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Winter Burrowing Owl Monitoring, 2016-2018

Final Report

For the Period February 1, 2016 to March 1, 2018



Prepared by:

Dr. Lynne Trulio, Debra Chromczak, and Philip G. Higgins

For:

Craig Weightman, Environmental Program Manager
California Department of Fish and Wildlife

7329 Silverado Trail

Napa, CA 94558

and

Yiwei Wang, Executive Director
San Francisco Bay Bird Observatory

524 Valley Way

Milpitas, CA 95035

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Table of Contents

Summary	1
Introduction	2
Objectives	3
Methods	3-5
Results	5-8
Discussion	8-9
Recommendations.....	9-10
Acknowledgements	10-11
Citations	11-12
Appendix 1 - Tables	13-16
Appendix 2 – Banding and Trapping Photographs.....	17-24
Appendix 3 – Winter Trapping Site Photographs.....	25-29

Summary. In September 2014, we initiated a study to determine if burrowing owls detected in the Santa Clara Valley Habitat Plan (SCVHP) HCP/NCCP area during the wintering season remained in the area to nest the following breeding season. The California Department of Fish and Wildlife (CDFW) initially funded this study with a Local Area Grant (LAG) from 2014 to 2016; we received a second LAG to continue work for two more years. Here we summarize our findings for the second two-year period, from February 1, 2016 to March 1, 2018.

We conducted this work at historical and current breeding sites (“recent breeding sites”) on the valley floor at low elevations (approximately 2-144 ft) and at sites in the foothills of the Diablo and Santa Cruz ranges (“foothill sites”), which were at relatively high elevation (approximately 150-2048 ft). Previously, the foothill sites we visited in the Diablo and Santa Cruz ranges had not been regularly surveyed for burrowing owls, either during the breeding season (February 1 to August 31) or the non-breeding, wintering season (September 1 to January 31).

At recent breeding and foothill sites, we trapped and banded wintering owls during the 2016-17 and 2017-18 winter seasons at specific locations where owls were seen or suspected so that they could be identified later. During the 2016 and 2017 breeding seasons, we searched for banded owls at the recent breeding sites, as well as at the foothill sites where wintering owls had been observed.

During the 2016 breeding season, we observed 49 owls at recent breeding sites and found no birds at the winter sites in the foothills. During the 2016-17 winter season, we observed 83 owls at the recent breeding locations and 41 at winter locations in the foothills of the Diablo and Santa Cruz ranges. We banded 25 birds, recaptured one previously banded bird, and resighted seven banded owls. During the 2017 breeding season, we observed 66 owls at recent breeding locations and none at the winter foothill locations. During the 2017-18 winter season, we observed 91 owls at the recent breeding locations and 23 at foothill locations. We banded 13 owls, recaptured two previously banded birds, and resighted 13 banded owls.

These results showed that owls did not appear to be nesting at the wintering sites in the foothills, and that a number of birds banded during the winter seasons had not stayed to breed at recent breeding locations. We found that no owls that were banded at foothill sites during the winter had moved to recent breeding sites the following breeding season. Additionally, we conducted a point-count survey at 50 locations along three driving routes in the foothills of the Diablo and Santa Cruz ranges during the 2016 breeding season and did not detect any owls.

None of the owls we found at foothill locations during the winter had been banded in the study area during any previous breeding season. Five owls that we banded during one winter were not resighted during the next breeding season, but were seen again the next winter. Two of these owls returned to the same location as the previous winter and the other three wintered 0.09 miles or less from their previous winter location.

These findings show that the SCVHP HCP/NCCP area attracts numerous migratory burrowing owls during the winter, but that many of these owls leave the region in the spring to breed elsewhere. The owls wintering in the foothills are separated in space and time from the owls breeding at lower elevations at recent nesting areas. Foothill areas are important habitat for winter birds, while the recent breeding sites are critical, not only for reproduction, but also for year-round resident owls and winter migrants.

Introduction. The burrowing owl (*Athene cunicularia*) population in the south San Francisco Bay area has declined precipitously in recent years. Since the surviving population clusters are located in areas likely to be developed in the next 50 years, the burrowing owl was selected as a covered species in the Santa Clara Valley Habitat Plan (SCVHP or the Plan), which is an HCP/NCCP (ICF 2012). The Plan's conservation strategy supports banding and monitoring migratory burrowing owls in the Plan area to determine habitat use and dispersal patterns for wintering owls.

A goal of the conservation strategy is to naturally expand populations of owls from existing breeding sites into unoccupied habitat. Understanding the spatial relationship between wintering and breeding populations of owls in the Plan area may reveal opportunities to expand the breeding population. While there has been much study of breeding burrowing owls in Santa Clara County (Trulio and Chromczak 2007; Barclay 2010), there has been no systematic study of the distribution, abundance or winter-to-breeding season movements of wintering burrowing owls in the region.

Overall, information on the movements and ecology of wintering western burrowing owls is quite limited. In the late 1990s, Holroyd and Trefey (2002, 2011) began tracking migratory burrowing owls captured in the prairie provinces of Canada that were fitted with radio-transmitters. The data from this work showed owls were wintering along the Gulf Coast of Texas and further south into Mexico. Data from banded owls as well as later studies using geolocators (Holroyd and Trefey 2011, Stutchbury et al. 2009) and satellite transmitters (Holroyd and Trefey 2011; David Johnson, pers. comm.) have expanded our knowledge of where migratory burrowing owls go in the winter. In particular, these studies have shown owls from British Columbia, Washington state and Oregon come to California, including the San Francisco Bay area, to winter.

In Santa Clara County, a number of owls are resident year-round at breeding sites, including Shoreline at Mountain View, Moffett Federal Airfield, Sunnyvale Baylands Park and the San Jose International Airport (Trulio 1997; Barclay et al. 2011; Trulio and Higgins 2012). In some cases, owls remain at the locations where they bred or were fledged the previous breeding season. An 18-month study of burrowing owl diets at Santa Clara County sites showed owls were able to find both insect and vertebrate prey year-round (Trulio and Higgins 2012). Studies have also shown that migrants come to the San Francisco Bay Area and coastal California in the winter, but leave those sites by the next spring (Chandler 2015). However, there are no systematic data on how many wintering owls come to Santa Clara County each winter, nor information on where they spend their time or where they go the next breeding season.

This research was designed to help fill gaps with respect to the wintering owls in Santa Clara County and adjacent areas of Alameda, San Mateo and San Benito Counties, with focused attention on the SCVHP area. Determining where owls winter in the SCVHP area can help wildlife managers understand the relationship between wintering and breeding owls and identify important wintering sites that need to be protected, both for owls that breed in California, as well as other owls from around the species' range.

One aspiration of this study was that we would locate previously unknown breeding sites, potentially at wintering sites not regularly surveyed in the breeding season. For longer-term management, these results may be used to evaluate how wintering sites could be enhanced to encourage wintering owls to stay and breed, or for burrowing owl relocation and reintroduction efforts.

Objectives. We located wintering burrowing owls both in historical and current breeding sites (hereafter, recent breeding sites), and outside these sites at foothill sites that were at higher elevation than the recent breeding sites. We examined whether owls banded during the wintering, non-breeding season (September 1- January 31) remained within the SCVHP area for the next breeding season (February 1 - August 31) at their winter locations where they were banded, if they moved to other locations in the Plan area, or if they left the study area. The data collected included:

1. Numbers and locations of wintering owls at foothill sites along the west and east sides of the SCVHP area in the Diablo and Santa Cruz ranges and at recent breeding sites in the Plan area.
2. Numbers and locations of owls during the breeding season at recent breeding sites and at winter sites where owls were observed during the previous winter.
3. Identification of owls and distances traveled by wintering owls staying to breed in the Plan area.
4. Identification of owls banded in the first winter that returned the next winter, but were not seen in the breeding season.

In this report, we interpret our findings for managers to assist them in preserving and increasing the burrowing owl population--both breeding and wintering--in the SCVHP area.

Methods. This study was conducted in the SCVHP area, including areas designed as the "Core Plan Area" and the "Expanded Plan Area" for burrowing owls (Figure 1). We located wintering owls based on information from biologists and resource managers, Christmas Bird Count data, previous reports, and our own observations. To find owls at potential wintering locations, we conducted surveys in accordance with the California Department of Fish and Wildlife protocols for burrowing owl surveys (CDFG 2012, ICF 2012).

We also conducted winter surveys at recent breeding sites, which included historical (sites that still exist and were occupied by nesting owls within the last 15 years) and currently active breeding sites in the Plan area. These sites, which we regularly surveyed during the breeding season (Trulio and Chromczak 2007), included Shoreline Regional Wildlife Area in the City of Mountain View, NASA Ames Research Center at Moffett Field, the San Jose/Santa Clara Regional Wastewater Facility, several isolated sites in the cities of San Jose and Santa Clara, the Warm Spring Unit of the Don Edwards San Francisco Bay National Wildlife Refuge, Byxbee Park in Palo Alto and Sunnyvale Baylands Park and Landfill Site in the City of Sunnyvale (Appendix 1A). All these sites supported one or more pairs of nesting owls for one or more breeding seasons in the last ten years, except Byxbee Park which had not supported breeding owls since 2004 and Sunnyvale Landfill where breeding birds had not been seen since 2006.

The foothills of the Diablo Range--on the east side of the City of San Jose and the Coyote Valley--and the Santa Cruz foothills, on the west side of the Coyote Valley, constitute large areas of the SCVHP and these foothills were a focus of this study. Coyote Valley is a low elevation area between the ranges south of San Jose, which has substantial agricultural and urbanized land uses. Biologists and land managers told us of potential wintering owl locations in these ranges at a number of different sites (Appendix 1A). We concentrated our efforts at protected open space sites in the foothills of the two ranges.

After we surveyed sites and confirmed the presence of burrowing owls, we

attempted trapping at active locations. During site visits and trapping sessions, we took GPS coordinates at each specific location where owls were observed, resighted, and/or captured. When we were unable to confirm presence during site surveys, we trapped at previously active winter locations in an attempt to attract foraging owls at dusk.

In summer 2016, we conducted two standardized roadside point-count surveys while broadcasting burrowing owl vocalizations in an attempt to locate owls during the breeding season in areas not typically surveyed. The survey was conducted as per Conway and Simon (2003). Three driving routes in the Coyote Valley and surrounding ranges, one route per day, were run on June 18, 19, and 20, 2016, then repeated on July 14, 16, and 17, 2016. Each route was approximately 7.5–10 miles in length. We conducted point-counts at least 0.5 miles apart, at a total of 50 locations that included agricultural, grazed, and ungrazed grassland habitats. Elevations at point-count locations ranged from approximately 170 ft to 1250 ft.

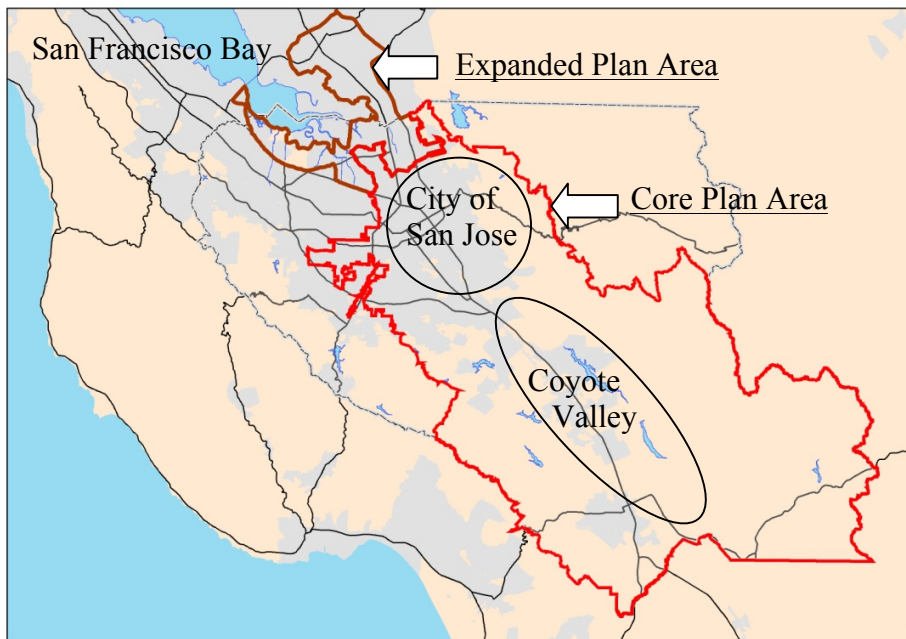


Figure 1. The Santa Clara Valley Habitat Plan area with Core Plan Area (large irregular polygon) and Expanded Plan Area for burrowing owls (small irregular polygon)

Burrowing owls that were not underground were captured using a spring trap (also called a "bow-net") with an MP3 player and speaker broadcasting the owl's primary call. Attached to the trigger of the set trap, we placed a small cage containing a live mouse as bait. When an owl grabbed the cage with the mouse, the trap closed over the owl. Burrowing owls underground were captured using a one-way door placed in the burrow entrance and a bubble trap over the one-way door (see photographs in Appendix 2). All traps were monitored from a short distance away using a scope or binoculars. When owls were caught, we quickly removed owls from the trap, placed each owl in a sock to keep the

owl contained, banded it with metal bi-colored alphanumeric Aircraft bands (left leg) and metal USGS bands (right leg), and collected morphometric measurements, including weight, wing cord length, and tarsus measurement. Owls were released at their capture location (see photographs in Appendix 2).

During the breeding season, we visited recent breeding and wintering sites. To locate owls, we conducted walk-through transect surveys with at least three people, examined burrows, and broadcasted primary calls. We identified owls by resighting unique alphanumeric band codes on previously banded burrowing owls with binoculars and spotting scopes. We observed all banded adults to identify their sex as determined by gender-based behavior/morphology. Owls were considered male if they stood guard near a nest burrow, gave the primary call, delivered food to their mate, or had plumage bleached from sun exposure. Incubating or brooding female owls usually remain underground for long periods of time, have darker plumage, and receive food from their mate.

After taking GPS coordinates at breeding locations, we used Google Earth maps to calculate the distance owls travelled from their previous non-breeding or breeding locations.

Results and Findings. We surveyed for owls at 25 sites during winter 2016-17 and 24 sites during winter 2017-18. During the 2016 and 2017 breeding seasons, we surveyed for owls at 17 and 19 sites, respectively (Figures 2 and 3; Appendix 1A). The elevations of the locations at foothill sites where winter owls were found varied from approximately 150 to 2048 ft (see photographs in Appendix 3). The elevations of the locations of owls at recent breeding sites varied from 2 to 144 ft.

During winter 2016-17, we observed a total of 124 burrowing owls with 41 owls observed at foothill sites and 83 owls observed at recent breeding sites. The next winter, we observed 114 owls, 23 at foothill sites and 91 at recent breeding sites (Figure 4; Appendix 1A). Since we surveyed nearly the same number of sites both winters and the survey effort between the winters was approximately the same, it seemed that migrants were especially abundant in the foothills in winter 2016-17.

We banded 25 birds in winter 2016-17, recaptured one previously banded bird, and resighted seven banded owls. We banded a total of 13 owls in the second winter, recaptured two, and resighted 13 previously banded owls. In the first winter, an unbanded owl was found dead in Sunnyvale; in winter 2017-18, a bird we banded in December 2017 at a site outside the SCVHP area, at the Wildlands Pajaro Wetlands Mitigation Bank, was found dead in January 2018.

An exceptional capture occurred on November 12, 2016 when we trapped an owl banded in British Columbia, Canada (bird band: green-over-black E13) on Valley Transportation Authority property at Coyote Ridge at an elevation of 1064 ft. E13 hatched on approximately May 17, 2016 and was banded on June 23, 2016 at nest #547 on the Elkink Ranch in the South Okanagan, British Columbia, Canada. This juvenile was one of three wild-born offspring from migratory, captive-bred parents that returned to British Columbia to nest in 2016. From Elkink Ranch near the United States border, E13 migrated approximately 850 miles before we recaptured the almost six-month old owl on Coyote Ridge.

None of the owls we observed during either winter at the foothill sites had been banded at the recent breeding sites in our study area. But, one bird at a foothill site (Diablo

Foothills Open Space Preserve) in winter 2017-18 had been banded the previous winter. We resighted four other winter birds, one each winter at two recent breeding sites, Shoreline and Sunnyvale, which had been banded the previous winter and were not seen in the intervening breeding season. Two of these birds that returned for a second winter were found at essentially the same burrow as the previous winter. The other three birds were 159 ft, 369 ft and 474 ft from the burrow they used the previous winter.

We observed 49 and 66 adult owls in summer 2016 and 2017, respectively; all these birds were observed at recent breeding sites. We detected no owls during summer surveys at winter locations in the foothill sites. Nor did we detect owls at any of the 50 survey points we visited or along routes we drove for the roadside point-count surveys we conducted in summer 2016 in Coyote Valley and the Diablo and Santa Cruz range foothills.

Ten owls observed in summer 2016 at recent breeding sites in the study area were seen in winter 2016-17. The maximum distance between breeding and winter sites where we resighted each owl was 1.2 miles. Between summer 2017 and winter 2017-18, we identified 13 previously banded birds. Again, most owls were resighted less than a mile away, with a maximum of 4.8 miles (Appendix 1C). Since the study was initiated in 2014, we identified nine local migrants, each of which moved between 1.78 and 7.55 miles between the five current breeding sites within the study area.

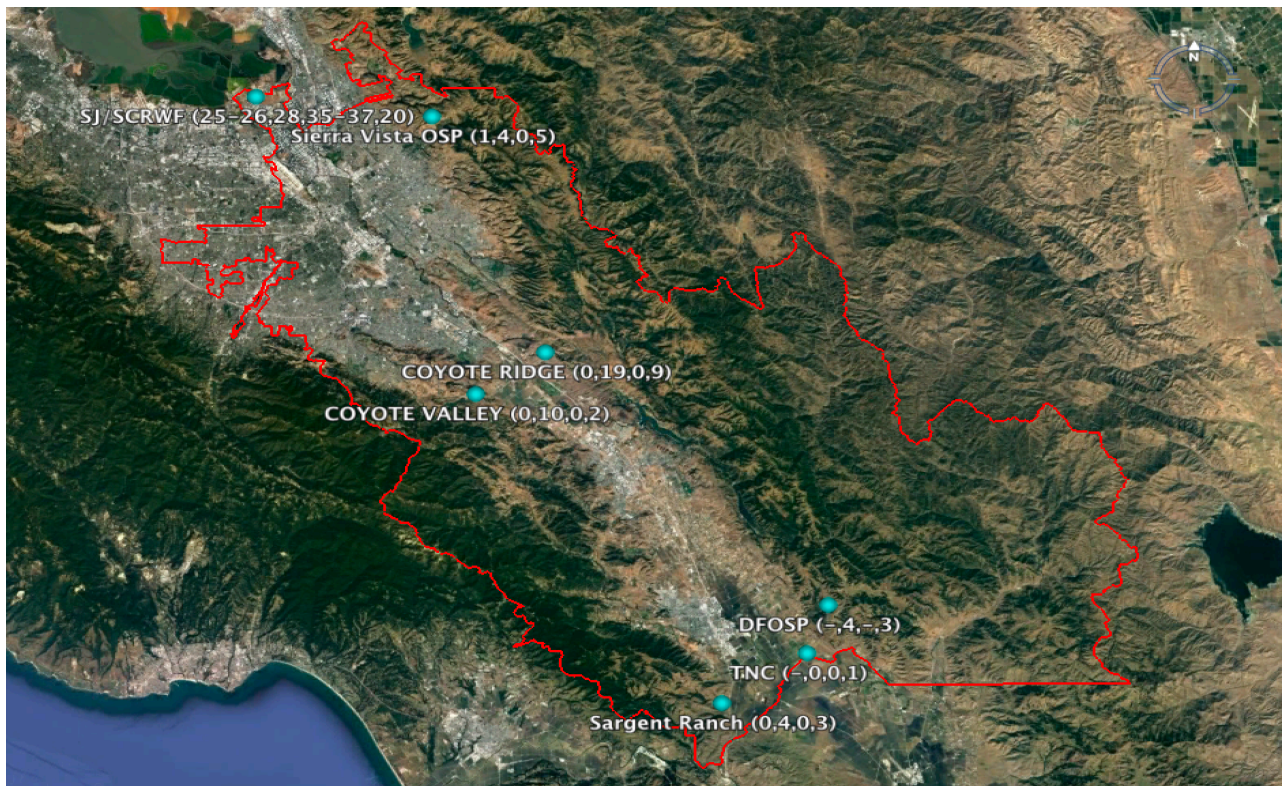


Figure 2. Number of burrowing owls observed at breeding and winter sites within SCVHP Study Area. In parentheses are numbers of owls observed in Summer 2016, 2016/2017 Winter, Summer 2017, and 2017/2018 Winter. (A dash [-] indicates a site not surveyed.)

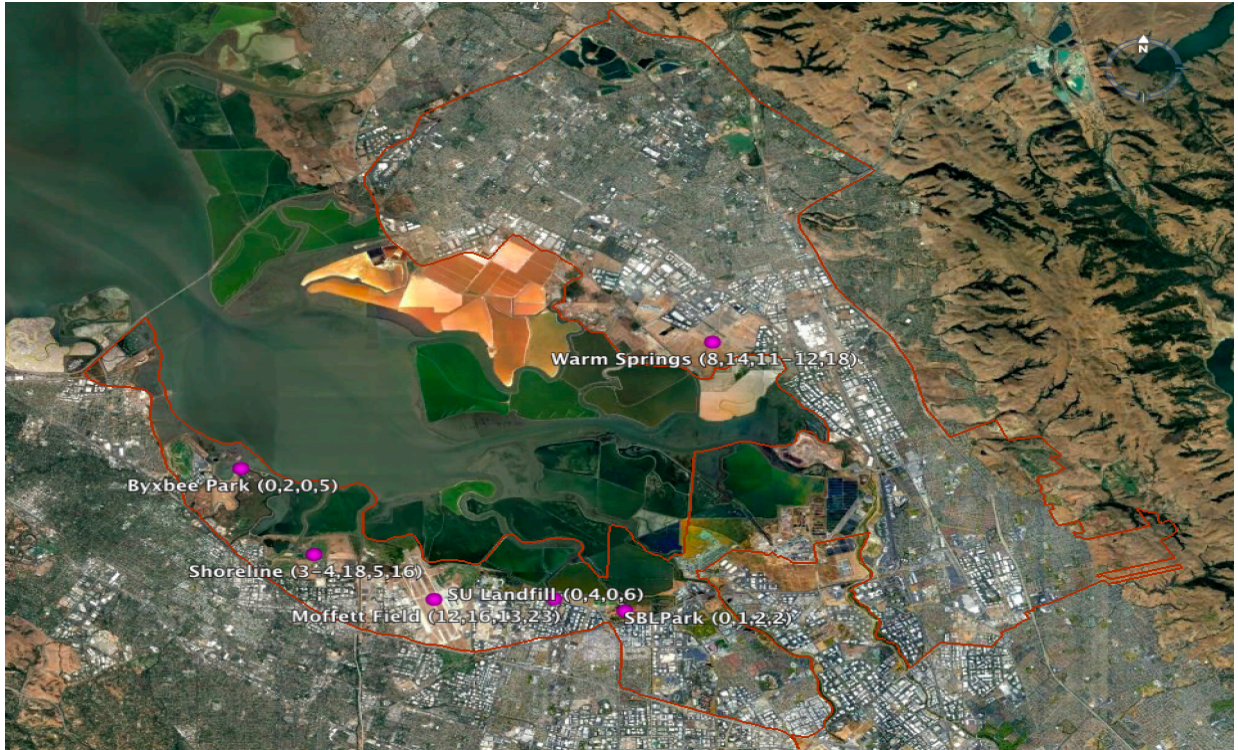


Figure 3. Number of burrowing owls observed at breeding and winter sites within SCVHP Expanded Study Area. In parentheses are numbers of owls observed in 2016 Breeding Season, 2016/2017 Winter, 2017 Breeding Season, and 2017/2018 Winter.

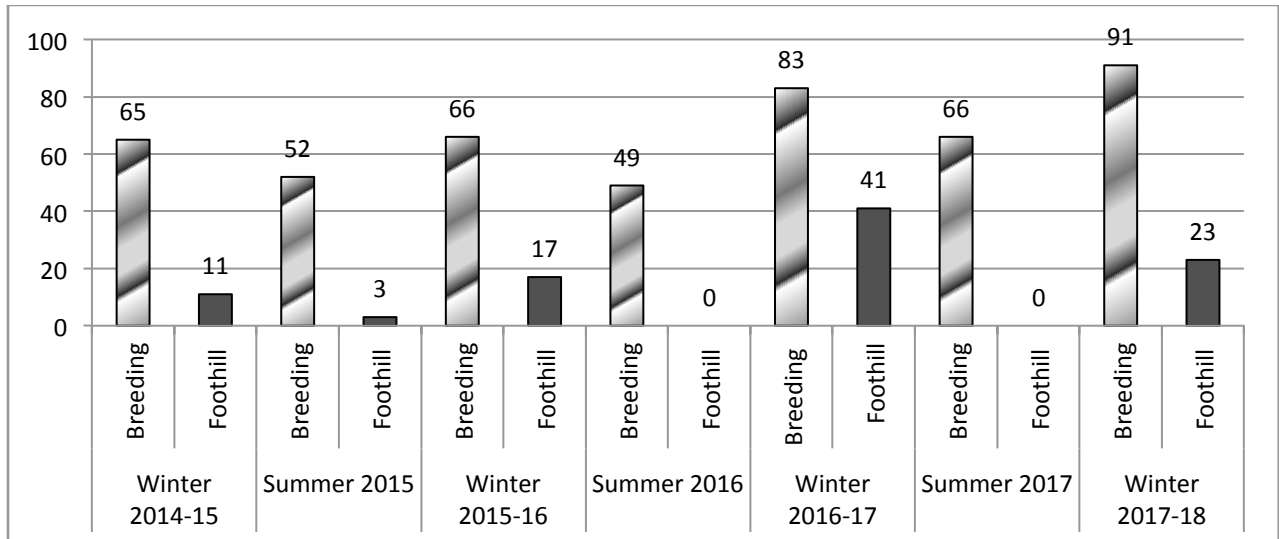


Figure 4. Minimum number of adult burrowing owls observed at recent breeding sites and foothill sites during winter and summer seasons, 2014-2018.

We also visited or contacted managers of five sites outside the study area, four in San Mateo County and one in San Benito County (Appendix 1A and 1B). During the two winters, we found a total of seven and three owls, respectively at these sites. At the San Mateo sites, birds were not seen in the summer. The Wildlands Pajaro Wetlands Mitigation site in San Benito County supported ideal breeding habitat on the valley floor (elevation approximately 150 ft). We observed birds both winter seasons and in the intervening summer, indicating that this site, immediately adjacent to the southern border of the SCVHP area, supports year-round birds and, very likely, breeding owls.

Discussion. We investigated the presence of wintering burrowing owls and the relationship of those owls to breeding owls in the Santa Clara Valley Habitat Plan (SCVHP) HCP/NCCP area. We found numerous owls wintering in our region, both at historic and current breeding sites, as well as at sites in the foothills of the Diablo and Santa Cruz ranges. The number of owls at recent breeding sites was greater in the winter than during the breeding season, showing that recent breeding sites support a significant number of owls year-round in the SCVHP area.

The owls we observed and banded at the foothill sites in the winter did not stay long enough into the breeding season to nest. In addition, we did not find any of the banded wintering owls from the foothill sites at recent breeding sites during the breeding season. Thus, it appears that the owls wintering in the foothills were from outside the region and left in spring to breed elsewhere. The bird we caught in November 2016 at a location in the Diablo range that was banded as a juvenile in British Columbia in the summer of 2016, supports this contention. Research by Holroyd and Trefry (2002, 2011) and recent satellite telemetry work by Courtney Conway and David Johnson (pers. comm.) also show that owls breeding or fledged in British Columbia, Washington state and Oregon migrate south to winter in northern, central and southern California. Migratory owls also seem to winter at the recent breeding sites, as suggested by the increase in numbers of adults in winter over summer and by the four owls we found in both winter seasons that were not seen in the intervening summer at two recent breeding sites.

We found no owls during the breeding seasons at the higher elevation foothill sites where owls wintered, results supported by DeSante et al. (2007) and Wilkinson and Siegel (2010) who found that nesting owls throughout California were infrequently found at elevations above 200 ft. An exception to this finding are the owls at the Altamont Pass, located in the Diablo Range, which breed at elevations of 440-600 ft (Smallwood et al. 2007, Smallwood and Neher 2008). To increase the area of the foothills we surveyed in summer, we conducted a wider-ranging driving survey to detect breeding burrowing owls (Conway and Simon 2003). Despite conducting point-counts at 50 locations twice in summer 2016, and driving at least 30 miles each time, we found no burrowing owls during these surveys. Thus, the assertion that burrowing owls do not breed in Santa Clara County outside the recent breeding areas still stands.

The recent breeding areas are low elevation sites that have been surveyed regularly, some for over 18 years (Trulio and Chromczak 2007). Not only do these breeding sites support the only nesting owls we found in the SCVHP area, they also appear to support a number of winter migrants, as indicated by the four owls that we found in two consecutive winters but not the intervening summer. At current breeding sites, 10 owls observed in winter 2016-17 and 12 in winter 2017-18 had been identified the previous breeding

season, showing the importance of these sites not only to nesting owls, but to year-round residents and, as noted above, to winter migrants.

Owls found in the breeding season that remained into the following winter tended to show site fidelity, staying at their breeding locations or moving less than a mile. (Although some owls dispersed many miles.) Migratory wintering owls may also show site fidelity, as indicated by the five owls we found in the two winters, not seen during the breeding season, that returned to essentially the same burrows the second winter.

We found numerous wintering burrowing owls at locations throughout the foothills of the Diablo and Santa Cruz ranges, showing these areas of the SCVHP area provide important habitat for wintering burrowing owls. We did not find a connection between owls wintering in the foothills and birds breeding at recent breeding sites. Nor did we find any owls breeding at the foothill winter sites. Our results show the extreme importance of the current and historic breeding sites to nesting and resident owls, as well as local migrants and winter migratory owls. When owls are evicted from such valuable areas, not only is the local population reduced, but breeding potential is harmed and habitat for wintering owls from other regions is decreased. Successful management of burrowing owls in the Santa Clara Valley Habitat Plan HCP/NCCP area can have far-reaching beneficial effects for the long-term survival of burrowing owls in the region and beyond.

Recommendations.

Research. In the immediate future, summer surveys in 2017 of breeding and winter sites are needed to provide four full winter-summer cycles of data, and we will seek funding for this work. Also, a randomized survey is needed to better determine the actual distribution and abundance of burrowing owls in the SCVHP area; Will Lawton, a graduate student from the Department of Environmental Studies at San José State University, is currently undertaking this study. We are continuing to conduct supplemental feeding studies to assess the potential benefits of this approach in protecting owl populations. And, we continue a study in which we are mapping potential burrowing owl habitat in the SCVHP and then physically assessing potential wintering and breeding sites.

Management. Continuing to manage existing breeding sites in the SCVHP extended plan area for burrowing owls is essential to preserving breeding owls in the County. We hope CDFW and the Santa Clara Valley Habitat Plan Agency will do everything possible to preserve the very important breeding site at the San Jose/Santa Clara Regional Wastewater Facility, as approximately 500 acres of this 700-acre site are slated for development.

Our research strongly suggests there are breeding burrowing owls directly across the Santa Clara County border in San Benito County. The presence of these birds presents an excellent opportunity to expand breeding birds into Santa Clara County by managing owl habitat at the south end of the county for breeding birds. The Nature Conservancy and the Santa Clara Valley Open Space Authority have lands managed for agriculture near the San Benito County border that might also be managed for breeding burrowing owls. Preserving low elevation lands and managing them for breeding burrowing owls will provide more opportunities to expand the breeding owl population in the SCVHP area.

Given the dire state of breeding burrowing owls in Santa Clara County, we recommend implementing these activities:

1) Induce Wintering Burrowing Owls to Remain into the Breeding Season. This is an approach to augment the breeding population of burrowing owls in Santa Clara County by enticing winter birds to stay and breed at their wintering sites, rather than migrating north. Whether this approach can succeed is unknown. To start this work, a literature search must be conducted to determine if this method has been used with other species and, if so, what techniques or inducements are most likely to succeed with burrowing owls. Several sites where owls winter in the SCVHP area seem to have qualities that could attract breeding owls and these sites may be ideal locations to attempt this type of management.

2) Supplement and Establish Breeding Populations using Juveniles Overwintered in Protected Facilities. This is an active approach to augment the breeding population of burrowing owls in Santa Clara County, and potentially establish new breeding sites. The goal is to protect young-of-the-year over the winter in captive-rearing facilities. The birds would then be released the next spring at current breeding areas as well as sites where owls have not bred but which are enhanced for breeding. This work is predicated on the knowledge that an estimated 70% of burrowing owl young-of-the-year do not survive their first winter season (Davies and Restani 2006). Thus, if a number of juveniles are captured and reared at a protective facility over the winter, many juveniles that would have died over the winter will survive to be released the next year.

3) Rearing and Releasing Captive-bred Burrowing Owls. This project is an active approach to augment the breeding population of burrowing owls in Santa Clara County by captive-breeding burrowing owls in protective facilities. This project is an extension of Project 2, above. Instead of releasing only over-wintered juveniles, several pairs would be kept in the facility for breeding. Owlets produced by these pairs would be captive-reared and released during the next breeding season as per Mitchell et al. (2011). This approach becomes essential for population reestablishment as the existing breeding populations dwindle to very low levels or are extirpated.

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Citations

Barclay, J.H., N.M. Korfanta, and M.J. Kauffman. 2011. Long-term population dynamics of a managed Burrowing Owl colony. *Journal of Wildlife Management* 75:1295-1306.

Barclay, J.H. 2010. Burrowing owl population viability analysis. Santa Clara Valley Habitat Plan/ Natural Communities Conservation Plan (HCP/NCCP), Appendix N. Pages N-1 to N-18.

California Department of Fish and Game (CDFG). 2012. Staff Report on Burrowing Owl Mitigation. Accessed on August 16, 2013 at <http://www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf>

Chandler, S. 2015. Burrowing owl diet at a migratory stopover site and wintering ground on Southeast Farallon Island, California. Master of Science Thesis. URL: http://scholarworks.sjsu.edu/envs_grad/.

Conway, C. J., and J. Simon. 2003. Comparison of detection probability associated with Burrowing Owl survey methods. *Journal of Wildlife Management* 67:501-511.

DeSante, D. F., E.D. Ruhlen, and R. Scalf. 2007. The distribution and relative abundance of Burrowing Owls in California during 1991–1993: Evidence for a declining population and thoughts on its conservation. Pages 1-41 in J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts (eds.), *Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1.* The Institute for Bird Populations and Albion Environmental, Inc.

Davies, J.M. and M. Restani. 2006. Survival and movements of juvenile burrowing owls during the post-fledgling period. *The Condor* 108:282-291.

Holroyd, G.L., and H. Trefry. 2002. Conservation and protection of wintering habitat of burrowing owls (*Athene cunicularia*) in Texas and Mexico: Edmonton, Canada, Beaverhill Bird Observatory and Canadian Wildlife Service, Final Rep., submitted to National Fish and Wildlife Foundation, 27 p.

Holroyd, G.L., and H. Trefry. 2011. Tracking movements of *Athene* owls: the application of North American experiences to Europe. *Animal Biodiversity and Conservation*, 34(2):379–387.

ICF International (ICF). 2012. Final Santa Clara Valley Habitat Plan. Available at: <http://scv-habitatagency.org/178/Final-Habitat-Plan>.

Mitchell, A.M., T.I. Wellicome, D. Brodie, and K.M. Cheng. 2011. Captive-reared burrowing owls show higher site-affinity, survival and reproductive performance when introduced using a soft-release. *Biological Conservation* 144:1382-1391.

Smallwood, K.S., C. Thelander, M.L. Morrison, and L. Ruge. 2007. Burrowing owl mortality in the Altamont Pass Wind Resource Area. *Journal of Wildlife Management* 71(5):1513-1524.

Smallwood, K.S., and L. Neher. 2008. Map-Based Repowering of the Altamont Pass Wind Resource Area Based on Burrowing Owl Burrows, Raptor Flights, and Collisions with Wind Turbines. California Energy Commission, PIER Energy-Related Environmental Research Program. CEC-500-2009-065.

Stutchbury, B.J.M., Tarof, S.A., Done, T., Gow, E., Kramer, P.M., Tautin, J., Fox, J.W., and Afanasyev, V. 2009. Tracking long-distance songbird migration by using geolocators. *Science*, 323:896.

Trulio, L.A. 1997. Burrowing Owl demography and habitat use at two urban sites in Santa Clara County, California. Pages 84-89 in J. L. Lincer and K. Steenhof (eds.), *The Burrowing Owl: its biology and management, including the proceedings of the First International Burrowing Owl Symposium*. *Raptor Research Reports* No. 9.

Trulio, L.A., and D.A. Chromczak. 2007. Burrowing Owl nesting success at urban and parkland sites in Northern California. Pages 115-122 in Barclay, J.H. K.W. Hunting, J.L. Lincer, J. Linthicum, and T.A. Roberts (eds.), *Proceedings of the Burrowing Owl Symposium (November 2003)*. *Bird Populations Monographs* No. 1. The Institute for Bird Populations and Albion Environmental, Inc.

Trulio, L.A., and P. Higgins. 2012. The diet of Western Burrowing Owls in an urban landscape. *Western North American Naturalist* 72:348-356.

Wilkerson, R.L., and R.B. Siegel. 2010. Assessing changes in the distribution and abundance of burrowing owls in California, 1993-2007. *Bird Populations* 10:1-36.

Appendix 1. Tables

Appendix 1A. Summary of Sites Surveyed, Site Ownership and Characteristics.

Site Surveyed	SCVHP Study or Expanded	Foothill Site, Known Breeding Site or Other	Site Ownership	Elevation (ft)
<i>Coyote Ridge</i> – Silicon Valley Land Conservancy (SVLC)	Study	Foothills-East side of Coyote Valley	Silicon Valley Land Conservancy	566
<i>Coyote Ridge</i> – Coyote Ridge Open Space Preserve (CROSP/UTC)	Study	Foothills-East side of Coyote Valley	Santa Clara Valley Open Space Authority	1174-1317
<i>Coyote Ridge</i> – Valley Transportation Authority (VTA)	Study	Foothills-East side of Coyote Valley	Valley Transit Authority	994-1200
<i>Coyote Ridge</i> – Santa Clara Valley Water District (SCVWD)	Study	Foothills-East side of Coyote Valley	Santa Clara Valley Water District	840
<i>Coyote Ridge</i> – Kirby Canyon Landfill (KCL)	Study	Foothills-East side of Coyote Valley	City of San Jose	1036
<i>Coyote Valley</i> – Santa Teresa County Park (STCP)	Study	Foothills-West side of Coyote Valley	County of Santa Clara	591
<i>Coyote Valley</i> – McKean Road (MK), Calero County Park	Study	Foothills-West side of Coyote Valley	County of Santa Clara	386
<i>Coyote Valley</i> – Tulare Hill Ecological Preserve (TH)	Study	Foothills-West side of Coyote Valley	Silicon Valley Land Conservancy	423-535
<i>Coyote Valley</i> – Laguna Avenue farmer's field (LG)	Study	Valley floor-West side of Coyote Valley	Private ownership	259
<i>Coyote Valley</i> – Coyote Valley Open Space Preserve (CVOSP)	Study	Foothills-West side of Coyote Valley	Santa Clara Valley Open Space Authority	304-317
<i>South County</i> – Diablo Foothill Open Space Preserve (DFOSP)	Study	Foothills-East side of Coyote Valley	Santa Clara Valley Open Space Authority	1136-1216
<i>South County</i> – The Nature Conservancy Gonzales Property (TNC)	Study	Valley floor-Southern Coyote Valley	Private ownership	150
<i>South County</i> – Sargent Ranch in Gilroy (SR)	Study	Foothills-West side of Coyote Valley	Private ownership	316-445
San Jose – Sierra Vista Open Space Preserve (SVOSP)	Study	Foothills-East side of San Jose	Santa Clara Valley Open Space Authority	1841-2048
San Jose – First Street & Component Drive/Phillips (SJ)	Study	Historic Breeding	City of San Jose	31
San Jose – San Jose/Santa Clara Regional Wastewater Facility (ALV)	Study	Current Breeding	City of San Jose	2-8
San Jose – Meadowfair Park (MF)	Study	Historic Breeding	City of San Jose	144
Santa Clara – Santa Clara University CalTrain Corridor (SCU)	Study	Historic Breeding	City of Santa Clara	65
Santa Clara – Tasman Drive, 49ers stadium, PG&E substation (TS)	Expanded	Historic Breeding	City of Santa Clara	12-46
Santa Clara – Mission Community College (MI)	Expanded	Historic Breeding	City of Santa Clara	19-28
Santa Clara County – Sunnyvale Baylands Park (SBLP)	Expanded	Current Breeding	County of Santa Clara	2-9
Sunnyvale – Landfill Site & Water Pollution Control Plant (SU)	Expanded	Historic Breeding	City of Sunnyvale	9-80
Moffett Field – NASA Ames Research Center (MO)	Expanded	Current Breeding	NASA Ames Research Center	2-34
Mountain View – Shoreline Regional Wildlife Area (SH)	Expanded	Current Breeding	City of Mountain View	17-76
Palo Alto – Byxbee Park (BX)	Expanded	Historic Breeding	City of Palo Alto	3-42
Don Edwards SF Bay National Wildlife Refuge – Warm Springs Unit (WS)	Expanded	Current Breeding	US Fish & Wildlife Service	8-16
Bair Island (BI) – Don Edwards SF Bay National Wildlife Refuge	Outside SCVHP	Other - Bay edge	California Department of Fish & Wildlife and US Fish & Wildlife Service	4-7
Stanford University Lands (ST)	Outside SCVHP	Other - Santa Cruz foothills	City of Palo Alto Stanford University	137-407
Menlo Park – Bedwell Bayfront Park (BBP)	Outside SCVHP	Other - Bay edge	City of Menlo Park	50
Foster City – Bay Trail levee (FC)	Outside SCVHP	Other - Bay edge	City of Foster City	7
Wildlands Pajaro Wetlands Mitigation Bank (WMB)	Outside SCVHP	Other - Southern Coyote Valley	County of San Benito	148-150

Appendix 1B. Seasonal summary results for the LAG1 and LAG2 Winter Burrowing Owl Projects (Sept 2014 – January 2018).

* burrowing owl observed in March (early breeding season) but did not stay to breed;

– site not surveyed ° new site surveyed this season

2014/2015 Non-Breeding Season	2015 Breeding Season	2015/2016 Non-Breeding Season	2016 Breeding Season	2016/2017 Non-Breeding Season	2017 Breeding Season	2017/2018 Non-Breeding Season	SCVHP STUDY AREA
–	–	1	0	1	0	0	<i>Coyote Ridge</i> – Silicon Valley Land Conservancy (SVLC)
3	0	5	0	8	0	5	<i>Coyote Ridge</i> – Coyote Ridge Open Space Preserve (CROSP/UTC)
4	0	2	0	8	0	3	<i>Coyote Ridge</i> – Valley Transportation Authority (VTA)
–	–	–	–	1°	–	1	<i>Coyote Ridge</i> – Santa Clara Valley Water District (SCVWD)
–	–	–	–	1°	–	–	<i>Coyote Ridge</i> – Kirby Canyon Landfill (KCL)
–	–	–	–	1°	–	0	<i>Coyote Valley</i> – Santa Teresa County Park (STCP)
–	–	–	–	2°	–	–	<i>Coyote Valley</i> – McKean Road (MK), Calero County Park
1	*2	1	0	4	0	2	<i>Coyote Valley</i> – Tulare Hill Ecological Preserve (TH)
1	*1	1	0	1	0	0	<i>Coyote Valley</i> – Laguna Avenue farmer's field (LG)
–	–	–	–	2°	–	0	<i>Coyote Valley</i> – Coyote Valley Open Space Preserve (CVOSP)
–	–	–	–	4°	–	3	<i>South County</i> – Diablo Foothill Open Space Preserve (DFOSP)
–	–	–	–	0°	0	1	<i>South County</i> – The Nature Conservancy Gonzales Property (TNC)
–	–	2	0	4	0	3	<i>South County</i> – Sargent Ranch in Gilroy (SR)
2	0	5	*1	4	0	5	San Jose – Sierra Vista Open Space Preserve (SVOSP)
1	1	2	0	0	0	0	San Jose – First Street & Component Drive/Phillips (SJ)
19	22-23	26	25-26	28	35-37	20	San Jose – San Jose/Santa Clara Regional Wastewater Facility (ALV)
0	0	0	0	0	0	0	San Jose – Meadowfair Park (MF)
0	0	–	–	–	–	1	Santa Clara – Santa Clara University CalTrain Corridor (SCU)
31	26-27	45	23-24	69	35-37	44	ADULT BUOWS Observed within SCVHP STUDY AREA

2014/2015 Non-Breeding Season	2015 Breeding Season	2015/2016 Non-Breeding Season	2016 Breeding Season	2016/2017 Non-Breeding Season	2017 Breeding Season	2017/2018 Non-Breeding Season	SCVHP EXPANDED STUDY AREA
0	0	0	–	0	0	0	Santa Clara – Tasman Drive, 49ers stadium, PG&E substation (TS)
0	0	0	0	0	0	0	Santa Clara – Mission Community College (MI)
1	0	2	0	1	2	2	Santa Clara County – Sunnyvale Baylands Park (SBLP)
3-5	*1	4	0	4	0	6	Sunnyvale – Landfill Site & Water Pollution Control Plant (SU)
17-20	16-17	10	12	16	13	23	Moffett Field – NASA Ames Research Center (MO)
13	6	14	3-4	18	5	16	Mountain View – Shoreline Regional Wildlife Area (SH)
2	0	1	0	2	0	5	Palo Alto – Byxbee Park (BX)
9	6	7	8	14	11-12	18	Don Edwards SF Bay National Wildlife Refuge – Warm Springs Unit (WS)
45-50	29-30	38	26-27	55	31-32	70	ADULT BUOWS Observed within SCVHP EXPANDED STUDY AREA

2014/2015 Non-Breeding Season	2015 Breeding Season	2015/2016 Non-Breeding Season	2016 Breeding Season	2016/2017 Non-Breeding Season	2017 Breeding Season	2017/2018 Non-Breeding Season	ESTIMATED NUMBER of ADULT BUOWS within SCVHP STUDY AREAS
76-81	55-57	83	49-51	124	66-69	114	

2014/2015 Non-Breeding Season	2015 Breeding Season	2015/2016 Non-Breeding Season	2016 Breeding Season	2016/2017 Non-Breeding Season	2017 Breeding Season	2017/2018 Non-Breeding Season	OUTSIDE SCVHP STUDY and EXPANDED STUDY AREAS
1	–	1	0	0	–	0	<i>San Mateo County</i> – Redwood City at Bair Island (BI)
2-3	0	1	0	4	–	2	<i>San Mateo County</i> – Palo Alto on Stanford University Lands (ST)
–	–	–	–	1	–	0	<i>San Mateo County</i> – Menlo Park at Bedwell Bayfront Park (BBP)
–	–	–	–	1	–	0	<i>San Mateo County</i> – Foster City near Bay Trail levee (FC)
–	–	–	–	1	2	1	<i>San Benito County</i> – Wildlands Pajaro Wetlands Mitigation Bank (WMB)
3-4	0	2	0	7	2	3	ADULT BUOWS Observed outside SCVHP STUDY/EXPANDED STUDY AREAS

Appendix 1C. Approximate distances moved by 89 burrowing owls identified during the LAG1 and LAG2 Winter Burrowing Owl Projects from September 2014 to January 2018.

Acraft Band COLOR	Acraft Band CODE	Sex	LAG Phases								Distances Moved Between Seasonal Site Locations (mile)										Apparent Migratory Status		
			LAG 1 PHASE 1	LAG 1 PHASE 2	LAG 1 PHASE 3	LAG 2 PHASE 1	LAG 2 PHASE 2	LAG 2 PHASE 3	LAG 2 PHASE 4	14/15 Winter -to- 2015 Breeding	14/15 Winter -to- 15/16 Winter	2015 Breeding -to- 15/16 Winter	15/16 Winter -to- 2016 Breeding	2015 Breeding -to- 2016 Breeding	15/16 Winter -to- 16/17 Winter	2016 Breeding -to- 16/17 Winter	16/17 Winter -to- 2017 Breeding	2016 Breeding -to- 2017 Breeding	2015 Breeding -to- 2017 Breeding	16/17 Winter -to- 17/18 Winter		2017 Breeding -to- 17/18 Winter	
			2014/2015 NON-BREEDING Site Location	2015 BREEDING Site Location	2015/2016 NON-BREEDING Site Location	2016 BREEDING Site Location	2016/2017 NON-BREEDING Site Location	2017 BREEDING Site Location	2017/2018 NON-BREEDING Site Location														
black-over-green	4X	unknown	SVOSP1		SVOSP1																		winter migrant
black-over-green	5U	unknown	SH68		SH68																		winter migrant
red-over-blue	2H	unknown	SU25		SU25																		winter migrant
black-over-green	7H	unknown			SH27			SH204						0.03									winter migrant
black-over-green	8V	unknown			SU39			SU42						0.07									winter migrant
black-over-green	A6	unknown						SH204													0.09		winter migrant
black-over-green	P5	unknown						DFOSP2													0.00		winter migrant
green-over-black	E13	unknown				British* Columbia CANADA		VTA14							850.00								winter migrant
black-over-green	P9	male						SU3													0.00		winter migrant
black-over-green	0A	female		ALV10	ALV10							0.00											resident
black-over-green	0H	female		WSF1-1			WSF3-33							0.19									resident
black-over-green	0P	female	SBLP4	ALV39	ALV19							2.41		0.06									SBLP-ALV migrant
black-over-green	0Z	female		ALV39*		ALV43		ALV35						0.35				0.15					resident
black-over-green	1B	male		ALV2*	ALV2	ALV63		ALV35				0.00	0.63					0.22					resident
black-over-green	1C	unknown		ALV1*	ALV49							0.75											resident
black-over-green	1N	male		ALV39	ALV39	ALV14		ALV46				0.00	0.08					0.03					resident
black-over-green	1P	male		ALV41*				ALV40										0.31					resident
black-over-green	1Z	female		ALV10*		ALV60								0.98									resident
black-over-green	2A	female	ALV7A	ALV2		ALV4						0.66		0.07									resident
black-over-green	2H	male		ALV2*	ALV2	ALV3A	ALV3A	ALV3A				0.00	0.10			0.00	0.00						resident
black-over-green	2U	female		ALV41		ALV41		ALV3A						0.00				0.13					resident
black-over-green	2V	male		ALV4	ALV4							0.00											resident
black-over-green	3C	male		ALV10*		ALV1	ALV1							0.21		0.00							resident
black-over-green	3D	unknown		ALV39*	ALV39							0.00											resident
black-over-green	3K	female		ALV6		ALV63		ALV40						0.23				0.28					resident
black-over-green	3R	male		WSF4-1				WSF1-91										0.43					resident
black-over-green	3V	unknown		ALV1*	ALV1							0.00											resident
black-over-green	3W	male		ALV2	ALV2							0.00											resident
black-over-green	4A	male		ALV26		ALV41								0.07									resident
black-over-green	4C	male		WSF1-1*		WSF6-3								0.54									resident
black-over-green	4M	unknown		ALV1*	ALV1							0.00											resident
black-over-green	4W	female		ALV2*	ALV3	ALV3		ALV46A				0.06	0.00					0.16					resident
black-over-green	5C	female		ALV1	ALV1							0.00											resident
black-over-green	5H	female		ALV41*		WSF6-3								4.42									ALV-WS migrant
black-over-green	5M	male		ALV14				ALV46A										0.05					resident
black-over-green	6M	female				ALV3A*		ALV3										0.03					resident
black-over-green	8K	unknown				ALV3A*	ALV3A									0.00							resident
black-over-green	8M	male		ALV7*		ALV50	ALV50							0.32		0.00							resident
black-over-green	8W	male				WSF6-3*		WSF1-86										0.51					resident
black-over-green	9C	male			ALV52	ALV36		ALV36				0.09						0.00					resident
black-over-green	9N	male				ALV41*		ALV36C										0.46					resident
black-over-green	9S	female				ALV36		ALV36										0.00					resident
black-over-green	9Z	female				ALV3*		MO251										4.94					ALV-MO migrant
black-over-green	A1	female				ALV14*		ALV7										0.47					resident

SITE LEGEND: ALV=Alviso (SJ/SCRWF), MO=Moffett Field, SH=Shoreline, SU=Sunnyvale Landfill, SBLP=Sunnyvale Baylands Park, WSF=Warm Springs field
SVOSP=Sierra Vista Open Space Preserve, DFOSP=Diablo Foothills Open Space Preserve, VTA=Valley Transportation Authority, BX=Byxbee Park
* burrowing owl banded as a juvenile

Appendix 1C. (cont.) Approximate distances moved by 89 burrowing owls identified during the LAG1 and LAG2 Winter Burrowing Owl Projects from September 2014 to January 2018.

Acraft Band COLOR	Acraft Band CODE	Sex	Distances Moved Between Seasonal Site Locations (mile)																				Apparent Migratory Status				
			LAG 1 PHASE 1	LAG 1 PHASE 2	LAG 1 PHASE 3	LAG 2 PHASE 1	LAG 2 PHASE 2	LAG 2 PHASE 3	LAG 2 PHASE 4	14/15 Winter -to- 2015 Breeding	14/15 Winter -to- 15/16 Winter	2015 Breeding -to- 15/16 Winter	15/16 Winter -to- 2016 Breeding	2015 Breeding -to- 2016 Breeding	15/16 Winter -to- 16/17 Winter	2016 Breeding -to- 16/17 Winter	16/17 Winter -to- 2017 Breeding	2016 Breeding -to- 2017 Breeding	2015 Breeding -to- 2017 Breeding	16/17 Winter -to- 17/18 Winter	2017 Breeding -to- 17/18 Winter						
			2014/2015 NON-BREEDING Site Location	2015 BREEDING Site Location	2015/2016 NON-BREEDING Site Location	2016 BREEDING Site Location	2016/2017 NON-BREEDING Site Location	2017 BREEDING Site Location	2017/2018 NON-BREEDING Site Location																		
black-over-green	A2	male				ALV1*	ALV1	ALV55C	ALV55C							0.00	0.07						0.00	resident			
black-over-green	C1	male				WSf3-33*		WSf1-92											0.57					resident			
black-over-green	D1	female				ALV63*		ALV32											0.67					resident			
black-over-green	E0	male				ALV4*		ALV20											0.24					resident			
black-over-green	K0	female				ALV61		ALV36B											0.18					resident			
black-over-green	K1	male				ALV43*		ALV7											0.08					resident			
black-over-green	P0	female				ALV36*		ALV34											0.10					resident			
black-over-green	R0	unknown				ALV14*	ALV37								0.4									resident			
black-over-green	S2	female				ALV4*		ALV55											0.11					resident			
black-over-green	UI	male				ALV4*		ALV32											0.09					resident			
black-over-green	X7	unknown						ALV40*	MO254													4.79		ALV-MO migrant			
black-over-green	Z3	female				ALV6*		ALV4											0.60					resident			
red-over-black	08	male	MO234	MO234												0.00								resident			
red-over-black	34	male	MO238	MO238		MO245								0.50										resident			
red-over-black	66	female	MO233	MO243																				resident			
red-over-black	0C	male	MO29	MO241																				resident			
red-over-black	0N	female		MO29		MO246		MO30						0.26								0.23		resident			
red-over-black	0U	female		MO14		MO233	MO233	MO233						0.07			0.00	0.00						resident			
red-over-black	1N	female				MO127		MO216	MO216										0.15				0.00	resident			
red-over-black	1V	male				MO244*		SH86	SH246										2.61				0.10	MO-SH migrant			
red-over-black	2C	unknown						MO251*	MO197														0.51	resident			
red-over-black	2E	unknown						MO252*	MO258															0.88	resident		
red-over-black	2K	male				MO244*	MO229	MO10	MO10							1.24	0.24						0.00	resident			
red-over-black	3B	male		MO108	MO85	MO233	MO224	MO233	MO86				0.09	0.03			0.07	0.08						0.04	resident		
red-over-black	3C	male	MO240	MO243		MO244									0.41										resident		
red-over-black	3Z	male		MO242		MO242																	0.04		resident		
red-over-black	4A	male				MO244*		MO253	MO251														0.91		resident		
red-over-black	4P	female	SH13	MO241												2.31									SH-MO migrant		
red-over-black	5V	male	MO108	MO108												0.00									resident		
red-over-black	5W	female	MO218	MO219		MO127										0.16									resident		
red-over-black	5X	male		MO243*		MO246		MO216	MO216														0.26		0.00	resident	
red-over-black	5Z	male				MO244*		MO108	MO108														1.26		0.00	resident	
red-over-black	6A	female	MO238	MO238												0.00										resident	
red-over-black	6E	unknown																							0.93	resident	
red-over-black	6K	female	MO108	MO108												0.00										resident	
red-over-blue	2A	male	BX10	SH195	SH205										1.78		0.11									BX-SH migrant	
red-over-blue	2B	female	ALV29	ALV3		ALV1	ALV1								0.20				0.04						0.00	resident	
red-over-blue	2V	unknown		SH156*	WSf3-1																					SH-WS migrant	
red-over-blue	2W	male				SH204*		SH154																0.83		resident	
red-over-blue	3X	unknown		SH156*	SH32											0.93										resident	
red-over-blue	4A	unknown		SH156*	SH128																					resident	
red-over-blue	4N	female				SH204*		ALV20															6.45			SH-ALV migrant	
red-over-blue	6U	female		SH156	SH128	SH204		SH154																		0.83	resident
red-over-blue	7R	male	SH84	SH226	SH227	SH204		SH13							0.16		0.07	0.14								0.07	resident
red-over-blue	7U	female	SH75	SH195											0.05												resident

SITE LEGEND: ALV=Alviso (SJ/SCRWF), MO=Moffett Field, SH=Shoreline, SU=Sunnyvale Landfill, SBLP=Sunnyvale Baylands Park, WSF=Warm Springs field
SVOSP=Sierra Vista Open Space Preserve, DFOSP=Diablo Foothills Open Space Preserve, VTA=Valley Transportation Authority, BX=Byxbee Park
* burrowing owl banded as a juvenile

Appendix 2. Trapping and Banding Photographs

Photo 1. Spring trap with MP3 player hidden under mesh, positioned for capture on Coyote Ridge Open Space Preserve



Appendix 2. Trapping and Banding Photographs

Photo 2. Burrowing owl captured inside spring trap during trapping session at Moffett Field



Appendix 2. Trapping and Banding Photographs

Photo 3. Burrowing owl chicks captured inside 1-way door bubble trap during trapping session at Warm Springs.



Appendix 2. Trapping and Banding Photographs

Photo 4. Banding process at Warm Springs Unit of Don Edwards San Francisco Bay National Wildlife Refuge



Appendix 2. Trapping and Banding Photographs

Photo 5. Burrowing owl during banding process at Shoreline Regional Wildlife Area



Appendix 2. Trapping and Banding Photographs

Photo 6. Burrowing owl (E13) banded in British Columbia and recaptured at the Valley Transportation Authority (VTA) site



Appendix 2. Trapping and Banding Photographs

Photo 7. Banded burrowing owl at San Jose/Santa Clara Regional Wastewater Facility



Appendix 2. Trapping and Banding Photographs

Photo 8. Burrowing owl observed at Tulare Hill Ecological Preserve on March 13, 2015



Appendix 3. Winter Survey Site Photographs

Photo 1. Tulare Hill, west side of Coyote Valley



Photo 2. Laguna Avenue, west side of Coyote Valley



Appendix 3. Winter Survey Site Photographs

Photo 3. Coyote Valley Open Space Preserve, west side of Coyote Valley



Photo 4. Sargent Ranch, west side of Coyote Valley



Appendix 3. Winter Survey Site Photographs

Photo 5. Sierra Vista Open Space Preserve, east side of Coyote Valley



Photo 6. Sierra Vista Open Space Preserve, east side of Coyote Valley



Appendix 3. Winter Survey Site Photographs

Photo 7. Coyote Ridge Open Space Preserve, east side of Coyote Valley



Photo 8. Coyote Ridge Open Space Preserve, east side of Coyote Valley



Appendix 3. Winter Survey Site Photographs

Photo 9. Valley Transportation Authority Property, east side of Coyote Valley

