERNETIDAE

Hesperochernes mirabilis (Banks) TB Southeastern cave pseudoscorpion

Lawrence Co.: Chase Cave

S3/G4; This species is frequently associated with mouse or woodrat nests, where it is found in caves in the southeastern U.S. (Muchmore, 1974). In Indiana it has been reported from caves in Crawford, Harrison, Jefferson, Martin, Orange and Washington counties (Lewis, 1998; 2002).

CLASS DIPLOPODA
ORDER CHORDEUMATIDA

FAMILY CONOTYLIDAE

Conotyla bollmani (McNeill) TB/TP Bollman's cave milliped

Lawrence Co.: Buddha Cave, Chase Cave

S3-4/G3-4; Hoffman and Lewis (1997) summarized the range of this Indiana endemic, which occurs in caves in southcentral Indiana in the East Fork of White River drainage (Orange, Lawrence, Monroe, Martin, Owen counties), with additional records added by Lewis (2003). The species has now been recorded from several dozen caves and it undoubtedly occurs in many more within the counties listed above. The state/global rank of this animal is tempered by its relatively narrow range. In Buddha Cave the millipeds were common on mudbanks and stream detritus.

ORDER POLYDESMIDA

FAMILY PARADOXOSOMATIDAE

Pseudopolydesmus sp. TX/AC milliped

Lawrence Co.: Chase Cave

This record represents the collection of a juvenile specimen from the cave entrance room. All of the members of this group in Indiana are woodland species, none of which are particularly cavernicolous.

Oxidus gracilis (Koch) TX Greenhouse milliped

Lawrence Co.: Buddha Cave

SE/G5; This is an invasive species that occurs in caves, sometimes in large numbers. In Buddha Cave single specimens were found in both the upper and lower levels. It is thought to have originated in Japan, although this is uncertain (Hoffman 1999).

FAMILY XYSTODESMIDAE

Apheloria virginiensis butleriana (Bollman) TX/AC Virginia milliped

Lawrence Co.: Buddha Cave

S4/G4; This milliped was found crawling across the ceiling about 100 feet from the entrance, at the far end of the twilight zone of the cave. An old exoskeleton of one the millipeds was taken on a nearby mudbank indicating past use of the cave in a similar manner by this species. Hoffman and Lewis (1997) reported this species in leaf litter at the bottom of the large pit-like entrance of Swinney Cave, Harrison County. The species is widespread in the eastern United States, where it is typically found in forests (Hoffman 1999).

ORDER JULIDA

FAMILY JULIDAE

Ophyiulus pilosus (Newport) TX/TP Garden milliped

Lawrence Co.: Buddha Cave

SE/G5; This is an exotic species, probably originating in Europe (Hoffman 1999). In Indiana, it has also been found in caves in Harrison, Jennings, Lawrence, Orange and Ripley counties (Lewis, 1994; 1995; 2001; Lewis et al. 2004).

CLASS COLLEMBOLA

FAMILY ISOTOMIDAE

Desoria trispinata (MacGillivray) TP Three-spined springtail

Lawrence Co.: Buddha Cave

S4/G4; This is a common nearctic species that is known from numerous collections from caves (Christiansen & Bellinger, 1998b). Lewis (1998) reported it from caves in Harrison and Martin counties, Indiana.

Folsomia candida Willem TP White springtail

Lawrence Co.: Buddha Cave

S4/G4; This species has been reported from caves in Crawford, Harrison, Lawrence, Monroe, Orange and Washington counties, Indiana (Lewis, 1998). Elsewhere

it has been found in caves in Missouri, Illinois and Arkansas (Peck and Lewis, 1978; Gardner, 1986; McDaniel and Smith, 1978; Craig, 1977).

FAMILY ENTOMOBRYIDAE

Pseudosinella collina Wray TP springtail

Lawrence Co.: Buddha Cave

G-rank: G3/4; This taxon may represent a species complex. It has been recorded from 8 eastern states from Louisiana to Pennsylvania (Christiansen & Bellinger, 1998).

Pseudosinella undescribed species near fonsa TB springtail

Lawrence Co.: Buddha Cave

S2/G2; This undescribed species is known only from caves in Crawford, Lawrence, Orange and Monroe counties. This is the sixth known site.

FAMILY SMINTHURIDAE

Arrhopalites sp. TP/TB springtail

Lawrence Co.: Buddha Cave

These springtails were taken from pitfall traps deep in the dark zone of Buddha Cave, adjacent to the stream. Numerous troglobitic species are known in this genus, along with the widespread troglophilie Arrhopalites pygmaeus.

FAMILY TOMOCERIDAE

Tomocerus bidentatus Folsom TP Two-toothed springtail

Lawrence Co.: Buddha Cave, Chase Cave

S3/G3-4; This species is slightly troglomorphic and is known from primarily caves, although a few surface records exist (Christiansen, 1982). It has been reported in Indiana from caves in Crawford, Harrison, Jennings, Lawrence, Monroe, Orange and Washington counties (Lewis, 1995; 1998).

CLASS INSECTA
ORDER ORTHOPTERA

FAMILY GRYLLACRIDIDAE

Ceuthophilus stygius (Scudder) TX Stygian cave cricket

Lawrence Co.: Buddha Cave, Chase Cave

S4/G4; This is the common cave cricket in most caves of Indiana. Outside of Indiana it has been reported from Ohio, Kentucky and Tennessee (Hubbell, 1936).

ORDER COLEOPTERA

FAMILY CARABIDAE

Pseudanophthalmus emersoni Krekeler TB Emerson's cave beetle

Lawrence Co.: Buddha Cave

S1/G1; This species is otherwise known only from the Doghill-Donnehue Cave System in Bedford (Barr 1960).

Pseudanophthalmus undescribed species TB Buddha cave beetle

Lawrence Co.: Buddha Cave

S1/G1; This species is endemic to Buddha Cave. It is related to another undescribed species from Jim Ray and American Bottoms caves (Barr personal communication).

Platynus tenuicollis (LeConte) TP/TX Slender ground beetle

Lawrence Co.: Buddha Cave, Chase Cave

S5/G5; This beetle is a common troglophile in the eastern U.S. (Barr, 1964).

FAMILY STAPHYLINIDAE

Subfamily Aleocharinae

Aleochara lucifuga (Casey) TP Rove beetle

Lawrence Co.: Buddha Cave, Chase Cave

S4/G4; This species is known only from caves and animals burrows and has been reported from caves in the Appalachians and Interior Low Plateaus Klimaszewski and Peck (1986). In Indiana it has been previously recorded from caves in Crawford, Harrison, Orange and Washington counties (Lewis, 1998). The members of this group of rove beetles have larvae that are ectoparasitoids of the pupae of flies.

Aloconota insecta (Thomson) TP rove beetle

Lawrence Co.: Buddha Cave, Chase Cave

S4/G4; This species has been reported from several caves in the southeastern U.S. by Klimaszewski and Peck (1986), although most of the records for the species are from Europe.

Subfamily Omaliinae

Lesteva pallipes (LeConte) TX rove beetle

Lawrence Co.: Buddha Cave

S4/G4; This beetle is common in cave riparian habitats and leaf litter in pit bottoms. Lewis (1998) reported it from caves in Crawford, Harrison, Orange and Washington counties.

ORDER LEPIDOPTERA

FAMILY NOCTUIDAE

Scoliopteryx libatrix (Linnaeus) TX Herald moth

Lawrence Co.: Buddha Cave

S5/G5; The Herald moth commonly over-winters in Indiana caves. The moths were found on the ceiling of the entrance passage in Buddha Cave.

ORDER DIPTERA

FAMILY HELEOMYZIDAE

Aecothea specus (Aldrich) TX heleomyzid fly

Lawrence Co.: Buddha Cave

S4/G4; This species occurs on the walls and ceilings of caves where it is the frequent associate of Amoebaleria. It is ubiquitous in Indiana caves (Busacca, 1975; Lewis, 1995; 1996; 1998).

Amoebaleria defessa (Osten Sacken)TX heleomyzid fly

Lawrence Co.: Buddha Cave

S4/G4; This species occurs on the walls and ceilings of caves, primarily during the cold part of the year.

FAMILY PHORIDAE

Megaselia cavernicola Brues TP Cave hump-backed fly

Lawrence Co.: Buddha Cave, Chase Cave

S5/G5; This species is ubiquitous in caves of the eastern U.S. and has also been reported from surface collections (Borgmeier, 1965). It probably occurs in nearly every cave in Indiana that is of any length (Lewis, 1994; 1995; 1996; 1998; 2002) and comes to baited pitfalls in abundance.

FAMILY SPHAEROCERIDAE

Spelobia tenebrarum (Aldrich) TB Cave dung fly

Lawrence Co.: Buddha Cave, Chase Cave

S5/G5; This fly is ubiquitous in Indiana caves (Blatchley, 1897; Banta, 1907; Lewis, 1994; 1995; 1996; 1998; 2001). It is particularly common on raccoon dung and has been found in essentially every cave in Indiana where baited pitfalls have been placed. The species occurs in caves across the eastern U.S. and is a mildly troglomorphic troglobite (Marshall & Peck, 1985).

PHYLUM CHORDATA
CLASS AMPHIBIA
ORDER CAUDATA

FAMILY PLETHODONTIDAE

Eurycea longicauda longicauda (Green) TX/TP Longtail salamander

Lawrence Co.: Buddha Cave

S5/G5; This species is usually associated with rocky streams and is frequently associated with springs (Minton, 2001). It was also noted by Minton that the Longtail salamander frequently occurred near the mouths of caves. In the HNF this salamander was sometimes found in significant numbers rather deep into the dark zone of caves. Its overall range encompasses much of the eastern U.S.

Eurycea lucifuga Rafinesque TP Cave salamander

Lawrence Co.: Buddha Cave

S4/G5; Most of the records for the Cave salamander are from springs, spring-fed brooks or caves, but have also been found under stones on dry, open hillsides, under trash in an open field, and in suburban yards (Minton, 2001). Compared to the Longtail salamander, the range of the Cave salamander is relatively restricted. In Indiana it occurs

only in the southern half of the state and a more compressed range essentially equal to the karst areas of the Appalachians, Interior Low Plateaus and Ozarks.

Plethodon dorsalis dorsalis (Cope) TX Zigzag salamander

Lawrence Co.: Chase Cave

S4/G5; In Indiana this species occurs primarily in the unglaciated southcentral karst area, otherwise being found only in rocky stream valleys where the glacial terrain has been dissected. It occurs in rocks slopes, sinkholes and occasionally in caves (Minton, 2001).

CLASS AVES

ORDER PASSERIFORMES

FAMILY TYRANIDAE

Sayornis phoebe (Latham) TX Eastern phoebe

Lawrence Co.: Buddha Cave

S5/G5; The Eastern phoebe constructs nests under overhangs and frequently chooses shelters and cave entrances.

CLASS MAMMALIA

ORDER CHIROPTERA

FAMILY VESPERTILIONIDAE

Pipistrellus subflavus (Cuvier) TX Eastern pipistrelle

Lawrence Co.: Buddha Cave

S4/G5; The Eastern pipistrelle is a common, permanent inhabitant of southern Indiana. Mumford and Whitaker (1982) reported that almost every cave visited contained at least one bat of this species, although only three caves had 50 or more. It was also noted that in small caves the pipistrelle was frequently the only bat species present. These bats always roost singly and usually occur on the walls or overhanging ledges rather than on the ceilings of caves. Pipistrelles occur in caves during all months of the year, although relatively few occur there during the summer months.

Eptesicus fuscus (Beauvois) TX Big brown bat

Lawrence Co.: Buddha Cave

S4/G5; One of these bats was found in the entrance room of the cave. This bat appears to withstand, perhaps prefer, more cold than most of the other bats that occur in Indiana. Big brown bats typically occur in or near the entrances of caves, where they typically hang singly on the cave walls or wedge themselves into cracks (both horizontal and vertical) (Mumford and Whitaker, 1982).

ORDER RODENTIA

FAMILY CRICETIDAE

Peromyscus leucopus (Rafinesque) TX White-footed mouse

Lawrence Co.: Buddha Cave

S5/G5; This species of mouse is one of the most common mammals in Indiana (Mumford and Whitaker, 1982). It frequently enters caves and Banta (1907) recorded it at least 1500 feet from the entrance of Mayfield's Cave in Monroe County. One of the mice was found among drift wood in the upper level passage near the entrance.

ORDER CARNIVORA

FAMILY PROCYONIDAE

Procyon lotor (Linnaeus) TX Raccoon

Lawrence Co.: Buddha Cave, Chase Cave

S5/G5; Evidence of raccoons in caves usually consists of latrines, which are important sources of food for the invertebrate community.

RESULTS

Fifty-two taxa were recorded during the survey of Buddha-Christian Cave, Chase Cave and Buddha Preserve Spring. These taxa were divided among 4 phya, 10 classes, 23 orders, 35 families and 47 genera. Of these, 13 were classified as obligate subterranean species:

Sphalloplana weingartneri Weingartner's cave flatworm S3/G3
Pseudocandona jeanneli Jeannel's groundwater ostracod S1/G2
Caecidotea stygia Northern cave isopod S4/G5
Caecidotea jordani Jordan's groundwater isopod S1/G1
Crangonyx packardi Packard's Groundwater amphipod S3/G4
Crangonyx indianensis Indiana cave amphipod S3/G3
Orconectes inermis Northern cave crayfish S3/G3
Phanetta subterranea Subterranean sheet-web spider S4/G5
Hesperochernes mirabilis Southeastern cave pseudoscorpion S3/G4
Conotyla bollmani Bollman's cave milliped S3/G3-4
Pseudosinella undescribed species near fonsa springtail S2/G2
Pseudanophthalmus emersoni Emerson's cave beetle S1/G1
Pseudanophthalmus undescribed species Buddha cave beetle S1/G1

Eleven of the obligate subterranean species were found in Buddha-Christian Cave, while Jordan's groundwater isopod was seen only in Chase Cave. The Indiana cave amphipod was found only in a spring on the preserve and is questionably stygobitic.

Three species of extreme rarity were found. Of these, Jordan's groundwater isopod is probably a phreatobite, an inhabitant of non-cave groundwaters. The range of this species now spans a distance of about 70 miles from Bloomington to the Blue River basin in Crawford County. The habitat of this species is notoriously difficult to sample and the range suggests that the lack of localities is an artifact of collection. Never-the-less, it certainly remains endemic to the southcentral Indiana karst.

The two species of cave ground beetles are a different case. In all likelihood the Buddha cave beetle is endemic to the small karst island isolated by the East Fork of White River and Guthrie Creek. At present it is known only from the Buddha-Christian Cave, but other caves within this limited area have not been sampled. Emerson's cave beetle is known only from two localities spanning about 5 miles, between which again no caves have been sampled.

Over the past 30+ years over 500 caves have been sampled in Indiana (Lewis, 1983-2006). Of these the following 17 sites are the most biologically diverse found to date. In this list, which is rank-ordered by number of obligate subterranean species, the Buddha-Christian Cave ties for 6th place.

Cave	Obligate Subterranean	G1-G3
Binkley Cave (Harrison Co.)	19	17
Wesley Chapel Gulf/Elrod Cave (Orange Co.)	18	15
Wyandotte Cave (Crawford Co.)	15	13
Blowing Hole (Harrison Co.)	12	10
Tucker Lake Spring Cave (Orange Co.)	12	9
Buddha-Christian Cave (Lawrence Co.)	11	9
Patton Cave (Monroe Co.)	11	9
Spring Springs Cave (Orange Co.)	11	9
Sibert's Well Cave (Crawford Co.)	11	9
Black Medusa Cave (Harrison Co.)	11	8
Patton Cave (Monroe Co.)	11	9
Dillon Cave (Orange Co.)	11	7
Hudelson Cavern (Orange Co.)	10	9
Linds Cave (Harrison Co.)	10	9
Murray Spring Cave (Orange Co.)	10	8
May Cave (Monroe Co.)	10	7
King/Bug Ear Cave (Lawrence Co.)	10	7

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