

**FINAL REPORT**

**BURROWING OWL DISPERSAL AND NATURAL HABITAT  
EXPANSION IN WESTERN RIVERSIDE COUNTY**

**Grant Agreement Number P1382109  
April 1, 2014 – March 31, 2016**



*Provided to*  
**California Department of Fish and Wildlife  
Natural Community Conservation Planning Local Assistance Grant**

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**March 1, 2016**

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## I. PROJECT HIGHLIGHTS

- Seven Land Managers or Land Owners participated as partners in this California Department of Fish and Wildlife Natural Community and Conservation Planning Local Assistance Grant
- 12 different conservation lands were monitored for western burrowing owl
- 29 western burrowing owl were newly trapped and banded
- 14 western burrowing owl were recaptured, providing valuable dispersal data of both adults and juveniles
- The use of wildlife camera traps was critical in capturing wildlife observations of California ground squirrel utilizing natural habitat enhancement areas
- Over 4,000 incidents were captured of successful California ground squirrel(s) dispersal to the east into the natural habitat enhancement areas
- Ambiguities were discovered in the identity of two western burrowing owl, highlighting the need for more attention to banding protocols and compliance in the western burrowing owl monitoring community

## II. INTRODUCTION

CNLM applied for a California Department of Fish and Wildlife (CDFW) Natural Community and Conservation Planning Local Assistance Grant (NCCP LAG) in 2013 and was awarded the grant in 2014. The focus of the NCCP LAG was on acquiring more information on the dispersal of and habitat enhancement techniques for the western burrowing owl (*Athene cunicularia hypugaea*; BUOW). This final report documents activities conducted towards completing the two project objectives listed in the Final Concept Proposal (CNLM 2013):

### 1. Restoration/Enhancement

To provide corridors and cover for fossorial mammals, specifically California ground squirrel (*Spermophilus beecheyi*; CAGS), by connecting colonies currently established in high-quality habitat to areas of currently low to moderate-quality habitat where no colonies exist.

### 2. Monitoring

To study BUOW dispersal across the Western Riverside County Multiple Species Habitat Conservation Plan (WRC MSHCP) area, in coordination with partnering land managers located in all five Core Areas.

## III. CONSERVATION AND LEGAL STATUS

There are two subspecies of burrowing owl found in North America, both of which have experienced declining populations attributed to habitat losses (Gervais et al. 2008) and are considered to be species of special concern in their respective regions. In the eastern United States, the Florida burrowing owl (*Athene cunicularia floridana*) has most recently been proposed for listing as a Florida State Threatened Species (FFWCC 2015), while the western BUOW is offered a variety of protections throughout the western states, ranging

from no special protections in some states to endangered in Minnesota (Klute et al. 2003). In California, the western BUOW is listed as a Species of Special Concern under CDFW (Gervais et al. 2008).

BUOW are also a “covered” species under the WRC MSHCP and there are several conservation objectives associated with that status (Dudek & Associates 2003, Volume 2-B, Species Accounts, pp B-63 through B-82). The objectives include acquiring or conserving a specific quantity of both primary and secondary habitat (Objectives 1 and 3, pp B-64), inclusion of some of the known nesting areas for conservation (Objective 4, pp B-64), mandates for surveys and creation of translocation sites (Objectives 5, 6, and 7, pp B-65-66), and population-specific goals (Objective 2, pp B-64).

#### **IV. BRIEF SUMMARY OF BURROWING OWL ECOLOGY**

BUOW are small owls 19-25 cm in length. The western subspecies has long, sparsely feathered legs, while the Florida subspecies has more heavily feathered legs. Adults are mostly brown and cream in coloration with spotting on the chest and underparts, a white malar stripe, barring on the wings and tail, and a white throat and white undertail coverts. Unlike most other owls, BUOW are both crepuscular and nocturnal. They are primarily active at both dusk and dawn; however, breeding owls have been observed foraging during daylight hours and are commonly seen at the burrow entrance during both day and night.

BUOW are found in generally open, treeless areas within flat to rolling grasslands, steppes, or sparse shrub lands. They utilize a variety of cavities and crevasses, but are mostly found to have symbiotic relationships with various fossorial mammals including prairie dogs (*Cynomys* spp.), American badgers (*Taxidea taxus*), pocket gophers (Fam. *Geomyida*) and foxes (*Urocyon* spp.). BUOW in southern California are most closely related to the CAGS burrows and frequently nest in their abandoned burrows. There are many studies identifying favorable habitat characteristics for BUOW (Clark et al. 1997). There is little literature available with a focus on enhancing habitat to encourage expansion of these burrowing mammal populations to establish new colonies and create natural burrows. The presence of suitable burrows is a critical component of appropriate habitat for this species.

In general, the BUOW population in southern California is thought to be non-migratory. Birds in the northern portion of its range winter in California, Arizona, New Mexico, Texas, Louisiana, Florida, and Mexico. Recent studies show there is gene flow between migratory and resident BUOW populations suggesting that some migratory BUOW breed within resident populations (Duxbury 2004; Korfanta et al. 2005).

BUOW are generalists in their feeding habits, and will focus on different prey species depending on availability. They take insects and small mammals primarily, but other species are taken as well including amphibians, lizards, small birds, and scorpions. The breeding season for BUOW in southern California is March through August. Mate and burrow selection occurs February through April, and egg laying has been observed in early

to late April (Short pers. obs.; Thomsen 1971). Eggs typically hatch from April to early June, after an approximate three-week incubation period (Thomsen 1971); however, G. Short has observed one instance of a July hatching. The chicks stay with the adults through the summer, using nearby burrows as “satellite” burrows as they learn to hunt and gain independence. By early September most young have left the site of the natal burrow and are hunting on their own. There are few data indicting what occurs after natal dispersal.

## **V. CALIFORNIA GROUND SQUIRREL NATURAL HABITAT ENHANCEMENT**

### **A. NCCP LAG objectives related to WRC MSHCP objectives**

WRC MSHCP BUOW Objective 1 requires conservation of at least 27,470 acres of primary habitat including grasslands, and Objective 3 requires conservation of an additional 22,120 acres of secondary habitat, including playas, vernal pools, and agricultural lands. Both types of habitat were designated based on models developed using vegetation maps and other information such as the California Natural Diversity Database (CNDDDB) (Dudek & Associates 2003). While valuable, these data layers are landscape scale and not at a scale that would allow the identification of local-scale habitat characteristics, such as the presence of burrowing mammals (Allen et al. 2005), specifically CAGS that are closely associated with BUOW burrows in southern California.

The NCCP LAG Objective 1 (Restoration/Enhancement) is related to the WRC MSHCP Objectives 1 and 3: CNLM staff implemented a natural habitat enhancement project for CAGS on Johnson Ranch Preserve and French Valley Wildlife Area (Johnson Ranch complex) by improving CAGS habitat, known to have a symbiotic relationship with BUOW in southern California. The objective of the Restoration/Enhancement project is to provide corridors and cover for fossorial mammals, specifically CAGS, by connecting colonies currently established in high-quality habitat to areas of low to moderate-quality habitat where no colonies. Such dispersal is natural for many ground squirrel species, especially for first-year males (Holekamp and Sherman 1989; Gillis 2002). The successful creation of new squirrel colonies on the central and eastern portions of the Johnson Ranch complex could further increase available natural burrowing habitat for BUOW.

### **B. Methods**

CAGS colonies in the Johnson Ranch complex tend to center around existing boulder piles that were created in the early 2000’s by previous CNLM staff (K. Klementowski pers. obs.); thus, we hypothesized that creating new boulder piles as well as safe connectivity to those areas could expand the current CAGS territories. CNLM Preserve Manager, Ms. Kim Klementowski, and Assistant Preserve Manager, Mr. Joseph Sherrock, met in early April 2014 with CDFW Wildlife Habitat Supervisor, Mr. Steve Kollenborn, and Fish and Wildlife Technician, Ms. Danielle Stewart, to assess the Johnson Ranch complex for potential locations for boulder pile installation, based on known dispersal distances for ground squirrel species (Evans and Holdenried 1943; Fitch 1948), topography of the landscape, and surrounding infrastructure and habitat. After sufficient winter rains arrived and the fire risk associated with mowing dry vegetation

was low, we mowed the pre-determined boulder pile locations and corresponding corridors and removed thatch to facilitate installation of boulders. Three 25-m diameter and two 10-m diameter areas were mowed clear of vegetation where boulder piles would be placed. Corridors approximately 10 meters in width were mowed between each boulder pile. Five boulder piles (Piles 1-5) were installed by a subcontractor using a crane on May 20, 2014, specifically three large piles and two small piles, each less than 250 meters apart from the next (Section IX, Figure 2). Boulders were roughly 1 m in size. The two small boulder piles contained four or five boulders as a base with one or two boulders placed on top to create shelter or cover for CAGS from predators. Similarly, the three large boulder piles were installed with a base of approximately 24 to 27 boulders with 10 to 12 boulders on top. Small boulder piles were roughly 2 m in diameter, while the larger boulder piles were approximately 5 m in diameter. All boulder piles were installed so that gaps and crevasses between boulders would facilitate entry by CAGS but were still small enough to prevent predators from following. Preliminary shallow holes were created using an auger around boulder piles to provide short-term protection during CAGS dispersal and encourage dispersers to remain in the new locations. Four burrow entrances were installed at each of the three large boulder piles and two burrow entrances were installed at each of the two small boulder piles. Holes were approximately 60-100 cm deep and some holes were reinforced using a 30-cm length of 15-cm-long corrugated tubing. Corridors between existing boulder piles and new boulder piles were mowed as needed to maintain low grass height and density.

Boulder monitoring was conducted by CNLM staff from May 21, 2014 through February 5, 2016. Boulder piles and corridors were formally monitored for 30 min every four to six weeks. During this monitoring all species observed were documented along with any evidence of visitation by any animals. Such evidence included white wash or scat on or in the immediate vicinity of the boulder piles. Additional incidental monitoring occurred while CNLM staff were on-site conducting other management activities. In June 2014, CNLM requested an amendment to the NCCP LAG funding for the purchase of wildlife cameras for 24-hour monitoring on a sample of the boulder piles. On November 5, 2014, two Bushnell Hybrid Trophy Cameras (cameras) were installed at the two westernmost new boulder piles (Pile 1 – small and Pile 2 – large) to provide more effective monitoring coverage for the remaining length of the project. The cameras were mounted inside a protective metal camera lock box and on four feet by four inch by four inch wood posts. Wood posts were set 1 ft. in the ground so that cameras were approximately 3 ft. above ground. Posts were placed within the mowed area surrounding each boulder pile. These hybrid cameras can be adjusted so the camera will take a picture and video during the trigger event (i.e., when camera detects movement or heat changes).

Cameras were set as follows from November 5, 2014, through June 5, 2015:

- **Mode:** Hybrid
- **Image Size:** 8 megapixel
- **Image Format:** Full Screen
- **Capture Number:** 1
- **LED Control** (controls night-time IR LED's): High
- **Camera Name:** Camera 1 (at Pile 1) and Camera 2 (at Pile 2)
- **Video Size:** 1280X720
- **Video Length:** 10 second (when active)
- **Interval** (between triggers): 10 seconds
- **Sensor Level:** Auto
- **Night Vision Shutter Speed:** High
- **Camera Mode:** 24 Hours
- **Time Stamp:** On
- **Field Scan:** Off (see explanation below)
- **Coordinate Input:** Off
- **Video Sound:** On

Between July 29, 2015 and August 26, 2015, the video hybrid option was turned off and cameras were set to take two photos after each trigger event. Field scan was originally in ON mode for the first date range but was turned off when it produced no results. Although cameras were deployed through February 5, 2016, batteries in both units died in August 2015 due to a high number of trigger events.

### C. Results

After the installation of the boulder piles CNLM staff immediately and consistently observed western meadowlark (*Sturnella neglecta*; WEME) and American kestrel (*Falco sparverius*; AMKE) perched on boulder piles. Upon visual close inspection of the boulder piles, staff observed evidence of usage by larger raptors due to the presence of snake and small rodent skeletal remains. On June 2, 2014, staff watched a striped skunk (*Mephitis mephitis*; STSK) go in and out of the boulders and coyote (*Canis latrans*; CALA) scat was observed on follow up visits. With continued mowing of the corridors, staff observed in the first year that small rodent burrows were detected where none were previously noted, specifically 32 burrows counted among piles and 11 burrows counted in the corridors.

The cameras were triggered 22,560 times for a total of 38,980 pictures and 6,137 videos. A total of 12 species were captured by the camera for a total of 6,349 pictures with wildlife. The camera on Pile 2 (large pile) captured three pictures of BUOW utilizing the burrow piles as a perch between November 24, 2014 and January 5, 2015. In one of the videos following one of those photos, a BUOW is perched on the pile and a barred wing swipes past the top of the screen, indicating a BUOW is likely sitting atop the camera post (sound on the video also confirms that something was moving around on top of the post). On August 17, 2015, the first incident of a CAGS dispersal to a boulder pile was captured on Pile 2. The wildlife camera continued to capture this and potentially other CAGS utilizing the boulder pile from August 17, 2015 through August

26, 2015, for a total of 4,897 pictures of CAGS. The batteries died on August 26, 2015 as a result of the continual CAGS activities constantly tripping the camera, thus it is likely that CAGS occupancy continued beyond August 26, 2015. In addition to BUOW and CAGS, other species captured by the wildlife camera include coyote, striped skunk, black-tailed jackrabbit (*Lepus californicus*; BTJR), western meadowlark, common raven (*Corvus corax*; CORA), American kestrel, ferruginous hawk (*Buteo regalis*; FEHA), red-tailed hawk (*Buteo jamaicensis*; RTHA), white-tailed kite (*Elanus leucurus*; WTKI) and unidentifiable small bird (possibly sparrows). A sample of pictures showing boulder installation, completed boulder piles, mowed corridors, and animals observed can be found in Section X.A and Section X.B. Table 1 below shows type and total number of species captured by cameras on both Pile 1 and Pile 2 as well as for the total project.

Table 1. Number of each species detected by camera traps on Pile 1 and Pile 2

Date Range	11/5/14 – 12/7/14		12/8/14 – 1/18/15		1/19/15 – 2/25/15		2/26/15 – 6/5/15		7/29/15 – 8/26/15		Sub Total		TOTAL	Max # indiv present
	Pile 1	Pile 2	Pile 1	Pile 2	Pile 1	Pile 2	Pile 1	Pile 2	Pile 1	Pile 2	Pile 1	Pile 2		
CAGS										4897		4897	<b>4897</b>	1
BUOW		2		1							3		<b>3</b>	1 (2 by video)
WEME			5	31	1	53	240	149	387	12	633	245	<b>878</b>	2
AMKE			3	7	2	2	37	11	65	218	107	238	<b>345</b>	2
CALA	2	1	5	9	14	15	18	4	2	7	41	36	<b>77</b>	4 (5 by video)
BTJR			10	8	5	2	16	6	4	11	35	27	<b>62</b>	2
CORA			5	1	1	6	2	4	4	2	12	13	<b>25</b>	2
STSK	2	1	1		6	7	8				17	8	<b>25</b>	1
RTHA				1		7						8	<b>8</b>	1
FEHA						4						4	<b>4</b>	1
WTKI					1						1		<b>1</b>	1
Unknown small bird species				9		5		5		5		24	<b>24</b>	4
<b>Total number of pictures with species</b>													<b>6349</b>	
TOTAL Species per Pile	4	4	6	8	7	9	6	6	5	7	7	11	<b>12 species captured</b>	

\*Species codes: CAGS – California ground squirrel; BUOW – Burrowing owl; WEME – Western meadowlark; AMKE – American kestrel; CALA – Coyote; BTJR – Black-tailed jackrabbit; CORA – Common raven; STSK – Striped skunk; RTHA – Red-tailed hawk; FEHA – Ferruginous hawk; WTKI – White-tailed kite

#### **D. Discussion**

This project has successfully demonstrated a new habitat enhancement technique that land managers within the WRC MSHCP area can implement on their lands to encourage new CAGS colonies and natural BUOW habitat. This is particularly important in conservation areas designated as primary and secondary BUOW habitat under WRC MSHCP Objectives 1 and 3, but that are currently lacking BUOW occupation. On the Johnson Ranch complex, CNLM staff observed a large number of CAGS and burrows on the west, but few burrows to the east, making this a perfect place to implement the natural habitat enhancement project for CAGS. Implementation of this project resulted in the successful movement of at least one CAGS to the east of existing colonies, specifically to an area the CAGS had heretofore avoided or been excluded from because of insufficient cover to allow safe movement.

It is critical, as land managers, to better understand and manage the primary grassland breeding habitat and secondary foraging habitats conserved under the WRC MSHCP for BUOW. It is widely accepted by land managers and researchers within the WRC MSHCP as well as in San Diego County (and throughout the range of the BUOW) that mowing, burning, and grazing can contribute significantly towards more favorably enhancing BUOW grassland habitats, by decreasing the height and density of nonnative grasses, and reducing the buildup of thatch to create more open ground for foraging. Such grassland enhancement techniques have proven particularly successful when coupled with the installation of supplemental artificial burrows and breeding boxes (Klementowski 2010). However, installation of artificial burrows should be viewed as an intensive short-term strategy (being expensive to install and maintain) and the long-term objective should focus on techniques that foster natural habitat that requires less maintenance.

It is important that land managers explore new habitat enhancement techniques, not just toward improving vegetation composition and structure or creation of artificial habitat, but toward supporting mutually valuable interspecific relationships. It is well documented that BUOW in Western Riverside County use CAGS burrows and the absence of burrows is likely a limiting factor in BUOW occupancy (Short 2008). This is particularly true because without burrows the habitat is not suitable for BUOW, regardless of the quality of the vegetation or structure of the land. A focus on enhancing grassland communities specifically for the CAGS will help to establish new colonies and thus creation of natural burrows available for BUOW. Implementation of such enhancement projects will be particularly important within areas designated under WRC MSHCP Objectives 1 and 3 as primary and secondary habitat since some of these lands may not currently support populations of CAGS.

CAGS relocation projects are still being explored in San Diego (Winchell and Weagley 2011) with some success but implementation of such a project involves many partners, robust resources, and multiple considerations focused on the translocated animal's

welfare as well as the recipient environment. Attempts to increase or extend populations through captive breeding or translocation have inherent additional risks including site naiveté (i.e., released into unfamiliar environment), possibly undeveloped or affected social behaviors, and introduction of animals into unsuitable habitat. For example, see L. Harrington (2013) for an extensive literature review of over 200 scientific papers related to welfare issues and considerations involved with the reintroductions of animals. Management of habitat may be more effective in the long-term, involve less risk, and provide opportunity for natural recolonization.

## **VI. WESTERN BURROWING OWL MONITORING AND BANDING**

### **A. NCCP LAG objectives related to WRC MSHCP objectives**

WRC MSHCP BUOW Objective 2 states first that there will be at least five Core Burrowing Owl Areas. The Core Areas have been established and consist of (1) Lake Skinner/Diamond Valley Lake area; (2) playa west of Hemet; (3) San Jacinto Wildlife Area/Mystic Lake area including Lake Perris area; (4) Lake Mathews; and (5) along the Santa Ana River (Dudek & Associates 2003) (Section IX, Figure 1). Additionally, a combined total of approximately 120 BUOW individuals within the WRC MSHCP plan area with no fewer than five pairs in any Core Area are required to meet the plan objectives (Dudek & Associates 2003). Since 2010, more than the requisite five pairs of BUOW have been consistently documented in Core Area 1 but no breeding pairs have been observed consistently within any of the other Core Areas and so Objective 2 for BUOW is not currently being achieved.

The NCCP LAG Objective 2 (Monitoring) is related to the WRC MSHCP Objective 2: CNLM staff monitored BUOW within three of the five Core Areas (as well as in a Proposed Core Area), and when the opportunity presented, trapped and banded both adults and juvenile BUOW to aid in continued dispersal monitoring. The objective of the Monitoring project is to study BUOW dispersal across the WRC MSHCP area, in coordination with CNLM's partner land managers located in the Core Areas. CNLM staff has been conducting a dispersal study since 2009 within a subset of Core Area 1, previously identified as the Johnson Ranch complex. While it is generally considered that banding results in few returns, as of 2013 the dispersal study has resulted in the banding of 175 individual BUOW and 32 unique re-sight events. This represents an 18% return. The efficacy of long-term banding efforts are well documented by such efforts as the MAPS and MAWs programs run by The Institute for Bird Populations (IBP 2002). An increased effort in banding and recapture efforts to include the entirety of Core Area 1 and the inclusion of other Core Areas will provide a better understanding of: 1) the pattern and distance of adult and juvenile dispersal; and 2) dispersal within and among Core Areas towards documenting natal and site fidelity.

### **B. Methods**

Monitoring for BUOW was conducted by Ms. Klementowski and Mr. Sherrock. Monitoring was performed at each location as soon as access permission was acquired

by the partnering land owner and after an initial orientation by the land manager. In addition to CNLM-managed Johnson Ranch Preserve (JRP) and Skunk Hollow Vernal Pool Preserve (SHVPP), CNLM staff acquired access permission and performed monitoring at ten other conservation lands located within the WRC MSHCP area (Table 2). Monitoring surveys occurred through 2014 and 2015, during both the breeding season, roughly March through August, and the non-breeding season, September through February. Monitoring was conducted using standard protocols (CBOC 1993; WRC MSHCP 2006; Wilkerson et al. 2006; CDFW 2012), with both binoculars and scopes being used. Most monitoring sessions were performed 2-3 hours immediately following sunrise but some were performed in the 2-3 hours prior to sunset. Some incidental observations occurred and were documented at that time. BUOW that were observed as banded and successfully identified during these monitoring sessions were considered to be recaptures (whether by resight or by actual capture in trap) and these individuals were reported to the United States Geological Survey Bird Banding Lab (USGS BBL).

Table 2. Participating owners and managers in NCCP LAG project

Core Area	Name	Owner	Manager	Comments
Lake Skinner, Diamond Valley Lake	Johnson Ranch Preserve	Riverside County	CNLM	
Outside Core Area	Skunk Hollow Vernal Pool Preserve	CNLM	CNLM	In Constrained Linkage A
Lake Skinner, Diamond Valley Lake	Southwestern Riverside County Multi-Species Reserve	Multiple owners	County Parks and Open Space District	
Lake Skinner, Diamond Valley Lake	El Sol	RCA	County Parks and Open Space District	Monitoring access only
Lake Skinner, Diamond Valley Lake	French Valley Wildlife Area	CDFW	CDFW	
San Jacinto Wildlife Area, Mystic Lake	San Jacinto Wildlife Area	CDFW	CDFW	
San Jacinto Wildlife Area, Mystic Lake	Lake Perris State Recreation Area	California State Parks	California State Parks	
Lake Mathews	San Timoteo Canyon State Park	California State Parks	California State Parks	
Lake Mathews	BLM – Lake Mathews	BLM	BLM	
Lake Mathews	El Sobrante Wildlife Preserve	USA Waste of California	Waste Management	
Lake Mathews	Lake Mathews Reserve	Multiple owners	RCHCA	Limited access, monitoring only
Proposed Core 2	McElhinney	RCA	County Parks and Open Space District	

Trapping and banding was conducted by CNLM Coachella Valley Preserve Manager, Ms. Ginny Short (California State MOU/SCP#8251 and United State Geological Survey (USGS) Permit # 23631). Ms. Short was assisted by Ms. Klementowski and Mr. Sherrock. Ms. Klementowski coordinated with partnering land managers to assist in determining where breeding pairs of BUOW were present in preparation for planning trap nights. One-way burrow traps were placed at burrow entrance(s). Traps were sometimes baited with a dead mouse or other invertebrates purchased from a pet store. Traps were set up 30 minutes prior to sunset and checked every 60 minutes thereafter. Typically the traps were within view, but were visited more often if visibility was limited. Adults and chicks that were captured for the first time and were unbanded were recorded as a unique capture and then they were measured, weighed, and banded using standards devised by the USGS BBL. Measurements taken included age, sex if known, weight, wing and tail length, body condition and overall health. BUOW were banded with an alpha-numeric color band on one leg and a metal USGS band on the other leg. The color band was placed on the right leg in both 2014 and 2015, but this is not always the case and depends on the set of bands. The alpha-numeric color bands are unique to Ms. Short's permit and have black text on a yellow band with a black stripe on the top of the band (Section X.C). USGS metal tags are also unique to Ms. Short and must be coupled with her specific color bands. Unique captures are defined as both a BUOW that is unbanded and captured for the first time, as well as a BUOW banded in a previous year but captured for the first time this year. To expand, occasionally one individual BUOW was captured multiple times during the same trapping effort; so regardless of how many times that same individual was captured during the breeding season, it was only counted as one unique recapture. On the other hand, a recapture is defined as the identification of a BUOW banded in a previous year, regardless of the year it was banded. Recaptures provide valuable dispersal data of adults and juveniles, males and females, as well as information about burrow usage and burrow returns. Banded adult BUOW that are recaptured for the first time in the season are recorded as a unique capture (i.e., also a recapture) and then measurements are taken as stated above.

### **C. Results**

A detailed schedule of monitoring and banding events for all locations can be found in Appendix A, including individuals banded, recaptures, age, sex, measurements and other field notes. A summary of monitoring sessions grouped by location and year can be found in Table 3. Highlights for each location are discussed in detail in Sections C.1 through C.8.

Table 3. BUOW observed and banded at each location by year

Area	Year	Apprx No. burrows monitored	No. burrows occupied		No. of unique captures		Comments
			Pairs	Singles or unknown	Newly banded	Recapture	
Johnson Ranch complex	2014	21 artificial plus multiple natural burrow options	8	2	18	7	Includes bands found on detached legs; uncertainty b/c of bird standing on one leg
	2015		7	1	11	6	Documentation of BUOW movement from artificial to natural burrow
Area	Year	Apprx No. burrows monitored	No. burrows occupied		No. of unique captures		Comments
			Pairs	Singles or unknown	Newly banded	Recapture	
El Sol	2014	25 artificial plus multiple natural burrow options	NA	NA	NA	NA	Did not monitor
	2015		2	1		One indiv banded with indiscernible black on white code	Four individuals observed during non-breeding season
Area	Year	Apprx No. burrows monitored	No. burrows occupied		No. of unique captures		Comments
			Pairs	Singles or unknown	Newly banded	Recapture	
Southwestern Riverside County Multi-species Reserve	2014	21	0	1	0	1	Identified as "C1" black on white on left from El Sol; unconfirmed identity
	2015	21	0	1	0	1	"C1" remained on-site

Area	Year	Apprx No. burrows monitored	No. burrows occupied		No. of unique captures		Comments
			Pairs	Singles or unknown	Newly banded	Recapture	
McElhinney	2014	Multiple natural burrow options	0	1	0	0	Confirmed as unbanded
	2015		0	1	0	0	Confirmed as unbanded
Area	Year	Apprx No. burrows monitored	No. burrows occupied		No. of unique captures		Comments
			Pairs	Singles or unknown	Newly banded	Recapture	
Lake Perris State Recreation Area	2014	5 artificial plus natural burrow options	NA	NA	NA	NA	Did not monitoring
	2015		0	0	0	0	No BUOW Observed
Area	Year	Apprx No. burrows monitored	No. burrows occupied		No. of unique captures		Comments
			Pairs	Singles or unknown	Newly banded	Recapture	
San Jacinto Wildlife Area	2014	Some natural burrow options	0	0	0	0	No BUOW Observed
	2015		1	0	1	0	One chick banded

Area	Year	Apprx No. burrows monitored	No. burrows occupied		No. of unique captures		Comments
			Pairs	Singles or unknown	Newly banded	Recapture	
Lake Mathews complex	2014	Over 70 artificial and multiple natural burrow options	1	4	0	1	Identified as "CO" black on yellow on left; duplicate band with old bird, thus initially misidentified
	2015		0	5	0	1	"CO" remained on-site
Area	Year	Apprx No. burrows monitored	No. burrows occupied		No. of unique captures		Comments
			Pairs	Singles or unknown	Newly banded	Recapture	
San Timoteo Canyon State Park	2014	Little to no natural burrows available	NA	NA	NA	NA	Did not monitor
	2015		0	0	0	0	Poor habitat, did not revisit

**1. Johnson Ranch complex**

The Johnson Ranch complex consists of the two CNLM-managed preserves JRP and SHVPP and CDFW's FVWA. JRP and FVWA are within Core Area 1 (Section IX, Figure 3) and SHVPP is adjacent in Constrained Linkage A. CNLM staff conducted breeding season and non-breeding season monitoring events, both formal and informal while on-site conducting other management activities. A sample of trapping and banding pictures can be found in Section X.C.

*a) 2014 monitoring, banding, and recaptures*

Ten burrows were monitored, eight of which were occupied with nesting pairs while two of the ten occupied burrows appeared to be single or of unknown status. Burrows that were monitored and classified as single or unknown status were done so for a variety of reasons, the most common being: 1) only one BUOW was ever observed, not demonstrating breeding behavior, and thus appears to be single; 2) BUOW pair was observed but does not appear to have nested successfully (i.e., no chicks observed); 3) BUOW pair was observed at burrow then seemingly abandoned the site or disappeared. Two trapping sessions were conducted in late May and early June resulting in 25 unique captures, 17 newly banded BUOW and eight recaptures. Of the 17 newly banded BUOW, 13 were chicks of unknown sex, one was an adult male and three were adult females. Two of the eight recaptures (with band codes "P9" and "M1") were nesting in the same burrow where they had originally been banded (Skunk Natural 8 and North Natural 7, respectively). "M1" successfully produced eight chicks while "P9" produced at least one chick. Three of the recaptures were nesting in different burrows but all within 500 meters of the original burrow where they were first banded; "R5" mated with "P9", while the other two both successfully produced at least one chick each. Two of the eight recaptures were simply the discovery of banded legs detached from the body with the assumption that the BUOW were dead. These were considered to be recaptures because it is an indication of movement or non-movement, although timing of death is uncertain. Both legs were found within 25 meters of the burrow where they had been originally banded. The final recapture of 2014 was via a bird scope (visual resights are considered as recaptures) of a bird that was banded in the area with a black on white number "12". This BUOW banded with "12" remained standing on the one banded leg during the entire observation, thus the observer was unable to ascertain whether the band was in fact on the right leg or left leg. Because banders will often maintain duplicate bands, one for each leg, the bander was unable to confirm where and when this bird was banded but suspected it was a bird banded around the Leon Road and Keller Road area. Ms. Klementowski submitted to the USGS BBL the observation of a "12" in black on white on an unknown leg and they returned a Certificate stating the bird was banded in 2009, "11 miles north of Temecula". It was recaptured approximately 8 km to the south of the Leon Road and Keller Road area. This BUOW was not observed during the remainder of the season.

*b) 2015 monitoring, banding, and recaptures*

Eight burrows were monitored, seven of which were occupied with nesting pairs and one was of unknown status. Only one trapping session was conducted in late May, due to the late age of the chicks being trapped, including one burrow that already fledged. This one trap session resulted in 15 unique captures: 11 newly banded BUOW and four recaptures. Of the 11 newly banded BUOW, eight were chicks of unknown sex, one was an adult male and one was adult female. Two of the four recaptures were the same two that had been recaptured in 2014

in their original burrows, recall “P9” and “M1”. In 2015, “M1” again nested in North Natural 7, successfully producing at least three chicks, while “P9” moved just 47 meters to another natural burrow, successfully producing at least three chicks. One recapture, “U5”, was the 2013 offspring of “M1”, and with the maternal parent nesting in the same burrow, “U5” moved 330 meters south to nest successfully in the Skunk Gate burrow, producing at least one chick. The fourth recapture moved almost 2.4 km from an artificial burrow on JRP to a natural burrow on SHVPP. This is the first known occurrence that CNLM staff have observed of a BUOW moving from an artificial burrow to a natural burrow since first actively banding in 2010, although there have been some recaptures of birds banded on other Reserves where the type of burrow is unknown.

## **2. El Sol property**

The El Sol property is located adjacent to and east of the Johnson Ranch complex (Section IX, Figure 4) and is part of Core Area 1. El Sol has 34 artificial BUOW burrows and numerous possible natural burrows. CNLM staff conducted two monitoring sessions during the 2015 breeding season and one during the non-breeding season. One session was ended prematurely due to excessive fog. During the second breeding season session in April 2015, five BUOW were observed: one pair at AB18, including an adult that was banded with black on white but no code was discernable; one pair was observed at AB08, which consisted of two unbanded adults; and one BUOW was observed at AB19 but its legs were not visible to check for bands. During the non-breeding season monitoring event in October 2015, four BUOW were observed at four different burrows (AB18, 09, 12, and 29). The BUOW at AB18 was unbanded, while the other three were unknown. The RCA opted out of trapping and banding as they conducted their own banding operation, thus these are the only activities that were conducted on the El Sol property under this NCCP LAG.

## **3. Southwestern Riverside County Multi-Species Reserve**

The Southwestern Riverside County Multi-Species Reserve (MSR), also within Core Area 1, is located directly to the northeast of the Johnson Ranch complex and north of the El Sol Property (Section IX, Figure 5). The MSR has 21 artificial BUOW burrows across the Reserve. CNLM staff conducted four breeding season monitoring sessions (one in 2014 and three in 2015) and two monitoring sessions during the non-breeding season, with the main focus of the monitoring events being on one BUOW with white bands.

### *a) “C1” recaptured BUOW*

In July 2014, Mr. Sherrock observed a BUOW banded with a black on white band on the left leg, thought to be “C1”. Mr. Sherrock emailed the Reserve Manager and County staff as the black on white band is used for the El Sol banding operation and other local Reserves. County staff responded back that this bird was the adult male from NB18 on El Sol. The bander was notified and was aware that we had received the data from the County and we had submitted an

observation report to the USGS BBL. The USGS BBL followed up on our report saying that they had spoken with the bander and that he was still in possession of the “C1” band, therefore picture confirmation was needed and subsequently provided (Section X.C). The USGS BBL again followed up with the bander to confirm with the picture evidence. Per their request, a second observation report was resubmitted and a Certificate from the USGS BBL was received in August 2015 stating this bird was “too young to fly when banded in 2014”—information that was seemingly inconsistent with that previously received. CNLM staff contacted the bander directly who confirmed that the Certificate was accurate (K. Klementowski pers. comm. January 2, 2016). With inconsistent statements, it was unable to be determined if this was an adult dispersal or a juvenile dispersal.

#### **4. McElhinney property**

The McElhinney property is located west of Core Area 1 in Proposed Core Area 2 (Section IX, Figure 6). There are no artificial burrows on this property but numerous natural burrow options. CNLM staff conducted one non-breeding season monitoring session in 2014, two breeding season monitoring sessions in 2015 and one non-breeding monitoring session in 2015. One BUOW was observed in the southeast portion of the property during both of the non-breeding season monitoring events. The BUOW was an unbanded adult. No BUOW were observed during the breeding season. The RCA opted out of trapping and banding as they conducted their own banding operation.

#### **5. Lake Perris State Recreation Area**

The Lake Perris State Recreation Area (LPSRA) is located within Core Area 3 (Section IX, Figure 7). The LPSRA has five artificial burrows (Section X.C) as well as some previously known-to-be-occupied natural burrows that were monitored during this project. CNLM staff conducted two monitoring sessions at LPSRA in 2015, one during the breeding season and one during the non-breeding season. No BUOW were observed at LPSRA during these monitoring events. The artificial burrows appeared to be in good condition, although tunnels were not inspected with a scope and nest boxes were not opened, but vegetation surrounding the burrows appeared to be well-maintained (Section X.C).

#### **6. San Jacinto Wildlife Area**

The San Jacinto Wildlife Area (SJWA) is located within Core 3 (Section IX, Figure 8). Breeding BUOW have been observed on SJWA in past years (MSHCP 2007; MSHCP 2008), but not in recent years and since the overall population crashed in 2014 (K. Klementowski pers. obs.). CNLM staff conducted one non-breeding season monitoring session in 2014 and one breeding season monitoring session in early 2015. No BUOW were observed at either of these sessions.

a) *“7R” newly banded BUOW*

CNLM was informed by CDFW staff later in the 2015 breeding season that there was a nesting pair with possibly two chicks. CNLM staff performed one monitoring session and scouted out the burrow prior to performing a trapping and banding session. CNLM received permission from Mr. Scott Sewell, Wildlife Area Manager, to schedule a night of trapping (K. Klementowski pers. comm. July 17, 2015). One juvenile BUOW was successfully trapped and banded as “7R”. CNLM staff attempted to conduct a second trapping and banding session the following week but quickly ended the session prematurely due to the auditory presence of a pack of coyotes in the area.

**7. Lake Mathews: BLM, El Sobrante, RCHCA**

The Lake Mathews complex, named as such for this report, consists of three partnering properties with contiguous property boundaries. Land managers for the different properties here frequently cooperate to manage the landscape with similar goals (Section IX, Figure 9). CNLM staff was permitted to access and monitor the BLM and El Sobrante portions of the Lake Mathews complex year-round, and were permitted to observe RCHCA lands from the roads during the breeding season and were permitted to enter the BUOW areas in late 2015. There are over 70 artificial burrows across the entire Lake Mathews complex. The RCHCA property was the recipient of six pairs of translocated BUOW in 2013 (K. Klementowski pers. comm. May 3, 2013) thus the Land Manager was sensitive to any disruptions of the remaining BUOW on-site. There were numerous BUOW still present when CNLM staff first visited the properties in May 2014.

a) *“C0” recaptured BUOW*

In May 2014, CNLM staff first observed a bird banded with “C0” in black on yellow on the left leg. The observation was reported to the Land Managers, the USGS BBL, and the bander. The USGS BBL responded back asking for picture confirmation, as this would be a new age record for a wild BUOW, with their records showing it was banded in 2005 by Ms. Short as a sub-permittee of another Master Bander. Color bands are unique to an individual bander (i.e., Master Bander), but banders can have numerous sub-permittees who use that same color combo while acquiring their training hours (Gustafson et al. 1997). Thus, this is why it was reported that Ms. Short was the original bander even though it was not her unique color combo (i.e., yellow with black stripe). CNLM successfully acquired a picture (Section X.C) and the USGS BBL confirmed the new age record. However, County staff then sent a picture of this bird as captured via wildlife camera, along with information that “C0” was part of the RCA translocation project. For the translocation project, the adults were banded with yellow bands with black text and the juveniles were banded with white bands with black text. The USGS BBL later sent a revised Certificate stating the bird was banded in 2013. As previously mentioned, duplicate bands are often used by banders and are managed as being for the right leg or the left leg. The bander stated he had used the yellow band on the correct leg as identified by

the original Master Bander (K. Klementowski pers. comm. January 6, 2015). The Master Bander stated that they yellow bands had been confiscated as they should not have been coupled with the other banders metal bands (Short pers. comm. December 12, 2014). Bands can be transferred to another permittee but permission from the USGS BBL is required, as the bands are considered to be property of the United States and Canadian government until they have been placed on birds (Gustafson et al. 1997).

*b) Unbanded BUOW*

Numerous unbanded BUOW were observed on the Lake Mathews complex. Two unbanded BUOW were assumed to be migrants based on years of observations by the Lake Mathews Reserve Manager (K. Klementowski pers. comms.). These two areas were frequently observed as being occupied by BUOW early in the migratory season, roughly November or December, and then the BUOW would seemingly move on by January, thus they were thought to be migrant BUOW. Other unbanded BUOW, thought to be residents, were observed during both the breeding and non-breeding seasons throughout the Lake Mathews complex. CNLM staff made one attempt to trap BUOW on BLM lands during the 2014 breeding season, but the effort was unsuccessful. CNLM was not permitted to trap on RCHCA lands and no BUOW were observed at the El Sobrante artificial burrows (although evidence of BUOW visitation was observed). In 2015, CNLM staff observed "C0" on BLM lands at the same time as an unbanded BUOW on the RCHCA lands. CNLM staff did not observe interaction between the two BUOW, nor did we observe either BUOW paired up with another during the season, and thus concluded they were both unpaired (hypothesized to be of the same sex). Later in 2015, at least three or four BUOW were observed, but CNLM staff was unable to confirm whether they were banded.

**8. San Timoteo Canyon State Park**

San Timoteo Canyon State Park (STCSP) is the northernmost extent of the survey area (Section IX, Figure 10). CNLM staff went out to the site to assess the habitat status as well as to monitor for BUOW. No BUOW were observed during the one occasion when CNLM staff visited the site. Based on personal communications with State Parks staff, no BUOW were expected to be observed on this property since a lack of funding did not permit for management of the annual grasses (K. Klementowski pers. comm. May 17, 2014).

**D. Discussion**

During the past two years, the trap and band efforts resulted in dramatically lower numbers of unique captures and recaptures than the previous four years. The decline is likely attributed to the ongoing drought in southern California that started in 2012 and continued through 2015 and is a trend for BUOW in other areas of the southwestern United States where some populations have declined by 98% (Cruz-McDonnell and Wolf 2016). The Johnson Ranch complex BUOW population crashed between 2013 and 2014, with 11 fewer pairs in the area than 2013. The crash affected trap and band numbers, with 36 fewer

BUOW banded in 2014 than in 2013. The population has remained stable from 2014 to 2015 but clutch size has seemingly diminished (2013 avg=2.5 [n=16]; 2014 avg=2.4 [n=5]; 2015 avg=1.5 [n=6]). With the exception of the one breeding pair at the San Jacinto Wildlife Area in 2015, no naturally occurring breeding pairs of BUOW were observed in the other Core Areas and one Proposed Area where CNLM staff had acquired access. This was also the case for the Lake Mathews complex (i.e., the BUOW that produced young in this Core Area were the result of a translocation project, not naturally established and breeding). The Santa Ana River Core Area and Hemet Playa were not included as part of this grant.

Recaptures shows movement within Core Area 1 among the various Reserves but no egress dispersal to other Core Areas or ingress dispersal from other Core Areas has been documented, which is consistent with most previous data. Both 2014 and 2015 saw the movement of at least two birds, one from north of Core Area 1 south into Johnson Ranch complex and one from El Sol to the MSR. The remaining recapture data (n=12) show very little movement, with some returning to the same burrow year after year, while the question still remains as to where the BUOW disperse to outside of the breeding season months. Results from the previous six years of BUOW trapping, banding, and recaptures on the Johnson Ranch complex alone, indicate that BUOW often return to the previous nesting/breeding locale but there has been at least one record of a BUOW moving multiple kilometers away (Klementowski and Short 2012) from the original banding location potentially indicating additional undocumented movement of banded BUOW far away from their original banding locations. To better understand BUOW dispersal within and among Core Areas it is important to increase BUOW monitoring effort so recaptures can continue to provide dispersal data. Monitoring efforts are currently relatively strong in the WRC MSHCP area during the breeding season, but monitoring during the non-breeding season can be increased (if resources permit) and provide valuable input about movement between breeding seasons.

BUOW monitoring efforts during this project also illuminated the possibility of errors occurring in BUOW banding records. Given that there were two inconsistencies noted among two banded individuals observed, this suggests a significant source of error. Although it was previously referenced that permittee's color bands are not to be coupled with another permittee's USGS metal bands, this information is not found in permit guidelines (Short 2009) nor is it referenced in the North American Bird Banding Manual (Gustafson et al. 1997), suggesting that this may be an ethical or etiquette practice passed on to banders by their mentor and trainer. Guidelines also reference that there are verbal and written protocols when bands are being transferred from one bander to another (Gustafson et al. 1997). More attention to or improvement of banding protocols as well as a robust revision of permit guidelines could help to mitigate mistakes and missed opportunities for data collection.

## VII. RECOMMENDATIONS FOR LAND MANAGERS AND FUTURE ACTIVITIES

- Provide cover for CAGS near occupied area to expand their chances for successful dispersal
  - Any pile of cover items would be helpful towards this point. For example, literature on controlling or exterminating squirrels will often recommend that you remove brush piles and rocks so that squirrels do not have a place to hide and burrow.
- CAGS dispersal and colonization will take time
  - Be patient, as it is the first year male CAGS that will be dispersing from their natal family so it may take a few generations to establish new colonies.
- Develop clear camera trapping methodologies prior to deployment
  - Camera trapping is one of our newer tools for monitoring wildlife and are great in remote locations or where projects may require more frequent monitoring than staff can provide.
  - Research and review current literature and have methodologies in place prior to deployment, including camera settings, date checks, and data management procedures.
  - Do not delete wildlife camera captures, regardless of whether they appear to be empty or do not contain your target species. Empty pictures help to quantify your long-term efforts and may also assist in understanding if camera sensitivity settings need to be modified.
  - Time investment in managing wildlife camera trapping data can be intense
    - Properly functioning cameras may only take 250 photos during a trapping session or if sensitivity is set too high, results could be over 10,000 photos. On the other hand, and as is the case for this NCCP LAG project, one trapping session resulted in over 10,000 photos because there was one very active CAGS constantly triggering the camera. Software exists to help organize and protect photos (Picture Information Extractor 6.87), as well as software to assist with data mining between photos with and without species (Presence 3.1). Ensure that you have the appropriate resources prior to deploying a camera trapping project.
- Continue managing BUOW habitat or potential habitat for best characteristics
  - It is critical that land managers continue to implement various management techniques to reduce vegetation height and density, for both BUOW and CAGS.
  - Artificial burrows still play an important role in enhancing a site for BUOW, choose the best design for the landscape and include small perches.
- CNLM will continue to work with CDFW to maintain boulder piles and associated corridors as well as monitor for CAGS dispersal and colonization
  - As a compliment to the NCCP LAG natural habitat enhancement, CDFW installed boulder piles further to the east of Piles 1-5, increasing the future potential for CAGS to disperse and colonize farther to the east.
- Participate in banding program

- CNLM was unable to conduct trapping/banding activities on two sites, one of which conducted their own banding program. To better understand BUOW dispersal in the WRC MSHCP area, it is critical that local biologists work together to band as many BUOW as possible. This will help to increase recapture rates and create more robust data across the region.
- Acquire equipment and monitoring tools, such as wildlife cameras, binoculars, and spotting scopes, for increased chances of sighting bands (i.e., recaptures)
- Promptly report bands to Land Manager, the USGS BBL, and the Master Bander if you are knowledgeable of local bander's unique color codes
- Monitor BUOW year-round with an emphasis on acquiring knowledge of whether BUOW individuals are banded
- Increase monitoring/recapture efforts in the non-breeding season

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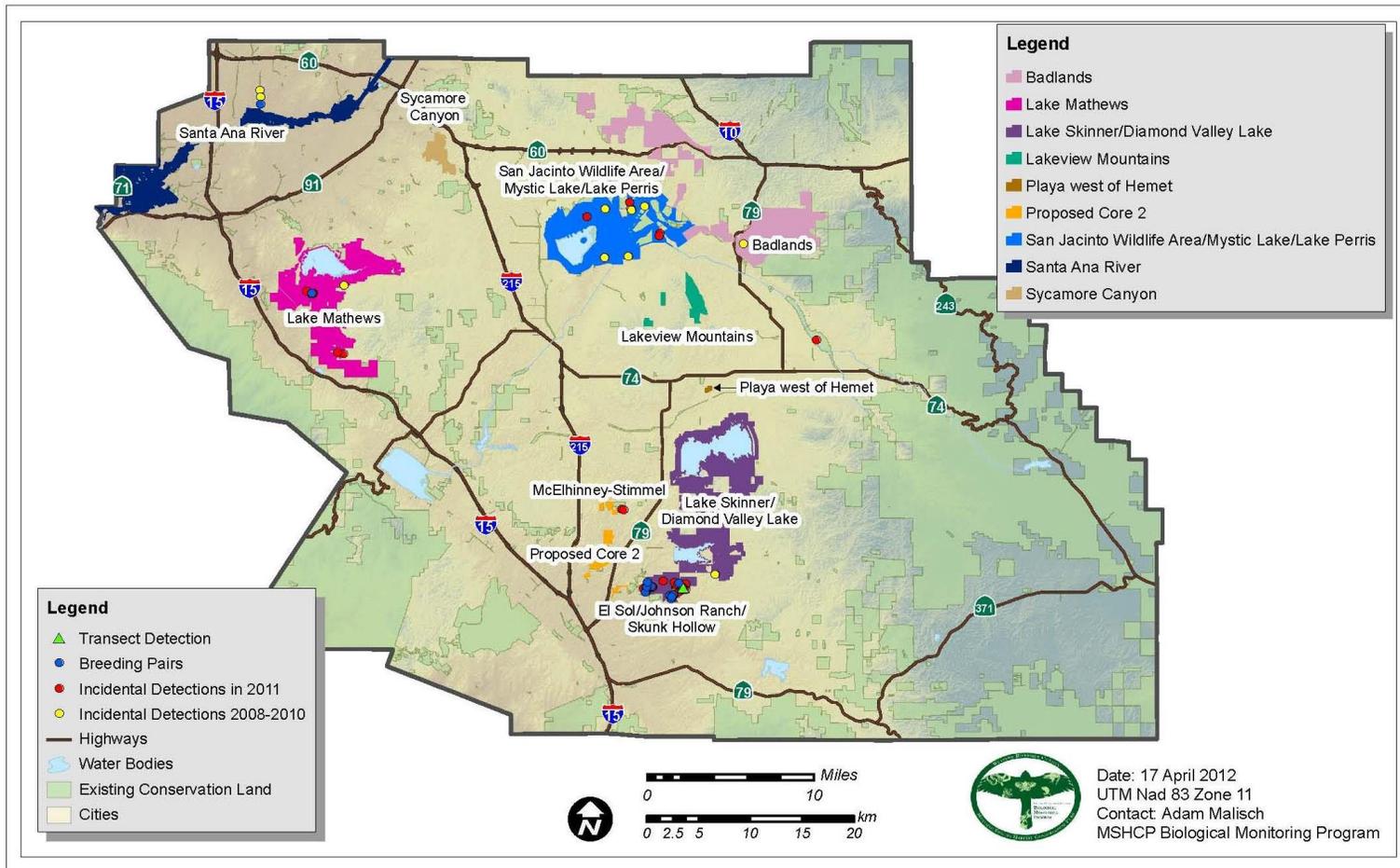
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IX. FIGURES



**Figure 1. Locations of Core Areas for BUOW**

(used with permission from RCA, Correa pers comm 2013)

(Core Area 1 = purple, Lake Skinner/Diamond Valley Lake and El Sol/Johnson Ranch/Skunk Hollow, Core Area 2 = brown, Playa west of Hemet, Core Area 3 = blue, San Jacinto Wildlife Area/Mystic Lake/Lake Perris, Core Area 4 = bright pink, Lake Mathews which includes El Sobrante, and Core Area 5 = navy blue, Santa Ana River)



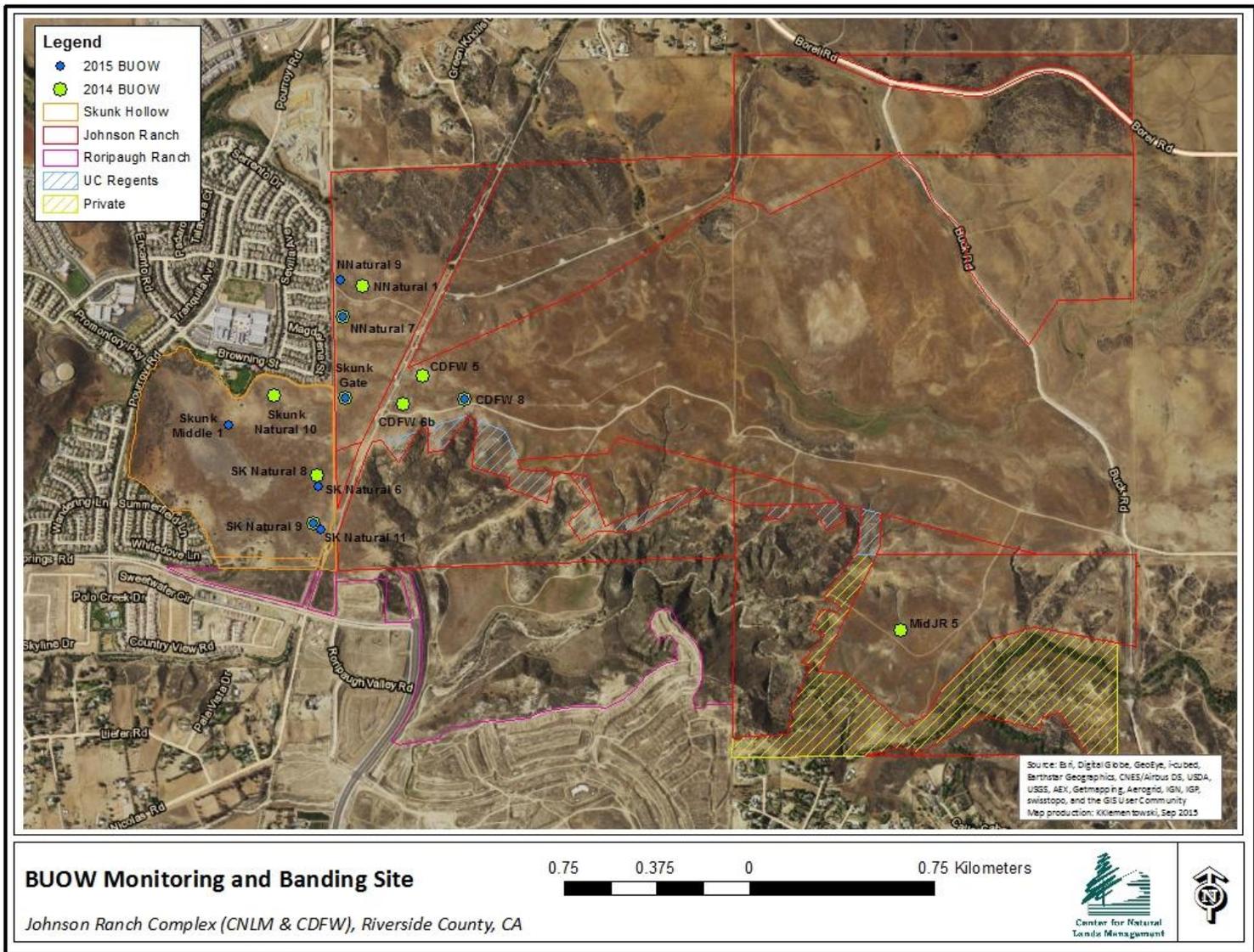


Figure 3. Johnson Ranch complex















**X. PHOTOS**

**A. Boulder piles installation**



©CNLM 2014

CDFW staff, Danielle Stewart, assisting CNLM staff with delivery of boulders



©CNLM 2014

Delivery truck dumping boulders



Boulder pile placement



Boulder pile placement, with mowed corridor in background



Completed boulder pile with mowed corridor to another boulder pile



Openings between boulders to provide shelter and cover

**B. Sample of wildlife camera trap pictures**



Western burrowing owl on Pile 2



California ground squirrel on Pile 2



California ground squirrel on Pile 2



California ground squirrel on Pile 2



Striped skunk near Pile 2



Coyote on Pile 2



Black-tailed jackrabbit near Pile 1

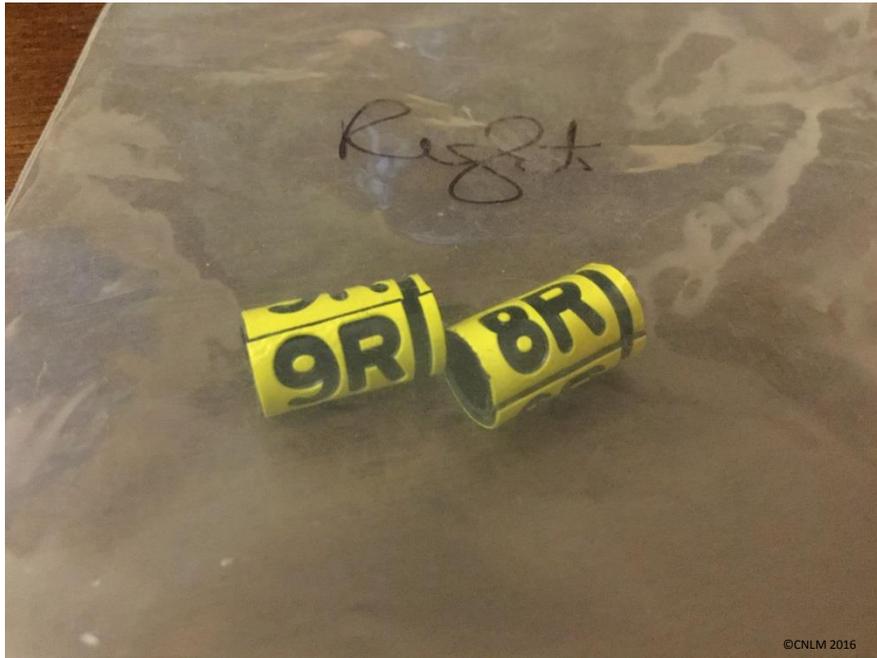


White-tailed kite on Pile 1



Ferruginous hawk on Pile 2

**C. BUOW monitoring and banding photos**



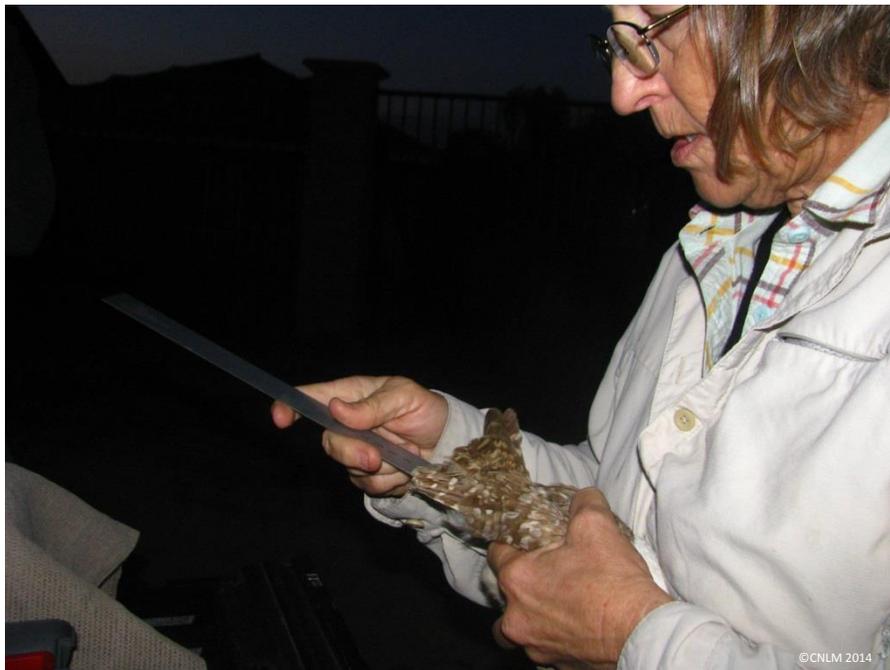
Example of two of Ms. Short's alpha-numeric color bands that would be placed on the right leg (when recaptured, would be reported as "9R" or "8R" black on yellow with black stripe on right)



CNLM staff setting up one-way trap in front of natural burrow on Johnson Ranch complex



Ms. Short fitting a color band on to an adult BUOW at Johnson Ranch complex



Ms. Short measuring tail feathers of adult BUOW at Johnson Ranch complex



Ms. Short weighing adult BUOW at Johnson Ranch complex



Adult BUOW stretching wings after being banded and prior to release, on Johnson Ranch complex



CNLM staff conducting monitoring of artificial burrows at MSR Lake Skinner



C1 banded BUOW at MSR Lake Skinner, taken through scope



CNLM staff inspects conditions of artificial burrows after monitoring for BUOW at Lake Perris State Recreation Area



One-way trap set in front of natural burrow at San Jacinto Wildlife Area



Ms. Short fitting a juvenile BUOW with a USGS metal band, on San Jacinto Wildlife Area



Ms. Short with juvenile BUOW after banding and prior to release, on San Jacinto Wildlife Area



One-way trap set up in front of artificial burrow on Lake Mathews complex, BLM



CO banded BUOW on Lake Mathews complex

**XI. APPENDICES**

**A. Monitoring session details**

	Date	Field Activities	BUOW Obsvd?	# Obsvd	BUOW Observation Details
Lake Mathews	5/1/2014	Orientation/BUOW Monitoring	Yes	1	1 single at BLM artificial burrows
	5/22/2014	BUOW Monitoring/Banding	Yes	3	1 pair at RCHCA artificial burrows; 1 single at RCHCA artificial burrows with "CO" black on yellow on left
	6/18/2014	BUOW Monitoring	Yes	1	"CO" on BLM/El Sobrante pipe along side of road
	9/18/2014	BUOW Monitoring	Yes	1	1 single at RCHCA artificial burrows
	3/19/2015	BUOW Monitoring	Yes	2	"CO" at BLM artificial burrows; 1 single unbanded at RCHCA artificial burrows
	5/7/2015	BUOW Monitoring	Yes	2	"CO" at RCHCA artificial burrow; 1 single unbanded at BLM artificial burrow; observed pellets on one El Sobrante artificial burrow
	11/10/2015	BUOW Monitoring	Yes	3	3 single BUOW, unknown if banded or not, all around RCHCA artificial burrows
McElhinney	10/29/2014	BUOW Monitoring	No	0	
	2/20/2015	BUOW Monitoring	Yes	1	1 single unbanded on southeast portion of property
	4/28/2015	BUOW Monitoring	No	0	
	10/28/2015	BUOW Monitoring	Yes	1	1 single unbanded on southeast portion of property
Perris	2/18/2015	BUOW Monitoring	No	0	Artificial burrows appear to be in good condition
	10/30/2015	BUOW Monitoring	No	0	
Timoteo	3/31/2015	Site Assessment	No	0	BUOW unlikely due to high density/height of nonnative annual grasses
SJWA	2/27/2015	Orientation/BUOW Monitoring	No	0	
	7/20/2015	BUOW Monitoring	Yes	1	1 single at nest burrow, flushed nearby
	7/21/2015	BUOW Banding	Yes	2	1 single at nest burrow, flushed nearby; 1 chick, newly banded 7R
	7/29/2015	BUOW Banding	Yes	1	1 single at nest burrow, flushed nearby; stopped effort early after hearing coyote pack nearby
	10/23/2015	BUOW Monitoring	Yes	2	2 BUOW observed in two burrows along berm

Skunk/JRP/FVWA	4/3/2014	Meet w/ CDFW to discuss boulder pile locations	No	0	
	4/4/2014	Mow boulder pile areas and corridors	No	0	
	4/18/2014	BUOW Monitoring	Yes		1 pair at NN7; 1 pair at CDFW 8; 1 single at CDFW 6; 1 pair at SKGate; 1 pair at MidJR5; 1 single at SkNat9; found "3F" left leg detached assume dead.
	4/21/2014	Mow/dethatch boulder areas	No	0	
	4/22/2014	Mow/dethatch boulder areas	No	0	
	5/13/2014	BUOW Monitoring	Yes		Recapture "M1" as AHY F at NN7 - same burrow as 2013; Recapture "U6" as AHY M at SKNat10; Recapture "12" black on white on unknown leg - stood on one leg entire time
	5/20/2014	Boulder delivery & installation	No	0	
	5/21/2014	BUOW Banding	Yes		Newly banded (all black on yellow with stripe on right): MidJR 5 - AHY F "0T"; NN7 - 5 LOC/UNK USGS band only, LOC/UNK "3T", LOC/UNK "4T", LOC/UNK "5T"; SkNat10 - AHY F "1T"; SKNat9 - AHY F ""2T"; Recapture "R5" as AHY F at SKNat8
	6/2/2014	Boulder Monitoring & Hole Installation	No	0	
	6/10/2014	BUOW Banding	Yes		Newly banded (all black on yellow with stripe on right): CDFW 8 - LOC/UNK "9T"; SKNat10 - LOC/UNK "2H"; SKNat8 - LOC/UNK "6T"; SKNat9 - AHY M "8T", LOC/UNK "7T", 1 LOC/UNK USGS band only; Recapture "P9" as AHY M at SKNat 8
	6/18/2014	BUOW Monitoring	Yes		1 single at SKGate; 1 single at SK6; 1 pair with 1 fledgling at CDFW 8
	6/25/2014	BUOW Monitoring	Yes		1 single at CDFW 8; 1 single at SKNat8
	7/29/2014	BUOW Monitoring	Yes		1 single to east of NN1; 1 single at SKGate
	8/14/2014	BUOW Monitoring	Yes		Found "3C" leg detached assume dead.
	8/21/2014	Boulder Monitoring & Hole Installation	No	0	

Skunk/JRP/FVWA continued	8/26/2014	Burrow Maintenance & BUOW Monitoring	Yes		1 single at MidJR2; 1 single near SK6
	9/26/2014	Boulder Monitoring	No	0	
	11/5/2014	Wildlife Camera Installation	No	0	
	12/8/2014	BUOW Monitoring	Yes		1 single east of NN1; 1 single at NN7; 1 single at MidJR3
	1/19/2015	BUOW Monitoring	Yes		1 single at MidJR5; 1 single at SKGate; 1 single at SKNat 9
	2/5/2015	Burrow Maintenance & BUOW Monitoring	Yes		1 single at SK6
	2/6/2015	Burrow Maintenance & BUOW Monitoring	Yes		1 single near SK6
	2/12/2015	Mow boulder piles and corridors	No	0	
	2/13/2015	Mow boulder piles and corridors	No	0	
	3/20/2015	BUOW Monitoring	Yes	13	1 pair at NN7, 1 banded "M1" black on yellow with stripe on left; 1 pair at CDFW 8, one banded, one unknown if banded; 1 pair at SKGate; 1 pair at SKNat9, one banded, one unknown if banded; 1 pair at SKNat11, one banded "OT" black on yellow with stripe on right; 1 pair at SKWNat1; 1 single unbanded at MidSk1
	3/25/2015	Mow boulder piles and corridors	No	0	
	3/28/2015	BUOW Monitoring	Yes		1 single at NN7; 1 single at SKNat9; 1 single at SKNat11; 1 single at CDFW 8
	4/8/2015	BUOW Monitoring	Yes	7	1 pair at NN7; 1 pair at SKGate; 1 single at SKNat9; 1 pair at SKNat11
	4/22/2015	BUOW Monitoring	Yes	5	1 single at CDFW 8; 1 pair at SKWNat1; 1 single at SKMid1; 1 single at SKNat11
5/27/2015	BUOW Monitoring	Yes	5	1 single at NN7; chicks observed at SKNat11; chick observed at SKNat6; 1 single at CDFW 8	

Skunk/JRP/FVWA continued	5/28/2015	BUOW Banding	Yes	12	Newly banded (all black on yellow with stripe on right): CDFW 8 - AHY F "3H", LOC/UNK "3R", LOC/UNK "4R"; NN7 - LOC/UNK "4H", LOC/UNK "5H", LOC/UNK "6R"; SKGate - LOC/UNK "7H"; SKMid1 - AHY M "0R"; SKNat6 - LOC/UNK "1R", LOC/UNK "2R", LOC/UNK "5R"; Recapture "M1" as AHY F at NN7
	6/5/2015	BUOW Monitoring	Yes		1 single at CDFW 8; 1 pair at NN7; 1 single at SKGate; 1 single at SKNat9
	6/12/2015	BUOW Monitoring	Yes		1 pair at SKNat9; 1 single at NN7; 1 single at SKGate; 1 single at SK6
	6/23/2015	Boulder Monitoring	No	0	
	7/29/2015	Boulder Monitoring	No	0	
	12/18/2015	BUOW Monitoring	Yes		1 single at Buck 5; 1 single at MidJR 1; 1 single at MidJR 4; 1 single at NN7; 1 single at CDFW 8; 2 at SKNat 9; 1 single at new burrow east of NN1
	2/5/2016	Pulled Wildlife Cameras	No	0	
MSR Skinner	8/26/2015	Orientation	No	0	
	12/18/2015	Monitoring	No	0	
	5/15/2014	Monitoring	No	0	
	6/25/2014	Monitoring	No	0	
	7/29/2014	Monitoring	Yes	1	"C1" black on white on left observed at artificial burrows to right of entrance
	9/29/2014	Monitoring	Yes	1	1 single banded with black on white on left but unable to confirm code, same artificial burrow cluster at previously observed "C1"
	2/5/2015	Monitoring	Yes	1	"C1" at artificial burrows to the left of entrance
	3/20/2015	Monitoring	Yes	1	"C1" at artificial burrows to the left of entrance, installed wildlife camera in an effort to get better picture of band
	4/30/2015	Monitoring	No	0	
10/22/2015	Monitoring	No	0		
El Sol	2/20/2015	BUOW Monitoring	No	0	Dense fog
	4/29/2015	BUOW Monitoring	Yes	5	1 pair at AB18, 1 banded with black on white on right with unknown code; 1 pair at AB08, both unbanded; 1 single at AB 19, unknown if banded
	10/29/2015	BUOW Monitoring	Yes	4	1 single at AB 18, unbanded; 1 single at AB 19, unknown if banded; 1 single at AB 12, unknown if banded; 1 single at AB 09, unknown if banded

CODES: LOC/UNK = Locally born of unknown sex (chick or fledgling); AHY = After Hatch Year, adult; M = Male; F = Female