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Terrestrial Arthropods of Edwards Air Force Base, 1996-1998

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Final report

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Preface

This report describes a series of flood and fauna surveys conducted for Edwards Air Force Base, Edwards, CA. These surveys checked for federally listed endangered or threatened species and obtained information for an overall resource management plan. Previously, surveys have been conducted for tortoises, butterflies, birds, and eubranchipods (including tadpole, clam, and fairy shrimp). This report details the final results of a survey for terrestrial macroarthropods conducted during 1996 through 1998 by Dr. Gordon Pratt, University of California at Riverside, under contract DACA39-39-96-0028. This report presents results of the 3-year study.

This work was monitored by members of the staff of the U.S. Army Engineer Research and Development Center (ERDC), Environmental Laboratory (EL), Vicksburg, MS.

During the conduct of this study, Dr. John Keeley was Director, EL, Dr. C. J. Kirby was Chief, Environmental Resources Division, and Dr. Al Cofrancesco was Chief, Aquatic Habitat Group.

At the time of publication of this report, Dr. James R. Houston was Director of ERDC, and COL James S. Weller, EN, was Commander.

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1 Introduction

Background

Edwards Air Force Base (EAFB) is located in the Mojave Desert in Southern California, north of the city of Los Angeles. This large military base spans parts of southeastern Kern, northern Los Angeles, and western San Bernardino Counties. Although the base covers approximately 2,589 sq km (1,000 sq miles), there is only about 305 m (1,000 ft) in topographic relief from the lake bottom around 610 m (2,000 ft) to the highest ridgeline at just above a 914-m (3,000-ft) elevation. Terrain of potential value for terrestrial arthropods and other organisms consists of sand dunes, dry open hills, valleys, dry lakes or playas, smaller claypans, and permanent pools. Vegetation around the playas, the pools, and claypans are saltbush scrub, joshua tree woodlands, cottonwood and willow thickets, and mesquite basque. Playas and most pools are devoid of macrophytes (Branchipod Research Group 1993). The uplands are largely composed of creosote bush scrub.

A series of floral and fauna surveys have been conducted by EAFB personnel. This is being done to check for federally listed, endangered, or threatened species and to obtain information for a complete resource management plan. Previous surveys have been conducted on tortoises, butterflies, birds, and eubranchipods (including tadpole, clam, and fairy shrimp). Surveys are in progress to obtain information on endangered or threatened species, as well as common species, to provide data for the proposed habitat management plan.

Southern California is unusually rich in biological diversity and endemicity (species with restricted distributions), particularly as compared to other regions of North America. Partly because of this high diversity and endemicity, this area of California has been identified as one of 18 global "hot spots" of conservation concern (Wilson 1992). Although arthropods comprise the largest fraction of this diversity, the actual number of species can only be approximated because of the near absence of comprehensive surveys of this group. Hogue (1974) estimated 3,000 to 4,000 insect species for the Los Angeles Basin; however, this number probably far underestimates the actual number. In any case, all of Southern California probably

has many times that number. Meanwhile, as a result of the rapid conversion of natural habitats for human uses, most of the region's unique natural communities are being rapidly extirpated even before their invertebrate components have been determined. This is particularly true of areas surrounding EAFB and of some concern, since in the near future, the base may have the only remaining undeveloped land in the region.

Intensive surveys of arthropod diversity are known from only two sites in southern California (Ballmer 1995). One site, the El Segundo Dunes, near Los Angeles International Airport was the subject of intensive (but incomplete) biological surveys during the late 1930s (Pierce and Pool 1938) and again during the late 1980s (Mattoni 1990). The University of California's Deep Canyon Desert Reserve near Palm Desert has been surveyed by a succession of University researchers, students, and visiting scientists over the past 34 years. So far, this survey has yielded about 5,000 invertebrate species, 2,600 of which have been classified (Frommer 1988).

There have been already many species lost from the El Segundo Dunes. During the 50-year period between the surveys of the 1930s and 1980s, 36 of the 91 plant species and 66 of 825 invertebrate species have been extirpated from the dunes. Since the original invertebrate survey was far from complete, the invertebrate number lost may be far greater. In addition, during that period, 171 nonnative plants and 20 invertebrate species have become established on the dunes.

The introductions of plants and animals have had an effect upon the interaction of species throughout the dunes. For instance, the introduction of *Eriogonum fasciculatum* could have caused the eventual extirpation of the endangered El Segundo Blue at the dunes (Pratt 1987; Longcore et al. in preparation). The larvae of this butterfly feed specifically on flowers and seeds of *Eriogonum parvifolium*. There are other insects that also use the same plant resource, but unlike the El Segundo Blue, these other insects are not adapted specifically to the bloom period of the buckwheat. Therefore, when *E. fasciculatum* was introduced to the dunes, they were able to switch to its earlier bloom period.

Therefore, when the *Eriogonum parvifolium* came into bloom a month after the *E. fasciculatum*, these insects switched back to their natural food plant. Therefore, after the introduction of *E. fasciculatum*, there was an increase in insects that fed upon the flowers and seeds of the *E. parvifolium*. These other insect herbivores became more effective competitors with the El Segundo Blue and seed production of the *Eriogonum parviflolium*, the specific food for the El Segundo Blue, was drastically reduced.

Based on correlations of plant with invertebrate species richness, Ballmer (1995) estimates there are as many as 10 invertebrates for every plant species. Of these invertebrates, over 95 percent are arthropods, and of the arthropods, 95 percent are insects. Previous plant surveys have found as

many as 330 plant species at EAFB (Charlton 1995). Therefore, from these surveys it is estimated there can be as many as 3,000 arthropods at EAFB.

Desert arthropods of the western Mojave are highly seasonal and dependent on rain during the winter and spring months. In this desert, everything depends on water and its availability. Many of the leaf litter species, such as Jerusalem and Camel Crickets, Diplurans, Jumping Bristletails, Centipedes, and Millipedes, only occur at the soil surface during moist months that usually occur between the months of November to March or April and sometimes into May. During the rest of the year, they are buried deep within the soil.

Other arthropods, such as butterflies, moths, leaf-feeding beetles, and herbivorous flies, follow the availability of their specific food plants and occur only when they are flowering or leafing out. Many bees, wasps, beetles, and flies seem to seasonally follow particular nectar sources. Even though the desert may appear extremely dry during the hottest season of the year, it comes alive with arthropods at night, such as large Tenebrionid and Scarab beetles, moths, wasps, ants, spiders, scorpions, and solfugids. This adaptive behavior is as a response to the diurnal conditions caused by drying effects of the hot desert sun. Because of the great morphological variation in arthropods, particularly the insects, they are well adapted to the desert's severe and often unpredictably changing environments.

The list of arthropods at EAFB is not complete. Special efforts were made on collecting the larger arthropods, since they were the easiest to identify and have been well-studied by Entomologists. New 'unique' species within this group are most easily identified. There are many species of tiny flies, tiny wasps, and microlepidoptera that were not specifically collected by this survey due to their difficulty in identification. Special nets are needed to collect some of these insects. Most of these wasps and microlepidoptera may not have been named, so at most they are only identifiable to the level of genus.

No specific efforts were made to collect the specialty insects. These insects include the gall making or mushroom and fruit feeding insects that have guilds of organisms that live together, as primary consumers, parasites, and predators. As an example, there are numerous insects that live and feed with the seeds and fruits of Joshua trees. Techniques such as pan and malaise traps, which would have provided many additional species, were not used. Pan traps, which use ethylene glycol, can be toxic to the vertebrate fauna. Malaise traps would not stand up to the strong winds that are common in the Mojave Desert.

During the 1997 season, over 300 species, and during the 1998 season, over 100 new species, were added to the list. It is expected that with each additional year and new sites sampled at EAFB, new species will be found. Many of them will not be encountered for a variety of reasons, such as small size and rarity. Each season provides different climatic advantages and disadvantages for each species. Some arthropods prefer cool, wet

springs and will be most apparent during those years. Other species that prefer wet summers will consequently be most common during those years. Even others may prefer dry seasons, since their resources are highest under those conditions. As examples, two butterfly species, *Precis coenia* and *Nathalis iole*, were not found through extensive collecting during the years of 1994 through 1997, yet they were observed during the wet El Nino season of 1998. One butterfly, *Libytheana bachmanii*, which depends on high summer rainfall in the neighboring state of Arizona, was only observed during the 1996 season.

Since 1997 was a dry year, the total number of species collected then was lower than expected. Although the 1998 season was more moist than previous years, it was also cooler and had fewer sunny days. Sunny conditions were needed for optimal collecting, therefore fewer collecting trips were made during less than ideal conditions. Also during the wet 1998 year, the best sites, such as Piute ponds and Branch Memorial Park that had high arthropod numbers during previous years, were not surveyed. The winter and spring of 1999 was even dryer than previous years, which was the reason that no surveys were made during that year. Many insects that were observed commonly during previous years were not noted during 1999. There are many problems with arthropod surveys, which are not encountered with more predictable organisms.

Purpose and Scope

The purpose of this work was to conduct a 3-year, four-season survey of terrestrial arthropods in major habitats at Edwards Air Force Base, California. Work was conducted in 1996, 1997, and 1998. This report includes the data from the 3-year survey.

2 Study Area and Methods

Study Area

Thirty-two sites were chosen to be surveyed to cover as much territory and habitats at EAFB as possible over the 3-year period (Figures 1 and 2). Currently the only region that has not been well-sampled is the high security area of the eastern quarter of the base. As a result of the complexity in arranging escorts for surveys in this region, several areas just outside of the base along the border were surveyed during the 1998 season.

All of the following sites had an approximate central location with a circle of a 0.81 km (1/2-mile) radius drawn around that spot. These sites are:

- 1a - Branch Memorial Park, areas around the pond, and the mesquite and cottonwood woodlands just to the north and west (N34° 49.419´ W117° 55.390´);
- 1b - The south end of Buckhorn Dry Lake, just 3.2 km (2 miles) west of Branch Memorial Park with a number of sand dunes and some mesquite (this locality contains the rare *Astragalus preussii*) (N34° 49.403´ W117° 57.367´);
- 1c - An area 3.2 km (2 miles) south of Branch Memorial Park with mesquite woodland (N34° 48.486´ W117° 57.123´);
- 1d - An area 3.2 km (2 miles) north of Branch Memorial Park (N34° 49.776´ W117° 55.620´);
- 2a - Red Hill, the hills just to the west and the wash to the north (N34° 52.367´ W118° 7.323´);
- 2b - The northwest end of Rosamond Dry Lake along the old paved road (N34° 52.406´ W118° 5.089´);
- 2c - The east end of Rosamond Hills (N34° 53.813´ W118° 1.060´);
- 2d - A site 3.2 km (2 miles) northwest of Red Hill along Pole Line road (N34° 52.767´ W118° 7.968´);
- 3a - The west side of Piute Ponds (N34° 47.185´ W118° 7.743´);
- 3b - The north side of Piute Ponds (N34° 47.499´ 118° 7.488´);

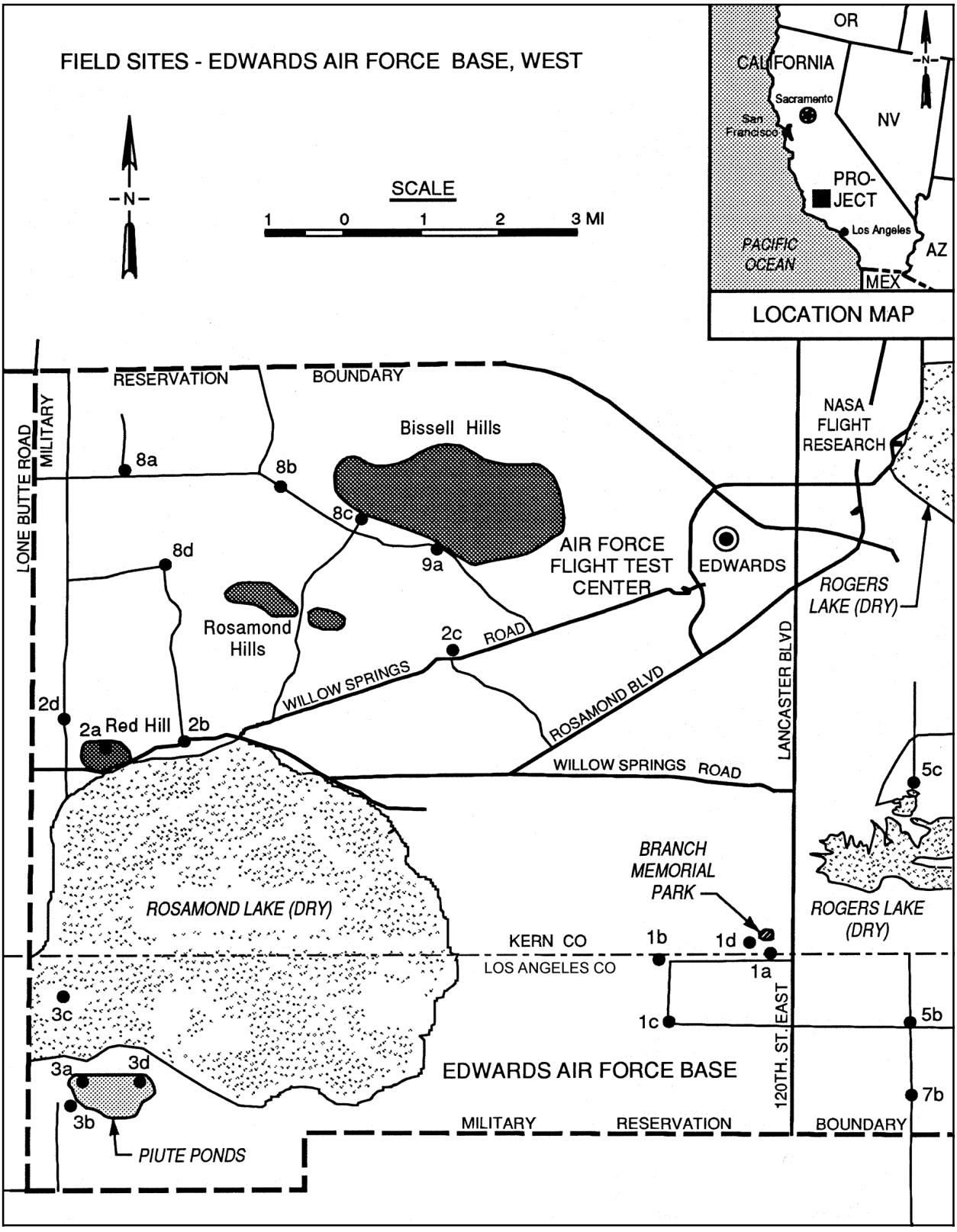

Figure 1. Sites on Edwards Air Force Base, West

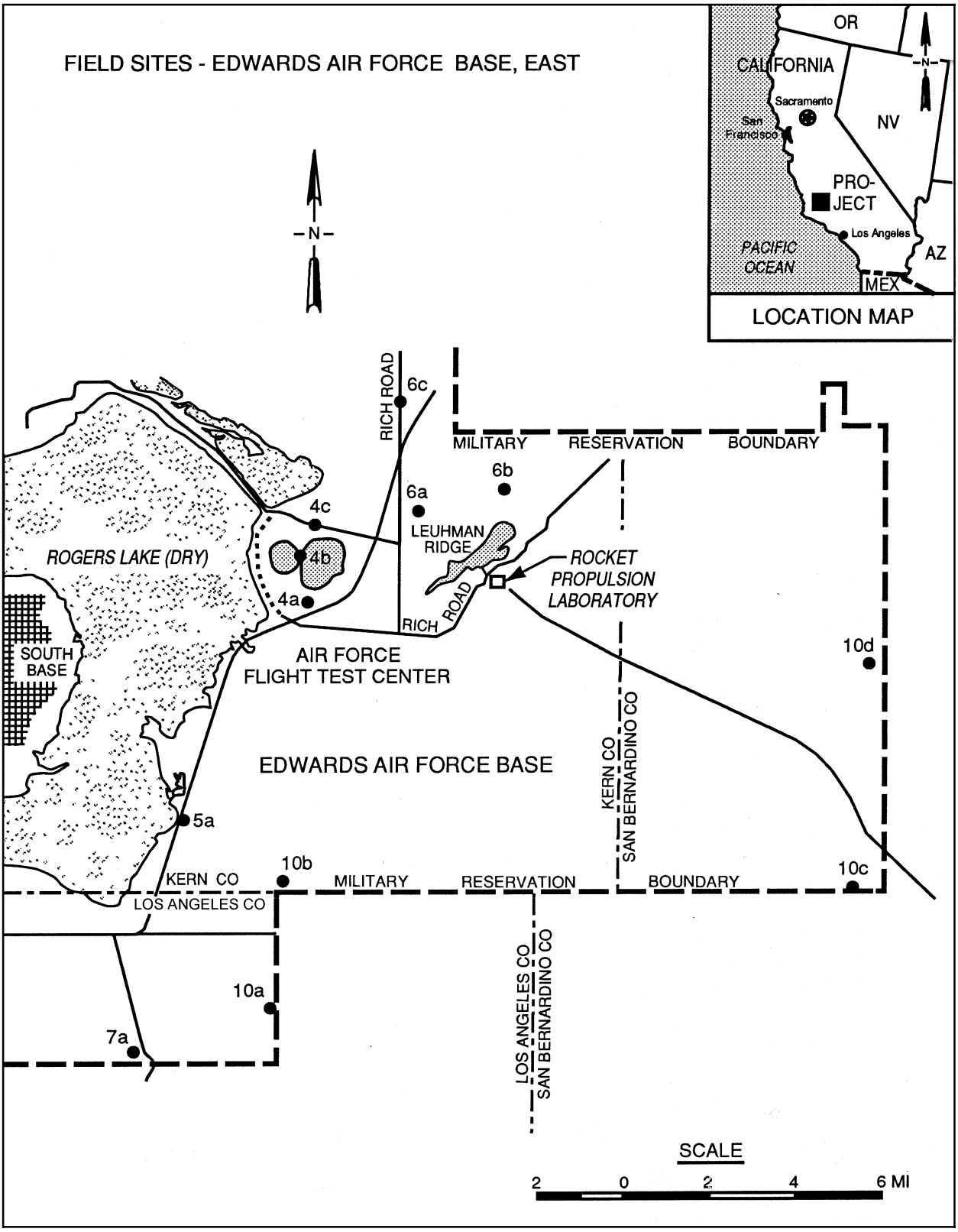

Figure 2. Sites on Edwards Air Force Base, East

- 3c - An area 2.4 km (1.5 miles) north northwest of Piute Ponds (N34° 48.708´ W118° 7.848´);
- 3d - The east side of Piute Ponds (N34° 47.515´ W118° 6.504´);
- 4a - A site approximately 1.6 km (1 mile) north of Mercury Blvd and 1.6 km (1 mile) east of Rogers Dry Lake (N34° 55.371´ W117° 45.915´);
- 4b - A site located near 4a on the peaks of the northeast side of Rogers Dry Lake (N34° 56.299´ W117° 46.089´);
- 4c - A site located 2.4 km (1.5 miles) northeast of the peaks (N34° 57.023´ W117° 45.677´);
- 5a - This area includes the sand dunes 4.0 km (2.5 miles) north of Avenue B on the west side of Mercury Blvd (N34° 50.748´ W117° 48.976´);
- 5b - This areas includes the mesquite woodland just north of Avenue B just west of the intersection with 140th street (34° 48.457´ W117° 52,879´);
- 5c - This site is along the west side of the sewage ponds on the west side of Rogers Dry Lake (N34° 51.917´ W117° 52.876´);
- 6a - This is an area 1.6 km (1 mile) north of Leuhman Ridge (N34° 57.217´ W117° 43.089´);
- 6b - This is along a hill on the northeast side of Leuhman Ridge (N34° 57.695´ W117° 43.932´);
- 6c - This is an area of saltbush scrub 8 km (5 miles) north of Leuhman Ridge (N34° 59.507´ W117° 43.612´);
- 7a - This is just off of base along the fence line directly south of Rogers Dry Lake (end of 165th street) (N34° 45.834´ W117° 50.213´);
- 7b - This area is a mesquite woodland, in an area on the west side of 140th street and south of B street (N34° 47.413´ W117° 52.844´);
- 8a - This is an area on the northwest corner of EAFB along Sopp Road 1.6 km (1 mile) east of Pole Line Road (N34° 56.365´ W118° 6.834´);
- 8b - This area is 6.0 km (3.7 miles) east of Pole Line Road along Sopp Road (N34° 56.179´ W118° 4.135´);
- 8c - This site is 8 km (5 miles) east of Pole Line Road along Sopp Road (N34° 55.720´ W118° 2.762´);
- 9a - This site includes the western side of Bissell Hills (N34° 55.309´ W118° 1.239´);
- 9b - This includes the western end of the Rosamond Hills (N34° 55.638´ W118° 6.168´);
- 10a - This site is at 200th Street south of C Street (N34° 46.777´ W117° 46.449´);
- 10b - This site is at 200th Street north of C Street (N34° 49.395´ W117° 46.468´);

- 10c - This site is at the northeast side Red Buttes (N34° 49.123´ W117° 31.831´); and,
- 10d - This site includes the western end of the Kramer Hills (N34° 54.113´ W117° 31.541´).

Methods

Experts have examined many of the species in the orders Coleoptera, Hymenoptera, Diptera, Lepidoptera, and Neuroptera; representative species from EAFB in these groups have been more accurately identified then they were in previous reports (Pratt 1998, 2000). In this report many of their names have been corrected. Spiders have also been examined and identified by experts. These new and more accurate determinations have been incorporated into this final report for the survey.

Many of the butterflies were identified by sight, since the author knows this group quite well. The remaining insects were identified to order and then family by the keys of Borror, DeLong, and Triplehorn (1981). The insects within each family were organized as to morphospecies. Matching these specimens to previously identified species and morphospecies of the 1996 and 1997 EAFB Survey Collection was a great aid in the identification of these specimens. Taxonomic keys and the Insect Collection at the Entomology Research Museum were used to identify the remaining species as previously described (Pratt 1998).

Dr. Norm Penny, California Academy of Sciences, identified the Neuroptera (Antlions and Lacewings). Dr. Rosser Garrison, research associate of the Los Angeles County Natural History Museum, identified the Odonata (Dragonflies and Damselflies). Mr. Ron Leushner, research associate of the Los Angeles County Natural History Museum, identified the Macrolepidoptera (other than butterflies). Dr. Jerry Powell, University of California at Berkeley, identified the Microlepidoptera. Dr. Arthur Evans, Los Angeles County Natural History Museum, identified the Scarabaeidae. Dr. Terry Griswold, University of Utah, identified the Megachilidae or Leaf Cutter Bees. Mr. Rob Velton, University of California at Riverside (UCR), identified the Buprestid beetles. Dr. John Pinto, UCR, identified the Meloidae of the Coleoptera. Mr. Dave Williams and Mr. Rick Villegas, research associates of the Entomology Museum at UCR, identified the Diptera families Assilidae and Mydidae. Mr. Rick Vetter, UCR, identified the spiders.

Some of the arthropod identifications in this report are incorrect. Certainly the reliability will depend on the level of expertise of the identifier of that group. The Lepidoptera, Neuroptera, and much of the Coleoptera, for this reason, are probably the most reliable. The author identified the grasshoppers, the genera of flies, and the ants through the use of various keys (Strohecker, Middlekauff, and Rentz 1968; McAlpine et al. 1981; Wheeler and Wheeler 1973). Those groups that the author identified

without the use of keys and was least comfortable with will be somewhat questionable as to their reliability. The advantage of identifying species to names, rather than to just morphospecies, although they may be incorrect, is that their identification gives some information on the characters of the specimens as to size, color, and general morphology.

One source of error in identifying arthropods just to morphospecies is that many species are dimorphic, in that the sexes can be quite different from one another. Without examining a collection, one may separate these sexes into different species, without realizing it. In fact, these sexes sometimes differ so greatly that Entomologists in the past have placed them not only in different species, but also in different genera. Some species of ants and termites have individuals in the same colony that perform different functions, such as soldiers and workers. They can be morphologically quite distinct as well. By studying these different levels of variability, these errors in identification can be reduced and possibly eliminated. The most important factor for this study is whether or not the identification is consistent to morphospecies from one specimen to the next, rather than whether or not the identification is correct down to the species level. In case there is future controversy, most of the specimens will be maintained at the Entomology Research Museum at UCR for future research.

3 Results

Background

There were over 1,000, 800, and 400 arthropod species collected at EAFB during the 1996, 1997, and 1998 field seasons, respectively. Some of the species of the 1996 and 1997 seasons were incorrectly identified and authorities of the specific groups have since improved these identifications. Therefore, those identifications that have changed in this document should be accepted over those of previous reports. From the 3-year survey on the base, there is a grand total of 1,536 species (Table 1). This total slightly exceeds 50 percent of the expected number of 3,000.

Of the 404 species collected in 1998, over 25 percent (107) were new to this survey (Table 1). As in the 1999 survey, over 75 percent of these invertebrates belonged to the four major orders: Coleoptera, Lepidoptera, Diptera, and Hymenoptera, whereas over 93 percent were of the eight major orders which included in addition Orthoptera, Homoptera, Hemiptera, and Neuroptera. There were only slight differences between the 1996, 1997, and 1998 percent totals of the arthropod groups. These changes can be explained in part by changes in focus. For instance, since an expert in Macrolepidoptera was acquired for this study, there was an increase in the collecting of nocturnal Lepidoptera. This explains the highest number of new species (90) being Lepidoptera for 1997. The Lepidoptera were the second highest for new species in 1998. The highest was Hymenoptera (31), and the next highest were Diptera (19) and Coleoptera (15).

The number of spiders nearly doubled during the 1997 over the 1996 season. Of the 13 total spiders collected in 1998, seven species were new. This increase was the result of an increased search for spiders, since it was a group that the author could identify with the aid of an expert.

Table 1
Numbers of Invertebrate Species on Edwards Air Force Base, 1995-1998

	1998 Total	New Species	New Percent Total	Grand Total	Percent Total
Spiders	14	7	0.5	45	2.9
Scorpions	3	1	0.1	3	0.2
Solpugids	2	1	0.1	2	0.1
Harvestman	1	1	0.1	1	0.1
Ticks	0	0		1	0.1
Mites	1	1	0.1	1	0.1
Isopods	0	0		1	0.1
Centipedes	0	0		1	0.1
Millipedes	1	0		2	0.1
Diplura	0	0		1	0.1
Thysanura	2	0		3	0.2
Ephemeroptera	0	0		2	0.1
Odonata	1	0		11	0.7
Orthoptera	17	0		39	2.5
Dictyoptera	2	0		6	0.4
Isoptera	0	0		1	0.1
Dermaptera	0	0		1	0.1
Psocoptera	0	0		1	0.1
Homoptera	9	0		52	3.4
Hemiptera	37	9	0.6	92	6.0
Thysanoptera	0	0		2	0.1
Neuroptera	8	1	0.1	23	1.5
Coleoptera	71	15	1.0	243	15.8
Trichoptera	1	0		4	0.3
Lepidoptera	64	21	1.4	265	17.3
Diptera	68	19	1.2	308	20.1
Hymenoptera	102	31	2.0	425	27.7
	404	**107**	**7.0**	**1,536**	

Coleoptera, Lepidoptera, Diptera, and Hymenoptera = 80.8%.
Orthoptera, Homoptera, Hemiptera, Neuroptera, Coleoptera, Lepidoptera, Diptera, and Hymenoptera = 94.2%.

Distribution

All sites visited during 1996 through 1998 were not comparable, since different factors seem to affect total number of species present. For example, of these 32 sites from the 1996 through 1998 survey, only 2 sites, 1a and 3b, had more than 300 total invertebrate species collected, 528 and 397, respectively (Table 2 and Appendix A). Both of these sites had permanent water present, were surveyed for more than 10 visits, and were surveyed for nocturnal invertebrates using a mercury vapor light. The next highest groups were from sites 2c, 5a, 6a, 8a, and 9a (165 to 300 species). Each of these sites was surveyed six or more times and for nocturnal invertebrates. The lowest group, with some overlap, included sites that were surveyed only for diurnal insects for one or two visits during the 1998 season (5 to 63 species).

Water plays an important factor in the number of species present. Sites 1a and 3b, with permanent water present, had a species richness nearly double that of most other sites. Site 5c was an exception, although it had permanent water, yet only 103 species were found. Plants adapted to these water bodies probably play a very large role in supporting high species richness. There were no willows, cottonwoods, or other mesic adapted plants at site 5c or the sewage ponds on the southwest side of Rogers Dry Lake; this was likely responsible for the comparatively few number of species. Two other factors play an important role in number of species present: (a) presence of mesquite woodland, and (b) sand dunes. During the surveys, it was noted that species richness was very high in Mesquite woodland, and there were many unique species in the sand dunes (Andrews, Hardy, and Giuliani 1979). These sand dune systems are acting like series of islands in an ocean of desert.

There are at least two basic criteria that are important in determining the quality of an area and its value for preservation. One is the total number of species and the other is the number of endangered organisms at the site. Certainly determining the total number of invertebrate species in an area is not as difficult as determining the number of those that are endangered. California desert invertebrates are poorly known, and EAFB is no exception. For this reason, endangered invertebrates not recognized on a State or Federal list may not be easily identified, and those collected may even lack descriptions or names. One biogeographic characteristic shared among most California endangered invertebrates is that they exhibit restricted localized ranges. In other words, they are endemic to very small areas. The next best thing, therefore, would be to identify species that exhibit restricted ranges or only occur at one or two very similar localities at the base. This will give some indication as to the uniqueness of the habitat or site in question.

The species that exhibit restricted ranges (here called unique species) on EAFB, i.e., species only found at one locality (Table 2, Appendix A), fall into two categories. One type will be species with actual restricted

Table 2
Unique and Total Species Per Locality, Edwards Air Force Base, 1995-1998

Site	No. Visits	No. Unique Species	No. Total Species	No. Unique Species Per Visit	No. Total Species Per Visit	Unique Percent of Total
*1a (Branch Memorial Park)	11	113	528	10.3	*48	21.4
1b (S. Buckhorn Dry Lake)	10	6	98	0.6	9.8	6.1
1c (2 mi S Branch Memorial Park)	7	13	68	1.9	9.7	19.1
1d (2 mi N Branch Memorial Park)	2	5	32	2.5	16	15.6
2a (Red Hill)	6	13	130	2.2	21.7	10.0
2b (NW end of Rosamond Dry Lake)	4	9	71	2.3	17.8	12.7
*2c (E Rosamond Hills)	7	55	227	7.9	*32.4	24.2
2d (W Red Hill)	4	1	27	0.3	6.8	3.7
3a (W Piute Ponds)	7	31	193	4.4	27.6	16.1
*3b (N Piute Ponds)	11	99	397	9.0	*36.1	24.9
3c (1.5 mi NW Piute Ponds)	7	11	86	1.6	12.3	12.7
3d (E Piute Ponds)	5	6	26	1.2	5.2	23.1
*4a (1 mi N Mercury Blvd. & 1 mi E Rogers D Lake)	4	30	185	7.5	*46.2	16.2
4b (peaks on the NE Rogers D Lake)	4	14	73	3.5	18.3	19.2
*4c (1.5 mi NE of the peaks)	4	10	104	2.5	*26	9.6
*5a (sand dunes 2.5 mi N Ave. B on W side Mercury Blvd.)	9	33	204	3.7	*22.7	16.2
5b (mesquite woodland N of Ave. B and just W intersection of 140th St.)	8	19	137	2.4	17.1	13.9

* The localities where night collecting was done by mercury vapor light.
[1] Mean unique and total species.
[2] Mean unique and total species found at mercury vapor light sites.

(Continued)

Table 2 (Concluded)

Site	No. Visits	No. Unique Species	No. Total Species	No. Unique Species Per Visit	No. Total Species Per Visit	Unique Percent of Total
5c (W side of sewage ponds on W Rogers D Lake)	7	13	103	1.9	14.7	12.6
*6a (NW Leuhman Ridge)	8	57	300	7.1	*37.5	19.0
6b (NE Leuhman Ridge)	5	10	55	2.0	11.0	18.1
6c (3 mi N of Leuhman Ridge)	1	0	5	0	5.0	0
*7a (N 165th St.)	5	23	165	4.6	*33.0	13.9
7b (W 140th St.)	4	11	91	2.8	22.8	12.1
*8a (1 mi E intersection of Sopp Rd. and Pole Line Rd.)	6	25	170	4.2	*28.3	14.7
*8b	4	27	121	6.8	*30.3	22.3
8c	5	1	42	0.3	8.4	2.4
*9a (W Bissell Hills)	6	31	226	5.2	*37.7	13.7
9b (W Rosamond Hills)	1	0	16	0	16.0	0
10a (200th St. S of Ave. C)	1	1	13	1.0	13.0	0
10b (200th St. N of Ave. C)	1	1	17	1.0	17.0	5.9
10c (Red Buttes)	1	4	31	4.0	31.0	12.9
*10d (Kramer Hills)	2	4	63	2.0	*31.5	6.3
Total	**90**	**169**	**1,316**	**1.9[1]**	**14.6[1]**	
Total	***77**	***507**	***2,690**	***6.6[2]**	***34.9[2]**	

ranges and the other will be rare species with wide ranges that were not encountered at the other localities simply because they were rare. The first type are true endemics, while the second type are identified as unique to the locality simply due to sampling bias. Since such rare species exhibit wide ranges, their frequencies should be relatively constant from one locality to the next. Therefore, the number of endemics should be the total number of unique species at a locality minus a relatively constant frequency of rare species. Unfortunately, we do not know the constant frequency of rare species, so the next best thing will be the number of unique species to a locality. With increased surveys over time, rare species should be encountered at multiple localities and eventually the number of unique species will be equal to the true endemics or the species with restricted ranges on base.

Unfortunately, some of the endemics with restricted ranges on base will be overlooked by this method. One reason is that no sampling method actually collects all species. There are many nocturnal invertebrates that are not attracted to lights, there are many species with very short adult life spans, many which are too small for accurate identification, and there are many that are small and wingless. On the other hand, there are species that will be collected and not determined to be endemics or unique species, since they occur in more than one locality. The Tiger Beetles provide a good example. They are probably best thought of as endemics since they are adapted to the salt flats around Piute Ponds. For this reason, these beetles were collected at sites 3a, 3b, and 3d. Another less dramatic example with a restricted range on base is *Apodemia palmeri*. This butterfly feeds specifically on *Prosopis glandulosa* and has a restricted range on base, but the plant is found at sites 1a, 1c, 5b, and 7b, which are all relatively close to one another. Since this species has been found at sites 1a, 1c, and 5b, it is by the selection method not considered an endemic.

As expected, the percentages of unique species represented in the 1998 total collection for most localities was less than those taken in 1997, since over time, rare species should be encountered at more sites as the number of visits increases. Of the 24 sites surveyed during 1996-1997, 16 had lower percent totals and 7 had higher totals in 1998 (Table 2, Appendix A). These decreases in percent totals were not as great as the decreases in 1997, so the percent totals appear to becoming stable. Most of those that were higher, only sites 1d, 3d, 6a, and 6b, had an increase of greater than 1 percent in 1998. In spite of the drop of unique species in percent of the total for most sites, their order in magnitude remained similar from 1 year to the next. For the five sites (which were surveyed by mercury vapor light), site 3b (north Piute Ponds) exhibited the largest percent unique species, site 2c was next, site 1a next, site 4a next, and site 5a last. Of these five sites, only site 5a fell below 20 percent and within the range of the other sites that were not surveyed at night.

The number of unique species per visit was determined for all sites surveyed at EAFB (Table 2). This number is an estimate of how many new species would be found if additional visits were made to the site. This

information would be particularly useful if this survey was continued for additional years. It is not an estimate that is relative to the other sites, since some sites that were visited only once or twice will have a far greater percentage of the total unique species to be added at that site. Therefore, with increased numbers of visits there should be fewer unique species at the site.

Toxic and Noxious Invertebrates

Toxic and Noxious Invertebrates were discussed in the report of the 1996 survey (Pratt 1998). There are two spiders, at least two scorpions, a number of wasps, a number of biting flies, and probably at least one true bug. The two spiders are the Black Widow (*Latrodectus hesperus*) and the Desert Recluse (*Loxosceles deserta*). These two species can be avoided by wearing gloves when turning trash, rocks, logs, etc. Since the scorpions are nocturnal, they can be avoided by wearing shoes at night and wearing gloves when turning over objects on the ground where they could be hiding. Most of the scorpions have only a mild sting and are not highly poisonous. The bug, which would be a *Triatoma* species, called a Kissing Bug (because it seems to prefer to bite people on their lips) is a nocturnal blood-sucking insect that largely feeds on Pack Rats (*Neotoma* sp.). This bug is common in the military bases of Fort Irwin and China Lake. The flies belong to the families Horseflies (Tabanidae), No Seeums (Ceratopogonidae), Mosquitoes (Culicidae), and Blackflies (Simulidae). Most of these can be avoided by keeping clear of permanent water sources such as Piute Ponds and Branch Memorial Park. A number of the bees and wasps that occur on base can sting under certain conditions. They can be avoided by staying clear of flowering bushes. The dog tick, *Dermacentor variabilis*, is at least present at EAFB. It is possible that other species may be present.

4 Discussion

A total of 404 invertebrate species, 107 considered to be unique, were collected in 1998 from the EAFB (Table 1). Eighty percent of the total species belonged to four large orders: Coleoptera, Lepidoptera, Diptera, and Hymenoptera. Most of the remaining species were true bugs and spiders.

The last survey year (1998) that fieldwork was done on this survey in EAFB was during an El Niño climate. Because of the high rainfall, one would have expected a higher number of species to be collected compared to previous years. Part of the reason that there were not more arthropods collected during 1998 is that the sites with the highest species richness during 1996 and 1997 were not included. Unfortunately, the purpose of this survey was to cover as much of the base as possible, not comparing sites from one year to the next. For this reason, some areas were not surveyed during the El Niño year. Some of the sites that were surveyed during 1998 may have had higher relative species richness when compared to previous years, simply because of the higher rainfall.

Noninsect Arthropods

Arthropods are organisms that have an external skeleton or exoskeleton. All of the species found during this survey are listed in Appendix A. In the deserts over 95 percent of these arthropods are insects. The remaining groups other than insects include crayfish, crabs, spiders, harvestmen, scorpions, ticks, fairy shrimp, tadpole shrimp, clam shrimp, mites, millipedes, centipedes, and isopods (pillbugs and sowbugs). Crayfish and crabs, if present at EAFB, were probably accidentally introduced. The remaining aquatic noninsects, such as fairy, tadpole, and clam shrimp, have been well studied by other EAFB personnel, while the nonaquatic species were covered to a great extent by this survey.

From this survey spiders probably represent the greatest diversity of the noninsect arthropods. Only one or two species of harvestmen (daddy longlegs) are apparent. It is suspected that there are only three or four species of isopods found on the EAFB, and only one or two of these are native. The centipedes and millipedes probably are represented by fewer than a

half a dozen species. Only a few species of scorpions were found during this survey. One of these, the hairy scorpion (Hadrurus species) reaches nearly 10 cm (4 in.) in length and may be the largest arthropod found on base. The single species of tick found at EAFB was found on the author of this document. There are probably a few more species found on the various native lizards.

The only group of noninsects, which may be far more diverse than indicated by this survey, is the mites. The only morphospecies found was a large red mite that was observed on the soil surface after fall-winter-spring rains and was collected in the pitfall traps. There are many mite species which are found on plants and in the leaf litter. All are small and difficult to identify. Many were not specifically searched for and if they were found were not identified. This is an extremely difficult group to identify.

The spiders were identified to species when possible. The advantage of working with this group, over the other noninsect arthropods, is that there are experts available that can identify them. Two of the species are considered poisonous, as discussed above. Although Tarantulas were not collected during this survey, they are undoubtedly present since Tarantula Hawks (a wasp) that specifically feeds on these spiders were present at the base.

Apterygota

The insects are divided into a number of evolutionary groups. The two most basic groups are the Apterygota and the Pterygota. The Apterygota represent the group of insects that predate the evolution and formation of wings, while the Pterygota are the insects that evolved after the formation of wings. Those species of the Pterygota that lack wings have lost them through time. Therefore, the Apterygota are the most primitive of the insects. Among this group are the orders called the Collembolans (Springtails), Diplurans, and Thysanurans (silverfish and jumping bristletails). Many of these arthropods are highly sensitive to water loss and are only visible during the winter and spring shortly after rain.

The Collembolans or springtails are not a very diverse group in the desert. The one species that was found at the east side of Piute ponds was not found elsewhere on base. There is an additional species of Collembolan that is found in Fort Irwin to the east that comes out after summer rains. This species was common during the summer of 1998.

There is only one species of Dipluran (a Japygid) that was observed during this survey. This species was found in late winter under rocks and logs and can be distinguished from other Diplurans by the scelerotized pincer structures at the posterior end. It is probable that there is one or two species of Campodeidae also on base during the winter months.

The Thysanurans or Silverfish and Jumping Bristletails are another group of Apterygota. This group is also not very diverse. There is one species on EAFB that is specific to dune habitats. There is a Jumping Bristletail that is found within the leaf litter. The other silverfish is often found beneath logs and rocks in a variety of habitats.

Pterygota (Ephemeroptera and Odonata)

The most primitive species of the Pterygota are the Mayflies (Ephemeroptera), Dragonflies, and Damselflies (Odonata). Species found in the fossil record indicate that species very similar to present day species of both Odonata and Ephemeroptera have been present for over 200 million years (Wootton 1981). All of these species have nymphs that are aquatic; therefore, they require water to complete their development. But the adults have wings and can travel great distances. The dragonflies are even known to migrate great distances. Only one of the species, *Tramera onusta*, is considered to be rare. The presence of the mayflies at the base is somewhat surprising, since it is very fragile and unlikely to travel great distances. However, one of these mayflies wandered a great distance from a water body.

Orthoptera

This group contains the grasshoppers, crickets, katydids, Jerusalem crickets, camel crickets, and long-horned grasshoppers. Ancestors to this group also have been around for over 200 million years (Wootton 1981).

The more visible a species is, the more likely it has been named and can be identified. Because of their behavior, the grasshoppers are among the best known of the Orthoptera. They are almost as well known as the butterflies and there is a book on the California species (Strohecker, Middlekauff, and Rentz 1968). Some of the species found on EAFB are restricted to sites along the western edge of the base.

One of the grasshoppers is specifically adapted to *Larrea tridentate* (creosote). The green, black, and white pattern makes this species very cryptic when on its food plant. The *Trimerotropis* have a number of species that are common in the desert and are difficult to identify, without close examination. One species, *Ligurotettix coquillettii,* commonly makes clicking noises that one can hear as one hikes through the desert. This species seems to prefer to hide in thorny bushes, such as *Lycium* species, but uses creosote when these thorny bushes are absent.

The only member of the long-horned grasshoppers (Tanaoceridae) found in EAFB is *Tanaocerus koebelii*. There is only one other species found in southern California. *Tanaocerus koebelii* is quite common throughout the Mojave Desert but is most commonly found in late winter along dry rocky slopes before most other insects become visible. The nocturnal crickets and katydids are next well known. The common desert narrow winged katydid, *Arethaea gracilipes*, may be at the western edge of its range in EAFB. *Capnobotes fuliginosus* is large and aggressive for a katydid and has been observed feeding on moths at mercury vapor lights. Identifying singing males in tall desert bushes can help locate this species during midsummer. This species looks even like a large desert locust (grasshopper) except for its long antennae. On warm nights during early summer, the beautiful green, black, yellow, and white shield backed katydid, *Neduba ovata*, can be found by following its singing males in low desert bushes and Joshua trees.

The camel and Jerusalem crickets are probably the least known of the Orthoptera. The reason is that they are not only nocturnal but hide within the sand, soil, or beneath rocks and logs, and are rarely seen. They also have characters that make the species more difficult to distinguish. The camel crickets are perhaps the best understood, since they often have specific leg characteristics, which can distinguish the species. On the other hand, the Jerusalem crickets have poorly defined morphological characters, but exhibit behaviors that are important in species recognition.

Dictyoptera

This group contains the cockroaches and praying mantises. They have been in the fossil record for near 300 million years (Wootton 1981). There are three species of desert cockroaches found on EAFB. Two of these species (in the genus *Arenivaga*) are restricted to sand dune habitats and at least one of them probably does not even have a name. The females of these species are wingless, so there may be local restricted species found on EAFB. Very little is known of the species, but it is suspected that this group may be very rich in southern California. The *Eremoblatta subdiphana* can be found along the coastal slope as well as in the desert. There may be a couple of more species found on the base, particularly species that are found in urban areas such as *Periplaneta americana*.

There are three praying mantises found in EAFB. Two of these are relatively large, green, and roost above the ground in bushes, while the third species, the ground mantis, *Litaneutra minor*, rarely crawls above the ground.

Isoptera and Dermaptera

There are probably a few species of termites (Isoptera) found on base. Identification to the species level is based on the soldiers or winged adults. These insects live in colonies and are responsible for the decomposition of wood from dead and dying Joshua trees, mesquite, and other bushes and trees. There are probably a few species in this order at the base, although this is not a species-rich group.

Only one Dermaptera (earwig) was found on base. This *Euborellia* species is not native to North America and is not well-adapted to the desert, which may be part of the explanation why this species was only observed once. None of the earwigs are adapted to or commonly found in the desert.

Psocoptera and Thysanoptera

These are the booklice (Psocoptera) and thrips (Thysanoptera). The adults of both of these families are quite small. Both orders probably do not have many species. The Thysanoptera are the most likely to have a dozen or more species. Their small size and morphological characters make them a difficult group to work with.

Homoptera

Homoptera have been divided into two suborders: the Auchenorrhyncha and the Sternorrhyncha. The Auchenorrhyncha have been well-studied during this survey, whereas the Sternorrhyncha have not. The reason for their better study is that the morphological characters of the Auchenorrhyncha can more easily separate the species than many of the Sternorrhyncha. The adult females of many of the Sternorrhyncha, which are the largest and most frequently collected stage, are simply bags of eggs without much in the way of morphological characters to separate the species. Only the Aphididae and Psyllidae, of the Sternorrhyncha, can be easily separated into morphospecies. Their soft bodies make the Aphididae easily damaged and often difficult to identify.

The one member of the Cicadidae found on EAFB, *Okanagana vanduzeei*, is the largest species of Homoptera on base. It is common on creosote bushes. During early to midsummer, the humming sounds made by this cicada carry great distances across the desert. Yet this cicada is very sensitive to approach, and often takes off long before one can get close enough to observe. This species is the food of the large wasp, the cicada killer.

All of the Homoptera are herbivores and feed by piercing-sucking mouthparts. Some of the species feed only on specific plant species. The Cicadellidae are the most species rich of the Auchenorrhyncha. Some of these species, such as from the *Norvellina* genus, probably feed only on one specific plant species. The Flatid, *Ormenis saucia*, is specifically adapted to *Ephedra*, or Mormon Tea. Two of the four treehoppers (Membracidae), *Multareis cornutus* and *Multareoides bifurcates*, are specifically associated with *Larrea tridentata*. Another treehopper, a *Micrutalis* species, is specifically associated with *Croton californica*.

Hemiptera

The Hemiptera are a complex of species with different feeding behaviors. They all have piercing mouthparts, which they use to suck up their food. Some species are plant specific, while others are predators, and still others such as some of the Pentatomidae exhibit the ability to be both. The Miridae are the most species-rich of the Hemiptera. The genus *Phytocoris* is one of the most species-rich groups of the different Miridae genera. Many of these species are probably plant species specific and some may have restricted ranges.

Of the predator species of Hemiptera, the ones associated with water are the most likely to have restricted ranges. Some of the aquatic species of Hemiptera belong to the Notonectidae and Corixidae. It is surprising that one of the species of the Notonectidae was only recorded from a ridgeline at a mercury vapor light. Other species occur along the edge of bodies of water, such as the Saldidae. Some other predators belonging to the families Phymatidae and Reduvidae feed and hide within flowers. It is interesting that the species of Phymatidae found in EAFB is rare and was found only in neighboring sites on the northwest side of base sites 8c and 9a (sites identified in Chapter 2).

Neuroptera

The Neuroptera are all predatory and exhibit a complex life history. They have what is called a complete metamorphosis with an egg, larval, pupal, and adult stages. All of the preceding species of insects have had a gradual or incomplete metamorphosis. In the Neuroptera, the larvae all have jaw like piercing-sucking mouthparts, while the adults have simply chewing mouthparts. The green and brown lacewings (Chrysopidae and Hemerobiidae) have hunting larval stages, while many of the Antlions (Myrmeleontidae) have larval stages that occur at the base of a sand pit. At the base of these pits, the larvae will capture and feed upon all of the ants that fall in.

Many of the species of Neuroptera exhibit broad ranges, so that there is probably no species found in EAFB with distributions restricted to one or two sites on base. Some of these species are restricted to sand dunes but, because of their ability to fly, they are not restricted to specific dunes. Many of these species of Neuroptera were collected at night at a mercury vapor light.

Coleoptera

Coleoptera or beetles are another rather old order since they also are present in the fossil record for over 230 million years (Wootton 1981). Some of the families, such as the Buprestidae, Cerambycidae, Cicindelidae, and Scarabaeidae, are very popular among Coleopterists. The Carabidae, Chrysomelidae, Melyridae, and Tenebrionidae are among the most species-rich families of desert beetles.

Many Carabidae exhibit restricted ranges, so fall into the category of unique species. There are probably many additional species in this group that are found on EAFB. Two of the larger species have a strong repellent odor. Some of the Bruchidae feed specifically on Mesquite seeds. Of the Buprestidae or metallic wood-boring beetles, *Hippomela obliterata* and *Hippomelas fulgida* are among the largest of the beetles on base. The *H. obliterata* were common on creosote during all 3 years of the survey. They often flew away when the creosote bushes were approached.

The Cerambycidae are the long-horned beetles. The larvae of many of the species of this family bore into wood. They are often large in size and some are rather attractive, which is the reason for their popularity. *Derobrachus geminatus* is the largest species. The Chrysomelidae, a species-rich family, is the closest relatives to the Cerambycidae. The larvae of this family feed on leaves, which is why they are called the leaf beetles. *Pachybrachys desertus* is common on Creosote. Both of these beetle families probably have species that would be additions to EAFB.

The tiger beetles or Cicindelidae are one of the most studied beetles of the desert. These beetles are well named since they are highly aggressive and actively hunt their prey. All of the species found in EAFB are associated with moist mud where their larvae can make burrows into the soft soil. Some of the species are associated with restricted habitats. Two of the four species collected on EAFB are major range extensions for the species.

There are several snout beetles (Curculionidae) found on EAFB. Of these species, the genus *Ophyrastes* has a couple of species that are found largely on Creosote (Hurd and Linsley 1975). The Dermestidae are important in the decomposition of dead animals. *Dermestes marmoratus* is the largest species found on EAFB. The Elateridae or click beetles are rather species rich in EAFB. There are probably many more species present than

were found during these surveys. Some of the click beetles are adapted to sand dune habitats and may have restricted distributions.

The aquatic beetles belong to the families Dytiscidae and Hydrophilidae. Over half of the species from EAFB were found around Piute ponds. The largest water beetle was *Hydrophilus triangulus*, which was common and only found around Piute ponds. The Meloidae or Blister beetles are common insects of the desert. *Cysteodemus armatus* is a common species that can be found running quickly over the desert floor like a large spider. *Lytta magister* is the largest Meloid and is colored aposematically with black and orange.

The Ptinidae are called spider beetles, because of their strong resemblance to spiders. The Scarabaeidae is a relatively species-rich family of a relatively large species. There is at least one undescribed species of *Serica* on EAFB. The Tenebrionidae is one family of beetles that is among the best-adapted family to desert environments. It is certainly one of the most species-rich families of the desert. The stinkbug (*Eleodes armata*) is a misnomer, since it is not a bug but a Tenebrionid beetle. When disturbed the beetle stops and points its posterior end up and at the end it produces a drop of a strong foul smelling fluid. *Abolus verrucosus* is one of the long-lived species and has a cuticle that is as hard as the Iron Clad beetle, another Tenebrionid. Many of these species become active late at night.

Trichoptera

Trichoptera or caddisflies look very similar to their closest relatives, the moths. The biggest difference is scales being present on wings for Lepidoptera, while the Trichoptera has hairs. Caddisflies hold their antennae together straight in front when they rest, while moths generally have their antennae not necessarily held together out in front. All caddisflies have larvae that require water. Only four species were found on EAFB. It is surprising that one of the species was only encountered at a site a long distance from water.

Lepidoptera

The Lepidoptera or butterflies and moths are the third largest order found on EAFB. They can be told by the presence of scales on the two pairs of wings. There are probably many more species present than have been described. The Microlepidoptera are one of the most species-rich groups in North America with many undescribed species. Unfortunately, the species of Microlepidoptera are small and are distinguished by genitalic characters, which always require microdissections.

Many of the species of Lepidoptera feed on specific plants as larvae. Those moths that feed on plants with restricted ranges also have restricted ranges like the definition here of a unique species. Many of the Geometrids have restricted food plants, such as species that feed upon *Eriogonum*. There is a species of Geometridae, *Singlochis perumbraria*, which feeds specifically on the Creosote. The Sphingidae, *Euproserpinus phaeton* and *Pachysphinx occidentalis*, also feed on specific plants, *Camissonia* species and *Populus* species, respectively. The Lycaenidae are far more variable in their choice of food plants. For instance, *Strymon melinus* feeds on more than 50 plant families, while *Euphilotes bernardino* feeds only on *Eriogonum fasciculatum*.

The Noctuiidae are species-rich and well-studied, so their identification can be useful and accomplished more easily than most other families of moths. Ninety species of Noctuiid moths were collected over the 3 years of this survey. This number represented nearly 6 percent of the total insect species identified. Many of the food plants of the Noctuid species as well as other moths are listed in Tietz (1972). For the reason that these moth species are so well known, new species can be easily identified. New species will therefore have relatively restricted ranges because of the fact that if the new species were not previously observed, the only explanation would be they had ranges restricted to the military base. One of the *Catocala* species, *C. versilluana*, feeds specifically on Oaks, which are not found on EAFB or anywhere near the base. The specific food plant for *Libytheana bachmanii*, Hackberry, is not found within 161 km (100 miles) of EAFB.

There were 10 species of Nymphalids observed during this study. One of the species observed during 1998, *Precis coenia*, was not observed during the prior 4-year period, 1994 to 1997. The range of *Charidryas neumogeni* on EAFB is also somewhat surprising, since its food plant *Xylorhiza tortifolia* has an extensive range throughout the higher elevation of the base. *Charidryas neumogeni* extends west to the hills on the northeast side of Rogers Dry Lake, while the food plant extends further west through the Rosamond Hills. The Checkerspot was not found in that area of the Rosamond Hills, although its food plant was common in the area. It is interesting that *Polygonia satyrus* was found in the vicinity of its food plant, *Urtica* species at Piute ponds.

There are a number of species of Pieridae. Most of the species feed upon members of the Brassicaceae. One species of Pierid, *Nathalis iole* was not previously observed on base. This is particularly surprising, since the base has been surveyed for the 4-year period of 1994 to 1997. This Pierid feeds on composite annuals.

Apodemia mormo has two distinct races at EAFB. These races are not sympatric, but come close to one another in the Rosamond Hills. *Apodemia mormo* near *virgulti* is specifically associated with *Eriogonum fasciculatum* and extends east to the north end of Rosamond Dry Lake, while *Apodemia mormo deserti* extends west to the hill on the northeast end of

Leuhman Ridge. *Apodemia mormo deserti* feeds specifically on *Eriogonum inflatum*.

There was only one species of Saturnid found on EAFB. This species was *Hemileuca burnsi*. This medium-size moth feeds on *Tetradymia* (Asteraceae) and *Psorothamnus* (Fabaceae). It appears to prefer one of these food plants over the other at each locality. The males are active late in the afternoon.

Diptera

The true flies are the second largest or species-rich orders on EAFB. The Assilidae, or Robber flies, are the second most complex and species rich of the desert arthropods. Some of these species are highly specialized as to the larval host. As adults they are relatively nonspecific predators. Because authorities familiar with the group identified the species, identifications to species are believed to be reliable. Some of the species are small and others can be quite large.

The *Apiocera* as a group of flies are relatively large in size. *Rhaphiomidas acton* was the largest fly found on base and was until very recently considered to be an Apioceridae. Some authorities now classify *Rhaphiomidas* as members of the Mydidae, rather than Apioceridae. Very little is known of the biology of this species although it is quite common in southern California.

The beeflies or Bombyllidae are important species of the desert. They have been well-named since many of them mimick bees. The species vary greatly in size from barely visible with the naked eye to some of the largest flies. This survey recorded 52 species on EAFB, which represented over 3 percent of the total species. Only a few of the species have been well-studied. In all cases they have been determined to be parasites of other insects. Because of their specialization there can be some unique species with restricted ranges on EAFB.

The blowflies or Calliphoridae are important in the breakdown of dead animals. These flies are often metallic green and as adults are important food for the larvae of various Specid wasps. The Cecidomiidae are flies that form galls on plants. Collecting these plant galls could have obtained many more species. The Ceratopoginidae are called no-see-ums. These are tiny biting flies that can leave welts, which do not match the size of the flies.

The Chironomidae species all have aquatic larvae and should be part of the aquatic arthropod part of this EAFB survey, examined by other personnel. At least 10 morpho-species of Chironomids were found by this survey. These species were largely associated with aquatic habitats. There may be two times this number of species present at EAFB. Identification of these

species is based on their legs which are very delicate, unlike the craneflies which are identified by wing patterns.

The Culicidae and Simulidae (mosquitoes and blackflies, respectively), both have aquatic larvae. The adults can fly some distances from their aquatic habitats as observed in this survey. The Tabanidae also require semiaquatic habitats and live in moist soils. The Dolichopodidae and Ephydridae are shore inhabiting flies. Some of these species may fit the category of having restricted ranges. Larvae of many of the Heleomyzidae, Mycetophilidae, and other fly families are specifically adapted to and feed on mushrooms and other fungi.

Sciomyzidae feed specifically on snails and may be adapted to specific species. Of the Sarcophagidae, *Blaesoxipha plinthopyga*, is probably the most common. This species constantly flies around and lands on people who are walking in or along the edge of the desert. It is a relatively large gray and black striped fly with a red posterior end.

The Syrphidae are flies that have larvae that feed upon aphids and other Homoptera. This is a relatively species-rich family and there are many more species to be expected on EAFB than were identified during this survey. The Tachinidae is another complex genus, with many species that look very similar to one another. These insects are typically parasitic on other insects, so each also requires the presence of a host species. They vary greatly in size and there are probably many species on EAFB.

The Tephritidae of California feed largely upon various Asteraceae. Most species live in the flowers, but some form galls in plants. Probably many more species could be found at the EAFB by searching among the flower heads of composites late in their fruiting stages. Such a collection would not only provide the different fly species, but their parasites.

Another species-rich group that may be under represented in this survey is the craneflies or Tipulidae. These are large flies that are usually found mainly in the winter and spring. One species, *Dactylolabis vestigipennis*, is wingless. This species was found around a dune system at site 2c.

Hymenoptera

There are many bees found in the desert. The families of bees found at EAFB are Megachilidae, Apidae, Anthophoridae, Andrenidae, Halictidae, Colletidae, and Melittidae. Most of these bees can be collected from flowers. Some are specific to the species of flower. As a group they represent 107 species or about 7 percent of the total arthropod species found during this survey. They can be separated from other Hymenoptera by the presence of branched hairs or setae on the body. There are probably many more species in this group at the EAFB than have been identified to date.

Another group of hymenopterans are the chalcid wasps which are tiny parasites or parasitoids (insect parasites). The important families are Chalcididae, Encyrtidae, Eulophidae, Eupelmidae, Eurytomidae, Mymaridae, Orymyridae, Perilampidae, Pteromalidae, Trichogrammitidae, and Torymidae. The Trichogrammitidae are not represented in this study, but the author has collected individuals in this group just to the east of EAFB in the Kramer Hills. These wasps often parasitize butterfly and moth eggs. The Trichogrammididae were reared from *Apodemia mormo deserti* eggs from the Kramer Hills. A single egg, which is about the size of a pinhead, can produce as many as five adult wasps.

Many of the other families of chalcid wasps are also parasitoids, but there are some exceptions. Some of the Eurytomidae are called seed chalcids and have larvae that feed specifically on seeds. Some of the species of Perilampidae are even secondary parasites or parasitoids of other parasitoids. The ecologies of these species are extremely complex.

There are many other families of parasitic wasps. These parasitoids include Bethylidae, Braconidae, Chrysididae, Gasterupidae, Ichneumonidae, Megaspilidae, Platygasteridae, Pompilidae, Proctotrupidae, and Scelionidae. The Gasterupidae are rare and were only found at one site. The Braconidae and Ichneumonidae are extremely large families and there are probably many more species on EAFB that are left to be discovered. The Pompilidae, or spider wasps, are also species rich. The Tarantula Hawk or *Pepsis chrysothemia*, a member of the spider wasps, is rather common and found at a number of localities. This is one of the largest wasps found on base.

The ants (Formicidae) are a very species-rich family. There are probably a number of other species not known from EAFB. *Camponotus semitestaceus*, or carpenter ants, are the largest species found on base. The acrobat ants, *Crematogaster* species, are quite distinctive with their triangular abdomens. The *Pheidole* species are quite interesting in their diverse forms. The soldiers are about three times the size of the workers and have a head that is several times in proportion to the size of the body. There are several species of Harvestor ants, *Messor pergandei*, *Pogonomyrmex californica*, and *Pogonomyrmex rugosus*.

The Velvet ants (Mutillidae) and Tiphiid wasps (Tiphiidae) are similar to one another. Many of the species of both are yellow to dark brown. The females of both families are wingless, whereas the males have wings. They can be told from one another by the presence of submarginal felt lines of the velvet ants and the presence of two lobelike metasternum projections of Tiphiid wasps. The wingless females of both families, although they look like just ants, have very powerful stings.

The Sphecidae is a species-rich family. They are closely related to bees, but lack the branched hairs that distinguish Spehcid wasps from bees. The species vary greatly in size from very tiny wasps to extremely large species. There are 74 species of these wasps that represent about 5 percent of

the total species on EAFB. There are probably many more species to be found on base.

The Vespidae are the most similar to the Sphecidae. The Vespid wasps do not have the pronotal lobe of Sphecid wasps and have different wing venation. The paper wasps (*Polistes* spp.) and potter wasps (*Eumenes species*) are some of the species of Vespid wasps.

New, Rare, or Unique Species

There are a number of new and unique invertebrate species found at EAFB. There were three Gryllacrididae that are new and undescribed species. Two may be restricted to the sand dune habitats of EAFB from just west of Branch Memorial Park and east to Kramer Hills. One of the species is an *Ammobaenetes* (Sand Treader), while the second is a species of *Stenoplematus* (Jerusalem Cricket). The records of the katydid, *Arethaea gracilipes*, may be a major range extension for the species. There are two Dune Roaches of the genus *Arenavaga* restricted to the same sand dune habitats as the Gryllacrididae. One of them may be a new species and also restricted to EAFB.

The *Enchenopa permutata* (Membracidae) specimen found around the northwest corner of EAFB may be a major range extension for the species. The Phymatid, *Macrocephalus cimicoides*, is not common in the Mojave Desert. The author has not seen this species elsewhere in the Mojave. The beetle family Phengodidae, of which *Zarhipis integripennis* is a member, was collected on EAFB and is usually considered uncommon to rare. There were two new Scarabaeidae species, which also may be restricted to EAFB. These species belong to the genus *Serica*.

A new species of Assilidae, *Cerotainiops*, was collected from EAFB. It is possible that this species is restricted to EAFB. These have been collected both in 1996 and 1997. The Asteiidae, of which *Astiosoma aridum* is one, are thought of as very rare flies. An unusual wingless cranefly or tipulid, *Dactylolabis vestigipennis* (or *damula*) was collected in the sand dunes on the eastern end of the Rosamond Hills. This could be an unusual species for the region. A few *Gasteruption nevadae*, which are also considered quite rare, were collected on the southern edge of base.

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Appendix A
Species Collected

*The species preceded by an asterisk are new additions to the invertebrate list.

Spiders

Family	Localities[1]	Date
Agelenidae		
***Rualena* species nv.**	8a, 9a	23 Nov 97
Araneidae		
Metepeira foxi	3a, 5c	4 Apr 96
	8b-c	16 Jun - 16 Aug 98
**Neoanagraphis chamberlini*	6a	23 Nov 97
Neoscoma oaxacensis	3a	3 Jun 97
Caponiidae		
**Tarsonops* species	6a	23 Nov 97
Clubionidae		
Agroeca near *omata*	3b	6 Jun 96
Micaria (immature)	5a	26 Jun 96
Syspira (immature)	1a	13 Jan 96
Dictynidae		
Argenna sp.	3b	2 Jun 96
Dictyna palomara	1a-b	6 Sep - 20 Oct 97
Tricholathys monterea	3a	3 Jun 97

[1] See page A61.

Filistatidae		
Kukulcania sp.	1a	13 Jan 96
Gnaphosidae		
Drassyllus insularis	3a	3 Jun 97
	6a	18 Jun 98
Drassyllus fractus	6a	13 Jun 97
Gnaphosa synthetica	3a	3 Jun 97
Herpyllus hesperolus	3c	20 Nov 96
**Haplodrassus dixiensis*	6a	18 Jun 98
Scopoides naturalisticum	9a	2 Aug 97
**Zelotes griswoldi*	6a, 9a	23 Nov 97
Lycosidae		
Allocasa subparva	1a	6 Aug 96
**Alopecosa kochii*	6a	18 Jun 98
Pardosa sp. (female)	3b	6 Jun 96
Schizocosa mccooki	3b	9 Oct 96
Mimetidae		
Mimetus hesperus	3b	6 Jun 96
	3b	11 Aug 97
	8b	19 Aug 98
Oxyopidae		
Oxyopes tridens	7a, 8a	7-13 May 97
Philodromidae		
Philodromus infuscatus	3d	22 Apr 97
Thanatus altimontis	3a	3 Jun 97
Tibellus chamberlini	3a	1 Sep 97
Tibellus chamberlini	3b	6 Jun - 11 Jul 96
Pholcidae		
Psilochorus utahensis	2c	13 Jun 96
	6a	18 Jun 98
Psilochorus sp.	3a	26 Feb 97
Salticidae		
Habronattus icenoglei	5a	29 Jun 96
Habronattus signatus	1b, 7b, 9a	29 Aug - 20 Sep 97
Marchena minuta	2c	13 Jun 96
**Phidippus imm*	8b	19 Aug 98
Pseudicius siticulosus	3b	21 Sep 97
Sicariidae		
Loxosceles deserta	1a, 3c, 5b	1 Nov - 18 Apr 96
	2a, 6a, 7a	29 Jan - 12 Oct 97

Theridiidae		
Dipoena abdita	5b	26 Jun 97
Euryopis californica	5a	29 Jun 96
	5b, 6a	13-26 Jun 97
Latrodectus hesperus	1a	8 Nov 96
	2a, 5b	15 May - 3 Jun 97
Steatoda fulva	2a, 7a	7 May - 3 Jun 97
	6a	18 Jun 98
Thomisidae		
Misumenops deserti	3a, 7b	3 Jun - 29 Aug 97
Misumenops importunus	1a, 3b	6-21 Sep 97
	8c	16 Jun 98
Xysticus aprilinus	6a	5 Oct 97
Xysticus californicus	2a, 4b	9 Apr - 2 May 96
	6a	18 Jun 98

Scorpions

Hadrurus obsurus	1a	16 Apr 96
Hadrurus sp.	6a	22 Aug 97
Species 1	6a, 10d	18 Jun - 19 Sep 98

Solpugidae

Species 1	3b	3 Jun 97
Species 2	6a, 8b	15-18 Jun 98

Harvestman

Species 1	9a	23 Nov 97

Ticks

Dermacentor variabilis	3b	3 Jun 97

Mites

Species 1	6a, 9a	23 Nov 97

Isopods (Pillbugs & Sowbugs)

Species 1	3c	20 Nov 96

Centipedes

Species 1	2a	29 Jan 97

Millipedes

Orthoporus sp.	2a, 4a	1 Nov - 29 Mar 96
	2a	29 Jan 97
	6a	18 Jun 98
Species 1	2a	29 Jan 97

Insecta Collembola

Entomobryiidae

Species 1	3a	18 Apr 96

Diplura

Japygidae

Species 1	2a	29 Jan 97

Thysanura

Lepismatidae

Species 1	1a, 5c	16 Apr - 9 May 96
Species 2	1a, 5c	16 Apr - 26 Jun 96
	1a, 2c, 6a, 9a	29 Jan - 23 Nov 97

Machilidae

Machilis species	2c	13 Jun 96
	2c, 4a, 4c, 9a	23 Nov - 9 May 98

Ephemeroptera

Baetidae

Baetis species	2c	13 Jun 96
Species 1	1a	6 Sep 97

Odonata

Aeshnidae

Aeshna multicolor	1a, 3a, 3b	May - Sep 96
	1a	6 Sep 97
Anax junius	1a, 3a, 3b	Jun - Sep 96

Libellulidae

Libellula saturata	1a, 2a	Jun - Aug 96
Pantala hymenaea	5b	May - Jun 96
Pachydiplax longipennis	1a, 3a, 3b	May - Aug 96
Sympetrum corruptum	1a, 2a, 3a-b, 4a, 5b	May - Oct 96
	7b	12 Oct 97
	8a	10 Jul 98
Tramera lacerata	1a, 3a, 3b, 4c	Jun - Aug 96
Tramera onusta (rare)	3a	Jun 96
	6a	13 Jun 97

Coenagrionidae

Enallagma carunculatum	1a-c, 2a, 3a-c, 5a-c	Apr - Sep 96
	1a, 3a-b, 3d, 7b, 8a	11 Aug - 21 Sep 97
Ischneura cervula	1a, 3a, 3b	Mar - Oct 96
Ischneura denticollis	3a	Apr 96

Orthoptera

Acrididae

Aeoloplides tenuipennis	1a, 3a, 4b, 5a, 5c	13 Jun - 18 Sep 96
Amphilitornus coloradus	3a	11 Jul 96
Anconia integra	2b, 3a, 4c, 5a-b	29 Mar - 11 Sep 96
	1d, 6a	8 Apr - 22 Aug 97
Bootettix argentatus	2c, 4a	5 Jul - 18 Sep 96
	6a, 9a	2-22 Aug 97
	6a, 10b, 10d	29 Jul - 10 Sep 98
Chimarocepha californica	3a-b	4-18 Apr 96
	3a	21 Sep 97
Cibolacris parviceps	2b-c, 4a	2 Apr - 18 Sep 96
	6a	3 May - 13 Jun 97
	6a, 8b, 10c	1 May - 29 Jul 98
Cordillacris occipitalis	1a-c, 2b-c, 4c, 5a, 5c	15 May - 26 Jun 96
	6a, 8a, 9a	2 May - 22 Aug 97
	8b-c	16 Jun 98
Derotimena delicatulum	1a, 4a, 5a	26 Jun - 18 Sep 96
Eremiacris pallida	1a, 3a-c, 5a, 5c	5 Jul - 25 Sep 96
	8b-c	19 Aug 98
Hesperotettix viridis	1c, 3a-c, 5c	26 Jun - 11 Jul 96
	8a	16 Jul 97
	10b	29 Jul 98
Ligurotettix coquilletti	2b, 4a, 4c, 5a	13 Jun - 11 Sep 96
	7a	29 Aug 97
	10b, 10d	29 Jul 98
Melanoplus cinereus	4c, 5a	26 Jun - 5 Jul 96
	8a	16 Jul 97
Melanoplus devastator	2a, 5a	2 May - 5 Jul 96
Melanoplus yarrowii	3b	3-9 Oct 96
Oedaleonotus enigma	3c	11 Jul 96
Opeia obscura	3a	18 Apr - 11 Jul 96
Poecilotettix sanguineus	2b, 5a	15 May - 13 Jun 96
	9a	2 Aug 97
	10a, 10d	29 Jul 98
Psoloessa delicatula	1a-b, 2a-c, 3a, 3c, 4a, 5a-c	26 Jun - 11 Sep 96
	7b	29 Jun 97
Schistocerca vaga	3b	11 Oct 95
	5b	5 Jul 96
Trimerotropis californica	1b, 3b, 4a, 5a	6 Jun - 18 Sep 96
	1a, 8a, 9a	16 Jul - 6 Sep 97
	8c	19 Aug 98

Trimerotropis inconspicua	4a, 4b	5 Jul 96
Trimerotropis pallidipennis	1a, 2a-c, 3a-b, 4a-c, 5a	2 Apr - 17 Oct 96
	1a, 3a, 3d, 6a, 6b, 7a	8 Apr - 5 Oct 97
	6a, 8a-c, 9a, 10b	1 May - 10 Sep 98
Trimerotropis pseudofasciata	1a-5c	2 Apr - 8 Nov 96
	3a, 3b, 7b, 8a, 9a	7 May - 12 Oct 97
	6a, 8b-c	16 Jun - 19 Aug 98
Trimerotropis rebellis	1- 2c, 4a-5c	9 May - 8 Jul 96
	6b, 8a, 9a	22 may - 2 Aug 97
	6a	18 Jun 98
Xanthippus olancha	2b	2 May 96

Gryllacrididae

Ammobaenetes n. sp.	1a	30 May 96
	6a	2 May 97
Ceuthophilus californianus	1a, 4c	Apr - May 96
Ceuthophilus hesperus	1a, 4c	Apr - May 96
Ceuthophilus n. sp.	6a	2 May 97
Stenoplematus n. sp.	1a, 5a	Jan - May 96
	1a	12 Feb 97

Gryllidae

Oecanthus californicus	3b	21 Sep 97
Gryllus assimilis	1a, 2c, 3a-b, 4c, 5a, 5c	15 May - 11 Sep 96
	1a, 3a, 6a, 7a, 9a	7 May - 21 Sep 97
	6a, 8b, 10d	29 Jul - 10 Sep 98

Tanaoceridae

Tanaocerus koebelii	2c	29 Mar 96
	8b	14 Mar 98

Tettigoniidae

**Arethaea gracilipes*	6a, 8b	18 Jun - 1 Jul 98
Ateloplus luteus	1a	8 Jul 96
	8a	16 Jul 97
	8b	10 Jul 98
Capnobotes arizonensis	4a	5 Jul 96
Capnobotes fuliginosus	4a, 4c	5 Jul 96
	7a	29 Jun 97
	8b	10 Jul 98
Neduba ovata	2c	2 May 96
	7a	7 May 97

	8b	16 Jun 98
Insara covilleae	2c	13 Jun 96

Dictyoptera

Mantidae

Iris orata	3a	11 Aug - 21 Sep 97
Litaneutra minor	1a, 5a, 3b	15 May - 8 Jul 96
	10a, 10d	29 Jul 98
Stagmomantis californica	3c	15 Sep 96
	7a, 8a, 9a	29 Aug - 20 Sep 97

Polyphagidae

Arenivaga apache	1a, 2c, 4a, 5a	16 Apr - 11 Sep 96
	7a, 9a	29 Aug - 20 Sep 97
Arenivaga species	1a	6 Aug - 15 Sep 96
	10d	29 Jul 98
Eremoblatta subdiaphana	5a	11 Sep 96
	6a, 7a, 8a, 9a	2 Aug - 20 Sep 97

Isoptera

Rhinotermitidae

Heterotermes sp.	1a, 2b, 3a, 4a	Jan - Dec 96

Dermaptera

Carcinophoridae

Euborellia sp.	1b	18 Mar 96

Psocoptera

Trogiidae

Species 1	3d	21 Sep 97

Thysanoptera

Thripidae

Species 1	3a	6 Jun 96
Species 2	3a	6 Jun 96

Homoptera

Acanaloniidae

Acanolonia clypea	1a	15 Sep 95
Species 1	8a	14 Sep 97

Aphididae

Species 1	3b	11 Jul 96
	6a	5 Oct 97
Species 2	9a	20 Sep 97

Cicadellidae

Aceratogallia californica	1a, 2a-b, 3b-c, 4a-b, 5a	11 Apr - 17 Oct 96
	1b, 3a, 3b, 7b, 8a	26 Feb - 27 Nov 97
Acinopterus dulchellus	5a, 5c	15 May - 11 Sep 96
Acinopterus sp.	5a-c	11 Apr 96
	1a	8 Apr 97
Ballana sp.	1a, 5c	11-16 Apr 96
	1a	6 Apr 97
Cochlorhinus sp.	5b	11 Apr 96
Deltocephalus fuscinervosus	3a	6 Jun 96
Empoasca fabae	3a-b, 5a	4 Apr - 26 Jun 96
	1a	6 Sep 97
Norvellina sp.	2c	13 Jun - 17 Oct 96
	7a	29 Jun - 29 Aug 97
	8b	10 Jul 98
Opsius stactogalus	1a-c, 3b-c, 5a-c	30 May - 6 Aug 96
	1a, 1d, 3b, 3d, 8a	11 Apr - 20 Oct 97
Scaphytopius irroratus	2a	17 Oct 96
	1d, 2d, 6b, 7a, 8a	22 Aug - 12 Oct 97
Texananus oregonus	2c, 3b	6-13 Jun 96
	7a	29 Jun 97
	8b	10 Jul 98
Texananus sp.	8a	14 Sep 97
Xerophloea peltata	3b	6 Jun 96

	1d	20 Oct 97
	8b	10 Jul 98
Species 1	3b, 5c	6 Jun - 11 Sep 96
Species 2	3b	11 Jul 96
Species 3	3b	18 Apr 96
Species 4	3a, 4a	9 May - 6 Jun 96
	2d, 8a	14 Sep 97
Species 5	5a	11 Apr 96
Species 6	4c	5 Jul 96
	6a, 8a	16 Jul - 14 Sep 97
	8b, 10d	10-29 Jul 98
Species 7	2a, 2c	13 Jun - 17 Oct 96
Species 8	8a	14 Sep 97
Species 9	1a, 7a	7 May - 6 Sep 97
Species 10	4a	5 Mar 97
Species 11	1a	6 Aug 97
Species 12	4c	5 Jul 97
Species 13	5a	15 May 97
Species 14	3b	6 Jun 96
	7a	29 Jun 97
Species 15	4a, 4b	18 Sep - 1 Nov 96
	3d, 6a, 7b	22 Apr - 5 Oct 97
Cicadidae		
Okanagana vanduzeei	4a	11 Jul 96
	8a-b, 9a, 10a-b	10-29 Jul 98
Cixiidae		
Oecleus decens	3b, 4a, 5b	9 May - 11 Sep 96
Oliarus zyxus	3b, 5b	11 Apr - 6 Jun 96
Species 1	5b	11 Sep 96
	3a	21 Sep 97
Species 2	6b	10 Sep 98
Delphacidae		
Delphacodes sp.	2c, 3a, 3b	6 Jun - 4 Sep 96
	3a	21 Sep 97
Species 1	3a	6 Jun 96
Dictyopharidae		
Acinaca sp.	2c	13 Jun 96
Orgerius concordus	5a	11 Sep 96
Species 1	9a	20 Sep 97
Species 2	8a	14 Sep 97
Flatidae		
Ormenis saucia	1a, 4b	5 Jul - 6 Aug 96
	7a, 8a	29 Aug - 14 Sep 97

	8b, 10b, 10d	10-29 Jul 98
Species 1	1b	8 Jul 96
Issidae		
Species 1	3a	6 Jun 96
Membracidae		
Enchenopa permutata	8a	16 Jul 97
Micrutalis sp.	6a, 7b	29 Jun - 22 Aug 97
Multareis cornutus	4a-c	9 May - 5 Jul 96
	6a-b, 7a-b, 8a, 9a-b	3 May - 14 Sep 97
	6b, 8c, 10b	16 Jun - 29 Jul 98
Multareoides bifurcatus	2a, 4a, 4c	5 Jul - 1 Nov 96
	3d, 6a, 7a, 7b, 8a, 9a	22 May - 12 Oct 97
Psyllidae		
Species 1	3b	4 Apr 96
Species 2	7a	29 Aug 97

Hemiptera

Alydidae		
Alydus pluto	1a, 3a, 3c	6 Jun - 11 Jul 96
Tallius setosus	2a, 3a	2 May - 6 Jun 96
Anthocoridae		
Anthocoris sp.	1c	8 Jul 96
Orius tristicolor	1a-b, 2a, 3a-c, 4a-b, 5a-c	4 Apr - 22 Oct 96
	1a-b, 5b, 6a-b, 7a-b, 8a, 9a-b	16 Jul - 8 Nov 97
	8a	21 May 98
Species 2	9a	20 Sep 97
Coreidae		
Merocoris curtatus	5b	11 Sep 96
Corixidae		
Corisella decolor	1a-b, 2c, 3b, 5a	18 Apr - 8 Nov 96
	1a, 3a-b, 6a, 7a, 8a, 9a	11 Apr - 21 Sep 97
	2b, 6a, 8b	14 Mar - 10 Sep 98

Cydnidae		
Pangaeus conguus	1a, 4c	9 May - 8 Jul 96
	2c	27 Mar 97
Largidae		
Largus californica	1a, 7b	12-20 Oct 97
Lygaeidae		
Emblethis vicarius	1a, 2a	29 Mar - 8 Jul 96
	9a	2 Aug 97
Geocoris pallens	1a-b, 2b, 3b, 4a, 5a	9 Apr - 22 Oct 96
	1a, 1d, 6a-b, 7a, 8a, 9a	8 Apr - 20 Oct 97
	6a-b, 8b-c, 9a, 10a, 10d	16 Jun - 19 Aug 98
Lygaeus kalmii	1a, 2b	16 Apr - 13 Jun 96
	8a	13 May 97
**Neacoryphus bicrucis*	9a, 10a	10-29 Jul 98
Neacoryphus lateralis	2c	17 Oct 96
	8a, 9a	16 Jul - 20 Sep 97
	6a	10 Sep 98
Nysius tenellus	1a, 2b-c, 3a-c, 4a, 5a-c	18 Mar - 22 Oct 96
	1a-b, 1d, 3a-b, 3d, 6a,7a-b, 8a, 9a-b	2 May - 20 Oct 97
	8b, 9b, 10d	16 Jun - 29 Jul 98
Pseudopamera nitidula	2c, 4c	29 Mar - 9 May 96
	8b	10 Jul - 19 Aug 98
**Rhyparochromus saturnius*	8b, 10d	29 Jul - 19 Aug 98
Xyonysius californicus	3c	6 Jun 96
Species 1	1d	20 Oct 97
Species 2	1a-b, 2b, 3b, 6b	8 Apr - 20 Oct 97
Miridae		
Atractotomus species	2c	30 May 96
Chaetophylidea moerens	1a, 4c, 5a, 5c	9-16 Apr 96
	6a, 9a	25 Mar - 1 May 98
Chlamydatus monilipes	2c, 4c	29 Mar - 9 May 96
	2c, 9a	25 Mar 97
**Coquillettia insignis*	8b	16 Jun 98
Deraeocoris brevis	2c	13 Jun 96
Hadronema princeps	2b, 4a, 5a	9 Apr - 2 May 96
Hadronema princeps	1a, 2c, 9a	25 Mar - 8 Apr 97
	8c, 10c	21-26 May 98
Haplomachides consors	4c, 5a	11 Apr - 9 May 96
	9a	25 Mar 98

**Irbisia californica*	2b	14 Mar 98
Irbisia species 1	2b, 5c	2-15 May 96
	9a	25 Mar 97
Lopidea confraterna	2b, 4c, 5a	2-15 May 96
	3a, 6a-b	3 May - 21 Sep 97
	8c	16 Jun 98
Orthotylus sp.	1a, 3c	25 Sep - 9 Oct 96
Parthenicus picicollis	2a, 2c, 4a	9 May - 17 Oct 96
	6a-b, 7a, 9a	20 Sep - 12 Oct 97
Parthenicus species	2c	13 Jun 96
	6a, 8a, 7b, 9a	29 Aug - 5 Oct 97
	5b	16 Jun 98
Phyllopidea picta	6a	1 May 98
Phytocoris albidopictus	1a, 2c, 4c	9 May - 13 Jun 96
	8a	13 May 97
Phytocoris ingens	4c	9 May 96
Phytocoris plenus	2c	13 Jun 96
Phytocoris ramosus	2c, 4c	2 Apr - 13 Jun 96
	2c, 6a-b, 7a, 9b	25 Mar - 12 Oct 97
	6a, 10c	1 May - 18 Jun 98
Phytocoris vanduzeei	4a, 4b	9 May 96
	6a	18 Jun 98
Phytocoris species 1	2c	25 Mar 97
	8a	21 May 98
Phytocoris species 2	1a	8 Nov 96
	1b	20 Oct 97
**Phytocoris* species 3	6a, 8b	21 May - 18 Jun 98
**Phytocoris* species 4	8b	16 Jun 98
Pseudopsallus species	5b	11 Apr 96
	9a	25 Mar 97
Rhinocloa forticornis	3c, 5a, 5c	11 Jul - 22 Oct 96
	1b, 1d, 2b	6 Sep - 20 Oct 97
Spanagonicus albofasciatus	1a	6 Aug 96
	6a	10 Sep 98
Taylorilgus pallidulus	1a-5c	9 Apr - 22 Oct 96
	1a, 1d, 3a-b, 3d, 6a-b, 7a-b, 8a, 9a	11 Apr - 5 Oct 97
	6a-b, 8b	16 Jun - 10 Sep 98
Tropidosteptes species	1a	8 Jul 98
Species 1	5a	11 Apr 96
Species 2	5a-c	11 Apr - 11 Sep 96
Species 3	1a, 5c	30 May - 11 Sep 96
Species 4	5b	11 Apr 96
Species 5	6b	5 Oct 97
Species 7	6a	5 Oct 97
	6a, 10c	26 May - 19 Jun 98
Species 8	2a, 7a	29 Jan - 12 Oct 97

Species 9	7a	12 Oct 97
Species 10	9a	20 Sep 97
Species 11	8a	14 Sep 97
Species 12	7b	29 Aug 97
Species 13	2d, 9a	14-20 Sep 97
*Species 14	4c, 6a, 8c	1 May - 18 Jun 98
Species 15	1a	6 Jun 95
Species 16	1c	8 Nov 96
*Species 17	6a	1 May 98
Nabidae		
Nabis americoferus	3a, 5a-b	11 Apr - 9 Oct 96
	1a	6 Aug 97
	8b	16 Jun - 10 Jul 98
Notonectidae		
Notonecta kirbyi	2c	13 Jun 96
Pentatomidae		
Acrosternum hilare	2b	2 Aug 96
Brochymena sulcata	5b	26 Jun 96
Chlorochroa sayi	1a, 2c, 3a-c, 4a-c, 5a, 5c	2 Apr - 11 Sep 96
	1b, 1d, 8a	13 May - 20 Oct 97
	6a, 8b	10-18 Jul 98
Dendrocoris contaminatus	2a, 4a, 4c	2-9 May 96
	2d, 6a, 7a, 9a	2 May - 12 Oct 97
	8c	19 Aug 98
Perillus splendidus	2b	2 May 96
Tepa brevis	3a, 4b	9 Apr - 6 Jun 96
Thyanta custator	2c	13 Jun 96
	8a	14 Sep 97
	6a, 8b, 10d	10 Jul - 10 Sep 98
Thyanta pallidovirens	3b, 4c	11 Jul - 2 Aug 96
Phymatidae		
Macrocephalus cimicoides	9a	20 Sep 97
	8c	16 Jun 98
Reduvidae		
Apiomerus sp.	6b, 7a, 8a	3-13 May 97
	6a	1 May 98
Rasahus biguttatus	3b	6 Jun 96
Sinea complexa	1a	6 Jun 97
Sinea diadema	1b, 3a, 3c	6 Jun - 9 Oct 96
	3a	21 Sep 97
Zelus renardii	1a, 1c, 2a, 3a-c, 5b-c	6 Jun - 9 Oct 96

	3a, 3d, 6a	29 Aug - 21 Sep 97
	10a	29 Jul 98
Rhopalidae		
Arhyssus lateralis	2a-b, 3a, 4a-b	29 Mar - 11 Jul 96
	1a, 3a, 3d, 6a	2 May - 21 Sep 97
	8c	16 Jun 98
Arhyssus scutatus	5c	11 Apr 96
Aufeius impressicollis	3a	11 Jul 96
	1a, 7b	29 Aug - 6 Sep 97
Boisea rubrolineata	3b	11 Jul 96
Harmostes reflexus	1a, 2a, 3b-c, 5a-b	29 Mar - 25 Sep 96
Liorhyssus hyalinus	2b, 3c, 4a-b	9 Apr - 1 Nov 96
	6a-b, 8b-c, 9a	1 May - 10 Sep 98
*Species 1	6a	18 Jun 98
Saldidae		
Saldula pallipea	3a-b, 5c	4 Apr - 11 Jul 96
	3a	20 Nov 97
Threocoridae		
Corimelaena lateralis	3b	11 Jul 96
Tingidae		
Corythucha morrilla	5a	11 Apr 96
	1b, 2d, 3a, 8a, 9a	6-21 Sep 97
Leptonypha minor	5c	26 Jun 96

Neuroptera

Inocellidae		
Inocella inflata	3b	11 Apr 96
Chrysopidae		
Chrysopa coloradensis	1a	6 Aug 96
Chrysopa comanche	5b	11 Apr 96
Chrysopa nigricornis	1a	8 Jul - 6 Aug 96
Chrysopa oculata	5a	11 Apr 96
Chrysopa plorabunda	1a	8 Jul 96
	1a, 3a-b	11 Apr - 21 Sep 97
Eremochrysopa tibialis	1b, 3b-c, 4c, 5b-c	9 Apr - 9 Oct 96
	9a	20 Sep 97
	6a	23 Nov 97
Pimachrysa albicostales	4a	1 Nov 96

Coniopterygidae		
Species 1	6a, 7b, 9a	22 Aug - 20 Sep 97
Species 2	7a	29 Aug 97
Hemerobiidae		
Hemerobius pacificus	1a	30 May 96
Micromus subanticus	3b	9 Oct 96
Micromus variolosus	9a	20 Sep 97
Myrmeleontidae		
**Brachynemuris pulchellus*	6a, 8b, 10d	29 Jul - 10 Sep 98
Brachynemuris sackeni	5a	11 Apr 96
	1d, 6a	8 Apr - 5 Oct 97
	6a	1 May 98
Clathroneura coquilletti	1a, 3b, 4c, 5a	6 Jun - 11 Sep 96
Scotoleon carrizonus	1a, 2c, 3b, 4c	13 Jun - 4 Sep 96
	7a, 9a	29 Aug - 20 Sep 97
	6a, 10d	29 Jul - 10 Sep 98
Scotoleon fidelitus	3a, 7a, 8a, 9a	29 Aug - 21 Sep 97
	6a	10 Sep 98
Scotoleon longipalpis	1a-b, 2c, 3b,	
	4a, 4c	13 Jun - 4 Sep 96
	6a, 7a, 8a, 9a	16 Jul - 20 Sep 97
	6a, 8b-c, 10d	10 Jul - 10 Sep 98
Scotoleon minusculus	7b	29 Aug 97
Scotoleon pallidus	6a, 8a, 9a	2 Aug - 20 Sep 97
	6a	10 Sep 98
Scotoleon quadripunctatus	1a	8 Jul 96
Scotoleon singularis	1a, 5a	11-25 Sep 96
	1a, 7b	29 Aug - 6 Sep 97
	8a	14 Sep 98

Coleoptera

Alleculidae		
Hymenorus montivagos	1a, 3b	30 May - 11 Jul 96
	8b	10 Jul 98
Anobiidae		
Megorama ingens	1a	8 Jul 96
Tricorynus mutans	2c	13 Jun 96
Xeranobium desertum	1a	6 Aug 96
Xeranobium laticeps	2c, 4c	5 Jul - 4 Sep 96
	8a	6 Jun 97
Species 1	2c	13 Jun 96
Species 2	1a, 2c	8 Jul 96
Species 3	1a, 3b	6 Jun - 8 Jul 96

Species 4	2c, 6a, 7a	25 Mar - 7 May 97
	6a, 8b	18 Jun - 10 Jul 98
Anthicidae		
Anthicus nanus	4b	5 Jul 96
Anthicus punctulatus	1a, 3b	8-11 Jul 96
	9a	2 Aug 97
	8b	10 Jul 98
Notoxus calaratus	1a	8 Jul 96
Notoxus robustus	3b	6 Jun 96
Omnnadus floralis	2c, 5a	4-11 Sep 96
Vascusus confinus	3b, 5a-c	26 Jun - 11 Jul 96
Species 1	2c, 3b	13 Jun - 11 Jul 96
	3b, 7a	2 Jun - 29 Aug 97
Species 2	7a	7 May 97
Bostrichidae		
Apatides fortis	1a	6 Sep 97
Scobicia sp.	1a	6 Aug - 25 Sep 97
Species 1	1a	25 Sep 96
Bruchidae		
Acanthoscelides sp.	1b-c, 5a-b	11 Apr - 8 Jul 96
Algarobius prosopis	1a, 5b	11-25 Sep 96
	1a, 7b	7 May - 20 Oct 97
Mimosestes protractus	5b	11 Sep 96
Species 1	2a	13 Jun 96
Species 2	3b	6 Jun 96
Species 3	8a	14 Sep 97
Buprestidae		
Acmaeodera lanata	2a, 3a, 4a, 5a-b	2 May - 13 Jun 96
	7a	7 May 97
Acmaeodera labyrinthica	1a, 5a	11 Apr - 6 Jun 96
	6a-b	18 Jun 98
Acmaeodera lucia	6b, 9a	22 May - 13 Jun 97
Acmaeodera quadrivittata	6a	22 Aug 97
Acmaeodera relifera	6a, 7b	3-7 May 97
Acmaeodera sphaeralceae	8a	13 May 97
Anambodera santarosae	6a	2 May 97
Agrilus blandus	2c	22 May 97
Agrilus gibbicollis	1b	22 May 97
Chrysobothris atriplexae	7b	7 May 97
Chrysobothris debilis	5b	15 May 96
Chrysobothris deserta	8a	16 Jul 97
Chrysobothris lucana	9a	2 Aug 97
Chrysobothris pupureoplagiata	7a	7 May 97

Hippomelas fulgida	3b	2 Aug 96
	7b	29 Aug 97
Hippomela obliterata	4a-c	5 Jul 96
	7a-b	29 Aug 97
	8b	19 Aug 98
Carabidae		
Agonoderus maculatus	2c, 4c	8 Jul - 16 Aug 96
Agonum funebre	3a, 3b	18 Apr - 11 Jul 96
	3a	26 Feb 97
	8b	10 Jul 98
Anisodactylus sp.	1a, 3b	5 Jul - 5 Sep 96
	6a	18 Jun 98
Armara insignis	2a	2 May 96
	1a, 2a, 2c, 3b,	
	9a	29 Jan - 20 Nov 97
	9a	21 Mar 98
Bembidion bifossulatum	3a-b	4 Apr - 11 Jul 96
	3a-b	26 Feb - 11 Apr 97
Bembidion insulatum	3b	18 Apr 96
Bembidion variegatum	3b	18 Apr - 2 Aug 96
	3a	26 Feb - 29 Aug 97
Bembidion sp.	1a	6 Aug 97
Bradycellus nitidus	3a	4 Apr 96
Callisthenes lariversi	2a	29 Jan 97
	2b, 6a-b, 8a-c,	
	9a, 10c	14 Mar - 18 Jun 98
Calosoma peregrinator	2c	25 Mar 97
	6a, 8b	1-21 May 98
Celia californica	1a, 5c	11-16 Apr 96
Celia sp.	1a, 3a-b	4 Apr - 11 Jul 96
Feronia isabellae	3b	20 Nov 97
Harpalus lascivus	3a	4 Apr 96
	3a	26 Feb - 21 Sep 97
Lebia perita	3b	6 Jun 96
**Rhadine gracilenta*	6a	23 Nov - 18 Jun 98
Stenolophus flavipes	3b	11 Apr 97
Tetragonoderus pallidus	1a	8 Apr 97
Species 1	3b	11 Jul 96
	8b	10 Jul 98
Species 2	3a	4 Apr 96
Species 3	3b	11 Jul 96
	3a	26 Feb 97
*Species 4	8b	10 Jul 98
*Species 5	8b	10 Jul 98
Cerambycidae		
Amanus pectoralis	3a	6 Jun 96
Aneflormorpha sp.	6a	22 Aug 97

Crossidius coralinus	3a, 3c	11 Jul - 11 Oct 96
Crossidius hirtipes	1c	11 Oct 96
Crossidius suturalis	1a	15-25 Sep 96
	3b	11 Aug 97
Derobrachus geminatus	1a	8 Jul - 14 Aug 96
	8a	16 Jul 97
**Plionoma rubens*	6b	18 Jun 98
Chrysomelidae		
Acalymma trivittata	1a	15 Sep 97
Altica carinata	1a	18 Mar 96
	7b	7 May 97
Chaetocnema ectypa	3a-c	6 Jun - 11 Jul 96
	1a	6 Sep 97
Diabrotica undecimpunctata	2c, 3a-b, 4c	6 Jun - 9 Oct 96
	1a, 3b	15-21 Sep 97
Galerucella xanthomelaena	1a, 2a, 3b, 4c	2 May - 6 Aug 96
**Galerucella species*	8c	16 Jun 98
Neochlamisus sp.	8a	14 Sep 97
Pachybrachys desertus	2c, 4a, 4c	13 Jun - 1 Nov 96
	6a, 7a-b, 8a, 9a	22 Aug - 12 Oct 97
	6a-b, 8c, 10d	29 Jul - 10 Sep 98
Phyllotreta sp.	1a, 2c	13 Jun - 8 Jul 96
	1d, 9a	20 Sep - 20 Oct 97
	8a, 8c	21 May - 16 Jun 98
Saxinus saucia californica	4c, 9b	13 May - 5 Jul 97
Stenopodius sp.	9a	22 May 97
Species 1	1a, 3b	2-6 Aug 96
Species 2	1a, 2b	2 May - 8 Jul 96
	1b, 2d, 8a, 7b, 9a	13 May - 20 Sep 97
*Species 3	8b	21 May 98
Cicindelidae		
Cicindela haemorrhagica	3a-b	6 Jun - 9 Oct 96
	3b	11 Aug 97
Cicindela oregona	1a, 3a-b	4 Apr - 3 Oct 96
Cicindela tranqueberrica	3b	9 Oct - 4 Apr 96
	3d	21 Sep 97
Cicindela willistoni	3b	6 Jun 96
	3b	22 Apr - 2 Jun 97
Cleridae		
Cymatodera oblita	1a, 4a	6 Aug - 18 Sep 96
	7a	29 Aug 97
	6a	10 Sep 98
Cymatodera punctata	1a	6 Aug 96
	9a	2 Aug 97

	8b, 10d	10-29 Jul 98
Enoclerus laetus	1a, 1b, 5b	11-25 Sep 96
Loedelia maculicollis	4a	9 May 96
Phyllobaenus scaber	4c	9 May 96
	6a, 9a-b	2 May - 2 Aug 97
Trichodes ornatus	2a, 4a-b	2-9 May 96
	2d, 6a	2-13 May 97
	6a, 8c	16-18 Jun 98
Coccinellidae		
Brumoides septentrionis	8a	16 Jul 97
Coccinella novemnotata	3a-b	6 Jun - 3 Oct 96
	2c, 3b, 3d, 8a, 9b	25 Mar - 21 Sep 97
	6a, 8c	21 May - 18 Jun 98
Hippodamia convergens	1a, 2b, 3a-c, 5c	18 Mar - 3 Oct 96
	3b, 6a, 8a	22 Apr - 16 Jul 97
	2a-b, 6a, 8a-c, 10c-d	14 Mar - 18 Jun 98
Hippodamia sp.	4c	9 May 96
Hyperaspis sp	2a	17 Oct 96
Olla v-nigrum	1a	6 Aug 96
	3b, 7a	7 May - 21 Sep 97
Species 1	6a	2 May - 22 Aug 97
Species 2	3d, 8a	14-21 Sep 97
	6a	10 Sep 98
Species 3	3a-b	21 Sep 97
Curculionidae		
Anthonomus sp.	1b, 8a, 9a	6-20 Sep 97
Apleurus angulans	3a, 4a, 5b	11 Jul - 1 Nov 96
	7b	29 Aug 97
Ophryastes argentatus	4a	5 Jul 96
	7a-b	29 Jun - 29 Aug 97
	10b	29 Jul 98
Ophryastes geminatus	1a	13 Jan 97
	10d	26 May 98
Sibinia setosus	1b	8 Jul 96
	1a	6 Sep 97
Smicronyx imbricatus	1a	8 Jul 96
Species 1	9a	22 May 97
	6a, 10b	18 Jun - 29 Jul 98
Species 2	9a	20 Sep 97
Dermestidae		
Anthrenus lepidus	1a, 3a-b, 5a-b	18 Mar - 6 Jun 96
	1a, 1d	8 Apr 97
Attagenus rufipennis	5b	11 Apr 96

	2c, 9b	13-22 May 97
Cryplorhopalum apicale	4b	9 May 96
	7a, 8a	7-13 May 97
Dermestes marmoratus	1a	6 Aug 96
	9a	2 Aug 97
	8b	10 Jul 98
Novelsis uteana	1a	30 May - 8 Jul 96
Trogoderma variabile	2a-c, 4c	2 May - 5 Jul 96
Species 1	2c, 7a, 9a-b	7 May - 16 Jul 97
Dytiscidae		
Copelatus chevrolati	3b	11 Apr 97
Hygrotus sp.	1d	18 Apr 96
Elateridae		
Aeolus sp.	3b	6 Jun 96
	8b	10 Jul 98
**Aphricus* species 1	6a	18 Jun 98
**Aphricus* species 2	10d	29 Jul 98
Conoderus falli	1a	6 Aug 97
Esthesopus dispersus	2c	13 Jun 96
Horistonotus fidelis	5a	15 May 97
Horistonotus inanus	1a	18 Mar 96
Horistonotus pallidus	7a, 8a, 9a	29 Jun - 2 Aug 97
	8b	10 Jul 98
Octinodes frater	2c, 4c	2 Apr - 9 May 96
	7a, 8a	7-13 May 97
	10d	26 May 98
Octinodes shaumi	1a, 4c, 5a	9 May - 8 Jul 96
	6a, 8b	18 Jun - 10 Jul 98
Helodidae		
Cyphon variabilis	3b	11 Jul - 2 Aug 96
	3b	11 Apr 97
Heteroceridae		
Heterocerus gnatho	1a, 2a, 3b, 5a	30 May - 11 Sep 96
	3b, 7a	11 Apr - 29 Aug 97
Hydrophilidae		
Berosus punctulatus	3b	11 Jul - 2 Aug 96
	6a	10 Sep 98
Berosus species	3b	11 Jul 96
	3b, 7a	11 Apr - 7 May 97
	6a, 8b	10 Jul - 10 Sep 98
Enochrus species	1a, 6a, 7a	22 Aug - 6 Sep 97
Hydrophilus triangularis	3b	11 Jul - 2 Aug 96
	3b	11 Aug 97
Troposternus lateralis	3b	11 Jul 96

Species 1	9a	20 Sep 97
*Species 2	8b	19 Aug 98
Lathridiidae		
Species 1	6a	5 Oct 97
Meloidae		
Cordylospasta opaca	4a, 5b	9-11 Apr 96
	2c	25 Mar 97
Cysteodemus armatus	5a	9 May 96
	6a, 8c, 10c	1 May - 18 Jun 98
Epicauta corybantica	1a-b, 3a-c	25 Sep - 22 Oct 96
Epicauta puncticollis	3c	6 Jun 95
Eupompha elegans	1a, 5a	15-30 May 96
	6a, 8b-c, 9a, 10c	1 May - 10 Jul 98
Lytta auriculata	1c	16 Apr 96
	1a	8 Apr 97
	6a	1 May 98
Lytta magister	4a	9 May 96
	6a, 8b-c, 10c	21 May - 18 Jun 98
Lytta stygica	2c	29 Mar 96
	2c, 9a	25 Mar 97
Lytta vulnerata	1c, 3a	11 Oct 96
Nemognatha macswaini	4a	9 May 96
	6a, 8c, 9a	21 May - 10 Jul 98
Pleurospasta mirabilis	1a, 3b	6 Jun 96
**Tearodera latecincta*	5c	late Jul 98
Zonitis atripennis	1a	25 Sep 96
Melyridae		
Amecocerus sp. 1	1c, 4a, 4c, 5b	9-16 Apr 96
	8b, 10c	26 May - 16 Jun 98
Amecocerus sp. 2	4c	9 May 96
Attalus difficilis	5a	11 Apr 96
	4b	18 Sep 97
Attalus oregonensis	1b, 2a, 3b, 4a, 4c, 5a, 5c	9 May - 26 Jun 96
	2c-d, 6a, 7a-b, 8a, 9b	7 May - 16 Jul 97
	8c	16 Jun 98
Attalus santarosae	4a-b	9 May 96
Attalus species 1	8a	16 Jul 97
Attalus species 2	2c	22 May 97
**Attalus* species 3	8b	16 Jun 98
Attalus species 4	9a	25 Mar 97
Collops limbellus	5a	15 May 96
Emmenotarsus species 1	2b, 5a	27 Mar - 11 Apr 96
	8c	21 May 98

Eschatocrepis constrictus	1a, 2a-b, 4a-b, 5b-c	29 Mar - 11 Sep 96
	2b, 6a, 8c	14 Mar - 16 Jun 98
Eutrichopleurus mucidus	3a, 5a-b	11 Apr - 6 Jun 96
Pristoscelis irwini	4b, 5c	9 May - 11 Sep 96
Pristoscelis schlingeri	1a, 5a-c	11-16 Apr 96
Pristoscelis species	2a	2 May 96
Tanaops lobulatus	2a	2 May 96
	2c	22 May 97
Species 1	2c	25 Mar 97
Species 2	1a, 1d, 6a, 7a-b, 8a, 9a-b	25 Mar - 13 May 97
Species 3	6a, 7a-b, 9b	2-13 May 97
Species 4	8a	16 Jul 97
Species 5	4a	5 Mar 97
Species 6	4a-b, 6a, 8a	5 Mar - 2 May 97
Species 7	2a	29 Mar 96
Species 8	7a	29 Jun 97
Mordellidae		
Anthobates nubilis	5b-c	11 Sep 96
Mordella albosutura	2a, 4c	2-9 May 96
	2d, 6b, 7a-b	3-13 May 97
	6a-b, 8b-c, 9a	16 Jun - 10 Jul 98
Mordellistena sp. 1	1a, 4c	16 Apr - 9 May 96
Mordellistena sp. 2	1a	8 Jul 96
Mycetophagidae		
Species 1	4c	5 Jul 96
Nitidulidae		
Species 1	1a	6 Aug 96
	6a, 9a	2-22 Aug 97
	9a	23 Nov 98
Oedemeridae		
Rhinoplatia ruficollis	4a	9 May 96
	6a	3 May 97
	6a-b, 8c, 10c	21 May - 18 Jun 98
Oxacis sp.	1a, 9a	8 Apr - 2 Aug 97
Phengodidae		
Zarhipis integripennis	2c	25 Mar 97
Ptinidae		
Species 1	9a	23 Nov 97

Scarabaeidae

Aphodius lividus	1a, 5a	6 Aug - 25 Sep 96
	1a, 7a, 9a	29 Aug - 20 Sep 97
	6a	10 Sep 98
Coenonycha pallida	4a	5 Mar 97
Cremastocheilus schaumii	1b	18 Mar 96
Cyclocephala longula	1a, 3b	30 May - 16 Aug 96
	8b	10 Jul 98
Diplotaxis subangulata	1a, 5a	8 Jul - 15 Sep 96
	6a, 7a, 9a	7 May - 2 Aug 97
	6a, 8b, 10d	10 Jul - 10 Sep 98
Gymnopyge hopliaeformus	2b, 4a	2-9 May 96
	6a-b, 10c	26 May - 18 Jun 98
Lygyrus gibbosus	1a, 3b	11 Jul - 25 Sep 96
	6a, 7a	3 May - 29 Aug 97
	6a, 10d	29 Jul - 10 Sep 98
Paracotalpa ursina	1a	12 Feb 97
Phobetus mojavus	4c	9 May 96
Polyphylla decemlineata	7a	29 Jun 97
**Serica elongatula*	4a, 5a	9-15 May 96
	6b, 8b	16 Jun - 10 Jul 98
Serica species 1	5a	15 May 96
Serica species 2	8a	13 May 97
Species 1	7a	7 May 97

Staphylinidae

Betonuchus species	3b	11 Jul 96
Coproporus species	2c	13 Jun 96
	7a	7 May 97
Philonthus cruentatus	1a, 2c, 3b, 5a	30 May - 11 Sep 96
	6a	18 Jun 98
Species 1	2c	13 Jun 96
	9a	20 Sep 97
	8b	10 Jul 98
Species 2	1a	25 Sep 96
	3b, 7a	11 Apr - 29 Aug 97
	8b	10 Jul 98
Species 4	9a	2 Aug 97
Species 5	7a	7 May 97

Tenebrionidae

Abolus verrucosus	1a, 2c, 3b	2 Apr - 6 Aug 96
	1a, 5a-b, 8a, 9a	12 Feb - 6 Sep 97
	6a, 8b	23 Nov - 10 Jul 98
Agorporis species	2a	29 Mar 97
Aloephus species	2a	13 Jun 96
	7a, 9a	29 Jun - 2 Aug 97
Apsena rufipes	5c	15 May 96

	3b	22 Apr 97
Araeoschizus andrewsi	1a	30 May 96
	3a	22 Apr 97
Asidina sp.	1a	12 Feb 97
Auchmobius picipes	1c	8 Jul 96
	8a	13 May 97
	9a	10 Jul 98
Blapstinus pulverulentus	1a-b, 3b, 5a	16 Apr - 2 Aug 96
	1a	8 Apr 97
Blapstinus species	1a	16 Apr - 6 Aug 96
	8b	10 Jul 98
Coniontis ellyptica	3a-c	18 Apr - 11 Jul 96
	3d	22 Apr 97
Coniontis parviceps	1a, 7a, 9a	12 Feb - 2 Aug 97
Coniontis species	2c	29 Mar 96
	2a, 9a	29 Jan - 22 May 97
Cryptoglossa muricata	7a	7 May 97
**Cryptoglossa laevis*	6a, 10d	18 Jun - 29 Jul 98
Edrotes ventricosus	1a-c, 4a, 5a,	
	8a	12 Feb - 14 Sep 97
Eleodes armata	1a-5c	1 Jan - 31 Dec 96
	1a, 2a, 3c, 7a,	
	8a, 9a	29 Jan - 6 Sep 97
	6b-c, 8b, 10d	14 Mar - 10 Sep 98
Eleodes species 1	1a-b, 2c, 3b,	
	5a-b	29 Mar - 8 Nov 96
	1a-b, 2c, 5a,	
	8a, 9a	13 Jan - 20 Oct 97
	6a	23 Nov - 18 Jun 98
Eleodes species 2	1c	8 Nov 96
Edrotes ventricosus	1a, 5c	25 Sep - 11 Apr 96
	6a, 8c	1-21 May 98
Eupsophus castaneus	7a	7 May 97
	6a, 8b	16-18 Jun 98
Eusattus dubius	2c	29 Jan - 25 Mar 97
Eusattus muricatus	1a-b, 5b	18 Mar - 6 Jun 96
	1a-b	12 Feb 97
Metopoloba sp.	1a	6 Aug - 15 Sep 96
Philolithus actuosus	2c	4 Sep 96
	2a, 7a, 8a, 9a	29 Jan - 12 Oct 97
Trogloderus costatus	1a, 5a	16 Apr - 16 Aug 96
	1a	12 Feb 97
	6a	18 Jun 98
Species 1	2a, 2c, 4c, 5a,	
	5c	29 Mar - 5 Jul 96
	3b, 8a	2 Jun - 16 Jul 97
Species 2	2c	29 Mar 96
Species 3	2c	4 Sep 96
	9a	2 Aug 97

Species 4	9a	2 Aug 97
*Species 5	9a	23 Nov 97
*Species 6	8b	16 Jun 98

Tricoptera

Hydropsychidae

Species 1	2c	13 Jun 96
	9a	20 Sep 97
	8b, 9a	10 Jul - 20 Sep 98
Species 2	1a	30 May 96

Leptoceridae

Species 1	2c	13 Jun 96
Species 2	1a	6 Aug 96

Lepidoptera

Arctiidae

Apantesis proxima	1a, 3b	11 Jul - 20 Nov 96
	3b	18 Apr - 11 Aug 97

Blastobasidae

Species 1	4a	5 Mar 97
	6a	1 May 98

Cochylidae

Aethes species	2c	2 Apr 96
Cochylis yuccatana	2c	29 Jan 97
Cochylini species	8a	14 Sept 97

Coleophoridae

Coleophora sp. 1	2a	2 May 96
	8a	14 Sept. 97
Coleophora sp. 2	3a, 4a	5 Mar - 14 Sep 97
Coleophora sp. 3	2c, 4a	5-25 Mar 97

Cosmopterigidae

Stagmatophora iridella	7a	7 May 97

Cossidae

Comadia henrici	6a	2 May 97
Givira mucida	2c	13 June - 4 Sep 96
	6a, 7a	7 May - 29 Aug 97
	6a, 10c	29 July - 10 Sep 98

Hypopta palmata	3b	5 Jul - 2 Aug 96
	6a, 9a	2-22 Aug 97
	10c	29 July 98
Hypopta species	1a	30 May 96

Gelechiidae

Aristotelia species	1a	30 May 96
Arotrura eburnean	2c, 5a	2 Apr - 15 May 96
Arotrura sponsella	4b, 5a	9 May - 22 Oct 96
Arotrura species 1	2c, 4a	5-25 Mar 97
Arotrura species 2	7a, 9a	7 May - 20 Sep 97
Arotrura species 3	6a	5 Oct 97
Aroga paulella	4a	5 Mar 97
Chionodes abdominella	4a	May 96
	3b, 6a	3 May - 2 Jun 97
Chionodes kincaidella	5a	22 Oct 96
Chionodes ochreisrigella	3d	20 Nov 96
Chionodes species 1	2c	13 Jun 96
Chionodes species 2	1a	30 May 96
Filatima species	2c	13 Jun 96
Gnorimoschema coquillettellum		
	9a	20 Sep 97
Lita incicur	5a	22 Oct 96
	7a, 9a	20 Sep - 12 Oct 97
Lita puertella	1a, 7a	12-20 Oct 97
Lita sp. 1	6a, 7a	5-12 Oct. 97
Species 1	4a, 6a	5 Mar - 5 Oct 97
Species 2	7a	7 May 97
Species 3	1a, 8a, 9a	14 Sep - 20 Oct 97
	10d	29 Jul 98
Species 4	7a	8 Apr 97
	10d	1 May 98

Geometridae

**Archirohoe neomexicana*	8b, 10d	16 Jun - 29 Jul 98
Chlorochalmys appellaria	5a	11 Sep 96
Eupithecia deserticola	2c	29 Jan 97
Glaucina baea	7a	29 Aug 97
Glacina erroraria	2c	13 Jun 96
	2c, 7a, 9a	25 Mar - 20 Sep 97
	6a, 8b, 10d	18 Jun - 10 Sep 98
Glaucina loxa	8a	16 Jul 97
Hesperumia sulphuria	3b	6 Jun 96
Lithostege deserticola	4a	1 Nov 97
Lobocleta ossularia	1a	25 Sep 97
Narraga fimetaria	1a	8 Jul 96
	8a	14 Sep 97
Nasusina minuta	1a	30 May 96
	2c	25 Mar 97

Paraglaucina hulstinoides	9a	20 Sep 97
Perizoma custodiata	4c, 5a	9 May - 22 Oct 96
	1a, 2c, 4a	5 Mar - 9 Apr 97
	4a	1 Nov 97
Pero meskaria	1a	6 Aug 96
Plataea diva	2c	25 Mar 97
Semiothisa californiaria	2c	29 Jan 97
Semiothisa colorata	2c, 4c	2 Apr - 13 Jun 96
	1a, 2c, 4a, 6a, 7a, 8a, 9a	29 Jan - 14 Sep 97
	6a, 8b, 10d	5 Oct - 10 Sep 98
Semiothisa cyda	1a	30 May - 6 Aug 96
	1b	6 Sep 97
Semiothisa excurvata	8a, 9a	16 Jul - 2 Aug 97
Singlochis perumbraria	2c, 4a, 7a, 8a, 9a	5 Mar - 20 Sep 97
	6a, 8b, 9a	2 Nov - 10 Sep 98
Synchlora aerata	1a	8 Jul - 6 Aug 96
	3b	2 Jun 97
Yermoia perplexa	2c	29 Jan 97

Hesperidae

Atalopedes campestris	3b	6 Jun - 11 Oct 96
	3b	11 Aug 97
Erynnis funeralis	1c	11 Oct 96
Helioptes ericetorum	1c	11 Oct 96
	9a	22 May 97
Hylephileus phyleus	3b	2 Aug - 9 Oct 96
	3b	11 Aug 97
Pholosora libya	1a-b, 2a, 5a-b	15 May - 15 Sep 96
Polites sabuleti	1a, 3a-b	6 Jun - 11 Oct 96
	3b	18 Apr - 11 Aug 97
Pseudocopaeodes eunis	1a-b, 3a-c	19 Apr - 11 Oct 96
	3a-b	18 Apr - 2 Jun 97
Pyrgus albescens	1a, 2a, 3a-b	30 May - 6 Jun 96
	9a	22 May 97
	6c, 8a	21 May - 10 Jul 98
Pyrgus scriptura	9a	22 May 97
	6c	10 Jul 98

Incurvariidae

Adela punctiferella	4b	5 Mar 97
Caucas trifascia	4b	5 Mar 97
Prodoxus sordidus	4c, 8a	5 Mar - 14 Sep 97
Tegeticula paradoxa	4c	5 Mar 97

Lasciocampidae

Malacosoma incurvum	2c, 3b	6-13 Jun 96

Lycaenidae		
Brephidium exilis	1a-5c	18 Mar - 20 Nov 96
	1a-b, 1d, 2c, 3a-b, 3d, 4a, 5a-c, 6a, 7a-b, 8a, 9a-b	26 Feb - 29 Aug 97
	7a, 7c, 7d, 8a, 8b, 8c, 10a, 10b, 10d	30 Apr - 29 Jul 98
Euphilotes bernardino	2d, 7a	7-13 May 97
Icaricia acmon	2b, 3b, 3c	29 Mar - 6 Jun 96
	10c	26 May 98
Leptotes marinus	1a	6 Jun - 6 Aug 96
Strymon melinus	1b, 3c, 5a-b	30 Mar - 11 Sep 96
	8a	10 Jul 98
Lobythiidae		
Libytheana bachmanii	1a	8 Nov 96
Nepticulidae		
Stigmella species	3b	6 Jun 96
Noctuiidae		
Abagrotis barnesi	3b, 4c	9 May - 9 Oct 96
	10c	29 Jul 98
Abagrotis nefascia	6a	2 May 97
Abagrotis trigona	1a, 2c	6 Aug - 4 Sep 96
	7a	29 Aug 97
**Acroncosa albiflavella*	8b	19 Aug 98
Agrotis ipsilon	1a, 3b, 4a	30 May - 9 Oct 96
	9a	20 Sep 98
**Agrotis orthogonia*	3b	21 Sep 98
Archanara alameda	3b	11 Jul 96
Archanara species	1a, 3b	8 Jul - 6 Aug 96
Aseptis monica	2c	25 Mar 97
Aseptis perrumosa	2c, 3d	6-13 Jun 96
Autographa californica	1a, 5a	22 Oct - 8 Nov 96
	4a	5 Mar 97
Bulia deducta	1a	8 Jul 96
**Canochares acutus*	6a	1 May 98
Canochares arizonae	1a, 2c	13 Jul 96
	6a, 8b	18 Jun - 5 Oct 98
Catocala aholibah	2c	25 Mar 97
Catocala junctura	1a	15 Sep 96
**Catacala versilluana*	8b	19 Aug 98
Copicuculia eulipes	8a	16 Jul 97
	1a	6 Aug 96
Copicuculia heinrichi	2c	25 Mar 97
Discestra fulgora	2c	25 Mar 97

	6a	1 May 98
Eigra curialis	2c	29 Jan - 25 Mar 97
Euxoa atomaris	1a, 3a, 6a, 7a, 8a, 9a	14 Sep - 20 Oct 97
Euxoa auxiliaris	1a	6 Aug 96
	1a, 6a, 9a	8 Apr - 5 Oct 97
Euxoa biformata	1a	6 Aug 96
Euxoa idahoenis	1a	16 Apr 96
Euxoa messoria	1a	6 Aug 96
Euxoa misturata	5a	22 Oct 96
Euxoa olivia	1a, 2c, 3b, 4c, 5a	9 May - 20 Nov 96
	1a, 3b, 4a, 7a	9 Oct - 1 Nov 97
	6a	1 May 98
Euxoa recula	1a, 2c, 5a, 5c	17 Oct - 8 Nov 96
	1a, 4a, 7a	12 Oct - 1 Nov 97
Euxoa selenis	1a, 2c, 3b	25 Mar - 22 Apr 97
Euxoa septembionalis	1a	6 Aug 96
Euxoa serricornis	1a	16 Apr 96
	2c, 6a	25 Mar - 2 May 97
	6a	1 May 98
Euxoa silens	1a, 5c	9-30 May 96
Heliothis paradoxis	3b	11 Jul 96
**Heliothis phloxiphagus*	8b	19 Aug 98
Heliothis zea	3b, 6a	22 Aug - 9 Oct 97
	6a, 8b	1 May - 10 Sep 98
Heliolonche pictipennis	1a, 5b	11-18 Apr 96
Helotropha reniformis	3b	11 Jul 97
	3b	6 Jun - 2 Aug 96
Heteranassa fraterna	1a, 5a	30 May - 11 Sep 96
Lacinipolia illaudabilis	4c	9 May 96
Lacinipolis leucogramma	1a	25 Sep 96
Manruta elingua	4a	1 Nov 96
**Melipotis indomita*	10c	29 Jul 98
Neogrotella spaldingi	1a	25 Sep 96
Oncocnemis augustus	4a	1 Nov 96
Peridroma saucia	1a, 3b, 4a	5 Mar - 11 Aug 97
Ponometia megocula	4a, 6a	5 Mar - 5 Oct 97
Protogygia biclavis	4a	5 Mar 97
Protogygia enalaga	1a	8 Apr 97
Protorthodes alfkeni	1a, 2c, 3b, 4a, 5a	11 Sep - 17 Oct 96
	1a, 3b, 7a, 8a	29 Aug - 9 Oct 97
Protorthodes texana	2c	17 Oct 96
Proxenus mindara	3b, 7a	11-29 Aug 97
Psuedaletia farcta	1a, 3b	6 Jun - 6 Aug 96
Psuedaletia unipuncta	1a, 4a	6 Aug - 18 Sep 96
Pseudanarta crocea	2c	17 Oct 96
Pseudarnarta flava	2c	17 Oct 96

Pseudohadena vulnera	4c	9 May 96
	4a, 6a, 7a	5 Mar - 7 May 97
	6a, 8b	16-18 Jun 98
Pseudorthosia variabilis	3b	21 Sep 97
Rancora comstocki	2c	29 Jan 97
**Rhizagrotis cloanthoides*	1a, 4c	9-30 May 96
	6a	3 May 97
	6a	18 Jun 98
Rhynchagrotis exsertistigma	2c, 3b, 6a, 7a	25 Mar - 7 May 97
	6a	18 Jun 98
Schinia argentiafascia	1a	25 Sep 96
**Schinia citrinella*	6a	10 Sep 98
Schinia dobla	4a	9 Apr 96
Schinia erosa	6a, 9a	20 Sep - 5 Oct 97
Schinia ligeae	2c	25 Mar 97
	6a	1 May 98
**Schinia mortua*	8b	19 Aug 98
Schinia oleagina	1a	
	6a	10 Sep 98
**Schinia scarletina*	8b	18 Jun 98
Schinia separata	1a, 2c, 3b	25 Sep - 17 Oct 96
	8a	14 Sep 97
**Schinia unimacula*	3c	21 Sep 98
Scotogramma ptilodonta	5a	11 Sep 96
Scotogramma yakima	1a, 3b, 3d, 5a,	
	5c	6 Jun - 20 Nov 96
	1a	20 Oct 97
	3c	21 Sep 98
Setagrotis radiatus	6a	2 May 97
Spaelothis chandestina	1a, 2c	13 Jun - 17 Oct 96
Spaelotis havilae	2c	2 Apr 96
	1a, 2c, 6a, 7a	8 Apr - 5 Oct 97
	6a	1 May 98
Spodoptera exugua	1a, 4a, 5a	6 Aug - 22 Oct 96
	3b, 4a, 7a, 8a,	
	9a	2 Aug - 1 Nov 97
	3c, 6a, 8b, 9a	21 Sep - 10 Sep 98
Spodoptera frugiperda	1a	20 Oct 97
Spodoptera praefica	1a, 4a	5 Mar - 20 Oct 97
Synedoida ochracea	4a	18 Sep 96
Synedoida tejonica	5a	11 Sep 96
Trichocerapoda oblita	2c	17 Oct 96
Trichoclea postica	1a	8 Apr 97
Trichoplusia ni	1a, 4a, 5a	11-25 Sep 96
	6a	10 Sep 98
Trichopolia dentatella	6a, 7a-b, 9a	20 Sep - 12 Oct 97
Tridepia nova	1a, 2c, 3b, 4a	13 Jun - 18 Sep 96
	3b, 6a, 9a	11 Jul - 22 Aug 97
	6a	10 Sep 98

**Tristyla alboplagiata*	6a	18 Jun 98
Tryocnemis saporis	4c	9 May 96
	6a	10 Sep 98
Trudestra arida	1a, 2c, 3b, 5a	6 Jun - 20 Nov 96
Walterela ocellata	2c	29 Jan 97
Nymphalidae		
Charidryas neumogeni	4a-b	9 Apr - 9 May 96
Danaus gilippus	1c	11 Oct 96
Danaus plexippus	1a, 3b	18 Mar - 9 Oct 96
	3b	11 Aug 97
Nymphalis antiopa	1a, 3b	18 Mar - 6 Jun 96
	3b	2 Jun 97
Polygonia satyrus	3b	11 Jul 96
Vanessa atlanta	2a, 3b	30 Mar - 9 Oct 96
Vanessa annabella	1a-c, 3b, 4c	18 Mar - 11 Oct 96
	3b	18 Apr - 2 Jun 97
	6b, 7a, 9a, 9c, 10c	20 Mar - 26 May 98
Vanessa cardui	1c, 2a-b, 3a-b, 4a-c, 5c	18 Mar - 11 Oct 96
	4a-c	5 Mar 97
	2d, 6b, 7a, 9a, 9c, 10c	20 Mar - 21 May 98
Vanessa virginiensis	2a	30 Mar 96
**Precis coenia*	6b	18 Jun 98
Papilionidae		
Papilio rutulus	1a	30 May 96
Oecophoridae		
Elachista species	2c	29 Jan 97
Inga cretacea	7a	7 May 97
Pleurota albastrigulella	2c	25 Mar 97
Pieridae		
Anthocharis cethura	1a, 2a, 3a, 4a, 5a	29 Mar - 11 Apr 96
	3b, 4a-c	26 Feb - 5 Mar 97
	2d	20 Mar 98
Artogeia rapae	3b	4 Apr - 2 Aug 96
	3b	2 Jun - 11 Aug 97
Colias eurytheme	1a, 3c	2 Aug - 11 Oct 96
Euchloe hyantis	1a-b, 2a-b, 3a, 3c, 4a-b, 5a-c	29 Mar - 11 Apr 96
	3b, 4a-c, 5a	18 Feb - Mar 97
	2d	20 Mar 98
**Nathalis iole*	6b	18 Jun 98
Pontia protodice	1a, 2a, 3a-c,	

	4a-c, 5a-b	15 Mar - 17 Oct 96
	3a-b, 3d, 7b, 8a, 9a	25 Mar - 11 Aug 97
	2d, 7a, 7c, 7d, 8a, 10c	20 Mar -10 Jul 98
Plutellidae		
Plutella nr albidorsella	2c	25 Mar 97
Plutella xylostella	1a, 2c, 4a	5 Mar - 20 Oct 97
Ypsolopha delscatella	6a, 8a	14 Sep - 5 Oct 97
Ypsolopha sp. 1	2c	25 Mar 97
Psychidae		
Oiketicus species	2b-c	Eclosed cocoons only
Pterophoridae		
Oidaematophorus fishii	2c	25 Mar 97
	6a	1 May 98
Oidaematophorus species	2c, 4c	9 May - 17 Oct 96
Species 1	2c, 4a, 6a, 9a	5 Mar - 20 Sep 97
Species 2	2c	25 Mar 97
Pyralidae		
Achyra rantalis	1a	6 Aug 96
Achyra sp. 1	3b	11 Aug 97
Alpheias sp. 1	7a	29 Aug 97
Arivaca artella	1a	30 May 96
Epheatia kuchniabla	2c	13 Jun 96
Euchromius ocelleus	1a, 3b	11 Aug - 20 Oct 97
Eugnosta species	2c	29 Jun 97
Eumysia sp.	3b	21 Sep 97
Frechinia laetalis	9a	20 Sep 97
Hymenia species	3b	9 Oct 96
Loxostege cereralis	1a, 4a	18-25 Sep 96
	9a	2 Aug 97
Loxostege stricticalis	5a	11 Sep 96
	7a	7 May - 29 Jun 97
	6a	18 Jun 98
Lygropia octonalis	3d	2 Aug 96
Myelopsis alatella	1a	16 Apr 96
Nomophila nearctica	1a, 2c	18 May - 8 Nov 96
	7a	12 Oct 97
	8b, 9a	23 Nov - 14 Mar 98
Passodena flavidorsella	2c, 8a	25 Mar - 14 Sep 97
Phobus species	2c	13 Jun 96
Pima abiplagiatella	2c	25 Mar 97
Prorasea sideralis	4a	18 Sep 96
	2c, 4a, 6a, 9a	5 Mar - 5 Oct 97
Pseudoschoenobius sp. 1	4a	5 Mar - 20 Sep 97

Rhagea packardella	6a	2 May 97
**Sarata pullatella*	9a	23 Nov 97
**Sosipatra* species 1	6a, 10d	29 Jul - 10 Sep 98
Sosipatra species 2	2c, 4c	2 Apr - 9 May 96
Spoladea recuralis	3b	9 Oct 96
Species 1 (Phycitinae)	2c	25 Mar 97
Species 2 (Phycitinae)	6a	22 Aug 97
Species 3 (Phycitinae)	9a	20 Sep 97
Species 4 (Phycitinae)	4a	5 Mar 97
*Species 5	10d	29 Jul 98
*Species 6	10d	29 Jul 98
Species 7	2c	25 Mar 97
*Species 8	8b	16 Jun 98
Riodinidae		
Apodemia mormo deserti	4a-b	9 May 96
	6a	13 Jun 97
	6a	30 Apr 98
Apodemia mormo nr virgulti	2a-b	2 May 96
	2d	13 May 97
	2d	21 May 98
A. palmeri	1a, 5b	15 May - 6 Jun, 11-16 Sep 96
Saturnidae		
Hemileuca burnsi	1a-c, 4a	18-25 Sep 96
	8a, 9a	14-20 Sep 97
Scythrididae		
Species 1	8a	16 Jul 97
Species 2	8a	13 May 97
Species 3	7b	7 May 97
Secpies 4	9a	20 Sep 97
Sphingidae		
Euproserpinus phaeton	1a	29 Jan - 18 Mar 96
	2b, 3b, 5a	29 Jan - 26 Feb 97
Pachysphinx occidentalis	1a	6 Aug 96
	8b	19 Aug 98
Hyles lineata	1a	8 Apr 97
Tineidae		
Acrolophus variabilis	4a, 5a	11-18 Sep 96
	6a, 8a	22 Aug - 14 Sep 97
	6a, 8b, 10d	29 Jul - 10 Sep 98
Acrolophus sp. 1	2c, 3b	11 Aug - 4 Sep 97
	8b	19 Aug 98
Acrolophus sp. 2	6a	22 Aug 97
Amydria species	2c, 4c	2 Apr - 9 May 96

Species 1	1a, 5a	11-25 Sep 96
Species 1 (Tineinae)	2c, 6a, 7a, 8a	25 Mar - 14 Sep 97
Tortricidae		
Bactra macopiana	3b	11 Jul -11 Aug 97
Cydia bracteatana	2c	13 Jun 96
Cydia latiferreana	8a	14 Sep 97
Cydia membrosa	1a	8 Jul - 6 Aug 96
Epiblema sosana	1a	30 May 96
Eucosma sandiego	1a, 5a	11-25 Sep 96
Eucosma nr totana	8a, 9a	14-20 Sep 97
Eucosma species 1	9a	20 Sep 97
Eucosma species 2	8a	14 Sep 97
Ofatulena duodecemstriata	1a, 1c	8 Jul - 6 Aug 96
	7a	29 Aug 97
Phaneta species 1	4a	5 Mar 97
**Sonia* species	3b	21 Sep 98
Species 1	8b	16 Jun 98
Species 2	1a	13 Jun 96
Species 3	2c	2 Apr 96
Microlepidoptera		
Species 1	6a	10 Sep 98
Species 2	1a	6 Sep 97

Diptera

Agromyzidae		
Melanagromyza sp.	5c	26 Jun 96
Species 1	3b	6 Jun 96
	8b	16 Jun 98
Species 2	1a, 3b, 6b, 7b,	
	8a, 9a	6 Sep - 5 Oct 97
	9a	23 Nov 97
Species 3	3b	26 Feb 97
Anthomyidae		
Delia angustiventralis	1a-b, 5a, 5c	11-16 Apr 96
Delia platura	3a-b, 5c	4-18 Apr 96
Hylema cinerella	1a, 2c	16 Apr - 13 Jun 96
Pegamya duplicata	1a	16 Apr - 8 Jul 96
	1a, 2a, 3a-b, 4c,	
	6a, 7a-b, 9a	29 Jan - 20 Oct 97
	6a, 9a	23 Nov - 18 Jun 98
Pegamya finita	3b	9 Oct 96
Orthacheta species	2b, 4a	2-9 May 96
Species 1	7a	7 May 97

Species 2	3b-c	26 Feb - 22 Apr 97
	8b	16 Jun - 10 Jul 98
Anthomyzidae		
Anthomyza sp.	3b	6 Jun 96
	3b	26 Feb - 20 Nov 97
Species 1	3b	6 Jun 96
Species 2	3b	20 Nov - 26 Feb 97
Apioceridae		
Apiocera acuticauda	1a	8 Jul 96
	9a	10 Jul 98
Apiocera pearcei	5a	15 May - 26 Jun 96
Rhaphiomidas acton	4a	5 Jul 96
	8a-b, 10b	10-29 Jul 98
Assilidae		
Ablautus basini	1a-b	18 Mar 96
Ablautus californicus	1a	18 Mar 96
Asilus californicus	3b	6 Jun 96
Asilus occidentalis	5a	15 May 96
Cerotainiops willcoxi	1b	8 Jul 96
Cerotainiops n. sp.	7b	29 Aug 97
Coleomyia sp.	9a	25 Mar 97
Comontella fallei	4a	1 Nov 97
Cophura clausa	5a	11 Apr 96
Cophura timberlakei	4b	1 Nov 97
Cophura tunca	6a	5 Oct 97
Cophura vanduzeei	1a	20 Oct 97
Efferia albibarbis	3b	2 Jun 97
Efferia near *antiochi*	1a-b	25 Sep 96
Efferia benedicti	8a	16 Jul 97
	8a, 10d	10-29 Jul 98
Efferia cana	1a, 3b, 4c, 5a	9 May - 13 Jun 96
	6a	1 May - 18 Jun 98
Efferia candida	1a, 5a	26 Jun - 6 Aug 96
	8a	16 Jul 97
	6a, 8b, 9a	18 Jun - 10 Jul 98
Efferia deserti	6a, 8a	3-13 May 97
Efferia producta	5b	2 May - 26 Jun 96
Efferia species 1	8b	10 Jul 98
Efferia species 2	2a, 4b, 4c	9 May - 13 Jun 96
Heteropogon sp.	9a	20 Sep 97
Lestomyia sabulana	2c, 9a	25 Mar 97
	6a	1 May 98
Mallaphorina frustrata	2a-b	13 Jun - 4 Sep 96
	8a	10 Jul 98
Metapogon tricellus	4b	1 Nov 97
Proctacanthus nearno	1a	30 May 96

Saropogon hyalinos	1a-c, 2a, 3a-c, 4a-b, 5b	30 May - 6 Aug 96
	8b, 9a, 10b, 10d	10-29 Jul 98
**Stenopogon ozenae*	6a, 9a	18 Jun - 10 Jul 98
**Stenopogon martini*	6a, 10c-d	26 May - 29 Jul 98
Stichopogon nr. fragilis	1a	15 Sep 97
Asteiidae		
Astiosoma aridum	1a, 2a	2-30 May 96
	7b	7 May 97
Bibionidae		
Bibio alpipennis	1a, 5b	11-16 Apr 96
Dilophus tingi	2c	13 Jun 96
Philia orbata	9a	20 Sep 97
Bombyllidae		
Anthrax irroratus	2b, 4c, 5b	29 Mar - 26 Jun 96
	9a	25 Mar 97
**Anthrax varicolor*	6a	18 Jun 98
Aphoebantus desertus	1a, 2c, 4a	5 Mar - 8 Apr 97
	6a	1 May 98
Aphoebatus marcidus	5a	11 Apr 96
Aphoebantus marginatus	1a, 6b	8 Apr - 13 Jun 97
	8b	10 Jul 98
Aphoebantus mus	3b	6 Jun 96
Aphoebantus transitus	4b	5 Mar 97
Aphoebantus species	2b, 4a, 5a-b	9 May - 17 Oct 96
Apolysis druias	1a-c, 3b, 4a, 4c, 5a-c	11 Apr - 25 Sep 96
	2d, 3b, 7a, 9a	22 Apr - 20 Sep 97
Apolysis sp. 1	4a-b	18 Sep 96
	1a, 1d, 2d, 7a-b	8 Apr - 20 Oct 97
	2c, 5b, 9a	22 Oct - 25 Mar 98
Apolysis sp. 2	5a	11 Apr 96
Bombylius californica	2b	29 Mar 96
	8b	14 Mar 98
Chrysanthrax pertusus	2a, 4a	5-13 Jul 96
	6b, 7b	13 Jun - 29 Aug 97
	8a-b, 10b, 10d	10-29 Jul 98
Conophorus fenestratus	2a-b, 5b	29 Mar - 11 Apr 96
	9a	25 Mar 97
**Conophorus* species	2b	14 Mar 98
Exepacmus species	4a, 5a	9-11 Apr 96
Exoprosa sharonae	5b	11 Sep 96
Geminaria canalis	2a, 4a	2-9 May 96
Geron nigripes	1a-5c	30 May -1 Nov 96

	1a, 1d, 6a, 7a-b, 8a	7 May - 20 Oct 97
	6b, 8a	23 Nov - 10 Jul 98
Hemipenthes eumenes group	1a, 4a, 5a-b	9-16 Apr 96
	1a, 2c, 9a	25 Mar - 8 Apr 97
	6a	1 May 98
Heterostylum robustum	3b, 4a	9 May - 2 Aug 96
	6a	1 May 98
Lepidanthrax inauratus	2a-b, 5a-b	15 May - 4 Sep 96
	6b	13 Jun 97
	6a	18 Jun 98
Lordotus cingulatus	3c, 5a	11 Sep - 9 Oct 96
Lordotus luteolus	1a, 4a, 5a	9 Apr - 25 Sep 96
	9a	25 Mar 97
	8b, 10c	21-26 May 98
Lordotus striatus	2b-c, 3a	9-17 Oct 96
Mythicomyia antecessor	1a-b, 4a, 5c	26 Jun - 25 Sep 96
	7a-b, 8a	29 Jun - 29 Aug 97
	10d	29 Jul 98
Mythiocomyia armata	5b-c	11 Apr - 22 Oct 96
Mythiocomyia californica	1b, 4a	18-25 Sep 96
Neodiplocampta sp.	3b	2 Aug 96
Oligodranes trochilus	1a, 2a-c, 4a-c, 5a-b	29 Mar - 1 Nov 96
	4a, 9a-b	5-25 Mar 97
Pantarbes erinos	5a	15 May 96
	6b	18 Jun 98
Pantarbes sp. 1	2c, 4a, 9a	5-25 Mar 97
**Paracosmus similis*	6a	18 Jun 98
Paravilla californica	4c	9 May 96
Paravilla mercedis	2a-b	13 Jun 96
Paravilla syrtis	2a-b, 4a, 4c	2 May - 18 Sep 96
	6a-b	3 May 97
‘	6a, 8b	16-18 Jun 98
Poecilanthrax californicus	2a, 2c, 3a, 3c	9-17 Oct 96
	6b, 7a	5-12 Oct 97
Poecilanthrax willistoni	2b, 3a-c, 5a	3-22 Oct 96
Toxophora virgata	1a, 3b, 3c	6 Jun - 11 Jul 96
Villa agrippina	1a-b, 2a, 3a-c, 4c, 5a, 5c	2 May - 9 Oct 96
	1b, 3b-c, 8a	22 Apr - 6 Sep 97
	6a, 8a-b, 10a	18 Jun - 10 Jul 98
Villa andrewsi	4c	9 Apr 96
	9a	25 Mar 97
Villa arenosa	2a	13 Jun 96
	3b	2 Jun 97
Villa caprea	1a-b	25 Sep 96
**Villa crocina*	8b	19 Aug 98
Villa lateralis	4a, 5a-c	9 May - 11 Sep 96

Villa pallida	1c, 2a	2-30 May 96
	6a	1 May 98
Villa species 1	1a	25 Sep 96
	6a	18 Jun 98
**Villa* species 2	6a, 8b	18 Jun -10 Jul 98
Villa species 3	7a	29 Jun 97
Species 1	1a	6 Sep 97
Species 2	8a	13 May 97
Species 3	4a	5 Mar 97
Calliphoridae		
Bufolucilia silvarum	3b	11 Jul 96
	3b	11 Apr 97
	9a	23 Nov 97
Calliphora terrae-novae	3a, 5b	11-18 Apr 96
	5b	19 Feb 97
Pollenia rudis	3b	18 Apr 96
	3b, 3d, 8a	11 Apr - 21 Sep 97
	9a	23 Nov 97
Species 1	3b	6 Jun 96
Species 2	3b	11 Jul 96
Species 3	7a, 8a	29 Jun - 12 Oct 97
Species 4	8a	16 Jul 97
Cecidomyiidae		
Asphondylia sp.1	2c, 4a, 5a	13 Jun - 18 Sep 96
	6a, 7a, 8a, 9a	7 May - 14 Sep 97
	6a, 8b	16 Jun - 19 Aug 98
Asphondylia sp. 2	1a, 2c	16 Apr - 17 Oct 96
	1a, 2a, 3b, 4a, 7a, 8a, 9a	29 Jan - 21 Sep 97
	6a, 8b	16 Jun - 29 Jul 98
Species 1	1c, 3c	4 Apr - 8 Jul 96
	2d, 3b, 6a, 7a, 8a, 9a	29 Aug - 5 Oct 97
Species 2	1a, 1d	6 Sep - 20 Oct 97
	6a, 9a	23 Nov 97
Ceratopoginidae		
Culicoides near *copiosus*	3a	4 Apr - 6 Jun 96
Culicoides sp. 1	1a, 7a	7 May - 6 Sep 97
Dasynelea sp.	3a	4 Apr 96
Forcipomyia brevippenis	5c	11 Apr 96
	1a, 3a, 8a, 9a	14 Sep - 20 Nov 97
	6a, 8b	23 Nov - 10 Sep 98
Leptoconops sp. 1	3b-c	4 Apr - 6 Jun 96
Leptoconops sp. 2	2b	29 Mar 96
Rhynchohelea sp.	3b	6 Jun 96
Species 1	7b	12 Oct 97

Chaemyiidae		
Leucopis species 1	1a, 1c	30 May - 8 Jul 96
	2c	25 Mar 98
Leucopis species 2	1c	8 Jul 96
Leucopis species 3	5c	26 Jun 96
Leucopis species 4	5a, 5c	11 Apr 96
Leucopis species 5	2a	2 May 96
**Leucopis* species 6	6a, 9a	23 Nov 98
Chironomidae		
Species 1	1a, 2c, 3b	30 May - 13 un 96
	1a, 3a-b, 3d, 7a	8 Apr - 21 Sep 97
Species 2	1a, 3a-c	4 Apr - 6 Jun 96
Species 3	1a, 3a-b	18 Apr - 6 Jun 96
	3b, 9a	20 Sep - 20 Nov 97
Species 4	1a	16 Apr 96
	1a, 3d	8 Apr - 20 Oct 97
Species 5	2c, 3b	18 Apr - 13 Jun 96
Species 6	1a, 3a-b	18 Mar - 6 Jun 96
Species 7	1a, 3a-b	16 Apr - 6 Jun 96
Species 8	3a-b	6 Jun 96
	1a	6 Sep - 20 Oct 97
Species 9	1a, 3b	11 Apr - 6 Sep 97
Chloropidae		
Biorbitella hesperia	3a	18 Apr - 6 Jun 96
Diplotoxa unicolor	3a	11 Jul 96
Hippelates species	1a, 2a, 3a-c, 4a, 4c, 5c	4 Apr - 22 Oct 96
Olcella punctifrons	1a, 3a	30 May - 6 Jun 96
	2d, 6a, 7a-b	2 May - 29 Aug 97
Ocella species	1a, 4a-c	9 May - 8 Jul 96
Siphonella species	1c, 2c, 3a-b, 5c	4 Apr - 22 Oct 96
	3b	11 Apr - 11 Aug 97
Thaumstomya rubida	1a, 1c	30 May 96
	1a, 2d	6-14 Sep 97
Species 1	2a, 3a-b, 5a-b	2 May - 22 Oct 96
Species 2	1c, 3c	4 Apr - 30 May 96
Species 3	3b	4 Apr 96
Species 4	1a, 3a-b, 7a-b, 8a	26 Feb - 20 Nov 97
Species 5	3b	2 Jun 97
Species 6	1a, 3b	6-21 Sep 97
Species 7	1a	6 Sep 97
Species 8	6a, 7a	2-7 May 97
Species 9	1a, 2d, 7a	8 Apr - 13 May 97
Species 10	1a	8 Apr 97

Chyromidae		
Gymnochiromyia sp.	1a	16 Apr 96
Conopidae		
Physocephala texana	3a-b	6 Jun - 3 Oct 96
	3b	11 Apr - 11 Apr 97
Thecophora propinqua	1a	8 Jul 96
Zodion fulvifrons	1a, 2a, 5a	2 May - 22 Oct 96
Culicidae		
Aedes varipalpus	5a	11 Sep 96
	1a, 3a-b	11 Apr - 20 Oct 97
	6a	23 Nov 97
Culiseta inomata	3b	6 Jun 96
	6a, 9a	20 Sep - 5 Oct 97
	6a, 9a	23 Nov 97
Culex peus	3b	6 Jun 96
	3a-b	11 Apr - 21 Sep 97
Dolichopodidae		
Dolichopus consanguineus	3a-b	18 Apr - 9 Oct 96
	3a-b, 6a	11 Apr - 5 Oct 97
Dolichopus sp.	3b	9 Oct 96
Hydrophorus eldoradensis	1a, 3b, 5c	4 Apr - 30 May 96
	3a	20 Nov 97
Hydrophorus innotatus	2, 3a-b	4 Apr - 17 Oct 96
Medetera species	1a, 3b	16 Apr - 6 Jun 96
	1a, 7a	6 Sep - 12 Oct 97
Species 1	3b	20 Nov 96
	1a	6 Sep 97
Drosophilidae		
Species 1	1a, 6a, 9a	6 Sep - 5 Oct 97
*Species 2	8b	16 Jun 98
Species 3	9a	23 Nov 97
Empidae		
Drapetis sp.	1a	25 Sep 96
Platypalpus sp.	3a	4 Apr 96
Species 1	3a	26 Feb - 20 Nov 97
Ephydridae		
Ephydra halophila	2c, 3a-b, 4a	4 Apr - 17 Oct 96
	3a-b	21 Sep - 20 Nov 97
Mosillus tibialis	1a-b, 2b, 3a-c, 5c	4 Apr - 6 Aug 96
	1a-b, 1d, 3a-b, 6a, 7a	26 Feb - 20 Nov 97
Parydra sp.	3a-b	4-18 Apr 96

Psilopa olga	3a	4 Apr - 11 Jul 96
	3a	26 Feb 97
Ptilomyia pleuriseta	3a-b	18 Apr - 11 Jul 96
Scatella paludum	3a-c	4 Apr - 6 Jun 96
Scatella stagnalis	3a	18 Apr 96
Species 1	3b	20 Nov 96
	6a	22 Aug 97
	8b	10 Jul 98
Species 2	1a	18 Mar 96
Species 3	2c	13 Jun - 4 Sep 96
Species 4	1a	25 Sep 96
	6a	10 Sep 98
Heleomyzidae		
Pseudoleria species	1a, 2c	2-16 Apr 96
	2a, 3b, 9a	29 Jan - 25 Mar 97
	6a, 9a	23 Nov 97
Species 1	4c, 9a	5-25 Mar 97
Species 2	1a	20 Oct 97
Longchopteridae		
Species 1	8b	16 Jun 98
Milichiidae		
Hemeromyia sp.	3b	18 Apr 96
Leptometopa latipes	1b-c, 5c	16 Apr - 30 May 96
Milichiella sp. 1	2b, 3b, 5b	29 Mar - 6 Jun 96
Milichiella sp. 2	1c, 2a, 3a-c, 4a-b, 5a-c	29 Mar - 22 Oct 96
	1a, 1d, 2d, 3a-b, 6a, 7a-b, 9a	26 Feb - 20 Oct 97
	6a	23 Nov - 1 May 98
Muscidae		
Limnophora narona	3b	2 Aug 96
	7b	12 Oct 97
Lispe species	1a, 2c, 3a-b	2 Apr - 9 Oct 96
	1a, 3a-b	2 Jun - 20 Oct 97
	6a, 10d	23 Nov - 29 Jul 98
Species 1	5c	15 May 96
Species 2	1a	8 Jul 96
Species 3	3b	8 Apr 96
Species 4	3a-b	4-18 Apr 96
	1a	20 Oct 97
	2b	14 Mar 98
Species 5	1c, 2a	8 Jul - 17 Oct 96
	1a, 3a, 8a, 9a	6-21 Sep 97
Species 6	3a, 3c, 5b-c	18 Apr - 22 Oct 96
Species 7	3a-b, 5a, 5c	4 Apr - 22 Oct 96

	1a, 3b	6 Sep - 20 Nov 97
Species 8	3b	18 Apr 96
		21 Sep 97
Mycetophilidae		
Docosia sp.	5c	11 Apr 96
Species 1	1a	20 Oct 97
*Species 2	6a	23 Nov 97
Mydidae		
Pseudonomo neuro	7b	29 Aug 97
**Pseudonomoneura california*	10d	29 Jul 98
Otitidae		
Euxesta sp. 1	3b	2 Aug 96
	3b	11 Apr 97
Euxesta sp. 2	3a-b	4 Apr 96
	3b	2 Jun 97
Euxesta sp. 3	3b	2 Aug 96
Euxesta sp. 4	5c	11 Apr 96
	3b, 7b, 9a	25 Mar - 12 Oct 97
Meliera similis	3b	11 Jul - 9 Oct 96
	3b	2 Jun 97
Physiphora demandata	1a, 5a	8 Jul - 11 Sep 96
	3b	22 Apr 97
Phoridae		
*Species 1	6a, 8a	23 Nov 97
Richardiidae		
Species 1	7b	12 Oct 97
Sarcophagidae		
Blaesoxipha plinthopyga	1b, 2a-b, 3c, 4b-c, 5a-b	15 May - 17 Oct 96
	1a, 6a, 7a-b, 8a	8 Apr - 5 Oct 97
	6a, 10d	1 May - 29 Jul 98
Blaesoxipha. omani	1a, 4a, 5a-b	9 May - 11 Sep 96
	1a, 7a, 8a, 9a	2 Aug - 20 Sep 97
Eumachronychia persolla	3c, 5b	6-26 Jun 96
Senotainia flvicornis	3b	2 Aug 96
Species 1	3b, 4a	9 May - 2 Aug 96
Species 2	1a	8 Jul 96
Scatopsidae		
Coboldia fuscipes	3a-b	4 Apr - 2 Aug 96
	3a-b	22 Apr - 20 Nov 97
Species 1	3b	6 Jun 96

Scenopinidae		
Belosta sp.	5a	11 Apr 96
	7b	29 Aug 97
Metatrichia bulbosa	1a, 2a, 3b-c, 4a-b, 5b	9 May - 18 Sep 96
	2d, 6a, 7a-b	2 May - 29 Aug 97
	6a	18 Jun - 10 Sep 98
Species 1	2d, 8a	13 May - 16 Jul 97
Sciomyzidae		
Pherbella vitalis	3b	9 Oct 96
Sepsidae		
Sepsis neocynipsea	3b	11 Jul 96
	9a	20 Sep 97
Simuliidae		
Simulium vittatum	3b	14 Apr 96
Species 1	7a	7 May 97
Sphaeroceridae		
Copromyza equina	2c	13 Jun 96
	6a	3 May 97
Leptocera limosa	2c, 3a-b	4 Apr - 11 Jul 96
	3a-b, 6a, 9a	26 Feb - 20 Nov 97
	6a, 8b	16 Jun - 10 Sep 98
Stratiomididae		
Dieuryneura stigma	1a	8 Jul 96
Nemotelus arator	3b	4 Apr - 2 Aug 96
Odontomyia alticola	1a	25 Sep 96
Odontomyia arcusta	1a, 3b	25 Sep - 9 Oct 96
Syrphidae		
Allograpta exotica	3b, 4a	18 Sep - 9 Oct 96
Ceriana species	1a, 3b	30 May - 2 Aug 96
	1a	8 Apr 97
Eristalis alhambra	3b	11 Aug 97
Eristalis latfrons	1a, 3b, 4b 5a	16 Apr - 8 Nov 96
	3a-b	11 Aug - 21 Sep 97
	8a-b, 10c	26 May - 16 Jun 98
Eristalis tenax	1a	16 Apr 96
	3b	22 Apr - 11 Aug 97
	8b-c, 10c	26 May - 16 Jun 98
Eupeodes volucris	5c	11 Apr 96
	1a, 3a-b, 4a	5 Mar - 21 Sep 97
	2b, 6a, 8a-c, 10c	14 Mar - 26 May 98
Helophilus bilineatis	3b	4 Apr 96

Mesograpta marginata	5a	22 Oct 96
	1a	6 Sep 97
Platycheirus stegnus	3c, 5b	4-11 Apr 96
	1a	8 Apr 97
Polydontomyi curvipes	3b	11 Aug 97
Syritta pipiens	3b	11 Jul 96
	3b, 3d	11 Apr - 21 Sep 97
*Species 1	6a	23 Nov 97
Tabanidae		
**Apatolestes comastes*	6a	18 Jun 98
Chrysopa discalis	3a-b	4 Apr - 9 Oct 96
	3b	11 Apr - 11 Aug 97
Silvius abdominalis	3b	6 Jun 96
Tabanus punctifer	3b	6 Jun - 11 Jul 96
	1a, 3a	6-21 Sep 97
Tachinidae		
Angiorhina robusta	3b	6 Jun 96
Cylindromyia armata	4b	9 May 96
Deopalpus contiguus	4b	9 Apr 96
Euphasiopteryx ochracea	1a	6 Aug - 25 Sep 96
Gymnosoma fuliginosum	1a, 3a-b, 3c,	
	4a, 5b	18 Mar - 9 May 96
	6a	18 Jun 98
Micrachaetina species	4c	9 May 96
	1a. 4a. 6a, 7a,	
	8a	5 Mar - 5 Oct 97
	6b, 8a, 10c	21 May - 19 Jun 98
Paradidyma species	1a, 2a, 3c	4 Apr - 8 Jul 96
Peleteria malleola	1a, 3c, 5a	4-16 Apr 96
	1a, 5a, 9a	19 Feb - 8 Apr 97
	2b, 10d	14 Mar - 29 Jul 98
Phasia aldrichii	2b, 4a, 5a-c	29 Mar - 22 Oct 96
	6a, 8c	16-18 Jun 98
Phasia species	4a, 5b	9-11 Apr 96
Trichopoda pennipes	2a	13 Jun 96
Species 1	6c, 8a	2-13 May 97
Species 2	1a, 2c	13 Jun - 8 Jul 96
	3b, 4a, 7a	5 Mar - 12 Oct 97
	6b, 8b-c 9a,	
	10a	16 Jun -29 Jul 98
*Species 3	8b	16 Jun - 10 Jul 98
Species 4	1a, 3b	22 Apr - 6 Sep 97
	6a, 9a, 10d	18 Jun - 29 Jul 98
Species 5	1a	6 Jun 95
	6b	18 Jun 98
Species 6	9a	25 Mar 97
Species 7	3b	11 Apr - 11 Aug 97

*Species 8	8b	14 Mar 98
Species 9	1a	25 Sep 96
Species 10	3b	6 Jun 96
Species 11	1a, 2c	13 Jun - 8 Jul 96
Species 12	1a	8 Jul 96
*Species 13	6a	23 Nov 97
Tenthinidae		
Pelomyia sp.	3b	4-18 Apr 96
Pelomyiella sp.	1a, 3b-c	4-18 Apr 96
Tephritidae		
Dioxyna picciola	4a	18 Sep 96
Euarestoides acutangulus	1a, 2b-c, 3c, 4a, 5b-c	29 Mar - 9 May 96
Neaspilota brunneostigmata	1b, 3c, 4a	9 May - 24 Sep 96
	8b-c	16 Jun 98
Paroxyma murina	4a	9 May 96
Prececidochares minuta	5a	11 Apr 96
Trupanea jonesi	5a-b	11 Apr 96
	6a	2 May 97
Species 1	1a	6 Sep 97
	8c	16 Jun 98
Species 2	1a	6 Sep 97
Species 3	1a, 3a, 9a	6-21 Sep 97
Species 4	1a, 9a	6-27 Sep 97
Therevidae		
Pherocera mojavensis	1b, 2a, 3c	30 May - 13 Jun 96
Thereva sp. 1	1b	16 Apr 96
	1d, 3a, 4b	5 Mar - 21 Sep 97
Thereva sp. 2	1b, 5a, 5c	11-16 Apr 96
Thereva sp. 3	1a-b, 5c	11 Apr - 6 Aug 96
	1d, 7b	8 Apr - 7 May 97
Thereva sp. 4	7a	7 May 97
Thereva sp. 5	8a	13 May - 14 Sep 97
Tipulidae		
Dactylolabis vestigipennis	2c	29 Jan 97
Erioptera cana	3b	26 Feb 97
Limnophila sp.	3b	6 Jun 96
	3b	2 Jun 97
Tipula species 1	1b	16 Apr 96
	1a, 2c, 7b	25 Mar - 7 May 97
Tipula species 2	2c	2 Apr 96
	1a, 2c	25 Mar - 8 Apr 97
Tipula species 3	2c	25 Mar 97
	6a	1 May - 18 Jun 98
Tipula species 4	1b	8 Apr 97

**Tipula* species 5	8b	16 Jun -10 Jul 98
Species 1	3a	26 Feb 97
Species 2	1a	6 Sep 97

Trixoscelidae

Trixoscelis frontalis	1a, 1c, 3b-c, 4a, 4c, 5a-c	4 Apr - 6 Jun 96
	9a	25 Mar 97
Species 1	1a, 2c, 4c, 9a	5 Mar - 8 Apr 97

Hymenoptera

Andrenidae

Andrena astragali	1a, 3b, 4a, 5b	18 Mar - 9 May 96
Andrena auricoma	1a, 5b	30 May - 11 Sep 96
Andrena blaisdelli	4a-b	5 Mar 97
	8c	21 May 98
Andrena bipunctata	5b	22 Oct 96
**Andrena candida*	3b	14 Mar 98
Andrena cleodora	1d, 4a	9-18 Apr 96
Andrena dissimulus	4a	9 Apr 96
Andrena levipes	2b	29 Mar 96
Andrena palpalis	4a	5 Mar 97
Andrena prunorum	1a, 4a-b	9 Apr - 9 May 96
Andrena subchalybea	1a	16 Apr 96
Andrena submoesta	2b, 3c, 4a	29 Mar - 9 Apr 96
Andrena species 1	2b	2 May 96
Andrena species 2	4a, 9a	5-25 Mar 97
**Andrena* species 3	2b	14 Mar 98
Nomadopsis puellae	1a	16 Apr 96
Nomadopsis scutellaris	3b	6 Jun - 3 Oct 96
	3b	11 Apr 97
**Nomadopsis* species 1	6a	1 May 98
**Nomadopsis* species 2	3b	11 Apr 98
Perdita claypolei	1a	16 Apr 96
	1a, 3b	8 Apr - 11 Aug 97
Perdita chrysomthamni	2b	17 Oct 96
Perdita intersecta	1a-b, 2a, 3a-b, 4c, 5a	2 May - 22 Oct 96
Perdita nigrella	1a, 3a, 5a	11 Apr - 6 Jun 96
Perdita species	1a, 1c	30 May 96
	2c, 4b	5-25 Mar 97
	7b	7 May 97
**Perdita* species 2	10c	26 May 98
Perdita species 3	2c, 4c	5-25 Mar 97
Perdita species 4	6a	2 May 97
Perdita species 5	1d	20 Oct 97

Perdita species 6	4a	5 Mar 97
Species 1	4b	9 Apr 96
Species 2	7b	7 May 97
Species 3	4a, 5a	9-11 Apr 96
Species 4	4a	5 Mar 97
Species 5	4a-b, 9b	5 Mar - 13 May 97
Species 6	4b	5 Mar 97
Species 7	3b	11 Apr 97
Anthophoridae		
Anthophora urbana	2a, 3a-b	6-13 Jun 96
	6a	5 Oct 97
Anthophora cockerelli	1a, 5a	26 Jun - 25 Sep 96
	8b	10 Jul 98
**Anthophora curta*	8b	19 Aug 98
Anthophora flavocincta	3a-c	6 Jun - 2 Aug 96
Anthophora hololeuca	5b-c	11 Sep 96
Anthophora petrophila	2c	25 Mar 97
Anthophora porterae	5a	11 Apr 96
Anthophora Species	7b	29 Jun 97
Centris hoffmanseggiae	2a, 4b-c, 5a	9 Apr - 15 May 96
	6a, 7b	2-7 May 98
Diadasia australis	2a, 3b-c	6 Jun - 2 Aug 96
**Diadasia diminuta*	8b	16 Jun 98
Diadasia enavata	1a, 2a	13 Jun - 25 Sep 96
Diadasia laticauda	1a, 3a-b	11 Jul - 25 Sep 96
Diadasia tuberculifrons	1a, 7b	7 May - 6 Sep 97
Melissodes tessellata	1a, 3a-c	6 Jun - 9 Oct 96
Melissodes appresa	1a-b, 2c, 3b	2 Aug - 17 Oct 96
	1d	20 Oct 97
	9a, 10c-d	26 May - 29 Jul 98
	3b	11 Aug 97
Melissodes bimatris	2b, 3a-c	2 May - 9 Oct 96
	1d	20 Oct 97
	10d	29 Jul 98
Melissodes species	3b	11 Apr 97
Nomada (Nomada) species	4a-b	9 Apr 96
	9a	25 Mar 97
Ptilothrix near bombiformis	2c	17 Oct 96
Synhalonia primavera	4a	5 Mar 97
	10c	26 May 98
Tetralonia primiveris	4a, 5b	9-11 Apr 96
**Tetraloniella eriocarpi*	8b, 9a	10 Jul 98
Triepeolus ancoratus	1b, 2a, 5a-b	2 May - 22 Oct 96
	7b	7 May 97
	6a	18 Jun 98
Xeromelecta californica	5a	22 Oct 96
Species 1	5b-c	11 Sep 96
Species 2	3c	6 Jun 96

Species 3	5b	11 Apr 96
Species 3	6a	7 May 97
Species 4	4a, 9a	5-25 Mar 97
Apidae		
Apis mellifera	1a, 2a-b, 5a-b	29 Mar - 8 Nov 96
Bombus crotchii	2c	13 Jun 96
	6a, 8a, 8c, 9a	21 May - 10 Jul 98
**Bombus vosnensenshii*	8a, 8c	16 Jun - 10 Jul 98
Bethylidae		
Epyris species	1a, 3b, 5a	8 Jul - 11 Sep 96
	3b, 3d, 5a, 7a, 8a	29 Jun - 20 Nov 97
	6a, 8b, 10d	10 Jul - 10 Sep 98
Species 1	2a	2 May 96
	6a, 7a, 8a	13 May - 29 Aug 97
Braconidae		
Agathis species 1	3b, 4c, 5b-c	4 Apr - 9 May 96
	8b-c	16 Jun - 10 Jul 98
Agathis species 2	1c	8 Jul 96
Agathis species 3	1c, 3c, 5a	11 Apr - 9 Oct 96
Agathis species 4	5b	11 Apr 96
Apanteles species 1	1c, 2a, 4b, 5a, 5c	11 Apr - 22 Oct 96
Apanteles species 2	5a	11 Apr 96
Bracon species 1	1c, 5b-c	11 Apr - 30 May 96
Bracon species 2	1a, 1c, 2c, 5a, 5c	11 Apr - 4 Sep 96
	6a, 9a	18 Jun - 10 Jul 98
Bracon species 3	1b	8 Jul 96
Bracon species 4	1a-b, 2c	11 Apr - 8 Jul 96
	8b	16 Jun - 19 Aug 98
Bracon species 5	2a	2 May 96
	9a	10 Jul 98
Bracon species 6	5c	26 Jun 96
Chelonus species	5a	11 Apr 96
	6a	18 Jun 98
Cheloninae species	1c	30 May 96
	7a	12 Oct 97
Microgaster species	2c	17 Oct 96
Microplitis species	5c	11 Apr 96
Species 1	5a-c	11 Apr 96
Species 2	2c, 2d, 3d, 7a-b	25 Mar - 21 Sep 97
Species 3	1a, 7a-b	8 Apr - 7 May 97
Species 4	1d	20 Oct 97
Species 5	4a	9 May 96

Species 6	2c	25 Mar 97
	6a, 9a	23 Nov 97
Species 7	4c	9 May 96
	6a	2 May 97
Species 8	1a	8 Apr 97
Species 9	1a, 7a	29 Aug - 20 Oct 97
	6b	18 Jun 98
Species 10	1d	20 Oct 97
Species 11	2a	29 Jan 97
Species 12	3b	11 Apr 97
Species 13	8a	14 Sep 97
Species 14	4c	5 Mar 97
Chalcididae		
Haltichella species 1	1a, 2a, 3a, 5b	18 Mar - 26 Jun 96
Haltichella species 2	6a	2 May 97
Hockeria species	5b	11 Sep 96
	8a	13 May 97
Species 1	5c	11 Apr 96
Species 2	3b	11 Jul 96
Species 3	1c	30 May 96
Species 4	5b	15 May 96
Species 6	6a	2 May 97
*Species 7	6a	18 Jun 98
*Species 8	6a	18 Jun 98
Chrysididae		
Chrysis astralia	3a	6 Jun 96
	6b	18 Jun 98
Chrysis fuscipennis	3b	11 Jul 96
	3a	21 Sep 97
Hedychridium boharti	5b	15 May 96
Hedychridium fletcheri	2c, 9a	25 Mar 97
Parnopes edwardsii	3a-b	6 Jun - 3 Oct 96
**Parnopsis* species	10b	29 Jul 98
Pseudolopyga taylori	1b	25 Sep 96
Pseudomalus sp.	3d	21 Sep 97
Colletidae		
Colletes californica	9a	25 Mar 97
Colletes clypoenitens	1a, 1c, 2c, 5a-b	15 May - 22 Oct 96
Colletes louisae	1a, 2b, 4a	2 May - 8 Nov 96
Colletes salicicola	1a	8 Apr 97
Colletes tectiventris	1a	6 Sep 97
Colletes species 1	2c, 5a-b	15 May - 22 Oct 96
Colletes species 2	4a	9 May 96
Colletes species 3	1a	30 May 96
Colletes species 4	1a-b, 5a, 5c	11-25 Sep 96

Colletes species 5	1a	25 Sep 96
Colletes species 6	1a-b, 2c, 5a-b	11 Sep - 17 Oct 96
Colletes species 7	1a, 1c, 2a, 4a-b, 5b	9 Apr - 30 May 96
Hylaeus episcopalis	5b	15 May 96
	2c, 7a	7-13 May 97
Hylaeus mesillae	2b, 3b	6 Jun - 11 Jul 96
Species 1	7a, 9b	7-13 May 97
Cynipidae		
Species 1	5a	11 Apr 96
Species 2	3b	4 Apr 96
*Species 3	6a	23 Nov 98
Encyrtidae		
Species 1	1a, 1c, 2a, 5a-c	18 Mar - 22 Oct 96
Species 2	1a, 2b, 4a	6 Aug - 1 Nov 96
Species 3	2a	17 Oct 96
Species 4	1c, 4b, 5b-c	9 May - 22 Oct 96
	6a, 7b, 8a	7 May - 12 Oct 97
Species 5	7a, 8a	29 Jun - 16 Jul 97
Species 6	8a	14 Sep 97
Species 7	7a	7 May 97
Species 8	6a, 7b	29 Aug - 5 Oct 97
Species 9	1d	8 Apr 97
Species 10	6a	22 Aug 97
Eulophidae		
Aprostocetus species 1	2b, 4b	13 Jun - 17 Oct 96
	4a, 6a, 7b, 8a, 9a	25 Mar - 5 Oct 97
Aprostocetus species 2	2a, 2c, 3b, 4a, 4c, 5a-b	11 Apr - 17 Oct 96
	8a, 9a	16 Jul - 20 Sep 97
	9a	1 Jul 98
Cirrospilus species 1	3a	9 Oct 96
Diglyphusia species	3a	11 Jul 96
Eulophinae species	1a	18 Mar 96
Entedoninae species 1	1a	8 Jul 96
Entedoninae species 2	5a	11 Apr 96
Eprhopalotus species	1a, 5b	18 Mar - 22 Oct 96
Sympiesis species	3c	4 Apr 96
Zagrammosoma americanum	7a	7 May 97
Zagrammosoma species	1c	30 May 96
Species 1	1a, 3b, 7b, 9a	8 Apr - 20 Sep 97

Eupelmidae		
Species 1	4c	9 May 96
	2d, 6a	14 Sep - 5 Oct 97
Species 2	1b	25 Sep 96
	7a	7 May 97
Eurytomidae		
Eurytoma complex	1a-b, 2a, 2c, 4c, 5a-c	11 Apr - 22 Oct 96
	1a-b, 3b, 7a-b, 8a	22 Apr - 20 Oct 97
	9a, 10d	10-29 Jul 98
Non *Eurytoma* complex	5a	11 Apr 96
Rileya cecidomyiae	1b, 3b, 5b	4 Apr - 25 Sep 96
Rileya hegeli	4a	18 Sep 96
Rileya mellea	5b	11 Apr 96
Rileya teqularis	2a, 5a-b	11 Apr - 22 Oct 96
Rileya sp.	1a, 6a, 7b, 8a, 9a	8 Apr - 20 Sep 97
Formicidae		
Camponotus semitestaceus	5a	15 May 96
	2a, 2c, 3b	29 Jan - 20 Nov 97
Crematogaster californica	6b, 8a	14 Sep - 5 Oct 97
**Crematogaster larreae*	6a	23 Nov 98
Crematogaster mormonum	1b	8 Nov 96
	6a 8a	13 May - 5 Oct 97
Dorymyrmex bicolor	1a, 1c	18 Mar - 6 Aug 96
	1a	12 Feb - 12 Oct 97
Dorymyrmex pyramicus	1a	8 Nov 96
Formica pilicornis	1a, 3b, 5c	4 Apr - 22 Oct 96
	1a, 3a, 3d, 5c	19 Feb - 21 Sep 97
Formica perpilosa	3b	4 Apr - 3 Oct 96
	3b	26 Feb 97
Formica subpolita	3d	21 Sep 97
Iridomyrmex pruinosus	1d, 3a-b, 3d, 6a, 8a	8 Apr - 5 Oct 97
	6a, 9a	23 Nov 98
Lasius neoniger	1a, 3b, 5a	4 Apr - 30 May 96
Leptothorax rugatulus	1a	12 Feb 97
Liometopum occidentale	1a, 3b	11 Jul - 8 Nov 96
Messor pergandei	2a-c, 3c, 4a-c, 4a	1 Jan - 31 Dec 96
	4c, 6a-b	22 Aug - 5 Oct 97
	6a	23 Nov 97
Monomorium minimum	1a, 4c	12 Feb - 5 Mar 97
Myrmecocystus creightoni	5a-b	11 Apr 96
Myrmecocystus mexicanus	4a	18 Sep - 1 Nov 96
	6a, 7a, 8a	13 Jun - 5 Oct 97

	6a	23 Nov 97
Myrmecocystus mimicus	1a-c, 2b, 4a, 4c, 5a	18 Mar - 8 Nov 96
	2a, 2c, 6a, 7a, 9a	29 Jan - 22 May 97
	9a	23 Nov 98
Pheidole barbata	1c, 4c	1-8 Nov 96
Pheidole desertorum	2c, 3a, 5c	18 Apr - 17 Oct 96
	6a	23 Nov 97
Pheidole hyatti	3a, 5c	19-26 Feb 97
Pogonomyrmex californicus	1a-b, 3b, 4a, 4c, 5a	18 Mar - 26 Jun 96
	2c, 3a-b, 4a, 6b, 7a, 8a, 9a	5 Mar - 20 Nov 97
	8b, 9a	23 Nov - 10 Jul 98
Pogonomyrmex rugosus	1c-d, 2a-c, 3a-c, 5c	29 Mar - 8 Nov 96
	1a, 2a, 2d, 3a, 7a-b, 9a	12 Feb - 12 Oct 97
	8a, 9a, 10c	23 Nov - 26 May 98
Solenopsis xyloni	1a-b, 2a, 3a-b, 4c, 5b	18 Mar - 22 Oct 96
	3a, 6b, 7a-b	26 Feb - 20 Nov 97
	6a, 9a, 10a	23 Nov - 29 Jul 98
**Tapinoma sessile*	6a	18 Jun 98

Gasterupidae

Gasteruption nevadae	7a	7 May 97

Halictidae

Agapostemon melliventris	1a, 3b	11 Jul - 8 Nov 96
	3b	11 Aug 97
Agapostemon texanus	1a	16 Apr 96
Augochlora species	3b	4 Apr 96
Dialitus species	1a-b, 2a, 3a-b, 4a-b, 5a-b	18 Mar - 22 Oct 96
	1a, 3b-c, 6a-b, 7a-b, 9a, 9b	7 May - 5 Oct 97
	6a, 8a-b, 9a, 10d	16 Jun - 10 Sep 98
Dufourea mulleri	3a, 5b	11-18 Apr 96
Halictus farinosus	1a	8 Nov 96
	9a	10 Jul 98
Lasioglossum sisymbrii	1a, 4c	9-16 Apr 96
Species 1	3b, 4a	9 Apr - 11 Jul 96
	3b	11 Aug 97
Species 2	1a, 3b, 6a, 7a-b, 8a	7 May - 5 Oct 97

Icheumonidae

Anomalon species	1c	8 Jul 96
Charops species	1c	16 Apr - 8 Jul 96
Compsocryptus species	5b	11 Apr 96
	4b	5 Mar 97
Cremastus species	5a	22 Oct 96
Eridolius species	5c	11 Apr 96
Erigorgus species	5b	11 Apr 96
Netelia species 1	1a	16 Apr 96
	6a	1 May 98
Netelia species 2	3b	9 Oct 96
Ophion species	1a	16 Apr 96
	6a	1 May - 18 Jun 98
Pterocormus inurbanus gp	3b	18 Apr 96
	6a, 8a	1-21 May 98
Species 1	2c, 6b, 9a	25 Mar - 3 May 97
	6a	1 May - 18 Jun 98
Species 2	1a, 6b	3 May - 20 Oct 97
Species 3	2a, 4a, 6a	29 Jan - 2 May 97
Species 4	2c	25 Mar 97
Species 5	6a	2 May 97
Species 6	9a	25 Mar 97
	6a, 10c	1-26 May 98
Species 7	9a	25 Mar 97
Species 8	2c	25 Mar 97
Species 9	2c, 4a	5-25 Mar 97
Species 10	1b	20 Oct 97
Species 11	1a	6 Sep 97
Species 12	1a	8 Apr 97
Species 13	2b, 4b, 5c	11 Apr - 17 Oct 96
Species 14	5c	15 May 96
Species 15	4b	1 Nov 96

Megachilidae

Anthidium ehrhorus	1a, 5b	15-30 May 96
Anthidium cockerelli	1a	30 May 96
Anthidium jocosum	2a	2 May 96
Ashmeadiella bigelovae	1b, 2b, 5b	2-30 May 96
Ashmeadiella prosopidia	5b	15 May 96
	7a-b	7 May 97
Ashmeadiella rhodognatha	5b	15 May 96
	7a-b	7 May 97
Coelioxys grindeliae	1a	25 Sep 96
**Dianthidium grindeliae*	8b	10 Jul 98
Dioxys pacificus	5a	11 Apr 96
Dioxys pomonae	5a, 5c	11 Apr 96
Haplitis bisentellus	5a	9 May 96
	6a	2 May 97
Megachile brachleyi	1a	15 Sep 95

Megachile brevis	1a	8 Jul - 6 Aug 96
	3b	11 Apr - 11 Aug 97
Megachile conerinnae	3b	6 Jun - 2 Aug 96
	3b	11 Aug 97
Megachile discorhina	7b	15 May 96
Megachile gravita	2a	13 Jun 96
Megachiile lobatifrons	1a, 2a	13 Jun - 4 Sep 96
Megachile nevadensis	1a	15 Sep 1995
	1a, 3d	25 Sep - 3 Oct 96
Megachile newberryae	1a	6 Jun 96
	1a	30 May 96
	7a-b	7 May 97
Megachile prosopidia	1a	6 Aug 96
Megachile texana	1a	6 Jun 95
Megachile species	2c, 6a, 7b	25 Mar - 7 May 97
	10c	26 May 98
Osmia crassa	5a	11 Apr 96
Osmia liogastru	4a, 5a	9-11 Apr 96
	9a	25 Mar 97
Osmia marginalis	5a	11 Apr 96
Osmia nothosmia	5a	11 Apr 96
	1a	8 Apr 97
Osmia titusi	5a	11 Apr 96
	1a	8 Apr 97
	6a	1 May 98
**Trachusa larreae*	10c	26 May 98
Megaspilidae		
Dendrocerus species	4a	18 Sep 96
Melittidae		
**Hesperapsis* species	10c	26 May 98
Multillidae		
Chyphotes melaniceps	1a, 2c, 5a	13 Jun - 17 Oct 96
	7a, 8a, 9a	16 Jul - 29 Aug 97
	8b, 9a	21 May - 10 Jul 98
Chyphotes mickeli	2c, 3b	2 Apr - 4 Sep 96
Chyphotes nubeculus	3b, 4a, 5a	11 Sep - 9 Oct 96
	1a, 7a, 9a	7 May - 20 Sep 97
	8b	10 Jul 98
Dasymutilla californica	3b-c	6 Jun 96
Dasymutilla phaon	1a	6 Jun 97
Dasymutilla species 1	3b	6 Jun - 9 Oct 96
Dasymutilla species 2	6a	2 May 97
Odontophotosis inconspicua	1a	15 Sep 1995
	7b	3 May 97
Sphaeropthalma blakei	3a, 8a	16 Jul - 21 Sep 97
Sphaeropthalma species 1	2a, 2c	13 Jun 96

	3b, 8a, 9a	11 Apr - 2 Aug 97
	6a, 8b, 10d	29 Jul - 10 Sep 98
Sphaeropthalma species 2	3b	6 Jun 96
Sphaeropthalma species 3	2c	17 Oct 96
Sphaeropthalma species 4	3b	9 Oct 96
Sphaeropthalma species 5	1a, 2c, 3b, 4a,	
	4c	9 May - 17 Oct 96
	6a, 8b, 10d	16 Jun - 10 Sep 98
Species 1	7a, 8a	16 Jul - 14 Sep 97
Mymaridae		
Species 1	6a	2 May 97
Orymyridae		
Species 1	4a	9 May 96
Species 2	1c	30 May 96
	6a	5 Oct 97
Perilampidae		
Species 1	1c, 3b	30 May - 11 Jul 96
	3b	11 Apr 97
Species 2	2a, 5a	11 Apr - 22 Oct 96
	7b	7 May 97
Platygasteridae		
Imostemma species	6a	2 May - 5 Oct 97
Isostasius species	2c, 5c	17-22 Oct 96
Platygaster species	2d, 6a, 7b, 8a	7 May - 5 Oct 97
Synopeas species	5a-b	22 Oct 96
	2c	25 Mar 97
Pompilidae		
Ageniella blaisdelli	1c, 3b	8-11 Jul 96
Anoplius deora	1b, 3b	3 May - 3 Oct 96
Anoplius dreisbachi	3b	18 Apr 96
Anoplius imbellis	1a-c, 3b-c, 4c,	
	5a-c	18 Apr - 2 Aug 96
	1b, 3b, 7b, 8a	13 Jun - 6 Sep 97
	6a	23 Nov - 18 Jun 98
Anoplius tenebrosus	3c	11 Jul 96
Anoplius toluca	3b	11 Jul 96
	6a	23 Nov 98
Aporinellus yucatanensis	1a, 5b	15 May - 22 Oct 96
	3b, 7a-b, 9a	7 May - 12 Oct 97
Aporus hirsutus	1c	30 May 96
**Hemipepsis* species	9a	10 Jul 98
Pepsis chrysothemia	1a, 2a, 3b-c,	
	4b-c, 5b	9 Apr - 11 Jul 96
	8c, 10d	16 Jun - 29 Jul 98

*Species 1	10a	29 Jul 98
*Species 2	6a	18 Jun 98
Proctotrupidae		
*Species 1	1a, 2c	13 Jun - 8 Jul 96
Pteromalidae		
Scutellista species 1	1b, 3b	11 Jul - 25 Sep 96
Species 1	1a, 1c, 3b, 4a, 5a-c	18 Mar - 22 Oct 96
Species 2	1a-b, 2a, 3b-c, 4b	4 Apr - 11 Jul 96
	6a	18 Jun 98
Species 3	1b-c, 3a-b, 5a, 5c	11 Apr - 22 Oct 96
Species 4	1c, 2b	29-30 Mar 96
Species 5	4b, 5a	11 Apr - 9 May 96
	8b, 9a	16 Jun - 10 Jul 98
Species 6	5a	11 Apr 96
Species 7	3c	4 Apr 96
Species 8	4b	9 May 96
Species 9	4b	9 May 96
Scelionidae		
Gryon radiculare	2c, 3b	13 Jun - 11 Jul 96
Psix tunetanus	1c, 2a, 3b	2 May - 11 Sep 96
	9a	10 Jul 98
Trissolcus species	3c	6 Jun 96
	8a	16 Jul 97
Scoliidae		
Campsomeris plumipes	1a, 3b	8 Jul - 6 Aug 96
	8a	16 Jul 97
Scolia species	1a, 3b	8 Jul - 6 Aug 96
Sphecidae		
Acistroma species	6a	2 May 97
Ammophila alberta	1a, 2a, 3a	6 Jun -11 Jul 96
	1d, 7a, 8a	13 May - 16 Jul 97
	10a	29 Jul 98
Ammophila placida	2c, 7a	25 Mar - 7 May 97
Ammophila pruinosa	1a, 3b, 4a, 4c, 5a-b	9 May - 22 Oct 96
	6a, 7a, 8a, 9a-b	3 May - 5 Oct 97
	6a, 8c, 9a, 10b, 10d	18 Jun - 19 Aug 98
Ammophila wrightii	6b	3 May 97
	6a	23 Nov - 18 Jun 98

Ammophila species 1	5b	22 Oct 96
	6a	23 Nov 98
Ammophila species 2	4a	9 Apr 96
Aphlanthops hispidus	7a	7 May 97
Astata nubecula	6a	2 May 97
	6b	18 Jun 98
Belomicrus eriogoni	2d	13 May 97
Bembix americana	1a, 3b	6 Jun - 6 Aug 96
	3b	11 Aug 97
Bembix sayi	1a	6 Sep 97
Cerceris acanthophi	8a	13 May 97
**Cerceris bridwelli*	6a, 10b	18 Jun - 29 Jul 98
Cerceris californica	2a, 5b	15 May - 13 Jun 96
	6a	18 Jun 98
Cerceris convergens	1a	8 Jul 96
**Cerceris macswaini*	9a	10 Jul 98
Cerceris sextoides	3b	2 Aug 96
Cerceris species 1	4a	5 Jul 96
	6a	1 May 98
Cerceris species 2	1a	8 Apr 97
**Cerceris* species 3	6a	1 May 98
Chalybion californicum	3b	11 Jul 96
Clypeadon lacticinctus	3c	9 Oct 96
Diodontus species	5b	11 Apr 96
	1a, 3b	8 Apr - 2 Jun 97
Dryudella aspersa	1a, 5a	11-16 Apr 96
	10b	29 Jul 98
**Dryudella* species	8b	10 Jul 98
Entomognathus species 1	3d, 7a	29 Jun - 21 Sep 97
Entomognathus species 2	3d	21 Sep 97
**Eucerceris arenaria*	6a, 9a, 10a, 10d	18 Jun - 29 Jul 98
**Eucerceris nevadensis*	6b	18 Jun 98
Fernaldina lucae	2a	13 Jun 96
	8a	16 Jul 97
Foxia navajo	1a-b	8 Jul - 6 Aug 96
	6b	18 Jul 98
**Foxia* species	6b	18 Jun 98
Glenosticta argentata	3b	2 Aug 96
Glenosticta scitula	1a	30 May 96
	10d	29 Jul 98
**Hoplisoides diversus*	6a	18 Jun 98
Larropsis tenuicornis	1a, 4b	9-30 May 96
	6b	18 Jun 98
Liris species	3b	11 Jul 96
Microbembix argyropleura	1a-b, 5a	15 May - 6 Aug 96
	7b	29 Aug 97
	10b	29 Jul 98
Mimesa cahuilla	6a	2 May 97

Ochleroptera species	7b	7 May 97
Oxybelus argenteopilosus	3a-b	6 Jun - 2 Aug 96
	3b	11 Apr 97
Oxybelus species 1	1a-b	25 Sep 96
	1a	6 Sep 97
	6a	18 Jun 98
**Oxybelus* species 2	6b, 10d	18 Jun - 29 Jul 98
Palmodes californica	4a	9 May 96
	10d	29 Jul 98
Palmodes species	1a, 1c, 3a-c	30 May - 6 Aug 96
Philanthus californicus	1a	6 Jun 95
Philanthus levini	1a, 3b	8 Jul - 9 Oct 96
	8b	19 Aug 98
Philanthus multimaculatus	1a, 3b	8 Jul - 9 Oct 96
Philanthus ventilabris	1a, 3b	2 Aug - 9 Oct 96
**Podalonia argentipilis*	6a, 10c, 10d	1-26 May 98
Podalonia deserticola	1a, 2b, 3a, 3c,	
	4b, 5a-b	4 Apr - 8 Nov 96
	1a-b, 5b, 7a-b,	
	8a, 9a	19 Feb - 20 Oct 97
	6a, 8a, 9a	1 May - 10 Jul 98
Podalonia luctuosa	2b, 3a, 3c,	
	5b-c	29 Mar - 15 May 96
**Podalonia sericea*	6b	18 Jun 98
Prionyx foxi	1a, 2a-b, 4a,	
	5a	13 Jun - 18 Jul 96
	10a	29 Jul 98
Prionyx parkeri	1a-b, 2a-b, 3a,	
	3c, 5a-b	2 May - 25 Sep 96
	7a-b	7 May 97
Sceliphron caementarium	1a, 3b	30 May - 6 Aug 96
	3a	21 Sep 97
Sphecius convallis	3b	11 Jul - 2 Aug 96
Sphex ashmeadi	1a, 5b	6 Aug - 11 Sep 96
	6a	22 Aug 97
	6a, 10a, 10d	1 May - 29 Jul 98
Sphex ichneumoneus	3b	11 Jul - 2 Aug 96
Steniolia duplicata	1a, 2a-b, 3a-c,	
	5a-c	15 May - 22 Oct 96
	1a, 3b, 7b, 8a,	
	9b	7 May - 6 Sep 97
	8a-b, 9a	10 Jul 98
Tachysphex ashmeadii	1a-b, 3c, 5b	30 May - 6 Aug 96
	10b	29 Jul 98
Tachysphex coquiletti	1a-b, 2a, 3b,	
	4b, 5b	2 May - 11 Jul 96
	6b	18 Jun 98
Tachysphex texanus	1a, 2a, 5b	15 May - 4 Sep 96
Tachysphex species	6a	13 Jun 97

Tachytes erimineus	1a, 2a, 4a	13 Jun - 6 Aug 96
	7a	29 Jun 97
	10a	29 Jul 98
Tachytes species	3b, 7b	11 Aug - 12 Oct 97
	10d	29 Jul 98
Trypoxylon aldrichi	6a	2 May 97
Trypoxylon californicum	3b	6 Jun 96
Species 1	1a, 3a-c	6 Jun - 11 Jul 96
Species 2	1a, 3b-c	6 Jun - 11 Jul 96
Species 3	5b	15 May 96
Species 4	5b	26 Jun 96
Species 5	7b	7 May 97

Tiphiidae

Brachycistis carinata	1a, 3b, 4c, 5a	9 May - 11 Sep 96
	1a, 3b, 5a, 8a, 9a	2 Aug - 5 Oct 97
	6a, 8b, 10d	10 Jul - 10 Sep 98
Brachycistic ioachinensis	2c, 3b	2 Apr - 17 Oct 96
	6a, 7a, 8a	7 May - 29 Aug 97
Brachycistic inaequalis	1a, 2c, 3b, 4c	2 Apr - 17 Oct 96
	3a, 6a, 7a 8a, 9a	3 May - 5 Oct 97
	6a, 8b, 10d	16 Jun - 10 Sep 98
Brachycistic lacustris	1a, 3b, 4c, 5a	16 Apr - 11 Sep 96
	6a, 8b, 10d	1 May - 29 Jul 98
Brachycistic triangularis	4a	18 Sep 96
Brachycistic species 1	4a, 4c, 5a	9 May - 18 Sep 96
Brachycistic species 2	1a, 2c	13 Jun - 4 Sep 96
Brachycistic species 3	7a, 8a	23 May - 16 Jul 97
	6a, 8b, 10d	16 Jun - 29 Jul 98
Species 1	6a, 8a, 9a	16 Jul - 14 Sep 97
Species 2	1a, 3b, 6a	11 Apr - 6 Sep 97
Species 3	6b	3 May 97
Species 4	1a, 3b, 7a	7 May - 6 Sep 97
Species 5	1a, 8a, 9a	13 May - 6 Sep 97
Species 6	8a	16 Jul 97
Species 7	4b	5 Mar 97
Species 8	1c	30 May 96

Torymidae

Species 1	2a	17 Oct 96
Species 2	5c	11 Apr 96
Species 3	5b	22 Oct 96
	1a, 3b, 6a, 7a, 8a	22 Apr - 12 Oct 97
Species 4	1a	30 May 96
Species 5	1a	18 Mar 96
	9a	20 Sep 97

Species 6	2a	13 Jun 96
Species 7	7b, 8a	12 Oct 97

Vespidae

Ancistrocerus adiabatus	5a	22 Oct 96
Ancistrocercus lineativentris	2c, 9a	25 Mar 97
Eucdynerus annulatus	1a, 1c, 4a	5 Jul - 6 Aug 96
	8a	16 Jul 97
Eucdynerus exoglyphus	1c, 3a-b, 5b	6 Jun - 2 Aug 96
Eucdynerus nidalgo	1a, 3a	8-11 Jul 96
Eucdynerus species 1	1a, 3b, 8a	16 Jul - 6 Sep 97
Eucdynerus species 2	3d, 7b, 8a, 9a	7 May - 21 Sep 97
**Eumenes bollii*	9a	10 Jul 98
Eumenes crucifera	3b	11 Jul - 2 Aug 96
Leptochilus electus	2a-b	2 May - 4 Sep 96
	9b	13 May 97
	6a	18 Jun 98
Leptachilus propodealis	6b	3 May 97
Leptachilus species	2b, 5a	26 Jun 96
	2d, 8a	13 May - 16 Jul 97
Parancistrocersu mcclayi	1a, 3b	6 Jun - 25 Sep 96
Polistes fuscatus	3a-c	4 Apr - 9 Oct 96
	3a-b, 3d	11 Aug - 21 Sep 97
**Pterocheilus mirandus*	9a	10 Jul 98
Pterocheilus trachysomus	5b	26 Jun 96
	8b	19 Aug 98
Pterocheilus species	2a	13 Jun 96
Stenodynerus pulvivestis	1a-b, 3b	11 Apr - 20 Oct 97
Vespula pensylvanica	1a	8 Nov 96
Species 1	7a	7 May 97
Species 2	7b	29 Aug 97

[1] The localities were as follows:

- 1a = Branch Memorial Park
- 1b = south end of Buckhorn Dry Lake
- 1c = area 2 miles south of Branch Memorial Park
- 1d = 2 miles N Branch Memorial Park
- 2a = Red Hill
- 2b = northwest end of Rosamond Dry Lake
- 2c = east end of Rosamond Hills
- 2d = W Red Hill
- 3a = west side of Piute Ponds
- 3b = north side of Piute Ponds
- 3c = 1.5 miles north northwest of Piute Ponds

- 3d = E Piute Ponds
- 4a = 1 mile north of Mercury Blvd and 1 mile east of Rogers Dry Lake
- 4b = peaks of northeast side of Rogers Dry Lake
- 4c = 1.5 miles northeast of peaks
- 5a = sand dunes 2.5 miles north of Avenue B on west side of Mercury Blvd.
- 5b = mesquite woodland just north of Avenue B and just west of intersection with 140th street
- 5c = west side of sewage ponds on west side of Rogers Dry Lake
- 6a = NW Leuhman Ridge
- 6b = NE Leuhman Ridge
- 6c = 3 miles N Leuhman Ridge
- 7a = N 165th Street
- 7b = W 140th Street
- 8a = 1 mile E intersection of Sopp Road and Pole Line Road
- 8b = 3.6 miles E intersection
- 8c = 5 miles E intersection
- 8d = N Rosamond Hills
- 9a = W Bissell Hills
- 9b = W Rosamond Hills
- 10a = 200th street S of C
- 10b = 200th street N of C
- 10c = Red Buttes
- 10d = Kramer Hills

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13. ABSTRACT ***(Maximum 200 words)***

A terrestrial arthropod survey was performed at 32 sites on Edwards Air Force Base (EAFB) from January 1996 through October 1998. Additional species found during a 1994 through 1998 butterfly survey have been added to the list. Survey methods involved sweeping of blooming and nonblooming vegetation, searching for arthropods beneath rocks, logs, and other objects, searching for diurnal and nocturnal crawling, flying, and calling arthropods (by hearing), collecting nocturnal arthropods drawn to a mercury vapor light, and those arthropods that have fallen into pitfall traps. From this study, over 15,000 arthropods representing 1,536 species were pinned or preserved in alcohol, labeled, and curated into the collection. During this study period, over 930, 770, and 400 species were collected in 1996, 1997, and 1998, respectively. In 1997 and 1998, over 300 and 100 new species, respectively, were added to this study of the EAFB. Of these species, approximately 96 percent were insects and over 80 percent belonged to the four major insect orders: Coleoptera, Lepidoptera, Diptera, and Hymenoptera. An additional 14 percent belonged to the next four major insect orders: Orthoptera, Homoptera, Hemiptera, and Neuroptera. At least three new species of Gryllacrididae and one new Scarabaeidae have been found. There are probably many other unrecognized species. There have also been many range extensions found by this survey. For example, of the four *Cicindela* species collected, two were major range extensions for their species.

14. SUBJECT TERMS

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Conservation	Invertebrates	Spiders
Environmental impacts	Mojave Desert	Survey

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