5-25-2017

Stoneflies (Plecoptera) of Nevada

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Information on species distributions is a cornerstone of ecological and evolutionary research and of conservation applications (Jetz et al. 2012), but such knowledge is incomplete and biased for many taxa, habitats, and regions (Whittaker et al. 2005, Duputié et al. 2014). In this paper we assemble and synthesize distributional records for an aquatic insect order across a large arid region of the western USA. The state of Nevada (area 284,396 km²) lies east of the Sierra Nevada–Cascade mountain system and is dominated by the Great Basin (Trimble 1989, Grayson 2011), a region of internal drainage covering most of Nevada and portions of adjoining states. An orographic rain shadow imposes an arid climate and landscapes of xeric vegetation from the eastern flank of the Sierra Nevada to the Rocky Mountains. Countering its label as a basin, Nevada is dramatically mountainous with 300 named ranges, 27 of these exceeding 3048 m (10,000 feet) elevation. Mean elevation for the state is 1676 m (maximum 4005 m; minimum 146 m). Long block-faulted ranges trending north–south are separated by parallel valleys, many of which are independent closed basins (Fiero 2009). Most precipitation falls on the higher ranges, giving rise to surprisingly numerous streams and springs (Fig. 1) that are used by many aridland species and the aquatic invertebrate fauna, including stoneflies (Appendix 1). Nevada has more than 2400 named streams, though some are dry channels that only flow briefly during cloudbursts or spring snowmelt. More than 4000 named springs are known, but when unnamed springs are added, the total is >30,000 (Stevens and Meretsky 2008, Abele 2011, Wildlife Action Plan Team 2012). Nevada has few natural mountain lakes except for a significant lake district in the Ruby–East Humboldt Ranges (>20 lakes), a smaller set (5 lakes) in the

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Fig. 1. Potential stonefly habitats in Nevada: A, distribution of running waters; B, distribution of springs (see page 3). Black lines delimit the 17 counties of the state of Nevada (Appendix 3). Modified from: Wildlife Action Plan Team 2012; used with permission.
Springs and Springbrooks

Fig. 1. Continued.
Snake Range, and a few in the Jarbidge and Pine Forest Mountains.

Individual streams on many ranges flow separately into desert valleys, where they disappear by evapotranspiration and infiltration. Thus, many Nevada streams are strongly insular at the scale of mountain ranges (sky islands) and, within ranges, at the scale of catchments. Most of Nevada’s streams are small, with important exceptions. In western Nevada, the Truckee (including Lake Tahoe), Carson, and Walker rivers derive most of their discharge from the forested, high-elevation snowfall regions of the Sierra Nevada in California. These short rivers flow eastward into Nevada, where they terminate in desert lakes or playas (Appendix 2).

In northern Nevada, the Humboldt River drains multiple ranges and a large catchment (Shiozawa and Rader 2005), and its 560-km
east–west course ends near Lovelock in a large playa or sink. A small area of external drainage in northern Nevada (Owyhee, Bruneau, Jarbridge, and Salmon Falls rivers) provides important lotic habitat and connections through the Snake River basin to the northern Rocky Mountains.

In southeastern Nevada, Meadow Valley Wash, Las Vegas Wash, Muddy River, Virgin River, White River, and other streams, often lacking perennial surface flow, discharge to the Colorado River.

Stream abundance in Nevada has a distinct north–south gradient, with running waters being relatively common in the northern third, less common in the central third, and scarce in the southern third of the state (Fig. 1, Appendix 2). This varied prevalence of surface water influences distributions of the stream fauna.

Stoneflies (Plecoptera), the focal group of this paper, are one of the dominant insect orders in running waters (Merritt et al. 2008). North America has a rich stonefly fauna (700 species) in which members of 9 families vary greatly in size, trophic role, habitat, and seasonality of growth and adult occurrence (Fochetti et al. 2008). Stoneflies are an excellent probe into the condition and function of stream ecosystems (Baumann 1979, Stewart and Stark 2002, Sheldon 2008). Ecologically, they most often inhabit running waters having cool temperatures, perennial flow, and coarse benthic substrates. They are excellent biological indicators of long-term persistence of aquatic habitats, integrating many environmental factors. As a group, stoneflies have low tolerance for pollution or damaged aquatic environments; thus, streams with diverse stonefly faunas invariably have good ecological conditions. Streams rich in stoneflies are among Nevada’s valued trout streams. Stonefly imitations and seasonality are important to anglers (Leiser and Boyle 1982). Stoneflies spend most of their annual life cycle growing as nymphs in streams, though some species live 2 or more years. When mature, nymphs crawl from the stream, shed their exoskeleton, and become adults with wings and reproductive genitalia. Adults remain hidden within streamside vegetation and substrates until they reproduce and deposit eggs back to the stream. Laymen rarely observe stonefly adults because these insects are small, secretive, cryptically colored, and seldom fly.

The Nevada Great Basin has long been a dynamic region in its climate, geology, and biology. Glacial periods brought montane glaciers (Osborn and Bevis 2001), expansion of pluvial lakes (Hershler et al. 2002), downslope shifts in montane vegetation, and increased dispersal of flora and fauna between mountain ranges (Waltari and Guralnick 2009, Grayson 2011). These conditions reversed during interglacial periods. Climate variation during the Holocene was reflected in changing vegetation (Wigand and Rhode 2002) and stream discharge and geomorphology (Miller et al. 2004). Continuing changes driven by human population growth, legacies of past land use, invasive species, climate change (Wagner 2003, Poff et al. 2010), and their interactions make management and understanding of Great Basin environments challenging (Chambers and Wisdom 2009). The stonefly records we report in this paper integrate historic and modern conditions and are baseline data for monitoring vital stream ecosystems.

History of Stonefly Collections and Studies in Nevada

Although Jewett (1959, 1960) and Baumann et al. (1977) monographed the stoneflies of the Sierra Nevada–Cascade ranges and Rocky Mountains, knowledge of the stonefly fauna of the vast Intermountain Region, and particularly Nevada, has been slow to develop. Ricker (1964), in a study of Canadian stoneflies, published maps that showed the Great Basin as a blank space surrounded by regions with numerous stonefly records.

The first mention of a Nevada stonefly that we found in the scientific literature was the description of *Pteronarcella regularis* by Hagen (1874). Ambiguity exists, however, about the sampling location and collector. The paper’s title indicates that Carpenter, a naturalist with the Hayden expedition to Colorado in 1873, was the collector. Yet, Hagen gives the habitat as “Truckee, Sierra Nevada; Nevada, June 10 (Crotch).” Entomologist George R. Crotch spent much of 1873 collecting insects in California, Oregon, and British Columbia, and during June he sampled in the Sierra Nevada near Truckee, Lake Tahoe, and Donner Lake, California (Calhoun 2015). It is unclear if he entered Nevada. Following his 1873 expedition, Crotch worked several months with Hagen at the Museum of Comparative Zoology, 2017] Stoneflies of Nevada 5
Harvard University. Undoubtedly, Hagen had access to stoneflies in Crotch’s collections and included the description of *P. regularis* in his 1874 report on Colorado stoneflies. *Pteronarcella regularis* has not been collected in Nevada since the original description.

Needham and Smith (1916) described 2 stonefly species from Nevada, but, again, collection locations were ambiguous. The first species, *Sierraperla cora*, was reported from “Reno, Nevada,” but a collector was not named. Later, Needham and Claassen (1925) gave the collector as Morrison, 1878. During our study, we confirmed the presence of *S. cora* in western Nevada. The second species, *Soliperla thyra*, was reported without a collector as being from “Nevada,” but this species has never been collected in the state since the original description. Using specimens collected by Morrison at “Reno, Nevada,” in 1878, Claassen (1923) described *Soyedina nevadensis*.

In their monograph on North American stoneflies, Needham and Claassen (1925) listed 11 species from Nevada: *Haploperla chilnualna, Isoperla marmorata, Kogotus modestus, Paraleuctra occidentalis, Paraperla frontalis, Pteronarcella regularis, Sierraperla cora, Soliperla thyra, Soyedina nevadensis, Suwallia pallidula*, and *Sweltsa pacifica*. Eight of these were gathered in 1878 by Herbert K. Morrison, professional insect collector, at “Reno, Nevada,” but actual collecting sites may have been at some distance from this general location. From this Nevada material, Needham and Claassen (1925) described *Isoperla marmorata* under a different generic name.

Ricker (1952) noted 2 Nevada stoneflies, *Soyedina nevadensis* and *Zapada cinctipes*, though detailed collection data were not given.

Gaufin (1964) listed 124 stonefly species from the Intermountain Region but only 11 species from Nevada. His Nevada list was similar to that of Needham and Claassen (1925), except that he added *Prostoia besametsa, Pteronarcys californica, and Skwala americana*, and excluded *Haploperla chilnualna, Paraperla frontalis*, and *Sweltsa pacifica*. Gaufin understood that many more species would be found in Nevada when it was properly studied. In 1965, two new Capniidae stoneflies, *Capnia lacustra* and *Utacapnia tahoensis*, were described from the Nevada side of Lake Tahoe (Jewett 1965, Nebeker and Gaufin 1965). Logan and Smith (1966) searched the University of Idaho stonefly collection and added 2 Nevada species, *Podmosta*
delicatula and Triznaka pintada, both from a single collection in Elko County.

Cather et al. (1975) reviewed the scientific literature and found 22 stonefly species from Nevada. In addition, they listed another 8 species and gave new collection records for 1951–1974, bringing the total known species for the state to 30. Also, Surdick and Cather (1975) collected the nymph of Utaperla sopladora in Nevada. Although Nevada was outside of their main Rocky Mountain study area, Baumann et al. (1977) listed Nevada distributions for 19 stonefly species. Their stonefly list was similar to that of Cather et al. (1975), but included 3 additional species: Doddsia occidentalis, Taenionema pallidum, and Zapada cinctipes.

In the first focused study of Nevada’s stoneflies, Sheldon (1979) collected at numerous sites on 14 mountain ranges and listed 40 stonefly species, including 23 species never before reported from the state, including 5 later described as new species: Arsapnia utahensis as Capnia utahensis, Capnia gracilaria, Capnia uintahi, Capnura icanica, Eucapnopsis brevicauda, Sierracapnia hornigi as Capnia sp. A, Utacapnia lemoniana, Sweltsa borealis, Sweltsa resima as S. townesi, Plumioperla diversa, Triznaka sheldoni as T. pintada, Moselia zonata as M. infuscata, Paraleuctra vershina, Malenka murooshi as Malenka sp. A, Zapada frigida, Zapada oregonensis, Yoraperla nigrisoma, Isoperla sobria as I. ebrìa, Cultus, Diura knowltoni, Frisonia picticeps, Kogotus nonus as Kogotus sp. A, and Megarcys signata. Because he sampled many areas and large elevation gradients at different seasons, his work revealed a much more diverse stonefly fauna for Nevada than found in any previous study. His efforts were particularly significant because he often hiked far into mountain ranges to find unique high-elevation headwater species.

Stewart and Stark summarized the known distributions of all North American stoneflies by state and province in 2002 and reported 52 stonefly species from Nevada. The most recent summary of Nevada’s stoneflies by DeWalt et al. (2015) listed 56 species.

Since the 1980s, seven new stonefly species that are largely restricted to Nevada and/or the Great Basin have been described: Capnia hornigi (Baumann and Sheldon 1984), Capnia mono (Nelson and Baumann 1987a), Malenka murooshi (Baumann and Kondratieff 2010), Sierracapnia washoe (Bottorff and Baumann 2015), Sweltsa resima (Surdick 1995), Taenionema uinta (Stanger and Baumann 1993), and Triznaka sheldoni (Baumann and Kondratieff 2008b).


Revisions of stonefly genera that are uncommon in the Great Basin but that occur along the western and northern border regions of Nevada include Claassenia (Stark and Sivec 2010), Isocapnia (Zenger and Baumann 2004),
Moselia (Stark and Harrison 2016), Paraperla (Stark et al. 2013), Plumiperla (Surdick 1985), Sierraperla (Stark et al. 2015a), Soliperla (Stark 1983, Stark and Gustafson 2004), and Yoraperla (Stark and Nelson 1994).

In addition to these taxonomic and distributional studies of Nevada’s stonefly fauna, there have also been increased efforts in recent decades by federal and state agencies, university research units, conservation groups, aquatic biologists, and others to survey and monitor the environmental health of riparian ecosystems by sampling aquatic macroinvertebrates in the state’s streams and springs. The Nevada Division of Environmental Protection began monitoring many Nevada streams during the 1990s. Their program continues and the agency now has a large database on Nevada’s streams and aquatic fauna, including the distributions of many stonefly species. Likewise, the National Aquatic Monitoring Center (Utah State University, Logan, Utah) and the National Water Quality Laboratory (U.S. Geological Survey, Lakewood, Colorado) began sampling the aquatic faunas of numerous streams throughout Nevada during the 1990s and accumulated several thousand stonefly records. All of these monitoring efforts gathered valuable distributional data on stonefly nymphs, though species-level identification was not possible for many specimens.

Also starting in the 1990s, Donald W. Sada (Desert Research Institute, University of Nevada, Reno) and research colleagues sampled the aquatic biota of several thousand springs, including some with stoneflies, from all regions of Nevada (Sada et al. 1992, Sada and Nachlinger 1996, 1998, Sada and Herbst 1999, Sada et al. 2000, 2005, Sada and Jacobs 2008). Marilyn J. Myers (University of California, Berkeley) sampled 170 springs in the western Great Basin in the 1990s. Her main focus was caddisflies (Trichoptera), but she incidentally obtained adults and nymphs of 17 stonefly species (Myers and Resh 2002). In 1995, David B. Herbst (Sierra Nevada Aquatic Research Laboratory, University of California, Mammoth Lakes) surveyed aquatic invertebrates at Sheldon National Wildlife Refuge in northwestern Nevada and found 3 stonefly taxa, Isoperla quinquepunctata, Malenka, and Sweltsa (Herbst 1996). Similarly, a survey of aquatic invertebrates inhabiting springs at Ruby Lake National Wildlife Refuge, Elko and White Pine counties found Malenka and Isoperla nymphs (Sada et al. 2000).
In the 1990s, the Biological Resources Research Center, University of Nevada, Reno, used the aquatic insect fauna to assess stream and riparian conditions of 18 creeks in the Toiyabe Range (Kennedy et al. 2000). Thirteen stonefly taxa occurred in 105 identified taxa, though only a few were identified to species: *Eucapnopsis brevicauda*, *Prostoia besametsa*, *Doroneuria baumanni*, *Hesperoperla pacifica*, and *Megarcys signata*.

Biologists surveyed the cave biota of Great Basin National Park, Nevada, in 2003–2007, and single specimens of stoneflies were found at Systems Key, Fox Skull, and Water Trough caves (Krejca and Taylor 2003, Taylor et al. 2008). These stoneflies, identified only to order, were considered to be accidentals and not part of the true cave fauna.

Caires et al. (2013) studied the benthic invertebrate fauna of Lake Tahoe, Nevada and California, in 2008–2009, and compared their results with a similar study done in 1962–1963 (Frantz and Cordone 1966, 1996). Abundance of *Capnia lacustra*, a stonefly endemic to Lake Tahoe, declined between the 2 study periods. A following study investigated reproductive details of this unique species (Caires et al. 2016).

In recent years, genetic variation has been determined for several Nevada stoneflies, including *Pteronarcyis californica* (Kauwe et al. 2004), *Doroneuria baumanni* (Schultheis et al. 2012), *Hesperoperla pacifica* (Schultheis et al. 2014, Arnaldi et al. 2015), and *Pteronarcyis badia* (Sproul et al. 2015). Different clades have been identified from the wide distribution of each species in western North America, and the evolution of these lineages has been related to Pleistocene events and dispersal modes.

Ecological and focused zoogeographical studies of Great Basin stoneflies are few. Nelson (1994) discussed the biogeography of Great Basin stoneflies. Houseman and Baumann (1997) made detailed stonefly collections in the Raft River Mountains of Utah and quantified faunistic similarity with potential source regions. In another study pertinent to research on Nevada stoneflies, Stark et al. (2008) listed 32 stonefly species from the Warner Mountains of California, only 20 km distant from northwestern Nevada. Sheldon (1980) took advantage of unique species associations in the Great Basin in an analysis of morphology and coexistence of several species of Perlidae. Relevant research on other orders...
of aquatic insects includes an annotated list of Nevada caddisflies (Trichoptera) (Ruiter et al. 2014), a species list of Nevada mayflies (Ephemeroptera) (McCafferty and Randolph 2009), a biogeographic prediction of the Nevada mayfly fauna (Allen and Murvosh 1991), evidence from Nevada mayfly records for the zoogeographic importance of the Humboldt River (Baumann and Kondratieff 2000), and a comparison of past and present diversities of Nevada dragonflies and damselflies (Odonata) (Ball-Damerow et al. 2014).

In addition to scientific publications on stonefly taxonomy, ecology, biogeography, genetics, and distribution, color photographs of live stonefly adults and nymphs that illustrate the diversity of forms, colors, and pigment patterns of this fauna have been published (Stark et al. 1998, Stewart and Stark 2002). These include color photographs for 50 stonefly species known to be present in Nevada.

**METHODS**

**Study Area**

This study focuses on stoneflies occurring within the political boundaries of the state of Nevada and its 17 counties (Appendix 3). Since stoneflies are aquatic insects most often associated with running waters, we explored many of the state’s rivers, creeks, and springs at different seasons and elevations to determine its stonefly fauna (Appendix 2). Because of the tight linkage between stoneflies and running waters, the state’s hydrographic system is important in finding and understanding this fauna. More than 80% of the state is located within the Great Basin, an interior-draining hydrographic region of western North America. The drainage network of this arid region contains many dry stream channels that lack stoneflies, but also numerous isolated perennial creeks and springs, primarily in the state’s many mountain ranges. Two smaller, exterior-draining areas of Nevada include those in the extreme northeast corner (Snake–Columbia river system) and southeast corner (Colorado River).

In addition to its interior and exterior drainages, Nevada has been classified into 5 Level III ecoregions (Bryce et al. 2003). An ecoregion is defined as an area sharing similar vegetation, wildlife, climate, soils, hydrology, and physiography. Over 75% of Nevada is within the Central Basin and Range ecoregion (Fig. 2), an area with north-to-south–trending mountain ranges and intervening dry valleys or alkaline playas. It is internally drained and drier than the Sierra Nevada and the northern tier of Nevada, but wetter and colder than southern regions. Near Nevada’s northern border, about 10% of the state’s area (parts of
Washoe, Humboldt, and Elko counties) is in the Northern Basin and Range ecoregion. Nearly all of southern Nevada is included in the Mojave Basin and Range ecoregion, except for a tiny area (Virgin Mountains) within the Arizona–New Mexico Plateau ecoregion. Mojave Basin and Range, with scattered mountains and broad basins lacking sagebrush, is generally lower, warmer, and drier than the Central and Northern Basin and Range ecoregions. The Sierra Nevada ecoregion extends a short distance into extreme western Nevada at Lake Tahoe and the Carson Range. Although this ecoregion composes <1% of Nevada, for stoneflies it is the most species-rich area of the state. We have sampled and studied the stonefly fauna in many of Nevada’s interior-exterior drainages, stream and spring habitats, and all 5 ecoregions.

Sampling

This study is largely based upon stonefly collections made by the authors during the past 5 decades (mid-1960s to 2017). Additional specimens from many personal and institutional collections have added important details on species presence and distributions. In our sampling, it was assumed that the stonefly species we found reflected natural distributions that have been established for thousands of years. We know of no artificial introductions of stonefly species into Nevada.

We located sampling sites by exploring different areas and mountain ranges of the state, with special interest in finding streams used by stoneflies: that is, those with perennial flow, cool water temperatures, and coarse substrates (Appendix 4). Finding such aquatic habitats within Nevada’s dry terrain was aided by examining (1) U.S. Geological Survey topographic maps, (2) U.S. Forest Service national forest maps, (3) the DeLorme Nevada Atlas and Gazetteer (DeLorme 2001), (4) the Nevada Map Atlas (NDOT 2013, and earlier editions), and (5) Google Earth images of Nevada. These sources not only gave information about possible suitable streams to examine, but also details on how to access desired locations via maintained paved or dirt roads, unmaintained 4-wheel drive tracks, hiking trails, or open country traversing. Stonefly streams also were located by talking with local ranchers, residents, and U.S. Bureau of Land Management and U.S. Forest Service personnel. Most collecting sites in Nevada were located on federal lands managed by the U.S. Bureau of Land Management and U.S. Forest Service (comprising 76% of Nevada’s total surface area); less often the sites were on state or private lands (about 13% of Nevada). Tribal lands, wildlife refuges, national parks, and military and national security lands account for about 11% of Nevada’s area. We particularly focused our sampling efforts on Nevada’s many north–south trending mountain ranges and their small creeks along a range of elevations. Playas and broad valleys lying at lower elevations between mountain ranges seldom had suitable small creeks for stoneflies. However, larger perennial rivers such as the Humboldt, Truckee, Carson, Walker, Jarbidge, Bruneau, and Owyhee, and their major tributaries, do
contain stoneflies and were sampled in this study. Stoneflies were absent from thermal springs, saline creeks, briefly flowing intermittent streams, reservoirs, and most natural lakes (the main exception being Lake Tahoe). Small alpine lakes were not explored for stoneflies.

To determine the fauna present at a stream or spring, we searched for stonefly adults, nymphs, and exuviae (the shed nymphal exoskeleton). The most effort went to finding adults since adult male specimens show the best diagnostic characters that define a species. Adults were obtained by use of (1) beating sheets (sizes 61 × 61 cm and 74 × 74 cm), (2) sweep nets, and (3) light traps, and (4) by hand-picking specimens from vegetation, rocks, tree trunks, logs, under bark, debris piles, leaf packs, and bridge abutments. Our efficiency at finding stonefly adults along the riparian zone increased with collecting effort as we learned where males and females were most likely to occur in streamside microhabitats in relation to distance from water, vegetation type, and rocky substrates. Occasionally, adults were obtained by raising mature nymphs for several days to emergence in instream growth cages or iced coolers. To aid species identification, the aedeagus was extruded in the field for some stonefly adult males, such as *Suwallia* (Chloroperlidae) and *Isoperla* (Perlodidae).

Stonefly nymphs and exuviae provided useful information about a stream’s stonefly fauna. Species identification using nymphs and exuviae was possible for some stonefly genera and families (Nemouridae, Peltoperlidae, Perlidae, Perlodidae, and Pteronarcyidae), but was not possible for most Capniidae, Chloroperlidae, Leuctridae, and Taeniopterygidae. Stonefly nymphs were collected using different sizes of kick nets depending on stream size and current speed (net width = 36–76 cm, mesh opening = 0.5–1.5 mm), and with D-frame nets of varying mesh size. Stonefly exuviae were handpicked from streamside substrates or found with beating sheets. The relative maturity of nymphs in samples and the presence of exuviae provided clues to the time of year when stonefly adults might be present at a site. Using such data, we revisited previously collected sites at different seasons to find adults of species with brief periods of emergence. Stoneflies of all life stages were preserved in 70%–80% ethanol and labeled with the collection information (location, date, and collector).

**Laboratory Identification and Curation**

Collected stonefly samples were identified to species in the laboratory using light stereomicroscopes: Wild M8, Olympus SZ61, and Bausch and Lomb StereoZoom 4. A full range of Plecoptera taxonomic literature was used in identifying species, including the following useful references that summarize information for many species found in Nevada: Baumann et al. 1977, Nelson and Baumann 1989, Szczytko and Stewart 1979, Stewart and Stark 2002. Occasionally, when greater detail was needed to clearly identify a specimen, scanning electron micrographs were prepared at the Brigham Young University Scanning Electron Microscope Laboratory using a Philips XL30 ESEM FEG microscope.

All stonefly field samples were sorted by species and each species was placed in a separate vial, along with a detailed collecting label listing the state, county, stream, location information (nearby landmark, GPS coordinates, mountain range, and elevation), date, and collector. Because stonefly habitats and assemblages vary with altitude, especially between lower playa and mountain crests, we provided the elevation on most collection labels. This attribute also is useful in pinpointing a collecting site since it is a unique quantitative locator. In recent years, collecting sites have been precisely located with GPS units that provide latitude and longitude coordinates (Appendix 5).

All of our stonefly collection and species data, along with data from other personal and institutional collections that we examined, were entered into a Microsoft Excel spreadsheet, the Nevada Stonefly Database (Appendix 6, with supplementary material archived at scholarsarchive.byu.edu/mwnan/vol10/iss1/1). This database of 3531 collection records is organized alphabetically by stonefly family and then by genus and species. Each record provides the number of individuals of each sex and life stage that were collected. These numbers are followed by the location information (state, county, stream name, location details, and elevation), collection date, collector, and person who identified the species. Finally, GPS coordinates are given in decimal degrees, using the convention of positive numbers for
north latitudes and negative numbers for west longitudes. Around the year 2000, stonefly collectors began measuring latitude and longitude coordinates in the field with GPS units. For collections prior to 2000, we added coordinates for all records in the database using our best estimate of the sampling site from the location description on the label, using U.S. Geological Survey topographic maps and Google Earth images. Coordinates originally given in degrees, minutes, and seconds were converted to decimal degrees. Likewise, locations originally given as township, range, and section were converted to decimal degree coordinates. Unnamed right and left branches of named streams are defined when facing downstream. Other adjustments to the database included those to a few early stonefly collections from Ormsby County, Nevada, which in 1969 was merged into the municipality of Carson City. For this study and stonefly database, we list Carson City as if it were a Nevada county (Appendix 3).

Collections

Most of the stonefly specimens of this study and database have been deposited and curated at the Monte L. Bean Life Science Museum, Brigham Young University, Provo, Utah, but we attempted to find and include as many previously collected stoneflies from Nevada as possible. The following is a list of institutions and people who provided specimens or data for this study:

Andrew L. Sheldon Collection, Missoula, Montana
Brigham Young University Collection, Provo, Utah
California Academy of Science Collection, San Francisco, California
California Department of Fish and Wildlife, Sacramento, California
California School of Fly Fishing, Nevada City, California
Chad M. Murvosh Collection, University of Nevada, Las Vegas, Nevada
Donald G. Denning Collection, Moraga, California
Derham Giuliani Collection, Big Pine, California
Donald W. Sada Collection, University of Nevada, Reno, Nevada
Illinois Natural History Survey, Champaign, Illinois
Marilyn J. Myers Collection, Durango, Colorado
National Aquatic Monitoring Center, Utah State University, Logan, Utah
National Water Quality Laboratory, U.S. Geological Survey, Lakewood, Colorado
Nevada Department of Agriculture, Reno, Nevada
Nevada Division of Environmental Protection, Carson City, Nevada
Richard L. Bottorff Collection, South Lake Tahoe, California
United States National Museum of Natural History, Washington, DC

Species Maps and Photographs

Dot distribution maps of all 104 stonefly species currently known from Nevada were assembled using a public web account at ArcGIS (https://www.arcgis.com/home/), a product of the Environmental Systems Research Institute.
Fig. 3. Collecting effort for Nevada stoneflies, 1873 to 2017.

Fig. 4. Accumulation curve of stonefly species known from Nevada, 1950–2015.
Institute (Esri) of Redlands, California (Appendix 5). Latitude and longitude coordinates of all collection records for each species were overlaid on a National Geographic Society and i-cubed base map entitled “USA Topo Maps.” Mike Keys of Crawfordville, Florida, prepared Figs. 10–14.

Photographs of Nevada’s deserts, streams, springs and mountain ranges were taken by Richard L. Bottorff using a Panasonic Lumix DMC-ZS15 camera and by Andrew L. Sheldon (Nikon FG, Panasonic Lumix DMC-F28). All stonefly photographs were taken by R.L. Bottorff.

RESULTS

Stonefly Collections in Nevada

Stoneflies were first collected in Nevada in 1873 (Hagen 1874), but very little attention was given these aquatic insects in the Intermountain Region for the next 80 years (Fig. 3). Stonefly sampling in Nevada became slightly more common in 1950–1969, followed by a burst of collecting activity from the 1970s onward by A.L. Sheldon and R.W. Baumann, who explored many of the state’s mountain ranges and intermountain valleys, including a wide range of running water habitats, elevations, and seasons. Their collections, and those of other aquatic biologists, continued to add new discoveries to the state’s species list (Fig. 4). In the last 2 decades, R.L. Bottorff collected in the Sierran region and in poorly known areas and habitats across the state and photographed living stoneflies and landscapes. During the 145 years between 1873 and 2017, stoneflies have been collected in Nevada on 582 unique days by 113 collectors. They have been collected at about 800 locations from 360 named streams throughout the state. Some sites were at different elevations of the same stream, and some sites were sampled more than once at different seasons during this period. In total, 104 stonefly species from 3531 collection records are now known from Nevada (Table 1; see detailed collection records in Appendix 6, the Nevada Stonefly Database).

Stoneflies occur over a wide range of elevations in Nevada, from a minimum of 482 m (1580 feet) in the Virgin River near Mesquite in Clark County to a maximum of 3127 m (10,250 feet) at Teresa Lake, Great Basin National Park, in White Pine County (Fig. 5). Less than 1% of Nevada’s stonefly records are from elevations above 3000 m, and all of these occurred in the Snake Range of Great Basin National Park. About 90% of all stonefly collections occurred at elevations 1500–2700 m (4900–8900 feet). The most common elevation range, 1800–2100 m (5900–6900 feet), accounted for nearly 40% of the records.

Stonefly Distributions in Northern and Southern Nevada

Most stonefly collections in Nevada were made in small creeks of many mountain ranges in the northern two-thirds of the state at 38°–42° north latitude (Fig. 6, Appendix 4). These mountains are wetter than surrounding lowlands and have perennial water sources used by stoneflies. For example in western Nevada near Lake Tahoe, many stonefly collections, mainly composed of Sierra Nevada species, are known from the water-rich Carson Range and Truckee River region. Collections are also known from south of Lake Tahoe along the western border of Douglas, Lyon, and Mineral counties, often in streams
**Table 1.** Stonefly species present in Nevada. Species marked with an asterisk (*) are restricted to the Tahoe–Truckee–Carson–Walker river region of western Nevada.

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<tr>
<td>Capnura intermontana Nelson &amp; Baumann</td>
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<td>Eucapnopsis bresciana Claassen</td>
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<td>Megarcys subtruncata* Hanson</td>
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<td>Rickera sorpta* (Needham &amp; Claassen)</td>
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<td>Skualacu americana (Klapalek)</td>
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<td>Pteronarcyella princes Banks</td>
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</table>
originating in eastern California and flowing into Nevada. In central and eastern Nevada, numerous collections exist from a succession of north–south mountain ranges between Humboldt and Elko counties in the north to White Pine and northern Nye counties in the south. These mountains provide a wide range of running water habitats and elevations for the stonefly fauna, but the flow of these small mountain creeks seldom penetrates far into surrounding playas and broad intermountain valleys. Five northern Nevada counties (Douglas, Elko, Humboldt, Washoe, and White Pine) make up about 40% of the state’s surface area but account for 75% of the stonefly collection records (Table 2).

In addition to many small mountain creeks, northern Nevada has several large streams that flow in intermountain valleys, where stoneflies have been regularly sampled (e.g., Truckee, Carson, Walker, Humboldt and major tributaries, Owyhee, Bruneau, and Jarbidge).
### TABLE 2. County summary of stonefly collections and species in Nevada.

<table>
<thead>
<tr>
<th>County</th>
<th>Area (km²)</th>
<th>%</th>
<th>Stonefly records</th>
<th>%</th>
<th>Stonefly species</th>
<th>Number</th>
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<td>127</td>
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<td><strong>Total</strong></td>
<td><strong>284,396</strong></td>
<td><strong>100.0</strong></td>
<td><strong>3351</strong></td>
<td><strong>100.0</strong></td>
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Black Rock Desert, northwestern Nevada.  
Dixie Valley playa and Clan Alpine Mountains, Churchill Co., Nevada.  
Winnemucca Lake playa, Pershing–Washoe counties, western Nevada.
Although the stonefly fauna is widely distributed across northern Nevada, a noticeable 100–150-km gap exists where they are absent. This barren swath extends along western Nevada, from the Black Rock Desert southeast through Pyramid and Walker lakes to the southern border (Fig. 6).

This sterile region coincides with a particularly arid zone of the Sierra Nevada rain shadow, which has an annual precipitation of only 101–250 mm. Besides the dryness, much of the area lies at low elevations (<1500 m) and has few running waters suitable for stoneflies (Fig. 1). Some collections that on distribution maps appear to lie within this dry region are instead from higher, wetter elevations of isolated mountain islands. At least 2 remote mountain islands within this dry zone contain unique stonefly species or genetically distinct clades (Schultheis et al. 2012, Bottorff and Baumann 2015). This barren region is best seen in the stonefly distributions of 4 widespread Nevada species, *Hesperoperla pacifica*, *Isoperla quinquepunctata*, *Pteronarcys princeps*, and *Zapada cinctipes*. Any stonefly collections from this arid region would be significant additions to the knowledge of Nevada’s fauna.

Relatively few stonefly collections exist from the southern third of Nevada at 35°–38° north latitude in Clark, Esmeralda, Lincoln, and southern Nye counties (Fig. 6). Compared to their surface areas in the state (33.4%), Clark, Lincoln, and Nye counties are underrepresented in total stonefly collections (8.2%; Table 2). The main exceptions to the scarce records from this region are 2 high mountain ranges where the stonefly fauna has been sampled: the White Mountains in Esmeralda County and the Spring Mountains in Clark County. Both ranges reach elevations over 3500 m, are snow-capped in winter, and have small perennial creeks and springs. Collections have been made on the east slope of the White Mountains on multiple occasions and at different seasons, but additional samples from the Spring Mountains are needed, especially during winter and spring, when stonefly adults are most likely to be present. Perennial streams, often associated with springs, are reported from the Spring Mountains at Carpenter Canyon, Clark Canyon, and Cold, Deer, McFarland, Santa Cruz, Sawmill, and Willow creeks (Chambers et al. 2013).

Beyond these 2 mountain ranges, stonefly habitats appear to be rare in southern Nevada, and only 5 collections are known from this vast region. Certainly, additional studies are warranted. Perennial creeks are uncommon in southern Nevada, but springs occur throughout the region (Fig. 1). For example, more than 500 springs are known from Clark County, and of these about 200 are perennial (RECON 2000, Sada and Jacobs 2008, Chambers et al. 2013). Spring sites occur in the Black, Eldorado, Gold Butte, McCullough, Muddy, Newberry, Sheep, and Virgin mountains of Clark County (RECON 2000, Sada and Jacobs 2008). Stoneflies may inhabit cold or cool springs that originate from local groundwater sources, but are unlikely to exist in larger, warmer (≥30 °C) springs flowing from the regional carbonate-rock aquifer (Chambers et al. 2013). These large springs include Ash Meadows, Ash, Blue Point, Crystal, Hiko, Moapa, and Rogers. Large intermountain drainages in southern Nevada, mostly without stonefly records, include the intermittent Meadow Valley Wash and White River, and the perennial Las Vegas Wash and Muddy and Virgin rivers. Any stoneflies found at sites beyond the Spring Mountains in southern Nevada would be significant discoveries.
The scarcity of stonefly records in southern Nevada may reflect (1) the rarity of stoneflies in this arid region and/or (2) incomplete sampling of the area’s running waters. Biological exploration in southern Nevada is constrained in part because large areas have been restricted by the U.S. Department of Defense. Much of southern Nye, southwestern Lincoln, and northwestern Clark counties cannot be sampled because they lie within the Nevada Test and Training Range, Nellis Air Force Base, and the Nevada National Security Site, though agency biologists have surveyed some aquatic habitats in these restricted areas. Despite these limitations, a number of streams and springs of southern Nevada have been examined for stoneflies, though few were found. To give some measure of the amount of sampling that has occurred in southern Nevada, we list the following locations where collections or studies have occurred, though most failed to find stoneflies:

**Muddy River.**—Richard W. Baumann and students of Brigham Young University sampled the aquatic fauna of Moapa Warm Springs and Muddy River in Clark County during 1984–2009 (elevations, 350–550 m). Mayflies, caddisflies, and other aquatic insects inhabited most sites, but stoneflies did not. Huillet (1998) regularly sampled aquatic insects for a year along 50 km of the Muddy River from headwater warm springs to downstream Lake Mead. Headwater springs were too warm (27–32 °C) for stoneflies; further downstream, near Glendale, the river cooled to tolerable levels (16–26 °C), but stoneflies were absent. North of the warm springs, Huillet checked pools in Arrow Canyon and Meadow Valley Wash near Farrier without result in 1997. Other biologists who have sampled the aquatic fauna of Muddy River and Moapa Valley National Wildlife Refuge without finding stoneflies include Sada and Herbst (1999), Robert L. Johnson (Monte L. Bean Life Sciences Museum, Brigham Young University), Bruce Lund (Odonata specialist, Moapa, Nevada), and Jason R. Eckberg (Southern Nevada Water Authority, Las Vegas, Nevada).

**Spring Mountains Springs.**—The aquatic fauna of 63 springs in the Spring Mountains of Clark County were surveyed during May–August 1995 and 1997 (Sada and Nachlinger 1996, 1998, Sada et al. 2005) and again in June–October 2003–2004. In most springs, no stoneflies were found, but Perlidae and Chloroperlidae occurred at a few sites. It may be helpful to sample these springs during winter and early spring when adults of Capniidae and Nemouridae are more likely to occur.

**Hiko and Ash Springs.**—The lead author checked these large springs in Lincoln County without result in 1996.

**Ash Meadows National Wildlife Refuge.**—The aquatic fauna of this refuge in southern Nye County has been surveyed without finding stoneflies (Harold Fairfield, personal communication, Ash Meadows National Wildlife Refuge). The lead author examined this site also without result in 1998.

**Corn Creek, Desert National Wildlife Range.**—No stoneflies were seen in 2004 when the lead author checked Corn Creek and Spring in Clark County. Likewise, none were found during a 2014 aquatic survey by the Nevada Division of Wildlife (Sarah L. Bullock, personal communication, Desert National Wildlife Range).

**Blue Point and Rogers Springs.**—No stoneflies were present when the lead author checked both springs southwest of Overton and north of Lake Mead, Clark County, in December 1995 and May 1997. Likewise, none were found during a survey of springs by Sada and Jacobs (2008).

**Las Vegas Wash.**—Nelson (2011) and Eckberg (2012) have studied aquatic macroinvertebrates in this stream since 2000, finding mayflies, caddisflies, and other aquatic insects, but no stoneflies.

**Nevada National Security Site.**—This area of restricted access in southern Nye County lacks perennial creeks but has a few perennial springs and ephemeral streams, none of which have stoneflies (Derek B. Hall, personal communication, National Security Technologies, LLC, Las Vegas, Nevada).

**Virgin Mountains.**—The lead author visited Cabin Canyon in July 2005 and September 2009 without finding stoneflies, though winter and spring samples may be more productive.

**Virgin River.**—The lead author checked the river 9 times at Riverside, Bunkerville, and Mesquite during 1977–2004 and only found a few adults of one stonefly species in January 1988. Visits without stoneflies occurred in February, March, May, July, August, September, November, and December.
LAKE MEAD NATIONAL RECREATION AREA.—In summer 2007, 89 springs, nearly all at elevations <1000 m, were surveyed near Lake Mead and Lake Mojave (Sada and Jacobs 2008). This survey included springs in the Black, Eldorado, Muddy, and Newberry mountains, and one spring near Gold Butte and Jumbo Peak. Sada and Jacobs (2008) stated that springsnails, amphipods, and ostracods occurred at some springs but data for aquatic insect taxa were not given in the report. Stoneflies may have been absent because springs often had high electrical conductance (>1000 μS), warm water temperatures (>20 °C), and high susceptibility to drying and scouring.

COLORADO RIVER.—Several benthic and fish food studies failed to find stoneflies in the Colorado River below Hoover and Davis dams, though mayflies and caddisflies were present (Paulson et al. 1980, Ohmart et al. 1988, Walters et al. 1996); however, Moffett (1942) reported the presence of stoneflies in the river below Hoover Dam.

In summary, many aquatic habitats of Clark County have been sampled but few stoneflies were found beyond the Spring Mountains. Lincoln County, which is poorly sampled for aquatic macroinvertebrates, appears to have greater potential for stoneflies since it has prominent mountain ranges with some perennial creeks and many springs.

Stonyfly Frequency of Occurrence

Stonyfly frequencies of occurrence in the collections follow the typical pattern of a few species that are common and many species of intermediate to very low frequency (Fig. 7, Appendix 6). Leading the list of common species is Hesperoperla pacifica whose conspicuous and distinctive nymphs were more often collected than adults. Zapada cinctipes (adults and nymphs), Sweltsa coloradensis (adults only), Paraleuctra vershina (adults), Pteronarcys princeps (mostly nymphs), Dorotheuria baumannii (mostly nymphs) and Isoperla quinquepunctata (adults and nymphs) complete the top 7 most frequently collected species. However, many other species were poorly represented in collections. The median was 14 collections per species. Eight species were collected only once: Capnia sextuberculata, Isocapnia hyalita, Malenka depressa, Soloperla thyra, Oroperla barbara, Perlínodes aureus, Pteronarcella regularis, and Taeniopteryx nivalis.

Stonyfly Diversity in Nevada

This study, based upon 3531 collection records, increases the number of stonyfly species known to exist in Nevada from 56 (DeWalt et al. 2015) to 104 (Table 1, Appendix 6). Despite the region's aridity, Nevada's stonyfly fauna is diverse and includes about 15% of North American species. It includes all 9 stonyfly families present in North America and 51 genera. Nevada's stonyfly diversity of 104 species is similar to or greater than that found in the neighboring arid states of Idaho (115 species), Utah (80 species), and Arizona (41 species), but is less than that occurring in the Pacific Coast states of California (194 species) and Oregon (161 species) (DeWalt et al. 2015).

Stonyfly richness varied widely in Nevada's 17 counties (Table 2), the top 3 being Washoe (59 species), Elko (55 species), and Douglas (45 species). Western counties that included part of the species-rich Carson Range had higher stonyfly diversities than expected from their surface areas. Clark, Lincoln, and Storey counties had the fewest (3–6) stonyfly species.

Most of Nevada lies within the interior-draining Great Basin, but smaller areas in the northeast and southeast drain to the Snake and Colorado rivers, respectively. Of Nevada's 104 stonyfly species, 98 occurred within the Great Basin, while 6 were outside, including 5 in the Snake River system (Capnia coloradensis, Capnia sextuberculata, Isocapnia hyalita, Podmosta decepta, Cultus aestivalis).
and 1 in the Colorado River system (*Mesocapnia frisoni*). The Great Basin and Snake River system in Nevada had 44 stonefly species in common, while the Great Basin and Colorado River system shared 3 species.

Although no Nevada stream has been exhaustively studied for stoneflies, this investigation provides preliminary diversity data for about 30 creeks and rivers that have been sampled at different seasons and elevations from 14 mountain ranges (Table 3, Appendix 1). Most streams throughout Nevada have at least 12–17 stonefly species (\(\bar{x} = 14\) species); a few had <10 species. Only 4 streams had \(\geq 20\) species, and these stonefly-rich and wetter regions included the Carson, Jarbidge, and Ruby mountains. The Carson Range is a hot-spot of Nevada stonefly diversity because it contains 31 species primarily found in the Sierra Nevada ecoregion (Table 1).

Undoubtedly, the above estimates of stonefly diversity are minimum values. Because life cycles and emergence periods of stonefly species differ, a stream must be sampled regularly at all seasons and elevations to determine its complete fauna. In Nevada, stonefly adults and nymphs are present during every month, including winter, when collector access to higher ranges is difficult. Adult winter stoneflies are typically found on streamside snowbanks and, though small, are easily seen because of their dark coloration. The upper reaches of Nevada streams often contain species, sometimes rare, that are absent at lower elevations.

When a Nevada stream site is sampled for stoneflies, often more than one species is

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**Table 3. Number of stonefly species in selected Nevada streams.**

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humboldt River–mainstem</td>
<td>7</td>
</tr>
<tr>
<td>Truckee River</td>
<td>14</td>
</tr>
<tr>
<td>Carson Range</td>
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</tr>
<tr>
<td>Third Creek</td>
<td>34</td>
</tr>
<tr>
<td>Galena Creek</td>
<td>29</td>
</tr>
<tr>
<td>Granite Range</td>
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</tr>
<tr>
<td>Cottonwood Creek</td>
<td>7</td>
</tr>
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<td>Rock Creek</td>
<td>12</td>
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<td>Independence Mountains</td>
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<tr>
<td>Dorsey Creek</td>
<td>15</td>
</tr>
<tr>
<td>Jarbidge Mountains</td>
<td></td>
</tr>
<tr>
<td>Jarbidge River</td>
<td>32</td>
</tr>
<tr>
<td>Seventy-six Creek</td>
<td>17</td>
</tr>
<tr>
<td>Monitor Range</td>
<td></td>
</tr>
<tr>
<td>Mosquito Creek</td>
<td>11</td>
</tr>
<tr>
<td>Pine Forest Range</td>
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</tr>
<tr>
<td>Big Creek</td>
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<td>20</td>
</tr>
<tr>
<td>Secret Creek</td>
<td>17</td>
</tr>
<tr>
<td>Soldier Creek</td>
<td>12</td>
</tr>
<tr>
<td>Santa Rosa Range</td>
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<tr>
<td>Cabin Creek</td>
<td>14</td>
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<td>Indian Creek</td>
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<td>Water Canyon</td>
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<td>Toiyabe Range</td>
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<td>Indian Creek</td>
<td>8</td>
</tr>
<tr>
<td>Leidy Creek</td>
<td>8</td>
</tr>
</tbody>
</table>

Seventy-six Creek, Jarbidge Mountains, Elko Co., Nevada. Site with *Diura, Kogotus, Moselia*, and *Utaperla*.

Third Creek, Carson Range, Washoe Co., Nevada. Site with *Despaxia, Doroneuria, Moselia*, and *Visoka*.
found. In our experience, single collections have included 1–14 stonefly species, though 1–4 is more common for most Nevada streams (2–6 for Carson Range creeks). We have found 14 stonefly species in single collections at SeventySix Creek (Jarbidge Mountains) and Third Creek (Carson Range).

Stonefly diversity in Nevada varies across the state’s 5 ecoregions (Fig. 8). The largest ecoregion, the Central Basin and Range, is the most diverse, having all 9 stonefly families and 66 species. The Northern Basin and Range and Sierra Nevada ecoregions also have diverse stonefly faunas of 56 and 58 species, respectively. Though the Sierra Nevada ecoregion comprises <1% of Nevada, numerous species occur there, including 31 species not found elsewhere in the state. Stoneflies are less diverse in southern Nevada, and only 6 species in 4 families (Capniidae, Chloroperlidae, Nemouridae, and Perlidae) exist in the Mojave Basin and Range ecoregion. No stoneflies are known from the tiny area in southern Nevada that is located within the Arizona–New Mexico Plateau ecoregion. This area includes the Virgin Mountains, which need to be explored for stoneflies.

Abundance of Stonefly Families and Life Stages in Collections

Of the 3531 stonefly records accumulated during this study, two-thirds were of adults, 28% were of nymphs, and 4% were of exuviae (Table 4). The most commonly collected stonefly families, with over 600 records each, were the Chloroperlidae, Nemouridae, and Perlidae, but the Capniidae, Leuctridae, Perlidae, and Pteronarcyidae were well represented.
Fig. 9. Seasonal presence of adult stonefly families in Nevada. Horizontal axis units are the number of adult stonefly collections. Note that the horizontal axes are scaled differently in each panel.
also, with 238–412 records each. There were 114–140 records each for the Peltoperlidae and Taeniopterygidae. Collections of Capniidae, Chloroperlidae, Leuctridae, and Taeniopterygidae were mainly of adults, while Nemouridae, Peltoperlidae, Perlidae, Perlodidae, Pteronarcyidae records included many of nymphs. Species identification using just nymphs usually is not possible for members of the former 4 families, but is possible for the latter 5 families.

**Seasonal Presence of Adult Stoneflies in Nevada**

The 9 stonefly families displayed unique seasonal patterns of adult presence, though as a single group were extant year round (Fig. 9). The Capniidae, well known as winter stoneflies, appear in late December, peak from late February to late April, and then decline until few are present after June. Chloroperlidae, typically with yellow, yellow-brown, or green adults, are present during June–August, although a few continue into autumn at higher elevations. Leuctridae begin emergence in April and May and continue into summer. This family contains the autumn-emerging *Despaxia*. Nemouridae are present throughout the year in Nevada, with a peak from May to early July. This family includes winter-emerging *Zapada* and autumn-emerging *Malenka*. The Peltoperlidae, known as roachflies, are present from May to early July, with a peak in mid-June. The Perlidae are present during June–September, but the seasonal pattern has 2 peaks: June–July for *Calineuria* and *Hesperoperla* and August–September for *Claassenia* and *Doroneuria*. Perlodidae adults are present from February to September, with a June peak for most species and later emergence (August–September) at higher elevations. *Skwala* is the first to appear in February–April, while *Kogotus* primarily occurs in August. Pteronarcyidae adults are present during summer, primarily from late May to early July. Taeniopterygidae adults are present from March to July, with a peak from mid-May to June. *Taenionema uinta* adults are the first to appear in March–April,
followed by *Doddsia* in April–May, and 2 other species of *Taenionema* in May–July.

**Stoneflies in Nevada Springs**

With important exceptions, most stoneflies in Nevada inhabit small perennial creeks that often are sustained by cool or cold springs and springbrooks. No stoneflies occur in warm, hot, or saline springs. Nearly all of Nevada’s stonefly species are eliminated from a creek or spring if it dries. Typically, headwater regions of mountain creeks, especially in northern Nevada, have multiple springs and springbrooks that coalesce into a single channel of flowing water. These headwaters can harbor unusual or rare stonefly species not found at lower elevations. Further downstream, other spring tributaries may add water and maintain continuous flow until surface discharge dwindles in the lower alluvial fan and intermountain valley. In Nevada, many small creeks display a succession of perennial and dry segments along their course, with springs sustaining flow over short reaches, followed by downstream drying. This flow–no flow sequence may repeat many times between the headwaters and the valley floor. Stoneflies can occur in short reaches if they are permanent flowing.

Within Nevada’s drier regions, where perennial creeks are uncommon, springs and springbrooks are the only viable habitats for stoneflies. Much to our surprise, during our studies of these dry areas, we found stoneflies surviving in very small springs and springbrooks. For example, in the Willow Creek drainage at Roberts Mountains, we found an isolated, unnamed spring with 3 stonefly species (*Hesperoperla pacifica, Malenka californica,* and *Zapada cinctipes*). Water flow was minuscule (1–5 cm deep, 10 cm wide) and extended about 50 m downstream before drying. The next running water appeared to be 3 km distant. Within the same mountain range, stoneflies were present in isolated Jack...
Spring (Zapada cinctipes) and Tonkin Springbrook (Isoperla quinquepunctata).

One of the most common stonefly genera associated with springs is Malenka. Nymphs of this genus feed on aquatic organic detritus and have been found in springs and springbrooks across Nevada, including dry regions of the Ruby Lake and Sheldon National Wildlife Refuges and many mountain ranges. The ubiquitous species, Malenka californica, occurs along perennial creeks but is especially abundant at springs. Malenka depressa has been found once in a spring seep in northwestern Nevada. Malenka murvoshi is endemic to springs and springbrooks in the Spring Mountains of southern Nevada, and Malenka tina occurs in small spring-fed creeks of northern Nevada.

Hesperoperla pacifica is another stonefly that occurs in springs, though it also inhabits
a wide diversity of running waters. This large stonefly preys on other aquatic invertebrates and, surprisingly, can exist in small, isolated springs at low and high elevations. Some spring-dwelling *Hesperoperla* populations have adults with short wings.

Other spring-dwelling stonefly species in Nevada or, more broadly, those inhabiting the upper reaches of creeks dependent on spring inflows, include *Capnia sextuberculata*, *Isocapnia hyalita*, *Plumoperla spinosa*, *Suwallia sublimis*, *Sweltsa borealis*, *Sweltsa lamba*, *Sweltsa resinina*, *Triznaka sheldoni*, *Utaperla soplandora*, *Malenka tina*, *Podnosta decepta*, *Soyedina nevadensis*, *Visoka cataractae*, *Zapada cinctipes*, *Zapada columbiana*, *Zapada haysi*, *Doroneuria baumanni*, *Diura knoultoni*, *Isoperla petersoni*, *Isoperla sobria*, *Isoperla sordida*, *Kogotus modestus*, *Kogotus nonus*, *Megarcess signata*, *Megarcyx subtruncata*, *Doddsia occidentalis*, and *Taeniopteryx nicales*. Nevada

endemic *Sierracapnia washoe* inhabits small spring-fed creeks.

**Zoogeographic Patterns in Nevada Stoneflies**

Many stonefly species are so widely distributed in Nevada and the western United States that they offer few clues concerning the origin and history of the Nevada stonefly fauna. Others are more localized and define patterns in the zoogeography of Nevada stoneflies. The restriction of 31 species to the Tahoe–Truckee–Carson–Walker region (Fig. 10, Table 1) is striking. Most of these species are widely distributed in neighboring California, but 2 species (*Capnia lacustra* and *Utacapnia tahoensis*) are endemic to Lake Tahoe.

Only a few unquestionable Sierra–Cascade stonefly species extend farther east into Nevada (Fig. 10). *Frisonia picticeps* and *Kogotus nonus* are limited to the White Mountains and Tahoe–Truckee–Carson–Walker region. *Yoraperla nigrisoma* extends to several small ranges in northwestern Nevada, and *Moselia zonata*, its common associate in small streams and springbrooks, reaches eastward to the
Jarbidge Mountains. Two large species (*Doroneuria baumanni* and *Pteronarctys princeps*), which probably are strong fliers, have much broader distributions that extend eastward to western Utah. A westward counter-flow of stonefly species from the Rocky Mountains extends to the west-central ranges of the Nevada Great Basin (Fig. 11). A strong tendency for Rocky Mountain species to dominate Great Basin biota (Harper et al. 1978) is generally true for stoneflies, but our data demonstrate additional patterns.

Only a few stoneflies are restricted to the Great Basin region. One of these, *Triznaka sheldoni*, is among the most widely distributed stoneflies in Nevada (Fig. 12) and extends into adjoining states. The remaining endemic species of Nevada have much smaller distributions
Malenka murvoshi occurs only in the Spring Mountains of southern Nevada, and Sierracapnia hornigi is similarly restricted to the White Mountains of Nevada and California. Recently discovered Sierracapnia washoe has a slightly larger range in northwestern Nevada where it occupies streams at relatively low elevations. The 2 species of Capniidae (Capnia lacustra and Utacapnia tahoensis) present only in Lake Tahoe illustrate the tendency for endemics with restricted ranges to occur along the western border of Nevada.

The Humboldt River and its major tributaries support a distinctive stonefly fauna (Fig. 13). Most notable are the westernmost records of Acroneuria abnormis, which is among the most widely distributed stonefly species in North America (DeWalt et al. 2015). Other species are characteristic of larger streams, and some also occur in large rivers of western Nevada or the external drainages of northeastern Nevada. An unmapped variant of this pattern is the distribution of 2 large Perlidae, Calineuria californica and Claassenia sabulosa. Both species occur in the Tahoe–Truckee–Carson–Walker region and both were discovered recently in the external Bruneau–Jarbidge drainage of northeastern Nevada. The large, distinctive nymphs of these species have not been collected in the Humboldt system.

Latitudinal zonation represents yet another pattern of Nevada stoneflies (Fig. 14). The distribution of Arsapnia utahensis extends from Utah to California. The narrow distributional track may be a dispersal route westward from the Rocky Mountains, as with the species shown in Fig. 11, or it may be determined by climate. The distribution of Sweltsa borealis also appears band-like but the species is widely distributed to the north and in both the Rocky Mountains and Sierra–Cascade ranges. The species’ southern margin in Nevada may be set by climate.

**Annotated List of Nevada Stoneflies**

All North America Plecoptera are included in the suborder Arctoperlaria, which includes 2 infraorders, Euholognatha and Systellognatha (DeWalt et al. 2015). The following summary of 104 species of stoneflies known to occur in Nevada is organized taxonomically, first by infraorder and then alphabetically by family and species. To make it easier to find
individual collection records, the layout of the Nevada Stonefly Database (Appendix 6) is alphabetical by family and species, without regard to infraorder. Distribution maps for all stonefly species are given in Appendix 5.

EUHOLOGNATHA
CAPNIIDAE

Arsapnia decepta Banks, 1897

**GEOGRAPHIC RANGE.**—Central and southern Rocky Mountains of Colorado, Arizona, and New Mexico; Baja California; mainland Mexico; southern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 1.

- **County:** Clark.
- **Mountain Range:** Spring.
- **Ecoregion:** Mojave Basin and Range.

**DISCUSSION.**—*Arsapnia decepta* is present in southern Nevada, where it has been recorded from small creeks in the Spring Mountains west of Las Vegas (Baumann and Stark 2017). Sampling in Clark, Lincoln, and southern Nye counties is needed to determine whether it occurs beyond the Spring Mountains. The Nevada records of this species are western extensions from Arizona and the southern Rocky Mountains. Adults are present during December–April.

Arsapnia tumida (Claassen, 1924)

**GEOGRAPHIC RANGE.**—Northern Sierra Nevada and southern Cascade Mountains in California; western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 2.

- **County:** Douglas and Washoe.
- **Major River Valley:** Carson and Truckee.
- **Ecoregion:** Sierra Nevada.

**DISCUSSION.**—*Arsapnia tumida* has been collected 4 times in Nevada near the Truckee River at Verdi and the East Fork Carson River near Gardnerville. These records expand its range slightly eastward into the western Great Basin from its main distribution in Northern California (Nelson and Baumann 1989). Though it may exist in the Carson Range of western Nevada, its presence farther eastward is unlikely. Adults are present in February–March.

Arsapnia utahensis (Gaufin & Jewett, 1962)

**GEOGRAPHIC RANGE.**—Southern Sierra Nevada in California; Great Basin in western Utah and central Nevada.

**DISTRIBUTION IN NEVADA.**—Map 3.

- **County:** Esmeralda, Land, Nye, and White Pine.
- **Mountain Range:** Monitor, Quinn-Grant, Schell Creek, Snake, Toiyabe, Toquima, White, and White Pine.
- **Ecoregion:** Central Basin and Range.

**DISCUSSION.**—*Arsapnia utahensis* is widely distributed across central Nevada, from the White Mountains in the west to the Snake Range in the east, but is absent from the northern and southern parts of the state. The Nevada records lie at the center of its total range, which runs in a 200-km-wide band from the southern Sierra Nevada in California to the Wasatch Mountains in Utah. And yet, a 150-km gap exists in this distribution between the White Mountains and southern Toiyabe and Toquima ranges. This gap region has received little attention from stonefly biologists because high-elevation mountains are absent and dry terrain makes it difficult to find...
suitable running waters. This species is present in the eastern Sierra Nevada (Nelson and Giuliani 2001) and southwestern Utah (Nelson and Baumann 1989, Call and Baumann 2002). Most adults are present during February–April, but some females persist into May.

**Capnia coloradensis** Claassen, 1937

**Geographic Range.**—Alaska; Yukon; Rocky Mountains from British Columbia to New Mexico; Coast and Cascade mountains in British Columbia; Canadian Prairies in Manitoba and Saskatchewan; northeastern Nevada.

**Distribution in Nevada.**—Map 4.

**County:** Elko.

**Mountain Range:** Jarbidge.

**Ecoregion:** Northern Basin and Range.

**Discussion.**—*Capnia coloradensis* has a wide distribution in the Rocky Mountains (Baumann et al. 1977, Nelson and Baumann 1989). It is uncommon in Nevada, having been found 3 times at the Jarbidge River, which drains north to the Snake River in Idaho. Records from northeastern Nevada are at the southwestern range limits of this Rocky Mountain species. Adults are present during April.

**Capnia confusa** Claassen, 1936

**Geographic Range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Canadian Prairies in Manitoba and Saskatchewan; Black Hills in South Dakota; Coast and Cascade mountains of British Columbia and Washington; northeastern Oregon; east-central Sierra Nevada in California; northern Nevada.

**Distribution in Nevada.**—Map 5.

**County:** Elko, Eureka, Humboldt, Nye, and White Pine.

**Mountain Range:** Jarbidge, Monitor, Ruby, Santa Rosa, Schell Creek, Toiyabe, Toquima, and Tuscarora.

**Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—*Capnia confusa* has a wide distribution in central and northeastern Nevada, but no records exist from the western or southern parts of the state. It is present in Alpine and Mono counties of the eastern Sierra Nevada, California (Nelson and Baumann 1989) and eventually may be found in Douglas, Esmeralda, Lyon, and Mineral counties in western Nevada. This species is also present near Nevada's southeastern border in Iron and Washington counties of Utah (Call and Baumann 2002). Female adults can be identified to species because of their uniquely shaped subgenital plate (Nelson and Baumann 1989). Adults are present during March–May, though most collections in May are females.

**Capnia glabra** Claassen, 1924

**Geographic Range.**—Rocky Mountains in central and western Idaho; southern Cascade Mountains in Oregon and California; northeastern Oregon; central and northern Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 6.

**County:** Carson City and Washoe.

**Mountain Range:** Carson.

**Ecoregion:** Sierra Nevada.

**Discussion.**—*Capnia glabra* has an unusual distribution in western North America, being present in 2 widely separated regions: (1) Cascade Range and Sierra Nevada and (2) northeastern Oregon and central Idaho (Nelson and Baumann 1989). In Nevada, *C. glabra* has been collected in the Carson Range between the Truckee River near Verdi and the Lake Tahoe area. Its presence in the Carson Range is an eastward extension from the Sierra Nevada into the western Great Basin. It is unlikely to occur east of the Carson Range, but may occur farther south in Douglas
Most adults are present during January–March, but some females persist into May–June. During winter emergence, they are found on snow along small streams. Both males and females are brachypterous, but males have especially short wings.

**Capnia gracilaria** Claassen, 1924

**Geographic Range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Black Hills in South Dakota; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northeastern Oregon; northeastern California; northern Baja California; northern Nevada.

**Distribution in Nevada.**—Map 7.

- **County:** Churchill, Elko, Humboldt, Lander, Nye, Pershing, Washoe, and White Pine.
- **Mountain Range:** Desatoya, East Humboldt, Granite, Jarbridge, Pine Forest, Ruby, Santa Rosa, Schell Creek, Shoshone, Snake, Sonoma, Toiyabe, and Toquima.
- **Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—**Capnia gracilaria** is distributed widely across northern and central Nevada, but it has not been found in the southern and extreme western parts of the state. It has, however, been found in the Granite Range of northwestern Washoe County, and Stark et al. (2008) recorded it in the Warner Mountains about 20 km west of the Nevada border. Its apparent absence from much of western Nevada is a mystery since records exist from California’s Coast Range but not from the Sierra Nevada (Nelson and Baumann 1989). The Toiyabe, Toquima, and Snake ranges mark its present southern limit in central Nevada, but high mountains in northern Nye and Lincoln counties appear to be suitable habitat. It occurs close to Nevada’s eastern border in Utah’s Box Elder, Juab, and Washington counties (Nelson and Baumann 1989, Houseman and Baumann 1997, Call and Baumann 2002). Most adults are present during February–May, but some females persist into June. The only adult males collected in June came from Cave Creek, a cold spring stream discharging from limestone caverns of the Ruby Mountains.

**Capnia lacustra** Jewett, 1965

**Geographic Range.**—Lake Tahoe, California and Nevada.

**Distribution in Nevada.**—Map 8.

- **County:** Douglas.
- **Mountain Range:** Carson (in Lake Tahoe).
- **Ecoregion:** Sierra Nevada.

**Discussion.**—**Capnia lacustra** is endemic to Lake Tahoe in California and Nevada (Jewett 1963, 1965). It is unique among North American stoneflies in having aquatic adults that have never been found to emerge onto the lake’s shoreline. This species completes its entire life cycle in the deep waters (60–270 m) of Lake Tahoe (Frantz and Cordone 1996). It was first collected with a bottom dredge in 1962 and was most abundant in the lake’s aquatic plant beds at 60 to 110 m depth. More recent attempts to collect this species with dredges were less successful, and it has declined in abundance in the 50 years since first discovery. Benthic sampling at Lake Tahoe during 2008–2009 documented severe reductions in *C. lacustra* density (93.5%) and biomass (97.4%) since 1962–1963 (Caires et al. 2013). The decline of *C. lacustra* was mainly attributed to reduction of aquatic macrophyte beds, though introduction of nonnative species may have contributed. Since the 2008–2009 sampling, *C. lacustra* has been found in aquatic plant beds at 30–55 m depth in southern Lake Tahoe, and details of its unusual univoltine life cycle have been studied (Caires et al. 2016). This species has 2 reproductive cohorts, one where females deposit eggs during spring (May) and another where females produce live offspring during autumn (November). Each female produces 38–40 eggs, which are stored in the abdomen, thorax, and head before being oviposited or hatched. Besides its type locality in Douglas County, this species likely occurs in the Washoe County and Carson City portions of Lake Tahoe, though recent sampling failed to find it there (Caires et al. 2013). Male and female adults lack wings. Because of its 2 cohorts, adults are present throughout the year.

**Capnia scobina** Jewett, 1966

**Geographic Range.**—Sierra Nevada in California; western Nevada.

**Distribution in Nevada.**—Map 9.

- **County:** Washoe.
Mountain Range: Carson.  
Ecoregion: Sierra Nevada.  

**DISCUSSION.**—In Nevada, *Capnia scobina* is present in the Lake Tahoe and Mount Rose areas of the Carson Range. These locations are slight eastward extensions into the western Great Basin from its Sierra Nevada range (Nelson and Baumann 1989, Nelson and Giuliani 2001). This species most likely occurs in Douglas County, the rural area of Carson City, and other western border counties south of Lake Tahoe. It is found at high elevations along the eastern Sierra Nevada at least as far south as Lone Pine in Inyo County, California (Nelson and Baumann 1989, Nelson and Giuliani 2001). Adults are present during February–April and often are collected from streamside snow banks.

**Capnia sextuberculata** Jewett, 1954  

**GEOGRAPHIC RANGE.**—Rocky Mountains from British Columbia and Alberta to Idaho and Montana; Cascade Mountains in British Columbia and Washington; northeastern Oregon; northeastern Nevada.  

**DISTRIBUTION IN NEVADA.**—Map 10.  
  County: Elko.  
  Mountain Range: Jarbidge.  
  Ecoregion: Northern Basin and Range.  

**DISCUSSION.**—*Capnia sextuberculata* is a rare species in Nevada, having been collected once during July at high elevation of the Jarbidge River, which drains north to the Snake River in Idaho. This Nevada record represents a considerable range extension to the southwest from its main Rocky Mountain distribution in Idaho (Nelson and Baumann 1989). Additional collections in high-elevation creeks and springs are needed to determine the Nevada distribution of this species. The single Nevada collection was a female adult, and its identification needs confirmation with a male adult.

**Capnia uintahi** Gaufin, 1964  

**GEOGRAPHIC RANGE.**—Central and southern Rocky Mountains from southern Idaho and Montana to Arizona and New Mexico; Great Basin in northeastern and central Nevada.  

**DISTRIBUTION IN NEVADA.**—Map 11.  
  Mountain Range: Desatoya, Monitor, Ruby, Schell Creek, Toiyabe, and Toquima.  
  Ecoregion: Central Basin and Range.  

**DISCUSSION.**—The North American distribution of *Capnia uintahi* includes the central and southern Rocky Mountains and part of the Great Basin in Nevada, but not western Utah (Nelson and Baumann 1989, Jacobi et al. 2005). It ranges across Nevada from the Desatoya Mountains on the west to the Schell Creek Range on the east. It has not been collected north of the Ruby Mountains in Elko County or south of the high mountains of northern Nye County. The Nevada records of this species are at the western limits of its total range. Adults are present during February–June, but most specimens collected after April are females. Males are brachypterous and much smaller than females.

**Capnia vernalis** Newport, 1848  

**GEOGRAPHIC RANGE.**—Alaska; Northwest Territories; Canadian Rocky Mountains; Canadian Prairies; eastern Canada; northern Midwestern states near the Great Lakes; Rocky Mountains from Idaho and Montana to New
Mexico; southeastern Oregon; northeastern Nevada.

**DISCUSSION.**—The distribution of *Capnia vernalis* extends across most of northern North America, from the Pacific to Atlantic coasts. In the west, it is found in the Rocky Mountains and Great Basin. This species has a smaller distribution in Nevada, being limited to the Humboldt River and its major tributaries in the northeastern part of the state. These records are westward extensions of its Rocky Mountain range into the Great Basin. The known populations nearest to those in Nevada occur more than 150 km distant in northeastern Utah and southern Idaho and Oregon (Nelson and Baumann 1989, Houseman and Baumann 1997). *Capnia vernalis* inhabits medium to large low-elevation (<1700 m) streams. Adults are present during March–April.

### Capnura intermontana

**Nelson & Baumann, 1987**

**GEOGRAPHIC RANGE.**—Eastern Oregon; southwestern Idaho; northwestern Utah; northeastern Nevada.

**DISCUSSION.**—*Capnura intermontana* occurs in northeastern Nevada in the Humboldt River and its larger tributaries (Huntington Creek, Maggie Creek, Marys Creek, Marys River, Susie Creek, and the North and South Fork Humboldt River) that drain from the Independence, Ruby, and Tuscarora mountains. Smaller streams containing this species are susceptible to summer drying. The Nevada collections reported here, all within the Great Basin, extend the known range of this species to the southwest from streams in Oregon, Idaho, and Utah that flow to the Snake River (Nelson and Baumann 1987b, Houseman and Baumann 1997). Adults are present during February–April.

*Capnura venosa* Banks, 1900

**GEOGRAPHIC RANGE.**—Southeastern Washington; northern Idaho; Montana; northwestern Nevada.

**DISCUSSION.**—The distribution of *Capnura venosa* in western North America is poorly known, with few collections and widely disjunct, or questionable, populations (Nelson and Baumann 1987b, DeWalt et al. 2015). This species has been found 4 times in Nevada: 3 times from Smoke Creek and once from Buffalo Creek in northern Washoe County. Both low-elevation creeks are susceptible to drying in late summer and discharge into a saline...
playa, the Smoke Creek Desert. The nearest confirmed record of this species is from Whitman County, Washington, 700 km distant from the Nevada collections, though a closely related species, *Capnura anas*, occurs in eastern Oregon (Nelson and Baumann 1987b). Mature nymphs of *C. venosa* are present in late January–February; adults are present in February. Adult males are brachypterous and much smaller than the macropterous females.
Adult males occurred only a few centimeters above the water surface on emergent rocks or streambank edges; females were found several meters above the creek on riparian vegetation.

*Capnura wanica* (Frison, 1944)

**Geographic range.**—Central and southern Rocky Mountains from Wyoming to Arizona and New Mexico; western Nebraska; extreme eastern California; northern and southeastern Nevada.

**Distribution in Nevada.**—Map 15.

**County:** Churchill, Douglas, Humboldt, Lander, Lincoln, Nye, Pershing, Storey, and Washoe.

**Mountain Range:** Clover, Desatoya, Flowery, Granite, Hays Canyon, Humboldt, Pine Nut, Shoshone, Sonoma, Toiyabe, Toquima, White Pine, and Wilson Creek.

**Ecoregion:** Mainly Central Basin and Range; few Northern Basin and Range.

**Discussion.**—*Capnura wanica* ranges in a wide diagonal band across northern and southeastern Nevada, from northern Washoe County and the Reno–Carson City area in the northwest to Lincoln County and Meadow Valley Wash in the southeast. Most collections are from the western half of the state. The Nevada records of *C. wanica* demarcate the western limits of the species’ North American distribution. No overlap exists in the Nevada distributions of *C. wanica* and *C. intermontana*; the former primarily occurs in the west and center of the state, the latter occurs in the northeast. Likewise, *C. wanica* and *C. venosa* have not been found in the same creek, though both are present north of Pyramid Lake. *Capnura wanica* is present in Beaver, Iron, and Washington counties of southwestern Utah, immediately adjacent to Nevada’s southeastern border (Nelson and Baumann 1987b, Call and Baumann 2002), and collections include specimens from Beaver Dam Wash only 4 km east of Nev. Adults are present at mid- to low-elevation small streams that are marginal stonefly habitat, with warm water or complete drying in summer. Adults are present during January–April.

*Eucapnopsis brevicauda* (Claassen, 1924)

**Geographic range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Black Hills in South Dakota; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; northern Nevada.

**Distribution in Nevada.**—Map 16.

**County:** Elko, Humboldt, Lander, Lyon, Pershing, Washoe, and White Pine.

**Mountain Range:** Carson, East Humboldt, Jarbidge, Humboldt, Ruby, Santa Rosa, Schell Creek, Snake, Sweetwater, and Toiyabe.

**Ecoregion:** Central and Northern Basin and Range; Sierra Nevada.

**Discussion.**—*Eucapnopsis brevicauda* ranges across central and northern Nevada, from the Carson Range near Lake Tahoe on the west, to the Snake Range on the east, and to the Oregon and Idaho border on the north. In northwestern Nevada, no records exist in a 150-km-wide band extending from the Oregon border to Reno, including the Granite, Jackson, and Pine Forest ranges. However, the species is common in the Warner Mountains of northeastern California (Stark et al. 2008) and the Sierra Nevada, including the
eastern slope as far south as Lone Pine (Nelson and Giuliani 2001). It has not been collected from the southern half of the state. Most adults are present during April–May, but a few occur as early as February and, at higher elevations, as late as August.

*Isocapnia hyalita* Ricker, 1959

**Geographic Range.**—Rocky Mountains from Alberta to Colorado and Utah; southeast Washington; northeast Oregon; northeast Nevada.

**Distribution in Nevada.**—Map 17.

*County:* Elko.

*Mountain Range:* Jarbidge.

*Ecoregion:* Northern Basin and Range.

**Discussion.**—*Isocapnia hyalita* has been collected once in Nevada (one female adult) at 2700 m elevation of the Jarbidge River. This Nevada collection, separated by more than 250 km from the next closest sites in Idaho and Utah, marks the southwestern limit of its main Rocky Mountain range (Zenger and Baumann 2004). It is known from only one site in the Great Basin, the Stansbury Mountains of Tooele County, Utah. Because females of the Hyalita Group of *Isocapnia* are difficult to identify (Zenger and Baumann 2004), the Nevada record of this species needs confirmation with adult males. The female adult was collected during July, which is late in an emergence season that usually peaks in April–May.

*Mesocapnia frisoni* (Baumann & Gaufin, 1970)

**Geographic Range.**—Central and southern Rocky Mountains in Arizona, Colorado, New Mexico, and Utah; Texas; southern California; Baja California; mainland Mexico; southern Nevada.

**Distribution in Nevada.**—Map 18.

*County:* Clark and Lincoln.

*Mountain Range:* Clover.

*Major River Valley:* Meadow Valley Wash near Caliente and Virgin River near Mesquite, Nevada.

*Ecoregion:* Central Basin and Range; Mojave Basin and Range.

**Discussion.**—*Mesocapnia frisoni* has been collected twice in southeastern Nevada from the Virgin River at Mesquite (482 m elevation) and Meadow Valley Wash near Caliente (1280 m elevation). Additional sampling in this poorly studied region may reveal a wider distribution in Clark and Lincoln counties. In Utah, Call and Baumann (2002) found this species at Beaver Dam Wash about 12 km downstream from the Nevada border, and Baumann and Gaufin (1970) first described it from a nearby creek in Washington County. This species tolerates warmer water temperatures and poorer stream conditions than are typical for most stoneflies. Adults are present during January–February.
Sierracapnia barberi (Claassen, 1924)

Geographic range.—Central and northern Sierra Nevada and southern Cascade Mountains in California; western Nevada.

Distribution in Nevada.—Map 19.
- County: Douglas and Washoe.
- Mountain Range: Carson Range and Truckee River near Verdi.
- Major River Valley: Truckee.
- Ecoregion: Sierra Nevada.

Discussion.—Sierracapnia barberi has been collected 8 times in western Nevada from the Truckee River and Carson Range in the Lake Tahoe area. These records are slight eastward extensions into western Nevada from the species’ main Sierra Nevada distribution (Nelson and Baumann 1989, Bottorff and Baumann 2015). All Nevada records occur within the Sierra Nevada ecoregion at mid elevations (1500–2000 m). Adults often are collected on snow near small streams, and most are present during January–April, though some females persist into May.

Sierracapnia hornigi (Baumann & Sheldon, 1984)

Geographic range.—Great Basin; eastern Sierra Nevada in Inyo and Mono counties, California; western Nevada.

Distribution in Nevada.—Map 20.
- County: Esmeralda.
- Mountain Range: White.
- Ecoregion: Central Basin and Range.

Discussion.—Sierracapnia hornigi was described by Baumann and Sheldon (1984) from specimens collected on the east side of the White Mountains in Nevada. It also is known from the west side of the White Mountains in Inyo and Mono counties, California (Nelson and Baumann 1989, Bottorff and Baumann 2015). This species has a limited range that extends a short distance into the western border region of Nevada, but it is unlikely to exist farther eastward in the state. Sierracapnia hornigi adults are present during February–March.

Sierracapnia mono (Nelson & Baumann, 1987)

Geographic range.—Eastern Sierra Nevada (Mono County) in California; western Nevada.

Distribution in Nevada.—Map 21.
- County: Carson City, Douglas, and Washoe.
- Mountain Range: Carson.
- Ecoregion: Sierra Nevada.

Discussion.—In Nevada, Sierracapnia mono has been collected from 6 creeks in the Carson Range, about 50 km northwest of its type locality near Topaz Lake in Mono County, California. All records of this species are located near the California–Nevada border. Additional sampling may find it at other sites between the type locality and the Lake Tahoe region. It inhabits the lower reaches of small mountain creeks that discharge easterly into desert valleys or into Lake Tahoe. This species is limited to the western edge of the Great Basin and has been found in eastern California as far south as Convict Lake and the Glass Mountains in Mono County (Nelson and Baumann 1989, Nelson and Giuliani 2001, Myers and Resh 2002, Bottorff and Baumann 2015). Adults are present during January–April, often on snow near small creeks.

Sierracapnia washoe

Bottorff & Baumann, 2015

Geographic range.—Western Nevada.

Distribution in Nevada.—Map 22.
- County: Pershing, Storey, and Washoe.
Granite, Selenite, and Virginia. 

**Ecoregion:** Central and Northern Basin and Range.

**DISCUSSION**—Bottorff and Baumann (2015) described *Sierracapnia washoe* from 4 creeks in 3 mountain ranges north and south of Pyramid Lake. Confined to western Nevada, it is one of the state’s few endemic stonefly species. Compared to 5 other species of *Sierracapnia* that occur in the Sierra Nevada and White Mountains, *S. washoe* exists farther eastward into the Great Basin, inhabiting small mountain creeks or springbrooks isolated within vast dry terrains and short flow reaches. The species occurs at mid elevations (1500–2000 m) and inhabits a region of Nevada seldom explored for stoneflies. Adults are present during January–March, often on snow near small creeks.

*Utacapnia lemoniana* (Nebeker & Gaufin, 1965)

**GEOGRAPHIC RANGE.**—Rocky Mountains in Colorado, Idaho, Utah, and Wyoming; Black Hills in South Dakota; central and northeastern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 23. 
- **County:** Elko, Lander, Nye, and White Pine.
- **Mountain Range:** Monitor, Ruby, Schell Creek, and Toiyabe.
- **Ecoregion:** Central Basin and Range.

**DISCUSSION.**—All Nevada records of *Utacapnia lemoniana* were discovered after Nebeker and Gaufin (1965) described the species from Idaho, Utah, and Wyoming. It has been collected 10 times in east-central and northeastern Nevada; these records are southwestern extensions of its Rocky Mountain range. No collections exist west of the Toiyabe Range and north of the Ruby Mountains in Nevada. This species is present in...
northwestern and southwestern Utah near Nevada’s eastern border (Houseman and Baumann 1997, Call and Baumann 2002). Male adults are micropterous; females are macropterous. Most adults are present during February–April, but females have been collected in June.

**Utacapnia tahoensis**  
(Nebeker & Gaufin, 1965)

**GEOGRAPHIC RANGE**.—Lake Tahoe in California and Nevada.

**DISTRIBUTION IN NEVADA**.—Map 24.

**County:** Washoe.

**Mountain Range:** Carson (in Lake Tahoe).

**Ecoregion:** Sierra Nevada.

**DISCUSSION.**—Utacapnia tahoensis only occurs at Lake Tahoe in California and Nevada. Two collections are known from Nevada, both from lakeshore sites in Washoe County, but the species undoubtedly occurs farther south in Douglas County and rural Carson City. It has been found several times along the California shoreline of Lake Tahoe. During a benthic survey of macroinvertebrates in Lake Tahoe during 2008–2009, Caires et al. (2013) reported Capniidae nymphs from the littoral zone that they thought were *U. tahoensis*, but adults were not collected to confirm this identification. Both male and female adults are wingless and are found on (and under) rocks and snow along the lakeshore during February–April.

**LEUCTRIDAE**

**Despaxia augusta** (Banks, 1907)

**GEOGRAPHIC RANGE.**—Alaska; Rocky Mountains from British Columbia and Alberta to Idaho and Montana; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; western Nevada.

**DISTRIBUTION IN NEVADA**.—Map 25.

**County:** Washoe.

**Mountain Range:** Carson.

**Ecoregion:** Sierra Nevada.

**DISCUSSION.**—Despaxia augusta has been collected twice from small creeks flowing to Lake Tahoe in the Carson Range of western Nevada. Few records of this species exist for Nevada because adults emerge late in the year when stonefly collections are scarce. It undoubtedly occurs throughout the Carson Range and eventually may be discovered at other sites near the western and northern Nevada borders. Collections from the Carson Range are short eastward extensions from the Sierra Nevada. Adults in this study were present during September–October, but they likely have a longer emergence period during autumn.

**Moselia zonata** Stark & Harrison, 2016

**GEOGRAPHIC RANGE.**—Coast and Cascade mountains of southern Oregon and northern California; Sierra Nevada; western and northern Nevada.
DISTRIBUTION IN NEVADA. —Map 26.

County: Carson City, Douglas, Elko, Humboldt, and Washoe.

Mountain Range: Carson, Granite, Jarbidge, Pine Forest, Santa Rosa, and Summit Lake

Ecoregion: Sierra Nevada; Northern Basin and Range.

DISCUSSION. — For many years, all Moselia in western North America were classified as M. infuscata. Recently, Stark and Harrison (2016) recognized M. zonata from Oregon, California, and Nevada. The Nevada range of this species extends in an arc from the Lake Tahoe region in the west across northern Washoe, Humboldt and Elko counties. All collections are within 60 km of the western and northern borders of the state. Despite considerable collecting effort in central and eastern Nevada, it has not been found there. Apparently, the Sierra Nevada and Cascade ranges are dispersal sources for the Nevada populations. Stark et al. (2008) found Moselia just beyond the northwestern border in the Warner Mountains of California. Farther south, Myers and Resh (2002) reported Moselia from the Glass Mountains of Mono County, California, about 25 km west of Nevada’s western border. Though M. zonata has distinctive banded wings in northwestern California and southern Oregon populations, individuals from Nevada lack this pattern. The small, charcoal-colored adults can be recognized in the field by basal white marks on the forewings. Adults are present during May–August, the later records being from higher elevations.

Paraleuctra occidentalis (Banks, 1907)

GEOGRAPHIC RANGE. — Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; northern half of Nevada.

DISTRIBUTION IN NEVADA. —Map 27.
**County:** Douglas, Elko, Humboldt, Lander, Nye, Washoe, and White Pine.

**Mountain Range:** Carson, Jarbidge, Ruby, Santa Rosa, Schell Creek, Snake, Toiyabe, and Toquima.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—*Paraleuctra occidentalis* is widely distributed across central and northern Nevada, from the Lake Tahoe region in the west to Great Basin National Park in the east. All collections are from the northern half of the state, the southernmost record being from the Toquima Range in Nye County. No records exist in a 200-km-wide band in northwestern Nevada, but it is present in the nearby Warner Mountains of California (Stark et al. 2008). In their review of Nearctic *Paraleuctra*, Stark and Kyzar (2001) documented this species at high elevations near Mount Rose, Nevada. Most adults are present in Nevada during April–July, but a few females linger into August. It often occurs at higher elevations and emerges earlier in the year than *Paraleuctra vershina*, but some spatial and temporal overlap exists between the 2 species.

*Paraleuctra vershina* Gaufin & Ricker, 1974

**GEOGRAPHIC RANGE.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Canadian Prairies in Saskatchewan; Black Hills in South Dakota; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northeastern Oregon and Washington; Sierra Nevada; northern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 28.

**County:** Carson City, Douglas, Elko, Humboldt, Lander, Lyon, Mineral, Nye, Washoe, and White Pine.

**Mountain Range:** Bull Run, Carson, Copper, East Humboldt, Independence, Jackson, Jarbidge, Ruby, Santa Rosa, Schell Creek, Snake, Sonoma, Snowstorm, Sweetwater, Toiyabe, Toquima, and Wassuk.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—*Paraleuctra vershina* is widely distributed throughout central and northern Nevada, but has not been recorded from the southern parts of the state. It is one of the most commonly collected species in Nevada, with 170 records from at least 17 mountain ranges. Although *P. vershina* and *P. occidentalis* have similar ranges in Nevada, *P. vershina* occurs at slightly lower elevations and emerges somewhat later, but with some spatial and temporal overlap. The distributions of
both species have a 100- to 200-km-wide gap without records in northwestern Nevada. *Paraleuctra vershina* is present near Nevada’s western border in the Warner Mountains (Stark et al. 2008) and Glass Mountains of eastern California (Myers and Resh 2002). Likewise, this species occurs near Nevada’s northeastern border in the Raft River Mountains, Utah (Houseman and Baumann 1997). Most adults are present during May–July, but a few occur during August.

NEMOURIDAE

*Malenka californica* (Claassen, 1923)

**GEOGRAPHIC RANGE.**—Rocky Mountains from British Columbia and Alberta to New Mexico; Canadian Prairies in Saskatchewan and Manitoba; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; central and northeastern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 29.


*Ecoregion:* Sierra Nevada; Central Basin and Range.

**DISCUSSION.**—*Malenka californica* is common in Nevada, with 59 records from 12 counties and at least 13 mountain ranges. Though widespread in the state, its distribution may be even larger than present data show. Current understanding of this species is restricted by too few field samples during autumn when adults are most abundant. Adult records are absent from the northern quarter of Nevada, even in mountain ranges relatively well sampled (e.g., Granite, Independence, Jarbridge, Pine Forest, and Santa Rosa). Many of the *Malenka* nymphs found in northern Nevada but not identified to species may prove to be *M. californica.* Close to Nevada, Houseman and Baumann (1997) and Myers and Resh (2002) found *M. californica* in the Raft River Mountains of Utah and Glass Mountains of California, respectively. Most adults emerge during autumn, but they can be present from May to November. This species inhabits small creeks, cold springs, and seeps.

*Malenka coloradensis* (Banks, 1897)

**GEOGRAPHIC RANGE.**—Central and southern Rocky Mountains from Wyoming to Arizona and New Mexico; Black Hills in South Dakota; eastern and southern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 30.

*County:* Clark and White Pine.

*Mountain Range:* Spring and Snake.

*Ecoregion:* Mojave and Central Basin and Range.

**DISCUSSION.**—*Malenka coloradensis* is uncommon in Nevada and the Great Basin. Adults have been collected 5 times from Deer Creek in the Spring Mountains of southern Nevada and once from Strawberry Creek in the Snake Range. These 2 locations are separated by 330 km, suggesting that additional populations may occur in eastern and southern Nevada. Call and Baumann (2002) found this species near southeastern Nevada in Iron and Washington counties, Utah. The Nevada records mark the western limit of its Rocky Mountain range. Its collection in the Snake Range is the only record from the Great Basin. Adults are present during June–August.

*Malenka depressa* (Banks, 1898)

**GEOGRAPHIC RANGE.**—Coast and Cascade mountains of Oregon and California; southeastern Oregon; northeastern California; Sierra Nevada; northwestern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 31.

*County:* Washoe.

*Mountain Range:* Granite.

*Ecoregion:* Northern Basin and Range.

**DISCUSSION.**—The distribution of *Malenka depressa* extends a short distance into western
Nevada from its main occurrence in the Sierra Nevada, Cascade, and Coast mountains. It is rare in Nevada, having been collected only once in the Granite Range of northern Washoe County. Additional sampling in late summer and autumn may reveal it at other sites in northwestern Nevada. *Malenka* nymphs found at Sheldon National Wildlife Refuge (Herbst 1996) and Pine Forest Range could be *M. depressa*, but adults are needed for positive identification. Stark et al. (2008) found this species in the Warner Mountains of California near Nevada’s northwestern border, and we found it in southeastern Oregon. It inhabits small creeks and springs. Our single adult collection occurred during July, but this species is known for its long emergence in California (Bottorff and Bottorff 2007).

*Malenka murvoshi*
Baumann & Kondratieff, 2010

**Geographic range.**—Southern Nevada.

**Distribution in Nevada.**—Map 32.

- **County:** Clark.
- **Mountain Range:** Spring.
- **Ecoregion:** Mojave Basin and Range.

**Discussion.**—*Malenka murvoshi* is endemic to the Spring Mountains in Clark County, southern Nevada (Baumann and Kondratieff 2010). It is present in Cold and Willow creeks and Whiskey Spring on the northeastern side of the Spring Mountains, but likely occurs at other sites in this isolated range. Additional collecting is needed in this range and in southern Nevada to delineate the distribution of this species and *M. coloradensis*. Both species are present in the Spring Mountains, but it is unknown if spatial and temporal overlap exists. Adults of *M. murvoshi* are present for at least 8 months during autumn, winter, and spring (October–May).

*Malenka tina* (Ricker, 1952)

**Geographic range.**—Rocky Mountains in Idaho, western Montana, and northern Utah; Coast and Cascade mountains of Washington and Oregon; northern Nevada.

**Distribution in Nevada.**—Map 33.

- **County:** Elko and Humboldt.
- **Mountain Range:** Copper, Independence, Ruby, and Santa Rosa.
- **Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—The diminutive stonefly *Malenka tina* is uncommon in Nevada, having been collected 10 times in the northern quarter of the state. This distribution extends southwest into the Great Basin from the species’ larger Rocky Mountain range. Near Nevada’s borders, it is present in the northwest in the Warner Mountains of California (Stark et al. 2008) and in the northeast in the South Hills of Idaho (Newell and Minshall 1976) and Raft River Mountains of Utah (Houseman and Baumann 1997). *Malenka tina* inhabits small creeks and springs. Adults are present during June–August.

*Podmosta decepta* (Frison, 1942)

**Geographic range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Colorado and Utah; Coast and Cascade mountains of British Columbia, Washington and Oregon; northeastern Oregon; northeastern Nevada.

**Distribution in Nevada.**—Map 35.

- **County:** Elko.
- **Mountain Range:** Independence and Jarbidge.
- **Ecoregion:** Northern Basin and Range.

**Discussion.**—*Podmosta decepta* has a limited presence in Nevada, having been collected 7 times from 3 creeks in northern Elko County. All records are from small tributaries that flow to the Bruneau, Jarbidge, and Owyhee rivers, each draining north to the Snake River in Idaho. The Nevada records of this species occur at the southwestern limits of its Rocky Mountain range, but it is absent from the Great Basin. It inhabits small to medium cool creeks at high elevations (>2200 m). Adults are present during June–August.
Podmosta delicatula (Claassen, 1923)

Geographic range.—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Canadian Prairies in Saskatchewan; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; eastern Oregon and Washington; northeastern California; Sierra Nevada; central and northern Nevada.

Distribution in Nevada.—Map 36.
County: Elko, Humboldt, Lander, and Nye.
Mountains Range: Copper, Desatoya, Diamond A Desert, Independence, Jarbridge, Monitor, Ruby, Santa Rosa, Toiyabe, and Toquima.
Ecoregion: Central and Northern Basin and Range.

Discussion.—Podmosta delicatula has been found in 10 mountain ranges of central and northern Nevada, but it is absent from the western third and southern parts of the state. Also, no records exist from mountain ranges near Ely and the eastern border region, even though these areas have been well sampled. Near Nevada’s northwestern and northeastern borders, it is present in the Warner Mountains (Stark et al. 2008) and Raft River Mountains (Housman and Baumann 1997), respectively. The Nevada distribution of P. delicatula is near the southern limits of its wide range in western North America. It has a wide distribution in the Great Basin, though its congener, P. decepta, is absent from that region. Adults are present from late May to early July.

Prostoia besametsa (Ricker, 1952)

Geographic range.—Yukon; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Black Hills in South Dakota; northwestern Nebraska; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northeastern and southern California; Sierra Nevada; western and northeastern Nevada.

Distribution in Nevada.—Map 37.
Ecoregion: Sierra Nevada; Central and Northern Basin and Range.

Discussion.—Prostoia besametsa occurs in 2 areas of Nevada: (1) the western edge of the state from Washoe County south to Esmeralda County and (2) the northeastern region of Elko and White Pine counties. Surprisingly, it has not been recorded from the center of the state despite considerable collecting there over many years. These 2 populations extend the distribution of this species into Nevada and the Great Basin from the Sierra Nevada and Rocky Mountains. This species has been found close to Nevada’s northern border in the Warner Mountains (Stark et al. 2008) and Raft River Mountains (Housman and Baumann 1997) and close to Nevada’s southeastern border in the Bull Valley Mountains of Utah (Call and Baumann 2002). Most adults are present during April–June and, at high elevation, during July.

Soyedina nevadensis (Claassen, 1923)

Geographic range.—Coast and Cascade mountains of Oregon and California; Sierra Nevada; western Nevada.

Distribution in Nevada.—Map 38.
County: Carson City, Douglas, Lyon, and Washoe.
Mountain Range: Carson, Pine Nut, and Sweetwater.
Ecoregion: Sierra Nevada; Central Basin and Range.
DISCUSSION.—*Soyedina nevadensis* was described in 1923 from specimens obtained at Reno, Nevada, but without information about the collection stream (Claassen 1923), which may have been the Truckee River or small creeks in the northern Carson Range. *Soyedina nevadensis* is common in the Sierra Nevada of California and has been found in western Nevada creeks of the Carson Range near Lake Tahoe and Mount Rose, and farther south in Lyon County. In addition, this species exists in the Pine Nut Mountains, the next range east of the Carson Range and 25 km farther into the Great Basin. The Nevada records are at the eastern limits of its main Sierra Nevada distribution. Near Nevada’s northwestern border, Stark et al. (2008) recorded a female adult *Soyedina* from the Warner Mountains, California. The limited distribution of *S. nevadensis* in Nevada demonstrates the formidable dispersal barrier that the western edge of the Great Basin forms for many Sierra Nevada stoneflies. Most adults are present during mid April through July, but at high elevations (>2500 m) a few are found in August.

Visoka cataractae (Neave, 1933)

GEOGRAPHIC RANGE.—Alaska; Rocky Mountains from British Columbia and Alberta to Idaho and Montana; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; eastern Washington; northeastern California; Sierra Nevada; western Nevada.

DISTRIIBUTION IN NEVADA.—Map 39.

County: Douglas and Washoe.

Mountain Range: Carson.

Ecoregion: Sierra Nevada.

DISCUSSION.—Adults and nymphs of *Visoka cataractae* have been collected 9 times in western Nevada from the Carson Range near Lake Tahoe and Mount Rose. It occurs
throughout this mountain range, but is unlikely to exist farther eastward in the Great Basin. Stark et al. (2008) recorded it near Nevada's northwestern border in the Warner Mountains of California. This species inhabits high-elevation, small, cold creeks. Based on 5 samples, adults were present in Nevada between late April and early June, but a wider emergence is expected during March–July. Nymphs are recognizable to species by their branched submental gills. The bodies of nymphs often are coated with fine organic detritus, a dressing that may camouflage them from predators.

*Zapada cinctipes* (Banks, 1897)

**GEOGRAPHIC RANGE.**—Alaska; Yukon and Northwest Territories; Rocky Mountains from British Columbia and Alberta to New Mexico; Canadian Prairies in Saskatchewan and Manitoba; Black Hills in South Dakota; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northeastern California; Sierra Nevada; Nevada.

**DISTRIBUTION IN NEVADA.**—Map 40.

**County:** Carson City, Churchill, Douglas, E Новошахтинске, Des Moines, Humboldt, Lander, Lyon, Nye, Pershing, Storey, Washoe, and White Pine.

**Mountain Range:** Carson, Clan Alpine, Desatoya, East Humboldt, Granite, Humboldt, Independence, Jarbidge, Monitor, Pah Rh, Pine Forest, Pine Grove, Pine Nut, Quinn–Grant, Roberts, Ruby, Santa Rosa, Schell Creek, Selenite, Snake, Sonoma, Sweetwater, Tobin, Toiyabe, Toquima, Tuscarora, Virginia, Wellington, White, and White Pine.

**DISCUSSION.**—*Zapada cinctipes* is one of the most abundant and widespread stoneflies in Nevada and the Great Basin. About 200 records exist from a wide range of running water habitats and elevations in at least 30 mountain ranges and 14 of the state's 17 counties. But within this broad distribution, a notable 100-km-wide gap exists that runs southeast from Pyramid Lake for at least 400 km within the driest parts of the Sierra Nevada rain shadow. We have not found this species in Clark, Lincoln, and Mineral counties, but these absences may reflect our limited sampling of those areas. The National Aquatic Monitoring Center (Utah State University, Logan) reports this species from Wilson Creek in Lincoln County. *Zapada cinctipes* inhabits small creeks, springs, and seeps that have good amounts of organic detritus. Some of its habitats are isolated small seeps or trickles of water that flow a short distance before drying in arid mountains and valleys. Nymphs can be identified to species by their 3–4 branched, anterior thoracic gills. Adults are recognized by their alternating dark and light wing bands. Most adults are present early in the year (January–May) and frequently are found on snow, but occasionally at high elevations some adults persist into June–July.

*Zapada columbiana* (Claassen, 1923)

**GEOGRAPHIC RANGE.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Utah; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; northern Nevada.
Zapada frigida female, 9 June 2016, Galena Creek, Washoe Co., Nevada.

**DISTRIBUTION IN NEVADA.**—Map 41.

*County:* Carson City, Douglas, Elko, Nye, Washoe, and White Pine.
*Mountain Range:* Carson, East Humboldt, Snake, and Toquima.
*Ecoregion:* Sierra Nevada; Central Basin and Range.

**DISCUSSION.**—Although uncommon in Nevada collections, *Zapada columbiana* nevertheless has a wide range in the state. Most collections are from multiple sites in the Carson Range near Lake Tahoe and Mount Rose, but additional records exist from central and eastern Nevada. Nymphs of this species also have been reported from creeks in the Independence, Sweetwater, and Toiyabe mountain ranges (Nevada Division of Environmental Protection). Adults often occur on streamside snow banks at high elevations, though some collections have been made as low as 1500 m. Most adults are present during April–June, but records also exist from October–March.

**Zapada frigida** ( Claassen, 1923)

**GEOGRAPHIC RANGE.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; eastern Oregon; Sierra Nevada; western and northeastern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 42.

*County:* Douglas, Elko, Humboldt, Nye, Washoe, and White Pine.
*Mountain Range:* Carson, Independence, and Jarbidge.
*Ecoregion:* Sierra Nevada; Northern Basin and Range.

**DISCUSSION.**—*Zapada frigida* is uncommon in Nevada, being known from 3 mountain ranges at the margins of the Great Basin. Even when adults and nymphs are found, they seldom are abundant. In Nevada, this species has 2 centers of distribution separated by 350 km: (1) the Carson Range in the west near Lake Tahoe, and (2) the Independence and Jarbidge Mountains in the northeast. The western population is continuous with those in the nearby Sierra Nevada; the northeastern population is closest to those in the Rocky Mountains. No records exist from central Nevada despite repeated sampling there. Stark et al. (2008) found this species in the Warner Mountains of California near Nevada’s northwestern border. Because *Z. frigida* is seldom collected in Nevada, its distribution remains unclear. Adults have uniform, dark gray-brown wings. The species occurs in small cool creeks and springbrooks at mid to high elevations. Adults are present during May–July.

**Zapada haysi** (Ricker, 1952)

**GEOGRAPHIC RANGE.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; northern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 43.

*County:* Elko, Humboldt, Lander, Nye, Washoe, and White Pine.
*Mountain Range:* Carson, Jarbidge, Ruby, Santa Rosa, Schell Creek, Snake, Toiyabe, and Toquima.
*Ecoregion:* Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—*Zapada haysi* is present in at least 8 mountain ranges scattered across northern Nevada. It ranges from the Carson Range at Lake Tahoe in the west to the Snake Range in the east, but has not been collected south of the Toiyabe and Toquima ranges. Accurate identification of *Z. haysi* requires close study of male...
adults to distinguish them from *Z. glacier* and *Z. oregonensis* (Baumann et al. 1977). Of the 29 Nevada records of this species, 14 have been confirmed with male adults. Jewett (1960) reported this species from the eastern Sierra Nevada near Nevada’s western border. This uncommon species inhabits small, high-elevation (>2500 m), cold creeks and springbrooks. Adults are present during May–July.

**Zapada oregonensis** (Claassen, 1923)

**GEOGRAPHIC RANGE.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; northwestern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 44.

**County:** Carson City, Douglas, Esmeralda, Humboldt, and Washoe.

**Mountain Range:** Carson, Granite, Pine Forest, Summit Lake, and White.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—In Nevada, *Zapada oregonensis* ranges from the White Mountains north to the Carson Range at Lake Tahoe and Pine Forest Range near the Oregon border. This species was described from Harney County, Oregon, just north of Nevada (Claassen 1923) and has been collected close to the western border in the Glass and Warner mountains of California (Myers and Resh 2002, Stark et al. 2008). It has not been reported from the Santa Rosa and Jarbidge mountains of northern Nevada, but further study of adult male specimens is needed from that region to clarify the ranges of *Z. oregonensis* and *Z. haysi*. Currently, the distributions of these 2 species only overlap in the Carson Range. Most *Z. oregonensis* adults are present during mid-May–July, but they can occur in August at elevations above 2500 m.

**TAEINOPTERYGIDAE**

**Doddsia occidentalis** (Banks, 1900)

**GEOGRAPHIC RANGE.**—Alaska; Rocky Mountains from British Columbia to New Mexico; Coast and Cascade mountains of Washington, Oregon, and California; Sierra Nevada; northeastern and western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 45.

**County:** Elko, Esmeralda, Washoe, and White Pine.

**Mountain Range:** Carson, Jarbidge, Schell Creek, Snake, and White.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—*Doddsia occidentalis* is present in Nevada at 2 general locations: (1) in the west, the Carson Range, Truckee River, and White Mountains, and (2) in the east, the Jarbidge, Schell Creek, and Snake ranges. No records exist from the center of Nevada despite extensive sampling there. This species is present in the nearby Warner Mountains of California (Stark et al. 2008), and the Raft River and Harmony mountains of Utah (Houseman and Baumann 1997, Call and Baumann 2002). *Doddsia occidentalis* most often occurs in small high-elevation, cold creeks and springbrooks. The distinctive adults, with black-white mottled wings, are present during April–May.
Taenionema kincaidi (Hoppe, 1938)

Geographic Range.—Alaska; Yukon; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; western Nevada.

Distribution in Nevada.—Map 46.

County: Washoe.

Mountain Range: Carson.

Ecoregion: Sierra Nevada.

Discussion.—Taenionema kincaidi, primarily a Pacific Coast species, has a limited distribution in western Nevada, being found at Galena, Mill, and Third creeks in the northern Carson Range, and at the Fish Hatchery.
creek near Verdi. These few records are slight eastward range extensions into Nevada from northern California and the Sierra Nevada (Stanger and Baumann 1993). The species is closely linked with the Sierra Nevada ecoregion. Since it is known from the eastern Sierra Nevada and Walker River basin in Mono County, California, *T. kincaidi* may occur south of Lake Tahoe along Nevada’s western edge. Adults have a range of colorations, including reddish brown, gray brown, and chalky tan. Most adults are present during May–June, with a few females persisting into July.

*Taenionema pallidum* (Banks, 1902)

**Geographic Range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northern Nevada.

**Distribution in Nevada.**—Map 47.
- **County:** Elko, Humboldt, Lander, Nye, and White Pine.
- **Mountain Range:** Independence, Jackson, Jarbridge, Ruby, Santa Rosa, Schell Creek, Snake, Sonoma, Summit Lake, and Toiyabe.
- **Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—*Taenionema pallidum* is the most abundant and widespread taeniopterygid species in Nevada, with 84 records from 10 mountain ranges. Most collections are from the eastern and northern two-thirds of the state, but it is present in the Jackson and Summit Lake mountains of northwestern Nevada, and Stark et al. (2008) found it nearby in the Warner Mountains of California. The southernmost records are from the Toiyabe Range in Nye County. Close to Nevada’s eastern border, *T. pallidum* is present in the Deep Creek and Raft River mountains of Utah (Stanger and Baumann 1993, Houseman and Baumann 1997). The Nevada records of this species expand its known distribution across much of the Great Basin from the Rocky Mountains. Little overlap exists in the distribution and habitats of Nevada’s 3 species of *Taenionema*. Adult coloration includes reddish-brown and dark-gray individuals. Most *T. pallidum* adults are present during May–June, but a few occur in late April and early July. This species is found at mid to high elevations in small to medium-sized creeks.

*Taenionema pallidum* male (top) and female (bottom), 15 June 2016, Dutch John Creek, Humboldt Co., Nevada.

*Taenionema uinta* Stanger & Baumann, 1993

**Geographic Range.**—Rocky Mountains in Colorado, Montana, Utah, and Wyoming; eastern Oregon; northeastern Nevada.

**Distribution in Nevada.**—Map 48.
- **County:** Elko, Eureka, and Lander.
- **Major River Valley:** Humboldt and its main tributaries; Salmon Falls Creek.
- **Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—*Taenionema uinta* has a restricted distribution in northeastern Nevada, being confined to lower-elevation intermountain rivers and large creeks. Most Nevada records of this species are from a 100-km reach of the Humboldt River between Battle Mountain and Elko, and the Humboldt’s northern and southern forks. It also is present in Salmon Falls Creek near Jackpot. The Humboldt River drains west to the Humboldt Sink near Lovelock, while Salmon Falls Creek drains north to the Snake River in Idaho, but the headwaters of both river systems lie in close proximity. The Nevada records of *T. uinta* are at the southwestern limits of its main Rocky Mountain distribution (Stanger and Baumann 1993). This species may occur farther upstream and downstream in the Humboldt River. Male adults have short wings and are much smaller than the long-winged females. Adults are present during March–April.
**Taeniopteryx nivalis** (Fitch, 1847)

**Geographic range.**—Southern Canada and northern United States, from the Pacific to Atlantic Coasts; northeastern Nevada.

**Distribution in Nevada.**—Map 49.

- **County:** Elko.
- **Mountain Range:** Ruby.
- **Ecoregion:** Central Basin and Range.

**Discussion.**—*Taeniopteryx nivalis* is widely distributed across North America (Ricker 1964, Ricker and Ross 1968, Kondratieff and Baumann 1988) but is rare in Nevada, having been collected once at Secret Creek at the north end of the Ruby Mountains. In addition, the National Aquatic Monitoring Center (Utah State University, Logan) has reported finding nymphs of this species at 2 sites in Elko County, Cutt and Jakes creeks, both flowing to the Humboldt River via the Marys and North Fork Humboldt rivers, respectively. Houseman and Baumann (1997) found *T. nivalis* at a single site in the Raft River Mountains of Utah, near Nevada's northeastern border. This species may exist at other Nevada locations since it has been found at widely scattered locations around western North America (California, Idaho, Oregon, and Utah), though its rarity makes it difficult to know which regions and microhabitats to sample. Adults were present during April for the single Nevada record, but most adults in nearby western states occurred in February–March (Kondratieff and Baumann 1988).

**SYSTELLOGNATHA**

**CHLOROPERLIDAE**

*Alloperla chandleri* Jewett, 1954

**Geographic range.**—Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 50.

- **County:** Carson City, Douglas and Washoe.
- **Mountain Range:** Carson.
- **Ecoregion:** Sierra Nevada.

**Discussion.**—*Alloperla chandleri* is common in the Sierra Nevada of California (Jewett 1954, Lyon and Stark 1997). It has extended its range a short distance eastward into western Nevada but still within the Sierra Nevada ecoregion. This species is present in small creeks near Incline Village, Glenbrook, Genoa, and Stateline, all in the Carson Range near Lake Tahoe. It may occur a short distance north and south of Lake Tahoe but is unlikely to be found farther eastward in Nevada. Bright yellow adults are present during May–July, extending into August at higher elevations.

*Alloperla delicata* Frison, 1935

**Geographic range.**—Coast Mountains and Vancouver Island of British Columbia; Coast and Cascade mountains of Washington, Oregon and California; Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 51.

- **County:** Washoe.
- **Mountain Range:** Carson.
- **Ecoregion:** Sierra Nevada.

**Discussion.**—*Alloperla delicata* is uncommon in western Nevada. It has been found 3 times at high elevation (>2200 m) at Third Creek near Mount Rose north of Lake Tahoe. This species is common in the Sierra Nevada of California and has been reported from Sierra and Nevada counties near Nevada’s western border (Hitchcock 1958, Sheldon and Jewett 1967, Lyon and Stark 1997). It may occur in other creeks of the Carson Range but is unlikely to exist farther eastward in the...
Great Basin. Adults are lime green when alive. All Nevada adults were collected in July; adults are present in nearby states during April–June (Lyon and Stark 1997). When collected at Third Creek, A. delicata was present with numerous adults of A. chandleri.

**Alloperla thalia** Ricker, 1952

**GEOGRAPHIC RANGE.**—Rocky Mountains from Idaho and Montana to Utah and Colorado; northeastern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 52.
- **County:** Elko, Humboldt, Nye, Pershing, and White Pine.
- **Mountain Range:** Bull Run, East Humboldt, Quinn, Ruby, Santa Rosa, Schell Creek, Snake, Sonoma, and White Pine.
- **Ecoregion:** Central and Northern Basin and Range.

**DISCUSSION.**—Baumann and Kondratieff (2008a) confirmed that **Alloperla thalia** is distinct from 2 closely related species that have nonoverlapping distributions in western North America. **Alloperla thalia** ranges across northern Nevada in Humboldt and Elko counties and south through White Pine and Nye counties. It has not been found west of the Santa Rosa and Sonoma ranges or south of the Quinn Range. Likewise, no records exist from central Nevada despite considerable sampling effort there. The Nevada records expand the known range of this species westward into the Great Basin from the Rocky Mountains. Adults are lime green when alive and most are present during June–July, with a few occurring in early August. The distribution of **A. thalia** in Nevada does not overlap with that of **A. chandleri** or **A. delicata**.

**Haploperla chilnualna** (Ricker, 1952)

**GEOGRAPHIC RANGE.**—British Columbia; Coast and Cascade mountains of Washington, Oregon, and California; Baja California; Sierra Nevada; western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 53.
- **County:** Douglas and Mineral.
- **Mountain Range:** Bodie.
- **Major River Valley:** Carson.
- **Ecoregion:** Sierra Nevada; Central Basin and Range.

**DISCUSSION.**—**Haploperla chilnualna** has been found 4 times near Nevada’s western border. Both collection streams, the West Fork Carson River in Douglas County and Bodie Creek in Mineral County, originate in eastern California, flow eastward into Nevada, and are closely associated with the Sierra Nevada. This species may be present in similar eastward-flowing streams near the border (e.g., Desert Creek, Rough Creek, and Walker River), but it is unlikely to occur farther eastward into the Great Basin. It is known northwest of Lake Tahoe from Sagehen Creek in California (Sheldon and Jewett 1967). The Nevada records are short eastward range...
extensions from the Sierra Nevada. The diminutive, light-yellow adults are present in June–July.

*Kathroperla perdita* Banks, 1920

**Geographic Range.** — Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Montana and Idaho; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; eastern Oregon; Sierra Nevada; western Nevada.

**Distribution in Nevada.** — Map 54.

**County:** Washoe.

**Mountain Range:** Carson.

**Ecoregion:** Sierra Nevada.

**Discussion.** — *Kathroperla perdita* is present in small streams near Lake Tahoe in western Nevada but is rarely collected. One adult and several mature nymphs of this species were found in a cold, high-elevation (2800 m) reach of Third Creek near Mount Rose, plus 2 exuviae at slightly lower elevations (2600 m). Gravid female specimens are needed to confirm our tentative identification because at least one other species of *Kathroperla* inhabits the nearby Sierra Nevada (Stark et al. 2015b).

The Nevada Division of Environmental Protection reported a *Kathroperla* nymph from Incline Creek (2200 m elevation) in the Carson Range. The Nevada records of *K. perdita* are short eastward range extensions from the Sierra Nevada. This species is often difficult to find because adults have a short emergence period and nymphs spend much of their life in the hyporheos beneath the upper layers of stream substrate. Both adults and nymphs are recognized by the location of their compound eyes, which are forward on the head. We found the one Nevada adult in late July, but collections in California and Oregon occur in April–July (Stark et al. 2015b).

*Paraperla frontalis* (Banks, 1906)

**Geographic Range.** — Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Black Hills of South Dakota; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; eastern Oregon; northeastern California; Sierra Nevada; western and northeastern Nevada.

**Distribution in Nevada.** — Map 55.
Paraperla frontalis female, 18 July 2016, Third Creek, Washoe Co., Nevada.

Paraperla frontalis exuviae, 26 June 2014, Jarbidge River, Elko Co., Nevada.

Plumiperla diversa male, 18 July 2016, Third Creek, Washoe Co., Nevada.

**County:** Elko and Washoe.

**Mountain Range:** Carson and Jarbidge.

**Ecoregion:** Sierra Nevada; Northern Basin and Range.

**DISCUSSION.**—Despite the large North American range of *Paraperla frontalis*, few collections exist from Nevada. The species is present in 2 widely separated areas of the state, the Carson Range in the west and the Jarbidge Mountains in the northeast. These 2 groups are separated by 450 km. Of the 14 records from Nevada, 4 were female adults, one was a nymph, and 9 were exuviae; male adults have yet to be found. Nymphs and exuviae can be accurately identified by their distinctive mouthparts (Stark et al. 2013). Near Nevada, this species is present in Modoc and Alpine counties of California (Stark et al. 2008, 2013). The 4 adults found in Nevada were collected in June–July, but adults are present during April–July in nearby states (Stark et al. 2013).

Plumiperla diversa (Frison, 1935)

**Geographic Range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northeastern Oregon; southern California; Sierra Nevada; western and northeastern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 56.

**County:** Elko, Esmeralda, and Washoe.

**Mountain Range:** Carson, Independence, Jarbidge, and White.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—*Plumiperla diversa* is widely distributed in western North America (Surdick 1985), but it has a restricted range in Nevada, occurring in 2 widely separated regions of the state: (1) the Carson Range and White Mountains in the west, and (2) the Independence and Jarbidge mountains in the northeast. It has not been found in central Nevada and is confined to the margins of the Great Basin. The western group is a short range extension from the Sierra Nevada; the northeastern group is a longer range extension from the Rocky Mountains. Adults are yellow with a narrow black dorsal stripe on the abdomen. Most adults are present during June–July, but some females persist into August at higher elevations.

Plumiperla spinosa (Surdick, 1981)

**Geographic Range.**—Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 57.

**County:** Washoe.

**Mountain Range:** Carson.

**Ecoregion:** Sierra Nevada.

**Discussion.**—*Plumiperla spinosa* is known from very few locations in western North America, all in close proximity to its Sagehen Creek type locality northwest of Lake Tahoe in California (Surdick 1981, 1985). It also is uncommon in Nevada, existing in 3 small small high-elevation (>2500 m) creeks and springs near Mount Rose north of Lake Tahoe and 30 km southeast of its type locality. This species may occur at other high-elevation streams in the Lake Tahoe region, but is
unlikely to exist farther eastward in the Great Basin. It is absent from lower-elevation (<2200 m) creeks flowing to Lake Tahoe. Most adults are present during July–August, with a few females persisting into September. Two species of *Plumiperla* are present in Third Creek, Nevada, though they are separated by elevation: *P. spinosa* at high elevations and *P. diversa* at lower elevations.

*Suwallia pallidula* (Banks, 1904)

**Geographic Range.**—Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; northern and central Nevada.

**Distribution in Nevada.**—Map 58.

**County:** Elko, Humboldt, and Nye.

**Mountain Range:** Diamond A Desert, Independence, Ruby, Santa Rosa, and Toiyabe.

**Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—When Alexander and Stewart (1999) revised *Suwallia*, the range of *S. pallidula* was given as the Rocky Mountains, yet no Nevada specimens were examined. As a result, our identification of this species is tentative since Nevada material may differ from those reviewed. *Suwallia pallidula* has been collected 33 times in Nevada, primarily from Humboldt and Elko counties, but also once from northern Nye County. These are southwestern range extensions from the Rocky Mountains. This species is present near Nevada’s eastern border in the Raft River Mountains (Houseman and Baumann 1997) and Iron County, Utah (Call and Baumann 2002). This species typically inhabits the lower, warmer reaches of medium-sized creeks. Adults seldom are abundant; most
occur during June and early July. Adult body colorations of live Nevada specimens vary from uniformly straw-yellow individuals to those with bright green-yellow patterns. We have observed these color variations within and between sampling locations.

**Suwallia starki** Alexander & Stewart, 1999

**Geographic range.**—Alaska; Rocky Mountains from British Columbia and Alberta to New Mexico; Washington, Oregon, and California; central and northern Nevada.

**Distribution in Nevada.**—Map 59.

- **County:** Elko, Esmeralda, Humboldt, Nye, and White Pine.
- **Mountain Range:** Copper, East Humboldt, Jarbidge, Ruby, Santa Rosa, Schell Creek, Toiyabe, and White.
- **Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—Alexander and Stewart (1999) reported that *Suwallia starki* had the largest range of all North America *Suwallia* species. Since they examined no Nevada specimens of *Suwallia*, our identification of this species is tentative. In Nevada, 44 records of this species are known from central and northern areas, plus 2 western records from the White Mountains. It is present near Nevada’s western border in Alpine County, California (Alexander and Stewart 1999). *Suwallia starki* inhabits small creeks that are colder and at higher elevations than those *S. pallidula* inhabits, but otherwise these 2 species have similar Nevada distributions. The diminutive, yellowish adults have a black abdominal stripe and are present during June–August.

**Suwallia sublimis** Alexander & Stewart, 1999

**Geographic range.**—Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 60.

- **County:** Carson City, Douglas, and Washoe.
- **Mountain Range:** Carson.
- **Ecoregion:** Sierra Nevada.

**Discussion.**—Little is known about the distribution of *Suwallia sublimis* except for its California type locality at high elevation (3150 m) in the eastern Sierra Nevada of Mono County and another site (2250 m) in El Dorado County (Alexander and Stewart 1999). This species has a limited distribution in western Nevada, having been found in small high-elevation (2000–2800 m) creeks and springbrooks of the Carson Range that flow to Lake Tahoe or Washoe Valley. The Nevada records extend the known range of *S. sublimis* about...
70 km to the north, but still within the Sierra Nevada ecoregion. *Suwallia sublimis* emerges late in the year, though adults are seldom abundant. Olive-brown adults are present during August–September, with a few continuing into October–November.

**Sweltsa borealis** (Banks, 1895)

**Geographic Range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Black Hills in South Dakota; Coast and Cascade mountains in British Columbia, Washington, Oregon, and California; northeastern Oregon; Sierra Nevada; western and northern Nevada.

**Distribution in Nevada.**—Map 61.

- **County:** Carson City, Douglas, Elko, Humboldt, and Washoe.
- **Mountain Range:** Carson, Independence, Granite, Jackson, Jarbidge, Pine Forest, Ruby, and Santa Rosa.
- **Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**Discussion.**—In Nevada, *Sweltsa borealis* is present in a long west–east arc extending north from the Lake Tahoe region and east across northern border mountains in Washoe, Humboldt, and Elko counties. It is known from 58 collections within the state but appears to be absent from central and southern Nevada. Near the eastern border, it occurs in Box Elder and Washington counties of Utah (Houseman and Baumann 1997, Call and Baumann 2002). In Nevada, *Sweltsa borealis* inhabits small cold creeks and springbrooks at high elevations (>1900 m). Both long-winged and short-winged adults are known, with the short form being common in the Carson Range. Adults are yellow with a dark-brown abdominal stripe and head-pronotum markings. Most adults are present during June–August, but a few females occur in September.

**Sweltsa coloradensis** (Banks, 1898)

**Geographic Range.**—Yukon; Rocky Mountains from British Columbia and Alberta to...
Arizona and New Mexico; Black Hills in South Dakota; Coast and Cascade mountains in British Columbia, Washington and Oregon; eastern Oregon; northeastern California; Sierra Nevada; central and northern Nevada.

**Distribution in Nevada.**—Map 62.

**County:** Churchill, Elko, Humboldt, Lander, Nye, Pershing, Washoe, and White Pine.

**Mountain Range:** Copper, Desatoya, East Humboldt, Independence, Granite, Jackson, Jarbidge, Monitor, Pine Forest, Ruby, Santa Rosa, Schell Creek, Snake, Snowstorm, Sonoma, Summit Lake, Toiyabe, Toquima, and White Pine.

**Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—*Sweltsa coloradensis* has a large distribution in western North America (Surdick 1985, DeWalt et al. 2015) and, likewise, is one of the most widespread and commonly collected stoneflies in central and northern Nevada. More than 160 records are known from the state, especially from many sites in the northern and eastern two-thirds. Fewer records exist from western Nevada, the most westerly being those from the Granite Range in northern Washoe County. Stark et al. (2008) found this species nearby in Modoc County, California. It is present in at least 19 mountain ranges and 8 counties of Nevada, but has not been found in southern Nevada and most western counties. *Sweltsa coloradensis* inhabits small to medium-sized streams and occurs over a wide elevation range (1400–2900 m). Adults are yellowish-tan with brown-black markings. Most adults are present during June–July; some occur during August at high elevations.

*Sweltsa lamba* (Needham & Claassen, 1925)

**Geographic Range.**—Rocky Mountains from Idaho and Montana to New Mexico; Cascade and northeastern mountains in Oregon; northern and southeastern Nevada.

**Distribution in Nevada.**—Map 63.

**County:** Elko, Humboldt, and Lincoln.

**Mountain Range:** Bull Run, Jarbidge, Santa Rosa, and Wilson Creek.

**Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—*Sweltsa lamba* is uncommon in Nevada. It is present primarily in the extreme northern parts of the state (Humboldt and Elko counties), except for an isolated record 400 km south in eastern Lincoln County. Nearly all northern records are from streams in the Jarbidge Mountains, which drain to the Bruneau and Jarbidge rivers and then north to the Snake River in Idaho. This distribution shows a direct aquatic link and possible dispersal pathway with the larger Rocky Mountain range. The Humboldt County record (a female adult) is from a creek in the Santa Rosa Range that flows to the Quinn River, which drains southwest and dissipates in the Black Rock Desert of Nevada. The Lincoln County record is far removed from the northern populations but is located near known populations in Washington County of southwestern Utah (Surdick 1985, Call and Baumann 2002). *Sweltsa lamba* inhabits small mountainous streams and springbrooks at medium to high elevations (1900–2600 m). Adults are yellow with brown-black markings on the head and pronotum. Adults are present during June–August.
**Sweltsa pacifica** (Banks, 1895)

Geographic range.—Alaska; Coast and Cascade mountains in British Columbia, Washington, Oregon, and California; southern California; Sierra Nevada; western Nevada.

Distribution in Nevada.—Map 64.

County: Douglas and Lyon.

Mountain Range: Wellington.

Major River Valley: Carson and Desert.

Ecoregion: Central Basin and Range.

Discussion.—*Sweltsa pacifica* is primarily confined to the Pacific Coast states of North America, though DeWalt et al. (2015) list it from Idaho. It has been collected at the western edge of Nevada south of Lake Tahoe from 2 large streams, the Carson River and Desert Creek. Both streams originate in the eastern Sierra Nevada of California and flow easterly into Nevada. Although these Nevada collections occurred at the western edge of the Central Basin and Range ecoregion, they are closely linked with the Sierra Nevada ecoregion. Since *S. pacifica* is common in the Sierra Nevada (Surdick 1985, Nye and Stark 2010), it may also occur in Nevada streams north and south of Lake Tahoe, such as the East and West Walker and Truckee rivers. In Nevada, this species occurs at low to mid elevations of medium to large streams. Adults are present in May–June.

**Sweltsa resima** Surdick, 1995

Geographic range.—Eastern and western slopes of central and southern Sierra Nevada; western Nevada.

Distribution in Nevada.—Map 65.

County: Esmeralda.

Mountain Range: White.

Ecoregion: Central Basin and Range.

Discussion.—*Sweltsa resima* has a very limited distribution in western North America. It was first described from creeks in the eastern Sierra Nevada and on the western slope of the White Mountains in Inyo and Mono counties, California (Surdick 1995). It also occurs in California in springbrooks of the Glass Mountains and eastern slope of the White Mountains (Myers and Resh 2000, 2002), and we found one population in the Kings River basin on the western slope of the Sierra Nevada in Fresno County. In Nevada, it has been found 5 times at 3 east-slope creeks of the White Mountains, and likely occurs throughout this range. The Nevada records define the eastern limits of its total range. *Sweltsa resima* occurs farther south than the closely related *S. townesi* (Nye and Stark 2010); their distributions do not overlap in western Nevada. Myers and Resh (2000) found many *S. resima* adults beneath undercut banks of an east-slope creek in the White Mountains. Both long- and short-winged adults are present in Nevada, but the reasons for the existence of these different forms are unknown. For example, in the White Mountains, a population of *S. resima* at 2800 m elevation was entirely long winged, while a second population about 10 km southeast at 2200 m elevation was entirely short winged. Adults have yellowish-tan bodies with dark-brown markings and are present during June–July.

**Sweltsa townesi** (Ricker, 1952)

Geographic range.—Southern Cascade Mountains in California; central and northern Sierra Nevada; western Nevada.

Distribution in Nevada.—Map 66.

County: Douglas, Lyon, and Washoe.

Mountain Range: Carson and Sweetwater.

Ecoregion: Sierra Nevada; Central Basin and Range.

Discussion.—*Sweltsa townesi* ranges from the Yosemite region north to Shasta County in California and is common on both the western and eastern slopes of the Sierra Nevada (Surdick 1985, Lee and Baumann 2010). Though
mainly a northern California species, its distribution extends a short distance eastward into western Nevada creeks at Lake Tahoe and in the Carson and Sweetwater ranges. Nevada records exist from near Mount Rose in the north to the Sweetwater Mountains in the south. This species primarily occurs in the Sierra Nevada ecoregion, but the Sweetwater record lies at the western edge of the Central Basin and Range ecoregion. *Sweltsa townesi* has a more northerly distribution than the closely related *S. resima* (Surdick 1995, Lee and Baumann 2010, Nye and Stark 2010). Adult bodies are yellow to yellow tan with a dark abdominal stripe and variable marks on the head and pronotum. Most adults are present during May–July, but at high elevations (>2500 m) some females persist into late August.

*Triznaka pintada* (Ricker, 1952)

**Geographic Range.**—Rocky Mountains from Idaho to Arizona and New Mexico; Black Hills in South Dakota; Cascade Mountains in Oregon and Washington; eastern Oregon and Washington; eastern Sierra Nevada; northern Nevada.

**Distribution in Nevada.**—Map 67.


**Ecoregion:** Central and Northern Basin and Range.

**DISCUSSION.**—Reviews of *Triznaka* have clarified the status and distribution of *T. pintada* in western North America (Surdick 1985, Baumann and Kondratieff 2008b, Kondratieff and Baumann 2012). In Nevada, most of the 54 records of this species are from the northeastern two-thirds of the state, occurring in at least 8 counties and 14 mountain ranges. Further west, *T. pintada* exists in the Carson River of the eastern Sierra Nevada and extends downstream into Douglas County, Nevada. Yet, it appears to be absent from most of western and southern Nevada. This species occurs close to Nevada’s eastern border in the Deep Creek Mountains of Utah. *Triznaka pintada* and *T. sheldoni* have similar broad distributions in Nevada and the Great Basin, but *T. pintada* is more common in the lower reaches
of small creeks than *T. sheldoni*. The yellow-tan adults have a dark head spot, pronotum marks, and a brown abdomen. Most adults are present during June–July.

**Triznaka sheldoni**
Baumann & Kondratieff, 2008

**GEOGRAPHIC RANGE.**—Great Basin in southern Idaho and northwestern Utah; eastern Sierra Nevada; Nevada.

**DISTRIBUTION IN NEVADA.**—Map 68.
*Mountain Range:* Clan Alpine, Desatoya, Diamond A Desert, Granite, Humboldt, Independence, Jackson, Jarbidge, Pine Nut, Ruby, Santa Rosa, Schell Creek, Shoshone, Sonoma, Spring, Toiyabe, and Toquima.
*Ecoregion:* Central, Northern, and Mojave Basin and Range.

**DISCUSSION.**—*Triznaka sheldoni* is present in 4 western states, but Nevada accounts for nearly all of its total range: extensions into eastern California, southern Idaho, and northwestern Utah are limited (Baumann and Kondratieff 2008b). This species was described from specimens found at a springbrook in the Schell Creek Range of eastern Nevada (Baumann and Kondratieff 2008b). It now has been recorded 78 times from 17 mountain ranges and 10 counties in Nevada, being present from the northern border to the Spring Mountains in the south. Most collections are from the northern and eastern two-thirds of the state, but recently *T. sheldoni* was discovered in the Pine Nut Mountains of far western Nevada. Though primarily a Great Basin species, it has been found at 4 Nevada sites in the Jarbidge and Independence mountains that are part of the Snake River system. *Triznaka sheldoni* is more common than *T. pintada* in the upper reaches of small creeks and springbrooks. Though both species have similar distributions in Nevada, they seldom are found at the same location and date. Both species have similar yellow-tan body colorations and dark head and pronotum markings. Most adults are present during June–July, with a few occurring during August at higher elevations.

**Triznaka signata** (Banks, 1895)

**GEOGRAPHIC RANGE.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Canadian Prairies in Saskatchewan; Black Hills in South Dakota; southeastern Washington and Oregon; northeastern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 69.
*County:* Elko.
*Mountain Range:* Copper, Ruby, and Wild Horse.
*Ecoregion:* Central and Northern Basin and Range.

**DISCUSSION.**—Of the 4 species of *Triznaka* found in western North America, *T. signata* has the largest total range, extending from Alaska to New Mexico (Baumann and Kondratieff 2008b, Kondratieff and Baumann 2012). In Nevada, *Triznaka signata* has a limited distribution, only occurring at a few locations in the northeast. It is present at Secret Creek in the Ruby Mountains and in the northward-flowing drainages of the Bruneau and Owyhee rivers. The few Nevada records of *T. signata* are southwestern extensions of its Rocky Mountain range. Near Nevada's eastern border, it is present in the Raft River Mountains and Washington County of Utah (Houseman and Baumann 1997, Call and Baumann 2002). This species inhabits medium to large streams at mid to low elevations. The yellow adults are recognizable in the field by their black, triangular head mark and wide pronotal stripe. Adults are present during June–July. Nevada's 3 species of *Triznaka* have little spatial-temporal overlap, but we did find one *T. signata* adult co-occurring with numerous *T. pintada* individuals at Secret Creek.

**Utaperla sopladora** Ricker, 1952

**GEOGRAPHIC RANGE.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Utah; northeastern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 70.
*County:* Elko.
*Mountain Range:* Jarbidge and Ruby.
*Ecoregion:* Central and Northern Basin and Range.

**DISCUSSION.**—*Utaperla sopladora* has a large distribution in western North America, though it is seldom collected. This species was first reported from Nevada in 1974, based upon a single mature nymph found in Lamoille Creek.
in the Ruby Mountains (Surdick and Cather 1975). Since then it has been collected at high elevations (>2000 m) in the Ruby (4 records) and Jarbidge (3 records) mountains of Elko County. These records are slight westward extensions from its larger Rocky Mountain range (Baumann et al. 1977, Stewart and Stark 2002). The records closest to Nevada include those from Utah and southern Idaho (Baumann et al. 1977, Houseman and Baumann 1997, Call and Baumann 2002, Baumann 2006). In the field, black adults with long cerci can be mistaken for species of Capniidae. Adults are present during June–July.

PELTOPERLIDAE

_Sierraperla cora_ (Needham & Smith, 1916)

**Geographic Range.**—Southern Cascade Mountains in California; Warner Mountains in northeastern California; central and northern Sierra Nevada; Lake Tahoe and Truckee River region in western Nevada.

**Distribution in Nevada.**—Map 71.

  County: Douglas and Washoe.
  Mountain Range: Carson.
  Ecoregion: Sierra Nevada.

**Discussion.**—_Sierraperla cora_ was described in 1916 from an adult female collected in 1878 at Reno, Nevada (Needham and Smith 1916). No further information was given about the type locality, but we assume that it was the Truckee River or a nearby small tributary. The Nevada status of this species has remained uncertain since 1916 because additional adults or nymphs were never reported. During this study, _S. cora_ nymphs were found in Corsser, Edgewood, and Genoa creeks of the Carson Range near Lake Tahoe. Additionally, the Nevada Division of Environmental Protection found nymphs in 2 streams flowing to Lake Tahoe, Edgewood Creek and an unnamed creek at Zephyr Cove. Thus, _S. cora_ is uncommon in Nevada, being restricted to the western edge of the state in the Carson Range and Truckee River region near Lake Tahoe and Reno. To learn about this species, we repeatedly visited Genoa Creek during spring–summer of 2016. Abundant nymphs inhabited the underside of logs submerged in cascading, high-velocity flows. Nymphs are recognized by theirroach-like body shape and median caudal spine. Exuviae were first observed in early June, but typical collecting methods with beating sheets failed to find adults. A male adult was obtained by raising a mature nymph to emergence in an instream growth cage. _Sierraperla cora_ is present in the Sierra Nevada, and the Nevada populations are slight eastward extensions from that region. Near Nevada’s northwestern border, the
species is present in the Warner Mountains, California (Stark et al. 2008). The single adult from Genoa Creek, Nevada, was present in mid-June, but adults throughout California were present during late May–early July (Stark et al. 2015a).

*Soliperla thyra* (Needham & Smith, 1916)

**Geographic Range.**—Coast Range in northern California; Sierra Nevada; Lake Tahoe or Reno region in western Nevada.

**Distribution in Nevada.**—Map 72.

- **County:** Washoe?
- **Mountain Range:** Carson?
- **Ecoregion:** Sierra Nevada.

**Discussion.**—*Soliperla thyra* was described in 1916 from an adult male collected in Nevada (Needham and Smith 1916). No further information was given about the collector, date, or type locality, though we assume that the specimen was found near Lake Tahoe or Reno because the species is known from the Sierra Nevada. The Nevada status of *S. thyra* is uncertain because additional specimens have not been collected since 1916. Stark (1983) and Stark and Gustafson (2004) reviewed the *Soliperla* of western North America and listed records for *S. thyra* from the Coast Range and west-slope Sierra Nevada. Despite repeated sampling in the Carson Range and Truckee River near Verdi, this species has not been found in Nevada. If the 1916 Nevada record of *S. thyra* is correct, this species may be present in the extreme western part of the state, such as the Lake Tahoe and Truckee River region. *Soliperla* nymphs often occur in thin sheet-flow or waterfall splash zones of small creeks and springs. This unique aquatic habitat needs further study in Nevada. We estimate that adults are present during May–June.

*Yoraperla nigrisoma* (Banks, 1948)

**Geographic Range.**—Coast and Cascade mountains in Washington, Oregon, and northern California; San Bernardino Mountains in California; northeastern California; Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 73.

- **County:** Carson City, Douglas, Esmeralda, Humboldt, Lyon, Mineral, and Washoe.
- **Mountain Range:** Bodie, Carson, Granite, Pine Forest, Summit Lake, Sweetwater, Wassuk, and White.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**Discussion.**—*Yoraperla nigrisoma* is restricted primarily to the Pacific Coast states.
of North America (Stark and Nelson 1994). In Nevada, this species is present in at least 8 mountain ranges located close to the western and northern borders. In the west it is quite common throughout the part of the Carson Range near Lake Tahoe and occurs as far south as the White Mountains in Esmeralda County. Somewhat further into the Great Basin, at least one population is present in the isolated Wassuk Range, Mineral County. In the north it exists in the Granite, Summit Lake, and Pine Forest ranges, but we have not found it in the well-sampled Santa Rosa Range and Jarbidge Mountains. However, the Nevada Division of Environmental Protection reported one nymph from the Jarbidge Mountains, while the National Aquatic Monitoring Center (Utah State University, Logan) reported one nymph each from the Independence Mountains and the Santa Rosa Range. In late May 2016, we visited the georeferenced Independence and Santa Rosa sites. Diligent collecting at both locations captured none of the distinctive and typically abundant nymphs of Y. nigrisoma, nor any adults. The Santa Rosa site apparently was affected by mine drainage and had a depauperate fauna lacking both stoneflies and mayflies. Previous directed searches in both the Santa Rosa and Jarbidge ranges failed to find Y. nigrisoma, even at sites containing its common associate Moselia zonata. Yoraperla nigrisoma has a limited presence in the western Great Basin, its distribution being a short eastward extension from the Sierra Nevada and northeastern California. Where present in Nevada, it often is abundant and can be easily recognized by its unique roach-like nymphs. This species inhabits mid- to high-elevation, small, cool streams. Adults are present during April–July.

**Perlidae**

*Acroneuria abnormis* (Newman, 1838)

**Geographic Range.**—Western, central, and eastern United States and Canada; northeastern Nevada.

**Distribution in Nevada.**—Map 74.

*County: Eureka and Lander.

*Major River Valley: Humboldt.

*Ecoregion: Central Basin and Range.

**Discussion.**—*Acroneuria abnormis* is one of the most widely distributed stoneflies in North America, ranging from the Atlantic states and provinces to the Rocky Mountains and Great Basin, but not to the Pacific Coast (Stark and Gaufin 1976, Baumann et al. 1977, Stewart and Stark 2002, DeWalt et al. 2015). In Nevada, this species has been collected 4 times, each collection a single nymph from a 25-km reach of the Humboldt River near Argenta and Dunphy east of Battle Mountain. Adults have not been found in Nevada. Although this rarely collected species appears to be restricted to the Humboldt River, additional sampling is needed to better understand its Nevada range. Its presence in northeastern Nevada, near the center of the arid Great Basin, is unusual in being the westernmost limit of its huge North American range. The Humboldt River population appears to be isolated from all other known populations, the closest being 450 km southeast in the Sevier River of central Utah (Call and Baumann 2002). *Acroneuria abnormis* may have first entered the Humboldt River system during the Pleistocene, when Nevada had a wetter climate and an interconnected network of lakes and rivers. The nymphs inhabit large rivers. Adults are expected to be present during June–August (Baumann et al. 1977).

**Calineuria californica** (Banks, 1905)

**Geographic Range.**—Rocky Mountains from British Columbia and Alberta to Idaho and Montana; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; western and northeastern Nevada.

**Distribution in Nevada.**—Map 75.

*County: Douglas, Elko, and Washoe.*

*Major River Valley: Bruneau, Carson, Jarbidge, Truckee, and their main tributaries.*
**Ecoregion:** Sierra Nevada; Northern Basin and Range.

**Discussion.**—The range of *Calineuria californica* extends throughout the northern Rocky Mountains and Pacific Coast states of western North America (Stark and Gaufin 1974, DeWalt et al. 2015). When Stark and Gaufin studied this species in 1974, no records existed from Nevada. It now has been found in several large streams within Nevada but always within 20 km of the state’s western and northeastern borders. In the west near Lake Tahoe, it is present in the Truckee River near Verdi and in Bryant Creek, a tributary of the East Fork Carson River; both river systems originate in the Sierra Nevada and flow eastward into Nevada. The Nevada Division of Environmental Protection has collected it in the East Fork Carson and Walker rivers and in the Truckee River west of Reno. Though present in larger streams entering the California side of Lake Tahoe, this species has not been found in small creeks on the Nevada side. In northeastern Nevada, *C. californica* occurs in at least 2 large river systems, the Bruneau and Jarbidge, both flowing northward to Idaho. It inhabits medium to large streams at low to medium elevations (<1700 m). Adults are present during June–July.

*Claassenia sabulosa* (Banks, 1900)

**Geographic range.**—Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Canadian Prairies; eastern and northern Canada; Black Hills in South Dakota; Washington, Oregon, and California; western and northeastern Nevada.

**Distribution in Nevada.**—Map 76.

- **County:** Douglas, Elko, Lyon, and Washoe.
- **Major River Valley:** Carson, Jarbidge, Truckee, Walker, and their main tributaries.
- **Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**Discussion.**—*Claassenia sabulosa* has a wide distribution in North America (Stewart and Stark 2002, DeWalt et al. 2015) but is restricted in Nevada to 2 regions, the western and northeastern border regions. In the west, this species is present in the Truckee, Carson, and Walker rivers and Desert Creek, all large streams that originate in the eastern Sierra Nevada and flow into Nevada. Our records, and those of the Nevada Division of Environmental Protection, show that *C. sabulosa* occurs at least 40–50 km downstream of the western border in the Truckee River (to Clark), Carson River (to Mound House), and Walker River (nearly to Yerington). The presence of this species in the lower reaches of these rivers demonstrates its tolerance of stream conditions altered by upstream urban or agricultural use. In northeastern Nevada, *C. sabulosa* is present in the lower Jarbidge River. It inhabits large streams at low to mid elevations (<1800–2100 m). Adults are present during August–September and often hide during the day under shoreline rocks. Male adults have short wings.

*Doroneuria baumanni* Stark & Gaufin, 1974

**Geographic range.**—Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Steens Mountain in southeastern Oregon; Warner Mountains in northeastern California; Sierra Nevada; northeastern Nevada.

**Distribution in Nevada.**—Map 77.

- **County:** Carson City, Douglas, Elko,
Humboldt, Lander, Lyon, Mineral, Nye, Pershing, and Washoe.


Ecoregion: Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—*Doroneuria baumanni* inhabits mountain streams in the Far West of North America (Stark and Gaufin 1974, DeWalt et al. 2015). This large stonefly is common throughout the northern half of Nevada, with 118 collections from 18 mountain ranges. Most records were of nymphs and only 16 were of adults. No records exist from southern Nevada or most of eastern Nevada. For example, the species has not been found in the Schell Creek and Snake ranges of White Pine County despite considerable sampling there. Nevada records define the eastern limits of its total range. Schultheis et al. (2012) studied genetic variation of *D. baumanni* from 9 mountain ranges of Nevada and found 3 distinct clades influenced by past climatic variations. This species inhabits small and medium-sized cool creeks, typically at higher elevations than other perlid stoneflies, but in Nevada it occasionally co-occurs with *Hesperoperla pacifica*. Adults are present during July–August.

**Hesperoperla pacifica** (Banks, 1900)

**GEOGRAPHIC RANGE.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Canadian Prairies in Saskatchewan; Black Hills in South Dakota; Coast and Cascade mountains of
British Columbia, Washington, Oregon, and California; Sierra Nevada; Nevada.

DISTRIBUTION IN NEVADA.—Map 78.


Mountain Range: Battle, Bull Run, Carson, Cherry Creek, Clan Alpine, Copper, Desatoya, Diamond, Diamond A.
Desert, East Humboldt, Grant, Humboldt, Independence, Jackson, Jarbidge, Monitor, Pilot, Pine Forest, Roberts, Ruby, Santa Rosa, Schell Creek, Shoshone, Snake, Sonoma, Spring, Summit Lake, Tobin, Toiyabe, Toquima, Tuscarora, Wellington, White, White Pine, and Wild Horse.

**Ecoregion:** Sierra Nevada; Northern, Central, and Mojave Basin and Range.

**DISCUSSION.**—*Hesperoperla pacifica* ranges across most of western North America (Stewart and Stark 2002, Schultheis et al. 2014, DeWalt et al. 2015). This large stonefly is also common throughout Nevada, having been recorded 262 times from 14 of the state’s 17 counties and from at least 35 of its mountain ranges. Besides its large geographic range, this species occurs in a diversity of running waters, including lower, warmer reaches of mountain streams and larger rivers, mid to upper sections of cool mountain creeks, and isolated cold springs at many elevations. And yet, its expansive distribution in Nevada has a notable 150-km-wide gap running southeast from the Black Rock Desert through Pyramid and Walker lakes to the state’s southeastern border. This barren area lies within the driest parts of the Sierra Nevada rain shadow. *Hesperoperla pacifica* has not been found in the main Humboldt River or in downstream reaches of the Truckee, Carson, and Walker rivers. Presently, it is unknown from Lincoln, Mineral, and Storey counties, but stoneflies there are little studied. In Nevada, *H. pacifica* nymphs are easily recognized in the field by their white anal gills and black-white pigment patterns that cover dorsal surfaces and legs. This black-white pigment pattern is found in nymphs across Nevada, but unique morphs also exist in the White Mountains and Carson Range—*Calineuria californica*, *Doroneuria baumanni*, and *Claassenia sabulosa*. Most *H. pacifica* adults are present during June–July, but a few occur during August. At Cave Creek, cold waters discharging year-round from limestone caverns of the Ruby Mountains retard growth, causing adults to be present in late September. Both short- and long-winged populations are present in the state. Adults may reside on streamside habitats not efficiently sampled with beating sheets; only 26 of 262 collections contained adults. In a Nevada study, Arnaldi et al. (2015) found that *H. pacifica*, a habitat generalist, had less genetic differentiation than did *Doroneuria baumanni*, a habitat specialist. Of eleven populations studied in Nevada, 3 (Roberts, Snowstorm, and Sonoma mountains) were genetically differentiated.

**PERLOIDAE**

*Cascadoperla trictura* (Hoppe, 1938)

**GEOGRAPHIC RANGE.**—Northern Rocky Mountains in Idaho and Montana; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 79.

**County:** Douglas and Washoe.

**Major River Valley:** Carson and Truckee.

**Ecoregion:** Sierra Nevada.

**DISCUSSION.**—*Cascadoperla trictura* has been collected twice in western Nevada, north and south of Lake Tahoe. This species inhabits large, low-elevation streams, such as the Carson and Truckee rivers, which originate in the Sierra Nevada and flow into Nevada. Similar streams where it may occur include the Walker River and Desert Creek in Douglas and Lyon counties, but it is unlikely to be found farther eastward in the Great Basin. The Nevada records are small eastward extensions from the Sierra Nevada. Nymphs can be identified to species by microscopic study of mouthparts (Szczytko and Stewart 1979, Stewart and Stark 2002). Adults are present during June.

*Cultus aestivalis* (Needham & Claassen, 1925)

**GEOGRAPHIC RANGE.**—Yukon and Northwest Territories; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; northeastern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 80.

**County:** Elko.

**Mountain Range:** Wild Horse.

**Ecoregion:** Northern Basin and Range.

**DISCUSSION.**—The recent discovery of *Cultus aestivalis* in northeastern Nevada was unexpected because this species primarily occurs in the Rocky Mountains (Baumann et al. 1977, Stewart and Stark 2002, DeWalt et al. 2015). In Nevada, it is present in the Owyhee River downstream from Wild Horse Dam in Elko County. The next closest records are
more than 400 km northeast and southeast in Idaho and Utah, respectively (Baumann et al. 1977). Other large streams in northern Elko County that may harbor this species include the Bruneau and Jarbidge rivers and Salmon Falls Creek. *Cultus* nymphs have been reported from Jarbidge River and Lamoille Creek in Elko County (Sheldon 1979), but these specimens have been lost and their identity is unknown. Typical of all western *Cultus* species, *C. aestivalis* occurs in low- to mid elevation reaches of rivers and large creeks (elevations <2000 m). The few adults collected in Nevada were present in June, but occur in April–August in nearby states.

*Cultus pilatus* (Frison, 1942)

*Geographic range.*—Northern Rocky Mountains in Idaho and Montana; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; eastern Washington; Sierra Nevada; western Nevada.

*DISTRIBUTION IN NEVADA.*—Map 81.

*County:* Washoe.

*Major River Valley:* Truckee at Verdi.

*Ecoregion:* Sierra Nevada.

*Discussion.*—*Cultus pilatus* has been reported 4 times from the Truckee River at Verdi; however, collections of *Cultus* nymphs from the Carson and Walker river drainages in Douglas and Lyon counties indicate that a larger range in western Nevada is possible. *Cultus* nymphs have also been reported from central and northeastern Nevada in Elko, Lander, and Nye counties (Sheldon 1979, Kennedy at al. 2000), but their identity is questionable without voucher specimens. The Nevada Division of Environmental Protection reported *Cultus* nymphs from several sites in the Santa Rosa and Ruby mountains and from the Carson and Truckee rivers. Those in the Truckee extended 50 km downstream from Verdi. Large streams at low to mid elevations are the preferred habitat of this genus. Nymphs have black and white transverse bands on each abdominal segment. Adults are present during April–May in Nevada.

*Cultus tostonus* (Ricker, 1952)

*Geographic range.*—Northern Rocky Mountains in Idaho, Montana, and Wyoming; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; Sierra Nevada; western Nevada.

*DISTRIBUTION IN NEVADA.*—Map 82.

*County:* Douglas and Washoe.

*Major River Valley:* Carson near Gardnerville and Truckee between Verdi and Reno.

*Ecoregion:* Sierra Nevada; Central Basin and Range.

*Discussion.*—*Cultus tostonus* exists in at least 2 large streams of western Nevada, including the West Fork Carson and Truckee rivers. Other large streams in this region, such as East Fork Carson and Walker rivers and Desert Creek, are likely additional sites. *Cultus* nymphs have been found in the East Fork Carson River and Desert Creek. Nymphs also have been reported from central and northeastern Nevada (Sheldon 1979, Kennedy at al.
Likewise, the Nevada Division of Environmental Protection found *Cultus* nymphs at several sites between Sparks and Wadsworth in the Truckee River, but it is unknown whether they were *C. tostonus* or *C. pilatus*. In Nevada, *C. tostonus* is primarily associated with the Sierra Nevada ecoregion, though some collections are just inside the western margins of the Central Basin and Range ecoregion. Nymphs have black and white bands on abdominal segments. Adults are present during May–July.

*Diura knowltoni* (Frison, 1937)

**GEOGRAPHIC RANGE.**—Yukon; Rocky Mountains from British Columbia and Alberta to New Mexico; Canadian Prairies in Saskatchewan; Coast and Cascade mountains of British Columbia, Oregon and California; Warner Mountains in northeastern California; Sierra Nevada; northern Nevada.

**DISTRIBUTION IN NEVADA.**—Map 83.

*County:* Elko, Humboldt, and Lander.

*Mountain Range:* Battle, Jackson, Jarbidge, Independence, Ruby, and Santa Rosa.

*Ecoregion:* Central and Northern Basin and Range.

**DISCUSSION.**—*Diura knowltoni* occurs in the northern quarter of Nevada, but is uncommon in samples. For example, after many years of searching Nevada streams for stoneflies, only one record is known for a female adult, 5 for nymphs, and 3 for exuviae. Most collections are from Humboldt and Elko counties, but one is from northern Lander County. Near Nevada’s borders, this species is present in the west at Sagehen Creek and the Warner Mountains of California, and in the east at the Raft River Mountains of Utah (Sheldon and Jewett 1967, Houseman and Baumann 1997, Stark et al. 2008). Since Sagehen Creek drains to the Truckee River, it is possible that the species is present in western Nevada. The Nevada Division of Environmental Protection reported *Diura* nymphs in Third Creek near Lake Tahoe and in Rough Creek in Mineral County. Additional samples of *D. knowltoni* adults are needed to better understand its Nevada distribution. This species inhabits small and medium-sized cool creeks. Adults are present during April–July (Baumann et al. 1977, Stewart and Oswood 2006).

*Frisonia picticeps* (Hanson, 1942)

**GEOGRAPHIC RANGE.**—Southern British Columbia; Coast and Cascade mountains of Washington, Oregon, and California; Sierra Nevada; western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 84.

*County:* Carson City, Douglas, Esmeralda, Lyon, and Washoe.

*Mountain Range:* Carson, Sweetwater, and White.

*Ecoregion:* Sierra Nevada; Central Basin and Range.

**DISCUSSION.**—*Frisonia picticeps* primarily occurs in the Pacific States of western North America, though it is uncommonly collected. In Nevada, it is restricted to cool mountain streams along the western border region, running in a narrow band from the Truckee River at Verdi in the north to the White Mountains in the south. Of 45 Nevada records, most were nymphs or exuviae and 12 were adults. Nearly
all records of this species were from the Sierra Nevada ecoregion; a few occurred at the western edge of the Central Basin and Range ecoregion. The Nevada records of *F. picticeps* expand its known range a short distance eastward from the Sierra Nevada, though it is unlikely to occur farther eastward in the Great Basin. Male adults are short winged and much smaller than the long-winged females. Repeated collection of adults and exuviae from a bridge at Third Creek near Lake Tahoe showed that peak emergence occurred during mid May. Adults are present during May–June.

*Isogenoides elongatus* (Hagen, 1874)

**Geographic Range.**—Rocky Mountains from British Columbia and Alberta to New Mexico; Canadian Prairies in Manitoba; Black Hills in South Dakota; Washington; northeastern Nevada.

**Distribution in Nevada.**—Map 85.

**County:** Elko, Eureka, Humboldt, and Lander.

**Major River Valley:** Jarbidge, Humboldt, and Salmon Falls.

**Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—*Isogenoides elongatus* primarily occurs in the Rocky Mountains. It has been collected from 3 drainages in northeastern Nevada: (1) from a 160-km reach of Humboldt River between Elko and Valmy near Battle Mountain, (2) from Salmon Falls Creek south of Jackpot, and (3) from Jarbidge River near the Nevada–Idaho border. Most of the 29 total records from Nevada were of nymphs collected during September–March from the Humboldt River and only 2 contained adults. The Humboldt River drains west to Humboldt Sink near Lovelock, and Jarbidge River and Salmon Falls Creek drain north to the Snake River in Idaho. The headwaters of Humboldt, Jarbidge, and Salmon Falls lie in close proximity and may be a dispersal route between these major drainages. Other large tributaries in the region, such as Marys River, could harbor this species. The Nevada Division of
Environmental Protection found *Isogenoides* nymphs in North Fork Humboldt River near Elburz, a short distance above its confluence with the main river, suggesting a larger range along the Humboldt River. This record confirms our May 1983 field notes of a single *Isogenoides* exuviae found at the same site. The Nevada records of *I. elongatus* expand its North American range a considerable distance westward (250 km) from the Rocky Mountains. In Nevada, this species inhabits large perennial rivers and creeks at low elevations (<1800 m). Nevada adults were present during mid-April; in its larger Rocky Mountain range, adults are present during late April to early July (Sandberg and Stewart 2005).

*Isoperla fulva* Claassen, 1937

**Geographic Range.**—Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Coast and Cascade mountains of British Columbia, Washington and Oregon; eastern Oregon; northeastern and north-central Nevada.

**Distribution in Nevada.**—Map 86.

- **County:** Elko and Humboldt.
- **Mountain Range:** Copper, East Humboldt, Jarbidge, Ruby, Santa Rosa, and Wild Horse.
- **Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—The known distribution of *Isoperla fulva* in western North America curves around Nevada’s northern and eastern borders (Szczytko and Stewart 1979, Houseman and Baumann 1997, Call and Baumann 2002, Sandberg 2011, Sandberg and Kondratieff 2013). Records along Nevada’s western border in northeastern California and Sierra Nevada are unconfirmed (Jewett 1960, Szczytko and Stewart 1979). In the northern quarter of Nevada, *I. fulva* is present in at least 13 streams and 6 mountain ranges. Streams in the East Humboldt, Ruby, and Santa Rosa ranges are located within the Great Basin, while those in the Copper, Jarbidge, and Wild Horse ranges lie outside the Great Basin and are part of the Snake–Columbia river system. Sandberg and Kondratieff (2013) found this species in southern Harney County, Oregon, about 20 km north of Nevada’s northern border. *Isoperla fulva* inhabits the lower and mid reaches of small to medium-sized mountain creeks and sometimes co-occurs with several other *Isoperla* species—*I. quinquepunctata*, *I. mormona*, *I. phalerata*, and *I. sobria*. The blackish male adults are much darker than females. Most adults are present in Nevada during June, but a few persist into early July.

*Isoperla marmorata* (Needham & Claassen, 1925)

**Geographic Range.**—Coast and Cascade mountains of Washington, Oregon, and California; southeastern Oregon; northeastern California; Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 87.

- **County:** Washoe.
- **Major River Valley:** Truckee at Verdi and Reno.
- **Ecoregion:** Sierra Nevada.

**Discussion.**—Needham and Claassen (1925) described *Isoperla marmorata* from a female adult collected in 1878 at Reno, Nevada, most likely from the Truckee River. This species is uncommon in western Nevada, having been collected once in the Truckee River at Verdi since its original description. It also occurs at several California sites near Nevada’s western border, including Modoc, Plumas, and Nevada counties (Jewett 1960, Sheldon and Jewett 1967, Szczytko and Stewart 1979, Stark et al. 2008, Sandberg 2011). We found it close to the Nevada border in the West Fork Carson River, Alpine County, California, and it is present 20 km north of Nevada’s northwestern border in Lake County, Oregon (Sandberg and Kondratieff 2013). Nevada records of *I. marmorata* extend its range a short distance eastward into
the Great Basin. Adults are present during May–June.

*Isoperla mormona* Banks, 1920

**Geographic Range.**—Rocky Mountains from British Columbia to Arizona and New Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; eastern Oregon; Warner Mountains in California; southern California; Baja California; Sierra Nevada; western and northern Nevada.

**Distribution in Nevada.**—Map 88.
- Major River Valley: Bruneau, Carson, Humboldt, Salmon Falls, Truckee, Walker, and their main tributaries.
- Ecoregion: Sierra Nevada; Central and Northern Basin and Range.

**Discussion.**—In contrast with most species of Nevada stoneflies, which inhabit mountain creeks, *Isoperla mormona* occurs in larger streams or rivers flowing in intermountain valleys. This species is present in 2 main areas of Nevada: (1) the northern quarter of the state, including the Bruneau River, Salmon Falls Creek, and Humboldt River and its major tributaries, and (2) the western border region north and south of Lake Tahoe, including the Truckee, Carson, and Walker rivers. These 2 areas are separated by a 200-km gap with no records. *Isoperla mormona* is the only stonefly species found in the lower Humboldt River near Rye Patch Reservoir. It is present near Nevada’s western and northwestern borders in Inyo, Modoc, Plumas, and Sierra counties of eastern California and southern Harney County in Oregon (Jewett 1960, Sandberg 2011, Sandberg and Kondratieff 2013). This species inhabits large warmer streams at lower elevations, and often coexists with *Isoperla quinquepunctata*. The 2 species overlap in emergence timing, but *I. mormona* is smaller and its males lack the red abdomen of *I. quinquepunctata* (Szczytko and Stewart 1979). Adults are present during June–July.

*Isoperla petersoni* Needham & Christenson, 1927

**Geographic Range.**—Alaska; Yukon and Northwest Territories; Rocky Mountains from British Columbia and Alberta to Utah and Colorado; Canadian Prairies in Saskatchewan; Cascade Mountains in Washington; northeastern Nevada.

**Distribution in Nevada.**—Map 89.
- County: Elko.
- Mountain Range: East Humboldt, Jarbidge, and Ruby.
- Ecoregion: Central and Northern Basin and Range.

**Discussion.**—*Isoperla petersoni* is present in at least 5 streams and 3 mountain ranges of northeastern Nevada but is uncommonly collected. Most records are from high-elevation cool streams or springbrooks above 2400 m elevation, though some have been reported from as low as 1900 m. Such high-elevation habitats have been sampled in central and western Nevada without discovery of this species, and it is absent from the Sierra Nevada. The nearest populations to Nevada are those in southern Idaho and central Utah (Baumann et al. 1977, Szczytko and Stewart 1979). The Nevada records extend the range
of this species 250 km westward from the Rocky Mountains. Adults are present during June–August. Adult males have short wings in some populations.

*Isoperla phalerata* (Needham, 1917)

**Geographic Range.**—Rocky Mountains from Idaho to New Mexico; eastern Oregon; Black Hills in South Dakota; northern Nevada.

**Distribution in Nevada.**—Map 90.

**County:** Humboldt.

**Mountain Range:** Santa Rosa.

**Ecoregion:** Northern Basin and Range.

**Discussion.**—*Isoperla phalerata* is uncommonly found at scattered locations in western North America. In northern Nevada, it has been collected 6 times at 2 adjacent midsized creeks in the Santa Rosa Range. Adults were difficult to find in these creeks because riparian substrates were hard to sample and specimens were present in low abundance. *Isoperla phalerata* and *I. pinta* are closely related and difficult to separate by general appearance. Separation using adult genitalia and wing venation also is difficult because diagnostic characters have subtle differences (Szczytko and Stewart 1979, Sandberg 2011, Sandberg and Kondratieff 2013). *Isoperla phalerata* is present in southern Harney County, Oregon, 20 km north of Nevada’s northern border, while the nearest populations of *I. pinta* to the Santa Rosa Range are 300 km distant in the Sierra Nevada, Rocky Mountains, and southern Oregon (Newell and Minshall 1976, Szczytko and Stewart 1979, Call and Baumann 2002, Sandberg and Kondratieff 2013). *Isoperla phalerata* coexisted with *I. fulva* and *I. sobria* in the Santa Rosa creeks, and adults of all 3 species were present at the same season. Mature nymphs are present during late May, and adults are present during June. Male adults of *I. phalerata* have short wings in Nevada; females have long wings. Short-winged males have been reported for this species but are unknown in *I. pinta* (Szczytko and Stewart 1979).

*Isoperla quinquepunctata* (Banks, 1902)

**Geographic Range.**—Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Canadian Prairies in Saskatchewan; Black Hills in South Dakota; Nebraska and Kansas; Coast and Cascade mountains of British Columbia, Oregon and California; eastern Oregon; northeastern California; Sierra Nevada; Baja California; Nevada.

**Distribution in Nevada.**—Map 91.


**Mountain Range:** Battle, Bodie, Clan Alpine, Clover, Diamond, Egan, Fish Creek, Granite, Hays Canyon, Independence, Jackson, Lost Creek, Pine Forest, Pinon, Roberts, Ruby, Santa Rosa, Schell Creek, Shoshone, Snake, Snowstorm, Toiyabe, Toquima, Tuscarora, Wellington, White, White Pine, and Wild Horse.
**Major River Valley:** Bruneau, Carson, Humboldt, Truckee, Walker, and their main tributaries.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—*Isoperla quinquepunctata* is abundant and widely distributed in western North America (Baumann et al. 1977, Szczytko and Stewart 1979, DeWalt et al. 2015). Few other species have such a wide range in Nevada, where it is common in a diversity of running waters, including mountain creeks, intermountain large streams, small springs, and irrigation ditches. Nearly all 147 records of this species are from the northern two-thirds of the state. It is found in 13 of Nevada’s 17 counties, at least 28 of its mountain ranges, and 5 of its major intermountain rivers. In northern Washoe and Humboldt counties, it is present in creeks and springs of Sheldon National Wildlife Refuge (Herbst 1996). Beaver Dam Creek in Lincoln County is the southernmost record. Surprisingly, it is unknown from the Carson, Jarbidge, Humboldt, and Sonoma ranges, which have all been fairly well sampled. As observed for other widespread Nevada species, *Isoperla quinquepunctata* is absent from a 120-km-wide band running from the Black Rock Desert to the southeastern border. *Isoperla quinquepunctata* usually inhabits medium to large, warmer streams. Male adults have reddish abdomens. Most adults are present during June–July; occasionally a few are found during April–May and August. Surprisingly, adults from a springbrook in Eureka County were found during mid-September.

*Isoperla sobria* (Hagen, 1874)

**Geographic Range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northeastern Oregon; Sierra Nevada; northern and western Nevada.

**Distribution in Nevada.**—Map 92.

**County:** Carson City, Douglas, Elko, Humboldt, Lyon, Nye, and Washoe.

**Mountain Range:** Carson, Independence, Jarbidge, Santa Rosa, Sonoma, Sweetwater, and Toiyabe.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**DISCUSSION.**—*Isoperla sobria* adults have been collected 21 times in Nevada, 18 times from the Carson Range near the western border and 3 times from the Santa Rosa and Independence ranges in the north. Most of the 59 Nevada records of this species have been of nymphs and exuviae, which can be identified to species using body pigment patterns and mouthpart characters (Szczytko and Stewart 1979, Sandberg 2011, Sandberg and Kondratiyeff 2013). It is present near Nevada in the Raft River Mountains in northwestern Utah (Houseman and Baumann 1997). *Isoperla sobria* inhabits the upper reaches of small cool creeks and springbrooks. When present in the same stream as *I. mormona* and *I. quinquepunctata*, the latter 2 species occur at lower elevations. In northern Nevada, *I. sobria*
coexists with *I. fulva* and *I. phalerata,* and adults of the 3 species are present at the same time. In western Nevada, *I. sobria* coexists with *I. sordida* but emerges a few weeks earlier. Adults of *I. sobria* are present during mid-May to mid-July.

*Isoperla sordida* Banks, 1906

**Geographic Range.**—Alaska; Rocky Mountains from British Columbia and Alberta to Idaho and Montana; Coast and Cascade Mountains of British Columbia, Washington, Oregon, and California; northeastern Oregon; southern California; eastern Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 93.

*County:* Carson City, Douglas, Lyon, and Washoe.

*Mountain Range:* Carson and Sweetwater.

*Ecoregion:* Sierra Nevada.

**Discussion.**—In Nevada, *Isoperla sordida* is restricted to the Sierra Nevada ecoregion. Most of the 47 records of this species came from repeated sampling of 6 small creeks in the Carson Range between Mount Rose and Zephyr Cove at Lake Tahoe. Collecting site elevations were usually above 2400 m but ranged from 1950 m to 2800 m. This species is also present south of Lake Tahoe in the Sweetwater Range of Lyon County. The Nevada distribution of *I. sordida* extends slightly eastward from its known California range that runs from Nevada County to Mono County in the eastern Sierra Nevada (Sandberg 2011). *Isoperla sordida* coexists with *I. sobria,* but emerges several weeks later in late summer or autumn. Most adults are present from mid-July to late August, with a few lasting into late September.

*Kogotus modestus* (Banks, 1908)

**Geographic Range.**—Rocky Mountains from British Columbia to New Mexico; northeastern and central Nevada.

**Distribution in Nevada.**—Map 94.

*County:* Elko, Lander, and Nye.


*Ecoregion:* Central and Northern Basin and Range.

**Discussion.**—Two species of *Kogotus* occur in Nevada, *K. modestus* and *K. nonus.* *Kogotus modestus* has been found 43 times in 6 mountain ranges of northeastern and central Nevada. It inhabits upper-elevation (>1800 m), cool mountain creeks and springbrooks, and, as such, is part of a special fauna found in headwaters near mountain crests (approximately 3000 m elevation). Most collections in Nevada have been of nymphs, which cannot be identified to species level, but are recognized at the generic level by their unicuspid lacinia mouthparts (Stewart and Stark 2002). Adults have been found 9 times, though only 4 collections included the males needed for accurate identification. Additional collections of adults are needed to understand this species’ range. Such data also may reveal if its
range overlaps with that of *Kogotus nonus* in western Nevada. Presently, the westernmost confirmed record of *K. modestus* is from Stewart Creek in the Toiyabe Range, about 200 km east of known locations of *K. nonus* near Lake Tahoe and 100 km northeast of those in the White Mountains. The Nevada records of *K. modestus* are western extensions from its main Rocky Mountain distribution. In Nevada, adults are present during August. Males have slightly shortened wings and are found very close to creek edges; females have long wings.

*Kogotus nonus* (Needham & Claassen, 1925)

Geographic range.—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Wyoming; Coast and Cascade Mountains of British Columbia, Washington, Oregon, and California; eastern Oregon; Sierra Nevada; western Nevada.

Distribution in Nevada.—Map 95.

County: Carson City, Douglas, Esmeralda, and Washoe.

Mountain Range: Carson and White.

Ecoregion: Sierra Nevada; Central Basin and Range.

Discussion.—*Kogotus nonus* occurs in the western border region of Nevada, from the Truckee River in the north to the White Mountains in the south. It has been collected 23 times, mostly as nymphs, from the Carson Range near Lake Tahoe and the White Mountains in Esmeralda County. Only 5 collections were adults, with 3 being the male specimens needed for accurate identification. In creeks where this species was known to occur, we had difficulty finding adults using standard beating-sheet methods. Adults were obtained by raising mature nymphs in instream growth cages and by hand searching tufts of creek-side grasses and herbs. *Kogotus nonus* coexists with *Rickera sorpta* in the Carson Range but usually occurs at higher elevations and
emerges 4–6 weeks later. Nymphs of both species have unicuspid lacinia and are easily confused. Both species are present in Sagehen Creek, California, where *R. sorpta* emerges in June and *K. nonus* emerges in July–August (Sheldon and Jewett 1967). The Nevada records of *K. nonus* expand its range a short distance eastward from the Sierra Nevada. Most Nevada adults are present during July–August and at high elevations during September.

*Megarcys signata* (Hagen, 1874)

**Geographic Range.**—Yukon; Coast Mountains in British Columbia and southeastern Alaska; Rocky Mountains from British Columbia and Alberta to New Mexico; northeastern and central Nevada.

**Distribution in Nevada.**—Map 96.
- **County:** Elko, Nye, and White Pine.
- **Mountain Range:** Jarbidge, Ruby, Schell Creek, Snake, and Toiyabe.
- **Ecoregion:** Central and Northern Basin and Range.

**Discussion.**—The North American distribution of *Megarcys signata* encompasses the entire Rocky Mountains, from Yukon to New Mexico, and the species is found at scattered locations within the Great Basin (Baumann et al. 1977, VanWieren et al. 2001, Stewart and Oswood 2006, DeWalt et al. 2015). It is present in at least 7 high-elevation (>2200 m), cold creeks and springbrooks in northeastern and central Nevada. Most of the 15 total collections from Nevada were of nymphs, which are recognized at the generic level by their curved thoracic gills but cannot be identified to species (Stewart and Kondratieff 2012). Adults have only been found in the upper Jarbidge River of Elko County and the upper McCoy and Timber creeks of White Pine County. An isolated nymphal record of this species from the southern Toiyabe Range needs confirmation with adults. The National Aquatic Monitoring Center (Utah State University, Logan) found *Megarcys* nymphs in 4 high-elevation creeks of Great Basin National Park and one creek in the Schell Creek Range, White Pine County. Additional sampling of high-elevation creeks and springs for isolated and unknown populations is needed in Nevada. These special headwater habitats have been little studied because of their difficult access and remote locations. Sampling of just the lower elevations of mountain creeks will often miss *M. signata*. The Nevada records of this species are significant western range expansions from the Rocky Mountains. Adults are present during June–August.

*Megarcys subtruncata* Hanson, 1942

**Geographic Range.**—Rocky Mountains in Idaho and Montana; Cascade Mountains of British Columbia, Washington, Oregon, and California; northern Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 97.
- **County:** Washoe.
- **Mountain Range:** Carson.
- **Ecoregion:** Sierra Nevada.

**Discussion.**—*Megarcys subtruncata* has a very restricted distribution in western Nevada, being limited to the Sierra Nevada ecoregion around Lake Tahoe. It has been found 15 times at high elevations (>2700 m) of Galena and Third creeks in the Carson Range. Nymphs were numerous in cold headwater springs (3 °C) and also were present as far as 1 km downstream. Nymphs can be identified to generic level, but adults are necessary for species identification (VanWieren et al. 2001, Stewart and Kondratieff 2012). At the headwater springs, adults were difficult to find using standard beating-sheet methods; a more productive method was searching thick mats of streamside vegetation by hand. Adults resided within a few centimeters horizontally and vertically of the water’s edge. Both males and females were micropterous, similar to those reported from central Oregon (Stark and Baumann 2005). Forewings and hindwings of Nevada adults measured less than 2 mm for males and 3 mm for females. Most adults were present during July–August, but emergence may continue at low levels for another 2 months since mature nymphs were found into late October. The Nevada records of *M. subtruncata* lie at the southern limits of its total North American range. The nearest records beyond Nevada are those from Sagehen Creek and Little Truckee River (30 km), Butte County (160 km), and the Mount Lassen region (190 km) of California (Sheldon 1972, Stewart and Kondratieff 2012). This species may exist at other high-elevation springs and springbrooks of the Carson Range. For example, the National Aquatic Monitoring Center (Utah State University, Logan) found a *Megarcys* nymph in a headwater creek from the
northern Carson Range. It is unlikely that *M. subtruncata* exists farther eastward because its preferred high-elevation habitats are absent or scarce for 200 km until higher mountains are reached in central Nevada. The specific identity of *Megarcys* nymphs in the Toiyabe Range of Nevada (presently assumed to be *M. signata*) needs confirmation with adult specimens.

*Oroperla barbara* Needham, 1933

**GEOGRAPHIC RANGE.**—Southern Cascade Mountains of California; Sierra Nevada; western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 98.

**County:** Douglas.

**Major River Valley:** East Fork Carson River south of Gardnerville.

**Ecoregion:** Sierra Nevada, Central Basin and Range.

**DISCUSSION.**—*Oroperla barbara* is known from one location in western Nevada, the East Fork Carson River about 10 km downstream from the California border. A single nymph was collected during an August 1993 sampling of aquatic macroinvertebrates by the U.S. Geological Survey. Nymphs and adults of *O. barbara* are easily recognized by their lateral, fingerlike gills on abdominal segments 1–7, a unique feature among North American stoneflies (Stewart and Stark 2002). This species primarily inhabits medium-sized streams at 600–2200 m elevation in the Cascade Mountains and Sierra Nevada in California, including both western and eastern drainages (Jewett 1966, Sheldon 1972, Siegfried et al. 1977). Most California collections are from western slope streams that flow to the Pacific Ocean, but several eastern slope records exist near Nevada’s border in the Truckee, Carson, and Walker river systems, all of which flow eastward and dissipate in the Great Basin. All 3 rivers may harbor *O. barbara* in extreme western Nevada. The Nevada record increases its known range into the Carson River drainage south of Lake Tahoe. Although primarily a species of the Sierra Nevada ecoregion, in Nevada it occurs at the western edge of the Central Basin and Range ecoregion. Adults of *O. barbara* are seldom abundant, and none have been found in Nevada. Throughout its wider California range, most adults occur in April–May. At low elevations (600 m) they are present as early as late March and at high elevations (>1800 m) as late as early June.

*Perlinodes aureus* (Smith, 1917)

**GEOGRAPHIC RANGE.**—Rocky Mountains from Alberta to Wyoming; Cascade Mountains
of Washington, Oregon, and California; Wallowa Mountains in northeastern Oregon; Sierra Nevada; western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 99.

**County:** Douglas.

**Major River Valley:** East and West Fork Carson River south of Gardnerville.

**Ecoregion:** Sierra Nevada, Central Basin and Range.

**DISCUSSION.**—*Perlinodes aureus* has been collected once in western Nevada, from the East Fork Carson River 8 km downstream of the border. Additionally, it has been found 5 km upstream of the border in the West Fork Carson River in California. The Nevada Division of Environmental Protection, the National Aquatic Monitoring Center, and the U.S. Geological Survey collected *P. aureus* nymphs in a 20-km reach of the East Fork Carson River from the Nevada border downstream to Minden. These records extend the distribution of this species a short distance eastward into the Central Basin and Range ecoregion, though *P. aureus* is primarily found in the Sierra Nevada ecoregion. It may eventually be found in the Truckee and Walker rivers. Nymphs and adults are readily recognized by their unique combination of thoracic gills (Stark and Stewart 1982, Stewart and Stark 2002). Adults have not been collected in Nevada, but in California, Oregon, and Washington they are present during March–May (Stark and Stewart 1982).

*Rickera sorpta* (Needham & Claassen, 1925)

**GEOGRAPHIC RANGE.**—Cascade Mountains of Washington, Oregon, and California; Sierra Nevada; western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 100.

**County:** Douglas, Lyon, and Washoe.

**Mountain Range:** Carson and Sweetwater.

**Ecoregion:** Sierra Nevada; Central Basin and Range.

**DISCUSSION.**—*Rickera sorpta* primarily occurs in Pacific Coast states of North America, but it ranges a short distance into western Nevada and the Great Basin. In Nevada, it has been collected 22 times at 5 creeks of the Carson Range near Lake Tahoe and one creek of the Sweetwater Mountains. All Carson Range records are within the Sierra Nevada ecoregion; the Sweetwater Mountain record lies at the western edge of the Central Basin and Range ecoregion. Because standard beating-sheet methods failed to collect adults, we held mature nymphs in instream growth cages to emergence. Both *R. sorpta* and *Kogotus nonus* inhabit the Carson Range, often in the same creek. Nymphs are easily misidentified since both species have unicuspид lacinia mouthparts and similar body pigment patterns. Adults of the 2 species are distinctly different. Some spatiotemporal overlap exists between the 2 species, but typically *R. sorpta* occurs at lower elevations (1900–2200 m) and emerges during June, 4–6 weeks before *K. nonus*.

*Skwala americana* (Klapálek, 1912)

**GEOGRAPHIC RANGE.**—Yukon; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Canadian Prairies in Saskatchewan and Manitoba; Black Hills in South Dakota; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northeastern Oregon; Sierra Nevada; northern and western Nevada.

**DISTRIBUTION IN NEVADA.**—Map 101.

**County:** Douglas, Elko, Eureka, Humboldt, Lander, Lyon, and Washoe.

**Mountain Range:** Battle, Bull Run, Carson, East Humboldt, Independence,
Jackson, Jarbidge, Ruby, Santa Rosa, Sweetwater, and Wild Horse.

Major River Valley: Humboldt main tributaries, and Carson, Truckee, and Walker.

Ecoregion: Sierra Nevada; Central and Northern Basin and Range.

Discussion.—Skwala americana has a wide distribution in western North America, including parts of the Great Basin (Baumann et al. 1977, DeWalt et al. 2015). It inhabits perennial streams in 2 regions of Nevada: the west central border region north and south of Lake Tahoe and the northern quarter of the state, primarily in Elko and Humboldt counties. In the west, it occurs in the Truckee, Carson, and Walker rivers, and a few smaller streams (Third and Sweetwater creeks). In the north, it is found in many tributaries of the Humboldt River; creeks in the Ruby, Santa Rosa, and Jackson mountains; and the Jarbidge and Owyhee rivers and tributaries. The western and northern groups are separated by a 200-km gap without records in northwestern Nevada, a common pattern for many species of stoneflies. Of 59 Nevada collections of
Skwala americana, most were nymphs and exuviae, and 18 were adults. The western border region of Nevada is a possible overlap zone for S. americana and S. curvata (Sheldon and Jewett 1967, Stark et al. 2008), and adult specimens are needed to separate the 2 species. No confirmed records of S. curvata exist from Nevada, but nymphs and exuviae from the Carson Range (tentatively listed as S. americana) need confirmation with adults. The Nevada Division of Environmental Protection, the National Aquatic Monitoring Center, and the U.S. Geological Survey reported Skwala nymphs in the Truckee River from Verdi to Pyramid Lake, in the Carson River from the western border nearly to Silver Springs, in the Walker River at least 25 km downstream, and in several other western border streams (Bryant, Desert, and Rough creeks). They reported nymphs in many north- and south-flowing large streams along Nevada’s northern border—Kings, Quinn, Owyhee, Bruneau, Jarbridge, Salmon Falls, and Goose. Skwala americana inhabits medium to large streams at mid to low elevations. Adults are present early in the year (February–May).

**PTERONARCYIDAE**

*Pteronarcella badia* (Hagen, 1874)

**Geographic Range.**—Alaska; Yukon and Northwest Territories; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Coast and Cascade mountains of British Columbia and Washington; Canadian Prairies in Saskatchewan and Manitoba; northeastern Oregon; northern half of Nevada.

**Distribution in Nevada.**—Map 102.

- Ecoregion: Central and Northern Basin and Range.

**Discussion.**—The distribution of *Pteronarcella badia* extends for more than 5000 km in western North America, from the Alaska Peninsula to the southern Rocky Mountains (Baumann et al. 1977, Stewart and Stark 2002, DeWalt et al. 2015). In a southwestern extension of this broad distribution, this species ranges across the northern half of Nevada, inhabiting small to medium cool creeks. It becomes less common near Nevada’s western border and is rare in California (Sproul et al. 2015). This species has not been collected south of the Toiyabe and Snake ranges in Nevada. *Pteronarcella* nymphs are readily recognized by their 3 pairs of abdominal gills, but cannot be distinguished to species level; adults are needed for species identification. In this study, 27 of the 63 Nevada records contained adults (11 were adult males). Near Nevada’s western border, *P. badia* may exist in close proximity with *Pteronarcella regularis*, which is known in California at Sagehen Creek, a Truckee River tributary (Sheldon and Jewett 1967). It is unknown whether their ranges overlap in western Nevada. Despite repeated sampling in the Carson Range, *P. badia* has not been found there, though just 20 km east it inhabits the Pine Nut Mountains. Sproul...
et al. (2015) studied the genetic variation of *P. badia* in western North America, including a Nevada population from the North Fork Humboldt River that was placed in its own clade. Male adults are short winged; females are long winged. Adults are present in Nevada during mid-May–early August.

*Pteronarcella regularis* (Hagen, 1874)

**Geographic Range.**—Alaska; Alberta; Coast and Cascade mountains of Washington, Oregon, and California; northeastern Oregon; Sierra Nevada; western Nevada.

**Distribution in Nevada.**—Map 103.
- **County:** Washoe?
- **Major River Valley:** Truckee River?
- **Ecoregion:** Sierra Nevada.

**Discussion.**—Hagen (1874) described *Pteronarcella regularis* from Nevada, but its current status in the state is uncertain because no additional specimens have been found since the original publication. Further, the description was ambiguous about type locality, giving it as "Truckee, Sierra Nevada; Nevada," which can be interpreted as being in either eastern California or western Nevada. In any event, it came from an area close to the California–Nevada border and near the Truckee River. Collector Robert R. Crotch is known to have sampled near Truckee, Lake Tahoe, and Donner Lake in 1873 (Calhoun 2015). Since first being described, this species has been found in the Pacific Northwest, Alaska, and Alberta (Baumann et al. 1977, Stewart and Stark 2002, Stewart and Oswood 2006). Thus, *P. regularis* occurs in Pacific Coast states; *P. badia* occurs inland in the Rocky Mountains and Great Basin. Examples of sympatry between the 2 species are unknown. Sheldon and Jewett (1967) reported *P. regularis* from Sagehen Creek, a Truckee River tributary 20 km west of Nevada’s border. Repeated collecting in the Carson Range and other sites of western Nevada failed to discover this species.
Adults in California, Oregon, and Washington are present in April–June.

*Pteronarcys californica* Newport, 1848

**Geographic Range.**—Alaska; Yukon; Rocky Mountains from British Columbia and Alberta to Arizona and New Mexico; Mexico; Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; northeastern Oregon and southeastern Washington; Sierra Nevada; western and northern Nevada.

**Distribution in Nevada.**—Map 104.

**County:** Douglas and Elko.

**Mountain Range:** Copper, Jarbridge, and Wild Horse.

**Major River Valley:** Bruneau, East Fork Carson, Jarbridge, Marys, and Owyhee.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**Discussion.**—*Pteronarcys californica* has a large North American range that wraps around the western, northern, and eastern borders of Nevada, but it is absent from most of the state (Baumann et al. 1977, Stewart and Stark 2002, Kauwe et al. 2004, DeWalt et al. 2015). In Nevada, this species occurs in 2 widely separated border areas: (1) in the west, it occurs in the East Fork Carson River south of Gardnerville, and (2) in the northeast, it occurs in northward-flowing rivers such as Owyhee, Bruneau, and Jarbridge. Farther inland, it inhabits the upper Marys River of northeastern Nevada (Kauwe et al. 2004), a location suggesting a possible wider distribution in the Humboldt River system. Other
similar low-elevation (<1800 m), large streams that may harbor this species include, in the west, the Truckee, West Fork Carson, and Walker rivers, and, in the northeast, Salmon Falls, Wilson, and Goose creeks. The Nevada records of *P. californica* extend its range eastward from the Sierra Nevada and southwestward from the Rocky Mountains. Kauwe et al. (2004) studied the genetic variation of this species in western North America.
**Pteronarcys californica** is the largest stonefly in Nevada, being 25–30 mm long as adults; females are larger than males. Mature nymphs are recognized by filamentous gills on abdominal segments 1–2 and by sharp pronotal spines. They inhabit low-elevation, large perennial streams. Adults are present in Nevada during June.

**Pteronarcys princeps** Banks, 1907

**Geographic Range.**—Coast and Cascade mountains of British Columbia, Washington, Oregon, and California; southeastern Idaho; northern and western Utah; northeastern California; Sierra Nevada; northern two-thirds of Nevada.

**Distribution in Nevada.**—Map 105.

**County:** Douglas, Elko, Esmeralda, Eureka, Humboldt, Lander, Lyon, Mineral, Nye, Pershing, Washoe, and White Pine.

**Mountain Range:** Battle, Bodie, Carson, Copper, Diamond A, East Humboldt, Humboldt, Independence, Jackson, Jarbidge, Monitor, Pine Forest, Ruby, Santa Rosa, Schell Creek, Shoshone, Snake, Sonoma, Sweetwater, Toiyabe, Toquima, Trout Creek, Wellington, White, and White Pine.

**Ecoregion:** Sierra Nevada; Central and Northern Basin and Range.

**Discussion.**—**Pteronarcys princeps** is widely distributed in mountainous streams across the northern two-thirds of Nevada, including 3 of the state’s 4 ecoregions. This species has been recorded 158 times in the state, mostly as nymphs and 16 times as adults. It is present in at least 25 mountain ranges and 12 counties of Nevada. Typically, it inhabits mid elevation cool creeks (1600–2200 m), but has been found as low as 1400 m and as high as 2700 m. No records exist from the southern parts of the state or the northwest border regions. Repeated sampling in the Carson Range failed to find this species in west-slope creeks flowing to Lake Tahoe, but it did occur in east-slope creeks flowing to the Carson and Washoe valleys. **Pteronarcys princeps** has an expansive range across Nevada and occurs in small to medium creeks, while its congener, *P. californica*, has a limited distribution and occurs in large streams. Both species are present in northward-draining rivers of northeastern Nevada, but usually are separated by elevation—*P. princeps* in upper reaches, *P. californica* in lower reaches. The 2 species are sympatric in the Bruneau and Jarbidge rivers at about 1700–1800 m elevation. Nymphs of *P. princeps* have blunt pronotal projections. Adults are present during May–June.

Stonefly Species with Distributions Close to Nevada

Although this study has nearly doubled the number of species known from Nevada, further sampling will undoubtedly find additional species. Stonefly studies and sampling just beyond Nevada’s western and eastern borders suggest several species that may occur in the state. For example, the Warner Mountains of California, lying 20–30 km west of Nevada’s northwestern border, have at least 2 species unknown from Nevada, *Perlomyia collaris* and *Skwala curvata* (Stark et al. 2008). Likewise, the well-studied Sagehen Creek of California (Sheldon and Jewett 1967, Kondratieff et al. 2010), which is 20 km west of Nevada’s western border, contains Sierra Nevada species that may exist in the Carson Range and...
Truckee River region—*Malenka marionae*, *Skwala curvata*, and *Utacapnia sierra*. The last species has been found in California on the west side of Lake Tahoe in El Dorado County and along the eastern Sierra Nevada in Alpine and Mono counties of California (Nelson and Giuliani 2001). Also near Nevada’s western border, *Malenka biloba* exists in Mono County, California (Myers and Resh 2002) and *Sierracapnia shepardi* is present in the eastern Sierra Nevada (Nelson and Giuliani 2001, Bottonff and Baumann 2015).

Several species also occur near Nevada’s eastern border. About 50 km east of the northeastern border, *Capnia petila*, *Isoperla pinta*, and *Suwallia lineosa* are present in the Raft River Mountains of Utah (Housman and Baumann 1997). About 50 km east of Nevada’s southeastern border, *Taenionema pacificum* inhabits the Pine Valley Mountains of Utah (Call and Baumann 2002) and the Virgin River of northwestern Arizona (Stanger and Baumann 1993). *Taenionema* nymphs have been found in the Virgin River near Bunkerville, Clark County, Nevada. Farther eastward, in the main branches of the Virgin River, *Amphinemura mogollonica*, *Isogenoides zionensis*, and *Utacapnia logana* exist in Washington County of southern Utah (Call and Baumann 2002).

Just as this monograph went to press, an additional stonefly species, *Capnia elongata* Claassen 1924, was found in western Nevada (15 March 2017, East Fork Carson River, SE Gardnerville, Douglas Co., Nevada).

**DISCUSSION**

The reported stonefly collections do much to fill the gap between the Sierra Nevada and the Rocky Mountains and provide a current list of Nevada stoneflies. Earlier conclusions
(Baumann et al. 1977, Nelson 1994) that Great Basin stoneflies are derived primarily from the Rocky Mountains are supported, but a few Sierra–Cascade species penetrate far eastward. However, the restriction of 30% of Nevada stoneflies to the Tahoe–Truckee–Carson–Walker region demonstrates the major environmental obstacle to eastward dispersal that the diverse Sierran fauna confronts at the western margin of the Great Basin. This stonefly pattern is strikingly like the mapped distributions of coniferous trees in Nevada (Charlet 1996). Endemisms, latitudinal zonation, and regional associations (e.g., Humboldt River) all imply that the biogeography of Nevada stoneflies is more complex than a simple, impoverished regional outlier of the Rocky Mountains.

This compilation of Nevada stoneflies is incomplete both geographically and taxonomically (Appendix 4). Although most species were present in multiple collections (Fig. 7), additional species probably are present, even on the better-collected ranges. Several examples illustrate the role of chance in detecting uncommon species. *Capnia sextuberculata* and *Isocapnia hyalita* were each represented by a single female adult in one collection from the remote headwaters of the Jarbidge River (elevation 2680 m). *Malenka depressa* and *Taenioptryx nivalis* were collected from easily overlooked streams or seeps in the Granite and Ruby ranges, respectively. *Capnura venosa* was discovered in an unlikely low-elevation intermittent creek near Smoke Creek Desert. Collections from uncommon habitats or high elevations may detect additional species. In 2012, *Isoperla phalerata* was discovered in 2 roadside streams from the Santa Rosa Range, both frequently sampled since 1977.

Although collection records span Nevada, collecting efforts have been concentrated in the higher ranges, especially those containing National Forest lands. For example, most collectors of Nevada stoneflies have visited scenic and accessible Lamoille Canyon in the Ruby Mountains (Humboldt–Toiyabe National Forest). Water-rich regions such as the Jarbidge, Independence, and Santa Rosa mountains have been sampled repeatedly for stoneflies, but coverage has important seasonal and geographic gaps (Appendix 4).

Lower mountain ranges with small, isolated, or seasonally dry streams have been neglected. Seasonal coverage, especially at less popular localities, should be expanded. Adult stoneflies are present throughout the year at all Nevada latitudes (35°–42° N), although species richness peaks in spring–early summer (Sheldon and Jewett 1967, Judson and Nelson 2011; Fig. 9). Nevada stonefly collections in late summer–autumn are limited, with the consequence, for example, that adult records of *Doroneuria baumanni* and *Kogotus modestus* are few relative to numerous nympha1 records. Collections targeting winter stoneflies (Capniidae, Nemouridae) are surprisingly numerous, but access to collecting sites by vehicle or foot travel is extremely difficult, so many localities remain unvisited during winter. Most stonefly samples have been made during short trips by collectors attempting to maximize numbers of species and locations. Comprehensive data for all streams on a single mountain range or at multiple stations throughout the year on one stream, such as Lamoille Creek, generally are lacking. As illustrated by research on Great Basin butterflies (Fleishman et al. 1997, 2001), such detailed data add new dimensions to species diversity and distributions. Resident citizen scientists could contribute much to the knowledge of Nevada stoneflies by regularly collecting at a few streams through an annual cycle and/or multiple sites along an elevational gradient. Application of molecular assays, such as for mitochondrial DNA, to widespread Great Basin stoneflies could reveal patterns of distribution and history not apparent at the species level. Schultheis et al. (2012) identified 3 clades within *Doroneuria baumanni* and dated their initial divergence to perhaps 500,000 years before present.

Locality records and our annotated species list provide a foundation for continuing research on Plecoptera. These data are also a baseline for monitoring vital stream ecosystems in this complex, dynamic, and arid region.

**Supplementary Material**

One online-only supplementary file accompanies this article (http://scholarsarchive.byu.edu/mwnan/vol10/iss1/1).

**Supplementary Material 1. Nevada Stonefly Database.** Collection data include numbers and life form of specimens, county, locality, mountain range, date, collector, identifier, latitude, and longitude.
ACKNOWLEDGMENTS

The following individuals helped us in a variety of ways as we worked on this study for some 50-plus years, and their help is much appreciated. Many were collectors, others provided technical help, some allowed access to their property, and others gave much needed encouragement that helped make this monograph a reality. It should be noted that a number of early biologists made major contributions to the knowledge of the stonefly fauna of Nevada, and it is appropriate that they be recognized here.

Gary Acordagoitia, JBR Environmental Consultants, Elko, Nevada
Brandon Albrecht, BIO-WEST Inc., Logan, Utah
Charles P. Alexander, Department of Entomology, University of Massachusetts, Amherst, Massachusetts
Richard K. Allen, California State University, Los Angeles, California
Cheryl Barr, University of California, Berkeley, California
Jeff Baumann, Santequin, Utah
Robert Bechtel, Survey and Systematic Entomologist, Nevada Department of Agriculture, Reno, Nevada
Tim Bertram, Bureau of Land Management, Ely, Nevada
Bottle Creek Ranch, Humboldt County, Nevada
Loren Bottorff, Cameron Park, California
James Brooks, Kent State University, Stark Campus, Canton, Ohio
Sarah Bullock, Desert National Wildlife Range, Las Vegas, Nevada
Ron Call, Rexburg, Idaho
Mary Cather, University of Utah, Salt Lake City, Utah
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Ralph Cutter, California School of Fly Fishing, Nevada City, California
Charles Daugherty, Victoria University, Wellington, New Zealand
Donald Denning, Moraga, California
Marianne Denton, Nevada Division of Environmental Protection, Carson City, Nevada
Ed DeWalt, Prairie Research Institute, Illinois Natural History Survey, Champaign, Illinois
Keith Dobry, Canoga Park, California
Jason Eckberg, Southern Nevada Water Authority, Las Vegas, Nevada
George Edmunds Jr., University of Utah, Salt Lake City, Utah
Harold Fairfield, Ash Meadows National Wildlife Refuge, Amargosa Valley, Nevada
Erica Fleishman, University of California, Davis, California
Oliver Flint Jr., United States National Museum, Smithsonian Institution, Washington, DC
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Evan Hornig, Seattle, Washington
Richard Houseman, University of Missouri, Columbia, Missouri
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Adam Huillet, Marysville, Washington
Craig Huish, Orem, Utah
Bret Huntsman, American Fork, Utah
Kim Huntzinger, Bayer Bee Care Center, Raleigh, North Carolina
Ronald Huntzinger, Lindon, Utah
Helen Jacob, Department of Biology, Perth University, Australia
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Joe Jarvis, JBR Environmental Consultants, Cedar City, Utah
Stanley Jewett Jr., U.S. Bureau of Commercial Fisheries, Portland, Oregon
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Katherine Kaiser, Lehman Caves National Monument, Baker, Nevada
Corey Kallstrom, U.S. Fish and Wildlife Service, Las Vegas, Nevada
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Boris Kondratieff, Colorado State University, Fort Collins, Colorado
Ira La Rivers, University of Nevada, Reno, Nevada
Jean Stanger-Leavitt, Lincoln, Nebraska
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Ken and Phyllis Merrill, Rescue, California
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Tsawhawbits Ranch Bed and Breakfast, Jarbidge, Nevada.
Chet Van Dellen, Nevada Department of Wildlife, Reno, Nevada
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Gary Vinyard, University of Nevada, Reno, Nevada
Samuel Wells, Cedar City, Utah
Michael Whiting, Department of Biology, Brigham Young University, Provo, Utah
Cliff “Bud” Williams, Gerlach, Nevada
Robert Winget, Center For Health and Environmental Studies, Brigham Young University, Provo, Utah
Bob Wiseman, Aquatic Biology Associates, Corvallis, Oregon
John Zenger, Department of Biology, Brigham Young University–Idaho, Rexburg, Idaho

Special thanks are given to the following student assistants who typed and organized the lengthy list of stonefly species that we found to occur in Nevada as part of this study: Laura Burwell, Kendra Ducan, and McKenzie Giles. These data are presented as an interactive Microsoft Excel spreadsheet that is Appendix 6.

We appreciate the comments of 2 reviewers and their improvements to the monograph. The initial work of ALS in Nevada was supported by the Penrose Fund of the American Philosophical Society.

Finally we give special thanks to family members for allowing us to continue this project over so many years. RWB thanks his wife Myrna for her understanding of many late nights and extended field trips. ALS is grateful to Susan Sheldon and Linda Sheldon who were supportive of long absences in the Great Basin. RLB thanks Loren Bottorff for joining some Nevada expeditions, providing important backup support for SPOT locator data, and helping to refine stonefly photographic methods.

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APPENDIX I. Nevada Mountain Ranges. Carson Range (11), Desatoya Mountains (14), Granite Range (1), Independence Mountains (8), Jackson Mountains (4), Jarbridge Mountains (9), Kawich Range (23), Monitor Range (18), Pine Forest Range (3), Pine Nut Mountains (12), Quinn Canyon Range (24), Roberts Mountains (19), Ruby Mountains (10), Santa Rosa Range (5), Schell Creek Range (20), Selenite Range (2), Shoshone Range (15), Snake Range (21), Sonoma Range (6), Spring Mountains (26), Tobin Range (7), Toiyabe Range (16), Toquima Range (17), Wasuk Range (13), White Mountains (22), and Wilson Creek Range (25). Non-Nevada Mountains Ranges: Deep Creek Range, Utah (29), Raft River Range, Utah (28), Sierra Nevada, California (30), and Warner Mountains, California (27). Base map used with permission. Copyright © 2016 Esri. All rights reserved.
APPENDIX 2. Nevada Streams and Lakes. Bruneau River (5), Carson River (19), Colorado River (26), Duck Creek (22), Goose Creek (8), Humboldt River (10), Jarbidge River (6), Kings River (2), Lake Tahoe (18), Lamoille Creek (15), Little Humboldt River (9), Huntington Creek (14), Marys River (12), Meadow Valley Wash (24), North Fork Humboldt River (11), Owyhee River (4), Pyramid Lake (16), Quinn River (1), Reese River (13) Salmon Falls Creek (7), South Fork Owyhee River (3), Truckee River (17), Virgin River (25), Walker Lake (21), Walker River (20), and White River (23). Solid blue lines indicate perennial streams; dashed blue lines indicate intermittent streams. Base map used with permission. Copyright © 2016 Esri. All rights reserved.
APPENDIX 3. Nevada’s 17 Counties. Prior to 1969, the region shown as the municipality of Carson City was known as Ormsby County. Base map used with permission. Copyright © 2016 Esri. All rights reserved.
APPENDIX 4. Stonefly-rich and unsampled areas of Nevada.

Six of Nevada’s 17 counties (Douglas, Elko, Humboldt, northern Nye, Washoe, and White Pine) accounted for 82% of the total 3531 stonefly records in this study, although they made up only 56% of the state’s total area (Table 2). This discrepancy shows that many stonefly-rich and productive mountain streams occur in these counties. In contrast, 6 counties (Clark, Churchill, Lincoln, Mineral, Pershing, and southern Nye) were underrepresented in stonefly records based on their surface area. Regional dryness, limited number of high-elevation mountains, and (for some) restricted access and little sampling caused stonefly records to be scarce in these counties. Following, we summarizes areas of Nevada that are known to be stonefly-rich and those that need to be explored.

Carson City

Stoneflies are common in both west- and east-slope creeks of the Carson Range, and nymphs (but no adults) have been collected in the main Carson River. The Pine Nut Mountains east of Carson City are unsampled, including Brunswick and El Dorado canyons.

Churchill County

The entire county is little studied, but in the east stoneflies exist in small creeks on the west slope of the Desatoya Mountains and in at least a few creeks of the Clan Alpine Mountains. The western half of Churchill County appears to lack stoneflies, being composed of low-elevation hills, farmlands, Naval Air Station Fallon, saline playas, and Carson Sink wetlands. The Stillwater Range has potential for stoneflies because of its high-elevation peaks but is unsampled.

Clark County

Stoneflies are known from some springs and short reaches of flowing creeks in the Spring Mountains, but much of this high range remains unsampled during winter and spring when stonefly adults are most likely to be present. The western slope of the Spring Mountains needs further study. One stonefly species has been found at the Virgin River near Mesquite, though a more diverse fauna may exist since Taenionema nymphs have been found there. Biologists have surveyed the aquatic fauna of a few perennial streams and many springs of Clark County, though beyond the Spring Mountains, stoneflies were absent (e.g., Muddy River, Moapa Valley National Wildlife Refuge, Ash Meadows National Wildlife Refuge, Corn Creek, Arrow Canyon, Meadow Valley Wash, Lake Mead National Recreation Area, and Blue Point and Rogers springs). Much of Clark County is dry and at low elevation, making perennial running waters scarce; any discoveries of stoneflies from this region would be of major interest. A few mountain ranges that may have perennial springs and small creeks with stoneflies include the Sheep, Virgin, McCullough, El Dorado, Muddy, and Newberry mountains. Northwestern Clark County has restricted access. A few stoneflies have been reported from the lower Colorado River downstream of Hoover Dam (Moffett 1942), but it is unknown if they still persist there.

Douglas County

Stonefly-rich streams exist in the southern Carson Range near Lake Tahoe. Stoneflies also occur in several large streams that flow from eastern California into Nevada, including the East and West Fork Carson rivers, West Fork Walker River, and Bryant and Desert creeks. Nymphs have been reported in the main Carson River downstream of Minden. In eastern Douglas County, the Pine Nut Mountains, which rise to over 2800 m elevation, are unsampled, except for 2 sites with stoneflies at Pine Nut Creek. The small creeks and springs in Spring Gulch between the Pine Nut and Buckskin ranges are unsampled.

Elko County

Stonefly-rich streams exist in the Bull Run, Independence, East Humboldt, Jarbidge, Snowstorm, and Ruby mountains. Lamoille Creek, at all elevations, is one of the most accessible and collected sites in the Ruby Mountains and Nevada. Stoneflies are also present in several large intermountain streams: Bruneau, Jarbidge, Owyhee, Salmon Falls, upper Humboldt and major tributaries (Marys, Maggie, Susie, and Huntington creeks and North and South Humboldt rivers). Headwaters of Marys River are poorly sampled but warrant attention as possible stonefly entry points to the Humboldt system from external drainages (Bruneau, Jarbidge, and Salmon...
Falls). Unsampled areas include all mountain ranges between the Ruby Mountains and Utah border, northern Tuscarora Mountains, Pinon Range, and extreme northwestern and northeastern corners of the county. South and east of Midas, Antelope, Rock, and Willow creeks are unsampled. Because stoneflies sometimes occur in lakes, especially at high elevation or latitude, the numerous alpine lakes of the Ruby Mountains should be explored.

Esmeralda County

Creeks on the east slope of the White Mountains have a diverse and abundant stonefly fauna, but the remainder of the county is unsampled. Much of Esmeralda County is dry and at low elevations, making stonefly streams rare. Yet, further exploration may be warranted in the Silver Peak Range, Palmetto Mountains, Sylvania Mountains, and Lone Mountain since most rise to about 2700 m
elevation. These mountains seem to lack well-defined flowing creeks, but perennial springs and canyons with short reaches of flowing water should be checked.

Eureka County

Stonfly streams exist in the Roberts, southern Tuscarora, southern Diamond, and northern Monitor mountains, though the fauna appears to have low diversity and the latter 2 mountain ranges have been little sampled. Several species of stoneflies also exist in the Humboldt River and its tributary, Maggie Creek, and in Trout Creek of the Pinon Range. Unsampled areas include Sulphur Springs, Simpson Park, Mountain Boy, and Fish Creek ranges, many of these rising to 2700 m elevation, and Pine Creek and most streams flowing westward from the Pinon Range.

Humboldt County

Stonfly-rich streams exist in the Santa Rosa, Pine Forest, Jackson, Summit Lake, and northern Sonoma mountains. Stonflies are present also in some streams and springs of Sheldon National Wildlife Refuge and at one site of the Humboldt River. Areas with little or no sampling include several mountain ranges (Bilk Creek, Black Rock, Calico, Trout Creek, Osgood, Montana, and Double H) and rivers (Kings, Quinn, and North and South Fork Little Humboldt). High-elevation streams and springs in the Pine Forest Range are unsampled.

Lander County

Stonfly-rich streams exist in the Battle, northern Shoshone, central Toiyabe, Fish Creek, and eastern Desatoya mountains. A few species of stoneflies also occur in the Humboldt River between Battle Mountain and Argenta. Unsampled areas include northern Toiyabe, most of Fish Creek, Simpson Park (Steiner and Dry creeks), central and southern Shoshone, east slope New Pass, and northern Toquima mountains. Rock Creek, in northeastern Lander County, is unsampled.

Lincoln County

Lincoln county is unsampled for stoneflies, except for 5 sites: Beaver Dam Wash, Craw and Wilson creeks in the Wilson Creek Range, and 2 locations of Meadow Valley Wash (northeast of Panaca and southwest of Caliente). Even at these locations, the stonfly fauna is poorly known beyond that of 1 or 2 species.
Lincoln County has many mountain ranges that need study, including the southern Quinn Canyon, southern Egan, southern Schell Creek, Wilson Creek, Fortification, White Rock, Highland, Delmar, and Clover mountains. In general, these mountains have lower elevations and lack the easily identifiable creeks common in high ranges of central and northern Nevada. Many mountain ranges in Lincoln County have maximum elevations <2400 m, but a few rise to >2700 m. Southwestern Lincoln County has restricted access. Hiko and Ash springs have been sampled but lacked stoneflies. Except for 2 sites, Meadow Valley Wash—the main internountain stream of the region—is unsampled for stoneflies; its headwater regions near Spring Valley State Park and Camp Valley Creek northeast of Pioche appear to have suitable running waters.

Lyon County

Stoneflies are present in the Pine Grove and Wellington hills in the southern regions of this county, though suitable running waters are small and uncommon, except for larger Desert Creek. They also are present in the

Trout Creek, Shoshone Range, Lander Co., Nevada. Site with Triznaka sheldoni.

Fish Creek, Fish Creek Mountains, Lander Co., Nevada. Site with Isoperla quinquepunctata.

North Fork Mill Creek, Shoshone Range, Lander Co., Nevada. Site with Triznaka sheldoni.
Sweetwater Mountains near Nevada’s western border. Stoneflies occur in the East and West Fork Walker River from the border downstream to Yerington, but the lower river is unsampled. The northern half of Lyon County is little studied, including the northern Pine Nut Mountains and lower Carson River (reports exist of stonefly nymphs in the river south of Silver Springs).

Mineral County

Stoneflies exist in Bodie and Rough creeks, both originating in the Bodie Hills of California and flowing east into Nevada. Stoneflies also occur in the prominent Wassuk Range at Cottonwood Creek and Sorhouet Springs, but other likely locations include Cat and Rose creeks and Lapon Meadows. The U.S. Army reopened public access (by permit) to parts of the Wassuk Range in 2015. The remainder of the county is unsampled. Though much of the county is dry and at low elevation, several mountain ranges may harbor stoneflies, including the Pilot, Excelsior, and northern White mountains. All have peaks that reach 2700 m or more. Reportedly, Telephone Canyon in the Pilot Mountains east of Mina has flowing water. The Walker River between Weber Reservoir and Walker Lake is unsampled.

Nye County

Stoneflies are present in northern Nye County, including the southern Toiyabe, Toquima, Monitor, and White Pine (Currant Creek) mountain ranges. In addition, a few stonefly records exist from the Quinn Canyon and Grant ranges, but both are largely unsampled even though they have peaks that rise above 3000 m elevation. Other unsampled areas in northern Nye County include Antelope, Hot Creek, and southern Shoshone and Monitor ranges. The White River, which traverses northeastern Nye County and has both flowing and dry reaches, is uninvestigated, as are Sunnyside Creek and several large perennial springs. No stoneflies have ever been reported from central and southern Nye County at latitudes 36°N to 38°N, in part because much of this area has restricted access. Part of the Kawich Range lies north of the restricted area and deserves further study, as does the northern tip of the Spring Mountains.
Stewart Creek, Toiyabe Range, Nye Co., Nevada. Site with Capnia uintahi and Kogotus modestus.
Pershing County

Stonfly-rich streams exist in the eastern half of the county in the Humboldt, southwestern Sonoma, and Tobin mountains, though the latter has been sampled at just 2 sites. The East and northern Stillwater ranges are unsampled. The lower Humboldt River appears to lack stoneflies, except for a single site upstream of Rye Patch Reservoir. The western half of the county is unsampled, except for one location with stoneflies in the Selenite Range. The western region has several mountain ranges at low-medium elevations (<2600 m) that need to be checked for stoneflies—Blue Wing, Eugene, Sahwave, Selenite, Seven Troughs, and Trinity mountains. In these mountains, creeks with good perennial flows are not obvious from searching topographic maps or Google Earth images, but springs are present. These ranges, and the Jackson Mountains in Humboldt County, are significant because they are in a region that was once a large island in Pleistocene Lake Lahontan. Schultheis et al. (2012) identified a unique clade of *Doroneuria baumanni* from the Jackson Mountains, and other ranges may harbor differentiated populations that evolved in isolation on this island.
Storey County

This small county has been poorly studied, though stoneflies exist in short reaches of Cedar Hill Canyon and Long Valley creeks. The Virginia and Flowery ranges need further sampling, as does the Truckee River. No stonefly adults have been collected in the lower Truckee River between Sparks and Wadsworth even though nymphs of at least three taxa (*Claassenia*, *Cultus*, and *Skwala*) have been reported.

Washoe County

Stoneflies are common in the northern Carson Range and Truckee River. Though stonefly nymphs are present in the Truckee River from Verdi to Pyramid Lake, adults have not been collected below Reno. In northern Washoe County, stoneflies are known from the Granite and Hays Canyon ranges, a few sites in Sheldon National Wildlife Refuge, and Buffalo and Smoke creeks. Areas with no sampling include the Virginia Mountains and Range; Buffalo,
Fox, and Pah Rah mountains; and the extreme northwestern region.

**White Pine County**

Most stonefly records in this county are from numerous creeks in 2 high, water-rich mountain ranges, the Snake and northern Schell Creek. The stonefly fauna of Great Basin National Park is reasonably well known because of several BioBlitz surveys done since 2009 and regular monitoring by the National Aquatic Monitoring Center (Utah State University, Logan, UT). Beyond these well-sampled areas, a few stonefly records exist from the little studied Cherry Creek, east-slope Diamond, Egan, White Pine, and southern Schell Creek mountain ranges. Unsampled areas in the northeast include the Antelope, Kern, and South mountains; unstudied areas in the northwest include Butte, southern Ruby, and northern Egan mountains. Although some of these mountain ranges rise to >2700 m elevation, perennial flowing waters are scarce. Unsampled intermountain streams include the north-flowing Huntington and Duck creeks (and inflowing springs) and south-flowing White River.
**APPENDIX 5. Distribution Maps for Nevada’s 104 Stonefly Species.**

Except for the first species map, which is on this page and covers a larger geographic area, all other maps are presented 4 per page. The larger first map provides context to important physiographic and ecological features located adjacent to Nevada’s western and eastern borders (i.e., the Sierra Nevada and Great Salt Lake Desert, respectively). These broader geographic areas were cropped from all remaining maps to make the maps as large as possible while conserving page space.

In addition to the 104 species maps, Appendix 5 includes a distribution map for unidentified *Malenka* nymphs and females (Map 34). These collection records lacked the male adults needed for precise species identification. Nevertheless, we present this map as an incentive to future collectors to investigate these sites and determine species presence.

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**Arsapnia decepta**

Arsapnia tumida


Arsapnia utahensis


Capnia coloradensis

Map 4. Page 32.

Capnia confusa

Map 5. Page 32.
Capnia glabra  
Map 6. Page 32.

Capnia gracilaria  
Map 7. Page 33.

Capnia laeustra  

Capnia scobina  
Capnia sextuberculata

Capnia uintahi

Capnia vernalis

Capnura intermontana

Map 10. Page 34.

Map 11. Page 34.

Map 12. Page 34.

Map 13. Page 35.
Mesocapnia frisoni

Sierracapnia barberi

Sierracapnia hornigi

Sierracapnia mono


Sierracapnia washoe

Utacapnia lemoniana

Utacapnia tahoensis

Despaxia augusta
Moselia zonata

Paraleuctra occidentalis

Paraleuctra vershipa

Malenka californica


Map 27. Page 42.

Map 28. Page 43.

Map 29. Page 44.
Malenka coloradensis

Map 30. Page 44.

Malenka depressa

Map 31. Page 44.

Malenka murvoshi

Map 32. Page 45.

Malenka tina

Map 33. Page 45.
Podmosta decepta

Map 35. Page 45.

Podmosta delicatula

Map 36. Page 46.

Prostoia besametsa

Map 37. Page 46.
Soyedina nevadensis

Visoka cataractae

Zapada cinctipes

Zapada columbiana
Zapada frigida

Map 42. Page 49.

Zapada haysi

Map 43. Page 49.

Zapada oregonensis

Map 44. Page 50.

Doddsia occidentalis

Map 45. Page 50.
**Taeniopteryx nivalis**

Map 49. Page 53.

**Taenionema kincaidi**

Map 46. Page 51.

**Taenionema pallidum**

Map 47. Page 52.

**Taenionema uinta**

Map 48. Page 52.

**Taeniopteryx nivalis**

Map 49. Page 53.
Alloperla chandleri

Map 50. Page 53.

Alloperla delicata

Map 51. Page 53.

Alloperla thalia

Map 52. Page 54.

Haploperla chilnualna

Map 53. Page 54.
Kathroperla perdita

Paraperla frontalis

Plumiperla diversa

Plumiperla spinosa

Map 54. Page 55.

Map 55. Page 55.

Map 56. Page 56.

Map 57. Page 56.
Suwallia pallidula

Map 58. Page 57.

Suwallia starki

Map 59. Page 58.

Suwallia sublimis

Map 60. Page 58.

Sweltsa borealis

Map 61. Page 59.
Sweltsa coloradensis

Sweltsa lamba

Sweltsa pacifica

Sweltsa resima
Sweltsa townesi

Triznaka pintada

Triznaka sheldoni

Triznaka signata
Utaperla sopladora

Map 70. Page 64.

Sierraperla cora

Map 71. Page 65.

Soliperla thyra

Map 72. Page 66.

Yoraperla nigrisoma

Map 73. Page 66.
Acroneuria abnormis

Calineuria californica

Claassenia sabulosa

Doroneuria baumannii
**Hesperoperla pacifica**

Map 78. Page 69.

**Cascadoperla trictura**

Map 79. Page 71.

**Cultus aestivalis**

Map 80. Page 71.

**Cultus pilatus**

Map 81. Page 72.
**Cultus tostonus**

Map 82. Page 72.

**Diura knowltoni**

Map 83. Page 73.

**Frisonia picticeps**

Map 84. Page 73.

**Isogenoides elongatus**

Map 85. Page 74.
Isoperla fulva

Map 86. Page 75.

Isoperla marmorata

Map 87. Page 75.

Isoperla mormona

Map 88. Page 76.

Isoperla petersoni

Map 89. Page 76.
Isoperla phalerata

Isoperla quinquepunctata

Isoperla sobria

Isoperla sordida

Map 90. Page 77.

Map 91. Page 77.

Map 92. Page 78.

Map 93. Page 79.
Kogotus modestus
Map 94. Page 79.

Kogotus nonus
Map 95. Page 80.

Megarcys signata
Map 96. Page 81.

Megarcys subtruncata
Map 97. Page 81.
Oroperla barbara

Perlinodes aureus

Rickera sorpta

Skwala americana
Pteronarcys princeps

Map 105. Page 89.

Pteronarcella badia

Map 102. Page 85.

Pteronarcella regularis

Map 103. Page 86.

Pteronarcys californica

Map 104. Page 87.

Pteronarcys princeps

Map 105. Page 89.
APPENDIX 6. Nevada Stonefly Database. All collection records from this study are compiled in the Nevada Stonefly Database, which is archived and accessible at http://scholarsarchive.byu.edu/mwnan/vol10/iss1/1. The database is organized alphabetically by stonefly family, genus, and species. Collection data include numbers and life form of specimens, county, locality, mountain range, date, collector, identifier, latitude, and longitude. A brief example of the database is given to illustrate its information and layout.

NEVADA STONEFLY DATABASE EXAMPLE

Archived and accessible at http://scholarsarchive.byu.edu/mwnan/vol10/iss1/1

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