THE BEE FAUNA OF THE HORSE MOUTAIN AND GROUSE MOUNTAIN REGION, HUMBOLDT COUNTY, CALIFORNIA

By

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A Thesis Presented to

The Faculty of Humboldt State University

In Partial Fulfillment of the Requirements for the Degree

Master of Science in Biology

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May 2017

ABSTRACT

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Recent concerns about the ecological well-being of bee communities in California and elsewhere have increased the need for monitoring programs and studies that evaluate the impact of habitat loss and alteration on bee diversity and abundance. Such studies depend critically on the expertise of people trained in taxonomy, but their numbers have declined in recent years. My primary goal was to gain a comprehensive first-hand experience with bee identification by documenting the fauna of a previously unstudied area in the mountains of northwestern California and by writing an identification key, intended for dedicated non-specialists, to the area's 35 species of the genus *Andrena*. I used a combination of aerial netting (103 hours) and pan-trapping (138 hours) to sample the bee communities at 29 sites along a 15.4 km road transect in the Horse and Grouse Mountain region of Humboldt County, California, at elevations ranging from 1200-1600 m, during the summer of 2013. The total area of my survey plots was 17.6 hectares. My collection of 3,643 specimens revealed a fauna of 229 species, 20% of which were unidentified morphospecies, distributed across 39 genera and five of the six North American bee families. About half of the identified species were new records for

Humboldt County based on previous taxonomic treatments. The fauna was dominated by *Andrena, Lasioglossum,* and *Osmia,* which together accounted for about half of the specimens and 15%, 14%, and 18% of the species, respectively. About half of the specimens were collected on flowers; the most important floral host was Asteraceae. With 229 species, the Horse and Grouse Mountain region supports about 12% of the bee species known for California and 6% of the species in the United States. This estimate may be too high given the large number of morphospecies (mostly *Lasioglossum*), but it suggests that the area may be worthy of special conservation concern. My annotated checklist sets a baseline for future surveys of the fauna and should be useful to ecologists and land managers. Also, my user-friendly key to *Andrena,* as yet untested on comparative novices, should make it easier to identify some of the most abundant flower visitors in the area.

ACKNOWLEDGEMENTS

First and foremost, I'd like to express my sincerest gratitude to my advisor, Dr. Michael Mesler, for the opportunity to pursue my love of taxonomy, for sharing your love for bees with us students, and for your patience with this fledgling scientist. I am also grateful to my committee Dr. Erik Jules and Dr. Mihai Tomescu for their support and inspiration; a special mention to Dr. Robbin Thorp for his wisdom, guidance and help with identifying my *Melissodes* and problematic *Andrena*.

I would like to thank the following individuals and institutions for their assistance with this project: Corey Andrikopoulus, Steve Stohlman, Tyler Lloyd, and Courtney Melody, the "beeple" who spent many hours with me out in the field collecting specimens; Terry Griswold for identifying my *Osmia* and *Stelis*; Emily Bzdyck for her help with *Litomegachile*; Jason Gibbs for his helpful suggestions regarding *Dialictus* and *Evylaeus*; Lewis McCrigler for making the metal pan-trap stakes; Robin Bencie and the Humboldt State University Herbarium for helping me identify my plants; the U.C. Davis Bohart Museum in Davis, California and the USDA Pollinating Insect-Biology, Management, Systematics Research unit in Logan, Utah for allowing me access to their reference collections; and to Kipp Pow, Sydney Carothers, Laura Julian, Byron Love, and Jim Cane for their time and resources.

I want to say thank you to my family and friends for their undying love and support throughout this journey. My love for you all reaches beyond the stars. Mom and

Dad, you are the reason I am here; you are the light in my life. My dearest friend and brother, Avery Louis, you pointed me on this journey and have been by my side the entire way. “Thank you” doesn’t begin to cover it. Haleigh Reyes, my amazing niece, you inspire me to be a better human and stronger woman. To my dear friends and fellow grad students Kim McFarland, Jane Monroe, and Elizabeth Wu, thank you for your aid in navigating this peculiar world of graduate school and for letting me love your pets as if they were my own. I’d also like to thank The Trashcan Sinatras and The Divine Comedy, whose music kept me calm and focused, and Chris Hardwick, without whom I wouldn’t have survived seven seasons of The Walking Dead.

DEDICATION

This thesis is dedicated to the memory of my grandparents Socorro and Alfredo Magdaleno, Isabel and Adrian Lopez, and Mary and Louis Miranda.

“The Road goes ever on and on
Down from the door where it began.
Now far ahead the Road has gone,
And I must follow, if I can,
Pursuing it with eager feet,
Until it joins some larger way
Where many paths and errands meet.
And whither then? I cannot say”
— J.R.R. Tolkien, The Fellowship of the Ring

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INTRODUCTION

Approximately 87.5% of the world's plants are pollinated by animals (Ollerton et al. 2011). The most important are bees, pollinating over 95% of the insect-pollinated plants in California (Moldenke 1976). There are over 20,000 bee species worldwide and approximately 4,000 species in the United States. The bee fauna of California is especially rich, with more than one-third of the total USA species count (Michener 2007). This richness is likely related to the variety of floral resources (Ornduff et al. 2003) and habitats that characterize the state (Moldenke 1976, Michener 1979), which together provide abundant food sources and nesting opportunities for bees. For example, the diverse habitats of Pinnacle National Monument (PNM) in California host 398 bee species in just 64.1 km^2. In sharp contrast, only 365 species are known for all of New England, an area 2500 times larger than PNM (Messinger and Griswold 2003). Unfortunately, bee populations in California and elsewhere appear to be in decline due to a variety of threats, such as habitat fragmentation, climate change, introduction of parasites, grazing, pesticides, and agricultural intensification (Potts et al. 2010, Burkle and Alarcón 2011). The potential loss of species that provide such important ecosystem services has increased the need for monitoring programs and ecological studies that analyze the impact of habitat alteration and loss.

Such studies depend critically on the expertise of people trained in taxonomy. Nevertheless, in spite of the growing need for species-level identification, the number of people who can provide this service has diminished over the last few decades and

relatively few young scientists are becoming museum taxonomists (FAO 2008). Funding agencies are less apt to support basic surveys of bee faunas in favor of ecological or agricultural studies, and peer-reviewed journals seldom consider publishing papers that are soley species lists (de Carvalho et al. 2007, Wilson et al. 2010). Young university taxonomists with expertise in species identification are often hired to perform other duties as their main responsibility (Hoagland 1996, Pearson et al. 2011). In short, there are too many bees to identify and not enough qualified people to do the job.

Aside from the shortage of taxonomists, the fundamental problem is that identification of bees to species is not a trivial task. It requires considerable training and experience, and is generally not realistic for field workers with a primary interest in ecology and conservation biology. By contrast, plant species identification is accessible to a wider range of biologists. As an illustration of this point, consider that bee taxonomists are often gratefully cited in the acknowledgments sections of journal articles, or are commonly included as junior authors. By contrast, plant taxonomists are seldom acknowledged in these ways.

Bee species identification is difficult for several reasons. First, the distinction between related species can be subtle and based on a suite of microscopic features that can vary within and among populations and gender. This variation presents a challenge both for writers and users of identification keys. Second, keys to the species of many genera are either quite old or do not exist. In some cases, they do not permit identification of both males and females. Third, regional keys to bee species are uncommon (compared

to the case for plants), which substantially increases the challenge of arriving at a correct identification. Furthermore, very few available keys are written for non-specialists. The bottom line is identification of bee species is not for the faint of heart – it takes dedication, experience, and the willingness to combine hours at the dissection scope with hours out in the field. An important consequence of the significant challenges of bee identification is there are still areas in California and across the nation whose bee faunas are poorly known.

The primary objectives of my study were to gain a comprehensive first-hand experience with bee identification and document the fauna of an understudied region. Specific goals were to (1) produce an annotated catalogue of the bee species found in the Horse and Grouse Mountain region of Humboldt County and (2) test the feasibility of writing a more user-friendly local key. I chose the Horse and Grouse Mountain region of Humboldt due to its assorted habitats with the potential to support a diverse bee fauna (M. Mesler, personal communication) and because little is known about the bee communities of the montane areas of northwestern California. For my local key, I focused on *Andrena*, a large and species-rich genus, because members are common flower visitors in our local mountains and a key would be beneficial to ecologists, agriculturists, and land managers.

METHODS

Study Region

The Horse Mountain and Grouse Mountain region (HGMR) lies on both public land (Six Rivers National Forest) and private land at the junction of the Coast Ranges and Klamath Mountains in the eastern part of Humboldt County (Figure 1). The geological history of these two mountain systems created a composite of parent rock materials that support a variety of vegetation types, both on serpentine and non-serpentine substrates, including wet meadows, montane chaparral, and mixed evergreen forests (Moldenke 1976, Ornduff et al. 2003). Over 500 plant species occur in the area (Witte-Scott 2010). Anthropogenic activities such as mining, logging, grazing, road building, and prescribed and natural fires add to the heterogeneity of this landscape.

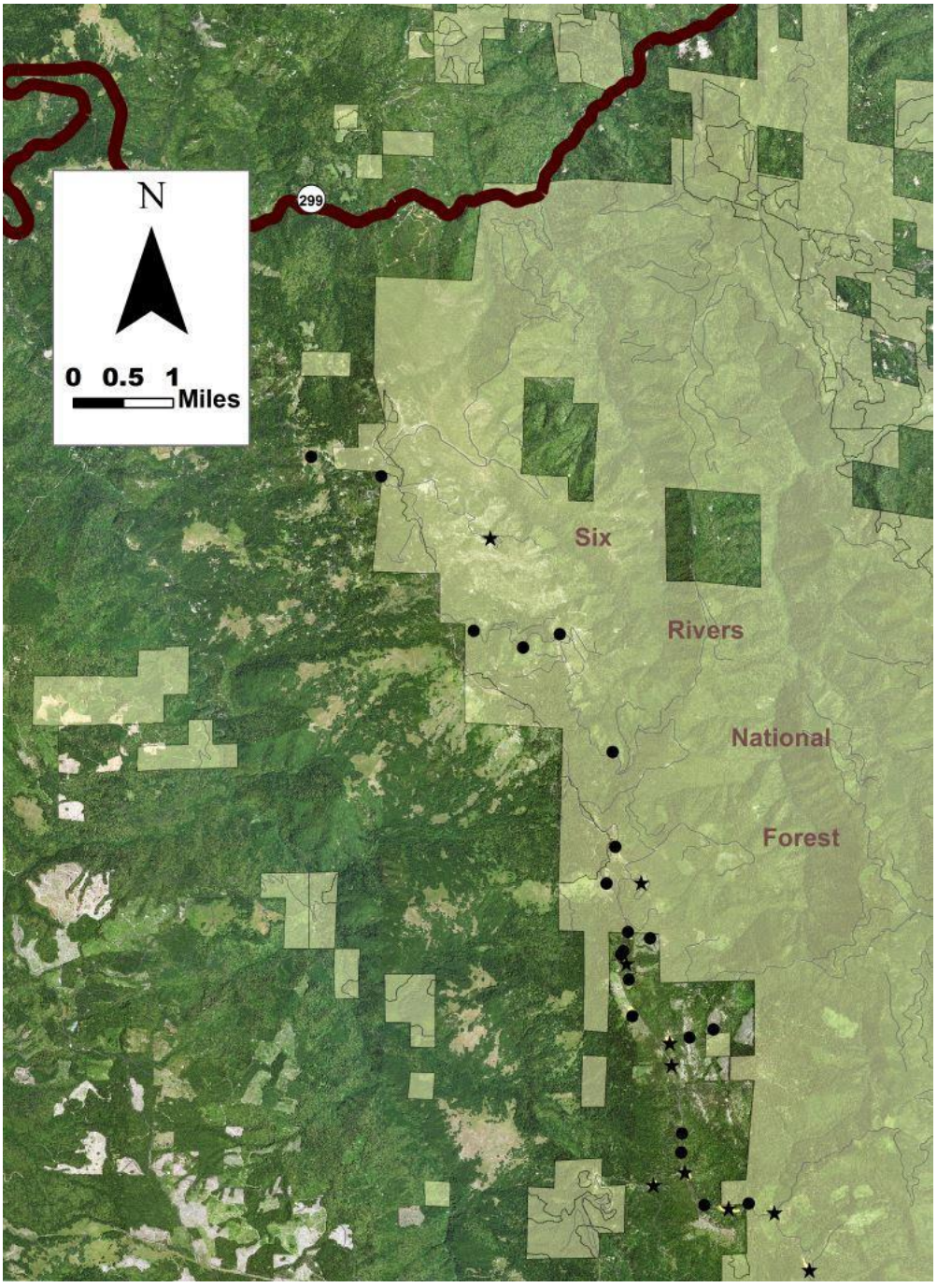

Figure 1. Map of study sites in Horse and Grouse Mountain region (HGMR). Stars indicate pre-determined (PD) sites; circles opportunistic (OPP) sites.

Study Sites

I sampled 29 sites over 26 days from May through August 2013. The majority of the sites were along Forest Service Road 1, traversing the length of the study region from north to south (Table 1). The distance between the northern- and southern-most sites was 15.4 km. Individual sites ranged in area from 0.008 ha to 3.093 ha and in elevation from 1216 m to 1624 m. The total area surveyed was approximately 17.6 ha. There were two types of sites: pre-determined (PD) and opportunistic (OPP). PD sites were chosen, in advance, to have abundant floral resources and to represent a range of vegetation types. I made a total of 49 visits to 11 PD sites. Each site was sampled more than once, but some were sampled several times if flowering continued to attract bees (Table 1). This approach was consistent with my goal of maximizing the number of species collected.

By contrast, OPP sites were chosen throughout the season as promising patches of flowers appeared along survey routes. OPP sites were generally smaller and more ephemeral than PD sites. Most OPP sites were sampled once and on the same day PD sites were sampled. I made a total of 21 visits to 18 OPP sites.

Table 1: Study sites names, abbreviations, coordinates, elevation in meters, area in hectares, total number of specimens collected at site (n), total number of species (morphospecies in parentheses), and total hours caught hand-netting (H) and pan-trapping (P). Coordinates are in Universal Transverse Mercator, North American Datum 1983, Zone 10N (UTM NAD83 Zone 10N). Site abbreviations in parentheses signify OPP site. Locality information was lost for six specimens; the site name for these is listed as Unknown.

Site Name	Abbreviation	UTM E	UTM N	Elev.	Area	n	Species		H	P
Allium Meadow	(AM)	441782	4516632	1562	0.1488	3	3		0.5	0
Andrena Nests	(AN)	441859	4516940	1573	0.0443	5	4		0.5	0
Ammon Road Clear Cut	(ARCC)	443237	4515369	1515	0.2765	23	14	(1)	1	0
Ammon Road Roadside	(ARR)	442851	4515237	1535	0.0396	5	4		1	0
Angelica Slope	(AS)	440756	4521738	1283	0.0668	5	6		0.75	0
Buckwheat/Chicory Patch	(BCP)	441611	4519843	1269	0.0688	13	12	(1)	0.75	0
Buck Flat Clear Cut	(BFCC)	441932	4515582	1590	2.2884	21	14	(1)	1.75	0
Chicory Roadside Opp	(CRO)	436749	4524601	1216	0.0103	7	7		0.5	0
Friday Ridge Opp	(FRO)	441509	4517723	1589	0.0869	11	6	(1)	1	0
Grouse Mtn Roadside Opp	(GMRO)	443807	4512559	1530	0.0081	8	8		0.5	0
Lily Meadow	(LM)	443089	4512536	1595	0.3679	41	8	(2)	1	0
Mud Lake Clear Cut	(MLCC)	442214	4516839	1523	0.3155	30	17	(1)	1	0
Mud Lake Roadside opp	(MLRO)	441744	4516573	1545	0.1350	27	19	(1)	0.5	0
Phacelia Slope	(PS)	437878	4524289	1405	0.0980	8	7		2	0

Site Name	Abbreviation	UTM E	UTM N	Elev.	Area	n	Species		H	P
Waterfall	(WF)	440166	4521527	1296	0.0387	7	6		0.75	0
Water Hole	(WH)	439370	4521796	1348	0.0123	10	8		0.75	0
Weedy Penstemon Patch	(WPP)	442716	4513383	1610	0.0750	35	18	(2)	1	0
White Rock Opp	(WRO)	441654	4518312	1598	0.0919	15	9		2	0
6N08D	6N08D	442071	4517728	1505	0.9768	370	92	(13)	11.5	24
Ammon Road Meadow	ARM	442534	4515147	1564	1.7819	321	69	(16)	2	6
Collinsia Meadow	CM	442269	4512855	1485	1.3677	179	38	(11)	5	12
Diadasia Nest Site	DNS	444222	4512407	1490	0.5561	376	96	(18)	13.5	12
Grouse Mtn Meadow	GMM	443483	4512480	1550	3.0928	839	130	(24)	13.5	24
Grouse Mtn Serpentine	GMS	444786	4511485	1380	1.4766	410	78	(14)	13.5	24
Horse Mtn Mine	HMM	439639	4523291	1251	0.2522	68	20	(1)	7	6
Horkelia Roadside	HR	442562	4514789	1590	0.2235	175	5	(6)	3.25	6
Incense Cedar Meadow	ICM	442729	4513685	1592	0.2206	138	35	(11)	2	6
Mud Lake	ML	441835	4516428	1580	1.7725	216	58	(8)	9.5	6
Titlow Field	TF	442775	4513064	1624	1.6516	271	63	(15)	5	12
Unknown	Unk					6	4	(3)		

Sampling Methods

PD sites were sampled using a combination of hand-netting and pan-trapping; OPP sites were hand-netted only. General hand-netting and pan-trapping methods followed the protocol of LeBuhn et al (2003). Hand-netting at PD sites was done for two one-hour periods at each site: in the morning (between 9 am and 12 pm) and in the afternoon (between 12 pm and 3 pm). OPP sites were hand-netted for 30-60 minutes, once a day, and between the regular one-hour netting periods and deployment/collection of pan-traps at PD sites. With the exception of some honeybees and bumblebees, all bees observed during survey periods were hand-netted then transferred to stackable plastic tackle jars for temporary storage in a freezer before pinning. For specimens collected on flowers, I identified the plant at least to family, with most identified to genus or species. Behavior on flowers (e.g., collecting pollen, consuming nectar) was not recorded. Honeybees and *Bombus vosnesenskii*, the yellow-faced bumblebee, were not collected but recorded as present at a site as these were easy to identify in the field. Other bumblebees were collected for voucher specimens from some sites. Although honeybees and bumblebees were not actively collected, some were caught in pan-traps or hand-netted accidentally. The annotated catalogue documents only the records of specimens collected.

I set out pan-traps at most of the PD sites in plots ranging from 0.25 ha to 1.75 ha (Table 1). Fifteen pan-traps were placed approximately five meters apart along a diagonal

transect bisecting the plot. Traps were 3.25 oz plastic soufflé cups filled with a solution of 1 tsp of liquid Seventh Generation: Free and Clear© dish soap to 1 gal of water. One-third of the traps were painted fluorescent blue, one-third fluorescent yellow, and one-third plain white, the recommended colors for bee traps (LeBuhn et al. 2003). Colors were positioned in alternating fashion along the transect. I deployed traps before 9 am and collected them after 3 pm. Initially, pan-traps were set on the ground but as vegetation cover increased later in the season, I used metal stakes to raise the traps off the ground and be more visible (Figure 2). Specimens were removed from traps and stored in 70% ethyl alcohol in Whirl-Pak© bags until processed.

Figure 2. Pan-trap held above vegetation by metal stake.

Processing and Identification

In addition to pinning, specimens were manipulated to make identification easier. In general, legs were repositioned allowing for examination of leg traits and ventral thoracic features, and the genitalia and sterna of males were exposed. Other important, group-specific identification features were prepared as appropriate (e.g., the mandibles of Megachilidae spread; the hypostomal area for *Osmia* and the pronotal area of *Andrena* made visible). Hand-netted specimens were processed within 48 hours of collection. Pan-trapped specimens remained stored in ethyl alcohol-filled bags until washed and dried per the protocol (Droege 2012) before being processed and pinned.

I used Michener (2007) and Michener et al. (1994) to identify specimens to genus and subgenus, and used species keys in the appropriate revision or monograph for each genus or subgenus, if available (sources are listed by family in Appendix C). For difficult or unrevised genera (*Andrena*, *Melissodes*, *Osmia*, *Stelis*, and *Lasioglossum*), I compared specimens to museum collections and/or consulted with experienced bee taxonomists. I visited the Bohart Museum at UC Davis under the guidance of Robbin Thorp for help with *Andrena* and *Melissodes* and for *Osmia* and *Stelis*, I visited Terry Griswold at the USDA Bee Biology and Systematics Laboratory in Logan, UT. They are credited in the annotated catalogue (Appendix A) under the species they identified.

In cases where reliable species identification was not possible, specimens were either assigned an “affinity” or grouped into morphospecies. Affinity status indicates a

likely but tentative identification based on similarity to an established species. They are labeled with "aff.", e.g *Stelis* aff. *interrupta*. All affinity entries are counted in the total species number. Other troublesome specimens were grouped into morphospecies. Since males and females of a given bee species can differ strongly, I was not able to match conspecific male and female morphospecies and thus listed sexes independently in the annotated catalogue. Members of the *Lasioglossum* subgenera *Dialictus* and *Evylaeus* were especially difficult to sort into morphospecies. I relied mostly on morphological characteristics (Table 2) suggested by Jason Gibbs (personal communication) to establish morphospecies.

Table 2. Characters and contrasting states useful for determining morphospecies for *Lasioglossum* subgenera *Dialictus* and *Evylaeus* (Jason Gibbs, personal communication).

Character	State 1	State 2
Integument	metallic	black
Head	long	short
Tegulae	large and punctate	small and impunctate
Scutum Punctures	dense	sparse
Pleural Punctures	smooth and punctate	coarse and punctures present but obscured by surface sculpturing
Hair on Abdomen	present	absent

I adopted a conservative approach for determining the number of morphospecies to include in the total species count for my study region. Since males and females are listed separately in the annotated catalogue (Appendix A), simply totaling the number of morphospecies listed would overestimate the species diversity. Instead, for genera with

more than two morphospecies for each sex, I used the greater number of the two. For example, there are three female morphospecies and 10 male morphospecies in *Nomada*. I used 10 to represent the total *Nomada* morphospecies instead of 13. I excluded morphospecies of three genera (*Andrena*, *Megachile*, and *Panurginus*) from my total species count all together. All three *Andrena* morphospecies are represented by a single specimen and may represent variants of identified species. *Megachile* (*Megachiloides*) *sp.* are almost certainly undescribed males of *Megachile pseudonigra* as they were caught at the same sites as the females, did not key out using the species key, and no additional *Megachiloides* species were identified. *Panurginus* was more challenging. I was able to assign male specimens of *Panurginus* to two species, *P*. aff. *atriceps* and *P*. aff. *nigrihirtus*, based on comparisons to reference specimens in the Bohart Museum, Davis. However, the female specimens of *Panurginus* were too difficult to separate into species or morphospecies and are listed in the annotated catalogue as *Panurginus spp*. This morphospecies group likely comprises the female counterparts to *atriceps* and *nigrihirtus* so I, therefore, excluded them from the species count.

Key to female *Andrena*

The key (Appendix B) is limited to female species of *Andrena* collected during my survey, as well as two species (*A. auricoma* and *A. nigrihirta*) collected earlier by M. Mesler in the same area. I excluded all three morphospecies (*Andrena* (*Andrena*) *spp*., *Andrena* (*Melandrena*) *spp*., and *Andrena* (*Scaphandrena*) *spp*.) and one affinity species (*Andrena* aff. *ferrugineipes*) as they were represented by only one specimen and appeared to be unusual variants of identified species (R. Thorp, personal communication). A key for males was not attempted because male *Andrena* are difficult to distinguish, and I did not collect enough representatives for each species.

The key is intended for non-specialists with basic knowledge of bee morphology. Terminology largely follows Michener (2007), but when possible I used simple accessible language to describe traits. A glossary with images is provided to aid with difficult *Andrena*-specific distinctions like the difference between complete and incomplete propodeal corbiculae. The design of the key is based on my own comparisons of the species and couplets taken from previously published keys (Appendix C: Key References). The early couplets use traits that are relatively easy to evaluate (e.g., the number of submarginal cells, the ornamentation of the propodeal triangle), and in most cases couplets include more than one trait. Given the relatively small number of species in my study area (37), I was able to use obvious traits, like clypeal color, that are not efficient in keys for larger groups.

Determining Range Extensions and New County Records

Determining range extensions and new county records was challenging because not all literature sources provide precise locality information. For example, some treatments simply give “California” as the geographical range for a particular species and others provide ambiguous maps. Thus, my assessments of range extensions and new county records are limited to a subset of the species, and are likely to be conservative. I considered a species’ range extended if it had been previously recorded no closer than northern Oregon to the north, the Great Basin to the east, or the San Francisco Bay Area to the south.

RESULTS AND DISCUSSION

I collected 3,643 specimens during 103 hours of hand-netting and 138 hours of pan-trapping. There were 229 species total, including 178 identified species, 45 morphospecies and six species assigned affinity status ("aff."), distributed among 39 genera and five of the six North American bee families (Appendix A; Table 3). More specimens were hand-netted (61%) than pan-trapped, and females (78%) were caught more frequently than males. The top ten most collected species accounted for a quarter of the entire set of specimens (Figure 3) with *Agapostemon texanus* the most common species. Nearly a third (32%) of the species were represented by one or two specimens; 26% of these were morphospecies. Only one non-native species, *Apis mellifera*, was found.

Table 3. Total number of species (n) in each genus, arranged by family (morphospecies in parentheses).

Family/Genus	n	
ANDRENIDAE		
Andrena	35	
Calliopsis	2	
Panurginus	2	
Perdita	1	
TOTAL	40	
APIDAE		
Anthophora	4	
Apis	1	
Bombus	9	
Ceratina	3	
Diadasia	3	
Epeolus	1	
Eucera	3	
Habropoda	1	
Melecta	1	
Melissodes	4	
Neopasites	1	
Nomada	19	(10)
Oreopasites	1	
Triepeolus	1	
Xeromelecta	1	
Xylocopa	1	
TOTAL	54	

Family/Genus	n	
COLLETIDAE		
Colletes	3	
Hylaeus	4	
TOTAL	7	
HALICTIDAE		
Agapostemon	1	
Dufourea	3	(1)
Halictus	4	
Lasioglossum	33	(24)
Sphecodes	4	(3)
TOTAL	45	
MEGACHILIDAE		
Anthidiellum	1	
Anthidium	6	
Ashmeadiella	1	
Atoposmia	2	
Chelostoma	1	
Coelioxys	4	
Dianthidium	4	
Heriades	1	
Hoplitis	3	
Megachile	11	
Osmia	41	(3)
Stelis	8	(4)
TOTAL	83	

Figure 3. Ranked abundance of top ten most commonly collected bee species. All *Lasioglossum* morphospecies are females. (*D.*) = *Dialictus* subgenus.

The bee fauna of HGMR constituted 12% of the extant species of California and about 6% of the contiguous United States. There were 98 new county species records and 15 range extensions. It is difficult to determine if the fauna of HGMR is remarkable given the limited documentation of species for the mountains of northwestern California. The only available species studies for NW CA are Humboldt State University theses based on the coastal dunes, a single habitat (Gordon 1984, Julian 2012, Nyoka 2004). The nearest study in montane California occurred in Pinnacles National Park in southern California and yielded nearly 400 species (Messinger and Griswold 2003). Larger faunal lists are expected at lower latitudes than HGMR since bees prefer drier climates.

Patterns of abundance and diversity. Halictidae, Apidae, Andrenidae, and Megachildae were almost equally abundant comprising 26%, 25%, 24% and 23% of collected specimens, respectively. However, Megachilidae was the most diverse family with 36% of the species (Table 3). Apidae, Halictidae and Andrenidae were roughly equal with 24%, 20%, and 17% of the diversity, respectively. Colletidae represented 2% of the total collection and comprised only 3% of the diversity. Three genera, *Osmia*, *Andrena,* and *Lasioglossum*, together accounted for 53% of the collection and almost half of the diversity (47%). *Andrena* was the most abundant genus representing 19% of the collection. *Lasioglossum* and *Osmia* were nearly equal in abundance with 17% and 16%, respectively. The most diverse genus was *Osmia* with 18% of the diversity followed by *Andrena* (15%) and *Lasioglossum* (14%).

Honeybees and bumblebees were not actively collected. However, some specimens were caught and documented in the annotated catalogue. The abundance of honeybees and bumblebees is likely greater than what is recorded given the low amount of specimens collected. Honeybees and *Bombus vosnesenskii* were observed at all sites on every day. *B. vosnesenskii* is the most abundant species in the region but was not included in the top ten commonly collected species (Figure 3) because not all observed individuals were collected; most were collected in pan-traps. Half of the specimens comprising the top ten abundant species (Figure 3) were caught in pan-traps. More than half of *Agapostemon texanus* and the three *Lasioglossum* morphospecies were collected in pan-traps.

The number of specimens and species varied across sites (Figure 4). In general, bee abundance, number of specimens, and species diversity increased with sampling efforts at PD sites (Table 1). The most intensively sampled site, Grouse Mountain Meadow (GMM), yielded 23% of the specimens and over half (57%) of the species diversity, 22 of which were unique to the site. The high yield at this site is probably due to a diverse array of microsites, which supported flowering across the season and provided a wide range of nesting substrates. Ammon Road Meadow (ARM) was sampled only once but had roughly the same abundance and diversity as sites sampled two (6N08D) or four times (DNS and GMS) (Figure 4).

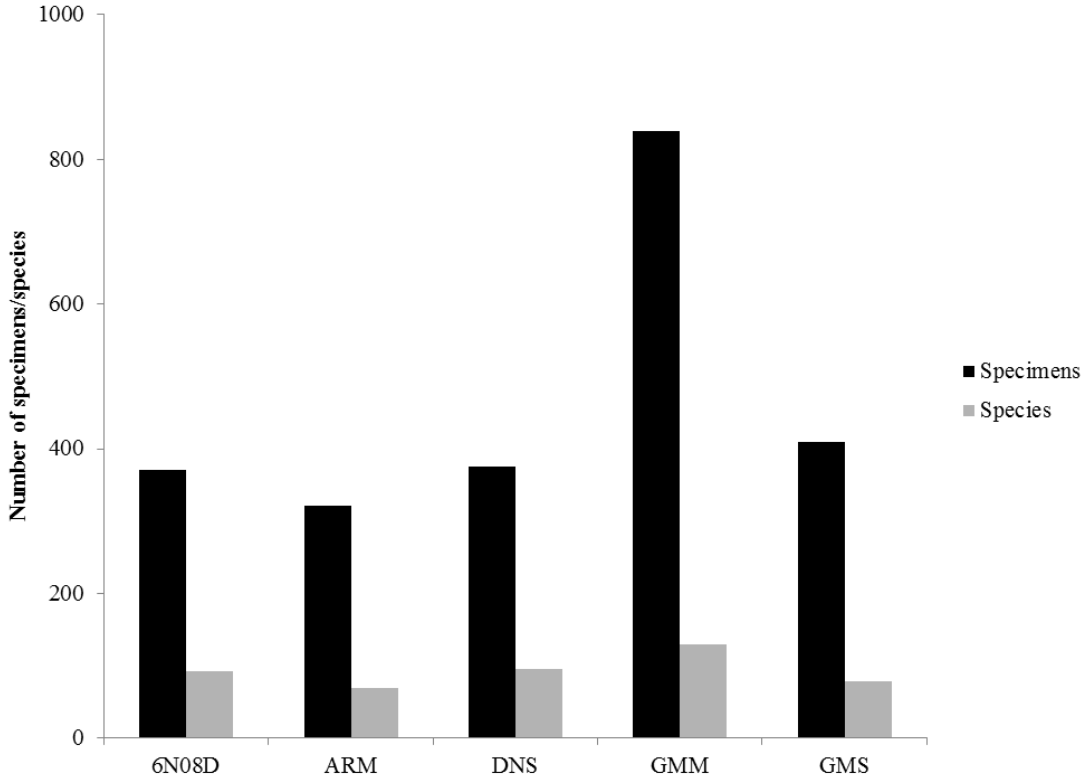

Figure 4. Comparison of five sites yielding the highest number of specimens (black bars) and number of species (grey bars).

The majority of specimens (60%) were collected in June (Figure 5). Four of the five families peaked in June. However, in July, Apidae and Megachilidae remained active but Andrenidae and Halictidae activity dropped (Figure 5). *Lasioglossum* and *Osmia* were mostly active May through July with activity peaking in June; August yielded only a handful of specimens. *Andrena* were active throughout the season but were considerably more active in May and June. Colletidae activity peaked in July with no specimens collected in May.

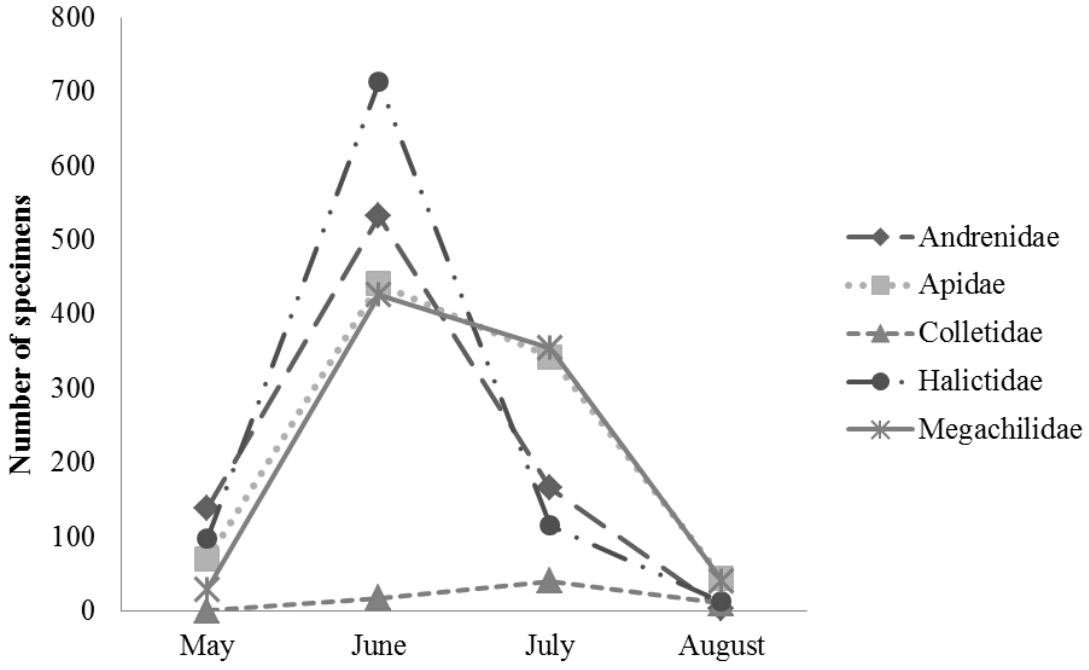

Figure 5. Comparison of number of specimens collected in each family by month.

Biology. I determined floral preference and nesting behavior from published and unpublished data (Appendix A). "Oligolecty" is used broadly and includes species with a "preference for" a plant or group of plants. Cleptoparasites in three families and 11 genera accounted for less than a quarter of the bee species (19%) with more than half (63%) in the Apidae. *Nomada* was the most diverse genus accounting for 44% of the parasitic fauna. The rest of the non-cleptoparasitic species (81%) are pollen-collectors. Ground-nesters constituted 62% of the pollen-collecting species with *Andrena* and *Lasioglossum* comprising most of the diversity with 30% and 28% of the species, respectively. Cavity-nesters make up roughly a third (34%) of the species, most of which are in the family Megachilidae (84%). *Osmia* accounted for 70% of the megachilid cavity-nesters. Six species of Megachilidae did not fit into either category of ground- or cavity-nesters. *Anthidium utahense, Dianthidium ulkei ulkei* and *Megachile montivaga* are ground and cavity nesters (Gonzalez and Griswold 2013, Grigarick and Stange 1968, Sheffield et al. 2011). *Dianthidium singulare* and *Anthidiellum notatum* attach their nests externally to the sides of rocks or vegetation (Grigarick and Stange 1968, Michener 2007). *Dianthidium pudicum pudicum* nests have been discovered attached to rocks but also in shallow cavities in both rocks and vegetation (Grigarick and Stange 1968).

Over half of the specimens were collected on a total of 73 plant species in 28 families. Almost a quarter of the specimens were collected on seven families: Asteraceae (18%), Rosaceae (12%), Boraginaceae (11%), Plantaginaceae (10%), Polygonaceae (9%), Apiaceae (9%), and Ericaceae (5%). Most of the identified pollen-collecting

species were polylectic with roughly a quarter (26%) oligolectic. Over a quarter (28%) of the oligolectic bees are specialists on Asteraceae. *Eriogonum nudum* and *Phacelia* attracted the most diversity with 39 species each (17% of species). Six species are oligolectic on *Phacelia* with one species, *Calliopsis xenus,* a monolect (Rozen 1958); no species are known oligolects of *E. nudum*. Only two of the most abundant bee species (Figure 3) are oligolectic: *Andrena melanochroa* on *Potentilla* and *Fragaria* (Ribble 1968), and *Diadasia nigrifrons* on *Sidalceae* (Mesler, personal communication; Sipes and Brooks, unpublished; Adlahka 1969, Sipes and Tepedino 2005).

Most hand-netted specimens were collected on plants or flying but a few specimens were caught emerging from possible nests (Appendix A). Two species collected from ground nests are apparently new records. In 2015, students from Humboldt State University dug up *Dianthidium subparvum* ground nests at DNS and determined they are constructed with tree resin mixed with bits of incense cedar needles, serpentine soil and pebbles (Kipp Pow, personal communication). *Osmia sedula* is a member of the *odontogaster* species group in *Melanosmia*, a group recognized for its ground-nesting habits (Rightmyer et al. 2013). Ground-nesting is not novel for the group but my observations may be the first record for *O. sedula*.

Key. Creating a key to *Andrena* for non-specialists (Appendix B) was an effective means of obtaining first-hand experience with bee taxonomy and enhanced my understanding of the genus, but was challenging. Describing features to non-taxonomists is difficult because some delineating traits are obvious and simple, like clypeal color, but

other are subtle and intangible. For example, one trait used to distinguish species *A. angustitarsata* and *A. orthocapri* is obvious, the distance between the lateral ocelli and vertex is either less than or more than one ocellar diameter, and the other is subtle, sutures delimiting the propodeal triangle are either weak or strong. Misidentification can occur if the key user does not have prior knowledge of the difference between "weak" and "strong" sutures. Another challenge with writing a key is only having a few specimens for some of the species because traits can vary significantly between conspecifics and similarities can occur in species whose distributions overlap.

Conclusion. This research has exposed me to the substantial challenges of applying and creating successful identification tools, meticulously examining and comparing taxa, and has contributed to our understanding of the bee fauna of the mountains in Humboldt County. Two of the largest and most diverse genera, *Lasioglossum* and *Osmia*, required the aid of other bee taxonomists because of the lack of published records and revisions, and further provided evidence that not only Humboldt County, but most of the northwestern region of the United States, are woefully understudied. Both genera are currently under revision but given the immense diversity in each genus, it could be years before anything is published. Until they are, it is still important for "mere" taxonomic studies to be conducted in undocumented regions in order to establish a baseline. The ground work laid by faunistic studies provides vital information to land managers and aids in conservation and restoration efforts.

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APPENDICES

Appendix A. Annotated catologue of bee species of the Horse Mountain and Grouse Mountain Region, Humboldt County, California.

Species in the following annotated catalogue are listed taxonomically based on Michener (2007). Species names in **bold** indicate range extensions; an asterisk (*) indicates a new record for Humboldt County.

Key to the checklist: (1) Genus (Subgenus) species (2) Author (3) Sex: total number of females (♀) and males (♂) collected. (4) Months collected. If months are connected by a dash, then bees were collected for the entire span. (5) Sites: total number of females (♀) and males (♂) collected at each site. Sites in parentheses are OPP sites. (6) Floral Records: number of females (♀) and males (♂) collected on each plant. (7) Pan-trapped: females (♀) and males (♂) collected by pan-trap.

FAMILY ANDRENIDAE

Subfamily Andreninae

1. *Andrena* (*Andrena*) aff. *thaspii* Graenicher, 1903 – Sex: 1♂; May; Sites: (WRO) 1♂ Notes: Identified by R. Thorp.
2. *Andrena* (*A.*) *ceanothifloris cretata* LaBerge, 1980* – Sex: 2♀; June; Sites: 6N08D 1♀, (ARCC) 1♀; Floral Records: *Arctostaphylos spp.* 1♀, *Ceanothus spp.* 1♀
3. *Andrena* (*Andrena*) *hemileuca* Viereck, 1904 – Sex: 1♀; June; Sites: GMM 1♀; Floral Records: *Ribes sanguineum* 1♀

Notes: Oligolectic on *Ribes* (LaBerge 1980).

4. *Andrena* (*A.*) *rufosignata* Cockerell, 1902* – Sex: 7♀; May-June; Sites: DNS 2♀, GMM 5♀; Floral Records: *Prunus emarginata var. emarginata* 1♀, *Ribes binominatum* 1♀, *Ribes sanguineum* 2♀
5. *Andrena* (*A.*) *saccata* Viereck, 1904 – Sex: 16♀; May-July; Sites: 6N08D 1♀, DNS 1♀, GMM 9♀, GMS 4♀, ML 1♀; Floral Records: *Ceanothus spp.* 1♀, *Eriogonum nudum* 2♀, *Phacelia procera* 1♀, *Phacelia spp.* 4♀, *Prunus emarginata var. emarginata* 1♀, *Rosa gymnocarpa* 3♀, *Rosa nutkana* 1♀, *Sanicula tuberosa* 1♀; Pan-trapped: 1♀
6. *Andrena* (*A.*) *washingtoni* Cockerell, 1901* – Sex: 3♀; June-July; Sites: GMM 1♀, GMS 1♀, ML 1♀; Floral Records: *Potentilla spp.* 2♀, *Rosa nutkana* 1♀
7. *Andrena* (*A.*) *spp.* Fabricius – Sex: 1♀; June; Sites: GMM 1♀
8. *Andrena* (*Dasyandrena*) *obscuripostica* Viereck, 1916* – Sex: 2♀ 5♂; May; Sites: DNS 2♀ 5♂; Floral Records: *Arctostaphylos spp.* 2♀ 4♂

   Notes: Females identified with help from R. Thorp. Oligolectic on *Arctostaphylos* (LaBerge 1977).
9. *Andrena* (*Derandrena*) *vandykei* Cockerell, 1936* – Sex: 2♀; June; Sites: DNS 1♀, GMS 1♀; Floral Records: *Arctostaphylos spp.* 1♀; Pan-trapped: 1♀
10. *Andrena* (*Diandrena*) *chalybioides* (Viereck, 1904) – Sex: 23♀ 36♂; May-July; Sites: ARM 5♀ 1♂, CM 1♂, DNS 1♀ 13♂, GMM 7♀ 1♂, HR 4♀ 7♂, ICM 5♀ 4♂, ML 1♀, TF 9♂; Floral Records: *Agoseris grandiflora* 2♂, *Agoseris heterophylla* 6♀,

Hemizonella minima 1♂, *Ranunculus occidentalis* 1♂, *Wyethia spp.* 1♀, Other Asteraceae 3♀; Pan-trapped: 10♀ 30♂

Notes: Oligolectic on *Agoseris* (Thorp 1969).

11. *Andrena* (*D.*) *cuneilabris* Viereck, 1926 – Sex: 26♀ 3♂; May-June; Sites: ARM 3♀, CM 8♀, GMM 6♀ 2♂, HR 2♀, ICM 1♀, ML 5♀, TF 1♀ 1♂; Floral Records: *Hemizonella minima* 1♀, *Horkelia spp.* 1♀, *Nemophila menziesii* 2♀, *Ranunculus occidentalis* 12♀; Pan-trapped: 5♀ 3♂

    Notes: Oligolectic on *Ranunculus* (Thorp 1969).

12. *Andrena* (*Euandrena*) *caerulea* Smith, 1879 – Sex: 42♀ 6♂; May-June; Sites: 6N08D 1♀, ARM 14♀, (AN) 1♂, CM 9♀ 1♂, DNS 1♀ 1♂, GMM 1♂, HR 7♀ 1♂, ICM 4♀, (LM) 1♂, ML 5♀, TF 1♀; Floral Records: *Hemizonella minima* 1♀, *Ranunculus occidentalis* 31♀ 2♂; Pan-trapped: 9♀ 2♂

    Notes: Preference for *Ranunculus* (LaBerge and Ribble 1975).

13. *Andrena* (*E.*) *chlorura* Cockerell, 1916 – Sex: 1♀; May; Sites: DNS 1♀; Floral Records: *Arctostaphylos spp.* 1♀

14. *Andrena* (*E.*) *nigrocaerulea* Cockerell, 1897 – Sex: 41♀ 2♂; May-June; Sites: 6N08D 1♀, ARM 1♀, CM 3♀, DNS 1♀, GMM 5♀, HR 8♀ 1♂, ICM 3♀ 1♂, (MLRO) 1♀, TF 18♀; Floral Records: *Calochortus tolmiei* 2♀, *Calyptridium monospermum* 14♀ 1♂, *Horkelia tridentata flavescens* 3♀ 1♂, *Horkelia spp.* 4♀, *Nemophila menziesii* 2♀, *Potentilla spp.* 1♀, *Ranunculus occidentalis* 1♀, *Sanicula tuberosa* 1♀; Pan-trapped: 13♀

15. *Andrena* (*Leucandrena*) *barbilabris* (Kirby, 1802) – Sex: 4♀; June; Sites: ARM 1♀, HR 1♀, GMM 1♀, TF 1♀; Floral Records: *Horkelia tridentata ssp. flavescens* 1♀; Pan-trapped: 3♀
16. *Andrena* (*Melandrena*) *cerasifolii* Cockerell, 1896 – Sex: 1♂; May; Sites: DNS 1♂
17. *Andrena* (*M.*) *nivalis* Smith, 1853 – Sex: 1♀; May; Sites: HR 1♀; Floral Records: *Horkelia tridentata ssp. flavescens* 1♀
18. *Andrena* (*M.*) *transnigra* Viereck, 1904* – Sex: 31♀ 10♂; May-June; Sites: ARM 3♀, (AN) 4♂, CM 1♀, DNS 2♀ 3♂, GMM 14♀ 2♂, HR 2♀, ICM 6♀, ML 1♀, TF 1♀, (WRO) 1♀ 1♂; Floral Records: *Arctostaphylos spp.* 1♀, *Calyptridium monospermum* 5♀, *Collinsia grandiflora* 1♀, *Eriogonum nudum* 1♀, *Horkelia tridentata ssp. flavescens* 2♀, *Horkelia spp.* 2♀, *Prunus emarginata var. emarginata* 1♀, *Sanicula tuberosa* 6♀, *Trifolium longipes* 1♀
19. *Andrena* (*M.*) *spp.* Perez – Sex: 1♀; May; Sites: GMM 1♀
20. *Andrena* (*Micandrena*) *melanochroa* Cockerell, 1898* – Sex: 71♀ 10♂; May-June; Sites: ARM 12♀, CM 1♂, DNS 9♀ 3♂, GMM 26♀ 2♂, GMS 1♀, HR 6♀ 4♂, ICM 1♀, ML 6♀, (MLRO) 3♀, TF 7♀; Floral Records: *Achillea millefolium* 1♀, *Arctostaphylos spp.* 1♀, *Ceanothus spp.* 1♀, *Horkelia tridentata ssp. flavescens* 12♀, *Horkelia spp.* 1♀ 2♂, *Lomatium spp.* 1♂, *Phacelia spp.* 1♀ 1♂, *Potentilla spp.* 30♀, *Prunus emarginata var. emarginata* 1♀, *Ranunculus occidentalis* 2♀, *Ribes sanguineum* 1♂, *Sanicula tuberosa* 11♀ 2♂; Pan-trapped: 10♀ 1♂

    Notes: Preference for *Potentilla* and *Fragaria* (Ribble 1968).

21. *Andrena* (*M.*) *microchlora* Cockerell, 1922* – Sex: 35♀; May-June; Sites: ARM 3♀, GMM 5♀, HR 6♀, ICM 3♀, (LM) 9♀, TF 9♀; Floral Records: *Hemizonella minima* 1♀, *Lomatium spp.* 6♀, *Sanicula tuberosa* 24♀; Pan-trapped: 3♀

    Notes: Preference for Apiaceae (Ribble 1968).

22. *Andrena* (*Nemandrena*) *torulosa* LaBerge, 1971 – Sex: 56♀ 1♂; May-June; Sites: CM 53♀, GMM 1♂, HR 3♀; Floral Records: *Nemophila menziesii* 2♀; Pan-trapped: 54♀ 1♂

    Notes: Preference for *Nemophila* (Krombein et al. 1979).

23. *Andrena* (*Plastandrena*) *prunorum* Cockerell, 1896* – Sex: 7♀ 6♂; May-August; Sites: 6N08D 1♀, DNS 1♀ 5♂, GMM 1♀, HR 1♀, ML 1♀ 1♂, (WPP) 1♀, TF 1♀; Floral Records: *Calyptridium monospermum* 1♀, *Eriogonum nudum* 1♀ 1♂, *Eriogonum umbellatum* 1♀, *Horkelia spp.* 1♀, *Hypericum perforatum* 2♀ 1♂

24. *Andrena* (*Scaphandrena*) *gordoni* Ribble, 1974* – Sex: 2♀ 2♂; May-June; Sites: HR 1♀, GMM 2♂, TF 1♀; Floral Records: *Lomatium spp.* 1♀, *Sanicula tuberosa* 1♀ 1♂; Pan-trapped: 1♂

25. *Andrena* (*S.*) *merriami* Cockerell, 1901* – Sex: 22♀ 3♂; June; Sites: ARM 3♀, HR 10♀ 1♂, (MLRO) 2♀, TF 7♀ 2♂; Floral Records: *Horkelia tridentata ssp. flavescens* 15♀ 2♂, *Horkelia spp.* 5♀, *Potentilla spp.* 2♀; Pan-trapped: 1♂

    Notes: Identified by R. Thorp. Preference for *Lomatium* and *Prunus* (Ribble 1974).

26. *Andrena* (*S.*) *spp.* Lanham – Sex: 1♀; June; Sites: DNS 1♀; Pan-trapped: 1♀

27. *Andrena* (*Simandrena*) *angustitarsata* Viereck, 1904 – Sex: 69♀ 2♂; May-June; Sites: 6N08D 4♀, GMM 38♀ 1♂, GMS 2♀, HR 10♀, ICM 2♀, (LM) 8♀ 1♂, (MLRO) 2♀, TF 3♀; Floral Records: *Calyptridium monospermum* 2♀, *Ceanothus spp.* 2♀, *Horkelia spp.* 2♀, *Lomatium spp.* 3♀, *Phacelia spp.* 1♀, *Potentilla spp.* 4♀, *Ranunculus occidentalis* 1♀, *Sanicula tuberosa* 46♀ 2♂, Other Asteraceae 3♀
    Notes: Identified by R. Thorp.
28. *Andrena* (*S.*) *orthocarpi* Cockerell, 1936 – Sex: 8♀; May-June; Sites: 6N08D 3♀, DNS 1♀, GMM 2♀, TF 2♀; Floral Records: *Lomatium spp.* 1♀, *Prunus emarginata var. emarginata* 1♀, *Sanicula tuberosa* 3♀
    Notes: Identified by R. Thorp.
29. *Andrena* (*Thysandrena*) aff. *candida* Smith, 1879 – Sex: 1♀; June; Sites: HR 1♀; Floral Records: *Horkelia spp.* 1♀
    Notes: Identified by R. Thorp. This specimen looks like *w-scripta* but has a slight metallic reflection. It keys to *candida*.
30. ***Andrena* (*T.*) aff. *ferrugineipes* LaBerge, 1977*** – Sex: 1♂; July; Sites: (WPP) 1♂; Floral Records: *Calyptridium monospermum* 1♂
    Note: *A. ferrugineipes* is a southern California bee and according to LaBerge (1977) *ferrugineipes* could be a variant of *w-scripta*. However, the legs of this specimen are more red-orange than my other male *w-scripta* and keys out to *ferrugineipes*.
31. *Andrena* (*T.*) *knuthiana* Cockerell, 1906 – Sex: 13♀ 54♂; May-July; Sites: 6N08D 4♂, DNS 1♀ 14♂, GMM 1♀ 28♂, GMS 4♂, HR 2♀ 1♂, HMM 1♂, ICM 2♀, TF

7♀, (WRO) 2♂; Floral Records: *Achillea millefolium* 1♂, *Calyptridium monospermum* 5♀, *Ceanothus spp.* 1♀, *Crepis pleurocarpa* 3♂, *Eriogonum nudum* 30♂, *Eriogonum umbellatum* 2♂, *Horkelia tridentata ssp. flavescens* 4♀, *Horkelia spp.* 1♂; Pan-trapped: 2♀ 1♂

32. *Andrena* (*T.*) *w-scripta* Viereck, 1904 – Sex: 8♀ 12♂; May-June; Sites: 6N08D 1♀, CM 2♂, DNS 1♀, GMM 4♀, HR 2♀ 2♂, TF 8♂; Floral Records: *Arctostaphylos spp.* 1♀, *Calyptridium monospermum* 1♂, *Ceanothus spp.* 1♀, *Horkelia tridentata ssp. flavescens* 1♂, *Horkelia spp.* 2♀ 2♂, *Phacelia spp.* 1♀, *Sanicula tuberosa* 2♀; Pan-trapped: 8♂

    Notes: Preference for Rosaceae, Rhamnaceae, and Salicaeae (LaBerge 1977).

33. *Andrena* (*Trachandrena*) *amphibola* (Viereck, 1904) – Sex: 2♀ 1♂; June; Sites: 6N08D 1♀, HR 1♂, GMM 1♀; Floral Records: *Phacelia spp.* 1♀, *Ranunculus occidentalis* 1♂

34. *Andrena* (*T.*) *cleodora* (Viereck, 1904)* – Sex: 1♀; June; Sites: TF 1♀; Floral Records: *Calyptridium monospermum* 1♀

    Notes: Preference for *Ceanothus* (Krombein et al. 1979).

35. *Andrena* (*T.*) *cupreotincta* Cockerell, 1901 – Sex: 6♀ 2♂; May-June; Sites: DNS 2♂, HR 6♀; Floral Records: *Horkelia tridentata ssp. flavescens* 2♀, *Horkelia spp.* 4♀

36. *Andrena* (*T.*) *forbesii* Robertson, 1891*– Sex: 1♀; June; Sites: 6N08D 1♀; Floral Records: *Phacelia spp.* 1♀

37. *Andrena* (*T.*) *fuscicauda* (Viereck, 1904)* – Sex: 2♀; June; Sites: GMM 1♀, GMS 1♀; Floral Records: *Ceanothus spp.* 1♀, *Phacelia spp.* 1♀

    Notes: Identified by R. Thorp.

38. *Andrena* (*T.*) *quintiliformis* Viereck, 1916* – Sex: 45♀ 2♂; May-July; Sites: 6N08D 3♀ 1♂, ARM 1♀, (BFCC) 1♀, DNS 6♀, (FRO) 1♀, GMM 11♀ 1♂, GMS 1♀, HR 2♀, ML 18♀, (MLRO) 1♀; Floral Records: *Arctostaphylos spp.* 1♂, *Ceanothus spp.* 1♀, *Downingia elegans* 1♀, *Eriogonum nudum* 7♀, *Eriogonum umbellatum* 1♀, *Hypericum perforatum* 1♀, *Phacelia procera* 2♀, *Phacelia spp.* 4♀, *Potentilla spp.* 8♀, *Rosa nutkana* 8♀, *Rubus spp.* 1♀; Pan-trapped: 4♀

Subfamily Panurginae

Tribe Calliopsini

39. *Calliopsis* (*Nomadopsis*) *edwardsii* (Cresson, 1878)* – Sex: 17♀ 14♂; June-July; Sites: ARM 1♂; GMM 6♀ 3♂; ML 8♀ 7♂, (MLCC) 2♂; (MLRO) 3♀ 1♂; Floral Records: *Erigeron aliceae* 1♂; *Potentilla spp.* 13♀ 11♂; Pan-trapped: 2♂

    Notes: Preference for *Potentilla* and *Calochortus* (Rozen 1958).

40. ***Calliopsis* (*N.*) *xenus* Rozen, 1958*** – Sex: 11♀ 3♂; May-June; Sites: DNS 1♀; GMM 10♀ 3♂; Floral Records: *Phacelia spp.* 1♀ 2♂; Pan-trapped: 10♀

    Notes: Possibly monolectic on *Phacelia* (Rozen 1958).

Tribe Panurgini

41. *Panurginus spp.* Nylander – Sex: 36♀; May-June; Sites: 6N08D 3♀, ARM 23♀, DNS 1♀, GMS 3♀, HR 3♀, ICM 1♀, (MLRO) 1♀, TF 1♀; Floral Records:

Eriophyllum lanatum 1♀, *Horkelia spp.* 1♀, *Potentilla spp.* 1♀, *Prunus emarginata var. emarginata* 1♀, *Ranunculus occidentalis* 12♀; Pan-trapped: 20♀

Notes: I was unable to successfully sort females into morphospecies. This group likely comprises the female counterparts to *P*. aff. *atriceps* and *P*. aff. *nigrihirtus*.

42. *Panurginus* aff. *atriceps* (Cresson, 1878)* – Sex: 10♂; May-June; Sites: DNS 4♂, ICM 6♂; Floral Records: *Prunus emarginata var. emarginata* 3♂, *Calyptridium monospermum* 3♂; Pan-trapped: 3♂

    Notes: One male caught mating with one *Panurginus* female at DNS on May 25.

43. *Panurginus* aff. *nigrihirtus* Michener, 1935 – Sex: 18♂; May-June; Sites: ARM 5♂, CM 10♂, DNS 1♂, GMM 2♂; Floral Records: *Ranunculus occidentalis* 1♂; Pan-trapped: 17♂

    Notes: The type specimen of *P. nigrihirtus* was collected on *Ranunculus* in Humboldt County and described by Michener (1935).

Tribe Perditini

44. *Perdita* (*Pygoperdita*) *nevadensis nevadensis* Cockerell, 1896* – Sex: 10♀ 43♂; July-August; Sites: 6N08D 7♀ 20♂; DNS 7♂; (FRO) 7♂, GMM 2♂, GMS 1♂, ML 1♀, TF 1♀, (WRO) 1♀ 6♂; Floral Records: *Eriogonum nudum* 4♀ 26♂, *Eriogonum umbellatum* 1♀ 8♂, *Penstemon spp.* 1♀ 2♂; Pan-trapped: 3♀ 3♂

    Notes: *P. nevadensis nevadensis* may be host for cleptoparasite *Oreopasites*.

FAMILY APIDAE

Subfamily Apinae

Tribe Anthophorini

45. *Anthophora* (*Anthophoroides*) *californica* Cresson, 1869* – Sex: 2♀ 2♂; June-July; Sites: GMS 1♀ 1♂, ML 1♀, (MLRO) 1♂; Floral Records: *Penstemon spp.* 2♂, *Rosa nutka* 1♀

46. *Anthophora* (*Clisodon*) *terminalis* (Cresson, 1869) – Sex: 10♀ 2♂; May-June; Sites: (BFCC) 1♀, GMM 2♀ 2♂, ML 4♀, (MLCC) 2♀, (WPP) 1♀; Floral Records: *Downingia elegans* 4♀, *Penstemon spp.* 4♀, *Phacelia spp.* 1♂, *Stachys ajugoides* 1♀ 1♂

    Notes: Bees in subgenus the *Clisodon* are cavity-nesters, a striking difference from other *Anthophora* which are ground-nesters (Brooks 1988).

47. *Anthophora* (*Lophanthophora*) *pacifica* Cresson, 1878 – Sex: 4♀ 4♂; June-July; Sites: ARM 1♀, (BFCC) 1♂, DNS 1♀, GMM 3♂, HR 1♀, TF 1♀, Floral Records: *Delphinium decorum ssp, tracyi* 1♀, *Ribes lobbii* 1♂, *Ribes sanguineum* 1♀ 2♂; Pan-trapped: 1♀

    Notes: Possible host for cleptoparasites *Melecta pacifica pacifica* and *Xeromelecta californica*.

48. *Anthophora* (*Mystacanthophora*) *urbana* Cresson, 1878 – Sex: 1♀ 4♂; July-August; Sites: GMS 2♂, HMM 1♀, TF 2♂; Floral Records: *Cirsium douglasii* 1♀, *Eriogonum nudum* 1♂, *Polygonum douglasii* 1♂, *Verbena lasiostachys* 1♂

    Notes: Possible host for cleptoparasite *Xeromelecta californica*.

49. *Habropoda depressa* Fowler, 1899* – Sex: 1♀ 2♂; May; Sites: DNS 1♀ 2♂; Floral Records: *Arctostaphylos spp.* 1♀ 2♂

    Notes: Possible host for cleptoparasite *M. pacifica pacifica*.

Tribe Apini

50. *Apis mellifera* Linnaeus, 1758 – Sex: 11♀ 1♂; June-July; Sites: 6N08D 1♀, ARM 2♀, DNS 1♀, GMS 5♀, HR 1♀, ICM 1♀, ML 1♂; Floral Records: *Calyptridium monospermum* 1♀; *Eriogonum nudum* 1♀; *Ranunculus occidentalis* 1♀; Pan-trapped: 8♀

    Notes: Present at all sites and only non-native found during study.

Tribe Bombini

51. *Bombus* (*Bombus*) *occidentalis* Greene, 1858 – Sex: 3♀; June-August; Sites: GMM 1♀, TF 2♀; Floral Records: *Hypericum perforatum* 2♀; Pan-trapped: 1♀

    Note: Populations in California have declined since the 1990s (Williams et al. 2014). *B. occidentalis* was once very common in Humboldt County (Mesler, personal communication). This is the first published record since David Gordon (1984) collected it during his study. I have submitted my records to the Bumble Bee Watch project (www.bumblebeewatch.org).

52. *Bombus* (*Psithyrus*) *flavidus* Eversmann, 1852– Sex: 7♂; June-July; Sites: 6N08D 2♂, ARM 1♂, GMM 3♂, (PS) 1♂; Floral Records: *Arctostaphylos spp.* 1♂, *Cirsium spp.* 1♂, *Phacelia spp.* 1♂, *Ribes sanguineum* 1♂, *Rubus spp.* 1♂, *Wyethia spp.* 1♂; Pan-trapped: 1♂

Notes: Cleptoparasite on *Bombus* (*Pyrobombus*) (Thorp et al. 1983). Formerly *B.* (*Psyithryus*) *fernaldae* (Franklin) (Williams et al. 2014).

53. *Bombus* (*P.*) *insularis* (Smith, 1861) – Sex: 3♂; June; Sites: 6N08D 1♂, ARM 1♂, GMM 1♂; Floral Records: *Phacelia spp.* 1♂, *Rubus spp.* 1♂, *Wyethia spp.* 1♂

    Notes: Cleptoparasite on *Bombus flavifrons* and *B. occidentalis* (Thorp et. al. 1983).

54. *Bombus* (*Pyrobombus*) *flavifrons* Cresson, 1863 – Sex: 32♀ 1♂; June-August; Sites: 6N08D 2♀, ARM 2♀, (CRO) 1♂, CM 1♀, DNS 1♀, GMM 6♀, GMS 10♀, HR 2♀, (MLCC) 1♀, TF 2♀, (WPP) 5♀; Floral Records: *Agastache urticifolia* 1♀, *Collinsia spp.* 1♀, *Delphinium decorum ssp. tracyi* 1♀, *Penstemon spp.* 11♀, *Phacelia procera* 2♀, *Phacelia spp.* 5♀, *Rafinesquia californica* 1♂, *Sedum spp.* 1♀, *Trifolium spp.* 1♀; Pan-trapped: 7♀

55. *Bombus* (*P.*) *melanopygus edwardsii* Cresson, 1878 – Sex: 23♀ 6♂; May-June; Sites: 6N08D 4♀ 1♂, ARM 3♀ 3♂, DNS 7♀, GMM 2♀, GMS 4♀, HR 2♀ 1♂, ICM 1♂, (WRO) 1♀; Floral Records: *Arctostaphylos spp.* 9♀, *Calyptridium monospermum* 1♂, *Ceanothus spp.* 1♀, *Collinsia spp.* 1♀, *Eriopyllum lanatum* 1♀, *Horkelia tridentata ssp. flavescens* 1♀, *Horkelia spp.* 1♀, *Ribes sanguineum* 2♀, *Rubus spp.* 1♂, *Sedum spp.* 1♀, *Trifolium spp.* 1♂, *Wyethia spp.* 2♀ 3♂; Pan-trapped: 3♀

56. *Bombus* (*P.*) *mixtus* Cresson, 1878 – Sex: 81♀ 7♂; May-August; Sites: 6N08D 5♀ 2♂, (ARCC) 1♀, ARM 4♀ 1♂, CM 1♀, DNS 3♀, (FRO) 2♀, GMM 30♀ 2♂, GMS 16♀ 1♂, HR 5♀, HMM 1♀, ML 10♀ 1♂, TF 2♀, (WH) 1♀; Floral Records: *Arctostaphylos spp.* 2♀ 1♂, *Calyptridium monospermum* 1♀, *Camassia leichtlinii*

ssp. suksdorfii 2♀, *Campanula scouleri* 1♀ 1♂, *Ceanothus spp.* 1♀, *Claytonia lanceolate* 1♀, *Downingia elegans* 4♀ 1♂, *Erigeron aliceae* 1♂, *Eriophyllum lanatum* 1♀, *Erysimum capitatum* 1♀, *Horkelia tridentata ssp. flavescens* 3♀, *Horkelia spp.* 2♀, *Hypericum perforatum* 2♀, *Penstemon spp.* 3♀, *Phacelia procera* 1♀, *Phacelia spp.* 16♀ 1♂, *Potentilla spp.* 1♀, *Prunus emarginata var. emarginata* 1♀, *Ribes lobbii* 1♀, *Rosa gymnocarpa* 3♀, *Rosa nutka* 4♀, *Sanicula tuberosa* 4♀, *Wyethia spp.* 2♀ 1♂; Pan-trapped: 16♀ 1♂

57. *Bombus* (*P.*) *sitkensis* Nylander, 1848 – Sex: 4♀; June; Sites: ARM 1♀, GMS 3♀; Floral Records: *Penstemon spp.* 1♀; Pan-trapped: 3♀
58. *Bombus* (*P.*) *vandykei* (Frison, 1927)* – Sex: 7♀ 1♂; May-July; Sites: ARM 1♀, DNS 2♀, GMM 4♀ 1♂; Floral Records: *Allium spp.* 1♀, *Phacelia spp.* 2♀ 1♂, *Ribes binominatum* 1♀, *Wyethia spp.* 1♀; Pan-trapped: 1♀
59. *Bombus* (*P.*) *vosnesenskii* Radoszowski, 1862 – Sex: 198♀ 1♂; May-August; Sites: 6N08D 23♀, ARM 19♀, (BFCC) 2♀, CM 4♀, DNS 6♀, GMM 28♀, GMS 68♀, HR 7♀, HMM 7♀ 1♂, ICM 1♀, ML 8♀, (MLCC) 1♀, (WPP) 1♀, TF 23♀; Floral Records: *Agastache urticifolia* 1♀, *Arctostaphylos spp.* 2♀, *Calochortus tolmiei* 1♀, *Calyptridium monospermum* 3♀, *Camassia leichtlinii ssp. suksdorfii* 2♀, *Ceanothus spp.* 1♀, *Cirsium douglasii* 4♀ 1♂ , *Cirsium occidentale* 1♀, *Collinsia grandiflora* 3♀, *Cordylanthus tenuis ssp. viscidus* 5♀, *Downingia elegans* 4♀, *Eriogonum nudum* 7♀, *Frangula californica ssp. occidentalis* 1♀, *Horkelia tridentata ssp. flavescens* 3♀, *Hypericum perforatum* 1♀, *Monardella sheltonii* 3♀, *Penstemon spp.* 6♀,

Phacelia spp. 16♀, *Polygonum douglasii* 1♀, *Potentilla spp.* 1♀, *Ranunculus occidentalis* 1♀, *Ribes lobbii* 1♀, *Ribes sanguineum* 2♀, *Rosa nutka* 1♀, *Sanicula tuberosa* 2♀, *Verbena lasiostachys* 1♀, *Wyethia spp.* 8♀; Pan-trapped: 110♀

Notes: Present at all sites.

Tribe Emphorini

60. *Diadasia* (*Coquillettapis*) *bituberculata* (Cresson, 1878)* – Sex: 21♀ 26♂; June-July; Sites: 6N08D 2♀ 3♂, ARM 1♂, DNS 10♀ 11♂, GMM 1♀ 2♂, GMS 7♀ 7♂, ML 1♀ 2♂; Floral Records: *Calystegia occidentalis ssp. occidentalis* 3♀ 1♂, *Crepis pleurocarpa* 1♂, *Penstemon spp.* 7♀ 10♂; Pan-trapped: 7♀ 13♂

    Notes: Prefers Convolvulaceae, primarily *Calystegia* but also collects pollen from Asteraceae (Adlahka 1969; Sipes and Brooks, unpublished; Sipes and Tepedino 2005).

61. *Diadasia* (*C.*) *nigrifrons* (Cresson, 1878)* – Sex: 33♀ 33♂; June-July; Sites: 6N08D 8♀ 13♂, (BFCC) 3♀ 2♂, GMS 1♀, ML 20♀ 18♂, (MLCC) 1♀; Floral Records: *Downingia elegans* 1♀, *Eriophyllum lanatum* 1♀, *Potentilla spp.* 1♀ 1♂, *Sidalcea asprella ssp. nana* 23♀ 17♂; Pan-trapped: 3♀ 6♂

    Notes: Oligolectic on Malvaceae primarily *Sidalcea* (Adlahka 1969; Sipes and Brooks, unpublished; Sipes and Tepedino 2005). One female caught emerging from hole in the ground at ML on July 15.

62. *Diadasia* (*Diadasia*) *diminuta* (Cresson, 1878)* – Sex: 4♀ 17♂; July; Sites: DNS 10♂, GMM 4♀ 7♂; Floral Records: *Achillea millefolium* 1♂, *Crepis pleurocarpa* 4♂, *Erigeron aliceae* 4♀ 7♂, *Eriogonum umbellatum* 2♂, *Gilia capitata* 3♂

    Notes: Restricted to Malvaceae; primarily *Sphaeralcea* and *Malvastrum* in other parts of its range (Adlahka 1969) but oligolectic on *Iliamna latibracteata* in northwestern California (Sydney Carothers, personal communication). I did not collect *diminuta* on any Malvaceae but Sipes and Tepedino (2005) discovered pollen loads to also contain Asteraceae and Cactaceae pollen.

Tribe Eucerini

63. *Eucera* (*Synhalonia*) *actuosa* (Cresson, 1878)* – Sex: 30♀ 6♂; Months: May-June; Sites: ARM 9♀, CM 8♀4♂, GMM 9♀, HR 4♀ 2♂; Floral Records: *Allium spp.* 1♀, *Collinsia grandiflora* 6♀, *Collinsia parviflora* 1♂, *Nemophila menziesii* 1♀ 1♂, *Phacelia spp.* 3♀, *Trifolium spp.* 1♂, *Wyethia spp.* 7♀; Pan-trapped: 10♀
64. *Eucera* (*S.*) *frater albopilosa* Fowler, 1899 – Sex: 9♀ 4♂; May-June; Sites: 6N08D 1♂, CM 5♀ 1♂, GMM 1♀, GMS 1♀, HR 1♀ 2♂, ICM 1♀; Floral Records: *Arctostaphylos spp.* 1♂, *Collinsia grandiflora* 1♀, *Trifolium spp.* 2♂; Pan-trapped: 7♀
65. *Eucera* (*S.*) *fulvitarsis fulvitarsis* (Cresson, 1878) – Sex: 1♀; June; Sites: 6N08D 1♀
66. *Melissodes* (*Callimelissodes*) *lupina* Cresson, 1878 – Sex: 3♂; July; Sites: (BFCC) 1♂, DNS 1♂, HMM 1♂; Floral Records: *Eriogonum nudum* 1♂, *Gilia capitata* 1♂, *Sidalcea asprella ssp. nana* 1♂

Notes: Identified by R. Thorp. Oligolectic on Asteraceae (Krombein et al. 1979); possible host for cleptoparasite *Triepeolus paenepectoralis*.

67. *Melissodes* (*C.*) *metenuus* Cockerell, 1924 – Sex: 5♀; July-August; Sites: (BCP) 1♀, (CRO) 3♀, DNS 1♀; Floral Records: *Achillea millefolium* 1♀, *Gilia capitata* 1♀, *Rafinesquia californica* 3♀

    Notes: Identified by R. Thorp. Possible host for cleptoparasite *Triepeolus paenepectoralis*.

68. *Melissodes* (*Eumelissodes*) *microsticta* Cockerell, 1905* – Sex: 15♀ 6♂; June-August; Sites: (BFCC) 1♀, (BCP) 1♀ 1♂, DNS 2♀ 2♂, GMM 4♀, GMS 1♀, ML 2♀ 1♂, (MLCC) 2♂, TF 4♀; Floral Records: *Achillea millefolium* 3♀, *Erigeron aliceae* 3♀ 2♂, *Gilia capitata* 2♂, *Hypericum perforatum* 1♀, *Polygonum douglasii* 3♀, *Potentilla spp.* 1♂, *Sidalcea asprella ssp. nana* 1♂; Pan-trapped: 4♀

    Notes: Identified by R. Thorp. Oligolectic on Asteraceae with Pacific Coast populations frequenting *Aster*, *Solidago*, *Erigeron*, *Gutierrezia*, and *Chrysothamnus* (LaBerge 1961); possible host for cleptoparasite *Triepeolus paenepectoralis*.

69. *Melissodes* (*Heliomelissodes*) *rivalis* Cresson, 1872 – Sex: 8♀ 9♂; July-August; Sites: GMS 4♀ 3♂, HMM 4♀ 6♂; Floral Records: *Cirsium douglasii* 4♀ 4♂, *Cirsium occidentale* 3♀ 2♂, *Monardella sheltonii* 1♀ 1♂

    Notes: Identified by R. Thorp. Oligolectic on Asteraceae with a strong preference for *Cirsium* (LaBerge 1956b); possible host for cleptoparasite *Triepeolus paenepectoralis*.

Tribe Melectini

70. *Melecta* (*Melecta*) *pacifica* Cresson, 1878* – Sex: 1♀ 1♂; June; Sites: 6N08D 1♀, DNS 1♂; Floral Records: *Arctostaphylos spp.* 1♀; Pan-trapped 1♂

    Notes: Mitchel (1962) notes *M. pacifica* is a cleptoparasite on *Anthophora*; Michener et al. (1994) states both *Anthophora* and *Habropoda* are *Melecta* hosts. At DNS site, *M. pacifica* was collected with *A. pacifica* and *H. depressa*.

71. *Xeromelecta* (*Melectomorpha*) *californica* (Cresson, 1878)* – Sex: 2♀ 1♂; June-July; Sites: DNS 1♂, TF 2♀; Floral Records: *Calyptridium monospermum* 2♀, *Eriogonum nudum* 1♂

    Notes: *Anthophora abrupta* is a known host species for cleptoparasite *Xeromelecta californica* (Hurd and Linsley 1951), but *A. abrupta* was not found at any sites during my study. However, *X. californica* was collected with *A. pacifica* at DNS and with *A. pacifica* and *A. urbana* at TF.

Subfamily Nomadinae

Tribe Ammobatini

72. *Oreopasites* (*Oreopasites*) *vanduzeei* Cockerell, 1925* – Sex: 1♀ 2♂; July; Sites: GMS 1♀ 1♂, (WRO) 1♂; Floral Records: *Eriogonum nudum* 1♂

    Notes: Cleptoparasite on *Calliopsis* (Rozen 1992) yet no *Calliopsis* were collected at these sites. However, one of its known hosts, *Calliopsis edwardsii*, was documented at nearby sites (GMM, DNS, and ML). Other species of *Oreopasites* are

cleptoparasites on *Perdita* (Rozen 1992). *O. vanduzeei* caught with *Perdita* at both sites.

Tribe Biastini

73. *Neopasites* (*Neopasites*) *fulviventris* (Cresson, 1873)* – Sex: 1♀; June; Sites: TF 1♀; Pan-trapped: 1♀

    Notes: Cleptoparasite on *Dufourea dentipes* (Torchio et. al. 1967). It was collected with *D. dentipes* at TF.

Tribe Epeolini

74. *Epeolus compactus* Cresson, 1878* – Sex: 2♀ 5♂; July; Sites: 6N08D 2♀ 2♂, DNS 1♂, HMM 2♂; Floral Records: *Eriogonum nudum* 3♂, *Eriophyllum lanatum* 1♀ 1♂

    Notes: Michener (2007) notes *Epeolus* is a cleptoparasite on *Colletes*. *C. hyalinus* and *C. kincaidii* were present at 6N08D and HMM.

75. *Triepeolus paenepectoralis* Viereck, 1905* – Sex: 2♀ 1♂; July; Sites: DNS 1♀ 1♂, HMM 1♀; Floral Records: *Gilia capitata* 1♀ 1♂, *Polygonum douglasii* 1♀

    Notes: Most species of *Triepeolus* are cleptoparasites of Eucerini (Apidae) (Michener 2007). Rightmyer (2008) lists *Melissodes microsticta* as the host for *T. paenepectoralis*. *T. paenepectoralis* was caught at DNS with *Melissodes microsticta*, *M. lupina*, and *M. metenuus* and at HMM with *M. rivalis* and *M. lupina*.

Tribe Nomadini

76. *Nomada* aff. *elegantula* Cockerell, 1903 – Sex: 2♀; May-June; Sites: GMM 1♀, ICM 1♀; Floral Records: *Calyptidium monospermum* 1♀, *Sanicula tuberosa* 1♀

77. *Nomada* aff. *latifrons* Cockerell, 1903* – Sex: 2♀; June-July; Sites: 6N08D 1♀, GMM 1♀; Pan-trapped: 1♀
78. *Nomada angelarum* Cockerell, 1903* – Sex: 1♀; May; Sites: CM 1♀; Pan-trapped: 1♀
79. *Nomada ashmeadi* Cockerell, 1903* – Sex: 1♀; June; Sites: TF 1♀; Pan-trapped: 1♀
80. *Nomada bifurcata* Cockerell, 1903* – Sex 3♂; May-June; Sites: ARM 1♂, GMM 1♂, ICM 1♂; Floral Records: Other Asteraceae 1♂; Pan-trapped: 1♂
81. *Nomada californiae* Cockerell, 1903* – Sex: 20♀; May-June; Sites: 6N08D 1♀, ARM 2♀, CM 1♀, DNS 3♀, GMM 5♀, HR 2♀, ICM 1♀, ML 1♀, (MLRO) 1♀, TF 3♀; Floral Records: *Arctostaphylos spp.* 1♀, *Calochortus tolmiei* 1♀, *Eriophyllum lanatum* 1♀, *Horkelia tridentata ssp. flavescens* 2♀, *Horkelia spp.* 1♀, *Potentilla spp.* 1♀, *Ranunculus occidentalis* 1♀; Pan-trapped: 3♀
82. *Nomada oregonica* Cockerell, 1903* – Sex: 3♂; May; Sites: DNS 2♂, GMM 1♂; Floral Records: *Ribes sanguineum* 1♂; Pan-trapped: 1♂
83. *Nomada rhodotricha* Cockerell, 1903* – Sex: 4♀; June; Sites: 6N08D 1♀, ICM 3♀; Floral Records: *Calochortus tolmiei* 1♀, *Calyptridium monospermum* 2♀
84. *Nomada sanctaecrucis* Cockerell, 1903* – Sex: 1♂; May; Sites: GMM 1♂; Pan-trapped: 1♂
85. *Nomada female sp. 1* Scopoli – Sex: 1♀; May; Sites: CM 1♀; Floral Records: *Nemophila menziesii* 1♀

86. *Nomada female sp. 2* Scopoli – Sex: 1♀; June; Sites: 6N08D 1♀; Floral Records: *Eriophyllum lanatum* 1♀
87. *Nomada female sp. 3* Scopoli – Sex: 1♀; June; Sites: ARM 1♀; Floral Records: Other Asteraceae 1♀
88. *Nomada male sp. 1* Scopoli – Sex: 1♂; July; Sites: GMS 1 ♂; Floral Records: *Eriophyllum lanatum* 1♂

    Notes: Possible male of *N. rhodotricha* (personal observation).
89. *Nomada male sp. 2* Scopoli – Sex: 1♂; May; Sites: GMM 1♂; Pan-trapped: 1♂
90. *Nomada male sp. 3* Scopoli – Sex: 1♂; May; Sites: GMM 1♂; Pan-trapped: 1♂
91. *Nomada male sp. 4* Scopoli – Sex: 1♂; June; Sites: 6N08D 1♂; Floral Records: *Arctostaphylos spp.* 1♂
92. *Nomada male sp. 5* Scopoli – Sex: 3♂; May-June; Sites: DNS 2♂, TF 1♂; Floral Records: *Arctostaphylos spp.* 1♂, *Ranunculus occidentalis* 1♂
93. *Nomada male sp. 6* Scopoli – Sex: 3♂; May-July; Sites: GMM 1♂, GMS 2♂; Floral Records: *Eriogonum nudum* 1♂, *Eriophyllum lanatum* 1♂; Pan-trapped: 1♂
94. *Nomada male sp. 7* Scopoli – Sex: 1♂; May; Sites: CM 1♂; Floral Records: *Nemophila menziesii* 1♂
95. *Nomada male sp. 8* Scopoli – Sex: 1♂; June; Sites: TF 1♂; Floral Records: *Horkelia tridentata ssp. flavescens* 1♂
96. *Nomada male sp. 9* Scopoli – Sex: 2♂; May-June; Sites: DNS 1♂, GMM 1♂; Floral Records: *Sanicula tuberosa* 1♂

97. *Nomada male sp. 10* Scopoli – Sex: 2♂; June-July; Sites: DNS 1♂, GMM 1♂; Floral Records: *Achillea millefolium* 1♂, *Eriogonum nudum* 1♂

Subfamily Xylocopinae

Tribe Ceratini

98. *Ceratina* (*Zadontomerus*) *acantha* Provancher, 1895 – Sex: 43♀ 4♂; May-July; Sites: 6N08D 4♀ 1♂, (ARCC) 1♀, DNS 4♀, (GMRO) 2♀, GMM 7♀, GMS 19♀, HR 1♂, (LM) 1♀ 1♂, ML 2♀, (MLCC) 2♀, (MLRO) 1♂, TF 1♀; Floral Records: *Erigeron aliceae* 5♀, *Eriophyllum lanatum* 14♀ 1♂, *Erysimum capitatum* 1♀, *Lomatium spp.* 1♂, *Penstemon spp.* 4♀, *Polygonum douglasii* 2♀, *Potentilla spp.* 2♀ 1♂, *Rubus ursinus* 1♀, *Sanicula tuberosa* 1♀ 1♂, *Senecio spp.* 1♀; Pan-trapped: 5♀
99. *Ceratina* (*Z.*) *micheneri* Daly, 1973* – Sex: 44♀ 14♂; May-July; Sites: 6N08D 2♀ 1♂, (ARM) 3♀, DNS 11♀ 8♂, (GMRO) 1♀, GMM 7♀ 1♂, GMS 12♀ 1♂, HR 1♀, ML 1♀ 1♂, (MLCC) 1♀, (MLRO) 1♀ 1♂, TF 3♀ 1♂, (WPP) 1♀; Floral Records: *Achillea millefolium* 1♀, *Calochortus tomiei* 1♀, *Calyptridium monospermum* 4♂, *Erigeron aliceae* 5♀, *Eriogonum nudum* 1♀ 1♂, *Eriophyllum lanatum* 11♀ 1♂, *Gilia capitata* 2♀ 1♂, *Hemizonella minima* 1♀ 1♂, *Horkelia tridentata ssp. flavescens* 1♀, *Hypericum perforatum* 1♀, *Penstemon spp.* 2♀, *Phacelia spp.* 1♀, *Polygonum douglasii* 2♀, *Potentilla spp.* 1♀ 2♂, *Ranunculus occidentalis* 1♀, *Sanicula tuberosa* 1♂, *Senecio spp.* 1♀, *Wyethia spp.* 1♀; Pan-trapped: 11♀ 3♂
100. *Ceratina* (*Z.*) *tejonensis* Cresson, 1864* – Sex: 62♀ 7♂; May-July; Sites: 6N08D 4♀ 2♂, ARM 1♀, DNS 6♀ 5♂, (GMRO) 2♀, GMM 4♀, GMS 41♀, ML 1♀, (MLRO)

2♀, (WPP) 1♀; Floral Records: *Arctostaphylos spp.* 2♂, *Calyptridium monospermum* 1♂, *Calystegia occidentalis ssp. occidentalis* 1♀, *Erigeron aliceae* 4♀, *Eriophyllum lanatum* 20♀, *Hypericum perforatum* 1♀, *Monardella sheltonii* 6♀, *Penstemon spp.* 17♀, *Polygonum douglasii* 1♀, *Potentilla spp.* 2♀, *Prunus emarginata* var. *emarginata* 1♂, *Senecio spp.* 3♂, *Verbena lasiostachys* 5♀, *Wyethia spp.* 1♀; Pan-trapped: 3♀

Tribe Xylocopini

101. *Xylocopa* (*Notoxylocopa*) *tabaniformis orpifex* Smith, 1874 – Sex 2♂; May-August; Sites: GMM 1♂, GMS 1♂; Floral Records: *Monardella sheltonii* 1♂

FAMILY COLLETIDAE

Subfamily Colletinae

Tribe Colletini

102. *Colletes consors pascoensis* Cockerell, 1898 – Sex: 7♀; June; Sites: GMM 7♀; Floral Records: *Phacelia spp.* 6♀, *Sanicula tuberosa* 1♀

Notes: Oligolectic on *Phacelia, Potentilla,* and *Sedum* (Krombein et al. 1979, Wilson et al. 2010).

103. *Colletes hyalinus oregonensis* Timberlake, 1951 – Sex: 1♀ 8♂; June-August; Sites: 6N08D 1♂, (AS) 1♀, (ARR) 3♂, GMS 2♂, HMM 2♂; Floral Records: *Angelica tomentosa* 1♀, *Eriogonum nudum* 8♂

Notes: Possible host for cleptoparasite *Epeolus compactus*.

104. *Colletes kincaidii* Cockerell, 1898* – Sex: 3♂; July; Sites: 6N08D 1♂, GMM 1♂, HMM 1♂; Floral Records: *Eriogonum nudum* 2♂

Notes: Possible host for cleptoparasite *Epeolus compactus*.

Subfamily Hylaeinae

105. *Hylaeus* (*Hylaeus*) *rudbeckiae* (Cockerell and Casad, 1895) – Sex: 9♀ 10♂; June-August; Sites: 6N08D 2♀ 4♂, (AS) 2♀, (ARR) 2♀, DNS 1♀ 1♂, GMM 1♀ 4♂, HMM 1♀ 1♂; Floral Records: *Achillea millefolium* 1♂, *Angelica tomentosa* 5♀, *Cirsium douglasii* 1♀ 1♂, *Eriogonum nudum* 3♀ 4♂, *Potentilla spp.* 1♂; Pan-trapped: 2♂

106. *Hylaeus* (*Cephalylaeus*) *basalis* (Smith, 1853) – Sex: 5♀ 4♂; June-July ; Sites: 6N08D 1♀, GMM 3♀ 4♂, ML 1♀: Floral Records: *Erigonum nudum* 1♀, *Potentilla spp.* 2♀ 2♂, *Rubus spp.* 1♀ 1♂

Note: Apparent preference for Rosaceae (Snelling 1968).

107. *Hylaeus* (*Paraprosopis*) *nevadensis* (Cockerell, 1896) – Sex: 1♀ 13♂; June-August; Sites: 6N08D 4♂, (AS) 1♂, DNS 5♂, GMM 1♀ 1♂ , HMM 1♂, (WRO) 1♂; Floral Records: *Achillea millefolium* 1♂, *Angelica tomentosa* 2♂, *Cirsium douglassii* 1♂, *Erigeron aliceae* 1♂, *Eriogonum nudum* 7♂, *Penstemon spp.* 1♂; Pan-trapped: 1♀

108. *Hylaeus* (*Prosopis*) *modestus citrinifrons* (Cockerell, 1896) – Sex: 4♀ 2♂; July-August; Sites: 6N08D 2♀ 1♂, GMS 1♀, ML 1♀, (WF) 1♂; Floral Records: *Eriogonum nudum* 3♀ 2♂; Pan-trapped: 1♀

FAMILY HALICTIDAE

Subfamily Halictinae

Tribe Halictini

109. *Agapostemon* (*Agapostemon*) *texanus* Cresson, 1872 – Sex: 184♀; May-August; Sites: 6N08D 13♀, ARM 15♀, CM 1♀, DNS 11♀, (GMRO) 1♀ , GMM 97♀, GMS 16♀, HR 3♀, ICM 5♀, ML 3♀, TF 19♀; Floral Records: *Achillea millefolium* 1♀, *Calyptridium monospermum* 1♀, *Cirsium occidentale* 1♀, *Erigeron aliceae* 3♀, *Eriogonum nudum* 1♀, *Eriophyllum lanatum* 1♀, *Erysimum capitatum* 3♀, *Phacelia spp.* 1♀, *Potentilla spp.* 3♀, *Senecio triangularis* 1♀, *Senecio spp.* 1♀, *Wyethia spp.* 1♀; Pan-trapped: 162♀

    Notes: 88% of individuals were caught in pan-traps.

110. *Halictus* (*Nealictus*) *farinosus* Smith, 1853 – Sex: 35♀ 1♂; June-August; Sites: 6N08D 14♀, ARM 1♀, (CRO) 1♀, CM 1♀, GMM 4♀ 1♂, GMS 1♀, HR 4♀, ML 5♀, TF 4♀; Floral Records: *Eriogonum nudum* 1♀, *Eriophyllum lanatum* 4♀, *Horkelia spp.* 1♀, *Rafinesquia californica* 1♀, *Wyethia spp.* 1♀; Pan-trapped: 26♀ 1♂

    Notes: Possible host for cleptparasite *Sphecodes arvensiformis* (Krombein et al. 1979).

111. *Halictus* (*Protohalictus*) *rubicundis* (Christ, 1791) – Sex: 1♀; July; Sites: (MLCC) 1♀; Floral Records: *Achillea millefolium* 1♀

    Notes: Host for cleptoparasites *Nomada* and *Sphecodes* (Krombein et al. 1979).

112. *Halictus* (*Seladonia*) *confusus* Smith, 1853* – Sex: 2♀; June; Sites: TF 2♀; Floral Records: *Calyptridium monospermum* 1♀; Pan-trapped 1♀

113. *Halictus* (*S.*) *tripartitus* Cockerell, 1895 – Sex: 23♀; May-August; Sites: 6N08D 10♀, DNS 6♀, GMS 4♀, HR 2♀, Unk 1♀; Pan-trapped: 22♀

114. *Lasioglossum* (*Dialictus*) *albohirtum* (Crawford, 1907) – Sex: 1♀; June; Sites: ICM 1♀; Pan-trapped: 1♀

115. *Lasioglossum* (*D.*) *female sp. 1* Robertson – Sex: 27♀; May-June; Sites: ARM 1♀, CM 1♀, DNS 3♀, GMM 18♀, ICM 3♀, TF 1♀; Floral Records: *Phacelia spp.* 12♀; Pan-trapped: 13♀

Notes: Possibly oligolectic on *Phacelia* (personal observation).

116. *Lasioglossum* (*D.*) *female sp. 2* Robertson – Sex: 7♀; May-June; Sites: ARM 2♀, DNS 2♀, GMM 1♀, GMS 1♀, TF 1♀; Pan-trapped: 7♀

117. *Lasioglossum* (*D.*) *female sp. 3* Robertson – Sex: 3♀; June-July; Sites: GMS 3♀; Pan-trapped: 3♀

118. *Lasioglossum* (*D.*) *female sp. 4* Robertson – Sex: 1♀; August; Sites: Unk 1♀; Pan-trapped: 1♀

119. *Lasioglossum* (*D.*) *female sp. 5* Robertson – Sex: 1♀; July; Sites: GMS 1♀; Pan-trapped: 1♀

120. *Lasioglossum* (*D.*) *female sp. 6* Robertson – Sex: 102♀; May-July; Sites: 6N08D 14♀, CM 1♀, DNS 10♀, GMM 10♀, ICM 10♀, (LM) 19♀, ML 1♀, TF 37♀; Floral Records: *Calochortus tolmiei* 1♀, *Eriogonum nudum* 1♀, *Sanicula tuberosa* 19♀;

Pan-trapped: 80♀

Notes: Possible preference for *Sanicula tuberosa* (personal observation). One female collected emerging from nest in the ground at TF on June 5; 78% of individuals were caught in pan-traps.

121. *Lasioglossum* (*D.*) *female sp. 7* Robertson – Sex: 93♀; May-July; Sites: 6N08D 1♀, ARM 9♀, CM 13♀, DNS 46♀, GMM 12♀, HR 7♀, ICM 1♀, TF 4♀; Floral Records: *Allium spp.* 3♀, *Calyptridium monospermum* 1♀, *Horkelia tridentata ssp. flacescens* 1♀, *Lomatium spp.* 2♀, *Sanicula tuberosa* 1♀; Pan-trapped: 84♀

    Notes: 90% of individuals were caught in pan-traps.

122. *Lasioglossum* (*D.*) *female sp. 8* Robertson – Sex: 73♀; May-August; Sites: 6N08D 1♀, ARM 5♀, CM 13♀, GMM 9♀, GMS 1♀, ICM 26♀, ML 1♀, TF 17♀; Floral Records: *Gayophytum diffusum* 1♀; Pan-trapped: 72♀

    Notes: 99% of individuals were caught in pan-traps.

123. *Lasioglossum* (*D.*) *female sp. 9* Robertson – Sex: 1♀; June; Sites: DNS 1♀; Pan-trapped: 1♀

124. *Lasioglossum* (*D.*) *female sp. 10* Robertson – Sex: 21♀; May-August; Sites: 6N08D 6♀, ARM 2♀, CM 1♀, DNS 6♀, GMS 2♀, ICM 1♀, TF 2♀, Unk 1♀; Floral Records: *Penstemon spp.* 1♀; Pan-trapped: 20♀

125. *Lasioglossum* (*D.*) *female sp. 11* Robertson – Sex: 11♀; June-July; Sites: ARM 1♀, CM 2♀, GMM 1♀, ICM 5♀, ML 1♀, TF 1♀; Pan-trapped: 11♀

126. *Lasioglossum* (*D.*) *male sp. 1* Robertson – Sex: 1♂; July; Sites: GMM 1♂; Pan-trapped: 1♂

127. *Lasioglossum* (*D.*) *male sp. 2* Robertson – Sex: 1♂; June; Sites: GMM 1♂; Pan-trapped: 1♂

128. *Lasioglossum* (*D.*) *male sp. 3* Robertson – Sex: 2♂; July; Sites: (MLCC) 2♂; Floral Records: *Agoseris grandiflora* 1♂, *Potentilla spp.* 1♂

129. *Lasioglossum* (*D.*) *male sp. 4* Robertson – Sex: 1♂; July; Sites: GMM 1♂; Pan-trapped: 1♂

130. *Lasioglossum* (*Evylaeus*) *female sp. 1* Robertson – Sex: 4♀; June-August; Sites: (BCP) 1♀, HR 1♀, GMM 1♀, TF 1♀; Floral Records: *Eriogonum nudum* 1♀; Pan-trapped: 3♀

131. *Lasioglossum* (*E.*) *female sp. 2* Robertson – Sex: 15♀; June-July; Sites: 6N08D 2♀, ARM 4♀, GMM 4♀, GMS 3♀, HR 1♀, (MLRO) 1♀; Floral Records: *Penstemon spp.* 2♀, *Phacelia spp.* 1♀; Pan-trapped: 12♀

132. *Lasioglossum* (*E.*) *female sp. 3* Robertson – Sex: 8♀; June; Sites: ARM 6♀, HR 1♀, ML 1♀; Floral Records: *Potentilla spp.* 1♀, *Ranunculus occidentalis* 1♀, *Wyethia spp.* 1♀; Pan-trapped: 5♀

133. *Lasioglossum* (*E.*) *female sp. 4* Robertson – Sex: 1♀; June; Sites: ARM 1♀; Pan-trapped: 1♀

134. *Lasioglossum* (*E.*) *female sp. 5* Robertson – Sex: 22♀; May-June; Sites: 6N08D 1♀, ARM 7♀, DNS 1♀, GMM 3♀, ICM 7♀, TF 3♀; Floral Records: *Achillea millefolium* 1♀, *Ranunculus occidentalis* 1♀; Pan-trapped: 19♀
135. *Lasioglossum* (*E.*) *female sp. 6* Robertson – Sex: 42♀; May-August; Sites: 6N08D 1♀, CM 10♀, DNS 3♀, GMM 2♀, GMS 2♀, ICM 11♀, (LM) 1♀, ML 2♀, (WPP) 1♀, TF 7♀, Unk 2♀; Floral Records: *Calochortus tolmiei* 1♀, *Nemophila menziesii* 1♀, *Penstemon spp.* 1♀, *Sanicula tuberosa* 2♀; Pan-trapped: 36♀
136. *Lasioglossum* (*E.*) *female sp. 7* Robertson – Sex: 3♀; June; Sites: ARM 3♀; Floral Records: *Ranunculus occidentalis* 3♀
137. *Lasioglossum* (*E.*) *female sp. 8* Robertson – Sex: 5♀; June-July; Sites: GMM 3♀, ICM 1♀, TF 1♀; Floral Records: *Rosa gymnocarpa* 1♀, *Sanicula tuberosa* 1♀; Pan-trapped: 2♀
138. *Lasioglossum* (*E.*) *female sp. 9* Robertson – Sex: 14♀; May-June; Sites: DNS 2♀, GMM 11♀, GMS 1♀; Floral Records: *Phacelia spp.* 3♀, *Potentilla spp.* 1♀, *Prunus emarginata var. emarginata* 1♀, *Sanicula tuberosa* 2♀; Pan-trapped: 7♀
139. *Lasioglossum* (*Evylaeus*) *female sp. 10* Robertson – Sex: 4♀; May; Sites: 6N08D 1♀, DNS 1♀, GMM 2♀; Floral Records: *Arctostaphylo spp.s* 1♀, *Ribes sanguineum* 2♀; Pan-trapped: 1♀
140. *Lasioglossum* (*E.*) *female sp. 11* Robertson – Sex: 1♀; June; Sites: ARM 1♀; Pan-trapped: 1♀

141. *Lasioglossum* (*E.*) *female sp. 12* Robertson – Sex: 3♀; May-June; Sites: DNS 1♀, ICM 1♀, TF 1♀; Floral Records: *Prunus emarginata var. emarginata* 1♀; Pan-trapped: 2♀

142. *Lasioglossum* (*E.*) *female sp. 13* Robertson – Sex: 64♀; May-July; Sites: 6N08D 3♀, ARM 5♀, (BFCC) 1♀, CM 2♀, DNS 1♀, GMM 39♀, GMS 7♀, HR 1♀, ML 1♀, (WPP) 3♀, TF 1♀; Floral Records: *Eriogonum nudum* 1♀, *Erysimum capitatum* 2♀, *Penstemon spp.* 3♀, *Phacelia procera* 2♀, *Phacelia spp.* 5♀, *Ribes lobii* 1♀, *Rosa nutka* 1♀; Pan-trapped: 49♀

143. *Lasioglossum* (*E.*) *male spp.* Robertson – Sex: 1♂; August; Sites: TF 1♂; Pan-trapped: 1♂

    Notes: male with odd wing venation, subgenus determination made by Robbin Thorp

144. *Lasioglossum* (*Hemihalictus*) *kincaidii* (Cockerell, 1898) – Sex 16♀; July; Sites: ARM 13♀, DNS 2♀, (ICM) 1♀; Pan-trapped: 16♀

145. *Lasioglossum* (*H.*) *ovaliceps* (Cockerell, 1898) – Sex: 1♀; July; Sites: 6N08D 1♀

146. *Lasioglossum* (*Lasioglossum*) *anhypops* McGinley, 1986* – Sex: 15♀; June-July; Sites: 6N08D 2♀, ARM 3♀, DNS 2♀, GMM 5♀, ML 1♀, TF 2♀; Floral Records: *Eriogonum umbellatum* 1♀; Pan-trapped: 14♀

147. *Lasioglossum* (*L.*) *egregium* (Vachal, 1904) – Sex: 2♀; June; Sites: ARM 2♀; Pan-trapped: 2♀

148. *Lasioglossum* (*L.*) *mellipes* (Crawford, 1907) – Sex: 20♀; May-June; Sites: 6N08D 1♀, ARM 3♀, DNS 7♀, GMM 3♀, GMS 4♀, TF 2♀; Floral Records: *Erysimum capitatum* 1♀; Pan-trapped: 18♀

149. *Lasioglossum* (*L.*) *olympiae* (Cockerell, 1898) – Sex: 43♀; June; Sites: ARM 42♀, HR 1♀; Pan-trapped: 43♀

150. *Lasioglossum* (*L.*) *titusi* (Crawford, 1902) – Sex: 1♀; August; Sites: (CRO) 1♀; Floral Records: *Rafinesquia californica* 1♀

Notes: Preference for Asteraceae (McGinley 1986).

151. ***Lasioglossum* (*L.*) *trizonatum* (Cresson, 1874)*** – Sex: 1♀; July; Sites: GMM 1♀

152. *Lasioglossum male sp. 1* Curtis – Sex: 1♂; June; Sites: GMM 1♂; Floral Records: *Potentilla spp.* 1♂

153. *Lasioglossum male sp. 2* Curtis – Sex: 1♂; July; Sites: HMM 1♂; Floral Records: *Frangula californica ssp. occidentalis* 1♂

154. *Lasioglossum male sp. 3* Curtis – Sex: 1♂; June; Sites: 6N08D 1♂

155. *Lasioglossum male sp. 4* Curtis – Sex: 3♂; June-August; Sites: (BFCC) 1♂, TF 1♂, Unk 1♂; Pan-trapped: 2♂

156. *Sphecodes arvensiformis* Cockerell, 1925 – Sex: 4♀ 3♂; June-August; Sites: 6N08D 2♀, (AS) 1♂, DNS 1♀ 1♂, GMM 1♂, TF 1♀; Floral Records: *Achillea millefolium* 1♂, *Allium spp.* 1♀, *Angelica tomentosa* 1♂, *Eriogonum nudum* 1♂

Notes: Cleptoparasite on *Halictus farinosus* (Krombein et al. 1979).

157. *Sphecodes sp.* 1 Latreille – Sex: 4♀; June-July; Sites: DNS 1♀, ICM 1♀, GMM 1♀, ML 1♀; Pan-trapped: 3♀

158. *Sphecodes sp.* 2 Latreille – Sex: 8♀; May-July; Sites: 6N08D 2♀, CM 1♀, DNS 2♀, (FRO) 1♀, GMS 2♀; Floral Records: *Eriophyllum lanatum* 1♀

159. *Sphecodes sp.* 3 Latreille – Sex: 3♀; June; Sites: ARM 2♀, GMM 1♀; Pan-trapped: 1♀

Subfamily Rophitinae

160. *Dufourea dentipes* Bohart, 1948 – Sex: 25♀ 6♂; May-June; Sites: 6N08D 1♀, CM 1♂, GMM 2♀, ICM 9♀ 3♂, TF 13♀ 2♂; Floral Records: *Calochortus tolmiei* 19♀ 4♂, *Sanicula tuberosa* 1♀; Pan-trapped: 3♀ 1♂

Notes: Identification based on species description (Bohart 1948), floral specialization (oligolectic on *Calochortus*) and known parasite, *Neopasites fulviventris* (Torchio et. al. 1967), found at same site, TF.

161. *Dufourea trochantera* Bohart, 1948 –Sex: 7♀ 3♂; June-July; Sites: GMM 7♀ 2♂, ICM 1♂; Floral Records: *Phacelia procera* 1♀, *Phacelia spp.* 5♀ 2♂; Pan-trapped: 1♀

Notes: Identification based on species description (Bohart 1948) and floral specialization (oligolectic on *Phacelia*) (Torchio et. al. 1967).

162. *Dufourea sp. 1* Lepeletier – Sex: 2♀; May-July; Sites: GMS 2♀; Pan-trapped: 2♀

163. *Dufourea sp. 2* Lepeletier – Sex: 1♂; May-July; Sites: GMS 1♂; Pan-trapped: 1♂

FAMILY MEGACHILIDAE

Subfamily Megachilinae

Tribe Anthidiini

164. *Anthidiellum* (*Loyoanthidium*) *notatum robertsoni* (Cockerell, 1904)* – Sex: 5♀ 2♂; July-August; Sites: (BCP) 1♂, GMS 3♀ 1♂, (WF) 2♀; Floral Records: *Cirsium occidentale* 1♀, *Eriogonum nudum* 2♀ 1♂, *Polygonum douglasii* 2♀

Notes: Builds single-celled nests attached to rocks and vegetation (Grigarick and Stange 1968).

165. *Anthidium* (*Anthidium*) *atrifrons* Cresson, 1868– Sex: 1♀ 2♂; June; Sites: GMM 1♀ 2♂; Floral Records: *Phacelia spp.* 1♀ 2♂

Notes: Preference for *Phacelia* (Gonzalez and Griswold 2013, Grigarick and Stange 1968). *A. atrifrons* is a recent segregate of *A. emarginatum* (Say) (Gonzalez and Griswold 2013), a ground-nester (Grigarick and Stange 1968).

166. *Anthidium* (*A.*) *maculosum* Cresson, 1878* – Sex: 1♀; July; Sites: (BFCC) 1♀

Notes: Slight preference for *Lotus* (Grigarick and Stange 1968).

167. *Anthidium* (*A.*) *placitum* Cresson, 1879* – Sex: 16♀ 4♂; July-August; Sites: 6N08D 14♀ 4♂, (WH) 2♀; Floral Records: *Cordylanthus tenuis ssp. viscidus* 9♀ 2♂; Pan-trapped: 1♀

Notes: Oligolectic on *Cordylanthus* (Grigarick and Stange 1968).

168. *Anthidium* (*A.*) *utahense* Swenk, 1914* – Sex: 16♀ 9♂; July-August; Sites: 6N08D 1♀ 1♂, (BCP) 1♀, DNS 1♀, GMM 1♀, GMS 3♀, ML 8♀ 7♂, TF 1♀ 1♂; Floral

Records: *Achillea millefolium* 1♀, *Collomia spp.* 1♀, *Downingia elegans* 7♀ 6♂, *Eriogonum nudum* 1♀, *Eriogonum umbellatum* 1♀, *Phacelia spp.* 1♀

Notes: Grigarick and Stange (1968) report that *A. utahense* is caught frequently on *Lotus,* collects pollen from *Phacelia* and *Melilotus,* and lines nest cells with *Cirsium* and *Artemisia.* Nests are built in holes in the ground or crevices (Gonzalez and Griswold 2013).

169. *Anthidium* (*Uncertain*) *banningense* Cockerell, 1904* – Sex: 4♀; June-July; Sites: GMM 4♀; Floral Records: *Phacelia procera* 1♀, *Phacelia spp.* 3♀

Notes: A ground-nester with a preference for *Phacelia* (Gonzalez and Griswold 2013).

170. *Anthidium* (*U.*) *mormonum* Cresson, 1878* – Sex: 1♀; July; Sites: 6N08D 1♀

Notes: Oligolectic on *Phacelia* (Wilson et al. 2010) but may also have a preference for *Lotus* (Grigarick and Stange 1968). *A. mormonum* is a host for cleptoparasite *Stelis* (Gonzalez and Griswold 2013).

171. *Dianthidium* (*Dianthidium*) *pudicum pudicum* (Cresson, 1879)* – Sex: 1♂; July; Sites: 6N08D 1♂; Pan-trapped: 1♂

Notes: Builds nests externally on sides or in crevices of rocks or vegetation (Grigarick and Stange 1968, Krombein et al. 1979).

172. ***Dianthidium* (*D.*) *singulare* (Cresson, 1879)*** – Sex: 5♀ 1♂; July; Sites: HMM 4♀ 1♂, GMS 1♀; Floral Records: *Cirsium douglasii* 1♀ 1♂; Pan-trapped: 4♀

Notes: Preference for Asteraceae (Grigarick and Stange 1968); constructs nests attached to rocks (Grigarick and Stange 1968, Krombein et al. 1979).

173. *Dianthidium* (*D.*) *subparvum* Swenk, 1914* – Sex: 16♀ 10♂; July-August; Sites: 6N08D 2♀ 2♂, (BCP) 2♀ 1♂, DNS 3♀ 2♂, GMM 1♀, GMS 3♀ 1♂, ML 2♀ 3♂, TF 2♀ 1♂, (WPP) 1♀; Floral Records: *Achillea millefolium* 1♀, *Erigeron aliceae* 1♀ 2♂, *Eriogonum nudum* 1♀, *Eriophyllum lanatum* 3♀ 1♂, *Hypericum perforatum* 1♀, *Polygonum douglasii* 1♂, *Rafinesquia californica* 1♂; Pan-trapped: 4♀ 2♂

Notes: Oligolectic on Asteraceae (Wilson et al. 2010); nests in pre-existing holes or cracks in the ground, cells contructed of conifer resin with embedded incence cedar and pebbles (Kipp Pow, unpublished). I caught one female specimen emerging from a ground nest at 6N08D on July 7.

174. *Dianthidium* (*D.*) *ulkei ulkei* (Cresson, 1878) – Sex: 1♀ 2♂; July-August; Sites: GMS 1♀ 2♂; Floral Records: *Polygonum douglasii* 1♀, *Verbena lasiostachys* 1♂

Notes: Oligolectic on Asteraceae (Wilson et al. 2010); builds nests in existing holes, tunnels, or cavities in the ground or wood (Grigarick and Stange 1968, Krombein et al. 1979).

175. *Stelis* (*Stelis*) *aff. interrupta* Cresson, 1897 – Sex: 6♀; June-July; Sites: ML 1♀, (WPP) 5♀

Notes: Identified by T. Griswold.

176. *Stelis* (*S.*) *calliphorina* (Cockerell, 1911) – Sex: 2♀; July; Sites: DNS 1♀, ML 1♀

Notes: Identified by T. Griswold.

177. *Stelis* (*S.*) *montana* Cresson, 1864 – Sex: 4♂; June-July; Sites: ARM 1♂, GMS 3♂; Floral Records: *Eriogonum nudum* 1♂, *Eriophyllum lanatum* 2♂, Other Asteraceae 1♂,

    Notes: Identified by T. Griswold. Cleptoparasite on *Osmia texana* and *O. montana* (Krombein et al. 1979, Rust 1974).

178. *Stelis* (*S.*) *monticola* Cresson, 1878 – Sex: 1♀; June; Sites: DNS 1♀; Floral Records: *Senecio spp.* 1♀

    Notes: Identified by T. Griswold. Cleptoparasite on *Hoplitis fulgida* (Krombein et al. 1979).

179. *Stelis sp.* 1 Panzer – Sex: 1♂; June; Sites: GMS 1♂; Floral Records: *Eriophyllum lanatum* 1♂

180. *Stelis sp.* 2 Panzer – Sex: 1♂; June; Sites: 6N08D 1♂; Floral Records: *Rubus spp.* 1♂

181. *Stelis sp.* 3 Panzer – Sex: 1♂; June; Sites: 6N08D 1♂

182. *Stelis sp.* 4 Panzer – Sex: 1♂; June; Sites: ML 1♂

Tribe Megachilini

183. *Coelioxys* (*Boreocoelioxys*) *novomexicana* Cockerell, 1909* – Sex: 3♀ 3♂; June-August; Sites: 6N08D 1♂, GMS 2♀ 1♂, (MLCC) 1♂, (WF) 1♀; Floral Records: *Achillea millefolium* 1♂, *Eriogonum nudum* 1♀ 2♂

    Notes: Cleptoparasite on *Megachile gentilis* and *M. brevis* (Baker 1975).

184. *Coelioxys* (*B.*) *porterae* Cockerell, 1900* – Sex 1♀ 1♂; June; Sites: ARM 1♂, (GMRO) 1♀; Floral Records: *Erigeron aliceae* 1♀, Other Asteraceae 1♂

    Notes: Cleptoparasite on *Megachile relativa* (Baker 1975). However, *M. relativa* was not found at any site. *C. porterae* was caught concurrently at ARM with *Megachile gemula*, *M. melanophaea,* and *M. perihirta*. GMRO site is near GMM site. *Megachile* species found at GMM are *M. fidelis*, *M. gemula*, *M. melanophaea,* and *M. montivaga*.

185. *Coelioxys* (*Coelioxys*) *hirsutissima* Cockerell, 1912* – Sex: 1♀; July; Sites: GMS 1♀; Floral Records: *Eriophyllum lanatum* 1♀

    Notes: Host unknown (Baker 1975) but caught concurrently with *Megachile angelarum*, *M. fidelis*, *M. perihirta*, *M. pugnata,* and *M. texana*.

186. *Coelioxys* (*Cyrtocoelioxys*) *gilensis* Cockerell, 1896* – Sex: 1♀ 3♂; July-August; Sites: 6N08D 1♀ 2♂, (BCP) 1♂; Floral Records: *Eriogoum nudum* 1♀ 2♂, *Eriogonum umbellatum* 1♂

    Notes: Cleptoparasite on *Megachile subexilis* and *M. rotundata* (Baker 1975) but neither species was present at any site. *C. gilensis* was caught concurrently with *M. angelarum*, *M. gentilis*, *M. montivaga*, *M. perihirta*, *M. pseudonigra,* and *M. texana*.

187. *Megachile* (*Chelostomoides*) *angelarum* Cockerell, 1902* – Sex: 24♀ 12♂; July-August; Sites: 6N08D 21♀ 4♂, GMS 4♂, HMM 2♂, (WF) 3♀, (WH) 2♂; Floral Records: *Cordylanthus tenuis ssp. viscidus* 21♀ 2♂, *Erigonum nudum* 1♀, *Eriophyllum lanatum* 1♂, *Frangula californica ssp. occidentalis* 2♂, *Lotus*

corniculatus 2♀, *Monardella sheltonii* 1♂, *Penstemon spp.* 1♂, *Polygonum douglasii* 1♂, *Verbena lasiostachys* 2♂

Notes: Possible host for cleptoparasites *Coelioxys hirsutissima* and *C. gilensis.*

188. *Megachile* (*Litomegachile*) *gentilis* Cresson, 1872* – Sex: 2♀ 1♂; July-August; Sites: 6N08D 1♀, (BCP) 1♂, (CRO) 1♀; Floral Records: *Cordylanthus tenuis ssp. viscidus* 1♀, *Eriogonum nudum* 1♂, *Rafinesquia californica* 1♀

Notes: Possible host for cleptoparasites *Coelioxys hirsutissima* and *C. novomexicana*.

189. *Megachile* (*L.*) *texana* Cresson, 1878* – Sex: 4♀ 6♂; June-August; Sites: 6N08D 2♀ 2♂, (BCP) 1♀, DNS 1♂, GMS 1♀ 2♂, HMM 1♂; Floral Records: *Eriogonum nudum* 3♀ 2♂, *Eriogonum umbellatum* 1♂, *Eriophyllum lanatum* 2♂, *Frangula californica ssp. occidentalis* 1♂

Notes: *M. texana* is a ground-nester unlike most *Megachile* (Byzdk 2012, Sheffield et al. 2011); possible host for cleptoparasites *Coelioxys hirsutissima* and *C. gilensis*.

190. *Megachile* (*Megachile*) *montivaga* Cresson, 1878* – Sex: 1♀ 4♂; July; Sites: 6N08D 1♂, GMM 1♀ 1♂, GMS 1♂, HMM 1♂; Floral Records: *Cirsium douglasii* 1♂, *Erigeron aliceae* 1♂, *Eriophyllum lanatum* 1♂, *Penstemon spp.* 1♂; Pan-trapped: 1♀

Notes: *Megachile montivaga* is unique in its nesting habits; it nests both in the ground and in cavities and uses flower petals to construct cells (Sheffield et al.

2011). Recently, nests have been discovered in live stems of *Cirsium* (Orr et al. 2015). Possible host for cleptoparasites *Coelioxys gilensis* and *C. porterae*.

191. *Megachile* (*Megachiloides*) *pseudonigra* Mitchell, 1927* – Sex: 14♀; June-July; Sites: 6N08D 10♀, ARM 1♀, GMS 1♀, ML 2♀; Floral Records: *Eriophyllum lanatum* 7♀; Pan-trapped: 2♀

    Notes: Apparently oligolectic on Asteraceae; nests in the ground (M. Mesler, personal communication). Males have not been described and are listed separately as *Megachile* (*M.*) *spp*. Possible host for cleptoparasite *Coelioxys gilensis*.

192. *Megachile* (*M.*) *spp*. Mitchell – Sex: 4♂; June; Sites: 6N08D 1♂, GMS 2♂, ML 1♂; Floral Records: *Eriophyllum lanatum* 2♂

    Notes: Most likely males of *M. pseudonigra*.

193. *Megachile* (*Sayapis*) *fidelis* Cresson, 1878* – Sex: 2♀ 1♂; July; Sites: GMM 1♀, GMS 1♀ 1♂; Floral Records: *Erigeron aliceae* 1♀, *Monardella sheltonii* 1♀, *Verbena lasiostachys* 1♂

    Notes: Oligolectic on Asteraceae (Wilson et al. 2010); possible host for cleptoparasites *Coelioxys hirsutissima* and *C. porterae*.

194. *Megachile* (*S.*) *pugnata* Say, 1837* – Sex: 1♀ 1♂; July; Sites: GMM 1♂, HMM 1♀; Floral Records: *Cirsium douglasii* 1♀, *Monardella sheltonii* 1♂

    Notes: Possible host for cleptoparasite *Coelioxys hirsutissima*.

195. *Megachile* (*Xanthosarus*) *gemula* Cresson, 1878* – Sex: 2♀ 2♂; June-July; Sites: ARM 1♂, DNS 1♀, GMM 1♀ 1♂; Floral Records: *Erysimum capitatum* 1♀, *Phacelia spp.* 1♀ 1♂, *Wyethia spp.* 1♂

    Notes: According to Mitchell (1935), species in the subgenus *Xanthosarus* are ground-nesters although nesting habits for *gemula* have not been documented. Possible host for cleptoparasite *Coelioxys porterae*.

196. ***Megachile* (*X.*) *latimanus* Say, 1823*** – Sex: 1♂; July; Sites: (BFCC) 1♂; Floral Records: *Eriogonum nudum* 1♂

    Notes: A ground-nester (Mitchell 1936a, Sheffield et al. 2011) and host for cleptoparasite *Coelioxys* (Krombein et al. 1979).

197. *Megachile* (*X.*) *melanophaea* Smith, 1853* – Sex: 3♀ 2♂; June-July; Sites: ARM 1♀ 1♂, (BFCC) 1♀, GMM 1♂, ML 1♀; Floral Records: *Hypericum perforatum* 1♀, *Lupinus spp.* 1♀ 1♂, *Symphoricarpos mollis* 1♂

    Notes: A ground-nester (Mitchell 1935, Sheffield et al. 2011) and oligolectic on Fabaceae (Wilson et al. 2010); possible host for cleptoparasite *Coelioxys porterae*.

198. *Megachile* (*X.*) *perihirta* Cockerell, 1898* – Sex: 7♀ 4♂; June-August; Sites: ARM 1♀, (BFCC) 4♀, (BCP) 1♂, DNS 1♀, GMS 3♂, ML 1♀; Floral Records: *Erigeron aliceae* 1♀, *Eriogonum nudum* 2♂, *Eriophyllum lanatum* 2♂, *Gilia capitata* 1♀, *Hypericum perforatum* 4♀, *Wyethia spp.* 1♀

Notes: A ground-nester (Mitchell 1936a, Sheffield et al. 2011) and oligolectic on Asteraceae (Wilson et al. 2010); possible host for cleptoparasites *Coelioxys hirsutissima*, *C. gilensis*, and *C. porterae*.

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199. *Ashmeadiella cactorum cactorum* (Cockerell, 1897)* – Sex: 2♀; July; Sites: 6N08D 1♀, GMS 1♀; Floral Records: *Penstemon spp.* 1♀, *Polygonum douglasii* 1♀

200. ***Atoposmia* (*Atoposmia*) *triodonta* (Cockerell, 1935)*** – Sex: 1♀ 2♂; June-July; Sites: DNS 1♂, GMM 1♂, GMS 1♀; Floral Records: *Penstemon spp.* 1♀; Pan-trapped: 2♂

Notes: Oligolectic on *Penstemon* (Hurd and Michener 1955).

201. *Atoposmia* (*Hexosmia*) *copelandica* (Cockerell, 1908)* – Sex: 3♂; June; Sites: GMM 3♂; Pan-trapped: 3♂

Notes: Oligoletic on Boraginaceae with a preference for *Nemophila* and *Phacelia* (Hurd and Michener 1955).

202. ***Chelostoma minutum* Crawford, 1916*** – Sex: 1♂; July; Sites: GMM 1♂; Pan-trapped: 1♂

Notes: Preference for *Phacelia* (Hurd and Michener 1955).

203. *Heriades* (*Physostetha*) *cressoni* Michener, 1938* – Sex: 1♂; July; Sites: GMM 1♂; Floral Records: *Erigeron aliceae* 1♂

Notes: Oligolectic on Asteraceae (Wilson et al. 2010).

204. *Hoplitis* (*Alcidamea*) *producta gracilis* (Michener, 1935)* – Sex: 2♀ 2♂; June-July; Sites: 6N08D 2♀ 1♂, ML 1♂; Floral Records: *Downingia elegans* 1♂, *Penstemon spp.* 2♀; Pan-trapped: 1♂

    Notes: Host for cleptoparasite *Stelis* (Krombein et al. 1979).

205. *Hoplitis* (*Monumetha*) *albifrons maura* (Cresson, 1878)* – Sex: 3♀ 4♂; June-July; Sites: GMM 3♀ 2♂, GMS 2♂; Floral Records: *Phacelia spp.* 3♀ 3♂; Pan-trapped: 1♂

    Notes: Host for cleptoparasite *Stelis* (Krombein et al. 1979).

206. *Hoplitis* (*M.*) *fulgida platyura* (Cockerell, 1911)* – Sex: 2♀ 11♂; June-July; Sites: 6N08D 1♂, ARM 1♂, DNS 1♀ 6♂, GMM 3♂, (PS) 1♀; Floral Records: *Allium spp.* 1♀ 2♂, *Phacelia spp.* 1♀ 2♂; Pan-trapped: 6♂

    Notes: Host for cleptoparasite *Stelis monticola* (Krombein et al. 1979).

207. *Osmia* (*Cephalosmia*) *californica* Cresson, 1864* – Sex: 4♀; June; Sites: ARM 3♀, HR 1♀; Floral Records: *Senecio spp.* 1♀, *Wyethia spp.* 3♀

    Notes: Common on *Cirsium* (Rust 1974) and host for cleptoparasite *Stelis* (Krombein et al. 1979).

208. ***Osmia* (*C.*) *grinnelli* Cockerell, 1910*** – Sex: 2♂; May; Sites: GMM 2♂; Pan-trapped: 2♂

209. *Osmia* (*C.*) *montana quadriceps* Cresson, 1878 – Sex: 36♀ 17♂; May-July; Sites: 6N08D 5♀ 2♂, ARM 6♀ 1♂, DNS 1♂, GMM 8♀ 8♂, GMS 14♀ 4♂, HR 2♀ 1♂, TF 1♀; Floral Records: *Arctostaphylos spp.* 1♀ 1♂, *Calyptridium monospermum*

1♀, *Claytonia lanceolata* 1♀, *Erigeron aliceae* 2♀, *Eriophyllum lanatum* 7♀ 1♂, *Phacelia spp.* 1♀ 2♂, *Potentilla spp.* 1♀, *Sanicula tuberosa* 1♂, *Senecio spp.* 1♂, *Wyethia spp.* 8♀ 1♂, Other Asteraceae 1♀; Pan-trapped: 8♀ 9♂

Notes: Preference for Asteraceae (Rust 1974). One female caught emerging from tree stump (possibly *Pinus*) at GMS on July 5.

210. *Osmia* (*C.*) *subaustralis* Cockerell, 1900* – Sex: 1♂; May; Sites: GMM 1♂; Pan-trapped: 1♂

Notes: Oligolectic on Asteraceae (Krombein et al. 1979, Wilson et al. 2010).

211. *Osmia* (*Helicosmia*) *coloradensis* Cresson, 1878 – Sex: 20♀ 4♂; June-July; Sites: 6N08D 5♀, DNS 1♀, GMM 1♀ 4♂, GMS 13♀; Floral Records: *Erigeron aliceae* 1♀ 1♂, *Eriophyllum lanatum* 14♀, *Potentilla spp.* 1♀, *Senecio spp.* 1♂, *Verbena lasiostachys* 1♀; Pan-trapped: 1♂

Notes: Preference for Asteraceae (Rust 1974); host for cleptoparasite *Stelis montana* (Krombein et al. 1979).

212. *Osmia* (*H.*) *texana* Cresson, 1872 – Sex: 31♀ 1♂; June-August; Sites: GMM 2♀ 1♂, GMS 3♀, HMM 26♀; Floral Records: *Cirsium douglasii* 25♀, *Cirsium occidentale* 2♀, *Erigeron aliceae* 1♀, *Monardella sheltonii* 1♀, *Phacelia spp.* 1♀, *Senecio triangularis* 1♂

Notes: Preference for *Cirsium*; host for cleptoparasite *Stelis montana* (Rust 1974).

213. *Osmia* (*Melanosmia*) *aglaia* Sandhouse, 1939* – Sex: 9♂; June; Sites: DNS 1♂, GMM 8♂; Floral Records: *Allium spp.* 1♂, *Phacelia procera* 1♂; Pan-trapped: 7♂

Notes: Identified by T. Griswold.

214. *Osmia* (*M.*) *albolateralis* Cockerell, 1906* – Sex: 19♀ 7♂; June-August; Sites: 6N08D 4♀, (ARCC) 1♀, ARM 1♀, CM 1♂, DNS 1♀, GMM 5♀ 2♂, HR 4♂, ML 3♀, (MLCC) 1♀, (MLRO) 1♀, (WH) 2♀; Floral Records: *Arctostaphylos spp.* 1♀, *Camassia leichtlinii ssp. suksdorfii* 1♀, *Collinsia spp.* 1♀, *Downingia elegans* 1♀, *Hypericum perforatum* 1♀, *Penstemon spp.* 12♀, *Phacelia spp.* 1♂, *Wyethia spp.* 1♀; Pan-trapped: 6♂

Notes: Identified by T. Griswold. Oligolectic on Fabaceae (Wilson et al. 2010).

215. *Osmia* (*M.*) *atrocyanea* Cockerell, 1897 – Sex: 5♀ 4♂; May-July; Sites: 6N08D 1♀ 1♂, DNS 1♂, GMM 1♂, GMS 1♀ 1♂, ML 3♀; Floral Records: *Allium spp.* 1♂, *Arctostaphylos spp.* 1♂, *Downingia elegans* 3♀, *Penstemon spp.* 2♀ 1♂, *Phacelia mutabilis* 1♂

Notes: Identified by T. Griswold.

216. *Osmia* (*M.*) *brevis* Cresson, 1864 – Sex: 20♀ 22♂; May-July; Sites: 6N08D 6♀ 1♂, (ARCC) 1♀ 1♂, DNS 2♂, GMM 4♀ 16♂, GMS 1♂, ML 1♀, (MLCC) 3♀, (MLRO) 1♀, (WPP) 4♀ 1♂; Floral Records: *Penstemon spp.* 17♀ 3♂; Pan-trapped: 18♂

Notes: Identified by T. Griswold. Oligolectic on *Penstemon* (Cane 2014).

217. ***Osmia* (*M.*) *cahuilla* Cooper, 1993*** – Sex: 1♂; June; Sites: GMM 1♂; Pan-trapped: 1♂

Notes: Identified by T. Griswold.

218. *Osmia* (*M.*) *calla* Cockerell, 1897 – Sex: 3♀ 7♂; June-July; Sites: 6N08D 2♀ 1♂, ARM 1♂, GMM 1♀ 4♂, ML 1♂; Floral Records: *Collinsia spp.* 1♀, *Penstemon spp.* 1♀, *Potentilla spp.* 2♂; Pan-trapped: 3♂

Notes: Identified by T. Griswold.

219. *Osmia* (*M.*) *cobaltina* Cresson, 1878 – Sex: 2♀; June-July; Sites: 6N08D 2♀; Floral Records: *Penstemon spp.* 1♀

Notes: Identified by T. Griswold.

220. *Osmia* (*M.*) *cyanella* Cockerell, 1897 – Sex: 41♀ 7♂; May-July; Sites: 6N08D 2♀, (ARCC) 1♀, ARM 1♀ 1♂, CM 2♂, DNS 1♀, GMM 5♀ 4♂, GMS 25♀, ML 2♀, (PS) 4♀; Floral Records: *Allium spp.* 1♀, *Downingia elegans* 2♀, *Eriophyllum lanatum* 1♀, *Lupinus spp.* 1♂, *Monardella sheltonii* 2♀, *Nemophila menziesii* 1♂, *Penstemon spp.* 7♀, *Phacelia procera* 1♀, *Phacelia spp.* 22♀, *Verbena lasiostachys* 4♀, *Wyethia spp.* 1♀; Pan-trapped: 5♂

Notes: Identified by T. Griswold.

221. *Osmia* (*M.*) *densa* Cresson, 1864 – Sex: 84♀ 13♂; May-July; Sites: 6N08D 5♀ 1♂, (ARCC) 1♀, ARM 2♀, CM 1♀ 1♂, DNS 4♀, GMM 51♀ 3♂, GMS 9♀, HR 5♂, ML 4♀, (MLCC) 1♀, (MLRO) 2♀, (WPP) 3♀, (PS) 1♀, TF 3♂; Floral Records: *Arctostaphylos spp.* 2♀, *Calochortus tolmiei* 1♂, *Collinsia spp.* 1♀, *Downingia*

elegans 3♀, *Hackelia bella* 1♀, *Monardella sheltonii* 1♀, *Penstemon spp.* 20♀ 1♂, *Phacelia procera* 1♀, *Phacelia spp.* 38♀, *Sedum spp.* 1♀, *Wyethia spp.* 1♀; Pan-trapped: 14♀ 11♂

Notes: Identified by T. Griswold.

222. *Osmia* (*M.*) *ednae* Cockerell, 1907 – Sex: 19♀ 6♂; June-August; Sites: 6N08D 2♀ 2♂, GMM 6♀ 2♂, GMS 1♀ 1♂, HR 1♂, ML 1♀, (MLCC) 4♀, (WPP) 3♀, (WH) 2♀; Floral Records: *Arctostaphylos spp.* 1♂, *Erigeron aliceae* 1♀, *Hypericum perforatum* 1♀, *Penstemon spp.* 15♀ 1♂, *Verbena lasiostachys* 1♀; Pan-trapped: 3♂

Notes: Identified by T. Griswold.

223. ***Osmia* (*M.*) *exigua* Cresson, 1878*** – Sex: 16♀ 11♂; May-July; Sites: 6N08D 3♀, CM 1♂, DNS 3♀ 3♂, GMM 7♀ 7♂, ML 1♀, (PS) 1♀, TF 1♀; Floral Records: *Allium spp.* 2♀ 1♂, *Calochortus tolmiei* 1♀, *Collinsia parviflora* 1♀, *Collinsia spp.* 1♀, *Nemophila menziesii* 1♂, *Penstemon spp.* 1♀, *Phacelia procera* 1♀, *Phacelia spp.* 2♀, *Rosa nutka* 1♀, *Sanicula tuberosa* 2♀ 1♂; Pan-trapped: 8♂

Notes: Identified by T. Griswold.

224. *Osmia* (*M.*) *gabrielis* Cockerell, 1910 – Sex: 1♀; June; Sites: DNS 1♀; Pan-trapped: 1♀

Notes: Identified by T. Griswold.

225. *Osmia* (*M.*) *juxta* Cresson, 1864 – Sex: 1♀ 1♂; May-July; Sites: CM 1♂, GMS 1♀; Floral Records: *Monardella sheltonii* 1♀, *Nemophila menziesii* 1♂

Notes: Identified by T. Griswold.

226. *Osmia* (*M.*) *kincaidii* Cockerell, 1897 – Sex: 6♀ 4♂; June-July; Sites: 6N08D 1♀, DNS 1♀ 1♂, GMM 1♀ 1♂, GMS 3♀, HR 1♂, TF 1♂; Floral Records: *Allium spp.* 1♀, *Collinsia parviflora* 1♀, *Collinsia spp.* 1♀, *Phacelia spp.* 3♀; Pan-trapped: 4♂
Notes: Identified by T. Griswold.

227. *Osmia* (*M.*) *lanei* Sandhouse, 1939 – Sex: 29♀ 5♂; June-July; Sites: (AM) 3♀, (ARM) 12♀, DNS 2♂, GMM 1♀ 1♂, HR 6♀ 2 ♂, ML 2♀, (MLCC) 4♀, (WPP) 1♀; Floral Records: *Acmispon americanus* 1♀, *Allium spp.* 13♀ 2♂, *Lomatium spp.* 1♀, *Penstemon spp.* 5♀, *Trifolium spp.* 4♀ 2♂, *Wyethia spp.* 2 ; Pan-trapped: 2♀
Notes: Identified by T. Griswold. *O. lanei* is a ground-nester and has a preference for *Trifolium longipes* (Otto 2006).

228. *Osmia* (*M.*) *malina* Cockerell, 1909 – Sex: 1♀; June; Sites: GMS 1♀; Floral Records: *Eriophyllum lanatum* 1♀
Notes: Identified by T. Griswold.

229. *Osmia* (*M.*) *melanopleura* Cockerell, 1916 – Sex: 7♀; May-July; Sites: 6N08D 2♀, CM 1♀, DNS 4♀; Floral Records: *Allium spp.* 3♀, *Arctostaphylos spp.* 1♀, *Calyptridium monospermum* 1♀, *Collinsia grandiflora* 1♀
Notes: Identified by T. Griswold.

230. *Osmia* (*M.*) *nemoris* Sandhouse, 1924 – Sex: 1♂; June; Sites: ARM 1♂; Pan-trapped: 1♂
Notes: Identified by T. Griswold. Nests in abandoned burrows of *Diadasia diminuta* and collects pollen mostly from *Penstemon* and legumes (Krombein et al. 1979).

231. *Osmia* (*M.*) *odontogastor* Cockerell, 1897* – Sex: 2♂; May-June; Sites: HR 1♂, GMM 1♂; Floral Records: *Trifolium spp.* 1♂; Pan-trapped: 1♂

    Notes: Identified by T. Griswold. Oligolectic on Fabaceae (Wilson et al. 2010). *O. odontogaster* is now a member of the *odontogaster* species group in *Melanosmia*, a group recognized for its ground-nesting habits (Rightmyer et al. 2013).

232. *Osmia* (*M.*) *pentstemonis* Cockerell, 1906 – Sex: 11♀; June-July; Sites: 6N08D 1♀, (GMRO) 1♀, GMM 5♀, ML 1♀, (MLRO) 1♀, (WPP) 1♀, TF 1♀; Floral Records: *Penstemon spp.* 6♀, *Potentilla spp.* 1♀, *Ribes sanguineum* 1♀; Pan-trapped: 1♀

    Notes: Identified by T. Griswold. Oligolectic on *Penstemon* (Wilson et al. 2010) and host for cleptoparasite *Stelis* (Krombein et al. 1979).

233. ***Osmia* (*M.*) *pikei* Cockerell, 1907*** – Sex: 1♀ 1♂; May; Sites: DNS 1♀, GMM 1♂; Floral Records: *Ribes lobbii* 1♂, *Ribes saguineum* 1♀

    Notes: Identified by T. Griswold. Oligolectic on *Ribes* (Wilson et al. 2010).

234. ***Osmia* (*M.*) *proxima* Cresson, 1864*** – Sex: 1♀ 2♂; June-August; Sites: DNS 1♂, GMM 1♂, (WH) 1♀; Floral Records: *Allium spp.* 1♂

    Notes: Identified by T. Griswold. Host for cleptoparasite *Stelis* (Krombein et al. 1979).

235. ***Osmia* (*M.*) *pusilla* Cresson, 1864*** – Sex: 2♀ 1♂; June-July; Sites: DNS 1♀, GMM 1♂, ML 1♀; Floral Records: *Allium spp.* 1♀, *Collinsia parviflora* 1♂, *Downingia elegans* 1♀

    Notes: Identified by T. Griswold.

236. *Osmia* (*M.*) *sedula* Sandhouse, 1924* – Sex: 21♀ 29♂; June-July; Sites: 6N08D 7♀ 5♂, ARM 2♀ 18♂, GMM 2♀ 2♂, HR 1♀, ICM 2♂, ML 9♀, TF 2♂; Floral Records: *Collinsia parviflora* 1♀, *Downingia elegans* 8♀, *Phacelia procera* 1♂, *Sanicula tuberosa* 1♂; Pan-trapped: 4♀ 22♂

    Notes: Identified by T. Griswold. Three female specimens were caught emerging from possible nest holes in the ground at 6N08D on July 7. *O. sedula* is now a member of the *odontogaster* species group in *Melanosmia*, a group recognized for its ground-nesting habits (Rightmyer et al. 2013).

237. ***Osmia* (*M.*) *simillima* Smith, 1853*** – Sex: 1♂; June; Sites: GMM 1♂

    Notes: Identified by T. Griswold. Host for cleptoparasite *Stelis* (Krombein et al. 1979).

238. *Osmia* (*M.*) *thysanisca* Michener, 1957* – Sex: 1♀; May; Sites: ML 1♀; Floral Records: *Viola hallii* 1♀

    Notes: Identified by T. Griswold.

239. ***Osmia* (*M.*) *trevoris* Cockerell, 1897*** – Sex: 9♀ 4♂; June-July; Sites: 6N08D 1♀ 1♂, ARM 1♂, GMM 1♂, ML 7♀, (WPP) 1♂, TF 1♀; Floral Records: *Downingia elegans* 6♀, *Eriophyllum lanatum* 1♀, *Penstemon spp.* 1♀ 1♂; Pan-trapped: 2♂

    Notes: Identified by T. Griswold.

240. *Osmia* (*M.*) *tristella* Cockerell, 1897 – Sex: 7♀ 9♂; May-July; Sites: 6N08D 1♀, CM 6♂, GMM 5♀ 3♂, GMS 1♀; Floral Records: *Erigeron aliceae* 1♀, *Penstemon spp.* 1♀, *Phacelia spp.* 3♀, *Ribes sanguineum* 1♀, *Sanicula tuberosa* 1♀; Pan-

trapped: 9♂

Notes: Identified by T. Griswold.

241. *Osmia* (*M.*) *sp.* Schmiedeknecht – Sex: 1♀; July; Sites: (MLCC) 1♀; Floral Records: *Penstemon spp.* 1♀

Notes: Identified by T. Griswold.

242. *Osmia* (*M.*) *sp. 1* Schmiedeknecht – Sex: 2♂; May-June; Sites: CM 1♂, GMM 1♂; Pan-trapped: 2♂

Notes: Identified by T. Griswold.

243. *Osmia* (*M.*) *sp. 2* Schmiedeknecht – Sex: 2♂; June; Sites: ARM 1♂, GMM 1♂; Floral Records: *Wyethia spp.* 1♂; Pan-trapped: 1♂

Notes: Identified by T. Griswold.

244. *Osmia* (*M.*) *sp. 3* Schmiedeknecht – Sex: 4♂; May-June; Sites: DNS 1♂, GMM 2♂, HR 1♂; Floral Records: *Allium spp.* 1♂, *Trifolium spp.* 1♂; Pan-trapped: 2♂

Notes: Identified by T. Griswold.

245. *Osmia* (*Osmia*) *lignaria propinqua* Cresson, 1864 – Sex: 2♀; May-June; Sites: GMM 2♀; Floral Records: *Achillea millefolium* 1♀, *Ribes sanguineum* 1♀

Notes: Host for *Stelis* cleptoparasite and nests in *Anthopora abrupta* burrows (Rust 1974).

246. *Osmia* (*O.*) *ribifloris biedermannii* Michener, 1936* – Sex: 4♀; May-June; Sites: 6N08D 1♀, DNS 3♀; Floral Records: *Arctostaphylos spp.* 4♀

Notes: Preference for *Arctostaphylos* (Rust 1974).

247. *Osmia* (*Uncertain*) *bakeri* Sandhouse, 1924 – Sex: 6♂; May-Junes; Sites: 6N08D 2♂, DNS 4♂; Floral Records: *Allium spp.* 2♂; Pan-trapped: 2♂

    Notes: Identified by T. Griswold.

248. *Osmia* (*U.*) *visenda* Sandhouse, 1924 – Sex: 1♀; June; Sites: ARM 1♀; Floral Records: *Wyethia spp.* 1♀

    Notes: Identified by T. Griswold.

Appendix B. Key to female *Andrena* species of the Horse Mountain and Grouse Mountain Region, Humboldt County, California.

Successful use of this key requires proper specimen preparation: mandibles must be spread and labrum, pronotum, propodeal corbiculae, and hind tibial spurs visible. I follow the standard terms used in Michener (2007). Terms specific to *Andrena* are explained in the glossary at the end of the key.

1. Submarginal cells two; integument blue-green metallic.....2
   Submarginal cells three; integument metallic or not 3
2. Hind wing a shallow indentation between vannal and jugal, jugal lobe narrow; hairs on sides of thorax, face, and genal area dark ..... *chalybiodes*
   Hind wing with deep incision separating vannal and jugal lobes, jugal lobe broad; hairs on sides of thorax, face, and genal area pale except along inner margin of facial fovea and outer margin of compound eye.....*cuneilabris*
3. Mandible tridentate; labrum below process with a weak vertical median crest ....*obscuripostica*
   Mandible bidentate; labrum below process without crest.....4
4. T1 with pale apical hair band, T2-T4 also with apical bands ..... *auricoma*
   T1 lacking hair band, T2-T4 with or without hair bands (may be worn or interrupted medially) 5
5. Propodeal triangle coarsely sculptured with a keel-shaped ridge along the edge where the vertical and horizontal faces of the propodeum meet 6

Propodeal triangle usually finely sculptured, but if coarsely sculptured then edge lacking ridge.....11

6. Scutum with pale short thick scaly hairs, bent backwards, central hairs reddish-brown .....*quintiliformis*

   Scutum generally lacking scaly hairs but if present then long and slender, mostly erect 7

7. Abdominal terga with weak blue metallic reflections ..... *cleodora*

   Abdominal terga without reflections, dark 8

8. Vestiture mostly dark except with hairs on scutum entirely pale ..... *cupreotincta*

   Vestiture mostly pale 9

9. T2 with gradulus about midpoint of the tergite so that the pregradular area is equal to or slightly greater than the disc, as measured centrally; T2-T4 with apical hairs bands laterally ..... *forbesii*

   T2 with gradulus closer to the base of tergite so that the pregradular area is less than the disc; T2-T4 lacking apical hair bands 10

10. Pregradular area about 1/3 the length of the whole tergite; bottom of facial fovea about half the width of top half..... *amphibola*

    Pregradular area less than 1/4 the length of the whole tergite; bottom of facial fovea broader than half the width of top half..... *fuscicauda*

11. Scutum with fine longitudinal folds, appears wrinkly..... *torulosa*

    Scutum punctate and lacking wrinkly folds.....12

12. Face below ocelli checkered ..... *vandykei*

    Face below ocelli with longitudinal folds, not checkered.....13

13. Clypeus creamy yellow with two small dark spots laterally, yellow sometimes reduced to small central spot; inner hind tibial spur twisted and bent.....*prunorum*

    Clypeus all black or metallic, no yellow; inner hind tibial spur straight 14

14. Hairs on scutum pale except with a transverse band of dark hairs between tegulae ....*transnigra*

    Hairs on scutum all black, all pale, or mixed.....15

15. Labral process tongue-shaped, length of process greater than the width at base .... *barbilabris*

    Labral process not tongue-shaped, usually rectangular and sometimes with bidentate or a slight emargination, length of process equal to or smaller than the width of the base 16

16. Scopal hairs on tibia plumose .....*caerulea*

    Scopal hairs simple 17

17. 1st transverse cubital close to stigma, within 1-3 vein widths.....18

    1st transverse cubital further from stigma, greater than 3 vein widths.....19

18. Integument blue-green metallic; tergal hairs bands on extreme lateral edge of T2 through T4, if not worn.....*microchlora*

    Integument dark, not metallic; no tergal hair bands ..... *melanochroa*

19. Propodeal corbicula complete, with anterior fringe of plumose hairs and internal hairs absent (see Glossary) 20

    Propodeal corbicula incomplete, anterior fringe absent and simple internal hairs usually present 21

20. Distance from lateral ocelli to vertex edge more than 1 ocellar diameter; sutures on propodeum delimiting the triangle strong..... *angustitarsata*

    Distance from lateral ocelli to vertex edge less than 1 ocellar diameter; sutures on propodeum weak..... *orthocarpi*

21. Pronotum with dorsolateral angle (see Glossary) 22

    Pronotum without dorsolateral angle 27

22. Edge of vertex with deep indentation at midpoint between lateral ocelli..... *hemileuca*

    Edge of vertex without indentation.....23

23. Scopal hairs along posterior edge of tibia short, hairs in apical half of tibia shorter than middle width of tibia 24

    Scopal hairs long, as long as or longer than middle width of tibia.....25

24. Hind trochanter and propodeal corbicula with dark hairs, T2 with pale hairs..... ..... *ceanothifloris*

    Hind trochanter and propodeal corbicula with pale hairs, T2 sometimes with pale hairs on extreme basal end (not visible if terga not extended) ..... *washingtoni*

25. Vestiture mostly pale .....*thaspii*

    Vestiture mostly dark, pale hairs only on top of thorax and sometimes T1 26

26. Hairs on propodeum and T1 dark; scopal hairs on hind trochanter and tibia dark..... ..... *saccata*

    Hairs on propodeum and T1 pale; scopal hairs on hind trochanter and tibial partly pale..... *rufosignata*

27. Hind tibia wedge-shaped, apex 4-5x wider than base; scopal hairs along posterior edge of hind tibia short, less than half as long as greatest tibia width.....28

    Hind tibia not wedge-shaped, but if apex of tibia slightly wider than base then scopal hairs more than half the length of the greatest tibia width.....29

28. Vestiture mostly dark except thorax with pale hairs dorsally.....*merriami*

    Vestiture mostly pale, hairs on entire thorax pale.....*gordoni*

29. Integument strongly metallic 30

    Integument dark or sometimes with weak metallic reflections on head and thorax....31

30. Head, thorax, and abdomen blue-black metallic.....*nigrocaerulea*

    Head black, only thorax and abdomen blue-black metallic..... *cerasifolii*

31. T2-T4 lacking apical hair bands 32

    T2-T4 with apical hair bands, these sometimes broadly interrupted medially.....33

32. Distance from lateral ocelli to vertex edge greater than 2 ocellar diameters; large bee (15-20 mm) .....*nivalis*

    Distance from lateral ocelli to vertex edge equal to or smaller than 1 ocellar diameter; medium-sized bee (10-15mm).....*nigrihirta*

33. Head and/or thorax with weak metallic reflections 34

Head and thorax dark, no reflections 35

34. Facial fovea broad and extending below lower margin of antennal socket, distance between fovea and lateral ocelli about 1 ocellar diameter ..... *candida*

    Facial fovea narrow and extending to about the lower end of antennal socket, distance between fovea and ocelli more than 1 ocellar diameter ..... *chlorura*

35. Clypeus convex with large coarse crowded punctures ..... *knuthiana*

    Clypeus flattened with punctures minute to small, less dense ..... *w-scripta*

GLOSSARY

Dorsolateral angle: area on pronotum in front of and inwards of each pronotal lobe

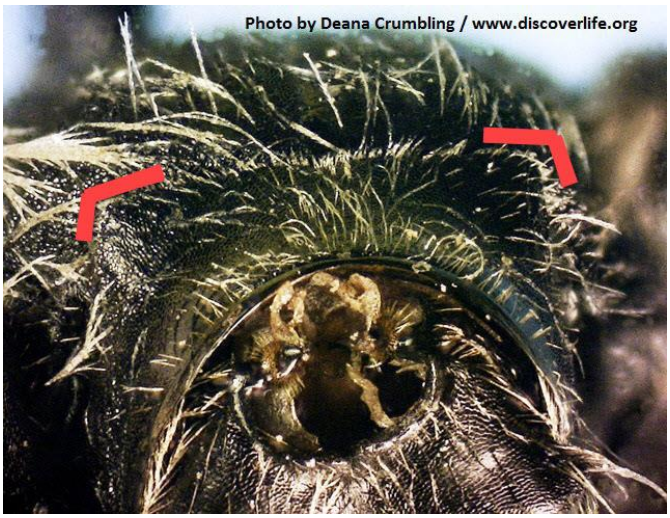

Figure 6. Dorsolateral angle on pronotum (frontal view, head has been removed from specimen so angles are visible)

Labral process (image below): basal elevated plate on labral surface

Figure 7. Labral process.

Metallic: integument visibly metallic to the naked eye

Metallic reflections: integument with slight metallic sheen usually noticeable with magnification

Propodeal corbiculae (image below): pollen-transport structure on both sides of propodeum outlined partially (incomplete) or entirely (complete) by long plumose hairs curling in towards middle of structure; internal hairs, when present, are located on the surface of the corbicula

Incomplete: plumose hairs absent along front edge of corbicula or if few hairs present then hairs are simple; internal hairs always present

Complete: plumose hairs entirely surrounding corbicula; internal hairs may or may not be present

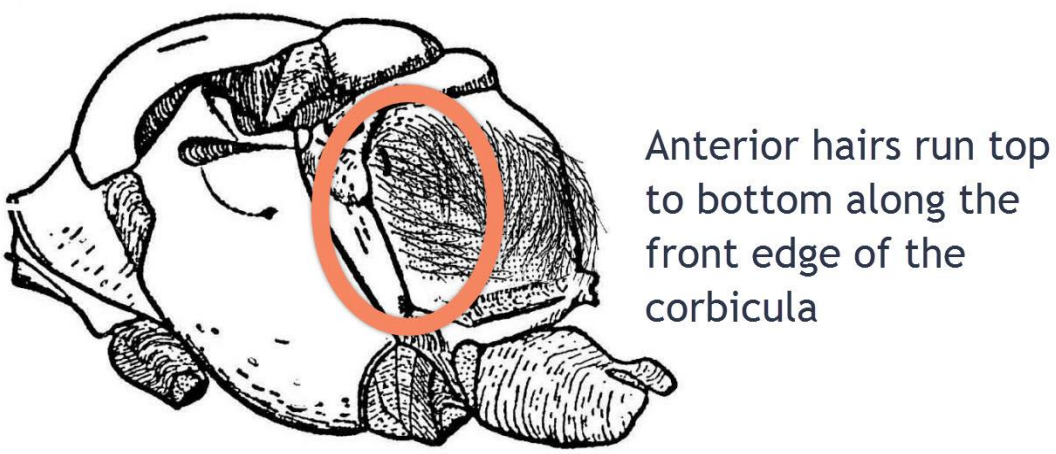

Image taken from C. D. Michener 1999 *The corbuculae of the bees* Apidologie 30:67-74

Figure 8. Lateral view of thorax highlighting the propodeal corbicula. The surface of the corbicula is stippled (Michener 1999).

Appendix C. Resources used to identify species and create key.

Andrenidae

Bouseman and LaBerge 1979; Crawford 1926; LaBerge 1969, 1971, 1973, 1977, 1980, 1986, 1987, 1989; LaBerge and Ribble 1975; Michener 1935; Ribble 1968, 1974; Rozen 1958; Timberlake 1954, 1956; Thorp 1969

Apidae

Adlakha 1969; Brooks 1988; Brumley 1965; Cockerell 1903ab, 1906; Daly 1973; Fowler 1899; Hurd 1955; Hurd and Linsley 1951; LaBerge 1956a, 1956b, 1961; Linsley 1940; Linsley 1943; Michener 1936; Mitchell 1962; Rightmyer 2004, 2008; Rozen 1992; Sipes, and Brooks, unpublished manuscript; Snelling 1986; Thorp et al. 1983; Timberlake 1941, 1969; Williams et al. 2014

Colletidae

Snelling 1966a, 1966b, 1968, 1970; Stephen 1954

Halictidae

Bohart 1948; Cockerell 1904, 1926; Crawford 1907; Gibbs 2010, 2011; Gibbs et al. 2009; Gibbs et al. 2013; McGinley 1986; Moure and Hurd 1987; Roberts 1972, 1973a, 1973b; Torchio et al. 1967

Megachilidae

Baker 1975; Bzdyk 2012; Cooper 1993; Gonzalez and Griswold 2013; Grigarick and Stange. 1968; Griswold, unpublished key to brilliant metallic *Osmia*; Griswold and Michener 1988; Rightmyer and Griswold, unpublished key to *Osmia*; Hurd and Michener 1955; Michener 1938a, 1938b, 1939, 1941, 1947, 1948; Mitchell 1933, 1935a, 1935b, 1936a, 1936b, 1937a, 1937b, 1973; Rust 1974; Sandhouse 1939; Schwarz 1926, 1927a, 1927b, 1940; Sheffield and Westby 2007; Sinha 1958; Timberlake 1943; White 1952

Key References

Ascher and Pickering 2016; Bouseman and LaBerge 1979; LaBerge 1967, 1969, 1971, 1973, 1977, 1980, 1986, 1987, 1989; LaBerge and Ribble 1975; Michener 1999, 2007; Ribble 1968, 1974; Thorp 1969

Appendix D. Bee species collected by plants.

Table 4. List of bee-visited flowers with bee species collected from them (n = number of individuals).

Agavaceae	n
Camassia leichtlinii ssp. suksdorfii	
Bombus mixtus	2
Bombus vosnesenskii	2
Osmia albolateralis	1
Alliaceae	
Allium spp.	
Bombus vandykei	1
Eucera actuosa	1
Hoplitis fulgida platyura	3
Lasioglossum (D.) morphospecies 7	3
Osmia aglaia	1
Osmia atrocyanea	1
Osmia bakeri	2
Osmia cyanella	1
Osmia exigua	3
Osmia kincaidii	1
Osmia lanei	15
Osmia melanopleura	3
Osmia proxima	1
Osmia pusilla	1
Osmia (M.) morphospecies 3	1
Sphecodes arvensiformis	1
Apiaceae	
Angelica tomentosa	
Colletes hyalinus oregonsis	1
Hylaeus nevadensis	2
Hylaeus rudbeckiae	5
Sphecodes arvensiformis	1
Lomatium spp.	
Andrena angustitarsata	3
Andrena gordoni	1
Andrena melanochroa	1

Andrena microchlora	6
Andrena orthocarpi	1
Ceratina acantha	1
Lasioglossum (D.) morphospecies 7	2
Osmia lanei	1
Sanicula tuberosa	
Andrena angustitarsata	48
Andrena gordoni	2
Andrena melanochroa	13
Andrena microchlora	24
Andrena nigrocaerulea	1
Andrena orthocarpi	3
Andrena saccata	1
Andrena transnigra	6
Andrena w-scripta	2
Bombus mixtus	4
Bombus vosnesenskii	2
Ceratina acantha	2
Ceratina micheneri	1
Colletes consors pascoensis	1
Dufourea dentipes	1
Lasioglossum (D.) morphospecies 6	19
Lasioglossum (D.) morphospecies 7	1
Lasioglossum (E.) morphospecies 6	2
Lasioglossum (E.) morphospecies 8	1
Lasioglossum (E.) morphospecies 9	2
Nomada aff. *elegantula*	1
Nomada morphospecies 9	1
Osmia exigua	3
Osmia montana quadriceps	1
Osmia sedula	1
Osmia tristella	1

Asteraceae

Unknown species	
Andrena angustitarsata	3
Andrena chalybioides	3
Coelioxys porterae	1
Nomada bifurcata	1
Nomada morphospecies 3 (♀)	1
Osmia montana quadriceps	1

Stelis montana	1
Achillea millefolium	
Agapostemon texanus	1
Andrena knuthiana	1
Andrena melanochroa	1
Anthidium utahense	1
Ceratina micheneri	1
Coelioxys novomexicana	1
Diadasia diminuta	1
Dianthidium subparvum	1
Halictus rubicundus	1
Hylaeus nevadensis	1
Hylaeus rudbeckiae	1
Lasioglossum (E.) morphospecies 5	1
Melissodes metenuus	1
Melissodes microsticta	3
Nomada morphospecies 10	1
Osmia lignaria propinqua	1
Sphecodes arvensiformis	1
Agoseris grandiflora	
Andrena chalybioides	2
Lasioglossum (D.) morphospecies 3 (♂)	1
Agoseris heterophylla	
Andrena chalybioides	6
Cirsium douglasii	
Anthophora urbana	1
Bombus vosnesenskii	5
Dianthidium singulare	2
Hylaeus nevadensis	1
Hylaeus rudbeckiae	2
Megachile montivaga	1
Megachile pugnata	1
Melissodes rivalis	8
Osmia texana	25
Cirsium occidentale	
Agapostemon texanus	1
Anthidiellum notatum robertsoni	1
Bombus vosnesenskii	1
Melissodes rivalis	5
Osmia texana	2

Cirsium spp.	
Bombus flavidus	1
Crepis pleurocarpa	
Andrena knuthiana	3
Diadasia bituberculata	1
Diadasia diminuta	4
Erigeron aliceae	
Agapostemon texanus	3
Bombus mixtus	1
Calliopsis edwardsii	1
Ceratina acantha	5
Ceratina micheneri	5
Ceratina tejonensis	4
Coelioxys porterae	1
Diadasia diminuta	11
Dianthidium subparvum	3
Heriades cressoni	1
Hylaeus nevadensis	1
Megachile fidelis	1
Megachile montivaga	1
Megachile perihirta	1
Melissodes microsticta	5
Osmia coloradensis	2
Osmia ednae	1
Osmia montana quadriceps	2
Osmia texana	1
Osmia tristella	1
Eriophyllum lanatum	
Agapostemon texanus	1
Bombus melanopygus edwardsii	1
Bombus mixtus	1
Ceratina acantha	15
Ceratina micheneri	12
Ceratina tejonensis	20
Coelioxys hirsutissima	1
Diadasia nigrifrons	1
Dianthidium subparvum	4
Epeolus compactus	2
Halictus farinosus	4
Megachile angelarum	1
Megachile montivaga	1

Megachile perihirta	2
Megachile pseudonigra	9
Megachile texana	2
Nomada californiae	1
Nomada morphospecies 2 (♀)	1
Nomada morphospecies 1 (♂)	1
Nomada morphospecies 6	1
Osmia coloradensis	14
Osmia cyanella	1
Osmia malina	1
Osmia montana quadriceps	8
Osmia trevoris	1
Panurginus morphospecies	1
Sphecodes morphospecies 2	1
Stelis montana	2
Stelis morphospecies 1	1
Hemizonella minima	
Andrena caerulea	1
Andrena chalybioides	1
Andrena cuneilabris	1
Andrena microchlora	1
Ceratina micheneri	2
Rafinesquia californica	
Bombus flavifrons	1
Dianthidium subparvum	1
Halictus farinosus	1
Lasioglossum titusi	1
Megachile gentilis	1
Melissodes metenuus	3
Senecio triangularis	
Agapostemon texanus	1
Osmia texana	1
Senecio spp.	
Agapostemon texanus	1
Ceratina acantha	2
Ceratina micheneri	1
Ceratina tejonensis	3
Osmia californica	1
Osmia coloradensis	1
Osmia montana quadriceps	1
Stelis monticola	1

Wyethia spp.

Agapostemon texanus	1
Andrena chalybioides	1
Bombus flavidus	1
Bombus insularis	1
Bombus melanopygus edwardsii	5
Bombus mixtus	3
Bombus vandykei	1
Bombus vosnesenskii	8
Ceratina micheneri	1
Ceratina tejonensis	1
Eucera actuosa	7
Halictus farinosus	1
Lasioglossum (E.) morphospecies 3 (♀)	1
Megachile gemula	1
Megachile perihirta	1
Osmia albolateralis	1
Osmia californica	3
Osmia cyanella	1
Osmia densa	1
Osmia lanei	2
Osmia montana quadriceps	9
Osmia visenda	1
Osmia (M.) morphospecies 2	1

Boraginaceae

Hackelia bella

Osmia densa	1

Nemophila menziesii

Andrena cuneilabris	2
Andrena nigrocaerulea	2
Andrena torulosa	2
Eucera actuosa	2
Lasioglossum (E.) morphospecies 6	1
Nomada morphospecies 1 (♀)	1
Nomada morphospecies 7	1
Osmia cyanella	1
Osmia exigua	1
Osmia juxta	1

Phacelia mutabilis

Osmia atrocyanea	1

Phacelia procera

Andrena quintiliformis	2
Andrena saccata	1
Anthidium banningense	1
Bombus flavifrons	2
Bombus mixtus	1
Dufourea trochantera	1
Lasioglossum (E.) morphospecies 13	2
Osmia aglaia	1
Osmia cyanella	1
Osmia densa	1
Osmia exigua	1
Osmia sedula	1

Phacelia spp.

Agapostemon texanus	1
Andrena amphibola	1
Andrena angustitarsata	1
Andrena forbesii	1
Andrena fuscicauda	1
Andrena melanochroa	2
Andrena quintiliformis	4
Andrena saccata	4
Andrena w-scripta	1
Anthidium banningense	3
Anthidium atrifrons	3
Anthidium utahense	1
Anthophora terminalis	1
Bombus flavidus	1
Bombus flavifrons	5
Bombus insularis	1
Bombus mixtus	17
Bombus vandykei	3
Bombus vosnesenskii	16
Calliopsis xenus	3
Ceratina micheneri	1
Colletes consors pascoensis	6
Dufourea trochantera	7
Eucera actuosa	3
Hoplitis albifrons maura	6
Hoplitis fulgida platyura	3
Lasioglossum (D.) morphospecies 1 (♀)	12

Lasioglossum (E.) morphospecies 2 (♀)	1
Lasioglossum (E.) morphospecies 9	3
Lasioglossum (E.) morphospecies 13	5
Megachile gemula	2
Osmia albolateralis	1
Osmia cyanella	22
Osmia densa	38
Osmia exigua	2
Osmia kincaidii	3
Osmia montana quadriceps	3
Osmia texana	1
Osmia tristella	3

Brassicaceae

Erysimum capitatum

Agapostemon texanus	3
Bombus mixtus	1
Ceratina acantha	1
Lasioglossum mellipes	1
Lasioglossum (E.) morphospecies 13	2
Megachile gemula	1

Campanulaceae

Campanula scouleri

Bombus mixtus	2

Downingia elegans

Andrena quintiliformis	1
Anthidium utahense	13
Anthophora terminalis	4
Bombus mixtus	5
Bombus vosnesenskii	4
Diadasia nigrifrons	1
Hoplitis producta gracilis	1
Osmia albolateralis	1
Osmia atrocyanea	3
Osmia cyanella	2
Osmia densa	3
Osmia pusilla	1
Osmia sedula	8
Osmia trevoris	6

Caprifoliaceae

Symphoricarpos mollis

Megachile melanophaea	1

Convolvulaceae

Calystegia occidentalis ssp. occidentalis

Ceratina tejonensis	1
Diadasia bituberculata	4

Crassulaceae

Sedum spp.

Bombus flavifrons	1
Bombus melanopygus edwardsii	1
Osmia densa	1

Ericaceae

Arctostaphylos spp.

Andrena ceanothifloris cretata	1
Andrena chlorura	1
Andrena melanochroa	1
Andrena obscuripostica	6
Andrena quintiliformis	1
Andrena transnigra	1
Andrena vandykei	1
Andrena w-scripta	1
Bombus flavidus	1
Bombus melanopygus edwardsii	9
Bombus mixtus	3
Bombus vosnesenskii	2
Ceratina tejonensis	2
Eucera frater albopilosa	1
Habropoda depressa	3
Lasioglossum (E.) morphospecies 10	1
Melecta pacifica	1
Nomada californiae	1
Nomada morphospecies 4	1
Nomada morphospecies 5	1
Osmia albolateralis	1
Osmia atrocyanea	1
Osmia densa	2
Osmia ednae	1

Osmia melanopleura	1
Osmia montana quadriceps	2
Osmia ribifloris biedermannii	51

Fabaceae

Acmispon americanus

Osmia lanei	1

Lotus corniculatus

Megachile angelarum	2

Lupinus spp.

Megachile melanophaea	2
Osmia cyanella	1

Trifolium longipes

Andrena transnigra	1

Trifolium spp.

Bombus flavifrons	1
Bombus melanopygus edwardsii	1
Eucera actuosa	1
Eucera frater albopilosa	2
Osmia lanei	6
Osmia odontogaster	1
Osmia (M.) morphospecies 3	1

Grossulariaceae

Ribes binominatum

Andrena rufosignata	1
Bombus vandykei	1

Ribes lobbii

Anthophora pacifica	1
Bombus mixtus	1
Bombus vosnesenskii	1
Lasioglossum (E.) morphospecies 13	1
Osmia pikei	1

Ribes sanguineum

Andrena hemileuca	1
Andrena melanochroa	1
Andrena rufosignata	2
Anthophora pacifica	3
Bombus flavidus	1
Bombus melanopygus edwardsii	2
Bombus vosnesenskii	2

Lasioglossum (E.) morphospecies 10	2
Nomada oregonica	1
Osmia lignaria propinqua	1
Osmia pentstemonis	1
Osmia pikei	1
Osmia tristella	1

Hypericaceae

Hypericum perforatum

Andrena prunorum	3
Andrena quintiliformis	1
Bombus mixtus	2
Bombus occidentalis	2
Bombus vosnesenskii	1
Ceratina micheneri	1
Ceratina tejonensis	1
Dianthidium subparvum	1
Megachile melanophaea	1
Megachile perihirta	4
Melissodes microsticta	1
Osmia albolateralis	1
Osmia ednae	1

Lamiaceae

Agastache urticifolia

Bombus flavifrons	1
Bombus vosnesenskii	1

Monardella sheltonii

Bombus vosnesenskii	3
Ceratina tejonensis	6
Megachile angelarum	1
Megachile fidelis	1
Megachile pugnata	1
Melissodes rivalis	2
Osmia cyanella	2
Osmia densa	1
Osmia juxta	1
Osmia texana	1
Xylocopa tabaniformis orpifex	1

Stachys ajugoides

Anthophora terminalis	2

Liliaceae

Calochortus tolmiei

Andrena nigrocaerulea	2
Bombus vosnesenskii	1
Ceratina micheneri	1
Dufourea dentipes	23
Lasioglossum (D.) morphospecies 6	1
Lasioglossum (E.) morphospecies 6	1
Nomada californiae	1
Nomada rhodotricha	1
Osmia densa	1
Osmia exigua	1

Malvaceae

Sidalcea asprella ssp. nana

Diadasia nigrifrons	40
Melissodes lupina	1
Melissodes microsticta	1

Montiaceae

Calyptridium monospermum

Agapostemon texanus	1
Andrena aff. *ferrugineipes*	1
Andrena angustitarsata	2
Andrena cleodora	1
Andrena knuthiana	5
Andrena nigrocaerulea	15
Andrena prunorum	1
Andrena transnigra	5
Andrena w-scripta	1
Apis mellifera	1
Bombus melanopygus edwardsii	1
Bombus mixtus	1
Bombus vosnesenskii	3
Ceratina micheneri	4
Ceratina tejonensis	1
Halictus confusus	1
Lasioglossum (D.) morphospecies 7	1
Nomada aff. *elegantula*	1
Nomada rhodotricha	2

Osmia melanopleura	1
Osmia montana quadriceps	1
Panurginus aff. *atriceps*	3
Xeromelecta californica	2
Claytonia lanceolata	
Bombus mixtus	1
Osmia montana quadriceps	1

Onagraceae

Gayophytum diffusum	
Lasioglossum (D.) morphospecies 8	1

Orobanchaceae

Cordylanthus tenuis ssp. viscidus	
Anthidium placitum	11
Bombus vosnesenskii	5
Megachile angelarum	23
Megachile gentilis	1

Plantaginaceae

Collinsia grandiflora	
Andrena transnigra	1
Bombus vosnesenskii	3
Eucera actuosa	6
Eucera frater albopilosa	1
Osmia melanopleura	1
Collinsia parviflora	
Eucera actuosa	1
Osmia exigua	1
Osmia kincaidii	1
Osmia pusilla	1
Osmia sedula	1
Collinsia spp.	
Bombus flavifrons	1
Bombus melanopygus edwardsii	1
Osmia albolateralis	1
Osmia calla	1
Osmia densa	1
Osmia exigua	1
Osmia kincaidii	1

Penstemon spp.

Anthophora californica	2
Anthophora terminalis	4
Ashmeadiella cactorum cactorum	1
Atoposmia triodonta	1
Bombus flavifrons	11
Bombus mixtus	3
Bombus sitkensis	1
Bombus vosnesenskii	6
Ceratina acantha	4
Ceratina micheneri	2
Ceratina tejonensis	17
Diadasia bituberculata	17
Hoplitis producta gracilis	2
Hylaeus nevadensis	1
Lasioglossum (D.) morphospecies 10	1
Lasioglossum (E.) morphospecies 2 (♀)	2
Lasioglossum (E.) morphospecies 6	1
Lasioglossum (E.) morphospecies 13	3
Megachile angelarum	1
Megachile montivaga	1
Osmia albolateralis	12
Osmia atrocyanea	3
Osmia brevis	20
Osmia calla	1
Osmia cobaltina	1
Osmia cyanella	7
Osmia densa	21
Osmia ednae	16
Osmia exigua	1
Osmia lanei	5
Osmia pentstemonis	6
Osmia trevoris	2
Osmia tristella	1
Osmia (M.) morphospecies (♀)	1
Perdita nevadensis nevadensis	3

Polemoniaceae

Collomia spp.

Anthidium utahense	1

Gilia capitata

Ceratina micheneri	3
Diadasia diminuta	3
Megachile perihirta	1
Melissodes lupina	1
Melissodes metenuus	1
Melissodes microsticta	2
Triepeolus paenepectoralis	2

Polygonaceae

Eriogonum nudum

Agapostemon texanus	1
Andrena knuthiana	30
Andrena prunorum	2
Andrena quintiliformis	7
Andrena saccata	2
Andrena transnigra	1
Anthidiellum notatum robertsoni	3
Anthidium utahense	1
Anthophora urbana	1
Apis mellifera	1
Bombus vosnesenskii	7
Ceratina micheneri	2
Coelioxys gilensis	3
Coelioxys novomexicana	3
Colletes hyalinus oregonsis	8
Colletes kincaidii	2
Dianthidium subparvum	1
Epeolus compactus	3
Halictus farinosus	1
Hylaeus basalis	1
Hylaeus modestus	5
Hylaeus nevadensis	5
Hylaeus rudbeckiae	7
Lasioglossum (D.) morphospecies 6	1
Lasioglossum (E.) morphospecies 1 (♀)	1
Lasioglossum (E.) morphospecies 13	1
Megachile angelarum	1
Megachile gentilis	1
Megachile latimanus	1
Megachile perihirta	2

Megachile texana	5
Melissodes lupina	1
Nomada morphospecies 6	1
Nomada morphospecies 10	1
Oreopasites vanduzeei	1
Perdita nevadensis nevadensis	30
Sphecodes arvensiformis	1
Stelis montana	1
Xeromelecta californica	1
Eriogonum umbellatum	
Andrena knuthiana	2
Andrena prunorum	1
Andrena quintiliformis	1
Anthidium utahense	1
Coelioxys gilensis	1
Diadasia diminuta	2
Lasioglossum anhypops	1
Megachile texana	1
Perdita nevadensis nevadensis	9
Polygonum douglasii	
Anthidiellum notatum robertsoni	2
Anthophora urbana	1
Ashmeadiella cactorum cactorum	1
Bombus vosnesenskii	1
Ceratina acantha	2
Ceratina micheneri	2
Ceratina tejonensis	1
Dianthidium subparvum	1
Dianthidium ulkei ulkei	1
Megachile angelarum	1
Melissodes microsticta	3
Triepeolus paenepectoralis	1
Ranunculaceae	
Delphinium decorum ssp. tracyi	
Anthophora pacifica	1
Bombus flavifrons	1
Ranunculus occidentalis	
Andrena amphibola	1
Andrena angustitarsata	1
Andrena caerulea	33

Andrena chalybioides	1
Andrena cuneilabris	12
Andrena melanochroa	2
Andrena nigrocaerulea	1
Apis mellifera	1
Bombus vosnesenskii	1
Ceratina micheneri	1
Lasioglossum (E.) morphospecies 3 (♀)	1
Lasioglossum (E.) morphospecies 5	2
Lasioglossum (E.) morphospecies 7	3
Nomada californiae	1
Nomada morphospecies 5	1
Panurginus aff. *nigrihirtus*	1
Panurginus morphospecies	12

Rhamnaceae

Ceanothus spp.

Andrena angustitarsata	2
Andrena ceanothifloris cretata	1
Andrena fuscicauda	1
Andrena melanochroa	1
Andrena quintiliformis	1
Andrena saccata	1
Andrena w-scripta	1
Bombus melanopygus edwardsii	1
Bombus mixtus	1
Bombus vosnesenskii	1

Frangula californica ssp. occidentalis

Bombus vosnesenskii	1
Lasioglossum morphospecies 2 (♂)	1
Megachile angelarum	2
Megachile texana	1

Rosaceae

Horkelia tridentata ssp. flavescens

Andrena barbilabris	1
Andrena cupreotincta	2
Andrena knuthiana	4
Andrena melanochroa	12
Andrena merriamii	17
Andrena nigrocaerulea	4

Andrena nivalis	1
Andrena transnigra	2
Andrena w-scripta	1
Bombus melanopygus edwardsii	1
Bombus mixtus	3
Bombus vosnesenskii	3
Ceratina micheneri	1
Lasioglossum (D.) morphospecies 7	1
Nomada californiae	2
Nomada morphospecies 8	1
Horkelia spp.	
Andrena aff. *candida*	1
Andrena angustitarsata	2
Andrena cuneilabris	1
Andrena cupreotincta	4
Andrena knuthiana	1
Andrena melanochroa	3
Andrena merriamii	5
Andrena nigrocaerulea	4
Andrena prunorum	1
Andrena transnigra	2
Andrena w-scripta	4
Bombus melanopygus edwardsii	1
Bombus mixtus	2
Halictus farinosus	1
Nomada californiae	1
Panurginus morphospecies	1
Potentilla spp.	
Agapostemon texanus	3
Andrena angustitarsata	4
Andrena melanochroa	30
Andrena merriamii	2
Andrena nigrocaerulea	1
Andrena quintiliformis	8
Andrena washingtoni	2
Bombus mixtus	1
Bombus vosnesenskii	1
Calliopsis edwardsii	24
Ceratina acantha	3
Ceratina micheneri	3
Ceratina tejonensis	2

Diadasia nigrifrons	2
Hylaeus basalis	4
Hylaeus rudbeckiae	1
Lasioglossum (D.) morphospecies 3 (♂)	1
Lasioglossum (E.) morphospecies 3 (♀)	1
Lasioglossum (E.) morphospecies 9	1
Lasioglossum morphospecies 1 (♂)	1
Melissodes microsticta	1
Nomada californiae	1
Osmia calla	2
Osmia coloradensis	1
Osmia montana quadriceps	1
Osmia pentstemonis	1
Panurginus morphospecies	1
Prunus emarginata var. emarginata	
Andrena melanochroa	1
Andrena orthocarpi	1
Andrena rufosignata	1
Andrena saccata	1
Andrena transnigra	1
Bombus mixtus	1
Ceratina tejonensis	1
Lasioglossum (E.) morphospecies 9	1
Lasioglossum (E.) morphospecies 12	1
Panurginus morphospecies	1
Panurginus aff. *atriceps*	3
Rosa gymnocarpa	
Andrena saccata	3
Bombus mixtus	3
Lasioglossum (E.) morphospecies 8	1
Rosa nutkana	
Andrena quintiliformis	8
Andrena saccata	1
Andrena washingtoni	1
Anthophora californica	1
Bombus mixtus	4
Bombus vosnesenskii	1
Lasioglossum (E.) morphospecies 13	1
Osmia exigua	1
Rubus ursinus	
Ceratina acantha	1

Rubus spp.

Andrena quintiliformis	1
Bombus flavidus	1
Bombus insularis	1
Bombus melanopygus edwardsii	1
Hylaeus basalis	2
Stelis morphospecies 2	1

Verbenaceae

Verbena lasiostachys

Anthophora urbana	1
Bombus vosnesenskii	1
Ceratina tejonensis	5
Dianthidium ulkei ulkei	1
Megachile angelarum	2
Megachile fidelis	1
Osmia coloradensis	1
Osmia cyanella	4
Osmia ednae	1

Violaceae

Viola hallii

Osmia thysanica	1