

Research Report

APPENDIX A

Annotated list of cave-dwelling taxa

By J. Judson Wynne

Editor's note: The following is an online-only supplement to the research report "Inventory, conservation, and management of lava tube caves at El Malpais National Monument, New Mexico," by J. Judson Wynne. It can be cited as Wynne, J. J. 2013. Appendix A: Annotated list of cave-dwelling taxa. [Online supplement.] *Park Science* 30(1)Appendix A:1–12. Available online at [http://www.nature.nps.gov/ParkScience/archive/PDF/Article_PDFs/ParkScience30\(1\)Summer2013_A1-A12_Wynne_3653.pdf](http://www.nature.nps.gov/ParkScience/archive/PDF/Article_PDFs/ParkScience30(1)Summer2013_A1-A12_Wynne_3653.pdf).

Author's notes: In cases where members of a given morphospecies were detected only in entrances and twilight zones, I erred cautiously and referred to them as "eisodophiles." In cases where both the location of the detection and known information concerning the morphospecies supported the likelihood of an animal being "troglophilic," but I was still uncertain, I categorized the animal as a "questionable troglophile." Additionally, when a morphospecies was found only in the deep zone of a cave (or several individuals of a morphospecies occurred only within the deep zone) but troglomorphic characters were lacking, I also referred to it as "questionable troglophile."

THERE WERE SEVERAL CASES WHERE INDIVIDUALS EVADED CAPTURE BUT WERE BELIEVED TO represent a distinct arthropod morphospecies for a given cave. Because this information is of limited value in this article, arthropod morphospecies groups for which specimens are lacking were not included. However, this information has been integrated into a larger El Malpais morphospecies database and will be analyzed and the results reported in additional publications.

For arthropod groups actively being studied, I either sent specimens or high-resolution images of specimens to taxonomic specialists for identification or verification of my identifications. These experts include Rolf Aalbu, Department of Entomology, California Academy of Sciences, San Francisco, California (Coleoptera: Tenebrionidae); R. Thomas Allen, The Academy of Natural Sciences of Drexel University, Philadelphia, Pennsylvania (Diplura); Max Barclay, Natural History Museum, London (Coleoptera), and Thomas Barr (deceased), formerly with Department of Biology, University of Kentucky, Lexington, Kentucky (Coleoptera: Carabidae); Ernest Bernard, Department of Entomology, The University of Tennessee, Knoxville (Collembola); Jostein Kjaerandsen, Museum of Zoology, Lund University, Lund, Sweden (Diptera: Mycetophilidae); Sarah Oliveira, Department of Biology, University of São Paulo, Brazil (Diptera: Mycetophilidae); Theodore Cohn (deceased), formerly with Department of Zoology, San Diego State University, California (Orthoptera: Rhamphidophoridae); Lynn Kimsey, Department of Entomology, University of California, Davis (Hymenoptera: Tiphiiinae); Robert Johnson, School of Life Sciences, Arizona State University, Tempe (Formicidae); Edward Mockford, Department of Biology, University of Illinois, Normal (Psocoptera); Glené Mynhardt, Department of Evolution, Ecology, and Organismal Biology, The Ohio State University, Columbus (Coleoptera: Ptinidae); Barry O'Connor, Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor (Acari); Stewart Peck, Department of Biology, Carleton University, Ottawa, Ontario, Canada (Coleoptera: Leiodidae); Pierre Paquin, Cave and Endangered Invertebrate Research, SWCA Environmental Consultants, Austin, Texas (Araneae); William Shear, Department of Biology, Hampden-Sydney College, Hampden Sydney, Virginia (Myriapods and Opiliones); and Harald Schillhammer, Department of Entomology, Naturhistorische Museum, Vienna, Austria (Coleoptera: Staphylinidae). For all other specimens, Colorado Plateau Museum of Arthropod Biodiversity staff and I identified the specimens to the lowest taxonomic level possible using available taxonomic keys.

"Det." following each species or morphospecies designation is the abbreviation for the Latin *dēterminēvit* or "determined by."

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Phylum Arthropoda**Class Arachnida****Order Araneae****Family Araneidae**

Metellina mimetoides Chamberlin & Ivie, 1941. Det. P. Paquin. Eisodophile.

One adult female was collected via timed search in the twilight zone of ELMA-262. Additionally, one juvenile specimen that may represent this species was collected via timed search at the entrance of ELMA-262.

Family Linyphiidae

Note: Numerous troglobitic and troglophilic forms of this family are known globally (e.g., Ruzicka 1998; Deltshv and Curcic 2002; Miller 2005).

Linyphiidae sp. Det. P. Paquin. Eisodophile.

One juvenile specimen was collected opportunistically near the entrance of ELMA-262. Another juvenile was collected via timed search in the twilight zone of ELMA-303.

Leptyphantes sp. Det. P. Paquin. Eisodophile.

Two female specimens were collected by timed searches at the entrance of ELMA-012; one female specimen was collected using direct intuitive searches in the moss gardens of ELMA-008.

Porrhomma sp. 1. Det. P. Paquin. Troglophile?

One female specimen was collected using direct intuitive searches within root curtains in the deep zone of ELMA-315.

Porrhomma sp. 2. Det. P. Paquin. Troglophile?

One female specimen was collected using direct intuitive searches within root curtains in the deep zone of ELMA-303. P. Paquin (personal communication, e-mail, 23 March 2007) suggests it differs from *Porrhomma* sp. 1.

Family Liocranidae

Liocranidae sp. Det. P. Paquin. Troglophile?

One juvenile specimen was collected via timed search in the deep zone of ELMA-012.

Family Nesticidae

Note: Nesticidae has an impressive cave fauna globally (Hedin 1997; Cokendolpher and Reddell 2001; Snowman et al. 2010).

Nesticidae sp. Det. P. Paquin. Eisodophile.

One juvenile specimen was collected opportunistically from the twilight zone of ELMA-012.

Eidmanella pallida (Emerton, 1875). Det. P. Paquin. Troglophile.

Three females were collected using direct intuitive searches within root curtains in the deep zone of ELMA-315. Two juvenile specimens (identified as Nesticidae sp.) were collected using direct intuitive searches within root curtains in the deep zone of this cave. While unconfirmed, these juveniles may also be *Eidmanella pallida*.

Note: Reddell and Cokendolpher (2004) consider this species a troglophile in Texas caves.

Family Pholcidae

Note: Both troglophilic and troglobitic forms of this family are known globally (e.g., Gertsch and Peck 1992; Deeleman-Reinhold 1993; Chen et al. 2011; Ferreira et al. 2011).

Psilochorus sp. 1. Det. P. Paquin. Troglophile?

One male and two females were collected using direct intuitive searches within root curtains in the deep zone of ELMA-303. Three males were collected via timed searches ($n = 2$) and pitfall trapping ($n = 1$) at the entrance and beneath the skylights of ELMA-008. One female specimen was identified via timed search in the twilight zone, directly below the entrance of ELMA-315. Two males were collected by timed searches in both the entrance and deep zone of ELMA-012, and two individuals (1 male, 1 female) were collected via timed search from the entrance in Hummingbird Cave.

Psilochorus sp. 2. Det. P. Paquin. Troglophile?

Two individuals were collected opportunistically in the deep zone near the bat maternity roost in ELMA-062. One adult female specimen was designated as a different species from *Psilochorus* sp. 1 (P. Paquin, personal communication, e-mail, 4 December 2009). Additionally, one juvenile specimen identified as *Psilochorus* was collected from the same cave. I suggest it is probably the same morphospecies because an adult female was identified in the same area as the juvenile specimen.

Family Theridiidae

Achaearanea porteri (Banks, 1896). Det. P. Paquin. Troglophile.

Two females were collected using timed searches, one near the entrance and the other in the twilight zone of ELMA-303. Three females were collected via direct intuitive searching ($n = 2$) in root curtains and with timed searches ($n = 1$) in the deep zone of ELMA-315.

Note: Cokendolpher and Reddell (2001) consider this species a troglophile in Texas caves.

Nesticodes rufipes (Lucas, 1846). Det. P. Paquin. Troglophile.

Three adult females were collected using direct intuitive searches in root curtains from the deep zone of ELMA-315.

Note: Because all were located within the same location and none had characters suggestive of troglomorphism, I consider this spider a troglophile. Additionally, theridiid spiders have been widely documented globally as being both troglophiles and troglobites (e.g., Ferreira and Martins 1998; Ruzicka 1998; Dippenaar-Schoeman and Myburgh 2009).

Steatoda sp. Det. P. Paquin. Unknown.

One juvenile specimen was collected from a pitfall trap within the twilight zone of ELMA-062.

Theridion n.sp.? Det. P. Paquin. Troglobite?

One adult female was collected via timed search in the twilight zone of ELMA-262. P. Paquin (personal communication, e-mail, 23 March 2007) suggests this may be a new species, and potentially has cave-adapted characteristics.

Order Opiliones

Family Sclerosomatidae

Leiobunum townsendii Weed, 1893. Det. W. Shear. Troglonexene.

This harvestman (n = 13) was identified from ELMA-012, ELMA-062, ELMA-008, ELMA-262, ELMA-303, ELMA-315, and Hummingbird Cave. It was collected via direct intuitive search in the moss gardens of ELMA-008 and ELMA-012 and in root curtains in the deep zone of both ELMA-303 and ELMA-315. It was collected both opportunistically and via timed search in the entrances and twilight zones of ELMA-062 and Hummingbird Cave. W. Shear (personal communication, e-mail, 12 April 2009) suggests this group in western North America requires major revision. It is possible multiple species exist across the southwestern United States, or greater North America. However, until it is revised, the accepted name provided here will be used.

Subclass Acari

Order Sarcoptiformes

Family Histiosomatidae

Histiosoma n.sp. Det. B. O'Connor. Troglophile?

Two deutonymphs were collected during timed searches in the deep zone of ELMA-315. B. O'Connor indicates this is an undescribed species. This animal is similar to *H. pierrestrinati* described from Carlsbad Cavern (B. O'Connor, personal communication, e-mail, 3 August 2012).

Order Trombidiformes

Family Bdellidae

Bdellidae sp. Det. B. O'Connor. Troglophile?

One specimen was collected by direct intuitive searches in the deep zone of ELMA-303. The palpi were damaged during collection, so lower-level taxonomic identification was not possible. B. O'Connor (personal communication, e-mail, 3 August 2012) indicates this family contains predators of soil, leaf litter, and littoral zones.

Family Erythraeidae

Erythraeus sp.? Det. B. O'Connor. Eisodophile.

Five specimens were captured via pitfall trapping from the twilight zone of ELMA-008. B. O'Connor (personal communication, e-mail, 3 August 2012) indicates this genus is known from the Southwest, but no species are described. Additional analysis will be required to identify these specimens to a lower taxonomic level.

Family Rhagiididae

Rhagiididae sp. Det. B. O'Connor. Troglophile?

One specimen was collected by direct intuitive searches in the dark zone of ELMA-012. The specimen was damaged and could not be identified beyond family level.

Family Smarididae

Phanolophus sp. Det. B. O'Connor. Unknown.

One specimen was collected via pitfall trapping at the entrance of ELMA-012. This family of predatory mites has not been studied in North America (B. O'Connor, personal communication, e-mail, 3 August 2012).

Subphylum Myriapoda

Class Chilopoda

Order Lithobiomorpha

Family Gosibiidae

Gosibiidae sp. Det. B. Shear. Troglophile?

One specimen was collected using direct intuitive searches from root curtains in the deep zone of ELMA-303. Additional specimens will be required to identify this centipede beyond the family level (W. Shear, personal communication, e-mail, 9 October 2009).

Class Diplopoda

Order Chordeumatida

Family Contylidae

Austrotyla sp.? Det. W. Shear. Eisodophile.

This specimen (n = 1), identified to genus level by W. Shear, was collected via direct intuitive search from the moss gardens of ELMA-008. Additional specimens will be required to identify this animal to a lower taxonomic level.

Austrotyla cf coloradensis (Chamberlin, 1910). Det. W. Shear. Troglophile?

One specimen was collected using direct intuitive searches from root curtains in the deep zone of ELMA-315. This is a tentative species designation because of a lack of material. Additional specimens will be required to confirm this species designation.

Class Entognatha

Subclass Collembola

Order Entomobryomorpha

Note: The two new collembolan species will be included in a paper describing several new cave-dwelling Collembola species from the southwestern United States.

Family Entomobryidae

Drepanura n.sp. Det. E. Bernard. Troglophile?

One specimen was collected using pitfall trapping near the entrance of ELMA-008. E. Bernard (personal communication, e-mail, 15 July 2010) indicates this specimen represents a new species.

Entomobrya guthriei Mills, 1931. Det. E. Bernard. Troglophile?

Five specimens were collected via pitfall trapping from the twilight zone to the deep cave zone of ELMA-110.

Entomobrya zona? Christiansen & Bellinger, 1980. Det. E. Bernard. Troglophile?

All specimens were collected in the entrances and twilight zones of ELMA-012 (n = 28) and ELMA-008 (n = 4). Seven specimens were collected using direct intuitive searches from moss gardens beneath the skylights of ELMA-012. All of the remaining specimens were captured using pitfall trapping. They likely represent *E. zona*. E. Bernard (personal communication, e-mail, 15 July 2010) made this tentative species designation, but indicated the specimens are not a "sure fit" for this species.

Family Tomoceridae

Pogonognathellus n.sp. Det. E. Bernard. Eisodophile.

All specimens were collected via direct intuitive searches from the moss gardens of ELMA-008 (n = 10) and opportunistic collecting of ELMA-012 (n = 2). E. Bernard (personal communication, e-mail, 15 July 2010) suggests these specimens represent a new species.

Order Diplura

Family Campodeidae

Campodeidae n.sp. Det. J. Wynne and T. Allen. Troglobite.

This animal was first reported by Northup and Welbourn (1997). Five specimens were collected using direct intuitive searches from the "mud room" at the terminus of ELMA-054. Dipluran taxonomist Dr. Thomas Allen has these specimens and has confirmed this as a new species (personal communication, e-mail, 5 May 2013). I will be working with him to describe this new species.

Class Insecta

Order Coleoptera

Family Carabidae

Rhadine n.sp. perlevis species-group. Det. T. Barr. Troglonexene.

These carabid beetles ($n = 25$) were identified primarily by pitfall trapping (but also with opportunistic collecting and timed searches) from ELMA-062, ELMA-110, ELMA-262, ELMA-303, and ELMA-315. This animal was observed from the twilight to deep zones of most caves. These specimens were initially sent to Dr. Thomas Barr for identification. T. Barr (personal communication, e-mail, 12 June 2009) suggested the specimens represent a new species and they belong to the *perlevis* species-group of *Rhadine*. Dr. Barr passed away in April 2011. The specimens are now at the Carnegie Museum of Natural History in Pittsburgh, Pennsylvania, and are awaiting formal description. Dr. Kipling Will, Essig Museum of Entomology, University of California, Berkeley, is coordinating this effort.

Family Cryptophagidae

Cryptophagidae sp. Det. M. Barclay. Eisodophile.

One specimen was collected via pitfall trapping from the entrance of ELMA-062. Additional work will be required to identify this specimen to a lower taxonomic level.

Family Leiodidae

Dissochaetus arizonensis Hatch, 1933. Det. S. Peck. Accidental.

This leiodid beetle was collected from cave entrances of ELMA-012 ($n = 1$) and ELMA-062 ($n = 1$), while specimens from ELMA-315 ($n = 2$) were detected in the cave deep zone; all were captured using baited pitfall traps.

Note: S. Peck (personal communication, e-mail, 28 February 2013) suggests this species is an accidental because there are no data to suggest it is a regular cave dweller or that it reproduces in caves.

Family Melyridae

Listrus sp. Det. M. Barclay. Eisodophile.

This coleopteran was captured via pitfall trapping ($n = 1$) in the twilight zone of ELMA-262. This specimen will require further study.

Family Ptinidae

Niptus ventriculus LeConte, 1859. Det. G. Mynhardt. Troglophile.

Five spider beetle specimens were collected via pitfall trapping in ELMA-008 ($n = 1$), ELMA-012 ($n = 2$), and ELMA-262 ($n = 1$) and by opportunistic collecting in ELMA-062 ($n = 1$). Four specimens were collected in the cave entrances, while one specimen was collected in the twilight zone.

Note: Spilman (1968) documented this species in packrat middens, while Aalbu (2005) indicated

larvae and potentially adults feed on the scat of packrats. Given that habitat exists for these spider beetles and that they complete a portion of their life cycle underground, I consider this animal a troglophile.

Family Staphylinidae

Staphylinidae sp. Det. J. Wynne. Eisodophile.

One individual was collected from the entrance of ELMA-012 during time searches. Additional work will be required to identify this specimen to a lower taxonomic level.

Subfamily Tachyporinae

Sepedophilus sp. Det. H. Schillhammer. Eisodophile.

Three individuals were collected from the twilight zone of ELMA-062 (n = 2) and entrance of ELMA-315 (n = 1). Each specimen was detected using a different technique from the others: opportunistic collecting, timed searches, and pitfall traps. H. Schillhammer (personal communication, e-mail, 19 April 2013) suggests this genus is generally not associated with caves.

Family Tenebrionidae

Neobaphion planipennis (LeConte, 1866). Det. R. Aalbu. Troglaxene.

Four individuals were collected opportunistically and via timed search from ELMA-062 (n = 3) and using direct intuitive searches in ELMA-303 (n = 1). In ELMA-062 this species was observed in the dark zone and beneath a skylight entrance; the individual in ELMA-303 was collected from the deep zone.

Note: Aalbu et al. (2012) consider this species an occasional troglaxene in ELMA-062.

Order Diptera

Family Culicidae

Culicidae sp. Det. J. Wynne. Troglaxene.

One culicid fly was collected opportunistically from the entrance of ELMA-012 and one via timed search in the deep zone of ELMA-315. Additional work will be required to identify this specimen to a lower taxonomic level.

Note: Reeves et al. (2000) and Makiya and Taguchi (1982) identified mosquitoes as troglaxenes.

Family Mycetophilidae

Mycetophila sp. Det. J. Kjaerandsen and S. Oliveira. Troglaxene?

One specimen was collected using direct intuitive searches from the root curtains in the deep zone of ELMA-303. Additional work will be required to identify this specimen to a lower taxonomic level.

Note: Peck (1981) considered a morphospecies of this genus and five morphospecies of this family to be troglaxenes from two caves (>2,134 m [7,000 ft] elevation) in the Uinta Mountains, Utah. Additionally, from caves in Grand Canyon National Park, Peck (1980) considered a morphospecies of this genus to be a troglaxene.

Family Phoridae

Phoridae sp. Det. J. Wynne. Eisodophile.

Eight specimens were collected from pitfall traps at the entrance of ELMA-062 (n = 7) and in the twilight zone of ELMA-008 (n = 1). One individual was collected using direct intuitive searches in the moss gardens beneath skylights of ELMA-012. Additional work will be required to identify

these specimens to a lower taxonomic level.

Family Sciaridae

Sciaridae sp. Det. J. Wynne. Eisodophile.

Twenty-one specimens were collected via opportunistic collecting, pitfall trapping, and timed searches from the entrance to the middle of ELMA-062; one specimen was collected using direct intuitive searches from the moss gardens beneath a skylight of ELMA-008; and three specimens were collected opportunistically from the entrance of ELMA-061. Additional work will be required to identify these specimens to a lower taxonomic level.

Order Hemiptera

Infraorder Fulgoromorpha

Superfamily Fulgoroidea

Fulgoroidea n.sp.? Det. J. Wynne. Troglobite?

Nymphal-stage planthoppers were collected using direct intuitive searches in root curtains from the deep zones of ELMA-303 and ELMA-315. Adults will be required to confirm troglomorphy, identify to a lower taxonomic level, and determine new species status.

Order Hymenoptera

Family Formicidae

Liometopum sp. Det. R. Johnson. Eisodophile.

One undetermined *Liometopum* specimen was collected using direct intuitive searches in the moss gardens of ELMA-008.

Pheidole sp. Det. R. Johnson. Eisodophile.

Two minor workers (R. Johnson, personal communication, e-mail, 10 December 2010) were collected via pitfall trapping near the entrance and at close proximity to the moss gardens of ELMA-008.

Family Tiphidae

Note: All specimens of both tiphid wasp species were found in a torpor beneath rocks; given the time of season, I suggest these individuals were in the early stages of hibernation and were likely using moss gardens as winter habitat.

***Tiphia andersoni* Allen, 1971.** Det. L. Kimsey. Eisodophile.

One female specimen was collected using direct intuitive searches in moss gardens (beneath large skylights) of both ELMA-012 and ELMA-008. Historically, this wasp is known to occur in central Mexico as well as southeastern and north-central Arizona (Allen 1971). This animal was not known to occur in New Mexico and thus represents a range expansion.

***Tiphia nona* Allen, 1965.** Det. L. Kimsey. Eisodophile.

One female specimen was collected using direct intuitive searches in the moss gardens of ELMA-008. Previously it was known from central Mexico, southeastern Arizona to the southern extent of the Mogollon Rim, and one locality in southwestern Kansas (Allen 1971). This animal was not known to occur in New Mexico and thus represents a range expansion.

Order Lepidoptera

Note: None of the larval specimens were reared in the lab and I was unable to locate a key for Lepidoptera larvae. Thus, all lepidopteran specimens have been sorted into operational taxonomic units, and further identifications were not possible before this article was published. This level of identification is acceptable for community-level as well as other analyses, which will be the subject of additional scientific publications.

Lepidoptera sp. 1. Det. J. Wynne. Troglophile?

Three larval specimens were collected with pitfall traps ($n = 2$) and via direct intuitive searches ($n = 1$) from the root curtains within the deep zone of ELMA-315.

Lepidoptera sp. 2. Det. J. Wynne. Troglophile?

Four larval specimens were collected using direct intuitive searches of the root curtains within the deep zone of ELMA-315 ($n = 3$) and ELMA-303 ($n = 1$).

Lepidoptera sp. 3. Det. J. Wynne. Troglophile?

One larval specimen was collected using direct intuitive searches of the root curtains within the deep zone of ELMA-315.

Lepidoptera sp. 4. Det. J. Wynne. Troglophile?

One larval specimen was collected using direct intuitive searches of the root curtains within the deep zone of ELMA-315.

Lepidoptera sp. 5. Det. J. Wynne. Troglophile?

One larval specimen was collected using direct intuitive searches of the root curtains within the deep zone of ELMA-303.

Lepidoptera sp. 6. Det. J. Wynne. Eisodophile.

One adult moth was collected during a timed search in the entrance of ELMA-262.

Lepidoptera sp. 7. Det. J. Wynne. Eisodophile.

One adult moth (different from *Lepidoptera sp. 6*) was collected during a timed search in the entrance of ELMA-012.

Family Tenididae

Tenididae sp. 1. Det. J. Wynne. Eisodophile.

One micro-lepidopteran was collected opportunistically in ELMA-262.

Tenididae sp. 2. Det. J. Wynne. Eisodophile.

One micro-lepidopteran (different from *Tenididae sp. 1*) was found in a pitfall trap in the twilight zone of ELMA-008.

Order Orthoptera

Family Rhaphidophoridae

Ceuthophilus sp. Det. T. Cohn. Troglaxene.

One juvenile male was captured via pitfall trapping from the entrance of ELMA-010. Given this animal's immature state, it was not possible to identify it to a lower taxonomic level.

Ceuthophilus cf apache n.sp. Det. T. Cohn. Troglaxene.

T. Cohn (personal communication, e-mail, 21 March 2011) indicated this was a new *Ceuthophilus* species, which is similar to *Ceuthophilus cf apache*. We collected one adult male and one adult female from ELMA-062, two adult males from ELMA-303, and one adult male from ELMA-315. This morphospecies was detected using opportunistic collecting, pitfall trapping and timed searches, and occurred from the entrances to each cave's dark/deep zone.

Ceuthophilus (Geotettix) polingi Hubbell, 1936. Det. T. Cohn. Troglaxene.

T. Cohn and A. Swanson identified all specimens in this group. We collected two adult females and four adult males from ELMA-262, one adult male from Hummingbird Cave, one adult male from ELMA-012, one adult male from ELMA-054, one adult female and two adult males from ELMA-303, and two adult females from ELMA-315. This species was detected using opportunistic collecting, pitfall trapping, and timed searching, and occurred from the entrances to each cave's dark/deep zone. T. Cohn (personal communication, e-mail, 21 March 2011) suggested this animal was considered rare until recently; we now know it is widespread in its range, but probably restricted to caves and animal burrows.

Order Psocoptera

Family Psyllipsocidae

Psyllipsocus ramburii Selys Longchamps, 1872. Det. E. Mockford. Troglophile.

This species was identified from ELMA-062 (n = 2), ELMA-262 (n = 1), and ELMA-315 (n = 6).

With the exception of one individual collected opportunistically, all were detected in pitfall traps and from cave entrances to the dark/deep zones.

Note: This species is known to occur in caves globally (E. Mockford, e-mail, 1 February 2013). E. Mockford and I (unpublished data) recently confirmed this species on Easter Island, South Pacific Ocean, as well as from a cave on Grand Canyon–Parashant National Monument, Arizona.

Order Siphonaptera

Family Pulicidae

Pulicidae sp. Det. J. Wynne. Parasite.

Nine specimens were collected from ELMA-315. I found no evidence of recent rodent activity within either cave. However, the presence of fleas suggests recent vertebrate use. Additional work will be required to identify these specimens to a lower taxonomic level.

Phylum Chordata

Subphylum Vertebrata

Class Reptilia

Family Colubridae

Pituophis catenifer (Blainville, 1835). Det. J. Wynne. Unknown.

A gopher snake carcass was found in the twilight zone of ELMA-061. This individual had numerous lacerations along the length of its body. A park visitor probably killed the snake. Because I am uncertain whether the snake was killed in the cave or brought into the cave postmortem, its functional group status is "unknown."

Class Mammalia**Order Chiroptera****Family Vespertilionidae**

Corynorhinus townsendii Cooper, 1837. Det. J. Wynne. Troglaxene.

This bat has been documented hibernating in ELMA-054 since 2005 (Wynne 2006). A maternity roost exists at ELMA-110. This maternity roost has been documented both in the tunnel section prior to the main section of the cave and in the twilight zone of the cave's main section.

Eptesicus fuscus (Palisot de Beauvois, 1796). Det. J. Wynne. Troglaxene.

One torpid big brown bat was observed near the entrance of ELMA-054.

Family Molossidae

Tadarida brasiliensis (I. Geoffroy, 1824). Det. J. Wynne. Troglaxene.

A long-established maternity roost of Mexican free-tailed bats exists in ELMA-062. We observed bats in residence during the October 2007 work.

Order Rodentia**Family Muridae**

Neotoma sp. Det. J. Wynne. Troglaxene.

Evidence of *Neotoma* sp. was documented at both ELMA-062 and ELMA-061. Both *N. mexicana* and *N. albigula* have been confirmed on the monument (Bogan et al. 2007). Either or both of these species likely use these caves.

Order Carnivora

Unknown family, genus, and species. Xenosylle?

Small carnivore scat was observed at the entrance of ELMA-054 and in the twilight zone of ELMA-110. Because we neither observed small carnivores nor saw them hunting bats within either cave, "questionable xenosylle" is most appropriate.

Class Aves**Order Tytonidae**

Tyto alba (Scopoli, 1769). Det. J. Wynne. Eisodophile.

A barn owl was spooked as the team entered ELMA-262. The animal was observed within the main entrance and flew deeper into the cave toward the next collapse pit entrance, where it exited the cave.

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