

las vegas wash coordination committee

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Las Vegas Wash Invertebrate Inventory, 2000-2010



April 2011



SOUTHERN NEVADA
WATER AUTHORITY

Las Vegas Wash
Coordination
Committee



**Las Vegas Wash Invertebrate Inventory,
2000-2010**

**SOUTHERN NEVADA WATER AUTHORITY
Las Vegas Wash Project Coordination Team**

Prepared for:

**Research and Environmental Monitoring Study Team
Las Vegas Wash Coordination Committee**

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ABSTRACT

This report summarizes previously documented, as well as undocumented, invertebrate specimens identified along the Las Vegas Wash (Wash), where this wildlife group has a significant impact on ecological components. Four of the six major environmental resource categories laid out in the Las Vegas Wash Comprehensive Adaptive Management Plan are impacted by invertebrates: water quality, soils, vegetation, and fish and wildlife. Living in both aquatic and terrestrial environments, many invertebrates serve as indicators of environmental quality in both areas. Insects are the primary pollinator for many plants along the Wash and provide many other benefits such as controlling herbivores and seed dispersal. Many insects can be primary consumers of plant material and secondary consumers of other insects. They are also the food source for a wide variety of birds, small mammals, fish, reptiles and amphibians. Cataloging these species will help researchers by providing baseline information and will provide managers' information on the species impacted by work being done. Further study of this animal group is needed to better understand their true impact on the ecological system at the Wash.

ACKNOWLEDGEMENTS

I would like to thank those that have helped in better understanding this important animal group at the Las Vegas Wash (Wash). Specifically, Mark Nelson has provided the bulk of the documentation on many of the groups described in this document. William Wiesenborn also provided unique information that would otherwise make this report incomplete. My co-collaborator on the bat foraging study, Marissa Foster assisted in the collection of many of the insects described. I would also like to thank Keiba Crear and Seth Shanahan for the support in gaining a better understanding of this rarely documented group and for reviewing this document. Patty Emery also provided important reviews as well as editing that made this a better document. Finally, I would like to thank the Las Vegas Wash Coordination Committee for its support of research along the Wash and providing a forum where a better understanding of the Wash's ecosystem is encouraged.

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1.0 INTRODUCTION

The Las Vegas Wash (Wash) is currently undergoing significant changes in terms of physiognomy and ecology. The ongoing project to control erosion and improve ecological functions of the system has resulted in substantial changes in wildlife along the channel. Bradley and Niles (1973) documented many of the plants and wildlife found along the Wash. This provided a baseline for which species were present after the Wash flows had increased significantly but erosion had yet to dramatically alter the channel. After erosion control and ecological improvements began in 2000, many surveys were conducted along the Wash to catalog species occurrence (O'Farrell and Shanahan 2006, Rice 2007, Shanahan 2005a and 2005b, Eckberg 2010, and Van Dooremolen 2005). These recent studies, along with Bradley and Niles (1973), documented plants, mammals, fish, reptiles, amphibians, and birds along the Wash.

There have been few studies (Wiesenborn 2005, Nelson 2009a, Nelson 2009b) performed at the Wash specifically on invertebrates. However, those studies that have been done provide a good idea of the types of invertebrate species found in the habitats studied. This report will provide a comprehensive look at all of the invertebrates identified along the Wash since the adoption of the Las Vegas Wash Coordination Committee's (LVWCC) Comprehensive Adaptive Management Plan (CAMP). There are no known studies that documented invertebrate species along the Wash prior to 2000, when the CAMP was published.

1.1.1 Importance of Invertebrates

Many view invertebrates as pests or vermin and that control of them is necessary (Kim 1993). The exceptions, like many other animal groups, are those that are aesthetically pleasing or economically beneficial, such as butterflies or honeybees. Invertebrates have not been taken seriously by policy makers or even scientists involved in ecological conservation (McNaughton 1989, Hafernik 1992). Therefore, invertebrate conservation has not been given due consideration and adequate understanding of them is lacking.

Insects occupy a wide variety of important niches in how ecosystems function. They are plant pollinators, filters of contaminants and nutrients, recyclers of dead or dying plant material, decomposers of plant and animal waste, predators of other insects, and provide a food source to hundreds of higher trophic level species, just to name a few. Insects however, are also one of the least known groups of animals on the planet. There are over a million known species of insects, making this group half of the world's known animals, but this group is believed to have between six and ten million species (Chapman 2006).

1.1.2 Purpose and Need

The purpose of this report is to assemble the first comprehensive inventory of invertebrates at the Wash. Combining information gathered in baseline invertebrate studies at the Wash will hopefully prove useful to future researchers. This information is much needed, since by looking at the Wash invertebrate community as a whole, policy-makers can gain a better understanding of what impact specific projects have on invertebrates and their ecosystem services.

A more specific need is knowledge of the status of insects that may directly have a negative impact on other ecological components at the Wash. One species of concern currently is the

Tamarisk leaf beetle (*Diorhabda carinulata*). This beetle has been introduced in the upper Colorado River basin to control salt cedar and populations are moving south at a fast pace (Figure 1). There is concern that the defoliation of salt cedar by these beetles will leave birds, including the federally endangered southwestern willow flycatcher (*Empidonax traillii extimus*), vulnerable to predation and habitat loss.

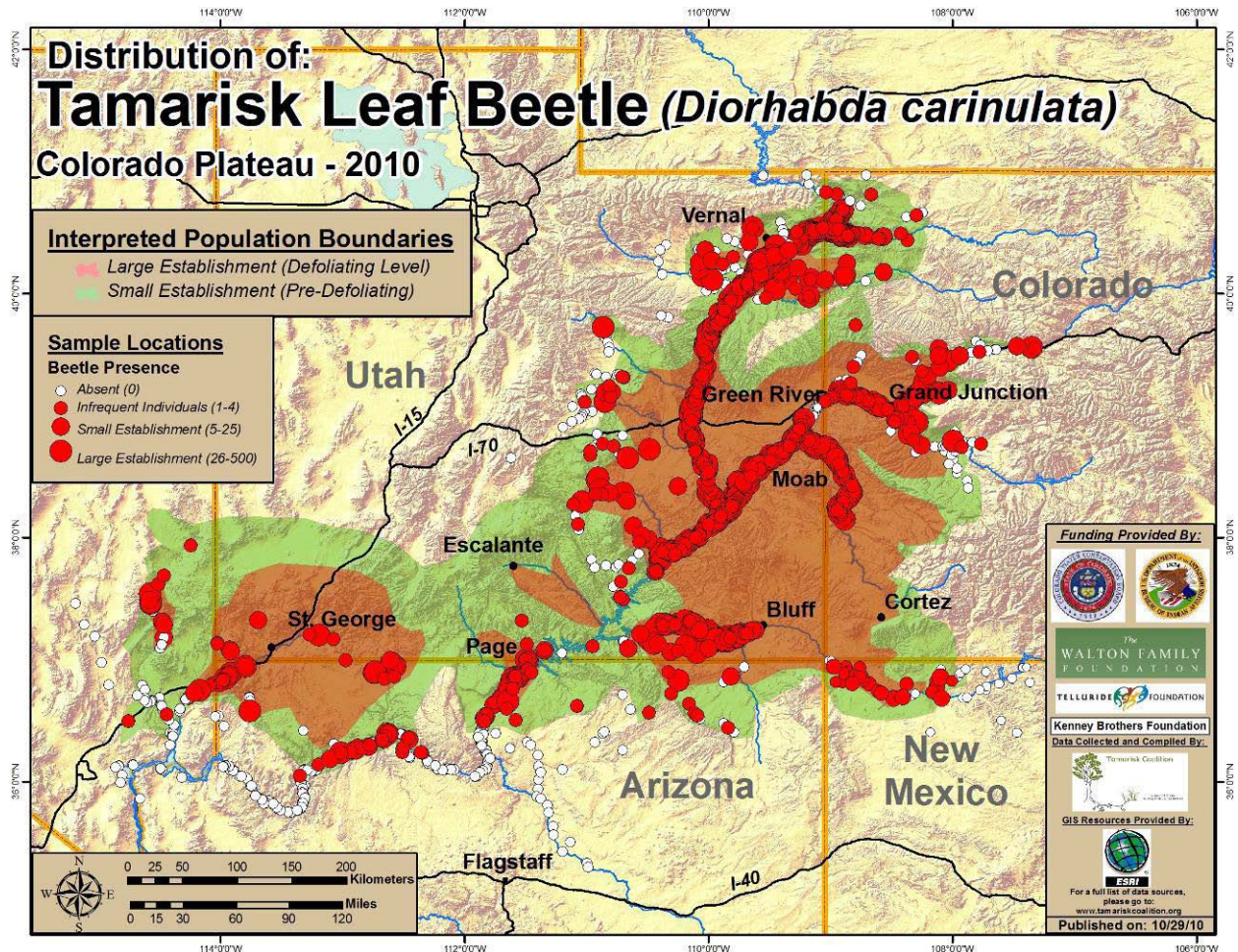


Figure 1. Tamarisk leaf beetle distribution across the Colorado River Basin, 2010.

2.0 MATERIALS AND METHODS

A list of invertebrate species was compiled from three primary sources: (1) species that were directly observed by groups other than the Las Vegas Wash Project Coordination Team (Wash Team), (2) species that were directly observed by the Wash Team during invertebrate-specific studies, and (3) species that were directly observed by the Wash Team while conducting any other activity. All of these projects primarily took place within the boundaries of the Clark County Wetlands Park (CCWP; Figure 2).

2.1 Literature Review

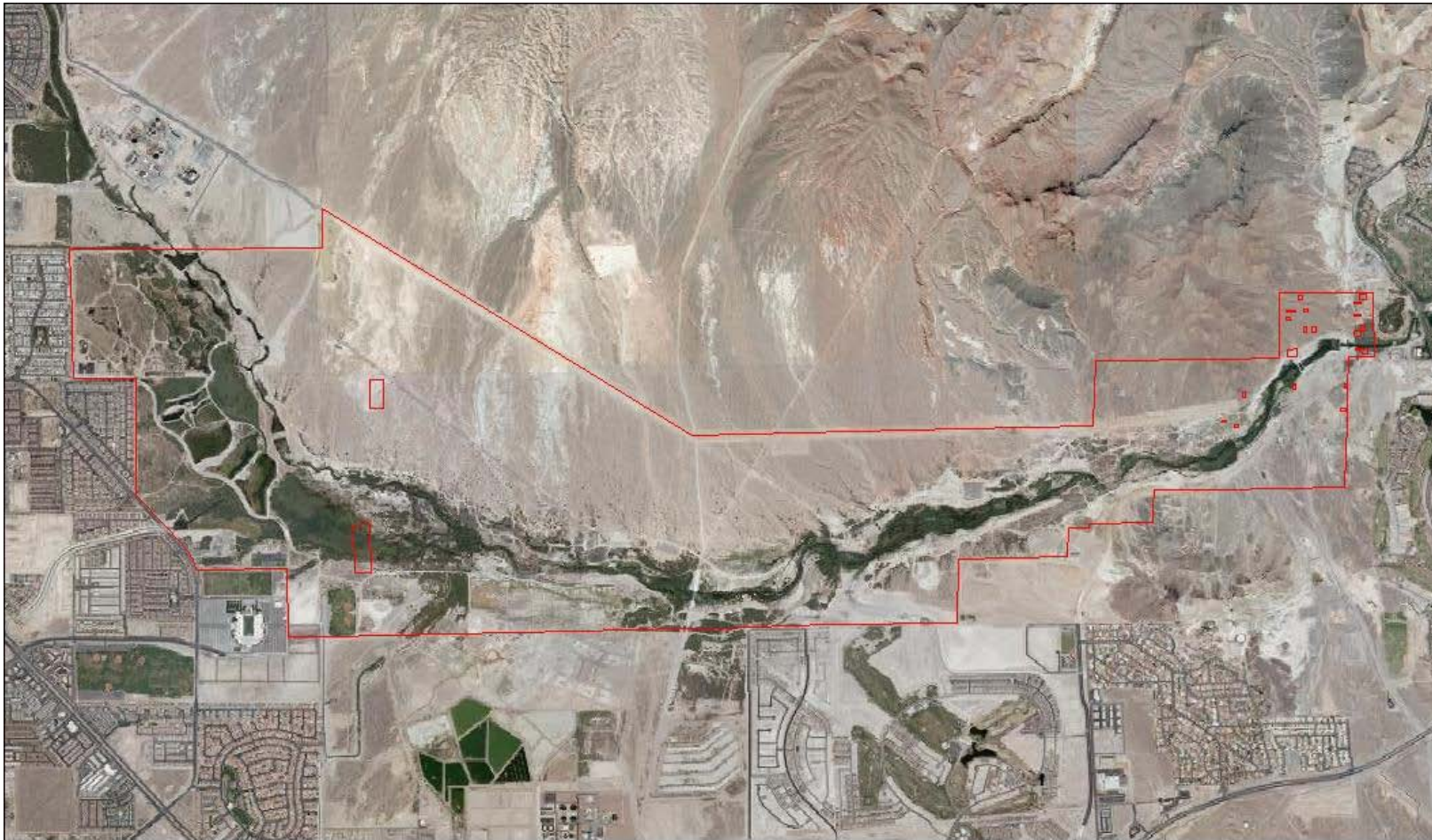
Wiesenborn (2005) conducted a study from 2002-2003 along the Wash on the biomass of arthropods on salt cedar (*Tamarix ramosissima*) branches. This study sampled arthropods from three locations along a south-north transects where surface water was present but near upland areas. The upper most location was bordered by creosote bush (*Larrea tridentata*). Arthropods were collected by placing plastic bags around salt cedar branches and cutting off the branch just outside the bag. The specimens found on the branches were later identified to the lowest taxonomic level possible.

Nelson (2009a) studied terrestrial invertebrates along the Wash by comparing the invertebrates associated with exotic vegetation such as salt cedar and common reed (*Phragmites australis*) to those sites that had been revegetated by the Wash Team. Two methods were used to catalog species found in each area. First, butterfly assemblages were identified by sight during timed searches at each of the ten sites monitored (five exotic and five revegetated). Second, other invertebrates in each site were sampled using sticky-traps. Five traps were placed along diagonal transects within each of the ten sites.

Nelson (2009b) also conducted a study to evaluate culm breakdown of three plant species along the Wash. This report described many macroinvertebrates responsible for the breakdown of nutrients in plants and the role each type of species has in this process. A litter bag technique was used to do this analysis. Standing dead culms of three plant species were first collected and then placed in mesh bags. After initial processing of the samples, invertebrates found on each sample were identified to the lowest taxonomic order possible. In addition, kick samples in the area near where the plant samples were collected increased the number of invertebrates identified.

Since 2000, the Bureau of Reclamation (BOR) has been contracted to perform aquatic macroinvertebrate sampling along the Wash and its tributaries for the purposes of monitoring changes in water quality. Nelson (2010) reports on ten years of data collected on this project. Nine sites along the Wash channel and 11 sites along tributaries and at wastewater discharge structures (the majority of inflow into the Wash) were sampled since 2003. A one-minute kick method with a D-frame net was used at these sites to sample the benthic invertebrates within a ten-meter sampling reach at each of the 20 locations. Samples were preserved and identified at a later date.

The most recent study to have components that specifically included the collection and identification of invertebrates along the Wash was done by the Wash Team. A study of bat foraging preferences in three distinct microhabitats along the Wash commenced in May of 2010 and concluded in October the same year (Eckberg and Foster in review.). Invertebrates were collected by reflecting a black light onto a white sheet which had been draped over a rope tied between two trees. Samples were collected one night a month at three sites during the six-month survey.



▭ Clark County Wetlands Park and private property boundaries



0 0.5 1 2 Miles

For planning purposes only
Prepared by the Southern Nevada Water Authority
Aerial Image taken July, 2010

Figure 2. Clark County Wetlands Park and private property boundaries.

2.2 Other Data Sources

Unpublished data from studies of mosquitoes within the CCWP by Jim Pollard and Gretchen Andrew at UNLV were presented to the LVWCC at a regular meeting of the Research and Environmental Monitoring Study Team on January 7, 2009. This research was implemented to ensure safety of visitors to the CCWP by documenting the mosquito species present and their activity time and seasons. Data from unpublished aquatic invertebrate collections made by Becky Blasius are also included in this report. These data contributed unique species and confirmed three others collected by other published sources.

The Wash Team has been doing a wide variety of projects along the Wash since 2000. Since that time, numerous photographs or physical collections of invertebrates have been taken. Some invertebrates were collected incidentally during surveys for other wildlife, specifically pitfall traps during the reptile survey. Others were collected or observed while performing other survey or maintenance activities along the Wash. Photographs and collections have been identified using standard field guides (Evans and Hogue 2006, Glassberg 2001, Paulson 2009, Evans 2008, and Capinera et. al. 2004), as well as online sources such as www.bugguide.net.

3.0 RESULTS AND DISCUSSION

Combining the invertebrates that were detected in the various reports and other sources has resulted in at least 259 species found along the Wash (Appendix A), making it the largest number of identified species of any animal group along the Wash. The term “at least” is used because many invertebrates collected were not able to be identified to the species level; in fact some could only be identified to phylum. This means that there may be many species within a specific group collected but not identified at a lower taxonomic level. The number of contributions to the invertebrate inventory of the Wash by each source is displayed in Table 1. There may be some overlap with those collected by multiple sources.

The invertebrates identified represent 6 phylum, 14 classes, 30 orders, and 130 families. The majority of phyla are Arthropoda, which includes all true insects. Five phyla (other than Arthropoda) were all contributed by two aquatic studies (Nelson 2009b, 2010). The description of specific individuals collected is broken down through the rest of this section by taxonomic level. Overall, a wide variety of invertebrates inhabiting the Wash have been identified in all habitat types matching the wide variety of ecotypes found in the area.

3.1 Phylum – Arthropoda

An arthropod is an invertebrate with an exoskeleton, a segmented body, and jointed appendages. Included in this phylum are insects, arachnids, and crustaceans. This phylum makes up the majority of invertebrates cataloged at the Wash to date.

3.1.1 Class – Arachnida

Arachnids are joint-legged invertebrates, all with eight legs - contrary to insects with six legs. Some species have converted the front pair of legs to a sensory, defense, or feeding function. Other traits that distinguish arachnids from insects are that arachnids do not have antennae or wings. No extant species of arachnid is aquatic, though many do live in freshwater habitats. The

Taxonomic Level	Source					
	Wiesenborn (2005)	Nelson (2009a)	Nelson (2009b)	Nelson (2010)	Eckberg and Foster (in prep.)	Other
Phylum	1	1	4	6	1	1
Class	2	2	5	11	2	4
Order	6	11	11	17	13	9
Family	28	16	21	41	46	24
Genus	31	34	33	51	60	35

Table 1: Contribution to Las Vegas Wash invertebrate inventory by publishing source.

Wash has 3 of the 11 arachnid orders: Araneae (spiders), Scorpiones (scorpions), and Solifugae (windscorpions).

3.1.1.1 Order – Araneae

There have been 11 families of spiders identified at the Wash (one specimen identified in each), with the exception of Theridiidae which has two. The family Araneidae (orb weavers) is represented at the Wash by the genus *Metepeira*. Orb weavers are one of the most populous families of spiders, making up about 25% of spider diversity. As the name implies, species in this family create wheel-shaped webs, with a new web typically created daily.

The one species of tarantula (family Theraphosidae) found at the Wash so far is the desert blond tarantula (*Aphonopelma chalcodes*; Figure 3). The front part of its body (carapace) is densely covered in pale hairs giving this species its name. This species grows to three or four inches and are a nocturnal species only coming out of their burrows to mate or look for food.

Two species in the family Theridiidae (cobweb spiders) have been documented at the Wash, *Latrodectus hesperus* (Western black widow), and a species in the *Steatoda* genus. The diet of the Western black widow includes beetles, cockroaches, and flies. They kill their prey by injecting poisonous venom through their fangs. This species is also particularly venomous to humans, and it is the most toxic spider bite to humans in North America.

3.1.1.2 Order – Scorpiones

The only scorpion identified at the Wash so far is the Arizona hairy scorpion (*Hadrurus arizonensis*). This scorpion is one of the largest in North America and is found throughout the Sonoran and Mojave deserts. It can grow to 14-15 cm in length and feeds on insects, spiders, other scorpions, and even small vertebrates like lizards and snakes.

3.1.1.3 Order – Solifugae

There are about 200 species of windscorpions in North America; one has been identified at the Wash - *Eremobates*. This genus is a very fast runner and has the largest jaw size to body ratio of any creature. It is not venomous but has a very powerful and painful bite, is nocturnal, and hunts at night using its pedipalps.



Figure 3. Desert Blond Tarantula (*Aphonopelma chalcodes*).

3.1.2 Class – Entognatha

The order Collembola is made up of springtail species and is the only represented member of the class Entognatha. This group used to be part of the Insecta class but have since been moved due to having internal mouthparts (insects have external mouthparts). Springtails get their name from having a small structure called a retinaculum folded beneath the body which when released snaps against the ground causing them to flip into the air. These species are usually found in leaf litter and other decaying material where they are primarily detritivores and microbivores. They are responsible for a significant amount of the control and dissemination of soil microorganisms.

3.1.3 Class – Branchiopoda

One species in the class Branchiopoda has been identified along the Wash and was recorded in 2002 during a sampling of invertebrates within the Nature Preserve. The species *Daphnia pulex* (water flea) is found all over the world and is prey to a wide variety of aquatic predators.

3.1.4 Class – Insecta

Insects are arthropods that have an external skeleton, a three-part body, three pairs of jointed legs, compound eyes, and two antennae. They are among the most diverse group of animals and represent more than half of all known living organisms. At the Wash, they are by far the majority of invertebrates described to date. There are currently 30 orders of insects in the world; 15 of these have had specimens found at the Wash so far.

3.1.4.1 Order – Blattodea

The order Blattodea includes cockroaches and termites. Three of the best-known species in this order have been found at the Wash, including the American cockroach (*Periplaneta americana*), the German cockroach (*Blattella germanica*), and the Oriental cockroach (*Blatta orientalis*). These three species are associated with humans and are considered pests all over the world. None of these species are native to the United States, including the incorrectly named American cockroach which is native to Africa.

3.1.4.2 Order – Coleoptera

Beetles are the order that have the largest number of known species. At the Wash, it has the second largest amount of identified specimens - 36 individuals; all but one identified to at least the genus taxonomic level, representing 19 different families.

The family with the most individuals identified at the Wash is Coccinellidae (Lady Beetles) with seven. Lady beetles are typically predators of Hemiptera, such as aphids and scale insects. They are often brightly colored as a defense for predators. The color is typically red, yellow, or orange with black spots (Figure 4), although some are black, grey, or brown. The distinct colors of these species allows for easier identification than many other insect orders.

The Dytiscidae family (predaceous diving beetles), a family of water beetles, has the second most individuals found at the Wash with four. Species in this family have short but sharp mandibles and deliver digestive enzymes into their prey immediately upon biting. Three other aquatic beetle species have been cataloged at the Wash are in the family Hydrophilidae (water scavenger beetle). *Optioservus* is also found but it is the lone representative of the Elmidae family (riffle beetles) identified so far.

Two weevils in the family Curculionidae have been identified at the Wash; *Ophryastes geminatus* (desert weevil) and *Coniatus splendidulus* (splendid tamarisk weevil; Figure 5). The identification of the splendid tamarisk weevil by Eckberg and Foster (submitted) marked the state record of this species in Nevada. Previously only identified in Arizona and Southern California, this species is native to the Mediterranean region and is a natural predator of salt cedar. It is possible that this species was brought to the United States as a biocontrol measure for the invasive tree.

Another state record in the Buprestidae family, *Prasinalia cuneata* (Metallic wood-boring beetles; Figure 6), was identified by Eckberg and Foster (in prep.). Very similar to another Buprestid species found at the Wash, *Gyascutus planicosta planicosta*, this species is common to riparian areas in the southwest and it was expected to inhabit the Wash area.

3.1.4.3 Order – Diptera

True flies are insects in the order Diptera. Species in this order have a single pair of wings which distinguishes them from other flying insects with similar names such as mayflies, dragonflies, caddisflies, and others having two pairs of wings. There have been 26 individuals from 18 different families identified.



Figure 4. Convergent Lady Beetle (*Hippodamia convergens*).

The family with the most flies is Chironomidae (midges; Figure 7). The study by Nelson (2009b) identified 12 different genera. Individuals were also collected by Eckberg and Foster (in prep.) but not identified below the family level. Chironomidae are informally known as non-biting midges to distinguish them from Ceratopogonidae (biting midges) of which three genera have been found. Midges resemble mosquitoes but lack the elongate mouthparts that mosquitoes famously have.

The family with the second most flies identified is Culicidae (mosquitoes). In studies performed by Andrew and Pollard (pers. comm) at the CCWP Nature Preserve, six species of mosquitoes were identified from four different genera, *Aedes*, *Anopheles*, *Culex* and *Culiseta*. Mosquitoes are of interest because they are known vectors of infection to humans. Both male and female mosquitoes are nectar feeders; females only take blood to help develop their eggs.



Figure 5. Splendid Tamarisk Weevil (*Coniatus splendidulus*).



Figure 6. *Prasinalia cuneata*.

3.1.4.4 Order – Embioptera

The order Embioptera is commonly known as webspinners because species in this order are able to spin silk from their front legs. Nelson (2009a) identified individuals from this order in exotic plant species dominated areas using sticky-trap sampling.



Figure 7. Midge (family: Chironomidae).

3.1.4.5 Order – Ephemeroptera

The order Ephemeroptera includes species known as mayflies. These insects are aquatic in the immature stage of their life and last about one year in freshwater. The adults are very short-lived, from a few days to as little as a few minutes, depending on the species. The immature naiads primarily live under rocks, decaying vegetation, or in the sediment in ponds, lakes, or streams. Most species feed on algae or diatoms, with a smaller amount of species being predatory. The adult's primary function is reproduction with their digestive system filled with air and has non-functional mouthparts. Nelson (2009b) documented two species of mayflies, both in the family Baetidae (small minnow mayflies). Nelson (2010) documented an additional five genera of mayflies in two different families; Baetidae and Caenidae (small squaregilled mayflies).

3.1.4.6 Order – Hemiptera

The order Hemiptera is known as true bugs. As currently described, it is a combination of what was historically two separate orders - Homoptera and Heteroptera. The physical appearance of species in this order varies greatly but are classified together due to their common mouthpart physiology. The mandible and maxillae have evolved into a fused proboscis which is capable of piercing plant tissues and sucking out sap (in most cases). There have been 17 families of Hemiptera described along the Wash.

One of the most numerous Hemipteran species at the Wash are aphids. Aphids are known to be pests in gardens and agricultural areas as they are a sap sucking species that can cause damage to plants. Many species are monophagous, meaning they only feed on one plant species. At the Wash, they have been primarily observed on common reed (*Phragmites australis*).



Figure 8. Apache Cicada
(*Diceroprocta apache*).

Another Hemipteran species that can be found in large numbers is *Diceroprocta apache* (apache cicada; Figure 8). This species has been described as a potential keystone species in riparian areas along the Lower Colorado River (Anderson 1994). The mass emergence of this species after metamorphosis has significant effects on the water transport of cottonwood and willow species as well as providing food for birds and other animals.

Opsius stactogalus (tamarix leafhopper) is a leafhopper that is native to Europe. This species was documented at the Wash by Wiesenborn (2005), and has been strongly associated with *Tamarix* sp. (Wiesenborn 2001, 2002). The tamarix leafhopper is a fluid-feeder and has been shown to reduce the growth of *Tamarix* when populations are of a substantial size (Liesner 1971).

3.1.4.7 Order – Hymenoptera

The Hymenoptera order includes wasps, bees, and ants, and includes over 130,000 recognized species. The diet of this order is very diverse. Some species feed on nectar and pollen, others are herbivorous, and still others are predatory. Fifteen families in this order have been documented along the Wash.

The honey bee (*Apis mellifera*) is native to Europe, Asia, and Africa, but can be found on every continent except for Antarctica. It is such an important and common species that it is the state insect for 17 states. Because it is used extensively in commercial agriculture throughout the United States, it's possible this is the reason it has been able to make its way to the Wash. Regardless of its origins, it is seen as a beneficial addition by being a pollinator in a system where substantial revegetation efforts are ongoing (Eckberg 2010).

There have been two species in the family Mutillidae (velvet ants) described at the Wash - *Dasymutilla creusa* and *D. gloriosa*. The name velvet ant comes from their hairy bodies and their ant-like body, though they are not true ants. Another common name for those species in Mutillidae is cow killers due to their painful sting if handled. Their life cycles are not very well understood but adults have been observed eating nectar.



Figure 9. Tarantula Hawk (*Pepsis chrysothemis*).

One species at the Wash that has been said to have a more painful sting than a velvet ant is the tarantula hawk (*Pepsis chrysothemis*; Figure 9). This species gets its name from the females in this genus needing a spider to serve as a host for its larvae; the tarantula is the preferred choice, although other spiders can be selected. The tarantula hawk will sting a tarantula causing paralysis and then bring the spider back to its den where it lays her eggs on the abdomen. When the egg hatches, the larva feeds on the spider.

3.1.4.8 Order – Isopoda

One species has been documented in the Isopoda (pillbugs) order, *Armadillidium vulgare* (woodlouse). Isopods are small crustaceans. This species is able to roll into a ball when disturbed, which gives it the other common name rollie-pollie. The woodlouse feeds on decaying plant matter, as well as lichens and algae.

3.1.4.9 Order – Lepidoptera

The Lepidoptera order (butterflies and moths) is the most documented order of invertebrates along the Wash having 45 species (12 moths and 33 butterflies) identified in 11 different families (4 moths and 7 butterflies). This may be a result of the Lepidoptera order being more extensively studied than most other orders, making identification easier. In addition, Nelson (2009a) described many butterflies in the only study at the Wash specifically designed to capture a specific group of insects.

Typically moths are nocturnal and butterflies are diurnal; however, not all species follow this rule all of the time. Their main physiological difference is that a butterfly's antenna has knobs at the end while moths do not. Another difference is that butterflies typically rest with their wings held up above their body while moths lay theirs out flat.

The most abundant family of Lepidoptera described at the Wash is HesperIIDae (skippers). Skippers are in the monotypic superfamily Hesperioidea and in their own lineage separate from other butterflies (Papilionoidea). They are identified by antennae clubs that are hooked backwards, as well as typically having a larger thorax similar to moths. There have been nine species of Skippers identified at the Wash, the most common of which is the Yuma skipper (*Ochlodes yuma*; Figure 10). One species that is notably absent is the MacNeil's sootywing (*Hesperopsis graciellae*). This species is a Lower Colorado River Multi-Species Conservation Program species found throughout the Lower Colorado River region whose host plants include the four-wing saltbush (*Atriplex canescens* var. *canescens*) and quailbush (*Atriplex lentiformis*). The apparent absence is most likely due to a lack of study in areas dominated by these species.



Figure 10. Yuma Skipper (*Ochlodes yuma*).

The family Nymphalidae (brushfooted butterflies) is the second most abundantly described family of Lepidoptera at the Wash. There have been eight species identified in this family. Species identified to date include the famous Monarch butterfly (*Danaus plexippus*) and the Queen butterfly (*Danaus gilippus*), a mimic of the Monarch. Those identified at the Wash are likely those of the Western population passing through as part of their migration.

The largest lepidopteron along the Wash are the sphinx moths (Sphingidae) with the Western poplar sphinx (*Pachysphinx occidentalis*) being the largest with a wingspan up to 148 mm. Other species identified in this family are the White-lined sphinx (*Hyles lineata*) and the five-spotted hawk moth (*Manduca quinquemaculata*). The five-spotted hawkmoth's caterpillar is known as the tomato hornworm and is a major pest in gardens and agriculture areas feeding on various plants in the Solanaceae family.

3.1.4.10 Order – Mantodea

The Mediterranean mantis (*Iris oratoria*) is the only species identified at the Wash in the Mantodea order. As the common name implies, this species is native to Europe but is found throughout Asia and the United States. Species in this order are easily identifiable by their grasping, spiked forelegs with which they catch prey. Prey for mantids is primarily other insects but can also include small lizards, frogs, birds, snakes, fish, and small rodents.

3.1.4.11 Order – Neuroptera

The order Neuroptera includes insects known as net-winged insects such as lacewings, mantidflies, and antlions. The larvae of most neuropterans are predatory, feeding on other insects such as aphids. Many of the adults are also predatory but some species feed on nectar while others do not feed at all.

There have been specimens collected from four different families of Neuroptera at the Wash so far: Chrysopidae (green lacewings), Coniopterygidae (dustywings), Hemerobiidae (Brown lacewings), and Myrmelontidae (antlions). Only antlions have had a specimen identified to a lower taxonomic level than order (the genus *Myrmeleon*), identified by Eckberg and Foster (in prep.).

3.1.4.12 Order – Odonata

The order Odonata (dragonflies and damselflies) is another well described order at the Wash with 6 families, 13 genera, and 20 individuals identified to the species level. Like Lepidoptera, this order is well studied and identification tools are more readily available making recognition of newly collected specimens easier. Odonata is further divided into two suborders: Epiprocta (dragonflies) and Zygoptera (damselflies).

So far, the largest number of Odonata identified at the Wash is in the family Libellulidae (skimmers) with a total of nine individuals. Skimmers are relatively large dragonflies that are primarily found in the New World. One common member of this family that is found at the Wash in large numbers is the flame skimmer (*Libellula saturata*). Native to the southwestern United States, this species chooses habitats consisting of warm ponds or streams. The aquatic larvae (naiad) feed on insects such as mosquito larvae, mayfly larvae, and tadpoles.

The second most abundant family identified at the Wash (eight species identified) is Coenagrionidae (narrow-winged damselflies). Within this family the most abundant genus is *Agria* (dancers), of which five species have been identified. This genus includes the Nevada state insect, the vivid dancer (*Argia vivida*; Figure 11).



Figure 11. Vivid Dancer Damselfly (*Argia vivida*); photo credit: Paul Dacko.

3.1.4.13 Order – Orthoptera

Orthoptera is an order of insects including grasshoppers, crickets, and locusts. One feature that all Orthopterans share is that they all have a paurometabolous life cycle, meaning that unlike most insects they do not go through a typical metamorphosis as part of their development. Instead, they go through gradual changes from nymphs to adults. Five species have been identified at the Wash from three different families: Acrididae (short-horned grasshoppers; Figure 12), Gryllidae (true crickets), and Tettigoniidae (katydids).

3.1.4.14 Order – Thysanoptera

Individuals in the order Thysanoptera are known as thrips. These small insects (0.5 to 14 mm in length) are considered pests in agricultural areas because they feed on many commercial plants. In addition, they are vectors for many plant infecting viruses. Nelson (2009a) provided the only documentation of this order at the Wash.

3.1.4.15 Order – Trichoptera

The caddisflies are the only species classified in the order Trichoptera. These flying insects appear similar to moths but have hairy membranous wings as opposed to having scales. Caddisfly larvae are aquatic, building large silk structures underwater to help catch food such as algae, invertebrates, and zooplankton. Caddisflies are commonly used in determining aquatic



Figure 12. Cattail Toothpick Grasshopper (*Leptysma marginicollis hebarði*).

ecosystem health because they breathe dissolved oxygen and do not cope well with low levels. In addition, many species are particularly sensitive to environmental stressors such as pollution.

While multiple studies have collected caddisflies at the Wash, only Nelson (2009b; 2010) has been able to classify specimens to the genus level. There have been four genera described: *Culoptila* (little black caddisflies; family: Glossosomatidae), *Smicridea* (net-spinning caddisflies; family: Hydropsychidae), *Hydroptila* (microcaddisflies; family: Hydroptillidae), and *Nectopsyche* (longhorned caddisflies; family: Leptoceridae).

3.1.5 Class – Malacostraca

Three species have been identified in this class, one of which is *Procambarus clarkii* (red swamp crayfish), in the order Decapoda. Native to the Gulf Coast region in Mexico and the United States, this species is now found all over the United States, Asia, Africa, and Europe. *Procambarus clarkii* is primarily carnivorous, eating insect larvae, tadpoles, and snails. With its characteristic behavior of burrowing, it has caused negative economic impacts by damaging levees, dams, and irrigation systems. In addition, it competes with native aquatic species for food and space, making it an invasive species in most locations where it is found. The other two genera identified are (*Crangonyx* and *Hyaella*) amphipods in the order Amphipoda.

3.1.6 Class – Maxillopoda

Maxillopods are within the subphylum Crustacea and those found along the Wash were in the sub-class Copepoda. Most maxillopods are very small with the exception of barnacles and use their maxillae for feeding. Copepods are found in almost every freshwater habitat around the world and are often used as bioindicators of water quality. In addition, they are a food source for a wide variety of predators. Individual copepods were identified during sampling of water sources within the Nature Preserve in 2002.

3.1.7 Class – Ostracoda

Nelson (2010) collected specimens in this class as part of a report on macroinvertebrates at the Wash. This is the only record of any specimen in this order. Ostracods are sometimes referred to as seed shrimp and are crustaceans. They are typically very small (~1 mm) and are food for many aquatic species.

3.2 Phylum – Annelida

Individuals in the Annelida phylum are segmented worms with over 17,000 extant species. All of the annelids identified at the Wash to date are in the class Clitellata. These worms are characterized by having a clitellum, a collar that forms on their body. Individuals have been collected by Nelson (2009b; 2010) in three different orders and five families. Identification has not been possible to any lower taxonomic level.

3.3 Phylum – Bryozoa

Commonly known as moss animals, individuals in the phylum Bryozoa are filter feeders. They sieve food particles out of the water using a crown of tentacles lined with cilia. Although not identified as such, Bryozoa collected by Nelson (2010) are likely in the class Phylactolaemata because all other Bryozoa classes are only found in marine environments. Further, there is only one extant order in this class, Plumatellida.

3.4 Phylum – Mollusca

The phylum Mollusca is commonly known as mullusks and has 85,000 recognized extant species. Most of the classified species live in marine habitats. At the Wash, two classes have been documented, Bivalvia and Gastropoda. The class Bivalvia is represented at the Wash by the genus *Corbicula* in the family Corbiculidae (Basket clams). The species *Corbicula fluminea* (Asian clam) was identified by Nelson (2010) while Nelson (2009b) cataloged an unknown species in the genus *Corbicula*, possibly the same species. The Gastropoda class includes snails and slugs. At the Wash, there have been four families in two orders documented: Anculidae (limpets), Lymnaeidae (freshwater snails), Physidae (bladder snails), and Thiaridae (swamp ceriths). The species *Melanoides tuberculatus* (red-rimmed melania) in the family Thiaridae is an aquarium species that has expanded its range from its native Africa to all over the world.

3.5 Phylum – Nemertea

The Nemertea phylum is known as ribbon worms or proboscis worms with the majority of species being marine with fewer being found in fresh water habitats and fewer still being terrestrial forms. The one specimen found at the Wash is in the genus *Prostoma* in the class Enopla, order Hoplonemertea, and family Tetrastemmatidae. These species are predators, feeding mainly on crustaceans and worms.

3.6 Phylum - Platyhelminithes

The phylum Platyhelminithes are flatworms and are represented at the Wash by the class Turbellaria. These species are mainly predators or scavengers while others are symbiotes of animals such as crustaceans; some are parasites.

4.0 CONCLUSIONS

The five studies that collected invertebrate taxonomic information at the Wash have increased the understanding of the wide array of species and groups of species found there. The classified invertebrates along the Wash corridor fill many ecological niches and are found in many microhabitats. It is clear that they are an important component to the ecosystem and provide many benefits to the system and other living organisms living at the Wash.

Most sources from which invertebrate information has been collected for this report were targeted towards specific groups of animals. Eckberg and Foster (in prep.), which contributed the largest number of genera to this inventory, targeted nocturnal species. Wiesenborn (2005) focused on those species specifically associated with a single plant species, salt cedar. The aquatic macroinvertebrate survey (Nelson 2010), research on culm breakdown on the Wash (Nelson 2009b), as well as the information provided by Becky Blasius (pers. comm.) all focused on aquatic species. Combined, these aquatic studies provide the most comprehensive understanding of any invertebrate community along the Wash. Only Nelson (2009a) inventoried invertebrates from various habitat types with varied plant species, comparing revegetated areas and those dominated by non-native plants. There are multiple microhabitats and plant communities within the CCWP that have yet to have any invertebrate collection performed.

5.0 RECOMMENDATIONS

While there have been more invertebrates documented at the Wash than any other animal group, it is likely that only a small fraction have been identified. It is recommended that additional invertebrate monitoring surveys be conducted, in addition to the ongoing benthic macroinvertebrate surveys. Some invertebrates can be surveyed simultaneously with other surveys, i.e. pit-fall traps used for reptile surveys also capture many invertebrates that could also be collected and identified. All of the invertebrate studies so far have focused on the riparian or aquatic habitats. There are many species found in upland areas that have significant impacts on the entire ecosystem; studies should be conducted to inventory saltbush and creosote dominated areas.

Many inventory surveys can be implemented to target specific invertebrate groups that require relatively few resources (staff time and money). These include sticky traps for small flying insects, black-light traps for nocturnal insects, dish traps for beetles, ants and flies, and color traps for pollinating insects. All of these can be set up in very little time, require minimal money to construct, and can provide significant results in terms of number of individuals collected.

Surveys of salt cedar areas should be conducted regularly to monitor the movement of the tamarisk beetle. This species may have a significant impact to the habitat along the Wash and surrounding areas. During these surveys, additional data can be collected on the current range and estimated populations of the splendid tamarisk weevil identified by Eckberg and Foster (in prep.) and the tamarisk leafhopper found by Wiesenborn (2005). While the ecological impact of these species is not believed to be as significant as the tamarisk beetle, they may have an impact. Only continual monitoring can ensure that future impacts are not left undiscovered.

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Appendix A
Invertebrates documented at the Las Vegas Wash

Specimens identified to any taxonomic level already described to a lower taxonomic level are excluded from this list

Phylum	Class	Order	Family	Family Common Name	Genus	Scientific Name	Common Name			
Annelida	Clitellata	Haplotaxida	Enchytraeidae	Potworms and Iceworms			Potworms and Iceworms			
			Lumbricidae	Earthworms			Earthworms			
			Naididae	Oligochaete worms			Sludge Worms			
			Lumbriculida	Lumbriculidae	Oligochaete worms		Small Worms			
Arthropoda	Arachnida	Araneae	Rhynchobdellida	Glossiphoniidae	Freshwater jawless leaches		Freshwater jawless leaches			
			Araneidae	Orb Weavers	Metepeira	Metepeira sp.	Orb Weaver			
			Corinnidae	Antmimics and Ground Sac Spiders	Trachelas	Trachelas pacificus	Sac Spider			
			Dictynidae	Mesh Web Weavers			Mesh Web Weaver			
Arthropoda	Arachnida	Araneae	Gnaphosidae	Ground Spiders	Micaria	Micara sp.	Ground Spider			
			Lycosidae	Wolf spiders	Pardosa	Pardosa sp.	Thinlegged wolf spider			
			Philodromidae	Running Crab Spiders			Running Crab Spider			
			Salticidae	Jumping Spiders	Habronattus	Habronattus sp.	Jumping Spider			
			Theraphosidae	Tarantulas	Aphonopelma	Aphonopelma chalcodes	Desert blond tarantula			
			Theridiidae	Cobweb Spiders	Latrodectus	Latrodectus hesperus	Western Black Widow			
				Cobweb Spiders	Steatoda	Steatoda sp.	Cobweb Spider			
			Scorpiones	Luridae	Largetooth scorpions	Hadrurus	Hadrurus arizonensis	Arizona hairy scorpion		
			Solifugae	Eremobatidae	Straight-faced Solifugids	Eremobates	Eremobates sp.	Windscorpion		
			Branchiopoda	Cladocera	Daphniidae	Water Fleas	Daphnia	Daphnia pulex	Water Flea	
			Arthropoda	Insecta	Blattodea	Blattellidae	Wood Cockroaches	Blattella	Blattella germanica	German Cockroach
						Blattidae	Cockroaches	Blatta	Blatta orientalis	Oriental Cockroach
		Periplaneta				Periplaneta americana	American cockroach			
Coleoptera	Anobiidae	Death-watch and Spider Beetles				Ptinus	Ptinus eximius	Spider Beetle		
	Anthicidae	Antlike Flower Beetles				Ischyropalpus	Ischyropalpus sp. nr. bipartitus	Antlike Flower Beetle		
	Bostrichidae	Horned Powder-post Beetles				Amphicerus	Amphicerus cornutus	Western Twig Borer		
	Buprestidae	Metallic Wood-boring Beetle				Gyascutus	Gyascutus planicosta planicosta	Metallic Wood-boring Beetle		
						Prasinalia	Prasinalia cuneata	Metallic Wood-boring Beetle		
	Carabidae	Ground Beetles				Cymindis	Cymindis sp.	Ground Beetle		
						Galerita	Galerita bicolor	False Bombadier Beetle		
						Scarites	Scarites sp.	Ground Beetle		
	Cerambycidae	Longhorned Beetles				Derobrachus	Derobrachus hovorei	Palo Verde Root Borer		
	Chrysomelidae	Leaf beetles	Lema	Lema daturaphila	Three-lined potato beetle					
	Coccinellidae	Lady Beetles	Coccinella	Coccinella septempunctata	Seven-spotted lady beetle					
			Cycloneda	Cycloneda polita	Western Blood-Red Lady Beetle					
		Hippodamia	Hippodamia convergens	Convergent Lady Beetle						
		Olla	Olla v-nigrum	Ashy Gray Lady Beetle						
		Psyllobora	Psyllobora vigintimaculata	Twenty-Spotted Lady Beetle						
		Scymnus	Scymnus sp.	Lady Beetle						
		Stethorus	Stethorus sp. nr. punctum	Spider Mite Destroyer						
Curculionidae	Snout and Bark Beetles	Coniatus	Coniatus splendidulus	Splendid Tamarisk Weevil						
		Ophryastes	Ophryastes geminatus	Desert Weevil						
Dermestidae	Carpet beetles	Cryptorhopalum	Cryptorhopalum sp.	Carpet beetle						
Dytiscidae	Predaceous Diving Beetles	Agabetes	Agabetes sp.	Predaceous Diving Beetles						
		Agabinus	Agabinus sp.	Predaceous Diving Beetles						
		Agabus	Agabus sp.	Predaceous Diving Beetles						
		Neoclypeodytes	Neoclypeodytes sp.	Predaceous Diving Beetles						
Elmidae	Riffle Beetles	Optioservus	Optioservus sp.	Riffle Beetles						
Hydrophilidae	Water Scavenger Beetles	Berosus	Berosus sp.	Water Scavenger Beetles						
		Enochrus	Enochrus sp.	Water Scavenger Beetles						
		Tropisternus	Tropisternus sp.	Water Scavenger Beetles						
Meloidae	Blister beetles	Eupompha	Eupompha schwarzi	Blister beetle						
		Lytta	Lytta stygica	Blister beetle						
Melyridae	Soft-winged Flower Beetles	Attalus	Attalus sp.	Soft-winged Flower Beetle						
Mordellidae	Tumbling Flower Beetles	Modellistena	Mordellistena sp.	Tumbling Flower Beetle						
Nitidulidae	Sap-feeding Beetles	Cybocephalus	Cybocephalus californicus	Sap Feeding Beetle						
Scarabaeidae	Scarab Beetles	Diplotaxis	Diplotaxis knausii	Scarab Beetle						
		Phyllophaga	Phyllophaga sp.	May Beetles						
Arthropoda	Diptera	Diptera	Staphylinidae	Rove Beetles			Rove Beetles			
			Agromyzidae	Leaf Miner Flies	Liriomyza	Liriomyza sp.	Leaf Miner Fly			
			Asilidae	Robber Flies			Robber Flies			
			Bombyliidae	Bee Flies	Neodiplocampta	Neodiplocampta sp.	Bee Fly			
			Ceratopogonidae	Biting Midges	Bezzia/Probezzia	Bezzia/Probezzia sp.	Biting Midges			
					Culicoides	Culicoides sp.	Biting Midges			
					Dasyhelea	Dasyhelea sp.	Biting Midges			
			Chironomidae	Midges	Chironomus	Chironomus sp.	Midge			
					Cladotanytarsus	Cladotanytarsus sp.	Midge			
					Cricotopus	Cricotopus sp.	Midge			
					Dicrotendipes	Dicrotendipes sp.	Midge			
					Endotribelos	Endotribelos sp.	Midge			
		Pentaneura	Pentaneura sp.	Midge						
		Polypedilum	Polypedilum sp.	Midge						
		Pseudochironomus	Pseudochironomus sp.	Midge						
		Rheotanytarsus	Rheotanytarsus sp.	Midge						
		Thienemanniella	Thienemanniella sp.	Midge						
		Xestochironomus	Xestochironomus sp.	Midge						
Culicidae	Mosquitoes	Aedes	Aedes vexans	Inland Floodwater Mosquito						
		Anopheles	Anopheles franciscanus	Mosquito						
			Anopheles freeborni	Western malaria mosquito						
		Culex	Culex erythrothorax	Tule mosquito						
			Culex quinquefasciatus	Southern house mosquito						
			Culex tarsalis	Encephalitis mosquito						
		Culiseta	Culiseta inornata	Winter marsh mosquito						
Dolichopodidae	Longlegged Flies			Longlegged Flies						
Empididae	Dance Flies	Hemerodromia	Hemerodromia sp.	Dance Flies						
Ephydriidae	Shore Flies	Brachydeutera	Brachydeutera sp.	Shore Flies						
Muscidae	House Flies	Limnophora	Limnophora sp.	House Flies						
Psychodidae	Moth Flies and Sand Flies			Moth Flies and Sand Flies						
Sciomyzidae	Marsh Flies			Marsh Flies						
Simuliidae	Black Flies	Simulium	Simulium sp.	Black Flies						
Stratiomyidae	Soldier Flies			Soldier Flies						
Syrphidae	Syrphid Flies	Copestylum	Copestylum sexmaculatum	Syrphid Fly						
Tabanidae	Horse and Deer Flies			Horse and Deer Flies						
Tachinidae	Tachina Flies			Tachina Flies						
Tipulidae	Crane Flies	Limonia	Limonia sp.	Limoniid Crane Fly						

Phylum	Class	Order	Family	Family Common Name	Genus	Scientific Name	Common Name
		Embioptera					Webspinners
		Ephemeroptera	Baetidae	Small Minnow Mayflies	Baetis	Baetis sp.	Small Minnow Mayflies
					Callibaetis	Callibaetis sp.	Small Minnow Mayflies
					Camelobaetidius	Camelobaetidius musseri	Small Minnow Mayflies
					Fallceon	Fallceon quilleri	Small Minnow Mayflies
			Caenidae	Small Squaregilled Mayflies	Caenis	Caenis sp.	Small Squaregilled Mayflies
			Siphonuridae	Primitive Minnow Mayflies	Siphonurus	Siphonurus sp.	Primitive Minnow Mayflies
		Hemiptera	Aphididae	Aphids			Aphids
			Berytidae	Stilt Bugs	Pronotacantha	Pronotacantha annulata	Stilt Bugs
			Cicadellidae	Leafhoppers	Exitianus	Exitianus exitosus	Gray Lawn Leafhopper
					Homalodisca	Homalodisca liturata	Smoketree Sharpshooter
					Opsius	Opsius stactogalus	Tamarix Leafhopper
					Diceroprocta	Diceroprocta apache	Apache Cicada
			Cicadidae	Cicadas			Water Boatmen
			Corixidae	Water Boatmen			Chionaspis scale
			Diaspididae	Armored Scale Insects	Chionaspis	Chionaspis sp.	Chionaspis scale
			Geocoridae	Big-eyed Bugs	Geocoris	Geocoris pallens	Western Big-eyed Bug
			Lygaeidae	Seed Bug	Nysius	Nysius sp.	Seed Bug
					Xyonysius	Xyonysius californicus	Seed Bug
			Mesovellidae	Water Treaders			Water Treaders
			Miridae	Plant Bugs	Atomoscelis	Atomoscelis onustus	Plant Bugs
					Phytocoris	Phytocoris sp.	Plant Bugs
					Trigonotylus	Trigonotylus caelestialium	Rice Leaf Bug
			Notonectidae	Backswimmers			Backswimmers
			Pentatomidae	Stink Bugs	Brochymena	Brochymena sulcata	Rough Stink Bug
			Pentatomidae	Stink Bugs	Chlorochroa	Chlorochroa uhleri	Uhler's Stink Bug
			Reduviidae	Assassin Bugs	Rasahus	Rasahus thoracicus	Western Corsair
			Rhopalidae	Scentless Plant Bugs	Liorhyssus	Liorhyssus hyalinus	Hyaline Grass Bug
			Saldidae	Shore Bugs			Shore Bugs
			Veliidae	Small Water Striders			Small Water Striders
		Hymenoptera	Apidae	Cuckoo,Carpenter,Digger,Bumble, and Honey Bees	Apis	Apis Mellifera	Honey Bee
			Bethylidae	Bethylid Wasps	Goniozus	Goniozus sp.	Bethylid Wasp
			Ceraphronidae		Ceraphron	Ceraphron sp.	Ceraphron
			Dryinidae	Dryinids	Gonatopus	Gonatopus sp.	Dryinids
			Eulophidae	Chalcidoid Wasps	Miotropis	Miotropis sp.	Miotropis
			Formicidae	Ants	Formica	Formica xerophila	Ant
					Leptothorax	Leptothorax sp.	Ant
					Pogonomyrmex	Pogonomyrmex sp.	Harvester Ant
			Halictidae	Sweat Bees	Lasioglossum	Lasioglossum sp.	Sweat Bee
			Mutillidae	Velvet ants	Dasymutilla	Dasymutilla creusa	Velvet ant
						Dasymutilla gloriosa	Velvet ant
			Mymaridae	Fairyflies	Polynema	Polynema saga	Fairyfly
			Platygastridae				
			Pompilidae	Spider wasps	Pepsis	Pepsis chrysothemis	Tarantula hawk
			Pteromalidae	Pteromalids	Pachyneuron	Pachyneuron sp.	Pteromalid
					Pteromalus	Pteromalus sp.	Pteromalid
			Sphecidae	Thread-waisted Wasps			Thread-waisted Wasps
			Trichogrammatidae	Chalcidoid Wasps	Ufens	Ufens sp.	Ufens
			Vespidae	Yellowjackets, paper wasps, and hornets	Polistes	Polistes aurifer	Paper wasp
		Isopoda	Armadillidiidae	Pillbugs	Armadillidium	Armadillidium vulgare	Woodlouse
		Lepidoptera	Crambidae	Crambid Snout Moths	Lygropia	Lygropia octonalis	Eight-barred Lygropia
					Petrophila	Petrophila jaliscalis	Hodges #4775
			Erebidae		Notarctia	Notarctia proxima	Mexican Tiger Moth
			Hesperiidae	Skippers	Erynnis	Erynnis funeralis	Funeral duskywing
					Heliopetes	Heliopetes ericetorum	Northern white skipper
					Hesperopsis	Hesperopsis alpheus	Saltbush sootywing
						Hesperopsis libya	Mojave sootywing
					Hylephila	Hylephila phyleus	Fiery skipper
					Lerodea	Lerodea eufala	Eufala skipper
					Ochlodes	Ochlodes yuma	Yuma skipper
					Pyrgus	Pyrgus communis	Common checkered-skipper
						Pyrgus scriptura	Small checkered-skipper
			Lycaenidae	Blues, coppers, hairstreaks, and harvesters	Brephidium	Brephidium exilis	Western pygmy-blue butterfly
					Echinargus	Echinargus isola	Reakirt's blue butterfly
					Hemiargus	Hemiargus ceraunus	Ceraunus blue
					Leptotes	Manduca quinquemaculata	Marine blue
					Plebejus	Plebejus acmon	Acmon blue
					Strymon	Strymon melinus	Grey hairstreak
			Noctuidae	Owlet moths	Noctua	Noctua pronuba	Large Yellow Underwing
					Ponometia	Ponometia elegantla	Arizona Bird Dropping Moth
					Schinia	Schinia deserticola	Hodges #1134.2
					Spaelotis	Spaelotis bicava	Hodges #10926.1
					Trichocosmia	Trichocosmia inornata	Hodges #10219
			Nymphalidae	Brushfooted butterflies	Danaus	Danaus gilippus	Queen butterfly
						Danaus plexippus	Monarch
					Junonia	Junonia coenia	Buckeye
					Libytheana	Libytheana carinenta	Snout butterfly
					Nymphalis	Nymphalis antiopa	Mourning cloak
						Nymphalis californica	California tortoiseshell
					Vanessa	Vanessa atalanta	Red admiral
						Vanessa cardui	Painted lady
			Papilionidae	Swallowtails and parnassins	Papilio	Papilio polyxenes	Black swallowtail
						Papilio polyxenes coloro	Desert Black Swallowtail
						Papilio zelicaon	Anise swallowtail
			Pieridae	Whites, sulphurs and yellows	Colias	Colias eurytheme	Orange sulphur
					Eurema	Eurema nicippe	Sleepy orange
					Nathalis	Nathalis iole	Dainty sulphur
					Pieris	Pieris rapae	Cabbage white
					Pontia	Pontia protodice	Checkered white
					Zerene	Zerene cesonia	Southern dogface
			Riodinidae	Metalmarks	Apodemia	Apodemia mormo	Mormon metalmark
			Sphingidae	Sphinx moths	Hyles	Hyles lineata	White-lined Sphinx
					Manduca	Manduca quinquemaculata	Five-spotted Hawk Moth
					Pachysphinx	Pachysphinx occidentalis	Western poplar sphinx
		Mantodea	Tarachodidae	Mantids	Iris	Iris oratoria	Mediterranean Mantid

Phylum	Class	Order	Family	Family Common Name	Genus	Scientific Name	Common Name
		Neuroptera	Chrysopidae	Green Lacewings			Green Lacewings
			Coniopterygidae	Dustywings			Dustywings
			Hemerobiidae	Brown Lacewings			Brown Lacewing
		Odonata	Myrmeleontidae	Antlions	Myrmeleon	Myrmeleon sp.	Antlion
			Aeshnidae	Darners	Anax	Anax junius	Common green darner
					Rhionaeschna	Rhionaeschna multicolor	Blue-eyed Darner
			Calopterygidae	Broad-winged damselflies	Hetaerina	Hetaerina americana	American rubyspot
			Coenagrionidae	Narrow-winged damselflies	Argia	Argia alberta	Paiute Dancer
						Argia moesta	Powdered dancer
						Argia sedula	Blue-ringed dancer
						Argia sp.	Dancers
						Argia vivida	Vivid Dancer
					Enallagma	Enallagma civile	Familiar Bluet
					Ischnura	Ischnura cervula	Pacific Forktail
						Ischnura denticollis	Black-fronted Forktail
			Corduliidae	Emeralds			Emeralds
			Gomphidae	Clubtails	Erpetogomphus	Erpetogomphus compositus	White-belted ringtail
			Libellulidae	Skimmers	Erythemis	Erythemis collocata	Western Pondhawk
					Libellula	Libellula comanche	Comanche Skimmer
						Libellula luctuosa	Widow Skimmer
						Libellula saturata	Flame skimmer
					Orthemis	Orthemis ferruginea	Roseate Skimmer
					Pantala	Pantala hymenaea	Spot-winged Glider
					Sympetrum	Sympetrum corruptum	Variigated Meadowhawk
					Tramea	Tramea lacerata	Black Saddlebags
					Tramea	Tramea onusta	Red Saddlebags
		Orthoptera	Acrididae	Short-horned Grasshoppers	Leptysma	Leptysma marginicollis hebaridi	Cattail Toothpick Grasshopper
					Melanoplus	Melanoplus yarrowii	Yarrow's Spur-throat Grasshopper
					Trimerotropis	Trimerotropis pallidipennis	Pallid-winged Grasshopper
			Gryllidae	True Crickets	Miogryllus	Miogryllus lineatus	Western Striped Cricket
			Tettigoniidae	Katydid	Neoconocephalus	Neoconocephalus triops	Broad-tipped Conehead
		Thysanoptera					Thysanoptera
		Trichoptera	Glossosomatidae	Little Black Caddisflies	Culoptila	Culoptila sp.	Little Black Caddisflies
			Hydropsychidae	Netspinning Caddisflies	Smicridea	Smicridea sp.	Netspinning Caddisflies
			Hydroptillidae	Microcaddisflies	Hydroptila	Hydroptila sp.	Microcaddisflies
			Leptoceridae	Longhorned Caddisflies	Crangonyx	Crangonyx sp.	Amphipod
	Malacostraca	Amphipoda	Crangonyctidae		Hyaella	Hyaella sp.	Amphipod
			Hyaellidae		Nectopsyche	Nectopsyche sp.	White Miller
		Decapoda	Cambaridae	Crayfish and crayfishes			Copepods
	Maxillopoda				Procambarus	Procambarus clarkii	Red swamp crayfish
	Ostracoda						Seed Shrimp
							Moss Animals
	Bivalvia	Veneroida	Corbiculidae	Basket Clams	Corbicula	Corbicula fluminea	Asian Clam
Bryozoa					Corbicula	Corbicula sp.	Basket Clam
Mollusca	Gastropoda	Basommatophora	Ancylidae	Limpets			Limpets
			Lymnaeidae	Freshwater Snails			Freshwater Snails
			Physidae	Bladder Snails			Bladder Snails
			Physella	Bladder Snails	Physa	Physa sp.	Bladder Snails
		Neotaenioglossa	Thiaridae	Swamp Ceriths	Melanoides	Melanoides tuberculatus	Red-rimmed melania
Nemertea	Enopla	Hoplonemertea	Tetrastemmatidae		Prostoma	Prostoma sp.	Freshwater Nemerteans
Platyhelminth	Tubellaria						Flatworms