COACHELLA VALLEY CONSERVATION COMMISSION

DECEMBER 2014

BIOLOGICAL MONITORING PROTOCOL

for

Stenopelmatus cahuilaensis

Coachella Valley Jerusalem Cricket

Prepared by the

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&
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Preface

The Coachella Valley Multiple Species Habitat Conservation Plan and Natural Communities Conservation Plan (CVMSHCP/NCCP, or Plan) was established in 2008 to ensure regional conservation of plant and animal species, natural communities and landscape scale ecological processes across the Coachella Valley. Areas where conservation must occur throughout the life of the Plan are designated by a Conservation Area Reserve system which is designed to include representative native plants, animals and natural communities across their modeled natural ranges of variation in the valley. The types and extent of Conservation requirements for covered species, natural communities and landscapes within these reserves are defined by specific goals and objectives that are intended to support the following guiding ecologically-based principles:

1) maintaining or restoring self-sustaining populations or metapopulations of covered species;
2) sustaining ecological and evolutionary processes necessary to maintain the functionality of the natural communities and Habitats for the species included in the Plan;
3) maximizing connectivity among populations and avoiding habitat fragmentation to conserve biological diversity, ecological balance, and connected populations;
4) minimizing adverse impacts from off road vehicle use, illegal dumping, edge effects, exotic species and other disturbances;
5) ensuring management is responsive to short-term and long-term environmental changes, and new science.

The Plan uses ongoing biological monitoring and land management programs to assure these general conservation principles, as well as species-specific Conservation Goals and Objectives, are met and maintained throughout the life of the Plan. The Biological Monitoring program uses a science-based approach that not only assesses species distributions and population fluctuations but also employs the peer-reviewed scientific research process to develop hypotheses and address information gaps relating to the ecology of covered species. These information gaps are species-dependent and could include (but are not limited to) certain aspects of life-cycle requirements, gene flow barriers, population threats and stressors, resiliency and resistance to threats and stressors, population drivers and responses to drivers, etc. The research element of the monitoring program is therefore value-added, as it provides the additional capacity to revise and refine the Plan’s habitat models, survey locations, and develop additional research questions and projects at the same time as population numbers are collected. Data from the Biological Monitoring program also feed into the Land Management program and assist Conservation Reserve managers with developing best management practices that are intended to ensure the Conservation Goals and Objectives for each species are met and maintained. This linkage between the monitoring and management programs enables the capacity to support an adaptive, self-updating process. As management prescriptions are employed and the biological monitoring program continues evaluating Covered Species, the effects from installed management prescriptions can be measured, evaluated, and fed back into the management program so that managers can review and revise conservation practices, as needed.

Introduction

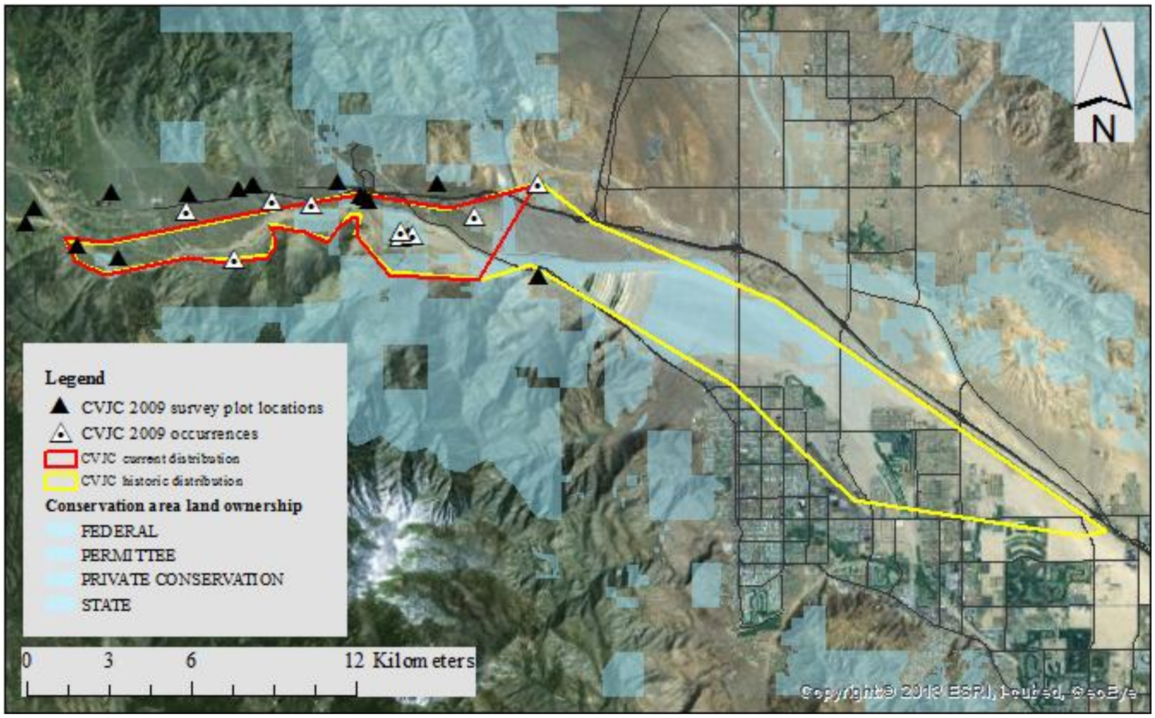
The Coachella Valley Jerusalem Cricket (CVJC), *Stenopelmatus cahuilaensis* (Tinkham 1968), has a narrow distribution, restricted to southern California's western Coachella Valley. They are an obligate sand species, occurring in sandy to somewhat gravelly sandy soils (G. Ballmer, as cited in CVMSHCP Section 9.3.2.4). According to Weissman (pers. comm.), CVJC require higher humidity and cooler temperatures than typically occur in the central Coachella Valley. He suggested that other than soil texture, the distribution of the species is most likely based on both temperature and moisture gradients. This apparent sensitivity to both heat and desiccation indicates CVJC may be either relicts from a wetter-cooler climatic regime or may only opportunistically enter the desert during wetter periods. From the eastern Coachella Valley up the San Gorgonio grade there are distinct east to west gradients with a steady drop in temperature and increase in precipitation as the elevation increases from Sea Level to 790 m. This temperature-precipitation gradient may be a key to understanding the current and future CVJC distribution in the face of projected climate change scenarios (Prentice et al. 2011). The historic and current distribution approximations for this species are shown in Figure 1A & B.

The Coachella Valley Jerusalem Cricket is classified as an Associated Covered species of the Aeolian Sands Community: Sand Dunes and Sand Fields Plan. Section 8.4.1.3.3 defines key species level monitoring objectives for this Community as:

1) estimating distributions or population sizes;
2) developing and evaluating ecological models that propose relationships between biotic and abiotic variables and Covered Species;
3) learning more about the ecology of Covered Species,
4) identifying and evaluating potential threats to Covered Species, and
5) developing effective and efficient non-lethal sampling protocols (CVMSHCP 8-61 to 8-62).

Species specific monitoring should determine whether Conservation Goals and Objectives for CVJC are attained (section 9.3.2.1 of the Plan), including:

1) protecting Core Habitat to allow for evolutionary processes and natural population fluctuations, minimizing fragmentation, human-caused disturbance and edge effects. Core Habitat is identified as occurring within the Snow Creek/Windy Point Conservation Area;
2) protecting Other Conserved Habitat to provide sufficient area and variety of Habitat types to accommodate population fluctuations, allow for genetic diversity and to conserve the full range of environmental conditions within which this species is known to occur;
3) ensuring conservation by maintaining the long-term persistence of self-sustaining populations and conserving Habitat quality through biological monitoring and Adaptive Management actions in the Plan area.



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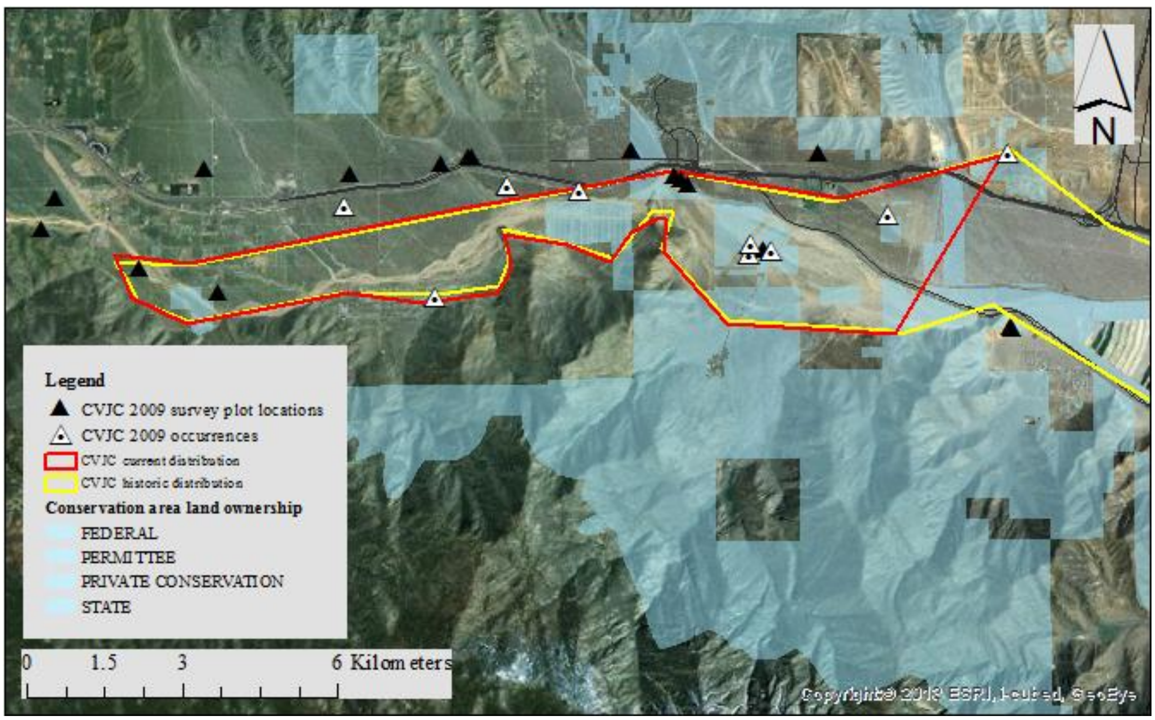

B

Figure 1 A & B. Approximations of Coachella Valley Jerusalem cricket historic (yellow polygon) and current (red polygon) distributions, delineated by known historic and recent occurrence points (T. Prentice, unpub. data).

Due to the cricket's general rarity, nocturnal behavior, and no distinctive or readily observable tracks (as they often occur in more stabilized, coarser aeolian deposits), the survey approach described for the species covered in the Aeolian Sand Community Monitoring Protocol will not work for this species. Preliminary studies were conducted in 2003 and 2009 to determine the best detection methodology for CVJC. A total of 2158 searches under random debris, 1389 searches under detection tiles, and 240 searches in pitfall traps resulted in very low overall detections: 1.9% of the debris searches, 1.0% of the detection tiles, and 0.4% of the pitfall traps yielded a cricket. When both the weather/soil moisture was suitable for above ground cricket activity and the searches were within the crickets' occupied range (i.e. at least one cricket was found at the site and day being surveyed), the detection rate rose to 16.0% and 2.9% under debris and detection tiles, respectively. Only one cricket was ever detected using pitfall traps so a similar comparison for that method was not possible.

Of each detection method, pitfall traps were time consuming to establish and maintain and had by far the worst detection success (Prentice et al. 2011). Jerusalem crickets captured by pitfall traps also had increased mortality rates due to desiccation and predation (Prentice et al. 2011). Surveying under debris and/or detection tiles has no known effect on survivorship as long as the debris is carefully replaced. Detections appeared to vary with soil moisture, so when the sand below the debris dried out days or weeks after a rain event, detections approached zero. For example, twenty-three days after the last heavy rain, over 50 pieces of debris were searched along a sandy, little-used dirt road resulting in no CVJC captures. The sand beneath all lifted pieces was quite dry. Two weeks later, following a heavy rain on the previous day, approximately 20 pieces of debris were overturned along the same road, resulting in the discovery of four CVJCs. The ground surface beneath all debris articles was quite moist. All of the objects under which CVJCs were found had previously been searched on the previous survey. Surveys should occur during the winter months, when soil moisture is likely to be high due to rainfall events.

Objectives

The CVMSHCP calls for a science-based biological monitoring program. Our primary objectives are to assess the presence and distribution of the Coachella Valley Jerusalem cricket within the Plan's Conservation Areas, and to collect information about potential habitat attributes that may determine habitat suitability in order to facilitate the development of hypotheses and distribution models. We will employ the California Native Plant Society (CNPS) and California Dept. of Fish and Wildlife (CDFW) Combined Vegetation Rapid Assessment relevés (Buck-Diaz and Evens 2011) in addition to species-focused methods to document habitat attributes such as elevation and substrate composition, and measure the presence and extent of invasive plant species. Some variables that will be recorded include adjacent land uses (suburban, agriculture, natural open space) and degrees of anthropogenic alteration, which will assist with determining whether detectable patterns exist that can be tested with future work. Sampling will also document varying densities of invasive species, such as but not limited to Sahara mustard (*Brassica tournefortii*) and Mediterranean grass (*Schismus barbatus*), to quantify the levels of invasive plant species infestations. The CVMSHCP identifies main threats to this species as OHV use and habitat fragmentation, yet one of the emerging threats to this species appears to be climate change (Prentice et al. 2011). Shifts of suitable habitat to the west in response to climate change may push this species out of the CVMSHCP area, where it may encounter constrained habitat or lack of conserved habitat, increased habitat fragmentation and degradation. The most important outcome of monitoring will be to document changes in distribution and habitat as/if they occur.

Survey work occurring in 2015 will support the development of more focused research and monitoring activities for this species within Conservation Areas of the Coachella Valley Multiple Species Habitat Conservation Plan. Several critical questions, aimed at beginning to develop and test hypotheses between perceived suitable habitat and this species' occupancy patterns, are outlined below:

1. What is the current distribution of this species and its habitat, and how do the 2015 survey occurrences compare, in geographic extent, to 2003-2005 and 2009 survey occurrences?
2. What are the habitat characteristics of this species?
3. What are the anthropogenic impacts associated with the habitat where this species is found to occur?
4. To what extent are invasive plant species present within occupied and unoccupied habitat, and do those invasive species have a clear and measurable impact on the occupancy patterns of CVJC?

Methods

Site Selection

The CVMSHCP/NCCP identifies that, at minimum, monitoring for the Coachella Valley Jerusalem Cricket (Section 9.3.2) should be implemented within the Core Habitat of the Snow Creek – Windy Point Conservation Area, and could also occur in areas designated as Other Conserved Habitat, as these areas provide for essential ecologically linked features. Other Conserved Habitat includes the Highway 111/I-10 Conservation Area, Whitewater Floodplain Conservation Area, Upper Mission Creek/Big Morongo Canyon Conservation Area, Willow Hole Conservation Area, and Edom Hill Conservation Area. The easternmost known occurrence is a record from the Thousand Palms area in the vicinity of Bob Hope Drive and Interstate 10. Surveys conducted by Tom Prentice in 2003 (Allen et al. 2005) within the potential habitat areas east of Windy Point did not yield any crickets.

As of 2014, conservation areas where surveys will be conducted are limited to the BLM lands, Coachella Valley Conservation Commission lands, CVMSHCP permittee lands (CVWD), and private conservation lands in the Stubbe and Cottonwood Canyons Conservation Area, Snow Creek/Windy Point Conservation Area, east of Fingal's Finger into the Highway 111/I-10 Conservation Area and the Whitewater Floodplain Conservation Area (Fig. 2). Sites in these areas will capture the eastern edge of CVJC distribution, allowing us to document if any change has occurred since the last survey (2009). The resulting data will be limited to presence/absence and a defined distribution within the areas surveyed, allowing the CVMSHCP to refine hypotheses for this species and develop the next version of this monitoring protocol.

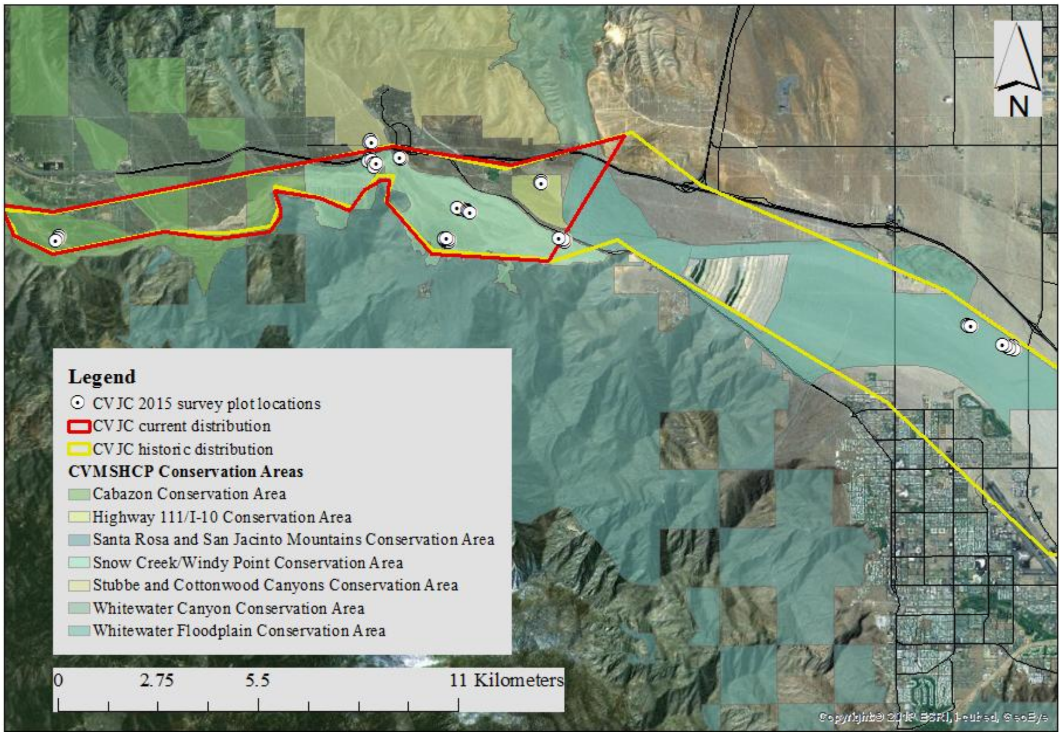

Figure 2. Detection tile plot locations identified for the 2015 survey efforts, with respect to CVMSHCP Conservation Areas and historic and current distributions of the Coachella Valley Jerusalem cricket.

Data Collection

Previous survey efforts have shown lifting and searching under debris to be an effective detection method. However debris are not randomly or regularly distributed across the desert. In order to sample in those areas without extensive debris we have developed a 60 cm x 60 cm cover board – also termed a detection tile – design that provides an adequate substitute for debris (Prentice et al. 2011). All surveys will occur in December-February, within one week following rainfall events. Debris searches are opportunistic, and occur wherever there is accumulated solid debris (small items, even cow dung can yield crickets). Detection tiles are envisioned to fill in surveying gaps to better define the distribution and habitat characteristics of this species. As such they are not randomly placed. We propose to search under debris when available (Fig. 3), and otherwise place survey plots consisting of 3 detection tiles located 50-100 m apart on conservation owned lands within the expected distribution of this species (Fig. 4). We do not intend to supplement the below-tile environment with water as was done by Prentice et al. (2011). This could increase the length of time a cricket stays beneath the tile, however if it continues to be dry, added water would only attract crickets that by chance were in subterranean burrows directly below the tile (and so not provide a measure of broader abundance). This could alter the behavior of the crickets, potentially subjecting them to greater risk of desiccation or predation by extending their surface activity.

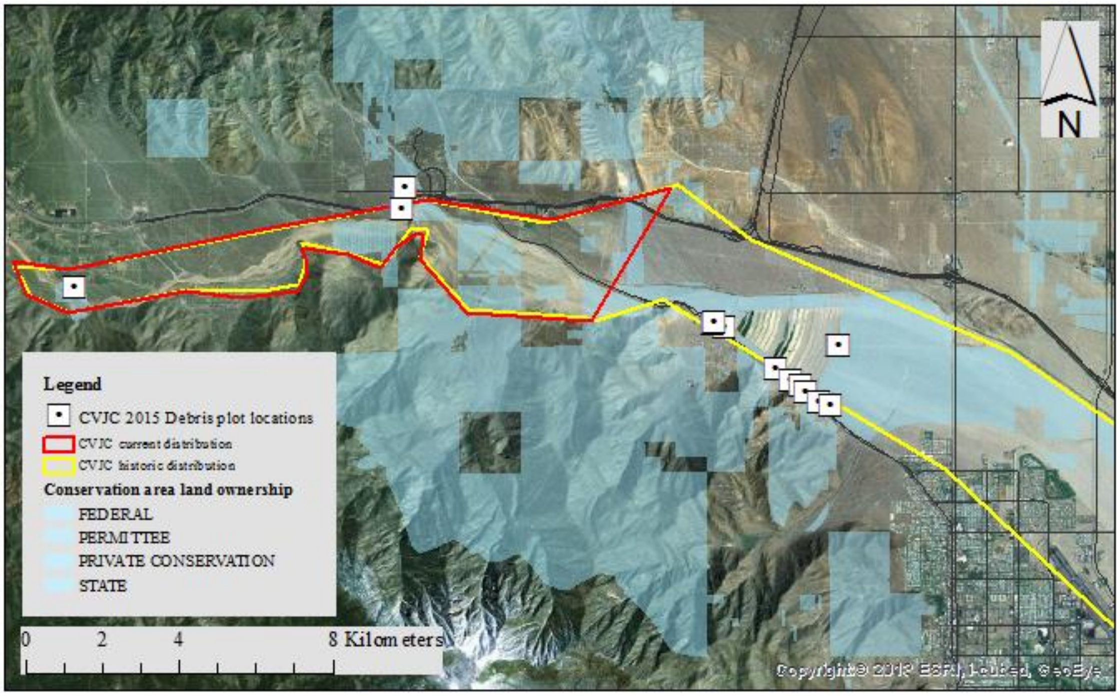

Figure 3. Debris plot locations identified for the 2015 survey efforts, with respect to historic and current distributions of the Coachella Valley Jerusalem cricket.

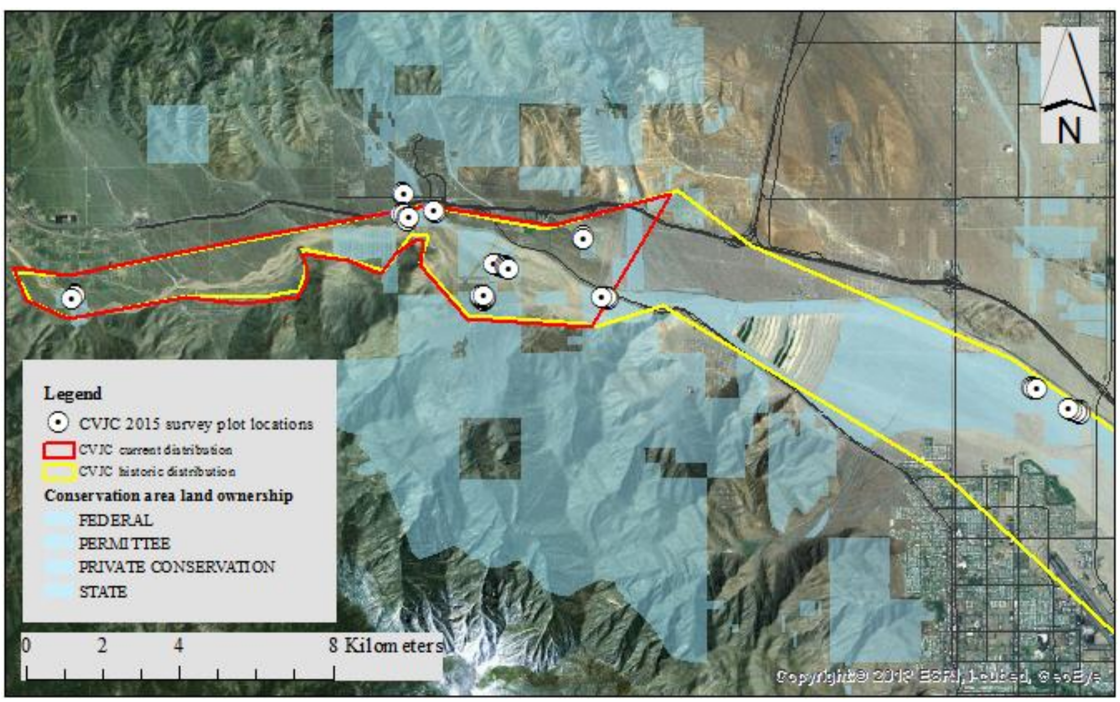

Figure 4. Detection tile plot locations identified for the 2015 survey efforts, with respect to historic and current distributions of the Coachella Valley Jerusalem cricket.

Upon location of a CVJC individual, sand compaction measurements and soil moisture near the individual will be collected, as well as digital photographs taken from several angles to aid in determination of exact species identification. The best morphological description of the Coachella Valley Jerusalem cricket species that occur in the San Gorgonio Pass region are from Tinkham (1968) (Fig. 5). Digital photos of all specimens located, showing the key tibial features, will provide an archive if future questions arise concerning correct species identifications. Figures 6 and 7 provide a comparison between the physical characteristics of CVJC and an unnamed Jerusalem cricket occurring in the Whitewater area. Tinkham's descriptions are included below:

- Foretibiae bearing only two ventral apical spurs immediately posterioradly of the third and fourth calcars. Caudal tibiae with three dorsal apical or subapical teeth on each margin. Size large, coloration orangish - ***cahuilaensis n. sp.***

- Calcars of the caudal tibiae forming a semi-ringlet of 6 long spurs, the two innermost much the longest and cylindrical in form - ***longispina*** Brunner

- Calcars of the caudal tibiae forming a semi-ringlet of 6 spurs, these spathulate or trowel-shaped on their inner faces; the three inner relatively equal and longer than the 3 outer spurs or calcars - ***fuscus*** Haldeman

- Entire body uniformly dark brown with black abdominal tergites. Caudal tibiae with 5 internal and 2 external apical dorsal teeth - ***intermedius*** Davis & Smith

- Upper half of head shining black with tan sutural areas. Pronotum with dorsum bearing irregular areas of shining black. Femora marked with pale fasciations. Caudal tibiae with 3 to 4 internal and 2 external apical dorsal teeth - ***pictus*** Scudder

Stenopelmatus cahuilaensis n. sp.
Size large for the genus; as the only arenicolous species of Stenopelmatus it is recognized from the other Californian species by its orangish coloration, narrow pronotum throughout and certain important chaetotaxical characters. These are: Foretibiae with only two ventral apical spurs whereas all previously described species have three, one of which is subapical in location. Like other species of Stenopelmatus in California, the caudal tibiae bear a large pair of ventral apical spurs immediately proximad to calcars 3 and 4.

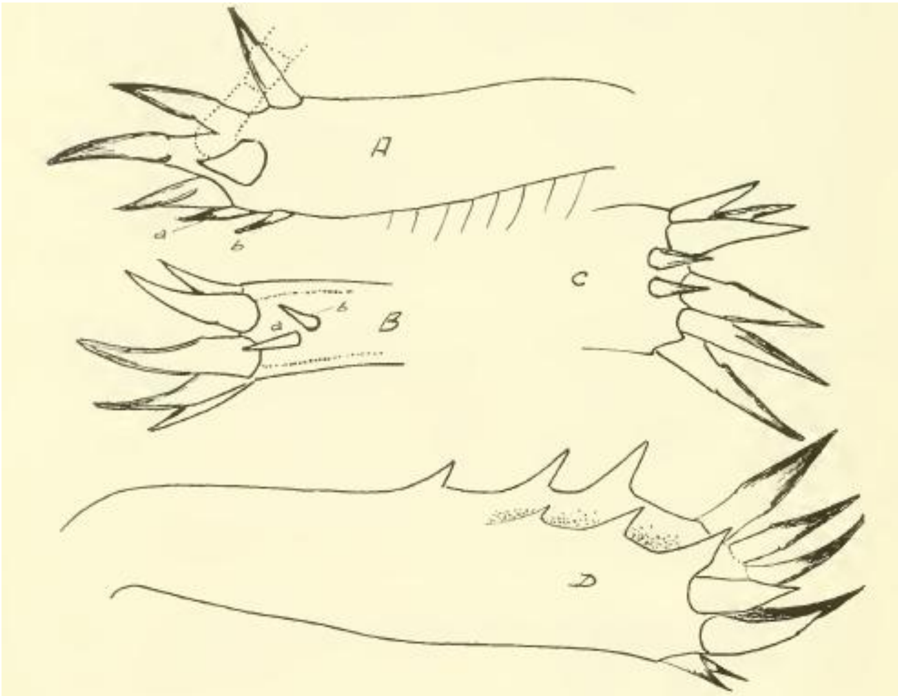

Figure 5. Plate of the holotype male of *Stenopelmatus cahuilaensis* Tinkham n. sp.

Explanation of Plate:
A. External view of left fore tibia showing the five calcars and the two ventral apical spurs (a) and (b).
B. Ventral view of left fore tibia showing the pair of ventral apical spurs in relation to the five calcars.
C. Ventral view of apical portions of the left caudal tibia showing the relationship of the pair of ventral apical spurs to the six calcars.
D. External view of the entire caudal tibia showing the three external and three internal dorsal teeth, the six calcars and the ventral pair of apical spurs.

Figure 6. CV Jerusalem cricket (narrow black bands)

Figure 7. Unnamed Jerusalem cricket north of I-10 (broader black bands)

Literature Cited

Allen, M. F., J.T. Rotenberry, C.W. Barrows, V. M. Rorive, R.D. Cox, L. Hargrove, D. Hutchinson, and K.D. Fleming. 2005. Coachella Valley Multiple Species Habitat Conservation Plan Monitoring Program: 2002-2005 Progress Report, Prepared for the Coachella Valley Association of Governments. UC Riverside: Center for Conservation Biology. Retrieved from: http://escholarship.org/uc/item/3024x2m7

Buck-Diaz, J., and J. Evens. 2011. Carrizo Plain National Monument Vegetation Classification and Mapping Project. A report submitted to the Bureau of Land Management. California Native Plant Society, Sacramento, CA.

Prentice, T.R., R.A. Redak, and C.W. Barrows. 2011. Survey methodology and distribution of a cryptic Jerusalem cricket species, *Stenopelmatus cahuilaensis* Tinkham (Orthoptera, Stenopelmatidae). Pan Pacific Entomologist 87:1-14.

Tinkham, E.R. 1968. Studies in nearctic desert sand dune Orthoptera, Part XI: a new arenicolous species of Stenopelmatus from Coachella Valley with key and biological notes. Western North American Naturalist 28(3):124-131.