

# **Terrestrial Invertebrate Survey Report** for San Clemente Island, California



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COVER PHOTO: Halictid bee (Family Halictidae), photo by S. Snover.

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# Naval Auxiliary Landing Field San Clemente Island

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## Terrestrial Invertebrate Survey Final Report

### 1.0 Introduction

The goal of this project was to conduct surveys for insects at Naval Auxiliary Landing Field San Clemente Island (NALF SCI), California. Surveys were designed to develop a more comprehensive species list of invertebrate species located on SCI lands. The intent of the surveys was to establish information and evaluate the foraging base of certain terrestrial vertebrate animals, including such sensitive species as the island night lizard (*Xantusia riversiana*), San Clemente loggerhead shrike (*Lanius ludovicianus mearnsi*), San Clemente sage sparrow (*Amphispiza belli clementae*), and San Clemente island fox (*Urocyon littoralis clementae*).

### 1.1 Regional Setting

San Clemente Island (SCI) is the southernmost of the California Channel Islands (Map 1-1). From SCI it is approximately 57 miles (92 kilometers [km]) to the nearest point on the mainland (Palos Verdes) and approximately 68 nautical miles (126 km) to San Diego, California. San Clemente Island is 21 miles long (34 km), varies in width from one and one half (1-1/2) miles (2.4 km) to four (4) miles (6.4 km), and encompasses about 36,480 acres (14,764 hectares).

### 1.2 Project Background

The purpose of this project was to sample the invertebrate fauna of SCI in order to evaluate the foraging base of terrestrial vertebrate animals, including such sensitive species as the island night lizard (federal threatened species), San Clemente loggerhead shrike (federal endangered species), San Clemente sage sparrow (federal threatened species), and island fox (California threatened species). All four of these species include invertebrate prey as at least a portion of their normal diet; therefore, an understanding of the available prey base and how that prey base varies both spatially and temporally, can provide valuable information on ecological relationships. Another goal of the project was to acquire information on potential pollinator species, for which little information exists at SCI.



## 1.2.1 Entomology of the Channel Islands

Island faunas generally exhibit low diversity when compared with nearby mainland faunas of similar size (Miller 1984). However, insects represent the largest and most diverse group of organisms among the fauna of the Channel Islands, although knowledge of the diversity and distribution of insects on these islands is poorly understood (Menke 1985; Miller 1985). In support of this project's surveys, a review of published literature and on-line museum databases was conducted in an effort to assemble as complete a list of arthropod fauna for SCI as possible. That effort yielded a list of approximately 376 species, which is provided in Appendix B along with the list of data sources accessed. The total number of insect species present on SCI, however, is likely to be much higher than the number currently known since so few systematic surveys of the island have been conducted.

Several studies have been published that have systematically examined the insect faunas of the eight islands, but only for specific groups (e.g. wasps of the family Sphecidae, bees, mealybugs, lepidopterans, and orthopterans). In all of these groups SCI ranks near the lower end, among the other Channel Islands, as far as diversity is concerned (Rentz and Weissman 1981; Rust *et al.* 1985; Powell 1994). A summation of these five specific, well-studied groups shows that species diversity increases as the area of the islands increases (Figure 1-1), a result in accordance with theories of island biogeography (MacArthur and Wilson 1967).

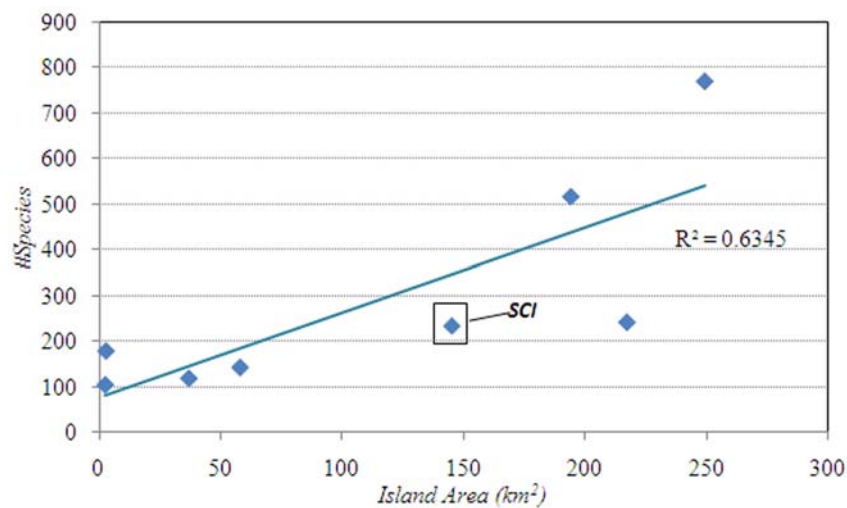


Figure 1-1. Comparison of insect diversity of five well-studied insect groups on the eight Channel Islands as a function of island area. Data compiled from three studies focusing on five specific groups of insects (see text). The numbers shown do not depict overall insect diversity for each island, which is currently unknown.

Endemism among island insect fauna is quite common (Chatzimanolis *et al.* 2010), and SCI is no exception. There are over 100 insect species endemic to the Channel Islands, 43 of which occur on SCI, including 26 that are endemic only to SCI (Miller 1985; Department of the Navy (DoN) 2002).

## 1.2.2 Feeding Behavior of Key Vertebrate Predators on San Clemente Island

### San Clemente Island Fox

Island foxes inhabit essentially all available habitats and are omnivorous, feeding opportunistically on a wide variety of fruits (toyon, lemonadeberry, cactus, cherry), insects, lizards, and rodents (Moore and Collins 1995; Center for Biological Diversity Institute for Wildlife Studies [CBDIWS] 2000; Spencer *et al.* 2006). Selection of food items appears to be determined largely by availability, which varies by habitat, as well as seasonally and annually. One study found that island fox diets on SCI were comprised of 57.7% invertebrate prey, 20.5% plant material, and 21.6% vertebrates (Phillips *et al.* 2007). At certain times of the year island foxes were documented to feed heavily on orthopterans (grasshoppers) (CBDIWS 2000).

### San Clemente Loggerhead Shrike

Shrikes forage from elevated perches, taking a variety of prey, primarily including insects and spiders, but also some lizards, birds and small mammals (U.S. Fish and Wildlife Service [USFWS] 1984, Institute for Wildlife Studies [IWS] 2011). The diet of the San Clemente loggerhead shrike is related more to prey abundance, detectability, and size than it is to specific prey type (USFWS 1984; Collins 2008; IWS 2011).

### Sage Sparrow

Sage sparrows feed primarily by gleaning prey from the ground or from plants, and their diet consists primarily of seeds (and other plant material) and invertebrates (USFWS 1984).

### Island Night Lizard

Island night lizards are omnivorous, feeding on a mix of plant and invertebrate items (USFWS 1984). While night lizard species on the mainland rely mostly on invertebrate prey, with relatively little plant material in their diets, the island night lizard was found to have a more evenly balanced diet of both animals and plants (Brattstrom 1952). Beetles, isopods, ants, seeds and leaves are the primary food items of this lizard (Brattstrom 1952).

## 1.2.3 Climate

San Clemente Island and the waters surrounding it are located in the Southern California Bight (SCB), a recessed curve in the southwestern California coastline from Point Conception in Santa Barbara County to just south of the U.S.-Mexican border. San Clemente Island is the southern-most member of the Channel Islands group. The islands belong to the Mediterranean Dry Summer Subtropical climatic type, where the sea has a strong moderating influence on air temperatures across all seasons (Yoho 2000). Diurnal differences in temperature are generally small and characterized by relatively cool days and warm nights. Of the eight Channel Islands, SCI is the driest (DoN 2002), and the island experiences dramatic fluctuations in annual rainfall even over relatively short time spans. Most rainfall that occurs on SCI falls from October to April. Typically, rainfall on SCI between May and October is insignificant, but fog drip during the dry season, partic-



ularly beneath broad leaf evergreen plants, is an additional source of moisture to the SCI ecosystem during the dry season (Fischer *et al.* 2008; Fischer 2007; Moody 2000). Average annual rainfall on SCI is 6.4 inches.<sup>1</sup>

## 1.2.4 Island Vegetation

The flora of SCI is similar to that of the mainland's coast with important exceptions. The Island is rich in endemics, most of which are relictual, but some are a result of divergent island evolution (Axelrod 1967). Endemics comprise 13% (47 out of 272) of the island's plant species, the largest proportion and the most number of species of any of the eight Channel Islands (Moody 2000). San Clemente Island's vegetation is currently mapped in 13 community categories (Table 1-1; Sward and Cohen 1980), and include grasslands dominated by a mix of both native and non-native grasses and forbs; shrublands defined as maritime desert scrub (MDS) dominated by California boxthorn (*Lycium californicum*) or maritime sage scrub (MSS) sagebrush (either California sagebrush (*Artemisia californica*) or island sagebrush (*A. nesiotica*)); and canyon woodlands dominated by a variety of native tree species including canyon oaks (*Quercus tomentella*), Catalina cherry (*Prunus ilicifolia* spp. *lyonii*), or Catalina Island ironwood (*Lyonothamnus floribundus* spp. *asplenifolius*).

Table 1-1. Terrestrial habitats, acreages and percentages of Island area for San Clemente Island (Sward and Cohen 1980).

Terrestrial Habitats	Acres	% of Island area
Canyon woodland	696.2	1.9
Maritime desert scrub - Boxthorn	3621.0	9.7
Maritime desert scrub - Boxthorn / Grassland	2188.8	5.9
Maritime desert scrub - Complex (terrace faces & terrace flats)	8921.4	23.9
Maritime desert scrub - Pyramid Cove and south-facing slopes	1611.5	4.3
Maritime sage scrub (northeast escarpment & canyon walls and canyon escarpments)	6228.2	16.7
Grasslands - loamy soils	5275.9	14.2
Grasslands - clay soils	5383.7	14.5
Active sand dunes	223.8	0.6
Stabilized sand dunes	412.9	1.1
Coastal strand	166.8	0.4
Coastal salt marsh	19.3	0.1
Sea bluff succulent	36.0	0.1
Developed	359.1	1.0
Unmapped	916.1	2.5

1. Data compiled from six weather stations located around San Clemente Island and operated by Cal State Northridge, and a seventh station operated by the National Park Service. Although the data covers the time period from 1996 to 2010, the data from each individual station is discontinuous and incomplete. Only data where a complete year's worth of data is available for a given station was used to calculate the overall annual mean precipitation over the period of record.

## 2.0 Methods

### 2.1 Sampling Locations

The selection of sampling sites for this study was based on evaluation of a number of criteria:

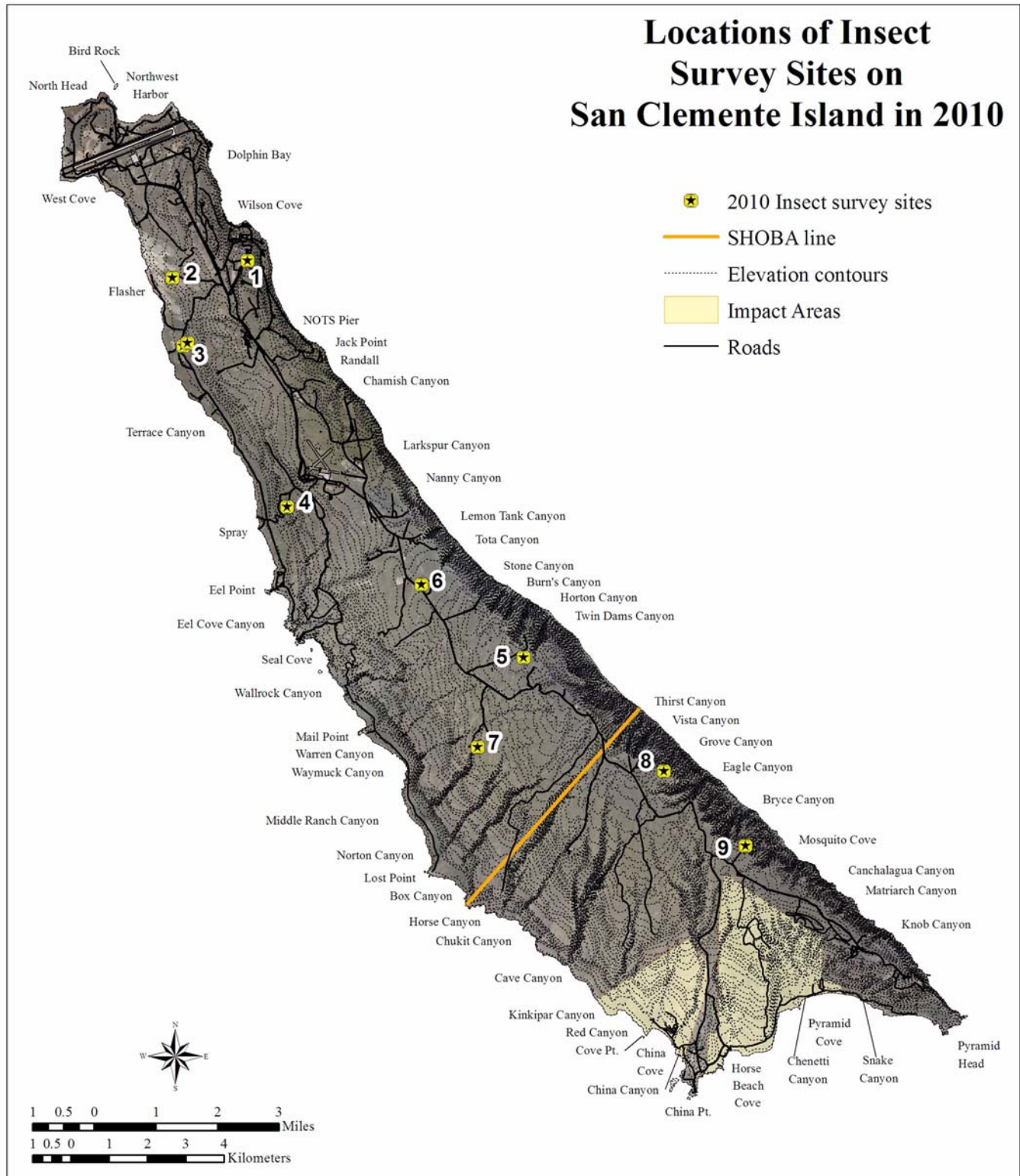
- Representative vegetation types, as depicted in the existing island-wide vegetation/ecosite map (Sward and Cohen 1980).
- Island fox monitoring grids (U.S. Navy GIS data layer, modified 2001).
- San Clemente sage sparrow habitat based on a geographic information system (GIS) layer depicting medium or high density habitat (U.S. Navy GIS data layer, modified 2010).
- San Clemente loggerhead shrike locations, based on locations dated 2006-2010 (U.S. Navy GIS data layer); sampling sites were kept well clear of 2010 occupied nests.
- Island night lizard habitat (medium or high density habitat), based on a GIS layer depicting density of night lizards island-wide (Mautz 2000).

Taking all of the above into consideration, nine sampling locations were established for this project. Table 2-1 provides the general location and vegetation types for each sampling site, and Map 2-1 shows the locations of the nine sampling sites. Appendix A provides photographs and descriptions of each survey site.

Table 2-1. Nine invertebrate sampling sites established on San Clemente Island in 2010.

Site ID	Location description	Vegetation type
1	Natural Resources Office greenhouse vicinity	Maritime Desert Scrub (MDS) boxthorn*
2	Dune area	Active sand dunes
3	Northwest terrace flat	MDS boxthorn
4	Terrace flat west of VC-3	MDS complex, terrace flat
5	Plateau above Twin Dams Canyon	High plateau fine loamy grassland
6	Plateau above Tota Canyon	High plateau clay grassland
7	Upper edge of Middle Ranch Canyon	MDS complex, terrace flat
8	Oak woodland at LCTA plot #5, south of Vista Canyon	Oak woodland
9	Escarpment edge south of Bryce Canyon	Maritime sage scrub (MSS)*

\*Although both of these sites are mapped in the Island-wide vegetation map as 'High plateau grassland', the specific locations of the sampling sites are shrub-dominated, Site 1 by California boxthorn and Site 9 by California sagebrush.



Map 2-1. Locations of nine invertebrate sampling sites established on San Clemente Island in 2010.

## 2.2 Sampling Methods

Invertebrate surveys were conducted and documented so that future surveys can duplicate the effort and compare results. Surveys were designed to assess the biodiversity of both day- and night-active invertebrates. In order to capture shifts in invertebrate abundance and species composition through spring and summer, each sampling site was sampled at least twice. All but two were sampled three times. Site #8 could not be sampled during the May-June sampling phase, due to access issues into the Shore Bombardment Area (SHOBA). Site #1 was not sampled during the August sampling phase, due to weather conditions. A schedule of site visits and personnel involved in the invertebrate surveys at NALF SCI in 2010 is shown in Table 2-2.

Table 2-2. Sampling dates and locations of invertebrate surveys on Naval Auxiliary Landing Field San Clemente Island in 2010, with weather conditions on the day the visual surveys were conducted\*.

Date	Sites Visited	Weather Conditions*
May-June Sampling		
5/8 - 5/9/10	5	Clear, sunny, light breeze (ave. <1mph, max. 4.7 mph), 78°F
5/15 - 5/16/10	9	Partly sunny, some drifting fog, light breeze (ave. 1.5 mph, max. 3.4 mph), 66°F
	1	Partly sunny, breezy (ave. 8.3 mph, max. 12 mph), 66°F
6/19 - 6/20/10	7	Mostly sunny, some coastal clouds, winds 5-10 mph, 62°F
6/25 - 6/26/10	6	Sunny, breezy (ave 3.8 mph, max. 9.7 mph), 64.5°F
6/26 - 6/27/10	2	Partly sunny, breezy (ave 7.8 mph, max. 9.6 mph), 66°F
	3*	Overcast, breezy (ave. 4.5 mph, max. 7.5 mph), 64°F
July Sampling		
7/9 - 7/10/10	8	Sunny, light breeze (0-5 mph), 70°F
7/10, 7/18/10**	2	Partly sunny, breezy (ave. 4.9 mph, max. 5.7 mph), 67°F
7/10, 7/17/10**	9	Mostly cloudy, winds 0-5 mph, 60°F
7/11 - 7/17/10**	4	Partly sunny, breezy (ave. 3 mph, max. 7 mph), 69°F
7/11 - 7/12/10	5	Partly cloudy, winds 5-6 mph, 65°F
7/11 - 7/12, 7/18/10	3	Partly to mostly cloudy, light breeze (ave. 1.9 mph, max. 3.4 mph), 76°F
7/16 - 7/17/10	1	Sunny, breezy (ave. 7.5 mph, max. 9.8 mph), 70.5°F
	7	Sunny, light breeze (ave. 4 mph, max. 5.5 mph), 75.5°F
7/18 - 7/19/10	6	Sunny, light breeze (ave. 1.3 mph, max. 2.8 mph), 81°F
August Sampling		
8/19 - 8/20/10	7	Sunny, light breeze (ave. 1.7 mph, max. 3.1 mph), 87°F
	6	Sunny, light breeze (ave. 1.3 mph, max. 3.7 mph), 75°F
8/20 - 8/21/10	2	Partly to mostly cloudy, breezy (ave. 6 mph, max. 9.9 mph), 69°F
	5	Sunny, light breeze (ave. 1.1 mph, max. 5.5 mph), 89°F
8/21 - 8/22/10	3	Sunny, breezy (ave. 4.1 mph, max. 7.4 mph), 70°F
	4	Partly cloudy, breezy (ave. 6 mph, max. 8 mph), 66°F
8/22 - 8/23/10	9	Sunny, light breeze (ave. 2.4 mph, max. 2.7 mph), 88°F
	8	Sunny, light breeze (ave. 1.5 mph, max. 2.5 mph), 81°F
*Each site would have been visited twice on each sampling visit, the first day to set out the stationary traps, the second to retrieve them. The visual surveys would be done one which of the two days had suitable weather conditions, and it is these conditions that are depicted here. In all but one instance at least one of the days at each site saw suitable conditions for the visual surveys to be conducted, the lone exception being Site #3 in June when no visual surveys could be conducted.		
**Conditions on the first date shown were not suitable to conduct the visual survey. The site was re-visited on the second date shown to conduct the visual survey. The weather conditions shown are for the day the visual survey was conducted.		

Passive collection methods were primarily employed to eliminate both the sampling bias generated by an investigator's collecting proficiency, and to enhance the repeatability of the project. Each sampling location included an array of various collection methods, which are described below. All sampling locations were mapped using an ortho-rectified aerial photograph in the field or global positioning system (GPS) and then converted to an ESRI ArcView shape file in the GIS laboratory. The following sections of this report detail the collection methods for different guilds and species of special interest.

## 2.2.1 Weather Constraints

Since weather conditions play a crucial role in insect activity patterns, a portable weather gauge, a Kestrel<sup>®</sup> 3000 meter, used to monitor and record weather conditions, was carried at all times determining if conditions were suitable to conduct insect surveys at each sample site. The weather conditions on SCI can be highly variable, not just day-to-day but hour-by-hour and from one locale to another. For example, heavy overcast and cold at the north end of the island may contrast with bright sun and warmth further south. The winds are also quite variable from one area to another during the day. This was primarily a concern for the visual surveys as cold temperatures or severe winds keep insects, by their inactivity, from being detected. Other sampling methods could be hampered as well. In May and June weather was a particular constraint because conditions were consistently foggy, very cold and very windy, in which case no insect surveys of any kind were attempted.

Survey protocols required by the USFWS for surveying endangered butterflies (e.g. the Quino checkerspot [*Euphydryas editha quino*]) were referenced. The USFWS protocol states surveys cannot be conducted if any of the following conditions apply:

- fog, drizzle, or rain
- sustained winds greater than 15 miles (24 kilometers) per hour (mph) measured 4-6 feet (1.2-1.8 meters) above ground level
- temperature in the shade at ground level less than 60°F (15.5°C) on a clear, sunny day; or less than 70°F (21°C) on an overcast or cloudy day

Wind was a constant constraint in early phases of the surveys, especially in May and June. At that time Tierra Data Inc. (TDI) personnel were also conducting vegetation surveys on SCI, along with insect sampling, as time and conditions allowed. However, during that time, sustained winds of 10-15 mph, with gusts as high as 30+ mph, were a daily occurrence. Extreme wind conditions severely limited conducting insect surveys for much of that time period; however, eventually each site was visited. The lone exception was Site #8, due to limited SHOBA access during survey months and access subsequently denied on a day originally scheduled for work in SHOBA with permission.

## 2.2.2 Ground-Dwelling Insects

For the collection of both ground-dwelling and flying insects, three pitfall traps were set at each sampling location (Photo 2-1). The pitfall traps consisted of a rectangular (6.5" x 12" x 1") plastic tray set on the ground as flat and level as possible. Since no ground disturbance activities were allowed during this survey, due to ordnance and cultural resources issues, the pans could not be set flush with the ground as is typical for this type of trapping. Instead, a supply of pot-

ting soil, provided by Natural Resources Office (NRO) greenhouse personnel was used to build a ramp around the pan from the ground to the pan lip allowing potential for ground-dwelling organisms to get caught (test runs of this modified method were conducted at the TDI offices, where found to be effective). Approximately one inch of killing fluid/attractant (a mixture of water, salt, dish soap, and yellow food coloring) was added to each pan, and a wire cage of quarter-inch mesh was placed over the trap to prevent accidental capture of non-target taxa. A general location for each pan trap was selected randomly within a radius of approximately 10-15 meters. At least one of the three pans was placed under the edge of a shrub canopy, with one or both of the other pans placed in the open, among annual forbs and grasses and in perennial plant interspaces.

The traps were retrieved the following day by transferring the contents of each pan to plastic containers, sealed with a tight-fitting lid, then transported to the lab for species identification. Samples were preserved in a 70% solution of isopropyl alcohol.



*Photo 2-1. A pan trap (left) with protective mesh cage.*

### **2.2.3 Nocturnal Flying Insects**

To sample nocturnal flying insects one automated blacklight trap (Photo 2-2) was set at each sampling location. These traps (John W. Hock Co., Trap Model 1212) consisted of a 4-watt blacklight, electric fan, hood, collection net, killing jar, and a battery pack of four, D-size batteries. Two methods were employed for mounting light traps. The first was to hang the light trap from a tree or shrub branch, taking care that the cord from the battery pack to the light was not hanging in such a way that wildlife could become entangled. However, since many of the sampling locations lacked tall shrubs or other existing vertical structures with sufficient clearance for the traps (at least 1 meter clearance is required to allow the traps to hang freely), a frame constructed of PVC piping was used at these locations. The traps were set to run overnight. Insects flying into the trap were captured in a killing jar containing approximately one inch of killing fluid (listed above). Trapped insects were collected the following morning, brought back to the lab, and preserved in alcohol for identification.



Photo 2-2. Black light traps mounted in (left) an oak tree at Site #8 and (right) a PVC frame at Site #4.

## 2.2.4 Sweep Netting

Sweep netting of the vegetation at each sampling location was conducted on each site visit. Sweep netting collects a large number of insect taxa that are not generally prone to collection by stationary traps. So that the sweep sampling could be duplicated and standardized, a set protocol was used to govern the number of sweeps taken. Two biologists, each with a sweep net, took 25 sweeps each (a sweep counted each time the net struck vegetation) from a representative sampling of the vegetation at each location. Sweepers took their samples using one of two protocols: directionally or by vegetation strata. Directional sampling required the two biologists to move outward from the center of the sampling location in two different, non-overlapping directions. If two strata of vegetation were present (e.g. grasses/forbs and shrubs), one biologist sampled one strata and the other sampled the second strata. In all cases, care was taken not to overlap or otherwise disturb the vegetation prior to sweeping.

One constraint on the sweep net surveys imposed by the vegetation at SCI was an inability to sample cactus patches in this way. Several sites had large patches of prickly pear (*Opuntia littoralis*) (Photo 2-3). Even though TDI used heavier canvas nets (as opposed to the more standard mesh nets) that allowed sweep sampling on California boxthorn (although the nets still could only graze along the top of the boxthorn canopy with little or no penetration as allowed by other shrub species) and non-native grasses (which can quickly ruin a mesh net with seeds), the canvas nets could not be used on prickly pear. Where cactus patches were present, visual surveys took place (see below) and at least one pan trap was placed in or on the edge of the cactus patch. In this way the insect fauna of the cactus patches could be assessed, if not directly sampled.



Photo 2-3. Prickly pear patches at Site #7.

Resulting sweep samples were collected in paper sacks, stapled shut, labeled, transported to the lab, and placed in a freezer to kill the collected insects before sorting and identifying took place. Freezing, rather than preservation in alcohol, is preferred for sweep samples because of the vegetation material unavoidably collected during the sweeping process along with any insects. Since the insects must be removed from the plant debris under a dissecting microscope, dry material is much easier to process than material soaked in alcohol. Also, freezing tends to yield specimens that are more conducive to pinning for the voucher collection (see below), whereas specimens preserved in alcohol tend to shrivel considerably when pinned and dry out (unavoidable for the pan and light traps).

### **2.2.5 Visual Surveys (for butterflies and other macro-invertebrates)**

Visual surveys in the form of walks were conducted for diurnally active lepidopterans and other large taxa such as grasshoppers and dragonflies, generally not sampled using the above mentioned techniques (Photo 2-4). These surveys occurred concomitantly during field work associated with pan and light trap installation, and sweep netting. To conduct the visual surveys the field crew walked a route through the surrounding area, identifying and recording on data sheets all insects seen. The walks lasted approximately 15-20 minutes and followed a meandering round-trip route from the trap locations and back. Butterflies or other taxa that can be recognized on the wing were recorded. Those that could not be easily identified were captured, identified in the field (and subsequently released) or collected and returned to the lab for identification there.





Photo 2-4. Conducting a visual survey at Site #5.

## 2.2.6 Miscellaneous Collections and Active Black- Lighting

### Miscellaneous Collections

In addition to the above described sampling methods, which were conducted systematically to enable site-to-site comparisons of insect fauna, a number of miscellaneous collections were made. While these collections cannot be included in the analysis of prey abundance for vertebrate insect predators, they provided some interesting additions to the species list compiled from the 2010 surveys. Most of the species acquired in this manner were completely random encounters, well away from the established sampling sites, particularly around buildings in the developed areas such as the NRO facilities and residential buildings. Records are included in the species list (Appendix B) but are not otherwise included in the analyses.

### Active Black Light Trapping

One limitation of the automated trap is the size of insect that can be captured, as only insects measuring no more than about three to four centimeters (cm) can enter the trap. This excludes some larger insects, especially larger moths and beetles. In an attempt to add to the species list a larger black light array was designed and set up to actively monitor for insect activity. For the August sampling period, an array composed of PVC piping, white sheets and a battery operated black-light was constructed and used as an attractant to draw nocturnal invertebrates (Photo 2-5). The active black light array was set up around dusk and allowed to run for an hour attracting insects to the white sheet. Using sweep nets and kill jars, the field device captures the insects as they arrive and land on the white sheet.

The array was utilized twice in August, once each from the nearest road access point to Sites #3 and #5. In each case the road is located within 25 meters of the sampling site. Since most sites are located too far from the roads for the equipment (most particularly the battery) to be carried into place, only two sampling sites were attempted. Therefore the samples obtained from near Sites #3 and #5 are intended only as an effort to add to the species list and were not used in the prey base analysis.



Photo 2-5. Active black light trap.

## 2.3 Sample Processing and Identification

### 2.3.1 Sample Processing

For the pan trap and light trap samples, which were preserved in alcohol, the samples were run through a strainer (~1 millimeter [mm] mesh size), transferred into a sorting tray (a plastic tray approximately 2.5" by 4") and placed under a dissecting microscope. Using forceps all invertebrate animals were removed from the debris matrix, consisting of varying amounts of the potting soil used to construct the trap ramps, some of which unavoidably falls into the pan during the process. The material is generally strained at least twice to ensure that all animals are removed. The animals are first set aside into a second tray onto a moistened piece of filter paper to prevent the specimens from drying out. Once all animals have been sorted out, the filter paper is placed under the scope and the extracted animals sorted out by taxa (i.e. all flies of a certain type placed together in one portion of the filter, a second fly

type, if present, in another spot, beetles in their own spots on the paper, etc.). This secondary sorting helps organize the specimens and facilitates the counting and identification process (see Section 2.3.2).

Sweep samples are run through metal sieves (2 mm and 1 mm mesh size) to separate the sample into multiple portions to facilitate the sorting process. The largest plant material (comprised of leaves and twigs of the shrubs and trees that were swept) and largest insects remain in the 2 mm sieve, which can be quickly sorted, then discarded once the insects are removed. With the large material sorted, the smaller sized items are easier to handle. The bulk of the insects are usually found in the material caught on the 1 mm sieve, the material passing through that sieve usually contains small numbers of the very smallest taxa (e.g. thrips, aphids, mites, etc.). During the sorting process the animals are handled the same way as described above, placing them first in a secondary tray, then separating into taxonomic groups for identification.

### **2.3.2 Identification of Distinct Taxa**

Identification of insects to the species level, or even to genus level, is difficult at best. Much time and effort is required to work through highly technical taxonomic keys or search through museum collections to identify even one species, much less the number of species typically collected in studies such as this one. Showy or well-known species were identified to species when specifically illustrated by a reliable reference source. Certain groups, such as butterflies, grasshoppers, and ants can be identified to species with a reasonable effort. However, to identify most of the insects collected during this study to every reasonable effort was put forth to distinguish distinct types within each Order and Family based on readily observable morphological features (color, size, wing vein patterns, etc.). For example, if two flies identified as belonging to the same Dipteran family showed clear morphological differences from one another, they were entered into the insect database as varieties 'A' and 'B' for that family (e.g. flies from the family Muscidae would be designated as 'Muscid fly A', 'Muscid fly B', etc.).

A variety of reference sources were used to aid in the identification of collected specimens:

General insects:

- Peterson Field Guide to the Insects (Borror and White 1970)
- American Insects: A Handbook of the Insects of America North of Mexico (Arnett 2000)
- California Insects (Powell and Hogue 1979)
- Bug Guide web site (<http://www.bugguide.net>)

Insect Orders- Books:

- How to Know the Spiders (Kaston 1978)
- Field Guide to Grasshoppers, Katydid, and Crickets of the United States (Capinera *et al.* 2004)
- Dragonflies and Damselflies of California (Manolis 2003)
- Plant Galls of California and Other Western States (Russo 2006)
- An Introduction to Southern California Butterflies (Heath 2004)

- Peterson Field Guides: Beetles (White 1983)
- Peterson Field Guides: Western Butterflies (Opler 1999)
- Ants of North America (Fisher and Cover 2007)
- Manual of Nearctic Diptera (McAlpine *et al.* 1981)

Insect Orders- Web sites:

- Ant Web (<http://www.antweb.org>)
- Singing Insects of North America (<http://buzz.ifas.ufl.edu>)
- Ants of North America (<http://www.cs.unc.edu/~hedlund/ants>)
- Field Guide to Common Western Grasshoppers (<http://www.sdvc.uwyo.edu/grasshopper>)
- California Insect Survey (<http://essig.berkeley.edu/pages/cispubs.htm>),
- Butterflies & Moths of North America (<http://www.butterfliesandmoths.org>)
- Manual of Nearctic Diptera (<http://www.esc-sec.ca/aafcmonographs>)

San Clemente Island insects:

- Faunal Affinities, Systematics, and Bionomics of the Orthoptera of the California Channel Islands (Rentz and Weissman 1981)
- Entomology of the California Channel Islands (Menke and Miller 1985)

Voucher specimens of most taxa collected were preserved, pinned, labeled and organized in collection boxes to use as reference while processing the collected samples. Also, brief verbal descriptions or simple drawings were made to help track various types collected, especially within the Diptera (flies), Homoptera (leaf hoppers), and Hemiptera (true bugs) Orders. In this way it was possible to determine if a particular insect was the same as one collected earlier, or was in fact, a new type.

### 2.3.3 Data Analysis

The following basic summary statistics were calculated:

- species richness (i.e. the number of species present), summarized by sampling site, sampling method, and sampling period
- numbers of arthropods collected or recorded, also summarized by sampling site, sampling method, and sampling period
- frequency distributions of size classes in the arthropods collected or recorded.

In order to understand the differences and similarities of the nine sampling sites, and therefore gain some insight into the variability of the insect fauna across SCI, two simple indices were employed to calculate both diversity (as opposed to species richness) of the fauna at each sampling site and the degree of similarity among all sites. For these calculations, only those records assigned to a unique taxonomic entity were used. Records identified simply as 'moth, small', 'spider, medium' etc. (as opposed to 'Moth A' or 'Spider B2', which carry descriptions allowing them to be recognized wherever they were found) were excluded, since such general designations do not allow for direct comparison from one site to another.

### Intra-Site Species Diversity

Species diversity indices take into account not only the number of species present but also the number of individuals of each that was collected. The index we chose was Menhinick's Index (Magurran 1988). Menhinick's Index ( $I_M$ ) is calculated as:

$I_M = S/\sqrt{N}$ , where  $S$  is the number of species in a sample and  $N$  is the total number of individuals in the sample.

Menhinick's Index approaches zero when there are fewer taxa but more individuals and increases as the number of taxa increases relative to the number of individuals. Another way to look at it is that Menhinick's Index increases inversely to the average number of individuals per taxa (Figure 2-1).

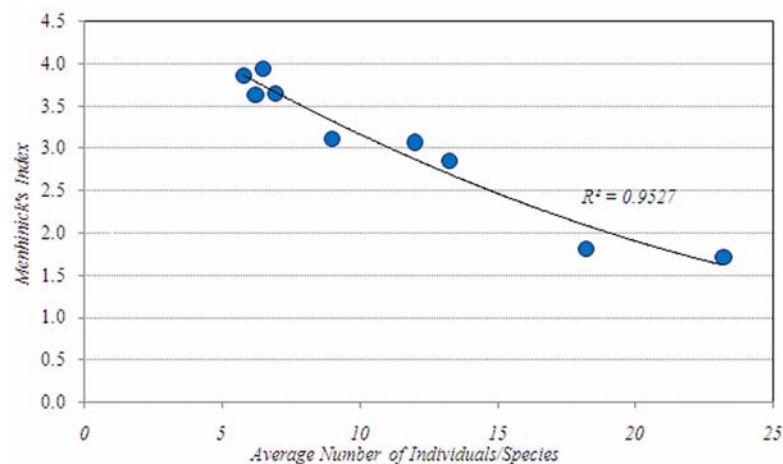


Figure 2-1. Plot of Menhinick's Index of species diversity against the average number of individuals per species collected at a given locale (plot based on data collected by this study).

### Inter-Site Similarity

The index chosen was the Sørensen Index, also known as Sørensen's similarity coefficient (Sørensen 1957). Sørensen's Index ( $I_S$ ) is calculated as:

$I_S = 2C/A+B$ , where  $A$  and  $B$  are the number of species in each of two samples being compared to one another, and  $C$  is the number of species shared by the two samples.

Sørensen's Index tends to increase in value as the numbers species shared by two sample sets increases (Figure 2-2), and ranges from a value of 0 if no species are shared and 1 if all species are shared by the two datasets.

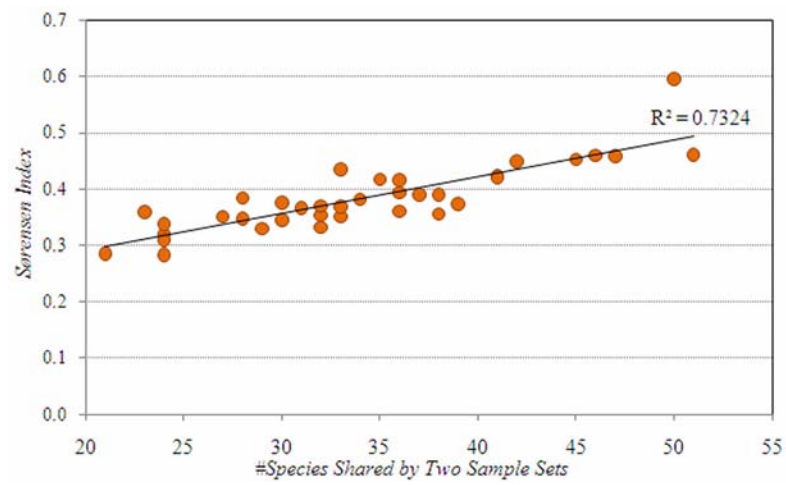


Figure 2-2. Plot of Sørensen's Index of similarity against the number of species shared by two data sets (plot based on data collected by this study).

## 3.0 Results

### 3.1 Species Richness

A total of 351 distinct taxa were collected or observed during the course of these surveys, representing 23 Orders and 150 Families (Table 3-1). Approximately 90 of these taxa are represented by only one collected specimen. The greatest species richness was seen in the bees and wasps (Order Hymenoptera) with 68 taxa, followed by the flies (Order Diptera) with 66 taxa (including several that could not be placed in a Family with the reference materials at hand) and the beetles (Order Coleoptera) with 39 taxa. Voucher specimens will be housed at the Santa Barbara Museum of Natural History under the care of Michael Caterino.

Among the various sampling methods utilized in these surveys, the sweep net samples and pan traps yielded the greatest number of taxa (Table 3-2). Although the black light traps and walking surveys recorded far fewer taxa, both yielded a number of taxa that were not collected from the sweeps and pans. An additional 40 species were found only in the miscellaneous collections made during the course of the project.

The sweep net samples consistently collected the greatest number of taxa per sample on average than the other sampling methods (Table 3-3). The number of taxa per sample did not change appreciably between survey periods.

*Table 3-1. Summary of insect taxa found at San Clemente Island in 2010. ('+' indicates that there are likely more Families within the indicated Orders that could not be fully identified).*

Order	#Families	#Taxa
<b><i>Non-Insect Orders</i></b>		
Ixodida (Mites & Ticks)	1+	5
Araneida (Spiders)	7	21
Opiliones (Harvestmen)	1	1
Pseudoscorpionida (Pseudoscorpions)	1	1
Scorpionidae (Scorpions)	1	1
Geophilomorpha (Centipedes)	1	1
Spirostreptida:Diplopoda (Millipedes)	1	1
Isopoda (Pill bugs)	1	1
<b><i>Insect Orders</i></b>		
Coleoptera (Beetles)	19	39
Collembola (Springtails)	3	3
Dermaptera (Earwigs)	1	1
Diptera (Flies)	36	66
Hemiptera (True bugs)	14	32
Homoptera (Aphids & Plant hoppers)	8	49
Hymenoptera (Ants, Bees & Wasps)	26	68
Lepidoptera (Moths & Butterflies)	10+	35
Neuroptera (Lacewings & Ant lions)	4	4
Odonata (Dragonflies & Damselflies)	2	2
Orthoptera (Crickets & Grasshoppers)	5	7
Psocoptera (Bark lice)	3	4

Table 3-1. Summary of insect taxa found at San Clemente Island in 2010. ('+' indicates that there are likely more Families within the indicated Orders that could not be fully identified).

Order	#Families	#Taxa
Thysanoptera (Thrips)	1	5
Thysanura (Silverfish)	2	2
Zygenstoma (Firebrats)	1	1
Unknown*	1	1
<b>Total</b>	<b>150</b>	<b>351</b>

\*This was a gall with pupal case inside that was found on a grass blade in a sweep sample. The pupal case bore the impressions of wings, so it was either a moth, fly or a wasp.

Table 3-2. Number of taxa and number of unique taxa collected by the four sampling methods utilized in this study.

Sampling method	#Total taxa	#Unique taxa not represented in any other collection method
Sweep netting	206	106
Pan traps	192	94
Light traps	47	19
Walking surveys	44*	21
Miscellaneous collections	87	40

\*Not counting 36 records such as 'fly, large' that could not be correlated with one of the species on the species list or voucher collections

Table 3-3. Average number of taxa per sample by sampling method and survey period.

Method	May-June	July	August
Pans	13.0	10.7	12.0
Sweeps	20.4	17.7	16.1
Walks	9.7	11.0	10.5
Lights	3.7	4.9	5.9

Among the various ecosites sampled, the number of taxa captured or recorded varied greatly (Figure 3-1). The greatest number of taxa was found on the High Plateau fine loamy grassland site (Site #5), and the lowest number was found on the MDS Boxthorn sites (Sites #4 and #7). On all ecosites, the pan traps and sweep netting captured by far the greatest diversity of arthropods.



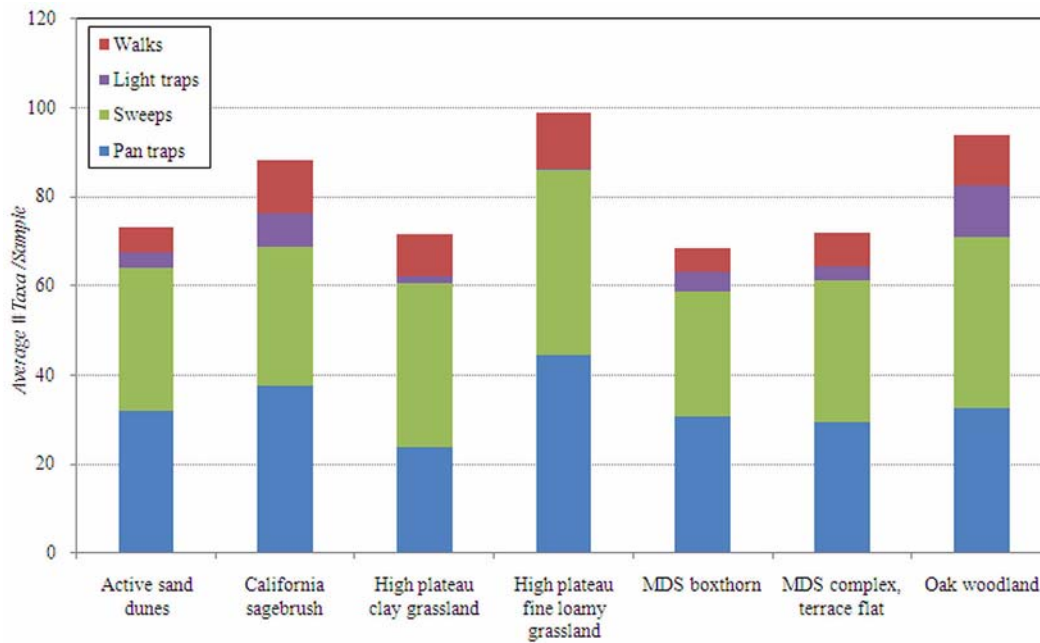


Figure 3-1. Average number of taxa captured/recorded by four sampling methods by ecosite. Data is averaged across all sampling periods.

### 3.2 Abundance

A total of 10,758 individual arthropods was collected or recorded by the four sampling methods employed in these surveys, with sweep netting accounting for approximately half (Table 3-4). For the most part the average number of arthropods recorded in the three sampling periods was very similar (Figure 3-2). One exception was the May-June sweep samples, which collected considerably more arthropods than in either of the subsequent sampling periods.

Table 3-4. Number of arthropods collected/recorded by four sampling methods utilized on SCI in 2010.

Sampling method	#Individuals	Average #/Sample	May-June	July	August
Pan traps	3914	54.4	68.5	45.7	49.0
Sweep netting	5026	100.5	144.1	72.8	88.2
Light traps	516	22.4	25.0	21.1	21.6
Walking surveys	1302	59.2	63.5	64.1	51.0

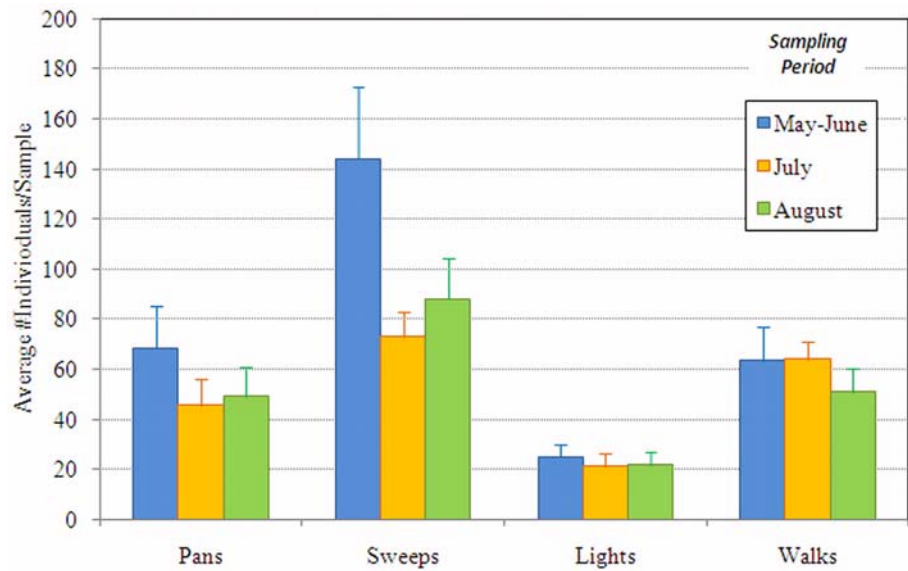


Figure 3-2. Mean number of arthropods (s.e.) collected/recorded by four sampling methods utilized on SCI in 2010.

Among the various ecosites sampled, the number of arthropods captured or recorded varied greatly (Figure 3-3). The greatest number of individuals were found on the high plateau fine loamy grassland site (Site #5), and the lowest number was found on the MDS Complex terrace flat sites (Sites #4 and #7). On both grassland ecosites the sweep samples accounted for the great majority of arthropods found, while on every other ecosite the pan traps tended to catch the most individuals.

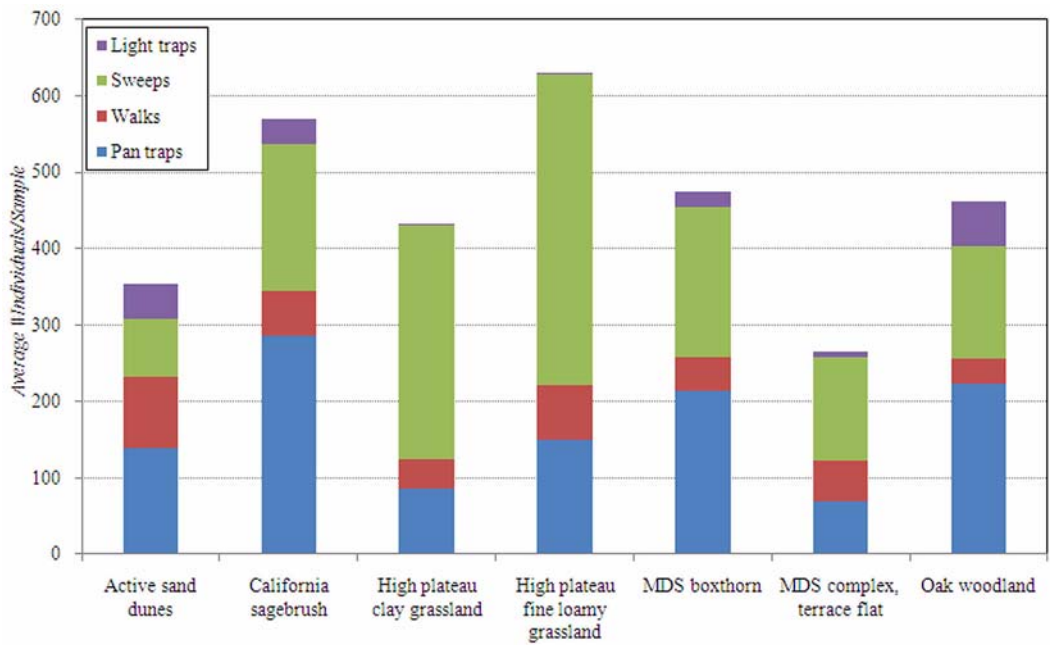


Figure 3-3. Average number of arthropods captured/recorded by four sampling methods by ecosite. Data is averaged across all sampling periods.

### 3.3 Arthropod Size Distribution

Most of the arthropods collected or recorded during the 2010 surveys were in the 2-5 mm size range, which were primarily found in the pan and sweep samples (Figure 3-4). Most of the arthropods in the larger size classes (11 mm and greater) were sampled in the walking visual surveys, as would be expected, since the pans and light traps only catch animals up to a certain size (~10 mm diameter).

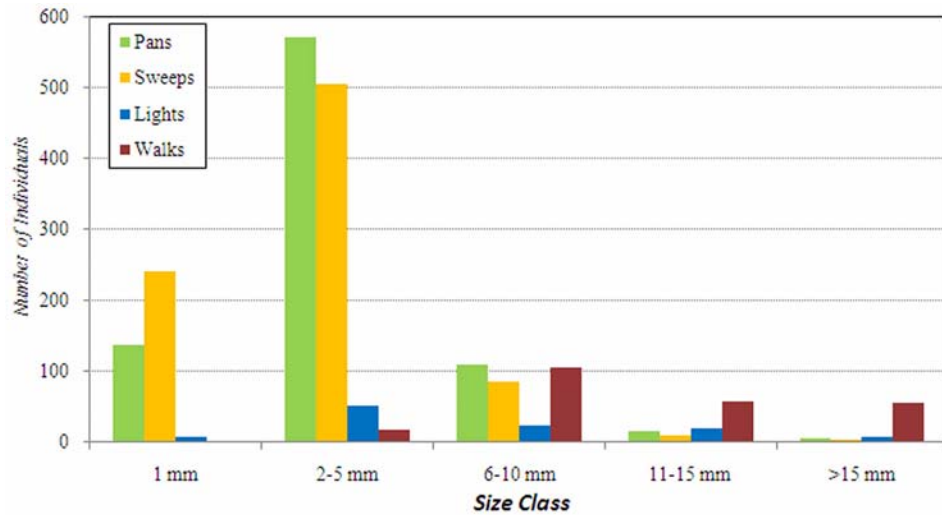


Figure 3-4. Size class distribution of arthropods captured/recorded by four sampling methods on San Clemente Island in 2010.

The two largest size classes (11-15 mm and > 15 mm) are comprised primarily of four Orders: flies (Order Diptera), bees and wasps (Order Hymenoptera), moths and butterflies (Order Lepidoptera, primarily moths), and grasshoppers and kin (Order Orthoptera) (Table 3-5 and Figure 3-5). Moreover, the abundance of these groups vary over time, with moths being the dominant form in early spring (May-June sampling period), including 31% as caterpillars. In July, although moths are still abundant, Orthopterans, primarily grasshoppers, account for more than twice the number of moths, and by August nearly all of the largest insects are grasshoppers.

Table 3-5. Numbers of large insects (>10 mm) by sampling period on San Clemente Island in 2010.

Sample Period	Total#	Flies	Bees & Wasps	Butterflies	Moths	Grasshoppers, etc.	Others
May-June	320	36	45	39	132 (31% as caterpillars)	64	4
July	516	17	22	65	123 (20% as caterpillars)	281	6
August	301	16	15	16	15 (all adults)	230	9

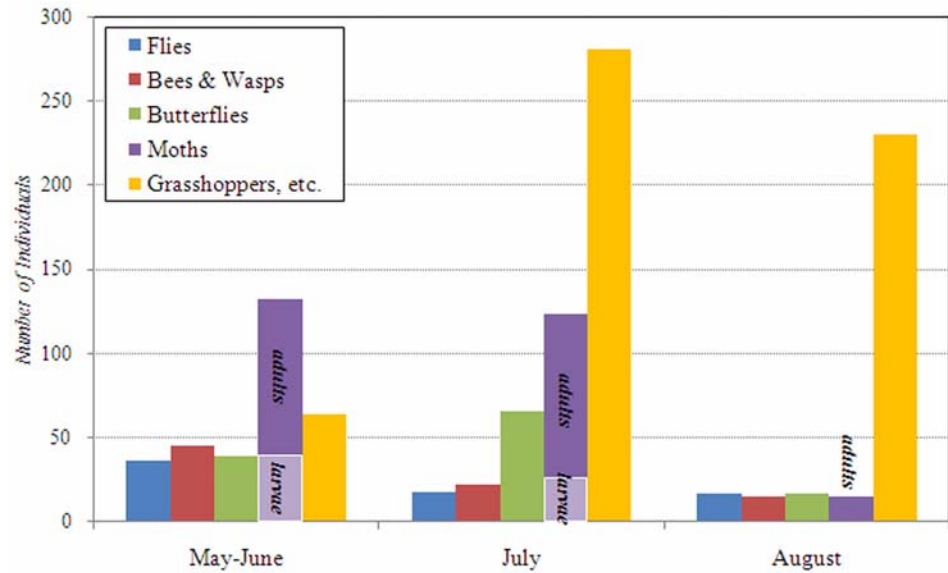


Figure 3-5. Numbers of large insects (>10 mm) in five major taxonomic groups by sampling period on San Clemente Island in 2010.

The distribution of large insects varied greatly among the ecosites sampled (Figure 3-6). The active sand dune site (Site #2) consistently had one of the highest counts of large insects in all three sampling periods, primarily comprised of grasshoppers and moths (Figure 3-7). Large insects were also abundant at the California sagebrush site (Site #9). The High plateau clay grassland site (Site #6) consistently had one of the lowest large insect counts in all three sampling periods.

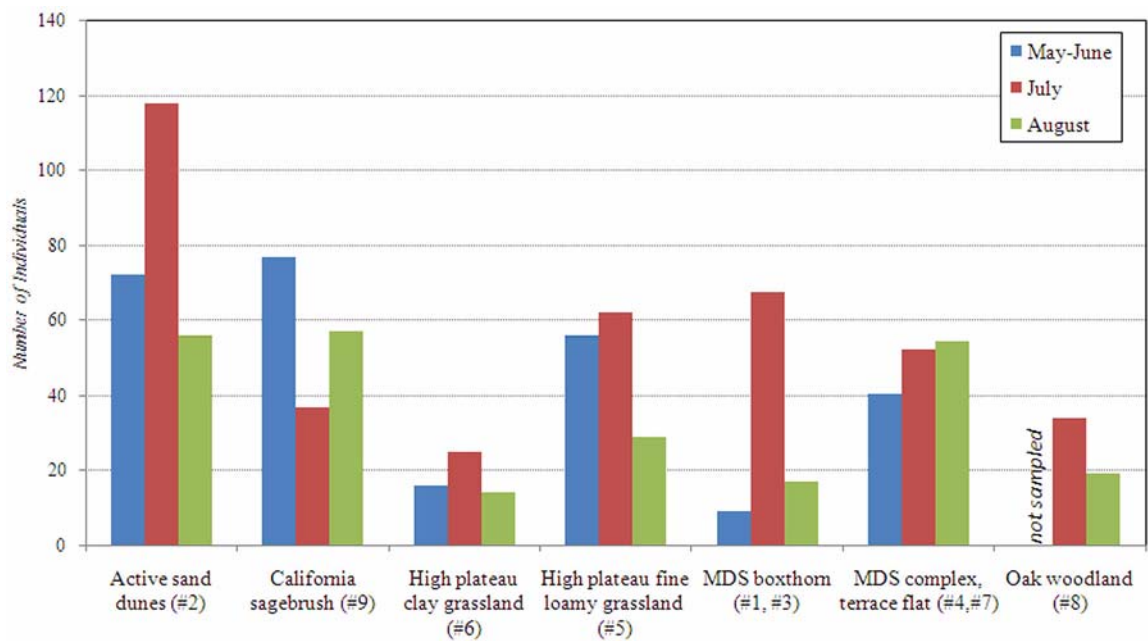


Figure 3-6. Distribution of large insects (>10 mm) by ecosite on San Clemente Island in 2010.

The taxonomic composition of the large insects varied greatly between the sites, especially in the relative contributions of Lepidoptera and Orthoptera (Figure 3-7), where the large insects at Sites 1, 3, and 4 were comprised primarily of Orthopterans, especially Site #3. Sites #5 and #8 had far more large Lepidopterans than Orthopterans.

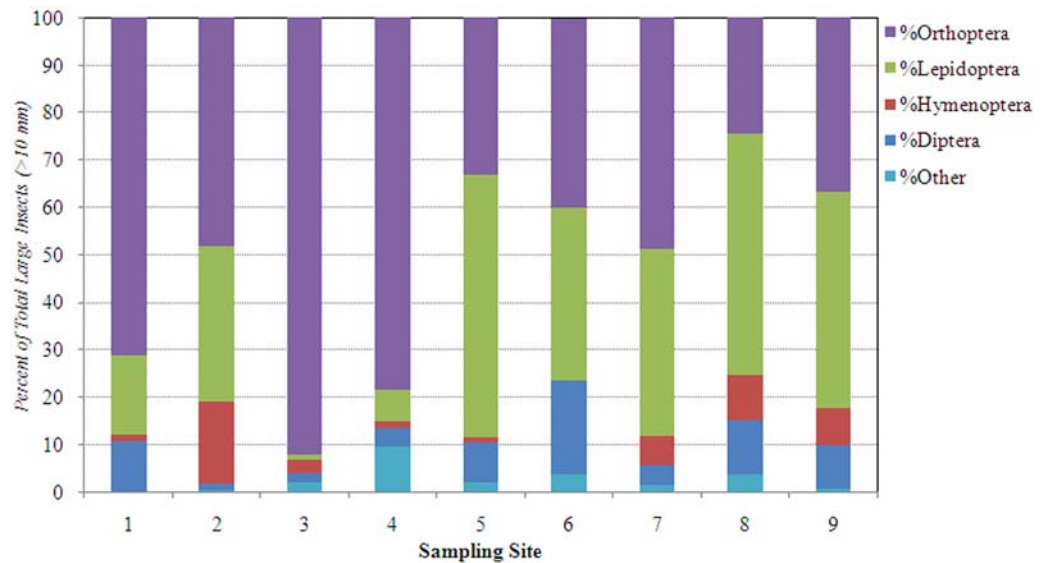


Figure 3-7. Percent taxonomic composition of large insects at each of 9 sampling locations on San Clemente Island in 2010.

### 3.4 Sampling Site Diversity and Similarity Indices

#### 3.4.1 Intra-Site Taxonomic Diversity

Calculation of Menhinick’s Index for each of nine sampling sites yielded values of between 1.71 (Site 1) and 3.95 (Site 2) (Table 3-6). The difference between simple taxonomic richness and Menhinick’s Index is readily apparent. Whereas Site #5 ranks first in taxonomic richness, with 113 unique taxa, it drops toward the lower end of the scale in taxonomic diversity (M.I.=3.07), indicating a predominance of a few taxa with many rare taxa present. Site #9 similarly drops from the 2nd highest taxonomic richness to the 7th lowest diversity. Meanwhile, Site #3 and #4, both of which rank among the lowest in taxonomic richness, received higher diversity indices, indicating relatively equal numbers present among taxa encountered.

Table 3-6. Calculation of Menhinick’s Index for each of nine sampling sites on San Clemente Island in 2010.

Summary statistics	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Vegetation Type	MDS-Boxthorn	Active sand dune	MDS-Boxthorn	MDS complex, terrace flat	Grassland	Grassland	MDS complex, terrace flat	Oak woodland	MSS
Total Taxonomic Richness	68	101	82	86	113	60	92	87	108
Total Count	1577	655	508	496	1353	1093	638	781	1429
Ave. #Indiv/Taxa	23.2	6.5	6.2	5.8	12.0	18.2	6.9	9.0	13.2
Menhinick’s Index	1.71	3.95	3.64	3.86	3.07	1.81	3.64	3.11	2.86

### 3.4.2 Inter-Site Similarity

Inter-site similarity was fairly consistent overall (Table 3-7), with an average Sørensen Index of 0.38 and a range of 0.28 - 0.60, with most (64%) pair-wise comparisons falling in the 0.35-0.4 range. The highest similarity index ( $I_S = 0.60$ ) was seen when comparing Sites #3 and #4, and the lowest similarity index ( $I_S = 0.28$ ) between Sites #1 and #2.

Table 3-7. Sørensen Indices for pair-wise comparisons of nine sampling sites on San Clemente Island in 2010.

Site#	Vegetation Type	1	2	3	4	5	6	7	8	9
1	MDS-Boxthorn	-	0.28	0.32	0.35	0.35	0.36	0.38	0.31	0.33
2	Active sand dune	0.28	-	0.39	0.45	0.36	0.35	0.33	0.35	0.37
3	MDS-Boxthorn	0.32	0.39	-	0.60	0.39	0.34	0.34	0.37	0.39
4	MDS complex, terrace flat	0.35	0.45	0.60	-	0.45	0.38	0.38	0.37	0.42
5	Grassland	0.35	0.36	0.39	0.45	-	0.42	0.46	0.36	0.46
6	Grassland	0.36	0.35	0.34	0.38	0.42	-	0.43	0.29	0.42
7	MDS complex, terrace flat	0.38	0.33	0.34	0.38	0.46	0.43	-	0.37	0.46
8	Oak woodland	0.31	0.35	0.37	0.37	0.36	0.29	0.37	-	0.42
9	MSS	0.33	0.37	0.39	0.42	0.46	0.42	0.46	0.42	-
Mean		0.335	0.361	0.392	0.426	0.406	0.373	0.395	0.354	0.409

## 4.0 Discussion

Insects are considered a key faunal group for defining the complex nature of biodiversity, and the condition of the insect fauna may be indicative of overall ecosystem health (Entomological Society of America [ESA] 2010). Documenting the species inhabiting a given area is fundamental to understanding that ecosystem's biodiversity. On SCI, the insect fauna, while certainly depauperate compared to the mainland fauna in areas of similar size as anticipated (Miller 1984), is still quite diverse. The 2010 surveys documented a total of 351 arthropod taxa. When compared with the compilation of previous lists for SCI (see Appendix B), the following observations were made:

- 48 of 185 families in the compiled list from previous studies are not represented in the 2010 list, including an estimated 83 taxa.
- Another 25 families are under-represented in the 2010 list compared to the compiled list, including an estimated 146 taxa.

However:

- there are 72 families in the 2010 list that do not appear in the compiled list, including 138 taxa, and
- in 10 families, there were more taxa found in 2010 than had appeared in the compiled list, including 49 taxa.

Combining the 2010 list with the compilation of previous lists would raise the island species list to approximately 536 total taxa. Since the list resulting from the 2010 surveys was primarily based on nine very specific and quite small areas, clearly the island arthropod list would only continue to expand if additional surveys were to be conducted in more areas. Even among the samples collected during these surveys new taxa were added to the list with nearly every sample processed until the last few were done.



Figure 4-1. Some of the invertebrates species found at San Clemente Island in 2010. From left: digger bee (Family Apidae), dragonfly (Order Odonata), halictid bee (Family Halictidae).

The pan traps and sweep netting were clearly the most effective methods in capturing both a diversity of arthropod fauna and overall numbers, despite the limitations imposed on sweep-netting by the prevalence of boxthorn and cacti at some locations. It is possible that alternative methods such as some form of vacuum-type sampler might have collected some additional taxa and we recommend that future studies consider adding such methods to the sur-

vey protocols. However, given the generally woody condition of boxthorn, with little or no green vegetative structures providing a food source for invertebrates, especially later in the season, there were likely very few taxa missed.

The black light traps and visual surveys functioned more to fill in gaps by documenting taxa not captured by the other methods, although the visual surveys are quite useful in documenting the larger fauna that provide an important food source for vertebrate predators.

There appeared to be little seasonality in the abundance data collected with the exception of the larger fauna (>10 mm), where moths were the most abundant large insects early on and grasshoppers in the later sampling periods. This was especially true in August when nearly all of the large insects were grasshoppers. While additional sampling even later into the year might have produced further insights into the seasonal distribution and abundance of insect fauna on SCI, the sampling times for this study likely captured the peak period of overall abundance and diversity. While an additional sampling period later in the summer or early fall might have picked up a few additional taxa, during late fall and winter the climate conditions on the island are too cold to allow for much insect activity. Even in the early spring and during the early portion of our surveys conditions were often not favorable, with little observed insect activity due to excessive winds and cold temperatures.

There were some clear differences in the insect fauna among the ecosites that were sampled. One curious observation was the difference between the two types of grassland, where the loamy grassland site had the highest species richness and overall abundance while the clay grassland sites was among the lowest in both measures. With only one sample site in each type, this could simply be a result of the two specific sites chosen, and only a larger sample size from additional sites could discern if there truly is a difference in the insect fauna in these two ecosites.

### **Special Note: Caterpillar Outbreak**

Starting in the early spring of 2010 an apparently unprecedented (for SCI) caterpillar outbreak occurred (Photo 4-1). Swarms of large 'teddy bear'-type caterpillars appeared over nearly the entire island. These caterpillars were identified as Nevada tiger moth caterpillars (*Grammia nevadensis*) (Photo 4-1, upper right). The NRO personnel on the island stated that in their experience such an outbreak had not been previously seen on SCI. The degree of herbivory observed was extreme in many areas, with nearly every forb and even low sub-shrubs stripped nearly bare to the stems. Only grasses appeared excluded from the caterpillars' diet (note the grasses left behind in Photo 4-1). Oddly, though, only a handful of adult moths were observed later in the year; two were collected inside buildings in Wilson Cove and two were collected by a black light trap. Very little predation of the caterpillars was observed by TDI personnel during the course of these surveys except by crows feeding on caterpillars killed on the roads, although others on the island observed predation by starlings, meadowlarks, and horned larks (M. Booker, pers. comm., 2011). It may be that the extremely dense, stiff hairs covering the caterpillars' bodies made them unpalatable to predators. With the numbers observed, and apparent lack of predation, the lack of adults observed is difficult to explain. It may be that many were parasitized by other insects, a



common occurrence, or perhaps retreated underground into soil cracks waiting for the following spring to complete development. There were many caterpillars seen sheltering deep in soil cracks as late as August, when few were seen moving about in the open. Observations in the spring of 2011 by island personnel have reported far fewer caterpillars present than were seen in 2010, although still more than have been seen in previous years (M. Booker, pers. comm., 2011). If these caterpillar outbreaks continue at the levels observed in 2010 and 2011, there could be a significant impact on the island's vegetation rich in endemic species.



Nevada tiger moth  
(*Grammia nevadensis*)

*Photo 4-1. Tiger moth caterpillar swarm. In this photo, the caterpillars (the darker reddish-brown patches) are moving in a swath from left to right. Note that nearly all of the yellow flowered goldfields (*Lasthenia glabrata*), abundant on the right side of the image, are almost completely removed from the left side. While this photo was not taken at one of the insect sampling locations, this same scene was playing out across the island in the Spring of 2010.*

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# Appendix A: Insect Sampling Site Descriptions

## Site #1

<b>Location:</b> NRO, near greenhouse	<b>Ecosite:</b> High plateau clay grassland	
<b>UTM83 Coord.:</b> E 354879.6  N 3651952.0	<b>Vegetation:</b> Site dominated by California boxthorn and non-native grasses, with <i>Opuntia</i> and <i>Calystegia</i> .	
	<b>Elevation:</b> 425 ft.	
<b>Directions:</b> Located behind the NRO greenhouse. Use utility pole to secure light trap.		



**Site #2**

<b>Location:</b> Dunes	<b>Ecosite:</b> Active sand dunes	
<b>UTM Coord.:</b> E 352910.7 N 3651503.9	<b>Vegetation:</b> Sparse <i>Ambrosia</i> and <i>Astragalus</i> up high, lower down more grasses and <i>Melilotus</i> .	
	<b>Elevation:</b> 200 ft.	
<b>Directions:</b> Walk down eroded road until it peters out to nothing, then across the ice plant and CALMAC flats and up onto the top of the dune.		



**Site #3**

<b>Location:</b> North-West Terrace Flat	<b>Ecosite:</b> MDS Boxthorn	
<b>UTM Coord.:</b> E 353298.7 (353192.8)* N 3649792.1 (3649717.9)*	<b>Vegetation:</b> Dense California boxthorn and Prickly pear.	
	<b>Elevation:</b> 75 ft.	

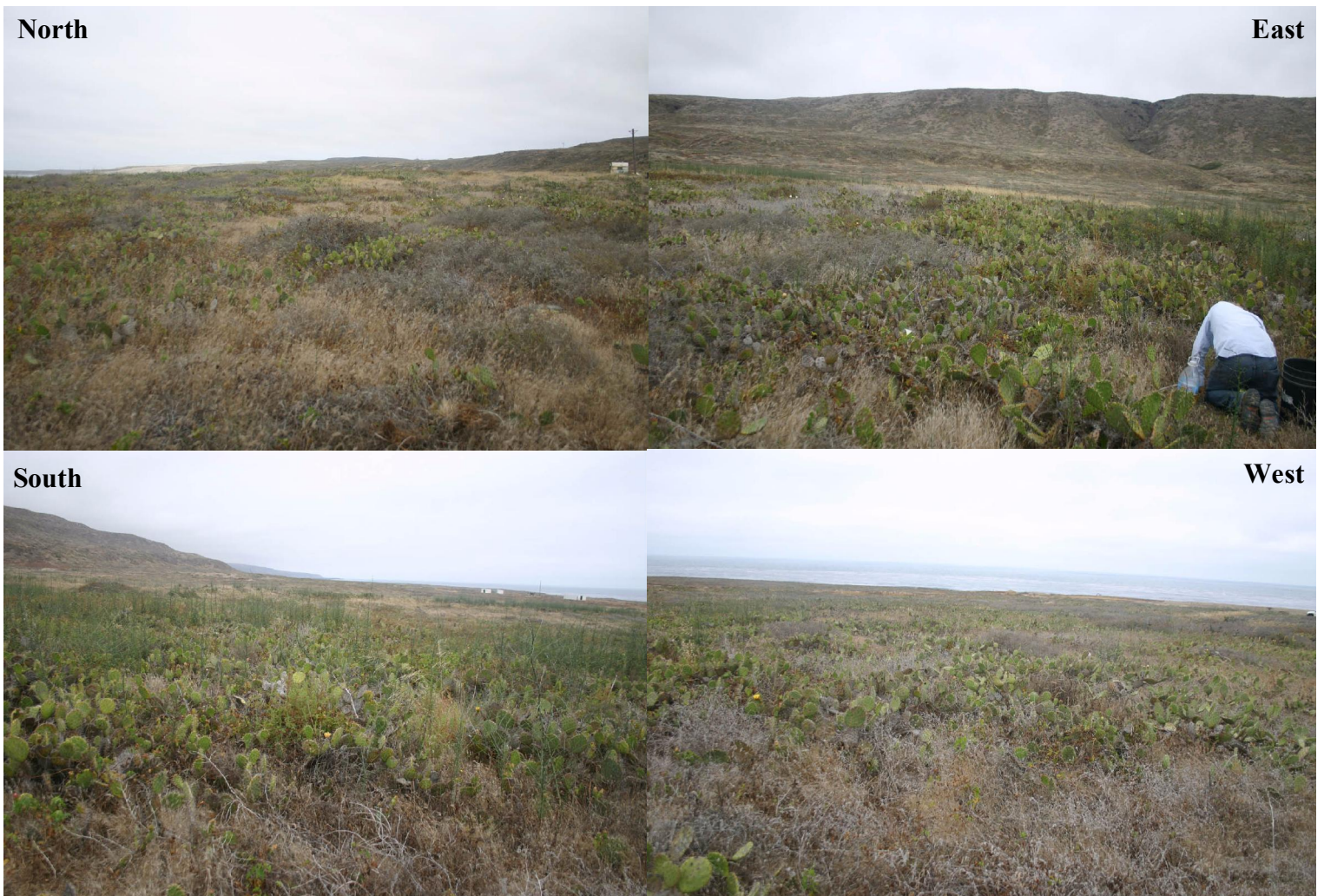
**Directions:** Drive down from Ridge Rd. and park near the dilapidated trailer\*. Walk out to odd-looking iron 'tripod' thing, which serves well for fastening the light trap.

\*Site was moved for 2nd and 3rd passes to a more accessible location ~120m from 1st pass location. First set of coord. shown and directions apply to the new location. Coord. of original location given in parentheses.



**Site #4**

<b>Location:</b> Spray	<b>Ecosite:</b> MDS complex, terrace flat	
<b>UTM Coord.:</b> E 355911.0 N 3645498.4	<b>Vegetation:</b> California boxthorn and Prickly pear, interspersed with non-native grasses.	
	<b>Elevation:</b> 475 ft.	
<b>Directions:</b> Park at end of road loop and walk south to old barbed wire fence. Hang light trap on fence.		





**Site #5**

<b>Location:</b> above Twin Dams Canyon	<b>Ecosite:</b> High plateau fine loamy grassland	
<b>UTM Coord.:</b> E 362105.6 N 3641566.3	<b>Vegetation:</b> Mostly non-native grasses with some Baccharis shrubs. Site includes a more mesic, low-lying area of lolium grass.	
	<b>Elevation:</b> 1600 ft.	
<b>Directions:</b> Drive 1.5 km. down old dirt road, park in pull out area. Walk out ~160 m south to clump of Baccharis shrubs on edge of mesic depression. Place light trap on Bacharis shrub.		



**Site #6**

<b>Location:</b> off Tank Rd. south of VC3	<b>Ecosite:</b> High plateau clay grassland	
<b>UTM Coord.:</b> E 359426.7 N 3643472.6	<b>Vegetation:</b> Non-native grasslands with a lot of <i>Deinandra clementina</i> and <i>Baccharis pilularis</i> .	
	<b>Elevation:</b> 1230 ft.	
<b>Directions:</b> Drive ~3.5 km. past last structures of the VC3 complex, turn off toward tank road, then continue on ~300 m. and park. Walk over to utility poles. Secure light trap to pole.		



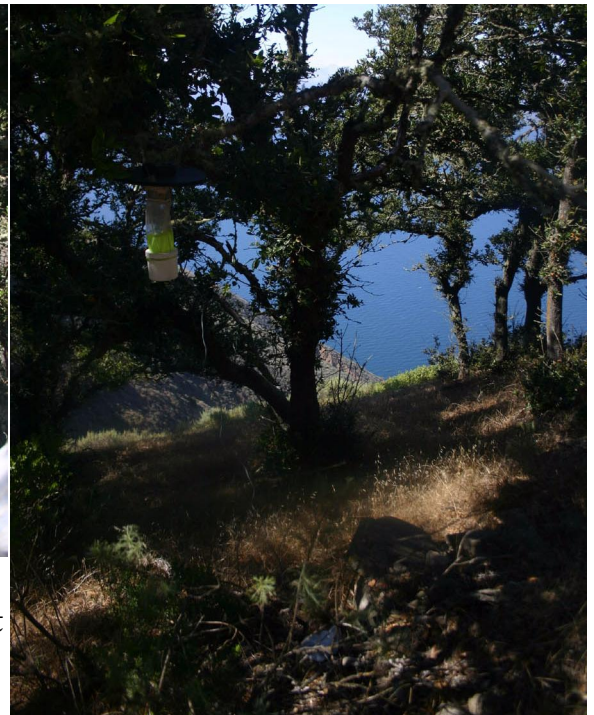
**Site #7**

<b>Location:</b> above Middle Ranch Canyon	<b>Ecosite:</b> MDS complex, terrace flat	
<b>UTM Coord.:</b> E 360910.0 N 3639218.1	<b>Vegetation:</b> Calystegia and Opuntia clumps interspersed with non-native grassland, with a few shrubs around (BACPIL, HETARB)	
	<b>Elevation:</b> 1325 ft.	
<b>Directions:</b> Drive down paved and dirt roads ~1.3 km., park at pull-out location at turning circle. Walk out ~400 m. along foot path until you see the large shrubs out toward the edge of the plateau. Place light trap on Heteromeles shrub.		



**Site #8**

<b>Location:</b> top of Grove Canyon	<b>Ecosite:</b> MSS-canyon walls and escarpments	
<b>UTM Coord.:</b> E 365785.6 N 3638590.3	<b>Vegetation:</b> Oak woodland, walking surveys extended up into Sagebrush/Grasslands above the woodland.	
	<b>Elevation:</b> 1560 ft.	
<b>Directions:</b> Drive out paved road ~500 m and park. Walk south-east another 500 m. or so, and drop down into oak woodland- you'll see an old fence, follow that downward ~30 m. to plot location.		



North

East



West



South

**Site #9**

<b>Location:</b> South-east Escarpment edge	<b>Ecosite:</b> High plateau fine loamy grassland	
<b>UTM Coord.:</b> E 367915.7 N 367915.7	<b>Vegetation:</b> California sagebrush, interspersed with native and non-native grasses. Some Prickly pear and Calysegia clumps.	
	<b>Elevation:</b> 1310 ft.	
<b>Directions:</b> Drive ~600 m. to end of dirt road, park in circle. Walk up into sagebrush scrub on escarpment edge.		



**North**



**East**



**South**



**West**

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# Appendix B: Species Lists

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# NALF San Clemente Island Compiled Species List, Previous Studies

The species list provided below represents a compilation of available reference sources, both in print and from on-line databases, for San Clemente Island documenting the insect fauna of the island prior to the 2010 surveys conducted for this study. Most of the references cited below cover only specific groups of insects and should not be considered a comprehensive list of the island's insect fauna.

## ***Data Sources***

*(Codes used in species table shown in parentheses)*

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Essig Museum of Entomology, California Insect Survey, [california\\_insect\\_survey.shtml](http://california_insect_survey.shtml). (CIS)

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Miller, Scott E. (Miller)

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Insect species list provided to TDI by E. Howe, SCI Botany lab, in 2010. (SCI NRO)

*Also:* A number of unpublished sources (see below) are cited as sources for the species lists presented in the Integrated Natural Resources Management Plan (INRMP) for San Clemente Island, dating back at least to the 2002 edition. There are 30 species in the INRMP list that are not attributable to one of the reference sources listed above, such that the list in the INRMP is the only currently available source for those species. Whether any of the species unattributable to the above sources originated from these unpublished sources is unknown. (INRMP)

### Unpublished References:

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# NALF San Clemente Island Compiled Species List, Previous Studies

Order	Family	Sub-Family	Species name	Common Name	Notation	Source
Araneida	Zodariidae		<i>Lutica clementea</i>	Ground spider	SCie	INRMP, Miller
Coleoptera	Anobiidae		<i>Xarifa insularis</i>	Death-watch beetle	Cie	INRMP, CBP, Miller
Coleoptera	Anthricidae		<i>Ischyropalpus nitidulus</i>	Ant-like flower beetle		CBP
Coleoptera	Attelabidae		<i>Temnocerus aureus</i>	Leaf rolling weevil		CBP
Coleoptera	Attelabidae		<i>Temnocerus insularis</i>	Leaf rolling weevil		CBP
Coleoptera	Carabidae		<i>Akephorus marinus</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Amara aurata</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Amara californica</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Amara clementina</i>	Ground beetle	SCie	Miller
Coleoptera	Carabidae		<i>Amara insularis</i>	Ground beetle	SCie	INRMP, CBP, Miller
Coleoptera	Carabidae		<i>Anchomenus funebris</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Bembidion insulatum</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Bembidion striola</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Bembidion versicolor</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Calathus ruficollis</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Calosoma eremicola</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Celia clementina</i>	Ground beetle		INRMP
Coleoptera	Carabidae		<i>Cicindela oregona</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Cicindela senilis</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Dicheirus dilatatus dilatatus</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Dicheirus piceus</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Platynus brunneomarginatus</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Pterostichus gliscans</i>	Ground beetle	SCie	CBP, Miller
Coleoptera	Carabidae		<i>Pterostichus isabellae</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Pterostichus laetulus</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Pterostichus menetriesii</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Tachys corax</i>	Ground beetle		CBP
Coleoptera	Carabidae		<i>Tanystoma maculicolle</i>	Ground beetle		CBP
Coleoptera	Carabidae	Harpalinae	<i>Pterostichus sp.1</i>	Ground beetle		SCI NRO
Coleoptera	Carabidae		<i>Carabidae sp. 1*</i>	Ground beetle	U	SCI NRO
Coleoptera	Cerambycidae		<i>Cerambycidae sp. 1</i>	Longhorn beetle		SCI NRO
Coleoptera	Chrysomelidae	Alticinae	<i>Phyllotreta pusilla</i>	Leaf beetle		CBP
Coleoptera	Chrysomelidae	Bruchinae	<i>Acanthoscelides pullus</i>	Leaf beetle		CBP
Coleoptera	Chrysomelidae	Cryptocephalinae	<i>Diachus auratus</i>	Leaf beetle		CBP
Coleoptera	Chrysomelidae	Eumolpinae	<i>Colaspidea smaragdula</i>	Leaf beetle	Cie	CBP, Miller
Coleoptera	Chrysomelidae	Galerucinae	<i>Erynephala puncticollis</i>	Leaf beetle		CBP
Coleoptera	Chrysomelidae	Galerucinae	<i>Monoxia sordida</i>	Leaf beetle		CBP
Coleoptera	Cleridae		<i>Necrobia ruficollis</i>	Checkered beetle		CBP
Coleoptera	Cleridae		<i>Necrobia rufipes</i>	Checkered beetle		CBP
Coleoptera	Coccinellidae		<i>Coccinella californica</i>	California lady beetle		CBP
Coleoptera	Coccinellidae		<i>Coccinella johnsoni</i>	Johnson's lady beetle		CBP
Coleoptera	Coccinellidae		<i>Coccinellidae sp. 1*</i>	Lady beetle	U	SCI NRO
Coleoptera	Coccinellidae		<i>Delphastus catalinae</i>	Lady beetle		CBP
Coleoptera	Coccinellidae		<i>Hippodamia convergens</i>	Convergent lady beetle		CBP
Coleoptera	Coccinellidae		<i>Hippodamia quinquesignata</i>	Five-spotted lady beetle		CBP
Coleoptera	Coccinellidae		<i>Rhyzobius lophanthae</i>	Lady beetle		CBP
Coleoptera	Corylophidae		<i>Corylophidae sp. 1</i>	Minute hooded beetle		SCI NRO
Coleoptera	Cryptophagidae		<i>Cryptophagidae sp. 1</i>	Silken fungus beetle		SCI NRO
Coleoptera	Curculionidae	Entiminae	<i>Trigonoscuta clemente</i>	Snout beetle		CBP
Coleoptera	Curculionidae	Entiminae	<i>Trigonoscuta clemente</i>	Snout beetle		CBP
Coleoptera	Curculionidae	Entiminae	<i>Trigonoscuta clemente isola</i>	Snout beetle		CBP
Coleoptera	Curculionidae	Entiminae	<i>Trigonoscuta clemente</i>	Snout beetle		CBP
Coleoptera	Curculionidae	Entiminae	<i>Trigonoscuta clemente traskiae</i>	Snout beetle		CBP
Coleoptera	Curculionidae	Lixinae	<i>Cleonus americanus</i>	Snout beetle		CBP
Coleoptera	Curculionidae	Lixinae	<i>Cleonus basalis</i>	Snout beetle		INRMP
Coleoptera	Curculionidae		<i>Emphyastes fucicola</i>	Snout beetle		CBP
Coleoptera	Curculionidae		<i>Notiodes aeratus</i>	Snout beetle		CBP
Coleoptera	Curculionidae		<i>Sciopithes insularis</i>	Root weevil	SCie	INRMP, CBP, Miller

# NALF San Clemente Island Compiled Species List, Previous Studies

Order	Family	Sub-Family	Species name	Common Name	Notation	Source
Coleoptera	Curculionidae		<i>Sciopithes setosus</i>	Snout beetle		CBP
Coleoptera	Dascillidae		<i>Anorus piceus</i>	Soft-bodied plant beetle		CBP
Coleoptera	Dermestidae		<i>Dermestes caninus</i>	Carpet beetle		CBP
Coleoptera	Dermestidae		<i>Dermestes caninus</i>	Carpet beetle		CBP
Coleoptera	Dermestidae		<i>Dermestes frischii</i>	Carpet beetle		CBP
Coleoptera	Dermestidae		<i>Dermestes marmoratus</i>	Carpet beetle		CBP
Coleoptera	Dytiscidae		<i>Rhantus gutticollis</i>	Predaceous diving beetle		CBP
Coleoptera	Dytiscidae		<i>Dytiscidae sp. 1*</i>	Predaceous diving beetle	U	SCI NRO
Coleoptera	Elateridae		<i>Limonius canus</i>	Click beetle		CBP
Coleoptera	Histeridae		<i>Neopachylopus sulcifrons</i>	Hister beetle		CBP
Coleoptera	Histeridae		<i>Saprinus lugens</i>	Hister beetle		CBP
Coleoptera	Histeridae		<i>Xerosaprinus lubricus</i>	Hister beetle		CBP
Coleoptera	Hydrophilidae		<i>Cercyon fimbriatus</i>	Water scavenger beetle		CBP
Coleoptera	Hydrophilidae		<i>Cercyon luniger</i>	Water scavenger beetle		CBP
Coleoptera	Kateretidae		<i>Amartus tinctus</i>	Short-winged flower		CBP
Coleoptera	Latridiidae		<i>Melanophthalma americana</i>	Minute brown scavenger		CBP
Coleoptera	Latridiidae		<i>Melanophthalma insularis</i>	Minute brown scavenger	Cle	CBP, Miller
Coleoptera	Meloidae		<i>Meloe barbarus</i>	Blister beetle		CBP
Coleoptera	Melyridae		<i>Attalus transmarinus</i>	Soft-wing flower beetle	SCle	CBP, Miller
Coleoptera	Melyridae		<i>Dasytes clementae</i>	Soft-wing flower beetle	SCle	CBP, Miller
Coleoptera	Melyridae		<i>Trichochrous pedalis</i>	Soft-wing flower beetle	Cle	CBP, Miller
Coleoptera	Nitidulidae		<i>Carpophilus pallipennis</i>	Sap beetle		CBP
Coleoptera	Nitidulidae		<i>Nitidulidae sp. 1*</i>	Sap beetle	U	SCI NRO
Coleoptera	Scarabaeidae		<i>Aegialia convexa</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Aphodius lividus</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Bolbocerastes regalis</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Canthon simplex</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Coenonycha clementina</i>	San Clemente Island	SCle	INRMP, CBP, Miller
Coleoptera	Scarabaeidae		<i>Cyclocephala longula</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Diplotaxis anxius</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Diplotaxis fimbriata</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Diplotaxis subangulata</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Parathyce palpalis</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Phobetus comatus</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Phyllophaga mucorea</i>	Scarab beetle		CBP, SCI NRO
Coleoptera	Scarabaeidae		<i>Scarabaeidae sp. 3*</i>	Scarab beetle	U	SCI NRO
Coleoptera	Scarabaeidae		<i>Serica alternata</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Serica mixta</i>	Scarab beetle		CBP
Coleoptera	Scarabaeidae		<i>Tomarus gibbosus obsoletus</i>	Scarab beetle		CBP
Coleoptera	Silphidae		<i>Nicrophorus sp.1</i>	Carrion beetle		SCI NRO
Coleoptera	Silphidae		<i>Nicrophorus guttula</i>	Carrion beetle		CBP
Coleoptera	Silphidae		<i>Nicrophorus nigrita</i>	Carrion beetle		CBP
Coleoptera	Silphidae		<i>Nicrophorus sp.1</i>	Carrion beetle		SCI NRO
Coleoptera	Staphylinidae		<i>Aleochara bimaculata</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Bledius ruficornis</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Cafius canescens</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Cafius lithocharinus</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Cafius luteipennis</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Cafius seminitens</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Creophilus maxillosus</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Diglotta pacifica</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Hadrotus crassus</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Neobisnius occidentoides</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Staphylinidae sp. 1*</i>	Rove beetle	U	SCI NRO
Coleoptera	Staphylinidae		<i>Tarphiota fucicola</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Tarphiota geniculata</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Thinopinus pictus</i>	Rove beetle		CBP
Coleoptera	Staphylinidae		<i>Thinusa maritima</i>	Rove beetle		CBP

## NALF San Clemente Island Compiled Species List, Previous Studies

Order	Family	Sub-Family	Species name	Common Name	Notation	Source
Coleoptera	Tenebrionidae	Opatrinae	<i>Blapstinus sp.1</i>	Darkling beetle		SCI NRO
Coleoptera	Tenebrionidae		<i>Apsena grossa</i>	Darkling beetle	Cle	CBP, Miller
Coleoptera	Tenebrionidae		<i>Apsena pubescens</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Blapstinus histricus</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Cibdelis bachei</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Coelus pacificus</i>	Dune beetle	Cle	CBP, Miller
Coleoptera	Tenebrionidae		<i>Coniontis lata</i>	Darkling beetle	Cle	INRMP, CBP, Miller
Coleoptera	Tenebrionidae		<i>Coniontis subpubescens</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Coniontis vandykei</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Cryptadius inflatus</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Eleodes dentipes</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Eleodes laticollis apprimus</i>	Darkling beetle	Cle	INRMP, Miller
Coleoptera	Tenebrionidae		<i>Epantius obscurus</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Eusattus difficilis</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Eusattus robustus</i>	Darkling beetle	SCle	INRMP, CBP, Miller
Coleoptera	Tenebrionidae		<i>Helops bachei</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Isomira comstocki</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Phaleria rotundata</i>	Darkling beetle		CBP
Coleoptera	Tenebrionidae		<i>Pterostichus gliscans</i>	Darkling beetle		INRMP
Coleoptera	Tenebrionidae		<i>Tenebrionidae sp. 1*</i>	Darkling beetle	U	SCI NRO
Coleoptera	Tenebrionidae		<i>Tonibius sulcatus</i>	Darkling beetle		CBP
Coleoptera	Trogidae		<i>Trox atrox</i>	Hide beetle		CBP
Coleoptera	Trogidae		<i>Trox gemmulatus</i>	Hide beetle		CBP
Coleoptera	Zopheridae		<i>Rhagodera tuberculata</i>	Ironclad beetle		CBP
Dermaptera	Forficulidae		<i>Euborellia annulipes</i>	Earwig		Miller
Dermaptera	Forficulidae		<i>Forficula auricularia</i>	Earwig		Miller, SCI NRO
Diptera	Anthomyiidae		<i>Anthomyiidae sp.1</i>	Anthomyiid fly		SCI NRO
Diptera	Asilidae		<i>Efferia clementi</i>	Robber Fly	SCle	INRMP, Miller
Diptera	Bibionidae		<i>Bibionidae sp.1</i>	March fly		SCI NRO
Diptera	Bombyliidae		<i>Bombylias lucifer</i>	Long-nose bee fly		INRMP
Diptera	Bombyliidae		<i>Bombyliidae sp. 1*</i>	Bee fly	U	SCI NRO
Diptera	Bombyliidae		<i>Bombyliidae sp. 2*</i>	Bee fly	U	SCI NRO
Diptera	Bombyliidae		<i>Bombyliidae sp. 3*</i>	Bee fly	U	SCI NRO
Diptera	Calliphoridae		<i>Calliphoridae sp. 1*</i>	Blow fly	U	SCI NRO
Diptera	Calliphoridae		<i>Calliphoridae sp. 2*</i>	Blow fly	U	SCI NRO
Diptera	Dolichopodidae		<i>Dolichopodidae sp.1</i>	Long-legged fly		SCI NRO
Diptera	Empididae		<i>Empididae sp.1</i>	Dance fly		SCI NRO
Diptera	Heleomyzidae		<i>Heleomyzidae sp.1</i>	Heleomyzid fly		SCI NRO
Diptera	Lonchaeidae		<i>Lonchaeidae sp. 1</i>	Lonchaeid fly		SCI NRO
Diptera	Muscidae		<i>Muscidae sp. 1</i>	Muscid fly		SCI NRO
Diptera	Mythicomyiidae		<i>Mythicomyia discreta</i>	fly		INRMP
Diptera	Pipunculidae		<i>Pipunculidae sp. 1</i>	Big-headed fly		SCI NRO
Diptera	Pipunculidae		<i>Pipunculidae sp. 2</i>	Big-headed fly		SCI NRO
Diptera	Pipunculidae		<i>Pipunculidae sp. 2</i>	Big-headed fly		SCI NRO
Diptera	Sarcophagidae		<i>Sarcophagidae sp. 1</i>	Flesh fly		SCI NRO
Diptera	Sarcophagidae		<i>Sarcophagidae sp. 2</i>	Flesh fly		SCI NRO
Diptera	Sciaridae		<i>Sciaridae sp. 1</i>	Dark-winged fungus		SCI NRO
Diptera	Syrphidae	Eristalinae	<i>Copestylum mexicanum</i>	Syrphid fly		SCI NRO
Diptera	Syrphidae		<i>Syrphidae sp. 1*</i>	Syrphid fly	U	SCI NRO
Diptera	Syrphidae		<i>Syrphidae sp. 2*</i>	Syrphid fly	U	SCI NRO
Diptera	Syrphidae		<i>Syrphidae sp. 3*</i>	Syrphid fly	U	SCI NRO
Diptera	Tachinidae		<i>Tachinidae sp. 3</i>	Tachinid fly		SCI NRO
Diptera	Tachinidae		<i>Tachinidae sp. 4</i>	Tachinid fly		SCI NRO
Diptera	Tachinidae		<i>Tachinidae sp.1</i>	Tachinid fly		SCI NRO
Diptera	Tachinidae		<i>Tachinidae sp.2</i>	Tachinid fly		SCI NRO
Diptera	Tachinidae		<i>Tachinidae sp.5</i>	Tachinid fly		SCI NRO
Diptera	Tephritidae		<i>Tephritidae sp. 1*</i>	Fruit fly	U	SCI NRO
Diptera	Tephritidae		<i>Euaresta stelligera</i>			CIS

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Diptera	Tephritidae		<i>Paroxyna genalis</i>			CIS
Diptera	Tephritidae		<i>Trupanea maculigera</i>			CIS
Diptera	Tephritidae		<i>Trupanea wheeleri</i>			CIS
Diptera	Therevidae		<i>Therevidae sp. 1</i>	Stiletto fly		SCI NRO
Diptera	Tipulidae		<i>Tipulidae sp.1</i>	Crane fly		SCI NRO
Diptera	Tipulidae		<i>Tipulidae sp.2</i>	Crane fly		SCI NRO
Hemiptera	Gerridae		<i>Gerris remigis</i>	Water strider		SCI NRO
Hemiptera	Miridae		<i>Miridae sp. 1</i>	Plant bug		SCI NRO
Hemiptera	Notonectidae		<i>Notonecta undulata</i>	Backswimmer		SCI NRO
Hemiptera	Reduviidae		<i>Emesinae sp. 1</i>	Assassin bug		SCI NRO
Hemiptera	Reduviidae		<i>Emesinae sp. 2</i>	Assassin bug		SCI NRO
Hemiptera	Reduviidae		<i>Emesinae sp.1</i>	Assassin bug		SCI NRO
Hemiptera	Reduviidae		<i>Reduviidae sp. 2</i>	Assassin bug		SCI NRO
Hemiptera	Reduviidae		<i>Reduviidae sp.1</i>	Assassin bug		SCI NRO
Hemiptera	Scutelliridae		<i>Scutelliridae sp.1</i>	Shield-backed bug		SCI NRO
Hemiptera	Tingidae		<i>Tingidae sp.1</i>	Lace bug		SCI NRO
Homoptera	Aphididae		<i>Aphididae sp. 1*</i>	Aphid	U	SCI NRO
Homoptera	Aphididae		<i>Aphididae sp. 2*</i>	Aphid	U	SCI NRO
Homoptera	Aphididae		<i>Aphis rumicis</i>			CIS
Homoptera	Cicadellidae		<i>Cicadellidae sp. 1</i>	Leaf hopper		SCI NRO
Homoptera	Cixiidae		<i>Cixiidae sp. 1</i>	Cixiid planthopper		SCI NRO
Homoptera	Cixiidae		<i>Cixiidae sp. 2</i>	Cixiid planthopper		SCI NRO
Homoptera	Pseudococcidae		<i>Chorizococcus abroniae</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Discococcus simplex</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Distichlicoccus salinus</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Ferrisia virgata</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Helicococcus clemente</i>	Mealybug	SCIE	INRMP, Rust et. al
Homoptera	Pseudococcidae		<i>Miserococcus arenarius</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Paludicoccus distichlium</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Phenacoccus eschscholtziae</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Phenacoccus solani</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Pseudococcus maritimus</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Pseudococcus obscurus</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Puto yuccae</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Radicoccus kelloggi</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Rhizoecus bicirculus</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Rhizoecus subcyperalis</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Spilococcus corticosus</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Spilococcus keiferi</i>	Mealybug		Rust et. al
Homoptera	Pseudococcidae		<i>Trionymus smithii</i>	Mealybug		Rust et. al
Hymenoptera	Andrenidae	Andreninae	<i>Andrena sp.3</i>	Mining bee		SCI NRO
Hymenoptera	Andrenidae	Andreninae	<i>Andrena chlorura</i>	Mining bee		Rust et. al
Hymenoptera	Andrenidae	Andreninae	<i>Andrena sp.1</i>	Mining bee		SCI NRO
Hymenoptera	Andrenidae	Andreninae	<i>Andrena sp.2</i>	Mining bee		SCI NRO
Hymenoptera	Andrenidae	Andreninae	<i>Andrena submoesta</i>	Mining bee		Rust et. al
Hymenoptera	Andrenidae	Panurginae	<i>Perdita sp.1</i>	Mining bee		SCI NRO
Hymenoptera	Andrenidae	Panurginae	<i>Pterosarus californicus</i>	Mining bee		Rust et. al
Hymenoptera	Andrenidae		<i>Andrenidae sp.1*</i>	Mining bee	U	SCI NRO
Hymenoptera	Andrenidae		<i>Andrenidae sp. 2*</i>	Mining bee	U	SCI NRO
Hymenoptera	Anthophoridae	Anthophorinae	<i>Anthophora urbana clementina</i>	Common Solitary Bee	SCIE	INRMP, Rust et. al,
Hymenoptera	Anthophoridae		<i>Diadasia bituberculata</i>	Bee		Rust et. al
Hymenoptera	Anthophoridae		<i>Diadasia rinconis</i>	Bee		Rust et. al
Hymenoptera	Anthophoridae		<i>Diadasia opuntiae</i>	Bee		Miller
Hymenoptera	Anthophoridae		<i>Emphropsis sp.</i>	Bee		Rust et. al
Hymenoptera	Anthophoridae		<i>Melecta separata</i>	Bee		Rust et. al
Hymenoptera	Anthophoridae		<i>Melissodes scotti</i>	Bee		Rust et. al
Hymenoptera	Anthophoridae		<i>Nomada formula</i>	Bee		Rust et. al
Hymenoptera	Anthophoridae		<i>Synhalonia actuosa</i>	Bee		Rust et. al

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Hymenoptera	Anthophoridae		<i>Synhalonia lunata</i>	Bee		Rust et. al
Hymenoptera	Anthophoridae		<i>Synhalonia tricinctella</i>	Bee		Rust et. al
Hymenoptera	Anthophoridae		<i>Xeromelecta californica</i>	Bee		Rust et. al
Hymenoptera	Apidae	Nomadinae	<i>Hypochrotaenia formula</i>	Cuckoo Bee		INRMP
Hymenoptera	Apidae	Anthophorinae	<i>Anthophora edwardsii</i>	Bee		INRMP, Rust et. al
Hymenoptera	Apidae	Anthophorinae	<i>Anthophora sp.3</i>	Bee		SCI NRO
Hymenoptera	Apidae	Anthophorinae	<i>Anthophora sp.4</i>	Bee		SCI NRO
Hymenoptera	Apidae	Apinae	<i>Apis mellifera</i>	Bee		SCI NRO, Rust et. al
Hymenoptera	Apidae	Apinae	<i>Melecta separata callura</i>	Bee		INRMP
Hymenoptera	Apidae	Apinae	<i>Synhalonia (=Eucera) actuosa</i>	Solitary Bee		INRMP
Hymenoptera	Apidae		<i>Apidae sp.1*</i>	Bee	U	SCI NRO
Hymenoptera	Apidae		<i>Apidae sp.2*</i>	Bee	U	SCI NRO
Hymenoptera	Apidae		<i>Apidae sp.3*</i>	Bee	U	SCI NRO
Hymenoptera	Aulacidae		<i>Aulacidae sp.1</i>	Wasp		SCI NRO
Hymenoptera	Chrysididae		<i>Chrysididae sp.1</i>	Cuckoo wasp		SCI NRO
Hymenoptera	Diapriidae		<i>Diapriidae sp. 1</i>	Diapriid wasp		SCI NRO
Hymenoptera	Evaniidae		<i>Evaniidae sp.1</i>	Ensign wasp		SCI NRO
Hymenoptera	Formicidae		<i>Aphaenogaster patruelis</i>	Spine-waisted ant	Cle	INRMP, Miller
Hymenoptera	Formicidae		<i>Camponotus bakeri</i>	Carpenter Ant	Cle	INRMP, Miller
Hymenoptera	Formicidae		<i>Dorymyrmex bicolor</i>	Bicolor pyramid ant		Medina
Hymenoptera	Formicidae		<i>Dorymyrmex insanus</i>	Pyramid ant		Medina
Hymenoptera	Formicidae		<i>Formica francoueri</i>	Field ant		Medina
Hymenoptera	Formicidae		<i>Leptothorax sp.?</i>			Medina
Hymenoptera	Formicidae		<i>Linepithema humile</i>	Argentine ant		Medina
Hymenoptera	Formicidae		<i>Pheidole clementensis</i>	Harvester Ant		INRMP
Hymenoptera	Formicidae		<i>Pogonomyrmex subnitidus</i>	Harvester Ant		Medina
Hymenoptera	Formicidae		<i>Solenopsis molesta</i>	Thief ant		Medina
Hymenoptera	Formicidae		<i>Solenopsis xyloni</i>	Southern fire ant		Medina
Hymenoptera	Formicidae		<i>Tapinoma sessile</i>	Odorous house ant		Medina
Hymenoptera	Halictidae		<i>Agapostamon femoratus</i>	Sweat Bee		INRMP
Hymenoptera	Halictidae		<i>Agapostemon texanus</i>	Sweat Bee		INRMP, Rust et. al
Hymenoptera	Halictidae		<i>Dialictus nevadensis</i>	Sweat Bee		Rust et. al
Hymenoptera	Halictidae		<i>Dialictus sp.3</i>	Sweat Bee		Rust et. al
Hymenoptera	Halictidae		<i>Evylaeus avalonensis</i>	Sweat Bee	Cle	Rust et. al, Miller
Hymenoptera	Halictidae		<i>Evylaeus nigrescens</i>	Sweat Bee		Rust et. al
Hymenoptera	Halictidae		<i>Halictidae sp. 2*</i>	Sweat Bee	U	SCI NRO
Hymenoptera	Halictidae		<i>Halictidae sp.3*</i>	Sweat Bee	U	SCI NRO
Hymenoptera	Ichneumonidae		<i>Ichneumonidae sp. 1</i>	Ichneumonid wasp		SCI NRO
Hymenoptera	Ichneumonidae		<i>Ichneumonidae sp. 2</i>	Ichneumonid wasp		SCI NRO
Hymenoptera	Ichneumonidae		<i>Ichneumonidae sp. 3</i>	Ichneumonid wasp		SCI NRO
Hymenoptera	Ichneumonidae		<i>Ichneumonidae sp. 4</i>	Ichneumonid wasp		SCI NRO
Hymenoptera	Ichneumonidae		<i>Ichneumonidae sp. 5</i>	Ichneumonid wasp		SCI NRO
Hymenoptera	Megachilidae		<i>Anthidium collectum</i>	Resin Bee		INRMP, Rust et. al
Hymenoptera	Megachilidae		<i>Diadasia rinconis</i>	Resin Bee		INRMP
Hymenoptera	Megachilidae		<i>Osmia clarescens</i>	Resin Bee		Rust et. al
Hymenoptera	Pompilidae		<i>Pompilidae sp.1</i>	Spider wasp		SCI NRO
Hymenoptera	Sphecidae	Ammophilinae	<i>Ammophila mcclayi</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Ammophilinae	<i>Podalonia mexicana</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Ammophilinae	<i>Podalonia valida</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Astatinae	<i>Astata bechteli</i>	Astatine wasp		Rust et. al
Hymenoptera	Sphecidae	Astatinae	<i>Diploplectron peglowi</i>	Astatine wasp		Rust et. al
Hymenoptera	Sphecidae	Astatinae	<i>Dryudella rhimpa</i>	Astatine wasp		Rust et. al
Hymenoptera	Sphecidae	Crabroninae	<i>Liris argentatus</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Crabroninae	<i>Liris beatus</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Crabroninae	<i>Microbembex californica</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Crabroninae	<i>Miscophus californicus</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Crabroninae	<i>Solierella sayi</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Crabroninae	<i>Tachysphex texanus</i>	Sphecid wasp		Rust et. al

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Hymenoptera	Sphecidae	Sceliphrinae	<i>Sceliphron caementarium</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Sphecinae	<i>Prionyx thomae</i>	Sphecid wasp		Rust et. al
Hymenoptera	Sphecidae	Crabroninae	<i>Bembix americana dugi</i>	Sphecid wasp	SCIE	INRMP, Rust et. al,
Hymenoptera	Sphecidae	Sphecinae	<i>Ammophila azteca clemente</i>	Thread-waisted wasp	SCIE	INRMP, Rust et. al,
Hymenoptera	Sphecidae	Sphecinae	<i>Chlorion aerarium</i>	Thread-waisted wasp		SCI NRO
Hymenoptera	Sphecidae	Sphecinae	<i>Chlorion sp.1</i>	Thread-waisted wasp		SCI NRO
Hymenoptera	Sphecidae	Sphecinae	<i>Palmodes insularis</i>	Thread-waisted wasp	CIE	INRMP, Rust et. al,
Hymenoptera	Sphecidae		<i>Sphecidae sp.1*</i>	Sphecid wasp	U	SCI NRO
Hymenoptera	Vespidae		<i>Vespidae sp. 1</i>	Vespid wasp		SCI NRO
Isoptera	Termitidae		<i>Termitidae sp. 1</i>	Termite		SCI NRO
Ixodida	Ixodidae		<i>Ixodes peromysci</i>	Shield Tick	CIE	INRMP, Miller
Lepidoptera	Arctiidae	Arctiinae	<i>Grammia</i>	nevadensis		CIS
Lepidoptera	Arctiidae	Arctiinae	<i>Grammia</i>	ornata		CIS
Lepidoptera	Arctiidae	Arctiinae	<i>Grammia virgo</i>	Tiger moth		SCI NRO
Lepidoptera	Crambidae		<i>Noctueliopsis grandis</i>	Snout moth		INRMP
Lepidoptera	Depressariidae		<i>Exaeretia gracilis</i>			CIS
Lepidoptera	Elachistidae		<i>Agonopterix toega</i>	Grass miner moth	SCIE	INRMP, Miller,
Lepidoptera	Gelechiidae	Gelechiinae	<i>Filatima sp.</i>			CIS
Lepidoptera	Gelechiidae	Gelechiinae	<i>Formosella kincaidella</i>			CIS
Lepidoptera	Gelechiidae	Gelechiinae	<i>Formosella sistrella</i>			CIS
Lepidoptera	Gelechiidae		<i>Coleotechnites n. sp.</i>	Twirler moth	CIE	INRMP, Powell
Lepidoptera	Gelechiidae		<i>Scrobipalopsis lycii</i>			CIS
Lepidoptera	Gelechiidae		<i>Scrobipalpula n. sp.</i>	Twirler moth	CIE	INRMP, Powell
Lepidoptera	Gelechiidae		<i>Scrobipalpula n. sp. nr.</i>	Twirler moth	CIE	INRMP, Powell
Lepidoptera	Gelechiidae		<i>Scrobipalpulopsis lycii</i>			CIS
Lepidoptera	Gelechiidae		<i>Tuta chiquitelloides</i>			CIS
Lepidoptera	Gelechioidea		<i>Vladimiria? n. sp.</i>	Twirler moth	CIE	INRMP, Powell
Lepidoptera	Geometridae		<i>Pero nr. giganteus</i>	Moth	CIE	INRMP, Powell
Lepidoptera	Geometridae		<i>Pterotaeta crinigera</i>	Moth	SCIE	INRMP, Miller,
Lepidoptera	Hesperiidae		<i>Erynnis funeralis</i>	Funereal Dusky-wing		INRMP
Lepidoptera	Lycaenidae		<i>Brephidium exilis</i>	Pygmy Blue Butterfly		INRMP
Lepidoptera	Lycaenidae		<i>Celastrina echo</i>	Echo Azure		INRMP
Lepidoptera	Lycaenidae		<i>Plebejus acmon acmon</i>	Acmon Blue		INRMP
Lepidoptera	Lycaenidae		<i>Strymon melinus</i>	Gray Hairstreak		INRMP
Lepidoptera	Nepticulidae		<i>Stigmella n. sp.</i>	Moth	CIE	INRMP, Powell
Lepidoptera	Noctuidae	Cuculliinae	<i>Sympistis augustus</i>			CIS
Lepidoptera	Noctuidae		<i>Agrotis venerabilis arida</i>	Cutworm moth		INRMP
Lepidoptera	Noctuidae		<i>Noctuidae sp. 2*</i>	Moth	U	SCI NRO
Lepidoptera	Noctuidae		<i>Noctuidae sp. 3*</i>	Moth	U	SCI NRO
Lepidoptera	Noctuidae		<i>Oncocnemis augusta</i>	Moth		INRMP
Lepidoptera	Noctuidae		<i>Oncocnemis nita</i>	Moth		INRMP
Lepidoptera	Noctuidae		<i>Zosteropoda clementei</i>	Moth	CIE	INRMP, Miller,
Lepidoptera	Nolidae		<i>Characoma nilotica</i>	Moth		INRMP
Lepidoptera	Nymphalidae		<i>Vanessa annabella</i>	West coast lady		INRMP
Lepidoptera	Nymphalidae		<i>Vanessa cardui</i>	Painted Lady		INRMP
Lepidoptera	Nymphalidae		<i>Vanessa virginiensis</i>	Thistle Butterfly		INRMP
Lepidoptera	Papilionidae		<i>Papilio zelicaon</i>	Anise Swallowtail		INRMP
Lepidoptera	Pieridae		<i>Colias eurytheme</i>	Alfalfa Butterfly		INRMP
Lepidoptera	Pieridae		<i>Pieris rapae</i>	Cabbage Butterfly		INRMP
Lepidoptera	Pieridae		<i>Pontia protodice</i>	Checkered white		INRMP
Lepidoptera	Scythrididae		<i>Arotrura longissima</i>	Moth		INRMP, CIS
Lepidoptera	Sphingidae		<i>Hyles lineata</i>	Moth		SCI NRO
Lepidoptera	Tortricidae		<i>Argyrotaenia fraciscana</i>	Moth		INRMP, CIS
Lepidoptera	Tortricidae		<i>Phaneta clementeana</i>			CIS
Lepidoptera	Tortricidae		<i>Phaneta straminiana</i>			CIS
Lepidoptera	Uraniidae	Epipleminae	<i>Uraniidae sp. 1</i>	Moth		SCI NRO
Lepidoptera	Uraniidae	Epipleminae	<i>Uraniidae sp. 2</i>	Moth		SCI NRO
Lepidoptera	Ypsolophidae		<i>Cerostoma lyonothamnae</i>	Moth		INRMP



## NALF San Clemente Island Compiled Species List, Previous Studies

Order	Family	Sub-Family	Species name	Common Name	Notation	Source
Lepidoptera	Ypsolophidae		<i>Ypsolopha lyonothamnae</i>	Moth	Cie	INRMP, Miller,
Neuroptera	Hemerobiidae		<i>Hemerobiidae sp. 1</i>	Moth		SCI NRO
Neuroptera	Mantisipid		<i>Mantisipid sp.1</i>	Moth		SCI NRO
Neuroptera	Myrmeleontidae		<i>Myrmeleontidae sp. 1</i>	Moth		SCI NRO
Neuroptera	Myrmeleontidae		<i>Myrmeleontidae sp. 2</i>	Moth		SCI NRO
Neuroptera	Raphidiidae		<i>Alena sp. 1</i>	Moth		SCI NRO
Neuroptera	Raphidiidae		<i>Raphidiidae sp. 1*</i>	Moth	U	SCI NRO
Neuroptera	Sisridae		<i>Sisridae sp.1</i>	Moth		SCI NRO
Odonata	Calopterygidae		<i>Calopterygidae sp. 1</i>	Damsel fly		SCI NRO
Odonata	Coenagrionidae		<i>Enallagma civile</i>			CIS
Opiliones	Protolophidae		<i>Protolophus cockerelli</i>	Harvestman	SCie	INRMP, Miller
Orthoptera	Acrididae	Cyrtacanthacridinae	<i>Shistocerca nitens nitens</i>	Gray bird grasshopper		R & W
Orthoptera	Acrididae	Oedopodinae	<i>Lepus intermedius</i>	Saussure's blue-winged		R & W
Orthoptera	Acrididae	Oedopodinae	<i>Scirtetica clementina</i>	San Clemente	SCie	R & W
Orthoptera	Acrididae	Oedopodinae	<i>Trimerotropis fontana</i>	Fontana grasshopper		R & W
Orthoptera	Acrididae	Oedopodinae	<i>Trimerotropis pallidipennis</i>	Pallid-winged		R & W
Orthoptera	Acrididae	Oedopodinae	<i>Trimerotropis pseudofasciata</i>	Caerulean-winged		R & W
Orthoptera	Blatellidae	Blatellinae	<i>Blatella germanica</i>	German cockroach		R & W
Orthoptera	Gryllidae	Gryllinae	<i>Gryllus sp.</i>	Field cricket		R & W
Orthoptera	Gryllidae	Mogoplistinae	<i>Hoplosphyrum boreale</i>	Long-winged scaly		R & W
Orthoptera	Gryllidae	Myrmecophilinae	<i>Myrmecophilus oregonensis</i>	Oregon ant cricket		R & W
Orthoptera	Gryllidae	Oecanthinae	<i>Oecanthus argentinus</i>	Prairie tree cricket		R & W
Orthoptera	Raphidophoridae	Ceuthophilinae	<i>Pristoceuthophilus marmoratus</i>	Camel cricket		R & W
Orthoptera	Stenopelmatidae	Henicinae	<i>Cnemetettix pulvillifer</i>	Silk-spinning cricket	SCie	R & W
Orthoptera	Tettigoniidae	Phaneropterinae	<i>Scudderia sp.1</i>	Fork-tailed bush katydid		SCI NRO
Scorpionidae	Vaejovidae		<i>Pseudouroctonus (=Vaejovis)</i>	Scorpion		INRMP
Spirostreptida	Cambalidae		<i>Tigolene clementinus</i>	Millipede	SCie	INRMP, Miller
Trichoptera	Hydroptilidae		<i>Hydroptilidae sp. 1</i>	Caddisfly		SCI NRO

CODES: SCie = San Clemente Island endemic species; Cie = Channel Islands endemic species; U = Possible endemic species, requires taxonomic work.

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# **NALF San Clemente Island 2010 Invertebrate Species List**

The following species list presents the listing of unique insect taxa collected or observed during the 2010 study surveys.

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# NALF San Clemente Island 2010 Invertebrate Surveys Species List

Order	Family	Species/Taxon name	Notes	Size Class
Araneida	Araneidae	Orb weaver A (Araneus ?)		6mm
Araneida	Araneidae	Orb weaver B	cthx black, abd brown, legs with brown stripes	8mm
Araneida	Araneidae	Silver argiope spider (Argiope argentata)		13mm
Araneida	Clubionidae	Clubiona sp. 2 (shaggy dog)	long white hairs on thx	4mm
Araneida	Clubionidae	Clubiona sp. 3	tan silky hairs	5mm
Araneida	Clubionidae	Clubiona sp.?		7mm
Araneida	Oxyopidae	Lynx spider		4mm
Araneida	Philodromidae	Running crab spider (Ebo sp.)	2nd pair of legs twice as long as others (see Kaston, p. 235)	3.5mm
Araneida	Philodromidae	Slender crab spider (Tibellus chamberlini)		8mm
Araneida	Salticidae	Jumping spider		3-4mm
Araneida	Salticidae	Jumping spider B	very hairy, mostly white with tan	2-6mm
Araneida	Salticidae	Jumping spider C	black w/ white hairs, orange and white markings on abd	4-7mm
Araneida	Theridiidae	Black widow spider (Latrodectus hesperus)	Observed fighting and killing a Digger bee	10mm
Araneida	unk	Funnel web spider	saw the nests, not the spider	unk
Araneida	Unk	Spider A	Very small, 1-2 mm	1-2mm
Araneida	unk	Spider A2	somewhat crab-like, highly mottled brown on white	2mm
Araneida	unk	Spider A3	black, somewhat ant-like	1mm
Araneida	Unk	Spider A4	white, especially bright white on dorsal surface of abd, ventral side of abd brown w/2 white spots, all legs joints brown	1mm
Araneida	Unk	Spider B	Small, 3-5 mm	3-5mm
Araneida	Unk	Spider B2	very unique 'leaf-like pattern on abd	3mm
Araneida	Unk	Spider C	Medium, 6-10 mm	6-10mm
Araneida	Unk	Spider C1	abd with red stripes	8mm
Araneida	Unk	Spider C2	yellow	6mm
Araneida	Unk	Spider C3	sides of thx dark brown center cream-colored, abd cream-colored	7mm
Coleoptera	Bruchidae	Seed beetle A	brown w/ white hairs	2mm
Coleoptera	Bruchidae	Seed beetle B	brown, not as hairy	1mm
Coleoptera	Carabidae	Ground beetle A	10 mm, reddish brown	10mm
Coleoptera	Carabidae	Ground beetle B	10 mm, dark brown, antennae thinner than A, head/thx less hairy, pits in thx/elytra finer and more closely packed	10mm
Coleoptera	Carabidae	Ground beetle C	greenish-black metallic	13mm
Coleoptera	Chrysomelidae (Alticinae)	Flea beetle (Phyllotreta?)	brown, hind femur enlarged, 1st tarsal segment longer than others	2mm
Coleoptera	Chrysomelidae (Cryptocephalinae)	Cylindrical leaf beetle A (Diachus?)	shiny, bronzish-brown	2mm
Coleoptera	Chrysomelidae (Cryptocephalinae)	Cylindrical leaf beetle B	metallic bronze, hairy	4mm
Coleoptera	Coccinellidae	California lady beetle (Coccinella californica)	either spotless or with small, faint spots	6mm
Coleoptera	Coccinellidae	Convergent lady beetle (Hippodamia convergens)	It has the 'convergent' white spots on the pronotum, but is missing one pair of black spots on the elytra (similar to H. variegata, a non-native)	6mm
Coleoptera	Coccinellidae	Eleven-spotted lady Beetle (Coccinella undecimpunctata)	new record in CA? Does not appear in CBP database	7mm
Coleoptera	Coccinellidae	Hyperaspis sp.	very similar to H. quadrioculata, but missing the two spots on top of the elytra	2mm
Coleoptera	Coccinellidae	Nine-spotted Lady Beetle (Coccinella novemnotata)		7mm
Coleoptera	Coccinellidae	Seven-spotted Lady Beetle (Coccinella septempunctata)	Specimen has two 'wounds' with dark blemishes underneath on its elytra, was it parasitized?	7mm
Coleoptera	Coccinellidae	'Ten-spot' lady beetle	there is something called a ten-spot, but it doesn't look anything like this one	6mm
Coleoptera	Cryptophagidae	Silken fungus beetle	brown, silky-haired	2mm
Coleoptera	Curculionidae	Snout beetle A	2mm, scaly, mottled white and tan, snout long and thin; found another, but slightly larger	2-3mm
Coleoptera	Dermestidae	Dermestid beetle	Black, hairy	2.5mm
Coleoptera	Elateridae	Click beetle A	8mm, reddish brown	8mm
Coleoptera	Latridiidae	Minute brown scavenger beetle (Melanophthalma?)	minute, brown (duh)	1mm
Coleoptera	Melandryidae	False darkling beetle	brown	4mm
Coleoptera	Melyridae	Soft-winged flower beetle A (Dasytes clemente?)	4-5mm, black, covered with silky hairs, elytra 5-5-5	4-5mm
Coleoptera	Melyridae	Soft-winged flower beetle B	2mm, black; very similar in appearance to A, but much smaller	2mm
Coleoptera	Mordellidae	Tumbling flower beetle		3mm
Coleoptera	Nitidulidae	Sap beetle		2mm
Coleoptera	Scarabeidae	Scarab beetle A		20mm
Coleoptera	Scarabeidae	Scarab beetle B	shiny black, ant. ball bright red	14-16mm
Coleoptera	Scolytidae	Ambrosia beetle	look like 'Hypothenemus' on f.145 in Peterson	1mm
Coleoptera	Staphilinidae	Rove beetle A	tiny, brown, parallel-sided, elytra very short	2-4mm
Coleoptera	Staphilinidae	Rove beetle B	long and narrow, parallel-sided, elytra short	6mm
Coleoptera	Staphilinidae	Rove beetle C	dark brown, body widest at thx, tapering off distally	6mm
Coleoptera	Tenebrionidae	Apsena grossa?		14mm
Coleoptera	Tenebrionidae	Darkling beetle A	5 mm, black-brown, front of head bearing a narrow 'shield' extending forward	5mm
Coleoptera	Tenebrionidae	Darkling beetle B		8mm
Coleoptera	Tenebrionidae	Darkling beetle C	brown, front tibia flattened (modified for digging?)	2mm

NALF San Clemente Island 2010 Invertebrate Surveys Species List

Order	Family	Species/Taxon name	Notes	Size Class
Coleoptera	Tenebrionidae	Dune beetle	These were collected dead from the sand surface, there were dozens of dead <i>Coelus</i> all over the place.	7mm
Coleoptera	Tenebrionidae	Eleodes		25mm
Coleoptera	Tenebrionidae	Eusattus?	dull black, elytral surface smooth	18mm
Coleoptera	Unk	Unid. Beetle (damaged)	maybe a Dermestid, but antennae and tarsi missing, can't confirm	2mm
Collembola	Entomobryidae	Elongate-bodied springtail		1mm
Collembola	Poduridae	Podurid springtail		<1mm
Collembola	Sminthuridae	Globular springtail		1mm
Dermaptera	Forficulidae	Common earwig		15mm
Diptera	Acroceridae	Small-headed fly	these are spider parasites	5mm
Diptera	Agromyzidae	Leaf miner fly		2mm
Diptera	Anthomyzidae	Anthomyzid fly A	black	2mm
Diptera	Anthomyzidae	Anthomyzid fly B	brown, 3mm	3mm
Diptera	Asilidae	Robber fly	grayish and hairy	17mm
Diptera	Bombyliidae	Bee fly A	striped black and orange, wings clear	12mm
Diptera	Bombyliidae	Bee fly B ( <i>Hemipenthes</i> sp.)	jet black, only distal end of wing transparent	9mm
Diptera	Bombyliidae	Bee fly C	v. sim. to B but wings entirely smoky-black	9mm
Diptera	Bombyliidae	Bee fly D	15mm, body black with thick blonde hairs	15mm
Diptera	Calliphoridae	Blow fly A	black	8-10mm
Diptera	Calliphoridae	Blow fly B	metallic greenish black	4mm
Diptera	Calliphoridae	Blow fly C	black, 10mm	10mm
Diptera	Cecidomyiidae	Gall gnat		3mm
Diptera	Cecidomyiidae	Sagebrush leaf gall midge? ( <i>Rhopalomyia</i> )	tiny gall embedded in ARTCAL leaf	1mm
Diptera	Ceratopogonidae	Punkies		1mm
Diptera	Chironomidae	Midge		2mm
Diptera	Chloropidae	Frit fly A	black	2mm
Diptera	Chloropidae	Frit fly B	light yellow w/ brown stripes on thx	2mm
Diptera	Coelopidae	Seaweed fly		7mm
Diptera	Dolichopodidae	Long-legged fly A	Metalic bronze	2mm
Diptera	Dolichopodidae	Long-legged fly B	black, shiny	2mm
Diptera	Drosophilidae	Pomace fly A		3mm
Diptera	Drosophilidae	Pomace fly B	black	2mm
Diptera	Drosophilidae	Pomace fly C	reddish brown	3mm
Diptera	Empididae	Dance fly A	black	2mm
Diptera	Empididae	Dance fly B	thx & top of head black, white patch on face, abd striped brown and white	2mm
Diptera	Ephydriidae	Shore fly ( <i>Scatella</i> sp.?)	black, wings dusky black with white spots, looks like <i>Scatella</i> on BugGuide	3mm
Diptera	Ephydriidae	Shore fly B	black	2mm
Diptera	Heleomyzidae	Heleomyzid fly	brown, wings smoky brown with faint blotches on 2 cross-veins	4-5mm
Diptera	Lonchaeidae	Lonchaeid fly		2mm
Diptera	Milichiidae	Milichiid fly		2mm
Diptera	Muscidae	Muscid A	black	5mm
Diptera	Muscidae	Muscid B	black, 3 dark spots on each wing ( <i>Helina</i> sp.?; very similar wing spots to pic on BG)	9mm
Diptera	Muscidae	Muscid D	gray	4mm
Diptera	Muscidae	Muscid E	slightly smaller than A, grayish	5mm
Diptera	Pallopteridae	Pallopterid fly	brownish-tan, arista bare, Sc complete, costa broken once (Keyed this out with MND, fairly confident I did it right, but this specimen appears slightly undeveloped so wing details a little hard to see)	3mm
Diptera	Phoridae	Hump-backed fly A		2mm
Diptera	Phoridae	Hump-backed fly B	huge (compared to A), much more robust	4mm
Diptera	Piophilidae	Skipper fly	metallic brownish, costa not broken, Sc complete, pvb diverge	2mm
Diptera	Piophilidae	Skipper fly	shiny-metallic black	2mm
Diptera	Pipunculidae	Big-headed fly		2mm
Diptera	Psilidae	Rust fly A	brown, some long hairs on thx	2mm
Diptera	Psilidae	Rust fly B	brown, no long hairs on thx	2mm
Diptera	Sarcophagidae	Flesh fly A	striped gray and black; may be male & female?	8-12mm
Diptera	Sarcophagidae	Flesh fly B	half the size of A but otherwise nearly identical	4mm
Diptera	Sciaridae	Dark-winged fungus gnat		2mm
Diptera	Sciomyzidae	Marsh fly A	black, post-ocellar bristles absent	4mm
Diptera	Sphaeroceridae?	Small dung fly?	brownish, costa broken 3-times, wings veins nearly identical to Fig. 92.5 in MND (see diagram)	2-3mm
Diptera	Syrphidae	Syrphid fly A	huge, black, thought it was a horse fly	18mm
Diptera	Syrphidae	Syrphid fly B	yellow and black	9mm
Diptera	Tachinidae	Tachinid fly A	black & gray, wing cross-veins w/ smokey strips	6-9mm
Diptera	Tachinidae	Tachinid fly B	black, bristly	5mm
Diptera	Tachinidae	Tachinid fly C	black w/ white face and white patch on chest	5.5mm
Diptera	Tephritidae	Fruit fly A		2mm
Diptera	Tephritidae	Fruit fly B	larger than A, white spots on wings much finer than A	3mm
Diptera	Tephritidae	Fruit fly C	wings more black, most white cells ranged along the margins	3mm
Diptera	Tephritidae	Fruit fly D	wing patterns differs from other, with basal 1/3 ± devoid of brown spots	3mm

**NALF San Clemente Island 2010 Invertebrate Surveys Species List**

<b>Order</b>	<b>Family</b>	<b>Species/Taxon name</b>	<b>Notes</b>	<b>Size Class</b>
Diptera	Tethinidae	Tethinid fly		2mm
Diptera	Tipulidae	Crane fly		15mm
Diptera	Trixoscelididae	Trixoscelidid fy		3mm
Diptera	Unk	Fly A	unid. Fly, blackish, body elongate, see sketch of wing veins	6mm
Diptera	Unk	Fly B		5mm
Diptera	Unk	Fly C	Costa broken once, pre-apical tibial bristle present, post-vertical bristles appear to converge, oral vibrssae present	4-5mm
Diptera	unk	Fly E	brown, arista bare, costa broken twice, wings w/ 2 marginal cells (sim. to Fig. 93-3(but its not the right Family))	2mm
Diptera	unk	Fly F	brown. arista bare, costa broken twice, Sc complete	4mm
Diptera	Unk (Hippoboscidae?)	Fly D	body black, compact, wing venation reduced (see sketch), prominent stigma (like in wasps), ant. with long arista	3mm
Geophilomorpha	unk	Centipede	very long and thin, eyeless (which places it in this Order, according to Wikipedia)	10mm
Hemiptera	Alydidae	Broad-headed bug A		6mm
Hemiptera	Alydidae	Broad-headed bug B	hd & thx tan, abd reddish, wings clear	6mm
Hemiptera	Alydidae	Broad-headed bug C	brown & tan, wings clear	5mm
Hemiptera	Alydidae	Broad-headed bug D	sort of greenish with black markings, wings clear	5mm
Hemiptera	Alydidae	Broad-headed bug E	a nymph, but distinct; mottled brown on tan, hind femur bowed	7mm
Hemiptera	Alydidae	Broad-headed bug F	mottled tan and black	9mm
Hemiptera	Alydidae	Broad-headed bug G	tan, wings cloudy-white	5.5mm
Hemiptera	Alydidae	Broad-headed bug H	mottled tan and brown, wings with heavy whitish veins in proximal area (clavus-corium-cuneus), mebranes clear	6mm
Hemiptera	Alydidae	Broad-headed bug I	brownish-black, wings clear except for a few brown segments on veins	3mm
Hemiptera	Alydidae	Broad-headed bug J	dark brown, proximal half of wings brown w/ darker brown spots on veins, distal half clear	3mm
Hemiptera	Anthocoridae	Minute pirate bug		2mm
Hemiptera	Berytidae	Stilt bug (Acanthophysa echinata?)		3mm
Hemiptera	Geocoridae	Big-eyed bug	mottled brown and tan	4mm
Hemiptera	Lygaeidae	Seed bug A	black, 2mm	2mm
Hemiptera	Lygaeidae	Seed bug B	brownish, surface punctate	7mm
Hemiptera	Miridae	Leaf bug A	Greenish white, legs spotted	2mm
Hemiptera	Miridae	Leaf bug B	hd & thx brown-tan, wing (corium, cuneus) tan and pitted, wing membrane clear with brown veins	5mm
Hemiptera	Miridae	Leaf bug C	bright yellow-green, red antennae (a nymph but very distinctive)	3mm
Hemiptera	Miridae	Leaf bug D	yellowish tan, a smattering of tiny pinkish-red dot on wings and legs	3mm
Hemiptera	Miridae	Leaf bug E	jet black, very cool	5mm
Hemiptera	Miridae	Leaf bug F	thx striped cream-brown-cream-brown-cream, body very long and narrow (head missing); v. sim. to Litomiris on BugGuide	7mm
Hemiptera	Miridae	Leaf bug G	body dark brown to black, some tannish patterning on thorax, wings opaque white w/ some smoky brown clouding	2.5mm
Hemiptera	Miridae	Leaf bug H	golden brown, thx & pronotum covered w/ brown freckles	3mm
Hemiptera	Nabidae	Damsel bug A	very narrow-bodied, wings underdeveloped	11mm
Hemiptera	Nabidae	Damsel bug B	narrow-bodied, four short spines across posterior margin of thx, last ant. segment very long and slightly thickened	12mm
Hemiptera	Naucoridae?	Creeping water bug (spider cache)	brown, oval-shaped, no veins apparent in wing membranes; legs missing	3.5mm
Hemiptera	Notonectidae	Backswimmer (Notonecta undulata)	body and legs metallic grren, wings black with red patches	13mm
Hemiptera	Pentatomidae	Stink bug	tan and brown, surface covered with little brown freckles	11mm
Hemiptera	Reduv./Coreidae	Assassin/Leaf-footed bug (spider cache)	only have the abd and thx, but edges of abd are clearly flared out and up and would have extended beyond edges of wings	7mm(e)
Hemiptera	Reduviidae:Emesinae	Thread-legged bug	forelegs highly modified with array of spines	4mm
Hemiptera	Scutellaridae	Shield-backed bug	tan	6mm
Hemiptera	Unk	Unid. Nymphs		<1mm
Homoptera	Aleyrodidae	White fly		<1mm
Homoptera	Aphididae	Aphids		1mm
Homoptera	Cicadellidae	Leaf hopper A	pale yellow, nose long and pointed	7mm
Homoptera	Cicadellidae	Leaf hopper AA	extr intricately patterned brown on whitish background	6mm
Homoptera	Cicadellidae	Leaf hopper AB	nymph: cloudy whitish-tan cast, small black spot on tip of nose flanked by a larger spot on each side (sim. to J), lacks any other distinctive markings	2-3mm
Homoptera	Cicadellidae	Leaf hopper AC	very green, smooth, no markings, legs reddish-brwon; a nymph but very distinct	2mm
Homoptera	Cicadellidae	Leaf hopper B	grass green, nose pointy	5mm
Homoptera	Cicadellidae	Leaf hopper C	mottled tan & brown, some light marking on head and dark mustachios	3mm
Homoptera	Cicadellidae	Leaf hopper D	cream-colored w/ brown spots; a nymph but quite different than others	2mm
Homoptera	Cicadellidae	Leaf hopper E	light tan with tiny brown spots; another nymph but again very different	5mm

# NALF San Clemente Island 2010 Invertebrate Surveys Species List

Order	Family	Species/Taxon name	Notes	Size Class
Homoptera	Cicadellidae	Leaf hopper F	green, nose flattened, surface highly textured	6mm
Homoptera	Cicadellidae	Leaf hopper G	light brown and tan, head narrow and flattened d-v	3mm
Homoptera	Cicadellidae	Leaf hopper H	head & thorax yellowish-tan, abdomen tiger-striped	3mm
Homoptera	Cicadellidae	Leaf hopper I	small, mottled brown & tan, 3 brown spots on either side of head (one on one side the two lateral spots were joined together around the back of the middle spot)	2mm
Homoptera	Cicadellidae	Leaf hopper J	nymph: small black dot on tip of nose, 2 larger black spots flanking, array of brown patches and spots on head and thx	2-3mm
Homoptera	Cicadellidae	Leaf hopper K	highly mottled dark brown and tan, very short and squat	2mm
Homoptera	Cicadellidae	Leaf hopper L	pale creamy-yellow with two triangular brown spots on nose, flanked by pairs of smaller dots, splotches of gold-tan on head and thorax	3mm
Homoptera	Cicadellidae	Leaf hopper M	a nymph, but distinct; whitish tan, tiny black spot on nose flanked by two larger black spots	3mm
Homoptera	Cicadellidae	Leaf hopper N	highly mottled, black or dark brown on tan with larger white splotches on head and wings	3mm
Homoptera	Cicadellidae	Leaf hopper O	golden brown, no distinct markings	6mm
Homoptera	Cicadellidae	Leaf hopper P	head flattened d-v like G, but body golden brown, wings mostly white w/ 3 tranverse spots mid-wing and small spots along margin	3mm
Homoptera	Cicadellidae	Leaf hopper Q	very highly mottled brown and tan, wings (???) with brown venation	7mm
Homoptera	Cicadellidae	Leaf hopper R	cream-yellow, 2 brown spots on nose, abd tiger-striped	3mm
Homoptera	Cicadellidae	Leaf hopper S	body yellowish, legs green, wings opaque white w/ brown mottling	2mm
Homoptera	Cicadellidae	Leaf hopper T	reddish-brown, no distinct marking, wing veins white	4mm
Homoptera	Cicadellidae	Leaf hopper U	all tan, no distinct markings, wings smoky-brown but clear	4mm
Homoptera	Cicadellidae	Leaf hopper V	sim. to G, but much more highly mottled, almost a fractal pattern of brown lines on wings	3mm
Homoptera	Cicadellidae	Leaf hopper W	mottled green and tan on hd & thx, wings opaque white with tan patterning	3mm
Homoptera	Cicadellidae	Leaf hopper X	green all over	3mm
Homoptera	Cicadellidae	Leaf hopper Y	pale yellow, thin brown dashes along front margin of head	3mm
Homoptera	Cicadellidae	Leaf hopper Z	small, whitish-yellow w/ smoky brown patches on thx and wings	2mm
Homoptera	Cicadidae	Cicada	heard during a walk, but never saw it	unk
Homoptera	Coccoidea (superfamily)	Scale insect A	crawler, tiny, black	<1mm
Homoptera	Coccoidea (superfamily)	Scale insect B	white, soft-bodied, got a winged male, too	1-2mm
Homoptera	Issidae	Issid plant hopper A	dark brown, wings clear w/ brown veins and single brown patch on wing margin (like a stigma)	3-4mm
Homoptera	Issidae	Issid plant hopper B	light tan	2mm
Homoptera	Issidae	Issid plant hopper C	black, but much bigger than A, no spots on wings	5mm
Homoptera	Issidae	Issid plant hopper D	mottled white and brown, wings clear with brown spots and hairs along veins	2-3mm
Homoptera	Issidae	Issid plant hopper E	body black, wings opaque white with brown veins (veins get darker distally)	3.5mm
Homoptera	Issidae	Issid plant hopper F	brown thorn-mimic	3mm
Homoptera	Issidae	Issid plant hopper G	dark brown, wings clear w/ brown veins and a few brown patches in addition to the 'stigma' on Issid A	6mm
Homoptera	Issidae	Issid plant hopper H	tan-brown, wings veins brown in distal half only (sim. To E, but this considerably larger and broader)	6mm
Homoptera	Pseudococcidae	Mealybug	brown (probably was white when alive)	2mm
Homoptera	Psyllidae	Psyllid A	cream-yellow, wings clear	2mm
Homoptera	Psyllidae	Psyllid B	body grass green, wings opaque-white and covered with purplish-red dots	2mm
Homoptera	Psyllidae	Psyllid C	hd & thx brown-black, abd green	2mm
Homoptera	Psyllidae	Psyllid D	yellow-tan, wings clear and lightly brown-smoky	3mm
Homoptera	Psyllidae	Psyllid E	sort of pinkish and brown, wings clear w/ a few small brown spots along upper wing margin	2mm
Homoptera	Psyllidae	Psyllid F	reddish-brown, wings clear w/ brown veins	2mm
Hymenoptera	Apidae	Honeybee ( <i>Apis mellifera</i> )		13mm
Hymenoptera	Apidae:Anthophorinae	Digger bee A	red hair, white face	10mm
Hymenoptera	Apidae:Anthophorinae	Digger bee B	dark/black hair, black face, almost exclusively on DEICLE	10mm
Hymenoptera	Apidae:Anthophorinae	Digger bee C	mostly white haired, black face, almost exclusively on DEICLE	10mm
Hymenoptera	Apidae:Anthophorinae	Digger bee D	larger than A-C, hairs white to reddish?	13mm
Hymenoptera	Apidae:Anthophorinae	Digger bee E	sim. to D but only very narrow white stripes on abd	13mm
Hymenoptera	Apidae:Apinae	<i>Synhalonia (=Eucera) actiosa</i>	I think this is the common bee seen on cactus flowers	
Hymenoptera	Bethylidae	Bethylid wasp	tiny, tan, wingless, ant-like	1mm
Hymenoptera	Braconidae	Braconid wasp A	2mm, black, whitish rings around eyes	2mm
Hymenoptera	Braconidae	Braconid wasp B	brown to black, wing venation greatly reduced (compared to A)	1-2mm
Hymenoptera	Braconidae	Braconid wasp C	3mm, black, wings like <i>Microgaster</i> (PG, p321)	3mm
Hymenoptera	Braconidae	Braconid wasp D	tan, 5mm	5mm



**NALF San Clemente Island 2010 Invertebrate Surveys Species List**

<b>Order</b>	<b>Family</b>	<b>Species/Taxon name</b>	<b>Notes</b>	<b>Size Class</b>
Hymenoptera	Braconidae	Braconid wasp E	black, 2 basal cells in forewing (MD, SMD, re:PG), costal veins prominent with long narrow stigma, marginal vein long but not reaching wing margin	2mm
Hymenoptera	Ceraphronidae	Ceraphronid wasp A	1mm, brown, wingless	1mm
Hymenoptera	Ceraphronidae	Ceraphronid wasp B	1mm, brown, this one has wings	1mm
Hymenoptera	Cynipidae	California jumping gall wasp (Neuroterus saltatorius)	on underside of QUETOM leaf	1mm dia
Hymenoptera	Cynipidae	Gall wasp	very similar to the 'oak apple gall wasp' depicted in PG	1mm
Hymenoptera	Cynipidae?	Gall wasp	tiny, brown, no wing venation, 14 ant. Segments	1mm
Hymenoptera	Diapriidae	Diapriid wasp	black, wing venation reduced to single marginal vein	2mm
Hymenoptera	Encyrtidae	Encyrtid wasp A	black, 2mm, abd bulbous and very thin-waisted	2mm
Hymenoptera	Encyrtidae	Encyrtid wasp B	black, hind femora swollen	3mm
Hymenoptera	Encyrtidae	Encyrtid wasp C	red, basal half of wing black, with black stripe at end of costal vein	2mm
Hymenoptera	Encyrtidae	Encyrtid wasp D	brown, wingless	1mm
Hymenoptera	Encyrtidae	Encyrtid wasp E	tiny, yellowish	<1mm
Hymenoptera	Encyrtidae	Encyrtid wasp F	black	1mm
Hymenoptera	Eulophidae	Eulophid wasp A	tiny, black	1mm
Hymenoptera	Eulophidae	Eulophid wasp B	tan, wings with brown stripes, white stripe across face from eye-to-eye	3mm
Hymenoptera	Eulophidae	Eulophid wasp C	yellow with intricate black markings (maybe something like Zagrammasoma, but head is of normal proportions)	1.5mm
Hymenoptera	Eulophidae	Eulophid wasp D	black, somewhat metallic, male ant. pectinate	2mm
Hymenoptera	Eulophidae	Eulophid wasp E	black metallic (steel blue), black spot on wing	3mm
Hymenoptera	Eulophidae	Eulophid wasp F	black spot on wing (like E, but only 1-1.5 mm), ant. Pectinate	1-1.5mm
Hymenoptera	Eupelmidae	Eupelmid wasp	black, somewhat metallic	3mm
Hymenoptera	Eupelmidae	Eupelmid wasp B	black, abd very small, thin-waisted	1mm
Hymenoptera	Eurytomidae	Eurytomid wasp?	black	1.5mm
Hymenoptera	Formicidae	Aphaenogaster patruelis		4-5mm
Hymenoptera	Formicidae	Carpenter ant (Camponotus sp.)		6-8mm
Hymenoptera	Formicidae	Fire ant (Solenopsis sp.)		1mm
Hymenoptera	Formicidae	Lasius sp. (Field ant)		4mm
Hymenoptera	Formicidae	Linepithemia humile (Argentine ant)		3mm
Hymenoptera	Formicidae	Monomorium ergatogyna		2mm
Hymenoptera	Formicidae	Pheidole clementensis		2mm
Hymenoptera	Formicidae	Pogonomyrmex subnitidus		2mm
Hymenoptera	Formicidae	Prenolepis imparis		3mm
Hymenoptera	Formicidae	Solenopsis xyloni		2mm
Hymenoptera	Formicidae	Tapinoma sessile		3mm
Hymenoptera	Formicidae	Temnothorax sp. (T. andrei?)		2mm
Hymenoptera	Halictidae	Halictid bee A (perhaps the female to D?)	metallic blue-green	10mm
Hymenoptera	Halictidae	Halictid bee B	hd & thx metallic greenish-black, abd black	5-7mm
Hymenoptera	Halictidae	Halictid bee C?	same size as B, but distinctly green rather than blue green	10mm
Hymenoptera	Halictidae	Halictid bee D (perhaps the male to A?)	hd & thx metallic green to blue-green, abd striped black & yellow [Agapostemon texanus?]	10mm
Hymenoptera	Ichneumonidae	Ichneumonid wasp A	nr. Ophion in PG	15mm
Hymenoptera	Ichneumonidae	Ichneumonid wasp B	tan, ant. Very long, nr. Cryptus in PG	9-12mm
Hymenoptera	Mutillidae	Velvet ant	brick red, only moderately hairy, hairs shiny red	11mm
Hymenoptera	Mymaridae	Fairy fly		<1mm
Hymenoptera	Platygasteridae	Platygasterid wasp A	black, no wing venation	1mm
Hymenoptera	Pompilidae	Spider wasp A	black	14mm
Hymenoptera	Pompilidae	Spider wasp B	Metallic bluish-black; the size difference is probably male-female	10-15mm
Hymenoptera	Pompilidae	Spider wasp C		8mm
Hymenoptera	Pteromalidae	Pteromalid wasp A	black, long antennae	2mm
Hymenoptera	Pteromalidae	Pteromalid wasp B	metallic green	2mm
Hymenoptera	Pteromalidae	Pteromalid wasp C	black and somewhat bronze-metallic	2.5mm
Hymenoptera	Pteromalidae	Pteromalid wasp D	black, smaller than the others	1mm
Hymenoptera	Sphecidae:Crabroninae	Sphecid wasp A	black, with white(yellowish) markings	5mm
Hymenoptera	Sphecidae:Sphecinae	Thread-waisted wasp A	hd & thx black, abd stalk and tip black, middle red	18mm
Hymenoptera	Sphecidae:Sphecinae	Thread-waisted wasp B (Palmodes?)		16mm
Hymenoptera	Trichogrammatidae	Trichogrammatid wasp	extr tiny, red	<1mm
Hymenoptera	Unk	Unid. Chalcid	head & thx shiny black, legs & abd red-brown, tarsi appear 5-segm'd, tibial spurs: front- none, middle- long & straight, hind - very long and straight	2.5mm
Hymenoptera	Vespidae	Vespid wasp	black, somewhat hairy, 3 sub-marginal cells, 1 spur on middle tibia, ant 12(13?) segmented	12mm
Isopoda	Armadillidiidae	Pill bug		2-12mm (ave.)
Isopoda	Unk	Woodlouse/Sow bug	not a pill bug, several choices for Family, can't find a key to Isopod Families	7mm
Ixodida	Unk	Mite A		1mm
Ixodida	Unk	Mite B (Galumna?)	Tiny, brown, shiny, hard-bodied	<1mm
Ixodida	Unk	Mite C	larger than the normal mites, body more elongated	3-4mm
Ixodida	Unk	Mite D	even smaller than B, brown, hard-bodied	<1mm
Lepidoptera (Butterflies)	Hesperiidae	Funereal Dusky-wing Butterfly (Erynnis funeralis)		18mm

# NALF San Clemente Island 2010 Invertebrate Surveys Species List

Order	Family	Species/Taxon name	Notes	Size Class
Lepidoptera (Butterflies)	Lycaenidae	Gray hairstreak ( <i>Strymon melinus</i> )		15mm
Lepidoptera (Butterflies)	Lycaenidae	Western pygmy blue ( <i>Brephidium exile</i> )		8mm
Lepidoptera (Butterflies)	Lyceanidae	Acmon Blue ( <i>Plebejus acmon acmon</i> )		9mm
Lepidoptera (Butterflies)	Nymphalidae	Painted lady ( <i>Vanessa cardui</i> )		38mm
Lepidoptera (Moths)	Noctuidae	European yellow underwing ( <i>Noctua pronuba</i> )	found in window sill of Bdg. 121	25mm
Lepidoptera (Moths)	Arcteiidae	Nevada tiger moth ( <i>Grammia nevedensis</i> )	I think this what all those caterpillars were	20mm
Lepidoptera (Moths)	Gelichiidae	Baccharis stem gall moth ( <i>Gnorimoschema baccharisella</i> )		n/a
Lepidoptera (Moths)	Geometridae	Emerald moth ( <i>Dichorda?</i> )	collected from wall of 3-Storey	15mm
Lepidoptera (Moths)	Geometridae	Geometrid caterpillar		12mm
Lepidoptera (Moths)	Pterophoridae	Plume moth	tan	10mm
Lepidoptera (Moths)	Unk	Moth A	6-7 mm, body thin, elongat, wings very narrow	7mm
Lepidoptera (Moths)	Unk	Moth B	5 mm, brown-scaly, ant. thread-like	5mm
Lepidoptera (Moths)	Unk	Moth C	8-9 mm, brown-scaly, ant. thread-like	9mm
Lepidoptera (Moths)	Unk	Moth D	3-4mm, brown	3-4mm
Lepidoptera (Moths)	Unk	Moth E	tannish-white, hairy	15-16mm
Lepidoptera (Moths)	Unk	Moth F	med, tan-white	10-11mm
Lepidoptera (Moths)	Unk	Moth G	brown, 19-20mm, ant. thread-like	20mm
Lepidoptera (Moths)	Unk	Moth H	whitish, feathery antennae	15mm
Lepidoptera (Moths)	Unk	Moth I	white and tan, palps very long	12mm
Lepidoptera (Moths)	Unk	Moth J	14mm, body much heavier and thicker than other moths so far	14mm
Lepidoptera (Moths)	Unk	Moth K	whitish, scaly, hind wings feathery	5mm
Lepidoptera (Moths)	Unk	Moth L	whitish w/ brown splotches, ant thread-like, shoulders covered in shaggy hair	18mm
Lepidoptera (Moths)	Unk	Moth M	orangish-brown with a few darker patches	11mm
Lepidoptera (Moths)	Unk	Moth O	brown, ant. Plain or short-plumose (comb-like)	16-17mm
Lepidoptera (Moths)	Unk	Moth P	mottled brown, tan & white	13mm
Lepidoptera (Moths)	Unk	Moth Q	mottled brown & tan, w/ striking dark brown and black lozenges near leading edge of forewing	18mm
Lepidoptera (Moths)	Unk	Moth R	large, tan-white	16mm
Lepidoptera (Moths)	Unk	Moth S	mottled brown and tan	7mm
Lepidoptera (Moths)	Unk	Moth T	whitish with nearly concentric brown rings toward distal end of wings	9mm
Lepidoptera (Moths)	Unk	Moth U	strikingly banded in white and brown	8mm
Lepidoptera (Moths)	Unk	Moth V	very dark brown	7mm
Lepidoptera (Moths)	Unk	Moth W	white, ant feathery (?this may have been the greenish one I saw in the bucket, faded by alcohol)	10mm
Lepidoptera (Moths)	unk	Moth X	extr. Tiny, whitish, wings very narrow and pointed	2mm
Lepidoptera (Moths)	Unk	Moth Y	brown, ant. short-plumose	15mm
Neuroptera	Chrysopidae	Green lacewing		8mm
Neuroptera	Coniopterygidae	Dusty-wing		2mm
Neuroptera	Hemerobiidae	Brown lacewing		5mm
Neuroptera	Myrmeleontidae	Antlion		30mm
Odonata	Calopterygidae	American Rubyspot ( <i>Hetaerina americana</i> )		42mm
Odonata	unk	Dragonfly, large	reddish, 4-5", saw these fly us by several times this year, never even got close to trying to catch one	115mm
Opiliones	Protolophidae	Harvestman ( <i>Protolophus?</i> )		8mm
Orthoptera	Acrididae:Oedipodinae	Band-winged grasshopper A	hind wing is more green than yellow, so not sure what genus it is	16mm
Orthoptera	Acrididae:Oedipodinae	Band-winged grasshopper B	hing wing yellow, much bigger than A	25mm
Orthoptera	Acrididae:Oedipodinae	Saussure's blue-winged grasshopper ( <i>Lepirus intermedius</i> )		17mm
Orthoptera	Gryllidae:Oecanthinae	Prairie tree cricket ( <i>Oecanthus argentinus</i> )		10mm
Orthoptera	Raphidophoridae	Camel cricket ( <i>Pristoceuthophilus marmoratus</i> )		9mm
Orthoptera	Stenopelmatidae	Silk-spinning cricket ( <i>Cnemotettix pulvillifer</i> )		14mm
Orthoptera	Tettigoniidae:Phaneropterinae	Fork-tailed bush katydid ( <i>Scudderia furcata</i> )		30mm
Pseudoscorpionida	Unk	Pseudoscorpion	!!lost the specimen!!!	3mm
Psocoptera	Pseudocaeciliidae	Pseudocaeciliid bark louse		1mm
Psocoptera	Psocidae	Common bark louse A		1mm
Psocoptera	Psocidae	Common bark louse B	hd & thx striped black and white	2mm
Psocoptera	Trogiidae	Trogiid booklouse		<1mm
Scorpionidae	Vaejovidae	<i>Pseudouroctonus (=Vaejovis) minimus minimus</i>		22mm
Spirostreptida (Diplopoda)	Cambalidae?	Millipede ( <i>Tigolene?</i> )		10mm
Thysanoptera	Phlaeothripidae	Tube-tailed thrips A	Brownish, wings narrow, feather-like	<1mm
Thysanoptera	Phlaeothripidae	Tube-tailed thrips B	black, wingless	2mm
Thysanoptera	Phlaeothripidae	Tube-tailed thrips C	black, wings banded black and white	2mm

## NALF San Clemente Island 2010 Invertebrate Surveys Species List

Order	Family	Species/Taxon name	Notes	Size Class
Thysanoptera	Phlaeothripidae	Tube-tailed thrips D	black, ant-like almost, head and thx narrow, abd broad and rounded, edges of abc flared upward, single white spot on each edge	2mm
Thysanoptera	Phlaeothripidae	Tube-tailed thrips E	black, wingless, body parallel-sided (not wedge-shaped like 'B')	3mm
Thysanura	Lepismatidae	Silverfish		4mm
Thysanura	Machilidae	Jumping bristletail		3-5mm
Unk	Unk	Unknown gall on BROMAD seed	leafy', covered with white short hairs, pupal skin inside appears to have four wings	3mm
Zygentoma	Lepismatidae	Firebrat	grayish, flat, covered with scales	10mm

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# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 5

Date: 5/8/10

Start time: 12:09

End time: 12:35

Temperature: 78.9

Weather conditions: clear, sunny, light breeze

WIND Ave 0.1, Max 4.7

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: CRDI, AVBA, under edge of BACPIL

Pan #2: CRDI, VUCMUS, in shallow channel

Pan #3: in opening around AVBA, LUSPIC, NASPOL

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? 0/1 n

**Meandering Transect**

**Insects seen**

caterpillars	moth, sm 1			
bee flies <del>4</del>	plume moth 1			
moth, lg, grey	bee, black 1			
crane fly 1	wasp, red, wings banded			
earwig 1				
ladybug, 7sp 1				

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set? 0/1 n in BACPIL

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 9

Date: 5/16/10

Start time: 11:30

End time: \_\_\_\_\_

Temperature: 66°F

Weather conditions: wind E=1.5; max 3-4; ± sunny w/ variable fog

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: under AFRAC

Pan #2: " "

Pan #3: " "

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? (y/n)

<b>Meandering Transect</b> <del>#1145</del> <u>1145 - 115B</u>			
<b>Insects seen</b>			
red butt wasp	1	blue butterfly(?)	
horse fly		lady bug (?)	
honey bee			
little black beetle on morning glory			
native bee			
<del>bee</del> fly			
7 spot lady bug			

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set? (y/n)



# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 1

Date: 16 May 2010

Start time: 1340

End time: 1355

Temperature: 60° F

Weather conditions: 8.3 mph avg. Max 12.4 mph

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: \_\_\_\_\_  
Pan #2: \_\_\_\_\_  
Pan #3: \_\_\_\_\_

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low) \_\_\_\_\_  
Card #2: (hi/low) \_\_\_\_\_  
Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken? y/n Small white moth-walk

### Meandering Transect

#### Insects seen

6 spot lady bug	1			
Small white moth				
Idneu wasp black	1			

### Incidental Observations (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set? y/n

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 7

Date: 6/20/10

Start time: 12:00

End time: 12:45

Temperature: 62°

Weather conditions: wind 5-10 mph, scattered coastal clouds

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: open, near EALMAC

Pan #2: open, grass

Pan #3: open, near OPULIT

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? y/n

**Meandering Transect**

**Insects seen**

<del>bees</del> III III bee fly III grass hopper III blue fly III <del>1. wh moth</del> II lg fly III	<del>harsh</del> III III tiny black beetle			
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**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

bee holes				
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Light Trap Set?

y/n bucket fell off! Nothing caught.

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 6

Date: 6/25/10

Start time: 1:45

End time: 2:04

Temperature: 64.5°F

Weather conditions: breezy, 3.8 mph, 9.7 max, sunny

**Pan Traps** (Describe location of pan, including plant species nearby)

- Pan #1: AVEBAR grassland  
 Pan #2: AVEBAR, under DEICLE  
 Pan #3: AVEBAR, under OPULIT + CALMAC, w/ ACHMIL

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

- Card #1: (hi/low)  
 Card #2: (hi/low)  
 Card #3: (hi/low)

Sweep Samples Taken? y/n

**Meandering Transect**

**Insects seen**

- hairstreak |||||
- ~~bee fly~~ ? ||||| } on DEICLE
- ~~honey bee~~ |||||
- (C) dragon fly - orange brown
- grasshopper ||
- (C) blue |
- (C) green fly |

- big black fly 11  
 - 10-spot 10y 6+1

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

hairstreak honey bee				
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Light Trap Set? (y/n)

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 2

Date: 6/26/10

Start time: 2:00

End time: 2:35

Temperature: 66°F

Weather conditions: partly sunny, breezy, 7.8 mph, 9.6 mph

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: Sand, AMBCHA, AST

Pan #2: " VER, AMB

Pan #3: " AST,

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken?  n

Meandering Transect			
<b>Insects seen</b> wasp, blk 12mm IIII wasp, blk 1cm I red, hairy bee III COLEBRA dead IIII IIII IIII bee IIII	grasshopper IIII white note IIII fly, med IIII fly, blk, angular wings I		

Incidental Observations (record all other wildlife observed, including insects seen not associated with sampling protocol)			
hairy treacle II			

Light Trap Set?  n

grasshoppers all in CALMAC, MELAB at base of dome

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 3

Date: 6/27/10

Start time: \_\_\_\_\_

End time: \_\_\_\_\_

Temperature: 64°F

Weather conditions: overcast, breezy, 4.5 mph, 7.5 max

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: open, grassy

Pan #2: edge of LYCCAL, in ANABUS

Pan #3: opening in OPUNT, grasses, CALMAC

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low) \_\_\_\_\_

Card #2: (hi/low) \_\_\_\_\_

Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken?  y  n

**Meandering Transect** NO, TOO CAP

**Insects seen**

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**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set?  y  n

Painted lady (2) @ Site 4

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 8

Date: 7/9/10

Start time: 4:00

End time: 4:30

Temperature: 70

Weather conditions: 0-5 mph

**Pan Traps** (Describe location of pan, including plant species nearby)

- Pan #1: beneath oaks near rocks with lots of lichen - canopy cover  
 Pan #2: beneath oaks and within grasses (non native) - canopy cover  
 Pan #3: within grasses (non-native) - no canopy cover (separated)

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

- Card #1: (hi/low) \_\_\_\_\_  
 Card #2: (hi/low) \_\_\_\_\_  
 Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken? y/n

**Meandering Transect**

Insects seen				
<del>Cricket hunter</del>	Gray hairstreak			
<del>wasp spider wasp</del>	fly			
grasshopper	Spider			
mosquito hawk	bee fly			
western blue	weevil			
"	leaf hopper			
	golden beetle			
	cicada			

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set?  y  n

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 2

Date: 7/10/10

Start time: \_\_\_\_\_

End time: \_\_\_\_\_

Temperature: 59°

Weather conditions: thin coastal layer

**Pan Traps** (Describe location of pan, including plant species nearby)

- Pan #1: Verbena → this trap was tampered with, likely a fox  
 Pan #2: Ambrosia  
 Pan #3: Bromus

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

- Card #1: (hi/low) \_\_\_\_\_  
 Card #2: (hi/low) \_\_\_\_\_  
 Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken?  (y)  (n)

Walk 7/18/2010 <sup>Partly</sup> cloudy 67°  $\bar{x} = 4.9$ , max = 5.7  
 Start: 1235 Stop: 1304

**Meandering Transect**

Insects seen				
small moth IIII	gray hairstreak 1			Large Black Beetle - dead 1 (C)
bee - whitish-yellow II	medium grasshopper			
medium fly IIII	small grasshopper			
black - black	halictid bee III			
medium moth I	- metallic green			
black wasp X IIII	black bee I			
ladybug I	large bluish-black fly I			
	black fly II			

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set?  (y)  (n)

all medium grasshoppers yellow winged variety on walk

↓  
very successful

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 9

Date: 7/10/10 + 7/17 (Pans & Light)

Start time: 1:06

End time: 1:45

Temperature: 60°F

Weather conditions: partly cloudy 0-5 mph  
7/17 Sunny, warm (70+°)

**Pan Traps** (Describe location of pan, including plant species nearby)

- Pan #1: ARTEN
- Pan #2: CT
- Pan #3: 1

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

- Card #1: (hi/low) \_\_\_\_\_
- Card #2: (hi/low) \_\_\_\_\_
- Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken? (y)/n

<b>Meandering Transect</b>				
<b>Insects seen</b>				
grasshoppers IIII TNTC  pygmy blue IIII TNTC  white moth IIII TNTC  black wasp IIII	gray handbreak TNTC red rump wasp  bee II	* there were 3 different types of grasshoppers 1 w/ a blue underwing		

<b>Incidental Observations</b> (record all other wildlife observed, including insects seen not associated with sampling protocol)				
large black horsefly				

Light Trap Set? (y)/n  
7/17

Light Trap not running when checked 7/18  
 Pan Trap 3 leaked; no liquid when checked 7/18



# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 4

Date: 7/11/10 + 7/17/2010

Start time: \_\_\_\_\_

End time: \_\_\_\_\_

Temperature: \_\_\_\_\_

Weather conditions: \_\_\_\_\_

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: Opuntia littoralis

Pan #2: Lycium and atriplex

Pan #3: Lycium and bromus

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low) \_\_\_\_\_

Card #2: (hi/low) \_\_\_\_\_

Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken? (y/n)

Weather for walk on 7/17: Temp - 69° Wind - R=3 max=7

**Meandering Transect**

Insects seen			
Small grasshopper - IIII		Hairstreak II	Start: 1330  Stop: 1401
Small moth - IIII		Large Black Wasp 1	
medium grasshopper - IIII		Large Fly II (E)	
Argiope spider III		Halictid Bee III	
Bee fly 1		- Green metallic	
Bee II		Small butterfly 1 - dusky underwing - brownish upperwing	

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set? (y/n)

# Sar Clemente Island

## Invertebrate Survey Datasheet

Site #: 5

Date: 7/12/10

Start time: 10:10

End time: 10:40

Temperature: 65

Weather conditions: partly cloudy / coastal layer 5-6 mph

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: Zupines → evaporated

Pan #2: Open grassland

Pan #3: Mossball patches + rocks

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)                     

Card #2: (hi/low)                     

Card #3: (hi/low)                     

Sweep Samples Taken? (y) n

**Meandering Transect**

Insects seen			
blue butterfly 	black wasp     green spider (collected)	bee crab spider (collected)	
grasshopper +10 	white moth 	brown moth ladybug -	
leaf hopper 	caterpillar til black bee (collected)	gray hornsteak	
	green bee		

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set? (y) n

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 3

Date: 7/12/10

Start time: \_\_\_\_\_

End time: \_\_\_\_\_

Temperature: \_\_\_\_\_

Weather conditions: \_\_\_\_\_

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: Atriplex and Opuntia littoralis

Pan #2: Zinnia californica, Ambrosia sp. → tampered with

Pan #3: Ambrosia sp. and Bromus sp.

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low) \_\_\_\_\_

Card #2: (hi/low) \_\_\_\_\_

Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken?  y /  n

Walk 7/18/2010 Weather: <sup>Partly to</sup> Mostly Cloudy Temp: 76°

Meandering Transect start: 1340 End: 1410 Wind: X = 1.9 max = 34

**Insects seen**

med. w. grasshopper IIII				
small moth IIII				
Small grasshopper IIII				
Small fly 1				
halictid bee 1				
black wasp 1				
bee fly 1				
		medium fly 1		
		Bee 1 ⊕		
		- blond, 1 cm		

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)


Light Trap Set?  y /  n

→ tampered with

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 1

Date: 7/16/10

Start time: 1412

End time: 1445

Temperature: 70.5°F

Weather conditions: cloud sunny, breezy, X=7.5 mph, max 9.8

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: AMBROS, BROSS

Pan #2: LYCCAL, AMBROS

Pan #3: AMBROS, BROSS

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? (y/n)

**Meandering Transect**

Insects seen

Miniature Blue	II	Muscid fly medium 1	
Medium moths	I		
Small grasshopper	IIII IIII		
medium grasshopper	IIII IIII IIII	IIII	
Small moths	IIII		
medium fan moths			
Bee fly	I		

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

Digger Bee	1		
Gray Hairstreak	1		

Light Trap Set? (y/n)

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 7

Date: 7/17/2010

Start time: 1140

End time: 1210

Temperature: 75-76°

Weather conditions:  $\bar{x} = 4$  max = 5.5 Sunny, Clear + light breeze

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: open sparse NASPUL near OPLUT + CALMAC

Pan #2: in NASPUL up against OPLUT

Pan #3: NASPUL, AVEBAR among OPLUT + CALMAC

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? (y/n)

**Meandering Transect**

Insects seen				
large dragonfly 1 4-5"		Gray/Black Striped	1	
medium grasshopper		Bee		
Gray Hairstreaks		Large Black Jumping Spider	1	
Digger Bees		Bee	1	
Acmon Blue	1			
Small grasshopper				
Blue(?)	1 (C)			

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

halictid bee (gray)				
gray hairstreaks				
Digger bee nests				
10 spot ladybug				

Light Trap Set? (y/n)

Pan 1 + 2 <sup>→ possibly tampered w/ by foxes</sup> dry + not collected

Light ok

Pan 3 collected, but low on fluids

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 6

Date: 7/18/10

Start time: 1100

End time: 1135

Temperature: 81°f

Weather conditions: sunny, light breeze x 1-3 mph, max 2-3 mph

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: grassland, AVEBAR, RASPUL, BROTHAL

Pan #2: under DEICKE in grasses

Pan #3: in OPULIT-CALMAC

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? y/n

Meandering Transect				
Insects seen				
medium grasshopper		Acmon blue 1		
Black bee 11		medium moth 1		
small moth 11		small orange/brown grasshopper	1 (C)	
small grasshopper 111		halictid bee		
Blue-winged medium grasshopper		metallic green		
large fly 111		bee fly 111		
		gray hairstreak 1		

Incidental Observations (record all other wildlife observed, including insects seen not associated with sampling protocol)				
large <del>horn</del> fly 1 syrphid				

Light Trap Set? y/n

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 7

Date: 8/19/2010

Start time: 15:00

End time: 1530

Temperature: 87°

Weather conditions: Sunny; Slight Breeze  $\bar{x}$  = 1.7 max = 3.1

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: Open ground w/ grasses

Pan #2: Under Het Arb

Pan #3: In grasses + Opulit

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low) \_\_\_\_\_

Card #2: (hi/low) \_\_\_\_\_

Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken?  y /  n

**Meandering Transect**

Insects seen				
Grasshopper medium 111				
Grasshopper small (clicking)				
Fly 11				Katydid (tray) 1
Pygmy Blue 1111				House fly 1
Unknown Bee 1111				Small fly 1
Bee Fly 11				Antlion 1
				Grey Hairstreak 1111
				Unknown Butterfly 111

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

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Light Trap Set?  y /  n

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 2

Date: 8/20/10

Start time: 1355

End time: 1415

Temperature: 69°

Weather conditions: Partly to mostly cloudy, breezy (wind = 26, max = 99)

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: Ambrosia

Pan #2: Verbena - trap was tampered with

Pan #3: Astragalus

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? y/n

**Meandering Transect**

Insects seen				
fly IIII	Small black wasp IIII			
moth 1	honeybee IIII			
black wasp IIII	bee fly 1			
surf id fly 1	III II			
grasshopper small III	III III III III	III III IIII		
salt pepper moth 1				
small white moth III				

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

Black widow eating bee on the way down - red, hairy solitary bee	small black bugs on Callistegia - too many to count	7 spot ladybug - collected dead beetle		
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Light Trap Set? (y/n)



# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 5

Date: 8/20/10

Start time: 9:38

End time: 9:55

Temperature: 89°

Weather conditions: sunny, warm, light breeze, wind 1-1, max 5:5

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: under BACCHIL, in grass GASVEN BRUSH, VILLOW (Dry!)

Pan #2: under BACCHIL, " " " " " "

Pan #3: in bottom of small channel, PUMPKIN

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? y/n

<b>Meandering Transect</b>			
<b>Insects seen</b>			
Fly 11 Black wasp 11 Grasshopper small <u>     </u> Gray hairstreak 1 antlion 1 (C) Acmon Blue <u>    </u>	<del>Echo Acmon</del> white moth 1	<del>There were blues</del>	

<b>Incidental Observations</b> (record all other wildlife observed, including insects seen not associated with sampling protocol)			
Hairstreak Surfidi fly Dragonflies (3)			

Light Trap Set? y/n

Light not running, looks like nothing in bucket

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 3

Date: 8/24/10

Start time: 2108

End time: 2132

Temperature: 70°F

Weather conditions: sunny, warm, breezy, wind T = 4-1, max 7.4

**Pan Traps** (Describe location of pan, including plant species nearby)

- Pan #1: in BEREMD + LYCCAL  
 Pan #2: in ANIBRUS + ATRSEM next to OPULIT + LYCCAL  
 Pan #3: " " " " " "

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

- Card #1: (hi/low)  
 Card #2: (hi/low)  
 Card #3: (hi/low)

Sweep Samples Taken? y/n

**Meandering Transect**

<b>Insects seen</b>			
Sm grasshopper (cricket) <del>    </del>		bee fly (yellow) 1	
Acron blue "			
mod. grasshopper 1			
small moth "			
small bee fly (silver/white abd)			
argiope spider 1			

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

Digger bee holes a-maybe but not many bees flying around - desert?			
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Light Trap Set? y/n

Trap #1 tampered but seems okay

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 4

Date: 8/26/10

Start time: 3:23

End time: \_\_\_\_\_

Temperature: 66°F

Weather conditions: wind  $\bar{x}$  = 6 mph, max 8, partly cloudy, breezy

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: in LYCAL

Pan #2: in open

Pan #3: in open on ORBIT

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: ~~(hi/low)~~

Card #2: ~~(hi/low)~~

Card #3: ~~(hi/low)~~

Sweep Samples Taken? (y/n)

**Meandering Transect**

Insects seen				
sm grasshopper (chiron)	<del>     </del> 	lg fly	1	
acorn blue	1			
orange bee	"			
arg rope spider				
sm white moth	1			
funnel web spider	1			

**Incidental Observations** (record all other wildlife observed, including insects seen not associated with sampling protocol)

funnel web spider				

Light Trap Set? (y/n)

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 9

Date: 8/27/10

Start time: 12:05

End time: 12:32

Temperature: 88°F

Weather conditions: overcast wind 2.4 max 2.7

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: grass in ARTICAL

Pan #2: basil ARTICAL

Pan #3: under UPLAIT + ARTICAL

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low) \_\_\_\_\_

Card #2: (hi/low) \_\_\_\_\_

Card #3: (hi/low) \_\_\_\_\_

Sweep Samples Taken? y/n

<b>Meandering Transect</b>			
<b>Insects seen</b>			
med fly IIII		sm. grasshopper (nest = 1/2) IIII	
Small grasshopper <sup>Centropus</sup> IIII	<del>IIII</del> <del>IIII</del> <del>IIII</del> <del>IIII</del>	bee fly org + blue II	
acorn blue IIII		small bee I	
sawflies lar gh IIII		gray hairstreak II	
grasshopper (ground) I		blow fly C I	
lg fly II			
med grasshopper III			

<b>Incidental Observations</b> (record all other wildlife observed, including insects seen not associated with sampling protocol)			
sawflies lar gh			

Light Trap Set? y/n

# San Clemente Island

## Invertebrate Survey Datasheet

Site #: 8

Date: 8/22/10

Start time: 1410

End time: 1430

Temperature: 84°F

Weather conditions: suny, light breeze, wind  $\approx$  1.5, max 2.5

**Pan Traps** (Describe location of pan, including plant species nearby)

Pan #1: base of oak

Pan #2: under oak on rocks

Pan #3: base of oak

**Sticky cards** (Describe location of card, including plant species card is in/under, indicate whether card is high or low)

Card #1: (hi/low)

Card #2: (hi/low)

Card #3: (hi/low)

Sweep Samples Taken? (y)n

<b>Meandering Transect</b>				
<b>Insects seen</b>				
Black wasp 1	Katydid green 1	Bee Fly 1		
fly 111	Medium moth 1 - white w/ strong black line	Beetle - orange striped 1 (C)		
Acron blue IIII		Robber Fly 1 (C)		
Grasshopper small III	III III III III	III IIII IIII		
small moth III 1	Gray batstreak II			

<b>Incidental Observations</b> (record all other wildlife observed, including insects seen not associated with sampling protocol)				
Katydid 1				
syrphid fly 1				

Light Trap Set? (y)n

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