Annotated Checklist of the Diplura (Hexapoda: Entognatha) of California

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Abstract

The first checklist of California dipluran taxa is presented with annotations. New state and county records are reported, as well as new taxa in the process of being described. California has a remarkable dipluran fauna with about 8% of global richness. California hosts 63 species in 5 families, with 51 of those species endemic to the State, and half of these endemics limited to single locales. The genera Nanojapyx, Hecajapyx, and Holjapyx are all primarily restricted to California. Two species are understood to be exotic, and six dubious taxa are removed from the State checklist. Counties in the central Coastal Ranges have the highest diversity of diplurans; this may indicate sampling bias. Caves and mines harbor unique and endemic dipluran species, and subterranean habitats should be better inventoried. Only four California taxa exhibit obvious troglomorphy and may be true cave obligates. In general, the North American dipluran fauna is still under-inventoried. Since many taxa are morphologically uniform but genetically diverse, genetic analyses should be incorporated into future taxonomic descriptions. Natural Heritage Program conservation status ranks were recommended.

Key words: biodiversity, endogean, subterranean, troglobiont, trogloomorphy, two-pronged bristletail

Introduction

We present here the first comprehensive checklist of the California dipluran fauna, building upon previous regional checklists by Hilton (1932), Condé & Thomas (1957), Bareth & Condé (1958), and Allen (1994, 2002). Diplurans, commonly known as two-pronged bristletails, are one of the most ancient groups of hexapods but their diversity is poorly documented. Globally, at least 800 species in 8 families are recognized, with many more taxa remaining to be described (Allen 2002). Diplurans have small segmented, pale bodies (most being a few millimeters in length), lack eyes and wings, and have two beaded antennae and two sensory tails (cerci). Due to their small size, cryptic habits, the loss of these appendages during collection, and the difficulty in identification (due to morphological homogeneity), diplurans are not well studied (Lock et al. 2010).

Methods

To build the checklist, we attempted an exhaustive literature review, examined museum collections, and queried various databases. The following data sources were particularly useful: California Academy of Sciences (CAS) Department of Entomology Collection Catalog Database; National Museum of Natural History (NMNH or USNM) Department of Entomology collections database; University of California at Berkeley Essig Museum of Entomology (EMEC); University of California at Davis Bohart Museum of Entomology (BME); and Natural History Museum of Los Angeles County (LACM). Of considerable importance were the unpublished determinations by L. Smith of slide mounted material that was curated by his associate, R. Schuster, former collections manager at BME. All records not directly attributed to others are new records of the authors. We did not refine taxonomic determinations of the material we summarize here, but taxonomic keys of families and subfamilies can be found in: ondé & Thomas (1957); Paclt (1957); Ferguson (1981a, 1990); and Allen (2002). The three superfamilies of diplura can easily be distinguished by the type of caudal cerci: Campodeoidea possess...
elongate, segmented, and filiform cerci; Projapygoidea possess shorter segmented cerci with glandular canals; and Japygoidea possess unsegmented, robust, and usually heavily sclerotized forceps (Allen 2002; Dallai et al. 2011).

Results

Suborder Rhabdura Cook, 1896

Superfamily Projapygoidea Pagés, 1959

Family Anajapygidae (Paclt, 1957)

*Anajapyx hermosus* Smith, 1960

Placer County: 4 miles west of Newcastle, 5 Apr. 1958, paratype female (BME), L. Smith and R. Schuster (Smith 1960c).

Superfamily Campodeoidea Handlirsch, 1903

Family Campodeidae Lubbock, 1873

Subfamily Campodeinae Condé, 1956

The genus *Campodea* Westwood, 1842 has a “worldwide distribution and comprises about 150 soil-dwelling, omnivorous species, sized up to 5 mm and highly uniform in appearance” (Podsiadlowski et al. 2006, p. 50).

*Campodea californiensis* Hilton, 1932

**Alameda County**: Berkeley, Charles Lee Tilden Regional Park, 50–100 meters east of intersection of Shasta Road (Rd.) and Hill Rd., 1 male, 28 Feb. 1955, P. Remy; Berkeley, canyon near Memorial Stadium, 1 female, 20 Feb. 1955, P. Remy; Oakland, middle and upper region of Strawberry Creek, 1 female, 18 Feb. 1955, P. Remy; Oakland, Strawberry Canyon, between the stream and the road, to the level of Jardin Botanique, 1 female, 19 Feb. 1955, P. Remy; Oakland, under wood, 350 meters downstream of Saint Theresa Catholic Church, left shore of the stream, 18 Mar. 1955, 1 female, P. Remy; Oakland, 130 meters south of Saint Theresa Catholic Church, 2 males, 1 female, 6 Mar. 1955, P. Remy; Oakland, 4400 Gilbert Street (St.), garden in fallow land, 1 male, 6 Mar. 1955, P. Remy; Redwood Park, 28 May 1954, 1 male, 1 female, E. Gilbert (Condé & Thomas 1957). **Contra Costa County**: Acalanes Valley, fallow land garden 30 meters uphill of 847 Acalanes Rd., 1 male, 16 Mar. 1955, P. Remy (Condé & Thomas 1957). **Fresno County**: Non-specific records reported by Allen (2002). **Humboldt County**: Redwood, south of Eureka (Allen 1994). **Inyo County**: Non-specific records reported by Allen (2002). **Los Angeles County**: Los Angeles, hill to the right of the entrance to the tunnel on the road to Pasadena, near Yale St., 15 Feb. 1955, 2 larvae, P. Remy; Elysean Park, 1 female, 15 Feb. 1955, P. Remy (Condé & Thomas 1957). **Marin County**: Muir Woods (Silvestri 1933; Allen 1994); “Region d’Inverness, forest near the coast of Tomales Bay, 2 males, 1 female, 8 Mar. 1955, A. Hill, J. MacSwain, P. Remy, P. Wygodzinsky; Tocaloma, forest near the bridge, 2 males, 1 female, 8 Mar. 1955, J. MacSwain and P. Remy; Oakland, 130 meters south of Saint Theresa Catholic Church, 2 males, 1 female, 15 Oct. 1953, V. Roth; 4 miles south of Woodacre, 6 females, 1 Nov. 1953, E. Gilbert, V. Roth, and R. Schuster (Condé & Thomas 1957). **Mendocino County**: Caspar, 1 male, 4 females, 1 larva, 3 Mar. 1954, J. Helfer; Hartsook Grove, 1 male, 3 females, 19 Apr. 1953, E. Gilbert and R. Schuster; Franklin Lake Park, 1 larva, 10 Oct. 1953, J. MacSwain (Condé & Thomas 1957). **Monterey County**: Monterey, forest on the right of the road to Salinas, 200 meters of intersection of Fremont St., 1 larva, 25 Mar. 1955, P. Remy; Carmel, 1 male, 21 Dec. 1953, V. Roth (Condé & Thomas 1957). **Riverside County**: “Idylwild, under needles,” 1 female, 1 Aug. 1947, R. Elliott (Bareth & Condé 1958). **San Benito County**: Pinnacles National Monument, near Headquarters and cabins, 1 male and 2 larvae, 24

The subspecies **C. c. nordica** Silvestri, 1933 is known only from Corvallis, Oregon (Silvestri 1933; Allen 2002).

**Campodea (Hypercampa) essigi** Silvestri, 1933


**Campodea insidiator** Bareth & Condé, 1958

**Humboldt County**: “1/2 mile S of Founder’s Tree, near Dyerville, in soil, under logs, and around Sequoia tree bases”, 4 males, 9 females, 1 undeterm., 18 Aug. 1947, C. and J. Remington (Bareth & Condé 1958); “in redwoods south of Eureka” (type in the Pomona College Collection) (Hilton 1932).

Bareth & Condé (1958) also reassigned these Humboldt County specimens formerly identified as **C. californiensis**: Freshwater, 1 male, 10 Oct. 1953, G. Marsh and R. Schuster; 1 mile south of Dyerville, 2 larvae, 19 Oct. 1953, E. Gilbert and R. Schuster; 19.3 miles east of Green Point Ranch, 1 female, 11 Aug. 1954, E. Gilbert and R. Schuster. Records that Silvestri assigned to **C. californiensis** from the San Francisco region are probably this taxon (Bareth & Condé 1958).

**Campodea kelloggi** Silvestri, 1912 (endogeanc)

**Alameda County**: Oakland, 4400 Gilbert St., residential garden, 1 male, 1 female, 6 Mar. 1955, P. Remy (Condé & Thomas 1957). **Los Angeles County**: Mount Lowe (Silvestri 1912a); Santa Catalina Island (Hilton 1932); “in and near Claremont”; “from the South Hills” (Hilton 1932); “from nearly every canyon north of Claremont, including...San Antonio, Palmers, Live Oak and San Dimas, as well as in the South Hills” (Gardner 1914); San Dimas Canyon and a residential garden in San Dimas on Saint George Dr.; Claremont (Condé & Thomas 1957); Pomona, just west of San Jose Hills (Condé & Thomas 1957). **Monterey County**: Pacific Grove (Silvestri 1912a; Bareth & Condé 1958); Crest Drive, Pebble Beach, in pine duff, 20 Sep. 1959, 2 specimens, L. Smith (BME). **Riverside County**: near Lake Elsinore and near Corona (Hilton 1932; Allen 1994). **San Bernardino County**: Camp Baldy, at edge of Cucamonga Wilderness under large stone in creek bed in campground, 1 female, 3 larvae, 2 Aug. 1947, C. Remington (Bareth & Condé 1958); Cucamonga Canyon (Gardner 1914). **San Diego County**: “...Temecula grade, in San Diego County” (Hilton 1932); Borrego Springs, Hellhole Canyon, 25 Mar. 1959, L. Smith (BME). **San Francisco County**: San Francisco (Silvestri 1912a). **San Mateo County**: Farm near Moss Beach (Condé & Thomas 1957). **Santa Barbara County**: Santa Cruz Island (Hilton 1932).

Common in southern California (Gardner 1914; Bareth & Condé 1958); Hilton (1937) reports it to be common in Baja California; also Arizona (Condé & Thomas 1957).
Campodea lamimani Silvestri, 1933


Campodea linsleyi Condé & Thomas, 1957


Campodea michelbacheri Condé & Thomas, 1957


Campodea monticola Condé & Thomas, 1957


C. m. helenae Bareth & Condé, 1958

Napa County: Mount Saint Helena near Lake County: line, loose serpentine soil underneath Ceanothus, 1 female, 27 Apr. 1949, C. Wood (Bareth & Condé 1958).

C. m. obsoleta Condé & Thomas, 1957


C. m. pilosa Condé & Thomas, 1957


Campodea montis Gardner, 1914


Common in southern California (Hilton 1936); also reported from Arizona (Bareth & Condé 1958).

Campodea repentina Condé & Thomas, 1957


Campodea scopigera Condé & Thomas, 1957

Campodea teresiae Condé & Thomas, 1957


Campodea usingeri Condé & Thomas, 1957


Campodea sp.


Haplocampa Silvestri, 1912

Haplocampa is the dominant taxon in volcanic caves of western North America, and 26 species are known from caves, primarily in the Pacific Northwest (Ferguson 2009). The majority of Haplocampa appear to be cryophiles as they are often found at high elevations and in caves with ice, and are sympatric with cryobionts such as ice crawlers (Grylloblattodea: Grylloblattidae: Grylloblatta) (Ferguson 1983; Schoville and Graening 2013).

Haplocampa wheeleri Silvestri, 1912


Silvestri erected a new subspecies—H. w. intermedia Silvestri, 1933—for specimens in Portland, Oregon.

Haplocampa “Roth’s Cave Dipluran”

Siskiyou County: Lava Beds National Monument, Indian Wells Ice Cave, extreme twilight zone, female type, female paratype, 1 paratype male, 8 Jul. 1959, J. Helfer (BME).

BME records indicate that L. Smith was describing two species from the Lava Beds National Monument cave region: Haplocampa “Helfer’s Cave Dipluran” and Haplocampa “Roth’s Cave Dipluran.” Helfer’s Cave Dipluran appeared to be more widespread, and 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.”
Haplocampa “Helfer’s Cave Dipluran”

Following are determinations by L. Smith from slide-mounted material from BME:

Lassen County: Eagle Lake Ice Cave, 21 miles northwest of Susanville, 5 Sep. 1959, V. Roth. Siskiyou County: Lava Beds National Monument: Merrill Ice Cave, 1 Sep. 1959, 2 female paratypes, etc., V. Roth; Indian Wells Ice Cave, extreme twilight zone, various types and paratypes, etc., 8 July 1959, J. Helfer; 3 paratype females, 2 juveniles, 1 Sep. 1959, V. Roth.

Haplocampa “Lava Beds N.M.”


Haplocampa sp. “B”


Meiocampa hermsi (Silvestri, 1933)

Los Angeles County: Mount Lowe, as Parallocampa (Meiocampa) hermsi (Silvestri 1933). Riverside County: Mount San Jacinto, Artemisia litter, 20 Apr. 1958, J. Helfer (BME).

Meiocampa mickeli (Silvestri, 1933)


Meiocampa wilsoni (Silvestri, 1912)

Los Angeles County: Mount Lowe, as Eutrhythocampa wilsoni (Silvestri 1912a); Claremont, Pomona, San Dimas Canyon, and South Hills as E. wilsoni (Gardner 1914; Hilton 1932). San Bernardino County: Cucamonga Canyon (Gardner 1914; Hilton 1932).
Known from central California and also Arizona (Silvestri 1911a; Bareth & Condé 1958; Allen 2002). Although Bareth & Condé (1958) assigned *wilsoni* to *Parallocampa*, Allen (1994) assigned it to *Meiocampa*.

**Metriocampa packardi** Silvestri, 1912

**Alameda County:** Oakland, John Garber Park, on Fish Ranch Rd., 1 male, 3 females, 5 Mar. 1955, P. Remy (Condé & Thomas 1957); Oakland, near Strawberry canyon, and at Dimond Canyon Park and at Redwood Park as *M. allura* (Condé & Thomas 1957). **Contra Costa County:** Acalanes Valley, garden in fallow land 30 meters uphill of 847 Acalanes Rd., 1 larva, 16 Mar. 1955, P. Remy (Condé & Thomas 1957); El Cerrito, garden near intersection of Navellier St. and Scott St., and Lafayette, canyon at Old Jonas Hill Rd. and Madrove Dr., and Lafayette, near Moraga Rd., around the Tofflemire Experimental Research Laboratory and in woods nearby, 11 Mar. 1955, P. Remy, and at Lafayette, near the intersection of Mount View Dr. and Mariposa Rd., and woods near Moraga Rd., as *M. allura* (Condé & Thomas 1957). **Del Norte County:** Gasquet, 3 males, 3 females, 28 larvae, 1 June 1950, K. Christiansen (Bareth & Condé 1958); 2 miles north of Fort Dick, 73 males, 120 females, 3 larvae, 21 Sep. 1953, V. Roth; 18 miles south of Klamath, 10 females, 6 larvae, 19 Sep. 1953, E. Gilbert and R. Schuster as *M. allura* (Condé & Thomas 1957). **Humboldt County:** 1/2 mi. S of Founder’s Tree, near Dyerville, in soil, under logs and around Sequoia tree bases, 1 male, 1 female, 18 Aug. 1957, C. L. and J. E. Remington (Bareth & Condé 1958). 14 miles east of Blue Lake, 4 males, 12 females, 2 larvae, 19 April 1953; Freshwater, 2 males, 9 females, 1 larva, 13 Aug. and 10 Oct. 1953, G. Marsh and R. Schuster; 1.5 miles of Dyerville, 2 males, 3 females, 1 larva, 13 Aug. 1953, G. Marsh and R. Schuster; 1 mile south of Dyerville, 22 males, 38 females, 3 larvae, 19 Sep. 1953, E. Gilbert and R. Schuster; 19.3 miles east of Green Point Ranch, 2 males, 14 females, 6 larvae, 11 Aug. 1954, E. Gilbert and R. Schuster (Condé & Thomas 1957). **Lassen County:** 10 miles north of Manton, 26 males, 35 females, 23 larvae, 18 June 1954 (Condé & Thomas 1957). **Marin County:** Inverness, 1 female, 8 November 1953, L. G. Marsh and R. Schuster (Condé & Thomas 1957). Tocaloma, forest near bridge, as *M. allura* (Condé & Thomas 1957). **Mariposa County:** Ostrander Lake, as *M. allura* (Condé & Thomas 1957). **Mendocino County:** Caspar, 36 males, 16 females, 10 larvae, 7 Mar. 1954, J. Helfer; Mendicino, 19 males, 18 females, 16 Nov. 1953, J. Helfer; Hartsook Grove, 21 males, 60 females, 7 larvae, 19 Nov. 1953, E. Gilbert and R. Schuster; Ryan Creek, 14 males, 22 females, 8 larvae, 5 Mar. 1955, R. Craig; Franklin Lane Park, 17 males, 27 females, 4 larvae, 10 Oct. 1953, J. MacSwain (Condé & Thomas 1957); Pygmy Forest, Mendicino Forest, as *M. allura* (Condé & Thomas 1957). **Napa County:** Oakville, 14 Mar. 1954, 8 males, 5 females, 4 larvae, J. Helfer; 7 miles west of Oakville, 15 Feb. 1954, 11 males, 13 females, V. Roth and R. Schuster (Condé & Thomas 1957); Mount Saint Helena, old toll road at Highway 29, as *M. allura* (Condé & Thomas 1957); 7 miles east of Rutherford, 6 Jan. 1957, several specimens, R. Schuster (BME). **Placer County:** Soda Springs Resort, 19 May 1959, F. Raney, as *M. allura* (L. Smith, unpub. data, BME). **San Mateo County:** near Moss Beach, private garden, 1 male, 4 Mar. 1955, E. Gilbert and P. Remy; between Crystal Springs Reservoirs and the Honda, 1 female, 4 Mar. 1955, E. Gilbert and P. Remy (Condé & Thomas 1957); 1 mile south of Sharp Park, as *M. allura* (Condé & Thomas 1957). **Shasta County:** Burney Falls, 18 males, 31 females, 2 larvae, 18 June 1954, R. Schuster (Condé & Thomas 1957); Lassen National Forest, Hat Lake, 22 males, 41 females, 3 larvae, 18 June 1954 (Condé & Thomas 1957). **Siskiyou County:** Shasta Springs, in wet soil around springs, 2 males, 1 female, 21 Aug. 1947, C. L. and J. E. Remington (Bareth & Condé 1958). **Sonoma County:** Armstrong Redwoods State Park, under Sequoia log, 1 female, 17 Oct. 1947, C. Remington, as *Metriocampa packardi allura* Silvestri, 1933 (Silvestri 1933; Bareth & Condé 1958). **Tuolumne County:** 14 miles east of Strawberry, under Jeffrey pines, as *M. allura* (Condé & Thomas 1957).

*Metriocampa packardi* and *M. p. allura* are also reported from Idaho, Oregon, and Washington (Silvestri 1912a, 1933; Bareth & Condé 1958; Allen 2002).

**Tricampa litura** (Condé & Thomas, 1957)

**Tulare County:** Sequoia National Park, General Grant Grove, under stone at edge of tiny marsh, 1 male, 1 female, 10 Aug. 1947, C. Remington (Bareth & Condé 1958). **Tuolumne County:** 14 miles east of Strawberry under Jeffrey pines, as *Metriocampa* (*Tricampa*) *litura* Conde & Thomas, 1957 (Bareth & Condé 1958).
Tricampa rileyi (Silvestri, 1933)

Bareth & Condé (1958) reported this species from California as Metriocampa (Tricampa) rileyi, but gave no specific locales. It is reported from Colorado, Illinois, Louisiana, Montana, Utah, Washington, Wyoming, and Canada (Alberta and British Columbia) (Silvestri 1933; Bareth & Condé 1958; Condé 1973; Ferguson 1981, 2009; Allen 2002).

Subfamily Lepidocampinae Condé, 1956

Lepidocampa weberi Oudemans, 1890

San Bernardino County: Camp Baldy, edge of Cucamonga Primitive Area, under large stone in creek bed in campground, 1 female, 1 male, 1 undeterm., 2 Aug. 1974, C. Remington (Bareth & Condé 1958).

Bareth & Condé (1958) believe that this record is an accidental introduction from vegetation imported from the Orient. This species has a worldwide distribution: Africa, China, Japan, Madagascar, Malaysia, and New Guinea (Allen 2002).

Subfamily Undetermined

Genus Undetermined


Family Procampodeidae Silvestri, 1948

Procampodea macswaini Condé and Pagés, 1956


Suborder Dicellurata Pagés, 1959

Superfamily Japygoidea Ewing, 1943

Family Japygidae Lubbock, 1873
Subfamily Evalliapyginae Silvestri, 1948

_Evalliapyx_ is most common dipluran genus in California and the dominant japygid genus in western North America (Reddell 1983, Smith 1959d, 1960a).

_Evalliapyx adonis_ Smith, 1960

**Kern County:** Kern River, 10.5 miles east of Cottonwood Creek Bridge, type female and paratype male, 31 Mar. 1959, F. Raney (Smith 1960a).

_Evalliapyx anombris_ Smith, 1960

Following are determinations by L. Smith from slide-mounted material from BME:


Smith (1960) describes this taxon’s distribution as primarily the “open grassland in semi-arid regions of low annual rainfall and no summer rain, i.e., the eastern foothills of the Coast Range Mountains…”

_Evalliapyx decorus_ Smith, 1960

**Santa Clara County:** Stevens Creek in damp humus, 2 June 1957, 2 females and 1 male, R. Schuster (Smith 1960b).

_Evalliapyx dispar_ Silvestri, 1947

**Monterey County:** Monterey, as _E. propinquus_ (Silvestri 1911, 1947). **Santa Barbara County:** Santa Cruz Island, La Playa Canyon, Apr. 1915 (Silvestri 1947).

_Evalliapyx diversipleura_ Silvestri, 1911

Following are determinations by L. Smith from slide-mounted material from BME:

**Del Norte County:** 2 miles northeast of Patrick Creek Post Office, in fir and elm humus, 19 paratype males and females, 10 July 1958, J. Powell (Smith 1959d); 18 miles south of Klamath, 13 Aug. 1953, G. Mersh and R. Schuster; 6 miles east of Crescent City, in redwood litter, 10 Jul. 1959, J. Powell. **Humboldt County:** Prairie Creek State Park, in redwood humus, 9 Sep. 1958, L. Smith (Smith 1959d); 5 miles south of Scotia, 1 Oct. 1959, V. Roth;

L. Smith (unpub. data, BME) also identified specimens from Oregon and Washington.

**Evalljapyx facetus** Smith, 1959


**Evalljapyx helferi** Smith, 1959

Evalljapyx leechi Smith, 1960

Tulare County: Lemon Cove, 2 females and 5 males, under stones on a grassy hillside, 5 Mar. 1957, H. Leech (Smith 1960b).

Evalljapyx mckenziei Smith, 1960

Los Angeles County: 5 miles south of Gorman, from soil under chaparral, 1 male and 1 female, 25 Mar. 1959, H. McKenzie (Smith 1960b).

Evalljapyx newelli Smith, 1960

Los Angeles County: Angeles National Forest, live oak, 7 Apr. 1957, I. Newell (BME); Angeles Nat’l Forest, Blue Ridge, Gaffey Camp, 10 June 1957, I. Newell (BME). Riverside County: Mount San Jacinto, in Artemisia litter, type female, 7 paratype females, 9 paratype males, 20 Apr. 1958, I. Newell; Mount San Jacinto, Strawberry Creek, elev. 3,000 feet, in willow litter, 1 paratype male, 21 Apr. 1957, I. Newell (Smith 1960a).

Evalljapyx ombris Smith, 1960

Following are determinations by L. Smith from slide-mounted material from BME:

This species is found only in damp humus in heavily forested areas, particularly redwood forests; distributed along the western Coastal Ranges (Smith 1960a). L. Smith (unpub. data, BME) has several determinations of *E. ombris* specimens from Victoria Island and Vancouver, B.C.

**Evalljapyx propinquus** Silvestri, 1911

**Los Angeles County**: Mount Lowe (type locale), Lancaster, San Dimas Canyon, Palmer’s Canyon, Live Oak Canyon, and other canyons in the vicinity (Silvestri 1911b; Gardner 1914, Reddell 1983; Allen 2002). **Monterey County**: Near the shores of Monterey (Silvestri 1911). **San Bernardino County**: Cucamonga Canyon, San Antonio Canyon, South Hills, Blanchard Park, and other canyons in the vicinity (Silvestri 1911; Reddell 1983; Allen 2002).

**Evalljapyx raneyi** Smith, 1959

**San Diego County**: Monte Vela Jamul, 4–8 cm. deep under *Quercus agrifolia*, 2 males, F. Raney, 30 Dec. 1958 (Smith 1959d).

**Evalljapyx sonoranus** Silvestri, 1911


**Evalljapyx sp.**


**Subfamily Japyginae** Womersley, 1939

**Hecajapyx bucketti** Smith, 1964

**Fresno County**: McKinley Grove, near Dinkey Creek, under redwood duff, 29 Apr. 1961, holotype, paratypes, etc., J. Edwards (Smith 1964).

**Hecajapyx vulgaris** Smith, 1959

Following are determinations by L. Smith from slide-mounted material from BME, unless otherwise noted: **Del Norte County**: 2 miles northeast of Patrick Creek P. O., 10 July 1958, J. Powell; 5 miles south of Crescent City, 8 Sep. 1958, L. Smith; 2 miles north of Fort Dick, 21 Nov. 1953, V. Roth; Gasquet, 1 June 1950, K. Christiansen. **Lake County**: Bushy Ridge, Cow Mtn., 3,000 feet, 12 Feb. 1956, D. Burdick; Upper Lake, 21 Feb. 1955, D. Burdick; 9 miles northeast, and 6 miles northwest, of Upper Lake, 12 Feb. 1955, D. Burdick; Middle Creek, 6

Distributed throughout California’s Coast Ranges, northward into Douglas, Josephine, and Klamath Counties, Oregon (Reddell 1983; Smith 1964; Allen 2002; L. Smith, unpub. data, BME).

**Hecajapyx sp. nov. Smith, in prep.**

**Kern County**: 2 miles west of Isabella Reservoir, 31 Mar. 1959, 2 juv., 6 males, F. Raney (L. Smith determ., BME).

**Holjapyx calaverasae Smith, 1959**

**Calaveras County**: 2 miles west of San Andreas, altitude 1,000 feet, sandy clay loam soil, under *Quercus wislizenii*, holotype female, 1 male paratype, 7 female paratypes, 1 juvenile, 25 Mar. 1958, Smith & Schuster (Smith 1959b).

**Holjapyx conspersus Smith, 1959**

**San Mateo County**: 3 miles north of Sharp Park, in humus under chaparral, holotype female, allotype male, Feb. 1958, D. Price (Smith 1959b).

**Holjapyx diversiunguis** (Silvestri, 1911)

**Alameda County**: Berkeley, 1 male, 24 Mar. 1938, A. Michelbacher (Smith 1959b; BME). **Fresno County**: Pinehurst (Reddell 1983). **Marin County**: Mill Valley, 427 Rose Ave, in damp soil, 5 and 9 May 1950, 1 male and 1 female, H. Leech (Smith 1959b); 6 miles east of Pt. Reyes Station, 1 Mar. 1960, A Grigarick, L. Smith, and R. Schuster (BME). **Mariposa County**: Yosemite Park (type locale) (Silvestri 1911). **San Mateo County**: Woodside (Reddell 1983).
Holjapyx humidus Smith, 1959


Holjapyx hyadis Smith, 1959


Holjapyx imbutus Smith, 1959

Calaveras County: 1 mile north of Murphys, in humus under oak tree, holotype male, 5 Mar. 1958, Smith & Schuster; 3 miles west of San Andreas, in wet humus and soil, paratype male, 1 juvenile, Smith & Schuster; Calaveras Big Trees, in rotten redwood log, paratype male, 5 Mar. 1958, Smith & Schuster (Smith 1959b).

Holjapyx insiccatus Smith, 1959


Holjapyx irroratus Smith, 1959


Also noted from Oregon (L. Smith, unpub. data, BME).

Holjapyx madidus Smith, 1959


Holjapyx schusteri Smith, 1959

**Holjapyx sp.**

**Alameda County:** Berkeley, Dwight Way Hill, two feet down in ground, 2 April 1947, MacSwain (BME). **Butte County:** Stringtown Hill northeast of Oroville, 9 Feb. 1956, several specimens coll. by R. Schuster and deterr. by L. Smith as “Holjapyx nr. insiccatus” (BME). **Santa Clara County:** Mt. Madonna State Park, 7 Feb. 1959, several specimens coll. by C. O’Brien and D. Burdick and deterr. by L. Smith as “Holjapyx nr. insiccatus” (BME).

**Occasjapyx californicus** Silvestri, 1948

**Marin County:** Mill Valley (Silvestri 1948). **Mendocino County:** Unspecified locale, in soil and humus, 4 males, 8 females, J. R. Helfer (Smith 1959c); Mendocino, allotype and other specimens, 4 June 1954, J. Helfer (BME); Hartsook Grove, one female, 19 Sep. 1953, E. Gilbert and R. Schuster (BME). **Yolo County:** Berryessa, just below dam, one female, 4 Feb. 1962, M. Irwin (BME).

**Occasjapyx kofoidi** (Silvestri, 1928)

**Shasta County:** Potter Creek Cave (type locality), 3 specimens, 1903, W. Sinclair, as Japyx kofoidi (Silvestri 1928), and 8 June 1995, D. Ubick, 1 indiv. (CAS).

Reddell (1983) does not consider this species to be cave-adapted (troglomorphic). Rudolph et al. (1985) reported a collection of Japygidae in Samwel Cave, which is only 16 km from the type locality. G.O. Graening inventoried both caves in 2012 and could not find any diplurans.

**Occasjapyx sierrensis** Smith, 1959

**El Dorado County:** 3 miles north of Nashville, in soil, 2 paratype females, 2 paratype males, 25 Apr. 1958, Smith & Schuster (BME; Smith 1959c); 4 miles west of Newcastle, 1958 and 1959, paratypes and other specimens, Smith & Schuster (BME). **Placer County:** Folsom Lake, under oak trees, 1 paratype female, 2 May 1958, W. Lange, R. James, and W. Crites (Smith 1959c); 4 miles west of Newcastle, paratypes, etc., Mar. and Apr. 1958, Smith & Schuster (Smith 1959c); Folsom Lake State Park, Rattlesnake Bar Road, under oaks, 2 May 1958, Lange and Crites (BME).

**Occasjapyx sp.**


**Japyginae genus nov. Smith, in prep.**


**Subfamily Provalljapyginae Smith, 1959**

**Nanojapyx coalingae** Smith, 1959

**Fresno County:** near Coalinga, in juniper leaf mold, holotype female, 22 Jan. 1958, H. Wilson (Smith 1959a).
Nanojapyx gentilei Smith, 1959

Sonoma County: near Trenton, 10 to 12 inches deep in sandy soil in a growth of poison oak, holotype female, paratype female and juvenile, 7 Aug. 1957, Smith & Schuster (Smith 1959a).

Nanojapyx hamoni Smith, 1959

Following are determinations by L. Smith from slide-mounted material from BME:


Nanojapyx pagesi Smith, 1959


Nanojapyx pricei Smith, 1959


Nanojapyx sp.


Subfamily Undetermined

Genus Undetermined


**Family Parajapygidae Womersley, 1939**

This family does not appear to be native to California.

**Parajapyx isabellae** (Grassi, 1886)

Following are determinations by L. Smith from slide-mounted material from BME:

Nov. 1958, W. Lange and H. McKenzie; Fort Ross, McKenzie’s pasture, soil/Indian middens, 27 Apr. 1959, A. Gray. **Yolo County:** In a barley field near Davis (Smith 1961); Winters, 23 Apr. 1959, F. Raney; Davis, Covell Ranch, Aug. 1944.

Also reported from Arizona, Arkansas, Hawaii, Indiana, Louisiana, Maryland, Missouri, Nebraska, New York, North Carolina, Oklahoma (Allen 2002; L. Smith, unpub. data, BME). This exotic, cosmopolitan species is associated with potting soil, probably distributed by the greenhouse industry; the type locality is Italy (Reddell 1983).

**Parajapyx sp.**

Following are determinations by L. Smith from slide-mounted material from BME: **Alameda County:** Corral Hollow, 10–12 Mar. 1958, Smith & Schuster. **Amador County:** 10 miles east of Ione, Martel, 21 Mar. 1959, L. Smith. **Butte County:** Chico, 4 Sep. 1985, and Bidwell Park, Chico Creek, 4 Sep. 1985, Smith & Schuster; 3.7 miles north of Gridley, Rocklin clay, 5 specimens, 24 Apr. 1959, F. Raney; 6.7 miles north of Gridley, Highway 99 East and Hazel Ave., 8 May 1959, F. Raney. **Fresno County:** Jacalitos Canyon, 20 May 1959, H. Wilson. **Kern County:** Kern River Canyon, 10 miles west of Isabella, 12 May 1959, L. Smith. **Los Angeles County:** 5 miles north of San Fernando, 25 Mar. 1959, H. MacKenzie. **Mendocino County:** Russian Gulch State Park, 30 Dec. 1964, R. Rice. **Placer County:** 4 Miles of Newcastle, 15 Apr. 1958, Smith & Schuster. **Sutter County:** Sutter Buttes, W. Butte Rd., 12 Mar 1958, Smith & Schuster. **Tulare County:** 1 mile east of Lemon Cove, 13 May 1959, L. Smith. **Yolo County:** 7 miles west of Winters, one female, 11 Mar. 1959, F. Raney; Davis, 721 Hunt Way, 1957 and 1959, several specimens, L. Smith; 5.4 miles south of Winters, 29 May 1959, L. Smith, F. Raney, and R. Schuster; Putah Creek ranchette near Winters, 23 Apr. 1959, F. Raney.

**Taxa not recognized**

The following taxa are removed from the California Checklist:

**Plusiocampa Silvestri, 1912**

Peck (1973) reported *Plusiocampa* sp. from Craig Ice Cave and Frozen River Cave (Siskiyou County); these may instead be *Haplocampa* “Lava Beds N.M.” We know of no specimens of *Plusiocampa* from California; Allen (2002) reports this genus only from Mexico; these records should be confirmed before this genus is confidently added to the California checklist.

**Campodea eurekae Hilton, 1932**

Hilton (1932) described this species from Humboldt County: “collected under redwoods above Eureka.” Condé & Thomas (1957) considered it a *nomen nudum*, and Allen (2002) doubted the taxon was valid.

**Campodea folsomi Silvestri, 1911**

This species was reported from the same region as the *C. montis* type locality—Claremont and Pomona—by Gardner (1914), but *C. folsomi* is currently understood to be restricted to Mexico (Hilton 1937; Condé & Thomas 1957; Allen 2002).
**Campodea staphylinus** Westwood, 1842

Schött (1897) reported the first published collection of a dipluran in California (in San Francisco by G. Eisen), but this is probably erroneous, according to Condé & Thomas (1957). *C. staphylinus* is understood to be limited to Europe (Lock *et al.* 2010).

**Campodea kerni** Hilton, 1932

*Tulare County*: “in the Kern River Canyon at an altitude of about five thousand feet” (type in the Pomona College Collection) (Hilton 1932). Allen (2002) doubted that this was a valid taxon. Condé & Thomas (1957) reported it as a *nomen nudum*.

**Japyx Haliday, 1864**

The description of a “*Japyx* sp.” specimen from “California,” figured by Kellogg (1908), is too vague to be recognizable, according to Reddell (1983). A specimen labeled *Japyx* sp. was collected in Crystal Springs Park, San Mateo, 27 Oct. 21, W. Pierce (LACM). The “*Japyx* sp. nov.” from Ventura County described by Cook (1898) is probably a mistaken locale, according to Reddell (1983). *Japyx* is currently understood to be limited to Europe and northern Africa (Reddell 1983).

**Discussion**

California hosts 63 species in 5 dipluran families, with 51 of those species endemic to the State, and half of these endemics limited to single locales. There is also endemism at higher taxonomic levels: the genera *Nanojapyx*, *Hecajapyx*, and *Holjapyx* are all primarily restricted to California (Reddell 1983; L. Smith, unpub. data). Also of note is that L. Smith was in the process of describing a new genus in the subfamily Japyginae (unpublished data, BME). Two species are understood to be exotic, and six dubious taxa are excluded from the State checklist. Condé & Thomas (1957) were surprised that *Campodea fragilis* Meinert, 1865 was not recorded from California, because it is widespread in northern North America, including Washington, and apparently on other continents as well (Paclt 1957; Allen 1994, 2002).

Sympatry in diplurans is common, especially among campodeids (Lock *et al.* 2010; this study). Certain locales, such as Mount Lowe (Los Angeles County) and Pinnacles National Monument (San Benito County), are unusually diverse in dipluran taxa, or represent errors in taxonomic determinations. For example, in one collection event (24 Mar. 1955), P. Remy apparently collected four different diplurans at Pinnacles National Monument, including 2 new species endemic to the locale: *Campodea californiensis*, *C. linsleyi*, *C. repentina*, and *Procampodea macswaini* (Condé and Pagés 1956; Condé & Thomas 1957). Because these specimens are lost, the taxonomy and sympatry of these species cannot easily be confirmed at this locale.

Species richness per county was plotted (Fig. 1), and shows that counties in the central Coastal Ranges have the highest diversity of diplurans. This may also indicate sampling bias, where regions near universities are typically better sampled, while some regions of California have yet to be sampled. Caves and mines harbor unique and endemic dipluran species (Ferguson 2009), and are under-sampled in California. However, most diplura are endogean and many may be incidental to caves, with only a few California species exhibiting obvious troglo-morphy and being true cave obligates: *Haplocampa* “Roth’s Cave Dipluran”; *Haplocampa* “Helfer’s Cave Dipluran”; *Haplocampa* “Lava Beds N.M.”; and *Haplocampa* sp. “B.” Troglo-morphic features are understood to consist of the following: increase in body size; increase in appendage size (legs, antennae, cerci, urites); presence in some genera of well-developed latero-tergal crests on pretarsal claws; and increase in number of sensilla in the cupuliform organ of the apical antenna segment (Condé 1956; Pagés 1964; Ferguson 1981b, 1992). Pagés (1964) noted that among the Diplura and Myriapoda, the phytophagous or saprophagous species (campodeid diplurans and millipedes) display extensive troglo-morphy or cave endemism, while the carnivorous species (japygid diplurans and centipedes) display very little troglo-morphy or cave endemism.
In general, the North American dipluran fauna is still under-inventoried, especially in subterranean habitats. The shortage of taxonomists, a global crisis (Agnarsson and Kuntner 2007), hampers the identification of additional, novel Californian taxa as well as the enumeration of true alpha and gamma richness. Since genera such as *Campodea* are morphologically very uniform, but genetically highly diverse, genetic analyses will need to be incorporated into future taxonomic descriptions (Podsiadlowski et al. 2006).

Based upon our current understanding of the distribution of diplurans in California, and the Natural Heritage Program conservation status assessment criteria established by Master (1991) and NatureServe (2013),
conservation rankings were assigned and should be adopted (Table 1). Equivalent IUCN Red List conservation rankings should also be assigned and adopted (IUCN 2013). Based upon these criteria, most of California taxa are considered globally rare or endangered. The use of diplurans as bioindicators of habitat quality and ecosystem integrity should be explored.

### TABLE 1. Suggested Natural Heritage Program conservation status ranks with notes on endemism and distribution. Asterisks indicate taxa found in only one or two sites and from only a single county.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Suggested Heritage Ranks</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anajapygida</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Anajapyx hermosus</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><strong>Campodeidae</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Campodea californiensis</em></td>
<td>G3S3</td>
<td>CA endemic; 17 counties</td>
</tr>
<tr>
<td><em>Campodea essigi</em></td>
<td>G1S1</td>
<td>CA endemic; only 2 sites</td>
</tr>
<tr>
<td><em>Campodea insidiator</em></td>
<td>G1S1</td>
<td>CA endemic; 5 sites</td>
</tr>
<tr>
<td><em>Campodea kelloggi</em></td>
<td>G3S2</td>
<td>Southern CA, AZ, and Mexico</td>
</tr>
<tr>
<td><em>Campodea lamimani</em></td>
<td>G2S2</td>
<td>CA endemic; 11 counties</td>
</tr>
<tr>
<td><em>Campodea linsleyi</em></td>
<td>G2S2</td>
<td>CA endemic; 6 counties</td>
</tr>
<tr>
<td><em>Campodea michelbacheri</em></td>
<td>G1S1</td>
<td>CA endemic; 4 counties, 4 sites</td>
</tr>
<tr>
<td><em>C. monticola helenae</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>C. m. obsoleta</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>C. m. pilosa</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Campodea montis</em></td>
<td>G3S3</td>
<td>Common in southern CA; also in AZ</td>
</tr>
<tr>
<td><em>Campodea repentina</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Campodea scopigera</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Campodea teresiae</em></td>
<td>G1S1</td>
<td>CA endemic; 2 counties; 2 sites</td>
</tr>
<tr>
<td><em>Campodea usingeri</em></td>
<td>G2S2</td>
<td>CA endemic; 5 counties, 6 sites</td>
</tr>
<tr>
<td><em>Haplocampa wheeleri</em></td>
<td>G1S1</td>
<td>Single site endemic</td>
</tr>
<tr>
<td><em>Haplocampa “Roth’s Cave Dipluran”</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Haplocampa “Helfer’s Cave Dipluran/Lava Beds N.M.”</em></td>
<td>G2S2</td>
<td>CA endemic; 3 counties; about 40 sites</td>
</tr>
<tr>
<td><em>Haplocampa sp. “B”</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Metiocampa hermsi</em></td>
<td>G1S1</td>
<td>CA endemic; 2 counties; 2 sites</td>
</tr>
<tr>
<td><em>Metiocampa mickei</em></td>
<td>G1S1</td>
<td>CA endemic; 3 counties; 3 sites</td>
</tr>
<tr>
<td><em>Metiocampa wilsoni</em></td>
<td>G3S2</td>
<td>Known from central CA and also AZ</td>
</tr>
<tr>
<td><em>Metriocampa packardi</em></td>
<td>G4S3</td>
<td>CA, ID, OR, WA</td>
</tr>
<tr>
<td><em>Tricampa litura</em></td>
<td>G1S1</td>
<td>CA endemic; 2 counties; 2 sites</td>
</tr>
<tr>
<td><em>Tricampa rileyi</em></td>
<td>G4S1?</td>
<td>CA, CO, IA, IL, LA, MT, OR, UT, WA, WY, Canada</td>
</tr>
<tr>
<td><strong>Procampodeidae</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Procampodea macswaini</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><strong>Japygidae</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Evalljapyx adonis</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Evalljapyx anombris</em></td>
<td>G2S2</td>
<td>CA endemic; 8 counties</td>
</tr>
<tr>
<td><em>Evalljapyx decorus</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Evalljapyx dispar</em></td>
<td>G1S1</td>
<td>CA endemic; 2 counties; 2 sites</td>
</tr>
</tbody>
</table>

......continued on the next page
The abbreviations and rationale for these conservation status ranking systems is detailed in Master (1991) and NatureServe (2013) for the Natural Heritage Program.

### Acknowledgements

We are indebted to the scientists who graciously shared their unpublished data or queried institutional databases, especially the following: Norm Penny and other staff at CAS; Peter Oboyski and other staff at the Essig Museum of Entomology; Weiping Xie (Natural History Museum of Los Angeles County); Lynn Kimsey and Steve Heydon (BME); unpublished determinations by Leslie Smith and the collections of Robert Schuster, former collections.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Suggested Heritage Ranks</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Evalljapyx facetus</em></td>
<td>G2S2</td>
<td>CA endemic; 11 counties</td>
</tr>
<tr>
<td><em>Evalljapyx diversipleaura</em></td>
<td>G3S2</td>
<td>10 sites in CA; also OR, WA</td>
</tr>
<tr>
<td><em>Evalljapyx helferi</em></td>
<td>G2S2</td>
<td>CA endemic; 7 counties</td>
</tr>
<tr>
<td><em>Evalljapyx leechi</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Evalljapyx mckenziei</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Evalljapyx newelli</em></td>
<td>G1S1</td>
<td>CA endemic; 2 counties; 4 sites</td>
</tr>
<tr>
<td><em>Evalljapyx ombris</em></td>
<td>G2*S2</td>
<td>4 counties in CA and possibly British Columbia</td>
</tr>
<tr>
<td><em>Evalljapyx propinquus</em></td>
<td>G2S2</td>
<td>CA endemic; 3 counties</td>
</tr>
<tr>
<td><em>Evalljapyx raneyi</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Evalljapyx sonoranus</em></td>
<td>G2S1</td>
<td>4 counties in CA; also AZ</td>
</tr>
<tr>
<td><em>Hecajapyx bucketti</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Hecajapyx vulgaris</em></td>
<td>G3S3</td>
<td>8 counties in CA and 3 counties in OR</td>
</tr>
<tr>
<td><em>Hecajapyx sp. nov.</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Holjapyx calaverasae</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Holjapyx conspersus</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Holjapyx diversiunguis</em></td>
<td>G2S2</td>
<td>CA endemic; 5 counties; 6 sites</td>
</tr>
<tr>
<td><em>Holjapyx humidus</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Holjapyx hyadis</em></td>
<td>G2S2</td>
<td>CA endemic; 5 counties; 6 sites</td>
</tr>
<tr>
<td><em>Holjapyx imbutus</em></td>
<td>G1S1</td>
<td>CA endemic; 1 county; 3 sites</td>
</tr>
<tr>
<td><em>Holjapyx insecctatus</em></td>
<td>G1S1</td>
<td>CA endemic; 3 counties; 3 sites</td>
</tr>
<tr>
<td><em>Holjapyx irroratus</em></td>
<td>G2S1</td>
<td>2 counties, 2 sites in CA; also OR</td>
</tr>
<tr>
<td><em>Holjapyx madidus</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Holjapyx shcusteri</em></td>
<td>G1S1</td>
<td>CA endemic; 2 counties; 2 sites</td>
</tr>
<tr>
<td><em>Nanojapyx coalingae</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Nanojapyx gentilei</em></td>
<td>G1S1</td>
<td>single site endemic</td>
</tr>
<tr>
<td><em>Nanojapyx hamoni</em></td>
<td>G1S1</td>
<td>CA endemic; 3 counties</td>
</tr>
<tr>
<td><em>Nanojapyx pagesi</em></td>
<td>G1S1</td>
<td>CA endemic; 2 counties; 4 sites</td>
</tr>
<tr>
<td><em>Nanojapyx pricei</em></td>
<td>G1S1</td>
<td>CA endemic; 1 county; 3 sites</td>
</tr>
<tr>
<td><em>Occasjapyx californicus</em></td>
<td>G1S1</td>
<td>CA endemic; 3 counties; 3 sites</td>
</tr>
<tr>
<td><em>Occasjapyx kofoidi</em></td>
<td>G1S1 or GHSH</td>
<td>single site endemic; not detected in recent bioinventory</td>
</tr>
<tr>
<td><em>Occasjapyx sierrensis</em></td>
<td>G1S1</td>
<td>CA endemic; 2 counties; 5 sites</td>
</tr>
</tbody>
</table>

* The abbreviations and rationale for these conservation status ranking systems is detailed in Master (1991) and NatureServe (2013) for the Natural Heritage Program.
manager at BME; and speleobiologists Rolf Aalbu, William Elliott, Jean Krejca, James Reddell, Dawn Ryan, Steve Taylor, and Darrell Ubick. We also thank Jack Smith and Astra Gleason (CSUS Interlibrary Services Dept.) for literature acquisition and anonymous reviewers for improving the manuscript.

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