

COLLECTING ENDEMIC AND RARE STONEFLIES (PLECOPTERA) IN CALIFORNIA, U.S.A.

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Introduction

California is a remarkable state in regard to its geographical and biological diversity. Death Valley in the southeast is 86 m below sea level, the lowest point in the United States, and Mount Whitney (4,417 m) is the highest point in the contiguous 48 states. It has been estimated that there are more than 27,000 species of insects that occur in California (Ballmer 1995). The myriad of freshwater aquatic habitats in California support an amazing number of aquatic insect species (Usinger 1956, McElravy et al. 1989), including stoneflies. Jewett (1956) in the classic volume: "Aquatic of Insects of California," listed 93 species of stoneflies from the state and then in 1960, he listed 101 species, noting that this number would increase. Currently, there are at least 186 species of stoneflies recorded from California (Stark et al. 2009, Baumann and Kondratieff 2009, Kondratieff and Lee 2010, Lee and Baumann 2010, Baumann and Kondratieff 2010). What makes California unique among all other states of the United States is that 39% of the 186 species or 72 species are only known from the state. For example, Nelson and Baumann (1987) described fifteen new species of *Capnia* in a single publication, all endemic to California.

A collecting trip was organized by John B. Sandberg of Chico, California to occur from April 25-29, 2010 to collect endemic or rare taxa of California stoneflies, especially in the central Sierra Nevada foothills.

Materials and Methods

Adult stoneflies were collected using a beating sheet and specimens were preserved in 80% ethanol. Additionally, nymphs were collected from selected streams and returned to Colorado State University for rearing. Material was studied using Wild M-8 stereomicroscopes. Specimens listed in this study are located at Brigham Young University, Provo, Utah (BYUC) and Colorado State University, Fort Collins, Colorado (CSUC).

Results and Discussion

We visited only six (Butte, El Dorado, Nevada, Plumas, Tehama, and Yuba counties) of the 58 California counties but collected fifty species of stoneflies, and of these 11 or 22% were endemic taxa (Table 1). A group of stonefly species restricted to intermittent streams of the western slope of the Central Sierra Nevada foothills (Storer and Usinger 1963) were especially targeted. These species included *Nemoura spiniloba* Jewett, *Oemopteryx vanduzeeae* (Claassen), *Suwallia sierra* Baumann and Bottorff, *Sweltsa californica* (Jewett), *Cosumnoperla hypocrena* Szczytko and Bottorff, *Isoperla acula* Jewett, *I. adunca* Jewett, and *I. miwok* Bottorff and Szczytko. These small streams are dry in the summer and autumn (Levick et al. 2008, Szczytko and Bottorff 1987), but support a diverse mayfly, stonefly, and caddisfly fauna during the wet period, but are often not sampled for adult stoneflies. The stoneflies of these unique aquatic systems were just recently elucidated through the efforts of Richard L. Bottorff (Szczytko and Bottorff 1987, Bottorff et al. 1990, Baumann and Bottorff. 1997). In all 14 species could be classified as uncommon or rare California stoneflies (Table 1). *Paraleuctra projecta* (Frison) is a new state record for California (Stark and Kyzar 2000, Stark et al. 2009).

Acknowledgments

John Sandberg and his colleagues, Brady Richards, Dan Pickard, and Joe Slusark from the Aquatic Bioassessment Laboratory at California State University, Chico, California enticed us to travel to their backyard in Central California with the promise that we would indeed be rewarded with many rare and exciting stonefly species, most of them in the adult stage. In addition, we took advantage of the fact that we were going to be in California at this ideal collecting time and asked Richard Bottorff and his brother Loren to show us some of their choice collecting sites near Placerville. The result was that we were abundantly rewarded and were able to collect almost all of the species that we targeted and several more that were an added bonus. We thank these colleagues profusely because we know that we would not have been nearly as successful without their help. John B. Sandberg is thanked for reviewing the manuscript. Bill Stark is thanked for checking the numbers of species known from California.

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Table 1. STONEFLIES COLLECTED APRIL 25-29, 2010 IN NORTH CENTRAL CALIFORNIA. * indicates uncommon or rare taxa; m=male(s), f=female(s), and n=nymph(s).

NEMOURIDAE

<i>Malenka depressa</i> (Banks)	Acorn Creek, Skunk Canyon, abv Folsom Lake	70 m 61 f
	Butte Creek, Humboldt Rd, Cherry Hill Cmpg	28 m 14 f
	spring, Big Chico Creek, Hwy 32	13 m 14 f
	Greenwood Creek, Hwy 49, nr Coloma	1 m 2 f
	Gurnsey Creek, Hwy 36, Gurnsey Creek Cmpg	1 m
* <i>Nemoura spiniloba</i>	Campbell Creek, North Table Mountain, Cherokee Rd	30 m 28 f

(Jewett)	stream, W Martinez Creek, S El Dorado	3 m 5 f
	Oregon Gulch, Red Bridge, Oregon City	2 f
<i>Prostoia besametsa</i> (Ricker)	South Fork American River, Hwy 50, Riverton	1 f
	Little Last Chance Creek, Hwy, 284, Chilcoot Cmpg	1 f
<i>Soyedina nevadensis</i> (Claassen)	Butte Creek, Humboldt Rd, Cherry Hill Cmpg	13 m 5 f
	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	2 m 2 f
	spring, Big Chico Creek, Hwy 32	33 m 7 f
	Little Chico Creek, Schott Rd	1 m
	Gurnsey Creek, Hwy 36, Gurnsey Creek Cmpg	1 m
<i>Zapada cinctipes</i> (Banks)	Butte Creek, Humboldt Rd, Butte Meadows Cmpg	1 f
	Butte Creek, Humboldt Rd, jct Colby Creek	1 m 2 f
	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	1 f
	Gurnsey Creek, Hwy 36, Gurnsey Creek Cmpg	10 m 6 f
	Little Last Chance Creek, Hwy 284, Chilcoot Cmpg	3 m 5 f
	Slate Creek, Hwy 32, Deer Creek	1 m
<i>Zapada frigida</i> (Claassen)	South Fork American River, Hwy 50, Riverton	1 m 1 f
	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	2 m
<i>Zapada oregonensis</i> (Claassen)	Butte Creek, Humboldt Road, Butte Meadows, Cmpg	10 m 1 f
	Butte Creek, Humboldt Road, Cherry Hill Cmpg	3 m
	Butte Creek, Humboldt Road, jct Colby Creek	3 m 2 f
	spring, Hwy 36, mm 94, nr Childs Meadow	1 f
	Gurnsey Creek, Hwy 36, Gurnsey Creek Cmpg	5 m 4 f
	Slate Creek, Hwy 32, Deer Creek	1 m
CAPNIIDAE		
<i>Capnia excavata</i> Claassen	Butte Creek, Humboldt Road, Butte Meadows Cmpg	2 f
	Butte Creek, Humboldt Road, Cherry Hill Cmpg	1 f
	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	3 f
	spring, Big Chico Creek, Hwy 32	1 f
	Greenhorn Creek, Hwy 70, Quincy	1 m 7 f
<i>Capnia quadrituberosa</i> Hitchcock	Butte Creek, Humboldt Road, jct Colby Creek	1 f
<i>Eucapnopsis brevicauda</i> Claassen	Spanish Creek, Hwy 30, Keddie Resort	3 f
	Butte Creek, Humboldt Road, Butte Meadows Cmpg	16 m 14 f
	Butte Creek, Humboldt Road, Cherry Hill Cmpg	5 m 9 f
	Butte Creek, Humboldt Road, jct Colby Creek	12 m 13 f
	Little Chico Creek, Schott Road	1 m
	Middle Fork Feather River, Hwy 70, Camp Layman	2 m
	Greenhorn Creek, Hwy 30, Quincy	2 m 1
	Gurnsey Creek, Hwy 36, Gurnsey Creek Cmpg	1 m 3 f
	stream, W Martinez Creek, S El Dorado	1 m 1 f
	Slate Creek, Hwy 32, Deer Creek	2 m 1 f
<i>Mesocapnia</i> sp.	Greenwood Creek, Hwy 70, S E Quincy	1 m
LEUCTRIDAE		
* <i>Megaleuctra complicata</i> Claassen	spring, Big Chico Creek, Hwy 32	1 f
<i>Moselia infuscata</i> (Claassen)	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	20 m 8 f
	spring, Big Chico Creek, Hwy 32	18 m 10 f
	Little Chico Creek, Schott Road	8 m 5 f
	spring, Hwy 36, mm 94, nr Childs Meadow	10 m 8 f
<i>Paraleuctra occidentalis</i> (Banks)	Butte Creek, Humboldt Road, Butte Meadows Cmpg	4 m 2 f
	Butte Creek, Humboldt Road, jct Colby Creek	4 m 5 f
	spring, Big Chico Creek, Hwy 32	1 m

	Greenhorn Creek, Hwy 70, Quincy	7 m 6 f
<i>Paraleuctra projecta</i> (Frison)	Butte Creek, Butte Creek Ecological Preserve	1 m
	spring, Hwy 36, mm 94, nr Childs Meadow	24 m 5 f
<i>Paraleuctra vershina</i>	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	10 m 20 f
Gaufin & Ricker	Little Chico Creek, Schott Road	5 m 10 f
	Spanish Creek, Hwy 70, Keddie Resort	1 m
<i>Perlomyia collaris</i> Banks	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	1 m 1 f
	Gurnsey Creek, Hwy 36, Gurnsey Creek Campg	1 m 1 f
<i>Perlomyia utahensis</i>	Butte Creek, Humboldt Road, Cherry Hill Cmpg	1 m 1 f
Needham & Claassen		
	Butte Creek, Humboldt Road, jct Colby Creek	15 m 11 f
TAENIOPTERYGIDAE		
<i>*Oemopteryx vanduzeeae</i>	Acorn Creek, Skunk Canyon, abv Folsom Lake	2 f
(Claassen)	North Fork American River, Hwy 49, nr Auburn	1 f
	South Fork American River, Hwy 49, Coloma	1 f
	Blue Tent Creek, Hwy 49, N Coloma	2 f 1 n
	Campbell Creek, Table Mountain, Cherokee Rd	7 m 12 f
	Deadman Creek, Church Mine Rd, S E El Dorado	6 m 4 f 1 n
	French Corral Creek, Pleasant Valley Road	2 m 7 f
	stream, W Martinez Creek, S El Dorado	2 m 9 f
	Oregon Gulch, Red Bridge, Oregon City	1 m 8 f
	Sweetland Creek, Hwy 49, Sweetland	2 m 4 f
<i>Taenionema pacificum</i> (Banks)	Middle Fork Feather River, Hwy 70, Camp Layman	3 m 8 f
	Greenhorn Creek, Hwy 70, S E Quincy	1 m 1f
	Spanish Creek, Hwy 89, Keddie Resort	7 m 9 f
<i>Taenionema raynorium</i>	South Fork American River, Hwy 50, Riverton	2 m 3 f
(Claassen)	Butte Creek, Humboldt Road, Butte Meadows Cmpg	1 f
	Butte Creek, Humboldt Road, jct Colby Creek	1 f
	Middle Fork Feather River, Hwy 70, Camp Layman	1 m 1f
	Greenhorn Creek, Hwy 70, Quincy	23 m 21 f
	Slate Creek, Hwy 32, Deer Creek	1 m 4 f
PTERONARCYIDAE		
<i>Pteronarcys californica</i>	South Fork American River, Hwy 49, Coloma	2 m 1f
Newport	Big Chico Creek, Big Chico Ecological Reserve	7 m 4 f
	Yuba River, Hwy 20, Hammon Grove Park	1 f
PELTOPERLIDAE		
<i>Yoraperla nigrisoma</i> (Banks)	Gurnsey Creek, Hwy 36, Gurnsey Creek Cmpg	1 m 1f
	Slate Creek, Hwy 32, Deer Creek	3 m 1 f 2 n
PERLODIDAE		
<i>*Cosumnoperla hypocrenea</i>	Blue Tent Creek, Hwy 49, nr Coloma	10 m 8 f 9 n
Szczytko & Bottorff	Campbell Creek, Table Mountain, Cherokee Rd	1 n
	Cooper Canyon Creek, 3 miles W Pilot Hill	16m 3 f
	Deadman Creek, Church Mine Road, S El Dorado	11 m 9 f
	stream, W Martinez Creek, S El Dorado	45 m 29 f 20 n
<i>Cultus aestivalis</i>	North Fork American River, Hwy 49, nr Auburn	1 m
(Needham & Claassen)		
<i>Cultus pilatus</i> (Frison)	Big Chico Creek, Big Chico Reserve	1 m 7 f
<i>Cultus tostonus</i> (Ricker)	Butte Creek, Butte Creek Ecological Preserve	1 m 1 f
<i>*Frisonia picticeps</i> (Hanson)	Butte Creek, Humboldt Road, Butte Meadows Cmpg	3 m 3 f
	Butte Creek, Humboldt Road, Cherry Hill Cmpg	2 m 2 f
	Butte Creek, Humboldt Road, jct Colby Creek	2 m

* <i>Isoperla acula</i> Jewett	Blue Tent Creek, Hwy 49, nr Coloma	1 m 1 f
* <i>Isoperla adunca</i> Jewett	Blue Tent Creek, Hwy 49, nr Coloma	4 m 6 f
	Sweetland Creek, Hwy 49, Sweetland	2 m 1 f
<i>Isoperla marmorata</i>	Acorn Creek, Skunk Canyon, abv Folsom Lake	6 m 8 f
Needham & Claassen)	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	4 m 2 f
	Big Chico Creek, Big Chico Creek Reserve	2 m
	Greenwood Creek, Hwy 49, nr Coloma	1 m
	South Fork Yuba River, Pleasant Valley Rd, Bridgeport	1 m
* <i>Isoperla miwok</i>	Campbell Creek, Table Mountain, Cherokee Rd	13 m 6 f
Bottorff & Szczytko	French Corral Creek, Pleasant Valley Road	2 m 1 f
	Oregon Gulch, Red Bridge, Oregon City	2 m 1 f
<i>Isoperla pinta</i> Frison	Butte Creek, Butte Creek Preserve	2 m 2 f
	Big Chico Creek, Big Chico Creek Reserve	1 m
<i>Isoperla quinquepunctata</i>	Yuba River, Hwy 20, Hammon Grove Park	187 m 175 f
(Banks)		
<i>Isoperla roguensis</i>	South Fork American River, Hwy 49, Coloma	21 m 27 f
Szczytko & Stewart	Middle Fork Feather River, Hwy 70, Camp Layman	6 m 4 f 3 n
<i>Osobenus yakimae</i> (Hoppe)	South Fork American River, Hwy 49, Coloma	1 f
	Big Chico Creek, Big Chico Creek Reserve	1 m
	Yuba River, Hwy 20, Hammon Grove Park	9 m 13 f
* <i>Perlinodes aureus</i> (Smith)	South Fork American River, Hwy 50, Riverton	1 m
	Butte Creek, Humboldt Road, Butte Meadows Cmpg	16 m 4 f
	Butte Creek, Humboldt Road, Cherry Hill Cmpg	2 m 1 f
	North Fork Feather River, Hwy 36, Chester	4 m
	Slate Creek, Hwy 32, Deer Creek	1 f
* <i>Rickera sorpta</i>	Butte Creek, Humboldt Road, Butte Meadows Cmpg	1 n
(Needham & Claassen)		
<i>Skwala curvata</i> (Hanson)	Butte Creek, Humboldt Road, Butte Meadows Cmpg	1 f
	Little Last Chance Creek, Hwy 284, Chilcoot Cmpg	13 m 2 f 3 n
* <i>Susulus venustus</i> (Jewett)	spring, Big Chico Creek, Hwy 32	1 m
	spring, Hwy 36, mm 94, nr Childs Meadow	1 m 9 f 3 n
	Gurnsey Creek, Hwy 36, Gurnsey Creek Cmpg	1 f
PERLIDAE		
<i>Calineuria californica</i> (Banks)	Butte Creek, Butte Creek Ecological Preserve	1 f
	Greenhorn Creek, Hwy 70, S E Quincy	1 n
	Yuba River, Hwy 20, Hammon Grove Park	1 m
<i>Hesperoperla pacifica</i> (Banks)	South Fork American River, Hwy 49, Coloma	1 m 1 f
	Butte Creek, Butte Creek Ecological Preserve	1 m
	Big Chico Creek, Big Chico Creek Reserve	5 m 5 f 1 n
	Yuba River, Hwy 20, Hammon Grove Park	2 m 1 f
CHLOROPERLIDAE		
* <i>Bisancora rutriformis</i> Surdick	Acorn Creek, Skunk Canyon, abv Folsom Lake	2 m
	North Fork American River, Hwy 49, nr Auburn	1 m 4 f
	South Fork American River, Hwy 49, Coloma	18 m 22 f
	Greenwood Creek, Hwy 49, nr Coloma	4 m 8 f
	Yuba River, Hwy 20, Hammon Grove Park	3 m 2 f
	South Yuba River, Pleasant Valley Road, Bridgeport	27 m 14 f
<i>Paraperla frontalis</i> (Banks)	South Fork American River, Hwy 49, Coloma	4 m 10 f
* <i>Suwallia sierra</i>	Blue Tent Creek, Hwy 49, nr Coloma	148 m 142 f
Baumann & Bottorff	Campbell Creek, North Table Mountain, Cherokee Rd	61 m 42 f

	Cooper Canyon Creek, Hwy 49, W Pilot Hill	65 m 63 f
	Deadman Creek, Church Mine Road, S El Dorado	76 m 74 f 5 n
	French Corral Creek, Pleasant Valley Road	13 m 13 f
	Oregon Gulch, Red Bridge, Oregon City	3 m 1 f
	stream, W Martinez Creek, S El Dorado	31 m 39 f
<i>Sweltsa borealis</i> (Banks)	South Fork Calf Creek, Hwy 32, nr Potato Patch Cmpg	11 m 4 f
	spring, Big Chico Creek, Hwy 32	5 m 3 f
* <i>Sweltsa californica</i> (Jewett)	Acorn Creek, Skunk Canyon, abv Folsom Lake	m 3 f 2 n
	North Fork American River, Hwy 49, nr Auburn	2 f
	Deadman Creek, Church Mine Road, S E El Dorado	4 m 9 f
	Greenwood Creek, Hwy 49, nr Coloma	5 m 8 f
	Sweetland Creek, Hwy 49, Sweetland	1 f
<i>Sweltsa pacifica</i> (Banks)	North Fork American River, Hwy 49, nr Auburn	3 m 7 f
	South Fork American River, Hwy 49, near Coloma	3 m 3f
	Butte Creek, Butte Creek Ecological Preserve	21 m 20 f
	Big Chico Creek, Big Chico Creek Reserve	22 m 29 f
	Greenwood Creek, Hwy 49, nr Coloma	5 m 10 f
	Yuba River, Hwy 20, Hammond Grove Park	1 m 1 f
	South Yuba River, Pleasant Valley Rd, Bridgeport	3 m 2 f
<i>Swelsa umbonata</i> Surdick	Butte Creek, Humboldt Road, Cherry Hill Cmpg	2 m 1 f 2 n

RECENT PLECOPTERA LITERATURE (CALENDAR YEAR 2010 AND EARLIER). Papers made available after 1 February 2011 will be included in the next issue. **If papers were missed, please bring these to the attention of the Managing Editor.** Drs. Dávid Murányi and Peter Zwick are thanked for reviewing and providing additions to this present list.

Amore, V, B. Gaetani, and R. Fochetti. 2010. The lack of hemocyanin in Oriental Plecoptera and multifunctionality of the protein in larvae. *Oriental Insects* 44: 429-446.

Angersbach, R., Wolf, B., and U. Stein. 2010. Two new records for *Taeniopteryx schoenemundi* (Plecoptera, Insecta) in Hesse/Germany. *Lauterbornia* 69: 51-58.

Aristov, D. S., and A. P. Rasnitsyn. 2009. The family Tillyardembiidae Zalesky, 1938 and the system of the plecopteroid insects. *Russian Entomological Journal* 18: 257-264.

Aura, C. M., P. O. Raburu, and J. Herrmann. 2010. A preliminary macroinvertebrate index of biotic integrity for bioassessment of the Kipkaren and Sosiani rivers, Nzoia River Basin, Kenya. *Lakes & Reservoirs Research and Management* 15: 119-128.

Avelino Capistrano da Silva, F. and J. Martins Costa, 2009. Coleção de tipos de Plecoptera (Insecta) do Museu Nacional (UFRJ), Rio de Janeiro, Brasil. *Biota Neotropica* 9:1-4.

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