

**Western Riverside County
Multiple Species Habitat Conservation Plan (MSHCP)
Biological Monitoring Program**

Vernal Pool Survey Report 2008



15 APRIL 2009

TABLE OF CONTENTS

INTRODUCTION	1
SURVEY GOALS:	1
RIVERSIDE FAIRY SHRIMP (<i>STREPTOCEPHALUS WOOTTONI</i>).....	1
SANTA ROSA PLATEAU FAIRY SHRIMP (<i>LINDERIELLA SANTAROSAE</i>).....	2
VERNAL POOL FAIRY SHRIMP (<i>BRANCHINECTA LYNCHI</i>).....	2
WESTERN SPADEFOOT (<i>SPEA HAMMONDII</i>).....	3
METHODS	3
PROTOCOL DEVELOPMENT.....	3
PERSONNEL AND TRAINING.....	3
SITE SELECTION	4
SURVEY METHODS.....	4
RESULTS	6
VERNAL POOL BRANCHIOPOD SURVEYS – CENTER FOR NATURAL LANDS MANAGEMENT	6
DISCUSSION	6
RECOMMENDATIONS FOR FUTURE SURVEYS.....	9
LITERATURE CITED	10

LIST OF TABLES AND FIGURES

Table 1. Core Area designation by species (denoted with ‘X’) and type of survey conducted. When a species was found within one of the surveyed locations, the box is shaded.	2
Figure 1. Fairy shrimp survey locations and detections at Santa Rosa Plateau and San Jacinto Wildlife Area.	5
Figure 2. Western spadefoot (<i>Spea hamondii</i>) detections in 2008.	7
Table 2. Presence of fairy shrimp species and western spadefoot at specific pool locations at 3 survey sites.	8

LIST OF APPENDICES

Appendix A. Western Riverside County MSHCP Biological Monitoring Program Protocol for Vernal Pool Species, January 2008.....	12
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NOTE TO READER:

This report is an account of survey activities undertaken by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. The Biological Monitoring Program monitors the distribution and status of the 146 Covered Species within the Conservation Area to provide information to Permittees, land managers, the public, the California Department of Fish and Game, and the U.S. Fish and Wildlife Service. Monitoring Program activities are guided by the MSHCP species objectives for each Covered Species, the information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

We would like to acknowledge the land managers in the MSHCP Plan Area, who in the interest of conservation and stewardship facilitate Monitoring Program activities on the lands for which they are responsible. A list of the lands where this year's data collection activities were conducted is included in Section 7.0 of the Western Riverside County Regional Conservation Authority (RCA) Annual Report to the Wildlife Agencies.

Partnering organizations and individuals contributing data to our projects are acknowledged in the text of appropriate reports. We would especially like to acknowledge the Santa Ana Watershed Association, the Center for Natural Lands Management, and the Orange County Water District for their willingness to initiate or modify their data collection to complement our survey efforts in 2008.

While we have made every effort to accurately represent our data and results, it should be recognized that our database is still under development. Any reader who would like to make further use of the information or data provided in this report should contact the Monitoring Program to ensure that they have access to the best available or most current data. All Monitoring Program data, including original datasheets and digital datasets are stored in the Monitoring Program office in downtown Riverside, CA.

The primary authors of this report were the 2008 Herpetology Program Lead, Robert Packard and Staff Biologist, Sinlan Poo. If there are any questions about the information provided in this report, please contact the Monitoring Program Administrator. If you have questions about the MSHCP, please contact the Executive Director of the RCA. For further information on the MSHCP and the RCA, go to www.wrc-rca.org.

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INTRODUCTION

Vernal pools, also known as temporary wetlands, ephemeral pools, and spring ponds, are non-flowing water bodies that periodically lose all or most of their water volume and surface area. The biological community is adapted to seasonal drying and typically lacks fish, thus providing a safer environment for aquatic invertebrates and amphibian reproduction (Colburn 2004).

The Western Riverside County MSHCP covers 3 fairy shrimp and 1 amphibian species that inhabit vernal pools in southern California: Riverside fairy shrimp (*Streptocephalus woottoni*; STWO), Santa Rosa Plateau fairy shrimp (*Linderiella santarosae*; LISA), vernal pool fairy shrimp (*Branchinecta lynchi*; BRLY), and western spadefoot (*Spea hammondi*; SPHA). Survey efforts for these species in 2008 focused on locating vernal pools in the Conservation Area, assessing the suitability of vernal pools for Covered Species, and documenting species presence within Core Areas and other potentially suitable habitat in the Conservation Area. The species objectives, suitable habitat, and MSHCP-identified Core Areas for each species are described under each species section below. The following were the overall survey goals for 2008:

Survey Goals:

- A) Identify ephemeral pools with suitable fairy shrimp habitat in species-specific Core Areas.
- B) Document presence of STWO, LISA, BRLY, and SPHA within as many species-specific Core Areas and other potential areas as possible (Table 1).
- C) Train new personnel in vernal pool survey procedures and fairy shrimp identification.
- D) Refine the fairy shrimp survey protocol to optimize methods for future surveys.
- E) Provide data to land managers for use in management decisions.

Riverside Fairy Shrimp (*Streptocephalus woottoni*)

Riverside fairy shrimp is a federally endangered species that is restricted to deep vernal pools, vernal pool-like ephemeral ponds, livestock ponds, and other human-modified depressions (Eng et al 1990, USFWS 1993). Riverside fairy shrimp prefer warm-water pools with low- to moderate-dissolved solids (Eriksen and Belk 1999). Riverside fairy shrimp is found in southeastern Orange County, western San Diego County, and western Riverside County (Eriksen and Belk 1999). Within its range, all known occupied pools lie within annual grasslands, which is interspersed with chaparral or coastal sage scrub vegetation (Dudek & Associates 2003).

The species objectives for STWO require the conservation of 5 Core Areas in the MSHCP Conservation Area: 1) Santa Rosa Plateau Ecological Reserve, 2) Murrieta, 3)

Table 1. Core Area designation by species (denoted with ‘X’) and type of survey conducted. When a species was found within one of the surveyed locations, the box is shaded.

Core Area	STWO	LISA ^a	BRLY	SPHA	Visual Survey	Vernal Pool Survey
Alberhill	X	-	-	-	No	No
Lake Elsinore	X	-	-	-	No	No
Murrieta	X	-	-	-	No	No
Hemet	-	-	-	X	No	No
Salt Creek	-	-	X	X	No	No
San Jacinto River	-	-	-	X	Yes	No
Santa Rosa Plateau	X	X	X	X	Yes	Yes
Skunk Hollow ^b	X		X	X	Yes	No
Antelope Valley/Hogbacks ^c	-	-	-	-	Yes	Yes
San Jacinto Wildlife Area ^c	-	-	-	-	Yes	Yes
El Sol ^c	-	-	-	-	Yes	No
MSR ^c	-	-	-	-	Yes	No

^a Species objectives met

^b Records from Center for Natural Lands Management

^c Non-core areas surveyed

Skunk Hollow, 4) Lake Elsinore, and 5) Alberhill. Although species-specific survey objectives are not listed for STWO, the default MSHCP monitoring objective states that species presence and continued use shall be maintained at 75 percent of the listed Core Areas at least once every 8 years (Dudek & Associates 2003).

Santa Rosa Plateau Fairy Shrimp (*Linderiella santarosae*)

Santa Rosa Plateau fairy shrimp is endemic to western Riverside County and has narrow habitat requirements (Dudek & Associates 2003). It is restricted to seasonal southern basalt flow vernal pools with cool, clear-to-milky waters that remain filled for extended periods of time (Thiery and Fugate 1994; Eriksen and Belk 1999). It is only known to occur on the Santa Rosa Plateau (Thiery and Fugate 1994; Eriksen and Belk 1999). Survey efforts in 2008 followed general MSHCP objectives as stated above because species-specific survey objectives are not listed for LISA.

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

Vernal pool fairy shrimp is federally threatened and has narrow habitat requirements. This species prefers cool-water pools that have low-to-moderate dissolved solids, are unpredictable, and often short-lived (Eng et al 1990; USFWS 1994).

The species objectives for BRLY require the conservation of 3 Core Areas in the MSHCP Conservation Area: 1) Salt Creek (west Hemet portion), 2) Santa Rosa Plateau Ecological Reserve, and 3) Skunk Hollow. Survey efforts in 2008 followed general

MSHCP objectives described above because species-specific survey objectives are not listed for BRLY.

Western Spadefoot (*Spea hammondi*)

Western spadefoot is a California near-endemic (ranging from Shasta County to Baja California) and a state species of special concern (Stebbins 1985). The species breeds primarily in vernal pools or other standing water free of exotic species and below 1500 m (Holland and Goodman 1998). Adults can also be found in chaparral, sage scrub, grassland, and alluvial scrub communities adjacent to breeding habitat (Holland and Goodman 1998). Western spadefoot require pools with water temperatures between 9°C and 30°C (Brown 1966, 1967) and a hydroperiod greater than 3 weeks (Feaver 1971) to reproduce and metamorphose successfully.

The species objectives for SPHA require maintaining successful reproduction at 75 percent of the conserved breeding locations as measured once every 8 years, and the conservation of 5 Core Areas in the MSHCP Conservation Area: 1) Santa Rosa Plateau Ecological Reserve, 2) San Jacinto River, 3) Salt Creek, 4) Skunk Hollow, and 5) Hemet (Dudek & Associates 2003).

METHODS

Protocol Development

We developed the protocol for 2008 vernal pool surveys (Appendix A) from the U.S. Fish and Wildlife Service (USFWS) 10(a)(1)(A) permit guidelines for vernal pool branchiopods (USFWS1996). The protocol focused on surveying Core Areas for covered fairy shrimp species and SPHA.

Personnel and Training

We trained crew members to identify local fairy shrimp species and other aquatic biota via field guides, keys, and preserved specimens. Fairy shrimp species identification training included a discussion of key distinguishing characteristics between species, as well as examining specimens at the Los Angeles Natural History Museum. All crew members passed the USFWS fairy shrimp identification exam for surveying and vouchering California fairy shrimp. Monitoring Program biologists conducting vernal pool surveys in 2008 included:

- Robert Packard, Herpetology Program Lead (Regional Conservation Authority)
- Natalie Marioni, former Herpetology Program Lead (Regional Conservation Authority)
- Sinlan Poo (Regional Conservation Authority)
- Carol Thompson (Regional Conservation Authority)
- Laura Weisel (Regional Conservation Authority)

Site Selection

Because the presence of vernal pools varies yearly depending on rainfall, we searched for vernal pools at known locations from historical records, and potential locations using satellite images in ArcGIS (ESRI 2006). Surveys for target species were subsequently conducted in pools that were over 3 cm deep, as measured 1 m from the edge of the pool, and that did not have running water or fish species present (USFWS 1996) (Appendix A).

We searched for vernal pools in 7 locations including: San Jacinto River, Santa Rosa Plateau, Skunk Hollow, McElhinney/Stimmel, San Jacinto Wildlife Area, El Sol, and Western Riverside County Multi-Species Reserve (MSR) (Table 1). Within these areas, we found vernal pools at the Santa Rosa Plateau (n = 23), San Jacinto Wildlife Area (n = 5), Skunk Hollow, and Antelope Valley/Hogbacks (n = 1) (Figure 1).

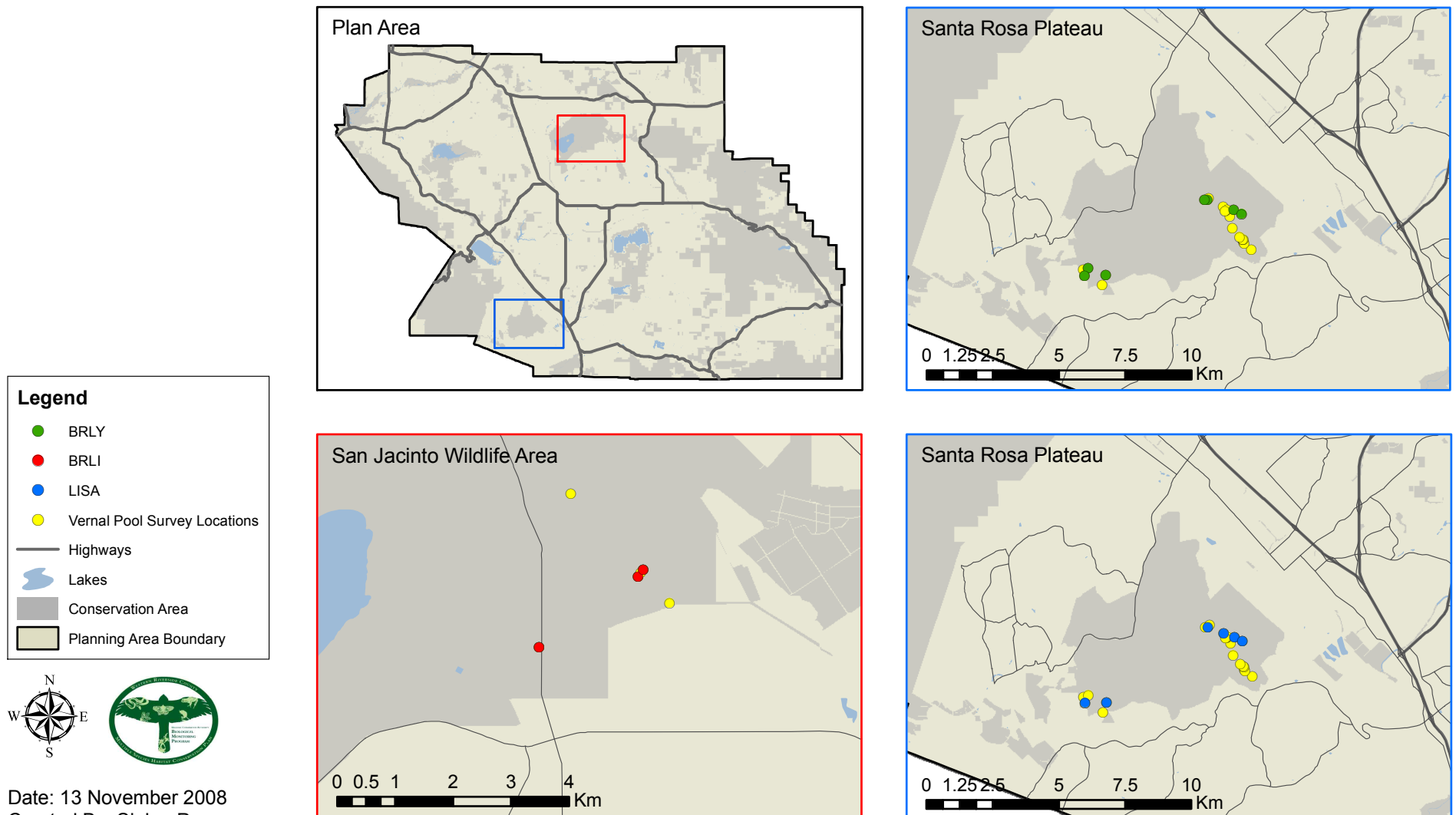
Survey Methods

At least 2 surveyors conducted visual and dip-net surveys in daylight hours between approximately 0800 h and 1500 h around the banks of the vernal pool. Survey time per site varied, from less than 10 minutes up to an hour and a half, according to the size of the pool and the presence and abundance of aquatic species. We recorded the following data at the beginning of each survey effort: date, observer, time, general weather description, ambient air temperature (°C), average wind speed (km/h), presence/absence of water, water temperature (°C), pH, dissolved oxygen (%), conductivity (mS/cm), total dissolved solids (mg/L), salinity (ppt), wetted depth 1 m from bank, length and width of the pool, and date of last rain event. We also identified all aquatic fauna and Covered Species when possible. In addition, we searched for covered plant species around each pool (results of these searches can be found in the 2008 Rare Plant Report). We conducted surveys between 11 February and 28 April 2008.

We collected a maximum of 3 voucher specimens per sex per pool for all fairy shrimp species detected, but only when the number taken was less than 10 % of the population in the pool. We collected specimens with dip-nets and placed them in small plastic vials containing vernal pool water and club soda to slow fairy shrimp movement and prevent specimens from contorting when placed in 70% ethanol for preservation. At least 2 MSHCP biologists confirmed identification of each voucher specimen before animals were euthanized. We then accessioned specimens to the Los Angeles Natural History Museum. Detailed survey methods are provided in *Western Riverside County MSHCP Biological Monitoring Program Protocol for Vernal Pool Species 2008* (Appendix A).

Surveys for fairy shrimp at Skunk Hollow and Johnson Ranch were conducted by Lee Ann Carranza from the Center for Natural Lands Management (CNLM). Please contact CNLM for the full report for that reserve, although brief results are reported below.

Figure 1. Fairy shrimp survey locations and detections at Santa Rosa Plateau and San Jacinto Wildlife Area.



RESULTS

We detected species of fairy shrimp at the Santa Rosa Plateau (Figure 1) and the San Jacinto Wildlife Area (Figure 1). We heard SPHA adults calling at the Santa Rosa Plateau and Antelope Valley/Hogbacks, and found SPHA tadpoles at El Sol (Table 1, Figure 2).

Riverside fairy shrimp were not detected during surveys by MSHCP biologist (Table 1). Of the 5 Core Areas for STWO, we conducted vernal-pool surveys in 23 pools at the Santa Rosa Plateau (Figure 1), and CNLM biologists surveyed pools at Skunk Hollow, as reported below.

Santa Rosa Plateau fairy shrimp populations were found in 6 pools at the Santa Rosa Plateau (Table 2, Figure 1) between 13 February and 7 April, with water temperatures ranging from 9.6°C to 20.2°C. LISA were detected in pools where pH ranged from 7.2 to 9.4, conductivity from 0.05 to 0.17 mS/cm, total dissolved solids (TDS) from 0.07 to 16.17 mg/L, and salinity from 0.03 to 0.09 ppt.

Vernal pool fairy shrimp were found in 7 pools at the Santa Rosa Plateau (Table 2, Figure 1), between 13 February and 3 March. Water temperatures ranged from 9.5°C to 17.3°C, pH from 7.2 to 9.2, conductivity from 0.05 to 0.13 mS/cm, TDS from 0.07 to 18.97, and salinity from 0.03 to 0.20 ppt.

Fairy shrimp species present on the Santa Rosa Plateau (LISA and BRLY) were present in pools of both extremes of depth and surface area.

We heard western spadefoots calling at 6 pools on the Santa Rosa Plateau and at Antelope Valley/Hogbacks during vernal pool surveys between 15 February and 3 March (Table 2). We also detected SPHA tadpoles incidentally at El Sol, a property within the Johnson Ranch Reserve roughly 4 km northeast of Skunk Hollow (Table 1, Table 2, and Figure 2).

Vernal Pool Branchiopod Surveys – Center for Natural Lands Management

Lee Ann Carranza, CNLM Preserve Manager, conducted vernal pool surveys for fairy shrimp species between 29 January and 28 March at Skunk Hollow. Ms. Carranza detected STWO at Skunk Hollow and the stock pond of Johnson Ranch, and BRLY at Skunk Hollow. Both species were vouchered and identified by Carranza. The presence/absence of SPHA at these locations is unknown because CNLM surveys only targeted Branchiopod species.

DISCUSSION

We focused 2008 vernal pool survey efforts on locating fairy shrimp species and SPHA in species-specific Core Areas and sites across the Conservation Area where potentially suitable habitat occurred. We conducted the majority of surveys at the Santa

Figure 2. Western Spadefoot (*Spea hammondi*) detections in 2008.

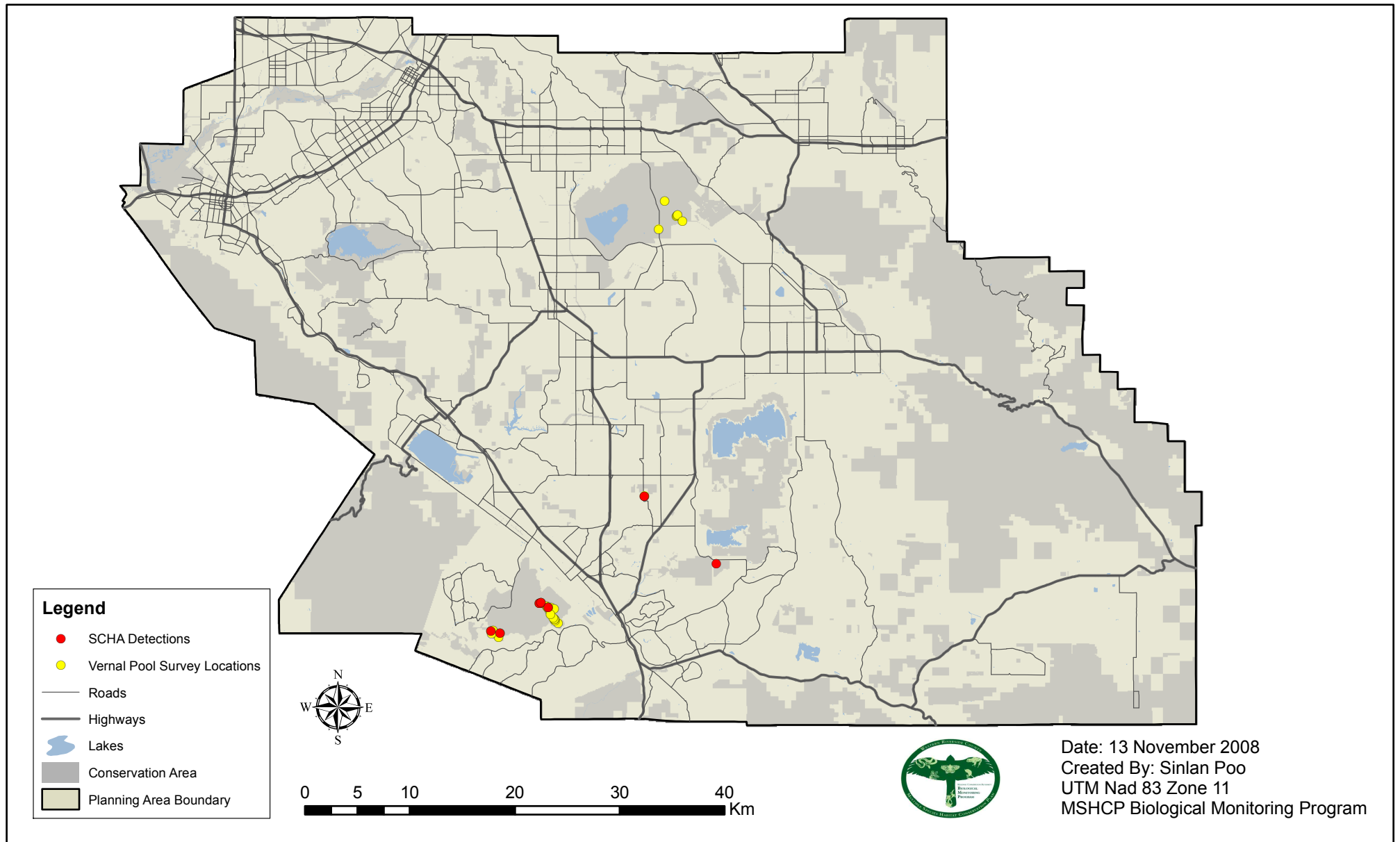


Table 2. Presence of fairy shrimp species and western spadefoot at specific pool locations at 3 survey sites.

Location ^a	STWO	LISA	BRLY	BRLI ^b	SPHA
Santa Rosa Plateau					
BURLIN	-	Yes	Yes	-	Yes
BDOZER	-	Yes	-	-	-
BURJ	-	Yes	Yes	-	-
BURE	-	-	Yes	-	Yes
BURI	-	Yes	Yes	-	-
BURG	-	-	-	-	Yes
BURH-3	-	-	-	-	Yes
CCORNR	-	Yes	Yes	-	-
CLARGE	-	Yes	Yes	-	Yes
CSMTRL	-	-	Yes	-	-
CTRAIL	-	-	-	-	Yes
San Jacinto Wildlife Area					
SJWA00	-	-	-	Yes	-
SJWA01	-	-	-	Yes	-
SJWA03	-	-	-	Yes	-
Antelope Valley/Hogbacks					
McElhinney/Stimmel pool	-	-	-	-	Yes

^a Site identification codes used (see Figure 1)^b *Branchinecta lindahli*, a non-covered fairy shrimp species detected during 2008 surveys

Rosa Plateau and the San Jacinto Wildlife Area, while 1 pool at Antelope Valley/Hogbacks was surveyed. We detected 3 of 4 targeted Covered Species (LISA, BRLY, and SPHA) at the Santa Rosa Plateau, and CNLM biologists detected STWO at Skunk Hollow and Johnson Ranch. The Santa Rosa Plateau is the only known location of LISA and the only Core Area listed, thus the Species Objective was met for LISA.

While CNLM detected STWO at Skunk Hollow and the stock pond of Johnson Ranch, we did not find STWO at any pools surveyed in 2008. However, there are no historical records of STWO at the Santa Rosa Plateau despite this location being listed as a Core Area (Eriksen and Belk 1999; USFWS 2004). Alberhill is also a STWO Core Area that the USFWS Biological Opinion reports has never supported a known STWO population (USFWS 2004).

We did not detect any targeted Covered Species at the San Jacinto Wildlife Area, but did record a non-covered fairy shrimp species, *Branchinecta lindahli* (BRLI), at 3 of the 5 pools surveyed there (Table 2, Figure 1).

Although SPHA was detected at several locations in 1 Core Area (Santa Rosa Plateau), and in 2 non-core areas (Antelope Valley/Hogbacks and El Sol), successful breeding was only documented at El Sol. Additional surveys targeting conserved breeding locations will be necessary to address the species objectives for SPHA.

Recommendations for Future Surveys

Surveys for fairy shrimp and SPHA should continue in species-specific Core Areas and non-core areas with vernal pools, given sufficient seasonal precipitation to fill pools. Priority should be given to areas where we did not detect target species in 2008 or where we have not yet surveyed. Furthermore, we should continue to conduct visual surveys to document the presence of vernal pools and assess potential suitable habitats.

Surveys for SPHA beyond vernal pool areas should also be done in applicable Core Areas (Hemet, Salt Creek, San Jacinto River, and Skunk Hollow) to determine presence and breeding activity for this species. This can be done either with call surveys or with visual encounter surveys for egg masses and tadpoles during the breeding season, which is generally January through March (Dudek & Associates 2003).

We recommend that the Santa Rosa Plateau and Alberhill be reconsidered as Core Areas for STWO because it is unlikely that the species ever occupied vernal pools at these locations.

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Appendix A. Western Riverside County MSHCP Biological Monitoring Program Protocol for Vernal Pool Species, January 2008

Prepared by Natalie Marioni, Herpetology Program Lead

Goals: To identify ephemeral pools with suitable fairy shrimp habitat in species-specific Core Areas. Presence of local fairy shrimp species and the spadefoot toad will be identified within Core Areas and other potentially relevant vernal pools within the Conservation Area through standard surveys, as described below.

Timing: January 2008 – April 2008 (dependant upon duration of pool hydration).

Survey Locations: The MSHCP Species Objectives lists Core Areas are listed the following Covered Species: Riverside fairy shrimp (*Streptocephalus woottoni*; “STWO”), Santa Rosa Plateau fairy shrimp (*Linderiella santarosa*; “LISA”), vernal pool fairy shrimp (*Branchinecta lynchi*; “BRLY”) and spadefoot toad (*Scaphiopus hammondi*; “SCHA”). Access and rain permitting, each of the fairy shrimp Core Areas will be surveyed in 2008.

Location	STWO	LISA	BRLY	SCHA
Alberhill	X			
Lake Elsinore	X			
Murietta	X			
Salt Creek (west Hemet)			X	X
San Jacinto River				X
Santa Rosa Plateau	X	X	X	X
Skunk Hollow	X		X	X

Methods: (adapted from: United States Fish and Wildlife Service. 1996. Interim survey guidelines to permittees for recovery permits under section 10(a)(1)(A) of the Endangered Species Act for the listed vernal pool branchiopods. 10 pp.).

Vernal Pool Identification / Assessment

GIS imagery will be used to identify ponded water and potential depressions throughout the Access Area. Access Areas are the portions of the MSHCP Conservation Area where we have permission from the land owner or manager to conduct survey work for the purpose of monitoring MSHCP Covered Species. This is done by visually

scanning the digital orthophoto quadrangles (DOQs) within Access Areas narrowed down to vegetation communities associated with known vernal pools. Areas marked as potential ephemeral pools are those that have the following characteristics: rounded shape, are lighter or darker in color than surrounding areas and are uniform in color and texture (likely devoid of thick vegetation). Areas that overlap the GIS lakes layer were eliminated from our list of potential vernal pools, since these are permanent, not ephemeral, water bodies.

Once potential vernal pools have been identified and sufficient rain has hydrated known vernal pools (e.g., Santa Rosa Plateau pools), reconnaissance surveys will be conducted to verify that the location is accessible and there is standing ephemeral water present. Ephemeral pools should maintain at least 3 cm of water 24 h after a rain event to be considered for fairy shrimp surveys. Assessment surveys will include the following data collection: date, surveyor names, specific pool ID and location (UTM coordinates and elevation), water depth, date of last rain event, pool surface area, presence of fairy shrimp (yes, no, maybe, or unknown) and notes regarding access and directions to the location. All surveys will be conducted by a crew of at least 2 people. Contact with the water will be avoided, but when that is not possible, 1 person will be designated the “wet surveyor” and will be the person walking into the wetter soil. Pool depth will be measured using a plastic meter stick and measured in centimeters, 1 meter from water’s edge or the center of the pool, whichever is in reach. Researchers will not wade into the pools in order to measure the depth of the pool center. If the center of the pool cannot be reached from the pool edge, then the depth of the pool will be measured 1 meter from the edge of the pool. The date of last significant rain event (minimum precipitation of 0.5 inches over 2 consecutive days) will be determined for the zip code of survey area using the following website: www.weather.com. Pool width and length will be measured in meters using either a tape measure or laser Rangefinder. The widest and longest sections of the pool will be measured. After completion of the survey, boots and all equipment touching the water will be disinfected per procedures listed below.

Vernal Pool Surveys

Surveys will begin within 2 weeks after the ephemeral pools are inundated, or as soon as they are located, and will continue once every other week until either 1) the pool dries up, 2) there are 120 days of continuous inundation, or 3) all fairy shrimp species have been identified in a given pool. If a pool dries up and becomes re-hydrated within the same season, surveys will recommence within 8 days of re-hydration with a minimum depth of 3 cm. **When multiple pools are visited in one day, pools will always be visited in the order of more pristine and upstream to those that are less pristine and/or downstream in the watershed.**

The following information will be collected during each visit: date, surveyor names, specific pool ID and location (UTM coordinates and elevation), digital photos (minimally north and south facing), ambient and water temperature (°C), weather

conditions (Beaufort scale), pool depth and surface area, abiotic conditions (conductivity, dissolved oxygen, turbidity, salinity and total dissolved solids), and evidence of recent disturbance. Additionally, the presence of target vernal pool animal and plant species and non-target vertebrates and other invertebrates (see datasheet) will be recorded. One surveyor (henceforth called 'observer') will walk around the entire perimeter of the ephemeral pool, while scanning the pool edge and water for spadefoot toads (all life stages) and other aquatic biota. Additionally, the observer will sample the pool every 3-5 meters using handheld dip nets and a dip cup to record the of presence fairy shrimp, other invertebrates, and amphibian larvae. Voucher specimens will be collected, as described below, when adult fairy shrimp are detected. The observer will avoid walking into the pool, by extending the nets with PVC pipe to reach as far into the pool as possible. Each scoop will be examined carefully and, if necessary, the contents placed in a small holding container filled with pool water to identify fairy shrimp and other species. Target animal and plant species will be recorded as an order of magnitude (10's, 100's, 1000's) with the exception of spadefoot toads where only tadpoles will be recorded as an order of magnitude. All other life stages (adults, juvenile, egg masses and audio detections) of the spadefoot toad will be enumerated.

While the observer is surveying for aquatic biota, the second surveyor (henceforth called 'recorder') will be collecting weather and aquatic conditions, as well as recording any species observed by the data observer. Ambient temperature and wind speed will be collected using a handheld Kestrel weather station. Pool depth and surface area will be collected in the same format outlined in the pool assessment section above. The recorder will collect biotic parameters using either a multi-parameter Sonde (YSI 556 MPS) or single unit probes. Abiotic data will be collected at a site at the pool's edge *only after* the observer has searched that area for aquatic biota. The recorder will also take at least two photos of the pool, using a compass for north and south facing photos. Photos will be taken from a standing position and the angle of the photo will be determined in the field in order to capture as much of the pool as possible in the photo.

All photos will be uploaded daily to the following location:
S:\Projects\VernalPools\Data\2008\Photos. Vernal pool survey photos will be named with the Waypoint ID denoting the pool name, pool visit number, north or south photo orientation, and the three-letter initials of the photographer. Species code can be substituted for north or south, where appropriate.

Examples:

1. vernal pool named Colo Large (Santa Rosa Plateau pool on Mesa de Colorado), third visit, north facing photo, photo taken by Adam: CLarge_v3_N_AJM
2. vernal pool named Burro J, first visit, *Streptocephalus woottoni* photo, photo taken by Natalie: BurroJ_v1_STWO_NKM

Once these data are collected, the recorder will walk around the pool a meter away from pool's edge and survey for target plant species. The recorder will follow the direction of the observer, so as not to disturb the aquatic biota. The area around the pool's edge and any area where the pool has receded will be searched for target plant species. Target plant species include: *Brodiaea filifolia*, *Brodiaea orcutii*, *Eryngium aritulum* var. *parishii*, *Limnanthes gracilis* var. *parishii*, *Myosurus minimus* ssp. *apus*, *Navarretia fossalis*, *Navarretia prostrata*, *Orcuttia californica* and *Trichocoronis wrightii* var. *wrightii*. If any target plant species are detected, the species (or genus when appropriate) will be recorded along with the percent of the population that is in vegetative, flower, fruit, or desiccated stage. UTM coordinates, an estimate of the population size, and photos will also be collected for each target plant species. When a covered plant species is observed in the field, the recorder will estimate what percent of the population is flowering, fruiting, vegetative, or desiccated. Plants are considered flowering when they have any flower buds and/or open flowers and a small minority, if any, flowers have developed into fruit. Plants are considered fruiting when they either have fruit or have already dispersed fruit and are still green. One sign that fruit have already dispersed are empty seeds pods. Plants are considered vegetative if they are green and are neither fruiting nor flowering. Plants are considered desiccated when they are completely devoid of any green color and all above-ground material is dead. When it is difficult to distinguish between flowering and fruiting individuals, recorder will look for worn-looking petals or other flowering parts, and investigate the plant more closely to see if the worn petals are now attached to fruit instead of a flower. Recorder will scan the area closely, before making phenological estimates, to determine if there are cryptic vegetative individuals present. The total percent across the 4 phenologies will add up to 100%. Each individual plant is counted as only one phenotypic state. For example, if an individual is both flowering and fruiting, it will count as fruiting. If an individual is fruiting, but beginning to desiccate, it will be counted as fruiting.

The recorder will make an exact count of the number of individuals, to determine population sizes of less than or equal to 50 individuals. If populations have more than 50 individuals, an estimate will be made to the nearest order of 10 (60, 70, 80 etc), or the nearest order of magnitude for estimates beyond 100 (i.e. 100s, 1000s, 10000s).

Fairy Shrimp Collections

Voucher specimen will be collected once for each pool for all fairy shrimp species detected. A maximum of 3 individuals of each sex for each species will be collected through the net sweeps outlined in the Vernal Pool Survey section. Fairy shrimp will be placed in small plastic vials containing pool water and club soda to initially slow the fairy shrimp's movements and prevent the specimen from contorting when placed into a vial of ethanol to be fixed (Mike Fugate, personal communication). Specimen of the same species may be placed in the same vials, in the field. Voucher specimen will be used both as a record of species inhabiting each pool as well as to confirm species ID in the lab when identification cannot be made in the field. Confirmation of species identification

will be made in the lab through microscope analysis and keying out of species, by research personnel who have passed the regional FWS fairy shrimp test. Mike Fugate, a local fairy shrimp expert, will be consulted should any fairy shrimp ID remain unclear. Fairy shrimp will be accessioned at the Los Angeles County Museum of Natural History and vouchered in the office according to standard procedures. Once species identification has been made, the specimen will be transferred to a 2 dram glass shell vial filled with ethanol and then plugged with a cotton ball. The shell vial will then be inverted and placed inside a 2 oz or 4 oz jar, also filled with ethanol. A voucher label will be completed on 100% rag paper with a Pigma Micron (acid free) pen and placed inside the larger jar and sealed with a poly lined lid. The following information, minimally, will be included on each voucher label: species ID, date collected (day, month, year), detailed location, latitude and longitude (degrees and decimal minutes), name of collector(s), name(s) of person(s) making identification, preservative used. Additional notes or information may also be included on the label as necessary.

Field Sanitization

Contact with pool water is to be avoided when at all possible. When equipment or boots do come into contact with water or wet soil, all materials will be disinfected before moving to the next group of pools. Again, pools will be visited in a pristine and upstream to less pristine and downstream order. Before leaving each pool area and hiking back to the truck, all mud and debris will be removed from all boots and equipment, using a stiff brush and tap water, if necessary. This will be done adjacent to the pool and not while standing in the water. Water quality equipment will then be rinsed with tap water and allowed to air dry while other cleaning is taking place. If necessary, water quality equipment will be dried at the truck with a portable hair dryer. Once back at the vehicle, boots and other equipment will be soaked in a bucket containing a 10% bleach solution (1:10, one part bleach to ten parts tap water) before visiting pools of different areas or watersheds. If not going directly to another wetland, this can be done at the office. A spray bottle containing the 10% bleach solution will be used to rinse the equipment that cannot be dipped into the bleach solution. All equipment will then be rinsed in a bucket (or sprayed) with clean tap water and towels will be used to remove excess moisture. All equipment must be dry before entering the next site. All bleach solutions will be made ahead of time at the office.

List of Field Equipment:

Measuring tape (Rangefinder)	Kestral
Meter stick	GPS (upload waypoints)
YSI 556 Sonde or single probes	Camera
Thermometer (for water temperature)	Hand lens
	Dip nets (2)
	Extended collection cup (1)

Plastic vials (2 per pool, minimum)
Club soda (1 bottle)
Petri dishes (4)
Soft forceps
Datasheets
Necessary maps and directions
Bucket & spray bottle with 10 %
bleach solution (1:10 bleach to
water)
Bucket & spray bottle with tap water
Scrub brush
Field notebook (including species
photos, disinfecting directions, etc.)

Voucher Equipment:

Microscope
Petri dish
Acid free pen
Acid free paper
70% ethanol
Double glass vials
Soft forceps
Fairyshrimp guides
Datasheets from field collection