

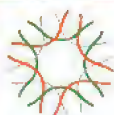
# The Cave Fauna of California

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G.O. Graening, Thomas S. Briggs, Darrell Ubick,  
Rolf L. Aalbu, Jean Krejca, Steven J. Taylor

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Front cover: Above, Fossil Cave, Lava Beds National Monument, Fig. 4, p. 8. Below, upper left, Fig. 45, p. 54; upper right, Fig. 95, p. 63; lower left, Fig. 56, p. 56. lower center, Palmer Cave entrance, Tulare County (J. Krejca photo); lower right, roots in Crystal Sequoia Cave, Tulare County (J. Krejca photo).

Back cover: Life in the caves. Upper left, Fig. 62, p. 57; upper right, Fig. 85, p. 61; center left Fig. 30, p. 52; center right, Fig. 96, p. 63; bottom left Fig. 32, p. 52; bottom right Fig. 21, p. 50.

## COVER DESIGN

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Hidden biodiversity is revealed in this study of California’s subterranean fauna, which contains distinctive elements that differentiate it from other North American regions. Since 1975, the rate of discovery of new species has accelerated with funded projects in most of the important cave areas of the state, including our own studies. Here we compile all available biological records for subterranean sites in California dating back to 1840.

California’s karst is primarily comprised of small outcrops of marble or limestone with thousands of caves. Additionally, lava and ash flows, tens of thousands of mines, hundreds of sea caves on the mainland coast and islands, and extensive groundwater systems provide habitat for subterranean life.

At least 4,600 caves of all types are known in California, of which 22% have been biologically sampled. We summarize 1,301 biological sites, and analyze data from

**998 caves: (693 karst caves and features, 181 lava tubes, and 124 sea caves), 143 groundwater sites, and 160 mines and tunnels.**

The richest regions for obligate subterranean species are the Sierra Nevada, Klamath Mountains, and lava flows in the northern portion of the State. The high number (72) of single-site endemic species is indicative of the insular distribution of karst, large differences in elevation, and the many river systems cutting across the state's mountain ranges.

In our database 1,366 taxa are recorded; 134 were determined to Family or higher taxa only. There are 102 troglobites (terrestrial cave obligates), 12 stygobites (aquatic cave obligates), and 32 phreatobites (obligate groundwater forms). Of those 146 obligate subterranean taxa, 11 are still undetermined beyond Order or Family, and represent an uncertain number of distinct species, although some may be more than single new species. Our species list includes 109 new (currently undescribed) species of all types, including 72 obligate subterranean species: 61 troglobites, 3 stygobites, and 8 phreatobites, significantly adding to the knowledge of California's biodiversity.

California has a long, complex geologic history. Karst with highly endemic, troglobitic (cave-obligate or troglolithic) species occurs in small outcrops of marble or limestone that originated from island terranes that were accreted onto the North American plate. Extensive lava and ash flows, mostly in northeastern California, also have rich cave fauna. More than 39,000 inactive mines occur all across the state, many of them containing bats and interesting invertebrates. One troglobitic species occurs in two littoral (sea) caves among the hundreds of sea caves on the coast and adjacent Channel and Farallon Islands, but many marine species are known from sea caves and there are some interesting terrestrial relicts. Extensive groundwater systems also provide habitat for subterranean life, some narrowly restricted to specific aquifers or river substrates. Boreal, montane, and tropical relicts are represented in the terrestrial cave fauna, but the true geographic origins of much of the fauna remain to be elucidated.

Records of groundwater fauna in California date back to 1840, and cave fauna to 1863. Early 20th century archaeologists and paleontologists conducted surveys of caves containing Pleistocene deposits, and they discovered many new extinct and extant species. Since 1975 the rate of discovery of new species has accelerated in most of the important cave areas of the state.

In 1979, five of the nine current authors began compiling an exhaustive faunal list and bibliography. Many new species and records were added during intensive field work sponsored by the U.S. Army Corps of Engineers in 1977–1978. Most of this work was concentrated in the Stanislaus River canyon of the Northern Sierra Nevada because of a new dam for the New Melones Lake (reservoir) and the scheduled inundation of numerous caves. In 1979 a study funded by the U.S. Fish and Wildlife Service expanded the study of caves across northern California.

By 1985 about 650 species and subspecies had been recorded from 281 caves, 23 sea caves, 26 mines and 10 groundwater localities. In the 2000s projects were funded by the National Park Service at Sequoia and Kings Canyon National Parks, Yosemite National Park, and Lava Beds National Monument. The number of known subterranean species has doubled since 1985. The nine authors collectively have done extensive field work across the state, and this paper and our associated Kryptos database (see Methods) document an effort to compile all biological records for subterranean sites in California.

We summarize data from 1,296 biological sites, which are detailed below in maps, tables, and discussions. Figure 1 is a map depicting California cave regions with density of caves per county and 500 representative sites (localities) of all types.



A troglobite is an animal that is limited to caves and similar habitats, and exhibits troglomorphy; also known as a “troglobiont,” obligate cavernicole, or obligate subterranean species. A stygobite (stygobiont) is an aquatic troglobite. Troglomorphy includes the physical characteristics of a troglobite or stygobite; e.g., reduced eyes and pigment, elongated appendages, well-developed tactile and olfactory organs, etc. See Appendix 3, Glossary, for definitions of biological and geological terms.

At least 1,366 taxa are recorded in subterranean habitats in California (Appendix 1), including 102 terrestrial troglobites (terrestrial troglobionts), 12 stygobites (aquatic troglobionts), and 32 phreatobites (obligate, usually troglomorphic groundwater forms), a total of 146 obligate subterranean taxa. Half (72) of the subterranean obligates are considered by taxonomists to be new (currently undescribed) species, with 61 troglobites, 3 stygobites, and 8 phreatobites. Our species list includes 109 new (undescribed) species of all types, significantly adding to our knowledge of California’s biodiversity.

The number of species known from California caves will doubtless increase dramatically as more caves, especially in remote areas, are studied. In addition, many collections, especially of mites, spiders, centipedes, collembolans, flies, and other insect groups, await taxonomic study.

## GEOLOGY AND CAVE REGIONS

### Geologic Setting

California is a large state (1,345 km by 350 km, 423,970 km<sup>2</sup>) with complex physiography and geology; it contains a diverse array of karst (carbonate rocks), volcanic, littoral (sea), and other cave types (Fig. 1). Along with 450 defined aquifers (Carle 2004), there are numerous subterranean habitats in which animals survive and adapt. In addition, more than 39,000 inactive mines occur in many rock types across the state (California Department of Conservation 2000).

The state is a mosaic of plutonic, volcanic, metamorphic, and sedimentary rocks, often closely juxtaposed. Karst areas in California are formed in ancient carbonate terranes that originated as reef islands in the Paleo-Pacific Ocean, and were rafted on the ancient Farallon plate until they accreted onto the west coast of North America along with other terranes. The Farallon plate collided with the North American plate and was largely subducted beneath it. The remains of the Farallon plate are the Juan de Fuca, Explorer and Gorda plates (Lonsdale 2005).

The oldest carbonates are from the late Paleozoic Era, Carboniferous age, about 300 Ma (million years ago). A major karst formation, the Calaveras Assemblage, contains sparse fossils of Permian age (299 to 252 Ma) in its upper part, and it is strung out in many outcrops along the west flank of the Sierra. Marble Mountain, part of the Klamath Mountains in the north, also is of Permian age. Later carbonates are from the Mesozoic Era, probably Triassic age, 250–200 Ma. These terranes underwent deep burial and metamorphism, and some became “roof pendants” embedded in the Sierra Nevada Batholith.

The Sierra Nevada is 600 km long and 60 to 120 km wide. The Sierra Nevada Batholith is the core of the Sierra, a large mass of igneous intrusive (plutonic) rock that formed during the late Triassic (~210 Ma) into the late Cretaceous (~80 Ma). The batholith formed from cooled magma deep in the Earth’s crust. The batholith is composed of many individual plutons, which formed deep underground during separate episodes of magma intrusion, long before the Sierra itself first began to rise (Bateman 1988).

Two major episodes of uplift and tilting ensued in the late Mesozoic, 120–80 Ma, followed by erosion. A second episode in the late Cenozoic, 10–3 Ma, caused uplift in the form of westward tilting of the range as a block. Exhumation of the carbonates and subsequent karstification followed

(Bateman 1988; Stock and Moore 2003). The ages of the karst caves are not well known, but dating of cave deposits indicates that caves of the southern Sierra began forming in the late Pliocene and Quaternary, ~5 Ma to the present (Stock and Anderson 2002). In the Mother Lode region (northern Sierra Nevada) deposits of Pliocene volcanic rocks (5.3 to 2.6 Ma) fill older karst caves and similar features (Bruce Rogers, pers. comm.). Cave sediments along the Stanislaus River in the central Mother Lode were dated to about 1.63 Ma by cosmogenic  $^{26}\text{Al}/^{10}\text{Be}$  burial dating (Stock, Anderson, and Finkel 2004). Many of the Sierran caves mark former river levels etched into the bedrock walls of deep river canyons that were uplifted about 3 Ma. Coarse sediments in Clough Cave, southern Sierra Nevada, are  $1.03 \pm 0.13$  Ma per cosmogenic  $^{26}\text{Al}/^{10}\text{Be}$  burial dating, but the cave could be much older (Stock et al. 2005).

The Sierra Nevada was repeatedly glaciated during the Pleistocene Epoch between 2 Ma to 10 ka (thousand years ago). During the glacial maximum about 22,000–18,000 ka, the Sierra had an icecap about 430 by 30–50 km. During the most recent glaciation valley glaciers descended to altitudes of 900 to 1,200 m. More than 15 glaciations may have occurred (Stock and Moore 2003). These glaciations could have caused repeated isolations, colonizations, and extinctions of cave fauna.

As a result of the great relief among caves in the southern Sierra Nevada (500–3,350 m above sea level), archipelagoes of caves and karst occur in a variety of different ecological zones, including grass and oak woodlands, pine forests, steep river canyons, and alpine areas. Cave temperatures range from 0 to 18°C. Few areas in North America display such ecological diversity in cave and karst areas over such short distances (Stock and Moore 2003).

Lava flows in Siskiyou County range in age from 200 Ma, to 4–3 Ma, and as recent as 114–12.3 ka at Lava Beds National Monument. Subway Cave, in the Hat Creek Lava Flow of Shasta County, is less than 2,000 years old. In many lava flows there has been ample time for animals to become isolated in the lava flow crevices and tubes and evolve subterranean adaptations.

### California's Cave Regions

Geology and physiography combine to divide the caves into a number of isolated regions and karst areas. The 12 regions in this paper (Fig. 1) correspond in part to commonly used biological regions. The Central Valley (Sacramento Valley and San Joaquin Valleys) has very few caves. In this paper the three coastal regions are treated in tabulations as one region, Coast Ranges. Our eight primary cave regions are defined to summarize cave geology and cave biogeography, providing a framework for broader summaries and biogeographic analyses. The descriptions of these regions, subregions, and cave areas that follow are derived from Halliday (1962), Bateman (1988), Stock and Moore (2003), Bruce Rogers (pers. comm.), and our own observations. Our relational database and geographic information system (see Methods) created with this effort will facilitate future biogeographic research, including smaller areas with distinctive faunas.

More than 4,600 caves are currently known in California (Bruce Rogers, pers. comm.). We have general locational data for about 2,776 sites in many rock types; this includes 1,322 caves, pits, rockshelters, sinkholes, crevices and talus; 451 lava and ash caves; 405 littoral (sea) caves; 260 groundwater sites (including 38 sampled springs, 44 streams and lakes, 49 other hyporheic habitats below streams, and 6 wells); and 223 mines. Table 1 provides details on regions, types of sites, and numbers of sites that were biologically sampled.

#### Cave Region 1 — Klamath Mountains

This region, similar to the conventional Sierra-Klamath region, comprises western Siskiyou,



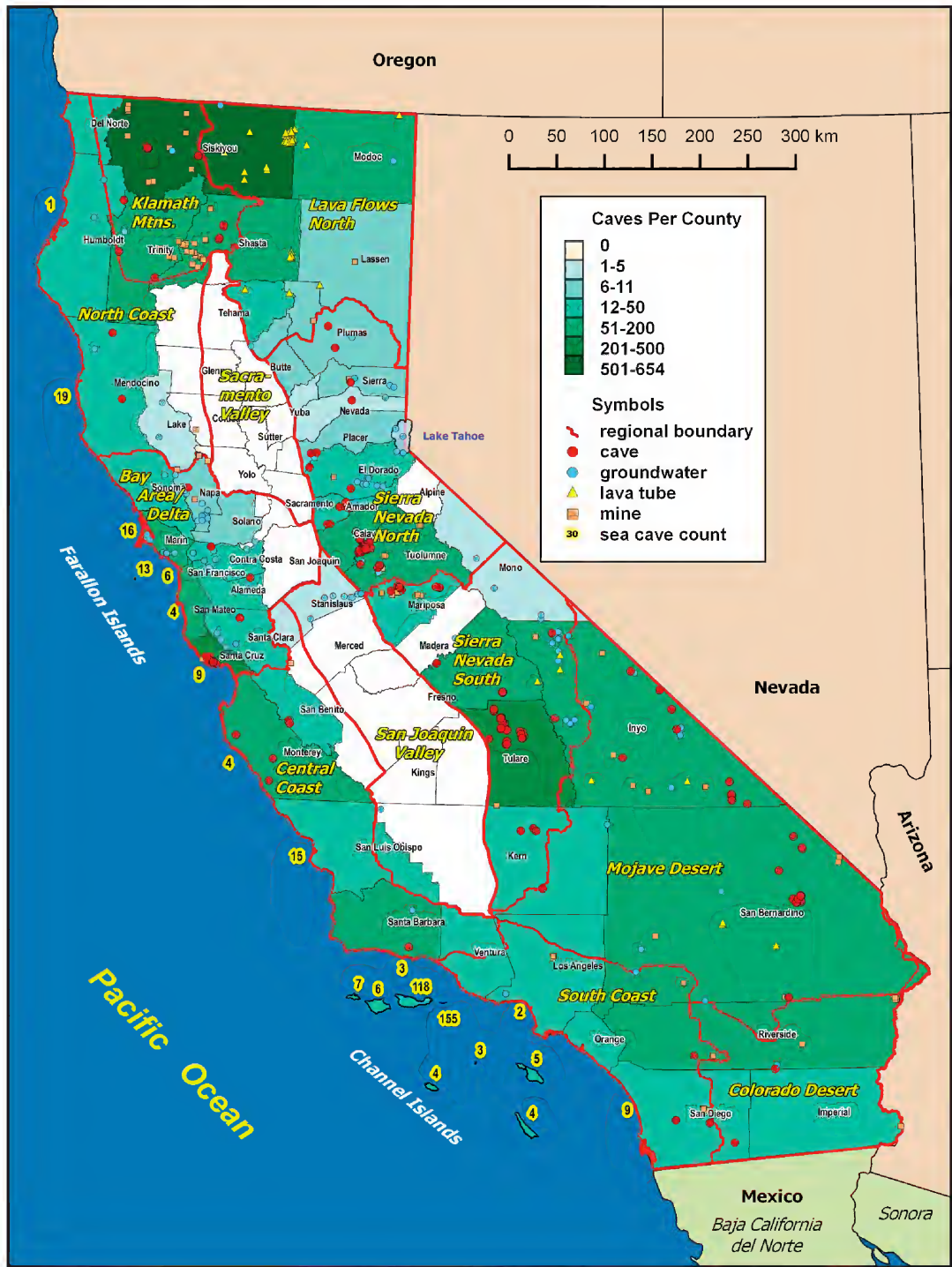


FIGURE 1. Map of 12 California regions with density of caves per county represented by color, and 500 representative localities of all types. The Central Valley (San Joaquin and Sacramento Valleys) has very few caves. In this paper the three coastal regions are treated in tabulations as one region, Coast Ranges. See legend for regions, counties, caves, groundwater sampling sites, lava tubes, mines, and numbers of sea caves in coastal counties and islands.

TABLE 1. Major types of sites in the regions, of which 997 caves were sampled, 22% of the known 4,600 caves. The total number of California mines exceeds 39,000. See Methods for a description of the Kryptos database.

Region	Caves	Lava Tubes	Sea Caves	Ground-water	Mines	Totals
1. Klamath Mountains	197			5	35	237
2. Lava Flows North	1	165		6	1	173
3. Sierra Nevada North	188			29	29	246
4. Sierra Nevada South	143	3		10	23	179
5. Bay Area/Delta	34		31	46	3	114
6. Coast Ranges	55		93	33	27	208
7. Mojave Desert	59	13		4	27	103
8. Colorado Desert	9			1	15	25
9. Sacramento Valley	1			1		2
10. San Joaquin Valley	2			8		10
11. Unknown	3					3
Total biological sites	692	181	124	143	160	1,300
Sites in Kryptos database	1,322	451	405	260	215	2,654



FIGURE 2. An outcrop of McCloud Limestone above Shasta Lake that contains Samwel Cave. Tree roots penetrate the cave via two entrances and cracks. Jessica Blois.

northern Trinity, and western Shasta counties in the Klamath, Shasta, and Trinity National Forests (Fig. 1). Mostly the caves are in carbonate rocks — limestone and marble. Table 1 lists 197 caves biologically sampled. In addition to scattered sites throughout the region, four distinct areas within the Klamath Mountains region contain subterranean sites. The **Marble Mountains Karst** contains a group of caves in Klamath National Forest. Elevations generally range from



1,200–2,000 m. The caves range widely in length, but a nationally important cave exists there: **Big-foot Cave**, 20 km long and 367 m deep, which is also biologically rich. The **Shasta Lake Karst** is an area developed in the immediate vicinity of Shasta Reservoir in Shasta National Forest, Trinity County. Samwel Cave (Fig. 2) and Shasta Caverns are important caves with high biodiversity in this karst. Caves are developed in the Permian McCloud Limestone. Moderate sized caves are present with elevations ranging from 300–600 m. Additional sites include the **Trinity Alps** and the **Hayfork Area**, both in Trinity and Siskiyou counties.

### Cave Region 2 — Lava Flows North

This region includes volcanic areas within the Southern Cascades and Great Basin physiographic provinces. Extensive basaltic lava flows from **Medicine Lake Volcano**, including **Mammoth Crater**, and **Modoc Crater**, are located in northeastern California in the Modoc Bioregion, mostly in **Lava Beds National Monument (LBE)** in eastern Siskiyou and Modoc counties, but also in **Modoc National Forest** to the south. LBE contains 790 lava tube caves (Jeanette Meleen, LBE, pers. comm.) and associated features and more than 28 miles of passages; 25 caves have marked entrances and developed trails for public access. In addition to their geological, anthropological and historical interest, the caves are home to a variety of cave-adapted organisms (Taylor and Krejca 2006; Lynn 2014). Two representative lava tubes are pictured in Figures 3 and 4. A map of the area is in Figure 5.

Many of the lava caves are complex and permanent ice is sometimes present. Most of the flows are relatively young, ranging in age from 114,000 to 12,300 years old. The oldest lava from the volcano is the basalt of Hovey Point, along the northern boundary of LBE, which is  $445,000 \pm 25,000$  years. The basaltic andesite of Callahan Flow is the youngest lava at LBE at 1,120 years.



FIGURE 3. Big Painted Cave entrance, with Schonchin Butte, a cinder cone in the background, Lava Beds National Monument, Siskiyou Co. Jean Krejca and Steve Taylor.



FIGURE 4. A caver rappels into Fossil Cave, Lava Beds National Monument. The lava tube has a moist microclimate that sustains ferns in the entrance. Jean Krejca and Steve Taylor.

About 90% of the lava in LABE is basaltic, a common extrusive igneous rock formed from the rapid cooling of lava at or very near the surface (Lynn 2014; Bunnell 2013), although some GIS geological coverage specifies dacite in many areas.

Lava tubes related to **Lassen Peak (Mount Lassen)** occur south of LABE in eastern Shasta, Tehama, northern Plumas, and Lassen counties in **Lassen National Volcanic Park**, **Lassen National Forest** and adjacent lands. Lassen Peak, southeastern Shasta County, is quite large, and it is the southernmost active volcano in the Cascade Range. The **Hat Creek Lava Area** in eastern Shasta County is an important focus of lava tubes (map, Fig. 5). Subway Cave is less than 2,000 years old.

We have data on 358 lava tubes in this region. Table 1 lists 165 lava tubes and 1 nonlava cave in the region that were biologically sampled. The region has 5 single-site endemics. Other, more isolated lava tubes exist in southeastern Sierra Nevada South and the Mojave Desert.

### Cave Region 3 — Sierra Nevada North

We define this important region as southern Plumas County in the north to the Tuolumne-Mariposa county line in the south. Caves are developed in the Calaveras Formation or Assemblage, a highly metamorphosed marble of Permian age dating to between (299 and 252 Ma) in its upper part; it is strung out in many outcrops along the west flank of the Sierra. The Calaveras is often referred to as a “melange” because it contains many types of rock. The oldest carbonate rocks can be found along the easternmost portions of this region, closer to the Sierra Nevada summits. These consist of carbonate rocks from ancient islands, accreted onto the western edge of North America during the late Permian about 275 Ma. The western carbonate rocks of the region are significantly younger, from the late Jurassic Period about 150 Ma.



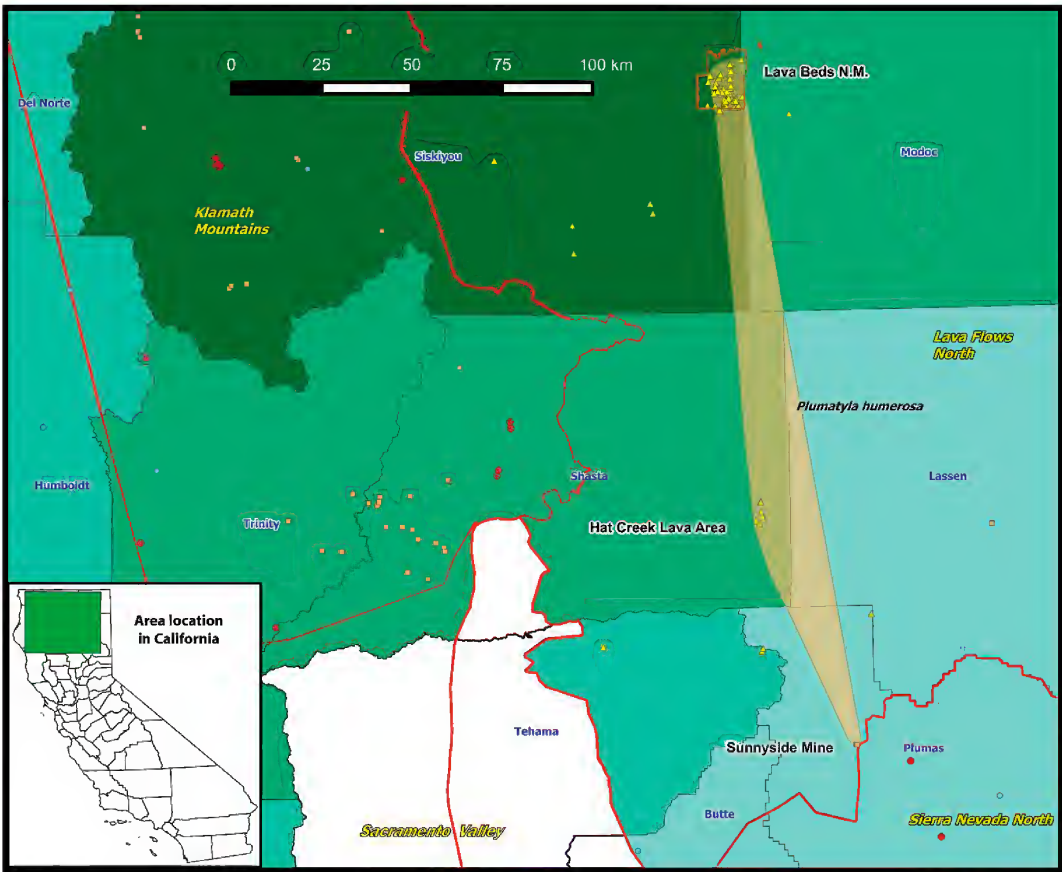


FIGURE 5. The Lava Flows North region, with the range (orange polygon) of the troglotic conotyloid millipede, *Plumatyla humerosa*, 194 km north-south by 8–10 km east-west, in lava tubes and one mine in lava.

Sierra Nevada North contains most of “**The Mother Lode Region**” or “**The Gold Country**,” an historic and geologic region of California stretching from El Dorado County to Mariposa County. It is famed for the mineral deposits and gold mines that attracted waves of immigrants, known as the 49ers, during the California Gold Rush of 1848–1855. Gold mines often were not far from pockets of karst in the Stanislaus River Canyon. The gold deposits were found in many situations, such as alluvium processed by placer or hydraulic mining, drift mines excavated through country rock into ancient river alluvium under volcanics, or hard rock mining. The Transplant Mine in Tuolumne County was a 1925 hard rock gold mine in Calaveras marble in which the miners followed a so-called “quartz vein” that may have showed signs of “color,” probably misidentified calcite crystals. The mine did not produce, and it was abandoned. As described below in Literature Review and History, in the 1970s the mine was used as an experimental transplant site for threatened cave fauna, particularly the harvestman *Banksula melones* (Elliott 1978, 2000b).

**Mother Lode Karst.** This karst area lies on the western flank of the Sierra Nevada North, but similar outcrops of the Calaveras Assemblage are widespread in the Sierra Nevada South, and form the most extensive karst in the state. There are many small, isolated karst outcrops, sometimes referred to as “pods” or “lenses.” Because of the vertically tilted bedding planes, caves are typically small and vertical, many consisting of simple vertical shafts. Nearly all caves in this region are in a narrow elevational range between 200 and 600 meters above sea level. No lava tubes are



FIGURE 6. Forested karst at the entrance to Waterfall Cave, Yosemite National Park, Tuolumne Co. Jean Krejca.

known, although volcanic rocks occur in the region. Karst areas within the Mother Lode Karst include: the Stanislaus River Canyon, Calaveras Natural Bridges, Rockpile Area, Toppled Table Talus Area, Volcano Area, and others. We have data on 409 sites, with 187 biologically sampled caves (Table 1). Figure 6 is a view of the entrance of Waterfall Cave, at an elevation of 1700 m on the boundary between Sierra Nevada North and South, Tuolumne Co., in Yosemite National Park. Two maps (Figs. 7 and 8) depict the insular nature of the Mother Lode Karst, particularly in the case of the distribution of the harvestman genus *Banksula*.

#### Cave Region 4 — Sierra Nevada South

We define this area as Mariposa County in the north to Kern County in the south. There are no caves in the San Joaquin Valley portion of Fresno, Tulare, and Kern counties. About 300 caves are generally developed in highly isolated carbonate roof pendants embedded in the Sierra Nevada Batholith (Joel Despain, pers. comm.). These deposits are of Triassic age. The range of cave elevations is extreme, extending from approximately 500 m to over 3,000 m. Cave development in this region is diverse because of the large elevational range and differences in metamorphic alteration of individual roof pendants. In Mariposa County a cluster of five important caves lies near the **North Fork of the Merced River**, and a few talus caves and karst caves have been studied in **Yosemite National Park**. Karst caves receiving the most study are in Tulare County, in **Sequoia-Kings Canyon National Parks** (about 35 caves), and the surrounding **Sierra and Sequoia National Forests**. This region contains some of the longer caves in the state, nine longer than



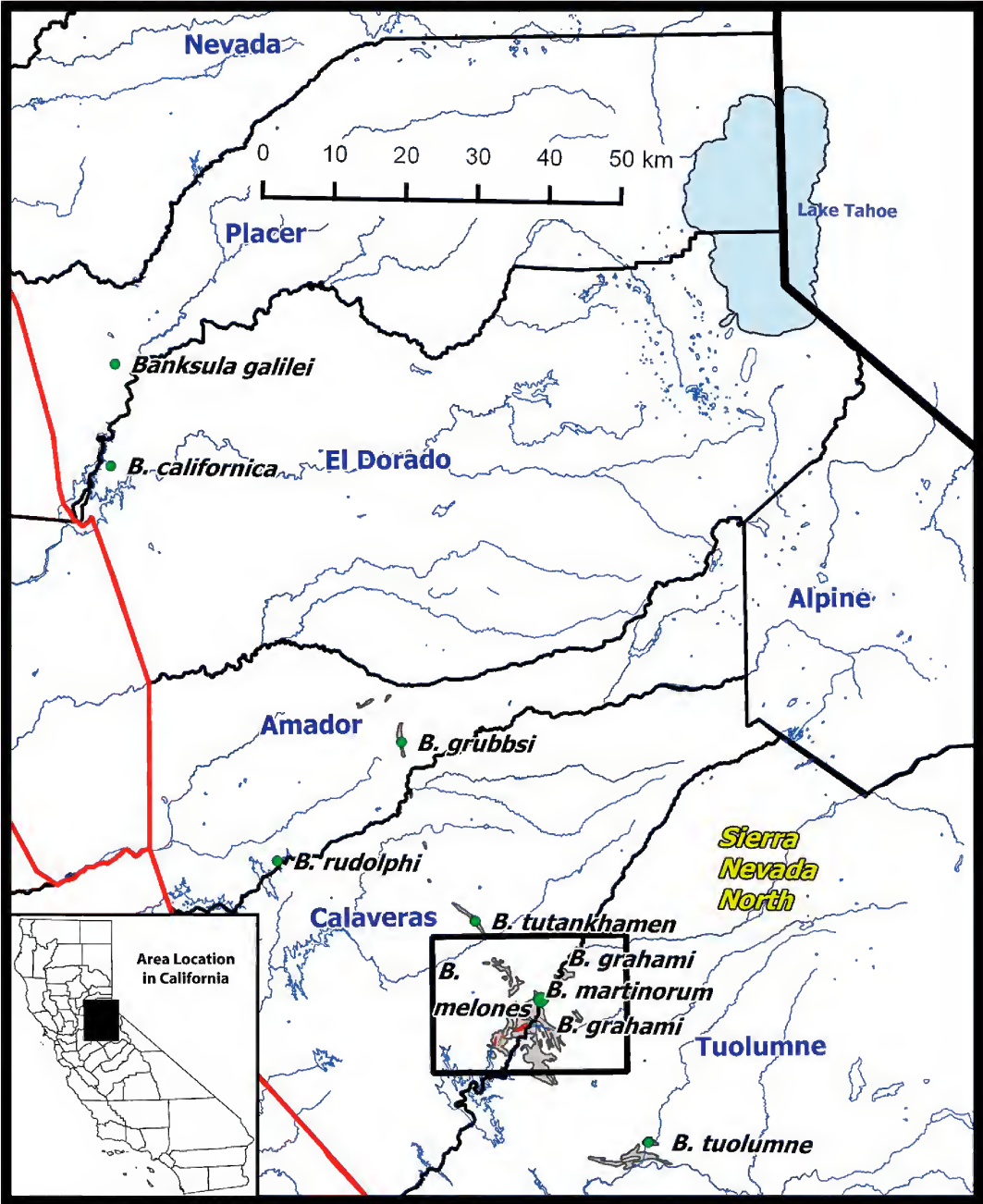


FIGURE 7. The distribution of nine *Banksula* harvestman species in the Sierra Nevada North region. The species are limited to small outcrops of Calaveras Assemblage marble (in gray) over a distance of 132 km. The small rectangle near the bottom encompasses the area in Figure 8, with the range of three species.

500 m. **Lilburn Cave**, Kings Canyon National Park, is formed in marble (Fig. 9), and is the largest cave in the region at 34.6 km long and 155 m deep. There are a few outlier caves in this region: Microps Cave is a sampled lava tube on the west side of the Inyo Mountains, Inyo County. Other, unsampled lava tubes are known there and on Crater Mountain, eastern Fresno County. We have

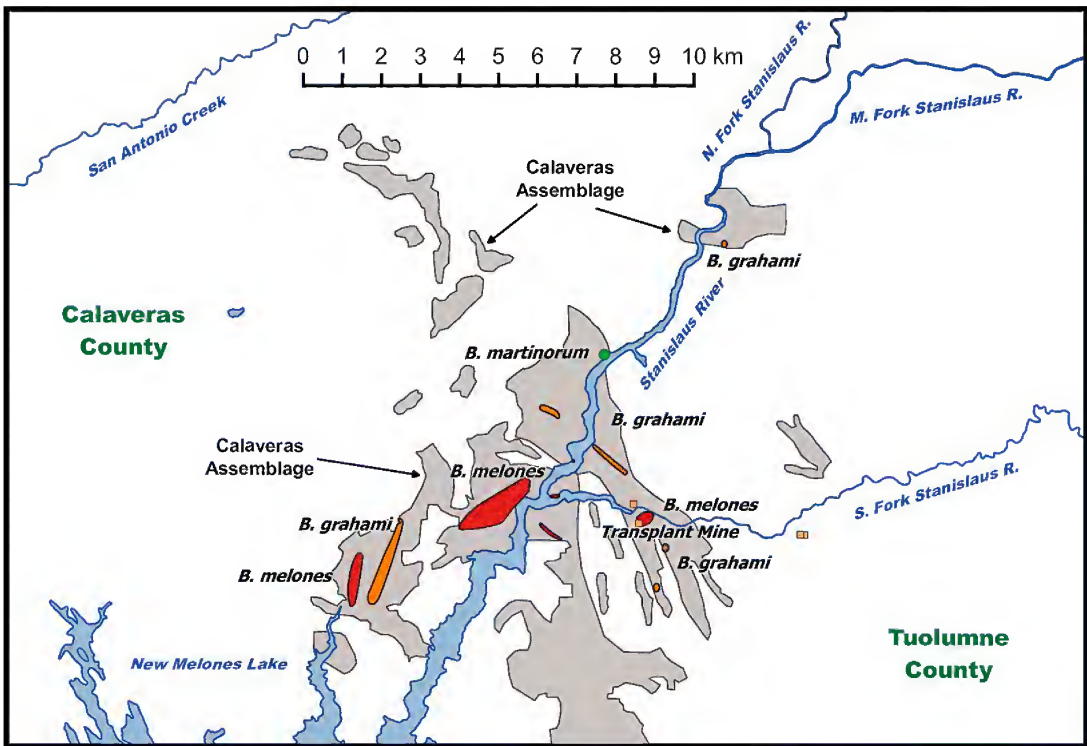


FIGURE 8. The distribution of *Banksula melones* (red), *B. grahami* (orange), and *B. martinorum* (green) in the Stanislaus River-New Melones Lake area, Calaveras and Tuolumne counties, Sierra Nevada North region. See Figure 7 for location in California. *B. grahami*, a troglophile/troglobite, is found in 15 caves and one mine in at least 7 clusters over 13 km. *B. melones*, a troglophile, occurs in 22 caves in at least 4 clusters over 8 km in the same area. The two species were sympatric in McLean's Cave, which was inundated by New Melones Lake. Both were introduced to the Transplant Mine.

records of 198 caves, of which 143 were sampled (Table 1), found in the following karst areas: Kaiser Wilderness/Twin Lakes Area, Kings Caverns Geologic Area, Kings Canyon, Mineral King Area, North Fork of the Merced River, Sequoia/Kings Canyon, South Fork of the Kaweah River, Sparking Karst Area, and talus caves in Yosemite National Park.

### Cave Region 5 — Bay Area/Delta

All counties in this region have small caves and groundwater sites. The region has 47 caves and karst features (34 biological sites) and sea caves (31 sampled). Important cave areas are **Napa County** (3 caves) and the **Santa Cruz Karst. Clay Cave**, Napa County, an important biological site, is a soil pipe formed in volcanic ash (Table 1).

**Santa Cruz Karst.** This small karst area, about 63 km<sup>2</sup>, comprises a series of small caves developed in marble near the city of Santa Cruz and on Ben Lomond Mountain. The outcrop is of limited extent at an elevation of 100–200 m. There are 44 known caves; we have data on 29 caves (25 biological sites). This small area has high endemism and biodiversity (including 3 stygobites and 2 troglobites), and some of the caves are protected. **Empire Cave** is an important biological site.





FIGURE 9. A caver admires the marble bedrock in Lilburn Cave, Kings Canyon National Park, Tulare Co. Peter Bosted.

### Cave Region 6 — Coast Ranges

This large region extends nearly the entire length of the state, and is divided into the subregions North Coast, Central Coast, and South Coast. Included in this category are parts of the Transverse and Peninsular Ranges to the south. Sea caves are covered below, but within the Coast Ranges carbonate caves are generally rare, and most of the reported caves are a diverse assemblage of rock shelters and talus caves. In Table 1 we have 55 caves, 33 sampled groundwater sites, and 27 mines (3 biological sites). **The Pinnacles Talus** in and surrounding **Pinnacles National Park**, San Benito County, has at least 9 pseudokarst caves with 4 biological sites.

The 1,350-km California coastline, including the Channel Islands and Farallon Islands, contain an estimated 800 littoral (sea) caves, distributed practically the entire length of the state, but the majority are on the **Channel Islands**, especially in **Channel Islands National Park**, and along the adjacent coast north to southern Mendocino County. Most are of limited extent and simple in layout, formed by powerful wave action driving into faults and joints (Fig. 10). Mainland sea caves are largely formed in Tertiary Period sandstone, mudstone, and shale. On the Channel Islands the caves are mostly in mid- to late-Miocene basalt (16 to 7 Ma), but some have formed in agglomerate, a coarse accumulation of blocks of volcanic material that contains many volcanic bombs (Bewley 1988; Bunnell 1988c, 1993a, 1998).

We have data on 405 sea caves, including 93 biological sites (Table 1). These caves often have dark zones and various communities depending on wave dynamics, nutrient input, light levels, and bottom substrate. See the overview of Sea Cave Fauna below.



FIGURE 10. A California sea lion, *Zalophus californianus* (on rock right of center), watches a kayaker in Painted Cave, a sea cave on Santa Cruz Island. Dave Bunnell.

### Cave Region 7 — Mojave Desert

A limited number of extremely isolated caves are known in the Paleozoic Limestones that crop out in the mountains of the Mojave Desert in southern California. Most caves are between 1,000 and 1,500 m in elevation. The caves are relatively dry due to the regional aridity. We have data on 207 caves and karst features (59 biological sites), 13 sampled lava tubes, 4 sampled groundwater sites, and 90 mines (27 biological sites, Table 1). **Pisgah Crater** and **Amboy Crater** contain many lava tubes, but biological studies have only recently begun there. Pisgah Crater has perhaps 200 lava tubes (Harter 1992) with age estimates from 50,000 to 2,000 years, depending on which eruption is dated. Amboy Crater's age ranges from 100,000 to 18,000 years  $\pm$  5,000 years (Wikipedia 2016c).

### Cave Region 8 — Colorado Desert

This region is the northwestern subdivision of the much larger Sonoran Desert, and contains the valley draining to the Colorado River in southeastern California, sometimes included in the Mojave Desert. The majority of the Colorado Desert lies below 300 m, with the lowest point at 84 m below sea level at the Salton Sea. Although the highest peaks of the Peninsular Range reach elevations of nearly 3,000 m, most of the region's mountains do not exceed 900 m. The region includes all of Imperial and portions of San Diego, Riverside and San Bernardino counties, including a narrow swath along the Colorado River (Fig. 1). More than 1,000 mines and a few caves are known in the region. Biological records are available from nine caves, 15 mines, and one well (Table 1). Obligate subterranean species are as yet unknown from this region.



## LITERATURE REVIEW AND HISTORY

The first scientific studies and collections of animals in California's caves were sporadic and opportunistic, and began with the discovery of California's rich diversity of bats in various cave and noncave habitats. Circa 1840, the famous naturalist John Audubon discovered the California Bat (*Myotis californicus* (Audubon and Bachman 1842)). In the next two decades, several new species of bats were discovered: California Leaf-nosed Bat (*Macrotus californicus*) and the Western Pipistrelle (*Parastrellus hesperus*) in Fort Yuma (Imperial Co.); the Long-Eared Bat (*Myotis evotis*) in Monterey; the Silver-Haired Bat (*Lasionycteris noctivigans*) in Fort Reading (Shasta Co.); and the Pallid Bat (*Antrozous pallidus*) in the Mojave Desert (LeConte 1831; Baird 1858, 1859; H. Allen 1864, 1893). Joel Allen, a mammalogist at the American Museum of Natural History, described many of these western bat species and in the 1890s added two new species from California: the Fringed Bat (*Myotis thysanodes*) from Dulzura (San Diego Co.) and Fort Tejon (Kern Co.); and the Spotted Bat (*Euderma maculatum*) from Piru (Ventura Co.) (J.A. Allen 1891). In this same decade, Clinton Merriam, known as the father of mammalogy and former head of the U.S. Bureau of Biological Survey, described two more new species of bats from California: the Western Bonneted Bat (*Eumops perotis californicus*) and the Pocketed Free-Tailed Bat (*Nyctinomops femorosaccus*) (Merriam 1889, 1890).

Under the tutelage of Joseph Grinnell (Director of the University of California Berkeley's Museum of Vertebrate Zoology), Hilda Grinnell published her doctoral studies on the bats of California in 1918. This comprehensive monograph described the distribution and habits of 63 bat species and subspecies, many of which are still valid today (H.W. Grinnell 1918).

In 1879, Franz Steindachner described the blind goby fish (*Typhlogobius californiensis*) from dark holes in rocky tidal pools in southern California. Because of its troglomorphic characters (degenerate eyes, lack of pigment, slow metabolism), this goby was studied by the ichthyologists Carl and Rosa Eigenmann alongside the typical cavefish that they were studying (R. Smith 1881; Eigenmann 1890).

In 1866, national attention was brought to the marble caves of Calaveras County when a gold miner discovered a human skull thought to be very old (Anonymous 1881). Josiah Whitney, then the State Geologist of California as well as a geology professor at Harvard University, published that this "Calaveras Skull" was proof of humans' presence in North America a million years ago (during the Pliocene Epoch he thought). It was later determined to be a hoax, with the skull, only a few hundred years old, transplanted from a nearby looted Indian burial. The date of the arrival of humans onto the North American continent is still debated to this day, with cave deposits being the primary evidence.

Around this same time, California's large diversity of cave invertebrates started to be discovered by naturalists and taxonomists who visited some of the well-known caves in the state. In 1868, L.G. Yates discovered a new genus and species of snail inside Cave City Cave (Calaveras Co.) — the Tight Coin Snail (*Ammonitella yatesii* [J.G. Cooper 1868]). James Cooper, then curator of general zoology at the California Academy of Sciences, described this new species, and in the 1870s, made various collections of his own, including the discovery of the Sierra Sideband Snail (*Monadenia mormonum*) in Pioneer Cave (El Dorado Co.) (Pilsbry 1939). In the 1890s, arachnologist George Marx discovered the California cave harvestman, *Banksula californica*, and the troglobitic spider, *Usofila gracilis*, in Alabaster Cave (El Dorado Co.); about this same time the troglophilic ground beetle, *Anillaspis explanata*, was also discovered in the now-destroyed Alabaster Cave (Packard 1888; Marx 1891; Banks 1900). In 1888, the entomologist and paleontologist Alpheus

Packard noted that California contained two cave-adapted species in his national checklist of the cave animals of North America (Packard 1888).

In 1878, a local explorer, J.A. Richardson, descended the pit inside Potter Creek Cave, Shasta Co., via a rope ladder and found a bear skull. He sent the specimen to Edward Cope, who in 1879 described it as a new but extinct species — the giant short-faced bear, *Arctodus simus*, which has since been found in many North American caves. In 1901, John Merriam, a paleontologist at U.C. Berkeley, initiated the first systematic study of California caves with a focus on caves in the Shasta Lake and Mother Lode cave regions, which contained rich paleontological deposits. Many prominent scientists collaborated with Merriam in the cave surveys, which had generous funding from the Hearst Family (Munthe 1975). In 1902, Eustace Furlong (Merriam's assistant) rediscovered the entrance to Potter Creek Cave, and over the next year the U.C. Berkeley team excavated the pit, which had accumulated organic sediments to a depth of 7.6 m over the millennia. This animal and sediment trap yielded thousands of bones and fragments, of which 4,600 uniquely identifiable vertebrate specimens were recovered. Over 50 undescribed animal species were discovered, at least 21 of which were extinct (Sinclair 1904). The Princeton paleontologist William Sinclair described many of these Ice Age species, and while visiting Potter Creek Cave, discovered five undescribed extant species: the Potter Creek Cave spider (*Nesticus potterius*), a crab spider (*Xysticus punctatus*), Kofoid's cave isopod (*Ligidium kofoidi*), a cave centipede (*Meinertophilus californicus*), and the troglobitic japygid, *Occasjapyx kofoidi* (Sinclair 1904; Silvestri 1928; J.C. Chamberlin 1930; Maloney 1930; R.V. Chamberlin 1933). In 1911, the Shasta Sideband Snail (*Monadenia troglodytes*) was discovered in Potter Creek Cave (Hanna and Smith 1933).

Potter Creek Cave also yielded human artifacts, such as bone tools, flaked stone, mussel shells, and charcoal. The anthropologist Frederick Putnam, along with U.C. Berkeley's Anthropology Department, was very interested in studying these northern California caves to determine "*the antiquity of man . . . when man first appeared in this region*" (Munthe 1975). The nearby Samwel Cave yielded similar troves of Ice Age animal bones, as well as human remains. A specimen of the Sierra ground sloth, *Megalonyx sierrensis* Sinclair, was uncovered in Mercer's Cave (Calaveras Co.) while the Berkeley anthropologists searched for ancient human remains. Hawver Cave (El Dorado Co.) was studied in 1906 by Furlong; extensive vertebrate deposits were uncovered, and an article on the amazing assortment of bird specimens recovered was published later (Furlong 1907). This cave survey program started by John Merriam was abruptly discontinued in 1913 when the massive fossil deposits in the Rancho La Brea tar pits were excavated.

Discoveries of new cave invertebrates continued sporadically during the early twentieth century. In the 1910s, Phyllis' false scorpion (*Saetigerocreagris phyllisae*) was discovered in Eaton's Cave, Los Angeles Co., and the troglobitic springtail, *Plutomurus californicus*, was discovered in Palser Cave, Santa Clara Co. (Folsom 1913; J.C. Chamberlin 1930). In the 1920s and 1930s, Harvard invertebrate zoologist Ralph Chamberlin described many arachnids and myriapods from caves in California and other cave regions (R.V. Chamberlin 1930, 1933, 1951, 1953a–b; R.V. Chamberlin and Ivie 1942, 1943). His nephew, Joseph Chamberlin, a Stanford graduate, continued these taxonomic labors, but focused on pseudoscorpions, and described many species from California caves (J.C. Chamberlin 1930; 1952; 1962; J.C. Chamberlin and Malcolm 1960; Judson and D.D. Chamberlin 1998).

By this time, mines were starting to be studied biologically, and the Argus Mountains desert-snail, *Eremarionta argus*, was discovered in Iron Cap Copper Mine (Inyo Co.) circa 1910; in 1928, the Sidewinder shoulderband snail, *Helminthoglypta crotalina*, was discovered in Sidewinder Mine, San Bernardino Co. (Edson 1912; Pilsbry 1939). In 1922, H. Barber, a USDA entomologist, explored Sunnyside Mine and discovered a remarkable assemblage of millipedes, including four



new species in three new genera: *Bdellozonium cerviculatum*, *Buzonium crassipes*, *Endere disora* and *Plumatyla humerosa* (Cook and Loomis 1928; Loomis 1938, 1943; Shelley 1997b).

Springs were studied sporadically, starting perhaps with the discovery of the pebblesnail, *Fluminicola seminalis*, in springs and lava tube streams in the upper Sacramento River in 1840; in 1912, the Modoc pebblesnail, *Fluminicola modoci*, and Lost Creek pebblesnail, *Fluminicola* new species #20, were discovered in Fletchers Spring, Modoc Co. (Hershler and Frest 1996). This was just a hint of the large diversity of springsnails that exist in springs of arid regions of California and neighboring states. All of these groups (*Pyrgulopsis*, *Pristinicola*, *Tryonia*, *Vorticifex*, *Juga*, etc.) are now in danger of extinction due primarily to ground water depletion.

The first systematic bioinventories of hot springs in California were performed by the Harvard entomologist Charles Brues in the late 1920s, who contributed to the knowledge of these heat-tolerant, or thermophilous, animals (Brues 1928, 1932). In 1931 entomologist Edward Essig discovered the California cave isopod, *Calasellus californicus*, in a well in Lake Co. (M.A. Miller 1933). In 1937, E. Chace collected the Natural Bridge snail, *Megomphix californicus*, in Shasta Springs, Shasta Co. (Smith 1960).

California's vast diversity of spiders continued to be uncovered, above and below ground. In 1934, the sheetweb spider, *Bathypantes diasosnemis*, was discovered in the lava tube, Subway Cave (Ivie 1969; Gertsch 1984). In a single trip to Potter Creek Cave in 1937, Ralph Chamberlin discovered three new spiders: *Cybaeus septatus*, the dwarf sheet spider, *Hahnia sanjuanensis*, and the sheetweb spider, *Arcuphantes potteri* (R.V. Chamberlin and Ivie 1942, 1943). Another spider, *Titiotus humboldti*, was discovered in Potter Creek Cave in 1950 (Platnick and Ubick 2008).

In the 1940s, several important speleological events occurred. In 1946, Erwin Bischoff (San Francisco State College) published the first list of the known caves of California. The Sequoia National Park naturalist, Frank Oberhansley, published a field book on Crystal Sequoia Cave, Sequoia National Park, which contained the first inventory of the fauna of a California cave (Oberhansley 1946). Philip Krutzsch, a master's student at San Diego State University, published an ecological study of the bats of San Diego County (Krutzsch 1948). California's first three chapters of the National Speleological Society were started, including the Southern California Grotto (co-founded by speleologist Bill Halliday) in 1948. In this same year, the Stanford Grotto was started, mostly by students of the Stanford Alpine Club and the Geological Sciences Department of Stanford University. For the next ten years, this grotto led a statewide survey of caves and made many collections of cave fauna, discovering several new species, including the Dolloff Cave spider (*Meta dolloff*) in Empire Cave (Danehy 1951b; Levi 1980). Edward Danehy, a co-founder of the Grotto, published the first checklist of the animals collected in California caves (Danehy 1951b, 1952). The Stanford Grotto published various other important studies of cave animals (e.g., Lange 1951). Co-founders Edward Danehy and Arthur Lange discovered a new genus and species of sideband snail (*Speleodiscoides spirellum*) in a cave in Amador Co. (Smith 1957). In 1957, Allyn Smith, a malacologist at California Academy of Sciences, published a summary of the snails from California caves, relying heavily on collections by the Stanford Grotto (Smith 1957). He concluded that there were no cave-adapted snails in California, although a few species are restricted to limestone caves and talus in California. In the early 1950s, the Stanford Grotto, along with the Southern California Grotto and Santa Barbara College, made the first expeditions to caves of the Channel Islands (Orr 1951b).

After the Stanford Grotto disbanded in 1954, some of the members and their associates formed new organizations that continued speleological studies in California, including the Cave Research Associates (CRA, 1958–1973) and the Western Speleological Institute (WSI, 1959–1973). These two organizations published the journals "Cave Studies", "Cave Notes", and "Caves and Karst"

from 1953 to 1973, in which Richard E. Graham published numerous ecological studies about California cave life (Graham 1960a–b, 1962a–e, 1963a–b, 1966a–b, 1967, 1968a–b, 1969a–c).

Founding members of CRA included Arthur Lange, Richard E. Graham, and Raymond deSaussure, who discovered and studied many new caves and cave animals. In 1959, Graham discovered the cave scorpion, *Uroctonus grahami*, and the cave pseudoscorpion, *Pseudogarypus spelaeus*, in Samwel Cave. In 1960–1961, Graham discovered a cave millipede, *Opiona siliquae*, in Fault Rock Cave, Mendocino Co.; the spider, *Nesticus sodanus*, in Soda Springs Cave, Plumas Co.; and Graham's cave amphipod, *Stygobromus grahami*, in caves of Calaveras County (Causey 1963; Gertsch and Soleglad 1972; Holsinger 1974; Benedict and Malcolm 1978a–b; Gertsch 1984). In 1963, Graham discovered the cave harvestman, *Banksula grahami*, in Moaning Cave, Calaveras Co., and the cave pseudoscorpion, *Fissilicreagris imperialis*, in Empire Cave (Santa Cruz Co.) (Briggs and Ubick 1981; Muchmore and Cokendolpher 1995).

Founding members of the Western Speleological Institute included Bill Halliday, Raymond de Saussure, and Arthur Lange. This Institute was involved in many speleological studies. An example was their partnership with Phil Orr of the Santa Barbara Museum of Natural History, and they assisted the Museum in archaeological excavations in Calaveras Co. and the Channel Islands (Orr 1951a, 1952a–b; Quick 1979; Danehy 2003). In 1962, Bill Halliday published the controversial, but important “Caves of California,” which included many observations of animals found in caves and the first grouping of caves by a physiographic system (Halliday 1962).

Two important studies on the reproductive cycles and natural histories of bats were performed in the 1950s: one by Robert Orr, a curator at the California Academy of Sciences, on the Pallid Bat, *Antrozous pallidus* (Orr 1954); and the other by scientists at U.C. Berkeley's Museum of Vertebrate Zoology on Townsend's Big-Eared Bat (*Corynorhinus townsendii townsendii*) (Pearson et al. 1952). The Pearson study was also important because it was one of the first papers to document the decline of several bat colonies from scientific activities (banding and specimen collection). In the 1980s, U.C. Berkeley biologists, Dixie Pierson and Bill Rainey, started surveying bats, and in the decades that followed they documented the decline of Townsend's Big-Eared Bat, primarily due to habitat disturbance. Until recently this bat was under consideration for listing as an endangered species by the California Department of Fish and Wildlife.

During the 1950s and 1960s, two entomologists at the University of California at Davis' Bohart Museum of Entomology, L. Smith and R. Schuster, made extensive collections of diplurans (japygids and campodeids) throughout California, and discovered many new subterranean species in the genera *Campodea*, *Hecajapyx*, *Holjapyx*, and *Nanojapyx* (Graening et al. 2014). John Funkhouser, a curatorial assistant at Stanford's Natural History Museum, published a checklist of the salamanders in California's caves (Funkhouser 1951).

Despite all of this published research on California's caves, the richness of the State's cave fauna was still not fully appreciated. The speleologist G. Nicholas Sullivan listed only eight troglodites from California in his national checklist of cave animals (Nicholas Sullivan 1960).

At the beginning of 1960s, Bruce Rogers and Thomas Briggs began their lifelong study of California caves. USGS geologist Bruce Rogers, although focused primarily on cave geology and cave exploration, facilitated many biological studies of California caves over five decades. With arachnologist Thomas Briggs, Rogers described the fauna and flora in caves of the Sierra Nevada (Briggs and GPC 1975). Briggs began studying California caves when he was an instructor at Galileo High School, and continued as an associate researcher in the Department of Entomology at the California Academy of Sciences. Briggs specialized in harvestmen, but he also made important contributions to other arachnid orders, and trained many students to become productive taxonomists. With former student and fellow arachnologist, Vincent Lee, Briggs discovered *Banksula*



*galilei* in 1966 in Lime Rock Caves, Placer Co., and the New Melones harvestman, *Banksula melones*, in McLean's Cave, Tuolumne Co., in 1967 (Briggs and Ubick 1981). In 1965, Lee discovered the scorpion, *Uroctonites sequoia*, in Clough Cave, Tulare Co. (Gertsch and Sologlad 1972) and a new species of ice crawler, *Grylloblatta*, in Lilburn Cave (Lee 1967). In 1971, Briggs discovered four new cave-adapted species in a single visit to Upper Shoshone Cave (Inyo Co.): a cave cricket (*Ceuthophilus* n. sp.); a schizomid or short-tailed whipscorpion, *Hubbardia shoshonensis*; a cave beetle, *Rhadine* n. sp.; and the cave harvestman, *Texella shoshone* (Briggs and Hom 1972; Ubick and Briggs 1992). With his student Kevin Hom, Briggs discovered the cave harvestman *Calicina sierra* in 1966 in Masonic Cave, Amador Co. (Briggs and Hom 1967). Together, Briggs, Lee, and Hom discovered *Calicina cloughensis* in Clough Cave (Briggs and Hom 1967). In 1968, Briggs discovered a new species of cave harvestman, *Texella kokoweef*, in Kokoweef Crystal Cave, San Bernardino Co., and in 1980, discovered the cave spider, *Calileptoneta briggsi*, in Indian Valley Creek Caves, Trinity County (Ubick and Briggs 1992; Ledford 2004). Briggs also documented the extinction of troglobitic arachnids from Alabaster Cave caused by limestone quarrying (Briggs 1974a). Darrell Ubick joined the arachnology lab at the California Academy of Sciences in 1972, and has discovered and described many new arachnids, primarily spiders and harvestmen, in his career. With Briggs, Ubick discovered the harvestman, *Banksula tutankhamen*, in O'Neil's Cave (also known as King Tut Cave), Calaveras Co. in 1991 (Ubick and Briggs 2002).

In the mid-1960s, Briggs and his associates continued the study of the Santa Cruz Karst, a biologically important cave region pioneered by Richard E. Graham and CRA in 1959 (Graham 1967, 1968a–b). They discovered new endemic species of opilionids and other fauna (Briggs 1968, 1971; Briggs and Ubick 1988; Ubick and Briggs 1989). Since 1988, Briggs and Ubick have urged wildlife agencies to preserve these caves (Briggs and Ubick 1988; Briggs 1990; Ubick 2001).

In 1966, the National Speleological Society held their annual convention at Sequoia National Park (Tulare Co.), which renewed speleological interest in this important cave region, especially Lilburn Cave, which would later be established as California's longest cave (Quick 1979).

In the 1970s, the Mineral King Conservation Task Force worked successfully to prevent establishment of a ski resort at Mineral King Valley by adding the area to Sequoia National Park (Quick 1979). This area contains important cave resources. White Chief Cave, Tulare Co., contains a new species of spider (*Pimoida*), harvestman (*Taracus*), and an ice crawler (*Grylloblatta*) (Krejca 2006; Graening et al. 2011).

Cave Research Associate and speleologist, Tom Aley, was among the first to explore the caves in the Marble Mountains Wilderness Area, Siskiyou Co., in the 1960s. Speleologist Steve Knutson established the Klamath Mountains Conservation Task Force in 1974 to organize the exploration and protection of caves in the Marble Mountains karst area. In 1979, Craig Rudolph's group made biological collections in these caves and discovered two new spider species, *Pimoida mephitis* and *Bathypantes* n. sp., and a cave mite, *Foveacheles auricularia* (Rudolph et al. 1985; Zacharda and Elliott 1985; Hormiga 1994). From the late 1970s through the early 1980s, Donald Hemphill and Roy Suggett, two biologists from Pacific Union College, studied the cave fauna of the Marble Mountains (Hemphill and Suggett 1978; Suggett 1982). This unique cave region is part of a larger region of endemism (the Klamath-Siskiyou coniferous forests ecoregion) that is a biodiversity hotspot of North America (Stein et al. 2000). Other endemic species have been found inside the caves of the Marble Mountains, such as the ice crawler, *Grylloblatta marmoreus*, and the sideband snails, *Monadenia churchi*, *M. fidelis leonina*, and *M. marmarotis* (Roth 2001; Shear 2011; Schoville and Graening 2013).

In 1974, Steve Shimek and Paul Hara discovered the Sequoia cave isopod, *Bowmanasellus sequoiae*, in Big Spring, part of the Lilburn Cave system (Bowman 1975; Lewis 2008). These

cavers also discovered new species of cave amphipods: *Stygobromus harai* in Pinnacle Point Cave, Tuolumne Co., and *Stygobromus wengerorum* in Bower Cave, Mariposa Co. (Holsinger 1974). In 1976, in conjunction with the Cave Research Foundation cartographic project of Lilburn Cave, a biological survey was also initiated, with assistance from biologists from Fresno State University (Campbell and Juarez 1979). Other biologists made occasional collections from the 1960s through the 1990s in Lilburn Cave and other caves in Redwood Creek, including by the Academy's arachnology group, Briggs, Lee, and Ubick; in Clough Cave by Rudolph's group (Rudolph 1979); and some by acarologist Cal Welbourn (Lee 1985; Despain 1993, 1994).

In addition to Mineral King, two more National Speleological Society conservation task forces were established in the 1970s: the New Melones Task Force and the Klamath Mountains Conservation Task Force. The former was organized by Ralph Squire of the Stanislaus Speleological Society to establish a cave protection program in the Stanislaus River basin (Calaveras and Tuolumne Counties) from the impacts of the New Melones Reservoir (Squire 1971, 1972; Quick 1979). Previously, in 1971, Thomas Briggs had alerted the U.S. Army Corps of Engineers (USACE) of the endangered status of the cave harvestman species and the importance of the subterranean resources, especially McLean's Cave (Elliott 1978). In 1974–1975, USACE contracted Briggs to transplant fauna to a surrogate cave habitat — the Transplant Mine (Briggs 1975). In 1977, USACE contracted Southern Methodist University's Archaeological Research Program to evaluate the 30 caves to be inundated on the Main and South Forks of the Stanislaus River (McEachern and Grady 1978). Andy Grubbs, cave biologist, discovered a new species of cave harvestman (*Banksula grubbsi*) in Black Chasm Cave, Amador Co. (Briggs and Ubick 1981).

McEachern and Grady's study, the previous studies by the New Melones Task Force, and cave inventories by Elliott, then Rudolph, revealed the biological importance of these caves in the Mother Lode karst region (Squire 1971, 1972; McEachern and Grady 1978; Elliott 1978, 1981b, 2000b; Rudolph 1979).

Unsure of the success of the first transplant project, USACE contracted with cave biologist William R. Elliott from Texas to transplant *Banksula melones*, *B. grahami* and other fauna from McLean's Cave to the Transplant Mine (Von Trump Mine) in 1977–78. He was assisted by Andy Grubbs, Steve Winterath, Thomas Briggs, David Cowan, and Bob Martin (Elliott 1978). The transplant project (Fig. 11) was temporarily successful in establishing *Banksula* in this cave-like habitat, however the population eventually dwindled as predicted by Elliott because of a lack of continued food input to the mine (Elliott 1981b, 2000b; Ubick and Briggs 2002).

In 1979, cave biologist and ecologist D. Craig Rudolph (now with USFS), working under a contract with the U.S. Fish and Wildlife Service, assembled a group of cavers from the Mother Lode Grotto and other affiliations, and made important contributions to the study of California cave life; the members were David Cowan, Steve Winterath, E. van Ingen, Barbara Martin, and for two weeks William R. Elliott, and James R. Reddell (Texas Memorial Museum taxonomist and cave biologist). Rudolph's team discovered two new cave amphipod species (*Stygobromus imperialis* and *S. mackenziei*) in Empire Cave, Santa Cruz Co., and they discovered the Trinity County amphipod, *S. trinus*, in Hall City Cave, Trinity Co., and *S. rudolphi* in Monterey Spring, Santa Barbara Co. (Wang and Holsinger 2001). They also discovered the cave harvestmen, *Banksula martinorum*, in Heater Cave, Calaveras Co., and *B. rudolphi* in Chrome Cave, Amador Co.; the cave mite, *Poecilophysis melanoseta*, in the Mother Lode cave region; and expanded the range of several cave isopods (Holsinger 1974; Briggs and Ubick 1981; Zacharda and Elliott 1985; Lewis 2001; Wang and Holsinger 2001).

In 1979, Rudolph, Elliott, Briggs, and Reddell began to assemble all available information into a manuscript on the cave fauna of California (Rudolph et al. 1985); this unpublished checklist doc-





FIGURE 11. Transplant Mine, Tuolumne Co., Andy Grubbs at transplant site "T2", January 1978. William R. Elliott.

umented about 650 species in caves and springs in the State, with about 75 being troglobites. Elliott et al. (1985, 2003) reported on California's high cave biodiversity at biospeleology meetings, but the forerunner of the current contribution remained unpublished, although it was available to interested cave biologists. In the ensuing decades, Elliott maintained a California cave fauna list and Reddell made many taxonomic determinations of additional specimens from California caves (Briggs 1990; Elliott 2003). The arachnologist Willis Gertsch of the American Museum of Natural History identified California as a hotspot with at least 20 troglobitic spiders known at the time of publication (Gertsch 1992). In 1998, the cave biologist and coleopterist Stewart Peck identified the Sierra Nevada foothills as a troglobitic hotspot in North America, and listed 60 troglobitic species

from California in his national checklist of cave animals (Peck 1998). Peck also documented the diversity of fungus beetles (Leiodidae) in caves of California and the world in general.

The contributions of several other taxonomists must be mentioned. From the 1960s to the present, William Shear, who began at Harvard's Museum of Comparative Zoology, has described hundreds of cave invertebrates, including nine new millipedes and harvestmen from California caves (Shear 1969, 1974, 2010, 2011). Rowland Shelley (North Carolina State Museum of Natural Sciences) has described hundreds of new species of millipedes and centipedes, including several cave millipedes from California caves (Shelley 1994, 1995, 1996, 1997a–b). In 2002, he published a checklist of the millipedes of California, which established California as a biodiversity hotspot for this invertebrate class (Shelley 2002). From the 1960s to the present, William Muchmore, an arachnologist at the University of Rochester, has described the diversity of pseudoscorpions in caves in California and the world in general.

Beginning in 1977, Rolf Aalbu, a coleopterist with the California Academy of Sciences, began extensive pitfall trapping in caves across the State. This method of collection revealed a different assemblage of invertebrates than those collected by the traditional method (opportunistically, by sight). Besides documenting the hidden diversity of caves in the southwestern desert regions, Aalbu discovered at least 14 new California cave species, including a new genus of cave pseudoscorpion, *Tuberochernes aalbui*, new cave spiders, and new genera and species of beetles (Muchmore 1984, 1997; Aalbu and Andrews 1985, 1992; Aalbu 1990; Aalbu et al. 2012; Peck and Gnaspini 1997; Platnick and Ubick 2005; Triplehorn 2007).

Since the 1990s, aquatic entomologists from the U.C. Berkeley Essig Museum of Entomology have been documenting the biodiversity of springs in California. Cheryl Barr, for example, discovered new species of subterranean amphipods, *Stygobromus cherylae*, *S. cowani*, etc. in springs in the counties of Modoc, Napa, and Sonoma (Wang and Holsinger 2001; Graening et al. 2012). William Shepard discovered a new amphipod species in a spring in Sonoma Co., and has documented many new aquatic invertebrates, especially riffle beetles, that are limited to springs in the arid regions of California (Shepard 1992; Graening et al. 2012). Other researchers continue to document this diverse and endangered fauna; recent genetic studies have shown that at least twelve species of amphipods in the genus *Hyaella* are limited to springs in the southern Great Basin ecoregion of California (Baldinger, Shepard, and Threlloff 2000; Witt, Threlloff, and Hebert 2006).

In the early 2000s, Joel Despain, a National Park Service speleologist, organized and secured funding for bioinventories of the caves in California's national parks. Under these contracts, cave biologist Jean Krejca and colleagues inventoried over 35 cave and spring sites in Sequoia, Kings Canyon, and Yosemite National Parks between 2002 and 2004, and accumulated nearly 6,000 taxonomic observations and collections (Krejca 2006, 2007, 2009a). Krejca's team discovered 40 new invertebrates, including new genera and species of cave millipedes, *Amplaria muii*, *Pratherodesmus despaini*, *Taiyutyla loftinae*, and *Sequoiadesmus krejcae*, a new species of *Grylloblatta* ice crawler, and a new cave pseudoscorpion, *Parobisium yosemite* (Shear and Krejca 2007, 2011; Cokendolpher and Krejca 2010; Schoville and Graening 2013). The study was featured in National Geographic magazine (September 2007). In 2010, an intensive ecological study of Clough Cave was funded (Tobin et al. 2013).

The National Park Service also funded biological studies of the caves of Lava Beds National Monument. This important cave region (Lava Flows North region, Medicine Lake highlands) received some previous studies and discoveries in the last century. In 1951, Joseph Kamp discovered the Monument's endemic ice crawler, *Grylloblatta gurneyi* (Kamp 1963). In 1959, two species of cave diplurans (*Haplocampa*) were discovered by Vince Roth, who made other collections in the Monument's caves (Graening et al. 2014). In the early 1970s, Peck reported the troglotic milli-



pede, *Plumatyla humerosa*, in caves of the Monument, and summarized the fauna in these and other volcanic caves in western North America (Peck 1973). In 1982, dipluran taxonomist Lynn Ferguson (Longwood College) discovered a third species of *Haplocampa* (Ferguson 1992).

Bat populations at Lava Beds have been monitored since at least 1988 by various researchers, including Dixie Pierson, Bruce Rogers, and David Cowan; that same year, the Cave Research Foundation established a long-term scientific study of the Monument's caves. Under contract in 1989, Rod Crawford (University of Washington), with colleagues Clyde Senger and David Cowan, bioinventoried some of the caves. In 1993, Christopher Richard, of the Oakland Museum of California, documented the diversity of ferns that exploited the microhabitats of the Monument's caves. Under contract in 2005, Jean Krejca and Steve Taylor (Illinois Natural History Museum) inventoried 29 caves in the Monument; these surveys revealed several new cave invertebrates that await taxonomic identification (Taylor and Krejca 2006; Shear et al. 2009). Diana Northup, National Cave and Karst Research Institute, and fellow microbiologists performed studies in the Monument's caves and other California caves to determine how microbes had adapted to these extreme environments (Northup and Boston 2006).

Arachnologists at the California Academy of Sciences continue to make important contributions to our understanding of cave faunas within California and beyond. Joel M. Ledford is documenting a huge diversity of species and adaptations in cave spiders in the genera *Usofila* and *Calileptoneta*, and with Charles Griswold, has described many new cave spiders in the family Leptonetidae (Ledford 2004; Ledford and Griswold 2010a–b). Griswold and colleagues also described a new family of cave spiders — Trogloraptoridae (Griswold et al. 2012); this new spider was first collected by G.O. Graening and fellow caver Ron Davis in a cave on the California-Oregon border in 2011.

Cave biologist G.O. Graening, Sacramento State University, began studying California caves in 2009. Teaming with cavers from California's NSS (National Speleological Society) grottos and researchers from various museums and universities, Graening has performed bioinventories in more than 140 caves and springs in 18 counties. Discoveries to date include a new troglobitic silverfish, *Speleonycta*, from Crystal Stanislaus Cave, Calaveras Co.; a new cave amphipod, *Stygobromus* n. sp., from springs in Pinnacles National Park; a new genus and three new species of cave millipedes from the Marble Mountains, *Opiona graeningi*, etc.; and a new species of dipluran, Campodeidae (Shear 2011; Graening, Scherbanyik, and Arghandiwal 2012). Graening and colleagues published checklists of California's isopods and amphipods and of North America's ice crawlers that also summarized the distribution and diversity of these groups in subterranean habitats (Graening, Rogers, Holsinger, Barr, and Bottorff 2012; Graening and Rogers 2013; Schoville and Graening 2013). Graening created a statewide cave fauna occurrence database, Kryptos, and is collaborating with the other authors of this monograph and other scientists and conservationists.

Recent taxonomic works include Gómez, Reddell, Will, and Moore (2016) on molecular systematics of the ground beetle *Rhadine*; Marek, Krejca, and Shear (2016) on the new millipede *Illacme tobini*; and Shear and Warfel (2016) on new species and revisions of *Oskoron* and *Taracus* harvestmen.

## METHODS

Besides the many literature records detailed above, collectively we have accumulated a large number of collections since the 1970s. Most collections were made by hand by the authors, their assistants and associates, cavers and entomologists working under permits or permissions from landowners. Most invertebrates were preserved in ethanol or other fluids appropriate for a particu-

lar taxonomic group. Early records of bats and other vertebrates generally were reported in the literature from field collections; later from observations or net/release, and not from collected specimens. Some invertebrates were collected using pitfall traps with or without bait.

There has been no organized sampling of groundwater fauna in California. Instead, groundwater fauna have been opportunistically discovered during other aquatic sampling programs, either for stream bioassessment or for cave bioinventories. These sampling programs employed kick nets during benthic sampling or harvest by hand net when visually detected. Nevertheless, these methods have uncovered a unique and diverse assemblage of macrocrustaceans, primarily amphipods and isopods. Meanwhile, microcrustaceans remain largely undocumented, except for bathynellaceans discovered while sorting benthic grab samples. When modern sampling techniques are employed and groundwater habitats are systematically sampled in California, a similarly diverse microcrustacean fauna probably will be found.

Our collective data were maintained in computer documents as species lists, cave lists, and bibliographies. In 2009, G.O. Graening created the Kryptos database in Microsoft Access®. Kryptos is a privately owned relational database with data primarily on California's subterranean species, locations, and occurrences, including field collections, observations, and literature records. Other tables cover taxonomists and literature. Kryptos was developed further with William R. Elliott and others, and queries were designed to generate summary tables for this paper. The data in this monograph are dated December 16, 2016.

Biodiversity, how diverse the species are in a defined area, may be measured in different ways. We were interested in examining biodiversity in California caves by using a multivariate metric including troglobite endemism, which we knew to be high in many caves. We calculated a biodiversity score,  $B$ , a composite value of several statistics of interest, as done by Elliott (2007). We examined the number of species (species richness or  $SR$ ) per site, the number of troglomorphic species per site ( $T$ ), and troglobite endemism,  $e$  (troglomorphic species with limited distribution) per site. The value  $e$  is the reciprocal of the number of known sites for an obligate cave species, e.g.,  $1/5 \text{ sites} = 0.20$ . We also calculated  $SE$ , "site endemism," that is the sum of  $e$  per site.  $B_1 = SR \times T \times SE$  was used to rank 38 top caves in descending order. In all 38 cases  $SE$  was  $> 0$ . We truncated the final dataset to the top 20 caves because  $SR$  fell below 12 after 20 caves, and we thought that insufficient sampling could be a problem in the caves with low  $SR$ .  $B_2$ , a similar measure of biodiversity, was calculated as  $SR \times T \times SST$  ( $SST$  is the number of single-site troglomorphic species in the cave).

Linear regression analysis and statistical tests were performed in the Excel® spreadsheet program of  $B_1$  vs. cave elevation,  $SR$  vs. cave depth, and  $T$  vs. cave depth.

For this paper and beyond, Elliott developed a geographic information system (GIS) using QGIS (Quantum GIS), a free, open-source, multi-platform computer program that uses many formats and tools to build maps for publication. Attribute tables and geotiffs were drawn from Kryptos and many online sources: California Polytechnical University/Pomona, California Department of Conservation, Caltrans GIS Data, Free California GeoTIFF Maps, Geospatial Innovation Facility at University of California/Berkeley, State of California Geoportal, University of California/Davis, USDA Forest Service Geodata, USGS National Geologic Map Database, and USGS National Map small scale. Point, polyline, and polygon shapefiles were developed as layers in the GIS. Researchers needing assistance with data and GIS layers may contact G.O. Graening through The Subterranean Institute at <http://www.subinstitute.org/California/index.html> or [graening@csus.edu](mailto:graening@csus.edu).

Many taxonomists were enlisted in identifying species and describing new species, and we have listed them in Acknowledgments. Most of the collections eventually were deposited in these museums: American Museum of Natural History, New York; California Academy of Sciences, San



Francisco; Illinois Natural History Survey, Urbana; University of Texas, Biodiversity Collections, Austin (about 1,000 California records are deposited in the Biospeleology collection); and the U.S. National Museum of Natural History, Washington, D.C.

## OVERVIEW OF FAUNA

### Sea Cave Fauna

California's sea caves sometimes have dark zones, and may contain many marine invertebrates and fishes that are attracted to dim light, darkness, or the shelter that crevices provide. California sea lions and harbor seals sometimes shelter in the caves (Fig. 12 in the contiguous photographic section). A troglobitic isopod has been found in two caves.

Henderson (1983, 1988) described in detail the marine ecology of two caves on **Santa Cruz Island**. **Diablo Anchorage Cave** has two entrances and is subject to the prevailing, violent north-west swell, which enters the west entrance and exits the smaller east entrance, a blowhole. The cave is usually submerged and the bottom is floored with boulders, influencing the variety of invertebrates. The high flow of seawater and nutrients support filter feeders such as white sponge (Fig. 13), blue sponge, corals, barnacles, rock mussels, polychaete worms, and their predators, such as California spiny lobster. Resident fishes include rockfish, opaleye, perch, sheepshead, blacksmith, senioritas, spiny dog shark, and swell shark (scientific names are listed in Appendix 1). The two sharks are night or dim-light feeders especially attracted to this cave, forming tangled masses of many sharks.

**Fry's Harbor Cave** has one entrance in the lee of Santa Cruz Island, calmer water than Diablo Anchorage Cave, less nutrient input, and a silty bottom with breakdown false floors creating upper and lower galleries. This environment attracts a different community. There are few lobsters, but many black abalone feeding on algal bits and kelp drifting in from the entrance. Green anemones grade from green near the entrance to translucent white with pink highlights, owing to a loss of symbiotic green algae in their tissues in the darkness. Commonly seen are giant rock scallops and nudibranchs, including a new species discovered there, *Jorrunna pardus*, the leopard spot nudibranch.

Two mainland sea caves, Brigadune Cave (Cliff House Cave) and Sutro Baths Cave (Sutro's Cave), San Francisco County, contain an undescribed troglobitic terrestrial isopod, "Undetermined Oniscidea." Cliff House Cave's entrance is usually partly blocked with granitic beach sand and tree trunks. These are the only records of a troglobite from California sea caves.

A few caves on the **Farallon Islands** contain the troglophilic raphidophorid cricket, *Farallonophilus cavernicolus*, a genus unique to those islands. The cricket colonies are moderately large (see Crickets overview below). The Farallon Islands were connected to the mainland during the low sea level stands in the late Pleistocene Epoch between about 25,000 and 15,000 ka and/or about 125,000 ka. Perhaps the crickets were distributed from the mainland to the present islands, and became isolated there relatively recently. The arboreal salamander, *Aneides lugubris*, is also known from sea caves on the Farallons and mainland caves (see Herpetofauna overview and Appendix 1).

Another troglophile, *Brackenridgia heroldi* (Fig. 14), may have originated from littoral environments; the Oniscidea were ultimately derived from marine ancestors (Broly et al. 2013). This terrestrial isopod, though blind and depigmented, was originally known from the seashore at San Mateo, San Mateo County, and up to 1,200 m in Muir Woods, Marin County, where it occurs in leaf litter and other organic debris. It is known from 39 terrestrial caves in eight counties from the

TABLE 2. The 57 troglobitic arachnids of California. D = described, unD = undescribed species. KM: Klamath Mountains; LFN: Lava Flows North; SNN: Sierra Nevada North; SNS: Sierra Nevada South; MD: Mojave Desert; BD: Bay Area/Delta.

Order	Family	Genus species	D	unD	County (Cave)	KM	LFN	SNN	SNS	MD	CR	
Scorpiones	Vaejovidae	<i>Uroctonus grahami</i>	1		Shasta (Samwei Cave)							
	Chthoniidae	<i>Aphrastochthonius</i>	2		Calaveras							
	Chthoniidae	<i>Apochthonius grubbsi</i>	1		Calaveras							
		<i>Neochthonius</i>	2	2	Calaveras, Tuolumne, Tulare, Santa Cruz							
	Pseudogarypidae	<i>Pseudogarypus</i>	2		Shasta, Calaveras, Tuolumne							
		<i>Australinocareagris</i>	1	1	Calaveras, Tuolumne							
	Neobisidae	<i>Fissilicreagris</i>	1	4	Tulare, Santa Cruz							
		<i>"Microcreagris"</i>		2	Calaveras, Tuolumne, Mariposa							
		<i>Parobisium yosemite</i>	1		Mariposa							
	Chernetidae	<i>Tuberochernes</i>	1	1	Tulare, Inyo							
Opiliones	Laridae	<i>Lorca laceyi</i>	1		Calaveras							
	unplaced			1	Siskiyou (Lyon's Road Cave)							
	Taracidae	<i>Toracus fluvipileus</i>	1		Shasta							
	Phalangodidae	<i>Banksula</i>	8		Placer, El Dorado, Amador, Calaveras, Tuolumne							
		<i>Colicino</i>	1		Tulare							
		<i>Texello</i>		1	Inyo (Titus Canyon Cave)							
	Araneae	Telemdae	<i>Usafila</i>		1	Shasta, El Dorado, Calaveras, Tuolumne, Tulare						
		Leptonetidae	<i>Colleptoneto</i>	1	2	Trinity, Calaveras, Tulare						
		Linyphiidae	Erigoninae		1	Amador, Tuolumne						
			Linyphiinae		1	Tulare (Lilburn Cave)						
<i>Oophontes</i>				1	Tulare (Paradise Cave)							
		<i>Spirembolus</i>		1	Tuolumne, Tulare							
Nesticidae		<i>Nesticus potterius</i>	1		Shasta							
Cybaeidae		<i>Cyboeozyga</i>		2	Shasta							
		<i>Cyboeus</i>		1	Shasta Co (Samwel Cave)							
Dictynidae		<i>Blabommo</i>		6	Shasta, Amador, Calaveras, Tuolumne							
Schizomida		<i>Yorimo</i>		1	Tulare							
	Hubbardiidae	<i>Hubbardia shoshonensis</i>	1		Inyo (Shoshone Cave)							
	Palpigradi	<i>Prokoenenia</i>		1	Amador, Calaveras							
	Acarl	Rhagidiidae	<i>Foveocheles titonico</i>	1	Calaveras, Tuolumne							
	unplaced	unplaced		1	Tulare							
			26+	31	= 57 Total							

Mojave Desert to Sierra Nevada North, but not from a sea cave. It was transplanted from McLean’s Cave to the Transplant Mine. Other species in the genus, all troglobitic, are known from Arizona, New Mexico, Texas, and eastern Mexico.

Arachnids

Members of the Class Arachnida are primitively cryptozoic organisms and denizens of moist dark habitats such as leaf litter, rock undersurfaces and crevices, including caves, where they constitute a significant part of the cavernicole fauna. Of the 928 terrestrial troglobite species recorded north of Mexico, 334 (36%) are arachnids (Peck, 1998). Similar results were found for the southern Cumberland Plateau, where the 52 arachnid troglobites are 35% of the fauna (Zigler et al. 2014). The Appalachian karst has fewer arachnids, only 42 species or about 23% of the total, and in sharp contrast to that of Texas, which has 73 species, or 68% of its total (Culver et al. 2003). In California, arachnid troglobites are well represented and the 57 species (see Tables 2 and 3) represent 57% of the fauna. This richness in species extends to higher taxonomic diversity; 7 of the 11 arachnid orders in California caves are represented by at least one obligate cavernicole. In descending order the common troglobites are pseudoscorpions (23), followed by spiders (18), and harvestmen (11). The same trend was found in the above studies, but with differing proportions: 161, 124, 42 for the entire United States (Peck 1998) and 39, 8, 4 for the Cumberland Plateau (Zigler et al. 2014); 62, 12, 5 for the Interior Low Plateau; and 23,15, 0 for Appalachia, which is unusual in lacking troglobitic harvestmen (Culver et al. 2003). In contrast, only 9 arachnid troglobites occur among Missouri’s 33 troglobites. Missouri is a mesic state with aquatic species being 60% of its



TABLE 3. Cave spiders of California. Gray highlights families without cavernicoles, green probable accidentals, light blue troglaphiles, and dark blue troglobites. For species tallies: CV-cavernicole; ?-unresolved; AX-accidental; TX-trogloxene; TP-troglophile; [C]-TP known only from caves; TB-troglobite.

group	Family	CV	?	AX	TX	TP	[C]	TB
mygalomorphs	Antrodiaetidae	1		1				
	Mecicobothriidae	0						
	Dipluridae	0						
	Nemesiidae	1				1		
	Ctenizidae	0						
	Euctenizidae	1			1			
	Theraphosidae	1		1				
haplogynes	Hypochilidae	2				2		
	Filistatidae	1	1					
	Caponiidae	1	1					
	Trogloaptoridae	0						
	Segestriidae	0						
	Dysderidae	0						
	Oonopidae	0						
	Pholcidae	9		2		7		
	Plectreuridae	1		1				
	Diguetaeidae	0						
	Sicariidae	3	3					
	Scytodidae	0						
	Telemidae	2				1	?	1
	Leptonetidae	7				4		3
misc	Oecobiidae	0						
	Titanoecidae	0						
	Homalonychidae	0						
	Zodariidae	0						
orbicularians	Uloboridae	1	1					
	Theridiidae	11		6		5		
	Mimetidae	0						
	Araneidae	1		1				
	Anapidae	1				1		
	Mysmenidae	1				1		
	Tetragnathidae	5		2		3	[1]	
	Nesticidae	3				2	[1]	1
	Linyphiidae	27	6	1		16	?	4
	Pimoidae	3				3		
amauro-dictynoids	Amaurobiidae	7		1	3	3		
	Agelenidae	1		1				
	Hahniidae	7	1			6	[1]	
	Cybaeidae	7	2			2		3
	Dictynidae	21		1		13	?	7
	Amphinectidae	0						
	Desidae	0						
lycosoids	Zoropsidae	10				10	[2]	
	Miturgidae	0						
	Pisauridae	0						
	Lycosidae	2		2				
	Oxyopidae	0						
dionychans	Thomisidae	1		1				
	Selenopidae	0						
	Sparassidae	0						
	Eutichuridae	0						
	Clubionidae	0						
	Anyphaenidae	1		1				
	Liocranidae	1	1					
	Philodromidae	1		1				
	Salticidae	1		1				
	Corinnidae	0						
	Phrurolithidae	1		1				
	Trachelidae	0						
	Gnaphosidae	2		2				
	Prodidomidae	0						
Species Totals		146	16	27	4	80	5	19
		%	100	11	18	2	54	3
Family Totals		61						
Cavernicoles		35						
AX only				12				
TP+TB						17		
TB								6

obligate subterranean fauna (Elliott 2007). A different trend occurs in Texas (16, 44, 13), where spider troglobites predominate (Culver et al. 2003).

In all, about 250 arachnid species are recorded from Californian caves, with the troglobites representing about 24%. Most of the remainder are troglaphiles (about 100 species), which exhibit varying degrees of troglomorphy and cave fidelity; the rest (about 80 species) are troglloxenes or accidentals.

Scorpions, schizomids and palpigrades each have one troglobitic species. Although several species of scorpions occur in caves, only *Uroctonus grahami* is a troglobite, and is known from a single cave in the forested karst of Shasta County. The troglaphile *Uroctonites sequoia* (Fig. 15), occurs only in Clough Cave, Tulare County; the median eyes are small and the third lateral eye is obsolete. The scorpion *Uroctonus mordax* also occurs in Clough Cave and other caves and epigean localities (Fig. 16). The schizomid, *Hubbardia shoshonensis*, is also known from a single cave, but from the Mojave Desert of Inyo County (Fig 17). An unidentified schizomid, probably a species of *Hubbardia*, was observed in Clough Cave. A palpigrade species, which remains to be described, has been collected in two caves in Sierra Nevada North.

Mites are very abundant and diverse in caves, but most are parasites associated with mammal residents. Only two troglobites have been recorded, a predatory rhagidiid, *Foveacheles titanica*,

from the Sierra Nevada North, and an undescribed species from Tulare County, Sierra Nevada South. A rhagidiid was photographed in a cave at Lava Beds National Monument (Fig. 18).

Harvestmen (Opiliones) are common cavernicoles in California, with the exception of the most primitive members, the mite-like Cyphophthalmi, which have not yet been recorded from Californian caves, although ranging in proximity of karst areas. Nine representative harvestmen of six families are illustrated in Figures 19–27. The Eupnoi, by comparison, are the most conspicuous cave harvestmen, especially the long-legged *Leiobunum* species (Fig. 19), or “Daddy longlegs,” sometimes referred to as “cave hair” because of their dense aggregations. Members of this suborder are troglonexes and not cave restricted. The Dyspnoi are moderate-legged forms, represented by several probably troglophilic species in five genera, but with only a single troglobite in *Taracus*, *T. fluvipileus*, which is the only troglobitic arachnid from lava tubes and is characterized by much longer appendages than its troglophilic relatives, such as *T. audisioae* (Fig. 20). The Laniatores family Phalangodidae, our shortest-legged harvestmen, is most diverse in the Californian region and is richly represented in caves. Of the 23 species (6 genera) so far recorded, 10 are troglobites, with eight in *Banksula* (Figs. 21–22), an endemic of Sierra Nevada North, and one each in *Calicina* (Fig. 23) from Tulare County, Sierra Nevada South, and *Texella* from Inyo County, Mojave Desert. Maps in Figures 7 and 8 illustrate the highly insular distribution of *Banksula* in the Sierra Nevada North region. Each of these genera also includes at least one troglophilic species known only from caves and likely cave restricted. The remaining eight troglophiles are of species with largely epigean distributions. With the exception of *Calicina*, which is the basal lineage of Phalangodidae, all other troglobites (including all Texan and eastern U.S.A. phalangodids) belong to the same, derived lineage, the bifurcate clade. The intermediate species, the sitalcinoid complex, are represented by several genera and many epigean species in California, but with only a few troglophiles in *Sitalcina* (Fig. 24) and *Megacina* (Ubick 2007).

Pseudoscorpions have the highest cave diversity, with 23 troglobites distributed mostly among the Neobisiidae (10) and Chthoniidae (7), followed by Pseudogarypidae (2), Chernetidae (2), Loricidae (1), and a species not placed to family. Most of the troglobites are in the Sierran karst (17), and the two species in the Santa Cruz Karst are the sole representatives of troglobitic arachnids in the Bay Area/Delta Region. The highest diversity of U.S. troglobites is in the Interior Low Plateau, which has an astonishing 62 species (Culver et al. 2003), although the pseudogarypid troglobites are strictly Californian. Eight representative pseudoscorpions of four families are shown in Figures 28–35.

Spiders are very common cavernicoles in California (Tables 2 and 3) and about 145 species are recorded from caves. Most of these species are troglophiles (79) and troglobites (19), and the remainder largely accidentals (27). Cavernicoles are recorded in 35 families, or just over half of the 61 families known for the region; 17 families include troglophiles and troglobites, 12 are represented only by accidentals. Troglobites are found in six families which represent three major spider groups. Twenty representative photographs of 15 families are shown in Figures 36–55.

The first spider group contains the haplogyne families, which are at the basal branches of true spider phylogeny (Araneomorphae), and are extremely well represented in caves with troglobites recorded from most of the families. In California, haplogyne cavernicoles are known in 8 families (29 species), mostly troglophiles, but with four troglobites recorded for Telemidae and Leptonetidae, both small spiders that construct delicate sheet webs. Telemids are represented by *Usofila* (Figs. 36–37), a wide-ranging genus in the western Nearctic of mostly epigean species, but with troglobites known only from California. The genus is in need of revision as the currently recorded, undescribed troglobite is widely-distributed and probably represents a species complex which has yet to be resolved (Ledford and Griswold 2010b). Leptonetids are represented in California by two



genera and 7 species of cavernicoles, which includes three troglobites in *Calileptoneta*. Unlike telemids, which are restricted to the Californian region, leptonetids range into the eastern Nearctic, with many troglobitic species in Texas (*Tayshaneta*) and the Appalachians (*Appaleptoneta*).

The second group with troglophilic spiders are the orbicularians, orb weavers and their relatives, and is also represented by eight families of cavernicoles, but with more species (40). All of the families have troglophilic representatives but only two, Linyphiidae and Nesticidae, have troglobites. Linyphiidae are well-known as troglobites, especially the numerous species of *Troglohyphantes* in the Mediterranean region, as well as several genera with troglobitic species in Appalachia. Troglobitic linyphiids (Figs. 38–39) are very rare in California, mostly discovered in recent surveys in the Sierra Nevada, and known by four undescribed species belonging to different genera. By contrast, California's Nesticidae are well known and the three species of *Nesticus* all occur in caves, but only *N. potterius* is troglobitic; the other two species (Figs. 40–41) are troglophiles, with one mostly epigean in distribution (*N. silvestrii*) and the other restricted to caves (*N. sodanus*). The family is common in caves globally and troglobitic species occur in both the Appalachian region, represented by a different species group of *Nesticus*, and in Texas, by *Eidmannella*. The families Pimoidae (Fig. 42) and Tetragnathidae include strongly troglophilic species, but are without troglobites in California. The tetragnathid genus, *Meta*, occurs in caves across the Holarctic and is known in California by *Meta dolloff* (Figs. 43–44), a species showing little troglomorphic modification but nonetheless appears to be cave restricted.

The third group includes spiders related to funnel weavers, the Amaurobiodea and Dictynoidea, or amauro-dictynoids, and is represented in California by 38 species of cavernicoles in five families, with 9 species of troglobites in two, Cybaeidae and Dictynidae. Cybaeidae (Fig. 45) are widespread in the Nearctic but have their greatest diversity in the Pacific NW, especially at the California-Oregon border where the three known troglobites occur (in *Cybaeus* and *Cybaeozyga*). By contrast, cavernicolous Dictynidae (Figs. 46–47) are widespread in the Nearctic, in California by 17 species, mostly troglophilic, but with 6 troglobites in *Blabomma* and *Yorima*, both genera endemic to the Californian region (Ubick et al. 2017). Troglobitic dictynids also occur in the Texan and Appalachian karst, but in California the genus *Cicurina* is only troglophilic. In addition to these families, troglophiles also occur in Amaurobiidae and Hahniidae, especially the very common *Calymmaria* species (Fig. 48) with their conspicuous webs near cave entrances.

Related to this group are the lycosoid spiders, which are typically large-eyed hunting spiders and only incidentally associated with caves. One exception is Zoropsidae, where the several species of *Titiotus* (Fig. 49) and *Anachemmis* are common troglophiles throughout the Californian karst. Although no troglobites are known from these genera, at least two species (of *Anachemmis*) show significant troglomorphy and are known only from caves.

The two large groups of spiders not represented by troglobites are, interestingly, the most primitive and most derived. In the former group are mygalomorphs, sister to all remaining spiders (araneomorphs), with only one troglophilic genus, *Calisoga* (Fig. 50), and three species (3 families) of accidentals. Troglobitic mygalomorphs do occur in southern latitudes, such as Mexico. Even more poorly represented in caves are the Dionycha, 2-clawed hunting spiders that have abandoned web-building and successfully radiated into a dozen families and thousands of species, but whose presence in Californian caves are 6 species (5 families) of accidentals.

The cavernicolous arachnid fauna of California agrees well with that of the other major karst areas in the Nearctic, those of Texas and the greater Appalachians. Gertsch (1992) tabulated the spider troglobites of the three regions and recorded 20 from California, 18 from the Appalachians, and a whopping 61 from Texas, of which 46 are blind *Cicurina* species. Currently, by our count, there are 75 troglobitic spiders, including 53 *Cicurina*. The three regions also share troglobite taxa

TABLE 4. Troglobitic (some possibly troglomorphic) myriapods (2 centipedes, 17 millipedes) of California. KM: Klamath Mountains; SNN: Sierra Nevada North; SNS: Sierra Nevada South; CR: Coast Ranges; BD: Bay Area/Delta; MD: Mojave Desert.

Species	Author	Region	Class	Order	Family	No. of Sites
<i>Stenophilus californicus</i>	(Chamberlin, 1930)	KM, SNN	Chilopoda	Geophilomorpha	Himantariidae	2
Undetermined Lithobiomorpha		SNN	Chilopoda	Lithobiomorpha	Undetermined	1
<i>Amplaria shastae</i>	Causey 1958	KM	Diplopoda	Chordeumatida	Striariidae	2
<i>Lophomus</i> sp. or new genus		KM	Diplopoda	Chordeumatida	Conotylidae	2
<i>Opiona graeningi</i>	Shear, 2011	KM	Diplopoda	Chordeumatida	Caseyidae	11
<i>Opiona</i> n. sp. no. 2		KM	Diplopoda	Chordeumatida	Caseyidae	1
<i>Plumatyla humerosa</i>	(Loomis, 1943)	LFN	Diplopoda	Chordeumatida	Conotylidae	43
<i>Plumatyla</i> sp.		CR, KM	Diplopoda	Chordeumatida	Conotylidae	2
<i>Speoseya grahami</i>	Causey, 1963	SNN	Diplopoda	Chordeumatida	Caseyidae	3
Undetermined Chordeumatida		LVN	Diplopoda	Chordeumatida	Undetermined	4
<i>Bidentogon</i> n. sp.		SNN	Diplopoda	Polydesmida	Polydesmidae	2
<i>Nevadesmus</i> n. sp. 1		SNS	Diplopoda	Polydesmida	Macrostermodesmidae	1
<i>Nevadesmus</i> n. sp. 2		MD	Diplopoda	Polydesmida	Macrostermodesmidae	1
<i>Pratherodesmus despaini</i>	Shear et al., 2009	SNS	Diplopoda	Polydesmida	Macrostermodesmidae	1
<i>Pratherodesmus</i> n. sp.		SNS	Diplopoda	Polydesmida	Macrostermodesmidae	1
<i>Sequoiadesmus kreyjcae</i>	Shear and Shelley, 2008	SNS	Diplopoda	Polydesmida	Macrostermodesmidae	3
Undetermined Polydesmida sp. no. 1 (troglomite)		MD	Diplopoda	Polydesmida	Undetermined	1
Undetermined Polydesmida sp. no. 2 (troglomite)		KM	Diplopoda	Polydesmida	Undetermined	1
Undetermined Diplopoda		KM, LVN, MD, SNN, SNS	Diplopoda	Undetermined	Undetermined	27



to varying degrees and four spider families (Leptonetidae, Linyphiidae, Nesticidae, and Dictynidae) are represented in all regions, but with different genera. One exception is *Nesticus*, which also has troglobites in the greater Appalachians. Pseudoscorpion troglobites are much more diverse in greater Appalachia, which has about 100 species in 9 genera, or about 5 times that in California. The families Chthoniidae, Neobisiidae and Chernetidae occur in all regions, with some shared genera. In addition to California, troglobitic *Aphrastochthonius* and *Apochthonius* also occur in Texas and Appalachia, respectively. In Opiliones, troglobitic Taracidae are represented by *Taracus* (Fig. 26) in California and *Hesperonemastoma* in the Interior Low Plateaus. The family Phalangodidae is well represented in the three regions with endemic genera, except for *Texella*, which occurs in both California and Texas.

### Myriapods

Myriapods (“many feet”) are an ancient Subphylum of arthropods grouped in four Classes. The first terrestrial arthropod was a millipede from the middle Silurian Period, about 428 Ma, its fossil discovered in Scotland (Wilson and Anderson 2004). But all myriapods may be descended from a basic body plan established in the late Cambrian period about 500 Ma. The evolutionary relationships of these classes are still being researched.

Myriapods are common in moist forests and caves. In caves millipedes are usually found near moist organic matter. Most are detritivores, but centipedes are generally nocturnal predators. These characteristics have led many species to adapt to caves (Table 4).

Myriapods have a single pair of antennae and, in most cases, simple eyes. Some groups, such as polydesmoid millipedes and geophilomorph centipedes, lack eyes even if not troglobitic. The mouthparts lie on the underside of the head, with an “epistome” and labrum forming the upper lip, and a pair of maxillae forming the lower lip. A pair of mandibles lie inside the mouth.

**Class Chilopoda**, centipedes, predators, one pair of legs per body segment, first pair of legs modified as venomous fangs under the head. The Orders Geophilomorpha and Lithobiomorpha are illustrated in Figures 56–58. One Californian troglobite, the geophilomorph *Stenophilus californicus*, is known from two caves in two regions: Brown Deer Cave, Calaveras County; and Potter Creek Cave (type locality), Shasta County. It is described from one male specimen, about 90 mm long and pale yellow. The legs were described as “short.” This may be the “large myriapod” referred to by Sinclair (1904). An undescribed lithobiomorph is known from Porcupine Cave Tuolumne County. This species is depigmented, eyeless, and has elongated appendages. Centipedes prey on small cave invertebrates, as shown in Figure 57.

**Class Symphyla**, garden centipedes, one pair of legs per segment, white and eyeless endogeans (soil dwellers). Undetermined species of tiny endogeans have been collected in 29 caves and 9 counties across the state, except in the deserts. *Symphylella oviceps* was found in gravelly Transplant Mine tailings, Tuolumne County. At least four species of Scutigereidae have been found in caves of the Mother Lode Region (Sierra Nevada North). *Scutigereella causeyae* is known from three caves, and it was introduced from McLean’s Cave to the Transplant Mine. It is also found in the mine tailings and on the surface in the vicinity. It ranges widely throughout the United States. Figure 59 is a symphylan from a cave in Sierra Nevada South, in Sequoia-Kings Canyon National Parks.

**Class Pauropoda**, dwarf millipedes, tiny endogeans rarely found in caves, possibly the most primitive myriapods, with semi-fused body rings and a short body. An undetermined species of endogean was found in Overhang Cave, Tulare County, the first pauropod record from a California cave.

**Class Diplopoda**, millipedes, two pairs of legs per most body rings (fusion of two segments). Many cave and eyed forms exist, and are illustrated in Figures 60–66. Millipedes are among the most commonly seen members of the cave community, and larva are preyed upon by centipedes in some cases (photo). At least six species of large, brown, troglomorphic or troglomorphic paeromopids are recorded, some up to 150 mm long (Fig. 60). Many millipedes are troglomorphic, and there are at least 18 troglomorphic species from 4 or more orders and 7 or more families. The orders Chordeumatida and Polydesmida contain the most troglomorphs. Chordeumatids (Figs. 61–63) are northern in distribution in the families Caseyidae, Conotylidae, and Striariidae. Polydesmids (Macrosternodesmidae, Polydesmidae, and undetermined) do not occur in Lava Flows North, but in other regions.

The caseyid *Opiona graeningi* is known from 11 caves in the Klamath and Marble Mountains Region. Most other troglomorphic millipedes are known from only a few sites; 11 are single-site endemics and 9 are from 2 to 5 sites.

The largest range for a troglomorphic in California is that of the conotylid *Plumatyla humerosa*, with 43 known sites in Lava Flows North, in a north-south strip 194 km long and 8–10 km east-west (Figs. 5 and 62). The type locality is Sunnyside Mine, excavated in mafic lava in the southern part of the range. Since there is continuous lava throughout its range, it could be a crevice dweller also found in caves. The species was taken from wooden mine props throughout the type locality, an old placer mine. This species has a reduced number of ocelli (eye spots) and is depigmented. Causey (1961) thought it to be a troglomorphic that infiltrated the mine from surrounding cavernous limestone, but geologic maps show no limestone within 100 km of the mine, and all occurrences of this species are in lava. Shear (1971) reported a population with some morphological differences from a lava cave far to the north. Shear (1972) stated that “. . . no other conotylid is as strongly modified for cave life.” Nelson and Smith (1976) collected this millipede from a *Neotoma cinerea* nest in a cave in Lava Beds National Monument, and Taylor and Krejca (2006) collected it from numerous caves at Lava Beds. Perhaps this species is a relatively recent cave form, and it may not have differentiated much from cave to cave.

The striariid *Amplaria shastae*, from Ancient Palace Cave and Samwel Cave (type locality), Shasta County, has pigmented eyes, is nearly white, has elongated legs and antennae, and a large body (a similar species is shown in Fig. 63). These probably are indications of cave adaptation. Fossils of this species were found in a Pleistocene stratum in the cave with several extinct mammals. Although Causey thought that the two fossil *Julus* species described from Samwel Cave by Grinnell (1908) may not be the same as this species, Grinnell's material needs to be restudied as indicated by Graham (1960b).

The first record from a cave in California of the unusual Order Siphonophorida is represented by a possible new species of *Illacme* from Lange Cave, Tuolumne County. The genus contains more legs than any other millipede in the world with 318 to 750 legs (Krejca 2009b).

*Colactis utorum* (Callipodida, Schizopetalidae) is limited to three sites in the Mojave Desert. Shear (1974) described *C. briggsi* (later synonymized with *C. utorum*), and speculated that it may be troglomorphic because of its reduced pigmentation and the harsh desert environment surrounding the cave. The species does possess numerous black ocelli, and we consider it a troglophile. Two polydesmids and an undetermined species occur in Mojave Desert caves as well.

### Collembolans

The collembolans (Class Collembola, Figs. 67–69) are known as springtails because of their peculiar, spring-like appendage, the furcula, which is folded beneath the body and used for jumping when the animal is threatened. The furcula is held under tension by a small structure called the retinaculum and when released, snaps against the substrate, flinging the springtail into the air.



Collembolans are primitive arthropods similar to insects except that they lack wings, they have internal mouth parts, and most have no tracheae.

Collembolans, usually less than 6 mm long, are soil and cave detritivores, free-living organisms that prefer moist conditions. They frequently are found near bacteria and fungi growing on biofilms, roots, wood, detritus, and feces. They provide the base of cave food chains, and are often consumed by micropredators such as rhagidiid mites, tiny spiders, harvestmen, and pseudoscorpions.

California caves have 43 verified, and up to 58 potential species of collembolans to date, summarized in Table 5. The various orders and families are distributed across most California cave regions. The largest group, the Family Entomobryidae with up to 18 species, has one described, probable troglobite, *Sinella tecta*, from five caves in Calaveras County, Sierra Nevada North (a related species is in Fig. 67). The Onychiuridae have two undescribed, probable troglobites from Clay Cave, Napa County, Bay Area/Delta Region, and three caves in Siskiyou County: Lava Flows North. Several undescribed, undetermined collembolans from three regions appear to be troglotic.

Few collembolans in California caves are troglobites, and many are common epigeal species or troglaphiles. The Tomoceridae are an important family with 14 species in most regions, and are noticeable as larger, gray to pale springtails (*Tomocerus*, Figs. 68 and 101). Hypogastruridae (Order Poduromorpha) are another important family with 5 species (Fig. 69). So far the Isotomidae seem to be limited to Lava Flows North, the Neanuridae to Sierra Nevada North, and the Katiannidae to Sierra Nevada South, but their true ranges probably are much larger. The round-shaped Order Symphypleona, Family Arrhopalitidae (3 potential species), are found in Lava Flows North and Sierra Nevada South caves. Both Oncopuridae and Arrhopalitidae contain troglotic species in other parts of the United States, but are not known as such in California.

It is apparent that we are just beginning to understand collembolans in California caves. Probably many new species will be found, and studies will be needed to delineate their roles in the cave ecosystems.

## **Diplurans (Class Diplura)**

### **Campodeids (Order Rhabdura)**

Campodeids (Fig. 70) are small, eyeless, white creatures with two long, filamentous cerci (tails). California has a remarkable dipluran fauna with about 8% of global richness (Graening et al. 2014). Members of the family Campodeidae are abundant as troglobites and troglaphiles in caves throughout much of the world. One described species, *Campodea (Campodea) californiensis*, has been recorded from a few California caves. The only troglobites or likely troglobites are several undescribed species of the genus *Haplocampa*, which are the dominant taxon in volcanic caves of western North America (Graening et al. 2014).

### **Japygids (Order Dicellurata)**

Japygids (Fig. 71) range up to 50 mm in length, but most are much smaller. They are all eyeless and the body is light-colored and have heavily sclerotized unsegmented cerci, shaped much like that of the earwigs (Dermaptera), which are not closely related. They are usually found in soil and leaf litter and under rocks. Most japygids from California caves remain undetermined or undescribed. The only species identified is *Occasjapyx kofoidi* (family Japygidae), known only from two caves in Shasta County. It is possible that it is a troglobite. The only definitely troglotic japygid in the U.S.A. is *Mixojapyx reddelli* from Texas.

TABLE 5. Summary of collembolans from California caves. Counts of genera and species are the maximum potential, but 15 taxa are as yet undetermined beyond order or family. Ecol. Class. is Ecological Classification. KM: Klamath Mountains; LFN: Lava Flows North; SNN: Sierra Nevada North; SNS: Sierra Nevada South; CR: Coast Ranges; BD: Bay Area/Delta; SV: Sacramento Valley.

Order	Family	Num. Genera	Num. Species	Genera	Ecol. Class.	Regions
Entomobryomorpha	Entomobryidae	6	18	<i>Drepanura</i> , <i>Entomobrya</i> , <i>Entomobryoides</i> , <i>Pseudosinella</i> , <i>Sinella</i> , Undetermined	EP, TP, <b>TB?</b>	BD, KM, LFN, <b>SNN</b> , SNS
Entomobryomorpha	Isotomidae	1	1	Undetermined	TP	LFN
Entomobryomorpha	Oncopoduridae	1	2	<i>Oncopodura</i>	TP	CR, SNN
Entomobryomorpha	Tomoceridae	5	14	<i>Plutomurus</i> , <i>Pogonognathellus</i> , <i>Tomocerina</i> , <i>Tomocerus</i> , Undetermined	TP, EP	BD, CR, KM, LFN, <b>SNN</b> , SNS
Poduromorpha	Hypogastruridae	4	5	<i>Ceratophysella</i> , <i>Hypogastrura</i> , <i>Xenylla</i> , Undetermined	EP	<b>SNN</b> , LFN, KM, SV?
Poduromorpha	Neanuridae	1	1	<i>Morulina</i>	EP	<b>SNN</b>
Poduromorpha	Poduridae	1	1	Undetermined		BD, LFN, <b>SNN</b>
Poduromorpha	Onychiuridae	3	4	<i>Deuteraphorura</i> , <i>Psyllaphorura</i> , Undetermined	EP, TP, <b>TB?</b>	KM, <b>BD</b> , LFN, <b>SNN</b>
Symphyleona	Dicyrtomidae	1	4	<i>Ptenothrix</i>		BD, KM, <b>SNN</b> , SNS
Symphyleona	Sminthuridae	1	1	Undetermined		BD, KM, LFN, <b>SNN</b> , SNS
Symphyleona	Arrhopalitidae	2	3	<i>Pygmarrhopalites</i> , Undetermined	EP	LFN, SNS
Symphyleona	Undetermined	1	1	Undetermined		SNS
Symphyleona	Katiannidae	1	1	<i>Sminthurinus</i>		SNS
Undetermined	Undetermined	1	1	Undetermined		BD, CR, KM, LFN, MD, <b>SNN</b> , SNS
Undetermined	Undetermined	1	1	Undetermined	<b>TB</b>	<b>BD</b> , LFN, <b>SNN</b>
<b>Totals 4</b>	<b>13</b>	<b>30</b>	<b>58</b>			

**Insects (Class Insecta)**

Nineteen orders of the Class Insecta have been found in California caves. Of these, three (Archaeognatha, Isoptera, and Thysanoptera) are only accidentals in caves. Six orders (Ephemoptera, Odonata, Megaloptera, Neuroptera, and Trichoptera) are occasionally found in caves, either as aquatic or terrestrial immatures or as adults in entrance areas. At least in California caves, they do not appear to be significant to the cave fauna. Of the remaining orders, two have troglobites (*Zygentoma* and Coleoptera), five have troglophiles (Psocoptera, Orthoptera, Notoptera, Hemiptera, and Diptera), three have troglonexes (Orthoptera, Lepidoptera, and Hymenoptera), and one is represented only by parasites (Siphonaptera, fleas). The more important orders are discussed separately below.



### Silverfish (Order Zygentoma)

Silverfish are rare in California caves, but two undescribed troglobitic species of the genus *Speleonecta* (Nicoletiidae) have been recognized, one known only from Clough Cave, Tulare County, and the other from caves in Calaveras and Tuolumne counties. The genus is otherwise known only from one troglobitic species in Arkansas and Oklahoma. *Speleonecta* is most closely related to *Texoreddellia*, which is ubiquitous in Texas caves.

Several undetermined specimens of the family Lepismatidae are known from California caves but show no cave adaptation, and are common in moist soils and forest litter.

### Barklice (Psocids, Order Psocodea)

Only two species of tiny barklice have been identified from California caves. One, *Psyllipsocus ramburii*, is a species known from caves throughout the U.S.A. and other parts of the world. The second, *P. kintpuashi*, is known only from five lava caves in Siskiyou County and one cave in Sequoia National Park. Both are troglophiles (Mockford 2011). Elliott (1978) discovered in feeding experiments that *Banksula* harvestmen would attack psocids and springtails in confinement.

### Crickets (Order Orthoptera)

Camel or cave crickets (Rhaphidophoridae, Figs. 72–73) are common to most American caves. Most are troglonexes that forage outside at night, but some are more troglophilic and may remain within the cave for extended periods. The distributions of California cave crickets are shown in Table 6. *Ceuthophilus* (Fig. 72) is the most widespread genus in North America. *Pristoceuthophilus* has about seven species in the Sierra Nevada, at least four of which are new species, including two troglophiles. *Tropidischia xanthostoma* (Fig. 73) is the dusky, slender troglonex that is common in Tulare County, but it ranges to Marin and Trinity counties.

Most population counts of cave crickets recorded in California are < 50 individuals. The largest colonies on record are 100–1,000 (mean of 620) of the troglophile *Farallonophilus caver-nicolus* in each of five caves on the Farallon Islands, San Francisco County (Steiner 1989; Anonymous 2011c; Valainis 2014). About 50 *Ceuthophilus* n. sp. were counted in Lower Shoshone Cave, Inyo County, Mojave Desert. One of us (Aalbu) has observed a cricket colony of perhaps 500 in a Sierra County cave. Most colony sizes are small compared to those of several species of *Ceuthophilus* in Central Texas (up to 2,500, Elliott 2000a) or *Hadonoecus* and *Euhadenoecus* in Kentucky (up to 5,000, Lavoie et al. 2007). In contrast to Texas, Kentucky, Tennessee, and other states, California lacks cave beetles that prey on cave cricket eggs, but it has cave beetles that make a living as micropredators or detritivores. Some specialize on mammal dung and the fauna around the dung.

### Grylloblattids (Ice Crawlers, Order Notoptera)

Grylloblattidae (Fig. 74) are a family of cold-loving, wingless insects that typically live on mountains and near glaciers. Some have been observed under snow crusts or on the walls of glacier caves. Only 32 species in 5 genera are known in Northeast Asia and North America. At least thirteen species of *Grylloblatta* occur in California. Formerly placed in the Order Orthoptera with crickets, they are now placed in the Order Notoptera, Suborder Grylloblattodea.

Grylloblattids, commonly called ice crawlers or icebugs, are an ancient group. They look like a cross between a cricket and a cockroach, hence the Latin name meaning “cricket-roach.” Their eyes are either missing or reduced and they have no ocelli. They are nocturnal and typically found in leaf litter and under stones in cold environments, usually at higher elevations in periglacial areas,

TABLE 6. Distribution of crickets (Order Orthoptera) in California caves and mines. Up to 6 species occur within a region. Most are troglomenes or epigeal, but 5 species are troglaphiles (designated TP).

Region	Species	Total Sites
Bay Area/Delta	<i>Ceuthophilus</i> sp.	3
Bay Area/Delta	<i>Pristoceuthophilus pacificus</i>	1
Bay Area/Delta	Rhaphidophoridae	3
Bay Area/Delta	<i>Stenopelmatus</i> sp.	1
Bay Area/Delta	<i>Tropidischia</i> sp.	1
Bay Area/Delta	<i>Tropidischia xanthostoma</i>	1
Coast Ranges	Rhaphidophoridae	1
Klamath Mountains	<i>Ceuthophilus</i> sp.	3
Klamath Mountains	<i>Pristoceuthophilus</i> sp.	4
Klamath Mountains	<i>Pristoceuthophilus</i> n. sp. no. 4 <b>TP</b>	1
Klamath Mountains	Rhaphidophoridae	2
Klamath Mountains	<i>Tropidischia</i> sp.	1
Klamath Mountains	<i>Tropidischia xanthostoma</i>	1
Lava Flows North	<i>Ceuthophilus inyo</i>	12
Lava Flows North	<i>Ceuthophilus</i> sp.	1
Lava Flows North	<i>Pristoceuthophilus celatus</i>	5
Lava Flows North	Rhaphidophoridae	26
Mojave Desert	<i>Ceuthophilus</i> n. sp. (Shoshone Cave) <b>TP</b>	3
Mojave Desert	<i>Ceuthophilus</i> n. sp. (Titus Canyon Cave) <b>TP</b>	1
Mojave Desert	Orthoptera	2
Mojave Desert	Rhaphidophoridae	2
Sea Caves	<i>Farallonophilus cavernicolus</i> <b>TP</b>	7
Sierra Nevada North	<i>Aglaothorax oratus</i>	1
Sierra Nevada North	<i>Ceuthophilus</i> sp.	1
Sierra Nevada North	<i>Gryllus</i> sp.	2
Sierra Nevada North	Orthoptera	1
Sierra Nevada North	<i>Pristoceuthophilus</i> n. sp. no. 1	1
Sierra Nevada North	<i>Pristoceuthophilus</i> n. sp. no. 3 <b>TP</b>	1
Sierra Nevada North	Rhaphidophoridae	2
Sierra Nevada South	<i>Ceuthophilus</i> sp.	1
Sierra Nevada South	Gryllacrididae	1
Sierra Nevada South	Orthoptera	11
Sierra Nevada South	<i>Pristoceuthophilus marmoratus</i>	1
Sierra Nevada South	<i>Pristoceuthophilus</i> n. sp. no. 2	1
Sierra Nevada South	Rhaphidophoridae	2
Sierra Nevada South	<i>Tropidischia</i> sp.	2
Sierra Nevada South	<i>Tropidischia xanthostoma</i>	13



where they feed on detritus. At lower elevations they can live in lava tubes that produce perennial ice, and almost all California ice caves that have been studied contain *Grylloblatta*. In California *Grylloblatta* occurs in caves from the Lava Flows North to the Sierra Nevada South, Tulare County, where Mays Cave is the second-most southern record for any grylloblattid to date (Lee 1967).

*Grylloblatta marmoreus* is restricted to caves and snow fields in the Marble Mountains. *G. gurneyi* is restricted to lava tube caves in or near Lava Beds National Monument, with the possible addition of a few records on the ice fields of Mount Shasta. One new species of *Grylloblatta* (Fig. 74) is found only in the caves and snow fields of Sequoia National Park. Another species, *G. chandleri*, is widespread in the Modoc Plateau and Basin Ranges of Eastern California (Kamp 1963, 1973). All are glacial relicts from times when montane glaciers descended to lower elevations than now (Schoville and Graening 2013).

### Beetles (Order Coleoptera)

Worldwide, one of every five species is a beetle (Figs. 75–81, 84). They are easily the largest group of animals in California. Cave Coleoptera comprise a number of families, most of which happen to be found in caves incidentally. Others are both habitual and occasional troglloxenes often being found in caves. A number of troglphilos exist with an even smaller number of trogllobites. Many take advantage of the sometimes rich organic matter that is brought in either from underground streams or by bats, birds, or mammals often associated with caves. California cave beetles are poorly known as only a few publications have concentrated on caves or have included cave beetles as part of a larger study.

Most trogllobitic cave beetles in California only recently have been formally described. In our experience the general diversity of beetles in the western United States is higher than the eastern U.S.A., and so far western cave beetles are about as diverse as in the east. According to the latest taxonomic studies, some of which are not yet published, the diversity of California's trogllobitic beetles may eventually prove to be higher than in the east.

In California, cave Coleoptera can be divided into three groups:

**1. Accidentals or incidentals**, which contain families such as Bostrichidae, Cantharidae, Carabidae, Coccinellidae, Cerambycidae, Chrysomelidae, Dytiscidae, Elateridae (adults), Elmidae, Gyrinidae, Hydrophilidae, Lampyridae, Meloidae, Melyridae, Monotomidae, Psephenidae, Scirtidae, Scydmaenidae, Trogidae and Zopheridae. *Scaphinotus* sp., a snail-eating carabid beetle, is an example of an accidental or incidental species. One unusual discovery in this group was finding the fungus-feeding *Usechimorpha montanus*, a rare species found at much higher elevations, deep in Sutter Creek Cave, Amador County, at a much lower elevation of about 707 m.

**2. Troglloxenes**, which include the families habitually found in caves, such as Agyrtidae, some Carabidae, Cleridae, Cryptophagidae, Curculionidae, Elateridae (larvae), Dermestidae, Histeridae, Lathridiidae, Phengodidae, Ptiliidae, Scarabaeidae, Silphidae, and Staphylinidae. *Trechus* sp. (Fig. 75) is a troglloxenic or troglphilic carabid, member of the Tribe Trechini, with important cavernicoles in the eastern U.S.A. The discovery of the carabid (ground beetle), *Amblycheila schwartzi*, prompted a study of the entire ecosystem of Mitchell Caverns. Someone found a "rare large tiger beetle" in the cave (tiger beetles are now classified in the Carabidae as the Subfamily Cicindelinae). This species is neither rare nor limited to caves, and it is often encountered at night in the Mojave Desert's Providence Mountains, San Bernardino County, and other eastern California ranges, or in caves. The staphylinid subfamily Pselaphinae, the ant-like litter or mold beetles (Fig. 76), is a group with important trogllobites in Texas and the eastern U.S.A. Two species of tenebrionid (darkling) beetles in the genus *Schizillus* are found in the Providence Mountains: *S. laticeps* and *S. nunenmacheri*. The latter has more elongate appendages and reduced eyes

compared to *S. laticeps*, and it was collected only in caves whereas *S. laticeps* was collected at night outside the caves. Furthermore, *S. nunenmacheri* has perhaps one of the largest eggs of any tenebrionid in the world.

**3. Troglaphiles and troglobites** include Anobiidae (Ptininae, spider beetles), Carabidae, Leiodidae, Staphylinidae, and Tenebrionidae. Common species include the leiodid, *Ptomaphagus nevadicus* (Fig. 77) and rove beetles (Staphylinidae, Fig. 78), which are found near dung. Table 7 lists the known troglobites. From just a few concentrated cave studies in California, remarkable troglophilic and troglobitic cave beetles are already known or are in the process of being described. Notable examples include the Anobiidae (Ptininae), *Niptus arcanus*, a troglobite endemic to Mitchell Caverns, San Bernardino County, Mojave Desert (Fig. 79). Despite having connected two adjacent caves in 1969 by a tunnel to facilitate tours, this species is still restricted to only one side of Mitchell Caverns: El Pakiva. Among the Carabidae are three noteworthy species, two of which are from the Anillina subtribe. Anillines are often completely blind beetles found in deep soil deposits often associated with groundwater. The completely blind, undescribed anilline troglobite from Clay Cave, Napa County, Bay Area/Delta, is a rather large member of this group and represents a new genus and species. The completely blind undescribed anilline troglobite (Fig. 80) from the Sierra Nevada North, in Moaning Cave, Calaveras County, and Crystal Palace, Tuolumne County, also represents a new genus and species. This giant new species is the largest known species in this tribe in the world! (D. Kavanaugh, *in lit.*). A third carabid, Tribe Pterostichini, from Paul Gibson Cave (limestone), Trinity County, *Pterostichus (Leptoferonia) enyo* Will, 2007, has very small eyes, and represents an endogean (soil interstitial species) that occasionally occurs under deep rocks/logs or in caves.

Among the Tenebrionidae, the genus *Eleodes* with about 200 species ranging from the Western U.S.A. to northern Guatemala, and the subgenus *Caverneleodes* contain a number of cave endemics from Mexico to California. Many are cave-adapted with long appendages and reduced eyes. The tenebrionid species from Clay Cave represents a new tribe of Tenebrionidae, along with another found under a rock at a spring mouth in Marin County. Both species are troglobites that prefer wet soil. The California species *E. (Caverneleodes) microps* (Fig. 81), a troglobite, has the

TABLE 7. Ten troglobitic beetles of California; only four are described species

Family/ Subfamily	Species	Cave	Ecol. Class.
Anobiidae, Ptininae	<i>Niptus arcanus</i>	San Bernardino Co.: Mitchell Caverns (El Pakiva Cave)	troglobite
Carabidae, Trechinae	<i>Anillaspis explanata</i>	El Dorado Co.: Alabaster Cave	troglobite
Carabidae, Trechinae	Anillina n. gen., n. sp. 1	Tuolumne Co.: McLean's Cave, Transplant Mine	troglobite
Carabidae, Trechinae	Anillina n. gen., n. sp. 2	Tulare Co.: Lost Soldier's Cave.	troglobite
Carabidae, Trechinae	Anillina n. gen., n. sp. 3	Napa Co.: Clay Cave	troglobite
Carabidae, Trechinae	Anillina n. gen., n. sp. 4	Calaveras Co.: Moaning Cave. Tuolumne Co.: Crystal Palace	troglobite
Curculionidae, Raymondionyminae	<i>Gilbertiola</i> sp.	Tulare Co.: Clough Cave	troglobite
Leiodidae, Leiodinae	<i>Ptomaphagus inyoensis</i>	Inyo Co.: Poleta Cave	troglobite
Tenebrionidae, Lagriinae	<i>Eschatoporis</i> n. sp.	Napa Co.: Clay Cave	troglobite
Tenebrionidae, Tenebrioninae	<i>Eleodes (Caverneleodes) microps</i>	Inyo Co.: Microps Cave, Defense Cave, Poleta Cave	troglobite

most reduced eyes of any species of *Eleodes*, although it is still a dark color. Pitfall trapping has not found *E. (C.) microps* outside of Poleta Cave, Inyo County. A typical troglophile or troglaxene, *Eleodes dentipes*, is seen in Figure 84.

### Flies (Order Diptera)

Common dipterans include Heleomyzidae (sun flies, Fig. 82), Mycetophilidae (fungus gnats, Figs. 83, 86), and crane flies in the families Limoniidae (Fig. 87), Tipulidae (Fig. 88), and Trichoceridae (the smaller winter crane flies). See the Ecology section below for a discussion of Graham's studies of these groups.

### Bees and Ants (Order Hymenoptera)

No California hymenopterans are troglobites, although a few ants are likely troglophiles and others are troglaxenes; one species in Laos may be a troglobite (Pape 2016). The honey bee, *Apis mellifera*, has been recorded from the entrance area of a few caves in California. Although eight species of ant have been found in California caves, most are accidental. *Prenolepis imparis*, however, has been taken from caves in Amador, Calaveras, Mariposa, and Tuolumne counties. In some it has been present in all parts of the cave. It is considered a troglaxene.

### Moths (Order Lepidoptera)

Two moth species frequent the entrance area of caves in California. The most common is the twilight moth, *Triphosa haesitata* (Family Arctiidae, Fig. 89). This species has been found in numerous caves at varying elevations and terrains. It was the subject of careful study in Empire Cave by Graham (1962b, 1968d). It seems to be absent from most Sierra Nevada caves, but it may occur in many more caves than are listed. The second species is *Scoliopteryx libatrix* (Family Geometridae), known from three caves in the Marble Mountains, Siskiyou County, but widespread across the U.S.A. Both hibernate in caves. Undetermined specimens of the clothes moth Family Tineidae have been recorded from caves. This family is frequently found in caves and some appear to be troglophiles.

### Fleas (Order Siphonaptera)

At least sixteen species of fleas have been recorded from rodents or their nests in caves in Lava Beds National Monument, but without specific caves being recorded. These were obtained during a study of plague in rodents in the monument (Nelson and Smith 1976; Stark and Kinney 1969). Three species in the genus *Myodopsylla* were taken from bats in mines and crevices.

## Groundwater Fauna

California's known groundwater fauna comprises crustaceans, flatworms, and aquatic snails. Groundwater collects underground in soil spaces, bedrock pores and cracks, constituting another kind of subterranean habitat in which life flourishes. Groundwater habitats are similar to cave habitats in that they are totally dark and have less variation in temperature than the surface above, but groundwater habitats differ from caves because there are fewer food inputs from the surface.

There has been no organized sampling of groundwater fauna in California. Instead, groundwater fauna have been opportunistically discovered during other aquatic sampling programs, either for stream bioassessment or for cave bioinventories (see Methods).



In California, 431 aquifers (groundwater basins) have been delineated, underlying about 40 percent of the surface area of the State. Of those, 24 basins are subdivided into a total of 108 sub-basins, giving a total of 515 distinct groundwater systems (California Department of Water Resources 2003).

The top of the groundwater is called the water table or piezometric surface. Between the water table and the land surface is the unsaturated zone or vadose zone. In the unsaturated zone, moisture moves downward to the water table to recharge the groundwater. The water table can be very close to the surface (within a few meters), or very deep (up to a few hundred meters). In most California regions, the water table is 3 to 30 m below the land surface; in some Southern California desert basins it is as deep as 100 m. Overall, ground water supplies one-third of the water used in California in a typical year, in drought years as much as one-half.

Groundwater occurs everywhere in California, but it is not continuously focused along river corridors. Along fault lines and where there are abrupt changes in bedrock on steep slopes, groundwater can emerge as seeps and springs. The hyporheic zone is in sediments below surface waters in valleys. The hyporheos ("below flow") is the biological community in the hyporheic zone.

It is in California's numerous valleys and intermontane basins that groundwater exists in the greatest quantity. The basins are like large bathtubs enclosed by the rocks of surrounding mountains. Over millions of years, these "bathtubs" were filled with many hundreds of meters of sediment and debris that were carried into the basins by rivers and floods. In these so-called alluvial basins, groundwater fills small, often microscopic pores between the grains of gravel, sand, silt, and clay. Groundwater is also quite common in the hills and mountains surrounding these valleys, although in most cases not nearly as plentiful. In these rocks groundwater occupies practically every fracture and fissure below the water table. However, unless fractures are large and numerous, little water can be extracted.

We have compiled biological data on 260 groundwater sites including 142 springs (38 biological sites); 52 streams and lakes (44 biological sites); 58 other hyporheic habitats below streams (49 biological sites), and 8 wells (6 biological sites).

We have many groundwater species in our database, but we omitted many of them from our species list here (Appendix 1) and included only phreatobites, which are obligate, generally troglomorphic groundwater species. California differs from eastern states in having no obligate subterranean snails, either in groundwater or in caves. There is high endemism in aquatic snails of the families Hydrobiidae and Physidae in California springs, but none are more than stygophilic.

However, 32 phreatobites from 59 groundwater sites (Table 8) have been discovered in California. Of these, 23 species (72%) are single-site endemics. Phreatobite sites that were studied are concentrated in the Bay Area/Delta and Coast Ranges and in a few desert oases; most are not in karst.

*Stygobromus* (Fig. 90) is a genus of crangonyctid amphipod crustacean that is an important component of many subterranean habitats in North America and Eurasia, with a total of 148 described species. Twenty-five species of *Stygobromus* are known from California, seven of which are stygobites and 18 are phreatobites; six are undescribed phreatobites, most of which are single-site endemics. *Stygobromus tahoensis* and *Stygobromus lacicolus* inhabit the dark depths of Lake Tahoe, along with the eyeless Lake Tahoe flatworm, *Dendrocoelopsis hymanae* and the endemic flatworm, *Phagocata tahoena*. Lake Tahoe is 501 m deep and about 2 million years old. There are 10 other stygobitic flatworms in California caves. The collection, preservation, and identification of flatworms is difficult.

The asellid isopod *Calasellus californicus* occurs in 24 groundwater sites and Empire Cave,

Santa Cruz County. *Calasellus longus* occurs in one spring in Fresno County. *Calasellus* sp. occurs in 12 groundwater sites and Pinnacle Point Cave, Tuolumne County. *Bowmanasellus* is a genus endemic to California with its only species, *B. sequoia* known only from 8 caves and springs in Sequoia National Park.

The crustacean Order Bathynellacea (Fig. 91) live interstitially in groundwater. Bathynellaceans are minute, blind, worm-like animals with short, primitive legs, reaching a maximum length of 3.4 mm. Since 1997, a rich fauna of 10 species in two families has been discovered in the hyporheos, springs, and streams in the coastal zone of Los Angeles, San Diego, and Marin counties. None have yet been found in caves.

We examined high-biodiversity groundwater sites by tabulating the number of phreatobites per site and their single-site endemic scores (SSEs). Table 9 details 12 high-biodiversity groundwater sites, in which seven regions are compared. A site score was calculated by multiplying phreatobites by SSEs (single-site endemics). A regional score was summed from the site scores in each region. The top regional score of 24 is Sierra Nevada North because of Lake Tahoe's 4 phreatobites and 2 SSEs. The Coast Ranges ranked second with 7 sites and a regional score of 16; Bathynellaceans weighed heavily there. Bay Area/Delta ranked third with five sites and a regional score of 10 with a variety of species and sites. These scores are for general comparisons only, but it is apparent that the pattern of phreatobite biodiversity differs from that of caves in California (see below).

### Herpetofauna

California supports a diverse array of amphibians and reptiles consistent with its latitude, complex geology, and diverse climatic regimes. Our numbers are approximate because of taxonomic flux: 14 genera and 64 species of native amphibians and 42 genera and 87 species of native, non-marine reptiles recorded from the state (Stebbins and McGinnis 2012). Despite this diversity, relatively few species have been reported from caves and related habitats. Records reported herein are limited to 13 species of salamanders in 6 genera, 3 species of anurans (frogs and toads) in 3 genera, one species of turtle, 5 species of lizards in 5 genera, and 8 species of snakes in 7 genera.

All of these records likely represent individuals of the local epigeal population that become trapped in caves or use caves for behavioral thermoregulation. With the notable exception of salamanders, cave-restricted species of amphibians and reptiles are extremely rare or nonexistent globally. Reptiles in particular, are precluded from occupying most cave environments due to low temperatures, which cause torpor. This is especially true in California where the maximum cave temperature is 18°C or less, typically much less. This is at the lower limits or below the preferred active temperature requirements of California reptiles. There is use of cave entrances as hibernacula by reptiles, a phenomenon widely observed in caves in many areas. Some of the records reported herein likely represent hibernation sites. Most reptile records, however, represent transient animals near entrances or animals trapped in caves.

Amphibians often tolerate lower temperatures and, therefore, have more potential to exist in temperate cave environments. There is no evidence of troglomorphic or troglotic adaptation to a cave environment among California species. Anurans (frogs and toads), due in part to their jumping locomotion and visual prey detection, are much less able to maneuver and thrive in deep cave habitats (Graham 1962d; Lannoo 2005). The primarily herbivorous diet of anuran larvae also poses a significant obstacle to the evolution of cave-adapted anurans. Consequently anurans are, like reptiles, generally lacking in cave environments except as transient animals from epigeal populations. An exception would be populations seasonally restricted to a moist cave environment, typically near entrances, in a generally more arid surface environment, such as *Pseudacris sierra* (formerly *Hyla regilla*), the Sierran treefrog (formerly Pacific treefrog, Fig. 92). Graham (1962d, 1963a)

TABLE 8. List of 32 phreatobites from 80 groundwater sites in California. Of these, 23 species (72%) are single-site endemics.

Region	County	Species	Common Name	Sites
Bay Area/Delta	Contra Costa, Napa	<i>Stygobromus</i> sp. nr. <i>cowani</i>		2
	Marin	<i>Pacificabathynella sequoiae</i>		1
		<i>Stygobromus hyporheicus</i>	Hypoheic Amphipod	1
	Napa	<i>Stygobromus cowani</i>	Cowan's Amphipod	1
	Sonoma	<i>Stygobromus cherylae</i>	Cheryl's Amphipod	1
		<i>Stygobromus</i> n. sp. no. 1	New Species of Amphipod	1
Coast Ranges	Los Angeles	<i>Califobathynella teucherti</i>		1
		<i>Hexabathynella muliebris</i>		1
		<i>Stygobromus</i> n. sp.( <i>hubbsi</i> group)	New Species of Amphipod	1
	San Benito	<i>Stygobromus</i> n. sp. no. 2	Cave Amphipod, new species	2
	San Diego	<i>Bathynella fraterna</i>		1
		<i>Bathynella germanitas</i>		1
		<i>Califobathynella noodti</i>		1
		<i>Californibathynella californica</i>		1
		<i>Hexabathynella hessleri</i>		1
		<i>Hexabathynella otayana</i>		1
		<i>Texanobathynella sachi</i>		1
	Santa Barbara	<i>Stygobromus rudolphi</i>	Rudolph's Amphipod	1
	Santa Clara	<i>Stygobromus</i> n. sp. cf. <i>mackenziei</i>	New Species of Amphipod	3
Klamath Mountains	Siskiyou	<i>Stygobromus mysticus</i>	Secret Amphipod	1
Lava Flows North	Modoc	<i>Stygobromus</i> n. sp. aff. <i>sierrensis</i>	New Species of Amphipod	1
Northern California	Alameda, El Dorado, Lake, Marin, Mendocino, Napa, Santa Clara, Santa Cruz	<i>Calasellus californicus</i>	California Cave Isopod	24
	Madera, Napa, Tuolumne	<i>Calasellus</i> sp.	Isopod	13
San Joaquin Valley	Stanislaus	<i>Stygobromus</i> n. sp. aff. <i>mackenziei</i>	New Species of Amphipod	1
Sierra Nevada North	Butte	<i>Stygobromus gallawayae</i>	Gallaway's Amphipod	1
	Lake Tahoe: El Dorado, Placer	<i>Stygobromus tahoensis</i>	Lake Tahoe Amphipod	5
	Nevada, Sierra	<i>Stygobromus sheldoni</i>	Sheldon's Amphipod	4
	Lake Tahoe: Placer	<i>Dendrocoelopsis hymanae</i>	Lake Tahoe Flatworm	1
		<i>Stygobromus lacicolus</i>	Deep Lake Amphipod	1
		<i>Stygobromus sierrensis</i>	Sierran Amphipod	2
Sierra Nevada South	Fresno	<i>Calasellus longus</i>	Isopod	1
	Inyo	<i>Stygobromus myersae</i>	Myers' Amphipod	2



TABLE 9. Twelve high-biodiversity groundwater sites with 26 species and 21 SSEs (single-site endemics). \*The site score is the number of phreatobites X SSEs. The regional score is the sum of site scores within a region.

Region	County	Site	Type	Phreato-bites	SSEs	Site Score*	Regional Score	Reg. Sites
Bay Area/Delta	Butte	unnamed spring on Rock Creek	Spring	1	1	1		
	Marin	Cronan Creek	Stream	2	1	2		
	Marin	Redwood Creek, Muir Woods	Hyporheos	1	1	1		
	Napa	unnamed spring	Spring	2	1	2		
	Sonoma	unnamed spring, just east of Maacama Creek Bridge	Spring	2	2	4	10	5
Coast Ranges	Los Angeles	Malibu Creek	Hyporheos	2	1	2		
	San Diego	San Clemente Canyon Park, La Jolla	Hyporheos	3	3	9		
	San Diego	dry stream bed in San Clemente Park, La Jolla	Hyporheos	1	1	1		
	San Diego	Otay Reservoir	Hyporheos	1	1	1		
	San Diego	San Diego River	Hyporheos	1	1	1		
	San Diego	stream in Otay Reservoir	Hyporheos	1	1	1		
	Santa Barbara	Montgomery Spring	Spring	1	1	1	16	7
	Siskiyou	subterranean habitat at Greenview	Well	1	1	1	1	1
Lava Flows North	Modoc	unnamed spring at the Stough Reservoir Campground	Spring	1	1	1	1	1
San Joaquin Valley	Stanislaus	Tuolumne River (River Mile 31.5)	Hyporheos	1	1	1	1	1
Sierra Nevada North	Placer	Lake Tahoe, center of lake	Lake	4	2	8	24	1
Sierra Nevada South	Fresno	unnamed spring at Shaver Lake	Spring	1	1	1	1	1

studied *P. sierra* in 13 caves, and he found that the frog used the crepuscular zone of caves to escape hot, dry conditions and nearby streams that dried out seasonally, making a good case that the frog is a troglaxene. This frog vacates the caves during winter rains and returns to its streams.

Salamanders are the major amphibian group that can adapt to the cave environment. A relatively large number of American salamander species are highly specialized stygobites, as neotenic species or populations. The only terrestrial/amphibious troglobitic salamander is *Eurycea spelaea* (grotto salamander) of the Ozark Plateau in Missouri and Arkansas, where water resources are abundant.

The geologic context of caves in California is not conducive to the evolution of troglobitic vertebrates. There is a lack of large cave systems due to the very limited extent of soluble rock and lava flows. As a consequence, cave habitats are extremely fragmented in California. This situation is illustrated by the observation that approximately 50% of California subterranean obligates are single-site endemics. In addition, aquatic habitats that would allow the evolution of stygobites, are also quite limited.

Due to the transient use of caves by reptiles and anurans in California these taxa play a very minor role in cave ecosystems, and caves are of minimal importance to populations of these taxa. Most salamander species recorded from caves in California, *Ensatina eschscholtzii* (*ensatina*) and species of *Aneides*, *Batrachoseps*, and *Taricha*, presumably fill a similar role. Two genera, however, may have the potential to play a larger role in cave ecosystems. *Dicamptodon*, specifically *D. ensatus* (Pacific giant salamander, Fig. 93) from caves in the Santa Cruz Karst, is regularly recorded both as larvae and adults (Anonymous 1964). They may be important predators in these caves. This genus also has neotenic representatives, but these have not been recorded in caves to date.

The genus *Hydromantes* is represented by three species endemic to California. Two, *H. brunus* (limestone salamander) and *H. shastae* (Shasta salamander, Fig. 94), are restricted to limestone substrates including caves. Although the bulk of the populations are presumably epigean, they regularly occur in caves, especially during dry periods and are potentially an important component of cave ecosystems. *H. shastae* has been reported using caves as ovipositing sites for their terrestrial eggs (Gorman 1956). A sister genus, *Speleomantes*, occurs in Italy (including Sardinia) and France in similar habitats. These two genera are a remarkable example of disjunction within the Family Plethodontidae, a taxon that is, except for two small genera, restricted to the New World, where it is quite diverse.

One additional geographic anomaly is the occurrence of *Aneides lugubris* (arboreal salamander) on Southeast Farallon Island, including a sea cave (Lee et al. 2012). The Farallon Islands are approximately 48 km west of the mainland opposite San Francisco. The maximum water depth is approximately 60 meters, and the islands were consequently connected to the mainland during the low sea level stands in the late Pleistocene Epoch, as discussed above regarding *Farallonophilus cavernicolus* cave crickets. The Farallon population is not currently recognized as taxonomically distinct from the mainland populations, and is most closely related to populations from the adjacent mainland. The Farallon Islands were potentially colonized by *A. lugubris* when the Farallon Islands were connected to the mainland. Alternatively, *Aneides lugubris* may have rafted to the Farallons on vegetation, potentially in large logs that are frequently washed out of the large rivers of the mainland. Rafting most likely accounts for the presence of *Aneides lugubris* on Catalina Island, one of the Channel Islands off southern California. Salamanders of the genus *Batrachoseps* and several additional amphibians and reptiles are also found on several of the Channel Islands. The California Channel Islands are separated from the mainland by deep water and have not been connected to the mainland during the Pleistocene, if at all.

Despite the richness of the California cave fauna, the relative rarity and lack of cave-adapted amphibians in California is what should be anticipated given the ecological conditions that prevail.

### **Bats (Class Mammalia, Order Chiroptera)**

At least 19 of the 27 species of bats in California have inhabited California's caves, mines, and tunnels (see Table 10 and Appendix 1). Early observations often were of collected bats from scientific surveys, while many later records tended to be sightings in which the species or even the genus and family could not be reliably identified. Reliable identifications and counts of bats are few, but are becoming more common as bats decline and conservation-based studies are supported. Since the 1980s mist net and harp trap surveys at some cave entrances have identified and released several species of bats. Some workers have used night vision scopes or infrared cameras.

TABLE 10. Bats known from California’s caves, mines, and tunnels.

Family	Species	Common Name
Molossidae	<i>Eumops perotis</i>	Western Mastiff Bat
Molossidae	<i>Tadarida brasiliensis</i>	Mexican Free-tailed Bat
Phyllostomidae	<i>Macrotus californicus</i>	California Leaf-nosed Bat
Vespertilionidae	<i>Antrozous pallidus</i>	Pallid Bat
Vespertilionidae	<i>Corynorhinus townsendii</i>	Townsend's Big-eared bat
Vespertilionidae	<i>Eptesicus fuscus</i>	Big Brown Bat
Vespertilionidae	<i>Euderma maculatum</i>	Spotted Bat
Vespertilionidae	<i>Lasionycteris noctivagans</i>	Silver-haired Bat
Vespertilionidae	<i>Myotis californicus</i>	California Myotis
Vespertilionidae	<i>Myotis ciliolabrum</i>	Western Small-footed Myotis
Vespertilionidae	<i>Myotis evotis</i>	Long-eared Myotis Myotis
Vespertilionidae	<i>Myotis lucifugus</i>	Little Brown Myotis
Vespertilionidae	<i>Myotis melanorhinus</i>	Dark-nosed Small-footed Myotis
Vespertilionidae	<i>Myotis occultus</i>	Arizona Myotis
Vespertilionidae	<i>Myotis thysanodes</i>	Fringed Myotis
Vespertilionidae	<i>Myotis velifer</i>	Cave Myotis
Vespertilionidae	<i>Myotis volans</i>	Long-legged Myotis
Vespertilionidae	<i>Myotis yumanensis</i>	Yuma Myotis
Vespertilionidae	<i>Parastrellus hesperus</i>	Western Pipistrelle, Canyon Bat

**Family Molossidae, Free-tailed bats**

**Free-tailed bats** are represented in California caves and mines by two species: *Eumops perotis*, Western Mastiff Bat, with six cave and crevice records from San Diego to Calaveras County in the Sierra Nevada North, and *Tadarida brasiliensis mexicana*, Mexican free-tailed bat. Although the latter is the most common cave bat in the southwestern United States, west coast populations inhabit caves infrequently (Barbour and Davis, 1969) and are thought to be nonmigratory (Cockrum 1969). The literature and cavers reported Mexican free-tailed bats in four mines and 11 caves from San Diego to Colusa County in the North Coast Range. An uncounted cluster was observed in Painted Rock Cave, San Luis Obispo County in 1911 (Grinnell 1918). An emergence flight of about 95,000 was observed at Bat Cave No. 1, LABE, Siskiyou County, in 2003 (U.S. Geological Survey 2016b), probably the largest bat colony in the state.

**Family Phyllostomidae, Leaf-nosed bats**

The California leaf-nosed bat, *Macrotus californicus*, was reported in 11 mines in the Mojave Desert and several caves in southern California. The largest colonies were 500 in a mine in Imperial County in 1924 (U.S. Geological Survey 2016b), 300 in caves in Coachella Valley, Riverside County, Mojave Desert, in 1908 (Grinnell 1918); 150 in an unnamed mine, and 30 in an unnamed cave, both in Imperial County in 1918 (Howel 1920). The most recent report was 200 seen in a mine in San Bernardino County in 1983. This is the only leaf-nosed bat in the U.S. with large ears. They forage by gleaning larger insects off the ground and other surfaces. They are susceptible to



human disturbance, which can be especially detrimental to the species during summer months, when these bats are rearing young. Human disturbance of caves in which they roost is a major threat. Because they often roost in abandoned mines, reclamation and re-working of old mines can severely impact populations. Because California leaf-nosed bats do not hibernate or migrate, the relatively warm mine shafts are critical for its survival in the northern portions of its range (Wikipedia 2016a).

### Family Vespertilionidae, Evening bats

*Antrozous pallidus*, Pallid Bat, was formerly thought to be common in caves of central and southern California, but few recent records are available. A colony on the order of 100 was seen in Painted Rock Cave, San Luis Obispo County, in 1911 (Grinnell 1918). It is known from three abandoned mines in Inyo County (Ellison et al. 20003; U.S. Geological Survey 2016b). Perhaps 50 were seen in Swordfish Cave on Santa Cruz Island, Santa Barbara County, in 1997–99, the only bats reliably reported from a California sea cave. Pallid Bat has been found in seven mines, two crevices, and 15 caves across the state. This species probably is a permanent resident in most of its range (Barbour and Davis 1969). Pallid Bat roosts in small colonies in rock crevices and buildings, and occasionally caves, mines, and tree cavities. (See, for example, a photo of a colony of roosting Pallid Bats (*Antrozous pallidus*) at Madera Canyon, Santa Rita Mountains, southeastern Arizona. (Photo by Geoff Gallice — <<http://www.flickr.com/photos/dejeuxx/4844640621/>>, CC BY 2.0, <<https://commons.wikimedia.org/w/index.php?curid=12165921>>).

*Corynorhinus townsendii*, Townsend's big-eared bat (Fig. 83), has several subspecies with two in California: *C. t. townsendii*, western big-eared bat or Pacific Townsend's big-eared bat, and *C. t. pallescens*, pale Townsend's big-eared bat. The subspecies *C. t. intermedius* was synonymized with *C. t. pallescens*.

Townsend's big-eared bat is by far the most commonly reported bat in California's caves and mines. Few of the recorded field identifications noted the subspecies, which are difficult to distinguish, so our species list lumps the two subspecies. Generally *C. t. townsendii* occurs in most of northern California on the west side of the Sierra Nevada, and *C. t. pallescens* in the deserts. Our species list has 308 localities, including 123 mines and 185 caves from 31 counties in most regions of the state, from Klamath and Marble Mountains to Mojave Desert, Coast Ranges to Sierra Nevada.

*Corynorhinus t. townsendii* has been a Species of Concern in California since 2013, and it was considered for listing by the state because of a significant loss of population size, maternity colonies, and hibernation colonies throughout the state. Few sites were protected, but colonies that have come under protection at Lava Beds National Monument, Pinnacles National Park, and Sequoia National Park have increased again. California denied a petition to list the subspecies as threatened or endangered (California Department of Fish and Wildlife 2016; Pierson and Fellers 1998).

Large colonies of *C. t. townsendii* used to exist. A colony of 1,000 was seen on July 1, 1935 in Alice Mine, Riverside County, Mojave Desert, the largest count of this species yet reported in a California mine or cave. The second largest colony was 425 on June 1, 2002 in Bear Gulch Cave, Pinnacles National Park, San Benito County, Coast Ranges (Pierson and Fellers 1998). Two colonies of 210 and 230 were observed in Inyo County mines in 1992–1993 (U.S. Geological Survey 2016b).

Graham (1966) reported that disturbance by humans had caused the abandonment of several nursery (maternity) colonies in limestone caves. He thought that *C. townsendii* did not roost in many California limestone caves, especially for hibernation, because most of the caves are at lower

elevations and thus are relatively warm. Pierson and Rainey (1994) and Pierson and Fellers (1998) reported a significant decline in big-eared bats in California caves, mines, and buildings; there has been a 52% decline in the number of known maternity colonies. The species is sometimes frightened out of caves by humans, but it may re-establish later, especially bachelor colonies. There are few sites that have had regular, long-term bat counts. Parrish Cave, a lava tube in Shasta County, had winter bat counts in 1948–1951, 1955, 1957, 1960, 1966, 1987, 1988, 1991, and 2015. The largest count was 201 in 1948, the smallest was 11 in 1988 and 1991. A graph of the counts, grouped by decades, could be interpreted as a long-term decline except that there were two data gaps of 21 and 24 years, then the colony peaked again at 177 in 1987. The cave is heavily visited by tourists.

Although *C. t. townsendii* was being considered for listing, it is still listed as Least Concern by IUCN because of its wide distribution, presumed large population, occurrence in a number of protected areas, and because it is unlikely to be declining at the rate for listing in a threatened category. There are two subpopulations/subspecies that are listed as endangered by the U.S. Fish and Wildlife Service (*ingens* and *virginianus*) (International Union for the Conservation of Nature 2016). A series of further, regular hibernation and maternity colony counts at a few sites would help in monitoring the status of this species, but they must be done carefully by professionals to limit disturbance.

*Eptesicus fuscus*, Big Brown Bat, is common across North America, and it has been reported from five caves, one crevice, three mines, and two tunnels across California. Suggett (1982) reported the subspecies *E. f. bernardinus* Rhoads in Upstairs-Downstairs Cave, Siskiyou County. Most summer roosts are attics, barns, bridges or other man-made structures; they move into caves, mines and crevices to hibernate only during the coldest weather conditions, and they usually vacate within weeks.

*Euderma maculatum*, Spotted Bat, was reported from a spring cave, San Bernardino County, in 1948 by Parker (1952) and V. Johnson (1990). It is otherwise known from southern California from a few buildings and a cliff face, and in one instance from a garage in Shasta County.

*Lasionycteris noctivagans*, Silver-haired Bat, is widespread in North America but has only been found in a mine in Inyo County (V. Johnson 1990; Szewczak et al. 1998). The bat is solitary, dark-colored, and difficult to identify on cave or mine walls.

*Myotis californicus*, California Myotis (Fig. 95 and front cover), is known in small numbers in eight caves and five mines from the Mojave Desert to northern California. The species also roosts in rock crevices, tree cavities and loose bark, and buildings.

*Myotis ciliolabrum*, Western Small-footed Myotis, seeks cover in crevices, caves, mines and buildings. Besides five mines in the Mojave Desert, it is known from two lava caves in Siskiyou County, where five to 12 bats were caught with harp traps in 1990 and 1999. One was a lactating female in Heppe Ice Cave. These records hint that many cave bat colonies are still unidentified in California.

*Myotis evotis*, Long-eared Myotis, has daytime roosts in buildings, tree cavities, caves, mines, and rock crevices. The species has been found in one tunnel, one mine, and ten caves.

*Myotis lucifugus*, Little Brown Myotis, is widespread in the U.S. and Canada, although it has declined greatly in the east because of White Nose Syndrome, and it is being considered for listing as endangered. The disease was found in this species in March 2016 in King County, Washington (U.S. Geological Survey 2016a). In summer *M. lucifugus* inhabits attics or other shelters near water, and it hibernates in caves and mines, formerly in large numbers in the eastern U.S.A. In California it has been found in small numbers in six caves and one mine, from the Mojave Desert to Lava Flows North.

*Myotis melanorhinus*, Dark-nosed Small-footed Myotis, roosts in rock-face crevices and riverbanks, and may use talus, tree bark or buildings; hibernation sites include mines and caves. The species has been seen in two mines in far southern California.

*Myotis occultus*, Arizona Myotis, another obscure vespertilionid, it has only been seen in an abandoned copper mine in the Riverside Mountains, Mojave Desert.

*Myotis thysanodes*, Fringed Myotis, known only in small numbers from seven mines from San Diego to Lake County. Danehy (1952) noted that this bat occurs in caves in central and southern California; roosts in caves, mines, and buildings.

*Myotis velifer*, Cave Myotis, is common across the southwestern U.S. to Central America. Danehy (1952) reported that this bat is common in the summer in sandstone and conglomerate caves near the Colorado River (Imperial, Riverside, San Bernardino counties). The subspecies *M. v. brevis* barely ranges into southeastern California. In summer, it congregates in caves and mines, and less often, buildings; winter roosts are primarily caves. California populations may be migratory, however we only have scant records from four mines in Riverside County.

*Myotis volans*, Long-legged Myotis. Danehy (1952) reported that this was an uncommon bat in central and southern California caves, but is sometimes found with *M. thysanodes*. Barbour and Davis (1969) claim that this bat uses caves as night roosts only. Primarily inhabits forested mountain regions, where it roosts in trees, rock crevices, stream banks, and buildings; hibernation sites are primarily caves and mines. Records consist of three caves and three mines from southern to northern California.

*Myotis yumanensis*, Yuma Myotis. Danehy (1952) notes only that this species is sometimes found with *M. velifer* in caves. Maternity colonies utilize buildings, caves, mines, or bridges. In 1918 600 were observed in Old Senator Mine, Imperial County (U.S. Geological Survey 2016b). Fifty Yuma bats were counted in a Dam Canyon cave, San Diego County, in 2003. Our records include six mines, two tunnels, and five caves from southern to northern California.

*Parastrellus hesperus*, Western Pipistrelle or Canyon Bat. Danehy (1952) reports that this bat is found in cracks in caves, but uncommonly. Primarily a desert species, it inhabits a variety of habitats from rocky canyons, cliffs, and outcroppings, to creosote bush flats; day roosts usually in rock crevices, mines, or buildings; hibernates in mines, caves, and rock crevices. Records include small numbers from nine caves and seven mines from southern to northern California.





FIGURE 12 (top left). California sea lions huddle on a ledge in Painted Cave, a sea cave on Santa Cruz Island. DB.

FIGURE 13 (top right). Sea cave life on Anacapa Island, Ventura Co.; white anemones and sponges have lost their mutualistic algae in the cave's darkness. Image 25–30 cm wide. DB.

FIGURE 14 (center left). *Brackenridgia heroldi*, 6 mm, Trichoniscidae, trogliphile, Clough Cave. JK.

FIGURE 15 (center right). *Urotonites sequoia*, 4 cm, Vaejovidae, trogliphilic scorpion, Clough Cave, Tulare Co., Sequoia National Park. JK.

FIGURE 16 (bottom left). *Uroctonus mordax* scorpion, 5 cm, troglaxene, Clough Cave. JK.

FIGURE 17 (bottom right). *Hubbardia pentapeltis*, about 5 mm, a male schizomid or short-tailed whipscorpion from southern California, similar to *Hubbardia shoshonensis* from Shoshone Cave. The male's flagellum (tail) is sculpted, the female's is simple. MH.

Photographers: Dave Bunnell, Marshal Hedin, Jean Krejca.





FIGURE 18 (top left). Rhagidiid mite, 0.5–1.0 mm, a predator of springtails, Lava Beds National Monument, Siskiyou Co. JK and ST.

FIGURE 19 (top right). *Leiobunum exilipes*, 10 mm, Sclerosomatidae, cluster of “Daddy longlegs” harvestmen, Stearns Cave, Santa Cruz Co. JML.

FIGURE 20 (center left). *Taracus audisioae*, about 12 mm including chelicerae, Taracidae, a troglomorphic harvestman with huge chelicerae, Forsythe Cave, Tulare Co. JK.

FIGURE 21 (center right). *Banksula melones*, 2 mm, Phalangodidae, a harvestman transplanted from McLean’s Cave to the Transplant Mine, Tuolumne Co. WRE.

FIGURE 22 (bottom left). Troglomorphic *Banksula grahami*, 1.5 mm, Phalangodidae, Pinnacle Point Cave, Tuolumne Co. The one on the right is catatonic. WRE.

FIGURE 23 (bottom right). *Calicina cloughensis*, 1 mm, Phalangodidae, troglotic harvestman, Hidden Cave, Tulare Co., Sequoia National Park. JK.

Photographers: William R. Elliott, Jean Krejca, Joel M. Ledford, Steve Taylor.



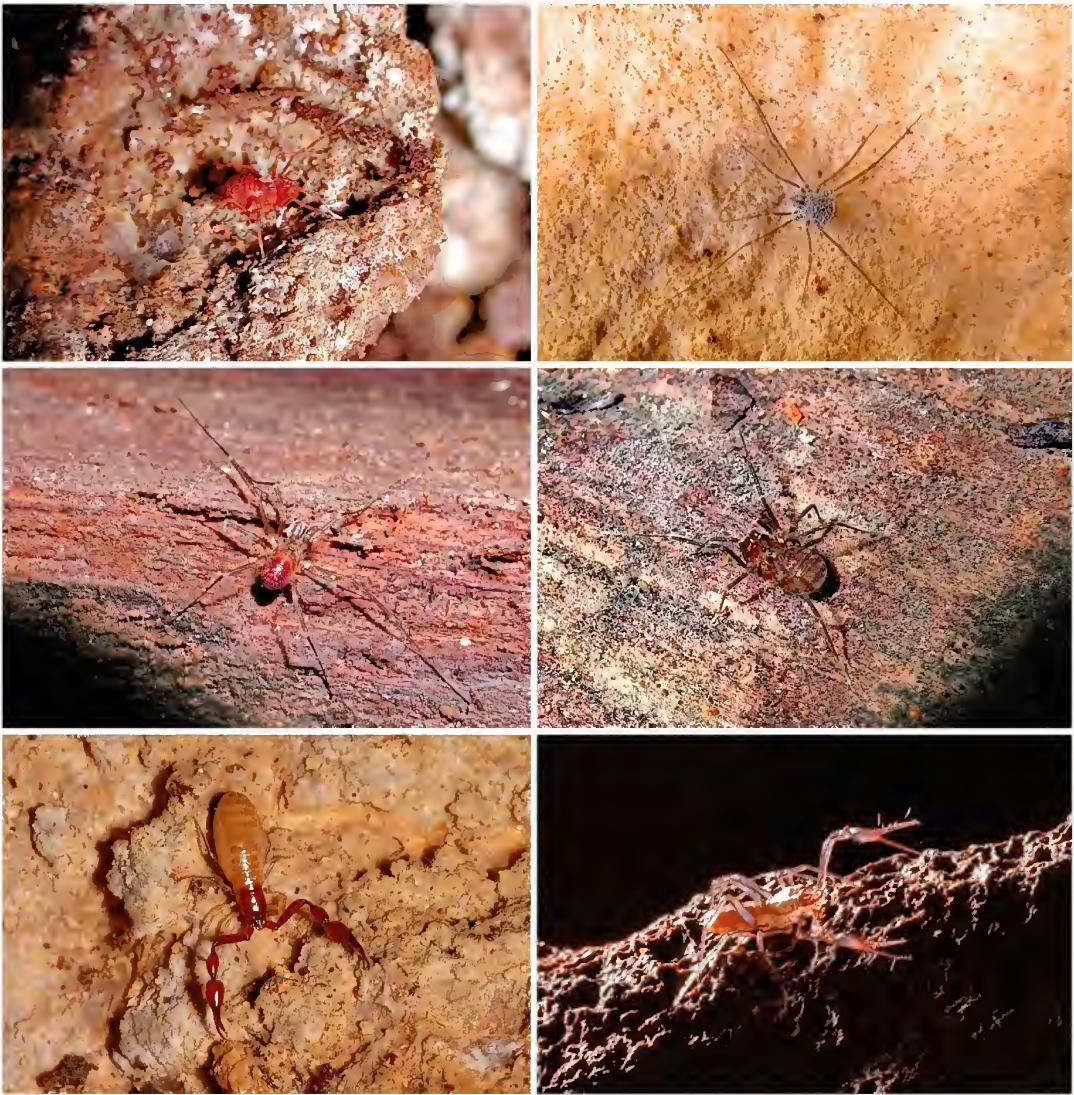


FIGURE 24 (top left). *Sitalcina californica*, 1.7 mm, Phalangodidae, troglophilic harvestman, Stearns Cave, Santa Cruz Co. JML.

FIGURE 25 (top right). *Ortholasma colossus*, 4 mm, Nemastomatidae, troglophilic harvestman, Bear Den Cave, Tulare Co. JK.

FIGURE 26 (center left). *Sabacon briggsi*, Sabaconidae, 3 mm, troglaxene?, Empire Cave, Santa Cruz Co. JML.

FIGURE 27 (center right). *Zuma acuta*, 1.5 mm, Sclerobunidae, troglophilic harvestman, Empire Cave, Santa Cruz Co. JML.

FIGURE 28 (bottom left). Chernetid pseudoscorpion, 3 mm, Walk Softly Cave, Tulare Co. JK.

FIGURE 29 (bottom right). Undetermined troglotic pseudoscorpion, 2mm, Lyon's Road Cave, Siskiyou Co. JK, ST. Photographers: Jean Krejca, Joel M. Ledford, Steve Taylor.





FIGURE 30 (top left). Undetermined species, Chthoniidae, 2 mm, a new species of troglobitic pseudoscorpion, Kaweah Cave, Tulare Co., Sequoia National Park. JK.

FIGURE 31 (top right). *Neochthonius imperialis*, 1.4 mm, Chthoniidae, troglobitic pseudoscorpion, Chthoniidae. Empire Cave, Santa Cruz Co. JML.

FIGURE 32 (center left). *Australinocreagris grahami*, 4 mm, Neobisiidae, troglobite, McLean's Cave, Tuolumne Co., Sierra Nevada North. WRE.

FIGURE 33 (center right). *Fissilicreagris imperialis*, 3 mm, Neobisiidae, troglobite, Empire Cave, Santa Cruz Co. JML.

FIGURE 34 (bottom left). *Parobisium yosemite*, 3 mm, Neobisiidae, troglobite, Indian Cave, Tulare Co., Sequoia National Park. JK.

FIGURE 35 (bottom right). *Pseudogarypus pseudoscorpions*, 3 mm, Pseudogarypidae, troglomenes, Indian Rock Shelter, Mariposa Co., Yosemite National Park. JK.

Photographers: William R. Elliott, Jean Krejca, Joel M. Ledford.



FIGURE 36 (top left). *Usofila* sp., 1.7 mm, Telemididae, trogllobitic spider, adult female of an undescribed species suspended from a silken line in Clough Cave, Tulare Co. JD.

FIGURE 37 (top right). *Usofila* sp., 1.5 mm, Lyons Road Cave, Siskiyou Co. JK and ST.

FIGURE 38 (center left). *Oaphantes* n. sp. 1, 3 mm, Linyphiidae, female of a blind trogllobitic species from Paradise Cave, Tulare Co. JK and ST.

FIGURE 39 (center right). *Oaphantes* n. sp. 2, 2.5 mm, female of an eyed troglphilic species from Bear Den Cave, Tulare Co. JK.

FIGURE 40 (bottom left). *Nesticus silvestrii*, 3.5 mm, Nesticidae, male suspended from web in Indian Cave, Yosemite National Park. JK.

FIGURE 41 (bottom right). *Nesticus silvestrii*, 3.5mm, male, Overhang Cave, Tulare Co. JK.

Photographers: Joel Despain, Jean Krejca, Steve Taylor.





FIGURE 42 (top left). *Pimoida hespera* sub-adult male, 7 mm, Pimoidae, Beulah Cave, Tulare Co. JK.

FIGURE 43 (top right). *Meta dolloff* female, 15 mm, Tetragnathidae, Dolloff Cave, Santa Cruz Co. This troglomorphic species is not modified for cave life, but has not been collected outside of caves. JML.

FIGURE 44 (center left). *Meta dolloff* male, 11 mm, Empire Cave, Santa Cruz Co. JML.

FIGURE 45 (center right). *Cybaeus* sp., 8 mm, Cybaeidae, female spider preying on a two-pronged bristletail (Japygidae), Clough Cave, Tulare Co., Sequoia National Park. JK.

FIGURE 46 (bottom left). *Blabomma* n. sp. no. 2, 3 mm, Dictynidae, juvenile of the troglomorphic species from Windeler Cave, Tuolumne Co. WRE.

FIGURE 47 (bottom right). *Yorima* n. sp., 5 mm, Dictynidae, female of a troglomite from Clough Cave, Tulare Co. JK.

Photographers: William R. Elliott, Jean Krejca, Joel M. Ledford.





FIGURE 48 (top left). *Calymmaria* sp., 8 mm, Hahniidae, Stearns Cave, Santa Cruz Co. JML

FIGURE 49 (top right). *Titiotus gertschi*, 15 mm, Zoropsidae, troglophile, McLean's Cave, Tuolumne Co. WRE.

FIGURE 50 (center left). *Calisoga* sp., 2 cm, Nemesiidae, a false tarantula, Overhang Cave, Tulare Co. JK.

FIGURE 51 (center right). *Hypochilus petrunkevitchi*, 8 mm, Hypochilidae, in typical flattened resting posture, juvenile, Beulah Cave, Tulare Co. JK.

FIGURE 52 (bottom left). *Trogloneta paradoxa*, 1mm, Mysmenidae, female in the hub of her 3-D orb web, Lava Beds National Monument, Siskiyou Co. JK and ST.

FIGURE 53 (bottom right). *Physocyclus* sp., 6 mm including palpi, Pholcidae, troglophile, male with well-developed pedipalps, Kaweah Cave, Tulare Co. JK.

Photographers: William R. Elliott, Jean Krejca, Joel M. Ledford, Steve Taylor.



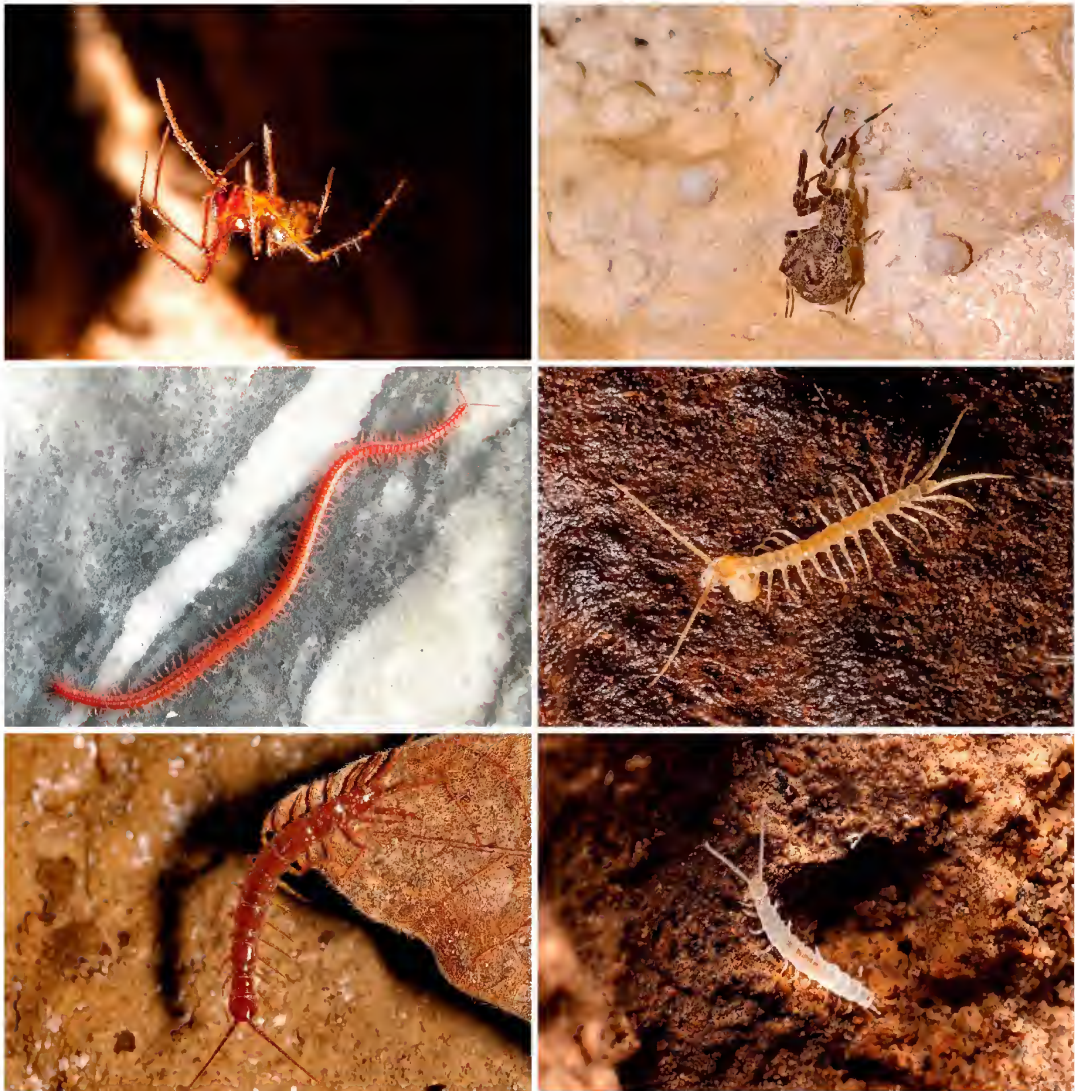


FIGURE 54 (top left). *Thymoites* sp., 1.7 mm, Theridiidae, Lava Beds, Siskiyou Co. JK and ST.

FIGURE 55 (top right). *Uloborus diversus*, 4 mm, Uloboridae, a cribellate orb weaver in standard posture, a female from Windy Pit, Tulare Co. JK.

FIGURE 56 (center left). *Strigamia* sp., Linotaeciidae, 6 cm, geophilomorph centipede on a marble wall, Kaweah Cave, Tulare Co., Sequoia National Park. JK.

FIGURE 57 (center right). Lithobiomorph centipede, 3.5 cm, preying on a young millipede, Big Painted Cave, Lava Beds National Monument. JK and ST.

FIGURE 58 (bottom left). Lithobiomorph centipede, 4 cm, troglophile, in Lange Cave, Tulare Co. JK.

FIGURE 59 (bottom right). A symphylan (*Symphyla*), 3 mm, from Hidden Cave, Tulare Co. JK.

Photographers: Jean Krejca, Steve Taylor.





FIGURE 60 (top left). *Paeromopus cavicolens*, 10–15 cm long, Paeromopodidae, a julid millipede common in the Stanislaus River caves. WRE.

FIGURE 61 (top right). *Taiyutyla loftinae*, 9 mm, troglophile, Chordeumatida, Conotylidae, Indian Cave, Yosemite National Park. JK.

FIGURE 62 (center left). *Plumatyla humerosa*, 9 mm, troglobitic conotylid millipedes mating in Fossil Cave, Siskiyou Co. JK and ST.

FIGURE 63 (center right). Chordeumatida, Striariidae, probably *Amplaria muiri*, 15 mm, troglophile, Lange Cave, Tulare Co. JK.

FIGURE 64 (bottom left). *Pratherodesmus despaini*, 9 mm, Polydesmida, Macrostermodesmidae, troglobite, known only from Kaweah Cave, Tulare Co., Sequoia National Park. JK.

FIGURE 65 (bottom right). *Sequoiadesmus krejcae*, 6 mm, troglobitic macrostermodesmid millipede, Clough Cave, Tulare Co., Sequoia National Park. JK.

Photographers: William R. Elliott, Jean Krejca, Steve Taylor.





FIGURE 66 (top left). Cambalid millipede, Spirostreptida, Cambalidae, Kaweah Cave Tulare Co., Sequoia National Park. JK.

FIGURE 67 (top right). *Sinella* sp., 2 mm, Entomobryomorpha, an entomobryid springtail, Hidden Cave, Tulare Co., Sequoia National Park. JK.

FIGURE 68 (center left). *Tomocerus* springtails (collembolans), 3 mm, Tomoceridae, are typically grayish and relatively large, Hidden Cave. JK.

FIGURE 69 (center right). Poduromorph collembolan, 2 mm, Kaweah Cave. JK.

FIGURE 70 (bottom left). *Haplocampa* sp., Campodeidae, a new species of two-pronged bristletail, probably troglomorphic, Nirvana Cave, Lava Beds National Monument, Siskiyou Co. JK and ST.

FIGURE 71 (bottom right). Two-pronged bristletail (Japygidae), about 5 mm long, McLean's Cave, Tuolumne Co. WRE.

Photographers: William R. Elliott, Jean Krejca, Steve Taylor.





FIGURE 72 (top left). *Ceuthophilus* sp, Rhaphidophoridae, about 20 mm, cave cricket, troglone, Lava Beds National Monument. JK and ST.

FIGURE 73 (top right). *Tropidischia xanthostoma*, about 30 mm, troglone, raphidophorid cricket, Crystal Sequoia Cave, Tulare Co., Sequoia National Park. JK.

FIGURE 74 (center left). *Grylloblatta* n. sp. 3, 12–20 mm, Notoptera, is known only from Lilburn Cave and Mays Cave, Tulare Co., the farthest south of any icecrawler. JK.

FIGURE 75 (center right). *Trechus* sp., 4 mm, Carabidae, Trechinae, Trechini, troglophile or troglone beetle, Empire Cave, Santa Cruz Co. JML.

FIGURE 76 (bottom left). Ant-like litter beetle or mold beetle, 5–6 mm, Staphylinidae, Pselaphinae, Yosemite National Park. JK.

FIGURE 77 (bottom right). *Ptomaphagus nevadicus*, 6–7 mm, a round fungus beetle, Leiodidae, McLean's Cave, Tuolumne Co. WRE.

Photographers: William R. Elliott, Jean Krejca, Joel M. Ledford, Steve Taylor.





FIGURE 78 (top left). Unidentified rove beetle, 7–10 mm, Staphylinidae, Lava Beds National Monument. JK and ST.

FIGURE 79 (top right). *Niptus arcanus*, 3 mm, a troglobitic spider beetle (Anobiidae, Ptininae) known only from the El Pakiva section of Mitchell Caverns, San Bernardino Co. RA.

FIGURE 80 (center left). A new species of blind carabid beetle, 8 mm, Subfamily Trechinae, Tribe Bembidiini, Subtribe Anillina, in a pitfall trap, Crystal Palace, Tuolumne Co. RA.

FIGURE 81 (center right). *Eleodes* (*Caverneleodes*) *microps*, 16 mm, Tenebrionidae, blind darkling beetle, Microps Cave, Inyo Co. RA.

FIGURE 82 (bottom left). Sun flies (Heleomyzidae) mating, 4 mm, Crystal Sequoia Cave, Tulare Co. JK.

FIGURE 83 (bottom right). A fungus gnat larva makes a web (Mycetophilidae), 15 mm, Lost Soldier's Cave, Tulare Co. JK.

Photographers: Rolf Aalbu, William R. Elliott, Jean Krejca, Steve Taylor.





FIGURE 84 (left). *Eleodes dentipes*, trogloxenic or troglophilic tenebrionid beetle, about 25 mm long, Crystal Palace, Tuolumne Co. Photographer: William R. Elliott.

FIGURE 85 (right). *Corynorhinus townsendii townsendii*, Western big-eared bat, about 10 cm long, Coral Reef Cave, Lava Beds National Monument. The torpid bat's right ear is rolled up to conserve body heat. Photographers: Jean Krejca and Steve Taylor.



FIGURE 86 (top left). A mycetophilid fungus gnat adult, 6 mm, Empire Cave. JML

FIGURE 87 (top right). *Limonia nubeculosa*, a limoniid crane fly, 10 mm, Empire Cave. JML.

FIGURE 88 (center left). A large crane fly, Tipulidae, about 50 mm wingspan, Windy Pit, Tulare Co. JK.

FIGURE 89 (center right). *Triphosa haesitata*, 16 mm, Geometridae, twilight moth, Stump Cave, Santa Cruz Co. JML.

FIGURE 90 (bottom left). *Stygobromus* sp., 4–8 mm, Amphipoda, Crangonyctidae, a widespread amphipod genus with many phreatobites and stygobites. JK.

FIGURE 91 (bottom right). A bathynellacean, <1 to 3 mm, phreatobitic (groundwater inhabiting) crustacean. KA.

Photographers: Kym Abrams, Jean Krejca, Joel M. Ledford, Steve Taylor.





FIGURE 92 (top left). *Pseudacris sierra*, 19–50 mm, Hylidae, the Sierran chorus frog or tree frog. JK.

FIGURE 93 (top right). *Dicamptodon ensatus*, 30 cm total length, Dicamptodontidae, the Pacific giant salamander, IXL Cave, Santa Cruz Co. JML.

FIGURE 94 (center left). *Hydromantes shastae*, 7.5–11 cm total length, Plethodontidae, salamander from the Shasta Karst. GN.

FIGURE 95 (center right). *Myotis californicus*, 7–9 cm body length, Vespertilionidae, California bat. SC.

FIGURE 96 (bottom left). Trichoniscid isopod, 5 mm, Trichoniscidae, *Ligidium* or *Brackenridgia* sp., in Maze Cave, Lava Beds National Monument. JK and ST.

FIGURE 97 (bottom right). Roots in Clough Cave support planthoppers (center) and other fauna. JD.

Photographers: Stan Cunningham, Joel Despain, Jean Krejca, Joel M. Ledford, Gary Nafis, Steve Taylor.





FIGURE 98 (top left). Planthopper nymph on roots, about 5 mm, Achilidae, Windeler Cave, Tuolumne Co. WRE.

FIGURE 99 (top right). Planthopper adult, 5–10 mm, McLean's Cave, Tuolumne Co. WRE.

FIGURE 100 (center left). Roots with a planthopper and spider in Overhang Cave, Tulare Co. JK.

FIGURE 101 (center right). Roots with a *Tomocerus* collembolan in Crystal Sequoia Cave, Tulare Co. JD.

FIGURE 102 (bottom left). Horsehair worm, 5–10 cm long, Nematomorpha, a parasite that probably erupted from a cave cricket in Lilburn Cave, Tulare Co. JK.

FIGURE 103 (bottom right). Submerged roots in Big Spring, the lower part of Lilburn Cave, Tulare Co. JK.

Photographers: Joel Despain, William R. Elliott, Jean Krejca.





FIGURE 104 (top left). *Bowmanasellus sequoia*, about 5 mm, Asellidae, the Big Spring Isopod, on a submerged root, Tulare Co., Sequoia National Park. JK.

FIGURE 105 (top right). *Bowmanasellus sequoia* isopods, Big Spring, Tulare Co. JK.

FIGURE 106 (center left). Stringy fungus on mammal scat, Tulare Co. JK.

FIGURE 107 (center right). A fungus in a lava tube, Lava Beds National Monument. JK and ST.

FIGURE 108 (bottom left). Fungus in a nutshell with collembolans, harvestman nymph, and a large mite. JK.

FIGURE 109 (bottom right). Mayfly naiad (immature) in stream, Waterfall Cave, Tuolumne Co., Yosemite National Park. JK.

Photographers: Jean Krejca, Steve Taylor.

## BIOGEOGRAPHY AND BIODIVERSITY

Here we summarize the geographic patterns of cave biodiversity in California and recognize the top caves for biodiversity. As mentioned above, we have compiled biological data on 1,301 sites, including many carbonate caves, lava tubes, sea caves, groundwater sites, and mines. At least 1,366 taxa are recorded, including 102 terrestrial troglobites (terrestrial cave obligates), 12 stygobites (aquatic cave obligates), and 32 phreatobites (troglomorphic groundwater forms), a total of 146 obligate subterranean species, detailed in Table 11. Of those 146 taxa, 11 are still undetermined beyond the level of Order or Family, and represent an uncertain number of true species, although some are likely new species. Half (74) of the obligates are undescribed species, comprised of 63 troglobites, 3 stygobites, and 8 phreatobites (Table 12). Our species list includes 111 undescribed species of all types.

The high number (72) of single-site endemic species is indicative of the insular distribution of karst, large differences in elevation, and the many river systems cutting across the Sierra Nevada. Sierra Nevada North has 18 single-site endemics, Sierra Nevada South has 16, and Klamath and Marble Mountains have 11. In contrast, Lava Flows North has but 5 single-site endemics. The lava flow conotylid millipede *Plumatyla humerosa* has the largest range of any troglobite in California (194 km).

Table 13 provides statewide counts of sites with subterranean species; these counts are not exclusive, but are the numbers of sites with each ecological class (the same site may be counted again for another class). The distinction between phreatobite and stygobite is sometimes blurred: three caves contain phreatobites that normally occur in groundwater sites, while 11 groundwater sites contain stygobites that typically occur in caves.

Table 14 shows the ranked regional counts of obligate subterranean species. Sierra Nevada North (SNN) has the highest number of obligate subterranean species at 41, Sierra Nevada South (SNS) has 32, Klamath Mountains (KM) has 18, Bay Area/Delta (BD) has 13, Coast Ranges 13, Lava Flows North (LFN) 11, and Mojave Desert (MD) 6. Some undescribed species seem to range across several regions, indicated in the table as California, Northern California, and Sierra Nevada, but that is not likely, and those species probably will turn out to be multiple species with further taxonomic study. These current rankings may partially reflect the amount of study that has gone into each region. However, the pattern of biodiversity in individual caves is somewhat different, discussed below.

Table 15 also shows obligates, but with regional and county counts. The table shows the number of obligates within each county (the same species may be counted again in other counties). These counts convey an impression of how the areas rank in subterranean species richness. Leading counties are Calaveras in SNN (31 species); Tulare (27) in SNS; Tuolumne in SNN (23); Shasta in two northern regions (21, with 14 karst and 7 lava); Siskiyou in two northern regions (19, with 12 karst and 7 lava); Santa Cruz in BD (6); SNN counties Amador (9) and El Dorado (7); SNS county Mariposa (5); SNN's Placer (5); Coastal Ranges' San Diego (7); and Napa (9) in Bay Area/Delta.

Table 16 focuses on caves, stygobites, and troglobites, providing a regional view of the numbers of sampled caves and the occupancy rate of stygobites and troglobites in the sampled caves. The BD region (especially Santa Cruz Karst and Napa County) has the highest occupancy (cave obligates/cave) at 0.88. The ranking is the natural occupancy by cave forms combined with the amount of field work that has been done in each region. Only two sea caves out of 800 have a troglobite, for example, and probably very few of the other sea caves have been searched for small terrestrial invertebrates.



Overall, 105 cave obligates occupy 291 caves (36% of sampled caves). Occupancy provides some measure of the success in finding obligate species in each region, and the potential for productive future work. Occupancy is high in the Sierra Nevada South (SNS) (0.64) and moderate in the Sierra Nevada North (SNN) (0.41). This also reflects the high endemism and biodiversity within SNS caves, discussed below.

TABLE 11. List of 146 obligate subterranean species in California. TB is troglobite, SB is stygobite, and PB is phreatobite. Twelve species are designated TB?, indicating that the status as a troglobite is not yet certain.

Species	Adaptation	Class	Order	Family	Total Sites
<i>Amplaria shastae</i>	TB	Diplopoda	Chordeumatida	Striariidae	2
<i>Anillaspis explanata</i>	TB	Insecta	Coleoptera	Carabidae	1
Anillina n. gen., n. sp. no. 1	TB	Insecta	Coleoptera	Carabidae	2
Anillina n. gen., n. sp. no. 2	TB	Insecta	Coleoptera	Carabidae	1
Anillina n. gen., n. sp. no. 3	TB	Insecta	Coleoptera	Carabidae	1
Anillina n. gen., n. sp. no. 4	TB	Insecta	Coleoptera	Carabidae	2
<i>Aphrastochthonius grubbsi</i>	TB	Arachnida	Pseudoscorpiones	Chthoniidae	1
<i>Aphrastochthonius similis</i>	TB	Arachnida	Pseudoscorpiones	Chthoniidae	1
<i>Apochthonius grubbsi</i>	TB	Arachnida	Pseudoscorpiones	Chthoniidae	4
<i>Australinocreagris grahami</i>	TB	Arachnida	Pseudoscorpiones	Neobisiidae	15
<i>Australinocreagris</i> sp.	TB	Arachnida	Pseudoscorpiones	Neobisiidae	4
<i>Banksula californica</i>	TB	Arachnida	Opiliones	Phalangodidae	1
<i>Banksula galilei</i>	TB	Arachnida	Opiliones	Phalangodidae	1
<i>Banksula grahami</i>	TB	Arachnida	Opiliones	Phalangodidae	18
<i>Banksula grubbsi</i>	TB	Arachnida	Opiliones	Phalangodidae	1
<i>Banksula martinorum</i>	TB	Arachnida	Opiliones	Phalangodidae	1
<i>Banksula rudolphi</i>	TB	Arachnida	Opiliones	Phalangodidae	1
<i>Banksula tuolumne</i>	TB	Arachnida	Opiliones	Phalangodidae	1
<i>Banksula tutankhamen</i>	TB	Arachnida	Opiliones	Phalangodidae	1
<i>Bathynella fraterna</i>	PB	Malacostraca	Bathynellacea	Bathynellidae	1
<i>Bathynella germanitas</i>	PB	Malacostraca	Bathynellacea	Bathynellidae	1
<i>Bidentogon</i> n. sp.	TB	Diplopoda	Polydesmida	Polydesmidae	5
<i>Blabomma</i> n. sp.	TB	Arachnida	Araneae	Dictynidae	1
<i>Blabomma</i> n. sp. no. 1	TB	Arachnida	Araneae	Dictynidae	4
<i>Blabomma</i> n. sp. no. 2	TB	Arachnida	Araneae	Dictynidae	6
<i>Blabomma</i> n. sp. no. 3	TB	Arachnida	Araneae	Dictynidae	1
<i>Blabomma</i> n. sp. no. 4	TB	Arachnida	Araneae	Dictynidae	1
<i>Blabomma</i> sp.	TB	Arachnida	Araneae	Dictynidae	3
<i>Bowmanasellus sequoiae</i>	SB	Malacostraca	Isopoda	Asellidae	9
<i>Caecidotea</i> n. sp.	SB	Malacostraca	Isopoda	Asellidae	1
<i>Calasellus californicus</i>	PB	Malacostraca	Isopoda	Asellidae	24
<i>Calasellus longus</i>	PB	Malacostraca	Isopoda	Asellidae	1
<i>Calasellus</i> sp.	PB	Malacostraca	Isopoda	Asellidae	13
<i>Calicina cloughensis</i>	TB	Arachnida	Opiliones	Phalangodidae	4
<i>Califobathynella noodti</i>	PB	Malacostraca	Bathynellacea	Parabathynellidae	1

TABLE 11 (continued). List of 146 obligate subterranean species in California. TB is troglobite, SB is stygobite, and PB is phreatobite. Twelve species are designated TB?, indicating that the status as a troglobite is not yet certain.

Species	Adaptation	Class	Order	Family	Total Sites
<i>Califobathynella teucherti</i>	PB	Malacostraca	Bathynellacea	Parabathynellidae	1
<i>Californibathynella californica</i>	PB	Malacostraca	Bathynellacea	Parabathynellidae	1
<i>Calileptoneta briggsi</i>	TB	Arachnida	Araneae	Leptonetidae	2
<i>Calileptoneta</i> n. sp. 1	TB	Arachnida	Araneae	Leptonetidae	1
<i>Calileptoneta</i> n. sp. 2	TB	Arachnida	Araneae	Leptonetidae	4
<i>Cybaeozyga</i> n. sp. 1	TB	Arachnida	Araneae	Cybaeidae	2
<i>Cybaeozyga</i> n. sp. 2	TB	Arachnida	Araneae	Cybaeidae	1
<i>Cybaeus</i> n. sp.	TB	Arachnida	Araneae	Cybaeidae	1
<i>Dendrocoelopsis hymanae</i>	PB	Turbellaria	Tricladida	Dendrocoelidae	1
<i>Eleodes (Caverneleodes) microps</i>	TB	Insecta	Coleoptera	Tenebrionidae	3
<i>Erigoninae</i>	TB	Arachnida	Araneae	Linyphiidae	4
<i>Eschatoporis</i> n. sp.	TB	Insecta	Coleoptera	Tenebrionidae	1
<i>Fissilicreagris imperialis</i>	TB	Arachnida	Pseudoscorpiones	Neobisiidae	4
<i>Fissilicreagris</i> n. sp. 1	TB	Arachnida	Pseudoscorpiones	Neobisiidae	1
<i>Fissilicreagris</i> n. sp. 2	TB	Arachnida	Pseudoscorpiones	Neobisiidae	1
<i>Fissilicreagris</i> n. sp. 3	TB	Arachnida	Pseudoscorpiones	Neobisiidae	1
<i>Fissilicreagris</i> sp.	TB	Arachnida	Pseudoscorpiones	Neobisiidae	2
<i>Foveacheles (Usitorhagidia) titanica</i>	TB	Arachnida	Acari	Rhagidiidae	3
<i>Gilbertiola</i> sp.	TB	Insecta	Coleoptera	Curculionidae	1
<i>Haplocampa</i> "Helfer's Cave Dipluran"	TB?	Diplura	Rhabdura	Campodeidae	4
<i>Haplocampa</i> "Roth's Cave Dipluran"	TB?	Diplura	Rhabdura	Campodeidae	1
<i>Haplocampa</i> n. sp. no. 1	TB?	Diplura	Rhabdura	Campodeidae	1
<i>Haplocampa</i> n. sp. no. 2	TB?	Diplura	Rhabdura	Campodeidae	2
<i>Haplocampa</i> n. sp. no. 3	TB?	Diplura	Rhabdura	Campodeidae	3
<i>Haplocampa</i> sp.	TB?	Diplura	Rhabdura	Campodeidae	15
<i>Haplocampa</i> n. sp. "Lava Beds N.M"	TB?	Diplura	Rhabdura	Campodeidae	26
<i>Hexabathynella hessleri</i>	PB	Malacostraca	Bathynellacea	Parabathynellidae	1
<i>Hexabathynella muliebris</i>	PB	Malacostraca	Bathynellacea	Parabathynellidae	1
<i>Hexabathynella otayana</i>	PB	Malacostraca	Bathynellacea	Parabathynellidae	1
<i>Hubbardia shoshonensis</i>	TB	Arachnida	Schizomida	Hubbardiidae	2
<i>Larca laceyi</i>	TB	Arachnida	Pseudoscorpiones	Garypidae	3
<i>Ligidium kofoidi</i>	TB	Malacostraca	Isopoda	Ligiidae	14
Linyphiinae n. gen., n. sp.	TB	Arachnida	Araneae	Linyphiidae	1
<i>Lophomus</i> sp. or new genus	TB	Diplopoda	Chordeumatida	Conotylidae	2
" <i>Microcreagris</i> " n. sp.	TB	Arachnida	Pseudoscorpiones	Neobisiidae	1
" <i>Microcreagris</i> " spp.	TB	Arachnida	Pseudoscorpiones	Neobisiidae	15
<i>Neochthonius imperialis</i>	TB	Arachnida	Pseudoscorpiones	Chthoniidae	1



TABLE 11 (continued). List of 146 obligate subterranean species in California. TB is troglobite, SB is stygobite, and PB is phreatobite. Twelve species are designated TB?, indicating that the status as a troglobite is not yet certain.

Species	Adaptation	Class	Order	Family	Total Sites
<i>Neochthonius</i> n. sp.	TB	Arachnida	Pseudoscorpiones	Chthoniidae	3
<i>Neochthonius</i> sp.	TB	Arachnida	Pseudoscorpiones	Chthoniidae	4
<i>Neochthonius troglodytes</i>	TB	Arachnida	Pseudoscorpiones	Chthoniidae	10
<i>Nesticus potterius</i>	TB	Arachnida	Araneae	Nesticidae	4
<i>Nevadesmus</i> n. sp. 1	TB	Diplopoda	Polydesmida	Macrosternodesmidae	1
<i>Nevadesmus</i> n. sp. 2	TB	Diplopoda	Polydesmida	Macrosternodesmidae	1
<i>Niptus arcanus</i>	TB	Insecta	Coleoptera	Anobiidae	1
<i>Oaphantes</i> n. sp. 1	TB	Arachnida	Araneae	Linyphiidae	1
<i>Occasjapyx kofoidi</i>	TB	Diplura	Dicellurata	Japygidae	2
<i>Opiona graeningi</i>	TB	Diplopoda	Chordeumatida	Caseyidae	11
<i>Opiona</i> n. sp. no. 2	TB	Diplopoda	Chordeumatida	Caseyidae	1
<i>Pacificabathynella sequoiae</i>	PB	Malacostraca	Bathynellacea	Bathynellidae	1
<i>Parobisium yosemite</i>	TB	Arachnida	Pseudoscorpiones	Neobisiidae	2
<i>Plumatyla humerosa</i>	TB	Diplopoda	Chordeumatida	Conotylidae	43
<i>Plumatyla</i> sp.	TB	Diplopoda	Chordeumatida	Conotylidae	2
<i>Polycelis</i> sp.	SB?	Turbellaria	Tricladida	Planariidae	6
<i>Pratherodesmus despaini</i>	TB	Diplopoda	Polydesmida	Macrosternodesmidae	1
<i>Pratherodesmus</i> n. sp.	TB	Diplopoda	Polydesmida	Macrosternodesmidae	1
<i>Prokoenenia</i> sp.	TB	Arachnida	Palpigradi	Prokoeneniidae	2
<i>Pseudogarypus orpheus</i>	TB	Arachnida	Pseudoscorpiones	Pseudogarypidae	2
<i>Pseudogarypus spelaeus</i>	TB	Arachnida	Pseudoscorpiones	Pseudogarypidae	1
<i>Ptomaphagus (Adelops) inyoensis</i>	TB	Insecta	Coleoptera	Leiodidae	1
<i>Sequoiadesmus krejcae</i>	TB?	Diplopoda	Polydesmida	Macrosternodesmidae	3
<i>Sinella tecta</i>	TB	Collembola	Collembola	Entomobryidae	5
<i>Speleonecta</i> n. sp. no. 1	TB	Insecta	Zygentoma	Nicoletiidae	1
<i>Speleonecta</i> n. sp. no. 2	TB	Insecta	Zygentoma	Nicoletiidae	4
<i>Speoseya grahami</i>	TB	Diplopoda	Chordeumatida	Caseyidae	3
<i>Sphalloplana (Sphalloplana) californica</i>	SB	Turbellaria	Tricladida	Kenkiidae	1
<i>Spirembolus</i> sp.	TB	Arachnida	Araneae	Linyphiidae	2
<i>Stenophilus californicus</i>	TB?	Chilopoda	Geophilomorpha	Himantariidae	2
<i>Stygobromus cherylae</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus cowani</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus gallawayae</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus gradyi</i>	SB	Malacostraca	Amphipoda	Crangonyctidae	5
<i>Stygobromus grahami</i>	SB	Malacostraca	Amphipoda	Crangonyctidae	8
<i>Stygobromus harai</i>	SB	Malacostraca	Amphipoda	Crangonyctidae	4
<i>Stygobromus hyporheicus</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1

TABLE 11 (continued). List of 146 obligate subterranean species in California. TB is troglobite, SB is stygobite, and PB is phreatobite. Twelve species are designated TB?, indicating that the status as a troglobite is not yet certain.

Species	Adaptation	Class	Order	Family	Total Sites
<i>Stygobromus imperialis</i>	SB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus lacicolus</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus mackenziei</i>	SB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus myersae</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	2
<i>Stygobromus mysticus</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus</i> n. sp. ( <i>hubbsi</i> group)	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus</i> n. sp. aff. <i>mackenziei</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus</i> n. sp. aff. <i>sierrensis</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus</i> n. sp. cf. <i>mackenziei</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	3
<i>Stygobromus</i> n. sp. no. 1	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus</i> n. sp. no. 2	PB	Malacostraca	Amphipoda	Crangonyctidae	2
<i>Stygobromus rudolphi</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus sheldoni</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	4
<i>Stygobromus sierrensis</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	2
<i>Stygobromus</i> sp. nr. <i>cowani</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	2
<i>Stygobromus tahoensis</i>	PB	Malacostraca	Amphipoda	Crangonyctidae	5
<i>Stygobromus trinus</i>	SB	Malacostraca	Amphipoda	Crangonyctidae	1
<i>Stygobromus wengerorum</i>	SB	Malacostraca	Amphipoda	Crangonyctidae	2
<i>Taracus fluvipileus</i>	TB	Arachnida	Opiliones	Taracidae	9
<i>Texanobathynella sachi</i>	PB	Malacostraca	Bathynellacea	Parabathynellidae	1
<i>Texella</i> n. sp.	TB?	Arachnida	Opiliones	Phalangodidae	1
<i>Tuberochernes aalhui</i>	TB	Arachnida	Pseudoscorpiones	Chernetidae	1
<i>Tuberochernes</i> n. sp.	TB	Arachnida	Pseudoscorpiones	Chernetidae	1
Undetermined Acari	TB	Arachnida	Acari	Undetermined	2
Undetermined Chordeumatida	TB	Diplopoda	Chordeumatida	Undetermined	4
Undetermined Collembola	TB	Collembola	Collembola	Undetermined	3
Undetermined Diplopoda	TB	Diplopoda	Undetermined	Undetermined	27
Undetermined Lithobiomorpha	TB	Chilopoda	Lithobiomorpha	Undetermined	1
Undetermined Oniscidea	TB	Malacostraca	Isopoda	Undetermined	7
Undetermined Onychiuridae	TB?	Collembola	Poduromorpha	Onychiuridae	4
Undetermined Polydesmida sp. no. 1	TB	Diplopoda	Polydesmida	Undetermined	1
Undetermined Polydesmida sp. no. 2	TB	Diplopoda	Polydesmida	Undetermined	1
Undetermined Pseudoscorpiones	TB	Arachnida	Pseudoscorpiones	Undetermined	1
Undetermined Tricladida	SB	Turbellaria	Tricladida	Undetermined	3
<i>Uroctonus grahami</i>	TB	Arachnida	Scorpiones	Vaejovidae	1
<i>Usofila</i> n. spp.	TB	Arachnida	Araneae	Telemidae	16
<i>Yorima</i> n. sp.	TB	Arachnida	Araneae	Dictynidae	9



TABLE 12. Numbers of subterranean species and their ecological classification in California. Half (74) of the obligates are undescribed species.

Ecological classification	Species
Phreatobite	32
Stygobite	12
Troglobite	102
<b>Obligates Subtotal</b>	<b>146</b>
Troglophile	192
Trogloxene	86
Stygophile	8
Accidental	56
Other terrestrial	362
Other groundwater	22
Unclassified	494
<b>Total</b>	<b>1,366</b>

TABLE 13. Sites with obligate subterranean species. At least 275 caves of all types (28% of sampled caves) contain obligates. Three caves contain phreatobites that normally occur in groundwater sites, while 11 groundwater sites contain stygobites that typically occur in caves.

Location Type	Phreatobite Sites	Stygobite Sites	Troglobite Sites	Totals
Caves	3	23	142	<b>168</b>
Groundwater	56	11		<b>67</b>
Lava Tubes			112	<b>112</b>
Mines		1	6	<b>7</b>
Sea Caves			2	<b>2</b>
<b>Totals</b>	<b>59</b>	<b>35</b>	<b>262</b>	<b>356</b>

Table 14. Ranked regional numbers of obligate subterranean species.

Region	Phreatobites	Stygobites	Troglobites	Totals
Sierra Nevada North	6	3	32	<b>41</b>
Sierra Nevada South	2	4	25	<b>31</b>
Klamath Mountains	1	1	16	<b>18</b>
Bay Area/Delta	6	3	4	<b>13</b>
Coast Ranges	13			<b>13</b>
Lava Flows North	2		9	<b>11</b>
California		1	5	<b>6</b>
Mojave Desert			5	<b>5</b>
Northern California			5	<b>5</b>
Sierra Nevada	1		1	<b>2</b>
San Joaquin Valley	1			<b>1</b>
<b>Totals</b>	<b>32</b>	<b>12</b>	<b>102</b>	<b>146</b>

TABLE 15. Records of obligate subterranean species per region and county.

Region	County	Total Obligates	Phreatobites	Stygobites	Troglobites
Bay Area/Delta	Alameda	1	1		
	Contra Costa	2	1		1
	Marin	3	3		
	Napa	9	4		5
	Santa Clara	2	2		
	Santa Cruz	7	1	3	2
	Sonoma	2	2		
BD Subtotal		25	14	3	8
Coast Ranges	Lake	1	1		
	Los Angeles	3	3		
	Mendocino	1	1		
	San Benito	1	1		
	San Diego	7	7		
	Santa Barbara	1	1		
CR Subtotal		14	14	0	0
Klamath Mountains	Shasta	14			14
	Siskiyou	7	1	1	5
	Trinity	4		1	3
KM Subtotal		25	1	2	22
Lava Flows North	Lassen	2			2
	Modoc	3	1		2
	Plumas	2			2
	Shasta	7			7
	Siskiyou	12			12
	Tehama	1			1
LFN Subtotal		27	1	0	26
Mojave Desert	Inyo	6	1		5
	San Bernardino	3			3
MD Subtotal		9	1	0	8
San Joaquin Valley subtotal	Stanislaus	1	1	0	0
Sea Caves subtotal	San Francisco	1	0	0	1
Sierra Nevada North	Amador	9		2	7
	Butte	1	1		
	Calaveras	31		1	30
	El Dorado	7	2	1	4
	Nevada	2	1	1	
	Placer	5	3	1	1
	Plumas	1			1
	Sierra	2	2		
	Tuolumne	23	1	2	20
SNN Subtotal		83	11	8	64
Sierra Nevada South	Fresno	2	1		1
	Inyo	4	1		3
	Madera	1	1		
	Mariposa	5		2	3
	Tulare	27		3	24
SNS Subtotal		39	3	5	31
Total Records		224	46	18	160



TABLE 16. Ranked regional view of 291 caves with stygobites and troglobites. Occupancy (cave obligates/ caves) is highest in the Bay Area/Delta (Santa Cruz Karst and Napa caves).

Region	Stygobite Sites	Troglobite Sites	Cave Obligates	Caves	Occupancy
Bay Area/Delta	1	7	7	8	0.88
Mojave Desert		9	6	9	0.67
Klamath Mountains	2	26	18	28	0.64
Sierra Nevada South	15	32	30	47	0.64
Sea Caves		2	1	2	0.5
Sierra Nevada North	17	69	35	86	0.41
Lava Flows North		112	9	112	0.08
Coast Ranges					0
Totals	35	257	105	291	0.36

TABLE 17. High biodiversity caves as measured with B<sub>1</sub> (Elliott’s biodiversity value, 2007) and B<sub>2</sub> (based on single-site endemics). B<sub>1</sub> = SR•T•SE, B<sub>2</sub> = SR•T•SST. Caves are ranked on B<sub>1</sub>. Abbreviations: KM, Klamath Mountains; LFN, Lava Flows North; SNN, Sierra Nevada North; SNS, Sierra Nevada South; BD, Bay Area/Delta; CR, Coast Ranges; SC, Sea Caves; MD, Mojave Desert ; CD, Colorado Desert.

Rank	Cave	Region	County	Type	SR	T	SE	B <sub>1</sub>	SST	B <sub>2</sub>
1	Clough Cave	SNS	Tulare	Cave	58	11	5.04	3216	3	1914
2	Samwel Cave	KM	Shasta	Cave	44	11	5.92	2865	4	1936
3	Empire Cave	BD	Santa Cruz	Cave	76	6	4.29	1956	4	1824
4	Clay Cave	BD	Napa	Ash Cave	68	5	3.08	1047	2	680
5	Lilburn Cave	SNS	Tulare	Cave	71	5	2.14	760	1	355
6	Transplant Mine	SNN	Tuolumne	Mine	53	7	1.35	501	0	0
7	Hurricane Crawl Cave	SNS	Tulare	Cave	51	5	1.76	449	1	255
8	Music Hall Cave	SNN	Calaveras	Cave	32	6	2.21	424	1	192
9	Lost Soldier's Cave	SNS	Tulare	Cave	81	2	2.00	324	2	324
10	McLean's Cave	SNN	Tuolumne	Cave	98	4	0.72	282	0	0
11	Hidden Cave	SNS	Tulare	Cave	52	3	1.58	246	1	156
12	Bower Cave	SNS	Mariposa	Cave	76	2	1.5	228	1	152
13	Carlow's Cave	SNN	Calaveras	Cave	26	5	1.57	204	1	130
14	Kaweah Cave	SNS	Tulare	Cave	45	2	2.00	180	2	180
15	Lost Piton Cave	SNN	Calaveras	Pit	37	3	1.27	141	1	111
16	O’Neil’s Cave	SNN	Calaveras	Cave	20	3	2.14	128	2	120
17	Walk Softly Cave	SNS	Tulare	Cave	43	2	1.25	108	1	86
18	Subway Cave	LFN	Shasta	Lava Tube	30	3	1.09	98	1	90
19	Shasta Caverns	KM	Shasta	Cave	17	3	1.75	89	1	51
20	Poleta Cave	SNS	Inyo	Cave	12	3	2.33	84	2	72

$B_1$  (see Methods) was used to rank 38 top caves in descending order for a final list of 20 caves (Table 17). Only the top 20 are given in Table 17 because of our concerns over low sampling in the others.  $B_2$ , a similar measure of biodiversity, is calculated as  $SR \times T \times SST$  ( $SST$  is the number of single-site troglomorphic species in the cave). Out of the top 20 caves thus ranked, only 2 fell below 20<sup>th</sup> in position by using  $B_2$  instead of  $B_1$ . Therefore,  $B_2$  and single-site endemics are highly predictive of overall biodiversity. Caves with high  $SR$  tend to also have more obligate cave species and  $SSTs$ , but not always. For example, McLean's Cave, Tuolumne County, had 98 species, but only 4 troglobites and no endemics, but it ranks 10<sup>th</sup> with  $B_1$  and 37<sup>th</sup> with  $B_2$ .

With either  $B_1$  or  $B_2$  the top 20 caves are concentrated in SNS, BD, SNN, and KM (see Table 17 for regional abbreviations). Although SNN has more troglomorphic species, SNS has higher biodiversity and endemism in individual caves. The top five caves are Clough Cave (SNS), Samwel Cave (KM), Empire Cave (BD), Clay Cave (BD), and Lilburn Cave (SNS). Complete species lists for these top five caves are given in Tables 18–22, and they are discussed in Ecology below.

The rankings of the top 20 caves may have been influenced by sampling intensity and moisture conditions at the time of sampling. Cave faunas are like soil faunas, and apparent abundances of cave creatures change with moisture conditions. Many of the small arthropods retreat into cracks during dry conditions. Most of California has an annual dry/wet cycle (Mediterranean climate) and is prone to severe droughts. The first intensive cave biology studies in the Stanislaus River basin in 1977 were during a drought, and it was not until studies during wetter conditions in 1978–1979 that many *Banksula* populations and other fauna were discovered in some of the caves (McEachern and Grady 1978; Elliott 1978; Rudolph 1979).

In California caves we find species with boreal and tropical origins, sometimes in the same vicinity. Boreal forms include some rhagidiid mites, which may be relicts related to species much farther north, even subpolar areas (Zacharda and Elliott 1982, 1985), although some species are found in Mexico (Elliott and Strandtmann 1971; Zacharda 1980). Grylloblattids, boreal forms, reach their most southern localities in May's Cave and Lilburn Cave, Tulare Co. Upper Shoshone Cave is the site of the second-most northern schizomid record in North America; schizomids are a basically tropical arachnid Order. The Arizona and California species are more closely related to Asian schizomids than to those elsewhere in the New World. These occurrences reflect past isolations of ancestors in caves and crevices caused by glaciation, warm periods, and droughts.

To summarize, high biodiversity caves are found in many regions of California, and tend to be those caves with many species found during multiple trips by cave biologists, but a few caves also have up to 11 troglomorphic species and up to 4 single-site endemics. We examined the possible relationship between biodiversity and elevation of caves, but found no significant linear regression.

The 9 SNS Region caves in the top 20 caves (Table 17) are at higher elevations than other regions, but they may have also have good depth and moisture. They are near the edges of former alpine glaciers.

Figure 113 (graph; see p. 77) is a scatterplot and linear regression of  $SR$  (species richness) for 221 caves vs. vertical cave depth. Although the slope of the regression is low, the positive regression is statistically significant (two-tailed test,  $p = 0.008$ ). However, the true ecological relationship may be between  $SR$  (species richness) and moisture and humidity rather than cave depth. Shallow caves may tend to be warmer and drier. A linear regression analysis of  $T$  (troglobites) vs. cave depth in 104 caves was not significant, but most caves had few troglobites, so this analysis begs for a larger dataset.

The only ash and lava caves in the top 20 are Clay Cave, BD region, and Subway Cave, LFN region. Tulare County (SNS) has 7 caves in the top 20 at higher elevations of 500–1600 m, but the



number of troglobites per cave varies between 2 and 11 within that range. Calaveras (SNN) has 4 caves in the top 20, Shasta (KM) 3, Tuolumne (SNN) 2, and the following with 1 each: Inyo (SNS), Mariposa (SNS), Napa (BD), Santa Cruz (BD). Looking at new species of obligates, SNN has 9 while SNS has 18. The Sierra Nevada has 15 caves in the top 20, with 6 in SNN and 9 in SNS.

### ECOLOGY

This section focuses on ecological studies, especially of cave communities. Some ecological topics were covered in previous sections. Figures 96–113 and previously mentioned figures illustrate cave community ecology over several regions.

Richard E. Graham published many small studies of California cave ecology, generally on troglloxenes, trogllophiles, and the twilight zone. He provided some of the earliest published data on temperature, humidity, zonation, and communities in California caves, as well as biogeography. As mentioned in Literature Review and History, he discovered seven new cave species, including the trogllobitic scorpion, *Uroctonus grahami*. Most of his work was published in *Caves and Karst* (formerly *Cave Notes*) by Cave Research Associates, a journal that is now extinct, but digital copies can be downloaded from the Karst Information Portal at <http://www.karstportal.org/>.

As mentioned in Herpetofauna, Graham (1962d, 1963a) established that *Pseudacris sierra* (formerly *Hyla regilla*), the Sierran treefrog (Fig. 92), is a troglloxene that dwells in cave entrance areas during hot, dry weather, and returns to nearby streams during the winter rainy season. This behavior differs from the pickerel frog, *Rana palustris*, in the Ozarks region, which overwinters in caves and takes temporary refuge in wet caves from hot and cold weather (Elliott 2003). These strategies are adaptive with respect to the climates of these two very different regions.

Graham studied the use of caves by the twilight moth, *Triphosa haesitata* (Fig. 89), a troglloxene also known from caves in Nevada. The species occupies entrances to deep caves in a varied geographic area from nearly sea level to 3,000 m elevation, in deserts and humid forests, and in all seasons, but it seems to be absent from most Sierra Nevada caves so far (Graham 1962b). Two other *Triphosa* species are known to inhabit caves in Great Britain, Europe, southwest Asia, and Japan (Graham 1968b). Suggett (1982) observed a woodrat preying on this moth in one Marble Mountains cave and reported different roosting behavior as compared to that reported by Graham for the low elevation Santa Cruz caves.

Graham studied the fauna of Subway Cave, a lava tube in the Hat Creek Lava Flow of Shasta County. Despite the cave being less than 2,000 years old, it has an extensive fauna list, including at least two trogllobites, a host of trogllophiles, and two species of bats. Graham reports, “Since cooling, it has developed many cracks and fissures, and the ceiling has collapsed in two places. At present, tree roots, wood rat nests, and bat guano provide food for an arthropod fauna which fluctuates according to the cyclic availability of moisture. Most of the species of Subway Cave are normally found in other northern California caves. . . the millipede [*Plumatyla humerosa*] and the isopod *Ligidium [kofoidi]* (Fig. 96) are restricted to damp, dark places and are two species which have dispersed into the Hat Creek flow since it cooled. . . .” Subway Cave runs close to the surface, has a wide temperature range, and contains a variety of habitats (Graham 1962d).

Graham (1963b) studied rove beetles, Staphylinidae (Fig. 79), and their burrowing and feeding habits in caves related to wood rat nests, including Subway Cave. He thought that many staphylinids are trogllophiles, such as *Lobrathium subseriatum* and *Quedius (Microsaurus) spelaeus*. According to his studies these two species are the only ones whose larvae are found in all cave zones. *Q. spelaeus* may feed on small arthropods associated with feces, nesting materials, or other organic matter. Most other rove beetles are in the deep entrance zone or just within the dark zone.

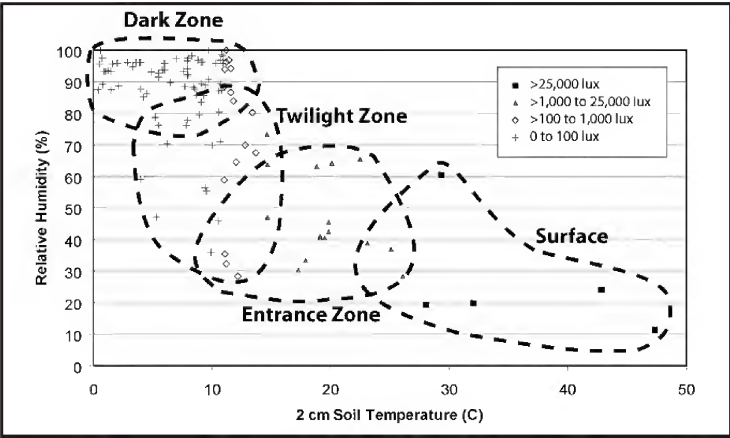


FIGURE 110. Relationship between soil temperature and relative humidity (2 cm below surface), and light, and approximate cave zones delineated on these metrics. Data obtained during 2 June – 4 August 2005 sampling period at lava tube caves in Lava Beds National Monument, California. (From Taylor and Krejca, 2006, Figure 8b.)

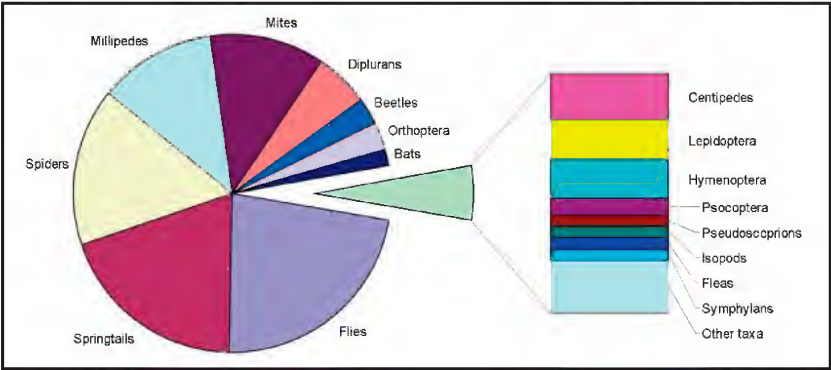


FIGURE 111. General taxonomic frequency of animals recorded from 29 caves at Lava Beds National Monument, California, based on fieldwork conducted between 2 June and 4 August, 2005. (From Taylor and Krejca, 2006, Figure 21.)

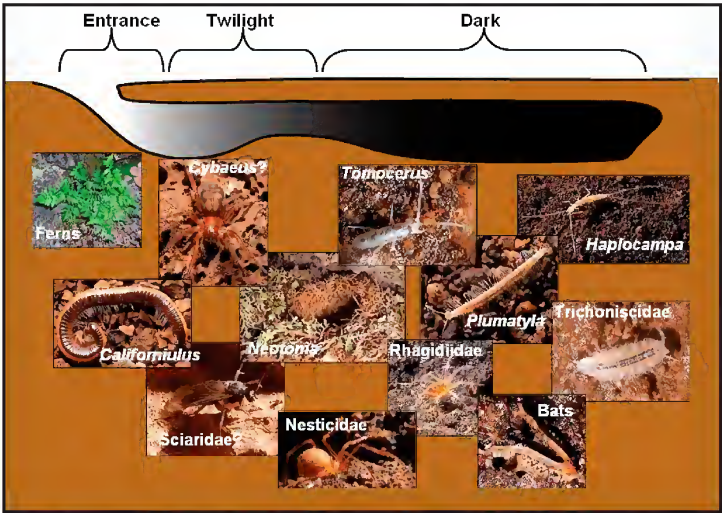


FIGURE 112. A diagrammatic representation of cave zones commonly found at Lava Beds National Monument, and some of the organisms which can be found in these areas. (From Taylor and Krejca, 2006, Figure 77.)

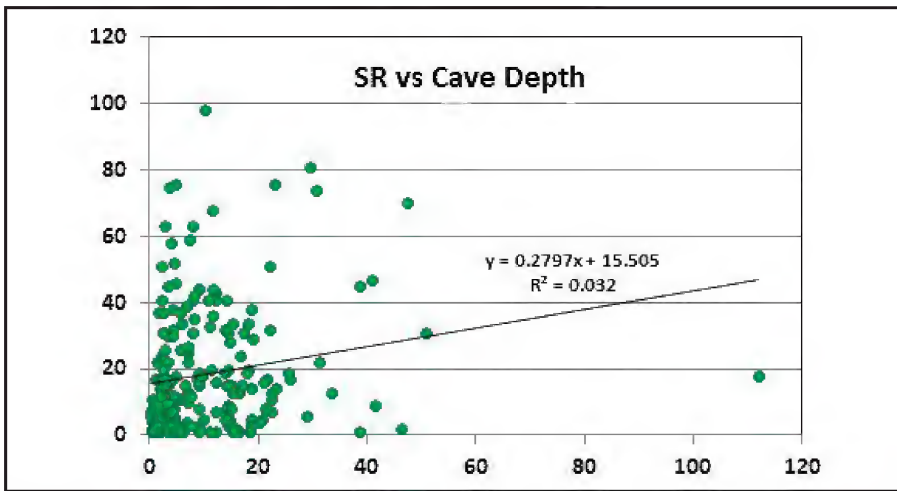


FIGURE 113. Scatterplot and linear regression of SR (species richness) for 221 caves vs. their vertical cave depth. Although the correlation is low, the positive regression is statistically significant (two-tailed test,  $p = 0.008$ ) indicating that deeper caves are richer in species than shallow caves. However, the true ecological relationship may be with moisture/humidity rather than cave depth. Shallow caves tend to be warmer and drier, which are less hospitable for moisture-sensitive arthropods.

The use of caves by porcupines was another subject studied by Graham (1962e). Porcupines nest in at least 38 caves in all California regions except the coastal regions and Sierra Nevada South, using a bed of quills and scats just inside the dark zone. The caloric value of the scats from these plant feeders may be low.

Graham (1966a) documented the crane flies, Tipulidae (including Limoniidae, Figs. 87–88) and winter crane flies, Trichoceridae, in California caves. The trichocerids, which are smaller, are found in remote, dark portions of caves on the floor amongst debris as well as in the entrances; tipulids are limited to twilight, and favor high, open walls and overhangs. The largest species is *Holorusia hespera*, giant western crane fly, formerly *H. rubiginosa*.

Graham (1966b) reported observations on the roosting habits of the Townsend's big-eared bat, *Corynorhinus* (formerly *Plecotus*) *townsendii* (Fig. 85). He thought that this bat did not often use Sierra Nevada caves, but was more drawn to cooler caves for hibernation, and warmer caves for nursery colonies. He reported on guano deposits as clues to former colonies, and the loss of this bat from some caves caused by human disturbance.

In Graham's 1967 study of the orb-weaving spider, *Meta dolloff* (formerly *Pseudometa biologica*, Figs. 43–44), in Empire Cave, Santa Cruz Karst, he mapped the occurrences of webs and prey from the cave mouth into deep twilight, and he estimated the potential catch of flying and jumping insects. He noted a shift in web locations owing to the near-closure of the cave by a concreted gate at the entrance. His studies of the twilight moth, *Triphosa haesitata* (Fig. 89), in the same cave mapped the clustering behavior of this geometrid moth in twilight to deep twilight, and he applied biometric methods (Graham 1968a–b). The concreted gate had caused a change in moth roosts owing to the reduction in light, possibly damaging the cave community. This is one of the first papers to document an ecological shift in a California cave from human activity, in what is one of the most heavily abused caves in the state.

Graham conducted an overall study of Bower Cave, Mariposa County, in three parts (1969a–c), all dealing with the outer vault, an unusual ecotonal sinkhole entrance with trees, columbine, animals falling in, and a deep lake with fauna.



Elliott (1978) provided temperature and humidity data, transplanted species counts, and population estimates for *Banksula grahami*, *B. melones*, and the beetle *Ptomaphagus nevadicus* in McLean's Cave and Transplant Mine, SNN, and feeding experiment data for *B. melones*. The mean air temperature in McLean's Cave in December/January 1977–78 was 14.1°C with a range of 2.0°C (13.6°C in the main level to 15.6°C in the highest level). Relative humidity (RH) ranged from 82–97% in McLean's as measured with wet and dry bulbs on a digital IMC thermometer. Conditions in the cave were generally dry and dusty because of a drought until January 1978, when considerable dripping began. Afterwards the atmosphere was saturated in most places except in the Entrance Room. From December 1977 to May 1978, the Transplant Mine air ranged from 12.2°C at the entrance gate to 15.1°C in a side passage where fauna was transplanted (Fig. 11). RH ranged from 80 to 100%. Temperature and humidity data were recorded in 3 other caves in the same interval, and ranged from 15.7–16.3°C in Moaning Cave (a show cave with electric lights); 10.0–15.5°C air and 13.1°C in the amphipod stream in Crystal Palace; and 11.2–11.3°C air in Windeler Cave.

Rudolph (1979) reported population evaluations for *B. melones* (Figs. 7, 8 and 21) in 18 caves, and conducted faunal surveys in 80 caves in northern California. More localities for *B. melones* were found in the Stanislaus River basin, partly because the drought had broken and the ground and caves were wetter, consequently more cave fauna was visible than during the surveys of McEachern and Grady in 1977 and Elliott in the winter of 1977–1978.

Taylor and Krejca (2006) reported on their extensive studies in 29 lava tubes at Lava Beds National Monument. Environmental data showed that most of the lava tubes have a dark zone varying from just above freezing to about 12°C. Relative humidity varies from about 85–100%. Many tables and graphs are presented in their report, three of which are reproduced here (Figs. 110–112). The preferences for light, RH, temperature, and substrate type were graphed for a rhagidiid mite, the millipede *Plumatyla humerosa*, a *Haplocampa* dipluran, a tomocerid collembolan, the cricket *Ceuthophilus inyo*, and the bat *Corynorhinus townsendii*. The fauna and caves were extensively photographed, providing a valuable record and photographic guide for future ecologists monitoring the fauna. At least 3 undescribed species were discovered among 25 caves: 2 *Haplocampa* cam-podeid diplurans (Fig. 70) and a telemid spider in the genus *Usofila* (Fig. 37).

Krejca (2006, 2009a) conducted similar studies of 35 caves in Sequoia National Park, Kings Canyon National Park, and Yosemite National Park (SNS), providing extensive faunal surveys and photographs, some of which show previously unknown species interactions. Twenty-seven new species were found. Two granitic talus caves in Yosemite ranged from 8.0–11.0°C. The high cave biodiversity of the two parks was not fully realized until these studies were done.

Our present study has much more information than was available to early researchers regarding the total fauna of some caves. Tables 18–22 give us the opportunity to compare and contrast the cave communities.

**Clough Cave.** The map of Clough Cave, Sequoia National Park, Tulare County, SNS Region, is shown in Figure 114. A marble cave, Clough is at 1,311 m above sea level (among the 6 highest caves), in a cliff 40 m above the South Fork of the Kaweah River. The cave is only 277 m long with 13 m of vertical relief. A minimal age for the cave is 1.03 +/- 0.13 Ma as dated by cosmogenic <sup>26</sup>Al/<sup>10</sup>Be burial dating of coarse sediment deposited in the cave (Stock et al. 2005), but it is probably much older. The cave probably retains moisture year-round because the entrance is at the lower end, thus limiting the invasion of cold, dry air in the winter. Cold air flows into down-sloping caves because it is dense, often causing winter drying for some distance. The cave was abused for many years, as evidenced by broken speleothems throughout, but it has been somewhat restored and is doubly gated.

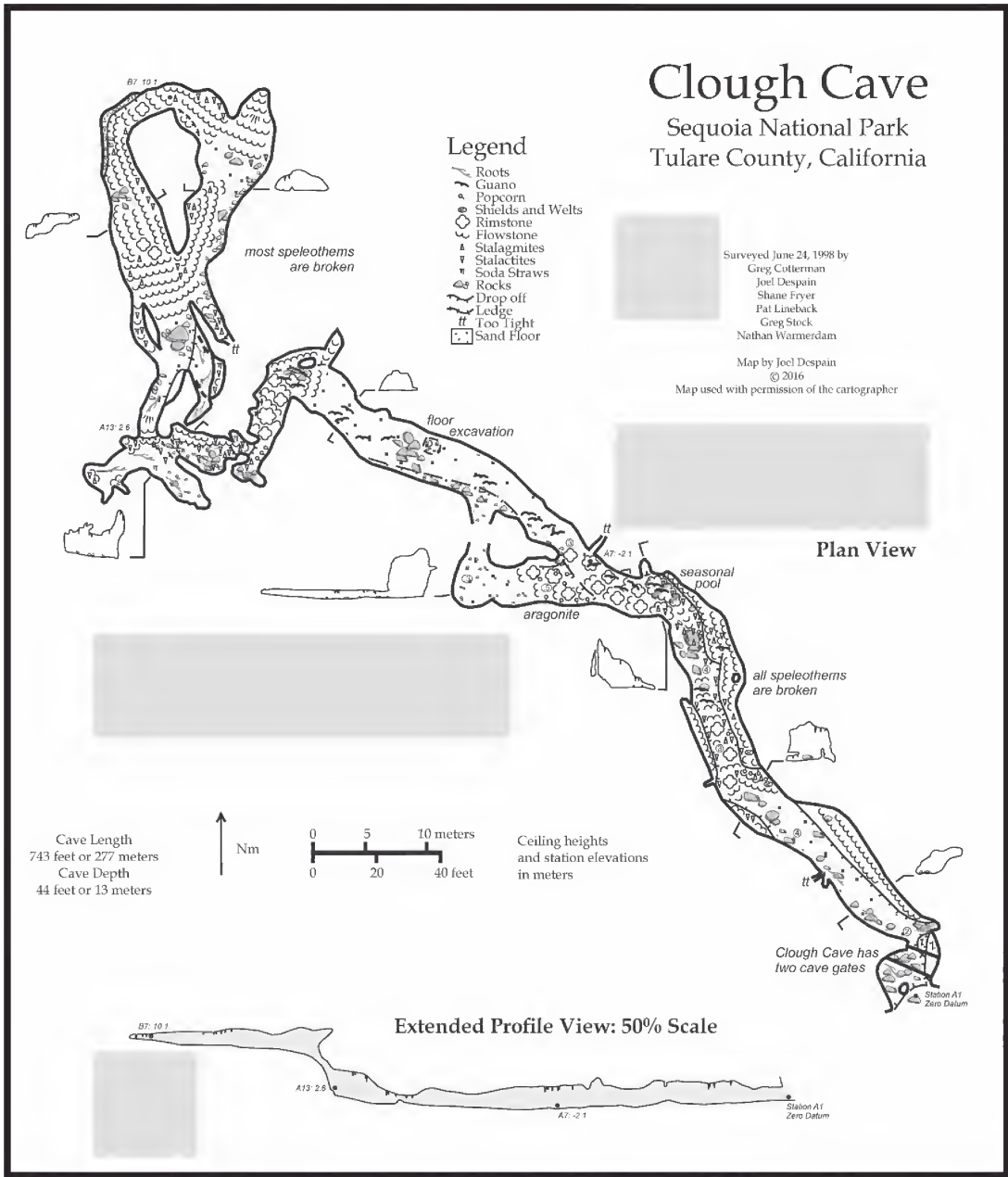


FIGURE 114. Clough Cave map.

This region has a mediterranean climate marked by extreme seasonality in temperature and humidity, with low temperatures ( $< 0^{\circ}\text{C}$ ) and high precipitation (700 mm) in winter (November-April) and seasonal drought and high temperatures ( $> 40^{\circ}\text{C}$ ) in summer (Tobin et al. 2013).

Clough Cave has 58 species, including 11 troglobites with 3 single-site endemics, and the top  $B_1$  score, which is a composite of SR, T, and SE. It is ranked second using the  $B_2$  score, which incorporates SR, T, and SST. Either way, it is a very important cave for biodiversity. Clough Cave

apparently escaped the glaciations of the higher elevation caves in that area, and it is regionally important in the western U.S.A. despite its modest size.

Table 18 is the species list for Clough Cave. The cave has a large list of micropredators, including 15 spiders, a harvestman, a schizomid, 3 pseudoscorpions, 2 scorpions, 2 centipedes, 3 beetles, and perhaps other arthropods. The detritivores include 1 mite, 3 collembolans, 6 millipedes, a bristletail, a silverfish, a japygid, 2 beetles, 2 flies, 2 hemipterans, 2 psocids, and a terrestrial isopod. Vertebrates include raccoon, 4 bats, a rodent, and a snake. This is amazing diversity, especially as there are no aquatic species or crickets. Other food inputs to Clough Cave include extensive tree roots, animal feces, fungi, pack rats, raccoons, bats, and small arthropods. The roots in Clough grow into the cave from the parallel canyon, supporting an associated fauna such as collembolans, planthoppers (Figs. 97–101), and arachnids. Many California caves have extensive root systems.

Clough Cave was the site of an intensive ecological study involving five surveys of terrestrial fauna between May and December 2010 (Tobin et al. 2013). The cave was divided into six quadrats and temperature was continuously logged in each; humidity was logged at the entrance and in the deep cave. With increasing distance from the entrance, temperature changes were increasingly attenuated and lagged relative to surface temperature changes. The temperature ranged from 2–28°C at the entrance and 12–18°C in the cave. Quadrat 6, at the far, upper end of the cave, was relatively stable with a range of 15.5–17.2°C over the study (May to December 2010). Linear regressions were created to determine the relationship between measured environmental variables and diversity for cavernicoles (troglobites and troglaphiles) and troglloxenes cave-wide and in the transition zone. Diversity for cavernicoles and troglloxenes peaked in the entrance and deep cave zones, respectively. Quadrat, date, 2-week antecedent temperature average, 2-week antecedent temperature range, and troglloxene abundance explained 76% of cavernicole diversity variability as measured by the Shannon-Weaver index,  $H'$ . Quadrat explained 55% of troglloxene diversity variability. In the transition zone, troglloxene abundance explained 26% of cavernicole variability and 2-week antecedent temperature and 2-week antecedent temperature range explained 40% of troglloxene variability. In the transition zone, troglloxene diversity was inversely related to 2-week antecedent temperature average and 2-week antecedent temperature range, suggesting that species were moving into the transition zone when temperature was most stable. In a canonical correspondence analysis of cavernicole distribution data and environmental variables, 35% of variation in species-specific distributions was attributable to quadrat, and nonsignificant percentages were explained by date and environmental variables.

**Samwel Cave.** A map of Samwel Cave (Fig. 115), Shasta County, Shasta National Forest, Klamath Mountains Region, and Table 19 detail its structure and fauna. With 44 species, 11 troglobites (including 4 single-site endemics), and a site endemism score of 5.92, the cave ranks second for  $B_1$  and first for  $B_2$ . It has the most single-site endemics of any California cave, probably because of the isolation of the Shasta Karst and because it has received extensive study. Samwel has 8 spiders with 4 troglobites, 2 pseudoscorpions (1 troglobite), 2 scorpions (including the only troglobitic scorpion in the state), 4 collembolans, 5 millipedes (3 troglobites), 1 japygid (troglobite), 3 beetles, 3 dipterans, a moth, a new species of cricket, a psocid, a terrestrial isopod (troglobite), a salamander, a bat, 7 snails, and has had a porcupine and a puma. Samwel Cave has been studied by many scientists since 1903, yielding interesting late Pleistocene fossils (Feranec et al. 2007) and new species of arthropods (see History section). It sits at 438 m elevation, is 300 m long and 30 m deep with a significant drop to the bottom. A tree grows at the entrance and roots are prominent in several parts of the cave. The roots support many arthropods, including *Titiotus* spiders, as observed by Darrell Ubick. A recent paleontological excavation in the top level of the cave (Putnam Hall) found roots down to 1.1 m below the floor level (Jessica Blois, pers. comm.). Unfortunately,



TABLE 18. Clough Cave, Sequoia National Park, Tulare County, Sierra Nevada South Region, species list (58 species). Site endemism (SE) scores are for troglobites only, based on the number of sites statewide.

Phylum/ Class	Order	Family	Species	Ecological classification	SE
<b>Arthropoda</b>					
Arachnida	Acari	Undetermined	Acari		
	Araneae	Anapidae	<i>Gertschanapis shantzi</i>	Troglophile	
		Cybaeidae	<i>Cybaeus</i> sp.	Epigean	
		Dictynidae	<i>Blabomma</i> n. sp. no. 4	Troglobite	1.00
		Dictynidae	<i>Yorima</i> n. sp.	Troglobite	0.11
		Hahniidae	<i>Calymmaria</i> sp.	Epigean	
		Hypochildae	<i>Hypochildus petrunkevitchi</i>	Epigean	
		Leptonetidae	<i>Archoleoneta schusteri</i>	Troglophile	
		Leptonetidae	<i>Calileptoneta</i> n. sp. 2	Troglobite	0.25
		Linyphiidae	<i>Arcuphantes</i> sp.	Troglophile	
		Linyphiidae	Linyphiidae		
		Nesticidae	<i>Nesticus silvestrii</i>	Troglophile	
		Pholcidae	<i>Physocyclus</i> sp.	Troglophile	
		Telemidae	<i>Usofila</i> n. spp.	Troglobite	0.06
		Tengellidae	<i>Titiotus</i> sp.	Troglophile	
		Undetermined	<i>Araneomorphae</i>		
	Opiliones	Phalangodidae	<i>Calicina cloughensis</i>	Troglobite	0.25
	Pseudoscorpiones	Chthoniidae	<i>Neochthonius</i> n. sp.	Troglobite	0.33
		Chthoniidae	<i>Neochthonius</i> sp.	Uncertain	
		Neobisiidae	<i>Fissilicreagris</i> sp.	Troglobite	0.50
	Schizomida	?Hubbardiidae	? <i>Hubbardia</i> sp.		
	Scorpiones	Undetermined	Scorpiones		
		Vaejovidae	<i>Uroctonites sequoia</i>	Troglophile	
		Vaejovidae	<i>Uroctonus mordax</i>	Epigean	
Chilopoda	Lithobiomorpha	Undetermined	Lithobiomorpha	Uncertain	
	Undetermined	Undetermined	Chilopoda		
Collembola	Collembola	Sminthuridae	Sminthuridae		
		Tomoceridae	<i>Pogonognathellus celsus</i>	Troglophile	
		Tomoceridae	Tomoceridae		
		Undetermined	Collembola		
Diplopoda	Chordeumatida	Conotylidae	<i>Taiyutyla</i> sp.	Troglophile	
		Striariidae	<i>Amplaria adamsi</i>	Troglophile	
	Julida	Paeromopodidae	<i>Californiulus yosemitensis</i>	Endogean	
	Polydesmida	Macrosterodesmidae	<i>Sequoiadesmus krejcae</i>	Troglobite?	0.33
		Polydesmidae	<i>Bidentogon</i> n. sp.	Troglobite	0.20
	Undetermined	Undetermined	Diplopoda		
Diplura	Dicellurata	Japygidae	Japygidae	Cave-limited	
Insecta	Archaeognatha	Undetermined	Archaeognatha		
	Coleoptera	Carabidae	Carabidae		
		Monotomidae	<i>Hesperobaenus abbreviatus</i>		
		Raymondionymidae	<i>Gilbertiola</i> sp.	Troglobite	1.00
		Undetermined	Coleoptera		
	Diptera	Mycetophilidae	Mycetophilidae		
		Undetermined	Diptera		
	Hemiptera	Achilidae	<i>Juniperthia succinea</i>		
		Aphididae	Aphididae		
	Psocoptera	Psyllipsocidae	<i>Psyllipsocus ramburii</i>	Troglophile	
		Undetermined	Psocoptera		
	Undetermined	Undetermined	Insecta		
	Zygentoma	Nicoletiidae	<i>Speleonecta</i> n. sp. no. 1	Troglobite	1.00

TABLE 18 (continued). Clough Cave, Sequoia National Park, Tulare County, Sierra Nevada South Region, species list (58 species).

Phylum/ Class	Order	Family	Species	Ecological classification	SE
Malacostraca	Isopoda	Trichoniscidae	<i>Brackenridgia heroldi</i>	Troglophile	
<b>Chordata</b>					
Mammalia	Carnivora	Procyonidae	<i>Procyon lotor</i>	Epigeic	
	Chiroptera	Molossidae	<i>Tadarida brasiliensis</i>	Trogloxene	
		Vespertilionidae	<i>Antrozous pallidus</i>	Trogloxene	
		Vespertilionidae	<i>Corymorhinus townsendii townsendii</i>	Trogloxene	
		Vespertilionidae	<i>Myotis evotis</i>	Trogloxene	
	Rodentia	Undetermined	Rodentia		
Reptilia	Squamata	Colubridae	<i>Lampropeltis</i> sp.		
				SE Score	5.04

Samwel Cave has a steel plate gate inside that is a barrier to wildlife. Samwel is an important cave for the entire western U.S.A.

**Empire Cave.** Figure 116 is the map and Table 20 is the species list for Empire Cave, Santa Cruz County, Bay Area/Delta Region, including 76 species with 6 troglobites, 4 single-site endemics, and a rank of number 3 in the state. The cave contains roots, and it is heavily used and abused, but also was well-studied by biologists. Its moist environment harbors 2 tubificid worms, 3 salamanders, 5 snails, occasional slugs, 2 stygobitic amphipods unique to the cave, a new species of stygobitic *Caecidotea* isopod, and a phreatobitic *Calasellus* isopod. The terrestrial arthropods include 1 mite, 7 spiders, 6 harvestmen, 2 troglobitic pseudoscorpions (1 known only from there), 3 centipedes, 7 millipedes, an unidentified cricket, 12 beetles, 12 dipterans, and a symphylan. More than half of the fauna is epigeic to trogloxenic (26 species) or troglphilic (16 species). Townsend’s western big-eared bat formerly occurred there, but not since increased usage of the cave since the opening of the surrounding college campus. Empire Cave’s fauna is quite different from caves in other regions.

**Clay Cave** (Fig. 117), Napa County, Bay Area/Delta Region, ranks 4<sup>th</sup> and is the most geologically odd of the top 20 caves, formed in Miocene Sonoma Volcanics, a continental packet of rhyolitic to andesitic volcanoclastic sediments and tephra (ash). Figure 117 is the map of Clay Cave and Table 21 details its fauna of 68 species, 22 of which are beetles (much of the field work was done by coleopterists). Five species are troglobites and 2 are single-site endemics. There are 1 mite, 10 spiders, 3 harvestmen, 2 pseudoscorpions, 2 centipedes, 5 millipedes, 7 collembolans, 22 beetles (2 troglobites in unusual families), 4 dipterans, 3 hemipterans, 1 ant, 1 moth, 1 cricket, 1 terrestrial isopod, 1 salamander, a rodent, 2 snails, and a horsehair worm (Fig. 102). Sitting at 750 m elevation, the cave is 229 m long and 38 m deep. The moist cave is formed by an underground stream that has eroded a soil pipe through the cemented ash. The cave may have originated along root casts in the bedded sediments that are mostly altered to smectite clay, locally stained with iron oxides. Subsequent invasion by seasonal streams has integrated the initial fist-sized soil pipes into vadose canyon passages (Bruce Rogers, pers. comm.) The cave descends steeply, and there are a number of squeezes along the narrow winding stream passage. There usually is standing water or a flowing stream with a seeping spring. The cave has roots, and there is a small number of crickets near the entrance.

**Lilburn Cave** (Fig. 118), Kings Canyon National Park, Tulare County, is one of the two very large caves of California at 33.5 km long and 155 m deep, with an entrance elevation of 1,600 m.

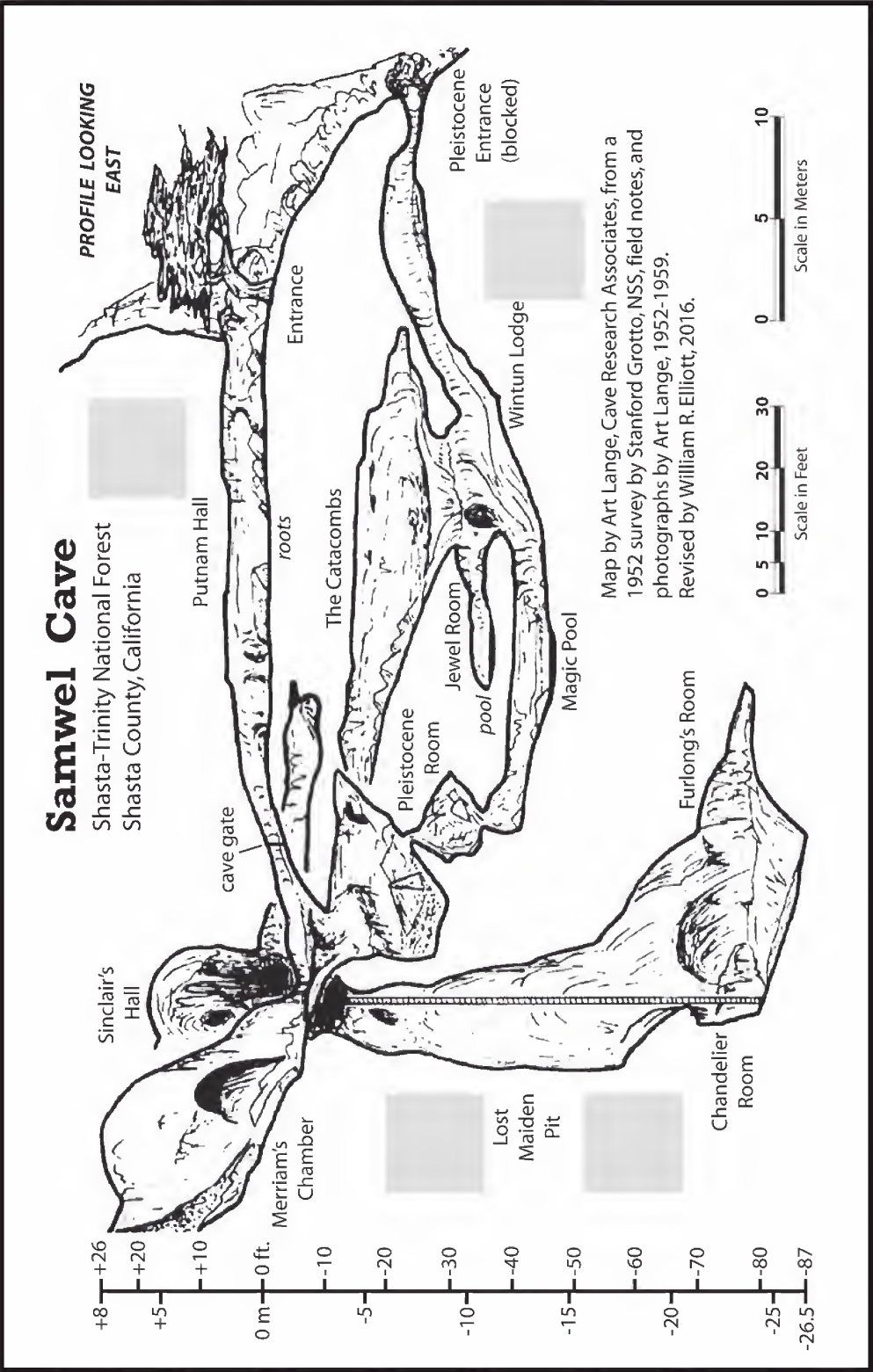


FIGURE 115. Samwel Cave map.



TABLE 19. Samwel Cave, Shasta County, Shasta National Forest, Klamath Mountains Region, species list (44 species).

Phylum/Class	Order	Family	Species	Ecological classification	SE
<b>Arthropoda</b>					
Arachnida	Araneae	Amaurobiidae	<i>Callobius tehama</i>	Epigean	
		Amaurobiidae	<i>Pimus nawtawaketus</i>	Troglophile	
		Cybaeidae	<i>Cybaeozyga</i> n. sp. 2	Troglobite	1.00
		Cybaeidae	<i>Cybaeus</i> n. sp.	Troglobite	1.00
		Leptonetidae	<i>Calileptoneta sylvia</i>	Troglophile	
		Nesticidae	<i>Nesticus potterius</i>	Troglobite	0.25
		Telemidae	<i>Usofila</i> n. spp.	Troglobite	0.06
		Tengellidae	<i>Titiotus humboldt</i>	Troglophile	
	Pseudoscorpiones	Chthoniidae	<i>Neochthonius</i> sp.	Uncertain	
		Pseudogarypidae	<i>Pseudogarypus spelaeus</i>	Troglobite	1.00
	Scorpiones	Vaejovidae	<i>Graemeloweus iviei</i>	Troglophile	
		Vaejovidae	<i>Uroctonus grahami</i>	Troglobite	1.00
Chilopoda	Lithobiomorpha	Undetermined	Lithobiomorpha	Uncertain	
Collembola	Collembola	Dicyrtomidae	<i>Ptenothrix maculosa</i>		
		Entomobryidae	<i>Entomobryoides guthriei</i>	Troglophile	
		Tomoceridae	<i>Plutomurus californicus</i>	Troglophile	
		Tomoceridae	<i>Pogonognathellus bidentatus</i>	Troglophile	
Diplopoda	Chordeumatida	Conotylidae	<i>Plumatyla</i> sp.	Troglobite	0.50
		Striariidae	<i>Amplaria shastae</i>	Troglobite	0.50
	Julida	Paeromopodidae	<i>Californiulus dorsovittatus</i>	Epigean	
		Parajulidae	<i>Bollmaniulus</i> sp.		
	Undetermined	Undetermined	<i>Undetermined Diplopoda</i>	Troglobite	0.04
Diplura	Dicellurata	Japygidae	<i>Occasjapyx kofoidi</i>	Troglobite	0.50
Insecta	Coleoptera	Staphylinidae	Aleocharinae		
		Staphylinidae	<i>Sepedophilus castanea</i>	Epigean	
		Tenebrionidae	<i>Eleodes productus</i>	Epigean	
	Diptera	Tipulidae	<i>Dactylolabis postiana</i>	Trogloxene	
		Tipulidae	<i>Dicranoptycha</i> sp.	Trogloxene	
		Tipulidae	<i>Tipula grahamina</i>	Trogloxene	
	Lepidoptera	Geometridae	<i>Triphosa haesitata</i>	Trogloxene	
	Orthoptera	Rhaphidophoridae	<i>Pristoceuthophilus</i> n. sp. no. 4	Troglophile	
	Psocoptera	Psyllipsocidae	<i>Psyllipsocus ramburii</i>	Troglophile	
Malacostraca	Isopoda	Ligiidae	<i>Ligidium kofoidi</i>	Troglobite	0.07
<b>Chordata</b>					
Amphibia	Caudata	Plethodontidae	<i>Hydromantes shastae</i>	Trogloxene	
Mammalia	Carnivora	Felidae	<i>Puma concolor</i>		
	Chiroptera	Vespertilionidae	<i>Corynorhinus townsendii townsendii</i>	Trogloxene	
	Rodentia	Erethizontidae	<i>Erethizon dorsatum</i>	Trogloxene	
<b>Mollusca</b>					
Gastropoda	Stylommatophora	Bradybaenidae	<i>Monadenia churchi</i>	Epigean?	
		Bradybaenidae	<i>Monadenia mariposa</i>	Epigean?	
		Bradybaenidae	<i>Monadenia troglodytes</i>	Troglophile	
		Haplotrematidae	<i>Haplotrema keepi</i>	Epigean?	
		Helminthoglyptidae	<i>Helminthoglypta cypreophila</i>	Troglophile	
		Pristilomidae	<i>Pristiloma cavator</i>	Troglophile	
		Pristilomidae	<i>Pristiloma</i> sp.	Epigean?	
			<b>SE Score</b>	<b>5.92</b>	

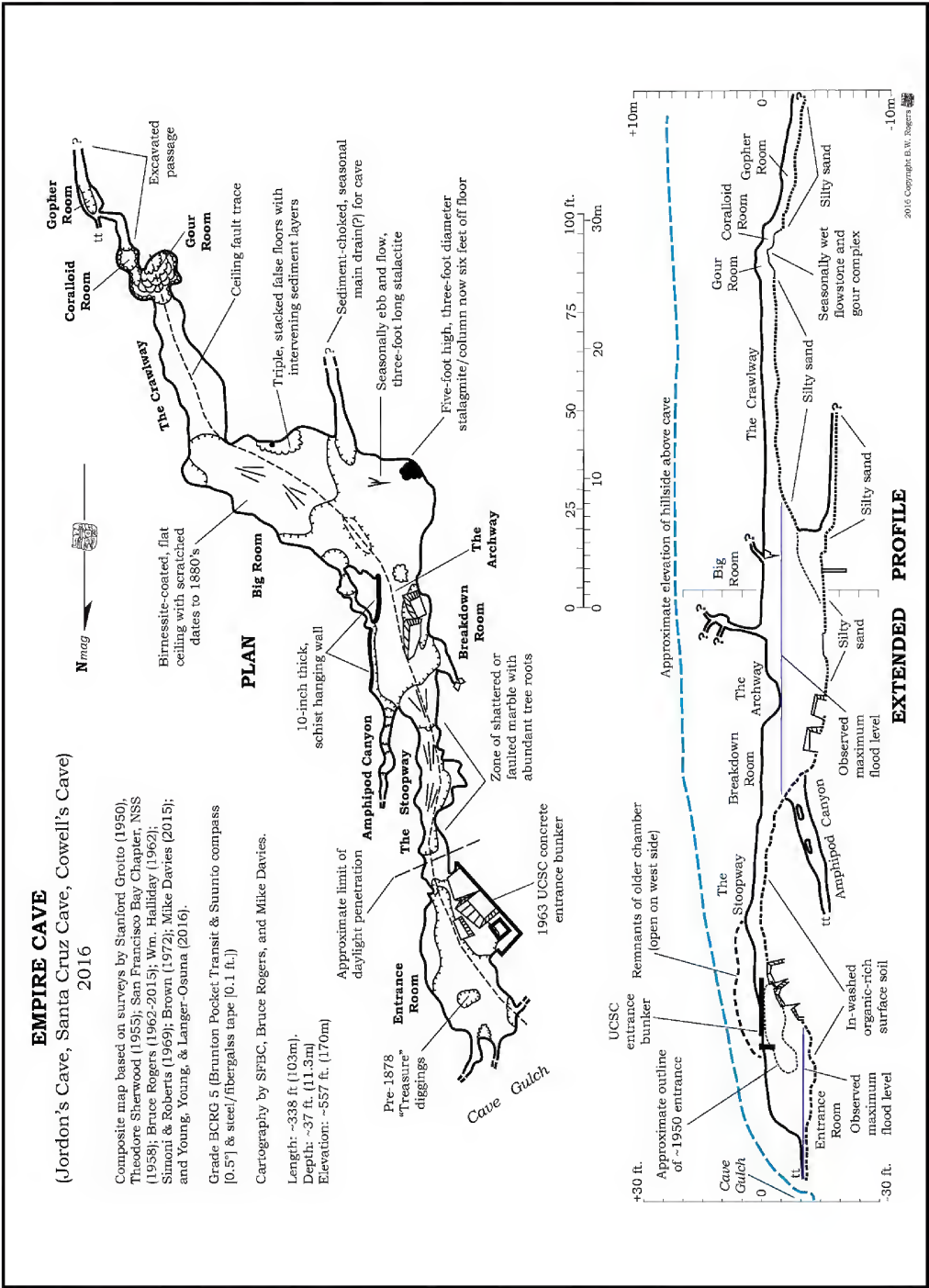


TABLE 20. Empire Cave, Santa Cruz County, Bay Area/Delta Region, species list (76 species).

Phylum/ Class	Order	Family	Species	Ecological classification	SE
<b>Annelida</b>					
Clitellata	Tubificida	Naididae	Phallodrilinae n. sp.		
		Naididae	Rhyacodrilinae n. sp.		
<b>Arthropoda</b>					
Arachnida	Acari	Trombiculidae	<i>Tecomatlana watkinsi</i>	Epigean	
	Araneae	Anyphaenidae	<i>Anyphaena</i> sp.	Epigean	
		Cybaeidae	<i>Cybaeus</i> sp.	Epigean	
		Hahniidae	<i>Calymmaria</i> sp.	Epigean	
		Linyphiidae	<i>Bathyphantes alameda</i>	Troglophile	
		Nesticidae	<i>Nesticus silvestrii</i>	Troglophile	
		Telemidae	<i>Usofila</i> n. sp.	Troglophile	
		Tetragnathidae	<i>Meta dolloff</i>	Troglophile	
	Opiliones	Nemastomatidae	<i>Ortholasma rugosum</i>	Troglophile	
		Phalangiidae	<i>Leiobunum exilipes</i>	Trogloxene	
		Phalangodidae	<i>Sitalcina californica</i>	Troglophile	
		Sabaconidae	<i>Sabacon briggsi</i>	Epigean	
		Taracidae	<i>Taracus ubicki</i>	Troglophile	
		Triaenonychidae	<i>Zuma acuta</i>	Troglophile	
	Pseudoscorpiones	Chthoniidae	<i>Neochthonius imperialis</i>	Troglobite	1.00
		Neobisiidae	<i>Fissilicreagris imperialis</i>	Troglobite	0.25
Chilopoda	Geophilomorpha	Geophilidae	Geophilidae	Epigean	
		Undetermined	Geophilomorpha		
	Scolopendromorpha	Undetermined	Scolopendromorpha		
Collembola	Collembola	Dicrytomidae	<i>Ptenothrix maculosa</i>		
		Entomobryidae	Entomobryidae		
		Entomobryidae	<i>Sinella baca</i>	Troglophile	
		Tomoceridae	<i>Plutomurus californicus</i>	Troglophile	
		Tomoceridae	<i>Plutomurus wilkeyi</i>	Troglophile	
		Tomoceridae	Tomoceridae		
Diplopoda	Chordeumatida	Rhiscosomididae	<i>Rhiscosomides</i> sp.		
		Striariidae	<i>Amplaria</i> sp.	Uncertain	
	Glomerida	Glomeridae	<i>Glomeroides primus</i>		
	Julida	Paeromopodidae	<i>Paeromopus angusticeps angusticeps</i>	Troglophile	
	Polydesmida	Macrosternodesmidae	Macrosternodesmidae		
		Polydesmidae	Polydesmidae		
	Spirobolida	Spirobolidae	<i>Tylobolus</i> sp.	Troglophile	
Insecta	Coleoptera	Carabidae	<i>Bembidion iridescens</i>	Accidental	
		Carabidae	<i>Pterostichus</i> sp.		
		Carabidae	<i>Pterostichus</i> sp. no. 3		
		Carabidae	<i>Scaphinotus</i> sp.	Epigean	



TABLE 20 (continued). Empire Cave, Santa Cruz County, Bay Area/Delta Region, species list (76 species).

Phylum/Class	Order	Family	Species	Ecological classification	SE
		Carabidae	<i>Trechus ovipennis californicus</i>	Trogloxene?	
		Carabidae	<i>Trechus</i> sp.	Trogloxene?	
		Curculionidae	Curculionidae	Epigean	
		Leiodidae	Leiodidae		
		Phengodidae	Phengodidae		
		Staphylinidae	Aleocharinae		
		Tenebrionidae	Tenebrionidae		
		Undetermined	Coleoptera		
	Diptera	Muscidae	Muscidae		
		Mycetophilidae	Mycetophilidae		
		Piophilidae	Piophilidae		
		Psychodidae	Psychodidae		
		Sciaridae	Sciaridae		
		Sphaeroceridae	<i>Leptocera</i> sp.	Epigean	
		Tipulidae	<i>Dicranoptycha</i> sp.	Trogloxene	
		Tipulidae	<i>Limonia maculicosta</i>		
		Tipulidae	<i>Limonia rubeculosa sciophila</i>	Trogloxene	
		Tipulidae	<i>Limonia</i> sp.	Trogloxene	
		Tipulidae	Tipulidae		
		Undetermined	Diptera		
	Hemiptera	Cixiidae	<i>Cixius</i> n. sp.	Troglophile	
	Lepidoptera	Geometridae	<i>Triphosa haesitata</i>	Trogloxene	
	Orthoptera	Rhaphidophoridae	<i>Ceuthophilus</i> sp.	Trogloxene	
Malacostraca	Amphipoda	Crangonyctidae	<i>Stygobromus imperialis</i>	Stygobite	1.00
		Crangonyctidae	<i>Stygobromus mackenziei</i>	Stygobite	1.00
	Isopoda	Asellidae	<i>Caecidotea</i> n. sp.	Stygobite	1.00
		Asellidae	<i>Calasellus californicus</i>	Phreatobite	0.04
		Trichoniscidae	<i>Brackenridgia heroldi</i>	Troglophile	
Symphyla	Cephalostigmata	Scutigerellidae	<i>Scutigerella</i> sp.	Troglophile	
<b>Chordata</b>					
Amphibia	Caudata	Dicamptodontidae	<i>Dicamptodon ensatus</i>	Epigean	
		Plethodontidae	<i>Ensatina eschscholtzii</i>	Epigean	
		Salamandridae	<i>Taricha torosa</i>	Epigean	
Mammalia	Chiroptera	Vespertilionidae	<i>Corynorhinus townsendii townsendii</i>	Trogloxene	
<b>Mollusca</b>					
Gastropoda	Stylommatophora	Arionidae	<i>Ariolimax</i> sp.	Accidental	
		Haplotrematidae	<i>Haplotrema minimum</i>	Epigean?	
		Undetermined	Stylommatophora	Uncertain	
	Undetermined	Undetermined	Gastropoda (slug)		
		Undetermined	Gastropoda (terrestrial snail)		
				<b>SE Score</b>	<b>4.29</b>

TABLE 21. Clay Cave, Napa County, Bay Area/Delta Region, species list (68 species).

Phylum/ Class	Order	Family	Species	Ecological classification	SE
Arthropoda					
Arachnida	Acari	Undetermined	Acari		
	Araneae	Cybaeidae	<i>Cybaeus</i> sp.	Epigean	
		Hahniidae	<i>Calymmaria</i> sp.	Epigean	
		Linyphiidae	<i>Bathyphantes</i> sp.	Troglophile?	
		Telemidae	<i>Usofila</i> n. sp.	Troglophile	
		Tetragnathidae	<i>Metellina curtisi</i>	Epigean	
		Tetragnathidae	<i>Metellina mimetoides</i>	Troglophile?	
		Undetermined	Araneomorphae		
		Undetermined	<i>Araneomorphae</i> sp. no. 2		
		Undetermined	<i>Araneomorphae</i> sp. no. 3		
		Zoropsidae	Zoropsidae		
	Opiliones	Phalangiidae	<i>Leiobunum</i> sp.	Trogloxene	
		Phalangodidae	<i>Megacina cockerelli</i>	Endogean	
		Undetermined	Opiliones	Uncertain	
	Pseudoscorpiones	Neobisiidae	<i>Globocreagris theveneti</i>		
		Undetermined	Pseudoscorpiones	Uncertain	
Chilopoda	Geophilomorpha	Undetermined	Geophilomorpha		
	Lithobiomorpha	Undetermined	Lithobiomorpha	Uncertain	
Collembola	Collembola	Entomobryidae	Entomobryidae		
		Poduridae	Poduridae		
		Sminthuridae	Sminthuridae		
		Tomoceridae	<i>Tomocerus</i> sp.		
		Undetermined	Collembola		
		Undetermined	Undetermined Collembola	Troglobite	0.33
	Poduromorpha	Onychiuridae	Undetermined Onychiuridae	Troglobite?	0.25
Diplopoda	Chordeumatida	Conotylidae	<i>Plumatyla</i> sp.	Troglobite	0.50
	Platydesmida	Andrognathidae	<i>Mitocybe auriporae</i>	Troglophile	
	Polydesmida	Undetermined	Polydesmida n. gen.		
	Spirobolida	Spirobolidae	<i>Tylobolus</i> sp.	Troglophile	
	Spirostreptida	Cambalidae	<i>Nannolene</i> sp.	Accidental	
Insecta	Coleoptera	Agyrtidae	<i>Necrophilus hydrophiloides</i>	Epigean	
		Anthicidae	Anthicidae		
		Carabidae	<i>Anillina</i> n. gen., n. sp. no. 3	Troglobite	1.00
		Carabidae	<i>Bembidion</i> sp.	Troglophile	
		Carabidae	Carabidae		
		Carabidae	Carabidae sp. no. 2		

TABLE 21 (continued). Clay Cave, Napa County, Bay Area/Delta Region, species list (68 species).

Phylum/ Class	Order	Family	Species	Ecological classification	SE
		Carabidae	<i>Scaphinotus interruptus</i>	Epigean	
		Cryptophagidae	<i>Cryptophagus</i> sp.	Troglophile	
		Leiodidae	<i>Agathidium virile</i>	Accidental	
		Leiodidae	<i>Catops basilaris</i>	Troglophile	
		Leiodidae	<i>Pinodytes minutus</i>	Troglophile	
		Leiodidae	<i>Ptomaphagus californicus</i>	Troglophile	
		Ptiliidae	<i>Acrotrichis</i> sp.		
		Scydmaenidae	Scydmaenidae		
		Silphidae	Silphidae		
		Staphylinidae	<i>Batrisodes (Empinodes) mendocino</i>	Troglophile	
		Staphylinidae	Pselaphinae		
		Tenebrionidae	<i>Eleodes</i> sp.	Epigean	
		Tenebrionidae	<i>Eschatoporis</i> n. sp.	Troglobite	1.00
		Tenebrionidae	Tenebrionidae		
		Undetermined	Coleoptera		
		Zopheridae	<i>Phloeodes plicatus</i>		
	Diptera	Mycetophilidae	Mycetophilidae		
		Trichoceridae	<i>Diazosma subsinuata</i>	Trogloxene	
		Undetermined	Diptera		
		Undetermined	Diptera sp. no. 2		
	Hemiptera	Achilidae	Achilidae		
		Cixiidae	Cixiidae	Edaphic	
		Undetermined	Fulgoroidea		
	Hymenoptera	Formicidae	Formicidae	Fossorial	
	Lepidoptera	Tineidae	Tineidae		
	Orthoptera	Rhaphidophoridae	Rhaphidophoridae	Trogloxene	
Malacostraca	Isopoda	Porcellionidae	<i>Porcellio dilatatus</i>	Exotic	
<b>Chordata</b>					
Amphibia	Caudata	Plethodontidae	<i>Ensatina eschscholtzii</i>	Epigean	
Mammalia	Rodentia	Muridae	<i>Neotoma</i> sp.	Trogloxene	
<b>Mollusca</b>					
Gastropoda	Stylommatophora	Arionidae	<i>Ariolimax</i> sp.	Accidental	
		Helminthoglyptidae	<i>Helminthoglypta nickliniana</i>	Epigean	
<b>Nematomorpha</b>					
Gordiaceae	Gordioidea	Undetermined	Nematomorpha	Parasite	
				<b>SE Score</b>	<b>3.08</b>





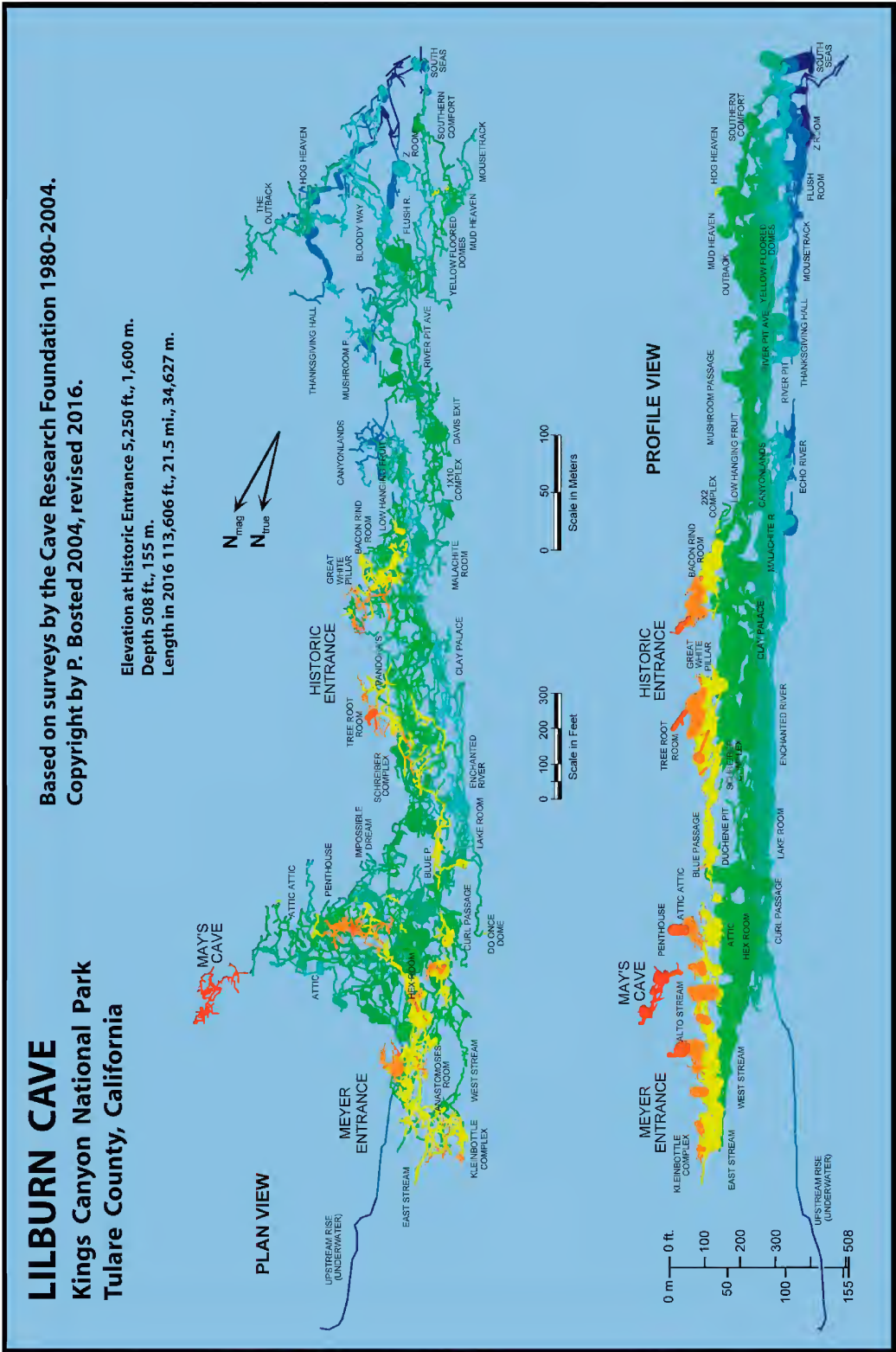


FIGURE 118. Lilburn Cave map.

TABLE 22. Lilburn Cave, Kings Canyon National Park, Tulare County, Sierra Nevada South Region, species list (71 species).

Phylum/ Class	Order	Family	Species	Ecological clas- sification	SE
<b>Annelida</b>					
Clitellata	Haplotaxida	Undetermined	Haplotaxida	Edaphic	
<b>Arthropoda</b>					
Arachnida	Acari	Undetermined	Acari		
	Acari	Undetermined	Undetermined Acari	Troglobite	0.50
	Araneae	Cybacidae	<i>Cybaeus</i> sp.	Epigean	
		Linyphiidae	<i>Bathypantes diasosnemis</i>	Troglophile	
		Linyphiidae	<i>Bathypantes</i> sp.	Troglophile?	
		Linyphiidae	Erigoninae		
		Linyphiidae	Linyphiidae		
		Linyphiidae	Linyphiinae n. gen., n. sp.	Troglobite	1.00
		Linyphiidae	<i>Oaphantes</i> sp.	Cave-limited	
		Nesticidae	<i>Nesticus silvestrii</i>	Troglophile	
		Pimoidae	<i>Pimoa hespera</i>	Troglophile	
		Pimoidae	<i>Pimoa</i> n. sp.	Troglophile	
		Tetragnathidae	<i>Tetragnatha</i> sp.		
	Opiliones	Sclerosomatidae	<i>Nelima paessleri</i>	Epigean	
		Taracidae	<i>Oskoron spinosus</i>	Troglophile	
		Taracidae	<i>Taracus audisioae</i>	Troglophile	
		Undetermined	Opiliones	Uncertain	
Chilopoda	Lithobiomorpha	Undetermined	Lithobiomorpha	Uncertain	
	Undetermined	Undetermined	Chilopoda		
Collembola	Collembola	Entomobryidae	Entomobryidae		
		Tomoceridae	<i>Pogonognathellus celsus</i>	Troglophile	
		Tomoceridae	Tomoceridae		
		Tomoceridae	<i>Tomocerus</i> sp.		
		Undetermined	Collembola		
Diplopoda	Chordeumatida	Conotylidae	<i>Taiyutyla loftinae</i>	Troglophile	
		Striariidae	<i>Amplaria muii</i>	Troglophile	
	Julida	Parajulidae	<i>Bollmanius</i> sp.		
	Polydesmida	Macrosternodesmidae	<i>Sequoiadesmus krejcae</i>	Troglobite?	0.33
		Polydesmidae	<i>Bidentogon</i> n. sp.	Troglobite	0.20
		Polydesmidae	<i>Bidentogon</i> sp.		
		Polydesmidae	<i>Calianotus yosemitensis</i>	Epigean	
	Undetermined	Undetermined	Diplopoda		
Insecta	Archacognatha	Undetermined	Archacognatha		
	Coleoptera	Carabidae	Carabidae		



TABLE 22 (continued). Lilburn Cave, Kings Canyon National Park, Tulare County, Sierra Nevada South Region, species list (71 species).

Phylum/ Class	Order	Family	Species	Ecological classification	SE
		Carabidae	<i>Omus californicus</i>	Epigean	
		Carabidae	<i>Pterostichus lama</i>	Epigean	
		Carabidae	<i>Pterostichus</i> sp.		
		Carabidae	<i>Scaphinotus riversi</i>	Epigean	
		Hydrophilidae	Hydrophilinae		
		Ptiliidae	<i>Acrotrichis</i> sp.		
		Staphylinidae	Aleocharinae		
		Staphylinidae	<i>Homaeotarsus</i> sp.		
		Staphylinidae	<i>Lobrathium</i> sp.		
		Staphylinidae	<i>Pseudopsis obliterated</i>		
		Staphylinidae	<i>Quedius</i> sp.		
		Staphylinidae	Staphylinidae		
		Undetermined	Coleoptera		
		Undetermined	Coleoptera sp. no. 2		
	Diptera	Heleomyzidae	Heleomyzidae		
		Heleomyzidae	<i>Oecothea specus</i>	Epigean	
		Mycetophilidae	Mycetophilidae		
		Tipulidae	<i>Limonia rubeculosa sciophila</i>	Trogloxene	
		Tipulidae	<i>Limonia</i> sp.	Trogloxene	
		Tipulidae	Tipulidae		
		Undetermined	Diptera		
		Undetermined	Diptera sp. no. 3		
	Hemiptera	Macroveliidae	<i>Macrovelia hornii</i>	Epigean	
		Undetermined	Hemiptera		
	Hymenoptera	Formicidae	Formicidae	Fossorial	
		Undetermined	Hymenoptera		
	Lepidoptera	Undetermined	Lepidoptera		
	Notoptera	Grylloblattidae	<i>Grylloblatta</i> n. sp. "Lilburn Cave"	Troglophile	
	Orthoptera	Rhaphidophoridae	<i>Tropidischia xanthostoma</i>	Trogloxene	
		Undetermined	Orthoptera		
	Plecoptera	Undetermined	Plecoptera (larva)		
Malacostraca	Isopoda	Asellidae	<i>Bowmanasellus sequoiae</i>	Stygobite	0.11
Symphyla	Cephalostigmata	Scutigerellidae	<i>Scutigerella inculta</i>	Endogean	
<b>Chordata</b>					
Amphibia	Caudata	Plethodontidae	<i>Ensatina eschscholtzii</i>	Epigean	
Mammalia	Rodentia	Undetermined	Rodentia		
<b>Mollusca</b>					
Gastropoda	Undetermined	Undetermined	Gastropoda (terrestrial snail)		
				SE ScoreScore	2.14

Lilburn (Table 22) has 71 species, 5 troglobites (1 single-site endemic) and ranks 5<sup>th</sup> in cave biodiversity in California. The cave is formed in marble (Fig 6) and has extensive roots growing in from the forest, especially at the lower resurgence (Big Spring) where submerged roots have cave isopods on them (Figs. 103–105), but also in the upper level Tree Root Room. The rich fauna includes 1 earthworm, 2 mites, 11 spiders (2 troglobites), 2 centipedes, 5 collembolans, 8 millipedes (2 troglobites), 1 bristletail, 15 beetles (none troglobitic), 8 dipterans, 1 new species of troglomorphic grylloblattid, 2 hemipterans, 2 hymenopterans, 1 moth, 2 crickets, 1 stygobitic isopod, 1 symphylan, a salamander, a rodent, and a terrestrial snail.

To compare and contrast the fauna of the top 5 caves is challenging. They are quite different in their origins, elevations, and faunal make-up. Generally speaking there is only a small aquatic component in California caves, unlike many eastern U.S.A. caves. There is scant presence of crickets; some are in Samwel, Empire, Clay, and Lilburn, but none have yet been observed in Clough Cave. There is a diversity of collembolans, four to seven species in the top five caves, providing a good food base for micropredators. Other food inputs are varied, including roots (Figs. 97–101, 104–105), feces (Fig. 106), amphibians and mammals, detritus with fungi (Figs. 106–108), and accidental invertebrates (Fig. 109), but these have only been quantified in Clough Cave. All are in forested or chaparral areas, which suggests important nutrient input from plant production and roots. However, interesting cavernicoles are now known from the Mojave Desert, presumably with few roots penetrating the caves.

Aside from the Transplant Mine, an artificial environment, the leading high-biodiversity site of the SNN Region is Music Hall Cave, Calaveras County, providing another region for comparison. The cave ranks 8<sup>th</sup> in California for overall biodiversity, and it has 32 species, 6 troglobites, 1 SST, and 2.21 SE score. The cave has 1 mite, 6 spiders (1 troglobite), 3 harvestmen (1 troglobite), 4 pseudoscorpions (all troglobites), 3 centipedes, 1 springtail, 3 millipedes, 3 beetles, 1 fly, 1 moth, 1 lacewing, 1 isopod, 1 bat, and 3 terrestrial snails. Roots protrude into the cave, as in Grapevine Gulch Cave, Calaveras County (also known as Hanging Gardens Cave). In adjacent Tuolumne County roots are seen in McLean's Cave and Windeler Cave, both having rich faunas, and others.

McLean's Cave, Tuolumne County, before it was inundated, would have ranked tenth, and had 98 species including 4 troglobites, the most species of any cave in California. That was partially the result of months of intensive collecting to rescue the cave community, which was doomed by inundation caused by construction of the New Melones Dam. McLean's fauna was moved to the Transplant Mine (Fig. 11), now ranked sixth in biodiversity, with 53 species, 7 troglobites, but a low SE of 1.35. McLean's was remarkable for its species richness insofar as it lies at only 366 m elevation near the South Fork of the Stanislaus River, had been inundated in the past, but had no aquatic fauna. The cave was rich in river silt and roots.

## CONSERVATION

Karst, lava field, and littoral caves are vulnerable to a diverse array of threats in California. The threats impact the caves and their faunas, and are primarily a consequence of high population density and the demands for water and food. This section will primarily concentrate on impacts on cave fauna, but direct impacts on caves are a related and important issue.

Information in this paper expands the breadth of cave resources first compiled by Halliday (1962). Our annotated checklist (Appendix 1) and tables detail the diversity of the cave fauna of California and permit a comparison of the state's cave fauna with other geographic areas. As we shall see in the discussion that follows, we believe that California now ranks about third among U.S. states in total number of obligate subterranean species. An appreciation of these factors underscores the importance of efforts to preserve cave habitats and their faunas in California.

The three major threats to cave faunas in California are 1) the massive development of water resources driven by the demands of an expanding population and agricultural development, 2) degradation of the cave environment because of increased visitation by uninformed people, and 3) destruction of caves by quarrying and land development.

The scope of development of California's water resources is phenomenal, involving damming of most major and minor rivers, extensive extraction of groundwater, and massive transfers of water across the length and breadth of the state (Carle 2009). As a consequence, some caves are vulnerable to inundation. For example, the construction of the New Melones Dam in the Sierra Nevada inundated approximately 30 known caves, including McLean's Cave (Elliott 1981b, 2000b; Anonymous 2009b), a biologically significant cave, which contained four cave-restricted species (Table 15). Dewatering of caves, as well as other subterranean aquatic habitats, due to depletion of groundwater is also possible. Numerous springs throughout the state have ceased to flow as a consequence of declining water tables, with resulting detrimental impacts on resident faunas.

Quarrying activities in both karst and volcanic rocks also pose a direct threat to caves and their faunas. Limestone is in demand for cement, road material, and construction/decorative stone. Cinder cones and associated lava flows are also exploited for road material and decorative stone. Alabaster Cave in El Dorado County, the type locality and only known site for two troglobites (the opilionid *Banksula californica* and trechine beetle *Anillaspis explanata*) has been nearly eliminated by quarrying, and the remnant was sealed with concrete. The two troglobites have not been observed in recent decades, and may be extinct (Briggs 1974 and our data). The population of the troglobite *Banksula melones* in McNamee's Cave in Tuolumne County apparently was extirpated by explosives used in quarrying (Briggs 1974; our data; Bruce Rogers, pers. comm.). The Pisgah lava flow in the eastern Mojave Desert contains a significant array of lava caves, estimated at 200–300 caves. The fauna has not been extensively documented. The cinder cone was subject to past quarrying activities beginning in 1948, although the actual caves are located at some distance from the quarry area (Harter 1992b).

Surface development (urbanization, agriculture) also threaten cave environments. Sealing of entrances, pollution (especially of groundwater), and increased disturbance all contribute to increased impacts on cave environments and their faunas as a direct consequence of surface development. The Santa Cruz Karst is in a highly developed urban area and has been significantly impacted. Empire Cave, in that karst region, ranks third in biodiversity among California caves, but it has been trashed by numerous visitors for many years. A concrete barrier greatly reduced the entrance dimensions with impacts on the fauna (Graham 1967). Although gated in the past, attempts to control access have been unsuccessful and significant disturbance continues.

Improperly designed cave and mine gates of the past were detrimental to fauna. Bats are most sensitive to this activity, however other taxa may be impacted from alteration of air flow, nutrient inputs, or exclusion. Gate designs have greatly improved in recent decades, and wildlife-friendly gates are now the norm. Airflow, nutrient inputs, and movement of small animals are increasingly taken into account. For example, by ensuring that the bottom bar of a steel gate is attached to the angle-iron columns a small distance above the floor, even small amphibians may come and go while excluding humans. Where there is a soil substrate, human intruders are prevented from tunneling under the gate by placing an expanded metal mat in a shallow trench below grade and building the gate on top of it, then backfilling the trench. Authorized visitors may enter via a hidden, removable bar with a protected lock. With this design there is little air dam or water dam effect (Elliott 2012). Bat Conservation International, an NGO, provides excellent information on the topic of cave and mine gating (Fant et al. 2009). Sealing off caves is obviously detrimental and



should be avoided. Sealing and gating of cave and mine entrances because of safety concerns or perceived liability remains controversial. Many states protect owners of natural features (caves) from liability for injuries to visitors unless admission tickets are sold, but man-made mines are a different matter and the “attractive nuisance” legal liability may exist unless barriers or gates are installed. It has been estimated that over 39,000 abandoned mines exist in California (California Department of Conservation 2000), and there are ongoing programs to properly gate or seal mine entrances. Managers of these programs are aware of the need to provide environmentally sensitive gates that allow the passage of bats in mines that they occupy. In recent years mines have become a valuable asset for bat conservation, especially as bats have been run out of some caves by recreational use. Mine owners have increasingly become involved in installing bat-friendly mine gates.

Numerous sources of pollution of the state’s waters have the potential to negatively impact cave faunas. Mining activities, extending back to the Goldrush, are a source of mercury and other pollutants, some that bio-accumulate, which can impact cave organisms, especially those higher in the food chain. Agricultural residues (fertilizers, pesticides, sediments) can also degrade the aquatic environments of caves. Inadequate treatment of wastewater, including system failures, can introduce an extremely diverse array of pollutants into the cave environment that can have direct toxic effects and/or lead to eutrophication of cave waters. This would especially apply to a biologically rich cave as Clay Cave in Napa County, which is near large areas of human habitation and where the fauna is dependent on a clean source of water.

Disturbance from human use of caves, especially if frequent and/or by individuals lacking an understanding of the fragile nature of the resource, is a constant conservation concern. In Missouri heavily used caves, once properly gated, often showed an increase of fauna during organized follow-up counts (Drees 1995; Elliott and Ireland 2001). Vandalism is, unfortunately, frequent in California caves, and, although the overall extent is unquantified, the consequences in many areas are obvious to experienced cavers (Bruce Rogers, pers. comm.). However, 9 of the 20 California caves with the highest biodiversity have experienced significant vandalism (Table 23). Bats are arguably the taxon most susceptible to disturbance, especially as they are often viewed negatively by the public. Many examples of harm to bat populations are known (Elliott 2000b). However, all taxa are potentially at risk from excessive levels of disturbance. Education and limitations to visitation (proper gates, permits with numerical quotas, etc.) can effectively address these issues if the specific problem is recognized and the owners/managers take appropriate actions.

Exotic and invasive species are a rapidly increasing threat to nearly all ecosystems worldwide. Caves are no exception. To date serious impacts have not been detected in California cave communities. However, several pathogens are on the horizon. White nose syndrome, caused by the exotic fungal pathogen *Pseudogymnoascus destructans* of European origin, has resulted in over 6 million bat deaths in eastern North America, primarily affecting hibernating bats. The pathogen is rapidly spreading west across the continent, and has recently been reported in King County, Washington (U.S. Geological Survey 2016a). It is only a matter of time before California bat populations will be impacted. The South American imported red fire ant (*Solenopsis invicta*) has caused serious impacts on cave faunas in Texas (Elliott 2000b). The species has now colonized California and the potential exists for impacts on cave faunas. Amphibians are experiencing a global extinction crisis from numerous factors including an array of exotic and invasive diseases (Whittaker et al. 2013). One of these organisms, chytrid fungus (*Batrachochytrium dendrobatidis*) has been reported in Missouri cave amphibians (Elliott 2012). Although amphibians are not generally major components of cave faunas in California, potential impacts on the *Hydromantes* species are of concern. Because of the tremendous global trade network and lax regulation of potential introductions of exotic species, the impact of invasive and exotic species will undoubtedly increase in the future.

TABLE 23. Conservation status of the top 20 biodiversity caves in California.

Biodiversity Rank	Location	County	Type	Owner Class	Vandalism?	Gated?	Access
1	Clough Cave	Tulare	Cave	Federal	Severe/ restored	Yes	Permit required
2	Samwel Cave	Shasta	Cave	Federal	Yes	Yes	Permit required
3	Empire Cave	Santa Cruz	Cave	State	Yes	Defunct	Unrestricted
4	Clay Cave	Napa	Ash Cave	Private	Yes	No	Unrestricted
5	Lilburn Cave	Tulare	Cave	Federal	Minor	Yes	Scientific study only
6	Transplant Mine	Tuolumne	Mines	Federal		Yes	Neglected
7	Hurricane Crawl Cave	Tulare	Cave	Federal		Yes	Permit required
8	Music Hall Cave	Calaveras	Cave	Federal	Yes	No	Unrestricted
9	Lost Soldier's Cave	Tulare	Cave	Federal	Yes	Yes	Permit required
11	Hidden Cave	Siskiyou	Cave	Federal	Minor	No	Unrestricted
12	Bower Cave	Mariposa	Cave	Federal	Yes	Yes	Permit required
13	Carlow's Cave	Calaveras	Cave	Federal	Yes	No	Unrestricted
14	Kaweah Cave	Tulare	Cave	Federal	Minor	No	Unrestricted
15	Lost Piton Cave	Calaveras	Cave	Federal	Minor	No	Unrestricted
16	O'Neil's Cave	Calaveras	Cave	Private	Minor	No	Restricted
17	Walk Softly Cave	Tulare	Cave	Federal	No	Yes	Permit required
18	Subway Cave	Shasta	Lava Tube	Federal	Yes	No	Unrestricted
19	Shasta Caverns	Shasta	Cave	Commercial	Yes	Yes	Entrance Fee
20	Poleta Cave	Inyo	Cave	Federal	Yes	Yes	Permit required

TABLE 24. Ownership of subterranean sites in California. NGO means nongovernmental organizations, usually nonprofits.

Type	Commer- cial	Federal	NGO	Private	State	Unknown	Totals
Caves	10	436	3	56	25	792	1322
Groundwater	1	48	1	5	11	195	261
Lava Tubes		255	1	7		188	451
Mines	4	74	1	8	10	121	218
Sea Caves	1	162				242	405
Totals	16	975	6	76	46	1,538	2,657

California is fortunate to have substantial public lands that provide basic protection to many caves. They are managed by the National Park Service, Bureau of Land Management, U.S. Forest Service, and various state agencies. Private conservation organizations also provide protection for caves, including The Nature Conservancy, which owns many littoral caves on Santa Cruz Island; Peninsula Open Space Trust and Sempervirens Fund, which owns several major caves in Santa Cruz County; and the Western Cave Conservancy, which owns a cave in Amador County. In addi-

tion, the California Coastal Commission has regulatory authority over coastal landscapes that provide limited protection for sea caves throughout the state. Our cave database lists the category of ownership for 1,119 caves. Of these 975 (87%) are federally owned, and a total of 1,043 (93%) are in some category of conservation ownership (Table 24).

Various laws, regulations, and policies mandate protection of caves and their associated faunas in California. Important in this regard is the Federal Cave Resources Protection Act of 1998 (FCRPA-16U. S. C. 4301–4309) which mandates that federal agencies “... secure, protect, and preserve significant caves on federal lands ....” In addition, the California Penal Code, Section 263, The California Cave Protection Act, protects all caves and cave features, and includes prohibitions against disturbing bats and other organisms in the state. Federal and state agencies also have policies to prevent destruction of caves and disturbance of bats and other organisms, i.e., The Federal Land Policy and Management Act of 1976 (P.L. 94–579) at Sec.102 (a) 8. There are also a number of cave management plans in existence that detail the management of specific caves or cave regions. Examples include Shoshone Cave (whip-scorpion habitat) Wildlife Habitat Management Plan (Anonymous 1982b), and Sequoia and Kings Canyon National Parks Cave Management Plan (Anonymous 1998b). These are important documents in the conservation of cave resources.

The highly fragmented distribution of cave resources because of the state’s geology poses substantial conservation challenges. Nearly all troglobitic and stygobitic species are narrow endemics (49% are known from single sites). The most extensive range of a cave-restricted species in California is only 194 km. Consequently, by some criteria, most are potentially endangered even in the absence of additional threats. An important benefit of our annotated species list is the ready availability of the known distributions of cave species that provide a resource base for conservation planning. It is of interest to contemplate an alternative outcome of the McLean’s Cave controversy if the biological importance of this cave (greatest number of species in any California cave) had been widely recognized prior to the initiation of construction of the New Melones Dam. More palatable mitigation options might have been seriously considered, such as adjustments of the reservoir pool level, resulting in the preservation of McLean’s Cave and its associated fauna, which was near the top of the pool anyway. Ironically, the modern era of California cave biology began with study contracts let by the agency responsible for the destruction of the 30 caves, followed by more studies sponsored by conservation-minded individuals and agencies.

Few cave species (six) are listed on Federal and California threatened and endangered species lists. Of these only four are potentially dependent on caves to the extent that threats to caves represent a conservation issue for these species. The two *Hydromantes* salamanders (State threatened) are frequent cave inhabitants (especially *H. shastae*), which combined with their extremely limited ranges suggests that threats to caves also could represent a threat to these two listed species. Similarly, two bat species (*Macrotus californicus* and *Corynorhinus townsendii* — both state species of concern) are habitual cave occupants, and caves represent critical habitat. The IUCN (International Union for the Conservation of Nature 2016), using quite different criteria, lists additional cave species in California at various levels of threat. Regardless of formal listing criteria, the high degree of endemism among the cave-restricted species, especially the many species known from single localities, strongly suggests that the actual number of potentially endangered species is much greater than formally recognized.

## DISCUSSION

California’s subterranean fauna is distinctly different from the eastern U.S.A., but has some similarities to neighboring states. Recognition of the high biodiversity of California’s caves came slowly at first. Peck (1973) reported the troglobitic millipede, *Plumatyla humerosa*, in caves of



Lava Beds National Monument, and summarized the fauna in these and other volcanic caves in western North America. Elliott et al. (1985, 2003a–b) reported on California's cave biodiversity at biospeleology meetings. The arachnologist, Willis Gertsch, of the American Museum of Natural History identified California as a hot spot with at least 20 troglobitic spiders (Gertsch 1992). Peck (1998) identified the Sierra Nevada foothills (our Sierra Nevada North) as a troglobite hotspot in North America, and listed 60 troglobitic species from California in his national checklist of cave animals. Peck also documented the diversity of fungus beetles (Leiodidae) in caves of California and the world in general.

Culver et al. (2000) mentioned the Mother Lode karst region as having a significant cave obligate fauna on the continental scale, but gave no details. Culver, Christman, Elliott, Hobbs, and Reddell (2003) included the Mother Lode in an analysis of nine North American karst regions based on genera. The 2003 paper found that the Mother Lode grouped generally with Texas, the Guadalupe Mountains of New Mexico, the Black Hills, and the Driftless Area of Iowa, but was fairly dissimilar to other regions. At that time only 20 troglobites and 3 stygobites were known from the Mother Lode region. The Mother Lode (Sierra Nevada North) now harbors 32 troglobites, 3 stygobites, and 6 phreatobites, nearly doubling what we knew in 2003.

The California cave fauna lacks the troglobitic vertebrates and larger crustaceans that occur in many eastern U.S.A. and Mexican faunas, presumably because of limited aquatic habitats in caves, but California is rich in minute phreatobites. Crickets, ecologically important troglonexes and troglaphiles in most U.S. cave faunas, are sparse or absent in many California caves. An important cave, Clough Cave, may lack crickets while Lilburn Cave, also important, has two species!

Some of the genera present in Californian subterranean habitats are widespread in the U.S. (e.g., *Stygobromus*, *Foveacheles*, *Poecilophysis*, *Oncopodura*, and the isopod *Caecidotea*). Twelve genera exhibit considerable California endemism or are limited to the western U.S. Eight genera (the isopods *Bowmanasellus* and *Calasellus*, the pseudoscorpions *Australinocreagris* and *Fissiliceagris*, the harvestman *Banksula*, and the millipedes *Sequoiadesmus*, *Speoseya* and *Speostriaria*) are endemic to California. The millipede *Plumatyla* is found in a limited range in California and Oregon. The millipede *Nevadesmus* is limited to Nevada and a cave in the SNS, and *Pratherodesmus* is limited to the SNS and caves in Arizona. The scorpion genus *Uroctonus* is limited to the western U.S. So, California has eight state endemic cave genera, but shares some genera with Oregon, Nevada, and Arizona.

Several groups exhibit significant range disjunctions, some of which relate to ancient vicariance events, such as continental drift. *Telema* spiders are known from the western U.S. and the Pyrenees, and *Meinertophilus* centipedes are known from California and Portugal. A third genus, the pseudoscorpion *Pseudogarypus*, is represented by four species in the western U.S. and related genera in Tasmania. In contrast the rhagidiid mite genera *Foveacheles* and *Poecilophysis* have many species of troglaphiles and troglobites in American caves, relicts of forms that probably dispersed circumboreally during the Quaternary across northern North America and Europe.

The cave fauna of the Mojave Desert exhibits a distinct zoogeographic pattern. The fauna is extremely restricted because of the limited number of caves and extreme aridity, but the limited fauna exhibits a close zoogeographic affinity to the caves of Arizona, New Mexico, Texas, and northern Mexico. Seven genera of troglobites are known from the region. The opilionid *Texella* is known only from California and Texas. The schizomid *Hubbardia* and the troglaphilic millipede *Colactis* are genera with distributions extending south and east of California; the closest relatives of the two California species are from Arizona. Three troglaphilic species of the beetle *Rhadine* represent a widespread genus with troglobitic species restricted to Texas and northern Mexico, and troglaphiles from there to New Mexico and California. In addition, the only troglaphilic pseudo-

scorpion known from the Mojave Desert, *Larca aalbui*, is related to cave-adapted species in Arizona and Texas.

In this paper the top 20 California caves for biodiversity are found in many regions, which rank as follows: Sierra Nevada South 9, Sierra Nevada North 6, Klamath and Marble Mountains 2, Bay Area/Delta 2, and Lava Flows North 1. Overall the Sierra Nevada has the largest share of high biodiversity caves, the northern half with the most single-site endemics, but the southern half with individual caves having higher site endemism and overall biodiversity. Bay Area/Delta has two very different caves with high biodiversity. Klamath and Marble Mountains (Samwel Cave and Shasta Caverns) have outstanding biodiversity. Subway Cave in Lava Flows North is remarkable in ranking 18<sup>th</sup> in biodiversity despite being in a lava flow less than 2,000 years old, which suggests that some of the troglobites, like *Plumatyla humerosa*, have invaded caves and cracks from adjacent, older lava flows, analogous to the lava tube fauna in Hawaii (Howarth 1972). As in other high biodiversity caves, tree roots enhance energy inputs and habitat complexity.

With the data then available, Elliott (2007) ranked California as ninth among U.S. states in subterranean biodiversity, with 7 phreatobites, 8 stygobites, and 42 troglobites, a total of 47 obligate subterranean species, which this paper has increased to 146 species. Table 25 is a comparison of numbers of obligate subterranean species in leading states, with data sources cited. California currently ranks third nationally if phreatobites are included (phreatobite data are not easily available from other states and definitions vary among authors.) These rankings are not precise, but California’s subterranean biodiversity is high on the national and the continental scale.

Many mechanisms have allowed cavernicoles to become isolated in California’s caves. We have presented examples of geology, elevation, drainage basins, aridity, and climate change. In his 1973 paper on lava tube faunas in the western U.S., Peck said, “Among the terrestrial invertebrate troglobites and obligate troglophiles, at least, the cave occupation seems certainly to have been motivated by a search for cool, moist habitats. Such habitats are those occupied by the species most closely related to the troglobites. This conclusion is reinforced by the observation that caves with cooler air and with standing water or ice contain a richer fauna . . . Much of the fauna probably

TABLE 25. Comparison of numbers of obligate subterranean species in leading U.S. cave states.

State	Ref.	No. sites sampled	All Species	Phreatobites	Stygobites	Troglobites	Obligate Sub. Species	Rank
Texas	Reddell pers. comm. 2016	4,092	1,519	42	49	200	291	1
Tennessee	Niemiller and Zigler 2013	661			40	160	200	2
California	This study	1,293	1,366	32	12	102	146	3
Alabama	Elliott 2007			2	23	120	145	4
Virginia	Elliott 2007			12	38	89	139	5
Kentucky	Elliott 2007			0	29	90	119	6
West Virginia	Fong et al. 2007	282			33	53	86	7
Missouri	Elliott 2007	960	927	13	36	33	82	8
Arkansas	Graening et al. 2011						72	9
Indiana	Elliott 2007			3	22	32	57	10
Oklahoma	Graening et al. 2011						48	11
Georgia	Elliott 2007			0	16	24	40	12

came from higher elevations, reaching the caves overland by migration during the cooler and more moist conditions of the last glaciation . . . As the glacial ice retreated and the warming and drying trends of the present interglacial continued, some of the populations retreated into the suitable environments offered by the cave. This mechanism certainly is true for *Plumatyla* and *Idagona*, and for the species of *Grylloblatta*, all of which show no special cave modification. The modified . . . troglobites, may have occupied caves during earlier interglacials.” He continued, “Some of this fauna has affinities with the faunas of limestone caves in the United States to the south and east, such as *Stygobromus*, *Apochthonius*, *Microcreagris*, *Rhagidia*, *Bathyphantes*, and *Plusiocampa*. However, some of this fauna is unique and is limited to the cave or to the general cave-containing region of the Pacific Northwest. A conclusion which may be drawn from this observation is that, although the caves themselves have histories different from those of caves in limestone regions, their internal conditions have attracted, isolated, and supported faunas in the same way as those of limestone caves.”

To Peck’s general conclusion that cavernicoles were isolated during interglacials, we must add the likely opposite effect in the southern Sierra Nevada and Mojave Desert, in which southern forms colonized caves after expanding in the general area during warm, wet periods, but survived underground during glacials or extremely arid periods. This could apply to schizomids, scorpions, certain spiders, *Texella* harvestmen, *Rhadine* beetles, and other associated fauna. This is perhaps why there is a mix of boreal and tropical elements in the caves of the Sierra Nevada South region.

Ecological, biogeographical, and evolutionary questions continue to draw the attention of cave biologists to California. We expect that many more species will be discovered in California’s diverse cave regions. To what degree is cave biodiversity related to root systems in caves and the adjacent topography? What food chains are related to different roots? How were boreal and tropical species isolated in caves? Why are there so many phreatobites, even at this early stage of knowledge, and so few stygobites in California? Why do raphidophorid crickets rarely form large cave colonies, or are absent from some caves?

Conservation of California’s caves and their diverse fauna benefit tremendously from the prevailing land ownership pattern within the state, with many caves on federal and state lands, although some of those caves are still abused. There also are opportunities to improve cave conservation on private lands. Pressures from an expanding human population and intense water usage present challenges to effective conservation of these resources. The authors hope that the information we have presented will be useful in identifying specific conservation issues, informing the discussions, and ultimately result in better conservation outcomes.

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## APPENDIX 1

### ANNOTATED CHECKLIST OF CALIFORNIA CAVE FAUNA

Records without citations are unpublished data from this study. Most sight records are designated with an asterisk (\*). See Appendix 2 for list of biological sites listed by county, island, site type, name, and synonyms

#### KINGDOM ANIMALIA

#### PHYLUM PORIFERA (sponges)

##### Undetermined

**Records:** Mendocino Co.: \*Cave of Lost Soles; \*Hitchhiker Cave. San Francisco Co.: *Farallon Islands*: \*Jewel Cave (more than 20 species). San Luis Obispo Co.: \*Cave-in-Rock. Santa Barbara Co.: *Santa Cruz Island*: \*H Cave; \*Lady's Harbor Cave; \*Little Scorpion Bay Cave No. 4; \*Mussel Cave; \*Point Arguello Cove East Cave; \*Point Arguello Cove West Cave; \*Seastack Cave; \*Seal Canyon Cave; \*Sponge Cave; \*Varicolored Sponge Cave. \*Surging "T" Cave. Santa Cruz Co.: \*Mussel Cave; \*Technicolor Dream Cave; \*Whale of a Cave. Ventura Co.: *Anacapa Island*: \*Catacombs Cave; \*Cathedral Cave; \*Cliff Chasm Cave; \*Treasure Chest Cave; \*Urchin's Lair Cave.

**Bibliography:** Bosted (1991a, 2000); Bunnell (1982, 1988b, 1988c, 1989b, 1990, 1993a, 1993b, 1994, 1998, 1999a, 1999b, 2000a); Bunnell and Vesely (1986, 1990); Danchy (1952), Halliday (1962); Orr, P.C. (1951b, 1952b); Vesely and Bunnell (1985).

*Acanthancora* sp. (blue sponge) (marine)

**Records:** Santa Barbara Co.: *Santa Cruz Island*: \*Diablo Anchorage Cave.

**Bibliography:** Bunnell and Vesely (1983a); Henderson (1983).

#### CLASS DEMOSPONGIAE

#### ORDER TETRACTINELLIDA

#### Family Ancorinidae

##### *Stelletta* sp. (white sponge) (marine)

**Records:** Santa Barbara Co.: *Santa Cruz Island*: \*Diablo Anchorage Cave.

**Bibliography:** Bunnell and Vesely (1983a); Henderson (1983).

#### ORDER POECILOSCLERIDA

#### Family Microcionidae

##### *Ophlitaspongia* sp. (marine)

**Records:** San Francisco Co.: *Farallon Islands*: \*Low Arch Cave.

**Comment:** This species was found 25 m from the entrance.

#### PHYLUM BRYOZOA

##### Undetermined

**Record:** San Luis Obispo Co.: \*Nudibranch Cave.

**Bibliography:** Vesely (1987, 1991).

#### PHYLUM CNIDARIA (jellyfishes, anemones, corals, hydrozoans)

#### CLASS HYDROZOA

#### ORDER ANTHOMEDUSAE (jellyfish)

##### Undetermined

**Record:** Santa Barbara Co.: *Santa Cruz Island*: \*Cave of the Bird's Eggs.

**Bibliography:** Bunnell (1988b, 1993b, 1999a).

#### Family Porpitidae

##### *Verella verella* (Linnaeus) (by-the-wind sailor jellyfish) (marine)

**Record:** Marin Co.: \*Faulty Jellyfish Cave.

**Bibliography:** Rogers (2010e, 2010f).



**CLASS ANTHOZOA**  
**ORDER ACTINARIA (anemones)**  
 Undetermined (marine)

**Records:** **Marin Co.:** \*El Reyes Cave. **Mendocino Co.:** \*Peters Creek Cove Cave; \*Starfish Sea Cave. **Santa Barbara Co.:** *Santa Cruz Island:* \*Mussel Cave, \*Painted Grotto. **San Diego Co.:** \*one of the Sea Cliff Caves; \*Little Blowhole Cave; \*Sea Surprise Cave. **San Francisco Co.:** \*Sutro Baths Cave. **San Luis Obispo Co.:** \*Anemone Swiss Cheese Cave; \*Grotto Rock Cave; \*Sea Dome Cave; \*Sea Maze Cave. **Santa Cruz Co.:** \*Davenport Area Sea Cave No. 20; \*Surfing Tunnel Sea Cave; \*Technicolor Dream Cave. **Ventura Co.:** *Anacapa Island:* \*Sea Lion Cave; \*Treasure Chest Cave.  
**Comment:** Sea anemones have been reported in littoral caves at Punta Banda, Baja California, Mexico by Bunnell and Vesely (1984). The anemones from Punta Banda were pink and white, indicating a loss of the usual mutualistic algae.  
**Bibliography:** Bailey (2008); Bosted (1984, 1991a, 1992, 2000); Bunnell (1984, 1985, 1988b, 1988c, 1993b, 1994b, 1998, 1999a, 1999b, 2000a); Bunnell and Vesely (1983a; 1983b, 1984); Halliday (1957); Leissring (2010); Linn (2013); Mele (1994); Vesely (1982, 1983, 1991); Vesely and Bunnell (1982a, 1982b, 1986).

**Family Actiniidae**  
*Anthopleura artemisia* (Pickering) (buried sea anemone) (marine)

**Record:** **San Luis Obispo Co.:** \*Cave-in-Rock.  
**Bibliography:** Vesely (1987, 1991); Vesely and Bunnell (1985).

*Anthopleura elegantissima* (Brandt) (aggregating sea anemone) (marine)

**Records:** **Marin Co.:** \*Millers Point Cave. **San Francisco Co.:** *Farallon Islands:* Little Murre Cave. **San Luis Obispo Co.:** \*Cave-in-Rock.  
**Bibliography:** Rogers (2013c, 2005c); Vesely and Bunnell (1985).

*Anthopleura xanthogrammica* (Brandt) (giant green anemone) (marine)

**Records:** **San Francisco Co.:** *Farallon Islands:* Little Murre Cave. **San Luis Obispo Co.:** \*Cave-in-Rock; \*Nudibranch Cave.  
**Bibliography:** Rogers (2014); Vesely (1987, 1991); Vesely and Bunnell (1983, 1985, 1991).

**PHYLUM PLATYHELMINTHES (flatworms)**  
**CLASS TURBELLARIA (planarians)**  
**ORDER TRICLADIDA**  
 Undetermined

**Records:** **Fresno Co.:** Boyden Cave. **Inyo Co.:** Grapevine Springs; Sponge Cave. **San Benito Co.:** Bear Gulch Cave. **Siskiyou Co.:** \*Francis' Folly Cave. **Tulare Co.:** Kuala Spring; White Chief Cave.  
**Bibliography:** Sluys (2009); Wolff, L. (2007a).

Undetermined Tricladida (stygobite)

**Records:** **Siskiyou Co.:** Planetary Dairy Cave. **Tulare Co.:** Crystal Sequoia Cave; Mossy Spring.  
**Bibliography:** Broeckel (2010e); Sluys (2009); Graening (2011a, 2011c).

**Family Dendrocoelidae**  
*Dendrocoelopsis hymanae* Kawakatsu (phreatobite)

**Record:** **Placer Co.:** Lake Tahoe, center of lake (type locality).  
**Comment:** This depigmented, eyeless species was taken from a depth of 474–495 m (1554 to 1623 ft.).  
**Bibliography:** Goubault (1986); Kawakatsu (1968); Kenk (1972, 1973, 1974).

**Family Kenkiidae**  
*Sphalloplana (Sphalloplana) californica* Kenk (stygobite)

**Records:** **Mariposa Co.:** Bower Cave (type locality).  
**Comment:** Divers collected this planarian at depths of 10 to 30 m. It is known only from Bower Cave.  
**Bibliography:** Goubault (1986); Holsinger (1974); Kawakatsu and Mitchell (1981); Kenk (1977).

**Family Planariidae***Phagocata crenophila* Carpenter (stygophile?)**Records:** Siskiyou Co.: Skunk Hollow Cave?; Trail Junction Cave.**Comment:** This species was originally described from springs in California, Nevada, and Utah. The cave population is a lighter color than the usually darkly pigmented spring populations (R. Kenk, pers. comm.).**Bibliography:** Carpenter (1969).*Polycelis* sp. (stygobite?)**Records:** Tulare Co.: Cirque Cave; Crystal Sequoia Cave; Panorama/Sink Cave System; White Chief Cave.**Bibliography:** Despaigne (2006); Krejca (2006, 2009b); Sluys (2009).**PHYLUM NEMATODA (roundworms)**

Undetermined

**Records:** Fresno Co.: Church Cave; Millerton Lake Cave System. Siskiyou Co.: Bigfoot Cave; Frozen Falls Cave. Tulare Co.: Hurricane Crawl Cave.**Bibliography:** Despaigne (1993); Graening (2011c).**PHYLUM NEMATOMORPHA (Gordian or horsehair worms)**

Undetermined (parasite)

**Records:** Tulare Co.: Lilburn Cave.**Comment:** In 2004 a horsehair worm was photographed by Jean Krejca in Lilburn Cave near water. The parasite probably erupted from a cave cricket (Figure x).**PHYLUM ANNELIDA****CLASS CLITELLATA (segmented worms)****SUBCLASS OLIGOCHAETA****ORDER HAPLOTAXIDA (earthworms)**

Undetermined

**Records:** Calaveras Co.: \*Cave City Cave. Fresno Co.: Boyden Cave; Church Cave; Millerton Lake Cave System. Santa Cruz Co.: Vanished River Cave; Dolloff Cave; IXL Cave; Vanished River Cave. Shasta Co.: \*Potter Creek Cave. Siskiyou Co.: \*Lyon's Road Cave; Sugar Pine Butte Ice Cave. Tulare Co.: Crystal Sequoia Cave; Eighteenth Hole; Harry's Bend Cave; Hurricane Crawl Cave; Kaweah Monkeyflower Cave; Lange Cave; Lilburn Cave; Overhang Cave; Panorama Cave; Paradise Cave; Seldom Seen Cave; Ursa Minor Cave; White Chief Cave.**Comment:** The earthworms and microdrile oligochaete families have been poorly documented, and deserve further study. Most of the records above were reported as Lumbricidae or *Lumbricus*.**Bibliography:** Bowers (2008a); Danchy (1951); Krejca (2006, 2009c); Lange (1954); Sinclair (1904); Taylor and Krejca (2006); Ubick (2001); Weaver (2008).**ORDER LUMBRICULIDA****Family Lumbriculidae (aquatic worms)***Stylodrilus californianus* Rodriguez (phreatophile)**Record:** Kern Co.: well RLSA 2204W (type-locality).**Bibliography:** Rodriguez (1996).**ORDER TUBIFICIDA****Family Naididae****Comment:** These undescribed species recently collected in Empire Cave appear to belong to the following subfamilies, but they are not clearly attributable to existing genera. Phallodrilinae have not yet been reported in Nearctic caves, although many stygophilic species and genera have been described in Europe. (S.V. Fend, pers. comm.)

Phallodrilinae n. sp.

**Record:** Santa Cruz Co.: Empire Cave.

Rhyacodrilinae n. sp.

**Record:** Santa Cruz Co.: Empire Cave.

**SUBCLASS HIRUDINEA (leeches)**

Undetermined

**Record: Tulare Co.:** Crystal Sequoia Cave.

**Bibliography:** Krejca (2006).

**ORDER RHYNCHOBDELLIDA**

**Family Glossiphoniidae**

*Helobdella stagnalis* (Linnaeus)

**Record: San Benito Co.:** Bear Gulch Cave.

**CLASS POLYCHAETA**

**ORDER CANALIPALPATA**

**Family Sabellidae (feather duster worms)**

*Phragmatopoma californica* Kinberg (honeycomb worm)

**Records: Marin Co.:** \*Point Resistance Cave. **Ventura Co.:** *Anacapa Island*: \*Cat's Eye Cave No. 6; \*Cat's Eye Cave No. 7. \*Honeycomb Worm Cave; \*Rippling Reflections Cave; \*Shipwreck Cave.

**Bibliography:** Bunnell (1993a, 1993b, 2003); Rogers (2012).

**PHYLUM NEMATOMORPHA (horsehair worms)**

Undetermined

**Records: Napa Co.:** \*Clay Cave. **Siskiyou Co.:** Bigfoot Cave; Broken Down Palace. **Tulare Co.:** Hurricane Crawl Cave.

**Bibliography:** Bunnell (2007); Krejca (2006).

**PHYLUM MOLLUSCA**

**CLASS POLYPLACOPHORA**

**SUBCLASS NEOLORICATA**

**ORDER CHITONIDA (chitons)**

Undetermined

**Record: Santa Cruz Co.:** \*Surfing Tunnel Sea Cave.

**Bibliography:** Bosted (1984).

**Family Mopaliidae**

*Tonicella lineata* (Wood) (lined chiton)

**Record: Marin Co.:** \*Rippled Window Grotto.

**Bibliography:** Rogers (2010e).

**CLASS BIVALVIA**

**SUBCLASS PTERIOMORPHIA (mussels)**

Undetermined (marine)

**Records: Marin Co.:** \*El Reyes Cave. **Santa Barbara Co.:** *Santa Cruz Island*: \*Deathtrap Cave; \*Mussel Cave. **Santa Cruz Co.:** \*Davenport Area Sea Cave No. 20; \*Needle Rock Sea Caves; \*Technicolor Dream Cave; \*White Mussels Sea Cave. **San Luis Obispo Co.:** \*Caverns of Mystery.

**Bibliography:** Bosted (1991a, 1992, 2000); Bunnell (1988a, 1988b, 1988c, 1993b, 1999a); Bunnell and Vesely (1982); Leissring (2010).

**CLASS GASTROPODA (snails, slugs)**

Undetermined slugs

**Records: Santa Clara Co.:** Joaquin Murrieta's Cave. **Santa Cruz Co.:** Dolloff Cave; Empire Cave; IXL Cave; Stearns Cave; Stump Cave. **Siskiyou Co.:** Skunk Hollow Cave; Streambed Cave. **Tuolumne Co.:** \*Toppled Table Talus Cave. **Trinity Co.:** \*Del Loma Cave; Paul Gibson Cave.

**Bibliography:** Broeckel, B. (2005b, 2008e); Graham (1968a); Rogers (2005b); Schmitz (2012); Wolff, J. (2008).

Undetermined snails

**Records: Amador Co.:** Helbing Ranch Caves; Rippled Cave; Skeleton Cave. **Calaveras Co.:** Bobcat Cave; Carlito's Cave; Cave City Cave; \*Cave of the Crystal Snail; Escargot Cave; Gastropod Cave; \*Grapevine Gulch Cave (Hanging Gardens Cave); \*Heater Cave; Moaning Cave; Snail Cave; Wool Hollow Cave. **Fresno Co.:** Beauty Cave; Church Cave; Millerton



Lake Cave System; Saturday Cave; unnamed cave in Kings Caverns Geological Area. **Monterey Co.:** Willow Creek Cave. **Santa Cruz Co.:** Bat Cave; Empire Cave; Stearns Cave; Stump Cave. **Shasta Co.:** Discovery 1 Cave. **Siskiyou Co.:** \*It ta Choo-mah Cave; Stiletto Cave. **Tuolumne Co.:** McNamee's Cave; Transplant Mine. **Trinity Co.:** \*Del Loma Cave; \*Trinity Natural Bridge and Cave; Paul Gibson Cave (2 species). **Tulare Co.:** Bear Den Cave; Dehydrated Cave; Hidden Cave; Hurricane Crawl Cave; Lange Cave; Lilburn Cave; \*Lost Soldier's Cave; Kaweah Monkeyflower Cave; Overhang Cave; Pet Cemetery Cave; Pine Grosbeak Cave; \*Popcorn Pit; Stand Up Cave; Ursa Minor Cave; Walk Softly Cave; Weissraum Cave. **Ventura Co.:** Clear Springs Cave.

**Bibliography:** Baumann (2012); Briggs (1991); Broeckel, B. (2008e); Damon (1963b); deSaussure (1953a); Doerr (1972); Fan (2010b); Graham (1968a); Halliday (1962); Halliday and Hedlund (1960); Johnson, E. (1996c); Johnson, V. (1990); Klette (1972, 1980); Lange (1954); McBride (1971); Merritt (2009); Poppoff (1980); Quick (1980c); Rogers (2005b, 2005e); Rogers and Johnson (2012); Russo (1992); Schmitz (1996a); Sharp (1990, 2000a); Ubick (2001); Wolff, L. (2013b); Wolff and Wolff (1990); Zidell (1987).

#### ORDER PATELOGASTROPODA

##### Family Lottiidae

*Collisella instabilis* (Gould) (unstable limpet) (marine)

**Record:** Marin Co.: \*Millers Point Cave.

**Bibliography:** Rogers (2014).

*Lottia digitalis* (Rathke) (fingered limpet)

**Record:** Marin Co.: \*Rippled Window Grotto.

**Bibliography:** Rogers (2010e).

*Lottia limatula* (Carpenter) (file limpet) (marine)

**Record:** Marin Co.: \*Millers Point Cave.

**Bibliography:** Rogers (2014).

#### ORDER ARCHAEOGASTROPODA

##### Family Tegulidae

*Tegula brunnea* Philippi (brown top shell) (marine)

**Record:** San Francisco Co.: *Farallon Islands*: Funky Arch Cave.

##### Family Haliotidae

*Haliotis* sp. (abalone) (marine)

**Records:** San Diego Co.: \*White Lady Cave. **Ventura Co.:** *Anacapa Island*: \*Green Abalone Caves.

**Bibliography:** Bunnell (1988); Orr P.C. (1951b, 1952b); Halliday (1962); Vesely and Bunnell (1982b, 1986).

*Haliotis cracherodii* Leach (black abalone) (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: Fry's Harbor Cave.

**Bibliography:** Henderson (1983).

*Haliotis fulgens* Philippi (green abalone) (marine)

**Record:** Santa Barbara Co.: Point Arguello Cove East Cave.

**Bibliography:** Bunnell (1989b; 1990).

#### ORDER NEOGASTROPODA

##### Family Nassariidae

*Nassarius mendicus* (Gould) (lean western nassa) (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: cave 0.5 mi. W of Pelican Bay.

**Bibliography:** Hewatt (1946).

#### ORDER NUDIBRANCHIA (nudibranchs)

Undetermined

**Records:** Mendocino Co.: \*Hitchhiker Cave. **San Luis Obispo Co.:** \*Anemone Swiss Cheese Cave; \*Green Algae Cave.

**Bibliography:** Broeckel, B. (2006c); Vesely (1987, 1991).

**Family Cadlinidae***Cadlina limboughorum* Lance (Conrad Limbough's nudibranch) (marine).**Record:** Santa Barbara Co.: *Santa Cruz Island*: Fry's Harbor Cave.**Bibliography:** Henderson (1983).**Family Chromodorididae***Felimida macfarlandi* (Cockerell) (three-stripe doris) (marine)**Record:** Santa Barbara Co.: *Santa Cruz Island*: cave 0.5 mi. W of Pelican Bay.**Comment:** This was reported as *Chromodoris macfarlandi*.**Bibliography:** Hewatt (1946).**Family Discororididae***Jorunna pardus* Behrens and Henderson (leopard spot nudibranch) (marine)**Record:** San Diego Co.: La Jolla subterranean canyon. Santa Barbara Co.: *Santa Cruz Island*: Fry's Harbor Cave.**Bibliography:** Behrens and Henderson (1981); Bunnell (1988c); Henderson (1983).*Montereina nobilis* McFarland (sea lemon)**Record:** San Luis Obispo Co.: \*Nudibranch Cave.**Bibliography:** Vesely (1987, 1991).**Family Facelinidae***Hermisenda* sp.**Record:** San Luis Obispo Co.: \*Nudibranch Cave.**Bibliography:** Bunnell (1998); Vesely (1987, 1990).**ORDER VETIGASTROPODA****Family Fissurellidae***Diodora aspera* (Rathke) (rough keyhole limpet) (marine)**Record:** Marin Co.: \*Millers Point Cave.**Bibliography:** Rogers (2014).**ORDER BASOMMATOPHORA****Family Physidae**

Undetermined

**Record:** San Diego Co.: Midnight Creek Cave.**Family Planorbidae***Gyraulus parvus* (Say)**Record:** Fresno Co.: Boyden Cave.**Family Trimusculidae***Trimusculus reticulatus* (Sowerby) (marine)**Record:** Santa Barbara Co.: *Santa Cruz Island*: cave 0.5 mi. W of Pelican Bay.**Bibliography:** Hewatt (1946).**ORDER STYLOMMATOPHORA****Family Arionidae***Ariolimax* sp. (banana slugs)**Records:** Calaveras Co.: \*Cave of the Catacombs; Two Bit Pit. Monterey Co.: \*Willow Creek Cave. Napa Co.: Clay Cave. Santa Cruz Co.: Empire Cave; Stearns Cave; Stump Cave. Siskiyou Co.: \*Gate Lake Cave; Skunk Hollow Cave. Trinity Co.: Paul Gibson Cave. Tuolumne Co.: Crack of Doom Cave; Toppled Table Talus Cave.**Bibliography:** Besse (1972); Briggs and Ubick (1988); Broeckel, B. (2005a); Conover (2013a); Graening (2011c); McBride (1971); Weaver (2007).*Ariolimax columbianus* Gould (Pacific banana slug)**Record:** Calaveras Co.: \*Sink Cave.**Bibliography:** Rogers (1994a, 1999d).

*Ariolimax dolichophallus* Mead (slender banana slug)

**Record:** Santa Cruz Co.: \*Empire Cave.

**Bibliography:** Rogers (2013b).

#### Family Discidae

*Discus selenitoides* (Pilsbry) (file disc snail)

**Record:** Mariposa Co.: Bull Creek Cave.

*Speleodiscoides spirellum* Smith (glass coil snail)

**Records:** Amador Co.: Black Chasm; Fiddler's Cave; Hummingbird Cave; Rippled Cave; Violin Cave (type locality).  
Calaveras Co.: Sink Cave.

**Comment:** Live specimens have been found on the surface southeast of Coloma, El Dorado County, along a wooded, leaf-covered, rocky slope. The species, though eyeless, is apparently a troglophile or troglaxene.

**Bibliography:** Briggs (1974a); Miller, W.B. (1972); Rogers (1994a, 1999d); Roth, B. (1972); Smith, A.G. (1957).

#### Family Gastrodontidae

*Zonitoides arboreus* (Say) (quick gloss snail)

**Records:** Amador Co.: Root Cellar Cave; Skeleton Cave; White Room Cave. **Fresno Co.:** Boyden Cave.

#### Family Haplotrematidae

*Ancotrema sportella* (Gould) (beaded lancetooth snail)

**Records:** Amador Co.: Santa Claus Cave; Skeleton Cave. **Fresno Co.:** Boyden Cave.

*Ancotrema zopherum* Roth (lancetooth snail)

**Record:** Amador Co.: Sutter Creek Cave (type locality).

**Comment:** This species is known only from empty shells.

**Bibliography:** Roth, B. (1989).

*Haplotrema* sp. (lancetooth snail)

**Record:** Amador Co.: Skeleton Cave.

*Haplotrema costatum* Smith (costate lancetooth snail)

**Records:** Tulare Co.: Cave No. 12-19 (type locality); Crystal Sequoia Cave; Lost Soldier's Cave.

**Bibliography:** Smith, A.G. (1957).

*Haplotrema (Ancomena) minimum* (Ancey) (California lancetooth snail)

**Records:** Santa Cruz Co.: Empire Cave.

**Bibliography:** Briggs and Ubick (1988); Graham (1968a).

*Haplotrema (Haplotrema) alameda* Pilsbry (Alameda lancetooth snail)

**Records:** Amador Co.: Sutter Creek Cave. **Fresno Co.:** Cave No. 12-1. **Tulare Co.:** Cave No. 12-1. **Tuolumne Co.:** Small Cave; Snell's Cave; The Catacombs.

**Bibliography:** Smith, A.G. (1957).

*Haplotrema (Haplotrema) keepi* (Hemphill) (glassy lancetooth snail)

**Records:** Shasta Co.: caves at headwaters of Brock Creek drainage; Ancient Palace Cave; Elk Antler Cave; Samwel Cave.  
Siskiyou Co.: Corkscrew Cave.

#### Family Helminthoglyptidae

*Eremarionta argus* (Edson) (Argus Mountains desertsnailed)

**Records:** Inyo Co.: Graham Jones' Mine; Iron Gap copper mine.

**Bibliography:** Edson (1912); Pilsbry (1939).



*Helminthoglypta* sp. (shoulderband snail)

**Records:** Kern Co.: Harrington Cave. **Mariposa Co.:** Barber Cave; Bull Creek Cave; Pool Pit. **Tulare Co.:** Lost Soldier's Cave. **Tuolumne Co.:** McLean's Cave; Scorpion Cave.  
**Bibliography:** Smith, A.G. (1957); Krejca (2006).

*Helminthoglypta allyniana* (Berry)

**Record:** Tulare Co.: Lost Soldier's Cave.  
**Bibliography:** Krejca (2006).

*Helminthoglypta allyniana allyniana* (Berry)

**Records:** Mariposa Co.: Barber Cave; Bull Creek Cave; Pool Pit. **Tuolumne Co.:** McLean's Cave.  
**Bibliography:** Smith, A.G. (1957).

*Helminthoglypta crotalina* Berry (sidewinder shoulderband snail)

**Records:** San Bernardino Co.: Sidewinder Mine. **Tulare Co.:** Lost Soldier's Cave.  
**Comment:** All individuals collected in the mine were dead.  
**Bibliography:** Graening (2010); Ingram (1946); Krejca (2006); Pilsbry (1939).

*Helminthoglypta cypreophila* (Binney and Bland) (foothill shoulderband snail) (troglophile)

**Records:** Amador Co.: Connie's Cave; Hare Cave; Rippled Cave; Santa Claus Cave. **Calaveras Co.:** Cataract Gulch Cave; Cave City Cave; Cave of the Catacombs; Cone Cave; Eagle View Cave No. 1; Fenceline Cave; Grapevine Gulch Cave; Heater Cave; Kenney's Grotto; Music Hall Cave; Sink Cave. **El Dorado Co.:** \*Pink Grotto. **Fresno Co.:** Millerton Lake Cave System. **Mariposa Co.:** Bull Creek Cave. **Shasta Co.:** Elk Antler Cave; Samwel Cave. **Tuolumne Co.:** Crystal Tuolumne Cave; McNamee's Cave; Mine Cave; Pinnacle Point Cave; Railing Cave; Small Cave; The Catacombs.  
**Bibliography:** McEachern and Grady (1978); Readdy and Damon (1962); Rogers (1994a, 1999d); Smith, A.G. (1957).

*Helminthoglypta exarata* (Pfeiffer) (San Lorenzo shoulderband snail)

**Records:** Santa Cruz Co.: Santa Cruz City Cave; Stearns Cave.

*Helminthoglypta ferrissi* Pilsbry (Kings shoulderband snail)

**Records:** Fresno Co.: Boyden Cave; Church Cave.  
**Bibliography:** Smith, A.G. (1957).

*Helminthoglypta hertleini* Hanna and Smith (Oregon shoulderband snail)

**Records:** Shasta Co.: Ancient Palace Cave; Bat Cave.

*Helminthoglypta napaea* cf. *H. n. yosemitensis* (Pilsbry)

**Records:** Mariposa Co.: Bower Cave.

*Helminthoglypta nickliniana anachoreta* (Binney)

**Records:** Napa Co.: Clay Cave.

*Helminthoglypta nickliniana nickliniana* (Lee) (Coast Range shoulderband snail)

**Records:** Santa Cruz Co.: Sea cave 8 km west of Santa Cruz; Coral Grotto.

*Helminthoglypta proles* (Hemphill) (Yosemite shoulderband snail)

**Records:** Plumas Co.: Juniper Cave.  
**Bibliography:** Smith, A.G. (1957).

*Helminthoglypta talmadgei* Roth (Trinity shoulderband snail)

**Record:** Trinity Co.: Del Loma Cave.

*Helminthoglypta tularensis* (Hemphill)

**Records:** Fresno Co.: Children's Cave. **Tulare Co.:** Cave 12-19; Crystal 67 Cave; Lost Soldier's Cave; Ursa Minor Cave.  
**Bibliography:** Smith, A.G. (1957); Whitfield (1963, 1965).

*Rothelix cuyamacensis* (Pilsbry) (Cuyamaca shoulderband snail)

**Record:** San Diego Co.: San Diego Mines.  
**Bibliography:** Pilsbry (1939).

**Family Megomphicidae***Ammonitella yatesii* Cooper (tight coin snail) (troglophile)

**Records:** Calaveras Co.: Cave City Cave (type locality for genus and species); Cave of the Catacombs; Mercer Caverns.  
**El Dorado Co.:** Pioneer Cave. **Fresno Co.:** Boyden Cave; Church Cave.  
**Bibliography:** Chamberlin and Jones (1929); Cooper, J.G. (1868); Danehy (1951b); Hanna and Rixford (1923); Ingram (1946); McEachern and Grady (1978); Packard (1877); Pilsbry (1939); Roth, B. (1972); Smith, A.G. (1957); Yates (1903).

*Megomphix californicus* Smith (Natural Bridge megomphix)

**Records:** Trinity Co.: Trinity Natural Bridge and Cave (type locality).  
**Comment:** Only empty shells were found.  
**Bibliography:** Smith, A.G. (1960)

**Family Monadeniidae***Monadenia* sp. (shoulderband snail)

**Records:** Calaveras Co.: Lost Piton Cave; Scat Cave. **Mariposa Co.:** Sprinkle Cave. **Siskiyou Co.:** Bigfoot Cave.  
**Tuolumne Co.:** Crack of Doom Cave; McLean's Cave; Scorpion Cave; Toppled Table Talus Cave.

*Monadenia (Coryadenia) circumcarinata* (Stearns) (keeled sideband snail)

**Records:** Tuolumne Co.: Cave Man Cave; Sauna Pit.  
**Bibliography:** Krejca (2006); Smith, A.G. (1957).

*Monadenia (Monadenia) fidelis leonina* Berry (Pacific sideband snail)

**Record:** Siskiyou Co.: Corkscrew Cave.

*Monadenia (Corynadenia) mariposa* Smith (Mariposa sideband snail)

**Records:** Fresno Co.: Boyden Cave. **Mariposa Co.:** Barber Cave; Damp Cave; Pool Pit. **Tuolumne Co.:** McLean's Cave.  
**Bibliography:** Smith, A.G. (1957); Sphon (1971).

*Monadenia (Corynadenia) mormonum* (Pfeiffer) (Sierra sideband snail) (troglophile)

**Records:** Amador Co.: Lulu Bell Cave; Santa Claus Cave. **Calaveras Co.:** small cave near Shaw's Cave; Bay Cave; Beta Cave; Bobcat Cave; Bone Cave; Brown Deer Cave; Buckeye Cave; Carlow's Bat Cavern; Carlow's Cave; Cataract Gulch Cave; Cave City Cave; Cave of Skulls; Cave of the Catacombs; Cliff Cave; Cib Cave; Clutch Cave; Creek Cave; Crystal Stanislaus Cave; Eagle View Cave No. 1; Eagle View Cave No. 2; Fenceline Cave; Grapevine Gulch Cave; Gray Pine Cave; Keith's Chasm; Kenney's Grotto; Linda's Cave; Lost Piton Cave; Men Cave; Music Hall Cave; Porcupine Cave; Secret Cave; Shaw's Cave; Snail Cave; Wool Hollow Cave. **El Dorado Co.:** Pioneer Cave. **Fresno Co.:** Boyden Cave; Church Cave; unnamed cave in Kings Caverns Geological Area. **Mariposa Co.:** Damp Cave; Millipede Cave; Pool Pit. **Placer Co.:** Lime Rock Caves. **Tulare Co.:** Lost Soldier's Cave. **Tuolumne Co.:** "small cave"; Border Pit; Cable Pit; Crystal Palace; McLean's Cave; McNamee's Cave; Mine Cave; Pine Log Cave; Pinnacle Point Cave; Railing Cave; Robber's Cave; Scorpion Cave; Small Cave; The Catacombs; Tube Cave.

**Comment:** Most of these records are probably the subspecies *M. m. mormonum* (Pfeiffer).  
**Bibliography:** Danehy (1951a); Bosted (1994b); Broeckel (2012d); Elliott (1978); Hanna and Rixford (1923); Ingram (1946); McEachern and Grady (1978); Pilsbry (1939); Rogers (2011b); Smith, A.G. (1957).

*Monadenia (Corynadenia) tuolumneana* Berry (Tuolumne side-band snail)

**Records:** Tuolumne Co.: Crystal Butterfly Cave; Crystal Tuolumne Cave.  
**Bibliography:** Roth, B. (1972); Smith, A.G. (1957).

*Monadenia (Shastelixa) churchi* Hanna and Smith (Klamath side-band snail) (troglophile?)

**Records:** **Shasta Co.:** Ancient Palace Cave; Elk Antler Cave; Monadenia Cave; Samwel Cave. **Siskiyou Co.:** Broken Down Palace; Echoplex Cave; Hoyle's Half-Dollar Hole; Planetary Dairy Cave; Skunk Hollow Cave; Stash Talus Cave; Trail Junction Cave; Wahashin Cave. **Trinity Co.:** Del Loma Cave; Hall City Cave; Trinity Natural Bridge and Cave.

**Bibliography:** Graening (2011c); Roth, B. (1981).

*Monadenia (Shastelixa?) marmarotis* Berry (troglophile?)

**Records:** **Siskiyou Co.:** Bighorn Cave; Marble Gap Cave; Planetary Dairy Cave; Skunk Hollow Cave; Trail Junction Cave; Upstairs-Downstairs Cave.

**Bibliography:** Roth, B. (2001); Rudolph et al. (1985); Suggett (1982).

*Monadenia (Shastelixa) troglodytes* Hanna and Smith (Shasta sideband snail) (troglophile)

**Records:** **Shasta Co.:** Bat Cave

**Comment:** Danchy (1951b) cited Hanna and Smith (1933) as believing this species to be extinct. It has been collected in many caves in recent years and we have also collected it on the surface 48 and 56 km northeast of Redding, Shasta County.

**Bibliography:** Danchy (1951b); Hanna and Smith (1933); Pilsbry (1939); Smith, A.G. (1957).

*Monadenia (Shastelixa) troglodytes troglodytes* Hanna and Smith (troglophile)

**Records:** **Shasta Co.:** Chute Cave; Crystal-Shasta Cave; Potter Creek Cave; Samwel Cave (type locality); Shasta Lake Caverns.

**Bibliography:** Danchy (1951b); Hanna and Smith (1933); Pilsbry (1939); Roth, B. (1981); Smith, A.G. (1957).

*Monadenia (Shastelixa) troglodytes wintu* Roth (troglophile)

**Records:** **Shasta Co.:** caves at headwaters of Brock Creek drainage; unnamed cave in Brock Creek Limestone; shelter below and to left of Goblin Shelter; unnamed cave in gray rocks on NE-SW trending ridge; unnamed cave between two limestone buttes at south end of Gray Rocks (type locality); caves above Pit River arm of Shasta Lake; Elk Antler Cave; Monadenia Cave.

**Bibliography:** Roth, B. (1981).

**Family Polygyridae***Trilobopsis roperi* (Pilsbry) (Shasta chaparral snail)

**Records:** **Shasta Co.:** Elk Antler Cave.

*Vespericola shasta* (Berry) (Shasta hesperian snail)

**Records:** **Shasta Co.:** Monadenia Cave.

**Comment:** We have also collected this species in McCloud River Canyon, 56 km northeast of Redding.

**Family Pristolomatidae***Pristiloma* sp.

**Records:** **Shasta Co.:** Shasta Lake Caverns. **Tuolumne Co.:** Snell's Cave; Windeler Cave.

*Pristiloma* cf. *nicholsoni* Baker

**Record:** **Santa Cruz Co.:** IXL Cave.

*Pristiloma cavator* Roth (excavator snail)

**Record:** **Shasta Co.:** Samwel Cave (type locality).

**Comment:** The species is known only from empty shells.

**Bibliography:** Roth, B. (1998).

*Pristiloma chersinella* (Dall) (black-footed tight coil snail)

**Record:** **Tuolumne Co.:** McLean's Cave.

**Bibliography:** Smith, A.G. (1957).



*Pristiloma gabrielinum* (Berry) (waxy tightcoil snail)

**Records:** Fresno Co.: Boyden Cave; Church Cave; Windy Cliff Cave.

**Bibliography:** Smith, A.G. (1957).

*Pristiloma spelaeum* (Dall) (tightcoil snail) (troglophile)

**Records:** Amador Co.: Black Chasm; Connie's Cave; Fern Frond Cave; Fiddler's Cave; Lulu Bell Cave; Mushroom Cave; Rippled Cave; Santa Claus Cave; Violin Cave. **Calaveras Co.:** Carlito's Cave; Carlow's Bat Cavern; Cave City Cave (type locality); Eagle View Cave No. 1; Music Hall Cave. **Plumas Co.:** Juniper Cave (= Kloppenberg Caverns) (type locality of *Pristiloma juniperum*).

**Comment:** Binney (1885) reported *Zonites indentatus* Say from "caves at Cave City." This almost certainly refers to this species, which is common in the limestone areas of Calaveras County and was not described until 10 years after Binney's citation. *Zonites indentatus* (now assigned to genus *Retinella* or *Glyphyalinia*) is not otherwise known from California. Dall distinguished *spelaeum* from *indentata* in the original description (B. Roth, pers. comm.).

**Bibliography:** Binney (1885); Bosted (1994b); Dall (1895); McEachern and Grady (1978); Smith, A.G. (1957).

#### Family Punctidae

*Punctum californicum* Pilsbry (ribbed spot snail)

**Record:** Calaveras Co.: Mercer Caverns.

**Bibliography:** Ingram (1949); Pilsbry (1948).

#### Family Vertiginidae

*Vertigo* sp.

**Records:** Shasta Co.: unnamed cave in Gray Rocks. **Tuolumne Co.:** Vulture Cave.

### CLASS CEPHALOPODA

#### ORDER OCTOPODA

Undetermined

**Record:** Marin Co.: \*El Reyes Cave (dead). **San Diego Co.:** \*White Lady Cave.

**Bibliography:** Leissring (2010); Vesely and Bunnell (1982b, 1986).

### PHYLUM ARTHROPODA SUBPHYLUM CRUSTACEA

#### CLASS MAXILLIPODA

#### SUBCLASS COPEPODA

Undetermined

**Record:** Siskiyou Co.: Adam's Homestead Cave.

**Bibliography:** Hammond (1994).

#### SUBCLASS THECOSTRACA (barnacles)

Undetermined

**Records:** Mendocino Co.: \*Sanctuary Cave. **Santa Barbara Co.:** *Santa Cruz Island:* Baby's Harbor Cave; \*Deathtrap Cave; \*Painted Cave; \*Surprise Blowhole Cave. **San Luis Obispo Co.:** \*Caverns of Mystery. **Ventura Co.:** *Anacapa Island:* \*Happy Lobster Cave.

**Bibliography:** Broeckel, B. (2006c); Bunnell (1982, 1988c, 1993b, 2000a); Bunnell and Vesely (1982); Orr, P.C. (1951b, 1952b).

#### ORDER PEDUNCULATA (gooseneck barnacles)

Undetermined

**Records:** Marin Co.: \*Seal Sleep Cave. **San Francisco Co.:** \*Creeping Ceiling Cave. **San Luis Obispo Co.:** \*Sea Maze Cave. **Santa Barbara Co.:** *Santa Cruz Island:* \*Mussel Cave; \*Shipwreck Cave. **Santa Cruz Co.:** \*Surfing Tunnel Sea Cave.

**Bibliography:** Bosted (1984); Bunnell (1985, 1987, 1988a, 1988c, 2013); Rogers (2013d).

#### Family Lepadidae

*Lepas anatifera* Linnaeus (pelagic gooseneck barnacle)

**Record:** Marin Co.: \*Pink Anemone Cave.

**Bibliography:** Rogers (2013c).

**Family Pollicipedidae***Pollicipes polymerus* (Gmelin) (marine)**Records:** Marin Co.: \*El Reyes Cave; \*Millers Point Cave; \*Pink Anemone Cave; \*Seal Sleep Cave. San Francisco Co.: Farallon Islands: Breaker Cove Cave.**Bibliography:** Rogers (2010d, 2010e, 2013c, 2014).**ORDER SESILLA (acorn barnacles)****Family Balanidae***Balanus glandula* Darwin (marine)**Record:** Marin Co.: \*El Reyes Cave; \*Grotto 249; Millers Point Cave; \*Seal Sleep Cave.**Bibliography:** Rogers (2010d, 2010e, 2013c, 2014).**CLASS MALACOSTRACA****ORDER BATHYNELLACEA****Family Bathynellidae***Bathynella fraterna* Cho and Kim (phreatobite)**Record:** San Diego Co.: San Clemente Canyon Park, La Jolla (type locality).**Comment:** This species was taken from a 60 cm deep pit in a dry stream bed in San Clemente Park, La Jolla.**Bibliography:** Cho and Kim (1997).*Bathynella germanitas* Cho and Kim (phreatobite)**Record:** San Diego Co.: San Clemente Canyon Park, La Jolla (type locality).**Comment:** This species was taken from a 60 cm deep pit in a drained stream bed.**Bibliography:** Cho and Kim (1997).*Pacificabathynella sequoiae* Schminke and Noodt (phreatobite)**Record:** Marin Co.: Redwood Creek, Muir Woods National Monument (type locality).**Comment:** This species was taken from a 50 cm deep pit on the gravelly bank of Redwood Creek. The site is not in Mt. Tamalpais State Park as stated in the description, but in the adjacent National Monument.**Bibliography:** Camacho, Newell, and Reid (2013); Schminke and Noodt (1988).**Family Parabathynellidae***Califobathynella noodti* Cho (phreatobite)**Record:** San Diego Co.: dry stream bed in San Clemente Canyon Park (type locality).**Comment:** This species was taken from a 60 cm deep pit in coarse sand.**Bibliography:** Cho (1997).*Califobathynella teucherti* Cho (phreatobite)**Record:** Los Angeles Co.: Hot Spring River, Los Angeles (type locality).**Comment:** This species was taken from a 60 cm deep pit in gravel.**Bibliography:** Cho (1997).*Californibathynella californica* (Schminke and Noodt) (phreatobite)**Record:** San Diego Co.: Otay Reservoir (type locality, "Otay-Reservoir").**Comment:** This species was taken from a 1.2 m deep pit on the gravelly bank of a stream discharging into the reservoir.**Bibliography:** Schminke and Noodt (1988).*Hexabathynella hessleri* Cho (phreatobite)**Record:** San Diego Co.: San Diego River, 500 m downstream from dam of El Capital Reservoirs (type locality).**Comment:** This species was taken from a 1.60 m deep pit in a dry river basin.**Bibliography:** Camacho (2004); Cho (2001); Cho and Schminke (2006).*Hexabathynella muliebris* Cho (phreatobite)**Record:** Los Angeles Co.: Hot Spring River, under the bridge of interstate highway 15, ca. 1 km from the junction of interstate 15 and 15E (type locality).

**Comment:** This species was taken from a 50 cm deep pit in gravel.

**Bibliography:** Camacho (2004); Cho (2001) Cho and Schminke (2006).

*Hexabathynella otayana* Cho (phreatobite)

**Record: San Diego Co.:** stream in Otay Reservoir (type locality).

**Comment:** This species was taken from a 120 cm deep pit, 5 m from the inner margin of a gravel bank.

**Bibliography:** Camacho (2004); Cho (2001); Cho and Schminke (2006).

*Texanobathynella sachi* Cho (phreatobite)

**Record: San Diego Co.:** San Clemente Canyon Park, La Jolla (type locality).

**Comment:** This species was taken from a 60 cm deep pit on a drained stream bed.

**Bibliography:** Camacho, Stanford, and Newell (2010); Cho (1996).

#### ORDER ISOPODA SUBORDER ASELLOTA

##### Family Asellidae Undetermined

**Records: Tuolumne Co.:** Experimental Mine Cave. **Ventura Co.:** Clear Springs Cave.

*Bowmanasellus sequoiae* (Bowman) Big Spring Isopod (stygobite)

**Records: Tulare Co.:** Big Spring; Crystal Sequoia Cave; Hurricane Crawl Cave; Kuala Spring; Lange Spring; Lilburn Cave (type locality); Mossy Spring; spring below Hurricane Crawl Cave.

**Bibliography:** Bowman (1976); Campbell and Juarez (1979); Despain (1993, 1994, 2003a, 2006); Despain and Fryer (2002); Graening and Rogers (2013); Henry, Lewis, and Magniez (1986); Krejca (2006, 2008, 2009b, 2009c); Lewis (2001, 2008, 2009a, 2009b); Lewis, Martin, and Wetzer (2003).

*Caecidotea* n. sp. (stygobite)

**Record: Santa Cruz Co.:** Empire Cave.

**Bibliography:** Graening and Rogers (2013); Rogers (2010c); Wang and Holsinger (2001).

*Caecidotea tomalensis* (Harford) Tomales Bay Isopod

**Record: Humboldt Co.:** well.

**Bibliography:** Graening and Rogers (2013); Holmes (1904); Lewis (2001).

*Calasellus* sp. (phreatobite)

**Records: Madera Co.:** Rock Creek Spring, adjacent to Minarets Road near Rock Creek Campground.

**Napa Co.:** Bell Creek Site BE03; Cyrus Creek Site CY-03-01; Diamond Mountain Creek; Heath Canyon; Milliken Creek at Westgate; Nash Creek; Pickle Creek Site PI-03; Rector Creek; Ritchey Creek; Soda Creek Site SO-03; upper Napa River at Tubbs Lane (Calistoga). **Tuolumne Co.:** Pinnacle Point Cave.

**Comment:** The Madera County record may be an undescribed species or belong to *C. longus*.

**Bibliography:** Graening and Rogers (2013).

*Calasellus californicus* (Miller) (phreatobite)

**Records: Alameda Co.:** arroyo in Livermore, Wente St. near Concannon Winery. **El Dorado Co.:** Knickerbocker Creek spring tributary, 1 mi. W of Hwy. 49. **Lake Co.:** well on William Tuttle Ranch near Kelseyville (type locality). **Marin Co.:** gravel bed of Cronan Creek. **Mendocino Co.:** Sugar Creek, Angelo Coast Range Reservoir; Garcia Creek. **Napa Co.:** mouth of spring under house in Napa; Napa River at Bale Lane; unnamed spring 9 mi. N of Napa; Bell (Canyon) Creek; Cyrus Creek; Diamond Mountain Creek; Heath Canyon; Milliken Creek at Westgate; upper Napa River at Tubbs Lane (Calistoga); Nash Creek; Pickle Creek; Rector Creek; Ritchey Creek; Soda Creek. **Santa Clara Co.:** springs of Black Creek on Black Mountain SW of Los Gatos; Coyote Creek at Gilroy Hot Springs; Los Gatos Creek below Lake Elsman. **Santa Cruz Co.:** Empire Cave; Stump Spring, Wilder Ranch State Park.

**Bibliography:** Bowman (1974, 1976, 1981); Chappuis (1950, 1953, 1955); Clifford and Bergstrom (1976); Cole and Minckley (1972); Fleming (1973); Graening and Rogers (2013); Henry and Magniez (1970); Henry, Lewis, and Magniez (1986); Lewis (2001, 2009a); Lewis, Martin, and Wetzer (2003); Miller, M.A. (1933); Miller and Hoy (1939); Nicholas (1960); Steeves (1963, 1969); Ubick (2001); Van Name (1936, 1940); Vandel (1950); Wang and Holsinger (2001).



*Calasellus longus* Bowman (phreatobite)

**Record:** Fresno Co.: unnamed spring at Shaver Lake.

**Comment:** Shaver Lake is an artificial reservoir on a tributary of the San Joaquin River in Sierra National Forest. This species presumably inhabited springs or caves now inundated.

**Bibliography:** Bowman (1981); Roth, J. (1999); Graening and Rogers (2013); Henry, Lewis, and Magniez (1986); Lewis (2001, 2009b); Lewis, Martin, and Wetzer (2003).

**SUBORDER ONISCIDEA (terrestrial isopods)**

## Undetermined Oniscidea (troglobite)

**Records:** Calaveras Co.: O'Neil's Cave (King Tut Cave). **Contra Costa Co.:** rockshelters on Carquinez Strait shoreline. **San Francisco Co.:** \*Brigadune Cave, \*Sutro Baths Cave. **Siskiyou Co.:** Harris Mountain Cave. **Trinity Co.:** Paul Gibson Cave. **Ventura Co.:** \*Clear Springs Cave.

**Bibliography:** Bailey (2008); Jorgensen and Rogers (2008); Krejca (2006); Rogers (2005c).

## Oniscidea n. sp.?

**Records:** Inyo Co.: Lower Shoshone Cave; Upper Shoshone Cave.

**Bibliography:** Briggs and Hom (1972); McFarlane (1990).

**Family Armadillidiidae (pillbugs)**

## Undetermined

**Record:** San Benito Co.: Balconies Cave.

**Family Ligiidae (rock lice, wood lice)***Ligia occidentalis* Dana (marine)

**Record:** San Mateo Co.: Your Fault Cave.

**Bibliography:** Rogers (2009b).

*Ligidium kofoidi* Maloney (troglobite)

**Records:** Shasta Co.: Alien Space Cave; Ancient Palace Cave; Bat Mummy Cave; Burnt Elderberry Cave; Christmas Tree Cave; Elisha Cave; North Christmas Tree Cave; Planetarium Cave; Potter Creek Cave (type locality); Rusty Cave; Samwel Cave; Subway Cave; USFS Cave #32; Wilcox Cave.

**Bibliography:** Danehy (1951b); Graham (1962d); Jass and Klausmeier (2000); Maloney (1930); Miller, M.A. (1938); National Park Service (2004); Nicholas (1960); Schultz (1964, 1970); Sinclair (1904); Van Name (1936); Vandel (1950); Wolf (1934–1937).

**Family Porcellionidae (sow bugs)***Porcellio* cf. *scaber* Latreille

**Record:** Shasta Co.: Potter Creek Cave.

**Bibliography:** Sinclair (1904).

*Porcellio dilitatus* Brandt

**Records:** Napa Co.: Clay Cave. **San Bernardino Co.:** old mine near Mitchell Caverns; Medicine Cave. **Santa Clara Co.:** Joaquin Murrieta's Cave.

**Family Trichoniscidae**

## Undetermined

**Records:** San Bernardino Co.: Kokoweef Cave. **Siskiyou Co.:** Catacombs Cave; Coral Reef Cave; Maze Cave. **Tulare Co.:** Clough Cave; Crystal Sequoia Cave; Hidden Cave; Hurricane Crawl Cave; Kaweah Cave; Lost Soldier's Cave; Overhang Cave; Paradise Cave.

**Comment:** Some of these records may be *Brackenridgia*.

**Bibliography:** Despain (1993, 2003a, 2003b, 2006); Despain and Fryer (2002); Hunter (2011b); Jorgensen (2009); Krejca (2006, 2009b); Shear, Taylor, Wynne, and Krejca (2009); Taylor and Krejca (2006); Taylor, Krejca, and Jacoby (2006).

*Brackenridgia heroldi* (Archangeli) (troglophile)

**Records:** Calaveras Co.: Beta Cave; Bobcat Cave; Carlito's Cave; Cone Cave; Eagle View Cave No. 1; Gerritt's Cave;

Grapevine Gulch Cave; Mercer Caverns; Moaning Cave; Music Hall Cave; Secret Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Fresno Co.:** Beauty Cave; Boyden Cave; Church Cave; Saturday Cave. **Inyo Co.:** Titus Canyon Cave. **San Bernardino Co.:** Virginia's Mine Cave. **Santa Cruz Co.:** Dolloff Cave; Empire Cave; IXL Cave; Stearns Cave; Stump Cave. **Tulare Co.:** Rattlesnake Cave; Ursa Minor Cave. **Tuolumne Co.:** Crystal Palace; McLean's Cave; Scorpion Cave; Transplant Mine; Windeler Cave.

**Comment:** This isopod, though blind and depigmented, was originally known from the sea shore at San Mateo, San Mateo County, and up to 1200 m in Muir Woods, Marin County. It occurs in leaf litter and other organic debris. It was transplanted from McLean's Cave to the Transplant Mine. The other species in the genus, all troglotitic, are known from Arizona, New Mexico, Texas, and eastern Mexico.

**Bibliography:** Bosted (1994b); Briggs (1975, 1987, 1991); Elliott (1978); Graening (2010); Krejca (2006, 2009); Lewis (2004); McEachern and Grady (1978); Reddell (1981); Rogers (2004b, 2010b, 2010c); Rogers and Legg  (1987, 1995); Schultz (1981); Ubick (2001).

## ORDER AMPHIPODA

Undetermined

**Records:** **Amador Co.:** Skeleton Cave. **Siskiyou Co.:** Daystream Cave; Skunk Hollow Cave. **Ventura Co.:** Clear Springs Cave.

**Bibliography:** Graening (2011c).

## Family Crangonyctidae

*Stygobromus* spp.

**Records:** **Alameda Co.:** Palo Seco Creek; San Leandro Creek Site SLC 4. **Butte Co.:** Sucker Run Creek, near Forbestown. **Calaveras Co.:** spring 5 km southeast of Angel's Camp; Grapevine Gulch Cave. **Contra Costa Co.:** Reliez Creek at 3400 Springdale Road; San Leandro Creek at Canyon School; San Leandro Creek at Huckleberry Park; Wildcat Creek at Big Springs. **El Dorado Co.:** North Cosumnes River and tributary seeps at Sciaroni Crossing, 3 km N of Grizzly Flat; North Cosumnes River, spring tributary upstream of Meiss, 18 km E of Grizzly Flat; Harrel Fire Tank spring tributary to Long Canyon 5 km NE of Grizzly Flat; Big Canyon Creek, 5 km E of Grizzly Flat; south bank of North Cosumnes River, about 3 km W of Capps Crossing; Snow Creek, 13 km E of Jenkinson Reservoir; Knickerbocker Creek spring tributary, 1 mi. W of Hwy. 49; Singleton Springs, headwaters of North Cosumnes River; Stump Spring, 16 km E of Jenkinson Reservoir. **Glenn Co.:** Cold Creek, 1.3 mi. above confluence with Plasket Creek. **Humboldt Co.:** Mason Gulch at Hwy. 299 (upper Willow Creek); Red Mountain Creek, Forest Service Road 10N12; South Fork Eel River above Briceland Bridge; Redwood Creek, 0.4 mi. above South Fork Eel River; Sholes Creek, 1.7 mi. above confluence with Mattole River; Squaw Creek, 0.3 mi. above Bull Creek. **Lake Co.:** Rice Fork Creek below Bear Creek confluence; Highland Creek. **Lassen Co.:** Ash Creek. **Los Angeles Co.:** Lower Santa Monica Canyon and Elizabeth Canyon. **Marin Co.:** Bill Williams Creek, 5 km NW of Corte Madero; Gerbode Valley. **Mendocino Co.:** Sugar Creek, Angelo Coast Range Reserve headquarters; Elder Creek, north of Branscomb, Nature Conservancy Reserve; Mud Creek 1 mi. above South Fork Eel River; North Fork of South Fork Noyo River, 0.2 mi. above confluence; Redwood Creek above Mill Creek. **Modoc Co.:** Canyon Creek at Hwy. 71. **Mono Co.:** Swauger Creek; upper Owens River at Big Springs, Inaya, and EBASCO site. **Monterey Co.:** Arnold Spring; San Clemente Creek, 1.3 mi. above Black Rock Creek. **Napa Co.:** Browns Valley Creek; Carneros Creek; Kimball Creek; Kreuse Creek; Napa River; Pickle Creek; Ritchey Creek; Sarco Creek; Sulphur Creek; York Creek. **Placer Co.:** Miners Ravine. **Plumas Co.:** Grizzly Creek, near Walker Mine, 19 km east of Quincy; Chips Creek. **San Luis Obispo Co.:** Arroyo de la Cruz at Hwy. 1; Coon Creek at Pecho Valley Rd. **Santa Clara Co.:** Upper Stevens Creek; Chestnut Picnic Area, Stevens Creek County Park. **Santa Cruz Co.:** Empire Cave. **Shasta Co.:** Bear Creek, Parkeville Rd., 8.5 mi S of Millville; Brandy Creek above South Shore Drive. **Sierra Co.:** Yuba River, 0.9 mi. downstream of Indian Creek. **Siskiyou Co.:** Fall Creek (tributary to Klamath River); above and below PacificCorp's bypass; Yreka Creek above Interstate 5; Scott River above Etna Creek. **Sonoma Co.:** Blue Spring, Geyserville area; Big Sulphur Creek, 1.2 mi. above Geyser Canyon Creek; Gilliam Creek. **Stanislaus Co.:** Orestimba Creek above Orestimba Road. **Trinity Co.:** unnamed, intermittent creek on Hwy. 299, river mile mark 16.23; Grassy Flat Creek, 0.2 mi. upstream of Hayfork Creek. **Tuolumne Co.:** spring 5.5 km southeast of Sonora. **Ventura Co.:** Lion Canyon, Tule Creek, and Piru Creek. **Yolo Co.:** Cache Creek.

**Bibliography:** Breaux, Born, Suer, Cochran, and Looker (2005); Cressey and Sommers (2004); Graening, Rogers, Holsinger, Barr, and Bottorff (2012).

*Stygobromus* n. sp. (*hubbsi* group) (phreatobite)

**Record:** **Los Angeles Co.:** Malibu Creek.

**Comment:** This species was taken from benthic sampling.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012).

*Stygobromus* n. sp. aff. *mackenziei* Holsinger (phreatobite?)

**Records:** Stanislaus Co.: Tuolumne River (River Mile 25.4, 31.5, 38.1, 42.3, 43.2, 48.8, 51.6 from confluence with San Joaquin River.

**Comment:** These specimens were from benthic samples.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Stillwater Sciences (2009).

*Stygobromus* n. sp. cf. *mackenziei* Holsinger (phreatobite?)

**Records:** Santa Clara Co.: creeks above Almaden Reservoir; Los Gatos Creek below Lake Elsmar; Saratoga Creek at Tollgate Road.

**Comment:** These specimens were probably washed out of sediments, in riffles, or seeps.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012).

*Stygobromus* n. sp. aff. *sierrensis* Holsinger (phreatobite)

**Record:** Modoc Co.: unnamed spring at the Stough Reservoir Campground, Warner Mountains, Modoc National Forest.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012).

*Stygobromus* n. sp. no. 1 (phreatobite)

**Record:** Sonoma Co.: unnamed spring, just east of Maacama Creek Bridge, 19.5 km east of Geyserville.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Wang and Holsinger (2001).

*Stygobromus* n. sp. no. 2 (phreatobite)

**Record:** San Benito Co.: Balconies Cave Spring and Oak Tree Spring, Pinnacles National Park.

**Comment:** This material may represent more than one new species.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012).

*Stygobromus cherylae* Wang and Holsinger (phreatobite)

**Records:** Sonoma Co.: unnamed spring, just east of Maacama Creek Bridge, 19.5 km east of Geyserville (type locality).

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Wang and Holsinger (2001).

*Stygobromus cowani* Wang and Holsinger (phreatobite)

**Record:** Napa Co.: unnamed spring, Soda Canyon Road, approximately 6.4 km N of junction with Silverado Trail and about 6.4 km E of Yountville (type locality).

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Wang and Holsinger (2001).

*Stygobromus gallawayae* Wang and Holsinger (phreatobite)

**Record:** Butte Co.: unnamed spring on Rock Creek, about 20.8 km N of Chico.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Wang and Holsinger (2001).

*Stygobromus gradyi* Holsinger (stygbite)

**Records:** Amador Co.: Fern Frond Cave; Lulu Bell Cave; Masonic Cave. **Tuolumne Co.:** small unnamed spring 14.8 km southeast of Angels Camp; Crystal Palace (type locality).

**Comment:** This species inhabits intermittent streams in the upper section of Crystal Palace.

**Bibliography:** Arnett (1984); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1977, 1986).

*Stygobromus grahami* Holsinger (stygbite)

**Records:** Amador Co.: Fern Frond Cave; Masonic Cave; Soldier Creek Cave. **Calaveras Co.:** Cave City Cave; Cave of the Catacombs (type locality); Shaw's Cave; Sink Cave. **El Dorado Co.:** Bacon Creek Spring.

**Comment:** Collection data indicate that this species reproduces at least during the spring and summer. Most of the animals were found in pools, some of which fluctuate seasonally. The Fern Frond Cave population may be a new, but closely related species.

**Bibliography:** Culver, Christman, Elliott, Hobbs, and Reddell (2000); Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1977, 1986); Wang and Holsinger (2001).



*Stygobromus harai* Holsinger (stygobite)

**Records:** Tuolumne Co.: mine tunnel near Pinnacle Point Cave; unnamed spring, 15 km SE of Sonora; Pinnacle Point Cave (type locality); Windeler Cave.

**Bibliography:** Arnett (1984); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1977, 1986); Elliott (1978); Wang and Holsinger (2001).

*Stygobromus hyporheicus* Wang and Holsinger (phreatobite)

**Record:** Marin Co.: gravel-bed of intermittent stream, Cronan Creek (type locality).

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Wang and Holsinger (2001).

*Stygobromus imperialis* Wang and Holsinger (stygobite)

**Record:** Santa Cruz Co.: Empire Cave (type locality).

**Bibliography:** Briggs (1990); Briggs and Ubick (1988); Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Rogers (2010c); Wang and Holsinger (2001).

*Stygobromus lacicolus* Holsinger (phreatobite, nectobenthic?)

**Record:** Placer Co.: Lake Tahoe, McKinney Bay; Lake Tahoe, Tahoe City area.

**Comments:** Fantz and Cordone (1966) recorded this species as *S. hubbsi*. The species is also known from Douglas and El Dorado counties, Nevada (also in Lake Tahoe). Specimens were taken from depths of 65 to 355 m.

**Bibliography:** Caires, Chandra, Wittmann, and Schladow (2010); Frantz and Cordone (1966); Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1986); Wang and Holsinger (2001).

*Stygobromus mackenziei* Holsinger (stygobite)

**Record:** Santa Cruz Co.: Empire Cave (type locality).

**Comment:** This or a closely related species has been collected from Montgomery Spring, Santa Barbara County.

**Bibliography:** Arnett (1984); Briggs and Ubick (1988); Elliott (1984); Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1977, 1986); Ubick (2001); Wang and Holsinger (2001);.

*Stygobromus myersae* Wang and Holsinger (phreatobite)

**Records:** Inyo Co.: unnamed hillside spring ca. 7 km S of Black Canyon Spring; Black Canyon Spring (type locality).

**Comment:** This species is also known from Log Spring in Esmeralda County, Nevada.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Wang and Holsinger (2001).

*Stygobromus mysticus* Holsinger (phreatobite)

**Record:** Siskiyou Co.: Subterranean habitat at Greenview (type locality).

**Comment:** The habitat is possibly a well.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1977, 1978, 1986); Wang and Holsinger (2001).

*Stygobromus rudolphi* Wang and Holsinger (2001) (phreatobite)

**Record:** Santa Barbara Co.: Montgomery Spring (type locality).

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Wang and Holsinger (2001).

*Stygobromus sheldoni* Holsinger (phreatobite)

**Records:** Nevada Co.: bog spring tributary to Sagehen Creek (type locality); Station Spring at Sagehen Field Station; three other springs along Sagehen Creek. **Sierra Co.:** Sardine Spring.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1977); Wang and Holsinger (2001).

*Stygobromus sierrensis* Holsinger (phreatobite)

**Record:** Sierra Co.: spring in Trosi Canyon (likely Sardine Spring); unnamed spring 4 km SE of Sardine Spring.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1977, 1986); Wang and Holsinger (2001).

*Stygobromus* sp. nr. *cowani* Wang and Holsinger (phreatobite)

**Records:** Contra Costa Co.: Wildcat Creek. Napa Co.: Tukukey Creek (Tulukey Creek).

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff. (2012).

*Stygobromus tahoensis* Holsinger (phreatobite, nectobenthic?)

**Records:** El Dorado Co.: Lake Tahoe, Emerald Bay; Lake Tahoe, South Tahoe shelf. Placer Co.: Lake Tahoe, center of lake (type locality); Lake Tahoe, McKinney Bay; Lake Tahoe, Tahoma.

**Comment:** This species has also been found in Lake Tahoe in Douglas and Washoe Counties, Nevada. Frantz and Cordone (1966) earlier reported this as *Stygobromus hubbsi*. This and *S. lacicolus* are the first phreatobitic amphipods reported from a deep oligotrophic lake. Specimens were taken from depths of 35 to 495 m.

**Bibliography:** Caires, Chandra, Wittmann, and Schladow (2010); Frantz and Cordone (1966); Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1986); Wang and Holsinger (2001).

*Stygobromus trinus* Wang and Holsinger (stygbite)

**Record:** Trinity Co.: Hall City Cave (type locality).

**Comment:** This species was collected from wood debris near the edge of a deep pool.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Wang and Holsinger (2001).

*Stygobromus wengerorum* Holsinger (stygbite)

**Records:** Mariposa Co.: Bower Cave (type locality); Centipede Cave.

**Comment:** Specimens were collected by divers at depths of 20 to 38 m in Bower Cave.

**Bibliography:** Graening, Rogers, Holsinger, Barr, and Bottorff (2012); Holsinger (1974, 1977, 1986); Kenk (1977); Wang and Holsinger (2001).

#### Family Hyalellidae

*Hyalella* n. sp.

**Record:** Inyo Co.: Sponge Cave.

#### Family Talitridae

*Megalorchestia californiana* Brandt

**Records:** San Francisco Co.: \*Brigadune Cave. San Mateo Co.: \*San Gregorio Point Cave.

**Bibliography:** McCoy (2011); Rogers (2010g); Rogers, Jorgensen, and Helton (2011).

### ORDER DECAPODA

#### INFRAORDER ASTACIDEA

##### Family Cambaridae

*Procambarus (Scapulicambarus) clarkii* (Girard)

**Record:** San Diego Co.: Monte Verde Cave.

#### INFRAORDER ACHELATA

##### Family Palinuridae

*Panulirus interruptus* (J.W. Randall) (California spiny lobster)

**Records:** Santa Barbara Co.: *Santa Cruz Island*: \*Diablo Anchorage Cave; \*Seal Canyon Cave; \*Lost Lobster Caves. Ventura Co.: *Anacapa Island*: \*Happy Lobster Cave; \*?Respiring Chimney Cave.

**Comment:** Some of these records are of "lobsters," but probably belong to this species.

**Bibliography:** Anonymous (1987b, 1990e); Bunnell (1988c, 2000a–b); Bunnell and Vesely (1983, 1986, 1990), Henderson (1983); Pistole (1990).

#### INFRAORDER BRACHYURA

Undetermined (crabs)

**Record:** San Francisco Co.: \*Sutro Baths Cave.

**Bibliography:** Bailey (2008).

Undetermined (hermit crabs)

**Record:** San Diego Co.: \*Sunset Cliffs Sea Cave.

**Bibliography:** Anonymous (1991d).

**Family Galatheidae***Pleuroncodes planipes* Stimpson (pelagic red crab) (marine)**Records:** Santa Barbara Co.: *Santa Cruz Island*: Diablo Anchorage Cave.**Bibliography:** Bunnell and Vesely (1983), Henderson (1983).**Family Xanthidae***Cycloxanthops novemdentatus* (Stimpson)**Record:** San Diego Co.: Littoral caves at La Jolla Cove.**Bibliography:** Knudson (1960).**CLASS ARACHNIDA****ORDER SCORPIONES (scorpions)**

Undetermined

**Records:** Amador Co.: \*Moss Cave. Calaveras Co.: Crystal Stanislaus Cave; \*Lost Piton Cave. Fresno Co.: Millerton Lake Cave System. Inyo Co.: ARC No. 2; Keane Travertine Cave. Kern Co.: Upper and Middle Greenhorn Caves. San Bernardino Co.: Cima Cave; \*Glove Cave. Santa Cruz Co.: Vanished River Cave. Shasta Co.: Bat Mummy Cave; Rusty Cave. Siskiyou Co.: Wahashin Cave. Tulare Co.: Clough Cave; \*Crystal Sequoia Cave; Kaweah Cave; Overhang Cave; Walk Softly Cave; Wiessraum Cave; Windy Pit.**Bibliography:** Bauman (2011); Graening (2010); Harter (1990, 1992a); Harter and Moon (1985); Hunter (2011b); Jackson, M. (2011b); Krejca (2006); Rogers (2015); Winterath (1970b; 1971).**Family Vaejovidae***Graemelowius glimmi* (Hjelle)**Records:** Shasta Co.: Shasta Lake Caverns.*Graemelowius iviei* (Gertsch and Soleglad) (troglophile?)**Records:** El Dorado Co.: "Crystal Cave" (probably Crystal Cosumnes Cave). Plumas Co.: Soda Springs Cave. Shasta Co.: Potter Creek Cave; Samwel Cave.**Comment:** Specimens were collected from the latter two caves in the entrance area. A male was collected 500 m into Crystal Cave under a stone. This is a small, brown scorpion known from the foothills and mountains of northern California.**Bibliography:** Gertsch and Soleglad (1972); Sissom and Reddell (2009).*Serradigitus gertschi striatus* (Hjelle)**Records:** Calaveras Co.: Diane's Cave. Tuolumne Co.: Confluence Cave; Indian Quarry Cave No. 2; Scorpion Cave; Vulture Cave.**Bibliography:** Sissom and Reddell (2009).*Smeringerus vachoni vachoni* Stahnke**Record:** Inyo Co.: Upper Shoshone Cave.*Stahnkeus subtilimanus* (Soleglad)**Record:** San Bernardino Co.: Scatard Cave.*Uroctonites sequoia* (Gertsch and Soleglad) (troglophile)**Records:** Tulare Co.: Clough Cave (type locality); Windy Pit.**Comment:** This reddish-brown, average-sized species is related to *U. monterus*. The median eyes are small and the third lateral eye is obsolete. It is known only from the type locality.**Bibliography:** Despain (2003b); Gertsch and Soleglad (1972); Hargreaves (2004b); Sissom and Reddell (2009).*Uroctonus grahami* Gertsch and Soleglad (troglobite)**Records:** Shasta Co.: Samwel Cave (type locality).**Comment:** This scorpion has reduced median eyes and was compared by the authors to the European *Belisaurus* as "probably endogean in habit." It was collected during an excavation for fossils at a depth of 2.4 m in the damp floor at the back of the main entrance. Other specimens have been collected from under a stone in the lower entrance and in an entrance crawlway. The species is known only from this cave. Its color is yellowish with black eyes.



**Bibliography:** Anonymous (2004); Briggs (1990); Gertsch and Soleglad (1972); Sissom and Reddell (2009); Stahnke (1974).

*Uroctonus mordax* Thorell (trogloxene)

**Records:** **Amador Co.:** Fern Frond Cave. **El Dorado Co.:** "Crystal Cave" (probably Crystal Cosumnes Cave). **Mariposa Co.:** Pool Pit. **Tulare Co.:** Clough Cave.

**Comment:** This is a robust, dark scorpion with heavy pedipalps. The color ranges from reddish to black. It is known from many epigeal localities in Oregon and California.

**Bibliography:** Gertsch and Soleglad (1972); Sissom and Reddell (2009).

#### ORDER PSEUDOSCORPIONES (false scorpions)

Undetermined

**Records:** **Amador Co.:** Root Cellar Cave; Santa Claus Cave; Skeleton Cave. **Calaveras Co.:** Bone Cave; Crystal Stanislaus Cave; Dragon's Breath Cave; Heater Cave; Keith's Chasm; Sink Cave. **Fresno Co.:** Bat Cave; Boyden Cave. **Inyo Co.:** unnamed lava tubes near Crater Mountain. **Mariposa Co.:** Indian Rock Shelter; Spider Cave. **Napa Co.:** Clay Cave. **San Bernardino Co.:** Egg Cave; Kokoweef Cave; Mitchell Caverns; Papoose Cave. **Santa Cruz Co.:** Bat Cave. **Shasta Co.:** Bat Mummy Cave; North Christmas Tree Cave. **Siskiyou Co.:** Caldwell Ice Caves; Deep Cavern; Rollercoaster Cave. **Trinity Co.:** Paul Gibson Cave. **Tulare Co.:** Hurricane Crawl Cave; Kaweah Cave.

**Bibliography:** Anonymous (1990b); Graening (2010, 2011c); Hunter (2011b); Krejca (2006); McEachern and Grady (1985); Rogers (1994a, 1999d, 2005b); Taylor, Krejca, and Jacoby (2006); Taylor and Krejca (2006); Zara Environmental (2009).

Undetermined Pseudoscorpiones (troglobite)

**Record:** **Siskiyou Co.:** Lyon's Road Cave.

**Comment:** This species was collected from complete darkness in the back of the cave.

**Bibliography:** Taylor and Krejca (2006).

#### Family Cheliferidae

Undetermined

**Record:** **Calaveras Co.:** Eagle View Cave No. 2.

**Bibliography:** McEachern and Grady (1978).

#### Family Chernetidae

Undetermined

**Records:** **Calaveras Co.:** Cave of Skulls; Scat Cave.

*Dinocheirus sicarius* J.C. Chamberlin

**Records:** **Amador Co.:** Chrome Cave.

*Hesperochnes* sp.

**Records:** **Calaveras Co.:** Bobcat Cave; Bone Cave; Coral Cave; Poison Oak Cave. **San Bernardino Co.:** Mitchell Caverns. **Tulare Co.:** Kaweah Cave. **Tuolumne Co.:** Banksula Cave; Vulture Cave.

*Hesperochnes laurae* J. C. Chamberlin

**Record:** **Inyo Co.:** Upper Shoshone Cave.

**Bibliography:** Briggs (1974a); Briggs and Hom (1972); McFarlane (1990).

*Hesperochnes mimulus* J. C. Chamberlin

**Records:** **Calaveras Co.:** Lost Piton Cave; Scat Cave.

**Bibliography:** McEachern and Grady (1978).

*Tuberochnes* n. sp. (troglobite)

**Record:** **Tulare Co.:** Kaweah Cave.

**Bibliography:** Despain (2006); Krejca (2006); Shear, Taylor, Wynne, and Krejca (2009).

*Tuberochernes aalbui* Muchmore (troglolbite)

**Record:** Inyo Co.: Poleta Cave (type locality).

**Bibliography:** Harvey (1991); Harvey and Wynne (2014); McDonald (2002); Muchmore (1997).

**Family Chthoniidae**

Undetermined

**Records:** Amador Co.: Mushroom Cave; Skeleton Cave; Sutter Creek Cave. Calaveras Co.: O'Neil's Cave. San Bernardino Co.: Mitchell Caverns. Tulare Co.: Clough Cave; Kaweah Cave.

**Comment:** This is a small, eyeless species.

**Bibliography:** Krejca (2006).

*Aphrastochthonius grubbsi* Muchmore (troglolbite)

**Records:** Calaveras Co.: Lost Piton Cave (type locality).

**Comment:** This and the following species are the only members of the genus known from California. Previously the only species of *Aphrastochthonius* known from the southwestern United States was *A. pachysetus* Muchmore from Doc Brito Cave, Eddy County, New Mexico, 1500 km away. Muchmore (1984) thinks that the forms may have been overlooked by collectors because of their small size (1 to 1.5 mm body length) and pale coloration.

**Bibliography:** Harvey (1991); McEachern and Grady (1978); Muchmore (1980, 1981a, 1981b, 1984).

*Aphrastochthonius similis* Muchmore (troglolbite)

**Record:** Calaveras Co.: Carlow's Cave (type locality).

**Comment:** This species is similar to, but smaller, than *A. grubbsi*. Lost Piton Cave and Carlow's Cave, although less than one km apart, are in separate outcrops or "pods" of the Calaveras Assemblage as well as on opposite sides of Coyote Creek. This has apparently been a sufficient barrier to allow speciation to occur.

**Bibliography:** Culver, Christman, Elliott, Hobbs, and Reddell (2000); Graening (2011b); Harvey (1991); McEachern and Grady (1978); Muchmore (1980, 1981a, 1984).

*Apochthonius* sp.

**Records:** Calaveras Co.: Keith's Chasm; Striped Dome Cave. Mariposa Co.: Damp Cave; Indian Cave; Spider Cave; Pool Pit. Tuolumne Co.: Transplant Mine tailings.

**Bibliography:** Cokendolpher and Krejca (2010); Elliott (1978); McEachern and Grady (1978); Zara Environmental (2009).

*Apochthonius grubbsi* Muchmore (troglolbite)

**Records:** Calaveras Co.: Carlito's Cave; Carlow's Bat Cavern; Linda's Cave; Music Hall Cave (type locality).

**Comment:** Most records of this species were previously identified only to genus.

**Bibliography:** Bosted (1994b); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Graening (2011b); Harvey (1991); McEachern and Grady (1978); Muchmore (1980, 1981b).

*Mundochthonius* sp.

**Record:** Tuolumne Co.: Transplant Mine tailings; Windeler Cave.

**Bibliography:** Elliott (1978).

*Mundochthonius* n. sp.

**Record:** Tulare Co.: Jordan Cave; Lange Cave.

**Bibliography:** Despain (2006); Krejca (2006).

*Neochthonius* spp.

**Records:** Calaveras Co.: Barren Cave; Beta Cave; Brown Deer Cave; Bryden's Cave; Carlito's Cave; Carlow's Cave; Cataract Gulch Cave; Cone Cave; Crystal Stanislaus Cave; Lost Piton Cave; Porcupine Cave; Secret Cave. Shasta Co.: Samwel Cave. Tuolumne Co.: Banksula Cave; Mine Cave; Porcupine Skull Cave.

**Comment:** These records could represent several species.

**Bibliography:** McEachern and Grady (1978).

*Neochthonius* sp. (troglolbite)

**Records:** Calaveras Co.: Cave of Skulls; Rabbit Hole. Tulare Co.: New Cave. Tuolumne Co.: Snell's Cave.

**Bibliography:** Elliott (1978).

**Comment:** It is not known if this species could be *N. troglodytes* from the same counties.

*Neochthonius* n. sp. (troglobite)**Records:** Tulare Co.: Clough Cave; Hidden Cave; Windy Pit.**Bibliography:** Despaigne (2006); Křeja (2006).*Neochthonius imperialis* Muchmore (troglobite)**Record:** Santa Cruz Co.: Empire Cave (type locality).**Comment:** This is a smaller, less slender species than *N. troglodytes*.**Bibliography:** Briggs (1990); Muchmore (1996); Rogers (2010c); Ubick (2001).*Neochthonius troglodytes* Muchmore (troglobite)**Records:** Calaveras Co.: Bobcat Cave; Eagle View Cave No. 2; Grapevine Gulch Cave; ?O'Neil's Cave; Secret Cave; Wool Hollow Cave (type locality). **Tuolumne Co.:** Crystal Palace; McLean's Cave; Pinnacle Point Cave; Transplant Mine; Windeler Cave.**Comment:** This species was transplanted from McLean's Cave to the Transplant Mine.**Bibliography:** Culver, Christman, Elliott, Hobbs, and Reddell (2000); Graening (2011b); Harvey (1991); McEachern and Grady (1978); Elliott (1978); Muchmore (1969b, 1980, 1981a, 1981b, 1996).**Family Larcidae***Larca* sp.**Record:** Calaveras Co.: Dirty Crack Cave.**Bibliography:** McEachern and Grady (1978).*Larca aalbui* (Muchmore) (troglophile)**Records:** San Bernardino Co.: Mitchell Caverns (type locality).**Comment:** Numerous specimens of this species were taken in pitfall traps in 1978–1979 by Rolf Aalbu. This species was formerly placed in *Archeolarca*.**Bibliography:** Harvey (1991); Muchmore (1984).*Larca chamberlini* Benedict and Malcolm (troglophile)**Records:** Calaveras Co.: Coral Cave; Confluence Cave; Crystal Stanislaus Cave; Dirty Fissure. **Siskiyou Co.:** ?Shasta View Cave. **Tuolumne Co.:** Confluence Cave; McLean's Cave; Milkcan Cave; Pinnacle Point Cave; Transplant Mine.**Comment:** This species was transplanted from McLean's Cave to the Transplant Mine.**Bibliography:** Elliott (1978); Harvey (1991); Muchmore (1981a, 1981b).*Larca laceyi* Muchmore (troglobite)**Records:** Calaveras Co.: Dirty Fissure; Gray Pine Cave; Music Hall Cave (type locality).**Bibliography:** Bosted (1994b); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Graening (2011b); Harvey (1991); McEachern and Grady (1978); Muchmore (1980, 1981a, 1981b).**Family Neobisiidae**

## Undetermined

**Records:** Santa Cruz Co.: Vanished River Cave. **Tuolumne Co.:** McLean's Cave.**Bibliography:** Briggs (1975).*Australinocreagris* sp. (troglobite)**Records:** Calaveras Co.: Eagle View Cave No. 1; Hawk Cave. **Tuolumne Co.:** Porcupine Skull Cave; Tube Cave.**Bibliography:** McEachern and Grady (1978).*Australinocreagris grahami* (Muchmore) (troglobite)**Records:** Calaveras Co.: Carlow's Cave; Cataract Gulch Cave; Grapevine Gulch Cave; Lost Piton Cave; Moaning Cave; Music Hall Cave; Pseudoscorpion Cave (type locality); Rabbit Hole; Secret Cave. **Tuolumne Co.:** Banksula Cave; Crystal Palace; Crystal Tuolumne Cave; McLean's Cave; McNamee's Cave; Scorpion Cave; Transplant Mine.**Comment:** Specimens were transplanted from McLean's Cave to the Transplant Mine.**Bibliography:** Bosted (1994b); Briggs (1975, 1987); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Čurčić (1984); Elliott (1978, 1981a, 1981b); Graening (2011b); Harvey (1990); Heurtault (1994); McEachern and Grady (1978); Muchmore (1969a, 1980, 1981a); Peck (1998).



*Fissilicreagris* sp. (troglolbite)

**Records:** Tulare Co.: Clough Cave; Crystal Sequoia Cave.

*Fissilicreagris* n. sp. no. 1 (troglolbite)

**Record:** Tulare Co.: Hurricane Crawl Cave.

**Bibliography:** Despain (2006); Krejca (2006).

*Fissilicreagris* n. sp. no. 2 (troglolbite)

**Record:** Tulare Co.: Hidden Cave.

**Bibliography:** Despain (2006); Krejca (2006).

*Fissilicreagris* n. sp. no. 3 (troglolbite)

**Record:** Tulare Co.: Walk Softly Cave.

**Bibliography:** Despain (2006); Krejca (2006).

*Fissilicreagris imperialis* (Muchmore) (troglolbite)

**Records:** Santa Cruz Co.: Dolloff Cave; Empire Cave (type locality); IXL Cave; Stump Cave.

**Comment:** This species was originally placed in the genus *Microcreagris*. It was listed in 1984 as a candidate for review as an endangered or threatened species.

**Bibliography:** Arnett (1984); Briggs and Ubick (1988); Coddington, Larcher, and Cokendolpher (1990); Ćurčić (1984); Drewry (1989); Elliott (1984); Harvey (1991); Muchmore (1969a, 1981a, 1996); Muchmore and Cokendolpher (1995); Peck (1998); Rogers (2010c); Ubick (2001).

*Globocreagris* sp.

**Records:** Amador Co.: Rippled Cave.

*Globocreagris theveneti* (Simon)

**Record:** Napa Co.: Clay Cave.

**Comment:** This species was taken from an antifreeze pitfall trap in the entrance.

**Bibliography:** Bradford (2005); Muchmore (1994).

*Halobisium occidentale* Beier

**Record:** Santa Cruz Co.: sea cave 8 km west of Santa Cruz.

“*Microcreagris*” spp. (troglolbite)

**Records:** Calaveras Co.: Barren Cave; Cone Cave; Coral Cave; Creek Cave; Eagle View Cave No. 1; Eagle View Cave No. 2; Hawk Cave; Porcupine Cave. **Mariposa Co.:** Damp Cave; Sprinkle Cave. **Tuolumne Co.:** Milkcan Cave; Porcupine Skull Cave; Transplant Mine; Tube Cave.

**Comment:** Most of these immature specimens probably belong either to *Australinocreagris* or *Parobisium*.

**Bibliography:** Briggs (1987, 1991); McEachern and Grady (1978); Muchmore (1981a).

“*Microcreagris*” n. sp. (troglolbite)

**Record:** Mariposa Co.: Bull Creek Cave.

**Comment:** This species does not belong in *Microcreagris*, used as a temporary placeholder.

*Parobisium* sp.

**Record:** Tuolumne Co.: Transplant Mine.

**Bibliography:** Elliott (1978).

*Parobisium yosemite* Cokendolpher and Krejca (troglolbite)

**Records:** Mariposa Co.: Elf Village Cave; Indian Cave (type locality).

**Bibliography:** Cokendolpher and Krejca (2010); Zara Environmental (2009).

*Saetigerocreagris phyllisae* (Chamberlin)**Record:** Los Angeles Co.: Eaton's Cave.**Comment:** This species was described from kelp at Coronado Beach. The location of Eaton's Cave is unknown to us.**Bibliography:** Chamberlin, J.C. (1930, 1962); Chamberlin and Malcolm (1960).**Family Pseudogarypidae***Pseudogarypus* sp.**Record:** Calaveras Co.: unnamed cave in Peruvian Gulch. Plumas Co.: Soda Springs Cave. Siskiyou Co.: Hypochilus Cave; Shasta View Grotto. **Unknown Co.:** Doney Crack.**Bibliography:** Benedict (1977, 1983).*Pseudogarypus bicornis* (Banks)**Record:** Siskiyou Co.: Skunk Hollow Cave.*Pseudogarypus hesperus* Chamberlin**Record:** Tulare Co.: Bear Den Cave.**Bibliography:** Krejca (2006).*Pseudogarypus orpheus* Muchmore (troglobite)**Records:** Calaveras Co.: Music Hall Cave (type locality). Tuolumne Co.: Indian Quarry Cave No. 2.**Comment:** Benedict and Malcolm used the erroneous name "Music Box Cave."**Bibliography:** Benedict (1977, 1983); Benedict and Malcolm (1978b, 1979); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Graening (2011b); Harvey (1990); Heurtault (1994); Muchmore (1980, 1981a, 1981b).*Pseudogarypus spelaeus* Benedict and Malcolm (troglobite)**Records:** Shasta Co.: Samwel Cave (type locality).**Comment:** This species was the first in its genus to exhibit troglomorphy, i.e. reduced eyes, giantism, and appendage attenuation. The family is known from North America and Tasmania; the genus, and its four species, from North America only. The nearest relative is *P. bicornis*, which is known from many localities in the western United States. *Pseudogarypus hypogeus* Muchmore is a troglobite in Arizona.**Bibliography:** Benedict (1977, 1980, 1983); Benedict and Malcolm (1978a, 1978b, 1979); Harvey (1990); Muchmore (1981a, 1981b).**ORDER SCHIZOMIDA (short-tailed whipscorpions)****Family Hubbardiidae***?Hubbardia* sp.**Record:** Tulare Co.: \*Clough Cave.**Comment:** A schizomid was observed by Benjamin Tobin in 2010.**Bibliography:** Krejca (2009b); Reddell (2009).*Hubbardia shoshonensis* (Briggs and Hom) (troglobite)**Records:** Inyo Co.: Upper Shoshone Cave (type locality); Lower Shoshone Cave.**Comment:** This is the only troglotibic species of the family Hubbardiidae known from the United States. The genus *Hubbardia* is more closely related to Old World genera than to New World genera (Fig. 17).**Bibliography:** Bennett (1985); Briggs (1974a, 1990); Briggs and Hom (1972); Georgescu (1994); Harvey (2003); McFarlane (1990); Rado and Tyner (1984); Reddell (1981, 2009); Reddell and Cokendolpher (1991, 1995); Rowland (1975); Rowland and Reddell (1977, 1979, 1981); Shear (1974); Ubick and Briggs (1992); U.S. Department of Interior and State of California (1982).**ORDER ARANEAE (spiders)****SUBORDER OPISTHOTHELE****INFRAORDER MYGALOMORPHA****Family Antrodiaetidae (folding door spiders)***Antrodiaetus* sp.**Record:** Amador Co.: Mushroom Cave.

**Family Euctenizidae (wafer-lid trapdoor spiders)***Aptostichus* sp.**Records:** Calaveras Co.: Gerritt's Cave; Keith's Chasm; Linda's Cave; Lost Piton Cave; Music Hall Cave.**Comment:** Trap door spiders may frequent many more caves than are indicated by these few records.**Bibliography:** Bosted (1994b); Elliott (1978a); McEachern and Grady (1978).*Aptostichus chavezii* Bond**Records:** Tuolumne Co.: Crystal Palace.**Comment:** This species has been taken on the surface in Fresno and Tulare counties.**Bibliography:** Bond (2012).**Family Nemesiidae***Calisoga* sp. (false tarantula) (troglophile?)**Records:** Calaveras Co.: Barren Cave; Carlito's Cave; Crystal Stanislaus Cave; Diane's Cave; Heater Cave; Poison Oak Cave. **Tulare Co.:** Lost Soldier's Cave; Overhang Cave. **Tuolumne Co.:** Bend Cave; Banksula Cave; Bend Cave; McLean's Cave.**Comment:** Although many of these records have been attributed to *C. theveneti* (Simon), the species composition of *Calisoga* has not yet been resolved and it is not clear which or how many species occur in caves.**Bibliography:** McEachern and Grady (1978).**Family Theraphosidae (tarantulas)**

Undetermined

**Records:** Calaveras Co.: Crystal Stanislaus Cave. **Riverside Co.:** \*Cahuilla Creek Caves.**Bibliography:** DeLucia (1982); Quick (1972a, 1980a).*Aphonopelma* sp.**Records:** San Benito Co.: Bear Gulch Cave. **Tulare Co.:** Overhang Cave.**Bibliography:** Krejca (2006).**INFRAORDER ARANEOMORPHAE****Family Agelenidae (funnel weavers)**

Undetermined

**Records:** Siskiyou Co.: Mushpot Cave; Crystal Ice Cave. **Tulare Co.:** Crystal Sequoia Cave.**Bibliography:** Krejca (2006).**Family Amaurobiidae (hacklemesh weavers)**

Undetermined

**Records:** Fresno Co.: Boyden Cave. **Tulare Co.:** Bear Den Cave; Lost Soldier's Cave; Overhang Cave; Walk Softly Cave; Wiessraum Cave.**Bibliography:** Krejca (2006).*Amaurobius* sp.**Record:** Tulare Co.: Crystal Sequoia Cave.**Bibliography:** Briggs (1993); Krejca (2006).*Callobius* sp.**Records:** San Benito Co.: Bear Gulch Cave. **Siskiyou Co.:** Anglemore/Lost Pinnacle Cave; Arch Cave No. 2; Catacombs Cave; Mushpot Cave; Skull Ice Cave; Spider Cave; Valentine Cave. **Tulare Co.:** May's Cave.**Bibliography:** Krejca (2006); Lee, V.F. (1985a); Taylor and Krejca (2006).*Callobius nevadensis* (Simon)**Record:** Shasta Co.: Subway Cave.**Bibliography:** Leech (1972).*Callobius rothi* Leech**Record:** caves.



**Comment:** Leech (1972) states that this species has been taken in caves in California.

**Bibliography:** Leech (1972).

*Callobius tehama* Leech

**Record:** Shasta Co.: Samwel Cave.

**Bibliography:** Leech (1972).

*Pimus* sp.

**Record:** Siskiyou Co.: Planetary Dairy Cave.

**Bibliography:** Graening (2011c).

*Pimus hesperellus* Chamberlin (troglophile)

**Record:** Shasta Co.: Potter Creek Cave.

**Bibliography:** Leech (1972).

*Pimus nawtawaketus* Leech (troglophile)

**Record:** Shasta Co.: Samwel Cave (type locality).

**Bibliography:** Leech (1972).

*Pimus pitus* Chamberlin (troglophile)

**Records:** Calaveras Co.: Shaw's Cave. Mariposa Co.: Bower Cave; Pool Pit.

#### Family Anapidae

*Gertschanapis shantzi* (Gertsch) (troglophile)

**Records:** Calaveras Co.: Barren Cave; Brown Deer Cave; Cave City Cave; Clutch Cave; Cone Cave; Dirty Crack Cave; Dirty Fissure; Eagle View Cave No. 2; Grapevine Gulch Cave; Porcupine Cave; Striped Dome Cave. **Tulare Co.:** Clough Cave; Overhang Cave; Walk Softly Cave. **Tuolumne Co.:** Transplant Mine.

**Bibliography:** Elliott (1978); Krejca (2006); McEachern and Grady (1978).

#### Family Anyphaenidae (ghost spiders)

*Anyphaena* sp.

**Records:** Mariposa Co.: Indian Cave. Santa Cruz Co.: Empire Cave.

**Bibliography:** Ubick (2001); Zara Environmental (2009).

#### Family Araneidae (orb weaver spiders)

Undetermined

**Records:** Fresno Co.: Boyden Cave. San Benito Co.: Balconies Cave. San Bernardino Co.: Peggy 5 Cave. San Francisco Co.: *Farallon Islands*: Cricket Cave. Tehama Co.: Inskip Cave.

**Bibliography:** Graening (2010); Anonymous (2011c).

#### Family Caponiidae (bright lungless spiders)

*Orthonops* sp.

**Records:** Tulare Co.: Kaweah Cave; Walk Softly Cave.

**Bibliography:** Krejca (2006).

#### Family Clubionidae (sac spiders)

Undetermined

**Records:** El Dorado Co.: Alabaster Cave; Crystal Cosumnes Cave. Inyo Co.: Upper Shoshone Cave. Mendocino Co.: Fault Rock Cave. Napa Co.: Clay Cave.

**Comment:** Clubionids in the currently restricted sense are not troglophilic and these cave records most probably represent zoropsids, especially *Titiotus*.

**Bibliography:** Briggs (1974a); Briggs and Hom (1972).

#### Family Cybaeidae

*Cybaeozyga* n. sp. 1 (troglomite)

**Records:** Shasta Co.: Potter Creek Cave; Shasta Lake Caverns.

**Bibliography:** Gertsch (1992).

*Cybaeozyga* n. sp. 2 (troglóbite)**Record:** Shasta Co.: Samwel Cave.**Bibliography:** Gertsch (1992).*Cybaeus* sp. (troglóphile?)**Records:** **Amador Co.:** Moss Cave. **Calaveras Co.:** Cone Cave; O'Neil's Cave. **Mariposa Co.:** Spider Cave. **Fresno Co.:** Boyden Cave. **Napa Co.:** Clay Cave. **Santa Cruz Co.:** Empire Cave; Stearns Cave; Stump Cave. **Siskiyou Co.:** ?Maze Cave. **Tulare Co.:** Bear Den Cave; Clough Cave; Dehydrated Cave; \*Hidden Cave; Kaweah Cave; Lilburn Cave; Lost Soldier's Cave; Overhang Cave; Paradise Cave; \*Pet Cemetery Cave; Pine Grosbeak Cave; \*Walk Softly Cave; \*Wiessraum Cave. **Tuolumne Co.:** Snell's Cave; Transplant Mine.**Bibliography:** Despaigne (2006); Elliott (1978); Krejca (2006); McEachern and Grady (1978); Taylor and Krejca (2006); Ubick (2001); Zara Environmental (2009).*Cybaeus* n. sp. (troglóbite)**Record:** Shasta Co.: Samwel Cave.**Bibliography:** Gertsch (1992).*Cybaeus penedentatus* Bennett**Record:** Santa Cruz Co.: Stump Cave.**Bibliography:** Copley, Bennett, and Perlman (2009).*Cybaeus septatus* Chamberlin and Ivie (troglóphile?)**Record:** Shasta Co.: Potter Creek Cave (type locality).**Comment:** This species is also known from Weed, Siskiyou County, and Grants Pass, Oregon.**Bibliography:** Bennett (2006); Chamberlin and Ivie (1942); Roth, V.D. (1952); Vogel (1967).*Cybaeus shastae* (Chamberlin and Ivie)**Record:** Siskiyou Co.: Hypochilus Cave.**Family Dictynidae (mesh web spiders)**

## Undetermined

**Records:** **Mariposa Co.:** Indian Cave; Spider Cave.**Bibliography:** Zara Environmental (2009).*Blabomma* n. sp. (troglóbite)**Record:** **Calaveras Co.:** O'Neil's Cave.**Comment:** This may belong to one of the undescribed species listed below.*Blabomma* n. sp. no. 1 (troglóbite)**Records:** **Calaveras Co.:** Barren Cave; Beta Cave; Cave of Skulls; Grapevine Gulch Cave.**Bibliography:** Gertsch (1992).*Blabomma* n. sp. no. 2 (troglóbite)**Records:** **Calaveras Co.:** Bobcat Cave; Bryden's Cave; Buckeye Cave; Grapevine Gulch Cave; Mercer Caverns; Shaw's Cave. **Tuolumne Co.:** Snell's Cave; Windeler Cave.**Bibliography:** Gertsch (1992); McEachern and Grady (1978).*Blabomma* n. sp. no. 3 (troglóbite)**Record:** Shasta Co.: Shasta Lake Caverns.**Bibliography:** Gertsch (1992).*Blabomma* n. sp. no. 4 (troglóbite)**Record:** **Tulare Co.:** Clough Cave.**Bibliography:** Despaigne (2006); Gertsch (1992); Krejca (2006).

*Blabomma* n. sp. no. 5 (troglophile?)**Record:** Amador Co.: Connie's Cave.*Blabomma* n. sp. no. 6 (troglophile?)**Record:** Amador Co.: Fern Frond Cave.**Bibliography:** Gertsch (1992).*Blabomma* n. sp. no. 7 (troglophile?)**Records:** Amador Co.: Fern Frond Cave. **Mariposa Co.:** Bower Cave; Bull Creek Cave; Damp Cave; Sprinkle Cave; Pool Pit.*Blabomma* n. sp. no. 8 (troglophile?)**Record:** Amador Co.: Santa Claus Cave.*Blabomma* n. sp. no. 9 (troglophile?)**Record:** Calaveras Co.: Moaning Cave.**Bibliography:** Gertsch (1992).*Blabomma* n. sp. no. 10 (troglophile?)**Record:** Santa Cruz Co.: Santa Cruz City Cave.*Blabomma* n. sp. no. 11 (troglophile?)**Record:** Tuolumne Co.: Crystal Palace.**Comment:** This species is known from only one female.**Bibliography:** Elliott (1978).*Blabomma* n. sp. no. 12 (troglophile?)**Record:** Tuolumne Co.: Crystal Tuolumne Cave.*Blabomma* n. sp. no. 13 (troglophile?)**Record:** Tuolumne Co.: Indian Quarry Cave [sic].*Blabomma* n. sp. no. 14 (troglophile?)**Record:** Tuolumne Co.: Vulture Cave.*Blabomma* n. sp. no. 15 (troglophile?)**Records:** Tulare Co.: Overhang Cave; Walk Softly Cave.**Bibliography:** Krejca (2006).*Blabomma* sp. (troglolbite)**Records:** Amador Co.: Root Cellar Cave. **Calaveras Co.:** Poison Oak Cave.**Comment:** Immature specimens make it difficult to assign a specific name to these records.**Bibliography:** Elliott (1978).*Blabomma* sp. (troglophile?)**Records:** Calaveras Co.: Carlow's Bat Cavern; Eagle View Cave No. 1; Grapevine Gulch Cave; Moaning Cave. **Kern Co.:** Harrington Cave. **Mariposa Co.:** Indian Cave. **San Benito Co.:** Bear Gulch Cave. **Tuolumne Co.:** Forsythe Cave; Windeler Cave.**Bibliography:** Elliott (1978, 1984); McEachern and Grady (1978); Krejca (2006); Zara Environmental (2009).*Cicurina* sp. (troglophile?)**Record:** Calaveras Co.: Hawk Cave. **Shasta Co.:** Rusty Cave.**Bibliography:** McEachern and Grady (1978).*Mallos* sp.**Record:** Tuolumne Co.: Snell's Cave.**Bibliography:** Elliott (1978).



*Yorima* sp.

**Records:** **Amador Co.:** Lulu Bell Cave; Root Cellar Cave; White Room Cave. **Fresno Co.:** Boyden Cave. **Tulare Co.:** Hurricane Crawl Cave.

*Yorima* n. sp. (troglobite)

**Records:** **Tulare Co.:** Clough Cave; \*?Crystal Sequoia Cave; Dehydrated Cave; Eighteenth Hole; ?Hurricane Crawl Cave; Lange Cave; New Cave; Schist Canyon Cave; Wiessraum Cave; Windy Pit.

**Bibliography:** Despaigne (2006); Hunter (2011b); Krejca (2006); Ubick (1991).

**Family Filistatidae (crevice weavers)***Filistatinella* sp.

**Record:** **Tulare Co.:** Walk Softly Cave.

**Bibliography:** Krejca (2006).

**Family Gnaphosidae (ground spiders)***Drassyllus* sp.

**Record:** **Tuolumne Co.:** Transplant Mine.

**Bibliography:** Elliott (1978).

*Drassyllus insularis* (Banks)

**Records:** **Tulare Co.:** ?Harry's Bend Cave; Overhang Cave.

**Bibliography:** Krejca (2006).

*Zelotes anglo* Gertsch and Riechert

**Record:** **San Bernardino Co.:** Mitchell Caverns.

**Bibliography:** Platnick and Shadab (1983).

**Family Hahniidae (dwarf sheet spiders)***Calymmaria* sp. (troglophile?)

**Records:** **Amador Co.:** Lulu Bell Cave; Santa Claus Cave; Skeleton Cave. **Calaveras Co.:** Buckeye Cave; Cave City Cave; Cave of the Catacombs; O'Neil's Cave. **Napa Co.:** Clay Cave. **Plumas Co.:** Soda Springs Cave. **Santa Cruz Co.:** Bat Cave; Clear Water Cave; Coral Grotto; Dolloff Cave; Empire Cave; IXL Cave; Laguna Creek Cave; Stearns Cave; Stump Cave. **Siskiyou Co.:** Hypochilus Cave; Planetary Dairy Cave; Shasta View Grotto; Snake Pit; True Shasta View Cave. **Trinity Co.:** Palmer Cave. **Tulare Co.:** Bear Den Cave; Dehydrated Cave; Eighteenth Hole; Hidden Cave; Hurricane Crawl Cave; Kaweah Cave; Clough Cave; Overhang Cave; Palmer Cave; \*Paradise Cave; Pine Grosbeak Cave; Walk Softly Cave; Wiessraum Cave. **Tuolumne Co.:** Crystal Butterfly Cave.

**Bibliography:** Briggs and Ubick (1988); Graening (2011c); Krejca (2006); Ubick (2001).

*Calymmaria alleni* Heiss and Draney (troglophile?)

**Record:** **Tulare Co.:** cave west of Soda Springs.

**Bibliography:** Heiss and Draney (2004).

*Calymmaria aspenola* Chamberlin and Ivie

**Records:** caves.

**Comment:** Heiss and Draney (2004) only report that the species has been taken in caves without giving specific site names.

**Bibliography:** Heiss and Draney (2004).

*Calymmaria farallon* Heiss and Draney (troglophile)

**Records:** **San Francisco Co.:** **Farallon Islands:** cave on north side of Shubrick Point, Southeast Farallon Island; Cricket Cave; former sea cave above landing (type locality); Rabbit Cave.

**Comment:** This species is known only from the ceiling of caves in the Farallon Islands.

**Bibliography:** Heiss and Draney (2004).

*Calymmaria rothi* Heiss and Draney (troglophile?)

**Record:** **Sierra Co.:** Monarch Mine (type locality).

**Bibliography:** Heiss and Draney (2004).

*Calymmaria shastae* Chamberlin and Ivie (troglophile?)

**Records:** Mariposa Co.: Bower Cave. **Shasta Co.:** Potter Creek Cave; Subway Cave. **Siskiyou Co.:** Catacombs Cave; Skull Ice Cave; Valentine Cave.

**Bibliography:** Heiss and Draney (2004); Taylor and Krejca (2006).

*Calymmaria suprema* Chamberlin and Ivie

**Records:** Napa Co.: Clay Cave. **Santa Cruz Co.:** Empire Cave.

**Bibliography:** Heiss and Draney (2004); Ubick (2001).

*Hahnina sanjuanensis* Exline (troglophile)

**Record:** Shasta Co.: Potter Creek Cave (type locality of *Hahnistea longipes* Chamberlin and Ivie 1942, junior synonym).

**Comment:** Known from USA and Mexico.

**Bibliography:** Chamberlin and Ivie (1942); Danehy (1951b); Opell and Beatty (1976); Vogel (1967).

**Family Hypochilidae (lampshade spiders)***Hypochilus kastoni* Platnick (troglophile)

**Records:** Siskiyou Co.: Hypochilus Cave; Skunk Hollow Cave; Stiletto Cave; Trail Junction Cave.

**Bibliography:** Graening (2011c).

*Hypochilus petrunkevitchi* Gertsch (troglophile)

**Records:** Calaveras Co.: Grapevine Gulch Cave. **Fresno Co.:** Maze Cave. **Mariposa Co.:** Spider Cave. **Tulare Co.:** Arch Cave; \*Beulah Cave; Clough Cave; Crystal Sequoia Cave; Eighteenth Hole; Eleven Range Shelter Cave No. 2; Hidden Cave; Hurricane Crawl Cave; Jordan Cave; Lightning Cave; New Cave; Overhang Cave; Rattlesnake Cave; Schist Canyon Cave; Upper Bryant Cave; White Chief Cave.

**Bibliography:** Briggs (1993); Despain (1993); Gertsch (1958); Krejca (2006).

**Family Leptonetidae***Archoleptoneta gertschi* Ledford and Griswold (troglophile)

**Records:** Amador Co.: Connie's Cave; Chrome Cave; Hummingbird Cave. **Calaveras Co.:** Bobcat Cave; Brown Deer Cave; Carlito's Cave; Coral Cave; Grapevine Gulch Cave; Moaning Cave; Music Hall Cave; Poison Oak Cave; Striped Dome Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Tuolumne Co.:** Crystal Palace; Indian Quarry Cave No. 2; McLean's Cave; Scorpion Cave; Transplant Mine.

**Comment:** This species was transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Ledford and Griswold (2010a).

*Archoleptoneta schusteri* Gertsch (troglophile)

**Records:** Tulare Co.: Clough Cave; Walk Softly Cave.

**Bibliography:** Briggs (1975); Briggs and Ubick (1981); Elliott (1978); Krejca (2006); Ledford and Griswold (2010a); McEachern and Grady (1978).

*Calileptoneta* n. sp. 1 (troglolite)

**Record:** Calaveras Co.: Music Hall Cave.

**Bibliography:** McEachern and Grady (1978).

*Calileptoneta* n. sp. 2 (troglolite)

**Records:** Tulare Co.: Clough Cave; Overhang Cave; Walk Softly Cave; Windy Pit.

**Bibliography:** Despain (2006); Krejca (2006).

*Calileptoneta briggsi* Ledford (troglolite)

**Records:** Trinity Co.: Butter Creek Cave; Indian Valley Creek Cave (type locality).

**Comment:** This species lacks pigmentation and the eyes are greatly reduced.

**Bibliography:** Ledford (2004).

*Calileptoneta helferi* (Gertsch) (troglophile)

**Record:** Mendocino Co.: Fault Rock Cave.

**Bibliography:** Ledford (2004).

*Calileptoneta sylvia* (Chamberlin and Ivie) (troglophile)

**Record:** Shasta Co.: Samwel Cave.

**Bibliography:** Ledford (2004).

**Family Linyphiidae (sheetweb and dwarf spiders)**

Undetermined

**Records:** **Amador Co.:** Hummingbird Cave; Santa Claus Cave. **Calaveras Co.:** Crystal Stanislaus Cave; Wool Hollow Cave. **Fresno Co.:** Millerton Lake Cave System. **Inyo Co.:** Upper Shoshone Cave. **Shasta Co.:** Subway Cave. **Siskiyou Co.:** Fossil Cave; Planetary Dairy Cave; Trail Junction Cave. **Tulare Co.:** Bear Den Cave; Carmoe Crevice Cave; Clough Cave; Crystal Sequoia Cave; Eighteenth Hole; Harry's Bend Cave; Hidden Cave; Jordan Cave; Kaweah Cave; Lange Cave; Lilburn Cave; Lost Soldier's Cave; Overhang Cave; Paradise Cave; Rattlesnake Cave; Stand Up Cave; Tufa Spring Cave; Walk Softly Cave. **Tuolumne Co.:** Forscythe Cave; Waterfall Cave.

**Bibliography:** Despain (2006); Graening (2011c); Krejca (2006).

Subfamily Erigoninae

Undetermined Erigoninae

**Records:** **Amador Co.:** unnamed cave 300 m NE Volcano; Root Cellar Cave. **Calaveras Co.:** Carlow's Cave. **Tulare Co.:** Crystal Sequoia Cave; Lilburn Cave. **Tuolumne Co.:** Border Pit.

**Bibliography:** Krejca (2006); McEachern and Grady (1978).

Erigoninae (troglobite)

**Records:** **Amador Co.:** unnamed cave 500 m NE of Volcano; Root Cellar Cave. **Calaveras Co.:** Carlow's Cave. **Tuolumne Co.:** Border Pit.

Subfamily Linyphiinae

Linyphiinae n. gen., n. sp. (troglobite)

**Record:** **Tulare Co.:** Lilburn Cave (Meyer's Entrance)

**Comment:** This is the first record of a completely eyeless linyphiid from California and may represent a new species or genus.

**Bibliography:** Lee, V.F. (1985a).

*Agyneta* sp.

**Record:** **Mariposa Co.:** Bower Cave.

*Arcuphantes* sp. (troglophile?)

**Records:** **Calaveras Co.:** Buckeye Cave. **Fresno Co.:** unnamed cave E of Millerton Lake. **Mariposa Co.:** Spider Cave. **San Benito Co.:** Balconies Cave. **Santa Cruz Co.:** Stearns Cave. **Shasta Co.:** Samwel Cave; Flashlight Cave. **Siskiyou Co.:** Hypochilus Cave; Lazaroff's Hole; The Lonely Palace Cave; Lyon's Road Cave; Nirvana Cave; Rollercoaster Cave; Snake Pit, True Shasta View Cave. **Trinity Co.:** Indian Valley Creek Cave; Trinity Natural Bridge and Cave. **Tulare Co.:** Clough Cave; \*Eighteenth Hole; Harry's Bend Cave; Hidden Cave; Jordan Cave; New Cave; Schist Canyon Cave; White Chief Cave; \*Windy Pit. **Tuolumne Co.:** unnamed cave on N side of Table Mountain.

**Bibliography:** Ubick (2001).

*Arcuphantes* sp. nr. *arcuatulus* (Roewer) (troglophile?)

**Record:** **Tulare Co.:** Clough Cave.

*Arcuphantes cavaticus* Chamberlin and Ivie (troglophile?)

**Records:** **Siskiyou Co.:** Arch Cave No. 2; Catacombs Cave; Merrill Ice Cave; Mushpot Cave; Skull Ice Cave; Spider Cave; Valentine Cave.

**Bibliography:** Taylor and Krejca (2006).

*Arcuphantes fragilis* Chamberlin and Ivie (troglophile?)

**Records:** **Tulare Co.:** Bear Den Cave; Eighteenth Hole; Paradise Cave. **Tuolumne Co.:** Forscythe Cave.

**Bibliography:** Krejca (2006).



*Arcuphantes potteri* Chamberlin and Ivie (troglophile?)

**Records:** **Amador Co.:** Lulu Bell Cave. **Calaveras Co.:** small cave near Shaw's Cave. **Plumas Co.:** Juniper Cave; Soda Springs Cave. **Shasta Co.:** Potter Creek Cave (type locality).

**Bibliography:** Chamberlin and Ivie (1943); Danchy (1951b); Vogel (1967).

*Arcuphantes sylvaticus* Chamberlin and Ivie (troglophile?)

**Records:** **Amador Co.:** unnamed cave 0.2 mi. NE Volcano; Santa Claus Cave. **Siskiyou Co.:** Boulevard Cave; Spider Cave; Township Cave; Upper Heppe Cave.

*Bathyphantes* sp. (troglophile)

**Records:** **Napa Co.:** Clay Cave. **San Benito Co.:** Bear Gulch Cave. **Shasta Co.:** Flashlight Cave (lava tube). **Siskiyou Co.:** Harris Mountain Cave. **Tulare Co.:** Crystal Sequoia Cave; Lilburn Cave.

**Bibliography:** Krejca (2006).

*Bathyphantes (Bathyphantes)* n. sp. nr. *alascensis* (Banks)

**Record:** **Siskiyou Co.:** Skunk Hollow Cave.

*Bathyphantes (Bathyphantes)* nr. *diasosnemus* Fage (troglophile?)

**Records:** **Tulare Co.:** Crystal Sequoia Cave; Lilburn Cave (Main Entrance).

**Bibliography:** Krejca (2006); Lee, V.F. (1985a).

*Bathyphantes (Bathyphantes)* *alameda* Ivie (troglophile?)

**Records:** **Santa Cruz Co.:** Bat Cave; Empire Cave.

**Bibliography:** Briggs and Ubick (1988); Ivie (1969); Ubick (2001).

*Bathyphantes (Bathyphantes)* *alascensis* (Banks) (troglophile?)

**Record:** **Trinity Co.:** Hall City Cave.

**Bibliography:** Ivie (1969).

*Bathyphantes (Bathyphantes)* *diasosnemis* Fage (troglophile?)

**Records:** **Shasta Co.:** Subway Cave. **Tulare Co.:** Crystal Sequoia Cave; Lilburn Cave.

**Comment:** This species is known from caves and epigean habitats in southern Oregon and northern California. Chamberlin and Ivie (1943) described *Bathyphantes hubbsi* from Subway Cave. This is now considered a synonym of *B. diasosnemis*.

**Bibliography:** Chamberlin and Ivie (1943); Ivie (1969); Krejca (2006); Lee, V.F. (1985); Peck (1973a); Vogel (1967).

*Bathyphantes (Bathyphantes)* *orica* Ivie (troglophile?)

**Records:** **Santa Cruz Co.:** Dolloff Cave; Laguna Creek Cave; Stump Cave. **Tulare Co.:** Crystal Sequoia Cave.

**Bibliography:** Briggs and Ubick (1988); Krejca (2006); Ubick (2001).

*Centromerus* sp. (troglophile?)

**Records:** **Tulare Co.:** ?Overhang Cave; Walk Softly Cave.

**Bibliography:** Krejca (2006).

*Ceratinops inflatus* (Emerton) (troglophile)

**Records:** **Amador Co.:** Lulu Bell Cave; Santa Claus Cave. **Calaveras Co.:** Buckeye Cave; Cave City Cave; mine on N side of Table Mountain. **Mariposa Co.:** Bower Cave; Sprinkle Cave. **Trinity Co.:** cave near Forest Glen Caves; Forest Glen Caves. **Tulare Co.:** Crystal Sequoia Cave; Lange Cave; Paradise Cave.

**Bibliography:** Briggs (1993); Krejca (2006).

*Lepthyphantes* sp.

**Record:** **Tuolumne Co.:** Forsythe Cave.

**Bibliography:** Krejca (2006).

*Linyphantes* sp.**Record:** Calaveras Co.: Waterfall Cave.**Bibliography:** McEachern and Grady (1978).*Oaphantes* sp.**Records:** Tulare Co.: Lilburn Cave.**Bibliography:** Krejca (2006).*Oaphantes* n. sp. 1 (troglóbite)**Record:** Tulare Co.: Paradise Cave.**Bibliography:** Despain (2006); Krejca (2006).*Oaphantes* n. sp. 2 (troglophile)**Records:** Tulare Co.: Bear Den Cave; Carmoe Crevice Cave; Pet Cemetery Cave.**Bibliography:** Despain (2006); Krejca (2006).*Oaphantes pallidulus* Banks (troglophile?)**Records:** Santa Cruz Co.: Dolloff Cave; Stump Cave.**Bibliography:** Briggs and Ubick (1988); Ubick (2001).*Pityohyphantes phrygianus* (C. L. Koch)**Record:** Tulare Co.: Crystal Sequoia Cave.**Bibliography:** Krejca (2006).*Scotinotylus* sp.**Record:** Tulare Co.: Walk Softly Cave.**Bibliography:** Krejca (2006).*Spirembolus* sp. (troglóbite)**Records:** Tulare Co.: Carmoe Crevice Cave. **Tuolumne Co.:** Transplant Mine.**Bibliography:** Despain (2006); Elliott (1978); Krejca (2006).*Tachygyna* sp.**Record:** Tulare Co.: Bear Den Cave.**Bibliography:** Krejca (2006).*Tapinocyba* sp. (troglophile)**Record:** Tulare Co.: Hidden Cave.**Comment:** This may be *T. dietrichi*.**Bibliography:** Krejca (2006).*Tapinocyba dietrichi* Crosby and Bishop (troglophile?)**Records:** Amador Co.: Fern Frond Cave. **Mariposa Co.:** Bull Creek Cave; Damp Cave. **Tulare Co.:** Eighteenth Hole; Hidden Cave.**Bibliography:** Krejca (2006).*Wubana* sp.**Records:** Tulare Co.: Bear Den Cave; Salamander Cave.**Bibliography:** Krejca (2006).**Family Liocranidae***Neoanagraphis* sp.**Record:** Inyo Co.: Lower Shoshone Cave.

**Family Lycosidae (wolf spiders)**

Undetermined

**Records:** Amador Co.: Rippled Cave. Fresno Co.: Rat Turd Cave. Shasta Co.: \*Mississippi Cave. Siskiyou Co.: Hoyle's Half-Dollar Hole.**Bibliography:** Anonymous (1999a, 1999b); Broeckel, B. (2001h); Graening (2011c).*Alopecosa* sp.**Record:** Mariposa Co.: Indian Cave.**Bibliography:** Zara Environmental (2009).*Alopecosa kochi* (Keyserling)**Records:** Calaveras Co.: Cataract Gulch Cave; Diane's Cave.**Family Mysmenidae (dwarf orb weavers)***Trogloneta paradoxa* Gertsch (troglophile?)**Records:** Amador Co.: Chrome Cave. Calaveras Co.: unnamed cave in Peruvian Gulch; Buckeye Cave; Cataract Gulch Cave; Sink Cave; Speleogen Cave. Plumas Co.: Juniper Cave. Tulare Co.: Kaweah Cave; Overhang Cave; Walk Softly Cave; Windy Pit.**Bibliography:** Briggs and Ubick (1981, 1988); Krejca (2006).**Family Nesticidae (cave cobweb spiders)**

Undetermined

**Records:** Shasta Co.: Elisha Cave.*Nesticus potterius* (Chamberlin) (troglobite)**Records:** Shasta Co.: Potter Creek Cave (type locality); Samwel Cave; Shasta Lake Caverns.**Bibliography:** Chamberlin, R.V. (1933); Danehy (1951b); Gertsch (1984); Nicholas (1960).*Nesticus silvestrii* Fage (troglophile)**Records:** Amador Co.: Black Chasm; Connie's Cave; Fern Frond Cave; Fiddler's Cave; Hummingbird Cave; Ive's Hill Cave; Moss Cave; Rippled Cave; Root Cellar Cave; Santa Claus Cave; Skeleton Cave; Soldier Creek Cave; Sutter Creek Cave. Calaveras Co.: Cave City Cave; Mercer Caverns; Shaw's Cave; Sink Cave. El Dorado Co.: Crystal Cosumnes Cave. Fresno Co.: Bat Cave; Beauty Cave; Boyden Cave; Church Cave; Millerton Lake Cave System; Saturday Cave. Mariposa Co.: Elf Village Cave; Indian Cave; Indian Rock Shelter; Mirror Lake Cave; Salamander Hideout Cave; Spider Cave. Mendocino Co.: Fault Rock Cave. Modoc Co.: Mammoth Cave. Monterey Co.: Ghost Cave. Plumas Co.: Juniper Cave. Santa Cruz Co.: Bat Cave; Clear Water Cave; Dolloff Cave; Empire Cave; Glory Cave; IXL Cave; Stump Cave; Vanished River Cave. Shasta Co.: Rusty Cave; Subway Cave. Siskiyou Co.: Fern Cave; Harris Mountain Cave; Red Tape Cave; ?Valentine Cave. Tehama Co.: Inskip Cave. Trinity Co.: Forest Glen Caves; Indian Valley Creek Cave; Lower Butter Creek Cave; Trinity Natural Bridge and Cave. Tulare Co.: Bear Den Cave; Carmoe Crevice Cave; Clough Cave; Crystal Sequoia Cave; Dehydrated Cave; Eighteenth Hole; Hidden Cave; Hurricane Crawl Cave; \*?Kaweah Cave; Lange Cave; Lilburn Cave; Lost Soldier's Cave; May's Cave; Overhang Cave; Paradise Cave; \*?Pet Cemetery Cave; Schist Canyon Cave; Ursa Minor Cave; Wiessraum Cave; Windy Pit. Tuolumne Co.: unnamed cave on N side of Table Mountain; Crack of Doom Cave; Snell's Cave; Windeler Cave; Zilch Cave.**Bibliography:** Briggs (1993); Briggs and Ubick (1988); Danehy (1951b); Despain (1993); Despain and Fryer (2002); Elliott (1978); Gertsch (1984); Krejca (2006, 2007); Lee, V.F. (1985a); Rogers (1994a, 1999d); Taylor and Krejca (2006); Ubick (1991, 2001); Zara Environmental (2009).*Nesticus sodanus* Gertsch (troglophile)**Record:** Plumas Co.: Soda Springs Cave (type locality).**Comment:** This species is known only from this cave, but will doubtless be found in epigeal habitats in this area.**Bibliography:** Gertsch (1984).



**Family Philodromidae***Apollophanes texanus* Banks**Record:** Tuolumne Co.: Transplant Mine.**Bibliography:** Elliott (1978).**Family Pholcidae (cellar spiders)**

Undetermined

**Records:** Calaveras Co.: Carlito's Cave; Crystal Stanislaus Cave; Porcupine Cave; Wool Hollow Cave. **Contra Costa Co.:** rock shelters on Carquinez Strait shoreline. **Fresno Co.:** Beauty Cave; Windy Cliff Cave. **Inyo Co.:** ARC No. 1; Lower Shoshone Cave; Shoshone Turk Cave; Sponge Cave. **San Bernardino Co.:** Cima Cave; Egg Cave; Glove Cave; Mitchell Caverns; Owl 3 Cave; Papoose Cave; Rat's Nest; Scaturd Cave. **Santa Cruz Co.:** IXL Cave; Stump Cave. **Shasta Co.:** Subway Cave. **Tehama Co.:** Inskip Cave. **Tulare Co.:** Kaweah Cave; New Cave; Overhang Cave; Walk Softly Cave.

**Bibliography:** Aalbu (1989); Krejca (2006); Ubick (2001).*Pholcophora americana* Banks**Records:** Mariposa Co.: "Short talus cave above Spider" [Spider Cave]. **Siskiyou Co.:** Shasta View Grotto.*Pholcus phalangioides* (Fuesslin)**Record:** El Dorado Co.: Alabaster Cave.*Physocyclus* sp. (troglophile)

**Records:** Amador Co.: Connie's Cave. **Fresno Co.:** Beauty Cave. **Inyo Co.:** Shoshone Turk Cave. **Tulare Co.:** Clough Cave; Hidden Cave; Kaweah Cave; Walk Softly Cave; Windy Pit. **Tuolumne Co.:** McLean's Cave.

**Bibliography:** Krejca (2006).*Physocyclus californicus* Chamberlin and Gertsch (troglophile)

**Records:** Calaveras Co.: Cone Cave; Coral Cave; Eagle View Cave No. 1; Porcupine Cave; Scat Cave. **Inyo Co.:** Lava tube caves. **Mariposa Co.:** Sprinkle Cave. **San Bernardino Co.:** Mitchell Caverns. **Tuolumne Co.:** Border Pit; Scorpion Cave; Vulture Cave.

**Bibliography:** Elliott (1978); Graening (2010); McEachern and Grady (1978).*Physocyclus enaulus* Crosby (troglophile)**Records:** San Bernardino Co.: Dusty Cave; Lost and Found Cave; Wishbone Cave.**Bibliography:** Valdez-Mondragon (2010).*Physocyclus tanneri* Chamberlin (troglophile)**Records:** San Bernardino Co.: Dusty Cave.**Bibliography:** Valdez-Mondragon (2010).*Psilochorus* sp. (troglophile)

**Records:** Amador Co.: Lulu Bell Cave. **Calaveras Co.:** Barren Cave; Brown Deer Cave; Carlito's Cave; Cataract Gulch Cave; Cave City Cave; Cave of the Catacombs; Coral Cave; Crystal Stanislaus Cave; Eagle View Cave No. 1; Grapevine Gulch Cave; Porcupine Cave; Scat Cave. **Mariposa Co.:** Pool Pit; Salamander Hideout Cave; Spider Cave; Sprinkle Cave. **San Diego Co.:** Midnight Creek Cave. **Tulare Co.:** Overhang Cave. **Tuolumne Co.:** Bend Cave; Confluence Cave; Crystal Butterfly Cave; McLean's Cave; Milkcan Cave; Pine Log Cave; Scorpion Cave; Snell's Cave; The Catacombs; Transplant Mine; Tube Cave; Vulture Cave.

**Comment:** Some of this material may belong to one of the species listed below.**Bibliography:** Briggs (1987, 1991); Elliott (1978); McEachern and Grady (1978).*Psilochorus acanthus* Chamberlin and Ivie (troglophile)**Record:** Calaveras Co.: Grapevine Gulch Cave.**Bibliography:** Slowik (2009).*Psilochorus apicalis* Banks**Records:** Calaveras Co.: Grapevine Gulch Cave. **San Bernardino Co.:** Pisgah Crater, Owl 3 Cave; Scaturd Cave.**Bibliography:** Slowik (2009).

*Psilochorus bantu* Chamberlin and Ivie**Record:** Calaveras Co.: Grapevine Gulch Cave.**Bibliography:** Slowik (2009).*Psilochorus californiae* Chamberlin**Records:** Mariposa Co.: Indian Rock Shelter, Spider Cave. San Benito Co.: Balconies Cave. San Bernardino Co.: Mitchell Caverns; Peggy 5 Cave; Rat's Nest.**Bibliography:** Slowik (2009).**Family Phrurolithidae***Phruronellus californicus* Chamberlin and Gertsch**Record:** Tuolumne Co.: Transplant Mine.**Bibliography:** Elliott (1978).**Comment:** This species has been recorded as *Scotinella californica*, but is currently cataloged by its original name. The family is in need of taxonomic revision and, until such time, both the generic placement and species identity must be regarded as tentative.**Family Pimoidae (large hammockweb spiders)***Pimoa* sp. (troglophile?)**Records:** Calaveras Co.: Dragon's Breath Cave. Fresno Co.: Children's Cave; Maze Cave. Mariposa Co.: Indian Cave; Spider Cave. Siskiyou Co.: Corkscrew Cave; Frozen Falls Cave; Marble Gap Cave; Stash Talus Cave; Upstairs-Downstairs Cave. Tulare Co.: \*Beulah Cave; Harry's Bend Cave; Lost Soldier's Cave; Schist Canyon Cave; Ursa Minor Cave; White Chief Cave.**Comment:** The records from Siskiyou County likely are *P. mephitis* and those from Tulare County may be *P. hespera*.**Bibliography:** Danahy (1951b); Elliott (1984); Fryer and Despain (2005); Graening (2011c); Krejca (2006, 2007); Oberhansley (1946); Reardon (1966); Rogers (2015); Suggett (1982); Zara Environmental (2009).*Pimoa hespera* (Gertsch and Ivie) (troglophile)**Records:** Mariposa Co.: Spider Cave. Tulare Co.: Carmoe Crevice Cave; Cirque Cave; Crystal Sequoia Cave; Deep Creek Cave (type locality); Harry's Bend Cave; Hurricane Crawl Cave; Jordan Cave; Lange Cave; Lilburn Cave (Meyer's Entrance); May's Cave; Pet Cemetery Cave; Salamander Cave; Schist Canyon Cave; Tufa Spring Cave; White Chief Cave.**Bibliography:** Danahy (1951b); Despain (1998, 1999); Despain and Fryer (2002); Hormiga (1994); Kirschman (2003); Krejca (2006); Lee, V.F. (1985a); Reardon (1966); Ubick (1991).*Pimoa mephitis* Hormiga (troglophile)**Records:** Siskiyou Co.: cave in Marble Valley, Marble Mountain Wilderness Area; Apogee Cave; Bigfoot Cave; Bighorn Cave; Echoplex Cave; Marble Gap Cave; Planetary Dairy Cave; Skunk Hollow Cave (type locality); Stash Talus Cave; Trail Junction Cave; Upstairs-Downstairs Cave; Wahashin Cave.**Comment:** This species is known only from the Marble Mountains, primarily from caves.**Bibliography:** Hemphill and Suggett (1978); Hormiga (1994); Suggett (1982).*Pimoa mono* Hormiga (troglophile)**Records:** Mono Co.: Meander Cave (type locality).**Comment:** This species, most closely related to *P. hespera*, is known only from the type locality.**Bibliography:** Hormiga (1994).**Family Plectreuridae**

## Undetermined

**Record:** San Bernardino Co.: Scatard Cave.*Kibramoa* sp.**Records:** Calaveras Co. Bobcat Cave. Shasta Co.: Potter Creek Cave.**Family Salticidae (jumping spiders)**

## Undetermined

**Record:** Tuolumne Co.: Transplant Mine.**Bibliography:** Elliott (1978).

**Family Sicariidae (recluse spiders)***Loxosceles* sp.

**Records:** Inyo Co.: ARC No. 1; ARC No. 2; Crack-'n-Mound Cave, Dirty Crack Cave, Keane Travertine Cave; No Snakes Cave. **San Bernardino Co.:** C10 Cave; Scaturd Cave.

**Bibliography:** Broeckel, B. (2009a).

*Loxosceles arizonica* Gertsch and Mulaik

**Record:** San Bernardino Co.: Peggy 5 Cave.

*Loxosceles deserta* Gertsch

**Record:** San Bernardino Co.: Mitchell Caverns; Scaturd Cave; Silver Shadow Cave.

**Bibliography:** Gertsch and Ennik (1983)

*Loxosceles russelli* Gertsch and Ennik

**Record:** Inyo Co.: Furnace Cave. **San Bernardino Co.:** abandoned mine shaft, Death Valley National Monument; Carlyle Mine.

**Bibliography:** Gertsch and Ennik (1983)

**Family Telemidae***Usofila* n. spp. (troglobite)

**Records:** Calaveras Co.: Crystal Stanislaus Cave; Mercer Caverns; Shaw's Cave; Wool Hollow Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Shasta Co.:** Ancient Palace Cave; Christmas Tree Cave; Elisha Cave; Potter Creek Cave; Samwel Cave. **Tulare Co.:** Clough Cave; Windy Pit. **Tuolumne Co.:** Mine Cave; Porcupine Cave; Porcupine Skull Cave; Transplant Mine.

**Bibliography:** Briggs (1987, 1991); Despaigne (2006); Elliott (1978); Gertsch (1992); Krejca (2006); Ledford and Griswold (2010b); Peck (1980).

*Usofila* n. spp. (troglophile)

**Records:** Amador Co.: Chrome Cave; Connie's Cave; Hummingbird Cave; Lulu Bell Cave; Moss Cave; Santa Claus Cave; Rippled Cave; Sutter Creek Cave. **Calaveras Co.:** Brown Deer Cave; Carlito's Cave; Carlow's Cave; Carlow's Bat Cavern; Cave City Cave; Cave of Skulls; Cave of the Catacombs; Crystal Stanislaus Cave; Dirty Crack Cave; Dirty Fissure; Eagle View Cave No. 1; Eagle View Cave No. 2; Grapevine Gulch Cave; Keith's Chasm; Kenney's Grotto; Linda's Cave; Moaning Cave; Music Hall Cave; O'Neil's Cave; Porcupine Cave; Pseudoscorpion Cave; Sink Cave; Striped Dome Cave; Williams Cave. **Fresno Co.:** Boyden Cave; Windy Cliff Cave. **Kern Co.:** Harrington Cave. **Mariposa Co.:** Bull Creek Cave. **Napa Co.:** Clay Cave. **Plumas Co.:** Juniper Cave; Soda Springs Cave. **San Benito Co.:** Balconies Cave; Bear Gulch Cave. **San Bernardino Co.:** Kokoweef Cave; Kokoweef Crystal Cave. **Santa Cruz Co.:** Bat Cave; Dolloff Cave; Empire Cave; IXL Cave; Stump Cave. **Shasta Co.:** Rusty Cave; Subway Cave. **Siskiyou Co.:** Hypochilus Cave; True Shasta View Cave; Valentine Cave. **Trinity Co.:** Forest Glen Caves; Indian Valley Creek Cave. **Tulare Co.:** Eighteenth Hole; Kaweah Cave; New Cave; Walk Softly Cave. **Tuolumne Co.:** Baconrind Cave; Crystal Palace; Crystal Tuolumne Cave; Lower Von Trump Mine; McLean's Cave; McLean's Cave; McNamee's Cave; Moss Cave; Pine Log Cave; Pinnacle Point Cave; Porcupine Cave; Quarry Cave; The Catacombs.

**Comment:** Some of these records may actually belong to *U. gracilis*.

**Bibliography:** Arnett (1984); Briggs (1975); Briggs and Ubick (1981, 1988); Despaigne (2006); Elliott (1978, 1984); Gertsch (1992); Graening (2010, 2011b); Ledford and Griswold (2010b); McEachern and Grady (1978); Peck (1973b, 1980); Taylor and Krejca (2006); Ubick (2001); Ubick and Briggs (1992).

*Usofila gracilis* Keyserling (troglophile)

**Records:** El Dorado Co.: Alabaster Cave (type locality).

**Comment:** This species has long legs and is known only from one cave.

**Bibliography:** Banks (1891, 1894); Berland (1931); Brignoli (1973); Comstock (1912, 1940); Fage (1912); Gertsch (1979); Keyserling (1891); Ledford and Griswold (2010b); Nicholas (1960); Packard (1988); Peck (1980); Petrunkevitch (1911).

**Family Tetragnathidae (long-jawed orb weavers)***Meta dolloff* Levi (troglophile)

**Records:** Monterey Co.: Ghost Cave; Willow Creek Cave. **Santa Cruz Co.:** unnamed cave near Davenport; Bat Cave; Bob's Secret Cave; Clear Water Cave; Dolloff Cave; Empire Cave (type locality); Friday Night Cave; Glory Cave; IXL Cave; Kalkar Grottos; Laguna Creek Cave; \*Pancake Cave; Pogonip Cave; Stearns Cave; San Vicente Creek Caves; Stump Cave; Vanished River Cave; Wrights Station Tunnel.



**Comment:** This orb-weaver occurs from the cave mouth into deep twilight. Graham studied the ecology of this species.

**Bibliography:** Anonymous (2005a, 2013); Arnett (1984); Branson (1958); Briggs (1990); Briggs and Gpc (1975); Briggs and Ubick (1988); Conover (2013b, 2015); Danehy (1951); Davies (2015); Elliott (1984); Fan (2010a); Frantz and Frantz (2005); Graham (1967); Leissring (2002); Levi (1980); McCoy (2011); Rogers (2009a, 2010c, 2011a, 2013b); Ubick (2001).

*Metellina* sp. (troglophile?)

**Records:** **Amador Co.:** Lulu Bell Cave. **Fresno Co.:** Millerton Lake Cave System. **Siskiyou Co.:** Catacombs Cave. **Trinity Co.:** Paul Gibson Cave.

**Bibliography:** Taylor and Krejca (2006).

*Metellina curtisi* (McCook) (troglophile?)

**Records:** **Napa Co.:** Clay Cave. **Tulare Co.:** Bear Den Cave; Crystal Sequoia Cave; Hidden Cave; Lost Soldier's Cave; Wiessraum Cave.

**Bibliography:** Krejca (2006).

*Metellina mimetoides* Chamberlin and Ivie (troglophile?)

**Records:** **Amador Co.:** Lulu Bell Cave. **Calaveras Co.:** Bone Cave; Cave of Skulls; Cave of the Catacombs; Coral Cave; Diane's Cave; Skull Cave. **Mariposa Co.:** Sprinkle Cave. **Napa Co.:** Clay Cave. **Tuolumne Co.:** Border Pit; Crystal Palace; Scorpion Cave.

**Bibliography:** Levi (1980).

*Tetragnatha* sp.

**Records:** **Siskiyou Co.:** Mushpot Cave. **Tulare Co.:** Crystal Sequoia Cave; Lilburn Cave.

**Bibliography:** Krejca (2006); Taylor and Krejca (2006).

*Tetragnatha versicolor* Walckenaer

**Record:** **Fresno Co.:** Millerton Lake Cave System.

#### Family Theridiidae (cobweb spiders)

Undetermined

**Records:** **Calaveras Co.:** Heater Cave. **Fresno Co.:** Boyden Cave. **Mariposa Co.:** Salamander Hideout Cave. **San Benito Co.:** Bear Gulch Cave. **Siskiyou Co.:** Skunk Hollow Cave; Spider Cave; Township Cave.

**Bibliography:** Graening (2011c).

*Cryptachaea ?blattea* (Urquhart) (troglophile)

**Records:** **Mariposa Co.:** Indian Rock Shelter.

*Cryptachaea canionis* (Chamberlin and Ivie) (troglophile)

**Records:** **Fresno Co.:** Beauty Cave. **Mariposa Co.:** Indian Cave; Spider Cave. **Siskiyou Co.:** Four Star Cave; Shasta View Grotto; Snake Pit; True Shasta View Cave.

*Cryptachaea fresno* (Levi) (troglophile)

**Records:** **Amador Co.:** Santa Claus Cave. **Calaveras Co.:** Bone Cave; Bryden's Cave; Carlito's Cave; Cave of the Catacombs; Clutch Cave; Coral Cave; Diane's Cave; Eagle View Cave No. 2; Grapevine Gulch Cave; Lost Piton Cave; Porcupine Cave; Scat Cave; Sink Cave; Striped Dome Cave. **Napa Co.:** Manhattan Mines. **Plumas Co.:** Soda Springs Cave. **Shasta Co.:** Potter Creek Cave. **Tulare Co.:** Bear Den Cave; Overhang Cave.

**Bibliography:** Krejca (2006); McEachern and Grady (1978); Rogers (1994a, 1999d).

*Enoplognatha selma* (Chamberlin and Ivie)

**Record:** **Mariposa Co.:** Bower Cave.

*Euryopsis spinigera* O. Pickard-Cambridge

**Record:** **Tulare Co.:** Walk Softly Cave.

**Bibliography:** Krejca (2006).

*Hentzietypus schullei* (Gertsch and Mulaik) (troglophile)

**Records:** San Bernardino Co.: Mexican Mine; Mitchell Caverns. Inyo Co.: ?Titus Canyon Cave.

*Latrodectus* sp. (black widow spiders)

**Records:** Lassen Co.: Snaked Cave (webs); San Bernardino Co.: Cima Cave; Triple Lead Shelter. Siskiyou Co.: Adam's Homestead Cave; It ta Choo-mah Cave. Tulare Co.: Deep Creek Cave.

**Bibliography:** Anonymous (1998a, 1999e); Graening (2010); Wolff, L. (2009a, 2013b).

*Rugathodes sexpunctatum* (Emerton)

**Record:** Plumas Co.: Juniper Cave.

*Steatoda* sp.

**Records:** San Benito Co.: Bear Gulch Cave. Siskiyou Co.: Caldwell Ice Caves.

*Theridion* sp.

**Record:** Santa Cruz Co.: Bat Cave.

**Bibliography:** Briggs and Ubick (1988).

*Thymoites* sp.

**Records:** Amador Co.: Masonic Cave. Siskiyou Co.: Hypochilus Cave.

*Thymoites camano* (Levi) (troglophile)

**Records:** Amador Co.: Fern Frond Cave; Lulu Bell Cave. Calaveras Co.: Buckeye Cave; Cave City Cave; Cave of the Catacombs; Seat Cave; Shaw's Cave. Fresno Co.: Boyden Cave. Mariposa Co.: Damp Cave; Spider Cave; Sprinkle Cave. Plumas Co.: Juniper Cave. Shasta Co.: Samwel Cave. Trinity Co.: Forest Glen Caves; Hall City Cave; Trinity Natural Bridge and Cave. Tulare Co.: Carmoe Crevice Cave; Crystal Sequoia Cave; Dehydrated Cave; Harry's Bend Cave; Jordan Cave; May's Cave; Overhang Cave; Salamander Cave; Tufa Spring Cave. Tuolumne Co.: Crystal Palace; Forscythe Cave; Porcupine Cave.

**Bibliography:** Krejca (2006).

*Thymoites pallidus* (Emerton) (troglophile?)

**Records:** Santa Cruz Co.: Bat Cave; Laguna Creek Cave.

**Bibliography:** Ubick (2001).

**Family Thomisidae (crab spiders)**

Undetermined

**Records:** Fresno Co.: Millerton Lake Cave System. Tuolumne Co.: Forscythe Cave.

**Bibliography:** Krejca (2006).

*Xysticus punctatus* Keyserling

**Record:** Shasta Co.: Potter Creek Cave.

**Bibliography:** Chamberlin, R.V. (1933); Gertsch (1953); Schick (1965).

**Family Uloboridae (hackled orb weavers)**

*Uloborus diversus* Marx

**Records:** Calaveras Co.: Buckeye Cave; Carlow's Bat Cavern; Clutch Cave; Eagle View Cave No. 2. San Bernardino Co.: Mitchell Caverns. Tulare Co.: Windy Pit. Tuolumne Co.: Indian Quarry Cave No. 2.

**Bibliography:** Krejca (2006); McEachern and Grady (1978).

**Family Zoropsidae**

Undetermined

**Records:** El Dorado Co.: Alabaster Cave; Crystal Cosumnes Cave. Fresno Co.: Fault Rock Cave. Napa Co.: Clay Cave. San Bernardino Co.: Cima Cave; Lost and Found cave; Papoose Cave.

*Anachemmis* sp.**Records:** San Bernardino Co.: Virginia's Mine Cave; Wishbone Cave.**Bibliography:** Graening (2010).*Anachemmis aalbei* Platnick and Ubick (troglophile)**Record:** San Bernardino Co.: Medicine Cave.**Comment:** This eyed species has longer legs and paler pigmentation than its epigeal relatives.**Bibliography:** Platnick and Ubick (2005).*Anachemmis jungi* Platnick and Ubick (troglophile)**Records:** Inyo Co.: Defense Cave; Titus Canyon Cave (type locality).**Comment:** This species is only known from caves and has long legs and pale pigmentation, but also well developed eyes.**Bibliography:** Platnick and Ubick (2005).*Anachemmis sober* Chamberlin**Records:** Tulare Co.: Kaweah Cave.**Bibliography:** Platnick and Ubick (2005).*Titiotus* spp. (troglophile)

**Records:** Amador Co.: Black Chasm; Chrome Cave; Connie's Cave; Fern Frond Cave; Fiddler's Cave; New Cave; Rippled Cave; Skeleton Cave; Soldier Creek Cave; Violin Cave. **Calaveras Co.:** small cave near Shaw's Cave; Barren Cave; Beta Cave; Bobcat Cave; Bone Cave; Bryden's Cave; Buckeye Cave; Bryden's Cave; Carlow's Bat Cavern; Cataract Gulch Cave; Clutch Cave; Cone Cave; Coral Cave; Diane's Cave; Dragon's Breath Cave; Eagle View Cave No. 1; Gerritt's Cave; Gray Pine Cave; Heater Cave; Kenney's Grotto; Linda's Cave; Lost Piton Cave; Mercer Caverns; Mercer's Big Pit; Moaning Cave; Poison Oak Cave; Pool Cave; Rabbit Hole; Scat Cave; Secret Cave; Shaw's Cave; Snail Cave; Two Bit Pit; Upper Calaveras Natural Bridge; Williams Cave. **Fresno Co.:** Bat Cave; Beauty Cave; Boyden Cave; Church Cave; Windy Cliff Cave. **Inyo Co.:** Titus Canyon Cave. **Kern Co.:** Harrington Cave. **Mariposa Co.:** Bower Cave; Bucks Cave; Bull Creek Cave; Damp Cave; Indian Cave; Spider Cave. **Santa Cruz Co.:** Vanished River Cave. **Shasta Co.:** Rusty Cave. **Siskiyou Co.:** Crystal Ice Cave; Hypochilus Cave; Planetary Dairy Cave; Skunk Hollow Cave; Trail Junction Cave. **Trinity Co.:** Hall City Cave. **Tulare Co.:** \*Bear Den Cave; Beulah Cave; Clough Cave; Dehydrated Cave; Eighteenth Hole; Hidden Cave; Hurricane Crawl Cave; Kaweah Cave; \*Lost Soldier's Cave; \*May's Cave; Overhang Cave; Paradise Cave; Pet Cemetery Cave; Rattlesnake Cave; Salamander Cave; Schist Canyon Cave; Upper Bryant Cave; Walk Softly Cave; Wiessraum Cave; Windy Pit. **Tuolumne Co.:** Baconrind Cave; Banksula Cave; Border Pit; Crack of Doom Cave; Crystal Butterfly Cave; Crystal Tuolumne Cave; Indian Quarry Cave No. 1; Indian Quarry Cave No. 2; Milkcan Cave; Mine Cave; Porcupine Cave; Snell's Cave; Tank Cave; Toppled Table Talus Cave; Troll Cave; Tube Cave; Vulture Cave; Zilch Cave.

**Comment:** Most of these records are based on immature specimens. The genus is also found in deep rock crevices along streams. Specimens were transplanted from McLean's Cave to the Transplant Mine.**Bibliography:** Briggs (1975, 1987, 1993); Briggs and Ubick (1981); Danehy (1951a, 1951b); Despain (1993, 2006); Elliott (1978); Graening (2011b); Krejca (2006, 2007); Reardon (1966); McEachern and Grady (1978); Ubick (1991, 2001); Zara Environmental (2009).*Titiotus californicus* Simon (troglophile)**Records:** Calaveras Co.: Cave City Cave; Cave of the Catacombs; Grapevine Gulch Cave; O'Neil's Cave. **San Benito Co.:** Balconies Cave; Bear Gulch Cave.**Bibliography:** Platnick and Ubick (2008).*Titiotus flavescens* (Chamberlin and Ivie) (troglophile)**Records:** Santa Cruz Co.: cave near Cave Gulch; Bat Cave; Coral Grotto; IXL Cave; Vanished River Cave.**Bibliography:** Briggs and Ubick (1988); Platnick and Ubick (2008); Ubick (2001).*Titiotus gertschi* Platnick and Ubick (troglophile)

**Records:** Amador Co.: Lulu Bell Cave; Moss Cave; Mushroom Cave; Santa Claus Cave. **Calaveras Co.:** Brown Deer Cave; Carlito's Cave; Carlow's Cave; Cave of Skulls; Crystal Stanislaus Cave; Grapevine Gulch Cave; Keith's Chasm; Music Hall Cave; Porcupine Cave; Pseudoscorpion Cave; Wool Hollow Cave. **Mariposa Co.:** Pool Pit. **Tuolumne Co.:** mine 2.5 km N Columbia; Bend Cave; Crystal Palace; McLean's Cave; Pinnacle Point Cave; Pine Log Cave; Porcupine Skull Cave; Razorback Grotto; Scorpion Cave; The Catacombs; Transplant Mine; Windeler Cave.

**Comment:** Specimens were transplanted from McLean's Cave to the Transplant Mine.



**Bibliography:** Anonymous (1999c); Briggs (1975, 1991); Elliott (1978); Jorgensen (2010b); McEachern and Grady (1978); Platnick and Ubick (2008); Smith, A.G. (1957).

*Titiotus hansii* (Schenkel) (troglophile)

**Records:** **Plumas Co.:** Juniper Cave; Soda Springs Cave. **Shasta Co.:** cave in Low Pass Creek. **Trinity Co.:** Indian Valley Creek Cave.

**Bibliography:** Platnick and Ubick (2008).

*Titiotus heberti* Platnick and Ubick (troglophile)

**Records:** **Kern Co.:** unnamed mine. **Tulare Co.:** cave in bank on road to Crystal Sequoia Cave; mine shaft, Cedar Creek Camp Ground; Carmoe Crevice Cave; Cedar Cave; Crystal Sequoia Cave; Harry's Bend Cave.

**Bibliography:** Danchy (1951a, 1951b); Krejca (2006); Platnick and Ubick (2008); Reardon (1966).

*Titiotus humboldti* Platnick and Ubick (troglophile)

**Records:** **Shasta Co.:** Ancient Palace Cave; Bat Cave; Potter Creek Cave; Samwel Cave; Shasta Lake Caverns. **Trinity Co.:** Forest Glen Caves.

**Bibliography:** Anonymous (1951); Platnick and Ubick (2008).

*Titiotus madera* Platnick and Ubick (troglophile)

**Record:** **Mariposa Co.:** Sprinkle Cave.

**Bibliography:** Platnick and Ubick (2008).

#### ORDER OPILIONES (harvestmen)

Undetermined

**Records:** **Calaveras Co.:** \*O'Neil's Cave. **Fresno Co.:** \*Hummel's Cave. **Napa Co.:** Clay Cave. **San Bernardino Co.:** Classroom Cave; Virginia's Mine Cave. **Santa Cruz Co.:** \*Coral Grotto; IXL Cave; Vanished River Cave. **Shasta Co.:** Edward Cave; \*Blanchet Cave; \*Klaydo Cave; Planetarium Cave; \*Samwel Cave. **Siskiyou Co.:** Marble Gap Cave; \*Million Dollar Cave. **Tulare Co.:** Bear Den Cave; Carmoe Crevice Cave; Eighteenth Hole; Hidden Cave; Hurricane Crawl Cave; Kaweah Cave; Lilburn Cave; Lost Soldier's Cave; Overhang Cave; Pet Cemetery Cave; White Chief Cave. **Ventura Co.:** Clear Springs Cave.

**Bibliography:** Anonymous (1991b); Broeckel, B. (1996a, 1998a); Danchy (1951b); Decker (2002); Graening (2010); Haliday (1962); Jackson, M. (1992); Jorgensen (2008); Quick (1996, 1997b, 1998b); Rogers (2010b); Suggett (1982).

#### SUBORDER EUPNOI

##### Family Phalangiidae

Undetermined

**Records:** **Calaveras Co.:** Music Hall Cave. **San Bernardino Co.:** Peggy 5 Cave. **Santa Cruz Co.:** Vanished River Cave. **Siskiyou Co.:** Lazaroff's Hole; Township Cave. **Trinity Co.:** Paul Gibson Cave. **Tulare Co.:** Cedar Cave.

**Comment:** Some or all of these records may belong in Sclerosomatidae or Protolophidae.

**Bibliography:** Graening (2010); Taylor and Krejca (2006).

##### Family Protolophidae

*Protolophus* sp. (troglaxene)

**Records:** **Amador Co.:** Rippled Cave; Violin Cave. **Calaveras Co.:** Grapevine Gulch Cave. **Tulare Co.:** Kaweah Cave; Lost Soldier's Cave; Paradise Cave; Pine Grosbeak Cave. **Tuolumne Co.:** Transplant Mine.

##### Family Sclerosomatidae

*Globipes spinulatus* Banks

**Records:** **Calaveras Co.:** Grapevine Gulch Cave. **Tuolumne Co.:** Milkcan Cave.

**Comment:** *Globipes* and relatives constitute a clade, the *Metopilio* group, often placed as the sister group to Sclerosomatidae.

*Leiobunum* sp. (troglaxene)

**Records:** **Fresno Co.:** Boyden Cave. **Inyo Co.:** Upper Shoshone Cave. **Napa Co.:** Clay Cave. **San Benito Co.:** Bear Gulch

Cave. **Santa Cruz Co.:** Stearns Cave. **Siskiyou Co.:** Crystal Ice Cave; Echoplex Cave; Frozen Falls cave; It ta Choo-mah Cave. **Trinity Co.:** Paul Gibson Cave. **Tuolumne Co.:** Transplant Mine.

**Bibliography:** Elliott (1978); Snyder (2005b); Wolff, L. (2013b).

*Leiobunum exilipes* (Wood) (trogloxene)

**Records:** **Santa Cruz Co.:** Bat Cave; Clear Water Cave; Coral Grotto; Dolloff Cave; Empire Cave; IXL Cave; Laguna Creek Cave; Stearns Cave; Stump Cave. **Siskiyou Co.:** Marble Gap Cave.

**Bibliography:** Briggs and Ubick (1988); Graham (1968a); Graening (2011c); Rogers (2013b); Steiger (2007); Ubick (2001).

*Leuronychus pacificus* Banks

**Records:** **Calaveras Co.:** Mercer Caverns. **Tuolumne Co.:** Bend Cave.

*Nelima* sp.

**Records:** **Tulare Co.:** Harry's Bend Cave; May's Cave.

**Bibliography:** Krejca (2006).

*Nelima paessleri* Roewer (trogloxene)

**Records:** **Mariposa Co.:** Bower Cave. **Siskiyou Co.:** Planetary Dairy Cave; Skunk Hollow Cave; Trail Junction Cave; Upstairs-Downstairs Cave. **Trinity Co.:** Hall City Cave. **Tulare Co.:** Lilburn Cave.

**Bibliography:** Krejca (2006).

#### SUBORDER DYSPNOI

##### Family Nemastomatidae

*Ortholasma* sp. (troglophile)

**Records:** **Fresno Co.:** Millerton Lake Cave System. **Tulare Co.:** Kaweah Monkeyflower Cave; Lange Cave; May's Cave; Overhang Cave; Ursa Minor Cave.

**Bibliography:** Krejca (2006).

*Ortholasma colossus* Shear (troglophile)

**Records:** **Tulare Co.:** Bear Den Cave (type locality); Carmoe Crevice Cave; Hidden Cave; Lightning Cave; Lost Soldier's Cave; Paradise Cave.

**Bibliography:** Krejca (2006); Shear (2010).

*Ortholasma levipes* Shear and Gruber

**Record:** **Calaveras Co.:** Wool Hollow Cave.

**Bibliography:** Shear and Gruber (1983).

*Ortholasma rugosum* Banks (troglophile)

**Records:** **Calaveras Co.:** Eagle View Cave No. 2; Moaning Cave. **Santa Cruz Co.:** Dolloff Cave; Empire Cave; Stearns Cave. **Tuolumne Co.:** McLean's Cave.

**Comment:** This species has also been found on the surface 4 km northwest of Columbia.

**Bibliography:** Elliott (1978); McEachern and Grady (1978).

#### Family Sabaconidae

Undetermined

**Record:** **Trinity Co.:** Paul Gibson Cave.

*Sabacon* sp.

**Records:** **Calaveras Co.:** Wool Hollow Cave. **Siskiyou Co.:** Maple Root Cave; Planetary Dairy Cave. **Trinity Co.:** Trinity Natural Bridge and Cave.

**Bibliography:** Graening (2011c).

*Sabacon* nr. *occidentalis* (Banks)

**Records:** **Amador Co.:** Masonic Cave; Moss Cave. **Trinity Co.:** Forest Glen Caves; Hall City Cave; Indian Valley Creek Cave.

*Sabacon briggsi* Shear

**Records:** Santa Cruz Co.: Empire Cave; Stearns Cave.

**Bibliography:** Ubick (2001).

*Sabacon siskiyou* Shear

**Record:** Trinity Co.: Pype Cave.

**Family Taracidae***Hesperonemastoma* sp.

**Records:** Tulare Co.: Cedar Cave; Palmer Cave.

**Bibliography:** Krejca (2006); Lee, V.F. (1985).

*Hesperonemastoma modestum* (Banks)

**Records:** Calaveras Co.: Carlow's Bat Cavern. **Tuolumne Co.:** Transplant Mine.

**Bibliography:** Elliott (1978); McEachern and Grady (1978).

*Oskoron* and *Taracus* sp.

**Records:** Shasta Co.: Burnt Elderberry Cave; Christmas Tree Cave; Elisha Cave; Flashlight Cave; North Christmas Tree Cave; Wilcox Cave. **Sierra Co.:** Avalanche Cave. **Siskiyou Co.:** Apogee Cave; Corkscrew Cave; Frozen Falls Cave; Horta's Den; Marble Gap Cave; Planetary Dairy Cave; Skunk Hollow Cave; Trail Junction Cave. **Tehama Co.:** Wilson Lake Ice Cave. **Trinity Co.:** Forest Glen Caves; Trinity Natural Bridge and Cave. **Tulare Co.:** Deep Creek Cave; Marmot Falls Cave; Marmot Highway Cave.

**Bibliography:** Audisio (2009a); Briggs (1969); Graening (2011a, 2011c); Krejca (2006).

*Oskoron spinosus* (Banks) (troglophile)

**Record:** Fresno Co.: Shaver Cave. **Sierra Co.:** Avalanche Cave; cave near Avalanche Cave. **Trinity Co.:** Indian Valley Creek Cave. **Tulare Co.:** Cirque Cave; Lilburn Cave.

**Bibliography:** Shear and Warfel (2016).

**Comment:** This species, previously classified as *Taracus spinosus*, is syntopic with *Taracus audisioae* in Cirque Cave. Records from Cirque Cave previously were listed in our database as *Taracus* n. sp. no. 1 (troglobite) and White Chief Cave as *Taracus* n. sp. no. 2.

**Bibliography:** Despain (2006); Krejca (2006); Shear and Warfel (2016).

*Taracus audisioae* Shear (troglophile)

**Records:** Fresno Co.: Black Lake Cave; Hidden Pond Cave; Meander Cave (type locality). **Tulare Co.:** Cedar Cave; Cirque Cave; Jordan Cave; Lilburn Cave; May's Cave; Panorama/Sink Cave System; Pet Cemetery Cave; Seldom Seen Cave; White Chief Cave. **Tuolumne Co.:** Fivescythe Cave; Forseythe Cave; Waterfall Cave.

**Bibliography:** Briggs (1969b); Despain (2006, 2009a); Krejca (2006); Lee (1985a); Shear and Warfel (2016).

**Comment:** This is the largest species of *Taracus* and is syntopic with *Oskoron spinosus* in Cirque Cave. Some records were previously listed in our database as *Taracus* n. sp. no. 2 (troglophile).

*Taracus fluvipileus* Shear (troglobite)

**Record:** Shasta Co.: Alien Space Cave; Bat Mummy Cave; Christmas Tree Cave; North Christmas Tree Cave; Parrish Cave; Pecan Cave; Planetarium Cave; Rusty Cave; Subway Cave (type locality).

**Bibliography:** Peck (1973a); Shear and Warfel (2016).

*Taracus ubicki* Shear (troglophile)

**Records:** Santa Cruz Co.: Empire Cave; Stearns Cave. **Siskiyou Co.:** Planetary Dairy Cave; Skunk Hollow Cave. **Trinity Co.:** Forest Glen Caves.

**Comment:** This species previously was listed as *Taracus* n. sp. no. 3 (troglophile) in our database.

**Bibliography:** Ubick (2001); Shear and Warfel (2016).



## SUBORDER LANIATORES

## Family Phalangodidae

## Undetermined

**Records:** Fresno Co.: Church Cave. Tulare Co.: Cedar Cave; Eighteenth Hole; Overhang Cave.

**Bibliography:** Krejca (2006).

*Banksula* sp.

**Records:** Tuolumne Co.: Crystal Butterfly Cave.

**Bibliography:** Snyder (2003).

*Banksula californica* (Banks) (troglomite)

**Records:** El Dorado Co.: Alabaster Cave (type locality).

**Comment:** Originally described as *Phalangodes californica*, this species has no retinae or corneas. Briggs (1974) reported that a thorough search of Alabaster Cave, which was partially destroyed by quarrying, failed to locate specimens. *Banksula incredula* Ubick and Briggs with elongate legs but well developed eyes was described from sandstone talus on San Bruno Mountain, San Mateo County (Ubick and Briggs (2002).

**Bibliography:** Banks (1900, 1904); Briggs (1974a, 1974b); Briggs and Ubick (1981); Comstock ('1912, 1940); Daney (1951b); Goodnight and Goodnight (1960, 1981); Jeannel (1943); Juberthie (1964); Kury (2003); McConnell (1976, 1983); Nicholas (1960); Popoff (1978); Rambla and Juberthie (1994); Roewer (1923); Ubick and Briggs (2002); Wolf (1934–1937).

*Banksula galilei* Briggs (troglomite)

**Records:** Placer Co.: Lime Rock Caves (type locality); Lime Rock Cave No. 3.

**Bibliography:** Briggs (1974b); Briggs and Ubick (1981); Goodnight and Goodnight (1981); Kury (2003); Rambla and Juberthie (1994); Ubick and Briggs (2002).

*Banksula grahami* Briggs (troglomite/troglomite)

**Records:** Calaveras Co.: Carlow's Cave; Grapevine Gulch Cave; Gray Pine Cave; Keith's Chasm; Moaning Cave (type locality); Music Hall Cave; Rabbit Hole. **Tuolumne Co.:** mine on ridge 4.5 km N of Columbia; mine tunnel on Experimental Mine road; Banksula Cave; Crystal Palace; Experimental Mine Cave; McLean's Cave; Pinnacle Point Cave (type-locality of synonymized *Banksula elliotti* Briggs and Ubick); Porcupine Cave; Snell's Cave; Transplant Mine.

**Comment:** This species is sympatric with *B. melones* in McLean's Cave. It has colonized at least two mines, probably by interstitial movement. Briggs and Elliott established the Transplant Mine population under U. S. Army Corps of Engineers contracts. This species is apparently now extinct in the Transplant Mine since none were found in 1986 or 1996. Recent study indicates that this species exhibits clinal variation in troglomorphic characters and that what had previously been considered a separate species (*B. elliotti*) represents only those populations with the highest degree of eye degeneration. Also, the southernmost populations of *B. grahami* have well-developed eyes and can be considered troglomorphs.

**Bibliography:** Briggs (1974a, 1974b, 1975, 1987, 1991); Briggs and Ubick (1981); Cooper (1978); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Elliott (1978, 1979b, 1981a, 1985); Fiack (1978); Goodnight and Goodnight (1981); Graening (2011b); Kury (2003); McEachern and Grady (1978); Martin, B. (1977); Martin, B.J. (1981); Rambla and Juberthie (1994).

*Banksula grubbsi* Briggs and Ubick (troglomite)

**Record:** Amador Co.: Black Chasm (type locality).

**Comment:** At present this species is known from a single male of light yellow color with small corneas and no retinae.

**Bibliography:** Briggs and Ubick (1981); Kury (2003); Rambla and Juberthie (1994); Ubick and Briggs (2002).

*Banksula martinorum* Briggs and Ubick (troglomite)

**Record:** Calaveras Co.: Heater Cave (type locality).

**Comment:** This species, known only from Heater Cave, has no retinae or corneas.

**Bibliography:** Briggs and Ubick (1981); Casper (1979); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Kury (2003); Rambla and Juberthie (1994); Rudolph (1979); Ubick and Briggs (2002).

*Banksula melones* Briggs (troglomite)

**Records:** Calaveras Co.: Barren Cave; Beta Cave; Bone Cave; Bryden's Cave; Cave of Skulls; Cone Cave; Coral Cave; Eagle View Cave No. 2; Fenceline Cave; Gerritt's Cave; Lost Piton Cave; Poison Oak Cave; Quail Cave; Scat Cave.

**Tuolumne Co.:** Border Pit; Gate Pit Cave; McLean's Cave; McNamee's Cave (type-locality); Mine Cave; Scorpion Cave; Transplant Mine; Vulture Cave; Zeke's Pit.

**Comment:** This species was sympatric with *B. grahami* in McLean's Cave and the Transplant Mine. It was established in the latter by the artificial transplant of 22 individuals in 1975 and 26 adults plus as many as 26 immatures in 1977–78. As of March 1979 *B. melones* had increased to a population of several hundred individuals. The population of *B. grahami* had also increased in the mine, but was not as numerous as *B. melones* despite having a larger founding population (116 adults). Subsequent visits to the mine turned up only *B. melones*, with about 50 individuals recorded in 1986 and only six in 1996. *Banksula melones* has large, dark, well developed eyes, therefore it may not be a troglobite, but it is known from the dark zone of caves, although it has been found under stones in the twilight zone of Vulture Cave and Bone Cave. At the time of the transplants its known distribution included only McLean's Cave (subsequently inundated by New Melones Lake) and McNamee's Cave (subsequently destroyed by quarrying). Both species will consume live collembola during confinement and will occasionally kill, but not consume, large psocids. Both species frequently exhibit catatonic behavior when disturbed, i.e. the legs are appressed to the body and the animal "freezes" for up to several minutes. One of us (WRE) has observed this same behavior in the related species, *Phalangodes armata*, in Mammoth Cave, Kentucky. This suggests that the behavior may be common throughout the Phalangodidae.

**Bibliography:** Anonymous (1979a, 1979b, 1979c); Arnold (1993); Briggs (1974a, 1974b, 1975, 1987, 1990, 1991); Briggs and Ubick (1981); Chapman (1993); Cooper (1978); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Ehr (1981b); Elliott (1978, 1979b, 1981b, 1985, 2000b); Fiack (1978); Goodnight and Goodnight (1981); Graening (2011b); Hardaker (1998, 2003); Kury (2003); McConnell (1976, 1983); McEachern and Grady (1978); Martin, B. (1977); Martin, B.J. (1981); Rambla and Juberthie (1994); Rudolph (1979); Strong (1978); Ubick and Briggs (2002).

*Banksula rudolphi* Briggs and Ubick (troglobite)

**Record: Amador Co.:** Chrome Cave (type locality).

**Comment:** This species has no retina and some individuals have no cornea.

**Bibliography:** Briggs and Ubick (1981); Kury (2003); Rambla and Juberthie (1994); Ubick and Briggs (2002).

*Banksula tuolumne* Briggs (troglobite)

**Records: Tuolumne Co.:** Crystal Tuolumne Cave (type locality as "Crystal-Tuolumne Cave").

**Comment:** This species possesses a small cornea and depigmented retina.

**Bibliography:** Briggs (1974); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Goodnight and Goodnight (1981); Kury (2003); Rambla and Juberthie (1994); Ubick and Briggs (2002).

*Banksula tutankhamen* Ubick and Briggs (troglobite)

**Record: Calaveras Co.:** O'Neil's Cave (King Tut Cave, type locality).

**Comment:** This species has degenerate retina and cornea.

**Bibliography:** Kury (2003); Ubick and Briggs (2002).

*Calicina* sp. (troglophile)

**Records: Tulare Co.:** Clough Cave; Overhang Cave.

**Bibliography:** Krejca (2006); Shear, Taylor, Wynne, and Krejca (2009).

*Calicina* n. sp. (troglophile)

**Records: Tulare Co.:** Kaweah Cave; Lange Cave; Walk Softly Cave.

**Bibliography:** Despain (2006); Krejca (2006).

*Calicina cloughensis* (Briggs and Hom) (troglobite)

**Records: Tulare Co.:** Clough Cave (type locality); Hidden Cave; Overhang Cave; Windy Pit.

**Comment:** This species is eyeless and lives in total darkness.

**Bibliography:** Briggs and Hom (1967); Despain (2003b); Ehr (1976); Goodnight and Goodnight (1981); Krejca (2006); Kury (2003); Rambla and Juberthie (1994); Ubick and Briggs (1989).

*Calicina digita* (Briggs and Hom) (troglophile)

**Records: Fresno Co.:** Saturday Cave. **Tulare Co.:** Bear Den Cave; Hurricane Crawl Cave; Pet Cemetery Cave.

**Comment:** This species has also been taken from the surface in Fresno, Mariposa, and Tulare counties.

**Bibliography:** Krejca (2006); Kury (2003); Ubick and Briggs (1989).

*Calicina serpentina* (Briggs and Hom) (troglophile)**Record:** Santa Cruz Co.: Bob's Secret Cave.**Comment:** This species is known from serpentine outcrops from the southern Bay Area from San Mateo and Contra Costa to San Benito counties.**Bibliography:** Briggs and Hom (1967); Ubick and Briggs (1989).*Calicina sierra* (Briggs and Hom) (troglophile)**Records:** Amador Co.: Masonic Cave (type locality). Calaveras Co.: unnamed cave in Peruvian Gulch; Carlow's Bat Cavern; Carlow's Cave; Music Hall Cave; Scat Cave; Speleogen Cave. Tuolumne Co.: Lower Von Trump Mine; McLean's Cave; Porcupine Skull Cave; Transplant Mine.**Comment:** This species is also found on the surface in gray pine-oak forests.**Bibliography:** Briggs (1968); Briggs and Hom (1967); Briggs and Ubick (1981); Elliott (1978); Kury (2003); McEachern and Grady (1978); Ubick and Briggs (1989).*Megacina cockerelli* (Goodnight and Goodnight)**Records:** Napa Co.: Clay Cave.**Bibliography:** Bradford (2005); Ubick and Briggs (2008).*Sitalcina californica* (Banks) (troglophile)**Records:** Santa Cruz Co.: Bat Cave; Empire Cave; IXL Cave; Stearns Cave; Stump Cave.**Bibliography:** Banks (1911); Briggs (1968); Halliday (1962); Ubick (2001); Ubick and Briggs (2002, 2008).*Sitalcina sura* Briggs**Record:** Monterey Co.: Ghost Cave.**Bibliography:** Ubick and Briggs (2008).*Texella* n. sp. (troglobite?)**Record:** Inyo Co.: Titus Canyon Cave*Texella bifurcata* (Briggs) (troglophile)**Records:** Shasta Co.: Samwel Cave; Shasta Lake Caverns.**Comment:** This species is known from surface localities in Del Norte and Shasta counties. The individuals from caves have distinctly longer appendages and are slightly less pigmented than surface populations.**Bibliography:** Ubick and Briggs (1992, 2002, 2004).*Texella kokoweef* Ubick and Briggs (troglophile)**Record:** San Bernardino Co.: Kokoweef Crystal Cave ("Crystal Kokoweef Cave" is type locality)**Comment:** This eyed species is known only from this locality and, apart from slightly longer appendages, shows little cave adaptation.**Bibliography:** Kury (2003); Ubick and Briggs (1992, 2004).*Texella shoshone* Ubick and Briggs (troglophile)**Records:** Inyo Co.: Lower Shoshone Cave; Upper Shoshone Cave (type locality).**Comment:** This species is known only from these isolated caves. Although the eyes are well developed this may be a relict species now restricted to the cave habitat. The cave is also inhabited by the endemic schizomid (*Hubbardia shoshonensis*), cave cricket (*Ceuthophilus* n. sp.), and ground beetle (*Rhadine* n. sp.).**Bibliography:** Briggs (1974a, 1990); Kury (2003); Ubick and Briggs (1992, 2004).**Family Sclerobunidae***Zuma acuta* Goodnight and Goodnight (troglophile)**Records:** Santa Cruz Co.: Dolloff Cave; Empire Cave; Stump Cave.**Comment:** Briggs (1967) reported that the Empire Cave population shows partial depigmentation.**Bibliography:** Briggs (1967, 1971); Briggs and Ubick (1988); Kury (2003); Rambla and Juberthie (1994); Ubick (2001).



**ORDER PALPIGRADI (micro whipscorpions)****Family Prokoeneniidae***Prokoenenia* sp. (troglobite?)**Records:** Amador Co.: Chrome Cave. Calaveras Co.: Grapevine Gulch Cave.**Comment:** The Chrome Cave species was the first micro-whipscorpion (palpigrade) reported from a California cave. The second record is new.**Bibliography:** Briggs (1986); Briggs and Ubick (1981); Condé (1996, 1998); Ehr (1981a).**SUBCLASS ACARI (mites and ticks)**

Undetermined

**Records:** Amador Co.: Rippled Cave; Skeleton Cave. Calaveras Co.: Beta Cave; Bobcat Cave; Carlito's Cave; Carlow's Bat Cavern; Cave of Skulls; Clutch Cave; Crystal Stanislaus Cave; Eagle View Cave No. 1; Porcupine Cave; Stripe Cave; Striped Dome Cave. El Dorado Co.: Crystal Cosumnes Cave. Fresno Co.: Beauty Cave; Boyden Cave; Church Cave; Windy Cliff Cave. Inyo Co.: unnamed lava tubes near Crater Mountain; Titus Canyon Cave. Mariposa Co.: Elf Village Cave; Indian Cave; Indian Rock Shelter; Spider Cave. Napa Co.: Clay Cave. Plumas Co.: Juniper Cave. San Benito Co.: Bear Gulch Cave. San Bernardino Co.: Mitchell Caverns; Papoose Cave. Santa Cruz Co.: Bat Cave; Stearns Cave. Shasta Co.: Alien Space Cave; Bat Mummy Cave; Christmas Tree Cave; Flashlight Cave; North Christmas Tree Cave; Rusty Cave; Wilcox Cave. Siskiyou Co.: Anglemorm/Lost Pinnacle Cave; Arch Cave No. 2; Catacombs Cave; Fern Cave; Mushpot Cave; Planetary Dairy Cave; Spider Cave; Tick City Cave; Valentine Cave. Tulare Co.: Bear Den Cave; Beulah Cave; Clough Cave; Crystal Sequoia Cave; Dehydrated Cave; Eighteenth Hole; Hidden Cave; Kaweah Cave; Kaweah Mon-keyflower Cave; Lange Cave; Lilburn Cave; Lost Soldier's Cave; New Cave; Overhang Cave; Panorama/Sink Cave System; Paradise Cave; Pet Cemetery Cave; Pine Grosbeak Cave; Walk Softly Cave; Wiessraum Cave; White Chief Cave. Tuolumne Co.: mine 3 km N Columbia; Crystal Palace; McLean's Cave; Sauna Pit; Transplant Mine.

**Bibliography:** Briggs (1993); Elliott (1978); Krejca (2006); Suggett (1982); Zara Environmental (2009).

Undetermined Acari (troglobite)

**Records:** Tulare Co.: Crystal Sequoia Cave; Lilburn Cave.

Acariformes undetermined

**Records:** Siskiyou Co.: Anglemorm/Lost Pinnacle Cave; Arch Cave No. 1; Catacombs Cave; Fern Cave; Mushpot Cave; Valentine Cave.**Comment:** These specimens were hypopi taken from flies.**Bibliography:** Taylor and Krejca (2006).

Acariformes undetermined

**Records:** Siskiyou Co.: Arch Cave; Fern Cave.**Comment:** These were hypopi taken from nonfly hosts.**Bibliography:** Taylor and Krejca (2006).**ORDER ORIBATIDA (nonparasitic, moss or beetle mites)**

Undetermined

**Records:** Mariposa Co.: Indian Cave; Spider Cave. Siskiyou Co.: caves in Lava Beds National Monument; Arch Cave No. 2; Caldwell Ice Caves; Catacombs Cave; Coda Cave; Fern Cave; Mushpot Cave; Planetary Dairy Cave; Rollercoaster Cave; Spider Cave; Upper Heppe Cave. Tuolumne Co.: McLean's Cave.

**Comment:** Some of these non-parasitic mites were taken from the nests of *Neotoma cinerea* along with a large variety of fleas and other mites.**Bibliography:** Briggs (1975); Krejca (2007); Nelson and Smith (1976); Taylor and Krejca (2006); Zara Environmental (2009).**Family Acaridae**

Undetermined

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.**Comment:** These mites were taken from the nests of *Neotoma cinerea*; they may be free-living but phoretic on rodents.**Bibliography:** Nelson and Smith (1976).

**Family Ceratozetidae***Ceratozetes* nr. *gracilis* (Michael)**Records:** Calaveras Co.: Grapevine Gulch Cave. Tuolumne Co.: McLean's Cave; ?Transplant Mine.**Comment:** This species was probably transplanted from McLean's Cave to the Transplant Mine.**Bibliography:** Briggs (1975); Elliott (1978).**Family Damaeidae**

Undetermined

**Records:** Siskiyou Co.: Catacombs Cave; Fern Cave; Mushpot Cave.**Bibliography:** Taylor and Krejca (2006).*Epidamaeus* n. sp.**Records:** Tuolumne Co.: McLean's Cave; ?Transplant Mine.**Comment:** This species was probably transplanted from McLean's Cave to the Transplant Mine.**Bibliography:** Briggs (1975); Elliott (1978).*Epidamaeus* (*Akrodamaeus*) sp.**Record:** Shasta Co.: Shasta Lake Caverns.**Family Liacaridae***Dorycranosus*nr. *parallelus* (Hammer)**Record:** Calaveras Co.: Grapevine Gulch Cave.**Family Oribatellidae***Oribatella* sp.**Record:** Calaveras Co.: Grapevine Gulch Cave.**Family Oribatulidae***Scheloribates* sp.**Records:** Calaveras Co.: Grapevine Gulch Cave; Gray Pine Cave;.**ORDER MESOSTIGMATA**

Gamasina undetermined

**Records:** Siskiyou Co.: Catacombs Cave; Fern Cave; Mushpot Cave; Spider Cave; Valentine Cave.**Bibliography:** Taylor and Krejca (2006).**Family Ascidae**

Undetermined

**Record:** Calaveras Co.: Porcupine Cave.*Arctoseius* nr. *cetrates* Sellnick**Record:** Calaveras Co.: Bobcat Cave.*Melichares* sp.**Record:** Fresno Co.: Boyden Cave.**Comment:** Only nymphs were found.**Family Laelapidae**

Undetermined

**Record:** Tuolumne Co.: McLean's Cave.*Androlaelaps fahrenheitzi* (Berlese)**Record:** Siskiyou Co.: caves in Lava Beds National Monument.**Comment:** This species was taken from the nests of *Neotoma cinerea*.**Bibliography:** Nelson and Smith (1976).

*Haemogamasus* sp. (parasite)

**Record:** Siskiyou Co.: Merrill Ice Cave.

**Comment:** These mites were taken from a mouse.

**Bibliography:** Taylor and Krejca (2006).

*Hypoaspis* sp.

**Records:** Shasta Co.: Shasta Lake Caverns. Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from the nests of *Neotoma cinerea* in caves in Lava Beds National Monument.

**Bibliography:** Nelson and Smith (1976).

*Ichoronyssus* sp.

**Record:** San Diego Co.: mine tunnel 4.8 mi. E of Laguna Junction.

**Comment:** This genus of mite was taken from *Myotis thysanodes thysanodes*.

**Bibliography:** Krutzsch (1955a).

**Family Macronyssidae***Chiropteronyssus robustipes* (Ewing) (parasite)

**Records:** Colusa Co.: Wilbur Springs Mine. Mariposa Co.: Bower Cave.

**Comment:** This species was taken from *Tadarida brasiliensis mexicana* in Wilbur Springs Mine.

**Bibliography:** Radovsky (1967).

*Macronyssus crosbyi* (Ewing and Stover) (parasite)

**Records:** Colusa Co.: Wilbur Springs Mine. Mariposa Co.: Bower Cave.

**Comment:** This species was taken from the wall of Wilbur Springs Mine.

**Bibliography:** Radovsky (1967).

*Macronyssus longisetosus* (Furman) (parasite)

**Records:** Colusa Co.: Wilbur Springs Mine. Ventura Co.: cave in Santa Paula Canyon.

**Comment:** This species was taken from *Corynorhinus townsendii* in Wilbur Springs Mine.

**Bibliography:** Radovsky (1967).

*Steatonyssus* sp.

**Records:** Kern Co.: crevices in sandstone outcrop near Carneros Spring. San Luis Obispo Co.: crevices at La Panza Ranch; crevices in sandstone outcrop, Carizzo Plain.

**Bibliography:** Orr, R.T. (1954).

**Family Ologamasidae**

## Undetermined

**Records:** Siskiyou Co.: Catacombs Cave; Mushpot Cave.

**Bibliography:** Taylor and Krejca (2006).

**Family Parasitidae***Gamasodes* sp.

**Records:** Siskiyou Co.: Angleworm/Lost Pinnacle Cave; Arch Cave No. 2; Catacombs Cave; Fern Cave; Mushpot Cave; Spider Cave; Valentine Cave.

**Comment:** These mites were taken off of flies.

**Bibliography:** Taylor and Krejca (2006).

*Parasitus* sp.

**Records:** Contra Costa Co.: cave on Mt. Diablo. Mariposa Co.: Bower Cave.

*Poecilochirus necrophori* Vitzthum

**Records:** Imperial Co.: mine tunnel 24 km NE of Yuma, Arizona. Mariposa Co.: Bower Cave. Riverside Co.: Alice Mine. San Bernardino Co.: bat cave 26 km N of Needles.



**Family Spinturnicidae***Spinturnix* sp.

**Records:** **Kern Co.:** crevices in sandstone outcrop near Carneros Spring. **San Diego Co.:** inspection tunnel of the Hodges Dam; mine tunnel 4.8 mi. E of Laguna Junction. **San Luis Obispo Co.:** crevices at La Panza Ranch; crevices in sandstone outcrop, Carizzo Plain.

**Bibliography:** Krutzsch (1955a); Orr, R.T. (1954).

**ORDER IXODIDA (ticks)**

Undetermined

**Records:** **Siskiyou Co.:** \*Sunnyside Tick Cave; \*Tick City Cave.

**Bibliography:** Rogers (1991c, 2000c); Wolff and Wolff (1990).

**Family Argasidae (soft ticks)***Argas cooleyi* Kohls and Hoogstraal (parasite)

**Records:** **Imperial Co.:** Senator Mine. **Ventura Co.:** cave in Santa Paula Canyon.

**Comment:** This tick was collected from the nest of a California condor.

**Bibliography:** Kohls and Hoogstraal (1960).

*Argas reflexus* (Fabricius) (parasite)

**Records:** **Contra Costa Co.:** cave on Mt. Diablo. **Imperial Co.:** mine tunnel 24 km NE of Yuma, Arizona; Senator Mine.

**Riverside Co.:** Alice Mine. **Unknown Co.:** \*cave utilized as a nest site by the California condor.

**Comment:** One male was taken from a nest in the cave on Mt. Diablo.

**Bibliography:** Cooley and Kohls (1944); Snyder, Ramey, and Sibley (1986).

*Ornithodoros* sp.

**Records:** **Kern Co.:** crevices in sandstone outcrop near Carneros Spring. **San Luis Obispo Co.:** crevices at La Panza Ranch; crevices in sandstone outcrop, Carizzo Plain.

**Bibliography:** Orr, R.T. (1954).

*Ornithodoros coriaceus* Koch (parasite)

**Records:** **Contra Costa Co.:** unnamed cave. **Tuolumne Co.:** Milkcan Cave.

**Comment:** One female was taken from a cliff swallow nest in the cave in Contra Costa County.

**Bibliography:** Cooley and Kohls (1944).

*Ornithodoros (Alectorobius) dyeri* Cooley and Kohls (parasite)

**Records:** **Contra Costa Co.:** unnamed cave. **Imperial Co.:** mine tunnel 24 km NE of Yuma, Arizona. **Riverside Co.:** Alice Mine. **San Bernardino Co.:** Bat Cave.

**Comment:** This species was found in rock crevices. The location given by Cooley and Kohls ("...16 miles north of Needles...") is unclear and could be in Nevada. This species was also found in crevices in a mine tunnel near Yuma, Arizona.

**Bibliography:** Cooley and Kohls (1944); Furman and Loomis (1984).

*Ornithodoros (Alectorobius) hermsi* Wheeler, Herms, and Meyer

**Records:** **Calaveras Co.:** Coral Cave. **Placer Co.:** mine shaft at Forest Hill.

*Ornithodoros (Alectorobius) stageri* Cooley and Kohls (parasite)

**Records:** **Imperial Co.:** Senator Mine. **Kern Co.:** crevices in sandstone outcrop near Carneros Spring. **San Luis Obispo Co.:** crevices at La Panza Ranch; crevices in sandstone outcrop, Carizzo Plain.

**Comment:** This species was taken from bat guano.

**Bibliography:** Cooley and Kohls (1941, 1944); Furman and Loomis (1984); Orr, R.T. (1954).

*Ornithodoros (Alectorobius) yumatensis* Cooley and Kohls

**Records:** **Imperial Co.:** mine tunnel 24 km NE of Yuma, Arizona; Senator Mine. **Riverside Co.:** Alice Mine. **Stanislaus Co.:** unnamed cave.

*Ornithodoros (Pavlovskyella) parkeri* Cooley (parasite)

**Records:** Colusa Co.: Wilbur Springs Mine. Stanislaus Co.: sandstone cave.

**Comment:** This species of tick infests burrows and nests of small mammals and burrowing owls. It was taken from sand in the cave and contained the causative agent of relapsing fever.

**Bibliography:** Davis, Wynns, and Beck (1941); Kohls, Sonenshine, and Clifford (1965).

## ORDER TROMBIDIFORMES

Undetermined

**Records:** Siskiyou Co.: Catacombs Cave; Fern Cave; Merrill Ice Cave; Valentine Cave.

**Comment:** The specimens from Fern Cave and Valentine Cave are reported as actinetid mites. Those from Catacombs Cave and Merrill Ice Cave are reported as a trombidoid mite larva.

**Bibliography:** Taylor and Krejca (2006).

### Family Anystidae

*Anystus* sp.

**Records:** Mariposa Co.: Bower Cave. Trinity Co.: Hall City Cave. Tuolumne Co.: Banksula Cave; Milkcan Cave; Pinnacle Point Cave; Scorpion Cave; Transplant Mine tailings; Vulture Cave.

### Family Caeculidae

*Caeculus* sp.

**Records:** Calaveras Co.: Coral Cave. Tuolumne Co.: McLean's Cave; Transplant Mine tailings.

### Family Cheyletidae

*Cheyletus cacahuamilpensis* Baker (troglophile)

**Records:** Calaveras Co.: Lost Piton Cave. Colusa Co.: Wilbur Springs Mine.

**Comment:** This predaceous mite was collected from bat guano. It was described from Grutas de Cacahuamilpa, Guerrero, Mexico.

**Bibliography:** Summers and Price (1970).

### Family Eupodidae

*Linopodes* probably n. sp. (troglophile?)

**Records:** Mariposa Co.: Bower Cave; Bull Creek Cave. Trinity Co.: Hall City Cave. Tuolumne Co.: Banksula Cave; Crystal Palace; Pinnacle Point Cave; Scorpion Cave; Transplant Mine tailings; Vulture Cave.

### Family Labidotomatidae

*Nicoletiella* sp.

**Records:** Calaveras Co.: Heater Cave; O'Neil's Cave. Siskiyou Co.: Planetary Dairy Cave; Skunk Hollow Cave; Trail Junction Cave. Tuolumne Co.: McLean's Cave; Transplant Mine tailings.

### Family Pyemotidae

*Pyemotes* sp.

**Records:** Calaveras Co.: Eagle View Cave No. 2; Lost Piton Cave. Tuolumne Co.: Indian Quarry Cave No. 2.

**Comment:** This species probably came off a beetle or other insect.

### Family Pygmophoridae

Undetermined

**Record:** Siskiyou Co.: Catacombs Cave.

**Bibliography:** Taylor and Krejca (2006).

### Family Rhagidiidae

Undetermined

**Records:** Amador Co.: Rippled Cave. Calaveras Co.: Grapevine Gulch Cave; Music Hall Cave; Wool Hollow Cave. Fresno Co.: Boyden Cave; Millerton Lake Cave System. Inyo Co.: unnamed lava tubes near Crater Mountain. Mariposa Co.: Bull Creek Cave; Indian Cave; Spider Cave. Santa Cruz Co.: Stump Cave. Shasta Co.: Pink Coat Cave. Sierra Co.: Avalanche Cave. Siskiyou Co.: Arch Cave No. 2; Bigfoot Cave; Boulevard Cave; Broken Down Palace; Caldwell Ice Caves;

Catacombs Cave; Corkscrew Cave; Echoplex Cave; Frozen Falls Cave; Harris Mountain Cave; Lyon's Road Cave; Maze Cave; Merrill Ice Cave; Mushpot Cave; Nirvana Cave; Santa Claus Cave; Post Office Cave; Red Tape Cave; Rollercoaster Cave; Spider Cave; Sugar Pine Butte Ice Cave; Tichnor Cave/Bertha's Cupboard Cave; Township Cave; Trail Junction Cave; Upper Heppe Cave; Upstairs-Downstairs Cave. **Trinity Co.:** Paul Gibson Cave. **Tulare Co.:** Hidden Cave; Ursa Minor Cave. **Tuolumne Co.:** Crystal Palace.

**Comment:** Some of these were badly damaged specimens. Specimens from Siskiyou County were taken from the middens and droppings of *Neotoma*, from the surface of small drip-pools, and under rocks.

**Bibliography:** Krejca (2007); Taylor and Krejca (2006); Zara Environmental (2009).

*Foveacheles (Foveacheles) auricularia* Zacharda and Elliott (troglophile)

**Records:** **Calaveras Co.:** Brown Deer Cave; Grapevine Gulch Cave. **Siskiyou Co.:** Planetary Dairy Cave; Trail Junction Cave (type locality).

**Comment:** This species seems closely related to *F. (F.) osloensis* (Sig Thor), a European troglophile. Zacharda (1980) and Zacharda and Elliott (1981, 1985) have discussed the zoogeography of post-glacial relicts of the family Rhagidiidae. Several species are epigeal forms in the Arctic but have cave-limited populations in the temperate zone. It would not be surprising to find this species as an epigeal form in northern Canada or Alaska. The air temperature in both of the Siskiyou County alpine caves was 3° C in late April, 1979, when the specimens were collected.

**Bibliography:** Graening (2011c); Palacios-Vargas, Decu, Iavorski, Hutz, and Juberthie (1998); Zacharda (1980); Zacharda and Elliott (1981a, 1985).

*Foveacheles (Usitorhagidia) titanica* Zacharda and Elliott (troglobite)

**Records:** **Calaveras Co.:** Eagle View Cave No. 2. **Tuolumne Co.:** Crystal Palace; Indian Quarry Cave No. 1 (type locality).

**Comment:** This is one of the largest rhagidiid species in the world (up to 2330 µm), and it bears a distinct troglotic morphology. The chelicerae are long (up to 430 µm) and slender. Rhagidiids are adapted for feeding on collembolans and generally have large chelicerae (Zacharda, 1980). This species is distributed on both sides of the Stanislaus River, as are the harvestmen *Banksula grahmi* and *B. melones*. The highly insular distribution of caverniferous limestone in this area probably precludes dispersal of troglotes under the river canyon. Since the river probably began downcutting in its present position in the late Pliocene or early Pleistocene it seems likely that these populations have been isolated from one another since that time (Zacharda and Elliott, 1985).

**Bibliography:** Culver, Christman, Elliott, Hobbs, and Reddell (2000); Palacios-Vargas, Decu, Iavorski, Hutz, and Juberthie (1998); Zacharda and Elliott (1981, 1985).

*Poecilophysis (Dentocheles) melanosea* Zacharda and Elliott (troglophile)

**Records:** **Calaveras Co.:** Diane's Cave; Dirty Fissure; Poison Oak Cave. **Mariposa Co.:** Damp Cave. **Riverside Co.:** Mountaineer Mine. **Tuolumne Co.:** Indian Quarry Cave No. 1; Transplant Mine tailings; Vulture Cave (type locality).

**Comment:** This species has also been found under stones in the Stanislaus River Canyon near the Indian Quarry Caves. Elliott (1978) and McEachern and Grady (1978) reported this as *Rhagidia* nr. *cavernarum* (Packard); however, this species is close to *P. (D.) pratensis* (C.L. Koch), which occurs in Europe, Alaska, Hawaii, and Japan (Zacharda and Elliott, 1981).

**Bibliography:** Elliott (1978); McEachern and Grady (1978); Palacios-Vargas, Decu, Iavorski, Hutz, and Juberthie (1998); Zacharda and Elliott (1981, 1985).

**Family Trombiculidae (chiggers)**

Undetermined

**Records:** **Calaveras Co.:** Brown Deer Cave; Grapevine Gulch Cave.

**Comment:** Immatures of this family are usually parasitic on vertebrates while the adults are free-living.

**Bibliography:** McEachern and Grady (1978).

*Euschoengastia* sp. (parasite)

**Records:** **Calaveras Co.:** Cave City Cave. **Mendocino Co.:** Negro Hole Cave. **Tulare Co.:** Lost Soldier's Cave. **Tuolumne Co.:** Crystal Palace.

*Tecomatlana (Tecomatlana) watkinsi* Vercammen-Grandjean (parasite)

**Records:** **Calaveras Co.:** Cave of Skulls. **Mariposa Co.:** Bower Cave; Pool Pit. **Riverside Co.:** Alice Mine; Mountaineer Mine. **Santa Cruz Co.:** Empire Cave. **Siskiyou Co.:** Skunk Hollow Cave; Trail Junction Cave. **Tulare Co.:** Lost Soldier's Cave. **Tuolumne Co.:** McLean's Cave; Pinnacle Point Cave.



**Comment:** This species was taken from the bat *Macrotus californicus* in Alice Mine and Mountaineer Mine.

**Bibliography:** Vercammen-Grandjean (1967).

*Whartonia glenni californica* Vercammen-Grandjean, Watkins, and Beck (parasite)

**Record:** Riverside Co.: Mountaineer Mine.

**Comment:** This species was taken from the bat *Macrotus californicus*.

**Bibliography:** Vercammen-Grandjean, Watkins, and Beck (1966).

#### Family Trombidiidae

Undetermined

**Records:** Calaveras Co.: Porcupine Cave. Fresno Co.: Boyden Cave; Windy Cliff Cave. Mariposa Co.: Bull Creek Cave.

Siskiyou Co.: Merrill Ice Cave; Tichnor Cave/Bertha's Cupboard Cave. Tuolumne Co.: Pinnacle Point Cave.

**Comment:** Two specimens were collected. Immatures of this family are generally parasitic on arthropods.

### ORDER SARCOPTIFORMES

#### Family Glycyphagidae

Undetermined

**Record:** Siskiyou Co.: Spider Cave.

**Bibliography:** Taylor and Krejca (2006).

### CLASS CHILOPODA (centipedes)

Undetermined

**Records:** Amador Co.: \*?Rippled Cave. Calaveras Co.: Carlito's Cave; \*Cave City Cave; \*Crystal Stanislaus Cave; \*Grapevine Gulch Cave; O'Neil's Cave. Fresno Co.: \*Church Cave. Marin Co.: \*Millers Point Cave. Mariposa Co.: Bull Creek Cave; Elf Village Cave. Mendocino Co.: \*Negro Hole. Modoc Co.: \*?Damon's Cave. San Benito Co.: Balconies Cave. Santa Cruz Co.: Bat Cave; Stearns Cave. Shasta Co.: Alien Space Cave; Burnt Elderberry Cave; Christmas Tree Cave; Parrish Cave; Planetarium Cave; Rusty Cave. Siskiyou Co.: \*?Bigfoot Cave. Trinity Co.: \*?Del Loma Cave. Tulare Co.: Bear Den Cave; Carmoe Crevice Cave; Clough Cave; Crystal Sequoia Cave; Dehydrated Cave; Eighteenth Hole; Harry's Bend Cave; Hidden Cave; Hurricane Crawl Cave; Kaweah Cave; Kaweah Monkeyflower Cave; Lange Cave; Lillburn Cave; Lost Soldier's Cave; May's Cave; Overhang Cave; Palmer Cave; Paradise Cave; Pet Cemetery Cave; Pine Grosbeak Cave; Walk Softly Cave; Schist Canyon Cave; Wiessraum Cave. Tuolumne Co.: Forsythe Cave; McLean's Cave; Snell's Cave; Transplant Mine.

**Comment:** Sight records marked with a question mark may actually be millipedes. Rogers (2005c) reports isopods with "electric blue-colored legs" in Millers Point Cave, but they could have been centipedes.

**Bibliography:** Broeckel, B. (2008d, 2008e); Craven (2001); Despain (1993); Despain and Fryer (2002); Elliott (1978); Hackman (1949); Halliday (1962); Hargreaves (2011); Kirschman (2003); Quick (1980c, 1980d); Krejca (2006); Merritt (2009); Seaborne (2004); Wolff, J. (2001).

### ORDER GEOPHILOMORPHA (soil centipedes)

Undetermined

**Records:** Amador Co.: Santa Claus Cave. Calaveras Co.: Cave of Skulls; Cone Cave; Crystal Stanislaus Cave; Grapevine Gulch Cave; Music Hall Cave. El Dorado Co.: Crystal Cosumnes Cave. Fresno Co.: Millerton Lake Cave System. Mariposa Co.: Bower Cave; Pool Pit. Napa Co.: Clay Cave. San Bernardino Co.: Cima Cave. Shasta Co.: Dead Wood Cave. Siskiyou Co.: Frozen Falls Cave; Rollercoaster Cave; Trail Junction Cave. Tulare Co.: Bear Den Cave; Lost Soldier's Cave; Pet Cemetery Cave.

**Bibliography:** Graening (2010, 2011c); Krejca (2006); Leissring (2009); Taylor and Krejca (2006).

#### Family Geophilidae

Undetermined

**Records:** Santa Cruz Co.: Dolloff Cave; Empire Cave; IXL Cave. Tuolumne Co.: McLean's Cave.

**Comment:** This species may have been transplanted to the Transplant Mine from McLean's Cave.

**Bibliography:** Briggs and Ubick (1988); Elliott (1978); Ubick (2001).

*Arctogeophilus* sp.

**Records:** Shasta Co.: Potter Creek Cave. Tuolumne Co.: Pinnacle Point Cave.

**Bibliography:** Elliott (1978).

*Arenophilus* sp.

**Records:** Amador Co.: Black Chasm; Violin Cave. **Calaveras Co.:** Carlito's Cave; Shaw's Cave. **Mariposa Co.:** Bower Cave. **Tuolumne Co.:** McLean's Cave.

**Comment:** This species may have been transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Elliott (1978); McEachern and Grady (1978).

*Taiyuna* sp.

**Records:** **Calaveras Co.:** Cone Cave; Grapevine Gulch Cave; Music Hall Cave. **Tuolumne Co.:** Porcupine Cave.

**Bibliography:** McEachern and Grady (1978).

**Family Himantariidae**

Undetermined

**Record:** **Tuolumne Co.:** Pinnacle Point Cave.

*Stenophilus californicus* (Chamberlin) (troglobite?)

**Records:** **Calaveras Co.:** Brown Deer Cave. **Shasta Co.:** Potter Creek Cave (type locality).

**Comment:** Described as *Meinertophilus californicus* by Chamberlin in 1930, the species was later placed in *Stenophilus*. It is described from one male specimen, about 90 mm long and pale yellow. It is eyeless, as are all geophilomorph centipedes. The legs were described as "short." This may be the "large myriapod" referred to by Sinclair (1904).

**Bibliography:** Chamberlin, R.V. (1930); Danehy (1951b); Mercurio (2010); Sinclair (1904); Wolf (1934–1937).

**Family Linotaeniidae**

*Strigamia* sp.

**Record:** **Tulare Co.:** Kaweah Cave.

**Comment:** Identified by Rowland Shelley from a photograph by Jean Krejca.

**Family Schendylidae**

?*Schendyla* sp.

**Record:** **Mariposa Co.:** Indian Cave.

**Bibliography:** Zara Environmental (2009).

**ORDER LITHOBIOMORPHA (stone centipedes)**

Undetermined

**Records:** **Amador Co.:** Black Chasm; Chrome Cave; Connie's Cave; Fern Frond Cave; Rippled Cave; Violin Cave. **Calaveras Co.:** Barren Cave; Bobcat Cave; Brown Deer Cave; Crystal Stanislaus Cave; Dirty Fissure; Grapevine Gulch Cave; Linda's Cave; Lost Piton Cave; Moaning Cave; Poison Oak Cave; Porcupine Cave; Shaw's Cave. **Fresno Co.:** Beauty Cave; Boyden Cave; \*Hummel's Cave; Millerton Lake Cave System; Saturday Cave. **Mariposa Co.:** Bower Cave; Bull Creek Cave. **Napa Co.:** Clay Cave. **Plumas Co.:** Juniper Cave. **San Benito Co.:** Balconies Cave; Bear Gulch Cave. **Santa Cruz Co.:** Dolloff Cave; IXL Cave; Stump Cave. **Shasta Co.:** Ancient Palace Cave; Bat Cave; Christmas Tree Cave; Potter Creek Cave; Rusty Cave; Samwel Cave; Shasta Lake Caverns; Subway Cave. **Siskiyou Co.:** Big Painted Cave; Boulevard Cave; Caldwell Ice Caves; Coda Cave; Coral Reef Cave; Fossil Cave; Pearl Cave; Rollercoaster Cave. **Tulare Co.:** Clough Cave; Lange Cave; Lilburn Cave; Lost Soldier's Cave; Ursa Minor Cave; White Chief Cave. **Tuolumne Co.:** Bend Cave; Crystal Palace; McLean's Cave; Porcupine Cave; Porcupine Skull Cave; Snell's Cave.

**Comment:** Two "stone centipedes" were seen in Hummel's Cave.

**Bibliography:** Krejca (2006); Quick (1997b, 1998b); Taylor and Krejca (2006).

Undetermined Lithobiomorpha (troglobite)

**Record:** **Tuolumne Co.:** Porcupine Cave.

**Comment:** This species is depigmented, eyeless, and has elongated appendages.

**Family Henicopidae**

Undetermined

**Record:** **Tulare Co.:** Lost Soldier's Cave.

**Bibliography:** Despain (2006); Krejca (2006).

**Family Lithobiidae**

Undetermined

**Records:** **Amador Co.:** Rippled Cave. **Mariposa Co.:** Spider Cave. **Siskiyou Co.:** Caldwell Ice Caves; Coral Reef Cave; Fossil Cave; Lazaroff's Hole; NSS No. 8851. **Tulare Co.:** Kaweah Cave; Overhang Cave.

**Bibliography:** Taylor and Krejca (2006); Zara Environmental (2009).

*Ethopolys* sp.

**Record:** **Siskiyou Co.:** Valentine Cave.

**Bibliography:** Taylor and Krejca (2006).

*Gosibius* sp.

**Records:** **Calaveras Co.:** Brown Deer Cave; Cave of Skulls. **Tuolumne Co.:** Scorpion Cave.

**Bibliography:** McEachern and Grady (1978).

*Nadabius* sp. (troglophile?)

**Records:** **Amador Co.:** Moss Cave. **Calaveras Co.:** Cave City Cave; Dirty Crack Cave; Dirty Fissure; Linda's Cave; Striped Dome Cave; Waterfall Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Mariposa Co.:** Salamander Hideout Cave.

**San Bernardino Co.:** Kokoweef Cave. **Tulare Co.:** Crystal Sequoia Cave.

**Bibliography:** McEachern and Grady (1978); Zara Environmental (2009).

*Oabius* sp. (troglophile?)

**Records:** **Calaveras Co.:** Carlito's Cave; Carlow's Bat Cavern; Carlow's Cave; Music Hall Cave; Secret Cave.

**Bibliography:** McEachern and Grady (1978).

**ORDER SCOLOPENDROMORPHA (bark centipedes)**

Undetermined

**Records:** **Fresno Co.:** Boyden Cave; Church Cave. **Shasta Co.:** Dead Wood Cave; Rusty Cave; Subway Cave. **Ventura Co.:** Clear Springs Cave.

**Bibliography:** Ubick (2001).

**Family Scolopocryptopidae***Kethops utahensis* Chamberlin

**Records:** **Calaveras Co.:** Cave of Skulls. **Tuolumne Co.:** Scorpion Cave.

**Bibliography:** Shelley (2002).

*Scolopocryptops* ?gracilis (Wood)

**Record:** **Santa Cruz Co.:** Empire Cave. **Shasta Co.:** Rusty Cave.

**Comment:** This species was recorded in Ubick (2001) as undetermined scolopendromorph. Identified by Rowland Shelley from a photograph by Joel Ledford.

**CLASS DIPLOPODA (millipedes)**

Undetermined

**Records:** **Amador Co.:** Connie's Cave; Hummingbird Cave; \*Moss Cave; Mushroom Cave; \*Santa Claus Cave; \*Rippled Cave; Root Cellar Cave; Skeleton Cave; Soldier Creek Cave; Sutter Creek Cave. **Calaveras Co.:** Brown Deer Cave; Carlito's Cave; \*Cave City Cave; Crystal Stanislaus Cave; Grapevine Gulch Cave; Hawk Cave; \*Heater Cave; \*Keith's Chasm; O'Neil's Cave; Mercer Caverns; Moaning Cave; Music Hall Cave; Penthouse Cave; Shaw's Cave; Sink Cave. **El Dorado Co.:** \*Crystal Cosumnes Cave. **Fresno Co.:** Boyden Cave; Church Cave; Maze Cave; \*\*Packsaddle Cave; unnamed cave in Kings Caverns Geological Area; Windy Cliff Cave. **Inyo Co.:** \*Millipede Cave; Shoshone Turk Cave. **Mariposa Co.:** Bower Cave; \*Carbonate Cave; Millipede Cave. **Mendocino Co.:** Spy Rock Cave. **Plumas Co.:** Juniper Cave. **San Bernardino Co.:** Kokoweef Cave. **Santa Cruz Co.:** unnamed cave near Davenport; Santa Cruz City Cave. **Shasta Co.:** Ancient Palace Cave; Bat Mummy Cave; Burnt Elderberry Cave; \*Boy Scout Cave; Christmas Tree Cave; \*Deanna Lyn Cave; \*Discovery 1 Cave; Edward Cave; \*Klaydo Cave; \*Lakelevel Cave; North Christmas Tree Cave; Parrish Cave; Pink Coat Cave; Planetarium Cave; Potter Creek Cave; Rusty Cave; Samwel Cave; Trail Cave; \*Whirligig Cave; Wilcox Cave. **Siskiyou Co.:** \*Arch Cave No. 1; \*Bear's Bed Cave; \*Bob Richardson Cavern; \*Elderberry Cave; Glacier Cavern; \*It ta Choo-mah Cave; McCloud Ice Caves; \*Streambed Cave; Tichnor Cave/Bertha's Cupboard Cave; \*Tree Cast Pillar Cave; \*Wolfe Den. **Tehama Co.:** Inskip Cave. **Trinity Co.:** Forest Glen Caves; Pye Cave. **Tulare Co.:** Bear Den Cave; \*Beu-



lah Cave; Carmoe Crevice Cave; \*Clough Cave; \*Crystal Sequoia Cave; \*Dehydrated Cave; \*Eighteenth Hole; Harry's Bend Cave; Hurricane Crawl Cave; \*Kaweah Cave; \*Lange Cave; \*Lilburn Cave; \*Lost Soldier's Cave; New Cave; \*Overhang Cave; \*Paradise Cave; Pine Grosbeak Cave; Stand Up Cave; Ursa Minor Cave; \*Walk Softly Cave; \*Wiessraum Cave. **Tuolumne Co.:** Crack of Doom Cave; \*Crystal Palace; Snell's Cave; \*Windeler Cave. **Ventura Co.:** \*Clear Springs Cave. **Bibliography:** Anonymous (1970a, 1990b, 2005c); Adamson (1982b, 1982c); Broeckel, B. (1998a, 2005b, 2008g, 2012a, 2012f); Carlon (2014); Damon (1963b); Danehy (1951b); Decker and Decker (2002); deSaussure (1953); Despaigne (1993); Doerr (1972); Fina (1971b); Halliday (1955, 1961a, 1961b, 1962); Hardaker (1970); Hardcastle (1981a); Hargreaves (2012, 2014); Hunter (2011b); Jackson, M. (1992, 2009, 2012b); Kirschman (2003); Krejca (2006); Klamen (1971a, 1971b); Lange (1954); Leissring (2001a, 2001c); McEachern and Grady (1978); McLellan (1951); National Park Service (2004); Oberhansley (1946); Quick (1978, 1980b, 1980c); Roark (1971a); Robinson (2004a); Rogers (1994a, 1999d); Rogers and Rice (2000); Russo (2011, 2012); Schmitz (1996a); Sherwood (1957a, 1957b); Sinclair (1904); Sowers (1989); Sundquist (1992); Thom (1977, 1983); Turrentine (1991); Wolff, L. (2003d, 2011c, 2013b); Zidell (1987).

#### Undetermined Diplopoda (troglobite)

**Records:** **Amador Co.:** Connie's Cave; Lulu Bell Cave; Santa Claus Cave. **Calaveras Co.:** Heater Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Lassen Co.:** Eagle Lake Ice Cave; Snaked Cave. **Plumas Co.:** Hamilton Branch Cave. **San Bernardino Co.:** Kokoweef Crystal Cave. **Shasta Co.:** Ancient Palace Cave; Christmas Tree Cave; \*Millipede Cave; Rusty Cave; Samwel Cave; Whirligig Cave. **Siskiyou Co.:** Barnum/Sand Caves System; Big Ice Cave; Broken Down Palace; Flushing Bush Cave; Golden Dome Cave; Hoyle's Half-Dollar Hole; Incline Cavern. **Tehama Co.:** Wilson Lake Ice Cave, Wilson Lake Ice Cave No. 3. **Tulare Co.:** Salamander Cave. **Tuolumne Co.:** Crystal Palace. **Bibliography:** Broeckel, B. (1994a, 2009b); Graening (2010); National Park Service (2004); Rogers and Helton (2007a).

#### ORDER GLOMERIDA (pill millipedes)

##### Family Glomeidae

*Glomeroides primus* (Silvestri)

**Records:** **Santa Cruz Co.:** Empire Cave; Santa Cruz City Cave.

**Bibliography:** Shelley (2002).

#### ORDER POLYZONIIDA

##### Family Polyzoniidae

*Bdellozonium cerviculatum* Cook and Loomis

**Records:** **Mariposa Co.:** Spider Cave. **Plumas Co.:** Sunnyside Mine. **Sierra Co.:** Monarch Mine.

**Comment:** It is not known if the material from these mines was taken inside the mine or on the surface at the mine.

**Bibliography:** Shelley (1998); Zara Environmental (2009).

*Buzonium crassipes* Cook and Loomis (endogean)

**Records:** **Amador Co.:** Rippled Cave. **Plumas Co.:** Sunnyside Mine (type locality).

**Comment:** The species was found under rotten boards in the mine.

**Bibliography:** Shelley (1998).

#### ORDER SPIROBOLIDA (long, cylindrical millipedes)

Undetermined

**Records:** **Siskiyou Co.:** Caldwell Ice Caves; Fossil Cave; Four Star Cave; Lyon's Road Cave; Maze Cave; Pearl Cave.

**Tuolumne Co.:** Transplant Mine.

**Bibliography:** Briggs (1987, 1991); Taylor and Krejca (2006).

##### Family Atopetholidae

*Atopetholus* sp.

**Records:** **Tulare Co.:** Hidden Cave; Kaweah Cave.

**Bibliography:** Krejca (2006).

##### Family Spirobolidae

*Tylobolus* sp.

**Records:** **Amador Co.:** Mushroom Cave; Rippled Cave. **Calaveras Co.:** Dragon's Breath Cave; Grapevine Gulch Cave; Music Hall Cave; Porcupine Cave; Wool Hollow Cave. **Napa Co.:** Clay Cave. **Santa Cruz Co.:** Bat Cave; Dolloff Cave; Empire Cave; IXL Cave; Stump Cave. **Tulare Co.:** Bear Den Cave; Harry's Bend Cave; Lost Soldier's Cave; Overhang

Cave; Stand Up Cave; Ursa Minor Cave. **Tuolumne Co.:** Crack of Doom Cave; Toppled Table Talus Cave.  
**Bibliography:** Krejca (2006); Ubick (2001).

*Tylobolus castaneus* Chamberlin

**Records:** **Amador Co.:** Fern Frond Cave. **Mariposa Co.:** Indian Cave; Indian Rock Shelter; Spider Cave.  
**Bibliography:** Zara Environmental (2009).

*Tylobolus uncigerus* (Wood)

**Record:** **Tuolumne Co.:** Scorpion Cave.

#### ORDER SPIROSTREPTIDA

##### Family Cambalidae

Undetermined

**Records:** **Fresno Co.:** Boyden Cave. **Shasta Co.:** Potter Creek Cave. **Tulare Co.:** Kaweah Cave; Overhang Cave.  
**Bibliography:** Krejca (2006); Shear, Taylor, Wynne, and Krejca (2009).

*Endere disora* Loomis (endogean)

**Record:** **Plumas Co.:** Sunnyside Mine (type locality).

**Bibliography:** Chamberlin and Hoffman (1958); Hoffman (1999); Loomis (1938).

*Nannolene* sp.

**Record:** **Napa Co.:** Clay Cave.

#### ORDER JULIDA

Undetermined

**Records:** **Siskiyou Co.:** Angleworm/Lost Pinnacle Cave; Fern Cave; Rollercoaster Cave.

**Comment:** A species of this order was taken from a Berlese sample of *Neotoma* midden material in Rollercoaster Cave.

**Bibliography:** Taylor and Krejca (2006).

##### Family Julidae

*Cylindroiulus latistriatus* (Curtis)

**Records:** **Amador Co.:** Connie's Cave; Fern Frond Cave; Fiddler's Cave; Violin Cave. **Calaveras Co.:** Coral Cave; Creek Cave; Grapevine Gulch Cave. **Mariposa Co.:** Damp Cave. **Tuolumne Co.:** Border Pit; McLean's Cave; Milkcan Cave; Porcupine Cave; Porcupine Skull Cave; Snell's Cave. **Ventura Co.:** Clear Springs Cave.

**Comment:** This is a synanthropic species.

*Julus cavicola* Grinnell

**Records:** **Shasta Co.:** Potter Creek Cave (type locality).

**Comment:** This species is a Pleistocene fossil. The species is too poorly described to be reliably placed in an order.

**Bibliography:** Danchy (1951b); Graham (1960b); Grinnell (1908); Hoffman (1999); Pierce (1944).

*Julus occidentalis* Grinnell

**Record:** **Shasta Co.:** Samwel Cave (type locality).

**Comment:** This species is a Pleistocene fossil. The species is too poorly described to be reliably placed in an order.

**Bibliography:** Causey (1958, 1960b); Danchy (1951b); Graham (1960b); Grinnell (1908); Hoffman (1999) Pierce (1944).

##### Family Paeromopodidae

Undetermined

**Records:** **Siskiyou Co.:** \*?Caldwell Ice Caves; \*?Fossil Cave; \*?Four Star Cave; \*?Lyon's Road Cave; \*?Pearl Cave.

**Comment:** These sight records were based on dead specimens.

**Bibliography:** Taylor and Krejca (2006).

*Californiulus* sp.

**Records:** **Amador Co.:** Fern Frond Cave; Fiddler's Cave; Violin Cave. **Calaveras Co.:** Cave City Cave; Cave of Skulls; Coral Cave; Creek Cave; Grapevine Gulch Cave. **Mariposa Co.:** Damp Cave. **Shasta Co.:** Ancient Palace Cave. **Siskiyou**

**Co.:** Caldwell Ice Caves. **Tuolumne Co.:** Windeler Cave.

**Comment:** Most of these records are all based on females or juveniles.

*Californiulus dorsovittatus* Verhoeff

**Records:** **Calaveras Co.:** Cave of the Catacombs; Shaw's Cave. **Shasta Co.:** Samwel Cave.

**Comment:** This species was collected in total darkness. The species is known from Lassen Volcanic National Park, Shasta County.

**Bibliography:** Danchy (1951b); Shelley (1994).

*Californiulus yosemitensis* Chamberlin

**Records:** **Amador Co.:** Connie's Cave; Mushroom Cave; Santa Claus Cave. **San Benito Co.:** Bear Gulch Cave. **Tulare Co.:** Bear Den Cave; Clough Cave; Crystal Sequoia Cave; Eighteenth Hole; Hidden Cave; Lost Soldier's Cave; May's Cave; Overhang Cave; Pet Cemetery Cave; Rattlesnake Cave; Walk Softly Cave. **Tuolumne Co.:** Border Pit; McLean's Cave; Milkcan Cave; Porcupine Cave; Porcupine Skull Cave; Snell's Cave.

**Bibliography:** Hunter (2011a); Krejca (2006).

*Paeromopus* sp. (troglophile)

**Records:** **Amador Co.:** Rippled Cave. **Calaveras Co.:** Bobcat Cave; Brown Deer Cave; Creek Cave; Grapevine Gulch Cave; Hawk Cave; Porcupine Cave; Shaw's Cave; Williams Cave; Wool Hollow Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Mariposa Co.:** Bower Cave. **Shasta Co.:** Ancient Palace Cave. **Tuolumne Co.:** Crystal Palace; McLean's Cave; Transplant Mine; Transplant Mine tailings.

**Comment:** Some of these large millipedes were transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Briggs (1975); Elliott (1978); McEachern and Grady (1978).

*Paeromopus angusticeps angusticeps* (Wood) (troglophile)

**Record:** **Santa Cruz Co.:** Empire Cave.

**Bibliography:** Graham (1968b); Shelley and Bauer (1997).

*Paeromopus angusticeps buttensis* Chamberlin (troglophile)

**Records:** **Calaveras Co.:** Cave City Cave; Cave of Skulls. **Tuolumne Co.:** Tank Cave.

**Bibliography:** McEachern and Grady (1978); Shelley (1994).

*Paeromopus cavicolens* Chamberlin (troglophile)

**Records:** **Amador Co.:** Santa Claus Cave. **Tuolumne Co.:** Windeler Cave (type locality).

**Comment:** This large species, or a similar one, is common in many of the caves on the Stanislaus River. It is not especially cave-adapted. The body is smooth, cylindrical, and brown; adults attain a length of 10 to 15 cm.

**Bibliography:** Causey (1955); Chamberlin, R. V. (1953a); Chamberlin and Hoffman (1958); Elliott (1978); Halliday (1955); Keller (2009a); McEachern and Grady (1978); Shelley (2002).

*Paeromopus paniculus* Shelley and Bauer (troglophile)

**Records:** **Mariposa Co.:** Elf Village Cave; Indian Cave.

**Comment:** Zara Environmental (2009) listed this as *Californiulus paniculus*.

**Bibliography:** Zara Environmental (2009).

**Family Parajulidae**

Undetermined

**Records:** **Calaveras Co.:** Cave City Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Fresno Co.:** Millerton Lake Cave System. **Tuolumne Co.:** Bend Cave; Confluence Cave; McLean's Cave.

*Bollmaniulus* sp.

**Records:** **Amador Co.:** Lulu Bell Cave; Rippled Cave; Santa Claus Cave. **Calaveras Co.:** Two Bit Pit. **Fresno Co.:** Bear Den Cave; Boyden Cave. **Mariposa Co.:** Bower Cave. **Shasta Co.:** Samwel Cave. **Tulare Co.:** Hidden Cave; Hurricane Crawl Cave; Lilburn Cave; May's Cave; Overhang Cave; Wiessraum Cave.

**Bibliography:** Krejca (2006).



*Spathiulus tribolus* Chamberlin

**Records:** Amador Co.: Black Chasm. Calaveras Co.: Cave of Skulls; Creek Cave. Siskiyou Co.: Slipstream Cave.

**ORDER PLATYDESMIDA (plated millipedes)****Family Andrognathidae***Brachycybe producta* Loomis

**Records:** Mariposa Co.: Pool Pit; Sprinkle Cave. Tuolumne Co.: Bend Cave; Confluence Cave; McLean's Cave; Windler Cave (type locality of *B. tuolumna* Chamberlin, 1953b).

**Comment:** One female was taken 15 m inside the cave in total darkness. This species is widespread on the surface.

**Bibliography:** Causey (1954, 1955); Chamberlin, R.V. (1953a); Chamberlin and Hoffman (1958); Gardner (1975); Hoffman (1999).

**Family Platydesmidae**

## Undetermined

**Record:** Tuolumne Co.: McLean's Cave.

**Comment:** One pigmented specimen was taken in the cave and appeared to be the same as a species taken in the Stanislaus River canyon.

**Bibliography:** Elliott (1978).

*Mitocybe auriportae* Cook and Loomis

**Records:** Napa Co.: Clay Cave. Santa Cruz Co.: Vanished River Cave.

**Comment:** The single specimen from Vanished River Cave is a female and was tentatively assigned to *Mitocybe auriportae*, but may represent a new species.

**Bibliography:** Shelley (2010).

**ORDER SIPHONOPHORIDA****Family Siphonorhinidae***Illacme tobini* Marek, Shear and Krejca

**Record:** Tulare Co.: Lange Cave.

**Comment:** This is the first record of the order Siphonophorida from a cave in California. The male holotype (the only specimen) has 414 legs. The genus contains more legs than any other millipede in the world with 318 to 750 legs.

**Bibliography:** Krejca (2009b); Shear (2009); Marek, Krejca, and Shear (2016).

**ORDER CALLIPODIDA****Family Schizopetalidae***Colactis utorum* (Chamberlin) (troglophile)

**Records:** Inyo Co.: Lower Shoshone Cave; Shoshone Turk Cave; Upper Shoshone Cave (type locality of *C. briggsi*).

**Comment:** Shear (1974) in the description of *C. briggsi* speculated that this species may be troglobitic because of its reduced pigmentation (light horn brown to pale testaceous as opposed to the usual near black in the genus) and the harsh desert environment surrounding the cave. The species does possess numerous black ocelli. Shelley (1996) placed *C. briggsi*, along with two epigean species in the synonymy of *C. utorum*.

**Bibliography:** Briggs (1974a, 1990); Briggs and Hom (1972); McFarlane (1990); Rado and Tyner (1984); Shear (1974); Shelley (1996); Ubick and Briggs (1992).

**ORDER CHORDEUMATIDA**

## Undetermined

**Records:** Tulare Co.: Hurricane Crawl Cave; Paradise Cave; Wiessraum Cave.

**Bibliography:** Krejca (2006).

## Undetermined Chordeumatida (troglomite)

**Records:** Siskiyou Co.: Adam's Homestead Cave; Harris Mountain Cave; Red Tape Cave; Sugar Pine Butte Ice Cave.

**Bibliography:** Hammond (1994).

**Family Caseyidae**

## Undetermined

**Records:** Amador Co.: Black Chasm. Calaveras Co.: Cave of Skulls. Siskiyou Co.: Mushpot Cave; Skunk Hollow Cave; Slipstream Cave. Tulare Co.: Walk Softly Cave.

**Comment:** These records are based on females and/or juveniles.

**Bibliography:** Krejca (2006); Taylor and Krejca (2006).

*Caseya* sp.

**Records:** **Mariposa Co.:** Indian Cave; Pool Pit; Sprinkle Cave. **Tulare Co.:** Hidden Cave; Lost Soldier's Cave; Upper Bryant Cave. **Tuolumne Co.:** Crystal Palace.

**Bibliography:** Krejca (2006); Zara Environmental (2009).

*Caseya paradoxa* Gardner and Shelley

**Record:** **Tulare Co.:** Overhang Cave.

**Bibliography:** Krejca (2006).

*Caseya taliae* Gardner and Shelley

**Record:** **Tulare Co.:** Dehydrated Cave.

**Bibliography:** Krejca (2006).

*Opiona* n. sp. no. 1

**Records:** **Amador Co.:** Black Chasm. **Calaveras Co.:** Cave City Cave; Shaw's Cave.

*Opiona* n. sp. no. 2 (troglobite)

**Records:** **Siskiyou Co.:** Bigfoot Cave.

**Comment:** A second troglobitic species differing from *O. graeningi* is also present in Bigfoot Cave (W. Shear, pers. comm. 2013).

*Opiona graeningi* Shear (troglobite)

**Records:** **Siskiyou Co.:** ?Apogee Cave; Bigfoot Cave; ?Broken Down Palace; ?Corkscrew Cave; ?Echoplex Cave; Frozen Falls Cave; Planetary Dairy Cave; ?Skunk Hollow Cave; Slipstream Cave; Trail Junction Cave (type locality); Upstairs-Downstairs Cave.

**Comment:** Specimens marked with a question-mark are represented only by juveniles or females but probably belong to this species.

**Bibliography:** Broeckel, B. (2010e); Gates (2005); Graening (2011c); Shear (2011).

*Opiona siliquae* Causey (troglophile)

**Record:** **Mendocino Co.:** Fault Rock Cave (type locality).

**Comment:** This species is known only from the type locality.

**Bibliography:** Causey (1963); Gardner and Shelley (1989); Hoffman (1999); Shear (1969, 1972); Shelley (2002).

*Speoseya grahami* Causey (troglobite)

**Records:** **Calaveras Co.:** Cave City Cave; Shaw's Cave (type locality). **Tuolumne Co.:** Crystal Palace.

**Comment:** The genus is monotypic.

**Bibliography:** Causey (1963); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Hoffman (1999); Shear, 1969, 1972); Shelley (2002).

#### Family Conotylidae

*Lophomus* sp. or new genus (troglobite)

**Records:** **Siskiyou Co.:** Planetary Dairy Cave; Stiletto Cave.

**Bibliography:** Graening (2011c).

*Plumatyla* sp. (troglobite)

**Records:** **Napa Co.:** Clay Cave. **Shasta Co.:** Samwel Cave.

**Bibliography:** Bradford (2005).

*Plumatyla humerosa* (Loomis) (troglobite)

**Records:** **Plumas Co.:** Sunnyside Mine (type locality). **Shasta Co.:** Elisha Cave; Flashlight Cave; Indian Cave; Jeffrey Pine Cave; Rusty Cave; Subway Cave; Trail Cave. **Siskiyou Co.:** Angletworm/Lost Pinnacle Cave; Big Painted Cave; Boulevard Cave; Bowling Alley Cave; Caldwell Ice Caves; Catacombs Cave; Catwalk Cave; Coral Reef Cave; Cox Ice

Cave; Craig Cave; Crazy Cave; Crystal Ice Cave; Deep Cavern; Fern Cave; Fossil Cave; Four Star Cave; Frozen River Cave; Glacier Cavern; Indian Well Cave; Lazaroff's Hole; Lyon's Road Cave; Maze Cave; Merrill Ice Cave; Mushpot Cave; Nirvana Cave; NSS No. 8851 Cave; Pearl Cave; Post Office Cave; Rollercoaster Cave; Spider Cave; The Lonely Palace Cave; Tichnor Cave/Bertha's Cupboard Cave; Upper Heppe Cave; Upper Thicket Cave; Valentine Cave.

**Comment:** The species was taken from mine props throughout the type locality, an old placer mine in a mafic volcanic rock area. This species has a reduced number of ocelli and is depigmented. Causey (1961) thought it to be a troglobite that infiltrated the mine from surrounding cavernous limestone. Geologic maps show no limestone within 100 km of the mine, and all 43 occurrences of this species are in lava. Shear (1971) reported a population with some morphological differences from a lava cave far to the north. Shear (1972) stated that "...no other conotyloid is as strongly modified for cave life." Nelson and Smith (1976) collected this millipede from a *Neotoma cinerea* nest in a cave in Lava Beds National Monument, and Taylor and Krejca (2006) collected it from numerous caves at Lava Beds. The species range is 190 km north-south and at least 8–10 km east-west, the largest range for a troglobite in California.

**Bibliography:** Causey (1960a, 1961); Graham (1962c); Hoffman (1999); Jorgensen (2009); Krejca (2007); Loomis (1943); Nelson and Smith (1976); Peck (1973a); Shear (1971, 1972); Shelley (2002); Taylor and Krejca (2006); Taylor, Krejca, and Jacoby (2006); Zara Environmental (2009).

*Taiyutyla* sp.

**Records:** Calaveras Co.: Grapevine Gulch Cave. El Dorado Co.: Crystal Cosumnes Cave. Fresno Co.: Boyden Cave. Trinity Co.: Paul Gibson Cave. Tulare Co.: Carmoe Crevice Cave; Clough Cave; Dehydrated Cave; Harry's Bend Cave; Kaweah Cave; Lost Soldier's cave; May's Cave; Overhang Cave; Pine Grosbeak Cave; Walk Softly Cave.

**Bibliography:** Krejca (2006).

*Taiyutyla* n. sp.

**Record:** Trinity Co.: Hall City Cave.

*Taiyutyla loftinae* Shear and Krejca (troglophile)

**Records:** Mariposa Co.: Indian Cave; Spider Cave. Tulare Co.: Bear Den Cave; \*Beulah Cave; Crystal Sequoia Cave; Eighteenth Hole; Hurricane Crawl Cave; Jordan Cave; Lange Cave; Lilburn Cave; Palmer Cave; Paradise Cave (type locality); Pet Cemetery Cave; Wiessraum Cave.

**Bibliography:** Despain (2006); Krejca (2006); Shear and Krejca (2011); Zara Environmental (2009).

**Family Rhiscosomididae**

*Rhiscosomides* sp.

**Record:** Santa Cruz Co.: Empire Cave.

**Bibliography:** Shelley (2002).

**Family Striariidae**

Undetermined

**Records:** Calaveras Co.: Crystal Stanislaus Cave; Wool Hollow Cave. Fresno Co.: Boyden Cave. Siskiyou Co.: Four Star Cave. Tulare Co.: Cirque Cave; New Cave; Ursa Minor Cave.

**Bibliography:** Taylor and Krejca (2006).

Undetermined genus, new species

**Record:** Amador Co.: Rippled Cave.

*Amplaria* sp.

**Records:** Amador Co.: Fern Frond Cave. Calaveras Co.: Carlow's Cave; Lost Piton Cave; Moaning Cave. Santa Cruz Co.: Dolloff Cave; Empire Cave; IXL Cave; Stearns Cave; Stump Cave. Tuolumne Co.: Crystal Palace; McLean's Cave; Pinnacle Point Cave; Transplant Mine.

**Comment:** These collections have been reassigned from *Striaria* sp.

**Bibliography:** Briggs and Ubick (1988); Danehy (1951a, 1951b); Krejca (2006); Ubick (2001).

*Amplaria adamsi* Shear and Krejca (troglophile)

**Records:** Tulare Co.: Clough Cave; Hidden Cave (type locality); Overhang Cave; ?Windy Pit.

**Comment:** This species is more darkly pigmented and has more ocelli than *A. muiiri*. The record for Windy Pit is likely this species but no males were collected.

**Bibliography:** Krejca (2006, 2009a); Shear and Krejca (2007).



*Amplaria eldora* (Chamberlin) (troglophile)

**Records:** Calaveras Co.: Grapevine Gulch Cave. **El Dorado Co.:** Crystal Cosumnes Cave (type locality).

**Comment:** The only cave adaptation in this species is the slight depigmentation of the ocelli. Three females were taken in total darkness in Crystal Cosumnes Cave. This species was described from females from that cave. A male from Grapevine Gulch Cave is only tentatively assigned to this species.

**Bibliography:** Causey (1960a); Chamberlin, R.V. (1951, 1953a, 1953b); Chamberlin and Hoffman (1958); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Danchy (1951b); Hoffman (1999); Nicholas (1960); Shear (1969); Shear and Krejca (2007); Shelley (2002).

*Amplaria muiri* Shear and Krejca (troglophile)

**Records:** Tulare Co.: Bear Den Cave; Carmoe Crevice Cave; Crystal Sequoia Cave ("Crystal Cave" type locality); Hurricane Crawl Cave; Lange Cave; ?Lilburn; Pet Cemetery Cave; ?Wiessraum Cave.

**Comment:** Although some specimens were somewhat depigmented, this species does not appear to be troglitic. The records for Lilburn and Wiessraum Caves are based on females and are only tentatively assigned to this species.

**Bibliography:** Anonymous (2006); Despain (1993); Despain and Fryer (2002); Hunter (2011a); Krejca (2006, 2009a); Reardon (1966); Shear and Krejca (2007).

*Amplaria shastae* (Causey) (troglite)

**Records:** Shasta Co.: Ancient Palace Cave; Samwel Cave (type locality).

**Comment:** Although this species has pigmented eyes, it is nearly white, has elongated legs and antennae and a large body. These probably are indications of cave adaptation. Fossils of this species were found in a Pleistocene stratum in the cave with several extinct mammals. Although Causey thought that the two fossil *Julus* species described by Grinnell (1908) may not be the same as this species, Grinnell's material needs to be restudied as indicated by Graham (1960b).

**Bibliography:** Causey (1958, 1960a, 1960b), Danchy (1951a, 1951b); Graham (1960b); Grinnell (1908); Hoffman (1969, 1999); Nicholas (1960); Peck (1968a, 1974a); Shear (1969, 1972); Shear and Krejca (2007); Shelley (2002).

## ORDER POLYDESMIDA

## Undetermined

**Records:** Calaveras Co.: Moaning Cave. **Mendocino Co.:** caves. **Napa Co.:** caves. **Santa Cruz Co.:** caves. **Siskiyou Co.:** Four Star Cave.

**Bibliography:** Causey (1960a); Taylor and Krejca (2006).

## Undetermined Polydesmida sp. no. 1 (troglite)

**Records:** Inyo Co.: Titus Canyon Cave.

**Bibliography:** Graening (2012, 2014).

## Undetermined Polydesmida sp. no. 2 (troglite)

**Records:** Trinity Co.: Paul Gibson Cave.

**Bibliography:** Graening (2012, 2014).

**Comment:** This is provisionally listed as a separate species from Polydesmida sp. no. 1 as it is 725 km from Titus Canyon Cave, Inyo County, and it is unlikely that one troglitic species could range so far in fragmented limestone outcrops of different types.

## Family Macrosterodesmidae

## Undetermined

**Record:** Santa Cruz Co.: Empire Cave.

*Nevadesmus* n. sp. 1 (troglite)

**Record:** Fresno Co.: Children's Cave.

**Bibliography:** Weaver (2009b).

*Nevadesmus* n. sp. 2 (troglite)

**Record:** San Bernardino Co.: Kokoweef Crystal Cave.

**Bibliography:** Graening (2010).

*Pratherodesmus* n. sp. (troglabite)

**Record:** Tulare Co.: Lost Soldier's Cave.

*Pratherodesmus despaini* Shear (troglabite)

**Record:** Tulare Co.: Kaweah Cave (type locality).

**Bibliography:** Krejca (2006); Shear, Taylor, Wynne, and Krejca (2009).

*Sequoiadesmus krejcae* Shear and Shelley (troglabite?)

**Records:** Tulare Co.: ?Clough Cave; Hurricane Crawl Cave (type locality); ?Lilburn Cave.

**Comment:** This well-sclerotized species may actually be a troglaphile. The records for Clough Cave and Lilburn Cave are based on females and only tentatively assigned to this species.

**Bibliography:** Despain (2006); Krejca (2006, 2009a); Shear (2009); Shear and Shelley (2008).

*Tidesmus hastingsus* (Chamberlin)

**Records:** Amador Co.: Fern Frond Cave. **Calaveras Co.:** small cave near Shaw's Cave; Cave of Skulls; Eagle View Cave No. 2; Lost Piton Cave; Pool Cave; Porcupine Cave. **Shasta Co.:** Shasta Lake Caverns. **Siskiyou Co.:** Skunk Hollow Cave; Trail Junction Cave. **Tuolumne Co.:** Banksula Cave; Indian Quarry Cave No. 2; McLean's Cave.

**Family Paradoxosomatidae***Oxidus gracilis* (C.L. Koch) (troglaphile)

**Records:** Calaveras Co.: Moaning Cave. **Shasta Co.:** Shasta Caverns.

**Comment:** Known as the hot house milliped, this species is cosmopolitan in distribution and has been spread by human agency. It is abundant in many caves near human habitations.

**Family Polydesmidae**

## Undetermined

**Records:** Calaveras Co.: Carlow's Cave; Grapevine Gulch Cave; Lost Piton Cave; Moaning Cave. **Santa Cruz Co.:** Bat Cave; Dolloff Cave; Empire Cave; IXL Cave; Stearns Cave; Stump Cave. **Tulare Co.:** Lost Soldier's Cave. **Tuolumne Co.:** Crystal Palace; Crystal Tuolumne Cave; McLean's Cave; Pinnacle Point Cave; ?Transplant Mine; Windeler Cave.

**Comment:** Some specimens were transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Briggs and Ubick (1988); Elliott (1978); McEachern and Grady (1978).

*Bidentogon* sp.

**Records:** Calaveras Co.: Carlow's Cave; Lost Piton Cave. **Tuolumne Co.:** McLean's Cave.

**Bibliography:** Elliott (1978).

*Bidentogon* n. sp. (troglabite)

**Records:** Tuolumne Co.: Pinnacle Point Cave; Windeler Cave.

**Bibliography:** Elliott (1978); Krejca (2006).

*Calianotus sastianus* (Chamberlin)

**Records:** Calaveras Co.: Crystal Stanislaus Cave. **Tuolumne Co.:** ?Crystal Tuolumne Cave.

**Comment:** Only a juvenile was collected from Crystal Tuolumne Cave.

*Calianotus yosemitensis* (Causey)

**Records:** Calaveras Co.: Barren Cave; Bobcat Cave; Cave City Cave; Cave of the Catacombs; Diane's Cave; Gerritt's Cave; Grapevine Gulch Cave; Poison Oak Cave; Porcupine Cave; Scat Cave; Secret Cave; Shaw's Cave; Sink Cave. **Mariposa Co.:** Bull Creek Cave. **Tulare Co.:** Lilburn Cave. **Tuolumne Co.:** mine on ridge 4.5 km N of Columbia; McLean's Cave; Mine Cave; Pinnacle Point Cave; Scorpion Cave; Tank Cave; Zilch Cave.

**Bibliography:** Krejca (2006); Shelley (1997a).

**Family Xystodesmidae**

## Undetermined

**Records:** Calaveras Co.: Barren Cave; Bobcat Cave; Cave of the Crystal Snail; Diane's Cave; Gerritt's Cave; Grapevine Gulch Cave; Poison Oak Cave; Rabbit Hole; Scat Cave; Secret Cave; Shaw's Cave. **Mariposa Co.:** Bull Creek Cave.

**Tuolumne Co.:** mine on ridge 4.5 km north of Columbia; Crystal Palace; Mine Cave; Pinnacle Point Cave; Porcupine Cave; Scorpion Cave; Transplant Mine tailings; Zilch Cave.

**Comment:** These records are based on females and/or juveniles.

**Bibliography:** McEachern and Grady (1978).

*Harpaphe haydeniana* (Wood)

**Records:** **Santa Cruz Co.:** Stearns Cave. **Siskiyou Co.:** Corkscrew Cave; Frozen Falls Cave; Trail Junction Cave.

**Bibliography:** Graening (2011c).

*Motyxia* sp.

**Records:** **Calaveras Co.:** Cave of Skulls. **Placer Co.:** Robber's Roost Cave. **Tulare Co.:** Eighteenth Hole; Lost Soldier's Cave; Pine Grosbeak Cave.

**Bibliography:** Krejca (2006); McEachern and Grady.

*Motyxia pior* Chamberlin

**Records:** **Tulare Co.:** Crystal Sequoia Cave; Wiessraum Cave.

**Bibliography:** Despaigne (1994); Krejca (2006); Shelley (1997b).

*Sigmocheir* sp.

**Records:** **Amador Co.:** \*small cave below Santa Claus Cave; Fern Frond Cave; Miser's Purse Cave; Mushroom Cave. **Calaveras Co.:** small cave near Shaw's Cave; Cave of Skulls; Cave of the Catacombs; Eagle View Cave No. 2; Lost Piton Cave; Pool Cave; Porcupine Cave; Rabbit Hole; Shaw's Cave; Upper Calaveras Natural Bridge. **Siskiyou Co.:** \*Roller-drome; Trail Junction Cave. **Tuolumne Co.:** Banksula Cave; Crystal Palace; Indian Quarry Cave No. 2; McLean's Cave; Pinnacle Point Cave; Toppled Table Talus Cave; Transplant Mine.

**Comment:** This genus was also collected 3.5 miles NNW of Columbia, Calaveras County; and 3 mi. NNW Columbia, Tuolumne County. Some of the records may belong to *S. calaveras* or undescribed species.

**Bibliography:** Briggs (1975, 1987); Craven (2001); Danehy (1951b); Jorgensen (2010b); Rogers (1977, 1983b); Rogers and Rice (1991); Weaver (2009c).

*Sigmocheir calaveras* Chamberlin (troglophile)

**Records:** **Calaveras Co.:** Bobcat Cave; Carlito's Cave; Cave City Cave; Cave of Skulls; Crystal Stanislaus Cave (type locality); Grapevine Gulch Cave; Music Hall Cave; Porcupine Cave; Two Bit Pit; Wool Hollow Cave. **Tuolumne Co.:** Crystal Palace (type locality of *Sigmocheir danehyi* Chamberlin); Indian Quarry Cave No. 2; McLean's Cave; Mine Cave; Tube Cave; Windeler Cave.

**Comment:** This species is also known from the surface. It has a black and yellow body with yellow legs and antennae. The original spelling of the species was *dohenyi*, a typographical error for *danehyi* (named after Edward A. Danehy of the Stanford Grotto), but this name was synonymized with *Sigmocheir calaveras*.

**Bibliography:** Buckett (1964); Causey (1955); Chamberlin, R.V. (1951, 1953b); Chamberlin and Hoffman (1958); Danehy (1951b); Hoffman (1980, 1999); Johnson, E. (1996a, 1996b); McEachern and Grady (1978); Shelley (1995, 2002); Vennum (2010); Weaver (2007).

*Sigmocheir furcata* Shelley

**Records:** **Amador Co.:** Connie's Cave; Santa Claus Cave; Rippled Cave. **Calaveras Co.:** Williams Cave (type locality)

**Bibliography:** Baumann (2013b); Danehy (1951b); Hoffman (1999); Shelley (1995, 2002).

**CLASS PAUROPODA (dwarf millipedes)**

Undetermined (endogean)

**Records:** **Tulare Co.:** Overhang Cave.

**Comment:** Pauropods are a small class of tiny, millipede-like creatures that are mostly soil dwellers. This is the first pauropod record from a California cave.

**CLASS SYMPHYLA (garden centipedes)**

Undetermined

**Records:** **Amador Co.:** Rippled Cave. **Fresno Co.:** Beauty Cave. **San Bernardino Co.:** Virginia's Mine Cave. **Santa Cruz Co.:** IXL Cave. **Shasta Co.:** Christmas Tree Cave; Elisha Cave; Pink Coat Cave; Subway Cave. **Siskiyou Co.:** Bighorn Cave; Four Star Cave; Frozen Star Cave; Marble Gap Cave; Planetary Dairy Cave; Upstairs-Downstairs Cave. **Tulare Co.:**



\*Beulah Cave; Cedar Cave; Harry's Bend Cave; Hidden Cave; Hurricane Crawl Cave; Kaweah Monkeyflower Cave; Lilburn Cave; Lost Soldier's Cave; May's Cave; Pet Cemetery Cave; Pine Grosbeak Cave; Ursa Minor Cave; Walk Softly Cave. **Tuolumne Co.:** Forsythe Cave. **Ventura Co.:** Clear Springs Cave.

**Bibliography:** Graening (2010, 2011c); Krejca (2006); Taylor and Krejca (2006).

#### ORDER CEPHALOSTIGMATA

##### Family Scolopendrellidae

*Symphylella oviceps* Michelbacher (endogean)

**Record:** **Tuolumne Co.:** Transplant Mine tailings.

**Bibliography:** Scheller (1986).

##### Family Scutigerellidae

*Hanseniella vandykei* Michelbacher (endogean)

**Record:** **Calaveras Co.:** Bobcat Cave.

**Bibliography:** Scheller (1986).

*Scutigerella* sp. (endogean)

**Record:** **Amador Co.:** Sutter Creek Cave. **Santa Cruz Co.:** Empire Cave.

**Bibliography:** Ubick (2001).

*Scutigerella causeyae* Michelbacher (endogean)

**Records:** **Calaveras Co.:** Porcupine Cave. **Tuolumne Co.:** McLean's Cave; Mine Cave; Transplant Mine.

**Comment:** This species was introduced to the Transplant Mine. It is also found in the mine tailings and on the surface in the vicinity. It ranges widely throughout the United States. The ecological status of cave symphylans is uncertain. All are white and eyeless but probably should be classified as part of the endogean fauna.

**Bibliography:** Briggs (1975, 1987, 1991); Elliott (1978); Scheller (1986).

*Scutigerella inculta* Michelbacher (endogean)

**Record:** **Tuolumne Co.:** Tube Cave.

**Comment:** This species is known only from California.

**Bibliography:** Scheller (1986).

*Scutigerella palmonii* Michelbacher (endogean)

**Record:** **Calaveras Co.:** Cave of Skulls.

**Comment:** This species has also been taken from caves in Texas. It is widely distributed in the United States.

**Bibliography:** Scheller (1986).

#### CLASS COLLEMBOLA (springtails)

##### Undetermined

**Records:** **Amador Co.:** Connie's Cave; Mushroom Cave; Santa Claus Cave; Rippled Cave; Root Cellar Cave; Skeleton Cave; Sutter Creek Cave. **Calaveras Co.:** Bone Cave; Cave of Skulls; Heater Cave. **El Dorado Co.:** \*Alabaster Cave; \*Pink Grotto. **Fresno Co.:** Beauty Cave; Boyden Cave; Church Cave; \*?Hummel's Cave; Saturday Cave. **Inyo Co.:** Upper Shoshone Cave; Poleta Cave; Titus Canyon Cave. **Lassen Co.:** Eagle Lake Ice Cave; **Mariposa Co.:** Elf Village Cave; Indian Cave; Indian Rock Shelter; Mirror Lake Cave; short talus cave above Spider Cave; Spider Cave. **Plumas Co.:** Juniper Cave. **Shasta Co.:** Ancient Palace Cave; Bat Mummy Cave; Burnt Elderberry Cave; Edward Cave; Elisha Cave; North Christmas Tree Cave; Planetarium Cave; Pink Coat Cave; Rusy Cave; Trail Cave; Wilcox Cave. **Siskiyou Co.:** caves in Lava Beds National Monument; caves in Marble Mountains Wilderness; Adam's Homestead Cave; Bear's Bed Cave; Bighorn Cave; Harris Mountain Cave; Marble Gap Cave; Planetary Dairy Cave; Red Tape Cave; Upstairs-Downstairs Cave. **Tulare Co.:** Bear Den Cave; Carmoe Crevice Cave; Cedar Cave; Cirque Cave; Clough Cave; Crystal Sequoia Cave; Eighteenth Hole; Harry's Bend Cave; Hidden Cave; Hurricane Crawl Cave; Jordan Cave; Kaweah Cave; Lange Cave; Lilburn Cave; Lost Soldier's Cave; May's Cave; New Cave; Overhang Cave; Palmer Cave; Panorama/Sink Cave System; Paradise Cave; Pet Cemetery Cave; Pine Grosbeak Cave; \*Red Tape Cave; Schist Canyon Cave; Seldom Seen Cave; Walk Softly Cave; Wiessraum Cave; White Chief Cave; Windy Pit. **Tuolumne Co.:** Forsythe Cave. **Ventura Co.:** Clear Springs Cave.

**Comment:** The specimens from unspecified caves in Lava Beds National Monument were found in nests of *Neotoma cinerea*.

**Bibliography:** Anonymous (1963); Briggs (1993); Broeckel, B. (2012a); Damon (1963a, 1963b); Despain (1993, 1999); Hunter (2011b); Kirschman (2003); Krejca (2006); National Park Service (2004); Readdy and Damon (1962); Suggett (1982); Ubick (1991); Wolff, L. (1987b, 1991c); Zara Environmental (2009).

Undetermined Collembola (troglobite)

**Records:** Amador Co.: Black Chasm. Napa Co.: Clay Cave. Siskiyou Co.: Catacombs Cave.

#### ORDER PODUROMORPHA

##### Family Hypogastruridae

Undetermined

**Records:** Siskiyou Co.: Caldwell Ice Caves; Fossil Cave; Rollercoaster Cave.

**Bibliography:** Taylor and Krejca (2006).

*Ceratophysella denticulata* (Bagnall)

**Record:** Calaveras Co.: Coral Cave.

**Comment:** This cosmopolitan species is primarily epigean.

*Ceratophysella pratorum* (Packard)

**Record:** Sacramento Co.: unspecified cave.

*Hypogastrura* sp.

**Record:** Calaveras Co.: Bobcat Cave.

*Xenylla acauda* Gisin

**Record:** Shasta Co.: unspecified cave.

**Bibliography:** Christiansen and Bellinger (1980a; 1998).

##### Family Neanuridae

*Morulina multituberculata* (Coleman)

**Record:** Calaveras Co.: Eagle View Cave No. 2.

**Comment:** This species is widespread on the surface in California.

##### Family Onychiuridae

Undetermined Onychiuridae (troglobite?)

**Records:** Napa Co.: Clay Cave. Siskiyou Co.: Coral Reef Cave; Four Star Cave; Pearl Cave.

**Bibliography:** Taylor and Krejca (2006).

*Deuteraphorura oregonensis* (Denis) (troglophile)

**Record:** Trinity Co.: Hall City Cave.

**Comment:** This species was previously recorded only from Oregon caves (K. Christiansen, pers. comm.).

*Deuteraphorura pseudofimetaria* (Folsom)

**Records:** Calaveras Co.: Eagle View Cave No. 2. Tuolumne Co.: Crystal Palace.

**Comment:** This species has also been recorded from caves in Arkansas and Missouri.

*Orthonychiurus folsomi* (Schäffer)

**Record:** Calaveras Co.: Porcupine Cave.

**Comment:** This is widespread throughout the mainland United States, Hawaii, and Japan.

*Psyllaphorura uenoi* (Yosii)

**Record:** Shasta Co.: Shasta Lake Caverns.

**Comment:** This species is otherwise known from Japan, Alaska, and the surface in California.

**Bibliography:** Christiansen and Bellinger (1980b, 1998).

##### Family Poduridae

Undetermined

**Records:** Amador Co.: Santa Claus Cave. Napa Co.: Clay Cave. Siskiyou Co.: Catacombs Cave (2 spp.); Mushpot Cave (2 spp.); Spider Cave.

**Bibliography:** Crawford (1998); Taylor and Krejca (2006).

## ORDER ENTOMOBRYOMORPHA

## Family Entomobryidae

## Undetermined

**Records:** **Amador Co.:** Santa Claus Cave; Rippled Cave; Skeleton Cave; White Room Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Fresno Co.:** Beauty Cave; Boyden Cave; Church Cave. **Inyo Co.:** Poleta Cave. **Mariposa Co.:** Indian Cave; Indian Rock Shelter. **Napa Co.:** Clay Cave. **Plumas Co.:** Juniper Cave. **Santa Cruz Co.:** Bat Cave; Empire Cave; IXL Cave; Stearns Cave; Stump Cave. **Sierra Co.:** cave near Avalanche Cave. **Siskiyou Co.:** Caldwell Ice Caves; Catacombs Cave; Coral Reef Cave; Craig Cave; Fern Cave; Fossil Cave; Lyon's Road Cave; Maze Cave; Mushpot Cave; Rollercoaster Cave; Spider Cave; Valentine Cave. **Tehama Co.:** Inskip Cave. **Tulare Co.:** Cedar Cave; Lilburn Cave; May's Cave. **Tuolumne Co.:** McLean's Cave.

**Comment:** Some of these records may belong in the Tomoceridae.

**Bibliography:** Briggs (1975); Cokendolpher and Krejca (2010); Lee, V.F. (1985a); Taylor and Krejca (2006); Ubick (2001).

## Undetermined sp. 2

**Records:** **Siskiyou Co.:** Catacombs Cave; Mushpot Cave; Valentine Cave.

**Comment:** This species is depigmented.

**Bibliography:** Taylor and Krejca (2006).

*Drepanura californica* (Schött)

**Record:** **Calaveras Co.:** Bryden's Cave.

**Comment:** This is primarily a surface species, but has also been found in caves in New Mexico.

**Bibliography:** Christiansen and Bellinger (1980c, 1998); McEachern and Grady (1978).

*Entomobrya* sp.

**Record:** **Shasta Co.:** unspecified cave.

*Entomobrya arnaudi* Wray (troglophile?)

**Records:** **Tuolumne Co.:** Bend Cave; Crystal Butterfly Cave; Indian Quarry Cave No. 2; Milkcan Cave; Vulture Cave.

**Bibliography:** Christiansen and Bellinger (1998).

*Entomobrya assuta* Folsom

**Record:** **Tuolumne Co.:** Crystal Palace.

**Bibliography:** Christiansen (2015).

*Entomobrya confusa* Christiansen

**Record:** **Shasta Co.:** Potter Creek Cave.

**Bibliography:** Christiansen (2015).

*Entomobrya suzannae* Scott

**Records:** **Calaveras Co.:** Cataract Gulch Cave. **El Dorado Co.:** Alabaster Cave. **Mariposa Co.:** Bower Cave. **Tuolumne Co.:** Confluence Cave.

**Bibliography:** Christiansen (2015); Christiansen and Bellinger (1980c, 1998).

*Entomobryoides* sp.

**Records:** **Tuolumne Co.:** McLean's Cave; ?Transplant Mine.

**Comment:** This species, and perhaps two others, may have been transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Briggs (1975); McEachern and Grady (1978); Elliott (1978).

*Entomobryoides guthriei* (Mills) (troglophile)

**Records:** **Amador Co.:** Connie's Cave; Fern Frond Cave; Violin Cave. **Calaveras Co.:** Bobcat Cave; Cave of Skulls; Coral Cave; Porcupine Cave; Shaw's Cave. **El Dorado Co.:** Alabaster Cave; Pink Grotto Cave; **Shasta Co.:** unspecified cave; Samwel Cave. **Tuolumne Co.:** Crystal Palace; McLean's Cave; McNamee's Cave; Mine Cave; Snell's Cave; ?Transplant Mine.

**Comment:** This species is primarily epigeal. It and perhaps two others may have been transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Briggs (1975); Christiansen (2015); Elliott (1978); McEachern and Grady (1978).



*Pseudosinella violenta* (Folsom) (troglophile)**Record:** Tulare Co.: Lost Soldier's Cave.**Comment:** This is an extremely abundant troglophile in the caves of Texas and northern Mexico.**Bibliography:** Krejca (2006).*Sinella* sp.**Records:** Calaveras Co.: two unspecified caves. **Mariposa Co.:** Indian Cave; Salamander Hideout Cave; Spider Cave.**Santa Cruz Co.:** unspecified cave. **Tulare Co.:** Kaweah Cave.**Comment:** This species probably belongs to one of the species listed below.**Bibliography:** Krejca (2006, 2007); Zara Environmental (2009).*Sinella* n. sp. (troglophile)**Records:** Calaveras Co.: Carlow's Cave.**Comment:** This record may actually apply to one of the species below.**Bibliography:** Graening (2011b); McEachern and Grady (1978).*Sinella baca* Christiansen and Bellinger (troglophile)**Records:** **Amador Co.:** Connie's Cave; Fiddler's Cave; Violin Cave. **Calaveras Co.:** Cave City Cave; Lost Piton Cave; Porcupine Cave. **Napa Co.:** Clay Cave. **Santa Cruz Co.:** Bat Cave; Empire Cave (type locality); IXL Cave; Stearns Cave; Stump Cave. **Tuolumne Co.:** Scorpion Cave.**Comment:** This species is also known from the surface in Butte and Contra Costa counties, California.**Bibliography:** Briggs and Ubick (1988); Christiansen (2015); Christiansen and Bellinger (1980c, 1998); Culver, Christman, Elliott, Hobbs, and Reddell (2000).*Sinella binoculata* (Schött)**Record:** Calaveras Co.: unspecified cave.**Bibliography:** Christiansen and Bellinger (1980c, 1998).*Sinella quadrioculata* Mills**Record:** Calaveras Co.: unspecified cave.**Bibliography:** Christiansen and Bellinger (1980c, 1998).*Sinella sexoculata* (Schött) (troglophile)**Records:** **Amador Co.:** Chrome Cave. **Calaveras Co.:** three unspecified caves; Barren Cave; Beta Cave; Bobcat Cave; Grapevine Gulch Cave; Gray Pine Cave; Moaning Cave; Poison Oak Cave; Porcupine Cave; Rabbit Hole. **Mariposa Co.:** Bower Cave; Bull Creek Cave. **Santa Cruz Co.:** Stearns Cave; Stump Cave. **Tuolumne Co.:** McLean's Cave; Scorpion Cave; ?Transplant Mine.**Comment:** This species is primarily hypogean. Large numbers of this, and other species, were probably transplanted from McLean's Cave to the Transplant Mine. It was also taken from the surface 4 km northwest of Columbia and 14.5 km south of Sonora.**Bibliography:** Briggs (1975); Briggs and Ubick (1988); Christiansen (2015); Christiansen and Bellinger (1980c, 1998); Elliott (1978); McEachern and Grady (1978).*Sinella tecta* Christiansen and Bellinger (troglolite?)**Records:** **Calaveras Co.:** Bryden's Cave; Carlow's Cave; Grapevine Gulch Cave; Lost Piton Cave (type locality); Secret Cave.**Bibliography:** Christiansen (2015); Christiansen and Bellinger (1980c); Culver, Christman, Elliott, Hobbs, and Reddell (2000).**Family Isotomidae**

## Undetermined

**Records:** Siskiyou Co.: Fern Cave; Spider Cave.**Comment:** Three species are represented by this material.**Bibliography:** Taylor and Krejca (2006).

**Family Oncopoduridae***Oncopodura mala* Christiansen and Bellinger (troglophile)

**Record:** Calaveras Co.: Eagle View Cave No. 2.

**Comment:** The type locality of this species is Malheur Cave, Harney County, Oregon. It has also been taken from the surface in Contra Costa and Tulare counties, California. It was earlier reported as *O. cruciata* Bonet.

**Bibliography:** Christiansen and Bellinger (1996); Culver, Christman, Elliott, Hobbs, and Reddell (2000).

*Oncopodura tunica* Christiansen and Bellinger (troglophile)

**Records:** Tuolumne Co.: McLean's Cave. Ventura Co.: unnamed cave.

**Comment:** This species may have been transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Briggs (1975); Christiansen and Bellinger (1980c); Culver, Christman, Elliott, Hobbs, and Reddell (2000); Elliott (1978); McEachern and Grady (1978).

**Family Tomoceridae**

## Undetermined

**Records:** Amador Co.: Connie's Cave; Lulu Bell Cave; Santa Claus Cave; Rippled Cave. Calaveras Co.: Crystal Stanislaus Cave; Grapevine Gulch Cave; Heater Cave; Keith's Chasm; Porcupine Cave; Wool Hollow Cave. Fresno Co.: Miller-ton Lake Cave System; Saturday Cave. Mariposa Co.: Indian Cave. Santa Clara Co.: Joaquin Murrieta's Cave. Santa Cruz Co.: Empire Cave; Stearns Cave; Stump Cave. Shasta Co.: Ancient Palace Cave; Christmas Tree Cave; North Christmas Tree Cave; Pink Coat Cave; Rusty Cave; Subway Cave; Sweet Sinkers. Siskiyou Co.: Bigfoot Cave; Boulevard Cave; Broken Down Palace; Catacombs Cave; Coral Reef Cave; Craig Cave; Echoplex Cave; Fossil Cave; Four Star Cave; Frozen Falls Cave; Maze Cave; Nirvana Cave; NSS No. 8851; Pearl Cave; Rollercoaster Cave; Skunk Hollow Cave; Spider Cave; Tichnor Cave/Bertha's Cupboard Cave; Trail Junction Cave; Upper Heppe Cave; Upper Thicket Cave; Upstairs-Downstairs Cave; Valentine Cave. Tulare Co.: Cirque Cave; Clough Cave; Hidden Cave; Lilburn Cave; Lost Soldier's Cave; May's Cave; New Cave; Rattlesnake Cave; Ursa Minor Cave.

**Bibliography:** Cokendolpher and Krejca (2010); Taylor and Krejca (2006).

*Plutomurus* cf. *californicus* Folsom (troglophile)

**Record:** Tulare Co.: Hurricane Crawl Cave.

**Bibliography:** Krejca (2006).

*Pluromurus* nr. *californicus* Folsom

**Record:** Tulare Co.: Crystal Sequoia Cave.

**Bibliography:** Krejca (2006).

*Plutomurus brevimucronatus* Denis (troglophile)

**Records:** Mariposa Co.: Bower Cave. Siskiyou Co.: Trail Junction Cave. Trinity Co.: Hall City Cave.

**Comment:** This species is primarily hypogean.

**Bibliography:** Christiansen (2015).

*Plutomurus californicus* Folsom (troglophile)

**Records:** Calaveras Co.: Cave City Cave. Mendocino Co.: Fault Rock Cave. Santa Clara Co.: Palser Cave. Santa Cruz Co.: Bat Cave; Dolloff Cave; Empire Cave; IXL Cave; Stearns Cave. Shasta Co.: Potter Creek Cave; Samwel Cave; Shasta Lake Caverns. Siskiyou Co.: Catacombs Cave; Fern Cave; Mushpot Cave; Spider Cave; Valentine Cave. Tulare Co.: Lost Soldier's Cave.

**Comment:** This species is primarily hypogean. It is also known from Oregon Caves, Josephine County, Oregon, and the surface in Marin and Santa Clara counties, California, and Lincoln County, Oregon. A recently described troglobitic (?) species, *Plutomurus grahami* (Christiansen, 1980), from Terrero Cave, Santa Fe County, New Mexico, is its closest relative.

**Bibliography:** Briggs and Ubick (1988); Christiansen (1964, 1980); Christiansen and Bellinger (1980c); Crawford (1975, 1982); Folsom (1913); Krejca (2006); Nicholas (1960); Taylor and Krejca (2006).

*Plutomurus wilkeyi* Christiansen (troglophile)

**Records:** Calaveras Co.: Brown Deer Cave; Carlito's Cave; Carlow's Bat Cavern; Carlow's Cave; Cave of Skulls; Eagle View Cave No. 2; Kenney's Grotto; Lost Piton Cave; Secret Cave; Shaw's Cave; Wool Hollow Cave. Mariposa Co.: Bower Cave; Damp Cave; Sprinkle Cave. Plumas Co.: Juniper Cave (type locality). Santa Cruz Co.: Bat Cave; Empire Cave; Stearns Cave; Stump Cave. Siskiyou Co.: Skunk Hollow Cave. Tuolumne Co.: Tube Cave.

**Comment:** This species was also taken on the surface 12 km south of Sonora. It is primarily epigeal in Arizona, California, Idaho, and Oregon. It is known from Bucklew Cave, Cochise County, Arizona.

**Bibliography:** Briggs and Ubick (1988); Christiansen (1964, 2015); Christiansen and Bellinger (1980c); McEachern and Grady (1978).

*Pogonognathellus bidentatus* Christiansen (troglophile)

**Records:** **Mariposa Co.:** Bower Cave. **Shasta Co.:** Samwel Cave. **Tulare Co.:** Hurricane Crawl Cave.

**Comment:** This species is known from caves in Alabama, Indiana, Kentucky, Maryland, Ohio, Tennessee, Virginia and West Virginia; and the surface in Illinois, Maryland, North Carolina, Tennessee, and West Virginia. The California records above may have been incorrectly labeled (K. Christiansen, pers. comm.). No specimens are in the Christiansen database.

**Bibliography:** Christiansen (1964b); Christiansen and Bellinger (1980c); Holsinger, Baroody, and Culver (1976); Krejca (2006).

*Pogonognathellus celsus* Christiansen (troglophile)

**Records:** **Amador Co.:** Buckeye Root Cave; Connie's Cave; Fiddler's Cave; Santa Claus Cave; Rippled Cave; Violin Cave. **Calaveras Co.:** Bobcat Cave; Buckeye Cave; Carlow's Cave; Carlow's Bat Cavern; Cataract Gulch Cave; Cave City Cave; Cave of the Catacombs; Coral Cave; Creek Cave; Dirty Crack Cave; Dirty Fissure; Grapevine Gulch Cave; Hawk Cave; Keith's Chasm; Linda's Cave; Lost Piton Cave; Mercer Caverns (type locality); Music Hall Cave; Porcupine Cave; Rabbit Hole; Secret Cave; Shaw's Cave; Sink Cave; Williams Cave; Wool Hollow Cave. **El Dorado Co.:** Alabaster Cave; Crystal Cosumnes Cave. **Mariposa Co.:** Bower Cave; Bull Creek Cave; Damp Cave; Pool Pit. **Plumas Co.:** unspecified cave. **Tulare Co.:** Bear Den Cave; Carmoe Crevice Cave; Clough Cave; Crystal Sequoia Cave; Eighteenth Hole; Hidden Cave; Hurricane Crawl Cave; Kaweah Cave; Lilburn Cave; Lost Soldier's Cave; Overhang Cave; Palmer Cave; Paradise Cave; Rattlesnake Cave; Salamander Cave; Stand Up Cave; Upper Bryant Cave. **Tuolumne Co.:** Crystal Palace; Indian Quarry Cave No. 2; Porcupine Cave; Porcupine Skull Cave; Snell's Cave.

**Comment:** This species is primarily hypogean. It is also known from the surface in Oregon.

**Bibliography:** Christiansen (1964, 1998); Christiansen and Bellinger (1980c); Despain (1994); Felderhoff, Bernard, and Moulton (2010); Krejca (2006); McEachern and Grady (1978).

*Pogonognathellus flavescens* (Tullberg) species complex (troglophile)

**Records:** **Calaveras Co.:** Cave City Cave; Mercer Caverns; Wool Hollow Cave. **El Dorado Co.:** unspecified cave; Crystal Cosumnes Cave.

**Comment:** Molecular data indicates that the European *P. flavescens* does not occur in North America. These records may represent undescribed species.

**Bibliography:** Christiansen (1964).

*Tomocerina curta* (Christiansen)

**Records:** **Siskiyou Co.:** Arch Cave No. 2; Catacombs Cave; Mushpot Cave.

**Bibliography:** Jorgensen (2009); Taylor and Krejca (2006).

*Tomocerina lamelifera* Mills

**Record:** **El Dorado Co.:** Alabaster Cave.

**Comment:** This widespread species is also known from caves in Alabama, Kentucky, and New Mexico.

**Bibliography:** Christiansen (2015).

*Tomocerus* sp.

**Records:** **Fresno Co.:** Boyden Cave; Church Cave; Windy Cliff Cave. **Mariposa Co.:** Indian Cave; Spider Cave. **Napa Co.:** Clay Cave. **Santa Cruz Co.:** unspecified cave. **Siskiyou Co.:** Boulevard Cave; Catacombs Cave; Coral Reef Cave; Craig Cave; Fossil Cave; Four Star Cave; Maze Cave; Nirvana Cave; NSS No. 8851 Cave; Pearl Cave; Red Tape Cave; Rollercoaster Cave; Spider Cave; Sugar Pine Butte Ice Cave; Upper Heppe Cave; Upper Thicket Cave; Valentine Cave. **Trinity Co.:** Paul Gibson Cave. **Tulare Co.:** Bear Den Cave; Carmoe Crevice Cave; Dehydrated Cave; Eighteenth Hole; Harry's Bend Cave; Hurricane Crawl Cave; Kaweah Cave; Lange Cave; Lilburn Cave; Lost Soldier's Cave; May's Cave; Paradise Cave; Pet Cemetery Cave; Pine Grosbeak Cave; Walk Softly Cave; Wiessraum Cave; Windy Pit. **Tuolumne Co.:** Crack of Doom Cave; Crystal Tuolumne Cave; Toppled Table Talus Cave.

**Comment:** These records may not belong in *Tomocerus*.

**Bibliography:** Audisio (2009b); Graening (2011c); Krejca (2006, 2007); Taylor, Krejca, and Jacoby (2006); Zara Environmental (2009).



*Tomocerus vulgaris* (Tullberg)

**Records:** Plumas Co.: Juniper Cave. **Tuolumne Co.:** McLean's Cave.

**Comment:** This species has been reported from caves in Pennsylvania and Wisconsin. It is abundant on the surface throughout much of the United States and Europe.

**Bibliography:** Christiansen (2015).

**ORDER SYMPHYPLEONA**

Undetermined

**Records:** Mariposa Co.: Spider Cave.

**Family Arrhopalitidae**

Undetermined

**Records:** Siskiyou Co.: Caldwell Ice Caves; Catacombs Cave; Coral Reef Cave; Valentine Cave.

**Bibliography:** Taylor and Krejca (2006).

*Pygmarrhopalites* sp.

**Record:** Mariposa Co.: Spider Cave.

**Bibliography:** Zara Environmental (2009).

*Pygmarrhopalites caecus* (Tullberg)

**Record:** Siskiyou Co.: Coral Reef Cave.

**Comment:** This species is world-wide in distribution.

**Bibliography:** Zeppelini, Taylor, and Slay (2009).

**Family Dicyrtomidae**

*Ptenothrix* sp.

**Record:** Mariposa Co.: Indian Cave; Spider Cave.

**Bibliography:** Zara Environmental (2009).

*Ptenothrix californica* Christiansen and Bellinger

**Record:** Amador Co.: Violin Cave.

**Comment:** This species is otherwise known from the surface in Fresno and Los Angeles counties, California.

*Ptenothrix maculosa* (H. Schött) (troglophile)

**Records:** Calaveras Co.: Barren Cave; Coral Cave. **Mariposa Co.:** Sprinkle Cave. **Santa Cruz Co.:** Empire Cave; Stump Cave. **Shasta Co.:** Samwel Cave. **Tuolumne Co.:** Crystal Palace.

**Comment:** This primarily epigeal species is known from the surface in California, Oregon, Washington, and British Columbia.

**Bibliography:** Briggs and Ubick (1988); Christiansen (2015).

*Ptenothrix marmorata* (Packard) (troglophile)

**Records:** Calaveras Co.: Clutch Cave; Music Hall Cave; Porcupine Cave.

**Comment:** This species occurs throughout much of the United States but is not infrequently taken from caves.

**Bibliography:** Christiansen (2015); McEachern and Grady (1978).

**Family Katiannidae**

*Sminthurinus* sp.

**Record:** Mariposa Co.: Spider Cave.

**Bibliography:** Zara Environmental (2009).

**Family Sminthuridae**

Undetermined

**Records:** Amador Co.: Rippled Cave; Skeleton Cave. **Calaveras Co.:** Grapevine Gulch Cave. **El Dorado Co.:** Crystal Cosumnes Cave. **Fresno Co.:** Bear Den Cave; Beauty Cave; Boyden Cave; Windy Cliff Cave. **Inyo Co.:** unnamed lava tubes near Crater Mountain. **Mariposa Co.:** Indian Rock Shelter. **Napa Co.:** Clay Cave. **Plumas Co.:** Juniper Cave. **Shas-**

**ta Co.:** Christmas Tree Cave; Rusty Cave; Subway Cave. **Siskiyou Co.:** Bigfoot Cave; Broken Down Palace; Catacombs Cave; Red Tape Cave; Valentine Cave. **Tulare Co.:** Clough Cave; Hidden Cave; Lange Cave; Lost Soldier's Cave; New Cave; Panorama/Sink Cave System.

**Comment:** Some or all of these records may belong in other families of Symphyleona.

**Bibliography:** Krejca (2006).

#### CLASS DIPLURA (two-pronged bristletails)

Undetermined

**Records:** **Calaveras Co.:** Eagle View Cave No. 2; Lost Piton Cave; Secret Cave. **Mariposa Co.:** Spider Cave. **Siskiyou Co.:** \*Francis' Folly Cave. **Tulare Co.:** Clough Cave; Lost Soldier's Cave; May's Cave; Panorama/Sink Cave System; Pet Cemetery Cave; White Chief Cave.

**Bibliography:** Krejca (2006); McEachern and Grady (1978); Wolff, L. (2007a); Zara Environmental (2009).

#### ORDER RHABDURA

##### Family Campodeidae (slender two-pronged bristletails)

Undetermined

**Records:** **Amador Co.:** Mushroom Cave; Root Cellar Cave. **Calaveras Co.:** Carlito's Cave; Heater Cave. **Fresno Co.:** Church Cave. **Siskiyou Co.:** Bigfoot Cave; Broken Down Palace; Catacombs Cave; Fern Cave; Lost Pinnacle Cave; Upstairs-Downstairs Cave. **Tulare Co.:** Ursa Minor Cave.

**Bibliography:** Broeckel, B. (2010e); Despain (2006); Ferguson (1992); Graening (2011a); Graening, Shcherbanyuk, and Arghandiwal (2014).

##### *Campodea sp. 1*

**Records:** **Calaveras Co.:** Eagle View Cave #2, Grapevine Gulch Cave, Scat Cave.

##### *Campodea sp. 2*

**Records:** **Tuolumne Co.:** unknown cave, Banksula Cave.

##### *Campodea (C.) californiensis* Hilton

**Records:** **Mariposa Co.:** Bower Cave; Spider Cave (probably). **Tulare Co.:** May's Cave (probably). **Tuolumne Co.:** unknown cave.

##### *Eumesocampa n.sp.*

**Records:** **Amador Co.:** Black Chasm; Connie's Cave; Fiddler Cave; Violin Cave.

##### *Haplocampa sp. (troglolbite?)*

**Records:** **Shasta Co.:** Alien Space Cave; Christmas Tree Cave; Elisha Cave; Flashlight Cave; Indian Cave; North Christmas Tree Cave; Parrish Cave; Planetarium Cave; Rusty Cave; Wilcox Cave. **Siskiyou Co.:** lava tubes: Harris Mountain Cave; Red Tape Cave; Sugar Pine Butte Ice Cave.

**Comment:** The Siskiyou County records may be the same as *Haplocampa* "Lava Beds N.M." (below).

##### *Haplocampa n. sp. no. 1 (troglolbite?)*

**Record:** **Plumas Co.:** Sunnyside Mine (n. sp. "B" in Ferguson 1975).

##### *Haplocampa n. sp. no. 2 (troglolbite?)*

**Records:** **Siskiyou Co.:** lava tubes: Adam's Homestead Cave, Merrill Ice Cave.

**Comment:** This probably is the same as *Haplocampa* "Lava Beds N.M." (below).

##### *Haplocampa n. sp. no. 3 (troglolbite?)*

**Records:** **Siskiyou Co.:** limestone caves: Planetary Dairy Cave, Skunk Hollow Cave, Trail Junction Cave.

##### *Haplocampa* "Helfer's Cave Dipluran" (troglolbite?)

**Records:** **Lassen Co.:** lava tube: Eagle Lake Ice Cave, Snaked Cave. **Siskiyou Co.:** lava tubes: Indian Well Cave; Merrill Ice Cave.

**Comment:** This species was taken from the extreme twilight zone in Indian Well Cave. Helfer's Cave Dipluran may be the same taxon that Ferguson (1992) reported to be common and endemic to the Lava Beds National Monument area: *Haplocampa* "Lava Beds N.M."

**Bibliography:** Ferguson (1983, 1992); Graening, Shcherbanyuk, and Arghandiwal (2014).

*Haplocampa* "Roth's Cave Dipluran" (troglomite?)

**Record:** Siskiyou Co.: Indian Well Cave.

**Comment:** This species was taken from the extreme twilight zone in Indian Well Cave. There may be two species in the cave.

**Bibliography:** Graening, Shcherbanyuk, and Arghandiwal (2014).

*Haplocampa* "Lava Beds N.M." (troglomite?)

**Records:** Siskiyou Co.: Angleworm/Lost Pinnacle Cave; Boulevard Cave; Bowling Alley Cave; Caldwell Ice Caves; Catcombs Cave; Coda Cave; Coral Reef Cave; Cox Ice Cave; Craig Cave; Crazy Cave; Crystal Ice Cave; Deep Cavern; Fern Cave; Frozen River Cave; Glacier Cavern; Lazaroff's Hole; Lyon's Road Cave; Maze Cave; Merrill Ice Cave; Mushpot Cave; Nirvana Cave; Pearl Cave; Rollercoaster Cave; Tichnor Cave/Bertha's Cupboard Cave; Upper Heppie Cave; Valentine Cave.

**Comment:** Peck (1973a) reported the Craig Cave and Frozen River Cave specimens as *Plusiocampa* sp., a genus not occurring in California.

**Bibliography:** Ferguson (1983, 1992); Graening (2011c); Graening, Shcherbanyuk, and Arghandiwal (2014); Jorgensen (2009); Peck (1973a); Taylor et al. (2006); Taylor and Krejca (2006).

*Meiocampa* sp.

**Records:** Calaveras Co.: Barren Cave, Dirty Fissure, Lost Piton Cave.

**Bibliography:** Ferguson (1981, 1983, 1992); Graening, Shcherbanyuk, and Arghandiwal (2014).

#### ORDER DICELLURATA (earwiglike two-pronged bristletails)

##### Family Japygidae

Undetermined

**Records:** Amador Co.: Bobcat Cave; Chrome Cave; Connie's Cave; Mushroom Cave. **Calaveras Co.:** Grapevine Gulch Cave; Keith's Chasm; Poison Oak Cave; Rabbit Hole. **Lassen Co.:** \*Eagle Lake Ice Cave. **Plumas Co.:** Juniper Cave. **Santa Cruz Co.:** Dolloff Cave; Glory Cave. **Shasta Co.:** Samwel Cave. **Siskiyou Co.:** Bobcat Cave; True Shasta View Cave. **Tulare Co.:** Clough Cave; Lost Soldier's Cave. **Tuolumne Co.:** McLean's Cave; Transplant Mine.

**Comment:** Several specimens were transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Despain (2006); Elliott (1978); Graening, Shcherbanyuk, and Arghandiwal (2014); Krejca (2006); Rogers (2005b); Wolff, L. (2009a).

*Occasjapyx kofoidi* (Silvestri) (troglomite)

**Record:** Shasta Co.: Potter Creek Cave (type locality); Samwel Cave.

**Comment:** Three specimens were collected in 1903 by W. J. Sinclair.

**Bibliography:** Danchy (1951b); Graening, Shcherbanyuk, and Arghandiwal (2014); Jeannel (1943); Paclt (1958, 1958); Pagés (1957, 1964); Reddell (1983); Silvestri (1928, 1934, 1948, 1949); Smith, L.M. (1959); Vandel (1964, 1965); Wolf (1934–1937).

#### CLASS INSECTA (insects)

Undetermined (larvae)

**Records:** Mariposa Co.: Elf Village Cave; Indian Cave; Salamander Hideout Cave; Spider Cave. **Tulare Co.:** Beulah Cave; Clough Cave; Eighteenth Hole; Harry's Bend Cave; Lange Cave; Lost Soldier's Cave; Wiessraum Cave; White Chief Cave. **Tuolumne Co.:** Crystal Palace; McLean's Cave; Pine Log Cave; Windeler Cave.

#### ORDER ARCHAEOGNATHA (bristletails)

Undetermined

**Records:** Calaveras Co.: Barren Cave; Crystal Stanislaus Cave; Dragon's Breath Cave. **Fresno Co.:** Bat Cave; Beauty Cave; Boyden Cave; \*Hummel's Cave; Millerton Lake Cave System. **Inyo Co.:** Shoshone Turk Cave. **Mariposa Co.:** Indian Cave; Indian Rock Shelter; Spider Cave. **Santa Cruz Co.:** Bat Cave. **San Benito Co.:** Bear Gulch Cave. **San Bernardino Co.:** Mitchell Caverns. **Shasta Co.:** Ancient Palace Cave; Bat Cave. **Siskiyou Co.:** Adam's Homestead Cave; NSS No.



8851 Cave; Planetary Dairy Cave; Stash Talus Cave. **Tulare Co.:** Bear Den Cave; Cirque Cave; Clough Cave; Dehydrated Cave; Eighteenth Hole; Harry's Bend Cave; Jordan Cave; Kaweah Cave; Lilburn Cave; Lost Soldier's Cave; Overhang Cave; Seldom Seen Cave; Walk Softly Cave.

**Bibliography:** Graening (2011c); Keller (2009b); Krejca (2006); Quick (1996, 1997b; 1998a); Taylor and Krejca (2006).

#### ORDER ZYGENTOMA (silverfish)

Undetermined

**Records:** Calaveras Co.: \*Heater Cave. **Fresno Co.:** Bat Cave. **Lassen Co.:** Eagle Lake Ice Cave. **San Bernardino Co.:** \*012 Cave; C10 Cave. **Siskiyou Co.:** Caldwell Ice Caves. **Tulare Co.:** \*Beulah Cave; Eighteenth Hole; Kaweah Cave; \*Lost Soldier's Cave. **Tuolumne Co.:** McLean's Cave; Transplant Mine. **Ventura Co.:** Clear Springs Cave.

**Comment:** Briggs reported transplanting a zygentoman to the mine.

**Bibliography:** Briggs (1975); Elliott (1978); Harter and Moon (1985); Healey (1991a); Krejca (2006).

#### Family Lepismatidae (silverfish and firebrats)

Undetermined

**Records:** **Fresno Co.:** Boyden Cave; Maze Cave. **Inyo Co.:** Furnace Cave; Keane Travertine Cave. **San Bernardino Co.:** Egg Cave; Peggy 5 Cave; Rat's Nest. **Tulare Co.:** Cirque Cave.

#### Family Nicoletiidae (subterranean silverfish)

*Speleonycta* n. sp. no. 1 (troglobite)

**Record:** **Tulare Co.:** Clough Cave.

**Bibliography:** Espinasa (2009); Espinasa, Furst, Allen, and Slay (2010); Krejca (2009b).

*Speleonycta* n. sp. no. 2 (troglobite)

**Records:** **Calaveras Co.:** Crystal Stanislaus Cave; Heater Cave; cave in Mountain Ranch. **Tuolumne Co.:** Windeler Cave.

#### ORDER EPHEMEROPTERA (mayflies)

Undetermined

**Records:** **Trinity Co.:** Paul Gibson Cave. **Tulare Co.:** Crystal Sequoia Cave; White Chief Cave.

**Bibliography:** Krejca (2006, 2009c).

#### Family Ameletidae (brown duns)

*Ameletus* sp.

**Records** **Tulare Co.:** Cirque Cave; White Chief Cave.

**Bibliography:** Krejca (2006).

#### Family Baetidae (small minnow mayflies)

Undetermined

**Record:** **Siskiyou Co.:** Upper Heppe Cave.

**Bibliography:** Taylor and Krejca (2006).

*Baetis bicaudatus* Dodds

**Records** **Tulare Co.:** Cirque Cave; White Chief Cave.

**Bibliography:** Krejca (2006).

*Callibaetis* sp.

**Record:** **Siskiyou Co.:** Fossil Cave.

**Bibliography:** Taylor and Krejca (2006).

#### Family Heptageniidae (flatheaded mayflies)

Undetermined

**Record:** **Tuolumne Co.:** Forsythe Cave.

**Bibliography:** Krejca (2006).

*Cinygmula* sp.**Record:** Tulare Co.: White Chief Cave.**Bibliography:** Krejca (2006).*Epeorus longimanus* (Eaton)**Record:** Tuolumne Co.: Waterfall Cave.**Bibliography:** Krejca (2006).**Family Leptophlebiidae (prongill mayflies)***Paraleptophlebia* sp.**Records** Tulare Co.: spring below Hurricane Crawl Cave; Cirque Cave; Salamander Cave.**Bibliography:** Krejca (2006).**ORDER ODONATA (damselflies and dragonflies)**

Undetermined

**Records:** Calaveras Co.: Upper Calaveras Natural Bridge. **San Bernardino Co.:** Owl 3 Cave; Scaturd Cave. **Tulare Co.:** Harry's Bend Cave; May's Cave; Walk Softly Cave. **Tuolumne Co.:** Waterfall Cave.**Bibliography:** Krejca (2006).**Family Coenagrionidae (narrow-winged damselflies)***Argia alberta* Kennedy**Record:** Tulare Co.: Harry's Bend Cave.**Bibliography:** Krejca (2006).*Argia vivida* Hagen**Record:** Tulare Co.: Harry's Bend Cave.**Bibliography:** Krejca (2006).**ORDER PLECOPTERA (stoneflies)**

Undetermined

**Records:** Calaveras Co.: Upper Calaveras Natural Bridge. **Fresno Co.:** Millerton Lake Cave System. **San Benito Co.:** Balconies Cave. **Sierra Co.:** Big Springs. **Trinity Co.:** Paul Gibson Cave. **Tulare Co.:** Cirque Cave; Harry's Bend Cave; Lilburn Cave; Salamander Cave; spring below Hurricane Crawl Cave; Tufa Spring Cave; White Chief Cave. **Tuolumne Co.:** Forsythe Cave; Waterfall Cave.**Bibliography:** Anonymous (1990b); Krejca (2006).**Family Chloroperlidae (green stoneflies)***Paraperla* sp.**Record:** Siskiyou Co.: Adam's Homestead Cave.**Bibliography:** Hammond (1994).**Family Leuctridae (rolled-winged winter stoneflies)***Despaxia augusta* (Banks)**Record:** Santa Cruz Co.: Vanished River Cave.**Bibliography:** Danchy (1951b).**Family Nemouridae (spring stoneflies)***Zapada cordillera* (Baumann and Gaufin)**Record:** Trinity Co.: Hall City Cave.**ORDER ORTHOPTERA (grasshoppers, crickets, katydids)**

Undetermined

**Records:** Calaveras Co.: Sink Cave. **Fresno Co.:** Hummel's Cave. **Inyo Co.:** Titus Canyon Cave. **Mariposa Co.:** Indian Cave. **San Bernardino Co.:** Egg Cave. **Tulare Co.:** Dehydrated Cave; Harry's Bend Cave; Hurricane Crawl Cave; Lilburn Cave; Lost Soldier's Cave; Palmer Cave; Pine Grosbeak Cave; Tufa Spring Cave**Bibliography:** Danchy (1951b); Graening (2010); Krejca (2006, 2007); Quick (1996, 1997b); Rogers (1994a, 1999d); Zara Environmental (2009).

**Family Gryllacrididae (ground crickets)**

Undetermined

**Record:** Tulare Co.: \*Tufa Spring Cave.**Bibliography:** Krejca (2006).**Family Gryllidae (crickets)***Gryllus* sp.**Records:** Calaveras Co.: Rabbit Hole. Tuolumne Co.: Cable Pit.**Comment:** Only nymphs were collected.**Family Rhaphidophoridae (cave and camel crickets)**

Undetermined

**Records:** Amador Co.: Root Cellar Cave. Fresno Co.: \*1-2-3 Cave; \*Hummel's Cave; \*unnamed cave in Kings Caverns Geological Area. Inyo Co.: unnamed lava tubes near Crater Mountain; \*Defense Cave. Napa Co.: Clay Cave. San Bernardino Co.: \*Silver Shadow Cavern. Santa Cruz Co.: Coral Grotto. Shasta Co.: Ancient Palace Cave; Christmas Tree Cave; Dead Wood Cave; Elisha Cave; \*Klaydo Cave; Mad Hatter Cave; North Christmas Tree Cave; Pink Coat Cave; Planetarium Cave; \*Red Shirt Cave; Rusty Cave; Subway Cave; Wilcox Cave. Siskiyou Co.: Catacombs Cave; Fossil Cave; It ta Choo-mah Cave; \*Million Dollar Cave; Tichnor Cave/Bertha's Cupboard Cave; Tichnor's Teepee; \*Tree Cast Pillar Cave; \*Waitangi Cave. Tehama Co.: Inskip Cave. Tulare Co.: Crystal Sequoia Cave; \*Nolisa Cave; Tufa Spring Cave. Tuolumne Co.: Experimental Mine Cave. Ventura Co.: \*Clear Springs Cave.

**Bibliography:** Bowers (2008b); Broeckel, B. (1996a, 1998a, 2001i, 2003b, 2008g); Halliday (1962); Jackson, G.F. (1964, 1965, 1966); Jorgensen (2008); Kirschman (2003); Krejca (2006); National Park Service (2004); Quick (1998b); Sharp (1991, 2000b); Szuakalski (2001a, 2003c); Whitfield (1963, 1965); Wolf, L. (2013b); Zidell (1987).

*Ceuthophilus* sp. (troglone)

**Records:** Calaveras Co.: Bone Cave. Mariposa Co.: Bull Creek Cave. Santa Cruz Co.: Bat Cave; Empire Cave; Stearns Cave. Siskiyou Co.: Bigfoot Cave; Planetary Dairy Cave; Spider Cave; Sugar Pine Butte Ice Cave; Trail Junction Cave.

**Bibliography:** Briggs and Ubick (1988); Graening (2011c); Taylor and Krejca (2006); Ubick (2001).*Ceuthophilus* n. sp. no. 1 (troglone?)**Records:** Inyo Co.: Upper Shoshone Cave; Lower Shoshone Cave; Shoshone Turk Cave.**Bibliography:** Briggs (1990); Rado and Tyner (1984); Ubick and Briggs (1992).*Ceuthophilus* n. sp. no. 2 (troglone?)**Record:** Inyo Co.: Titus Canyon Cave.*Ceuthophilus* (*Geotettix*) inyo Hubbell (troglone)

**Records:** Siskiyou Co.: Boulevard Cave; Coral Reef Cave; Cox Ice Cave; Fern Cave; Lazaroff's Hole; Lyon's Road Cave; Maze Cave; NSS No. 8851 Cave; Pearl Cave; Spider Cave; Township Cave; Valentine Cave.

**Bibliography:** Taylor and Krejca (2006).*Farallonophilus cavernicolus* Rentz (troglone)

**Records:** San Francisco Co.: *Farallon Islands*; sea cave on SW face of South Farallon Island near the generator housing (type locality); 10 caves on Southeast Farallon Island; Corn Blind Cave; Cricket Cave; Rabbit Cave; Spooky Cave.

**Comment:** This species has reduced eyes and attenuated appendages. It is abundant in caves and in auklet burrows.**Bibliography:** Anonymous (1911c); Rentz (1972); Steiner (1989); Valainis (2014).*Pristoceuthophilus* sp. (?troglone)**Records:** Shasta Co.: Ancient Palace Cave; Bat Cave; Potter Creek Cave. Siskiyou Co.: Trail Junction Cave.**Comment:** One juvenile was collected.*Pristoceuthophilus* n. sp. no. 1 (troglone)**Record:** Plumas Co.: Soda Springs Cave.



*Pristoceuthophilus* n. sp. no. 2 (troglaxene)**Record: Tulare Co.:** Crystal Sequoia Cave.**Comment:** A single male was collected.*Pristoceuthophilus* n. sp. no. 3 (probable troglophile)**Record: Plumas Co.:** Juniper Cave.**Comment:** This species has not been found outside of this cave.*Pristoceuthophilus* n. sp. no. 4 (probable troglophile)**Record: Shasta Co.:** Samwel Cave.**Comment:** This species has not been found outside of this cave.**Bibliography:** Hardaker (1970).*Pristoceuthophilus celatus* (Scudder) (troglaxene)**Records: Siskiyou Co.:** Catacombs Cave; Fern Cave; Mushpot Cave; Spider Cave; Valentine Cave.**Bibliography:** Jorgensen (2009); Taylor and Krejca (2006).*Pristoceuthophilus marmoratus* Rehn (troglaxene)**Record: Mariposa Co.:** Indian Rock Shelter.**Bibliography:** Zara Environmental (2009).*Pristoceuthophilus pacificus* Scudder (troglaxene)**Record: Marin Co.:** deserted copper mines on Bolinas Ridge near southern end of Tomales Bay.**Bibliography:** Rentz (1972).*Tropidischia* sp. (troglaxene)**Records: Fresno Co.:** Maze Cave. **Santa Cruz Co.:** Clear Water Cave; Vanished River Cave. **Trinity Co.:** Paul Gibson Cave. **Tulare Co.:** Bear Den Cave; \*Beulah Cave, Crystal Sequoia Cave; Dehydrated Cave; Harry's Bend Cave; Hurricane Crawl Cave; Lilburn Cave; Lost Soldier's Cave; May's Cave; \*Palmer Cave; Pine Grosbeak Cave; Tufa Spring Cave; \*Walk Softly Cave.**Comment:** Some of these records may belong to *T. xanthostoma*.**Bibliography:** Danchy (1951b); Krejca (2006); Lee, V.F. (1985a); Reardon (1966).*Tropidischia xanthostoma* Scudder (troglaxene)**Records: Marin Co.:** deserted copper mines on Bolinas Ridge near southern end of Tomales Bay. **Trinity Co.:** Indian Valley Creek Cave. **Tulare Co.:** Bear Den Cave; Beulah Cave; Crystal Sequoia Cave; Dehydrated Cave; Harry's Bend Cave; Hurricane Crawl Cave; Lilburn Cave; Lost Soldier's Cave; May's Cave; Palmer Cave; Pine Grosbeak Cave; Tufa Spring Cave; Walk Softly Cave.**Bibliography:** Despaigne (1994); Krejca (2006); Oberhansley (1946); Reardon (1966); Rentz (1972); Snyder (2005b).**Family Stenopelmatidae (Jerusalem crickets)***Stenopelmata* sp.**Record: Contra Costa Co.:** rockshelters on Carquinez Strait shoreline.**Family Tettigoniidae (long-horned grasshoppers, katydids)***Aglaothorax oratus* Scudder**Record: Tuolumne Co.:** Crystal Tuolumne Cave.**Comment:** One juvenile male was collected.**ORDER NOTOPTERA****SUBORDER GRYLLOBLATTODEA (rock crawlers, ice crawlers)****Family Grylloblattidae***Grylloblatta* sp. (troglophile or troglaxene)**Records: Plumas Co.:** Griffith Ranch Ice Cave; Ice Cave. **Siskiyou Co.:** Freudian Complex; Harris Mountain Cave;

\*Leapin' Lizards Cave; Red Tape Cave; Sugar Pine Butte Ice Cave; \*Tag No. 4-1 Cave; Tag No. 4-2 Cave.

**Bibliography:** Broeckel, B. (2008f); Broeckel, Wolff, and Wolff (2002); Halliday (1962); Kamp (1973); Sanders (2014).

*Grylloblatta* n. sp. 1 ("Ostrander Lake")

**Record: Mariposa Co.:** Indian Cave; Indian Rock Shelter.

**Comment:** This species represents a distinct lineage based on molecular studies.

**Bibliography:** Schoville and Graening (2013); Zara Environmental (2009).

*Grylloblatta* n. sp. 2 ("Southwest Sierra Nevada")

**Record: Tulare Co.:** ?White Chief Cave.

**Comment:** This record is based on nymphs, but probably identical to surface specimens from nearby.

**Bibliography:** Schoville and Graening (2013).

*Grylloblatta* n. sp. 3 ("Lilburn Cave")

**Records: Tulare Co.:** Lilburn Cave; May's Cave.

**Comment:** The May's Cave record is the southernmost for any grylloblattid to date. It was found in breakdown under rocks at the base of a 10 m vertical entrance (Lee, 1967).

**Bibliography:** Despain (2006); Graening (2013); Kamp (1973); Krejca (2006); Lee, V.F. (1967, 1985a); Schoville and Graening (2013); Schoville and Roderick (2010).

*Grylloblatta chandleri* Kamp (troglophile)

**Records: Lassen Co.:** Eagle Lake Ice Cave (type locality); Griffith Meadows Ice Cave. **Shasta Co.:** North Christmas Tree Cave; Subway Cave; Trail Cave. **Tehama Co.:** Wilson Lake Ice Cave

**Bibliography:** Anonymous (1971a); Halliday (1962); Kamp (1953, 1963, 1970, 1973); Noble (1954); Peck (1973a); Schoville and Graening (2013); Uéno and Decu (1998).

*Grylloblatta gurneyi* Kamp (troglophile)

**Records: Siskiyou Co.:** ?lava cave near Hambone; Angeworm Cave/Lost Pinnacle Cave; Arch Cave No. 2; ?Bray Ice Cave; Castle Cave; Catacombs Cave; Cox Ice Cave; Crystal Ice Cave; Deep Ice Caves; Frozen River Cave; Indian Well Cave; ?Jack Jones Ice Cave; ?Jake Bell Cave(s); ?Mayfield Ice Cave; Merrill Ice Cave (type locality); Mushpot Cave; Post Office Cave; Skull Ice Cave; ?Starr Cave; Three-Level Ice Cave; Upper Heppe Cave.

**Bibliography:** Halliday (1962); Kamp (1963, 1970); Peck (1968b, 1973a, 1974a); Schoville and Graening (2013); Suggett (1983); Taylor and Krejca (2006); Uéno and Decu (1998); Wolff and Wolff (1990).

*Grylloblatta marmoreus* Schoville (troglophile)

**Records: Siskiyou Co.:** Bigfoot Cave (type locality); Broken Down Palace; Planetary Dairy Cave.

**Comment:** This species was found in the twilight zone.

**Bibliography:** Graening (2011c); Schoville (2012); Schoville and Graening (2013); Sugget (1983).

*Grylloblatta washoea* Gurney (troglophile)

**Record: Sierra Co.:** ? Avalanche Cave.

**Bibliography:** Schoville and Graening (2013).

**ORDER ISOPTERA (termites)**

Undetermined

**Records: Calaveras Co.:** Wool Hollow Cave. **Shasta Co.:** Rusty Cave. **Tuolumne Co.:** Transplant Mine.

**Bibliography:** Elliott (1978).

**Family Rhinotermitidae (subterranean termites)**

*Reticulitermes* sp.

**Record: Calaveras Co.:** Gray Pine Cave.

**ORDER PSOCODEA (booklice, barklice)**

Undetermined

**Records:** **Calaveras Co.:** Crystal Stanislaus Cave; Grapevine Gulch Cave; Keith's Chasm. **Fresno Co.:** Boyden Cave; Windy Cliff Cave. **Inyo Co.:** ARC No. 2; Titus Canyon Cave. **Mariposa Co.:** Bower Cave; Indian Rock Shelter. **San Bernardino Co.:** C10 Cave; Glove Cave; Owl 3 Cave; Papoose Cave; Scaturd Cave. **Santa Cruz Co.:** Coral Grotto. **Shasta Co.:** Ancient Palace Cave; Bat Cave; Potter Creek Cave. **Siskiyou Co.:** Catacombs Cave; Fern Cave; Maze Cave; Spider Cave.

**Bibliography:** Graening (2010); Taylor and Krejca (2006); Zara Environmental (2009).

**Family Liposcelidae (booklice)***Liposcelis* sp.

**Record:** **Tulare Co.:** Overhang Cave.

**Bibliography:** Krejca (2006).

**Family Psyllipsocidae (cave barklice)***Psyllipsocus kintpuashi* Mockford (troglophile)

**Records:** **Siskiyou Co.:** Craig Cave; Maze Cave; NSS No. 8851 (type locality); Rollercoaster Cave; Valentine Cave. **Tulare Co.:** Crystal Sequoia Cave.

**Comment:** This species is known only from these caves.

**Bibliography:** Krejca (2006); Mockford (2011); Taylor and Krejca (2006).

*Psyllipsocus ramburii* Selys (troglophile)

**Records:** **Amador Co.:** Chrome Cave; Fern Frond Cave; Santa Claus Cave. **Calaveras Co.:** Bobcat Cave; Cave of Skulls; Coral Cave; Diane's Cave; Grapevine Gulch Cave; Gray Pine Cave; Heater Cave; Poison Oak Cave; Porcupine Cave; Shaw's Cave. **Mariposa Co.:** Bower Cave; Bull Creek Cave. **Santa Cruz Co.:** Bat Cave. **Shasta Co.:** Samwel Cave; Shasta Lake Caverns. **Tulare Co.:** Bear Den Cave; Clough Cave; ?Crystal Sequoia Cave; Eighteenth Hole; Hidden Cave; Kaweah Cave; Walk Softly Cave; Wiessraum Cave; Windy Pit. **Tuolumne Co.:** Banksula Cave; Crystal Butterfly Cave; Crystal Palace; McLean's Cave; McNamee's Cave; Milkcan Cave; Porcupine Cave; Scorpion Cave; Transplant Mine.

**Comment:** This bark louse is found in caves in many parts of the world. The species was transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Briggs and Ubick (1988); Elliott (1978); Krejca (2006); McEachern and Grady (1978); Ubick (2001).

**ORDER HEMIPTERA (bugs)****SUBORDER HETEROPTERA (true bugs)**

Undetermined

**Records:** **Amador Co.:** Lulu Bell Cave; Santa Claus Cave; Rippled Cave; Skeleton Cave; White Room Cave. **Calaveras Co.:** Barren Cave; Bone Cave; Wool Hollow Cave. **Fresno Co.:** Millerton Lake Cave System. **Inyo Co.:** Keane Travertine Cave; Poleta Cave. **Mariposa Co.:** Indian Cave; Spider Cave. **Nevada Co.:** Gretta's Grotto. **San Benito Co.:** Bear Gulch Cave. **San Bernardino Co.:** Medicine Cave; Virginia's Mine Cave. **Shasta Co.:** Pink Coat Cave; Trail Cave. **Tulare Co.:** Hurricane Crawl Cave; Kaweah Cave; Lilburn Cave; May's Cave; Salamander Cave; Overhang Cave; Ursa Minor Cave.

**Bibliography:** Graening (2010); Krejca (2006).

**Family Cicadellidae (leafhoppers)**

Undetermined

**Record:** **Mariposa Co.:** Indian Rock Shelter. **Siskiyou Co.:** Pearl Cave.

**Bibliography:** Taylor and Krejca (2006).

*Osbornellus* sp.

**Record:** **Tulare Co.:** Pine Grosbeak Cave.

**Bibliography:** Krejca (2006).

**Family Cimicidae (bed bugs, bat bugs)***Cimex incrassatus* Usinger and Ueshima (parasite)

**Records:** **Imperial Co.:** mine tunnel at Laguna Dam. **San Luis Obispo Co.:** small cave on La Panza Ranch along San Juan Creek.

**Comment:** This species was taken from the bat *Antrozous pallidus* and the wall of the cave in which it roosted.

**Bibliography:** Orr, R.T. (1954); Usinger (1966).



*Haematosiphon inodorus* (Dugés)**Record: Unknown Co.:** \*caves utilized as nest sites by the California condor.**Bibliography:** Snyder, Ramey, and Sibley (1986).**Family Gerridae (water strider bugs)**

Undetermined

**Records: San Benito Co.:** Balconies Cave; Bear Gulch Cave.*Aquarius remigis* (Say)**Records: Mariposa Co.:** Bower Cave. **Tulare Co.:** Cirque Cave.**Bibliography:** Krejca (2006).**Family Largidae (red bugs and ant mimic bugs)***Largus cinctus* Herrich-Schaeffer**Record: Calaveras Co.:** Eagle View Cave No. 2.**Family Lygaeidae (seed bugs)***Ozophora* sp.**Record: Tuolumne Co.:** Bend Cave.**Family Macroveliidae (shore bugs)***Macrovelia hornii* Uhler**Records: Tulare Co.:** Cedar Cave; Hurricane Crawl Cave; Lilburn Cave; Lost Soldier's Cave.**Comment:** This species was taken from the Main Entrance section of Lilburn Cave and from walls in both caves.**Bibliography:** Krejca (2006); Lee, V.F. (1985a, 1985b); Tinsley (1985).**Family Polycetenidae (bat bugs)***Hesperoctones eumops* Ferris and Usinger**Record: San Diego Co.:** rock crevice 1.5 mi. N of Barrett Junction.**Comment:** This species was taken from *Eumops perotis californicus*.**Bibliography:** Kruttsch (1955a).**Family Reduviidae (assassin bugs)**

Undetermined

**Records: Calaveras Co.:** Dragon's Breath Cave. **San Bernardino Co.:** Cima Cave; Egg Cave. **Tulare Co.:** Cirque Cave; White Chief Cave; Windy Pit.**Bibliography:** Graening (2010); Krejca (2006).

## Emesinae

**Record: Fresno Co.:** Boyden Cave.*Triatoma protracta* Uhler**Records: Tulare Co.:** Kaweah Cave; ?Windy Pit.**Bibliography:** Krejca (2006).**SUBORDER AUCHENORRHYNCHA**

Undetermined

**Records: Calaveras Co.:** Barren Cave. **Tulare Co.:** Kaweah Cave.**Bibliography:** Krejca (2006).**INFRAORDER FULGOROMORPHA**

Undetermined (troglophile)

**Records: Amador Co.:** Root Cellar Cave. **Napa Co.:** Clay Cave. **Shasta Co.:** Christmas Tree Cave; Elisha Cave; Indian Cave; North Christmas Tree Cave; Wilcox Cave. **Siskiyou Co.:** Bigfoot Cave; Corkscrew Cave; Echoplex Cave; Frozen Falls Cave. **Tulare Co.:** Crystal Sequoia Cave. **Tuolumne Co.:** McLean's Cave; Transplant Mine; Windeler Cave.

**Comment:** Several individuals were transplanted from McLean's Cave to the Transplant Mine. Troglotitic plant hoppers are known from Hawaii and Mexico.

**Bibliography:** Elliott (1978); Krejca (2006).

**Family Achilidae (achilid planthoppers)**

Undetermined

**Records:** **Fresno Co.:** Windy Cliff Cave. **Napa Co.:** Clay Cave. **Santa Cruz Co.:** Bat Cave. **Tulare Co.:** Eighteenth Hole; Harry's Bend Cave; Hurricane Crawl Cave; Lost Soldier's Cave; May's Cave; Overhang Cave; Paradise Cave; Pine Grosbeak Cave. **Tuolumne Co.:** McLean's Cave.

**Bibliography:** Krejca (2006); McEachern and Grady (1978); Ubick (2001).

*Juniperthia* sp.

**Records:** **Tulare Co.:** Bear Den Cave; Lange Cave; Lost Soldier's Cave.

**Bibliography:** Krejca (2006).

*Juniperthia producta* (Van Duzee)

**Records:** **Tulare Co.:** Bear Den Cave; Lange Cave; Lost Soldier's Cave

**Bibliography:** Krejca (2006).

*Juniperthia succinea* (Van Duzee)

**Records:** **Mariposa Co.:** ?Indian Cave. **Tulare Co.:** Bear Den Cave; Carmoe Crevice Cave; Clough Cave; Eighteenth Hole; Hidden Cave; Hurricane Crawl Cave; Lost Soldier's Cave; May's Cave; New Cave; Overhang Cave.

**Bibliography:** Krejca (2006, 2007); Zara Environmental (2009).

*Synedoche rubella* (Van Duzee)

**Record:** **Tulare Co.:** Overhang Cave.

**Bibliography:** Krejca (2006).

**Family Cixiidae (cixiid planthoppers)**

Undetermined

**Records:** **Calaveras Co.:** Heater Cave; O'Neil's Cave. **Napa Co.:** Clay Cave. **Shasta Co.:** Christmas Tree Cave.

**Bibliography:** Anonymous (1991b).

*Cixius* sp. (troglophile)

**Records:** **Santa Cruz Co.:** Clear Water Cave; Laguna Creek Cave.

*Cixius* n. sp. (troglophile)

**Records:** **Santa Cruz Co.:** Bat Cave; Dolloff Cave; Empire Cave; IXL Cave; Stump Cave.

**Bibliography:** Briggs and Ubick (1988); Ubick (2001).

*Cixius nervosus* (Linnaeus)

**Record:** **Tulare Co.:** Harry's Bend Cave.

**Bibliography:** Krejca (2006).

**SUBORDER STERNORRHYNCHA**

**Family Aphidiidae (aphids)**

Undetermined

**Record:** **Tulare Co.:** Clough Cave.

**Bibliography:** Krejca (2006).

*Aulacorthum solani* (Kaltenbach)

**Record:** **Alameda Co.:** Joaquin Murrieta Caves.

*Brachycaudus helichrysi* Kaltenbach

**Record:** **Alameda Co.:** Joaquin Murrieta Caves.

*Rhopalosiphoninus latysiphon* (Davidson)

**Record:** Calaveras Co.: Grapevine Gulch Cave.

**Comment:** Numerous specimens were found presumably on or near the extensive roots hanging from the ceiling of the cave, also known as Hanging Gardens Cave. Known hosts of this species are *Vinca major* Linnaeus and *Convolvulus arvensis* Linnaeus.

**ORDER THYSANOPTERA (thrips)**

Undetermined

**Records:** Siskiyou Co.: Mushpot Cave; Rollercoaster Cave.

**Comment:** The specimen from Rollercoaster Cave was taken by Berlese funnel extraction of *Neotoma* midden material in the dark zone.

**Bibliography:** Taylor and Krejca (2006).

**ORDER MEGALOPTERA (dobsonflies, alderflies)****Family Corydalidae (dobsonflies)**

Undetermined

**Records:** Calaveras Co.: Upper Calaveras Natural Bridge. Fresno Co.: Millerton Lake Cave System. Trinity Co.: Paul Gibson Cave. Tulare Co.: Harry's Bend Cave.

**Bibliography:** Krejca (2006).

*Corydalus* sp.

**Record:** Santa Cruz Co.: Dolloff Cave.

**Bibliography:** Briggs and Ubick (1988).

*Corydalus texanus* Banks

**Record:** Tulare Co.: Harry's Bend Cave.

**Bibliography:** Krejca (2006).

*Neohermes* prob. *californicus* (Walker)

**Record:** Amador Co.: Fern Frond Cave.

*Neohermes californicus* (Walker)

**Records:** Tulare Co.: Crystal Sequoia Cave; Harry's Bend Cave; Hurricane Crawl Cave.

**Bibliography:** Krejca (2006).

**ORDER NEUROPTERA (net-winged insects)**

Undetermined

**Records:** Calaveras Co.: Bone Cave; Music Hall Cave. Fresno Co.: Boyden Cave. San Bernardino Co.: Peggy 5 Cave.

**Tulare Co.:** Hurricane Crawl Cave.

**Bibliography:** Graening (2010); Krejca (2006).

**Family Myrmeleontidae (antlions)**

Undetermined

**Records:** San Bernardino Co.: Scaturd Cave; \*Whipple Wash Cave. Tulare Co.: Hurricane Crawl Cave.

**Bibliography:** Halliday (2007); Krejca (2006).

*Eremoleon insipidus* Adams

**Record:** Inyo Co.: Old Spanish Trail Cave.

**ORDER COLEOPTERA (beetles)****SUBORDER ADEPHAGA****Family Carabidae (ground beetles, tiger beetles)**

Undetermined

**Records:** Amador Co.: Hummingbird Cave; Moss Cave; Mushroom Cave; Santa Claus Cave; Rippled Cave. Calaveras Co.: Bone Cave; O'Neil's Cave; Porcupine Cave. Fresno Co.: Boyden Cave; Church Cave. Inyo Co.: Crack-'n-Mound Cave. Napa Co.: Clay Cave. San Bernardino Co.: Peggy 5 Cave. Santa Cruz Co.: Bat Cave; Stearns Cave. Shasta Co.:

Subway Cave. **Siskiyou Co.:** Apogee Cave; Hoyle's Half-Dollar Hole; Planetary Dairy Cave; Tichnor Cave/Bertha's Cupboard Cave. **Tulare Co.:** Carmoe Crevice Cave; Cirque Cave; \*Clough Cave; Crystal Sequoia Cave; Eighteenth Hole; Lilburn Cave; Lost Soldier's Cave; Panorama/Sink Cave System; \*Paradise Cave; Pet Cemetery Cave; Ursa Minor Cave; Wiessraum Cave. **Tuolumne Co.:** Fivescythe Cave; McLean's Cave.

**Bibliography:** Graening (2011c); Krejca (2006); McEachern and Grady (1978).

**Subfamily Carabinae (ground beetles)**

**Tribe Cychrini**

*Scaphinotus* sp.

**Records:** **Amador Co.:** Rippled Cave. **Fresno Co.:** Millerton Lake Cave System. **Santa Cruz Co.:** Empire Cave; Stearns Cave. **Tulare Co.:** Lost Soldier's Cave; Palmer Cave; Paradise Cave; Wiessraum Cave.

**Bibliography:** Krejca (2006); Ubick (2001).

*Scaphinotus (Brennus) interruptus* (Ménétriés)

**Record:** **Napa Co.:** Clay Cave.

**Bibliography:** Gidaspow (1968).

*Scaphinotus (Bennus) riversi* Roeschke

**Record:** **Tulare Co.:** Lilburn Cave.

**Comment:** Members of this genus of ground beetle usually feed on snails. This may be the minute ground beetles referred to by Reardon (1966).

**Bibliography:** Danchy (1951b); Krejca (2006); Lee, V.F. (1985a); Reardon (1966).

**Subfamily Cicindelinae (tiger beetles)**

**Tribe Amblycheilini**

*Amblycheila schwartzi* Horn (trogloxene)

**Records:** **Inyo Co.:** Poleta Cave. **San Bernardino Co.:** Mitchell Caverns, Cave of the Winding Stair.

**Bibliography:** Aalbu (1990); McDonald (2002).

**Tribe Cicindelini**

*Omus californicus* Eschscholtz

**Records:** **Tulare Co.:** Cirque Cave; Lilburn Cave; May's Cave. **Tuolumne Co.:** Forscythe Cave.

**Bibliography:** Lee, V.F. (1985a); Krejca (2006).

**Subfamily Harpalinae**

**Tribe Chlaeniini**

*Chlaenius (Chlaenius) sericeus* (Forster)

**Record:** **San Diego Co.:** unnamed cave on Santa Margarita Ranch.

**Bibliography:** Grinnell (1918).

**Tribe Lebiini**

*Cymindis (Tarulus) arizonensis* Schaeffer

**Record:** **San Bernardino Co.:** Mitchell Caverns.

**Comment:** This species was found on the surface and in the Tecopa area of the caverns.

**Bibliography:** Aalbu (1990).

**Tribe Platynini**

*Platynus (Platynus) brunneomarginatus* (Mannerheim)

**Records:** **Mariposa Co.:** Bower Cave. **Tuolumne Co.:** The Catacombs.

**Bibliography:** McEachern and Grady (1978).

*Rhadine* sp. no. 1 (troglophile)

**Records:** **Inyo Co.:** Old Spanish Trail Cave; Titus Canyon Cave. **San Bernardino Co.:** Mitchell Caverns; Cave of the Winding Stair.

**Comment:** This species was taken both on the surface and in the El Pakiva section of Mitchell Caverns. The genus *Rhadine* ranges from Canada to Mexico and contains many cavernicole species.

**Bibliography:** Aalbu (1990); Graening (2010); Gómez et al. (2016); Taylor and Krejca (2006).



*Rhadine* sp. no. 2 (troglophile)**Records:** Siskiyou Co.: Catacombs Cave; Fern Cave.**Bibliography:** Graening (2010); Taylor and Krejca (2006).*Rhadine* n. sp. (troglophile)**Records:** Inyo Co.: Lower Shoshone Cave; Upper Shoshone Cave.**Bibliography:** Briggs (1990); Gómez et al. (2016); Ubick and Briggs (1992).**Tribe Pterostichini***Pterostichus* sp.**Records:** Tulare Co.: Carmoe Crevice Cave; Eighteenth Hole; Hidden Cave; Hurricane Crawl Cave; Lilburn Cave; Paradise Cave; Walk Softly Cave.**Bibliography:** Krejca (2006).*Pterostichus (Hypherpes)* n. sp. no. 1**Record:** Mariposa Co.: Bower Cave.*Pterostichus (Hypherpes)* n. sp. no. 2**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This species was taken both within the cave and on the surface. It is not known if this is the same as one of the four listed above.**Bibliography:** Aalbu (1990).*Pterostichus (Hypherpes)* sp. no. 1**Record:** Santa Cruz Co.: Bat Cave; IXL Cave.**Bibliography:** Briggs and Ubick (1988); Ubick (2001).*Pterostichus (Hypherpes)* sp. no. 2**Record:** Santa Cruz Co.: Empire Cave.**Bibliography:** Briggs and Ubick (1988); Ubick (2001).*Pterostichus (Hypherpes)* sp. no. 3**Record:** Tuolumne Co.: Crystal Butterfly Cave.*Pterostichus (Hypherpes)* cf. *vicinus* Mannerheim**Record:** Calaveras Co.: Porcupine Cave.*Pterostichus (Hypherpes) congestus* Mémétrés**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This species was taken on the surface and in both the Tecopa and El Pakiva sections of the caverns. It is not known if this is the same as one of the four species listed above.**Bibliography:** Aalbu (1990).*Pterostichus (Hypherpes) lama* Ménétrés**Record:** Tulare Co.: Lilburn Cave.**Bibliography:** Krejca (2006); Lee, V.F. (1985a).*Pterostichus (Leptopheronia) enyo* Will (troglophile)**Record:** Trinity Co.: Paul Gibson Cave.**Tribe Zabринi**

Undetermined

**Record:** Tulare Co.: Paradise Cave.

**Subfamily Scaritinae****Tribe Promecognathini***Promecognathus* sp. (troglonexene)**Records:** Calaveras Co.: Porcupine Cave. Santa Cruz Co.: Bat Cave.**Bibliography:** Ubick (2001).**Subfamily Trechinae****Tribe Bembidiini****Subtribe Anillina***Anillina* n. gen., n. sp. no. 1 (troglobite)**Records:** Tuolumne Co.: McLean's Cave; Transplant Mine.**Comment:** A large species of blind beetle was found in the dark zone of Crystal Palace (D.H. Kavanaugh, pers. comm.). A second species and possibly second new genus of blind beetle but smaller was found in the same habitat in McLean's Cave. Some may have been transplanted from McLean's Cave to the Transplant Mine. Both species are fossorial and may not be true troglobites (D.H. Kavanaugh, pers. comm.).**Bibliography:** Briggs (1975, 1987); Ehr (1981a); Elliott (1978); Krejca (2006).*Anillina* n. gen., n. sp. no. 2 (troglobite)**Records:** Tulare Co.: Lost Soldier's Cave.**Bibliography:** Briggs (1975); Elliott (1978); Krejca (2006).*Anillina* n. gen., n. sp. no. 3 (troglobite)**Record:** Napa Co.: Clay Cave.**Bibliography:** Anonymous (2005d); D.H. Kavanaugh (pers. comm.)*Anillina* n. gen., n. sp. no. 4 (troglobite)**Records:** Calaveras Co.: Moaning Cave. Tuolumne Co.: Crystal Palace.**Bibliography:** Bradford (2013); (D.H. Kavanaugh, pers. comm.).*Anillaspis explanata* (G. Horn) (troglobite)**Records:** El Dorado Co.: Alabaster Cave.**Bibliography:** Bousquet (2012); Horn, G.H., (1888); Packard (1988); Schwarz (1990)*Anillodes* sp. (troglophile?)**Records:** Calaveras Co.: Grapevine Gulch Cave; Gray Pine Cave. Santa Cruz Co.: Dolloff Cave. Tulare Co.: Lost Soldier's Cave. Tuolumne Co.: McLean's Cave; Porcupine Cave.**Bibliography:** Krejca (2006).*?Anillus***Record:** Calaveras Co.: Music Hall Cave.**Comment:** The genus *Anillus* does not occur in California. This may have been a misspelling of *Anillinus*.**Bibliography:** McEachern and Grady (1978).**Subtribe Bembidiina***Bembidion* sp.**Records:** Napa Co.: Clay Cave. Shasta Co.: Subway Cave. Tulare Co.: Lost Soldier's Cave.**Bibliography:** Krejca (2006); Reardon (1966).*Bembidion (Trechonepha) iridescens* (LeConte)**Records:** Amador Co.: Violin Cave. Calaveras Co.: Gray Pine Cave. Mariposa Co.: Bower Cave; Bull Creek Cave; Pool Pit. Santa Cruz Co.: Dolloff Cave; Empire Cave.**Bibliography:** Briggs and Ubick (1988); Ubick (2001).

**Tribe Trechini***Trechus (Microtrechus) sp. (vandykei group)***Records:** Santa Cruz Co.: Dolloff Cave; Empire Cave.**Comment:** The subgenus *Microtrechus* is otherwise known only from the eastern United States.**Bibliography:** Briggs and Ubick (1988); Ubick (2001).*Trechus (Trechus) chalybius* DeJean (troglophile)**Record:** Santa Cruz Co.: Empire Cave.**Comment:** A small colony formerly inhabited this cave, but no teneral (young adults) have been found there.**Bibliography:** Barr (1964); Briggs and Ubick (1988).**Family Dytiscidae (predaceous diving beetles)**

Undetermined

**Records:** San Benito Co.: Bear Gulch Cave. **Tulare Co.:** White Chief Cave; Cirque Cave. **Trinity Co.:** Paul Gibson Cave.**Family Gyrinidae (whirligig beetles)**

Undetermined

**Records:** Amador Co.: Lulu Bell Cave. **San Benito Co.:** Bear Gulch Cave.*Gyrinus plicifer* LeConte**Record:** Tuolumne Co.: McLean's Cave.**SUBORDER POLYPHAGA****Superfamily Cucujoidea (fungus beetles, lady beetles)**

Undetermined

**Record:** Mariposa Co.: Spider Cave.**Bibliography:** Zara Environmental (2009).**Family Agyrtidae (primitive carrion beetles)****Subfamily Necrophilinae***Necrophilus sp.***Records:** Amador Co.: Connie's Cave. **Plumas Co.:** Juniper Cave.*Necrophilus hydrophiloides* Mannerheim**Records:** Amador Co.: Moss Cave; Mushroom Cave; Rippled Cave; Root Cellar Cave; Santa Claus Cave; Skeleton Cave; Sutter Creek Cave. **Calaveras Co.:** Crystal Stanislaus Cave. **Mariposa Co.:** Pool Pit. **Napa Co.:** Clay Cave.**Comment:** This carrion beetle was collected in the twilight zone of Crystal Stanislaus Cave.**Bibliography:** Danchy (1951b).**Family Anobiidae (wood-boring beetles, spider beetles)****Subfamily Ptininae**

Undetermined

**Record:** Calaveras Co.: Wool Hollow Cave.*Niptus arcanus* Aalbu and Andrews (troglobite)**Record:** San Bernardino Co.: Mitchell Caverns (type locality).**Comment:** This species is known only from the El Pakiva section of the caverns.**Bibliography:** Aalbu (1990); Aalbu and Andrews (1992).*Ptinus sp.***Record:** Inyo Co.: Lower Shoshone Cave.

*Ptinus feminalis* Fall

**Record: San Bernardino Co.:** Mitchell Caverns.

**Comment:** Most specimens of this species were found near entrances. This species was identified as *Ptinus clavipes* Panzer by Aalbu (1990).

**Bibliography:** Aalbu (1990); Aalbu and Andrews (1992).

**Family Anthicidae (ant-like flower beetles)**

Undetermined

**Record: Napa Co.:** Clay Cave.

**Bibliography:** Bradford (2005).

**Family Bostrichidae (powder-post beetles)**

*Lyctus planicollis* (LeConte)

**Record: Santa Barbara Co.:** Chumash Painted Cave.

**Family Cantharidae (soldier beetles)**

*Podabrus* sp.

**Record: Amador Co.:** Connie's Cave.

*Cultellunguis americana* (Pic)

**Record: Amador Co.:** Rippled Cave.

**Family Cerambycidae (long-horned beetles)**

Undetermined

**Record: Inyo Co.:** ARC No. 2.

**Family Chrysomelidae (leaf beetles)**

Undetermined

**Record: Siskiyou Co.:** Cox Ice Cave.

**Bibliography:** Taylor and Krejca (2006).

**Family Cleridae (checkered beetles)**

*Cymatodera latefascia* Schaeffer (troglophile)

**Record: San Bernardino Co.:** Mitchell Caverns.

**Comment:** This species was found in both sections of the caverns. It was not taken on the surface.

**Bibliography:** Aalbu (1990).

**Family Coccinellidae (lady beetle)**

Undetermined

**Record: Tulare Co.:** White Chief Cave.

*Hippodamia convergens* Guérin-Méneville

**Record: Tulare Co.:** Cirque Cave.

**Family Cryptophagidae (silken fungus beetles)**

*Atomaria* sp.

**Records: Calaveras Co.:** Porcupine Cave. **Mariposa Co.:** Damp Cave.

*Cryptophagus* sp. (troglophile)

**Records: Amador Co.:** Mushroom Cave. **Calaveras Co.:** Keith's Chasm. **Napa Co.:** Clay Cave. **Plumas Co.:** Juniper Cave. **Siskiyou Co.:** Anglemorm/Lost Pinnacle Cave; Skunk Hollow Cave; Valentine Cave.

**Bibliography:** Taylor and Krejca (2006).



*Cryptophagus* nr. *fumidulus* Casey**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This species was found near the cave entrances.**Bibliography:** Aalbu (1990).*Cryptophagus* nr. *politus* Casey**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This species was found both in the caves and on the surface.**Bibliography:** Aalbu (1990).**Family Curculionidae (weevils, bark beetles)**

Undetermined

**Records:** Calaveras Co.: Gerritt's Cave. **Santa Cruz Co.:** Empire Cave; Stump Cave. **Siskiyou Co.:** Planetary Dairy Cave. **Tulare Co.:** Hidden Cave; Upper Bryant Cave; Walk Softly Cave.**Bibliography:** Graening (2011c); McEachern and Grady (1978); Ubick (2001); Zara Environmental (2009).**Subfamily Entiminae***Nemocestes puncticollis* (Casey)**Record:** Mariposa Co.: Spider Cave.**Subfamily Raymondionyminae***Gilbertiola* sp. (troglóbite)**Record:** Tulare Co.: Clough Cave.**Subfamily Scolytinae (bark beetles)***Alniphagus aspericollis* (LeConte) (alder bark beetle)**Record:** Santa Barbara Co.: Chumash Painted Cave.**Family Dermestidae (skin beetles)***Novelsis varicolor* (Jayne) (troglóxene)**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This species is widespread in the southwestern United States and into Sonora, Mexico.**Bibliography:** Beal (1970).**Family Elateridae (click beetles)**

Undetermined

**Records:** Amador Co.: Moss Cave. **San Bernardino Co.:** Classroom Cave. **Siskiyou Co.:** Planetary Dairy Cave. **Tulare Co.:** Hidden Cave; Walk Softly Cave; Cirque Cave.**Bibliography:** Graening (2010); Krejca (2006).*Ampedus cordifer* (LeConte)**Record:** Tulare Co.: Bear Den Cave.*Estesopus mitis* (Horn)**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This species was found near an entrance and on the surface.**Bibliography:** Aalbu (1990).*Limonius* sp.**Records:** Mariposa Co.: Damp Cave. **Santa Cruz Co.:** Bat Cave.**Comment:** Only larvae have been indentified from these caves.**Bibliography:** Briggs and Ubick (1988).*Limonius mirus* LeConte**Records:** Amador Co.: Connie's Cave; Fern Frond Cave. **Tuolumne Co.:** Porcupine Skull Cave.

*Limonius pictus* Van Dyke**Record:** Siskiyou Co.: Trail Junction Cave.**Bibliography:** Graening (2011c).**Family Elmidae (riffle beetles)***Microcylloepus similis* Horn (Amargosa riffle beetle)**Record:** Inyo Co.: Sponge Cave.**Family Histeridae (clown beetles)**

Undetermined

**Records:** Fresno Co.: Bear Den Cave. **San Bernardino Co.:** Cave of the Winding Stair.*Geomysaprinus laramiensis* (Casey)**Record:** Calaveras Co.: Porcupine Cave*Geomysaprinus (Priscosaprinus) ?n. sp.* (troglophile)**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** Most of the specimens were found in the caverns. Most species of the genus breed in animal burrows.**Bibliography:** Aalbu (1990).*Hister* sp.**Records:** San Bernardino Co.: Medicine Cave; Mitchell Caverns.**Comment:** This belongs to the *Hister comes* Lewis complex, comprising several undescribed species.**Bibliography:** Graening (2010).*Margarinotus umbilicatus* (Casey)**Record:** Tuolumne Co.: Porcupine Skull Cave.*Saprinus alienus* LeConte**Record:** San Bernardino Co.: Mitchell Caverns.**Bibliography:** Aalbu (1990).*Saprinus discoidalis* (LeConte)**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** Four specimens were trapped in the caverns. This species is usually found on carrion and is widespread in deserts in North America.**Bibliography:** Aalbu (1990).**Family Hydrophilidae (water scavenger beetles)**

Undetermined

**Record:** Amador Co.: Moss Cave.

Hydrophilinae

**Record:** Tulare Co.: Lilburn Cave.*Cymbiodyta punctatostriata* Horn**Record:** Tuolumne Co.: McLean's Cave.**Comment:** This species is limited to California.**Family Lampyridae (fireflies)***?Lampyris* sp.**Record:** Calaveras Co.: Heater Cave.**Comment:** This is a tentative identification of a single larva.

**Family Lathridiidae (minute brown scavenger beetles)**

Undetermined

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.**Comment:** This species was taken from nests of *Neotoma cinerea*.**Bibliography:** Nelson and Smith (1976).*Akalypsoischion hadromorphus* Hartley, Andrews and McHugh.**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** Most of these specimens were found in the El Pakiva section of the caverns. This species is associated with litter and probably feeds on microfungi.**Bibliography:** Aalbu (1990); Hartley, Andrews and McHugh (2007).*Metophtalmus rudis* Andrews (troglophile)**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This was the most abundant beetle found during the Mitchell Caverns survey with 99% of specimens found in the caverns. The species probably feeds on spores and hyphae of microfungi.**Bibliography:** Aalbu (1990).*Microgramme* n. sp.**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** Only two specimens were found near the entrances.**Bibliography:** Aalbu (1990).**Family Leiodidae (round fungus beetles)**

Undetermined

**Records:** Amador Co.: Rippled Cave. **Calaveras Co.:** Carlito's Cave; Grapevine Gulch Cave; Lost Piton Cave. **Fresno Co.:** Boyden Cave. **Mariposa Co.:** Damp Cave; Indian Cave; Spider Cave. **San Bernardino Co.:** Cima Cave. **Santa Cruz Co.:** Empire Cave. **Shasta Co.:** Elisha Cave. **Tulare Co.:** Crystal Sequoia Cave; New Cave; Ovehang Cave; Ursa Minor Cave. **Tuolumne Co.:** McLean's Cave; Windeler Cave.**Bibliography:** Briggs (1975); Graening (2010); McEachern and Grady (1978).**Subfamily Catopocerinae***Pinodytes* sp. (troglophile or edaphobite)**Record:** Tulare Co.: Ursa Minor Cave.**Bibliography:** Krejca (2006).*Pinodytes minutus* Peck and Cook (troglophile or edaphobite)**Record:** Napa Co.: Clay Cave.**Comment:** This was taken from the cave entrance area.**Bibliography:** Peck and Cook (2011)*Pinodytes pusio* Horn (troglophile or edaphobite)**Records:** Calaveras Co.: Carlito's Cave. **Tulare Co.:** Eighteenth Hole; Pet Cemetery Cave.**Bibliography:** McEachern and Grady (1978); Peck and Cook (2011).*Pinodytes sequoia* Peck and Cook (troglophile or edaphobite)**Records:** **Tulare Co.:** Carmoe Crevice Cave (type locality); Hurricane Crawl Cave; Lost Soldier's Cave; Palmer Cave; Pet Cemetery Cave; Wiessraum Cave.**Comment:** This species is known only from these caves, but should be considered a troglophile.**Bibliography:** Krejca (2006); Peck and Cook (2011).**Subfamily Cholevininae***Catops* sp.**Record:** Amador Co.: Violin Cave.

*Catops basilaris* Say (troglophile)

**Records:** Amador Co.: Skeleton Cave. Napa Co.: Clay Cave. Siskiyou Co.: Fern Cave. Tulare Co.: Carmoe Crevice Cave; Lost Soldier's Cave; Overhang Cave; Palmer Cave; Pine Grosbeak Cave.

**Bibliography:** Krejca (2006); Taylor and Krejca (2006).

*Ptomaphagus (Adelops)* spp.

**Records:** Amador Co.: Hummingbird Cave; Moss Cave; Mushroom Cave; Santa Claus Cave; Rippled Cave (sp.1, sp.2); Root Cellar Cave; Skeleton Cave; Sutter Creek Cave; White Room Cave. Calaveras Co.: Dragon's Breath Cave; Keith's Chasm.

*Ptomaphagus (Adelops)* nr. *cocytus* Peck

**Record:** Inyo Co.: Titus Canyon Cave.

*Ptomaphagus (Adelops) californicus* (LeConte) (troglophile)

**Records:** Amador Co.: Hummingbird Cave; Lulu Bell Cave; Skeleton Cave; Violin Cave. Calaveras Co.: Barren Cave; Bobcat Cave; Carlow's Bat Cavern; Crystal Stanislaus Cave; Diane's Cave; Grapevine Gulch Cave; Moaning Cave; Porcupine Cave; Rabbit Hole; Wool Hollow Cave. Fresno Co.: Bear Den Cave; Beauty Cave; Saturday Cave; Windy Cliff Cave. Mariposa Co.: Damp Cave. Napa Co.: Clay Cave. San Bernardino Co.: Mitchell Caverns. Siskiyou Co.: Red Tape Cave. Tulare Co.: Hidden Cave; Lost Soldier's Cave; Ursa Minor Cave. Tuolumne Co.: mine; Crystal Palace; Mine Cave; Porcupine Cave; Porcupine Skull Cave.

**Comment:** This species is also found in animal burrows.

**Bibliography:** Aalbu (1990); Bradford (2005); Graening (2010); McEachern and Grady (1978); Peck (1973b); Peck and Gnaspini (1997).

*Ptomaphagus (Adelops) fisus* Horn (troglophile)

**Records:** San Bernardino Co.: Medicine Cave; Mitchell Caverns.

**Comment:** This species is more common around animal burrows than caves.

**Bibliography:** Aalbu (1990); Graening (2010); Peck and Gnaspini (1997).

*Ptomaphagus (Adelops) inyoensis* Peck and Gnaspini (troglobite)

**Record:** Inyo Co.: Poleta Cave (type locality).

**Comment:** This species has reduced eyes and functionless flight wings. It is known only from Poleta Cave.

**Bibliography:** Peck and Gnaspini (2004).

*Ptomaphagus (Adelops) nevadicus* (troglophile)

**Records:** Calaveras Co.: Lost Piton Cave. Mariposa Co.: Indian Cave; Spider Cave. Tuolumne Co.: McLean's Cave; Scorpion Cave; Transplant Mine.

**Comment:** Numerous adults and some larvae of this species were transplanted from McLean's Cave to the Transplant Mine. Specimens identified by McEachern and Grady as "Leiodidae" probably refer to this species.

**Bibliography:** Briggs (1975); Elliott (1978); McEachern and Grady (1978); Peck (1973b); Zara Environmental (2009).

**Subfamily Leiodinae***Agathidium concinnum* Mannerheim

**Record:** Tulare Co.: Cirque Cave.

*Agathidium virile* Fall

**Record:** Napa Co.: Clay Cave.

**Bibliography:** Wheeler and Miller (2005).

**Family Meloidae (blister beetles)***Eupompha elegans perpulchra* (Horn)

**Record:** San Bernardino Co.: Mitchell Caverns.

**Comment:** It is possible that species was not actually taken within Mitchell Caverns but on the surface at the cave.

**Bibliography:** Pinto (1979).



**Family Melyridae (soft-winged flower beetles)**  
*Attalusinus submarginatus* LeConte**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This species was taken from the surface and from near cave entrances.**Bibliography:** Aalbu (1990).*Collops* sp.**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** One specimen was trapped near the entrance to the El Pakiva section of the caverns.**Bibliography:** Aalbu (1990).**Family Monotomidae (root-eating beetle)**  
*Hesperobaenus abbreviatus* (Motschulsky)**Record:** Tulare Co.: Clough Cave.**Bibliography:** Bousquet (2002).**Family Phengodidae (glowworm beetles)**  
Undetermined**Records:** Amador Co.: Lulu Bell Cave. Calaveras Co.: Bobcat Cave; Cone Cave. Santa Cruz Co.: Empire Cave. Shasta Co.: Ancient Palace Cave. Siskiyou Co.: Broken Down Palace. Tulare Co.: Ursa Minor Cave.**Family Psephenidae (water-penny beetles)**  
*Eubrianax edwardsii* (LeConte)**Record:** Santa Barbara Co.: Chumash Painted Cave.**Family Ptiliidae (feather-winged beetles)**  
*Acrotrichis* spp.**Records:** Amador Co.: Mushroom Cave; Rippled Cave. Napa Co.: Clay Cave. Plumas Co.: Juniper Cave. Tulare Co.: Lilburn Cave.**Family Scarabaeidae (scarab beetles)**  
Undetermined**Records:** Amador Co.: Connie's Cave; Santa Claus Cave. Plumas Co.: Juniper Cave. Siskiyou Co.: Spider Cave. Tulare Co.: Paradise Cave.**Bibliography:** Krejca (2006); Taylor and Krejca (2006).*Aphodius* sp.**Records:** Amador Co.: Hummingbird Cave; Miser's Purse Cave; Moss Cave; Mushroom Cave; Santa Claus Cave; Rippled Cave; Root Cellar Cave; Skeleton Cave; White Room Cave;. Shasta Co.: Trail Cave.*Diplotaxis* sp.**Record:** Inyo Co.: Upper Shoshone Cave.*Onthophagus* sp.**Record:** Siskiyou Co.: Merrill Ice Cave.**Bibliography:** Taylor and Krejca (2006).*Onthophagus velutinus* Horn**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This species is believed to feed exclusively on packrat dung.**Bibliography:** Aalbu (1990).*Polyphylla decemilineata* (Say)**Record:** San Diego Co.: unnamed cave on Santa Margarita Ranch.**Bibliography:** Grinnell (1918).

*Stenothorax nr. nevadensis* (Horn)**Record:** Siskiyou Co.: Arch Cave No. 2.**Bibliography:** Taylor and Krejca (2006).*Stenothorax sparsus* (LeConte)**Records:** **Amador Co.:** Connie's Cave; Fern Frond Cave; Fiddler's Cave; Violin Cave. **Calaveras Co.:** Bobcat Cave; Diane's Cave; Lost Piton Cave; Porcupine Cave; Rabbit Hole; Shaw's Cave. **Mariposa Co.:** Bull Creek Cave. **Tuolumne Co.:** Crystal Palace; Porcupine Cave; Porcupine Skull Cave.*Tomarus gibbosus* (De Geer)**Record:** San Diego Co.: unnamed cave on Santa Margarita Ranch.**Bibliography:** Grinnell (1918).**Family Silphidae (burrowing beetles)**

Undetermined

**Records:** **Amador Co.:** Rippled Cave. **Fresno Co.:** Millerton Lake Cave System. **Napa Co.:** Clay Cave. **Siskiyou Co.:** Fern Cave.**Bibliography:** Benedict (1973).*Nicrophorus nigrita* (Mannerheim)**Record:** Calaveras Co.: Scat Cave.**Bibliography:** McEachern and Grady (1978).**Family Scirtidae (marsh beetles)***Cyphon concinnus* LeConte**Record:** Mariposa Co.: Sprinkle Cave.**Family Staphylinidae (rove beetles, ant-like litter beetles)**

Undetermined

**Records:** **Amador Co.:** Rippled Cave; Skeleton Cave (3 spp.). **Calaveras Co.:** Cave of the Catacombs; Crystal Stanislaus Cave; Music Hall Cave; O'Neil's Cave; Williams Cave; Wool Hollow Cave. **Fresno Co.:** Boyden Cave; Millerton Lake Cave System. **Inyo Co.:** unnamed lava tubes near Crater Mountain. **Mariposa Co.:** Spider Cave. **Napa Co.:** Clay Cave. **Plumas Co.:** Juniper Cave. **San Benito Co.:** Bear Gulch Cave. **San Bernardino Co.:** Mitchell Caverns. **Shasta Co.:** Rusty Cave; Wilcox Cave. **Sierra Co.:** cave near Avalanche Cave; Avalanche Cave. **Siskiyou Co.:** Apogee Cave; Catacombs Cave; Coda Cave; Coral Reef Cave; Fossil Cave; Frozen Falls Cave; Maze Cave; Planetary Dairy Cave; Rollercoaster Cave. **Trinity Co.:** Paul Gibson Cave. **Tulare Co.:** Beulah Cave; Cedar Cave; Cirque Cave; Eighteenth Hole; Lilburn Cave; Lost Soldier's Cave; Salamander Cave; Ursa Minor Cave. **Tuolumne Co.:** Crack of Doom Cave.**Comment:** The Calaveras County records are based on larvae found under stones.**Bibliography:** Graham (1963b); Krejca (2006, 2007); Lee, V.F. (1985a); Taylor and Krejca (2006).**Subfamily Aleocharinae**

Undetermined

**Records:** **Amador Co.:** Skeleton Cave. **San Bernardino Co.:** Mitchell Caverns. **Santa Cruz Co.:** Dolloff Cave; Empire Cave. **Shasta Co.:** Samwel Cave. **Tulare Co.:** Lilburn Cave; Palmer Cave.**Comment:** Three different species of Aleocharinae were found in the El Pakiva and Tecopa sections of Mitchell Caverns.**Bibliography:** Aalbu (1990); Briggs and Ubick (1988); Graham (1963b); Ubick (2001).*Acrolacha* sp.**Record:** Siskiyou Co.: Arch Cave No. 2.**Bibliography:** Taylor and Krejca (2006).*Aleochara* sp.**Record:** Plumas Co.: Juniper Cave.**Comment:** One female was found under a rock near wood rat nests in twilight.**Bibliography:** Graham (1963b).

*Aleochara (Calochara) cavernicola* Klimaszewski (troglophile)

**Record:** Calaveras Co.: Porcupine Cave (type locality).

**Comment:** This species is known only from this cave, from which two males were collected.

**Bibliography:** Klimaszewski (1984).

*Atheta* sp.

**Record:** Calaveras Co.: Barren Cave.

*Blepharrhymenus* sp.

**Record:** Fresno Co.: Boyden Cave.

*Falagria laeviuscula* LeConte

**Record:** Calaveras Co.: Wool Hollow Cave.

**Comment:** One adult was found in twilight on damp, rocky substrate.

**Bibliography:** Graham (1963b).

**Subfamily Omalinae**

*Brathinus californicus* Hubbard

**Record:** Fresno Co.: Church Cave.

*Dropephylla cacti* (Schwarz)

**Record:** San Bernardino Co.: Mitchell Caverns.

**Comment:** Two specimens were found in El Pakiva near an entrance.

**Bibliography:** Aalbu (1990).

*Orobatus* sp.

**Record:** Calaveras Co.: Cave of Skulls.

**Subfamily Oxytelinae**

*Aploderus* sp.

**Record:** Tulare Co.: Paradise Cave.

**Subfamily Paederinae**

Undetermined

**Records:** Amador Co.: Santa Claus Cave; Sutter Creek Cave; Hummingbird Cave; Skeleton Cave.

*Homaeotarsus* sp.

**Record:** Tulare Co.: Lilburn Cave.

*Lathrobium* sp.

**Records:** Mariposa Co.: Bull Creek Cave. **Tuolumne Co.:** Crystal Palace.

*Lobrathium* sp.

**Records:** Amador Co.: Rippled Cave. **Mariposa Co.:** Spider Cave. **Tulare Co.:** Lilburn Cave.

*Lobrathium gnoma* (Casey)

**Records:** Mariposa Co.: Bull Creek Cave. **Tuolumne Co.:** Crystal Palace.

*Lobrathium subseriatum* LeConte (troglophile)

**Records:** Amador Co.: Soldier Creek Cave. **Calaveras Co.:** Cave City Cave; Mercer Caverns; Shaw's Cave; Sink Cave; Williams Cave.

**Comment:** Both larvae and adults were found in the above caves. This species is usually found in damp areas under stones or wood or on guano.

**Bibliography:** Graham (1963b); Moore, I. (1964).

*Medon (Platymedon) sp.*

**Record:** Mariposa Co.: Bower Cave.

**Comment:** One female was found in wet leaf litter in daylight.

**Bibliography:** Graham (1963b).

*Sunius mollis* (Casey) or new species

**Record:** San Bernardino Co.: Mitchell Caverns.

**Comment:** These species were most abundant in the El Pakiva section; some were found at the entrance. This species is usually found under bark, stones or near water.

**Bibliography:** Aalbu (1990).

*Tetartopeus sp.*

**Record:** Mariposa Co.: Spider Cave.

**Bibliography:** Zara Environmental (2009).

**Subfamily Pselaphinae (ant-like litter beetles)**

Undetermined

**Records:** Amador Co.: Connie's Cave; Mushroom Cave; Santa Claus Cave. Napa Co.: Clay Cave. Santa Cruz Co.: Stearns Cave.

**Bibliography:** Ubick (2001).

## Pselaphinae species No. 1

**Records:** Calaveras Co.: Dragon's Breath Cave; Grapevine Gulch Cave; Keith's Chasm; Music Hall Cave; Scat Cave; Secret Cave.

**Bibliography:** Bosted (1994b); McEachern and Grady (1978).

## Pselaphinae species No. 2

**Records:** Calaveras Co.: Beta Cave; Gerritt's Cave.

**Bibliography:** McEachern and Grady (1978).

## Pselaphinae species No. 3

**Record:** Calaveras Co.: Brown Deer Cave.

**Bibliography:** McEachern and Grady (1978).

*Batrissodes (Empinodes) mendocino* (Casey) (troglophile)

**Record:** Napa Co.: Clay Cave.

*Pselaphotrichus sp.*

**Record:** Mariposa Co.: Indian Cave.

**Bibliography:** Krejca (2007); Zara Environmental (2009).

**Subfamily Pseudopsinae**

*Pseudopsis obliterata* LeConte

**Record:** Tulare Co.: Lilburn Cave

**Subfamily Scydmaeninae (ant-like stone beetles)**

Undetermined

**Record:** Napa Co.: Clay Cave.

**Subfamily Staphylininae (large rove beetles)**

*Quedius sp.*

**Record:** Tulare Co.: Lilburn Cave

*Quedius (Distichalius) marginalis* Mäklin

**Record:** Santa Barbara Co.: Chumash Painted Cave.



*Quedius (Microsaurus) erythrogaster* Mannerheim (troglophile)

**Records:** Amador Co.: Fern Frond Cave; Violin Cave. Calaveras Co.: Cave City Cave; Wool Hollow Cave. Mariposa Co.: Bull Creek Cave.

**Comment:** Graham (1963b) reported one male found running near a wood rat nest in the entrance of Wool Hollow Cave as *Q. (M.) neotomae* Hatch. Graham (1963b) reported an immature male found in a damp rocky guano pocket in the dark zone of Cave City Cave as *Q. (M.)* sp.

**Bibliography:** Graham (1963b); Peck and Thayer (2003); Smetana (1971).

*Quedius (Microsaurus) limbifer* Horn

**Record:** Mariposa Co.: Bower Cave.

**Comment:** One female was found in wet leaf litter in daylight.

**Bibliography:** Graham (1963b).

*Quedius (Microsaurus) pella* Smetana (troglophile)

**Record:** Calaveras Co.: Wool Hollow Cave.

**Comment:** Five imagoes of this species were collected from soil and debris beneath a wood rat nest.

**Bibliography:** Graham (1963b); Smetana (1971).

*Quedius (Microsaurus) planus* Hatch

**Record:** Siskiyou Co.: Trail Junction Cave.

**Bibliography:** Graening (2011c).

*Quedius (Microsaurus) spelaeus* Horn (troglophile)

**Records:** Plumas Co.: Juniper Cave. Shasta Co.: Subway Cave. Siskiyou Co.: Catacombs Cave; Cox Ice Cave; Mushpot Cave; Planetary Dairy Cave; Sentinel Cave; Skunk Hollow Cave; Slipstream Cave; Valentine Cave.

**Comment:** This species is often associated with wood rat nests in twilight zones or damp soils in the dark zone.

**Bibliography:** Graham (1963b); Peck (1973a); Peck and Thayer (2003); Smetana (1971).

**Subfamily Steninae (water skaters)***Stenus* sp.

**Record:** Santa Cruz Co.: Vanished River Cave.

**Bibliography:** Danchy (1951b); Graham (1963b).

**Subfamily Tachyporinae (crab-like rove Beetles)***Bolitobius* sp.

**Record:** Tulare Co.: Ursa Minor Cave.

*Lordithon* sp.

**Record:** Mariposa Co.: Spider Cave.

*Lordithon thoracicus thoracicus* Say

**Record:** Mariposa Co.: Bower Cave.

**Comment:** One specimen was found under damp wood in twilight.

**Bibliography:** Graham (1963b).

*Sepedophilus castaneus* (Horn)

**Record:** Shasta Co.: Samwel Cave.

**Comment:** One adult was collected in a sugar trap in twilight. This species was originally cited as *Conosomus*.

**Bibliography:** Graham (1963b).

**Family Tenebrionidae (darkling beetles)**

## Undetermined

**Records:** Calaveras Co.: Bone Cave; Grapevine Gulch Cave; Porcupine Cave; Seat Cave; Wool Hollow Cave. Fresno Co.: Boyden Cave; \*Hummel's Cave; Windy Cliff Cave. Kern Co.: Bodfish Cave. Mariposa Co.: cave next to Spider Cave; Indian Cave; Spider Cave. Napa Co.: Clay Cave. San Benito Co.: Bear Gulch Cave. Santa Cruz Co.: Bat Cave; Empire Cave. Siskiyou Co.: Fossil Cave; Harris Mountain Cave; Lazaroff's Hole; Sugar Pine Butte Ice Cave. Tulare Co.:

Carmoe Crevice Cave; \*Dehydrated Cave; Kaweah Cave; \*Lange Cave; New Cave; Overhang Cave; Paradise Cave; Rattlesnake Cave; Upper Bryant Cave; Walk Softly Cave. **Tuolumne Co.:** McLean's Cave.

**Bibliography:** Graening (2010); Huffman (1967); Krejca (2006); McEachern and Grady (1978); Quick (1997b, 1998b); Taylor and Krejca (2006).

*Argoporis bicolor* (LeConte)

**Records:** Inyo Co.: Upper Shoshone Cave. **San Bernardino Co.:** Scaturd Cave.

*Cibdellus* sp.

**Record:** Fresno Co.: Millerton Lake Cave System.

*Coelocnemis californica* Mannerheim

**Records:** Tulare Co.: Overhang Cave. **Siskiyou Co.:** Harris Mountain Cave.

**Bibliography:** Krejca (2006).

*Conibosoma elongatum* (Horn)

**Record:** Inyo Co.: Lower Shoshone Cave.

*Craniotus pubescens* LeConte

**Record:** Inyo Co.: Upper Shoshone Cave.

*Cryptoglossa muricata* (LeConte)

**Record:** San Bernardino Co.: Scaturd Cave.

*Eleodes* sp.

**Records:** Amador Co.: Connie's Cave. **Calaveras Co.:** Bone Cave; Scat Cave. **Fresno Co.:** Boyden Cave; Millerton Lake Cave System. **Inyo Co.:** Poleta Cave. **Napa Co.:** Clay Cave. **San Bernardino Co.:** Cima Cave; Papoose Cave; Peggy 5 Cave. **Santa Cruz Co.:** Bat Cave. **Shasta Co.:** Ancient Palace Cave; Bat Cave; Potter Creek Cave. **Siskiyou Co.:** Fern Cave. **Tulare Co.:** Crystal Sequoia Cave; Hidden Cave; Lost Soldier's Cave; Ursa Minor Cave; Wiessraum Cave. **Tuolumne Co.:** Forsythe Cave.

**Bibliography:** Benedict (1973); Graening (2010); Krejca (2006); McDonald (2002); McEachern and Grady (1978); Taylor and Krejca (2006).

*Eleodes (Blapyllis) alticolus* Blaisdell

**Records:** Tulare Co.: Hidden Cave; Lost Soldier's Cave; Paradise Cave; Wiessraum Cave.

**Bibliography:** Aalbu, Smith, and Triplehorn (2012); Krejca (2006).

*Eleodes (Blapyllis) consobrinus* LeConte

**Records:** Calaveras Co.: Mercer Caverns. **Tulare Co.:** Hidden Cave; Overhang Cave; Wiessraum Cave

**Bibliography:** Aalbu, Smith, and Triplehorn (2012); Danehy (1951b); Krejca (2006).

*Eleodes (Blapyllus) constrictus* LeConte

**Records:** Tulare Co.: Bear Den Cave; Eighteenth Hole; Lost Soldier's Cave; Wiessraum Cave.

**Bibliography:** Aalbu, Smith, and Triplehorn (2012); Krejca (2006).

*Eleodes (Blapyllus) fuchsi* Blaisdell

**Records:** Calaveras Co.: Coral Cave; Poison Oak Cave. **Tuolumne Co.:** Crystal Butterfly Cave; Crystal Palace; Indian Quarry Cave No. 2; Pinnacle Point Cave; Porcupine Cave.

*Eleodes (Blapyllis) horni* Blaisdell

**Record:** Calaveras Co.: Crystal Stanislaus Cave.

**Comment:** This species was collected in total darkness.

**Bibliography:** Danehy (1951b).

*Eleodes (Blapyllis) parvicollis* Escholtz

**Records:** Amador Co.: Connie's Cave. **Mariposa Co.:** Bower Cave; Damp Cave; Pool Pit. **San Francisco Co.:** Bat Cave.  
**Bibliography:** Aalbu, Smith, and Triplehorn (2012); Briggs and Ubick (1988); Ubick (2001).

*Eleodes (Blapyllis) productus* Mannerheim

**Records:** Amador Co.: Connie's Cave. **Shasta Co.:** Samwel Cave; Shasta Lake Caverns. **Tulare Co.:** Bear Den Cave; Eighteenth Hole; Lost Soldier's Cave; Wiessraum Cave.  
**Bibliography:** Aalbu, Smith, and Triplehorn (2012).

*Eleodes (Blapyllus) tenebrosus* Horn (troglophile)

**Records:** Inyo Co.: Poleta Cave. **Tulare Co.:** Crystal Sequoia Cave; Ursa Minor Cave.

*Eleodes (Caverneleodes) microps* Aalbu, Smith, and Triplehorn (troglobite)

**Records:** Inyo Co.: Defense Cave; Microps Cave (type locality); Poleta Cave.  
**Bibliography:** Aalbu, Smith, and Triplehorn (2012).  
**Comment:** This species is known from caves in the Inyo-White and Argus Ranges.

*Eleodes (Cratidus) osculans* LeConte

**Record:** Kern Co.: Harrington Cave.  
**Bibliography:** Aalbu, Smith, and Triplehorn (2012).

*Eleodes (Eleodes) armatus* LeConte

**Record:** Inyo Co.: Upper Shoshone Cave.

*Eleodes (Eleodes) dentipes* Escholtz

**Records:** Amador Co.: Violin Cave; White Room Cave. **Calaveras Co.:** Barren Cave; Cave of Skulls; Keith's Chasm; Mercer Caverns; Rabbit Hole. **Kern Co.:** Harrington Cave. **Tehama Co.:** Inskip Cave. **Tulare Co.:** Kaweah Cave. **Tuolumne Co.:** Crystal Palace; McLean's Cave; Pinnacle Point Cave; ?Transplant Mine.  
**Comment:** All but Mercer Caverns are new records. Individuals, probably of this species, were transplanted from McLean's Cave to the Transplant Mine.  
**Bibliography:** Briggs (1975); Danehy (1951b); Elliott (1978); Krejca (2006); McEachern and Grady (1978).

*Eleodes (Eleodes) grandicollis* Blaisdell

**Records:** Calaveras Co.: Mercer's Big Pit. **Tuolumne Co.:** Windeler Cave.  
**Bibliography:** Danehy (1951b).

*Eleodes (Melaneleodes) carbonarius omissus* LeConte

**Record:** Ventura Co.: Clear Springs Cave.

*Eleodes (Metablapyllis) aalbei* Triplehorn

**Records:** Inyo Co.: unnamed lava tubes near Crater Mountain; Defense Cave; Poleta Cave.  
**Bibliography:** Aalbu, Smith, and Triplehorn (2012); Triplehorn (2007).

*Eleodes (Metablapyllis) californicus* Blaisdell (troglophile)

**Records:** Inyo Co.: Lower Shoshone Cave; Shoshone Turk Cave; Upper Shoshone Cave. **San Bernardino Co.:** C10 Cave; Cave of the Winding Stair; Dusty Cave; Medicine Cave; Mitchell Caverns; Scaturd Cave.  
**Comment:** Most of the specimens collected during the study of Mitchell Caverns were found in the caves, with the species more abundant in the Tecopa section.  
**Bibliography:** Aalbu (1990); Graening (2010); Aalbu, Smith, and Triplehorn (2012).

*Eschatomoxys wagneri* Blaisdell

**Records:** Imperial Co.: unnamed mine No. 2. **Inyo Co.:** ARC No. 1; ARC No. 2; Furnace Cave; unnamed Amargosa soil pipe cave. **San Bernardino Co.:** Cima Cave.  
**Bibliography:** Pape, Thomas, and Aalbu (2007).

*Eschatoporis* n. sp. (troglomite)**Record:** Napa Co.: Clay Cave.**Bibliography:** Bradford (2005).*Schizillus nunenmacheri* Blaisdell (troglophile)**Records:** San Bernardino Co.: Cima Cave; Classroom Cave; Egg Cave; Glove Cave; Mitchell Caverns; Owl 3 Cave; Papoose Cave; Scaturd Cave; Wishbone Cave. **Inyo Co.:** Amargosa Cave No. 1; Furnace Cave; Microps Cave; unnamed Amargosa soil pipe cave.**Comment:** Numerous larvae were found living in the deepest pit of Mitchell Caverns. This species is more highly cave adapted than related epigeal species (*S. laticeps*). It has longer appendages, a longer adult and larval life, and fewer, larger eggs.**Bibliography:** Aalbu (1990, 2005); Graening (2010).*Stibia imperialis* Blaisdell**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** One specimen was taken in each of the El Pakivo and Tecopa sections of the caverns.**Bibliography:** Aalbu (1990).*Typhlusechus chemehuevii* Aalbu and Andrews (troglophile)**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** This rare, small, soil dwelling species is closely associated with packrats. It was taken in packrat nests and runways in the caverns.**Bibliography:** Aalbu (1990).**Family Trogidae (hide beetles)***Trox punctatus* Germar**Record:** San Bernardino Co.: Mitchell Caverns.**Comment:** One specimen was trapped near an entrance.**Bibliography:** Aalbu (1990).**Family Zopheridae (ironclad beetles)***Nosoderma plicatum* (LeConte)**Record:** Napa Co.: Clay Cave.*Nosoderma pustulosum* LeConte**Records:** Tulare Co.: Walk Softly Cave. **Ventura Co.:** Clear Springs Cave.**Bibliography:** Krejca (2006).*Usechimorpha montanus* Doyen and Lawrence**Record:** Amador Co.: Sutter Creek Cave.**ORDER TRICHOPTERA (CADDISFLIES)**

## Undetermined

**Records:** Tulare Co.: Cirque Cave; \*?Hurricane Crawl Cave; Pet Cemetery Cave; White Chief Cave.**Comment:** One possible larva case was seen in Hurricane Crawl Cave.**Bibliography:** Krejca (2009c); Weaver (2010).**Family Brachycentridae (humpless casemaker caddisflies)***Micrasema bactro* Ross**Record:** Tulare Co.: Big Spring.**Bibliography:** Krejca (2006).**Family Hydropsychidae (net spinning caddisflies)***Parapsyche elsis* (Milne)**Records:** Tulare Co.: Panorama Cave; Tufa Spring Cave; Lost Soldier's Cave; White Chief Cave.**Bibliography:** Krejca (2006).



**Family Limnephilidae (northern caddisflies)**

Undetermined (2 small cases)

**Record: Tulare Co.:** Panorama Cave.**Bibliography:** Krejca (2006).*Cryptochia* sp.**Record: Tuolumne Co.:** Waterfall Cave.**Bibliography:** Krejca (2006).*Dicosmoecus pallicornis* Banks**Record: Tulare Co.:** Panorama Cave.**Comment:** Two large cases were collected.**Bibliography:** Krejca (2006).**Family Philopotamidae (finger-net caddisflies)***Dolophilodes* sp.**Record: Tulare Co.:** Harry's Bend Cave.**Bibliography:** Krejca (2006).*Dolophilodes novusamericanus* (Ling)**Record: Tulare Co.:** Harry's Bend Cave.**Bibliography:** Krejca (2006).**Family Rhyacophilidae (free-living caddisflies)***Rhyacophila betteni* Ling**Record: Tuolumne Co.:** Waterfall Cave**Bibliography:** Krejca (2006).*Rhyacophila vagrita* Milne**Record: Tulare Co.:** Tufa Spring Cave.**Bibliography:** Krejca (2006).**Family Uenoidae (stonecase caddisflies)***Neothremma* sp.**Record: Tulare Co.:** Tufa Spring Cave.**Bibliography:** Krejca (2006).**ORDER HYMENOPTERA (bees, wasps, ants)**

Undetermined

**Records:** Calaveras Co.: Bobcat Cave; Dianne's Cave; O'Neil's Cave. **Mariposa Co.:** Bower Cave; Spider Cave. **Riverside Co.:** \*Durmid Bat Caves. **San Bernardino Co.:** Mitchell Caverns; Triple Lead Shelter. **Siskiyou Co.:** \*Beestro Cave; \*Tree Cast Pillar Cave. **Tulare Co.:** Cirque Cave; Kaweah Cave; Lange Cave; Lilburn Cave; Lost Soldier's Cave; Windy Pit. **Tuolumne Co.:** Fivescythe Cave. **Ventura Co.:** B Hole; \*Bee's Nest Cave; \*Vanowen Bat Cave.

**Comment:** "Mud dauber nests" were seen in one of the Durmid Bat Caves (Quick, 1997a, 1998a).**Bibliography:** Broeckel, B. (2008g); Graening (2010); Harter (2010); Krejca (2006); Quick (1994, 1997a, 1997c, 1998a); Wolff, L. (2004b).**Superfamily Proctotrupoidea**

Undetermined

**Record: Calaveras Co.:** Porcupine Cave.**Comment:** These small wasps are parasitic on immatures of other insects.**Family Apidae (bees)**

Undetermined

**Records: Inyo Co.:** Old Spanish Trail Cave. **Siskiyou Co.:** Four Star Cave. **Tulare Co.:** Cedar Cave.**Bibliography:** Krejca (2006); Taylor and Krejca (2006).

*Apis mellifera* Linnaeus (trogloxene)

**Records:** Fresno Co.: Cliff Cave. Los Angeles Co.: \*Vanowen Cave. Siskiyou Co.: \*small cave near Etna; \*vertical fissure at Gazelle; Skull Ice Cave. Tulare Co.: \*small caves in Cave Cliff. Unknown Co.: \*cave utilized as nest site by the California condor.

**Comment:** The first cave above was reportedly used by “honey bees.” Gurnee reported three colonies in small caves in Sequoia National Park. One of the colonies was estimated to number ten to fifteen thousand.

**Bibliography:** Danehy (1951b); Gurnee (1957); Quick (1998c); Reynolds (1948); Snyder, Ramey, and Sibley (1986); Wolff, J. (1990a).

*Bombus* sp. (bumblebee)

**Record:** Unknown Co.: \*cave utilized as nest site by the California condor.

**Bibliography:** Snyder, Ramey, and Sibley (1986).

**Family Braconidae**

Undetermined

**Record:** Calaveras Co.: O’Neil’s Cave.

**Family Diapriidae (parasitic wasps)**

Undetermined

**Record:** Tulare Co.: Cedar Cave.

**Bibliography:** Krejca (2006); Lee, V.F. (1985a).

**Family Formicidae (ants)**

Undetermined

**Records:** Amador Co.: Lulu Bell Cave; Mushroom Cave; Root Cellar Cave; Santa Claus Cave; White Room Cave. Calaveras Co.: Crystal Stanislaus Cave; Diane’s Cave; Grapevine Gulch Cave; Heater Cave; Wool Hollow Cave. Contra Costa Co.: rockshelters on Carquinez Strait shoreline. Fresno Co.: Children’s Cave; Church Cave; Saturday Cave; Windy Cliff Cave. Inyo Co.: Upper Shoshone Cave. Kern Co.: \*Harrington Cave. Mariposa Co.: Indian Cave; Spider Cave. Napa Co.: Clay Cave. San Bernardino Co.: Dusty Cave; Medicine Cave; Mitchell Caverns; Peggy 5 Cave. Santa Clara Co.: Joaquin Murrieta’s Cave. Shasta Co.: Ancient Palace Cave; Bat Cave; Bat Mummy Cave; Dead Wood Cave; \*Samwel Cave. Siskiyou Co.: Apogee Cave; \*Burgermeister Bridge Cave; Coda Cave; Coral Reef Cave; Fossil Cave; Frozen Falls Cave; Maze Cave; NSS No. 8851; Red Tape Cave; Spider Cave; Trail Junction Cave; \*Tree Cast Pillar Cave. Trinity Co.: Paul Gibson Cave. Tulare Co.: Carmoe Crevice; Eighteenth Hole; Hidden Cave; Hurricane Crawl Cave; Jordan Cave; Lilburn Cave; Overhang Cave; Paradise Cave; Rattlesnake Cave; Salamander Cave; Stand Up Cave; Upper Bryant Cave.

**Bibliography:** Anonymous (1970b); Broeckel, B. (2002c, 2008g); Graening (2010, 2011c); Hardaker (1970); Krejca (2006, 2007); Lee, V.F. (1985a); Leissring (2001c); McEachern and Grady (1978); Taylor and Krejca (2006); Zara Environmental (2009).

**Subfamily Dolichoderinae***Liometopum luctuosum* Wheeler

**Records:** Amador Co.: Fern Frond Cave. Tuolumne Co.: Confluence Cave.

**Bibliography:** Reddell and Cokendolpher (2001).

*Liometopum occidentale* Emery

**Record:** Tuolumne Co.: Confluence Cave.

**Bibliography:** Reddell and Cokendolpher (2001).

*Tapinoma sessile* (Say)

**Record:** Tuolumne Co.: McNamee’s Cave.

**Bibliography:** Reddell and Cokendolpher (2001).

**Subfamily Formicinae**

Undetermined

**Record:** Siskiyou Co.: Fern Cave.

**Bibliography:** Taylor and Krejca (2006).

*Formica moki* Wheeler**Record:** Calaveras Co.: Barren Cave.**Bibliography:** Reddell and Cokendolpher (2001).*Prenolepis imparis* (Say) (trogloxene)**Records:** Amador Co.: Connie's Cave; Fern Frond Cave; Fiddler's Cave; Violin Cave. Calaveras Co.: Cave of Skulls; Coral Cave; Grapevine Gulch Cave; Porcupine Cave; Scat Cave. Mariposa Co.: Damp Cave. Tuolumne Co.: Crystal Tuolumne Cave; Transplant Mine tailings.**Comment:** This species was found near the entrance of Grapevine Gulch Cave (Hanging Gardens Cave) and in all parts of Porcupine Cave. This species "feeds on liquids, especially the honey-dew of homopterans, nectar and exudates of plants as well as juices of dead and dying earthworms" (Reddell and Cokendolpher, 2001).**Bibliography:** Reddell and Cokendolpher (2001).**Subfamily Myrmecinae**

Undetermined

**Record:** Siskiyou Co.: Arch Cave No. 2.**Bibliography:** Taylor and Krejca (2006).*Aphaenogaster occidentalis* (Emery)**Records:** Mariposa Co.: Indian Cave; Salamander Hideout Cave.**Bibliography:** Zara Environmental (2009).*Pogonomyrmex* sp.**Record:** San Bernardino Co.: Seaturd Cave.*Solenopsis (Solenopsis) xyloni* McCook**Record:** Tuolumne Co.: McLean's Cave.**Bibliography:** Elliott (1978); Reddell and Cokendolpher (2001).**Family Sphecidae (digger wasps)**

Undetermined

**Records:** Inyo Co.: ARC No. 1; ARC No. 2; Old Spanish Trail Cave; Titus Canyon Cave. San Bernardino Co.: Rat's Nest.**Family Vespidae (true wasps)**

Undetermined

**Record:** Tulare Co.: Rattlesnake Cave.*Dolichovespula maculata* (Linnaeus) (bald-faced hornet)**Record:** Siskiyou Co.: \*Beebowl Cave.**Bibliography:** Wolff, L. (2004b).**ORDER LEPIDOPTERA (moths and butterflies)**

Undetermined

**Records:** Amador Co.: Hummingbird Cave; Moss Cave; Rippled Cave; Santa Claus Cave. Calaveras Co.: Bobcat Cave; Crystal Stanislaus Cave; Chrome Cave; Grapevine Gulch Cave; Porcupine Cave; Sink Cave. Fresno Co.: Beauty Cave; Boyden Cave; Children's Cave; Maze Cave; Saturday Cave. Inyo Co.: Shoshone Turk Cave. Kern Co.: Harrington Cave. Mariposa Co.: Bull Creek Cave; Elf Village Cave; Indian Rock Shelter; Spider Cave; Sprinkle Cave. Monterey Co.: Willow Creek Cave. Nevada Co.: \*Big Sink. San Bernardino Co.: Cima Cave; Mitchell Caverns; Prospector's Cave. Santa Cruz Co.: unnamed cave near Davenport; Bat Cave; Dolloff Cave; \*Empire Cave; IXL Cave; Stearns Cave. Shasta Co.: Ancient Palace Cave; \*Jacob Davis Cave; \*Klaydo Cave; Rod's Clay Worm Cave. Siskiyou Co.: caves in Lava Beds National Monument; Angeworm/Lost Pinnacle Cave; \*Bigfoot Cave; \*Black Bug Cave No. 2; \*Bobcat Cave; Boulevard Cave; Bowling Alley Cave; Broken Down Palace; Caldwell Ice Caves; Catacombs Cave; Craig Cave; Fern Cave; Flushing Bush Cave; Fossil Cave; \*Gate Lake Cave; \*Gigantopithecus Cave; \*Hourglass Lava Tube; It ta Choo-mah Cave; Jack Jones Ice Cave; Looping Route Cave; Planetary Dairy Cave; \*Rat Castle Cave; Red Tape Cave; Skunk Hollow Cave; \*Skunk's Tail Cave; Spider Cave; \*Spider Moth Annex; Streambed Cave (caterpillars); \*Tag No. 4-1 Cave; Tag No. 4-2

Cave; Tichnor Cave/Bertha's Cupboard Cave; \*Tin Pail Cave; Township Cave; Upstairs-Downstairs Cave **Tehama Co.:** Inskip Cave. **Trinity Co.:** Hall City Cave. **Tulare Co.:** \*Carmoe Crevice Cave; Cirque Cave; Eighteenth Hole; Jordan Cave; Lilburn Cave; Lost Soldier's Cave; Overhang Cave; Panorama Cave; \*Pine Grosbeak Cave; Salamander Cave; \*Walk Softly Cave; \*Wiessraum Cave; White Chief Cave; \*Windy Pit. **Tuolumne Co.:** Crack of Doom Cave; Crystal Palace; Crystal Tuolumne Cave; Forsythe Cave; Indian Quarry Cave; Toppled Table Talus Cave; Transplant Mine.

**Comment:** Specimens from Lava Beds caves were found in nests of *Neotoma cinerea*. Larvae were collected in Angleworm/Lost Pinnacle Cave and Spider Cave, Siskiyou County.

**Bibliography:** Adamson (1982a); Benedict (1973); Bosted (1981); Briggs (1987, 1991); Broeckel, B. (1996a, 1998a, 2004b, 2005a, 2005b, 2007c, 2008f, 2011e, 2012e); Coffman (1996); Conover (2010); Gates (2005); Graening (2010); Graham (1966b); Hargreaves (2011); Jackson, M. (2012a); Krejca (2006, 2007); National Park Service (2004); Nelson and Smith (1976); Papke (2001); Robinson (2004a); Rogers (1994a, 1999d, 2005b, 2005e); Taylor and Krejca (2006); Wolff, J. (1982b, 1986); Wolff, L. (1983, 1988, 1991b, 1994, 2011a, 2013b); Wolff and Wolff (1990); Zara Environmental (2009).

#### Family Arctiidae (tiger moths)

Undetermined (larvae)

**Records:** **Calaveras Co.:** Crystal Stanislaus Cave. **San Bernardino Co.:** Agave Shelter; Papoose Cave; Rat's Nest.

#### Family Geometridae (geometer moths)

Undetermined

**Records:** **Calaveras Co.:** Cave of Skulls. **Siskiyou Co.:** Apogee Cave.

*Triphosa* sp.

**Records:** **Siskiyou Co.:** Corkscrew Cave; Frozen Falls Cave. **Tulare Co.:** Hurricane Crawl Cave; Schist Canyon Cave.

**Bibliography:** Briggs (1993); Krejca (2006); Ubick (1991).

*Triphosa haesitata* Guenée (trogloxene)

**Records:** **Amador Co.:** Lulu Bell Cave. **Fresno Co.:** Children's Cave. **Plumas Co.:** Juniper Cave; Soda Springs Cave. **San Benito Co.:** Balconies Cave; Bear Gulch Cave. **San Bernardino Co.:** Mitchell Caverns. **Santa Cruz Co.:** Bat Cave; Black Moth Cave; Coral Grotto; Dolloff Cave; Empire Cave; Humpty-Dumpty Cave; IXL Cave; Stearns Cave; Stump Cave; Vanished River Cave. **Shasta Co.:** Drip Cave; Flashlight Cave; Samwel Cave; Subway Cave; Trail Cave. **Siskiyou Co.:** Arch Cave No. 2; Bighorn Cave; Bowling Alley Cave; Marble Gap Cave; Planetary Dairy Cave; Upstairs-Downstairs Cave; Valentine Cave. **Trinity Co.:** Forest Glen Caves; Hall City Cave; Paul Gibson Cave; Trinity Natural Bridge and Cave. **Tulare Co.:** Jordan Cave; White Chief Cave.

**Comment:** The twilight moth is also known from six caves in Nevada. The species occupies entrances to deep caves in a varied geographic area from nearly sea level to 3000 m elevation, both in deserts and humid forests, and in all seasons (Graham, 1962d). Two other *Triphosa* species are known to inhabit caves in Great Britain, Europe, southwest Asia, and Japan (Graham, 1968b). Suggett (1982) observed a woodrat preying on this moth in one Marble Mountains cave and reported different roosting behavior as compared to that reported by Graham for the low elevation Santa Cruz caves.

**Bibliography:** Briggs and Gpc (1975); Briggs and Ubick (1988); Graening (2010, 2011c); Graham (1962b, 1968a, 1968b); Halliday (1962); Jorgensen (2010a); Kennedy, C. (2013b); Krejca (2006); Rogers (2013b); Suggett (1982); Ubick (2001).

#### Family Noctuidae (owlet moths)

Undetermined

**Records:** **Amador Co.:** Rippled Cave. **Calaveras Co.:** Crystal Stanislaus Cave. **Siskiyou Co.:** Skunk Hollow Cave.

**Bibliography:** Graening (2011c).

*Epizeuxis* nr. *lubricalis* Geyer

**Record:** **Tuolumne Co.:** Banksula Cave.

*Scoliopteryx libatrix* Linnaeus (trogloxene)

**Records:** **Siskiyou Co.:** Marble Gap Cave; Planetary Dairy Cave; Upstairs-Downstairs Cave.

**Comment:** This species is less common than *Triphosa haesitata* in the Marble Mountains caves (Suggett, 1982b). Both species hibernate in the caves.

**Bibliography:** Suggett (1982).



**Family Nymphalidae (brushfooted butterflies)***Limenitis lorquini* (Boisduval) (Lorquin's admiral)**Record:** Siskiyou Co.: Arch Cave No. 2.**Bibliography:** This was reported to be "spider prey," but may be from bats. Butterflies do not normally enter caves.**Bibliography:** Taylor and Krejca (2006).**Family ?Pterophoridae (plume moths)**

Undetermined

**Record:** Siskiyou Co.: Catacombs Cave.**Comment:** This species was found in the entrance.**Bibliography:** Taylor and Krejca (2006).**Family Sphingidae (hawk moths)***Hyles lineata* (Fabricius)**Record:** San Bernardino Co.: Scatard Cave.**Family Tineidae (clothes moths)**

Undetermined

**Records:** Amador Co.: Lulu Bell Cave; Mushroom Cave; Santa Claus Cave. **Calaveras Co.:** Crystal Stanislaus Cave; Music Hall Cave. **Napa Co.:** Clay Cave. **San Bernardino Co.:** Egg Cave; Papoose Cave; Peggy 5 Cave. **Santa Clara Co.:** Joaquin Murrieta's Cave. **Santa Cruz Co.:** Dolloff Cave. **Siskiyou Co.:** Apogee Cave; Fossil Cave; Skunk Hollow Cave. **Bibliography:** Graening (2010, 2011c).**ORDER DIPTERA (flies)****SUBORDER NEMATOCERA****Family Blephariceridae (net-winged midges)***Agathon* sp.**Record:** Fresno Co.: Millerton Lake Cave System.**Family Cecidomyiidae (gall midges)***Lestremia cinerea* Macquart**Record:** Mariposa Co.: Bull Creek Cave.**Comment:** This is a widespread species*Monardia* sp.**Record:** Calaveras Co.: Grapevine Gulch Cave.**Comment:** A single female was collected.**Family Ceratopogonidae (biting midges)***Dasyhelea* sp.**Records:** Unknown Co.: \*caves utilized as nest sites by the California condor.**Bibliography:** Snyder, Ramey, and Sibley (1986).**Family Chironomidae (nonbiting midges)**

Undetermined

**Records:** Fresno Co.: Millerton Lake Cave System. **San Benito Co.:** Balconies Cave. **Siskiyou Co.:** Pearl Cave; Roller-coaster Cave; Spider Cave; Upper Heppe Cave. **Tulare Co.:** White Chief Cave.**Bibliography:** Taylor and Krejca (2006).

Orthocladinae

**Records:** Calaveras Co.: Gray Pine Cave. **Tuolumne Co.:** Porcupine Cave.**Comment:** These specimens could not be further identified because of improper mounting.**Family Culicidae (mosquitoes)**

Undetermined

**Records:** Amador Co.: Lulu Bell Cave; Mushroom Cave; Rippled Cave. **Calaveras Co.:** Upper Calaveras Natural Bridge.

**Fresno Co.:** Boyden Cave; Children's Cave; Maze Cave; Millerton Lake Cave System. **Mariposa Co.:** Indian Cave; Spider Cave. **Modoc Co.:** \*cave at Cave Lake Campground. **San Bernardino Co.:** \*Mosquito Morgue Cave. **San Diego Co.:** \*Alpine Cave. **Santa Clara Co.:** Joaquin Murrieta's Cave. **Santa Cruz Co.:** Bat Cave; Stearns Cave. **Shasta Co.:** Rod's Clay Worm Cave; Rusty Cave. **Siskiyou Co.:** Apogee Cave; \*Blue Bucket Cave; Boulevard Cave; Broken Down Palace; Corkscrew Cave; Echoplex Cave; Frozen Falls Cave; Nirvana Cave; Planetary Dairy Cave; \*Pot Belly Cave; Skunk Hollow Cave; Spider Cave; Stash Talus Cave; \*Sunnyside Tick Cave; Trail Junction Cave; Upstairs-Downstairs Cave; Wahashin Cave. **Trinity Co.:** Del Loma Cave; Paul Gibson Cave. **Tulare Co.:** Carmoe Crevice; \*Panorama Cave; Seldom Seen Cave. **Tuolumne Co.:** mine 3 km N Columbia; Milkcan Cave; Transplant Mine.

**Bibliography:** Briggs (1987, 1991); Coffman (1996); Graening (2011c); Halliday (1959); Krejca (2007); Lattka (1976, 1983); Quick (1974a); Rogers (1991c, 2000c); Schmitz (1993); Szukalski (2001b, 2003a); Taylor and Krejca (2006); Ubick (2001); Weaver (2009a); Wolff, L. (2009b); Zara Environmental (2009).

*Culiseta* sp.

**Record:** Calaveras Co.: Cataract Gulch Cave.

**Family Limoniidae (crane flies)**

*Chionea alexandriana* Garrett

**Record:** Siskiyou Co.: Crystal Ice Cave.

**Bibliography:** Alexander (1967).

*Dactylolabis (Dactylolabis) postiana* Alexander

**Record:** Shasta Co.: Samwel Cave.

**Comment:** This is a tentative identification of a single male.

*Dicranoptycha* sp.

**Record:** Shasta Co.: Samwel Cave.

**Bibliography:** Graham (1966a).

*Dicranoptycha* cf. *occidentalis* Alexander

**Record:** Santa Cruz Co.: Empire Cave.

**Bibliography:** Briggs and Ubick (1988); Graham (1966a, 1968a).

*Limonia* sp.

**Record:** Fresno Co.: Church Cave.

**Bibliography:** Graham (1966a).

*Limonia maculicosta* (Coquillett)

**Records:** Santa Cruz Co.: Bat Cave; Dolloff Cave; Empire Cave; IXL Cave; Stump Cave. Tulare Co.: Cedar Cave; Lilburn Cave; May's Cave.

**Bibliography:** Graham (1966a); Krejca (2006); Ubick (2001).

*Limonia nubeculosa* Meigen

**Records:** Amador Co.: Masonic Cave; Soldier Creek Cave. Calaveras Co.: Cave City Cave; Cave of the Catacombs; Shaw's Cave; Wool Hollow Cave. Santa Cruz Co.: Empire Cave. Trinity Co.: Hall City Cave. Tulare Co.: Cedar Cave; Lilburn Cave; May's Cave.

**Comment:** Specimens from Lilburn Cave were taken from the Main Entrance section.

**Bibliography:** Alexander (1967); Graham (1966a, 1968a); Krejca (2006); Lee, V.F. (1985a).

**Family Mycetophilidae (fungus gnats)**

Undetermined

**Records:** Amador Co.: Connie's Cave; Moss Cave; Rippled Cave; Santa Claus Cave; Violin Cave. Calaveras Co.: Cone Cave; Crystal Stanislaus Cave; Grapevine Gulch Cave; Music Hall Cave; O'Neil's Cave; Sink Cave; Wool Hollow Cave. Fresno Co.: Boyden Cave; Children's Cave; Maze Cave; Millerton Lake Cave System. Napa Co.: Clay Cave. San Benito Co.: Balconies Cave; Bear Gulch Cave. San Bernardino Co.: Mitchell Caverns. Santa Cruz Co.: Empire Cave; Stearns Cave. Shasta Co.: Alien Space Cave; Christmas Tree Cave; Elisha Cave; North Christmas Tree Cave; Parrish Cave; Rusty

Cave. **Siskiyou Co.:** Adam's Homestead Cave; Anglemorm/Lost Pinnacle Cave; Apogee Cave; Arch Cave No. 2; Boulevard Cave; Deep Cavern; Fossil Cave; Hoyle's Half-Dollar Hole; Lyon's Road Cave; Merrill Ice Cave; Red Tape Cave; Spider Cave; Sugar Pine Butte Ice Cave; Trail Junction Cave; Planetary Dairy Cave; Stiletto Cave; Upper Heppe Cave; Upper Thicket Cave. **Tulare Co.:** Cedar Cave; Cirque Cave; Clough Cave; Hidden Cave; \*Hurricane Crawl Cave; Lilburn Cave; May's Cave; New Cave; \*Overhang Cave; \*Paradise Cave; Rattlesnake Cave; Stand Up Cave; Ursa Minor Cave; White Chief Cave. **Tuolumne Co.:** Crack of Doom Cave; Transplant Mine. **Ventura Co.:** Clear Springs Cave.

**Comment:** Many of these records are based on larvae.

**Bibliography:** Briggs (1987); Briggs and Ubick (1988); Graening (2011c); Graham (1967, 1968a); Hammond (1994); Krejca (2006); Rogers (1994a, 1999d); Senger (1991); Taylor and Krejca (2006); Ubick (2001).

*Exechia* sp.

**Records:** **Mariposa Co.:** Indian Cave. **Siskiyou Co.:** Skunk Hollow Cave.

**Bibliography:** Zara Environmental (2009).

*Exechiopsis* sp.

**Records:** **Tulare Co.:** Cedar Cave; May's Cave.

**Bibliography:** Krejca (2006); Lee, V.F. (1985a).

*Monardia* sp.

**Record:** **Calaveras Co.:** Grapevine Gulch Cave.

*Mycetophila* sp., group D

**Record:** **Tulare Co.:** Cedar Cave.

**Bibliography:** Krejca (2006); Lee, V.F. (1985a).

*Mycomya* sp.

**Record:** **Calaveras Co.:** Grapevine Gulch Cave.

*Rhymosia* sp.

**Records:** **Mariposa Co.:** Spider Cave. **Tulare Co.:** Cedar Cave.

**Bibliography:** Krejca (2006); Lee, V.F. (1985a); Zara Environmental (2009).

*Speolepta* sp.

**Record:** **Siskiyou Co.:** Spider Cave.

**Comment:** The genus *Speolepta* is a frequent inhabitant of caves in Europe but this is apparently the first record of the genus in a cave in the United States. The only described species from North America is *S. vockerothi* Ševčík, Kjøransen, and Marshall from caves in British Columbia and Ontario Canada, and from surface localities in Alaska and New Hampshire.

**Bibliography:** Taylor and Krejca (2006).

**Family Psychodidae (moth flies)**

Undetermined

**Records:** **Inyo Co.:** Titus Canyon Cave. **Santa Cruz Co.:** Empire Cave. **Siskiyou Co.:** Caldwell Ice Caves. **Tulare Co.:** White Chief Cave.

**Bibliography:** Taylor and Krejca (2006).

*Lutzomyia* sp.

**Record:** **Calaveras Co.:** Gray Pine Cave.

**Family Scatopsidae (minute black scavenger flies)**

Undetermined

**Record:** **Siskiyou Co.:** Spider Cave.

**Bibliography:** Taylor and Krejca (2006).

**Family Sciariidae (dark-winged fungus gnats)**

Undetermined

**Records:** **Mariposa Co.:** Indian Cave. **Santa Cruz Co.:** Dolloff Cave; Empire Cave; IXL Cave. **Shasta Co.:** Pink Coat Cave; Rusty Cave. **Siskiyou Co.:** Anglemorm/Lost Pinnacle Cave; Arch Cave No. 2; Big Painted Cave; Catacombs Cave;

Coda Cave; Coral Reef Cave; Cox Ice Cave; Echoplex Cave; Fern Cave; Lyon's Road Cave; Merrill Ice Cave; Mushpot Cave; Spider Cave; Upper Heppe Cave; Valentine Cave.

**Bibliography:** Graham (1967, 1968a); Taylor and Krejca (2006); Ubick (2001); Zara Environmental (2009).

#### Family Tipulidae (crane flies)

Undetermined

**Records:** **Amador Co.:** Connie's Cave; Moss Cave. **Calaveras Co.:** Cave of Skulls; Cone Cave; O'Neil's Cave; Sink Cave; Skeleton Cave; Upper Calaveras Natural Bridge. **Fresno Co.:** Boyden Cave; Children's Cave; Church Cave; Maze Cave; Saturday Cave; Windy Cliff Cave. **Mariposa Co.:** \*Carbonate Cave; Damp Cave; ?Spider Cave. **San Bernardino Co.:** Virginia's Mine Cave. **Santa Clara Co.:** Joaquin Murrieta's Cave. **Santa Cruz Co.:** Bat Cave; Empire Cave; Stearns Cave. **Siskiyou Co.:** Apogee Cave; Bigfoot Cave; Bowling Alley Cave; Craig Cave; Deep Cavern; Hoyle's Half-Dollar Hole; Merrill Ice Cave; Planetary Dairy Cave; Spider Cave; Stash Talus Cave; \*Sunnyside Tick Cave; Tichnor Cave/Bertha's Cupboard Cave; Tichnor's Teepee; Township Cave; Upper Heppe Cave. **Tulare Co.:** Cirque Cave; Crystal Sequoia Cave; Eighteenth Hole; Kaweah Cave; Lilburn Cave; Lost Soldier's Cave; May's Cave; Overhang Cave; Schist Canyon Cave; Ursa Minor Cave; White Chief Cave; Windy Pit. **Tuolumne Co.:** Forsythe Cave.

**Comment:** Some of the records may now belong to the family Limoniidae.

**Bibliography:** Graening (2010, 2011c); Graham (1966a); Krejca (2006, 2007); McLellan (1951); Rogers (1991c, 1994a, 1999d, 2005b); Taylor and Krejca (2006); Ubick (1991); Zara Environmental (2009).

#### *Holorusia hespera* Arnaud and Byers

**Records:** **Calaveras Co.:** Shaw's Cave. **Santa Barbara Co.:** **Santa Cruz Island:** Cueva Valdez. **Ventura Co.:** Clear Springs Cave.

**Bibliography:** Alexander (1967).

#### *Tipula* sp.

**Records:** **Fresno Co.:** Millerton Lake Cave System. **Siskiyou Co.:** Spider Cave.

**Comment:** This was the prey of spiders.

**Bibliography:** Graham (1966a); Taylor and Krejca (2006).

#### *Tipula (Lunatipula)* sp.

**Record:** **Calaveras Co.:** Cave City Cave.

**Bibliography:** Graham (1966b).

#### *Tipula (Lunatipula) grahamina* Alexander (trogloxene)

**Records:** **Plumas Co.:** Juniper Cave (type locality). **Shasta Co.:** Samwel Cave. **Trinity Co.:** Hall City Cave.

**Comment:** Alexander (1963) erroneously lists Hall City Cave as in Plumas County.

**Bibliography:** Alexander (1963, 1967); Graham (1966a).

#### *Tipula (Trichotipula) gertschi* Alexander (trogloxene)

**Records:** **Calaveras Co.:** Buckeye Cave (type locality); Carlito's Cave; Cave of the Catacombs; Crystal Stanislaus Cave; Porcupine Cave; Shaw's Cave; Wool Hollow Cave.

**Bibliography:** Alexander (1963, 1967); Graham (1966a).

#### Family Trichoceridae (winter crane flies)

Undetermined

**Records:** **Amador Co.:** Skeleton Cave. **Fresno Co.:** Boyden Cave. **San Benito Co.:** Balconies Cave. **Santa Clara Co.:** Joaquin Murrieta's Cave. **Shasta Co.:** Rusty Cave. **Siskiyou Co.:** Echoplex Cave; Red Tape Cave; Sugar Pine Butte Ice Cave. **Trinity Co.:** Paul Gibson Cave.

#### *Diazosma subsinulatum* (Alexander)

**Records:** **Mariposa Co.:** Spider Cave. **Napa Co.:** Clay Cave. **Plumas Co.:** Juniper Cave. **Shasta Co.:** Subway Cave. **Trinity Co.:** Hall City Cave.

**Comment:** This species frequently occurs in the dark zone as well as in twilight.

**Bibliography:** Alexander (1967); Graham (1966a); Zara Environmental (2009).



*Trichocera* sp.

**Records:** Santa Cruz Co.: Bat Cave. Shasta Co.: Flashlight Cave; Pink Coat Cave; Trail Cave. Siskiyou Co.: Angleworm/Lost Pinnacle Cave; Catacombs Cave.

**Bibliography:** Taylor and Krejca (2006).

*Trichocera columbiana* Alexander

**Record:** Shasta Co.: Subway Cave.

**Comment:** One individual was collected at a wet area in the dark zone.

**Bibliography:** Alexander (1967); Graham (1966a).

**SUBORDER BRACHYCERA****Family Bombyliidae (bee flies)**

Undetermined

**Record:** Siskiyou Co.: \*Catacombs Cave.

**Bibliography:** Taylor and Krejca (2006).

**Family Calliphoridae (blow flies)**

Undetermined

**Record:** Siskiyou Co.: \*?Sunnyside Tick Cave.

**Comment:** "Several persistent blue bottle flies" were reported from Sunnyside Tick Cave (Rogers, 2000c).

**Bibliography:** Rogers (2000c).

**Family Heleomyzidae (sun flies)**

Undetermined

**Records** Amador Co.: Hummingbird Cave. Calaveras Co.: Bobcat Cave. Fresno Co.: Children's Cave; Maze Cave. Santa Clara Co.: Joaquin Murrieta's Cave. Santa Cruz Co.: IXL Cave. Shasta Co.: Ancient Palace Cave. Siskiyou Co.: Apogee Cave; Echoplex Cave; Sugar Pine Butte Ice Cave. Trinity Co.: Paul Gibson Cave. Tulare Co.: Bear Den Cave; Cirque Cave; Crystal Sequoia Cave; Dehydrated Cave; Eighteenth Hole; Hurricane Crawl Cave; Lilburn Cave; Overhang Cave; Paradise Cave; Pine Grosbeak Cave; Salamander Cave; Ursa Minor Cave.

**Bibliography:** Krejca (2006, 2007).

*Eccoptomera spinosa* (Garrett)

**Record:** Mariposa Co.: Spider Cave.

**Bibliography:** Zara Environmental (2009).

*Heleomyza* sp.

**Record:** Tulare Co.: Lange Cave.

**Bibliography:** Krejca (2006); Reardon (1966).

*Oecothea specus* (Aldrich) (troglophile)

**Records:** Mariposa Co.: Spider Cave. Siskiyou Co.: Angleworm/Lost Pinnacle Cave; Arch Cave No. 2; Catacombs Cave; Fern Cave; Fossil Cave; Mushpot Cave; Rollercoaster Cave; Spider Cave; Valentine Cave. Tulare Co.: Cedar Cave; Lilburn Cave.

**Bibliography:** Krejca (2006); Lee, V.F. (1985a); Taylor and Krejca (2006); Zara Environmental (2009).

*Scolecocentra (Scolecocentra) caesia* Meigen

**Record:** Tulare Co.: Lange Cave.

**Comment:** This fly is also known from European caves.

**Bibliography:** Briggs and Gpe (1975); Danchy (1951b); Krejca (2006); Reardon (1966).

*Scolecocentra (Scolecocentra) tularensis* (Gill)

**Records:** Tulare Co.: unnamed cave, Yucca Creek Canyon, Sequoia National Park (type locality).

**Bibliography:** Gill (1963).

**Family Hippoboscidae (louse flies)**

Undetermined (parasite)

**Record:** Siskiyou Co.: Planetary Dairy Cave.

**Comment:** These parasitic, wingless flies were reported from the bat *Corynorhinus townsendii*.

**Bibliography:** Suggett (1982).

**Family Muscidae (house flies)**

Undetermined

**Records:** Amador Co.: Rippled Cave. San Bernardino Co.: Peggy 5 Cave. Santa Cruz Co.: Bat Cave; Empire Cave. Shasta Co.: Ancient Palace Cave; Subway Cave. Siskiyou Co.: Apogee Cave. Tulare Co.: Ursa Minor Cave.

**Bibliography:** Graening (2010); Ubick (2001).

**Family Nycteribiidae (bat flies)**

*Basilia antrozoi* Townsend

**Records:** Kern Co.: crevices in sandstone outcrop near Cameros Spring. San Luis Obispo Co.: crevices in sandstone outcrop, Carizzo Plain; crevices at La Panza Ranch.

**Bibliography:** Orr, R.T. (1954).

**Family Phoridae (scuttle flies)**

Undetermined

**Records:** Tuolumne Co.: McLean's Cave; Transplant Mine.

**Comment:** Several species were probably transplanted from McLean's Cave to the Transplant Mine.

**Bibliography:** Briggs (1975); Elliott (1978).

*Megaselia (Megaselia)* sp.

**Record:** Tulare Co.: Cedar Cave.

**Bibliography:** Lee (1985a).

**Family Piophilidae (skipper flies)**

Undetermined

**Records:** Santa Cruz Co.: Empire Cave; Stump Cave.

**Bibliography:** Ubick (2001).

**Family Sphaeroceridae (small dung flies)**

Undetermined

**Record:** Siskiyou Co.: Rollercoaster Cave.

**Bibliography:** Taylor and Krejca (2006).

*Leptocera* sp.

**Records:** Santa Cruz Co.: Empire Cave. Siskiyou Co.: Arch Cave No. 2; Mushpot Cave.

**Bibliography:** Taylor and Krejca (2006); Ubick (2001).

*Spelobia (Spelobia)* sp.

**Record:** Tulare Co.: Cedar Cave.

**Bibliography:** Krejca (2006); Lee, V.F. (1985).

*Xenelimosina sicula* Marshall

**Record:** Trinity Co.: Forest Glen Cave.

**Bibliography:** Marshall (1985).

**Family Streblidae (bat flies)**

*Trichobius corynorhini* Cockrell (parasite)

**Record:** Siskiyou Co.: Planetary Dairy Cave.

**Comment:** Three males of this parasitic bat fly were collected, presumably from or near *Corynorhinus townsendii*.

**Family Syrphidae (flower flies)**

Undetermined

**Record:** Siskiyou Co.: \*Catacombs Cave.

**Bibliography:** Taylor and Krejca (2006).

**Family Tabanidae (horseflies)**

Undetermined

**Records:** Inyo Co.: Old Spanish Trail Cave. Shasta Co.: Rusty Cave.**Family Tephritidae (fruit flies)***Euarestoides acutangula* (Thomson)**Records:** San Bernardino Co.: Mitchell Caverns.**Bibliography:** Graening (2010).*Neaspilota viridescens* Quisenberry**Records:** San Bernardino Co.: Mitchell Caverns.**Bibliography:** Graening (2010).*Trupanea bisetosa* (Coquillett)**Records:** San Bernardino Co.: Mitchell Caverns.**Bibliography:** Graening (2010).*Trupanea jonesi* Curran**Records:** San Bernardino Co.: Mitchell Caverns.**Bibliography:** Graening (2010).*Trupanea pseudovicina* Hering**Records:** San Bernardino Co.: Mitchell Caverns.**Bibliography:** Graening (2010).**ORDER SIPHONAPTERA (fleas)**

Undetermined

**Records:** Amador Co.: Hummingbird Cave. Calaveras Co.: Wool Hollow Cave. Inyo Co.: unnamed lava tubes near Crater Mountain; Poleta Cave. Plumas Co.: Juniper Cave. San Bernardino Co.: Egg Cave; Mitchell Caverns. Siskiyou Co.: Arch Cave No. 2; Catacombs Cave; Coda Cave; Cox Ice Cave; Fern Cave; Merrill Ice Cave; Planetary Dairy Cave; Spider Cave; Valentine Cave. Tulare Co.: Lost Soldier's Cave.**Comment:** At least 16 species of flea have been collected from packrats and mice inhabiting caves and crevices in Lava Beds National Monument. They are vectors of the plague bacillus, *Pasturella pestis* (Lehman and Neumann). Stark and Kinney (1969) and Nelson and Smith (1976) studied the ecological effects of a plague epizootic on these rodents.**Bibliography:** Aalbu (1990); Broeckel, B. (1990, 1991b); Graening (2010); Suggett (1982); Taylor and Krejca (2006).**Family Ceratophyllidae (bird and rodent fleas)***Diamanus montanus* (Baker) (parasite)**Records:** Siskiyou Co.: caves in Lava Beds National Monument; Planetary Dairy Cave.**Comment:** This species was taken from a *Neotoma cinerea* nest in Planetary Dairy Cave and from the nests and body of *Neotoma cinerea* in Lava Beds National Monument.**Bibliography:** Nelson and Smith (1976); Stark and Kinney (1969); Suggett (1982).*Malaraeus* sp. (parasite)**Record:** Siskiyou Co.: caves in Lava Beds National Monument.**Comment:** This flea was taken from nest of *Neotoma cinerea* in 1969 and from *N. cinerea* and *Peromyscus crinitus* in 1976.**Bibliography:** Nelson and Smith (1976); Stark and Kinney (1969).*Malaraeus bitterrootensis* (Dunn) (parasite)**Record:** Siskiyou Co.: caves in Lava Beds National Monument.**Comment:** This species was taken from *Neotoma cinerea*.**Bibliography:** Nelson and Smith (1976).*Malaraeus sinomus* (Jordan) (parasite)**Record:** Siskiyou Co.: caves in Lava Beds National Monument.**Comment:** This species was taken from *Peromyscus crinitus*.**Bibliography:** Nelson and Smith (1976).

*Malaraeus telchinus* (Rothschild) (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Peromyscus maniculatus* and the nests of *Neotoma cinerea*.

**Bibliography:** Stark and Kinney (1969).

*Monopsyllus wagneri* (Baker) (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Peromyscus maniculatus*.

**Bibliography:** Stark and Kinney (1969).

*Opisodasys keeni* (Baker) (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Neotoma cinerea*, *Peromyscus crinitus*, and *P. maniculatus*.

**Bibliography:** Nelson and Smith (1976); Stark and Kinney (1969).

*Orchopeas sexdentatus* (Baker) (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument; Hercules' Leg/Juniper Cave Lava Tube System.

**Comment:** This species was taken from *Neotoma cinerea* and *Peromyscus maniculatus*.

**Bibliography:** Nelson and Smith (1976); Stark and Kinney (1969).

**Family Hystrichopsyllidae (rodent fleas)***Anomiopsyllus* sp. (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from the nests of *Neotoma cinerea*.

**Bibliography:** Stark and Kinney (1969).

*Atyphloceras multidentatus* (C. Fox) (parasite)

**Records:** Siskiyou Co.: caves in Lava Beds National Monument; Planetary Dairy Cave.

**Comment:** This species was taken from the nest of *Neotoma cinerea* in Planetary Dairy Cave and from *N. cinerea* in Lava Beds National Monument.

**Bibliography:** Nelson and Smith (1976); Suggett (1982).

*Callistopsyllus deuterus* Jordan (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Peromyscus crinitus*.

**Bibliography:** Nelson and Smith (1976).

*Catallagia* sp. (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Neotoma cinerea* and *Peromyscus maniculatus*.

**Bibliography:** Nelson and Smith (1976).

*Catallagia mathesoni* Jameson (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Neotoma cinerea* and *Peromyscus maniculatus*.

**Bibliography:** Stark and Kinney (1969).

*Catallagia sculleni* Hubbard (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Neotoma cinerea* and *Peromyscus crinitus* in 1969 and from *P. maniculatus* in 1976.

**Bibliography:** Nelson and Smith (1976); Stark and Kinney (1969).

*Megarthroglossus* sp. (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Neotoma cinerea*, *Peromyscus crinitus*, and *P. maniculatus*.

**Bibliography:** Nelson and Smith (1976); Stark and Kinney (1969).



*Phalacrotopsylla allos* Wagner (parasite)

**Records:** Siskiyou Co.: caves in Lava Beds National Monument; Planetary Dairy Cave.

**Comment:** This species was taken from *Neotoma cinerea* in the caves in Lava Beds National Monument and from the nest of *N. cinerea* in Planetary Dairy Cave.

**Bibliography:** Nelson and Smith (1976); Stark and Kinney (1969); Suggett (1982).

**Family Ischnopsyllidae (bat fleas)***Myodopsylla* sp. (parasite)

**Record:** Riverside Co.: gold mine in the Riverside Mountains. **San Diego Co.:** inspection tunnel of the Hodges Dam.

**Comment:** This flea was taken from *Myotis velifer* in Riverside County and from *Myotis yumanensis sociabilis* in San Diego Co.

**Bibliography:** Krutzsch (1955a) ; Stager (1939).

*Myodopsylla collinsi* Kohls (parasite)

**Records:** Riverside Co.: abandoned mine SW of Blythe; Mountaineer Mine.

**Comment:** This species was taken from an unidentified bat in the mine southwest of Blythe and from *Myotis velifer* in the Mountaineer Mine.

**Bibliography:** Haas, Beck, and Tomich (1983).

*Myodopsylla gentilis* Jordan and Rothschild (parasite)

**Record:** Lake Co.: Sulfur Bank Mine.

**Comment:** This species was taken from *Myotis yumanensis*.

**Bibliography:** Haas, Beck, and Tomich (1983).

*Myodopsylla palposa* (Rothschild)

**Records:** Kern Co.: crevices in sandstone outcrop near Carneros Spring. **San Luis Obispo Co.:** crevices at La Panza Ranch; crevices in sandstone outcrop, Carrizo Plain.

**Bibliography:** Orr, R.T. (1954).

**Family Leptopsyllidae (scaled fleas)***Peromyscopsylla hesperomys* (Baker) (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Peromyscus crinitus* and *P. maniculatus*.

**Bibliography:** Nelson and Smith (1976).

*Peromyscopsylla selenis* (Rothschild) (parasite)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Comment:** This species was taken from *Peromyscus crinitus*.

**Bibliography:** Stark and Kinney (1969).

**PHYLUM ECHINODERMATA****CLASS HOLOTHUROIDEA (sea cucumbers)**

Undetermined

**Record:** San Luis Obispo Co.: \*Anemone Swiss Cheese Cave.

**Bibliography:** Vesely (1987, 1991).

**CLASS OPHIUROIDEA (brittle stars and basket stars)****ORDER OPHIURIDA (brittle stars)**

Undetermined

**Record:** San Diego Co.: \*White Lady Cave.

**Bibliography:** Vesely and Bunnell (1982b, 1986).

**Family Ophiotrichidae***Ophiotrix* (*Ophiotrix*) *spiculata* Le Conte (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: cave 0.5 mi. W of Pelican Bay.

**Bibliography:** Hewatt (1946).

**CLASS ASTEROIDEA (starfish)**

Undetermined (marine)

**Records:** Mendocino Co.: \*Starfish Sea Cave. Santa Barbara Co.: *Santa Cruz Island*: \*littoral cave. San Diego Co.: \*Sunset Cliffs Sea Cave. San Luis Obispo Co.: \*Cave-in-Rock; \*Caverns of Mystery; \*Sea Dome Cave. Santa Cruz Co.: \*Surfing Tunnel Sea Cave; \*Technicolor Dream Cave; \*Whale of a Cave.

**Comment:** Bunnell's photos (1998) of batstars in sea caves probably are *Patiria miniata*, Order Valvatida, Family Asterinidae.

**Bibliography:** Anonymous (1991d); Bosted (1984, 1991a, 1994b, 2000); Bunnell (1998); Bunnell and Vesely (1982); Mele (1994); Vesely and Bunnell (1982a, 1985).

**ORDER FORCIPULATIDA****Family Asteridiidae***Pisaster giganteus* Stimpson (giant sea star) (marine)

**Record:** San Luis Obispo Co.: \*Cave-in-Rock.

**Bibliography:** Vesely and Bunnell (1985).

*Pisaster ochraceus* (Brandt) (ochre sea star) (marine)

**Records:** Marin Co.: \*Millers Point Cave. San Luis Obispo Co.: \*Cave-in-Rock.

**Bibliography:** Rogers (2005c); Vesely and Bunnell (1985).

**ORDER SPINULOSIDA****Family Echinasteridae***Henricia* sp.

**Record:** San Luis Obispo Co.: \*Cave-in-Rock.

**Bibliography:** Vesely and Bunnell (1985).

**ORDER VALVATIDA****Family Asterinidae***Patiria miniata* (Verrill) (bat star) (marine)

**Record:** Mendocino Co.: \*Peters Creek Cove Cave. San Diego Co.: \*littoral caves at La Jolla Cove. San Francisco Co.: *Farallon Islands*: Little Murre Cave. San Luis Obispo Co.: \*Cave-in-Rock; \*Nudibranch Cave. Santa Barbara Co.: *Santa Cruz Island*: \*littoral caves.

**Bibliography:** Bunnell (1994, 1998, 1999b); Bunnell and Vesely (1983b); Vesely (1987, 1991); Vesely and Bunnell (1985).

**Family Ophidasteridae***Linckia columbiae* Gray (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: cave 0.5 mi. W of Pelican Bay.

**Bibliography:** Hewatt (1946).

**CLASS ECHINOIDEA (sea urchins)**

Undetermined (marine)

**Records:** Mendocino Co.: \*Starfish Sea Cave. San Diego Co.: \*littoral caves at La Jolla Cove. San Luis Obispo Co.: \*littoral caves at Shell Beach and Montaña de Oro State Park; \*Sea Maze Cave. Santa Barbara Co.: *Santa Cruz Island*: \*Emerald Pool Cave; \*H Cave; \*Purple Urchin Cave; \*Surging "T" Cave. Ventura Co.: *Anacapa Island*: \*Dead Seal Cave; \*Frenchy's Cave; \*Slippery Rock Cave; \*Three Door Cave; \*Three Fingers Cave; \*Urchin's Lair Cave.

**Bibliography:** Bunnell (1982, 1985, 1988c, 1993a); Bunnell and Vesely (1983b, 1986, 1990); Mele (1994).

**Family Strongylocentrotidae***Strongylocentrotus purpuratus* (Stimpson) (purple sea urchin)

**Record:** Marin Co.: \*Millers Point Cave.

**Bibliography:** Rogers (2014).

**PHYLUM CHORDATA**  
**CLASS ASCIDACEA (tunicates)**  
**ORDER ENTERGONA**  
**Family Ritterellidae**

*Ritterella rubra* Abbott and Trason

**Record:** Monterey Co.: cave at Pescadero Point

**Bibliography:** Abbott and Trason (1968).

*Distaplia smithi* Abbott and Trason

**Records:** Monterey Co.: caves at Pescadero Point, Shell Beach. Sonoma Co.: small caves at Shell Beach.

**Bibliography:** Abbott and Trason (1968).

**CLASS CHONDRICHTHYES (sharks)**  
**ORDER HETERODONTIFORMES (bullhead sharks)**  
**Family Heterodontidae**

*Heterodontus* sp. (spiny dog shark) (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: Diablo Anchorage Cave.

**Bibliography:** Henderson (1983).

**ORDER LAMNIFORMES (mackerel sharks)**  
**Family Scyliorhinidae**

*Cephaloscyllium* sp. (swell shark) (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: \*Diablo Anchorage Cave.

**Bibliography:** Henderson (1983).

**CLASS ACTINOPTERYGII (bony fishes)**  
 Undetermined

**Records:** Calaveras Co.: \*Keith's Chasm; \*Yother's Water Cave. Fresno Co.: \*Black Lake Cave (dead); \*Hidden Pond Cave; \*Millerton Lake Cave System. Imperial Co.: \*artesian well near Frink siding, between Hecca and Niland. Mariposa Co.: \*Bower Cave. San Bernardino Co.: \*artesian well near Kokoweef Peak. Santa Clara Co.: artesian well at Santa Clara University. Tuolumne Co.: \*McLean's Cave.

**Comment:** Apparently Yother's Water Cave is separated from O'Neil Creek by only a ledge-like entrance, so fishes from the creek presumably could be found in the cave. "Sightless fishes" were reportedly discharged from a 52-m deep artesian well on the campus of Santa Clara University, but no verification has ever been established. The only blind fishes known from California are the marine gobiids, *Lethops connectens* Hubbs and *Typhlogobius californensis* Steindachner. These two species are found in coastal rock crevices and crustacean burrows.

**Bibliography:** Anonymous (1950, 1986a, 1991a); Benn (1945); Bowers (2008b); Bruce (1998); Caton (1885); Cooper, Frantz, and Frantz (2002); Danehy (1952); Davis, R. (2011); Dearolf (1956); McEachern and Grady (1978); Richards (1986).

**ORDER CLUPEIFORMES**  
**Family Salmonidae (salmon, trout)**

Undetermined

**Records:** Fresno Co.: \*Hidden Pond Cave. Mariposa Co.: \*Bower Cave. Shasta Co.: \*Shasta Lake Caverns. Unknown Co.: Natural Bridge Cave.

**Comment:** Trout were reportedly introduced into Bower Cave at one time. Trout introduced into Shasta Lake Caverns did not survive. There are four natural bridge caves in Calaveras and Trinity counties with potential freshwater habitat.

**Bibliography:** Anonymous (1999d); Graham (1969c); Rodgers (1983c, 1991b); Rodgers and Legg  (1984); Wolff and Wolff (1990).

*Oncorhynchus* sp. (trout)

**Record:** Siskiyou Co.: Daystream Cave.

**Bibliography:** Broeckel, B. (2008d); Graening (2011c).

*Oncorhynchus mykiss* (Walbaum) (rainbow trout)

**Record:** Mariposa Co.: Bower Cave.

**Bibliography:** Graham (1969c).

**ORDER CYPRINIFORMES****Family Cyprinidae (minnows)**

Undetermined

**Records:** Calaveras Co.: Upper Calaveras Natural Bridge. Fresno Co.: Millerton Lake Cave System. Mariposa Co.: Bower Cave.

**Bibliography:** Graham (1969c).

*Carassius auratus* (Linnaeus) (goldfish)

**Record:** Shasta Co.: \*Shasta Lake Caverns.

**Comment:** Goldfish were introduced into the caverns but did not survive.

**Bibliography:** Wolff and Wolff (1990).

*Hesperoleucus symmetricus* (Baird and Girard) (California roach) (troglophile)

**Record:** Mariposa Co.: Bower Cave.

**Comment:** This species of minnow was collected during diving operations. The fish population is supposedly no longer present in the cave (Anonymous, 1982, 1986a)

**Bibliography:** Anonymous (1982, 1986a); Graham (1969).

**Family Cyprinodontidae (pupfish)**

Undetermined

**Record:** Mendocino Co.: \*Cave of Lost Soles.

**Bibliography:** Bunnell (1998).

**ORDER PERCIFORMES**

Undetermined

**Record:** San Diego Co.: \*Sunny Jim Cave.

**Bibliography:** Vesely (1990, 2000).

**Family Embiotocidae (surfperches)**

Undetermined (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: \*Diablo Anchorage Cave.

**Bibliography:** Henderson (1983).

**Family Gobiidae (gobies)**

Undetermined

**Record:** Santa Barbara Co.: *Santa Cruz Island*: \*Surging "T" Cave.

**Bibliography:** Bunnell and Vesely (1986, 1990).

**Family Kyphosidae (sea chubs)**

*Girella nigricans* (Ayres) (opaleye) (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: \*Diablo Anchorage Cave.

**Bibliography:** Henderson (1983).

**Family Labridae (wrasses)**

*Limelometopon pulcher* (Ayres) (California sheephead) (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: \*Diablo Anchorage Cave.

**Bibliography:** Henderson (1983).

**Family Scaridae (parrotfishes)**

*Oxyjulis californica* (Günther) (señorita) (marine)

**Records:** Santa Barbara Co.: *Santa Cruz Island*: \*Fry's Harbor Cave; \*Surging "T" Cave. San Diego Co.: \*Sunny Jim Cave.

**Bibliography:** Bunnell and Vesely (1990); Henderson (1983); Vesely (1990, 2000).



**ORDER OPHIDIIFORMES****Family Brotulidae (brotulas)**

Undetermined (red brotula) (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: \*Fry's Harbor Cave.**Bibliography:** Henderson (1983).**ORDER SCORPAENIFORMES (mail-checked fishes)****Family Scorpaenidae (scorpion fishes)**

Undetermined (rockfish) (marine)

**Record:** Santa Barbara Co.: *Santa Cruz Island*: \*Diablo Anchorage Cave.**Bibliography:** Henderson (1983).**CLASS AMPHIBIA****ORDER CAUDATA (salamanders)**

Undetermined

**Records:** Amador Co.: \*small cave below Santa Claus Cave; Moss Cave; Rippled Cave. Calaveras Co.: \*Bobcat Cave; \*Carlow's Cave; \*Cave City Cave; \*Grapevine Gulch Cave; \*Gray Pine Cave; \*Heater Cave; \*Keith's Chasm; \*Lost Piton Cave; \*Thunder Cavern (two species). Fresno Co.: \*unnamed cave in Kings Caverns Geological Area. Kern Co.: Held Hole. Santa Cruz Co.: \*Bat Cave. Shasta Co.: \*Battle Creek Cave No. 2; \*Blue Foamy Cave; \*Discovery 1 Cave (dead); \*Hole-of-the-Bear; \*IXL Cave; \*Rock Block Cave. Tehama Co.: \*Inskip Cave. Tulare Co.: \*Lilburn Cave; \*Lost Soldier's Cave; \*Moorehouse Springs Cave; \*Noontime Cave; \*Orrin Belden Cave; \*Paradise Cave. Ventura Co.: \*Clear Springs Cave.

**Bibliography:** Anonymous (1999c); Baumann (2013a); Bosted (1993, 1994c); Bowers (2008a); Broeckel, B. (2011b, 2011d); Carlon (2014); Fiederer (1996); Flurkey (1975); Funkhouser (1950b); Grundy (2005); Halliday (1961a, 1962); Krejca (2006); Lange (1954); McEachern and Grady (1978); Moore, G. (1998); Razo (1980); Reardon (1966); Robinson (2004a); Russo (1999); Russo and Johnson (2011); Weaver (2005a, 2009c); Winterath (1971) Wolff, J. (1982a, 1997, 1998); Zidell (1987).

**Family Dicamptodontidae***Dicamptodon ensatus* (Eschscholtz) (Pacific giant salamander)**Records:** Santa Cruz Co.: \*Bat Cave; Dolloff Cave; Empire Cave; IXL Cave; Stump Cave.**Comment:** This species has aquatic larvae. An adult was taken in Dolloff Cave while a larva was found in Empire Cave.

**Bibliography:** Anonymous (2015); Briggs and Gpe (1975); Briggs and Ubick (1988); Danehy (1952); Dearolf (1956); Decker (2002); Fan (2010a); Funkhouser (1951); Halliday (1962); Johnson, V. (1990); Nussbaum (1976); Rodgers (1962); Rogers (2005b, 2010c); Rogers and Helton (2007b); Sherwood (1956, 1957a); Steiger (2007).

*Dicamptodon tenebrosus* (Baird and Girard) (coastal giant salamander)**Records:** Trinity Co.: \*?underwater cave at Griffith's Lake in the Trinity Mountains; Paul Gibson Cave.

**Comment:** Rumors of gigantic salamanders up to eight feet long in caves and wells in Trinity County have never been substantiated (Graham, 1960b). It is conceivable that these are exaggerated reports of this species, which may reach 14 inches in length.

**Bibliography:** Anonymous (1962); Graening (2014); Graham (1960c).**Family Plethodontidae (lungless salamanders)***Aneides flavipunctatus flavipunctatus* (Strauch) (speckled black salamander)**Records:** Lake Co.: horizontal mine shaft on Clear Creek 0.5 mi. NW Lucerne. Mendocino Co.: Negro Hole Cave.

**Comment:** Two were reported from just inside the dark zone among litter and in crevices along the wall in Negro Hole. The Lake County specimen was taken from wet rubble at the end of the mineshaft.

**Bibliography:** Christianson and Coombs (1970); Johnson, V. (1990); Myers and Maslin (1948).*Aneides lugubris* (Hallowell) (arboreal salamander)

**Records:** Amador Co.: Black Chasm. Calaveras Co.: Carlow's Cave; Cave of Skulls; Cave City Cave; Cave of the Catcombs; Grapevine Gulch Cave; Gray Pine Cave; Lost Piton Cave; Thunder Cavern; Wool Hollow Cave. Los Angeles Co.: Dawn Mine in Millard's Canyon. San Francisco Co.: *Farallon Islands*: caves on Southeast Farallon Island; Rabbit Cave. Santa Clara Co.: Joaquin Murrieta's Cave. Tuolumne Co.: Gate Pit Cave.

**Bibliography:** Anonymous (2011c); Bogert (1930); Danehy (1951b, 1952); Dearolf (1956); Funkhouser (1951); Graham

(1963a, 1963b); Halliday (1962); Johnson, V. (1990); Leissring and Rogers (2010); McEachern and Grady (1978); Orr, P.C. (1951b); Rogers (2011b); Steiner (1989).

*Batrochoseps* sp.

**Records:** **Calaveras Co.:** Grapevine Gulch Cave. **Santa Cruz Co.:** Pogonip Cave. **Tulare Co.:** Carmoe Crevice Cave; \*Harry's Bend Cave; \*Lost Soldier's Cave; Stand Up Cave.

**Bibliography:** Funkhouser (1950b); Krejca (2006).

*Batrochoseps attenuatus* (Eschscholtz) (California slender salamander)

**Records:** **Calaveras Co.:** Bobcat Cave; \*Carlow's Bat Cavern; Poison Oak Cave; Shaw's Cave. **Santa Cruz Co.:** Stump Cave. **Tulare Co.:** caves in Sequoia National Park; \*Salamander Cave.

**Comment:** Two types of salamander were observed in Salamander Cave in 1949, but the cave was unstable and was sealed off.

**Bibliography:** Danehy (1952); Briggs and Gpc (1975); Dearolf (1956); Eastman (2011); Funkhouser (1951); Halliday (1962); Krejca (2006); Martin, B. (1983); Reardon (1966).

*Batrochoseps relictus* Brame and Murray

**Records:** **Fresno Co.:** \*Hummel's Cave. **Tulare Co.:** Crystal 67 Cave.

**Comment:** One specimen was collected in Crystal 67 Cave. This species ranges south from Mariposa to Kern counties.

**Bibliography:** Brame and Murray (1968); Krejca (2006); Quick (1996, 1997b, 1998b).

*Ensatina eschscholtzi* Gray (ensatina)

**Records:** **Amador Co.:** \*Lulu Bell Cave; Mushroom Cave; Violin Cave. **Calaveras Co.:** Cave City Cave; Cave of Skulls; Cave of the Catacombs; Heater Cave; Mercer Caverns; Wool Hollow Cave. **Fresno Co.:** Bear Den Cave; Maze Cave; Millerton Lake Cave System. **Kern Co.:** Harrington Cave. **Mariposa Co.:** Spider Cave; \*Yosemite Falls Indian Cave. **Monterey Co.:** Willow Creek Cave. **Napa Co.:** Clay Cave. **San Benito Co.:** Balconies Cave. **San Diego Co.:** Eagle Lode Mine. **Santa Cruz Co.:** Bat Cave; Dolloff Cave; Empire Cave; Stearns Cave; Stump Cave. **Shasta Co.:** Ancient Palace Cave. **Tehama Co.:** \*Inskip Cave. **Tulare Co.:** \*Bear Den Cave; \*Carmoe Crevice Cave; Clough Cave; Crystal Sequoia Cave; Kaweah Monkeyflower Cave; \*Lange Cave; Lilburn Cave; Lost Soldier's Cave; \*May's Cave; Moorehouse Springs Cave; Paradise Cave; Sequoia National Park Mine (probably); Wiessraum Cave. **Tuolumne Co.:** McLean's Cave; Windler Cave. **Ventura Co.:** Clear Springs Cave.

**Comment:** This salamander is quite variable in coloration and has several subspecies. The subspecies *E. e. platensis* ("Sierra Nevada," brown above with orange spots) was reported from caves in Mariposa and Tulare counties and *E. e. xanthoptica* ("Yellow-eyed," brownish orange above, belly orange, yellow eye patch) from caves in the Mother Lode Region. The latter subspecies was collected in Cave of Skulls in 1853 by Isaac W. Baker (Danehy, 1952). The record of a "black and orange salamander" observed in 1971 by D. Quick, is probably *E. e. platensis*. Reardon's (1966) report of *E. e. croceator* from Tulare County caves may be a misidentification, since that subspecies is reportedly limited to Kern County (Behler and King, 1979). The Clear Springs Cave record (probably *E. e. eschscholtzi*) is from Chris Royce (D. Quick, pers. comm.). Stebbins (1949, 1954) reported the latter subspecies from "Sequoia Mine" in "Barber County" (there is no such county in California). We have provisionally placed that record in Sequoia National Park Mine, Tulare County, as the closest match to the name. Stebbins also reported *E. e. klauberi* from Eagle Lode Mine, San Diego County. In cold or dry weather the species retreats into caves, animal burrows, and crevices among rotted roots and logs.

**Bibliography:** Behler and King (1979); Bradford (2005); Briggs and Gpc (1975); Briggs and Ubick (1988); Campbell and Juarez (1979); Danehy (1952); Dearolf (1956); Despain (1994); Funkhouser (1949, 1950a, 1950b); Furuyama (1996); Graham (1963a); Healey (1991b); Hunter (2011b); Johnson, V. (1990); Kirschman (2003); Krejca (2006); Leissring (2001c); McDonald (2005); McLellan (1951); Mendoza (1981); Reardon (1966); Rogers (2003, 2005c, 2013b); Shear and Krejca (2007); Stebbins (1949, 1954); Weaver (2008); Zara Environmental (2009).

*Hydromantes brunus* Gorman (limestone salamander) (trogloxene)

**Record:** **Mariposa Co.:** unspecified caves.

**Comment:** This species is known only from limestone crevices and talus in Mariposa County. This is the only genus of salamander found in both the New and Old Worlds, although some researchers consider the European populations to belong to a separate genus (*Speleomantes*).

**Bibliography:** Johnson, V. (1990); Stebbins (1972).

*Hydromantes shastae* Gorman (Shasta salamander) (trogloxene)

**Records:** **Shasta Co.:** unspecified caves; small cave on Brock Mountain; limestone caves at the edge of Flat Creek Road in the narrow of Low Pass Creek (type locality); Ancient Palace Cave; Golinski Mine; Ground Zero Cave; \*Jacob David Cave; Lakelevel Cave; Potter Creek Cave; Samwel Cave.

**Comment:** This species is associated with limestone crevices and talus and prefers moist caves and fissures during dry weather. The female lays her eggs in crevices and broods the clutch. There is no aquatic larval stage.

**Bibliography:** Anonymous (1989a); Behler and King (1979); Broeckel, B. (2001h, 2003c, 2009a); Bury (1972); Bury, Fellers, and Ruth (1969); Cooper (1979); Danchy (1953); Dearolf (1956); Funkhouer (1951); Gorman (1954, 1956, 1964); Gorman and Camp (1953); Halliday (1962); Honneger (1970); Jackson, M. (1992, 2009); Johnson, V. (1990); National Park Service (2004); Roots (1974); Stebbins (1972); Sweet (1986); Wolff, L. (1984, 1993, 1994b); Wolff and Wolff (1990).

**Family Salamandridae (true salamanders and newts)**

*Taricha granulosa* (Skilton) (rough-skinned newt)

**Records:** **Siskiyou Co.:** Black Widow Cave; Creature Feature Cave; Sinking Waters Cave; Sisyphus Cave; Sky High Cave; Trail Junction Cave.

**Bibliography:** Broeckel, B. (1991c); Graening (2011c).

*Taricha rivularis* (Twitty) (red-bellied newt)

**Record:** **Mendocino Co.:** Negro Hole Cave.

**Comment:** Four were found just inside the dark zone among litter and in wall crevices, and five were found in the south passageway. This species is rarely seen.

**Bibliography:** Christianson and Coombs (1970); Halliday (1962).

*Taricha sierrae* (Twitty) (Sierra newt)

**Records:** **Calaveras Co.:** one unspecified cave; Bobcat Cave; Cataract Gulch Cave; Grapevine Gulch Cave; Porcupine Cave; Thunder Cavern; Wool Hollow Cave. **Fresno Co.:** Millerton Lake Cave System. **Mariposa Co.:** Bower Cave; Pool Pit. **Tuolumne Co.:** McLean's Cave; Snell's Cave; Windeler Cave.

**Comment:** An emaciated specimen was found dead in a pit trap in the lowest level of McLean's Cave (Elliott, 1978).

**Bibliography:** Anonymous (2011a); Christianson and Coombs (1970); Danehy (1952); Elliott (1978); Funkhouser (1951); Hargreaves (2014); McDonald (2012a); McEachern and Grady (1978); Mackey (2015); Rogers (2011b).

*Taricha torosa* (Rathke) (California newt)

**Records:** **Los Angeles Co.:** well near Santa Susana Pass. **Santa Cruz Co.:** Dolloff Cave; Empire Cave; IXL Cave. **Tulare Co.:** Deep Creek Cave; Lost Soldier's Cave.

**Bibliography:** Baumann (2004); Bogert (1930); Halliday (1962); Rogers (2013); Schmitz (2001).

**ORDER ANURA (frogs and toads)**

Undetermined

**Records:** **Amador Co.:** \*Moss Cave; \*Rippled Cave. **Calaveras Co.:** \*Bobcat Cave; \*Carlow's Cave; \*Cave City Cave; \*Cave of Skulls; \*Dragon's Breath Cave; \*Gastropod Cave; \*Heater Cave; \*Keith's Chasm; \*Lower Calaveras Natural Bridge; \*Moaning Cave; \*Two Bit Pit. **El Dorado Co.:** \*Hawver Cave. **Fresno Co.:** \*Millerton Lake Cave System. **Lassen Co.:** \*Eagle Lake Ice Cave. **Los Angeles Co.:** \*Falls Creek Cave. **Riverside Co.:** \*Cahuilla Creek Caves. **Shasta Co.:** \*unnamed cave in Grinch Caves cluster; \*Frog Cave. **Siskiyou Co.:** \*Battle Creek Cave No. 2; \*Elderberry Cave; \*Lost Glove Cave. **Tulare Co.:** \*Deep Creek Cave. **Tuolumne Co.:** \*Crystal Palace; \*McLean's Cave; \*Snell's Cave.

**Bibliography:** Baumann (2012, 2013b); Bischoff (1943); Chern (2014); Davis, S. (1942); Eastman (2011); Grile (2012); Hackman (1949); Healey (1991a); Hose (2001); Johnson, E. (1996b); Jones (1999); Keller (2009c); Lange (1954) McEachern and Grady (1978); Orr, P.C. (1952); Quick (1997c); Rogers, Russo, and Johnson (2010); Ross (2012); Russo (1999); Schmalenberger (2011); Schmitz (2001); Weaver (2007); Winterath (1971a); Wolff, J. (1981, 1982a); Wolff, L. (1997a, 1998a, 2003d, 2009a, 2012b).

**Family Bufonidae (true toads)**

Undetermined

**Records:** **San Bernardino Co.:** \*Afton Slot Canyon Cave. **Shasta Co.:** \*Cinder Pit Cave. **Siskiyou Co.:** \*Harris Mountain Cave.

**Bibliography:** Szukalski (2000a); Wolff, L. (2000a, 2001b, 2013c).

*Anaxyrus boreas halophilus* (Baird and Girard) (California toad)

**Records:** Amador Co.: \*Fiddler's Cave. Calaveras Co.: \*Shaw's Cave; \*Wool Hollow Cave. Siskiyou Co.: \*Catwalk Cave; \*Fern Cave.

**Bibliography:** Danchy (1952); Funkhouser (1951); Rogers (1990, 2000b).

**Family Hylidae** (treefrogs)*Pseudacris sierra* (Jameson, Mackey, and Richmond) (Sierran treefrog)

**Records:** Amador Co.: Black Chasm; Connie's Cave; Masonic Cave; Rippled Cave; \*Skeleton Cave; Soldier Creek Cave. Calaveras Co.: Bobcat Cave; Carlow's Cave; Cave City Cave; Cave of the Catacombs; Heater Cave; Mercer Caverns; Mercer's Big Pit; Shaw's Cave; Sink Cave; Two Bit Pit; Wool Hollow Cave. El Dorado Co.: Hawver Cave. Fresno Co.: Millerton Lake Cave System. Mariposa Co.: Bower Cave; Indian Cave. Napa Co.: Manhattan Mines. San Benito Co.: Bear Gulch Cave. San Diego Co.: Midnight Creek Cave. Shasta Co.: Christmas Tree Cave. Siskiyou Co.: Fern Cave; Harris Mountain Cave; Skunk Hollow Cave; Wahashin Cave.

**Comment:** This species was previously considered to be *P. regilla* (Baird and Girard) but study has shown that that species is restricted to the extreme northern coast of California north to Washington. This frog lives in the twilight zone and is usually found on flat walls, floors, and in corners. Up to 26 individuals were counted in Wool Hollow Cave. Lange (1951) summarizes a report of an "eyeless albino frog" in Anonymous (1881).

**Bibliography:** Anonymous (1881); Baumann (2013b); Bischoff (1943); Damon (1963b); Danchy (1952); Davis and Audisio (2007); Eastman (2011); Funkhouser (1951); Graham (1962d, 1963a, 1969c); Hackman (1949); Hargreaves (2007, 2013); Heusler (1996); Hopson (1949); Lange (1951); Peck (1967, 1974a); Rogers (1994a, 1999d); Rogers and Johnson (2012); Zara Environmental (2009).

**Family Ranidae** (true frogs)*Rana boylei* Baird (foothill yellow-legged frog)

**Record:** Mariposa Co.: Bower Cave.

**Comment:** Up to 22 individuals were seen congregating at patches of sunlight on the shore of the subterranean lake. No eggs or tadpoles were seen.

**Bibliography:** Graham (1969c).

**CLASS REPTILIA****ORDER TESTUDINES** (turtles)**Family Testudinidae***Ectynemys marmorata* (Baird and Girard) (northern western pond turtle)

**Record:** Mariposa Co.: Bower Cave.

**Bibliography:** Graham (1969c).

**ORDER SQUAMATA** (lizards and snakes)**SUBORDER ANGUIMORPHA****Family Anguidae** (alligator lizards, glass lizards, etc.)*Elgaria multicarinata multicarinata* (Blainville) (southern alligator lizard)

**Records:** Calaveras Co.: Barren Cave. Fresno Co.: Millerton Lake Cave System. Mariposa Co.: Bower Cave. San Bernardino Co.: Scaturd Cave.

**Bibliography:** Graham (1969c); Hargreaves (2007).

**SUBORDER LACERTILIA**

## Undetermined

**Records:** Riverside Co.: \*Cahuilla Creek Caves (dead).

**Bibliography:** Quick (1972, 1980a)

**Family Iguanidae***Sauromalus ater* Duméril (common chuckwalla)

**Record:** San Bernardino Co.: \*Cave C134.

**Bibliography:** Harper (1982b).



**Family Phrynosomatidae (spiny lizards, horned lizards, fence lizards)***Sceloporus* sp. (fence lizard)**Record:** Kern Co.: Harrington Cave.*Sceloporus occidentalis* Baird and Girard (western fence lizard)**Records:** Kern Co.: \*Harrington Cave. **Mariposa Co.:** Bower Cave. **Shasta Co.:** Subway Cave. **Siskiyou Co.:** Fern Cave.**Comment:** A semi-torpid lizard was clinging to the wall in the Bat Roost of Bower Cave.**Bibliography:** Graham (1969c); Hopson (1949).**Family Scincidae (skinks)***Plestiodon skiltonianus skiltonianus* Baird and Girard (western skink)**Record:** Mendocino Co.: Negro Hole Cave.**Bibliography:** Christianson and Coombs (1970).**SUBORDER SERPENTES (snakes)**

Undetermined

**Records:** Calaveras Co.: \*Crystal Stanislaus Cave. **Riverside Co.:** \*Cahuilla Creek Caves (dead).**Bibliography:** Collier (2005); Quick (1972a, 1980a).**Family Boidae (boas)***Charina bottae* (Blainville) (rubber boa)**Records:** Modoc Co.: \*unnamed lava tubes. **Siskiyou Co.:** Fern Cave; \*Sentinel Cave. **Tulare Co.:** \*Crystal Sequoia Cave.**Bibliography:** Benedict (1973); Krejca (2006); Rogers, Leissring, McDonald, Steiger, and Helton (2009).**Family Colubridae (colubrid snakes)***Coluber constricta mormon* Baird and Girard (western yellow-bellied racer)**Record:** Siskiyou Co.: Fern Cave.**Bibliography:** Benedict (1973).*Coluber lateralis lateralis* (Halowell) (California striped racer)**Record:** Siskiyou Co.: \*Sunbeam Pit.**Bibliography:** Rogers (1980).*Lampropeltis* sp. (kingsnake)**Records:** Amador Co.: \*unnamed sink near Santa Claus Cave. **Siskiyou Co.:** \*Snake Pit. **Tulare Co.:** \*Clough Cave; \*Lost Soldier's Cave.**Bibliography:** Krejca (2006); McBride (1971); Wolff, J. (1985b).*Lampropeltis californiae* (Blainville) (California kingsnake)**Record:** Calaveras Co.: Beta Cave.**Bibliography:** McEachern and Grady (1978).*Pituophis catenifer catenifer* (Blainville) (Pacific gopher snake)**Records:** Fresno Co.: Millerton Lake Cave System. **Mariposa Co.:** Bower Cave. **Siskiyou Co.:** Fern Cave; \*Paradise Alleys Cave; **Tulare Co.:** \*Packsaddle Cave; \*Wiessraum Cave.**Bibliography:** Baker (2008b); Benedict (1973); Ceditla (2007); Gale (1959); Graham (1969c); Hopson (1949); McDonald (2012b).*Trimorphodon lyrophanes* (Cope) (California lyre snake)**Record:** Riverside Co.: mine tunnel in the Riverside Mountains.**Comment:** This species was found on the floor of the mine tunnel with *Myotis velifer* wedged in its throat.**Bibliography:** Stager (1942).

**Family Natricidae (garter snakes, in part)***Thamnophis elegans elegans* (Baird and Girard) (western garter snake)**Records:** **Fresno Co.:** Millerton Lake Cave System. **Mariposa Co.:** Bower Cave. **Siskiyou Co.:** \*Yellow Tuber Cave.**Bibliography:** Graham (1969c); Hargreaves (2013); Wolff, L. (2008b).**Family Viperidae (vipers)***Crotalus* sp. (rattlesnake)**Records:** **Fresno Co.:** \*Church Cave; \*Millerton Lake Cave System; \*Windy Cliff Cave. **Kern Co.:** \*Harrington Cave (dead). **Riverside Co.:** \*mine tunnel in the Riverside Mountains. **San Bernardino Co.:** \*shallow pit in Pisgah Lava Flow; \*Glove Cave; \*Medicine Cave. **San Diego Co.:** \*Carey's Big Mud Cave. **Siskiyou Co.:** Despoiled Cave No. 1 and 2; Tin Can Alley.**Bibliography:** Anonymous (1971a, 1996a, 2009); DeLucia (1983, 1991, 1994); Dunn (2009); Furuyama (1997); Graening (2010); Harter (1997, 2011); Lee, R. (2001b); Quick (2003); Stager (1943a).*Crotalus oreganus helleri* Meek (Pacific rattlesnake)**Records:** \*new cave in Lava Beds National Monument. **Calaveras Co.:** \*Gray Pine Cave; \*Lost Piton Cave; \*Men Cave. **Mendocino Co.:** Negro Hole Cave. **Placer Co.:** \*Canyon Creek Cave. **Plumas Co.:** Juniper Cave. **Shasta Co.:** Potter Creek Cave. **Siskiyou Co.:** \*Bonzai Cave; \*Coyote Cave; \*Fern Cave; \*Foxhole Cave; \*Snake Pit. **Tulare Co.:** \*Deep Creek Cave; \*Palmer Cave. **Tuolumne Co.:** \*Crack of Doom Cave.**Bibliography:** Anonymous (1971b); Benedict (1973); Christianson and Coombs (1970); Dunn (2006); Jackson, M. (2003b, 2011a); Johnson, V. (1990); Leissring (2001a); Levin (2001, 2009); McDonald (2014); McEachern and Grady (1978); Rogers, Leissring, McDonald, Steiger, and Helton (2009); Wolff, J. (1985b); Wolff, L. (2006).**CLASS AVES (birds)**

Undetermined

**Records:** **Calaveras Co.:** Bay Cave (?bones); Bobcat Cave (?bones); \*Bone Cave; Cabin Cave (?bones); Cave of Skulls (recently dead); Fenceline Cave (?bones); Gray Pine Cave (?bones); Keith's Chasm (?bones); \*Upper Calaveras Natural Bridge. **El Dorado Co.:** \*Crystal Cosumnes Cave. **Inyo Co.:** \*Gneiss Cave (guano); \*Old Spanish Trail Cave; \*Shoshone Turk Cave; \*Sponge Cave. **Los Angeles Co.:** \*Vanowen Cave. **Riverside Co.:** \*Durnid Bat Caves. **San Bernardino Co.:** \*Bat Cave (guano); \*C10 Cave; \*Cima Cave (nest); \*Egg Cave (nest); \*Greene Canyon Mine; \*King Kong Cave (nest); \*Lost and Found Cave; \*Papoose Cave; \*Rainbow Cave (guano); \*Rat's Nest; \*Scaturd Cave; \*Slot Cave. **Santa Barbara Co.:** **Santa Cruz Island:** \*Big Sandy Beach Cave; \*Birdtracks Cave (tracks); \*Cave of the Bird's Eggs (eggs); \*Del Mar Cove Cave (nests); \*Dry Sandy Beach Cave. **Santa Cruz Co.:** \*Screeching Bird Sea Cave. **Shasta Co.:** \*Elk Antler Cave System; \*North Christmas Tree Cave. **Siskiyou Co.:** \*Airy Ice Cave; \*Bigfoot Cave; \*Birdnest Cave (nests); \*Cox Ice Cave (nest); \*Dock Yock Cave (nest); \*Duffy's Well; \*Guano Bridge; \*Skull Ice Cave (nest); \*Water Bridge Cave; \*Yellowjacket Ice Cave. **Tuolumne Co.:** McLean's Cave (?bones); Razorback Cave (?bones); Snell's Cave (?bones). **Ventura Co.:** Vanowen Bat Cave. **Anacapa Island:** \*The Aerie.**Bibliography:** Bosted (1991a, 2000); Broeckel, B. (2006d, 2010a, 2011b); Brown (1998, 2000); Bunnell (1984, 1988a, 1988b, 1993a, 1993b, 1999a); Chlor (2005); Halliday (2008); Larson (1990); Lee, R. (2001a); Orr (1951); Quick (1983, 1991, 1997a, 1997c, 1998a, 1998c); Rogers (1988, 1990a, 1999c); Snyder (1996a); Szukalski (2008a, 2008b); Wolff, L. (1991a).**ORDER ACCIPITRIFORMES****Family Accipitridae (hawks and eagles)***Accipiter striatus* Viellot (sharp-shinned hawk)**Record:** **Siskiyou Co.:** Upper Heppe Cave.*Haliaeetus leucocephalus* (Linnaeus) (bald eagle)**Record:** **Santa Barbara Co.:** **San Miguel Island:** Eagle Cave.*Buteo jamaicensis* (Gmelin) (red-tailed hawk)**Records:** **Mariposa Co.:** \*Bower Cave. **Unknown Co.:** \*cave utilized as a nest site by the California condor.**Comment:** Only an unused nest was observed in a niche below the cave rim.**Bibliography:** Graham (1969c); Snyder, Ramey, and Sibley (1986).

**Family Cathartidae (New World vultures)***Cathartes aura* (Linnaeus) (turkey vulture) (trogloxene)

**Records:** **Amador Co.:** \*Rippled Cave. **Calaveras Co.:** \*Cliff Cave; \*Keith's Chasm; \*Rex Cave. **Placer Co.:** \*two small caves in quarry south of Alabaster Cave. **San Bernardino Co.:** \*Egg Cave. **Siskiyou Co.:** \*Scorpion Cave; \*Wolverine Cave. **Tuolumne Co.:** \*Buzzard Cave; \*Scavenger Cave; \*Vulture Cave. **Unknown Co.:** \*six caves utilized as nest sites by the California condor.

**Bibliography:** Coffman (1998); Fiack (1978); Fisher (1971b); Frantz (2006); Graening (2010); Hesselden (1987); McEachern and Grady (1978); Snyder, Ramey, and Sibley (1986); Westberg (2009); Wolff and Wolff (1990).

*Gymnogyps californianus* (Shaw) (California condor) (trogloxene)

**Records:** **San Benito Co.:** \*shallow caves in Pinnacles National Monument. **San Luis Obispo Co.:** \*shallow caves. **Santa Barbara Co.:** \*shallow caves. **Ventura Co.:** \*caves; \*cave in Santa Paula Canyon; \*Condor Cave.

**Comment:** The species is endangered.

**Bibliography:** Anonymous (1980); Collins, Snyder, and Emslie (2000); Danehy (1952); Finley (1906, 1908); Koford (1953); Kohls and Hoogstraal (1960); McMillan (1968); Snyder and Hamber (1985); Snyder, Ramey, and Sibley (1986).

**ORDER GALLIFORMES****Family Odontophoridae***Oreortyx pictus* (Douglas) (mountain quail)

**Record:** **Siskiyou Co.:** Upper Heppe Cave.

**ORDER CHARADRIIFORMES (waders, gulls, auks)****Family Alcidae (auks)***Cephus columba* (Pallas) (pigeon guillemot)

**Records:** **Santa Barbara Co.:** **Santa Cruz Island:** **Santa Cruz Island:** \*Double Decker Cave; \*Pigeon Guillemots Cave; \*Shipwreck Cave.

**Bibliography:** Brooks (1996); Bunnell (1984, 1988b, 1998c, 1993b, 1999a).

*Cerorhinca moncerata* (Pallas) (rhinoceros auklet) (trogloxene)

**Record:** **San Francisco Co.:** **Farallon Islands:** \*Rabbit Cave.

*Ptychoramphus aleuticus* (Pallas) (Cassin's auklet) (trogloxene)

**Records:** **San Francisco Co.:** **Farallon Islands:** \*caves on Southeast Farallon Island.

**Comment:** This species lives in burrows in the floor of the caves.

**Bibliography:** Steiner (1989).

**Family Laridae (seagulls)**

Undetermined

**Record:** **Santa Barbara Co.:** **Santa Cruz Island:** \*Cave of the Bird's Eggs (carcass)

**Bibliography:** Bunnell (1993b).

**ORDER SULIFORMES****Family Phalacrocoracidae***Phalacrocorax pelagicus* Pallas (pelagic cormorant)

**Records:** **Santa Barbara Co.:** **Santa Cruz Island:** \*Bat Cave; \*Cave of the Swimming Cormorants; \*Cormorant Cave; \*Shipwreck Cave. **Ventura Co.:** **Anacapa Island:** \*Nesting Cormorant Cave; \*Wooden Lettuce Cave.

**Bibliography:** Brooks (1996); Bunnell (1988a, 1988b, 1988c, 1999a).

**ORDER STRIGIFORMES (owls)**

Undetermined

**Records:** **Inyo Co.:** \*ARC No. 1; Old Spanish Trail Cave. **Placer Co.:** \*Lime Rock Caves; \*Lime Rock Cave No. 5. **San Bernardino Co.:** \*A Cave; \*Owl Pellet Cave; \*Prospector's Cave; \*Scatard Cave. **Siskiyou Co.:** \*two-entrance cave at Gazelle (mummified); \*Fern Cave (pellets); \*Pluto's Cave (nest); \*S Canyon Cave; \*Yellowjacket Ice Cave. **Tulare Co.:** \*Palmer Cave.

**Bibliography:** Blanchard (1973, 1980); Broeckel, B. (1996b); Danehy (1952); Graening (2010); Grundy (2009); Halliday (1961b, 1962); Harter (2007); Hopson (1949); Tyler (1863); Wolff, J. (1990a); Wolff and Wolff (1999c, 2000).

**Family Strigidae (typical owls)**

*Asio flammeus* (Pontoppidan) (short-eared owl)

**Record:** Siskiyou Co.: \*Guano Bridge.

*Athene cunicularia* (Molina) (burrowing owl)

**Record:** San Francisco Co.: *Farallon Islands*: \*Corn Blind Cave.

**Bibliography:** Anonymous (2011c).

*Bubo virginianus* (Gmelin) (great horned owl)

**Records:** Inyo Co.: \*ARC No. 2. Siskiyou Co.: \*?Caldwell Ice Caves.

**Comment:** Owl pellets and a nest in the entrance area probably belong to this species.

**Bibliography:** Briggs and Gpc (1975); Taylor and Krejca (2006).

*Strix occidentalis* (Xantus) (spotted owl)

**Record:** Mariposa Co.: \*Bower Cave.

**Comment:** An owl was observed roosting in the bower over the entrance.

**Bibliography:** Graham (1969c); Grinnell and Storer (1924).

**Family Tytonidae**

*Tyto alba* (Scopoli) (barn owl)

**Records:** San Bernardino Co.: \*Owl 4 Cave. Siskiyou Co.: \*Caldwell Ice Caves; \*Flat Arch Cave; \*Fossil Cave; \*Guano Bridge; \*Lower Heppe Cave. Tuolumne Co.: \* White Owl Cave.

**Bibliography:** McDonald (2006); Rogers (1999c); Schmitz (1994).

**ORDER APODIFORMES**

**Family Apodidae (swifts)**

*Cypseloides niger* (Gmelin) (black swift)

**Records:** Monterey Co.: \*sea cave at Rocky Point. Santa Barbara Co.: *Santa Cruz Island*: \*Cave of the Sea Swifts.

**Bibliography:** Bunnell (1984, 1988c).

**Family Trochilidae (hummingbird)**

Undetermined

**Record:** Mariposa Co.: \*Bower Cave.

**Bibliography:** Graham (1969c).

**ORDER COLUMBIFORMES**

**Family Columbidae**

Undetermined (pigeon)

**Record:** Trinity Co.: \*Pigeon Cave.

**Bibliography:** Anonymous (1987a).

*Columba livia* Gmelin (rock dove)

**Record:** Trinity Co.: Lover's Leap Caves.

**Bibliography:** Briggs and Gpc (1975); Wolff and Wolff (1990).

*Zenaidura macroura* (Linnaeus)

**Record:** Siskiyou Co.: Upper Heppe Cave.

**ORDER PASSERIFORMES (perching birds)**

Undetermined

**Records:** Inyo Co.: \*Gneiss Cave. Tulare Co.: \*Paradise Cave.

**Bibliography:** Halliday and Ek (2009); Krejca (2006).



**Family Cinclidae (dippers)***Cinclus mexicanus* Swainson (dipper)**Records:** Calaveras Co.: \*Lower Calaveras Natural Bridge; \*Upper Calaveras Natural Bridge.**Comment:** This species of diving bird was nesting as late as 1979 in these two caves which bridge over Coyote Creek.**Bibliography:** Danchy (1952).**Family Corvidae***Corvus corax* Linnaeus (common raven)**Records:** Inyo Co.: \*ARC No. 1. Siskiyou Co.: \*?Dock Yock Cave; \*Guano Bridge (nest); \*Lower Heppe Cave; \*Yellowjacket Ice Cave (nests). Tulare Co.: \*Crystal Sequoia Cave. Unknown Co.: \*caves utilized as nest sites by the California condor.**Bibliography:** Rogers (1990a, 1999c); Snyder, Ramey, and Sibley (1986); Wolff and Wolff (1999).**Family Emberizidae**

Undetermined (sparrow)

**Record:** Siskiyou Co.: \*Red Tape Cave.**Bibliography:** Wolff, L. (2013c).*Junco hyemalis* (Linnaeus) (dark-eyed junco)**Record:** Siskiyou Co.: \*Red Tape Cave.**Bibliography:** Wolff, L. (2013c).**Family Fringillidae (finches and allies)***Leucosticte atrata* Ridgway (black rosy finch)**Record:** Siskiyou Co.: \*?Upstairs-Downstairs Cave.**Comment:** Scattered among the colony of *L. tephrocotis* were darker individuals that may be *L. atrata*, but positive identification was uncertain lacking specimens.**Bibliography:** Suggett (1982).*Leucosticte tephrocotis littoralis* Baird (gray-crowned rosy finch) (trogloxene)**Records:** Siskiyou Co.: \*Marble Gap Cave; \*Upstairs-Downstairs Cave.**Comment:** This subspecies was observed roosting in the upper cliff entrance of Upstairs-Downstairs Cave during the winters of 1980 and 1981. By March of each year they vacate the cave and migrate.**Bibliography:** Suggett (1982).**Family Hirundinidae (swallows and martins)**

Undetermined

**Records:** Santa Barbara Co.: *Santa Cruz Island*: \*Bat Cave. Siskiyou Co.: \*Boulevard Cave. Tuolumne Co.: \*Crystal Tuolumne Cave (nests).**Bibliography:** Bunnell (1988a, 1988c); Fiack (1978); Snyder (2003); Taylor and Krejca (2006).*Hirundo rustica* Linnaeus (barn swallow)**Records:** Amador Co.: \*Chrome Cave. Mariposa Co.: \*Fissure Cave; \*Bower Cave.**Comment:** All three caves were utilized as nesting sites.**Bibliography:** Graham (1969c); Grinnell and Stower (1924).*Petrochelidon pyrrhonota* (Vieillot) (cliff swallow)**Records:** Amador Co.: \*Black Chasm. Mariposa Co.: \*Bower Cave. Shasta Co.: \*Potter Creek Cave. Siskiyou Co.: \*Cricket Cave; \*Fern Cave; \*Yellowjacket Ice Cave.**Comment:** Nests were noted in Bower Cave in 1979.**Bibliography:** Briggs and Gpc (1975); Danchy (1952); Graham (1969c); Grinnell and Stower (1924); Sinclair (1904); Wolff, L. (1993, 1994b); Wolff and Wolff (1999).*Progne subis* (Linnaeus) (purple martin)**Records:** Siskiyou Co.: \*Fern Cave; \*Fossil Cave; \*Skull Ice Cave.

**Comment:** This species was reported nesting in Fern Cave and Fossil Cave.

**Bibliography:** Danchy (1952); Gale (1959); Hopson (1949); Johnson, V. (1990).

**Family Mimidae**

*Toxostoma crissale* Henry (crissal thrasher)

**Record:** San Bernardino Co.: \*Mitchell Caverns.

**Family Paridae**

*Poecile gambeli* Ridgway (mountain chickadee)

**Record:** Siskiyou Co.: \*Adam's Homestead Cave.

**Family Troglodytidae (wrens)**

Undetermined

**Record:** Shasta Co.: \*Potter Creek Cave.

**Bibliography:** Sinclair (1904).

*Catherpes mexicanus* (Swainson) (canyon wren)

**Records:** Mariposa Co.: \*Bower Cave. **Siskiyou Co.:** \*Lower Heppe Cave; \* Crystal Ice Cave. **Tuolumne Co.:** \*Vulture Cave.

**Bibliography:** Briggs and Gpc (1975); Graham (1969c).

*Salpinctes obsoletus* (Say) (rock wren)

**Record:** Mariposa Co.: \*Bower Cave.

**Bibliography:** Briggs and Gpc (1975).

**Family Turdidae**

*Sialia mexicana* Swainson (western bluebird)

**Record:** Amador Co.: \*Black Chasm.

**Bibliography:** Danchy (1952).

**Family Tyrannidae (flycatchers)**

*Sayornis nigricans* (Swainson) (black phoebe)

**Records:** Calaveras Co.: \*Lower Calaveras Natural Bridge. **Inyo Co.:** \*Wallboard Cave. **Mariposa Co.:** \*Bower Cave.

**Comment:** Lower Calaveras Natural Bridge and Bower Cave were used as nesting sites.

**Bibliography:** Graham (1969c).

**CLASS MAMMALIA (mammals)**

**ORDER INSECTIVORA (insectivores)**

**Family Soricidae (shrews)**

*Sorex monticulus* Merriam (shrew)

**Records:** Calaveras Co.: Porcupine Cave. **Fresno Co.:** Church Cave. **Mariposa Co.:** Bower Cave. **Tuolumne Co.:** Crystal Palace.

**Comment:** The first and last records are from 1979. Shrews were found inhabiting leaf litter in Bower Cave. Steve Fairchild reported to the California Speleological Survey that shrews used to inhabit Church Cave but they are no longer there (D. Quick, pers. comm.).

**Bibliography:** Graham (1969c).

**Family Talpidae (moles)**

*Scapanus latimanus* (Bachman) (broad-footed mole)

**Records:** Mariposa Co.: \*Bower Cave. **Tuolumne Co.:** \*Gate Pit Cave.

**Comment:** A dead individual was found at the bottom of the entrance of Gate Pit Cave in 1979. Graham observed mole tunnels in the terrace at Bower Cave.

**Bibliography:** Graham (1969c); Jackson, H.H. (1915).

**ORDER RODENTIA (rodents)**

## Undetermined

**Records:** **Calaveras Co.:** \*Mercer Caverns. **Fresno Co.:** \*Church Cave; \*Millerton Lake Cave System (decomposing carcasses). **Humboldt Co.:** \*large earth crack just north of Trinidad (dead). **Inyo Co.:** \*Defense Cave; \*Gneiss Cave (scat). **Kern Co.:** \*Bodfish Cave; \*Popcorn Pit. **San Bernardino Co.:** \*Bat Cave (scat); \*Owl Canyon Cave; \*Rainbow Cave; \*Scatard Cave; \*Striped Waterfall Hole (scat). **San Diego Co.:** \*Rat Cave. **Shasta Co.:** Christmas Tree Cave; Elisha Cave; Mad Hatter Cave; Rusty Cave. **Siskiyou Co.:** Big Ice Cave; \*Forrest's Cave (scat); \*Skunk's Tail Cave (scat). **Tulare Co.:** \*Cat Leg Cave (scat); \*Clough Cave; \*Pet Cemetery Cave; \*Speas View Shelter (scat); \*Windy Pit.

**Bibliography:** Anonymous (1983); Broeckel, B. (2011e); Bunnell and Vesely (1984); Graening (2010); Hackman (1949); Halliday (1962, 2008); Halliday and Ek (2009); Kuo (2008); Krejca (2006); Quick (1983, 1991, 2003); LaForge (1976); Sundquist (2011); Szukalski (1998b, 2000b, 2008a, 2008b, 2011).

**Family Aplodontidae (mountain beaver)***Aplodontia* sp.

**Record:** **Siskiyou Co.:** Urin Heaven Cave.

**Family Cricetidae***Neotoma* sp. (woodrats) (trogloxene)

**Records:** **Amador Co.:** \*Fern Frond Cave (nests); \*Lulu Bell Cave; \*Masonic Cave (evidence); \*Mushroom Cave; \*Rat Condo Cave; \*Santa Claus Cave. **Calaveras Co.:** \*Cave City Cave; \*Gastropod Cave; \*Grapevine Gulch Cave; \*Keith's Chasm; \*Porcupine Cave; \*Scat Cave; \*Wool Hollow Cave (nests). **Contra Costa Co.:** \*rockshelters on Carquinez Strait shoreline. **Fresno Co.:** \*artificial feature near Darwin; \*Bat Cave; \*Boyden Cave; \*Church Cave; \*Maze Cave; \*Millerton Lake Cave System; \*Rat Turd Cave; \*Windy Cliff Cave. **Inyo Co.:** \*ARC No. 1; ARC No. 2; \*Crack-'n-Mound Cave; \*Defense Cave; \*Dirty Crack Cave; \*Furnace Cave; \*Keane Travertine Cave; \*Mountain Springs Cave; \*No Snakes Cave; \*Shoshone Turk Cave; \*Sponge Cave; \*Titus Canyon Cave; \*Wallboard Cave. **Kern Co.:** \*Harrington Cave. **Lassen Co.:** \*Packrat Cave. **Modoc Co.:** \*Damon's Cave (nest). **Napa Co.:** \*Clay Cave (scat). **Plumas Co.:** Juniper Cave (nests). **San Benito Co.:** \*Balconies Cave; \*Bear Gulch Cave. **San Bernardino Co.:** \*cave in mine on west side of Kokoweef Peak" (dead); \*Afton Canyon Caves; \*B Cave; \*Box Flap Shelter; \*C10 Cave; \*Arch Cave (amberat); \*Cactus Cave (nest); \*Cat House Cave (amberat); \*Cima Cave; \*Clark Mountain Cave; \*Classroom Cave; \*Dusty Cave; \*Egg Cave; \*Glove Cave; \*Green Canyon Mine; \*Lost and Found Cave; \*Papoose Cave; \*Peggy 5 Cave; \*Prick Me Cave (midden); \*Prickling Cave (midden); \*Rat's Nest (scat/midden); \*Room With A View (midden); \*Slot Cave; \*Stark Shelter (scat/midden); \*Toni Rowe's Cave; \*Tuckered Cave (scat); \*Wind Breaker Crack (middens). **San Diego Co.:** \*Midnight Creek Cave. **Santa Clara Co.:** \*Joaquin Murrieta's Cave. **Santa Cruz Co.:** \*unnamed cave near Davenport; \*Bat Cave; \*Coral Grotto; \*Empire Cave (nest); \*Stump Cave. **Shasta Co.:** \*Ancient Palace Cave; \*Animal Den (nest); \*Cascadia Cave; \*Casel Lava Tube (scat and nests); \*Cinder Pit Cave (nest); \*Dead Wood Cave; \*Discovery 1 Cave (dead); \*Ebb & Flo Cave (nest); \*Enchanted Chimney Cave (nest); \*Folded Cave (nest); \*Glazier Cavern (nests); \*Hole-of-the-Bear; \*Jay Feather Cave (midden); \*Mad Hatter Cave (nest); \*Millipede Cave (nest); \*Nine Lives Cave (nests); \*North Christmas Tree Cave; \*Packrat Cave (nest); \*Pecan Cave (nest); \*Pinchbug Cave (nest); \*Potter Creek Cave; \*Rusty Cave; \*Sandman Cave (nest); \*Subway Cave (nest); \*Sweet Sinkers. **Sierra Co.:** \*Avalanche Cave. **Siskiyou Co.:** \*two-entrance cave at Gazelle (nest); \*Adam's Homestead Cave; \*Alarming Extension; \*aMazing Cave (nest); \*Angleworm/Lost Pinnacle Cave (nest); \*Apogee Cave; \*Arch Cave No. 1 (nest); \*Arch Cave No. 2; \*Bear Tooth Pit (nest); \*Beebowl Cave (scat); \*Beetle Cave (nests); \*Blowing Hole Cave (nest); \*Caldwell Ice Caves (nest); \*Catacombs Cave (nest); \*Checkout Cave (midden); \*Cold Water Cave (midden); \*Cox Ice Cave (nest); \*Craig Cave; \*Despoiled Cave No. 1 and 2; \*Dock Yock Cave (nest); \*Duffy's Well; \*Easy Street Cave (scat); \*Elderberry Cave (nest); \*Fern Cave; \*Flat Rat Cave; \*Flush Cave (scat); \*Fossil Cave; \*Freudian Complex (nests); \*Glacier Cavern; \*Go Worm Cave (sign); \*Harris Mountain Cave; \*Hercules' Leg/Juniper Cave Lava Tube System (nest); \*Hopkins Chocolate Cave (nest); \*Incline Cavern; \*Jack Jones Ice Cave; \*Jibili Cave (scat); \*Just a Room Cave (nest); \*Labyrinth Cave System; \*Lost Glove Cave (midden); \*Low Blow Cave (nest); \*Maze Cave (scat); \*Merrill Ice Cave; \*Monkeyface Cave (midden); \*Planetary Dairy Cave; \*Pluto's Cave (evidence); \*Pool Parlor Cave (nest); \*Rat Cave (nest); \*Rat Castle Cave (midden); \*Red Tape Cave; \*Rollercoaster Cave (scat); \*Rollerdrome (nests); \*Skull Ice Cave; \*Skunk Hollow Cave; \*Spider Cave; \*Stiletto Cave; \*Stinking Cave (nest); \*Sugar Pine Butte Ice Cave; \*Two Hammer Hole; \*Uncle Fester's Cave (nest); \*Upper Heppe Cave; \*Water Caves Complex Cave (midden); \*Wolfe Den (nest); \*Yellow Tuber Cave (midden). **Trinity Co.:** \*Paul Gibson Cave. **Tulare Co.:** \*Cirque Cave; \*Deep Creek Cave; \*Flowstone Wall Pit; \*Harry's Bend Cave; \*Hidden Cave; \*Overhang Cave; \*Popcorn Pit (scat); \*Rattlesnake Cave; \*Seldom Seen Cave; \*Upper Bryant Cave; \*Ursa Minor Cave; \*White Chief Cave. **Ventura Co.:** \*Clear Springs Cave.

**Comment:** With the exception of Rat Cave, a littoral cave in San Diego County, all records of rats are presumed to belong to *Neotoma*, and most are probably *N. cinerea*. Mineralized urine, termed "amberat," has been observed in many caves. Packrats may deposit urine trails in caves and use them to find their way in the dark by smell. Amberat deposits may range in color from clear yellow through brown and red to black. Spontaneously combusted amberat has left gray ash on floors

and ceiling soot containing minerals which only form at high temperature in at least one cave (Briggs and Gpc, 1975).

**Bibliography:** Anonymous (1958, 1982, 1998a, 1999b, 1999c, 2009); Bradford (2005); Baumann (2011); Briggs and GPC (1975); Broeckel, B. (1990, 1991b, 1994a, 1994b, 1998b, 1999a, 2000a, 2000b, 2000c, 2000d, 2001b, 2001c, 2001g, 2006a, 2006b, 2007b, 2008c, 2010b, 2011d, 2012c, 2012g); Carlon (2014); Chlor (2005); Damon (1963b); Given (1956); Graening (2010, 2011c); Graham (1963b); Harper (1982a, 1986); Harter (1990); Hildebrand (1991); Howells and Milbourne (1970); Jackson, G.F. 1965); Jorgensen (2013); Kisling (1994); Koehn (1995); Krejca (2006); Lange (1954); Larson (1990); Leissring (2001b); Logan (1998); McDonald (2009); McEachern and Grady (1978); McLane (1963); Miller, B. (2008); Miller, R. (1987b); Miller and Wolff (1989); Moore, G.W. (1964); Quick (2001a); Rogers (1983b, 1990a, 1988, 1999b, 1999e, 2000d); Rogers and Rice (1991, 2000); Russo (1996); Sharp (1990, 2000a, 2008, 2009); Sinclair (1904); Sowers (1990b); Sundquist (1993, 1994); Szukalski (2005a, 2005b, 2009); Taylor and Krejca (2006); Taylor, Krejca, and Jacoby (2006); Tinney (2013); Wolff, J. (1985a, 1990a, 2001); Wolff, L. (1990b, 1991a, 1997c, 1998c, 1999c, 2000b, 2001b, 2002b, 2003d, 2004a, 2004b, 2004c, 2006, 2008b, 2009a, 2011a, 2011b, 2011c, 2012a, 2012b); Wolff and Wolff (1992, 2001); Zacharda and Elliott (1985).

*Neotoma cinerea* (Ord) (bushy-tailed woodrat) (trogloxene)

**Records:** **Siskiyou Co.:** Bighorn Cave; Blue Grotto; Catacombs Cave; Crystal Ice Cave; Hercules' Leg/Juniper Cave Lava Tube System; Labyrinth Cave System; Lava Brook Cave; Marble Gap Cave; Mushpot Cave; Planetary Dairy Cave; Sentinel Cave; Sunshine Cave; Tichnor Cave/Bertha's Cupboard Cave; Thunderbolt Cave; Upstairs-Downstairs Cave; Valentine Cave.

**Comment:** Stark and Kinney (1969) and Nelson and Smith (1976) studied the effects of a plague epizootic on the Lava Beds packrats. Numerous fleas, mites, and insect larvae were collected from the nests of this species. Nest materials have also been observed in Trail Junction Cave, Marble Mountains. Suggett (1982) reported the subspecies *N. C. pulla* Hooper from the Marble Mountains caves and noted that den sites were virtually islands for invertebrate populations. Den sites are often abandoned, perhaps because of plague. Suggett also noted a regression of moonmilk deposits in the Creamery and den site sections of Planetary Dairy Cave after the den site was abandoned.

**Bibliography:** Graham (1962c, 1963a); Hemphill and Suggett (1978); Johnson, V. (1990); Murray and Barnes (1969); Nelson and Smith (1976); Stark and Kinney (1969); Suggett (1982).

*Neotoma fuscipes* Baird (dusky-footed woodrat) (trogloxene)

**Records:** **Calaveras Co.:** Barren Cave; Bobcat Cave; Cave of Skulls. **Inyo Co.:** Lower Shoshone Cave; Upper Shoshone Cave (carcasses). **Mariposa Co.:** Bower Cave. **Monterey Co.:** \*Willow Creek Cave. **Siskiyou Co.:** caves 18 km northeast of Weed. **Tulare Co.:** Crystal Sequoia Cave.

**Comment:** Staphylinid beetles often are found near nests (Graham, 1963b). In northeastern California this species overlaps the range of *N. cinerea*, but typically *N. fuscipes* builds lodges among thickets while *N. cinerea* nests in rock crevices and caves (Murray and Barnes, 1969).

**Bibliography:** Briggs and Gpc (1975); Despain (1994); Johnson, V. (1990); McFarlane (1990); Graham (1963b, 1969c); Hall and Kelson (1959); Krejca (2006); McFarlane (1990); Murray and Barnes (1969); Oberhansley (1946); Reardon (1966); Rogers (2005e); Sherwood (1957a); Sinclair (1904).

*Neotoma lepida* Thomas (desert woodrat)

**Records:** **Inyo Co.:** Poleta Cave. **San Bernardino Co.:** Mitchell Caverns; Newberry Cave (middens). **San Luis Obispo Co.:** sandstone cave on NW edge of Carrizo Plain.

**Bibliography:** Aalbu (1990); Aalbu and Andrews (1985); Aalbu, Smith, and Triplehorn (2012); Davis and Smith (1981); McDonald (2002); Orr, R.T. (1954); Peck and Gnaspini (1997).

*Peromyscus* sp. (trogloxene)

**Records:** **Calaveras Co.:** \*Carlow's Cave (dead). **Fresno Co.:** \*Millerton Lake Cave System. **Mariposa Co.:** \*Bower Cave. **Modoc Co.:** \*Cracker Cave. **Riverside Co.:** \*Cahuilla Creek Caves. **San Bernardino Co.:** \*C10 Cave; \*King Kong Cave; \*Medicine Cave; \*Scaturd Cave. **Shasta Co.:** \*Discovery 1 Cave. **Siskiyou Co.:** \*Angleworm/Lost Pinnacle Cave (scat); \*Arch Cave No. 2 (scat); \*Catacombs Cave; \*Cox Ice Cave; \*Fern Cave (scat) \*Hanging Ledges Cave (nest); \*Incline Cavern (scat); \*Merrill Ice Cave (scat); \*Mushpot Cave (scat); \*Spider Cave (scat); \*Upper Heppe Cave; \*Valentine Cave (scat); \*Wolfe Den (dead). **Santa Cruz Co.:** \*IXL Cave. **Tulare Co.:** \*Crystal Sequoia Cave; \*House Cave; \*Lost Soldier's Cave (dead); \*Ursa Minor Cave. **Tuolumne Co.:** \*Crystal Palace (dead). **Ventura Co.:** \*Clear Springs Cave.

**Comment:** All records of mice are presumed to belong to *Peromyscus*.

**Bibliography:** Broeckel, B. (2011c); Brown (1998); di Falco (1989); Dunn (2009); Gale (1959); Graham (1969c); Hargreaves (2012, 2013); Kirschman (2003); Lee, R. (2001b); Moore, M. (1986); Oberhansley (1946); Quick (1972a, 1980a);



Rogers (1993, 1994b); Schmitz (1996b); Taylor and Krejca (2006); Wolff, J. (1997, 1998; Wolff, L. (2011c); Yoder (1998, 2000).

*Peromyscus boylii* (Baird) (brush mouse) (trogloxene)

**Records:** Shasta Co.: Ancient Palace Cave. Tulare Co.: Crystal Sequoia Cave; Lost Soldier's Cave.

**Comment:** Mice were collected deep within both caves.

**Bibliography:** Briggs and Gpc (1975); Despain (1994); Krejca (2006); National Park Service (2004); Reardon (1966).

*Peromyscus crinitus* (Merriam) (canyon mouse) (trogloxene)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Bibliography:** Nelson and Smith (1976); Stark and Kinney (1969).

*Peromyscus maniculatus* (Wagner) (deer mouse) (trogloxene)

**Records:** Siskiyou Co.: \*Bighorn Cave; \*Hercules' Leg/Juniper Cave Lava Tube System; \*Planetary Dairy Cave; \*Upstairs-Downstairs Cave. Tulare Co.: \*Crystal Sequoia Cave. Tuolumne Co.: McLean's Cave.

**Comment:** Elliott (1978) erroneously reported this species as *Rattus norvegicus* (Bekenhout). Three specimens that had been raiding baited pit traps in the cave were collected in total darkness. The records from the Marble Mountains apparently are of scat only, observed in the dark zones of three caves (Suggett, 1982).

**Bibliography:** Briggs and Gpc (1975); Despain (1994); Elliott (1978); Nelson and Smith (1976); Oberhansley (1946); Reardon (1966); Stark and Kinney (1969); Suggett (1982).

*Rattus norvegicus* (Berkenhout) (brown rat)

**Record:** San Diego Co.: Thunder Canyon Cave System (dead)

**Bibliography:** Baker (2008a).

#### Family Erethizontidae (porcupines)

*Erethizon dorsatum* (Linnaeus) (porcupine) (trogloxene)

**Records:** Amador Co.: \*Fern Frond Cave (scat); Fiddler's Cave; \*Porcupine Cave. Calaveras Co.: \*small hole near Natural Bridge; \*Buckeye Cave; \*Cave City Cave; \*Cave of the Catacombs; \*Cave of the Quills (quills); \*Gleibe's Cave (remains); \*Porcupine Cave; \*Scat Cave; \*Sink Cave; \*Slab Cave; \*Winzerr Cave (quills). Fresno Co.: \*unnamed cave in Kings Caverns Geological Area (quills, scat). Lassen Co.: \*Indian Cave. Plumas Co.: \*Indian Cave. Shasta Co.: \*Bat Cave; Fair Dinkum Cave; Jeffrey Pine Cave; Pecan Cave; \*Samwel Cave. San Bernardino Co.: \*Scaturd Cave. Siskiyou Co.: \*Nother Cave (quills, scat); \*aMazing Pits (remains); \*Barnum/Sand Caves System (dead); \*Beebowl Cave (scat); \*Blue Bucket Cave (scat); \*Coral Reef Cave (quills); \*Jibili Cave (scat); \*Planetary Dairy Cave; \*Skunk's Tail Cave; \*Traffic Jam Cave; \*Windy Cave. Trinity Co.: \*Forest Glen Caves. Tuolumne Co.: \*Crystal Palace; \*Indian Quarry Cave No. 1; \*Porcupine Cave; \*Porcupine Skull Cave.

**Bibliography:** Anonymous (1965, 1990a); Bridgemon (1974); Briggs and Gpc (1975); Broeckel, B. (1991b, 2002a, 2008a, 2008b); Given (1956); Graham (1962e); Halliday (1961b); Johnson, V. (1990); McEachern (1968); McEachern and Grady (1978); Rogers (1983b, 1994a, 1999d); Suggett (1982); Taylor and Krejca (2006); Whitfield (1963, 1965); Winterath (1971); Wolf, J. (1989); Wolf, L. (1998c, 2003b, 2004b, 2006, 2009b); Zerr (1970).

#### Family Geomyidae (gophers)

*Thomomys* sp. (pocket gopher)

**Records:** Siskiyou Co.: Bighorn Cave; Marble Gap Cave; Planetary Dairy Cave; Upstairs-Downstairs Cave.

**Bibliography:** Suggett (1982).

#### Family Heteromyidae

*Dipodomys* sp. (kangaroo rat)

**Records:** Siskiyou Co.: \*Fern Cave; \*Golden Dome Cave (dead).

**Bibliography:** Benedict (1973).

#### Family Sciuridae (squirrels and chipmunks)

Undetermined (chipmunk)

**Record:** Siskiyou Co.: \*Airy Ice Cave.

**Bibliography:** Broeckel, B. (2010a).

*Callospermophilus lateralis* (Say) (golden-mantled ground squirrel)

**Record:** Siskiyou Co.: caves in Lava Beds National Monument.

**Bibliography:** Stark and Kinney (1969).

*Eutamias townsendii siskiyou* Howell (Townsend's chipmunk)

**Record:** Siskiyou Co.: \*Duffy's Well; Upstairs-Downstairs Cave.

**Comment:** This species was found in the entrance zone.

**Bibliography:** Larson (1990); Suggett (1982).

*Marmota* sp. (marmot)

**Records:** Lassen Co.: \*Indian Cave. Mono Co.: \*Sticks and Stones Cave. Tulare Co.: \*Marmot Highway Cave; \*Seldom Seen Cave; \*White Chief Cave.

**Bibliography:** Audisio (2009a); Given (1956); Szukalski (2008b).

*Neotamias* sp. (chipmunk)

**Records:** Shasta Co.: \*Subway Cave. Siskiyou Co.: \*Apogee Cave; \*Harris Mountain Cave.

*Otospermophilus beecheyi* (Richardson) (California ground squirrel)

**Record:** Mariposa Co.: Bower Cave.

**Bibliography:** Graham (1962c, 1969c).

*Sciurus (Hesperosciurus) griseus* Ord (western gray squirrel)

**Record:** Calaveras Co.: Mercer Caverns.

**Bibliography:** Rogers and Legg  (1987, 1995).

**ORDER LAGOMORPHA (rabbits, hares, pikas)**

Undetermined

**Records:** Kern Co.: \*Dragon's Wing Cave. Siskiyou Co.: \*Cellar Cave; \*Mushpot Cave; \*Rollerdrome; \*Snake Pit (cass); \*Windy Cave.

**Bibliography:** Broeckel, B. (1991a); Quick (2000a); Rogers and Rice (1991, 2000); Wolff, J. (1985b).

**Family Leporidae (rabbits and hares)***Lepus americanus* (snowshoe hare)

**Record:** Siskiyou Co.: caves in the Marble Mountains Wilderness; \*Mushpot Cave (scat).

**Comment:** Tracks are often seen in the snow leading into entrances.

**Bibliography:** Suggett (1982); Taylor and Krejca (2006).

**Family Ochotonidae (pikas)***Ochotona princeps* (Richardson) (pika)

**Records:** Inyo Co.: \*Brownstone Cave. Siskiyou Co.: \*Boulevard Cave (scat); \*Jibili Cave (scat); \*Merrill Ice Cave; \*Thunderbolt Cave; \*Twin Falls Cave; \*Upper Heppe Cave (scat).

**Bibliography:** Gale (1959); Szukalski (2004a); Taylor and Krejca (2006); Wolff, L. (2006).

**ORDER CHIROPTERA (bats)**

Undetermined

**Records:** Amador Co.: \*Collapse Cave; \*Connie's Cave; \*Fiddler's Cave; \*Oak Tree Cave; \*Rippled Cave; \*Skeleton Cave. Calaveras Co.: \*Bobcat Cave; \*Carlow's Cave; \*Carlow's Bat Cavern; \*Cave City Cave; \*Crystal Stanislaus Cave; \*Dragon's Breath Cave; \*Heater Cave; \*Music Hall Cave; \*Porcupine Cave; \*Rabbit Hole; \*Sink Cave; "three-entrance cave up from Natural Bridge"; \*Wool Hollow Cave. El Dorado Co.: \*Alabaster Cave. Fresno Co.: Church Cave; \*Hour Glass Cave; \*unnamed cave in Kings Caverns Geological Area; \*Windy Cliff Cave. Inyo Co.: \*Big Dusty Cave; \*Pebble Stash Cave; \*lava cave on Crater Mountain; \*Mountain Springs Cave; \*Roosevelt Wells Mine; \*Shoshone Turk Cave; Tale Mines at Saddle Park Hills; Tecopa Soil Pipe Caves. Kern Co.: \*abandoned mines in Caliente Canyon; \*Bodfish Cave; \*Harrington Cave; \*Rincon Rift (guano); \*Upper and Middle Greenhorn Caves; \*Walker's Cave. Los Angeles Co.: Black Cargo Mine; Emma Annex Mine. Mariposa Co.: \*Bower Cave; \*Last Chance Adit (guano); Prospect Adit, Star Mine

(guano). **Modoc Co.:** \*Cracker Cave. **Riverside Co.:** Cahuilla Creek Caves; \*Durmid Bat Caves. **San Benito Co.:** \*Balconies Cave. **San Bernardino Co.:** \*A Cave; \*Afton Slot Canyon Cave; \*Arrastre Canyon Caves; \*B Cave; \*Cave of the Winding Stair; \*Cima Cave; Owl 3 Cave; \*Medicine Cave; \*Mitchell Caverns; \*Owl Canyon Cave; Rainbow Talc Mine. **San Diego Co.:** \*Carey's Big Mud Cave; \*Crusher Cave; \*Midnight Creek Cave; \*Thunder Canyon Cave System; \*Warner's Cave. **Shasta Co.:** \*unnamed cave below Potter Creek Cave; \*pit at Potter's Creek; \*unnamed mine, Section 16 (guano); \*1074 Mine No. 2 (guano); \*Ajax Mine No. 2 (guano); \*Argus Cave; \*Big Cave; \*Branch Pit Cave; \*Burnt Elderberry Cave; \*Cinder Pit Cave (guano); \*Critter Cave; \*Davis Gulch (Three Amigos) Mine (guano); \*Discovery 3 Cave; \*Dock Yock Cave; \*Enchanted Chimney Cave; \*Franklin Mine No. 10 (guano); \*Gamin Adit No. 3 (guano); \*Goonie's Cave (moth wings); \*Hourglass Cave; \*Jacob David Cave; \*Lakelevel Cave; \*Mad Hatter Cave; \*Milkmaid Mine No. 2 (guano); \*Modesty Gulch Mine No. 2 (guano); \*Camp Mine Upper Adit (guano); \*Orus District Mine No. 4 (guano); \*Orus District Mine No. 5 (guano); \*Popcorn Cave; \*Potter Creek Cave; \*Rattlecane Cave; \*Razorback Cave (moth wings); \*Riley's Cave; \*Samwel Cave; \*Sandfill Cave; \*Scorpion Mine Complex No. 2 (guano); \*Subway Cave; \*Sunday Morning Coffee Cave; \*Sweet Sixteen Cave. **Sierra Co.:** \*Avalanche Cave. **Siskiyou Co.:** \*unnamed cave across road from Catcombs Cave; \*small cave near Insanity Culvert Cave; \*Barnum/Sand Caves System; \*Bat Cave No. 1; \*Beestro Cave; \*Beaconlight Cave; \*Bend of the Skylight Cave; \*Bigfoot Cave; \*Billibee's Cave; \*BLM Cave (guano); \*Broken Ladder Cave; \*Brushy Hole; \*Caldwell Ice Caves; \*Camilla's Cavern; \*Catacombs Cave; \*Checkout Cave (guano); \*Cherry Hill Mine No. 1 (guano); \*Cox Ice Cave (guano); \*Dance Hall Cave; \*Dragon Cave; \*Dragon's Head Cave; \*Four Balcony Pit Cave; \*Gigantopithecus Cave; \*Hercules' Leg/Juniper Cave Lava Tube System; \*Hourglass Lava Tube; \*Huey Mine No. 1 (guano); \*Immaculate Shaft; \*It ta Choo-mah Cave; \*Jack Jones Cave Annex; \*Jack Jones Ice Cave; \*Jibili Cave (guano); \*Jack Jones Ice Cave; \*Low Blow Cave; \*Mushpot Cave (guano); \*Pool Parlor Cave; \*Poor Georges Cave; \*Post Office Cave; \*Red Tape Cave; \*RP6 Cave; \*Sentinel Cave; \*Shark Cave; \*Skunk Hollow Cave; \*Stinking Cave; \*Sugar Pine Butte Ice Cave; \*Sunbeam Cave; \*Sunshine Cave; \*Teeter Rock Cave; \*Trench Bench Cave; \*Triangular Cave; \*Upper Heppe Cave; \*Upstairs-Downstairs Cave; \*Valentine Cave; \*Yellow Tuber Cave (guano). **Tehama Co.:** \*Inskip Cave. **Trinity Co.:** unnamed cave; \*crack cave on Barker Creek; cave on Butter Creek 4-5 mi. S of Hyampom; \*Hall City Cave; \*Indian Creek Cave; \*Indian Valley Creek Cave (guano); \*Trinity Natural Bridge and Cave (guano). **Tulare Co.:** \*Clough Cave; \*Crystal Sequoia Cave; \*Deep Creek Cave; \*Eighteenth Hole; \*Kaweah Cave; \*Lilburn Cave; \*Lost Soldier's Cave; \*Nolisa Cave; \*Paradise Cave; \*Pine Grosbeak Cave; \*Popcorn Pit; \*Walk Softly Cave; \*Wiessraum Cave. **Tuolumne Co.:** \*unnamed mine near Stampmill (guano); \*Adit 5/6 (Hetch Hetchy) (guano); \*Adit 8/9 (Hetch Hetchy) (guano); \*Crack of Doom Cave; \*Crystal Palace; \*Early Intake Adit (Hetch Hetchy) (guano); McLean's Cave; \*McNamee's Cave; \*Predator Cave; \*Snell's Cave; \*Toppled Table Talus Cave. **Unknown Co.:** \*Lassie, Timmy's Still in the Mine Cave (southern Sierras).

**Bibliography:** Anonymous (1970b, 1976, 1989c, 1990c, 1991a, 1991b, 1991c, 1996a, 1996c, 1997a, 2011b); Adamson (1982c); Baumann (2004, 2013c); Belan (2002); Blanchard (2005, 2006); Bosted (1983, 1991b, 1994a); Bowers (1993); Breisch (1979a, 1979b, 1981a, 1981b, 1986); Broeckel, B. (1993a, 1993b, 1994c, 1999b, 2001e, 2001f, 2001h, 2002b, 2003a, 2004a, 2006d, 2007a, 2007b, 2009a, 2010c, 2010d, 2012b, 2012e, 2012g, 2013a); Broeckel and Broeckel (2014); Bunnell (1988a, 1988c, 2010); Cedidla (2006); Chern (2008, 2009a, 2009b, 2011); Chlor (2005); Collier (2005); Cooper, M. (2003); Cowan (1991); Craven (2001); Damon (1962a, 1962b); Davis, R. (2008); Davis and Audisio (2007b); Despain (1992, 1996, 1999, 2001); Dolinger (2009); Dudden (1998); Elor (2012); Everest (1997); Fielding (1997); Fina (1971a); Fisher (1971a); Foster (1977); Frantz (2007); Hackman (1949); Halliday (1962); Hardaker (1970); Hardcastle (1991b, 1991c, 1991d, 1994); Harper (1982b); Harter (2007); Hasbrouck, Helton, Devereaux, and Rogers (2006); Healey (1991a); Henthorn (1996); Hickerson (1971); Hose (2001); Inderkum (1989); Jackson, M. (1997, 1999, 2000, 2003a, 2003c, 2009, 2014); Johnson, A. (2004); Johnson, E. (1999); Johnson, P. (2002); Jorgensen (2009, 2013); Keller (2003a, 2003b); 2008b); Kennedy, C. (2013a, 2013b); Kennedy, S. (2010); Klette (1972, 1980); Krejca (2006); LaGrange (1995); Lankford (1989, 1991a); Lee, R. (2001a, 2001b); Leissring (2001b, 2006); Lipin (1991); Loftin (1992, 1999); Lukshin, Plett, and Redenbaugh (1990); McDonald (1999, 2009); McDonough (2011); McEacheren and Russell (1966); Marschner (1988); Martin, B. (1978, 1983); Miller, R. (1987a, 1992b, 2001); Mroczkowski (1973); Powell (1994a, 1994b); Prebil; (2003); Quick (1972a, 1973, 1974b, 1978, 1980a, 1980b; 1998a, 2003, 2010); Quinlivan (2009); Rice (2006); Richardson and Bosted (1989, 1990); Robinson (2004a); Rogers (1988, 1990a); Rogers, Helton, and McDonald (2009a, 2009b); Ross (2012); Schmalenberger (2011, 2014a, 2014b); Schmalenberger, Kull, and Levin (2012); Schmitz (2001); Sharp (1990, 1991, 2000a, 2000b); Sims, L. (1976, 1983); Smith, D. (1963, 1965); Snyder (1996d); Sowers (1989, 1990a); Sutton (1999); Szukalski (1998a, 1998b, 1999, 2000a, 2000b, 2001a, 2003c, 2008b); Taylor and Krejca (2006); Tinney (2010, 2013); Tobin and Thomas (2010); Troutman (1996); Vennum (2008); Weaver (2005b); Weaver and Wheeler (2009); Weibel (2008); Whitefield (1963, 1965); Wilson-Hartwig (2004); Winterath (1970a); Wolff, J. (1989, 1997, 1998, 2005); Wolff, L. (1984, 1985a, 1985b, 1985c, 1986, 1987c, 1987d, 1989b, 1990a, 1993, 1994a, 1997b, 1999a, 1999b, 2000a, 2001a, 2001b, 2004a, 2004b, 2006, 2007b, 2008a, 2008b, 2012c, 2013b); Wolff and Wolff (1999a, 1999b); Zidell (1987).

**Family Molossidae (free-tailed bats)***Eumops perotis* (Schinz) (western mastiff bat) (trogloxene)

**Records:** **Calaveras Co.:** Upper Calaveras Natural Bridge (dead). **Kern Co.:** crevice near Bakersfield; crevice on Karl Twisselman Ranch near McKittrick. **Mariposa Co.:** Bower Cave. **Monterey Co.:** Wagon Caves. **San Benito Co.:** crevice in sandstone cliff 7.5 mi. ESE of Panoche. **San Diego Co.:** three vertical cracks 1.5 mi. N of Barrett Junction; Dam Canyon Caves.

**Bibliography:** Anonymous (2010); Cockrum (1960); Dalquest (1946); Krutzsch (1955a).

*Tadarida brasiliensis mexicana* (Saussure) (Mexican free-tailed bat) (trogloxene)

**Records:** **Colusa Co.:** Wilbur Springs Mine. **Inyo Co.:** dolomite mine at western base of Inyo Mountains near the shoreline of Owens Dry Lake. **Kern Co.:** \*old pumice mine at China Lake Weapons Center; **Riverside Co.:** unnamed cave on Echo Island. **San Bernardino Co.:** \*Rainbow Talc Mine. **San Diego Co.:** vertical crack 1.5 mi. N of Barrett Junction. **San Luis Obispo Co.:** sandstone cave on NW edge of Carrizo Plain; Painted Rock Cave. **Siskiyou Co.:** Bat Cave No. 1; \*Guano Bridge (guano); Lower Heppe Cave; \*Pluto's Cave; Tichnor Cave/Bertha's Cupboard Cave. **Tulare Co.:** Clough Cave; Crystal Sequoia Cave.

**Comment:** Although this is the most common cave bat in the southwest United States, west coast populations inhabit caves infrequently (Barbour and Davis, 1969) and are thought to be nonmigratory (Cockrum (1969). However, an emergence flight of about 95,000 was observed at Bat Cave No. 1, Siskiyou County, in 2003 (U.S. Geological Survey 2016b), probably the largest bat colony in the state.

**Bibliography:** Barbour and Davis (1969); Briggs and Gpc (1975); Casper (1978); Cockrum (1969); Davis and Loomis (1971); Despain (1994); Grinnell (1918); Johnson, V. (1990); Kirschman (2003); Krejca (2006); Krutzsch (1955b); Orr, R.T. (1954); Perkins (1991); Radovsky (1967); Riley (1981); Sowers (1999); Szewczak, Szewczak, Morrison, and Hall (1998); Rogers (1999c); Snyder (1996c); Szukalski (2003b); U.S. Geological Survey (2016b); Wolff, L. (2014).

**Family Phyllostomidae (leaf-nosed bats)***Macrotus californicus* Baird (California leaf-nosed bat) (trogloxene)

**Records:** **Imperial Co.:** abandoned mine 3 km N of Potholes; mine shaft near Palo Verde; mines near Laguna and Imperial Dams; unnamed mine No. 1; Senator Mine. **Los Angeles Co.:** Vanowen Cave. **Riverside Co.:** cave near Torres; deserted mine tunnels and rock shelters in the Riverside Mountains; gold mine in the Riverside Mountains; caves in Coachella Valley near Toro; mine tunnel 56 km N of Blythe; "tidal caves at base of hills SW of Thermal"; Alice Mine; Intaglio Cave; Mountaineer Mine. **San Bernardino Co.:** Mountaineer Mine. **San Diego Co.:** cave on upper part of Santa Margarita Ranch, Santa Margarita River; Artery Mine; mine. **Ventura Co.:** conglomerate caves near Chatsworth.

**Comment:** Constantine (1967) reported the rabies virus in the species in an unspecified mine tunnel.

**Bibliography:** Anderson (1969); Anderson and Nelson (1965); Arnold (1943); Barbour and Davis (1969); Constantine (1967); Danchy (1952); Davis and Baker (1974); Grinnell (1918); Howell (1920); Huey (1925); Johnson, V. (1990); Krutzsch (1948); Nelson-Rees, Kniazeff, Baker, and Patton (1968); Stager (1939); U.S. Geological Survey (2016b); Vercammen-Grandjean (1967); Vercammen-Grandjean, Watkins, and Beck, 1965).

**Family Vespertilionidae (evening bats)**

Undetermined

**Records:** **Amador Co.:** \*Lulu Bell Cave; \*Santa Claus Cave. **Calaveras Co.:** \*Carlow's Bat Cavern; \*Clutch Cave; \*Lower Calaveras Natural Bridge; \*Penthouse Cave; \*Rabbit Hole; \*Striped Dome Cave. **Fresno Co.:** \*Church Cave; \*Hummel's Cave; \*Windy Cliff Cave; \*unnamed cave in Kings Caverns Geological Area. **Kern Co.:** \*Bodfish Cave; \*Held Hole; \*Walker's Cave. **Siskiyou Co.:** \*Caldwell Ice Caves; \*Fossil Cave; \*Four Star Cave; \*Guano Bridge; \*Hoyle's Half Dollar Cave; \*Incline Cavern; \*Lyon's Road Cave; \*Nirvana Cave; \*Planetary Dairy Cave; \*Skull Ice Cave; \*Valentine Cave. **Tulare Co.:** \*Rough Cave. **Tuolumne Co.:** \*McLean's Cave; \*Razorback Cave; \*Transplant Mine. **Ventura Co.:** \*Bat Cave.

**Comment:** Most of these are probably sight records of *Corynorhinus townsendii*. A colony of 200 bats inhabited Windy Cliff Cave (Reardon, 1966).

**Bibliography:** Craven (2001); Halliday (1961b, 1962); Halliday and Hedlund (1960); McEachern and Grady (1978); Quick (2000b, 2001b); Reardon (1966); Taylor, Krejca, and Jacoby (2006); Whitfield (1963).

*Antrozous pallidus* (LeConte) (pallid bat) (trogloxene)

**Records:** **Contra Costa Co.:** crevice in limestone cliff 6 mi. E of Walnut Creek. **Inyo Co.:** Goldtooth Mine; Lower Briggs Mine; Old Spanish Trail Cave; Titus #6 Mine. **Kern Co.:** crevices in sandstone outcrop near Carneros Spring; \*old pumice mine at China Lake Weapons Center. **Lake Co.:** Mirabel Mine. **Los Angeles Co.:** old mine in Soledad Canyon, 2



mi. S Acton. **Mariposa Co.:** Bower Cave. **San Bernardino Co.:** Rainbow Talc Mine; Seaturd Cave; Woodsey Owl Cave. **San Luis Obispo Co.:** shallow cave on NW edge of Carrizo Plain; cave on La Panza Ranch 15 km W of Simmler; Painted Rock Cave. **Santa Barbara Co.:** **Santa Cruz Island:** Swordfish Cave. **Shasta Co.:** Potter Creek Cave. **Siskiyou Co.:** Merrill Ice Cave; Post Office Cave; Upper Heppie Cave; Wind Cave. **Tulare Co.:** Clough Cave; Crystal Sequoia Cave.

**Comment:** This bat is thought to be common in caves of central and southern California, but few actual records are available. This species is probably a permanent resident in most of its range (Barbour and Davis, 1969). It roosts in small colonies in rock crevices and buildings, and occasionally in caves, mines, and tree cavities.

**Bibliography:** Briggs and GPC (1975); Danchy (1952); Despain (1994); Grinnell (1918); Johnson, V. (1990); Martin and Schmidly (1982); Orr, R.T. (1954); Orr and Silva Taboada (1960); Riley (1981); Schmitz (1994); Szukalski (2003b); U.S. Geological Survey (2016b).

*Corynorhinus townsendii* (Cooper) (western big-eared bat) (trogloxene)

**Records:** **Alameda Co.:** Dos Mesas Wine Cave. **Amador Co.:** \*Connie's Cave; \*Fiddler's Cave; \*Masonic Cave; \*Moss Cave; Rippled Cave; \*Santa Claus Cave; \*Sink Cave; \*Soldier Creek Cave; Sutter Creek Cave; Violin Cave. **Calaveras Co.:** Bobcat Cave; Brown Deer Cave; Buckeye Cave; Carlito's Cave; Carlow's Cave; Cave City Cave; Coral Cave; Crystal Stanislaus Cave; Diane's Cave; Grapevine Gulch Cave; Heater Cave; Mercer Caverns; \*Murphys Cave; \*Music Hall Cave; Porcupine Cave; Shaw's Cave; Wool Hollow Cave; Yother's Water Cave. **Colusa Co.:** Wilbur Springs Mine. **El Dorado Co.:** Crystal Cosumnes Cave; Pioneer Cave. **Fresno Co.:** Bear Cave; Boyden Cave; Millerton Lake Cave System; Saturday Cave; Windy Cliff Cave. **Imperial Co.:** Senator Mine. **Inyo Co.:** ARC No. 1; ARC No. 2; Chipmunk Mine; Argenta Mine; Bighorn Canyon Adits; Briggs Adit No. 10; Briggs Adit No. 13; Briggs Adit No. 14; Briggs Adit No. 15; Briggs Adit No. 4; \*Briggs Mines; cave near Westgard Pass; Cecil R. Mine; Chipmunk Mine; Christmas 1 Mine; Christmas 6 Mine; Denver Mine; Devil's Hole Cave; Eureka Mine No. 1; Eureka Mine No. 2; Goldtooth Mine; Harrisburg No. 1 Mine; Harrisburg No. 3 Mine; Hatchet Spring Mine; Jackpot Mine; Jackson Claims Mine; lava tube caves; Lower Briggs Mine; mine; mine at 2140 m elevation in Inyo Mountains; mine in White Mountains at 2400 m elevation; mine complex; mine, Inyo Mountains; Napoleon Mine; North Briggs Mine; No Snakes Cave; Old Spanish Trail Cave; Peacetalk Mine; Phinney Canyon Adits; Skidoo Main Mine; Skidoo North Mine; Skidoo South Mine; Snow Flake Mine; Titus Canyon Cave; Titus No. 3 Mine; Titus No. 6 Mine; Titus No. 9 Mine; Tuber Canyon Adits; Upper Emigrant Springs Mine; Upper Redlands Canyon Adits; Yaney Mine. **Kern Co.:** \*mine shaft at China Lake Naval Air Weapons Station; \*Bodfish Cave; Harrington Cave; \*Mountain Springs Mine. **Lake Co.:** \*mine one ridge over south of Clear Lake; Bartlett Mountain Cave. **Mariposa Co.:** \*Barium North Mine; Bower Cave; \*Lindsey Mine No. 1; \*Merced Cave No. 1; \*Merced Cave No. 2; \*Metzner Mine No. 1 (guano); \*Metzner Mine No. 4 (guano); \*Metzner Mine No. 5; Miller Gulch Mine No. 1; \*Munition Cave (guano). **Mendocino Co.:** Negro Hole Cave. **Modoc Co.:** Mammoth Cave. **Mono Co.:** mine complex on west side of White Mountains; Poleta Mine; Post Office Cave. **Monterey Co.:** Willow Creek Cave. **Napa Co.:** \*McLaughlin Mine; Manhattan Mines. **Placer Co.:** Lime Rock Caves. **Plumas Co.:** Juniper Cave; Soda Springs Cave. **Riverside Co.:** unnamed cave near Whitewater; mine tunnel at Kenworthy Ranger Station; gold mine in the Riverside Mountains; \*Alice Mine; \*Mountaineer Mine; Steece Copper Mine. **San Benito Co.:** abandoned mercury mine 1.6 km WNW of Panoche; \*Balconies Cave; \*Bear Gulch Cave; \*Condor Gulch Cave; North Chalone Peak Mines; Tunnel Cave. **San Bernardino Co.:** mine tunnel 8 km SW of Ivanpah; \*mine in Macedonia Canyon; mine tunnel at Mitchell [Caverns?]; \*Cave of the Winding Stair; Greene Canyon Mine; Green Mountain Mine; \*Hart Mine Complex; Mitchell Caverns; \*Warner's Cave. **San Diego Co.:** \*cave at Mussey Grove; \*cave near Suncrest; hillside cave or mine shafts; Mine Tunnel No. 2; Mine Tunnel No. 3; mine at Boulder Creek; mine tunnel 4.8 mi. E of Laguna Junction; \*mine in Noble Canyon; \*second mine in Noble Canyon; Artery Mine; Ready Relief Mine. **San Luis Obispo Co.:** mine tunnels between Paso Robles and Cambria. **Santa Clara Co.:** \*Joaquin Murrieta's Cave. **Santa Cruz Co.:** Bat Cave; Empire Cave; IXL Cave; Stearns Cave; Stump Cave; Vanished River Cave. **Shasta Co.:** \*Ajax Mine No. 1; Alice Consolidated Mine; Alien Space Cave; \*Ancient Palace Cave; Bat Mummy Cave; Boot Scoot'n Cave; Burnt Elderberry Cave; Cul de Sac Cave; \*Parrish Cave; Duckunder Cave; \*Eldorado Mine No. 1; Flashlight Cave; \*Franklin Mine No. 6 (guano); Grinch 4 Cave; Lost Creek Cave; Mahogany Seed Cave; North Christmas Tree Cave; \*North Star Mine No. 2 (guano); \*North Star Main Mine; \*Orus District Mine No. 1; Orus District Mine No. 3; Pantheon Cave; Parrish Cave; Planetarium Cave; Potter Creek Cave; \*Rock Creek Mine No. 7; \*Rusty Cave; Samwel Cave; \*Sand Cave; \*Scorpion Mine Complex No. 1 (bat sign); Shasta Lake Caverns; \*Subway Cave; Trail Cave; Wilcox Cave. **Siskiyou Co.:** caves in Lava Beds National Monument; \*Angleworm/Lost Pinnacle Cave; \*Arch Cave No. 2; \*Balcony Cave; \*Balcony Extension Cave; \*Barnum/Sand Caves System; \*Bat Cave No. 1; \*Bear Creek Mine; \*Bilibee's Cave; \*Black Bear Mine (guano); \*Black Bug Cave No. 2; \*Blue Grotto; \*Boulevard Cave; \*Caldwell Ice Caves; \*Catacombs Cave; \*Cecilville Cave; \*Chan Jade Mine No. 2; \*Chris' Cupboard; Coral Reef Cave; \*Cox Ice Cave; \*Craig Cave; Crane Fly Hole; \*Dance Hall Cave; \*Deep Throat Cave No. 2; \*Devised Ham Cave; Devil's Homestead Grotto; \*Dock Yock Cave; \*Flushing Bush Cave; \*Greenview Lower Mine; \*Greenview Upper Mine; \*Harris Mountain Cave; \*Hercules' Leg/Juniper Cave Lava Tube System; Hidden Valley Grotto; \*Hopkins Chocolate Cave; \*Independence Creek Mine No. 2 (guano); \*Insanity Culvert Cave; \*Intruded Cave; \*Jack Jones Ice Cave; \*Juniper Pole Cave; \*Labyrinth Cave System; \*Marble Gap Cave; \*Maze Cave; \*Merrill Ice Cave; \*Mushpot Cave; \*Ovis Bridge; \*Paradise Alleys Cave; \*Plan-

etary Dairy Cave; \*Pluto Lava Flow Cave No. 1; Pluto Lava Flow Cave No. 2; Pluto Lava Flow Cave No. 3; \*Pluto Lava Flow Cave No. 4; \*Pluto Lava Flow Cave No. 5; \*Pluto Lava Flow Cave No. 6; \*Pluto's Cave; \*Pool Parlor Cave; \*Post Office Cave; \*Rollercoaster Cave; \*Rollerdrome (Rollerdrome Cave); \*Sentinel Cave; \*Skull Ice Cave; \*Snake Pit; \*Spider Cave; \*Thunderbolt Cave; \*Teeter Rock Cave; \*Tichnor Cave/Bertha's Cupboard Cave; \*Trail Junction Cave; \*Upstairs-Downstairs Cave; \*Valentine Cave; \*Yellowjacket Ice Cave. **Tehama Co.:** \*Inskip Cave. **Trinity Co.:** \*Butter Creek Cave; \*Forest Glen Caves; \*Hall City Cave; \*Hayfork Cave No. 2; Hayfork Cave No. 2; \*Hyampom Cave No. 2; \*Indian Creek Mine No. 1; \*Indian Creek Mine No. 2; \*Indian Valley Creek Cave; Shasta-Trinity National Forest Cave No. 1; \*Shasta-Trinity National Forest Cave No. 2; Shasta-Trinity National Forest Cave No. 3; Shasta-Trinity National Forest Cave No. 4; \*Trinity Natural Bridge and Cave; \*Tunnel Rock Campground Mine; \*Venicia Mine No. 1; \*Venicia Mine No. 2. **Tulare Co.:** \*Clough Cave; \*Crystal Sequoia Cave; \*Dehydrated Cave; Eclipse Mine; \*Flowstone Wall Pit; \*Hidden Cave; \*Kaweah Cave (bat sign); \*Lost Soldier's Cave; \*Packsaddle Cave; \*Palmer Cave; \*Walk Softly Cave (guano). **Tuolumne Co.:** \*unnamed mine near Stampmill (guano); \*Crystal Butterfly Cave; \*Crystal Palace; \*Devils Gate Adit No. 2; \*Ellen Minton Mine No. 1 (guano); \*Ellen Minton Mine No. 2; \*Eye of the Alligator Cave; \*Gate Pit Cave; \*Indian Quarry Cave No. 1; \*Lower N Mt. Prospect No. 3; \*Lower N Mt. Tunnel No. 1; \*Lower N Mt. Tunnel No. 2; \*Lower N Mt. Tunnel No. 4; Mt. Lily Mine No. 1 (guano); \*Pinnacle Point Cave; \*Porcupine Cave; \*Riverbend Mine No. 1 (guano); \*Sarbo Mine (guano); \*Snell's Cave; \*Crystal Tuolumne Cave.

**Comment:** *Corynorhinus townsendii* (Cooper, 1837), common name Townsend's big-eared bat, has several subspecies, two in California: *C. t. townsendii*, western big-eared bat or Pacific Townsend's big-eared bat, and *C. t. pallescens*, pale Townsend's big-eared bat. The subspecies *C. t. intermedius* was synonymized with *C. t. pallescens*. Townsend's big-eared bat is by far the most commonly reported bat in California's caves and mines, and it is recognizable with its very large ears, which are usually rolled up during hibernation. This bat rarely forms large colonies, and it hibernates primarily in caves or mines, and sometimes roosts in buildings. Few of the recorded field identifications noted the subspecies, and we lump the two subspecies: *C. t. townsendii* in most of northern California and *C. t. pallescens* in the deserts. Thirty-nine Inyo County records were obtained from the U.S. Geological Survey (2016b).

**Bibliography:** Anonymous (1963, 1986b, 1987c, 1989b, 1990d, 1990f, 1991a, 1997a, 2007, 2008a, 2008b, 2014, 2015); Bosted (1994d); Briggs and Gpc (1975); Briggs and Ubick (1988); Broeckel, B. (1995, 1996b, 1997, 2001a, 2001c, 2004b, 2010f); Broeckel, J. (2000); Broeckel and Wolff (2001); Christianson and Coombs (1970); Dalquest (1947); Damon (1963b); Danchy (1952); Davies (2015); Dearolf (1956); Eastman (2011); Ellison, O'Shea, Bogan, Everett, and Schneider (2003); Fan (2010a); Fesnock (2003); Fitzwater (1984a, 1984b); Fryer and Despain (2005); Gilleland (2010); Graening (2010, 2011c); Graham (1966b); Grinnell (1914, 1918); Grinnell and Swarth (1913); Hackman (1949); Halliday (1955, 1961a, 1962); Halliday and Hedlund (1960); Handley (1959); Hargreaves (2004a); Heusler (1996); Hildebrand and Marin (1990); Hitchings (2014); Horn, J. (1988); Howell (1920); Irminger (1994); Jackson, M. (2003a, 2004); Johnson, S. (2008); Johnson, V. (1990); Johnson, Bryant, and Miller (1948); Keller (2008a); Kirschman (2003); Krejca (2006); Kruttsch (1946, 1948); Kunz and Martin (1983); Lankford (1991b); Leissring and Rogers (2010); McEachern and Grady (1978); McGahey (1991); Marcot (1984); Miller, R. (1988a, 1988b, 1988c, 1989, 1992a); Miller and Wolff (1988, 2000); Mitchell (1956); National Park Service (2004); Oberhansley (1946); Pearson, Koford, and Parson (1952); Perkins (1991); Pierson (1986, 1989, 1990); Pierson and Fellers (1998); Pierson and Rainey (1986, 1994); Radovsky (1967); Reardon (1966); Reel (1990); Rimmer (1993); Roark (1971b); Robinson (2004b); Rogers (1983a; 1988, 1990b; 1991a, 1991d; 1994a, 1998, 1999a; 1999b, 1999d, 2000a, 2004a, 2005a; 2005b, 2005d, 2005f, 2010a; 2010b, 2013a); Rogers and Helton (2009); Rogers, Helton, and McDonald (2009a, 2009b); Rogers, Frantz, Despain, and Portillo (2003); Rogers, Leissring, McDonald, Steiger, and Helton (2009); Rogers, Pierson, Gardner, and Hilton (2009); Rogers, Pierson, Woodward, Rainey, Rice, and Gardner (1990, 2000); Rogers and Rice (1991, 2000); Sharp (2008, 2009); Sherwin, Stricklan, and Rogers (2000); Sinclair (1904); Snyder (2003, 2005a, 2013); Sowers (1991, 1999, 2000); Stager (1939); Steiger (2007); Suggett (1982); Szweczek, Szweczek, Morrison, and Hall (1998); Szukalski (2004b); Taylor (1919); Taylor and Krejca (2006); Tobin and Thomas (2010); U.S. Geological Survey (2016b); Weaver (2009c); Wolff, J. (1990b, 1992, 1996, 2000, 2001); Wolff, L. (1985a; 1988, 1989a; 1997b, 1999c, 2000c, 2002a, 2003a, 2003c); Wolff and Miller (n.d.); Wolff and Wolff (1990, 1992, 1999c, 2000, 2001); Yoder (2003).

*Eptesicus fuscus* (Palisot de Beauvois) (big brown bat) (trogloxene)

**Records:** **Inyo Co.:** mine, White Mountains. **Mariposa Co.:** \*Bower Cave; \*Metzner Mine No. 1 (guano); \*Metzner Mine No. 4 (guano). **San Diego Co.:** rock crevice 1.5 N of Barrett Junction; Boulder Creek Mine, Barrett Junction; unnamed mine at Boulder Creek. **Shasta Co.:** Potter Creek Cave. **Siskiyou Co.:** \*Upstairs-Downstairs Cave. **Tulare Co.:** Crystal Sequoia Cave. **Tuolumne Co.:** \*Lower N Mt. Tunnel No. 1; \*Lower N Mt. Tunnel No. 4; McLean's Cave.

**Comment:** Suggett (1982) reported the subspecies *E. f. bernardinus* Rhoads in Upstairs-Downstairs Cave. Most summer roosts are attics, barns, bridges or other man-made structures; they move into caves, mines and other underground structures to hibernate only during the coldest weather conditions.

**Bibliography:** Danchy (1952); Despain (1994); Grinnell (1918); Johnson, V. (1990); Kruttsch (1946, 1955b); McEachern and Grady (1978); Suggett (1982); U.S. Geological Survey (2016b).

*Euderma maculatum* (Allen) (spotted bat)

**Record:** San Bernardino Co.: spring cave at Granite Wells near Pilot Knob.

**Comment:** day roosts include high cliffs or shallow caves.

**Bibliography:** Johnson, V. (1990); Parker (1952).

*Lasionycteris noctivagans* (LeConte) (silver-haired bat)

**Record:** Inyo Co.: mine on southern slope of White Mountains.

**Comment:** hibernates in trees, buildings, and rock crevices.

**Bibliography:** Johnson, V. (1990); Szewczak, Szewczak, Morrison, and Hall (1998).

*Myotis* sp. (trogloxene)

**Records:** Amador Co.: \*Masonic Cave. Calaveras Co.: \*Bone Cave; \*Crystal Stanislaus Cave; \*Porcupine Cave. Fresno Co.: Windy Cliff Cave. Inyo Co.: Eureka Mine No. 1; Lower Briggs Mine. Mariposa Co.: Bower Cave; \*Star Mine Complex No. 3 (guano). Shasta Co.: \*?Snail Shell Cave; \*A1Red Gulch Mine (guano); \*Subway Cave. Siskiyou Co.: \*Bigfoot Cave; \*Coyote Cave; \*Dock Yock Cave; \*Guano Bridge (guano); \*Independence Creek Mine No. 2; \*Jack Jones Ice Cave; \*Steiner Flat Mine (guano); \*Stinking Cave; \*Upstairs-Downstairs Cave. Trinity Co.: \*Hall City Cave (guano). Tuolumne Co.: \*Ellen Minton Mine No. 1 (guano); \*Fair Oaks Mine No. 1 (guano); \*Juniper Adit No. 1 (guano); \*Juniper Adit No. 2 (guano); \*Lucky Strike Mine No. 1 (guano); \*McLean's Cave; \*Playpen Adit No. 1 (guano).

**Bibliography:** Graham (1969e); Halliday (1961a, 1962); Jackson, M. (1996); Johnson, V. (1990); McEachern and Grady (1978); Rogers (1991d, 1999b, 1999b, 1999c); Snyder (2013); Suggett (1982); U.S. Geological Survey (2016b); Wolff and Wolff (1990).

*Myotis californicus* (Audubon and Bachman) (California bat) (trogloxene)

**Records:** Fresno Co.: Boyden Cave; \*Hummel's Cave. Inyo Co.: Chipmunk Cave; Eureka Mine No. 1; Lower Briggs Mine; Titus No. 6 Mine. Kern Co.: mine tunnel, Red Rock Canyon; old pumice mine at China Lake Weapons Center. Mariposa Co.: unspecified cave in Yosemite Valley. Siskiyou Co.: \*?Angleworm/Lost Pinnacle Cave. Tulare Co.: \*Crystal Sequoia Cave; \*Overhang Cave; \*White Chief Cave.

**Comment:** roosts in rock crevices, tree cavities and loose bark, and in buildings; also caves and mines.

**Bibliography:** Dalquest (1947); Despain (1994); Grinnell (1918); Krejca (2006); Quick (1996, 1997b, 1998b); Riley (1981); Sims, M. (1991); Tobin and Thomas (2010); U.S. Geological Survey (2016b).

*Myotis ciliolabrum* (Merriam) (western small-footed bat) (trogloxene)

**Records:** Inyo Co.: mine in Marble Canyon on E side of the Inyo Mountains; mine, White Mountains; small mine on NW slope of Deep Springs Valley. San Diego Co.: mine tunnel 4.8 mi. E of Laguna Junction; mine tunnel No. 2; mine tunnel No. 3. Siskiyou Co.: Merrill Ice Cave; Upper Heppe Cave.

**Comment:** Seeks cover in crevices, caves, mines and buildings. Bats were taken singly from various deserted mine tunnels in San Diego County on 6/1/1946.

**Bibliography:** Krutzsch (1948); Szewczak, Szewczak, Morrison, and Hall (1998); U.S. Geological Survey (2016b).

*Myotis evotis* (H. Allen) (long-eared bat) (trogloxene)

**Records:** Fresno Co.: tunnel near Huntington Lake; Boyden Cave. San Luis Obispo Co.: mine tunnels between Paso Robles and Cambria. Siskiyou Co.: Big Painted Cave; Merrill Ice Cave; Upper Heppe Cave. Trinity Co.: Shasta-Trinity National Forest Cave No. 1; Shasta-Trinity National Forest Cave No. 2; Shasta-Trinity National Forest Cave No. 3; Shasta-Trinity National Forest Cave No. 4. Tulare Co.: \*Clough Cave; \*Crystal Sequoia Cave; \*Lost Soldier's Cave.

**Comment:** daytime roosts include buildings, tree cavities, caves, mines, and rock crevices.

**Bibliography:** Briggs and Gpc (1975); Dalquest (1947); Ingles (1949); Johnson, V. (1990); Krejca (2006); Marcot (1984); Reardon (1966); Tobin and Thomas (2010); U.S. Geological Survey (2016b).

*Myotis lucifugus* (LeConte) (little brown bat) (trogloxene)

**Records:** Amador Co.: \*Rippled Cave. Fresno Co.: Maze Cave. Riverside Co.: Garnet Queen Mine. Shasta Co.: Subway Cave. Siskiyou Co.: ice caves 10 km west of Tule Lake; \*Big Waitangi Cave. Tulare Co.: Crystal Sequoia Cave.

**Comment:** in summer, inhabits buildings or other shelters near water; hibernates in caves and mines.

**Bibliography:** Briggs and Gpc (1975); Broeckel, B. (2011a); Despain (1994); Grinnell (1918); Johnson, V. (1990); Kirschman (2003); Miller and Allen (1928); Rogers (1991d); Russo (2012); Weaver (2009b).



*Myotis melanorhinus* Merriam (dark-nosed small-footed bat) (trogloxene)

**Records:** **Riverside Co.:** Garnet Queen Mine. **San Diego Co.:** tunnels.

**Comment:** roosts in crevices in rock faces and riverbanks, and may use talus, tree bark or buildings; hibernation sites include mines and caves.

**Bibliography:** Briggs and Gpc (1975); Grinnell and Swarth (1912, 1913); Johnson, V. (1990); Koford and Koford (1948).

*Myotis occultus* Hollister (Arizona bat)

**Record:** **Riverside Co.:** abandoned copper mine in the Riverside Mountains.

**Comment:** day roosts include crevices in canyon walls, caves, and buildings.

**Bibliography:** Stager (1943b).

*Myotis thysanodes* Miller (fringed bat) (trogloxene)

**Records:** **Inyo Co.:** Titus No. 1 Mine; Titus No. 6 Mine. **Lake Co.:** unnamed mine tunnel. **San Bernardino Co.:** mine tunnel at Mitchell [Caverns?]. **San Diego Co.:** mine tunnel 4.8 mi. E of Laguna Junction; mine tunnel No. 2; mine tunnel No. 3.

**Comment:** Danehy (1952) noted that this bat occurs in caves in central and southern California; roosts in caves, mines, and buildings.

**Bibliography:** Danehy (1952); Johnson, V. (1990); Johnson, Bryant, and Miller (1948); Krutzsch (1948, 1955a); U.S. Geological Survey (2016b).

*Myotis velifer* (J. A. Allen) (cave bat) (trogloxene)

**Records:** **Riverside Co.:** gold mine in the Riverside Mountains; mine, Riverside Mountains; mine 2, Riverside Mountains; mine tunnel, Riverside Mountains; Mountaineer Mine.

**Comment:** Danehy (1952) reported that this bat is common in the summer in sandstone and conglomerate caves near the Colorado River (Imperial, Riverside, San Bernardino counties). The subspecies *M. v. brevis* barely ranges into southeastern California. In summer, it congregates in caves and mines, and less often, buildings; winter roosts are primarily caves. California populations may be migratory.

**Bibliography:** Barbour and Davis (1969); Danehy (1952); Davis and Baker (1974); Haas, Beck, and Tomich (1983); Johnson, V. (1990); Stager (1939, 1942); U.S. Geological Survey (2016b).

*Myotis volans* (H. Allen) (long-legged bat) (trogloxene)

**Records:** **Fresno Co.:** Boyden Cave. **Los Angeles Co.:** mine, Grandview Canyon, San Gabriel Mountains. **San Bernardino Co.:** mine tunnel 8 km SW of Ivanpah. **San Diego Co.:** mine tunnel No. 1. **Siskiyou Co.:** Merrill Ice Cave; Upper Heppe Cave.

**Comment:** Danehy (1952) reported that this was an uncommon bat in central and southern California caves, but is sometimes found with *M. thysanodes*. Barbour and Davis (1969) claim that this bat uses caves as night roosts only. Primarily inhabits forested mountain regions, where it roosts in trees, rock crevices, stream banks, and buildings; hibernation sites are primarily caves and mines.

**Bibliography:** Barbour and Davis (1969); Danehy (1952); Johnson, Bryant, and Miller (1948); Krutzsch (1948); Tobin and Thomas (2010); U.S. Geological Survey (2016b).

*Myotis yumanensis* (H. Allen) (Yuma bat) (trogloxene)

**Records:** **Calaveras Co.:** \*Crystal Stanislaus Cave. **Colusa Co.:** Wilbur Springs Mine. **Fresno Co.:** Boyden Cave. **Imperial Co.:** Mine No. 1; Senator Mine. **Lake Co.:** Sulfur Bank Mine. **Lassen Co.:** cave, Eagle Lake Field Station. **San Diego Co.:** flume tunnel, El Capitan Dam; inspection tunnel of the Hodges Dam; mine tunnel 4.8 mi. E of Laguna Junction; mine tunnel No. 3; Dam Canyon Caves. **Siskiyou Co.:** Captain Jack's Ice Cave.

**Comment:** Danehy (1952) notes only that this species is sometimes found with *M. velifer* in caves. Maternity colonies utilize buildings, caves, mines, or bridges.

**Bibliography:** Anonymous (1991a); Briggs and Gpc (1995); Danehy (1952); Davis and Baker (1974); Haas, Beck, and Tomich (1983); Howell (1920); Johnson, V. (1990); Krutzsch (1948, 1955a); Parkinson (1979); Radovsky (1967); Tobin and Thomas (2010); U.S. Geological Survey (2016b).

*Parastrellus hesperus* (H. Allen) (western bat) (trogloxene)

**Records:** **Calaveras Co.:** Crystal Stanislaus Cave; Keith's Chasm; Mercer Caverns. **Inyo Co.:** four mines at 1340–1400 m elevation; Goldtooth Mine. **Riverside Co.:** cave, Riverside Mountains; mine tunnels in the Riverside Mountains. **San Benito Co.:** Bear Gulch Cave. **San Bernardino Co.:** Rainbow Tale Mine. **Siskiyou Co.:** Cox Ice Cave; Hercules' Leg/Juniper



Cave Lava Tube System; Sentinel Cave. **Tulare Co.:** Crystal Sequoia Cave.

**Comment:** Danchy (1952) reports that this bat is found in cracks in caves, but uncommonly. Primarily a desert species, it inhabits a variety of habitats from rocky canyons, cliffs, and outcroppings, to creosote bush flats; day roosts usually in rock crevices, mines, or buildings; hibernates in mines, caves, and rock crevices.

**Bibliography:** Danchy (1952); Despain (1994); Gale (1959); Johnson, V. (1990); McEachern and Grady (1978); Rogers and Legg  (1987, 1995); Stager (1943a); Szewczak, Szewczak, Morrison, and Hall (1998); Szukalski (2003b); U.S. Geological Survey (2016b).

#### ORDER ARTIODACTYLA

##### Family Bovidae

*Capra hircus* (Linnaeus) (domestic goat)

**Record:** Siskiyou Co.: \*Upper Heppe Cave.

*Ovis canadensis* Shaw (bighorn sheep)

**Record:** San Bernardino Co.: \*Glove Cave (carcass)

**Bibliography:** Harter (2009).

##### Family Cervidae

*Odocoileus hemionus* (Rafinesque) (black-tailed deer)

**Records:** Mariposa Co.: \*Bower Cave (carcass). **Siskiyou Co.:** \*Cauliflower Cave (carcass). **Tulare Co.:** \*Crystal Sequoia Cave.

**Comment:** Deer enter the entrance to Crystal Sequoia Cave as far as the gate.

**Bibliography:** Graham (1969c); Oberhansley (1946).

#### ORDER CARNIVORA

##### Family Canidae

*Canis latrans* Say (coyote)

**Records:** Inyo Co.: \*Furnace Cave (scat); \*Gnomes Grotto (scat). **San Benito Co.:** \*Bear Gulch Cave (scat). **Shasta Co.:** Bat Cave (scat). **Siskiyou Co.:** \*Coyote Cave; \*Craig Cave; \*Guano Bridge (mummified); \*Upper Heppe Cave.

**Bibliography:** Gale (1959); Rogers (1999c).

##### Family Felidae (cats)

*Lynx rufus* (Schreber) (bobcat) (troglodene)

**Records:** Calaveras Co.: \*Bobcat Cave. **Siskiyou Co.:** \*Caldwell Ice Caves.

**Comment:** Bobcats were seen in the caves.

**Bibliography:** Gale (1959).

*Puma concolor* (Linnaeus) (mountain lion, cougar)

**Records:** Inyo Co.: \*cave in Death Valley. **Siskiyou Co.:** \*Cougar Den Cave; \*Upper Heppe Cave.

**Comment:** Possible mountain lion cubs were seen in a cave in Death Valley.

**Bibliography:** Anonymous (2005b); Broeckel, B. (2012a).

##### Family Mephitidae (skunks)

*Mephitis mephitis* (Schreber) (striped skunk)

**Records:** Amador Co.: \*Rippled Cave. **San Bernardino Co.:** \*B Cave; \*Owl Pellet Cave; \*QQ/Cat Cave. **Santa Cruz Co.:** \*Bat Cave. **Tuolumne Co.:** \*Transplant Mine.

**Bibliography:** Briggs and Gpc (1975); Graening (2010).

*Spilogale gracilis* Merriam (western spotted skunk)

**Records:** Santa Cruz Co.: \*Bat Cave. **Siskiyou Co.:** \*Barnum/Sand Caves System; \*Stinking Cave; \*Upstairs-Downstairs Cave. **Tuolumne Co.:** \*Bend Cave.

**Bibliography:** Briggs and Gpc (1975); Broeckel, B. (2010f); McEachern and Grady (1978); Rogers (1988, 1999b); Snyder (1996b); Suggett (1982).

**Family Mustelidae***Martes americana* (Turton) (American marten)**Record:** Siskiyou Co.: \*cave in Marble Mountains Wilderness.**Comment:** Marten tracks were seen to follow snowshoe rabbit tracks in the snow into a cave entrance.**Bibliography:** Suggett (1982).**Family Otariidae (sea lions and fur seals)***Zalophus californianus* (Lesson) (California sea lion) (marine troglodene)**Records:** San Diego Co.: \*Seal Sleep Cave; \*Sunny Jim Cave. Santa Barbara Co.: *Santa Barbara Island*: \*Sea Lion Cave. *Santa Cruz Island*: \*Blue Grotto; \*Could Go Cave; \*Hidden Room Cave; \*Painted Cave, \*Painted Grotto; \*Sea Lion's Tunnel; \*Sponge Cave; \*Swiss Surprise Cave. *Santa Rosa Island*: \*San Augustine Caves. Ventura Co.: *Anacapa Island*: \*Sea Lion Cave; \*Seal Cave; \*Three Fingers Cave.**Comment:** This species was also reported from sea caves on Middle Coronado Island, off the coast of Baja California del Norte, Mexico, near San Diego (Rowley, 1929).**Bibliography:** Bunnell (1982, 1984, 1988a, 1988b, 1988c, 1993a, 1993b, 1999a, 2003); Bunnell and Vesely (1983a); Halliday (1962), Heald (1956); Orr, P.C. (1951b, 1952b); Richards (1984, 1994); Rogers (2010c); Rowley (1929); Vesely (1990, 2000).**Family Phocidae (seals)**

Undetermined

**Records:** Santa Barbara Co.: *Santa Cruz Island*: \*Hidden Amphitheater; \*Kiwi Cave; \*Potato Rock West Cave; \*Sea Lion's Tunnel; \*Seal Canyon Cave; \*Seal's Secret Cave; \*Swiss Surprise Cave. Ventura Co.: *Anacapa Island*: \*Dead Seal Cave (carcass).**Bibliography:** Bunnell (1988a, 1988c, 1993b, 2003); Bunnell and Vesely (1986).*Phoca vitulina* Linnaeus (harbor seal)**Records:** Santa Barbara Co.: *Santa Cruz Island*: Leftover Cave; \*Little Scorpion Bay Cave No. 1; \*Natural Bridge Cave; \*West Cavern Point Cave. Ventura Co.: *Anacapa Island*: \*Catacombs Arch.**Bibliography:** Bunnell (1988c, 1989a, 1993a, 1993b, 2003).**Family Procyonidae (raccoons, ringtails, and allies)***Bassariscus astutus* (Lichtenstein) (ringtail) (troglodene)**Records:** Kern Co.: \*Bodfish Cave. San Bernardino Co.: Mitchell Caverns. Shasta Co.: \*Ancient Palace Cave (scat); Bat Mummy Cave; Lantern Glass Cave. Tulare Co.: \*Crystal Sequoia Cave; \*Harry's Bend Cave.**Bibliography:** California State Parks (2010); Graening (2010); Halliday (1962); Krejca (2006); National Park Service (2004).*Procyon lotor* (Linnaeus) (raccoon)**Records:** Calaveras Co.: \*Crystal Stanislaus Cave; Gleibe's Cave (remains); Sink Cave. Shasta Co.: \*Sleepy Coon Cave. Siskiyou Co.: Bigfoot Cave. Tulare Co.: Clough Cave. Tuolumne Co.: \*Indian Dwelling Cave.**Bibliography:** Broeckel, B. (2001c); Damon (1962b); Jackson, M. (1999); McEachern (1968); McEachern and Grady (1978); Rogers (1994a, 1999d).**Family Ursidae (bears)***Ursus americanus* Pallas (American black bear) (troglodene)**Records:** Fresno Co.: \*Bear Cave. Shasta Co.: \*Bat Cave; \*Bear Den Cave (nest); \*Comfy Bear Cave; Hole-of-the-Bear. Siskiyou Co.: \*Apogee Cave; \*Bear's Bed Cave (bed); \*Chimney Cave (den); \*Echoplex Cave; \*Harris Mountain Cave; \*Merrill Ice Cave; \*Red Tape Cave (scat); \*Skull Ice Cave; \*Upper Heppe Cave. Tulare Co.: \*Bear Den Cave (den); \*Crystal Sequoia Cave.**Comment:** A bear cub was seen exiting Bear Cave, Fresno County, after it was intersected by a road crew in 1937.**Bibliography:** Broeckel, B. (2011d, 2012a, 2014); Despain (1992, 1994); Halliday and Hedlund (1960); Larson and Larson (1990); Oberhansley (1946); Sundquist (2011); Wolff, L. (2013a).

## Appendix 2

### Sites Listed by County, Island, Site Type, Name, and Synonyms

Note: This list only includes sites for which biological records are known. Listed in parentheses following the most correct name, many synonyms are recorded in the literature and in museum collections.

Tunnels are listed here as mines.

**Alameda County: Caves & Karst:** Dos Mesas Wine Cave; Joaquin Murrieta Caves (Joaquin Murrieta). **Groundwater:** arroyo in Livermore, Wente St. near Concannon (Livermore, Wente Street (Concannon Street)); Palo Seco Creek (Palo Seco); San Leandro Creek Site SLC 4 (upper San Leandro Creek).

**Amador County: Caves & Karst:** Black Chasm; Buckeye Root Cave; Chrome Cave; Collapse Cave; Connie's Cave; Fern Frond Cave; Fiddler's Cave (Fiddler Cave, Fiddletown Crystal Cave); Hare Cave; Hummingbird Cave (Humming Bird Cave); Ive's Hill Cave; Lulu Bell Cave (Lulabell Cave); Masonic Cave (Volcano Cave; Masonic Caves); Miser's Purse Cave; Moss Cave; Mushroom Cave; Oak Tree Cave; Rat Condo Cave; Rippled Cave; Root Cellar Cave; Santa Claus Cave (Pearl Cave); Sink Cave; Skeleton Cave; small cave below Santa Claus Cave; Sutter Creek Cave (WSI #C-61); unnamed cave 500 m NE of Volcano; unnamed sink near Pearl Cave; Violin Cave (Stanford Grotto #142); White Room Cave.

**Calaveras County: Caves & Karst:** Barren Cave (Cave 002); Bay Cave (Cave 003, Ca-Cal-646); Beta Cave (Cave 006); Bobcat Cave (Cave 009); Bone Cave (Cave 010, Cal-S-435); Brown Deer Cave (Cave 030, Deer Cave); Bryden's Cave (Cave 011); Buckeye Cave; Cabin Cave (Cave 013); Carlito's Cave (Dublin Cave, Dublen Cave, Cave 015); Carlow's Bat Cavern (Cave 017); Carlow's Cave (Carlos' Cave, Cave 016); Cataract Gulch Cave (Bad Air Cave, Gold Tooth Cave, WSI #C-161); Cave City Cave (California Cavern, California Caverns, Great Cave of Calaveras, Calaveras Cave, Crystal Cave, Stanford Grotto #9-a & 9b, WSI #C-173 and C-174); cave in Mountain Ranch; Cave of the Quills (connected to Cave City Cave); Cave of Skulls (Cave of the Skulls, Frenchmen's Cave, Limestone Cave, Skull Cave, Stanford Grotto #133, Cave 018); Cave of the Catacombs (Miller's Cave, Skull Cave, Stanford Grotto #139); Cave of the Crystal Snail; Cib Cave (Cave 020); Cliff Cave (Cave 021); Clutch Cave (Cave 022); Cone Cave (Cave 023); Coral Cave (Cave 025, Ca-Cal-648); Creek Cave; Crystal Stanislaus Cave (Crystal Cave, Mobley Cave, Crystal-Stanislaus Cave); Diane's Cave (Cave 027); Dirty Crack Cave (Cave 029); Dirty Fissure; Dragon's Breath Cave (Dragon's Mouth); Eagle View Cave No. 1 (Cave 034); Eagle View Cave No. 2 (Cave 035); Escargot Cave (Escargo Cave, Crawl Through Cave); Fenceline Cave (Cave 037); Gastropod Cave (Cave 040); Gerritt's Cave (Garrett's Cave, Cave 041, Quail Cave); Gleibe's Cave (small cave near Shaw's Cave, Papke's Cave?); Goldtooth Cave; Grapevine Gulch Cave (Hanging Gardens Cave, Cave 043, Stanford Grotto #95, WSI #C-3, C-5, C-7, Grapevine Canyon Cave); Gray Pine Cave (Digger Cave, Digger Pine Cave, Cave 028); Hawk Cave (Hawk Pit, Cave 045); Heater Cave; Keith's Chasm (Cave 049); Kenney's Grotto (WSI #C-215); Linda's Cave (Cave 050); Lost Piton Cave (Cave 051); Lower Calaveras Natural Bridge (Calaveras Natural Bridges, Cave 052, Lower Natural Bridge Cave); Men Cave (Cave 055); Mercer Caverns (Mercer's Cave, Mercer Cave); Mercer's Big Pit; Moaning Cave (Moaning Caverns, Mays Cave, Ossiferous Cavern); Murphys Cave; Music Hall Cave (Music Hall, WSI #C-2, Cave 058, Speleogen Cave (=WSI #C-4, C-32, and C-50)); one unspecified cave; Papke's Cave; Penthouse Cave (Cave 063); O'Neil's Cave (King Tut Cave); Poison Oak Cave (Cave 064); Pool Cave; Porcupine Cave (WSI #C-6, Buckeye Cave, Cave 065); Pseudoscorpion Cave; Quail Cave (Gerritt's Cave); Rabbit Hole (Rabbit Cave, Rabbit Hole Cave, Rabbit Hole Pit, Rabbit Pit, Cave 066); Rex Cave (Cave 069, Ca-Tuo-776); Scat Cave (Plocher Cave, Cathedral Cave, Cave 072); Secret Cave (Cave 073); Shaw's Cave (Stanford Grotto #36); Sink Cave; Slab Cave (Cave 076); Snail Cave; Striped Dome Cave (Stripe Cave, Cave 079); three-entrance cave up from Natural Bridge Cave; Thunder Cavern; Two Bit Pit (Main Drain); unnamed cave in Peruvian Gulch (Cave 084?); unspecified cave(s) (1-3 unspecified caves); Upper Calaveras Natural Bridge (Calaveras Natural Bridges, Cave 085, Upper Natural Bridge Cave); Water Cave (Yother's Caves); Waterfall Cave (Cave 086); Williams Cave (William's Cave); Winzerr Cave; Wool Hollow Cave (Wool Hollow Cove Cave, WSI #C-212, C-216, and C-217); Yother's Water Cave (Yother's Cave). **Groundwater:** spring 5 km southeast of Angel's Camp. **Mines:** mine on N side of Table Mountain (Red Top Mine?).

**Colusa County: Mines:** Wilbur Springs Mine.

**Contra Costa County: Caves & Karst:** cave on Mt. Diablo; crevice in limestone cliff 6 mi. E of Walnut Creek; rockshelters on Carquinez Strait shoreline; unnamed cave (cave). **Groundwater:** Reliez Creek at 3400 Springhill Road; San Leandro Creek at Canyon School (Site SLC 4, Chabot Regional Park, headwaters of San Leandro Creek, Site No. SLC-4 (Canyon School)); San Leandro Creek at Huckleberry Park (Site SLC 5, Chabot Regional Park, headwaters of San Leandro Creek, Site No. SLC-5 (Huckleberry Park); Wildcat Creek at Big Springs (Wildcat Creek Site WCC-1).

**El Dorado County: Caves & Karst:** Alabaster Cave (Coral Cave, Crystal Cave, Quarry Cave); Crystal Cosumnes Cave (Crystal-Cosumnes Cave, Cosumnes Cave, Crystal Cave, Limestone Cave, Grizzly Flat Cave); Hawver Cave (Quarry Cave, Lake Cave, Hawver's Cave, Coral Cave); Pink Grotto; Pioneer Cave (destroyed by quarrying in 1972, Martin's Cave, Marten's Cave, Cave Valley Cave, Green Grotto, Quarry Cave, Stanford Grotto #31); unspecified cave(s). **Groundwater:** Bacon Creek Spring; Harrel Fire Tank spring (Harrel Fire Tank spring tributary to Long Canyon 5 km NE of Grizzly Flat); Knickerbocker Creek spring tributary, 1 mi. W of Hwy. 49 (unnamed spring tributary to Knickerbocker Creek near Cool, 1 mi. W of Highway 49); Lake Tahoe, Emerald Bay; Lake Tahoe, South Tahoe Shelf; North Cosumnes River and tributary seeps at Sciaroni Crossing, 3 km N of Grizzly Flat; North Cosumnes River, spring tributary upstream of Meiss, 18 km E of Grizzly Flat; Singleton Springs; Snow Creek, 13 km E of Jenkinson Reservoir; Stump Spring.

**Fresno County: Caves & Karst:** 1-2-3 Cave; Bat Cave; Bear Cave; Bear Den Cave; Beauty Cave; Black Lake Cave; Boyden Cave (Boyden's Cavern, Bowden Cave); Cave No. 12-1 (Stanford Grotto #9); Children's Cave (Green Moss Cave, Herman Cave); Church Cave (WSI #C-132, C-133, C-134); Cliff Cave (Keyhole Cave, Cliff-Keyhole Cave); Fault Rock Cave; Hidden Pond Cave (Twin Lakes Cave); Hour Glass Cave; Hummel's Cave (Qanat Cave); Maze Cave (Sunset-Graduation Caves; Sunset Cave; Wanda's Cave); Meander Cave; Millerton Lake Cave System (Lower Millerton, Middle Millerton, Upper Millerton); Rat Turd Cave; Saturday Cave; unnamed cave E of Millerton Lake; unnamed cave in Kings Caverns Geological Area (Kings Caverns is an area not a cave); Windy Cliff Cave (Windy Cliffs Cave). **Groundwater:** Rock Creek Spring, adjacent to Minarets Road near Rock Creek Campground; unnamed spring at Shaver Lake (springbox at Shaver Lake). **Lava Tubes:** lava cave on Crater Mountain. **Mines:** artificial feature near Darwin; tunnel near Huntington Lake.

**Glenn County: Groundwater:** Cold Creek, 1.3 mi. above confluence with Plasket Creek.

**Humboldt County: Caves & Karst:** large earth crack just north of Trinidad. **Groundwater:** Mason Gulch at Hwy. 299 (upper Willow Creek); Red Mountain Creek, Forest Service Road 10N12; Redwood Creek, 0.4 mi. above South Fork Eel River; Sholes Creek, 1.7 mi. above confluence with Mattole River; South Fork Eel River above Briceland Bridge; Squaw Creek, 0.3 mi. above Bull Creek; well.

**Imperial County: Groundwater:** artesian well near Frink siding between Hecca and Niland. **Mines:** abandoned mine 3 km N of Potholes; mine shaft near Palo Verde (old mine shaft near Palo Verde); mine tunnel 24 km NE of Yuma, Arizona; mines near Laguna and Imperial Dams (mine tunnel at Laguna Dam); Senator Mine (Old Senator Mine); unnamed mine No. 1 (unnamed mine, Mine No. 1); unnamed mine No. 2 (unnamed mine).

**Inyo County: Caves & Karst:** ARC No. 1 (Amargosa River Cave No. 1, Tincal Cave); ARC No. 2 (Amargosa River Cave No. 2, Adit Cave); Big Dusty Cave; Brownstone Cave; Chipmunk Cave; Crack-'n-Mound Cave; Defense Cave (Argus Cave, Modoc Cave); Dirty Crack Cave; Furnace Cave (Squeaky's Cave); Gneiss Cave; Gnomes Grotto; Keane Travertine Cave; Lower Shoshone Cave (Shoshone #1 Cave); Millipede Cave; Mountain Springs Cave (Ross Cave); No Snakes Cave; Old Spanish Trail Cave; Pebble Stash Cave; Poleta Cave; Shoshone Turk Cave (Turk Shoshone Cave; Shoshone #3 Cave); Sponge Cave; Tecopa Soil Pipe Caves; Titus Canyon Cave (Great Western Mine Cave); Upper Shoshone Cave (Shoshone Cave; Shoshone #2 Cave);



Wallboard Cave. **Groundwater:** Black Canyon Spring; Grapevine Springs; unnamed hillside spring ca. 7 km S of Black Canyon Spring. **Lava Tubes:** lava tube cave; Microps Cave (lava tube cave); unnamed lava tubes near Crater Mountain. **Mines:** Briggs Mines; Carlyle Mine; Chipmunk Mine; dolomite mine at western base of Inyo Mountains near the shoreline of Owens Dry Lake; four mines at 1340–1400 m elevation; Graham Jones' mine; Iron Cap copper mine; mine at 2140 m elevation in Inyo Mountains; mine in Marble Canyon on E side of the Inyo Mountains; mine in White Mountains at 2400 m elevation; mine on southern slope of White Mountains; Poleta Mine; Roosevelt Wells Mine; small mine on NW slope of Deep Springs Valley; Snow Flake Mine (Snowflake Mine); Talc Mines at Saddle Park Hills; Yaney Mine.

**Kern County: Caves & Karst:** Bodfish Cave (Erskine Creek Cave); crevice near Bakersfield; crevice on Karl Twisselman Ranch near McKittrick; crevices in sandstone outcrop near Carneros Spring; Dragon's Wing Cave; Harrington Cave (California Caverns); Held Hole; Popcorn Pit; Rincon Rift; Upper and Middle Greenhorn Caves (Upper Greenhorn Cave, Upper-Middle Greenhorn Cave); Walker's Cave (Granite Cave). **Groundwater:** well RLSA 2204W. **Mines:** abandoned mines in Caliente Canyon; mine shaft at China Lake Naval Weapons Center (old pumice mine at China Lake Weapons Center?); Mountain Springs Mine; old pumice mine at China Lake Weapons Center (mine shaft at China Lake Naval Air Weapons Station?); unnamed mine.

**Lake County: Caves & Karst:** Bartlett Mountain Cave. **Groundwater:** Highland Creek; Rice Fork Creek below Bear Creek confluence; well on William Tuttle Ranch. **Mines:** horizontal mine shaft on Clear Creek 0.5 mi. NW Lucerne; mine one ridge over south of Clear Lake; Mirabel Mine; Sulfur Bank Mine; unnamed mine tunnel.

**Lassen County: Lava Tubes:** Ash Cave; cave, Eagle Lake Field Station; Eagle Lake Ice Cave; Indian Cave; Packrat Cave; Snaked Cave.

**Los Angeles County: Caves & Karst:** Falls Creek Cave; well near Santa Susana Pass. **Groundwater:** Hot Spring River. **Mines:** Dawn Mine in Millard's Canyon; Emma Annex Mine; old mine in Soledad Canyon, 2 mi. S Acton.

**Madera County: Groundwater:** Rock Creek Spring.

**Marin County: Groundwater:** Bill Williams Creek (Bill Williams Creek, 5 km NW of Corte Madera); Cronan Creek (Cronin Creek, Cronin Gulch, gravel bed of Cronan Creek); Redwood Creek, Muir Woods National Monument. **Mines:** deserted copper mines on Bolinas Ridge near southern end of Tomales Bay (deserted copper mines on Bolinas Ridge). **Sea Caves:** El Reyes Cave (Elephant Cave, Reyes Cave, Gerbode Valley, Secret Cave); Faulty Jellyfish Cave; Grotto 249; Millers Point Cave; Pink Anemone Cave; Point Resistance Cave; Rippled Window Grotto; Seal Sleep Cave.

**Mariposa County: Caves & Karst:** Barber Cave (WSI #C-147, C-148); Bower Cave (Marble Springs Cave); Buck's Cave; Bull Creek Cave (Cave of Orpheus, Centipede Cave, WSI #C-36, C-39, C-41) Carbonate Cave; cave next to Spider Cave; Centipede Cave (Miller's Cave); Damp Cave; Elf Village Cave; Fissure Cave; Indian Cave; Indian Rock Shelter (Indian Cave Rock Shelter); Merced Cave No. 1; Merced Cave No. 2; Millipede Cave (Milliped Cave, WSI #C-22); Munition Cave; Pool Pit; Salamander Hideout Cave; Spider Cave; Sprinkle Cave; unspecified cave in Yosemite Valley; Yosemite Falls Indian Cave. **Mines:** Barium North Mine; Last Chance Adit; Lindsey Mine No. 1; Metzner Mine No. 1; Metzner Mine No. 4; Metzner Mine No. 5; Miller Gulch Mine No. 2; Prospect Adit, Star Mine; Star Mine Complex No. 3.

**Mendocino County: Caves & Karst:** Fault Rock Cave (Rock Fault Cave); Mammoth Cave; Negro Hole Cave (Nigger Hole, Nigger Hole Cave). **Groundwater:** Elder Creek; Garcia Creek; Mud Creek 1 mi. above South Fork Eel River; North Fork of South Fork Noyo River, 0.2 mi. above confluence; Redwood Creek above Mill Creek; Sugar Creek, Angelo Coast Range Reserve headquarters. **Sea Caves:** Cave of Lost Soles

(Cave of the Lost Soles); Hitchhiker Cave; Peter's Creek Cove Cave; Sanctuary Cave; Spy Rock Cave; Starfish Sea Cave.

**Modoc County: Groundwater:** Canyon Creek at Hwy. 71; unnamed spring at the Stough Reservoir Campground, Warner Mountains, Modoc National Forest. **Lava Tubes:** cave at Cave Lake Campground; Cracker Cave; Damon's Cave; Mammoth Cave; unnamed lava cave(s).

**Mono County: Caves & Karst:** Meander Cave; Sticks and Stones Cave. **Groundwater:** Swauger Creek; upper Owens River at Big Springs, Inaya, and EBASCO site. **Mines:** mine complex on west side of White Mountains; Poleta Mine.

**Monterey County: Caves & Karst:** Ghost Cave; Wagon Caves; Willow Creek Cave (Massacre Cave). **Groundwater:** Arnold Spring; San Clemente Creek, 1.3 mi. above Black Rock Creek. **Sea Caves:** cave(s) at Pescadero Point (cave(s) at Pescadero Point, Shell Beach); Glory Cave; sea cave at Rocky Point.

**Napa County: Groundwater:** Bell Creek Site BE03 (Bell (Canyon) Creek); Browns Valley Creek; Carneros Creek; Cyrus Creek Site CY-03-01 (Cyrus Creek); Diamond Mountain Creek; Heath Canyon; Kimball Creek; Kreuse Creek; Milliken Creek at Westgate; mouth of spring under house in Napa; Napa River; Napa River at Bale Lane; Nash Creek; Pickle Creek Site PI-03 (Pickle Creek); Rector Creek; Ritchey Creek; Sarco Creek; Soda Creek Site SO-03 (Soda Creek); Sulphur Creek; Tucukey Creek (Tulucay Creek); unnamed spring (unnamed spring 9 mi. N of Napa); unnamed spring, Soda Canyon Road, approximately 6.4 km N of junction with Silverado Trail and about 6.4 km E of Yountville; upper Napa River at Tubbs Lane (Calistoga); York Creek. **Mines:** Manhattan Mines; McLaughlin Mine (Knoxville Mine). **Volcanic Ash Cave:** Clay Cave (Kiel Cave, White's Cave; White Cave).

**Nevada County: Caves & Karst:** Big Sink; Gretta's Grotto. **Groundwater:** bog spring tributary to Sagehen Creek; Station Spring at Sagehen Field Station (outflow pipe from boxed spring, Sagehen Field Research Station); three other springs along Sagehen Creek (springs in Sagehen Creek).

**Placer County: Caves & Karst:** Canyon Creek Cave ; Lime Rock Cave No. 3; Lime Rock Cave No. 5; Lime Rock Caves (Clipper Gap Caves, Robber's Cave); Robber's Roost Cave ; two small caves in quarry south of Alabaster Cave. **Groundwater:** Lake Tahoe, center of lake (between Skunk Harbor and Tahoe City); Lake Tahoe, McKinney Bay ("off McKinney Bar"); Lake Tahoe, Tahoe City area (Lake Tahoe, Tahoe City area); Lake Tahoe, Tahoma. **Mines:** mine shaft at Forest Hill (mine shaft at Forest Hill).

**Plumas County: Caves & Karst:** Griffith Ranch Ice Cave; Ice Cave; Juniper Cave (Kloppenbergs Caverns, Klopenburg Cave, Erftenbeck's Cave, Little Volcano Cave, Rich Bar Crater, WSI #C-96, C-103, C-105); Soda Springs Cave; unspecified cave. **Groundwater:** Chips Creek; Little Grizzly Creek (near Walker Mine 19 km east of Quincy, Grizzly Creek). **Mines:** Sunnyside Mine.

**Riverside County: Caves & Karst:** Cahuilla Creek Caves (Cahuilla Creek Cave, Coahuila Creek Cave); cave near Torres; caves in Coachellas Valley near Toro; Durmid Bat Caves (Bat Cave, Register Cave); Intaglio Cave; "tidal caves at base of hills SW of Thermal"; unnamed cave near Whitewater; unnamed cave on Echo Island. **Mines:** abandoned copper mine in the Riverside Mountains; abandoned mine SW of Blythe; Alice Mine; deserted mine tunnels and rock shelters in the Riverside Mountains; Garnet Queen Mine; gold mine in the Riverside Mountains; mine tunnel 56 km N of Blythe; mine tunnels in the Riverside Mountains; Mountaineer Mine; Steece Copper Mine (Steece Mine).

**Sacramento County: Caves & Karst:** unspecified cave.

**San Benito County: Caves & Karst:** Balconies Cave; Bear Gulch Cave (Upper Bear Gulch Cave); Condor Gulch Cave; crevice in sandstone cliff 7.5 mi. ESE of Panoche; shallow caves in Pinnacles National Park; Tunnel Cave. **Mines:** abandoned mercury mine 1.6 km WNW of Panoche; North Chalone Peak Mines.

**San Bernardino County: Caves & Karst:** Afton Canyon Caves (Cave Mountain Caves, Afton Slot Canyon Cave); Agave Shelter; Arch Cave; Arrastre Canyon Caves; artesian well near Kokoweef Peak; Bat Cave; bat cave 26 km N of Needles; Box Flap Shelter; Cactus Cave; Cat House Cave; Cave C134; cave in mine on west side of Kokoweef Peak; Cave of the Winding Stair (Winding Staircase Cave); Cima Cave (Indian Cave); Clark Mountain Cave; Classroom Cave; Dusty Cave; Egg Cave (Shaman's Cave); King Kong Cave; Kokoweef Cave (Kokoweef Caverns); Kokoweef Crystal Cave (Crystal Cave, Crystal Kokoweef Cave, Dorr's Cavern of Gold); Lost and Found Cave; Mitchell Caverns (Mitchell's Caverns, Providence Caves, Crystal Caves, El Pakiva Cave, Tecopa Cave, Medicine Cave); Mosquito Morgue Cave; Newberry Cave (CA-SBr-199; SBCM-102); Owl Canyon Cave; Owl Pellet Cave; Papoose Cave (Battlestar Galactica); Peggy 5 Cave; Prick Me Cave; Prickling Cave; Prospector's Cave; Rainbow Cave (Rainbow Canyon Cave); Rat's Nest; Room With A View; Silver Shadow Cave; Slot Cave; Stark Shelter; Striped Waterfall Hole; Toni Rowe's Cave; Triple Lead Shelter (Triple High Lead Shelter); Tuckered Cave; Virginia's Mine Cave (Virginia Mine Cave, Virgin Virginia's Cave); Warner's Cave; Wind Breaker Crack; Wishbone Cave. **Groundwater:** spring cave at Granite Wells near Pilot Knob. **Lava Tubes:** A Cave; B Cave; C10 Cave; C12 Cave (012 Cave); Glove Cave; Owl 3 Cave; Owl 4 Cave; QQ/Cat Cave; Scaturd Cave (Scat Cave, Turd Cave); shallow pit in Pisgah Lava Flow; Whipple Wash Cave; Woodsey Owl Cave. **Mines:** abandoned mine shaft, Saratoga Springs; Carlyle Mine; Green Canyon Mine; Green Mountain Mine; Hart Mine Complex; Mexican Mine; mine in Macedonia Canyon; mine tunnel at Mitchell Caverns; Mountaineer Mine; old mine near Mitchell Caverns; Rainbow Talc Mine; Sidewinder Mine.

**San Diego County: Caves & Karst:** Alpine Cave; Carey's Big Mud Cave (Arroyo Tapiado Mud Caves (part)); cave at Mussey Grove (unnamed cave at Mussey Grove); cave near Suncrest; cave on upper part of Santa Margarita Ranch, Santa Margarita River (unnamed cave on Santa Margarita Ranch); Crusher Cave; Dam Canyon Caves; hillside cave or mine shafts; Little Blowhole Cave; Midnight Creek Cave; Monte Verde Cave; Rat Cave; rock crevice 1.5 N of Barrett Junction; three vertical cracks 1.5 mi. N of Barrett Junction; Thunder Canyon Cave System (TCC System); vertical crack 1.5 mi. N of Barrett Junction; Warner's Cave; White Lady Cave. **Groundwater:** dry stream bed in San Clemente Park, La Jolla (San Clemente Park, La Jolla, dry stream bed in San Clemente Canyon Park); Otay Reservoir (Otay-Reservoir, stream in Otay Reservoir); San Clemente Canyon Park, La Jolla; San Diego River, 500 m downstream from dam of El Capitan Reservoir; stream in Otay Reservoir. **Mines:** Artery Mine; Eagle Lode Mine; mine at Boulder Creek; mine in Noble Canyon; mine tunnel 4.8 mi. E of Laguna Junction; Mine Tunnel No. 1 (mine tunnel 1); Mine Tunnel No. 2 (mine tunnel 2); Mine Tunnel No. 3 (mine tunnel 3); Ready Relief Mine; San Diego Mines; second mine in Noble Canyon; tunnels; unnamed mine at Boulder Creek; unnamed mine tunnel 4.8 mi. E of Laguna Junction. **Sea Caves:** littoral caves at La Jolla Cove; one of the Sea Cliff Caves; Sea Surprise Cave; Seal Sleep Cave; Sunny Jim Cave (one of littoral caves at La Jolla Cove); Sunset Cliffs Sea Cave.

**San Francisco County: Sea Caves:** Brigadune Cave (Cliff House Cave, Sea Cliff Cave); Creeping Ceiling Cave (Creeping Sea Cave); Sutro Baths Cave (Sutro's Cave). **Farallon Islands: Sea Caves:** Breaker Cove Cave; caves on Southeast Farallon Island; Corn Blind Cave; Cricket Cave (cave on N side of Shubrick Point); former sea cave above landing; Funky Arch Cave; Jewel Cave; Low Arch Cave; Rabbit Cave; sea cave on SW face of South Farallon Island near the generator housing; Spooky Cave.

**San Luis Obispo County: Caves & Karst:** cave on La Panza Ranch 15 km W of Simmler (small cave on La Panza Ranch along San Juan Creek?); crevices at La Panza Ranch; crevices in sandstone outcrop, Carizzo Plain; Painted Rock Cave; sandstone cave on NW edge of Carizzo Plain. **Groundwater:** Arroyo de la Cruz at Hwy. 1; Coon Creek at Pecho Valley Rd. **Mines:** mine tunnels between Paso Robles and Cambria. **Sea Caves:** Anemone Swiss Cheese Cave; Cave-in-Rock; Caverns of Mystery (includes Captain Kidd's Cave); Green Algae Cave; Grotto Rock Cave; littoral caves at Shell Beach and Montaña de Oro State Park; Nudi-branch Cave; Sea Dome Cave; Sea Maze Cave.

**San Mateo County: Sea Caves:** San Gregorio Point Cave; Your Fault Cave.



**Santa Barbara County: Caves & Karst:** Chumash Painted Cave; shallow caves; Swordfish Cave. **Groundwater:** Montgomery Spring. **Sea Caves:** Lost Lobster Caves. **San Miguel Island:** Eagle Cave. **Santa Barbara Island:** Sea Lion Cave. **Santa Cruz Island:** Baby's Harbor Cave (Babys Cave, Babies Cave); Bat Cave; Big Sandy Beach Cave; Birdtracks Cave; cave 0.5 mi. W of Pelican Bay; Cave of the Bird's Eggs; Cave of the Sea Swifts; Cave of the Swimming Cormorants; Cormorant Cave; Cueva Valdez; Deathtrap Cave; Del Mar Cove Cave; Diablo Anchorage Cave; Double Decker Cave; Dry Sandy Beach Cave; Emerald Pool Cave; Fry's Harbor Cave (Fry's Cave, Frys Harbor Cave); H Cave; Hidden Amphitheater; Hidden Room Cave; Kiwi Cave; Lady's Harbor Cave (Ladys Harbor Cave); Leftover Cave; Little Scorpion Bay Cave No. 1; Little Scorpion Bay Cave No. 4; littoral cave(s); Mussel Cave; Natural Bridge Cave; Painted Cave (Cueva Pintada); Painted Grotto; Pigeon Guillemots Cave; Potato Rock West Cave; Purple Urchin Cave; Sea Lion's Tunnel; Seal Canyon Cave; Seal's Secret Cave; Seastack Cave; Shipwreck Cave; Sponge Cave; Surging "T" Cave; Surprise Blowhole Cave; Swiss Surprise Cave; Swordfish Cave; three large caves near Chase Anchorage (Blue Grotto, Could Go Cave, Swiss Surprise Cave); Varicolored Sponge Cave; West Cavern Point Cave. **Santa Rosa Island:** San Augustine Caves (Augustine Caves, Booming Cave).

**Santa Clara County: Caves & Karst:** Joaquin Murrieta's Cave; Palser Cave. **Groundwater:** artesian well at Santa Clara University; Chestnut Picnic Area, Stevens Creek County Park; Coyote Creek at Gilroy Hot Springs (No. 142); creeks above Almaden Reservoir; Los Gatos Creek below Lake Elsmán (Los Gatos Creek below reservoir); Saratoga Creek at Tollgate Road; springs of Black Creek (on Black Mountain SW of Los Gatos); upper Stevens Creek.

**Santa Cruz County: Caves & Karst:** Bat Cave (Cliff Cave, Skunk Cave); Black Moth Cave; Bob's Secret Cave; Cathedral Cave; cave near Cave Gulch; Clear Water Cave (Clear Cave); Cliff Chasm Cave; Coral Grotto; Dolloff Cave (Stovepipe Cave); Empire Cave (Cave Gulch Cave, Santa Cruz Cave, Jordon's Cave; Porter Caves); Friday Night Cave; Glory Cave; Humpty-Dumpty Cave; IXL Cave (Man Trap Cave, Tom Sawyer Cave, Hell Hole Cave, ); Kalkar Grottos; Laguna Creek Cave; Pancake Cave; Pogonip Cave; Santa Cruz City Cave (Santa Cruz Cave); Stearns Cave (Sterns Cave); Stump Cave (Stump Hole Cave, Bat Cave, Batman Cave); Technicolor Dream Cave; unnamed cave near Davenport; Vanished River Cave (Davenport Cave, Davenport Quarry Cave, White Moon Cave, San Vicente Creek Cave). **Sea Caves:** Davenport Area Sea Cave No. 20; Mussel Cave; Needle Rock Sea Caves; Screeching Bird Sea Cave; Surfing Tunnel Sea Cave; Urchin's Lair Cave; Whale of a Cave; White Mussels Sea Cave.

**Shasta County: Caves & Karst:** Ancient Palace Cave; Animal Den; Argus Cave; Bat Cave; Battle Creek Cave No. 2 (Wellhella Cave); Bear Creek, Parkeville Rd., 8.5 mi S of Millville; Blanchet Cave; Blue Foamy Cave (LASH #031); Boy Scout Cave; Branch Pit Cave; Burnt Elderberry Cave; Cascadia Cave; cave in Low Pass Creek; caves above Pit River arm of Shasta Lake; Chute Cave; Cinder Pit Cave; Critter Cave; Crystal-Shasta Cave; Deanna Lyn Cave; Discovery 1 Cave; Discovery 3 Cave; Drip Cave; Ebb & Flo Cave; Edward Cave; Elisha Cave; Elk Antler Cave System (LASH #030); Enchanted Chimney Cave; Frog Cave; Glazier Cave; Goonie's Cave; Ground Zero Cave; Hole-of-the-Bear (LASH #028); Hourglass Cave; Jacob David Cave; Jay Feather Cave; Klaydo Cave; Lakelevel Cave (Lakehead Cave); limestone caves at edge of Flat Creek Road; Millipede Cave; Mississippi Cave; Monadenia Cave; Nine Lives Cave; Packrat Cave (Packrat Pit); Pecan Cave (Cave 51); Pinchbug Cave; pit at Potter's Creek; Potter Creek Cave; Rattlecane Cave; Razor-back Cave; Red Shirt Cave; Riley's Cave; Rod's Clay Worm Cave (south of Oregon border); Samwel Cave (Samwell Cave, Stanford Grotto #23, Eagle Rock Cave, Ellery Cave, Cave of the Lost Maiden, Cave of the Magic Pool); Sand Cave; Sandfill Cave; Sandman Cave; Shasta Caverns (Baird Cavern, Lake Shasta Caverns, Shasta Lake Caverns, Stone Man Cave, Lower Baird Cave); shelter below and to left of Goblin Shelter; Sleepy Coon Cave; small cave on Brock Mountain above Squaw Creek; Snail Shell Cave; Sunday Morning Coffee Cave; Sweet Sixteen Cave; unnamed cave at Gray Rocks; unnamed cave at south end of Gray Rocks; unnamed cave below pit at Potter's Creek; unnamed cave in Brock Creek limestone; unspecified cave(s); Wilcox Cave. **Groundwater:** Brandy Creek above South Shore Drive. **Lava Tubes:** Alien Space Cave (Cave 6, USFS #6); Bat Mummy Cave (Cave 28, USFS #28); Big Cave; Casel Lava Tube; Christmas Tree Cave; Comfy Bear Cave; Flashlight Cave; Mad Hatter Cave; North Christmas Tree Cave; Parrish Cave (Double



Door Cave, Cave 4, USFS #4); Pink Coat Cave; Planetarium Cave (Cave 5, USFS #5); Popcorn Cave; Rusty Cave (Cave 26, USFS #26); Subway Cave; Sweet Sinkers Cave; Trail Cave; Whirligig Cave. **Mines:** 1074 Mine No. 2; A1 Red Gulch Mine; Ajax Mine No. 1; Ajax Mine No. 2; Alice Consolidated Mine (Alice Mine); Davis Gulch (Three Amigos) Mine; El Dorado Mine No. 1; Franklin Mine No. 10; Franklin Mine No. 6; Gamin Adit No. 3; Golinski Mine; Milkmaid Mine No. 2; Modesty Gulch Mine No. 1; North Star Main Mine; North Star Mine No. 2; Orus District Mine No. 1; Orus District Mine No. 3; Orus District Mine No. 4; Orus District Mine No. 5; Rock Creek Mine No. 7; Scorpion Mine Complex No. 1; unnamed mine, Section 16.

**Sierra County: Caves & Karst:** Avalanche Cave (Big Avalanche Cave); cave near Avalanche Cave. **Groundwater:** Big Springs; Sardine Spring (probably spring in Trosi Canyon); unnamed spring 4 km SE of Sardine Spring; Yuba River, 0.9 mi. downstream of Indian Creek. **Mines:** Monarch Mine.

**Siskiyou County: Caves & Karst:** Apogee Cave; Battle Creek Cave No. 2; Bear Tooth Pit; Bear's Bed Cave; Bend of the Skylight Cave; Big Waitangi Cave; Bigfoot Cave; Bighorn Cave; Birdnest Cave; Black Bug Cave No. 2; Black Widow Cave; Blowing Hole Cave; Blue Bucket Cave; Bonzai Cave; Broken Down Palace (Brokedown Palace Cave, Tag 144); Brushy Hole; Camilla's Cavern; Cauliflower Cave; cave in Marble Valley; caves 18 km NE of Weed; caves in Marble Mountains Wilderness; Cecilville Cave; Cellar Cave; Check-out Cave; Chimney Cave; Cold Water Cave; Corkscrew Cave; Cougar Den Cave; Creature Feature Cave; Cricket Cave; Daystream Cave; Deep Throat Cave No. 2; Deviled Ham Cave; Easy Street Cave Elderberry Cave; Echoplex Cave; Elderberry Cave; Flat Rat Cave; Flush Cave (Ski Jump Cave, Spiral Staircase Cave, Kip's Cave); Forrest's Cave; Foxhole Cave; Francis' Folly Cave; Frozen Falls Cave (#109); Frozen Star Cave; Go Worm Cave; Hanging Ledges Cave; Horta's Den; Hoyle's Half-Dollar Hole (Half Dollar Hole); Hypochilus Cave; Immaculate Shaft; Insanity Culvert Cave (Limestone Bluff Cave); Intruded Cave; It ta Choo-mah Cave; Jake Bell Cave(s) (Bell Cave); Jibili Cave; Just a Room Cave; Leapin' Lizards Cave; Marble Gap Cave; Million Dollar Cave; Monkeyface Cave; Paradise Cave; Planetary Dairy Cave; Pool Parlor Cave; Poor Georges Cave; Pot Belly Cave; Rat Castle Cave; Rat Cave; Richardson Cavern (Richardson Caverns); RP6 Cave; S Canyon Cave; Scorpion Cave; Shark Cave; Shasta View Grotto; Sinking Waters Cave; Sisyphus Cave; Skunk Hollow Cave (Skunk Cave?); Skunk's Tail Cave; Sky High Cave; Slipstream Cave; small cave near Etna; small cave near Insanity Culvert Cave; Snake Pit; Spider Moth Cave Annex; Stash Talus Cave (Stash Cave); Stiletto Cave; Streambed Cave; Streamline Cave; Tag No. 4-1 Cave (Tag #4-1); Tag No. 4-2 Cave (Tag #4-2); Tin Pail Cave; Traffic Jam Cave (Traffic Jam); Trail Junction Cave; Triangular Cave; True Shasta View Cave; Two Hammer Hole; two-entrance cave at Gazelle; Uncle Fester's Cave; Upstairs-Downstairs Cave (#110, Skyline, Xanadu); Urin Heaven Cave; vertical fissure at Gazelle; Wahashin Cave; Waitangi Cave; Water Bridge Cave; Wind Cave (Ice Cave); Wolfe Den; Wolverine Cave. **Groundwater:** above and below PacifiCorp's bypass; Fall Creek; Scott River above Etna Creek; subterranean habitat at Greenvew; Yreka Creek above Interstate 5. **Lava Tubes:** Adam's Homestead Cave (Ice Cave); Airy Ice Cave; Alarming Extension Cave; aMazing Cave; aMazing Pits; Anglemorm/Lost Pinnacle Cave; Arch Cave No. 1 (Arch Cave); Arch Cave No. 2 (Arch Cave); Balcony Cave; Balcony Extension Cave; Barnum/Sand Caves System (Shastina Lava Caves, Barnum Cave, Sand Cave [New Cave]); Bat Cave No. 1 (Bat Cave); Bat Cave No. 2 (Half Mile Cave, Bat Cave); Beaconlight Cave; Beebowl Cave; Beestro Cave (The Beestro); Beetle Cave; Big Ice Cave (The Big Ice Caves); Big Painted Cave; Billibee's Cave (So What Cave?); BLM Cave; Blue Grotto (Gold Grotto); Bobcat Cave; Boulevard Cave; Bowling Alley Cave; Bray Ice Cave; Broken Ladder Cave (Ice Cave); Burgermeister Bridge Cave; Caldwell Ice Caves (Caldwell Ice Cave); Captain Jack's Cave (Captain Jacks Ice Cave); Castle Cave; Catacombs Cave; Catwalk Cave; caves in Lava Beds National Monument; Chris' Cupboard; Coda Cave; Coral Reef Cave (Coral Cave); Cox Ice Cave (Cox Cave); Coyote Cave; Craig Cave (Craig Ice Cave); Crazy Cave; Crystal Ice Cave (Crystal Cave, Crystal Ball Ice Cave, Crystal Cave, Blue Crystal Ice Cave); Dance Hall Cave; Deep Cavern; Deep Ice Caves; Despoiled Cave No. 1 and No. 2; Despoiled Cave No. 2; Dock Yock Cave (Doc Yok Cave); Dragon Cave; Dragon's Head Cave; Duffy's Well (Duff's Well); Fern Cave; Flat Arch Cave; Flushing Bush Cave; Fossil Cave (M-910); Four Balcony Pit Cave; Four Star Cave; Freudian Complex Cave; Frozen River Cave; Gigantopithecus Cave; Glacier Cavern; Golden Dome Cave; Guano Bridge (Guano Bridge Cave); Harris Mountain Cave; Hercules' Leg/Juniper Cave Lava Tube System; Hopkins Chocolate Cave (Chocolate Cave, Mitertite Cave?); Hourglass Lava Tube; ice

caves 4 km west of Tule Lake; Incline Cavern (Inclined Cavern, Inclined Cave, Incline Cave); Indian Well Cave (Indian Wells Ice Cave); Jack Jones Cave Annex; Jack Jones Ice Cave (Jones Cave, John Jones Ice Cave); Juniper Pole Cave (Juniper Cave [incorrect]); Labyrinth Cave System; Lava Brook Cave; lava cave near Hambone; Lazaroff's Hole; Looping Route Cave (Looping Route Cave); Lost Glove Cave; Low Blow Cave; Lower Heppe Cave; Lyon's Road Cave; Maple Root Cave; Mayfield Ice Cave; Maze Cave; McCloud Ice Caves; Merrill Ice Cave (Bear Foot, Bear Paw, Big Bearpaw Cave and Upper Merrill); Mushpot Cave; new cave in Lava Beds National Monument; Nirvana Cave; NSS No. 8851 (NSS #8851); Ovis Bridge (Ovis Cave); Paradise Alleys Cave; Pearl Cave; Pluto Cave; Pluto Lava Flow Cave No. 1; Pluto Lava Flow Cave No. 2; Pluto Lava Flow Cave No. 3; Pluto Lava Flow Cave No. 4; Pluto Lava Flow Cave No. 5; Pluto Lava Flow Cave No. 6; Post Office Cave (Coca Pipeline Cave, Cocoa Pipeline Cave); Red Tape Cave; Rollercoaster Cave; Rollerdrome (Roller Drome Cave); Sentinel Cave; Skull Ice Cave (Skull Cave); Spider Cave; Starr Cave; Stinking Cave; Sugar Pine Butte Ice Cave; Sunbeam Cave; Sunbeam Pit; Sunnyside Tick Cave; Sunshine Cave; Teeter Rock Cave; The Lonely Palace Cave; Three-Level Ice Cave (Mummy Cave); Thunderbolt Cave; Tichnor Cave/Bertha's Cupboard Cave (Tickner Cave, Bertha's Cupboard Cave); Tichnor's Teepee; Tick City Cave; Tin Can Alley; Township Cave; Tree Cast Pillar Cave; Trench Bench Cave; Twin Falls Cave; unnamed cave across road from Catacombs Cave; Upper Heppe Cave (Heppe Ice Cave, Heppe's Ice Cave); Upper Thicket Cave; Valentine Cave; Water Caves Complex Cave; Windy Cave (Cellar Cave); Yellowjacket Ice Cave; Yellow Tuber Cave. **Mines:** Bear Creek Mine (Bear Creek Road Mine, Gold Bug Mine?); Black Bear Mine; Chan Jade Mine No. 2; Cherry Hill Mine No. 1; Greenview Lower Mine (Johnson Mine?); Greenview Upper Mine (Gibraltar Mine?); Huey Mine No. 1; Independence Creek Mine No. 2 (Independence Mine).

**Sonoma County: Caves & Karst:** small caves at Shell Beach. **Groundwater:** Big Sulphur Creek, 1.2 mi. above Geyser Canyon Creek; Blue Spring, Geyserville area; Gilliam Creek; unnamed spring, just east of Maacama Creek Bridge, 19.5 km east of Geyserville (unnamed spring at Highway 128 at Maacama Bridge).

**Stanislaus County: Caves & Karst:** sandstone cave; unnamed cave. **Groundwater:** Orestimba Creek above Orestimba Road; Tuolumne River (River Mile 25.4); Tuolumne River (River Mile 31.5); Tuolumne River (River Mile 38.1); Tuolumne River (River Mile 42.3); Tuolumne River (River Mile 43.2); Tuolumne River (River Mile 48.8); Tuolumne River (River Mile 51.6).

**Tehama County: Lava Tubes:** Inskip Cave (Cottonwood Cave, Inskip Hill Cave); Wilson Lake Ice Cave (Wilson Ice Cave).

**Trinity County: Caves & Karst:** Butter Creek Cave; cave near Forest Glen Caves; cave on Butter Creek 4–5 mi. S of Hyampom; crack cave on Barker Creek; Del Loma Cave (Del-Loma Cave, Candian Bar Cave, French Flat Cave, Taylor's Flat Cave); Forest Glen Caves (Marble Caves, Limestone Caves); Hall City Cave; Hayfork Cave No. 2; Hyampom Cave No. 2 (Hyampon Cave No. 2); Indian Creek Cave; Indian Valley Creek Cave; Lover's Leap Caves; Lower Butter Creek Cave; Palmer Cave; Paul Gibson Cave; Pigeon Cave; Pype Cave; Shasta-Trinity National Forest Cave No. 1; Shasta-Trinity National Forest Cave No. 2; Shasta-Trinity National Forest Cave No. 3; Shasta-Trinity National Forest Cave No. 4; Trinity Natural Bridge and Cave (Natural Bridge, Lower Natural Bridge Cave); unnamed cave. **Groundwater:** Grassy Flat Creek, 0.2 mi. upstream of Hayfork Creek; underwater cave at Griffith's Lake in the Trinity Mountains; unnamed, intermittent creek on Hwy. 299, river mile mark 16.23. **Mines:** Indian Creek Mine No. 1; Indian Creek Mine No. 2; Steiner Flat Mine (Steiner's Flat Mine); Tunnel Rock Campground Mine; Venicia Mine No. 1; Venicia Mine No. 2.

**Tulare County: Caves & Karst:** Arch Cave; Bear Den Cave; Beulah Cave (Bulah Cave); Carmoe Crevice; Cat Leg Cave; Cave No. 12-19 (Cave #12-19, Stanford Grotto #115 and 116); cave west of Soda Springs; caves in Sequoia National Park; CC Cave; Cedar Cave; Cirque Cave (House Cave, White Chief Cirque, Big Sink Cave, Hedlund's Cave, Cave of the Cold Air); Clough Cave; Comfy Bear Cave; Crystal 67 Cave (Crystal Cave, Camp Lena Crystal Cave, Haughton's Cave, Houghton's Cave, WSI #A-18, Cave No. 67); Crystal Sequoia Cave (Crystal-Sequoia Cave, Crystal Cave, Patawin Cave); Deep Creek Cave (Mace Cave, Crystal

Cave); Dehydrated Cave; Eighteenth Hole (18th Hole, Eighteenth Cave); Eleven Range Shelter No. 2; Flowstone Wall Pit; Harry's Bend Cave (Harrys Bend Cave); Hidden Cave; House Cave; Hurricane Crawl Cave (Hurricane Hole Cave, Schist Canyon Cave); Jordan Cave (Jordon Cave); Kaweah Cave; Kaweah Monkeyflower Cave; Lange Cave; Lightning Cave; Lilburn Cave (Redwood Canyon Crystal Caverns, Redwood Canyon Cave, Wilburn Cave); Lost Soldier's Cave (Soldier's Cave); Marble Falls Cave; Marmot Falls Cave; Marmot Highway Cave; May's Cave (Mays Cave, May's Hole); Moorehouse Springs Cave; New Cave; Nolisa Cave; Noontime Cave; Orrin Belden Cave; Overhang Cave; Packsaddle Cave (Crystal Cave); Palmer Cave; Panorama Cave; Panorama/Sink Cave System (Panorama Cave, Sink Cave); Paradise Cave (Cave No. 12); Pet Cemetery Cave; Pine Grosbeak Cave; Popcorn Pit; Rattlesnake Cave (Rattlesnake Hole); Red Tape Cave; Rough Cave; Salamander Cave; Schist Canyon Cave; Seldom Seen Cave; small caves in Cave Cliff in Sequoia National Park; Speas View Shelter; Stand Up Cave; Tufa Spring Cave; unnamed cave, Yucca Creek Canyon, Sequoia National Park; Upper Bryant Cave; Ursa Minor Cave; Walk Softly Cave; White Chief Cave (Main White Chief Cave, Cave of the Cold Air); Wiessraum Cave (Weissraum, Weiss Raum, Weissram, Weisram Cave); Windy Pit. **Groundwater:** Big Spring; Kuala Spring; Lange Spring; Mossy Spring; spring Below Hurricane Crawl Cave. **Mines:** Eclipse Mine; mine shaft, Cedar Creek Camp Ground; Sequoia National Park Mine (Sequoia Mine).

**Tuolumne County: Caves & Karst:** Baconrind Cave; Banksula Cave; Bend Cave (Cave 005, Ca-Tuo-769); Border Pit; Buzzard Cave (Cave 012); Cable Pit; Cave Man Cave (Caveman Cave?); Confluence Cave (Cave 024, Ca-Cal-770); Crack of Doom Cave (Crack of Doom); Craig's Pit; Crystal Butterfly Cave (Butterfly Cave, WSI #C-184); Crystal Palace (Crystal Palace Cave, WSI #C-60 and C-64; Marble Cave); Crystal Tuolumne Cave (Crystal-Tuolumne Cave, WSI #C-183); Experimental Mine Cave; Eye of the Alligator Cave; Fivescythe Cave (Fivesyth Cave); Forscythe Cave (Forsyth Cave); Gate Pit Cave; Indian Dwelling Cave (Cave 046, Ca-Tuo-771); Indian Quarry Cave No. 1 (Indian Quarry Cave #1, Cave 047, Ca-Tuo-772); Indian Quarry Cave No. 2 (Indian Quarry Cave #2, Cave 048, Ca-Tuo-773); Lower N Mt. Prospect No. 3; McLean's Cave (Cave 054, WSI #C-146, Mclean's Cave, McLean Cave); McNamee's Cave (Quarry Cave, The Old Cave, Railing Cave); Milkcan Cave; Mine Cave; Moss Cave; Pine Log Cave; Pinnacle Point Cave; Porcupine Cave; Porcupine Skull Cave; Predator Cave; Railing Cave (WSI #C-67, C-77, C-81, and C-82); Razorback Cave (Cave 067); Razorback Grotto (Cave 068, Razorback Grotto Cave); Robber's Cave (Lime Rock Cave #6); Sauna Pit (Sauna Cave); Scavenger Cave; Scorpion Cave (Cave 089); Small Cave (WSI #C-88); Snell's Cave (Snells Cave, Snell Cave, Cave 077, Tuol-S-18); Tank Cave; The Catacombs (WSI #C-87, Pine Log Cave, Pine Log Caves); Toppled Table Talus Cave (TTT); Transplant Mine tailings; Troll Cave; Tube Cave (Cave 083); Tuolumne Crystal Cave (Crystal Tuolumne Cave); unnamed cave on N side of Table Mountain (unnamed cave); Vulture Cave (Cave 088); Waterfall Cave (Catch Me if You Can Cave); White Owl Cave (Snowy Owl Cave); Windeler Cave (Wendeler Cave, Wendler Cave); Zeke's Pit; Zilch Cave (Cave 087). **Groundwater:** small unnamed spring 14.8 km southeast of Angels Camp; spring 5.5 km SE of Sonora; unnamed spring (small unnamed spring, ca. 14.8 km southeast of Angels Camp); unnamed spring 15 km SE of Sonora. **Mines:** Adit 8/9 (Hetch Hetchy); Devils Gate Adit No. 2; Early Intake Adit (Hetch Hetchy); Ellen Minton Mine No. 2; Ellen Winton Mine No. 1; Fair Oaks Mine No. 1; Juniper Adit No. 1; Juniper Adit No. 2; Lower N Mt. Tunnel No. 1; Lower N Mt. Tunnel No. 2; Lower N Mt. Tunnel No. 4; Lower Von Trump Mine (Lower von Trump Mine, Lower Van Trump Mine); Lucky Strike Mine No. 1; mine; mine 2.5 km N Columbia; mine 3 km N Columbia; mine on ridge 4.5 km N of Columbia; mine tunnel along road to Experimental Mine; mine tunnel near Pinnacle Point Cave; Mountain Lily Mine No. 1; Playpen Adit No. 1; Riverbend Mine No. 1; Sarbo Mine; Transplant Mine (Von Trump Mine); unnamed mine near Stampmill.

**Unknown County: Caves & Karst:** cave(s) utilized as nest site by the California condor (six caves utilized as nest sites by the California condor); Doney Crack; Lassie, Timmy's Still in the Mine Cave (southern Sier-ras); Natural Bridge Cave.

**Ventura County: Caves & Karst:** B Hole; Bat Cave (Vanowen Bat Cave, Venowen Bat Cave); Bee's Nest Cave; cave in Santa Paula Canyon; Clear Springs Cave; Condor Cave (Hole in the Wall); conglomerate caves near Chatsworth; unnamed cave (unspecified cave). **Groundwater:** Lion Canyon, Tule Ceek, and Piru Creek.

**Anacapa Island: Sea Caves:** Catacombs Arch (East Island #17); Cathedral Cave (East Island #6); Cat's Eye Cave No. 6 (Cat's Eye Cave #6, West Island #43); Cat's Eye Cave No. 7 (Cat's Eye Cave #7, West Island #44); Cliff Chasm Cave (Middle Island #50); Dead Seal Cave (East Island #12); Frenchy's Cave (West Island #28); Green Abalone Caves (Middle Island #35); Happy Lobster Cave (East Island #7); Honeycomb Worm Cave (Middle Island #33); If You Dare Cave (West Island #10); Nesting Cormorant Cave (West Island #14); Respiring Chimney Cave (Middle Island #40); Rippling Reflections Cave (Middle Island #55); Sea Lion Cave (Sea Lion Cave, Anacapa Island); Seal Cave; Shipwreck Cave (Middle Island #34); Slippery Rock Cave (Middle Island #57); The Aerie (Middle Island #4); Three Door Cave (Middle Island #43); Three Fingers Cave (West Island #9, Dark Cave); Treasure Chest Cave (Middle Island #23); Truth or Dare Cave (West Island #11); Urchins' Lair Cave (Middle Island #52); Wooden Lettuce Cave (West Island #23).

**Yolo County: Groundwater:** Cache Creek;



## Appendix 3

### Glossary

- Accidental:** An animal that does not normally live in caves; “incidental” means nearly the same.
- Aquatic:** Living in water. Aquatic cave animals include amphipods, isopods, crayfish, planarians, fishes, and blind salamanders. See also Terrestrial and Marine.
- Arthropods:** Animals with jointed legs and hard exoskeletons. The group includes insects, crustaceans, spiders, millipedes, and several other types of animals commonly found in caves.
- Aquifer:** A geologic formation from which significant amounts of groundwater can be pumped for domestic, municipal, or agricultural uses. Many small organisms are adapted to groundwater.
- Biospeleology (speleobiology):** Cave biology, the scientific study of cave animal life, or the biology of caves, karst, and groundwater. A biologist who specializes in this study is called a cave biologist, biospeleologist, or speleobiologist.
- Breakdown:** A heap of rock filling all or part of a cave passage after the collapse of part of the walls or ceiling. The term usually refers only to large accumulations of rock.
- Carbonate:** Rocks composed of limestone, marble, dolomite or other types containing the carbonate group,  $\text{CO}_3$ .
- Carnivore:** A member of the Order Carnivora, e.g., bears, wolves, cats, etc., or an animal that lives by eating the flesh of other animals (many groups). See also Herbivore; Insectivore; Omnivore.
- Cave:** Any natural cavity or series of cavities beneath the surface of the earth. Such cavities are usually classed as caves only if they are large enough to permit entrance by humans. The term is generally synonymous with cavern and is commonly applied also to wind- or water-eroded rock cavities, sea caves, lava tubes, crevice and talus caves, soil pipes, and other natural features. In a narrow context cave may apply only to karst caves, formed by the dissolution of rock. In a broad context all holes, cracks, crevices, and interstitial spaces are caves to tiny subterranean creatures.
- Cave deposit:** An accumulation of material other than speleothems, such as charcoal, fossils, clay, silt, gravel, and other flood-borne debris.
- Caver:** A person who explores caves as a hobby or for recreation. See also Speleologist and Spelunker.
- Cavernicole:** A species that is either a facultative cave form, such as a troglophile or stygophile, or an obligate cave form, such as a troglobite or stygobite.
- Cave system:** All the cavities and underground passages in a given area, which are now or at one time were interconnected.
- Community:** All the organisms that live in a particular habitat and are bound together by food chains and other interrelations.
- Constant-temperature zone:** The area of a cave where air temperature is nearly constant throughout the year and approximates the average annual temperature aboveground. See also Zonation.
- Consumer:** Any living thing that is unable to manufacture food from nonliving substances, but depends instead on the energy stored in other living things. See also Carnivore; Decomposers; Food chain; Herbivore; Omnivore; Producers.
- Crustaceans:** The large class of animals that includes lobsters, crayfish, amphipods, isopods, and many similar forms. Crustaceans typically live in water and have many jointed appendages, segmented bodies, and hard exoskeletons.
- Decomposers:** Living things, chiefly bacteria and fungi, that live by extracting energy from the decaying tissues of dead plants and animals. In the process, they also release simple chemical compounds stored in the dead bodies and make them available once again for use by green plants.
- Detritivore:** An animal that feeds on dead and decomposing organic matter, e.g., millipedes.
- Ecology:** The scientific study of the relationships of living things to one another and to their environment. A scientist who studies these relationships is an ecologist.
- Edaphobite, endogean:** A soil-dwelling animal, sometimes found in caves. Endogean environments are the parts of caves that are in communication with surface soils through cracks, groundwater, and roots. It is sometimes difficult to say if small insects, symphylans, millipedes, mites, and the like, are endogeans or true troglobites.

**Epigean:** An adjective used to describe the **epigeum** (surface environment), as opposed to the hypogean (subterranean) environment.

**Epigeum:** The surface environment.

**Epikarst:** The upper zone of a karst area that extends downward as sinkholes, fractures, fissures, and other surface karst features to where the natural porosity of the bedrock is located. Epikarst can range from almost nonexistent to tens of meters deep.

**Fault:** A planar rock fracture which shows evidence of relative movement of the opposite sides.

**Food chain:** A series of plants and animals linked by their food relationships; the passage of energy and materials from producer through a succession of consumers. Green plants, plant-eating insects, and an insect-eating bat would form a simple food chain. See also Food web.

**Food pyramid:** The normally diminishing number of individuals and amount of organic material produced at each successive level along a food chain. The declining productivity at each level results from the constant loss of energy in metabolism as the energy passes along the chain. See also Trophic levels.

**Food web:** An interlocking system of food chains. Since few animals rely on a single food source and since no food source is consumed exclusively by a single species of animal, the separate food chains in any natural community interlock and form a web.

**Formation:** A distinct layer of rock from one geologic period, such as the Calaveras Formation. Also a term commonly used for a speleothem.

**Fossil:** Any remains or traces of animals or plants that lived in the prehistoric past, whether bone, cast, track, imprint, pollen, or any other evidence of their existence.

**Geological map:** A map that shows the kinds of rock lying beneath the soil or reaching the surface in a given area. A topographic map shows the contour or elevation lines, and surface features such as watercourses.

**Geology:** The scientific study of the earth and the rocks that form it. A scientist who specializes in this study is a geologist.

**GIS:** Geographic information system, a computer program used for mapping with geographic coordinates.

**Guano:** Excrement, as of bats, crickets, or sea birds. In certain bat caves and on islands colonized by sea birds, guano sometimes accumulates in such vast quantities that it is mined commercially for fertilizer.

**Groundwater:** Water that collects underground in soil spaces, bedrock pores and cracks, constituting a subterranean habitat in which life flourishes. California is the single largest user of groundwater in the nation.

**Habitat:** The immediate surroundings (living place) of a plant or animal; everything necessary to life in a particular location except the organism itself.

**Herbivore:** An animal that eats plants, thus making the energy stored in plants available to carnivores. See also Carnivore; Insectivore; Omnivore.

**Herps, herpetofauna:** Amphibians and reptiles.

**Hibernation:** A prolonged dormancy or sleeplike state in which animal body processes such as heartbeat and breathing slow down drastically and the animal neither eats nor drinks. Nearly all cold-blooded animals and a few warm-blooded animals hibernate during the winter in cold climates. Extremely large aggregations of bats, crickets, and spiders hibernate in some caves.

**Holocene Epoch:** The name given to the last 11,700 years of the Earth's history — the time since the end of the last major glacial epoch, or "ice age." The current epoch of the Quaternary Period following the Pleistocene Epoch.

**Humidity, relative:** The ratio, expressed as a percentage, of the amount of water vapor actually present in air of a given temperature, as compared with the greatest possible amount of water vapor that could be present in air at that temperature. Calculation of relative humidity can be done from tables, special slide rules or calculators, graphs, or complex equations. See also Hygrometer and Psychrometer.

**Hygrometer:** An instrument that reads the humidity in the air directly; some are based on a hair's ability to shrink or expand with humidity, or on certain electronic chips. Generally, a psychrometer is more accurate at higher humidities (above 95%). See also Psychrometer.

**Hypogean:** An adjective for the **hypogeum** (cave environment), as opposed to surface (epigean) and endogean environments.

- Hyporheos:** From Greek, *hypo* (below) and *rheos* (flow). The **hyporheic zone** is beneath and alongside a stream bed, where there is mixing of shallow groundwater and surface water. The biological community that inhabits this zone is called the **hyporheos**.
- Insectivore:** A member of the Order Insectivora, e.g., shrews and moles, or an animal that feeds on insects. Almost all species of North American bats (Order Chiroptera) are insectivorous. See also Carnivore; Herbivore; Omnivore.
- Invertebrate:** An animal, such as a planarian, snail, or crayfish, without a backbone. See also Vertebrate (Phylum Chordata).
- Joint:** A more-or-less vertical crack in bedrock, along which caves often form through dissolution by groundwater.
- ka:** Thousands of years ago.
- Karst:** Landscapes formed by the dissolution of soluble rocks such as limestone, dolomite, and gypsum, with underground drainage systems, caves, sinkholes, dolines, and springs. Also the typical surface terrain of a limestone region. See also Epikarst and Pseudokarst.
- Larva** (plural larvae): An active immature stage in an animal's life history when its form usually differs from the adult form, such as the grub stage in the development of a beetle or the tadpole stage in the life history of a frog. See also Metamorphosis; Pupa.
- Lava tube:** A natural conduit formed by flowing lava which moves beneath the hardened surface of a lava flow. Tubes can be actively draining lava from a volcano during an eruption, or can be extinct, meaning the lava flow has ceased and the rock has cooled and left a long, cave-like channel.
- Limestone, marble:** Sedimentary rock composed primarily of calcite (calcium carbonate). It usually originates through the accumulation of calcareous (limy) remains of marine animals. Because limestone is easily dissolved by carbon dioxide in water, caves are more common in limestone than in any other type of rock. Marble is a metamorphic rock that may be foliated or non-foliated, composed of recrystallized calcite or dolomite.
- Littoral:** On the shore or coast. A sea cave is a littoral cave.
- Ma:** Millions of years ago.
- Mammals:** The class of animals that includes bats, mice, man, and many others. They typically have a body covering of hair and give birth to living young, which are nursed on milk from the mother's breast.
- Marine relict:** An animal whose presently extinct ancestors lived in salt water but became adapted to life in fresh water when an area formerly covered by the sea became dry land.
- Mesozoic Era:** An interval of geological time from about 252 to 66 Ma (million years ago).
- Metamorphosis:** A change in the form of a living thing as it matures, especially the drastic transformation from a larva to an adult. See also Pupa.
- Metamorphism:** The change of minerals or geologic texture in pre-existing rock, without the rock melting, e.g., limestone metamorphosed into marble. The change occurs primarily due to heat, pressure, and the introduction of chemically active fluids. The chemical components and crystal structures of the minerals making up the rock may change even though the rock remains a solid.
- Microclimate:** "Little climate." The environmental conditions, such as temperature; humidity, and air movement, in a very restricted area, such as a sheltered nook in a cave wall or beneath a rock.
- Microhabitat:** A miniature habitat within a larger one; a restricted area where environmental conditions differ from those in the surrounding area. A sheltered nook in a cave wall is an example of a microhabitat within the cave.
- Mine:** A man-made vertical shaft, sloping or horizontal excavation (slope or adit) in the earth from which mineral substances are taken. In this study we use "mine" to refer generally to abandoned or inactive underground mines which may be in any type of hard rock, and in which cave-inhabiting species may occur. Many different minerals are mined in California. The term may also refer to an open quarry.
- Mold:** A microscopic form of fungus responsible for much food spoilage and, in caves, for conspicuous tufts quickly covering scats, dead insects and bats, and even wooden structures such as ladders.
- Neotenic:** Retaining juvenile traits as an adult, as in salamanders that retain their gills throughout life.
- Omnivore:** An animal that habitually eats both plants and animals. See also Carnivore; Herbivore; Insectivore.



**Organic:** Pertaining to anything that is or ever was alive or produced by a living plant or animal. Organic material brought into the cave from outside is virtually the only source of food for cave dwellers.

**Paleontologist:** A scientist who studies the life of the past by interpreting fossil remains of plants and animals.

**Parietal fauna:** Pertaining to the inhabitants on the walls of the entrance and twilight zones of a cave.

**Paleozoic Era:** An interval of geological time from about 541 to 252 Ma (million years ago.)

**Permian Period:** A geologic period and system which extends from 298.9 to 252.17 Ma (million years ago). It is the last period of the Paleozoic Era, following the Carboniferous Period and preceding the Triassic Period of the Mesozoic Period.

**Photosynthesis:** The process by which green plants convert carbon dioxide and water into simple sugar. Chlorophyll and sunlight are essential to the series of complex chemical reactions involved in the process.

**Phreatic:** An inhabitant of groundwater, often exhibiting troglomorphy, but usually not found in caves. Many blind amphipods and other crustaceans are found in springs, upwellings and bottoms of streams, the hyporheos below stream beds, gravels, wells, and deep lakes.

**Pigment:** A chemical substance that imparts color to an object by reflecting or transmitting only certain light rays and absorbing all others. For example, a substance that absorbs all but green rays appears green. An object that contains no pigment, on the other hand, appears white because it reflects all light rays and absorbs none. Many troglodites have lost most or all their pigment.

**Planarian:** A flatworm. A relatively simple wormlike animal with a flattened ribbonlike body, a distinct head end, and a mouth located more or less centrally on the underside of the body.

**Pleistocene Epoch:** Pertaining to the epoch in the earth's history from 2,588,000 to 11,700 years ago, when the last major glaciation ended. The epoch includes at least four major retreats and advances of continental glaciers. See also Holocene.

**Pollution:** The fouling of water or air with sewage, industrial wastes, or other contaminants, making them unfit to support many forms of life. Pollution can be especially serious underground where extensive networks of passages spread contaminating materials for long distances.

**Preadapted:** Possessing adaptations that would contribute to survival in a habitat other than the immediate one because of similarities in living conditions in the two habitats. Insects that live in leaf litter on the forest floor, for example, may be pre-adapted to cave life.

**Predator:** An animal that lives by capturing other animals for food. See also Prey.

**Prey:** A living animal that is captured for food by another animal. See also Predator.

**Producers:** Green plants, the basic link in any food chain; by means of photosynthesis, green plants manufacture the food on which all other living things ultimately depend. They are available in the cave community only in the twilight zone, or as debris that falls or washes in. A few types of bacteria also manufacture food from nonliving substances and therefore serve as producers in some cave communities. See also Consumer.

**Psychrometer:** An instrument used for measuring atmospheric saturation or relative humidity. The simplest sling psychrometers consist of two thermometers mounted on a rotating frame. One thermometer's bulb is kept moist, the other dry. By comparing the "wet bulb" and "dry bulb" readings of the two thermometers after they have been whirled in the air, one can determine the relative humidity. An electric fan is used to ventilate the wet bulb in many psychrometers. See also Hygrometer.

**Pupa (plural pupae):** The inactive stage in the life history of certain insects during which the larva undergoes a gradual reorganization of its tissues in the process of becoming an adult. See also Metamorphosis.

**Pseudokarst:** A cave area that resembles karst but that is not formed by the dissolution of soluble rocks. Examples are lava tubes and related features, talus caves, soil-pipe caves, tectonic caves, sea caves, and others.

**Quaternary Period:** Relating to the most recent period in the Cenozoic era, following the Tertiary period and comprising the Pleistocene and Holocene epochs (and thus including the present).

**Scats:** Animal droppings, an important source of food in caves.

**Scavenger:** An animal that eats the dead remains and wastes of other animals and plants. See also Predator.

**Sea cave:** Also known as a littoral cave, a type of cave formed primarily by the erosive wave action of the sea.



**Sinkhole:** A surface depression in cave country. A sinkhole is produced when the roof of a cave collapses or when limestone rock underlying the soil is slowly dissolved by water.

**Species** (singular or plural): A group of plants or animals whose members breed naturally only with each other and resemble each other more closely than they resemble members of any similar group. A “new species” is one that has been recognized by an expert taxonomist, but is not yet described in the scientific literature.

**Speleologist:** A person who studies caves in any of their scientific aspects. See also Caver and Spelunker.

**Speleothem:** A general term for any mineral deposit or formation found in caves, such as stalactites, stalagmites, or gypsum flowers.

**Spelunker:** A person who explores caves as a hobby or for recreation. In recent years this term has been applied more to the untrained cave visitor. “Cavers rescue spelunkers” is one way that cavers explain the difference. See also Caver and Speleologist.

**Stygobite (stygobiont):** An aquatic troglobite.

**Stygophile:** An aquatic troglophile.

**Stygoxene:** An aquatic troglaxene.

**Terrestrial:** Living on land. Not to be confused with “epigean.” Terrestrial cave animals include blind beetles, millipedes, spiders, and crickets. See also Aquatic.

**Troglobite (troglobiont):** “Cave dweller.” An animal that is limited to caves and similar habitats, and exhibits troglomorphy. Also known as a “troglobiont,” obligate cavernicole, or obligate subterranean species. See Sket (2008).

**Troglomorphy:** The physical characteristics of a troglobite or stygobite; e.g., reduced eyes and pigment, elongated appendages, well-developed tactile and olfactory organs, etc.

**Troglophile:** “Cave lover.” An animal that can complete its life cycle in caves but may also do so in suitable habitats outside caves. Some troglophiles are cave-limited but may or may not exhibit some troglomorphy, and may be relicts of climatic change. Facultative cavernicole is synonymous. Sket (2008) defined additional terms that are not used in this paper: **eutroglophile** is an essentially epigean species, but able to maintain a permanent subterranean population; **subtroglophile** is inclined perpetually or temporarily to inhabit a subterranean habitat but is bound to the surface for some biological functions (e.g., feeding).

**Troglaxene:** “Cave visitor.” An animal that habitually enters caves but must return periodically to the surface for certain of its living requirements, usually food. Examples are bats, crickets, and many other species.

**Trophic levels:** Feeding levels in a food chain, such as producers, herbivores, detritivores, predators, and so on. Most food chains include a maximum of four or five trophic levels.

**Twilight zone:** The area of a cave where light penetrating through the entrance is sufficient to permit human vision. See also Zonation.

**Type locality:** The place from which the name-bearing specimen (holotype) of a species is described.

**Variable-temperature zone:** The area of a cave where air temperature fluctuates with the seasons. See also Zonation.

**Vertebrate:** An animal with a backbone. The group includes fishes, amphibians, reptiles, birds, and mammals. Some amphibians and fishes live permanently in caves. See also Invertebrate.

**Water table:** The upper level of the under-ground reservoir of water; the level below which the soil and all cracks and channels in the rocks are saturated.

**Zonation:** The organization of a habitat into a more or less orderly series of distinctive plant and animal associations as a result of variations in environmental conditions. Zones in a cave are the twilight zone, the variable-temperature zone, and the constant-temperature zone, or simply the twilight and dark zones.

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