

Comprehensive Thrasher Surveys in the California Mojave Desert

2022 Season Summary Report to the Bureau of Land Management



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Introduction and Background

The Desert Thrasher Working Group (DTWG) was formed in 2011 with the goal of addressing knowledge gaps to advance effective conservation action by land managers. Specifically, the group designed standardized inventory, monitoring, and centralized data management protocols that address basic needs for the conservation of desert thrasher species (GBBO 2019, BADC 2020). Of particular concern are Bendire's Thrasher (BETH, *Toxostoma bendirei*) and LeConte's Thrasher (LCTH, *Toxostoma lecontei*), species that have been identified among the fastest declining bird species of arid lands (NABCI 2014). Both BETH and LCTH have been recently listed by Partners in Flight as 'Red Watch List' species – species with an extremely high vulnerability to extinction due to multiple factors – with a need to recover populations well above current levels (Rosenberg et al. 2016). From 1970 to 2014, LCTH lost 67% of its global population and is estimated to decline by an additional 50% over the next 27 years (i.e., its 'half-life'; Rosenberg et al. 2016). BETH has been found to be at greater risk, with a global population loss of 86% over the same time period and a 'half-life' of only 18 years (Rosenberg et al. 2016). The California Bureau of Land Management (BLM) has listed BETH as a sensitive species and both thrasher species are listed by the U.S. Fish and Wildlife Service (USFWS) as birds of conservation concern (USFWS 2021). The Sonoran Joint Venture (SJVTG 2006) designates both as species of continental concern requiring management attention. In California, BETH is considered a California State Bird Species of Special Concern throughout its range, whereas LCTH has this designation for the San Joaquin population only (Fitton 2008, CDFW 2018).

Long-term monitoring programs such as Breeding Bird Survey (BBS) report range-wide population declines for both thrasher species (Sauer et al. 2017). However, conventional bird monitoring protocols such as point count surveys, including BBS and Integrated Monitoring in Bird Conservation Regions (IMBCR; Pavlacky et al. 2017), do not effectively sample desert thrasher populations for a variety of reasons, including: low densities, secretive behavior, ventriloquial vocalizations, and early breeding season phenology (Bear Sutton et al. 2017, Weigand and Fitton 2008). To fill resultant data gaps, the DTWG developed and implemented a standardized area search protocol targeted at desert thrashers that allows observers to detect secretive non-vocal birds (McCreedy et al., in prep.). Sites were randomly selected throughout the study area, which included all of the known U.S. breeding ranges of both thrashers, stratified by likelihood of thrasher occupancy using MaxEnt models (GBBO 2019).

Our specific goals in 2022 were to: 1) survey sites in California where historical data and our previous surveys had found BETH recently and to monitor those populations for persistence; 2) survey sites with recent historical BETH sightings along the western edge of their range in the Mojave NP to monitor for range contraction; 3) survey sites within, along and around the recent (August 2020) Dome Fire footprint to evaluate the fire's effects on BETH and habitat within the core of California's population; 4) survey sites in the western Mojave Desert where we have detected LCTH and monitor their populations; and 5) explore the IMBCR

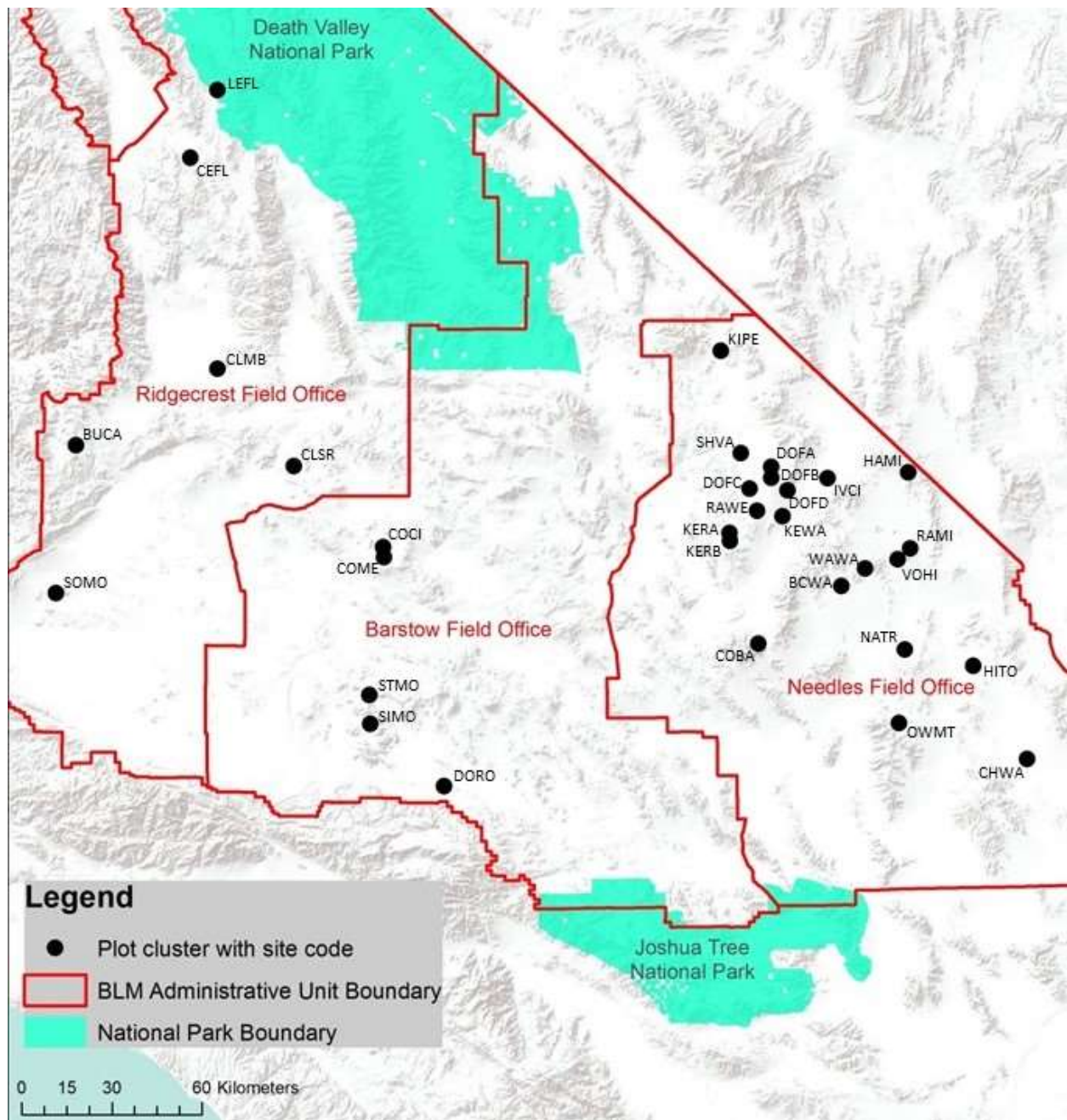
methodology's (Pavlacky et al. 2017) effectiveness at detecting thrashers on a subset of our area search survey sites.

Methods

Site Selection

In 2022, we focused our survey site selection within the Mojave Desert at sites where we have had recent sightings of BETH and LCTH. Of the 46 sites (2-9 plots per site) we surveyed from 2017-2021, we selected 30 sites that had at least one detection of BETH or LCTH. Seventeen of these sites were within the Mojave National Preserve (MNP), while others were located outside the preserve to the north and south where we have also detected BETH, and several were located in the western Mojave Desert where we had previously detected LCTH. The sites in the western Mojave Desert are also within the BETH Areas of Critical Environmental Concern (ACEC), and our results may assist the BLM with habitat protection, restoration, and management decisions (pers. comm., C. Otahal). Within the Mojave NP, we continued surveys at our sites in and around the Dome Fire footprint. In total, we surveyed 246 plots at 30 different sites (Fig. 1, Appendices B and C).

Figure 1. Plot cluster locations by BLM Field Office Districts in California. Each cluster consists of 2-13 plots that were surveyed in 2022 for Bendire's and LeConte's Thrashers.



In addition, we established 12 new survey plots at the China Lake Naval Weapons Station, four plots on the Main Base at Ridgecrest and eight on the South Range. In areas we were authorized to survey, we gridded UTM coordinates for 300 m x 300 m plots, with all plots at least 300 m apart. This resulted in 24 plots on the Main Base and 34 plots on the South Range. At each plot, we conducted an on-site assessment to determine the habitat suitability for BETH. Suitability was defined as sufficient cover of appropriate vegetation (e.g., Joshua tree, cholla, yucca) and a slope that was not too steep (generally <5% on average). On the Main Base, four plots were surveyed, and on the South Range, eight plots were surveyed (Fig. 2 and 3).

Figure 2. Plots visually inspected and surveyed at the China Lake Naval Weapons Station – Main Base (CLMB). Each plot was visually assessed to determine whether there was suitable habitat for thrashers. Only plots with suitable habitat were surveyed.

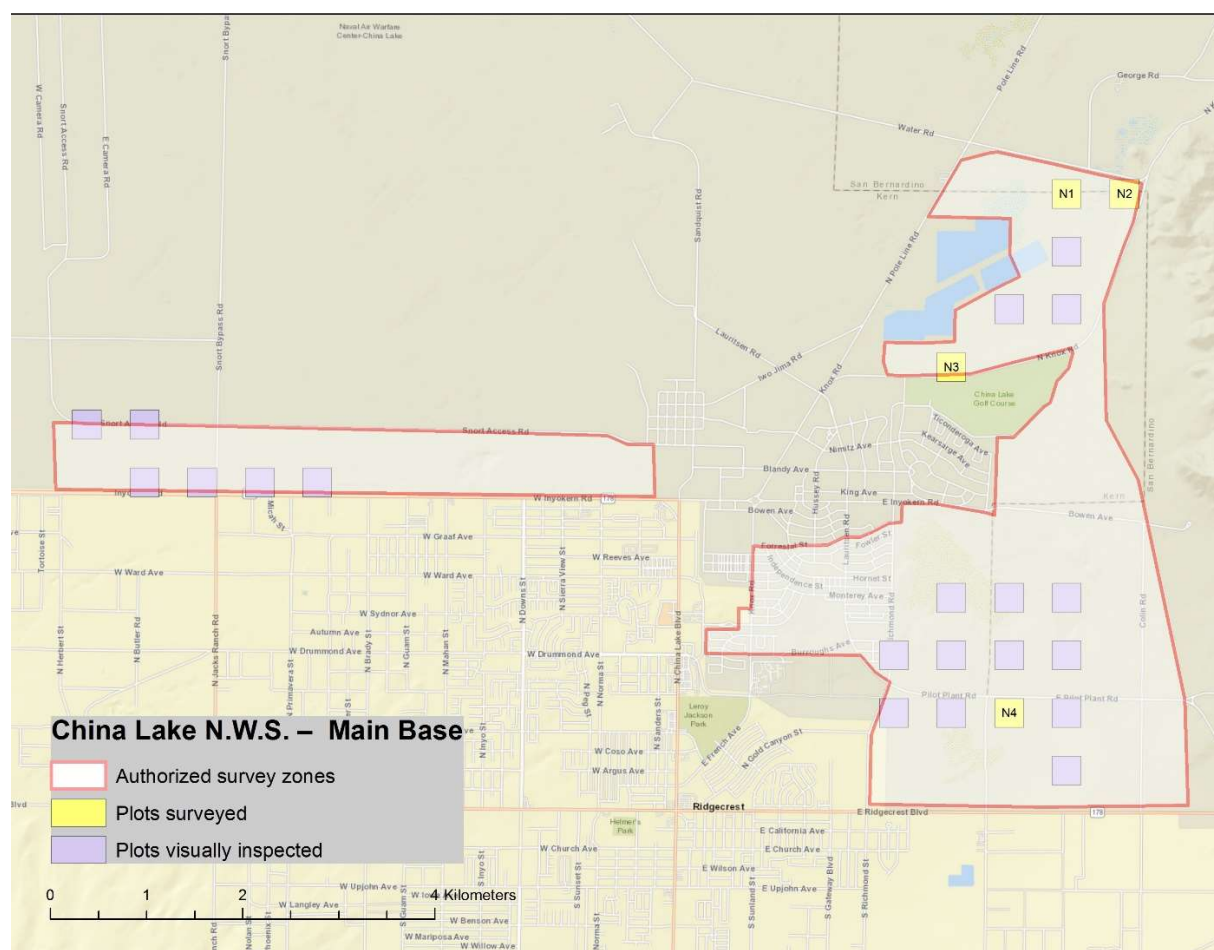
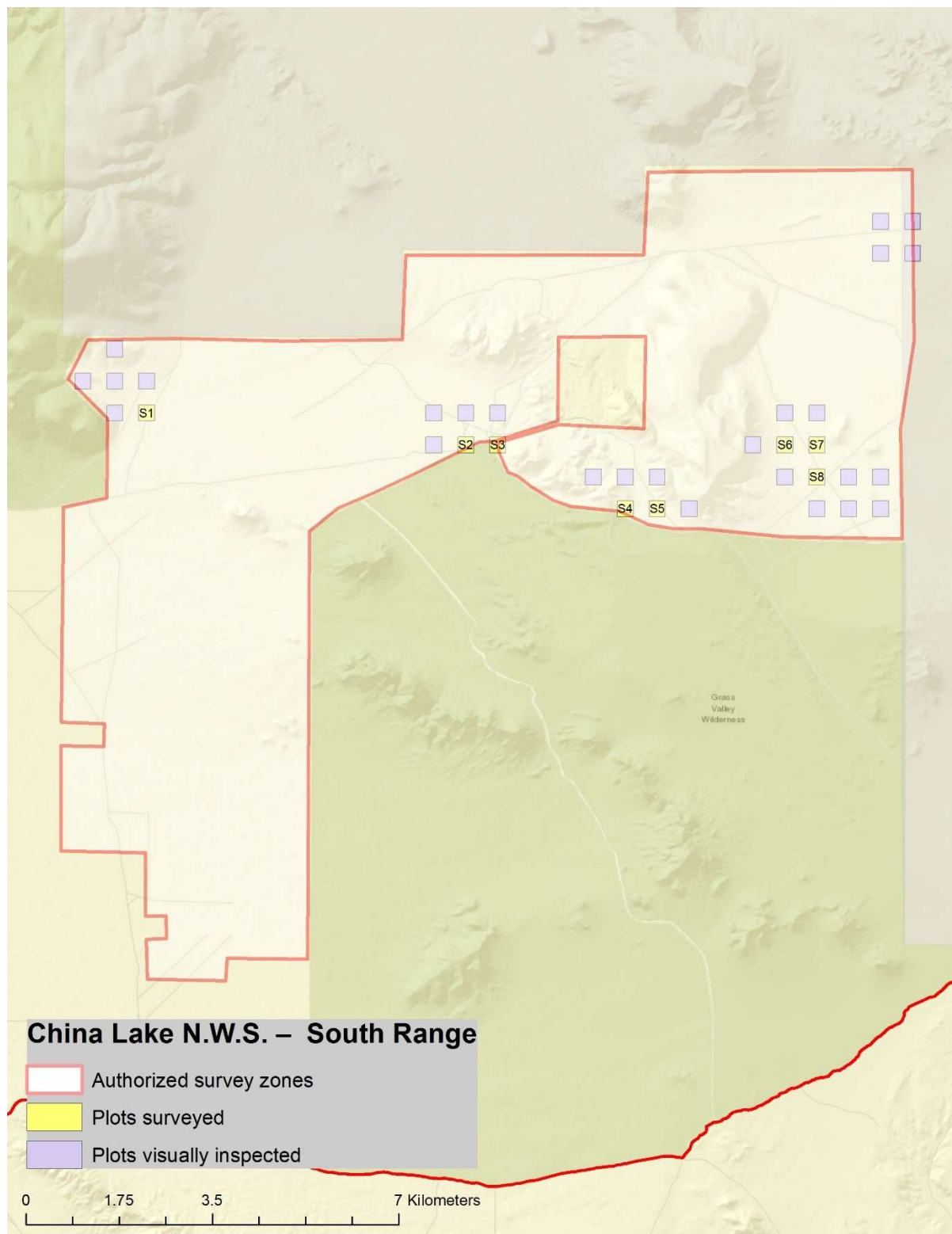


Figure 3. Plots visually inspected and surveyed at the China Lake Naval Weapons Station – South Range (CLSR). Each plot was visually assessed to determine whether there was suitable habitat for thrashers. Only plots with suitable habitat were surveyed.



Area-search Survey Protocol

Our survey protocol was based on and modified (increased size and amount of time) from methods developed by Point Blue for LeConte's Thrasher surveys conducted in the BLM Carrizo Plain National Monument since 2010 (Jongsomjit et al. 2013, 2014; Tietz et al. 2016, DTWG 2018, McCreedy et al., in prep). Surveys consisted of a 40-minute area search on each 300 m x 300 m plot. To maintain a consistent search pattern, the surveyor walked systematically through the plot in transects spaced approximately 50 m apart but was free to pursue individual birds upon detection. We recorded birds and mammals only if they were within the plot and within the 40-minute search window. We recorded detections of all avian and mammal species, with additional information collected on target species: BETH, LCTH, and Loggerhead Shrike (*Lanius ludovicianus*; LOSH), a Species of Special Concern in California (Humple 2008). Any target species detections that fell outside of the plot area and/or survey timing window were still recorded as incidental detections on a target species datasheet. See Appendix A for an example survey datasheet and target species datasheet. Surveys began on February 24, 2022, and continued through May 25. Plots were visited once (79 plots), twice (115 plots) or three times (64 plots) over the season for a total revisit rate of 2.0 (i.e., number of surveys/number of plots). We attempted to survey every site two to three times, but weather-related events (primarily wind in excess of 30 kph) and logistical issues (e.g., illnesses) prevented us from achieving this.

Integrated Monitoring of Bird Conservation Regions (IMBCR)

In 2022, we conducted point counts following IMBCR protocols (Pavlacky et al. 2017) at one site (Shadow Valley) where we did point counts in 2021. The point counts were located on the same random grid system as our area search plots by using the plot corners so that our points were 300 m apart. Hence, we conducted 16 point counts at this site. The surveys were conducted on May 12, which is generally the peak singing period for most bird species in the Mojave, including BETH. Each point count was six minutes in duration (Pavlacky et al. 2017). Detections of the same individual at different points were noted so a total number of individuals per site could be obtained.

Habitat Evaluation Protocol

The habitat evaluation protocol is used by DTWG research teams across five states (Arizona, California, Nevada, New Mexico, and Utah; DTWG 2018). These habitat evaluations were conducted once during the season at each plot surveyed for birds that had not been surveyed in a prior year. The methodology uses the Point-Center Quarter method (Krebs 1989), in which the plot is divided into quadrants (northeast, southeast, southwest, northwest) extending outward from the center point in the four cardinal directions. We used a rangefinder to measure distances from the center point to each of the following for each quadrant: woody shrubs (<0.5m), shrub/trees (0.5 to 2m), cholla and yucca (>0.5 m), and trees (>2m).

Additionally, we recorded the following for each habitat evaluation:

1. **Mistletoe density**

Desert Mistletoe (*Phoradendron californicum*) clumps within 50 m of center-point, counted by rounding to the nearest 10 (i.e., 0, 10, 20, 30, etc.)

2. **Fruit-bearing shrub density**

Counts of fruit-bearing shrubs, separated by species, within 50 m of the center-point, excluding mistletoe.

3. **Yucca density**

Counts of yucca individuals >2 m in height, separated by species, within 100 m of center-point. Joshua trees were included in these counts.

4. **Grass and forbs groundcover**

Proportion of ground covered by grass or forbs along a 50 m transect extending north from plot center-point, separated into native and non-native.

5. **Ground cover composition**

Describes the dominant ground cover within 100 m of the plot center-point, with cover-types defined as boulder, cobble, pebble, sand, silt, or other.

6. **Physical attributes and invasive plant presence**

Describes the presence/absence of various invasive plants and anthropogenic impact from livestock grazing, OHV use, water tanks, rural sprawl, and more. See example datasheet in Appendix A for the full list.

Dome Fire habitat data

Habitat data for the Dome Fire sites were collected in 2021. However, as trees killed by the Dome Fire decay and fall, the habitat structure at these plots will change. Therefore, we also counted the number of trees that were alive, dead, or had fallen over. This will allow us to track these structural changes in the coming years and see how it affects the avian community.

Data entry and management

All bird and related plot and weather data from the area search surveys has been entered and curated in the California Avian Data Center (<http://data.prbo.org/cadc/>), a node of the Avian Knowledge Network (<http://www.avianknowledge.net/>). Additional bird data from sites identified as a Sonoran Joint Venture 'Avicaching Location' (<https://sonoranjv.org/avicaching/>), which overlapped with our area search locations, were also entered into eBird (<https://ebird.org/home>). Checklists of all birds encountered from survey sites and at incidental thrasher sightings were entered into eBird. Our 'Target species data' for sightings of the three target species (BETH, LCTH, and LOSH) and all plot vegetation data for CA

are currently stored on Point Blue servers. These data were also combined with the other participating states and reside on Great Basin Bird Observatory servers.

Results

Area-searches

During surveys, we detected 30 adult and 2 juvenile BETH on 18 plots within nine sites, 15 adult and 3 juvenile LCTH on 11 plots within six sites, and 71 adult and 11 juvenile LOSH on 42 plots of 23 sites. In some cases, these may have been the same individuals sighted more than once on repeat visits. Incidentally (either outside of the plot or survey timing window), we detected an additional 50 BETH, 38 LCTH, and 97 LOSH. In the field we prioritized data gathering of incidental sightings in the following order: BETH, LCTH, and LOSH; hence, not every incidental shrike sighting was recorded, which led to the disproportionately low number of incidental sightings for that species.

Across all area-search surveys, we detected a total of 6,918 individuals of 100 avian species (Appendix D). In addition, we detected 122 individuals of four mammal species: white-tailed antelope squirrel (54; *Ammospermophilus leucurus*), desert cottontail (7; *Sylvilagus audubonii*), black-tailed jackrabbit (60; *Lepus californicus*), and kangaroo rat (1; *Dipodomys* sp.).

Nesting Behavior

We located nests opportunistically during area-search surveys and travelling between sites (Table 1). We found four BETH nests, four LCTH nests, and eleven LOSH nests. Two BETH nests were discovered in Joshua trees (*Yucca brevifolia*), one in a Mojave yucca (*Yucca schidigera*), and one in a fourwing saltbush (*Atriplex canescens*). Discovery dates ranged from March 25th to May 11th. Fledging from the Mojave yucca nest at Vontrigger Hills was confirmed on May 17th and fledging was confirmed from the saltbush nest at Shadow Valley on May 11th. The outcomes of the other two nests were not determined.

Of the four LCTH nests, two were discovered in Mojave yucca and two in branched pencil cholla (*Cylindropuntia ramosissima*). Discovery dates ranged from March 17th to May 14th. Only one of these nests was determined to have fledged, while the outcomes of the other nests were not determined.

Of the eleven LOSH nests, six were discovered in Joshua tree, one in Mojave yucca, one in peach thorn (*Lycium cooperi*), one in catclaw acacia (*Senegalia greggii*), one in blue palo verde (*Parkinsonia florida*), and one in a saltbush (*Atriplex* sp.). Discovery dates ranged from February 27th to May 13th. The outcomes of these LOSH nests were not determined.

Table 1. Bendire's Thrasher, LeConte's Thrasher, and Loggerhead Shrike nest locations, contents, and substrate. Coordinates in NAD83 Zone 11.

Species	Date found	Nest fate	UTM easting	UTM northing	Site	District	Substrate
BETH	25 Mar	fledged	669125	3882647	VOHI	Needles	<i>Yucca schidigera</i>
BETH	3 Apr	Unknown	623170	3898696	RAWE	Needles	<i>Yucca brevifolia</i>
BETH	26 Apr	Fledged	617885	3916766	SHVA	Needles	<i>Atriplex canescens</i>
BETH	11 May	Unknown	619554	3905756	DOFC	Needles	<i>Yucca brevifolia</i>
LCTH	17 Mar	Unknown	494231	3837271	STMO	Barstow	<i>Yucca schidigera</i>
LCTH	17 Mar	Unknown	493869	3837459	STMO	Barstow	<i>Cylindropuntia ramosissima</i>
LCTH	17 Apr	Unknown	670995	3827795	OWMT	Needles	<i>Yucca schidigera</i>
LCTH	14 May	Fledged	650110	3873976	BCWA	Needles	<i>Cylindropuntia ramosissima</i>
LOSH	27 Feb	Unknown	492634	3837746	STMO	Barstow	<i>Yucca brevifolia</i>
LOSH	7 Mar	Unknown	388572	3871272	SOMO	Bakersfield	<i>Yucca brevifolia</i>
LOSH	23 Mar	Unknown	498962	3883466	COME	Needles	<i>Lycium cooperi</i>
LOSH	25 Mar	Unknown	669171	3881616	VOHI	Needles	<i>Senegalia greggii</i>
LOSH	30 Mar	Unknown	444030	3948802	CLMB	Ridgecrest	<i>Atriplex sp</i>
LOSH	2 Apr	Unknown	627502	3912965	DOFA	Needles	<i>Yucca brevifolia</i>
LOSH	10 Apr	Unknown	715456	3823641	CHWA	Needles	<i>Parkinsonia florida</i>
LOSH	15 Apr	Unknown	613501	3891481	KERA	Needles	<i>Yucca brevifolia</i>
LOSH	26 Apr	Unknown	617581	3917225	SHVA	Needles	<i>Yucca brevifolia</i>
LOSH	13 May	Unknown	622381	3897873	RAWE	Needles	<i>Yucca schidigera</i>
LOSH	13 May	Unknown	626756	3913371	DOFA	Needles	<i>Yucca brevifolia</i>

IMBCR Results

We had 14 BETH detections at 11 points at the Shadow Valley site (Table 2). Although it was difficult to determine whether some BETH detections were the same bird or not, there appeared to be at least six BETH individuals. All detections were by song. Estimated distances to the birds ranged from 104-415 m with a mean of 263.7 m $\pm$ 96.1 (SD) and median of 293 m. No LCTHs were detected during the point counts (Table 2).

Table 2. Comparison of BETH detections in 2022 using IMBCR point counts and plot area searches at the Shadow Valley site in the Mojave National Preserve. PC = point count and AS = area search.

Site	PC date	# of PC detections	Avg PC distance	# AS visits	# AS plots occupied	# incidental AS sightings
SHVA	5/12/2022	14	263.7	3	4	18

Dome Fire Results

At the two sites entirely within the Dome Fire footprint, sites DOFB and DOFD (Table 3 and Fig. 4), we detected one BETH at DOFD. This bird was flushed from a small cluster of unburned desert almond shrubs (*Prunus fasciculata*), where it may have been foraging. It then flew 177 m away to a live Joshua tree. The shrubs and tree were searched, but no BETH nest was found. It is possible the bird was just passing through the area.

We noted two potential post-fire effects that may impact BETH presence within the Dome Fire footprint. The regrowth of annual forbs at these sites attracted numerous pallid-winged grasshoppers (*Trimerotropis pallidipennis*), perhaps as many as 1-3 per square meter over the entire 2.25 square km DOFB survey site, and maybe half as many at the DOFD site. The percentage of fallen Joshua trees on burned plots was still low, with just 3% of trees having fallen on average.

At the two sites straddling the edge of the fire footprint, sites DOFA and DOFC (Table 3 and Fig. 4), we detected two BETH on survey at each site. At each site, one bird was detected on an unburned plot (0% burned) and one was found on a partially burned plot (coincidentally, the partially burned plots were 60% burned at each site). We found one BETH nest at the DOFC site in unburned forest in an 8 m tall Joshua tree approximately 60 m from the fire perimeter. The adults were observed carrying grasshoppers to their nestlings.

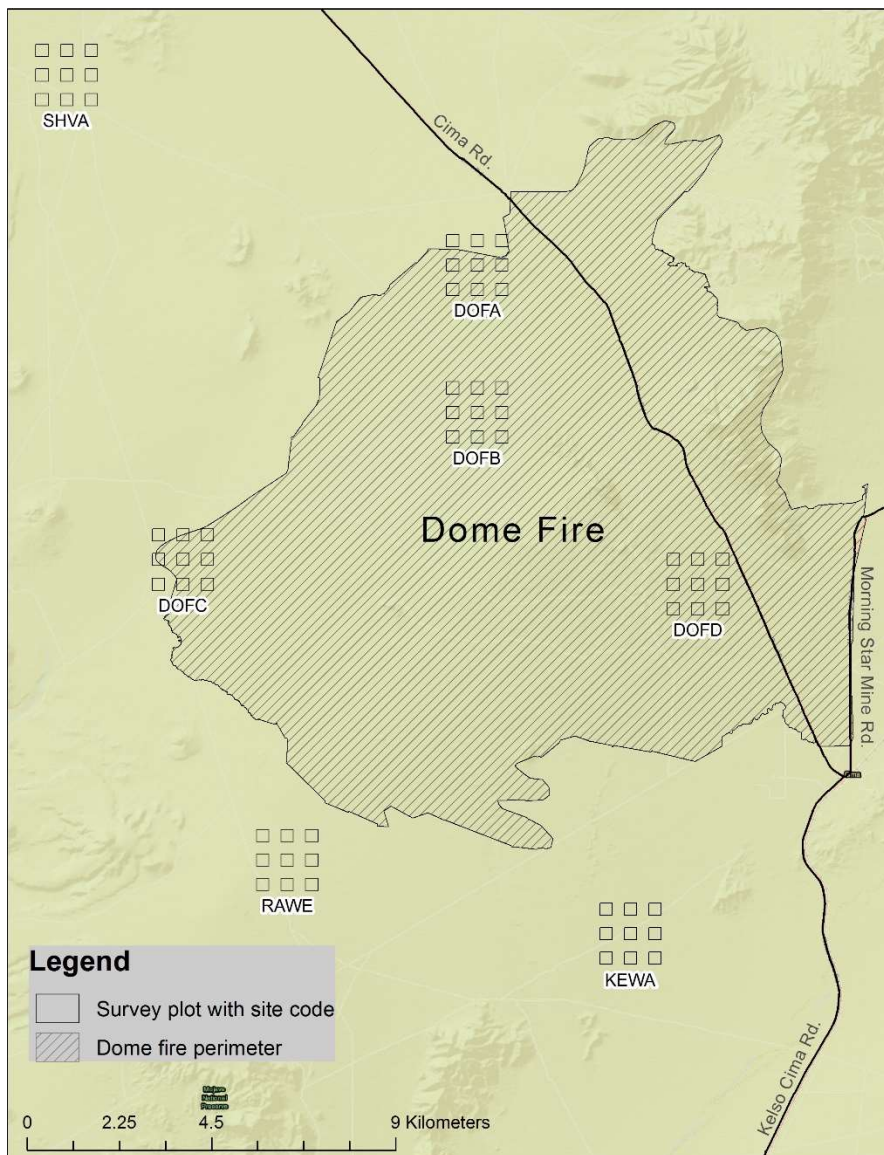
At the three unburned sites near the Dome Fire (Table 3 and Fig. 4), we detected BETH on four plots at SHVA, 1 plot on RAWE, and 0 plots at KEWA. Incidentally, we detected 17 additional BETHs at SHVA, 8 at RAWE, and 1 at KEWA. We found nests at two of the unburned sites (RAWE and SHVA). The RAWE nest was in a 2 m tall Joshua tree, while the SHVA nest was in a 1.2 m tall fourwing saltbush (*Atriplex canescens*).

Table 3. Comparison of sites within, straddling the perimeter, or outside of the Dome Fire, which occurred in Aug 2020 on the Cima Dome, Mojave N.P.

Site	Plots surveyed	Resurvey rate ¹	Dist (km) to fire perimeter ²	# plots burned ³	Avg % plot burned ⁴	Avg # JT ⁵ /plot	Avg % JT dead/plot	# plots occupied by BETH
DOFB	9	1.0	-2.7	9	100	243	100	0
DOFD	9	1.0	-1.9	9	95	180	85	1
DOFA	9	2.0	0	6	60	235	59	2
DOFC	9	1.7	0	7	52	153	52	2
RAWE	9	2.7	0.7	0	0	171	0	1
KEWA	9	1.7	1.8	0	0	86	0	0
SHVA	9	2.0	7.9	0	0	71	0	4

1. Resurvey rate = # surveys/# plots. 2. Distance to fire perimeter is positive going out and negative going in. 3. # plots burned counts plots with any amount of burn. 4. Average % of plot burned is an average of all nine plots. 5. JT = Joshua Tree. (See Fig. 2 and Appendices B and C for site locations.)

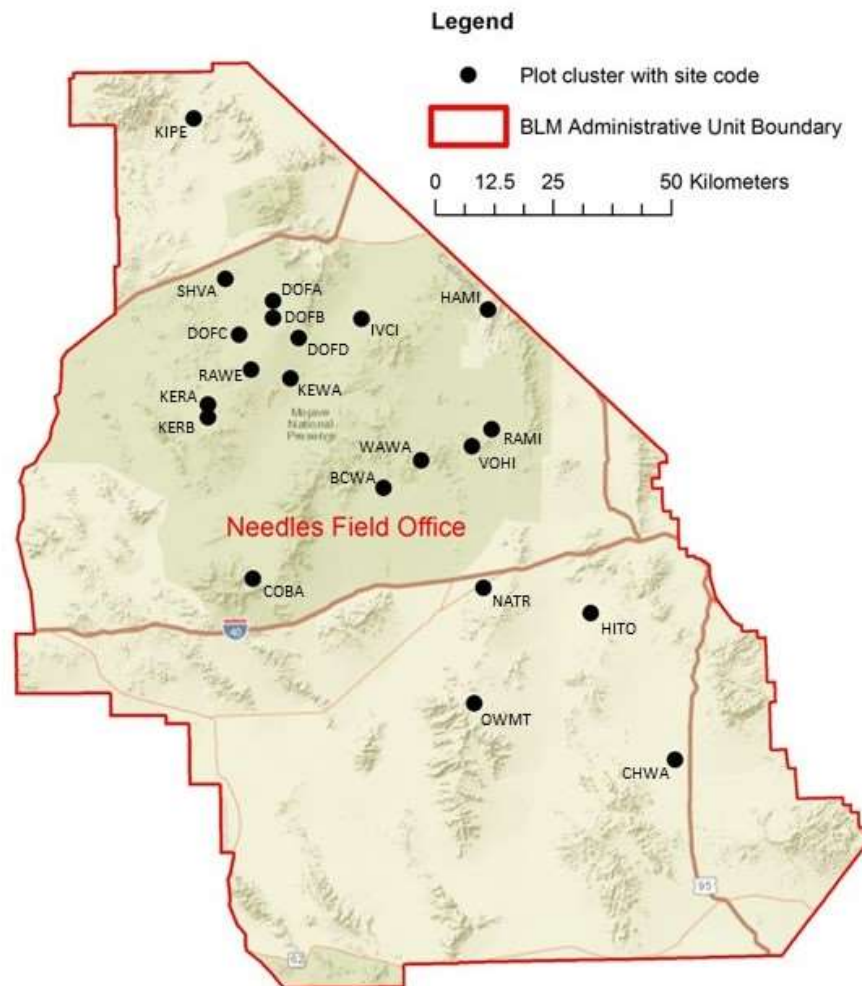
Figure 4. The Dome Fire perimeter and the survey sites we are using to monitor the fire's effects on thrasher occupancy at the Mojave National Preserve. The sites entirely outside the perimeter (KEWA, RAWE, SHVA) were first surveyed in 2018, while the sites on the perimeter (DOFA, DOFC) or entirely inside the perimeter (DOFB, DOFD) were first surveyed in 2021.



Regional Results by BLM District

Needles District

Figure 5. Site locations in the Needles Field Office District



In the Needles Field Office District, we surveyed 21 site clusters consisting of 178 plots (Fig. 5). Fourteen of the site clusters were within the MNP, which had a resurvey rate of 1.8. In addition, we surveyed one site along Excelsior Mine Road north of the MNP (KIFE), one site in the Old Woman Mountains (OWMT), one site on the edge of the Piute Mountains Wilderness (NATR), one site along High Tower Road south of Highway 40 (HITO), one site along the Chemehuevi Wash (CHWA), one site in the Granite Mountain Reserve (COBA), and one site in the Castle Mountain N.M. (HAMI). (Appendix B and C). On surveys, we detected 31 adult and 2 juvenile BETH, 5 adult and 2 juvenile LCTH, and 33 adult and 9 juvenile LOSH. An additional 49 incidental BETH sightings were detected within this district, and we found four BETH nests

(Table 1), two of which were confirmed to have fledged young. We detected an additional 19 adult LCTH incidentally in this district.

We also detected 33 adult and 9 juvenile LOSH on survey and an additional 48 adults and 7 juveniles incidentally. Furthermore, we found 7 LOSH nests, of which 4 were built in Joshua trees, 1 in a cat claw acacia, and 1 in a blue palo verde tree (Table 1). The nest contents ranged from eggs to nestlings. At Cottonwood Basin we did not find any thrashers on survey or incidentally, but a LOSH family group was detected with 2 juveniles begging from their parents.

Barstow District

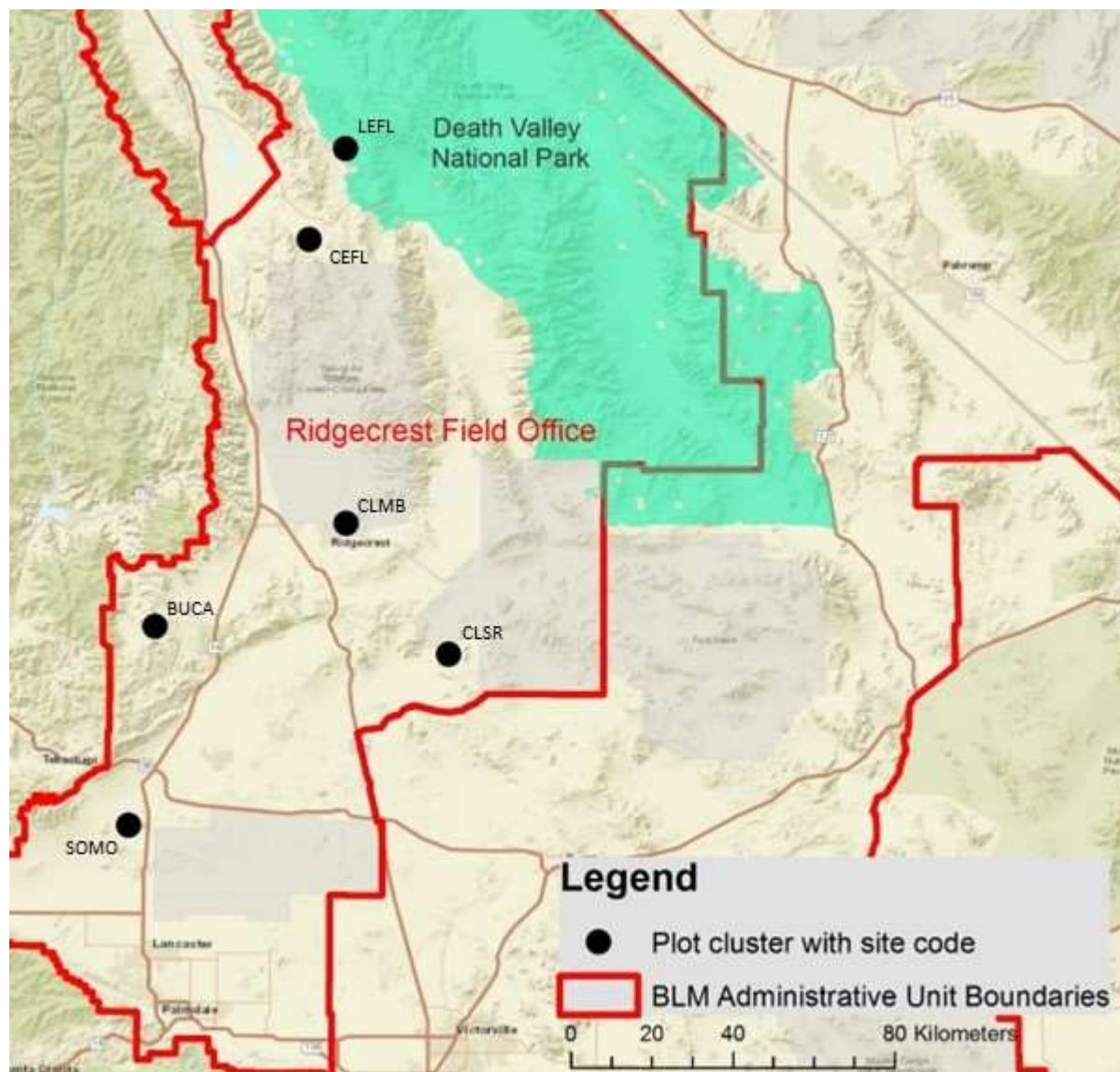
Figure 6. Site locations in the Barstow Field Office District



In the Barstow Field Office District, we surveyed five site clusters consisting of 38 plots (Fig. 4) with a resurvey rate of 2.5. On survey, we detected zero BETH, 14 LCTH including 1 juvenile, and 33 LOSH including 2 juveniles. The LCTHs were found on survey at three of the five site clusters. Incidentally, we detected 16 adult LCTHs, and we found one LCTH nest with two nestlings in a 1.8 m tall *Cylindropuntia ramosissima* at the Stoddard Mountain site on 17 Mar. In addition, we had 29 incidental sightings of LOSH, and we found one LOSH nest in a 1.3 m tall *Lycium cooperi* at the Stoddard Mountain site on 23 Mar.

Ridgecrest District, China Lake N.W.S., and Death Valley National Park

Figure 7. Site locations in the Ridgecrest Field Office District, China Lake Naval Weapons Station, and at Death Valley National Park.



In the Ridgecrest Field Office District, we surveyed six site clusters consisting of 42 plots total (Fig. 5) with a resurvey rate of 1.5. The Lee Flat site we surveyed was within Death Valley National Park, and two sites were within the China Lake N.W.S.: one on the Main Base and one on the South Range. We did not encounter any BETH or LCTH on survey or confirm any sightings incidentally within the BLM field office district, within the park, or at either China Lake site. However, we found LOSH on survey at four sites and incidentally at one other. One LOSH nest was found on survey at the China Lake N.W.S. – Main Base in an unidentified species of saltbush (*Atriplex* sp.).

Discussion

In 2022, all of our BETH detections were on the MNP except for two individuals detected at our Kingston Peak site along Excelsior Mine Road. LCTH and LOSH detections were more widespread, but surprisingly we did not detect any LCTH on the northwestern side of the Mojave Desert in the Ridgecrest Field Office region, even though we detected them there in 2019 (Tietz et al. 2020). In 2022, 70% of our BETH detections were on or in the vicinity of the Cima Dome, while just 22% of our sites (the 7 sites in Fig. 4) were in the Cima Dome area. This percentage near Cima Dome is a 16% decrease from 2021, which suggests that BETH were more widespread in California in 2022.

In 2022, the Dome Fire continues to affect BETH occupancy and will likely continue to impact BETH use in the future, and the continued drought will likely slow or inhibit revegetation in burned areas (Loik et al. 2000). Although we detected one BETH on a burned plot in 2022, it seems unlikely that bird was using the plot for nesting or had a territory nearby. The numbers of BETH this year remained relatively high at the unburned sites and unburned plots straddling the fire perimeter.

At the new China Lake sites, we found the habitat was mostly unsuitable for thrasher nesting, and we did not encounter any LCTH or BETH during our surveys or incidentally. On the main base area near Ridgecrest, we determined that only 17% of plots (4 of 24 plotted) had habitat that was marginally suitable, while only 24% of plots (8 of 33 plotted) on the south base had marginally suitable habitat. Based on our on-site assessments, we determined that most of the shrub cover was too low (<1 m) and unable to provide nest structures for thrashers (Sheppard 2018). LCTHs do not necessarily require large areas of tall shrubs, but at a minimum, several shrubs 1-3 m in height among shorter shrubs 0.5-1 m may suffice (Sheppard 1996). Although we did not detect LCTH at China Lake N.W.S., several eBird records are near or at sites we surveyed (eBird 2021), where there may be adequate shrub cover (e.g., Main Base sewage ponds and Blackwater Well on the South Range). Because thrashers can be secretive, and it was another dry year which may inhibit them from nesting and singing (Sheppard 2018), it's possible that there were LCTHs in the area at low densities that we failed to detect. From our previous surveys in the Mojave and the Carrizo Plain, the detection probability for non-singing LCTHs is quite low, so more surveys may be required to determine occupancy at our survey sites (Jongsomjit et al. 2014, Tietz et al. 2020).

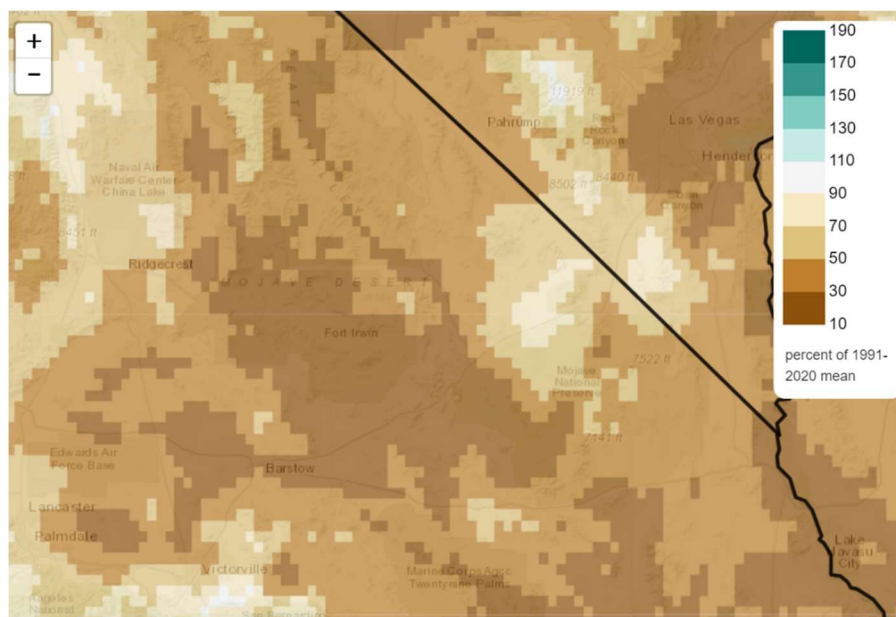
The number of black-tailed jackrabbits and desert cottontails detected from our surveys remained low relative to what we detected in 2018 (Table 4). It will be interesting to see if their numbers will recover after the wet monsoon during the summer of 2022, or if the Rabbit Hemorrhagic Disease recently documented in California prevents this from occurring (CDFW 2020).

Table 4. Numbers of Black-tailed Jackrabbits (BTJR) and Desert Cottontails (DECO) detected during area searches from 2018-2022. Numbers are standardized by numbers of surveys conducted by year.

Year	Surveys	BTJR	BTJR/Survey	DECO	DECO/Survey
2018	201	229	1.14	75	0.37
2019	194	78	0.40	6	0.03
2021	298	43	0.14	3	0.01
2022	501	60	0.12	7	0.01

The precipitation during the 2021-2022 water-year (July-June) in the Mojave was fairly localized (Fig. 5; U.C. Merced 2021). Some areas, like the north side of the MNP, received near average rainfall, while many areas in the western and northern parts of the Mojave Desert received less than 30% of their average rainfall. This rainfall discrepancy may explain why thrashers were more abundant in the Cima Dome region and successfully nested there, whereas we did not detect any thrashers in the far western or northern regions of the Mojave Desert. The year-upon-year of drought severely affected the vegetation at the northern sites such that most shrubs failed to put on leaves for a second year (<1% of shrubs at LEFL put on any leaves this year), and the leaves that were on were dry and crispy to the touch in May. Furthermore, and of greater concern, is the effect the drought is having on the Joshua trees. At our Coolgardie Mesa and Copper City sites, approximately 10% of the trees are dying or recently dead. Any more years of drought will likely increase the level of mortality (DeFalco et al. 2010, Esque et al. 2015). Hopefully the monsoon rains this summer were less localized than the winter rains of 2021-2022.

Figure 8. Precipitation anomaly for the southwestern United States from 1 Oct 2021-31 May 2022 showing the percentage deviation from the 1981-2010 mean (U.C. Merced 2021).



Acknowledgments

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Appendix A - Survey Forms

[illegible]

Comments:

Target Species Sighting Form																			
Fill out entire top half of data sheet. If nest found, also fill out bottom half.																			
Record sightings of Bendire's Thrasher, LeConte's Thrasher, and Loggerhead Shrike								Plot ID:											
Observer:				Contact email:				Date:											
Species:				Time:				Visit #:											
UTM E (NAD83):				UTM N (NAD83):				Site Name (opt.):											
Distance (m):				Bearing:															
# Adults:				# Juveniles:		# Unknown age:		Group Code:											
Within Plot:				Y N (circle one)		Location Information (owner, contact info, etc):													
Within Survey Time:				Y N (circle one)															
Activity (circle all that apply):				Sing		Call		Forage		Fly		Flush		Run		Perch		Incubate	
Record perch substrate and height for all birds in a group. If >3, record in notes				Bird 1		Bird 2		Bird 3		Habitat description:									
Perch Substrate (species):										Highest Breeding Code:									
Perch Height (0.1 m):										Photo/Recording taken: Yes No				Photo number(s):					
Nest found (circle one):				Yes		No		Occupied Nest (circle one):				Yes		No					
If NEST FOUND, complete section below with nest information: see codes below																			
UTM E (NAD83):				Nest Stage															
UTM N (NAD83):				# of Eggs															
Elevation (m):				# of Nestlings															
*Estimates ONLY, unless nest is no longer occupied.				# of Adults Present															
Habitat:				See protocol for list of habitat codes															
Substrate:				species of substrate and nursing plants (if applicable)															
*Plant Height				m measure or estimate to highest point															
*DBH:				cm diameter of main trunk, if present, at 1.3 m off ground															
*Plant Width				m width of substrate plant at widest point															
*Distance to Center/Trunk:				cm measure interior outer edge of nest to the center or trunk of substrate															
*Nest Height:				m measure ground to top of nest															
*Nest Orientation (dgrs):				° measure degrees in the direction from trunk/center to nest outward.															
Follow-up Date:				Nest Contents:				# of Fledglings (if known):											
Comments/Diagram of Nest Site:																			
Breeding Codes																			
NY	Nest with young	FL	Recently fledged young	C	Courtship or copulation														
NE	Nest with eggs	ON	Occupied nest	P	Pair														
FY	Feeding young	DD	Distraction display																
CF	Carrying food	NB	Nest building																
Additional Comments:																			

Habitat Evaluation Form			
Surveyor:	mE(NAD83):	Plot ID:	
	mN(NAD83):	Date:	
Habitat Type:	Elevation (m):	Zone:	Site Name:
Point-Center Quarter: Measure distance to the first visible vegetation. Note: When cholla or yucca are NOT present, record the dominant woody/shrub species less than 0.5 m.			
Northwest	Distance	Species	
Atriplex sp. (> 0.5m)			
Cholla (>0.5m)			
Yucca (>0.5m)			
Shrub sp. (<0.5m)			
Shrub/tree(>0.5 to 2m)			
Tree (>2 m)			
Northeast			
Atriplex sp. (> 0.5m)			
Cholla (>0.5m)			
Yucca (>0.5m)			
Shrub sp. (<0.5m)			
Shrub/tree(>0.5 to 2m)			
Tree (>2 m)			
Southeast			
Atriplex sp. (> 0.5m)			
Cholla (>0.5m)			
Yucca (>0.5m)			
Shrub sp. (<0.5m)			
Shrub/tree(>0.5 to 2m)			
Tree (>2 m)			
Southwest			
Atriplex sp. (> 0.5m)			
Cholla (>0.5m)			
Yucca (>0.5m)			
Shrub sp. (<0.5m)			
Shrub/tree(>0.5 to 2m)			
Tree (>2 m)			
Fruit-bearing shrub (estimate # of fruiting shrubs within 50 m radius) Exact count or estimate by 10: 0, 10, 20, 30, etc.			
Count:	Species:		
Count:	Species:		
Count:	Species:		
Yucca Species. If not present dominant shrub/woody sp. (> 2 m within 100 m radius) Exact count or estimate by 10: 0, 10, 20, 30, etc.			
Count:	Species:		
Count:	Species:		
Count:	Species:		
Ground Composition w/in 50m	%	If ground composition outside 50m circle differs significantly, identify difference:	
silt/clay			
sand			
pebble			
cobble			
boulder			
other:			
		Ground Cover (along 50 m line N) nearest M	
		# of meters bunchgrass:	
		# of meters invasive:	
		# of meters bare ground:	
		% of Wash Cover within whole plot	

2. POINT-CENTERED QUARTER

Disturbance Codes

1 = >50% of plot has recent activity < 1 yr

2 = >50% of plot has past evidence > 1yr

3 = <50% of plot has recent activity < 1 yr

4 = <50% of plot has past evidence > 1yr

5 = Some evidence within ~1km from plot

6 = No sign in plot or within 1km of plot

7 = Other, explain in comments

Disturbance Evaluation:	CODE
OHV (2-track) use evidence	
Burned habitat	
Livestock evidence	
Mechanical	
Other:	

Presence - mark if on plot	X
Tank w/ standing water	
Rural sprawl w/in 5km	
Fruit-bearing Shrubs	
Stinknet	
Cheatgrass	
Red brome	
Buffleggrass	
Arab. Mediterranean grass	
Bermuda grass	
Fountain grass	
Russian thistle	
Other:	

Appendix B – Plot Locations

All coordinates given in NAD83 UTM zone 11.

Plot ID	Easting	Northing	Plot ID	Easting	Northing
BCWA.2	649650	3873850	CLSR.S7	474600	3912700
BCWA.5	650250	3873850	CLSR.S8	474600	3912100
BCWA.6	650850	3872650	COBA.1	623850	3855250
BCWA.7	650850	3873250	COBA.2	623850	3854650
BCWA.8	650850	3873850	COBA.3	623250	3854650
BCWA.9	651450	3873850	COBA.4	623850	3854050
BUCA.2	395250	3920050	COBA.5	623250	3854050
BUCA.3	395250	3920650	COBA.6	622650	3854050
BUCA.4	395850	3919450	COBA.7	622650	3853450
BUCA.5	395850	3920050	COBA.8	622050	3853450
BUCA.6	395850	3920650	COBA.9	622050	3852850
BUCA.7	396450	3919450	COCI.5	498150	3886150
CEFL.1	433350	4016350	COCI.6	498750	3886150
CEFL.2	433950	4016350	COCI.8	498150	3885550
CEFL.3	434550	4016350	COCI.9	498750	3885550
CEFL.4	433350	4015750	COME.1	497850	3882250
CEFL.5	433950	4015750	COME.2	497850	3882850
CEFL.6	434550	4015750	COME.3	497850	3883450
CEFL.7	433350	4015150	COME.4	498450	3882250
CEFL.8	433950	4015150	COME.5	498450	3882850
CEFL.9	434550	4015150	COME.6	498450	3883450
CHWA.1	712650	3815650	COME.7	499050	3882850
CHWA.2	713850	3814450	COME.8	499050	3883450
CHWA.3	715050	3813850	DOFA.1	626850	3913450
CHWA.4	716850	3812650	DOFA.2	627450	3913450
CHWA.5	719250	3812050	DOFA.3	628050	3913450
CHWA.6	720450	3812050	DOFA.4	626850	3912850
CHWA.7	721650	3810850	DOFA.5	627450	3912850
CHWA.8	721650	3812050	DOFA.6	628050	3912850
CHWA.9	709950	3818950	DOFA.7	626850	3912250
CHWA.10	709050	3819550	DOFA.8	627450	3912250
CHWA.11	707850	3820450	DOFA.9	628050	3912250
CHWA.12	706950	3821350	DOFB.1	626850	3909850
CHWA.13	706350	3822250	DOFB.2	627450	3909850
CLMB.N1	443400	3948700	DOFB.3	628050	3909850
CLMB.N2	444000	3948700	DOFB.4	626850	3909250
CLMB.N3	442200	3946900	DOFB.5	627450	3909250
CLMB.N4	442800	3943300	DOFB.6	628050	3909250
CLSR.S1	462000	3913300	DOFB.7	626850	3908650
CLSR.S2	468000	3912700	DOFB.8	627450	3908650
CLSR.S3	468600	3912700	DOFB.9	628050	3908650
CLSR.S4	471000	3911500	DOFC.1	619650	3906250
CLSR.S5	471600	3911500	DOFC.2	620250	3906250
CLSR.S6	474000	3912700	DOFC.3	620850	3906250

Plot ID	Easting	Northing	Plot ID	Easting	Northing
DOFC.4	619650	3905650	KERA.5	613650	3890950
DOFC.5	620250	3905650	KERA.6	614250	3890950
DOFC.6	620850	3905650	KERA.7	613050	3890350
DOFC.7	619650	3905050	KERA.8	613650	3890350
DOFC.8	620250	3905050	KERA.9	614250	3890350
DOFC.9	620850	3905050	KERB.1	613050	3888850
DOFD.1	632250	3905650	KERB.2	613650	3888850
DOFD.2	632850	3905650	KERB.3	614250	3888850
DOFD.3	633450	3905650	KERB.4	613050	3888250
DOFD.4	632250	3905050	KERB.5	613650	3888250
DOFD.5	632850	3905050	KERB.6	614250	3888250
DOFD.6	633450	3905050	KERB.7	613050	3887650
DOFD.7	632250	3904450	KERB.8	613650	3887650
DOFD.8	632850	3904450	KERB.9	614250	3887650
DOFD.9	633450	3904450	KEWA.1	630600	3897100
DORO.1	517950	3807250	KEWA.2	631200	3897100
DORO.2	518550	3807250	KEWA.3	631800	3897100
DORO.3	519150	3807250	KEWA.4	630600	3896500
DORO.4	517950	3806650	KEWA.5	631200	3896500
DORO.5	518550	3806650	KEWA.6	631800	3896500
DORO.6	519150	3806650	KEWA.7	630600	3895900
DORO.7	517950	3806050	KEWA.8	631200	3895900
DORO.8	518550	3806050	KEWA.9	631800	3895900
DORO.9	519150	3806050	KIPE.1	610050	3952150
HAMI.1	673050	3911050	KIPE.2	610650	3952150
HAMI.8	672450	3910450	KIPE.3	611250	3952150
HITO.1	694200	3847300	KIPE.4	610050	3951550
HITO.2	694800	3847300	KIPE.5	610650	3951550
HITO.3	695400	3847300	KIPE.6	611250	3951550
HITO.4	694200	3846700	KIPE.7	610050	3950950
HITO.5	694800	3846700	KIPE.8	610650	3950950
HITO.6	695400	3846700	KIPE.9	611250	3950950
HITO.7	694200	3846100	LEFL.1	442350	4038850
HITO.8	694800	3846100	LEFL.2	442950	4038850
HITO.9	695400	3846100	LEFL.3	443550	4038850
IVCI.1	645600	3909700	LEFL.4	442350	4038250
IVCI.2	646200	3909700	LEFL.5	442950	4038250
IVCI.3	646800	3909700	LEFL.6	443550	4038250
IVCI.4	645600	3909100	LEFL.7	442350	4037650
IVCI.5	646200	3909100	LEFL.8	442950	4037650
IVCI.6	646800	3909100	LEFL.9	443550	4037650
IVCI.7	645600	3908500	NATR.1	671400	3852700
IVCI.8	646200	3908500	NATR.2	672000	3852700
IVCI.9	646800	3908500	NATR.3	672600	3852700
KERA.1	613050	3891550	NATR.4	671400	3852100
KERA.2	613650	3891550	NATR.5	672000	3852100
KERA.3	614250	3891550	NATR.6	672600	3852100
KERA.4	613050	3890950	NATR.7	671400	3851500

Plot ID	Easting	Northing	Plot ID	Easting	Northing
NATR.8	672000	3851500	SIMO.3	490950	3827650
NATR.9	672600	3851500	SIMO.4	493950	3827350
OWMT.1	669450	3827650	SIMO.5	494250	3827350
OWMT.2	670050	3828250	SIMO.7	493650	3825550
OWMT.3	669450	3828250	SIMO.8	494250	3825550
OWMT.4	670050	3827650	SIMO.9	493650	3824950
OWMT.5	670050	3827050	SOMO.1	388650	3871450
OWMT.6	670650	3827650	SOMO.2	389250	3871450
OWMT.7	668850	3827050	SOMO.4	389250	3870850
OWMT.8	669450	3827050	SOMO.5	389850	3870550
RAMI.1	673200	3886300	SOMO.6	390150	3870550
RAMI.2	673800	3886300	SOMO.7	389550	3870250
RAMI.3	674400	3886300	STMO.1	492750	3837550
RAMI.4	673200	3885700	STMO.2	493350	3837550
RAMI.5	673800	3885700	STMO.3	493950	3837550
RAMI.6	674400	3885700	STMO.4	494550	3837550
RAMI.7	673200	3885100	STMO.5	493650	3836950
RAMI.9	674400	3885100	STMO.6	494250	3836950
RAWE.1	622200	3898900	STMO.7	493650	3836350
RAWE.2	622800	3898900	STMO.8	494250	3836350
RAWE.3	623400	3898900	STMO.9	494850	3836350
RAWE.4	622200	3898300	VOHI.1	669000	3882700
RAWE.5	622800	3898300	VOHI.2	669600	3882700
RAWE.6	623400	3898300	VOHI.3	670200	3882700
RAWE.7	622200	3897700	VOHI.4	669000	3882100
RAWE.8	622800	3897700	VOHI.5	669600	3882100
RAWE.9	623400	3897700	VOHI.6	670200	3882100
SHVA.1	616800	3918100	VOHI.7	669000	3881500
SHVA.2	617400	3918100	VOHI.8	669600	3881500
SHVA.3	618000	3918100	WAWA.1	658200	3879700
SHVA.4	616800	3917500	WAWA.2	658800	3879700
SHVA.5	617400	3917500	WAWA.4	658200	3879100
SHVA.6	618000	3917500	WAWA.5	658800	3879100
SHVA.7	616800	3916900	WAWA.6	659400	3879100
SHVA.8	617400	3916900	WAWA.7	658200	3878500
SHVA.9	618000	3916900	WAWA.8	658800	3878500
SIMO.1	490950	3828250	WAWA.9	659400	3878500
SIMO.2	491550	3828250			

Appendix C

Driving Directions by Site

These driving directions are intended to be used in addition to map resources such as USGS quad maps, California Atlas and Gazetteer, Google Earth or other sources. Roads in the southern California deserts are often unmarked and may not appear on maps or may be rough and impassible for most vehicles. These directions may be useful for biologists and volunteers in future seasons. We specify where 4wd or high clearance is recommended and offer specific help in accessing field sites.

Black Canyon Wash (BCWA): In Mojave Preserve, from Black Canyon Wash Rd., turn east onto dirt road at UTM 647150, 3877130. This road is about 1.1 miles south of the turnoff for Hole-in-the-Wall Campground. This road goes all the way to the plots. Road is sandy, high clearance and 4wd necessary.

Butterbrecht Canyon (BUCA): From CA highway 14, take Jawbone Canyon Rd to the west, go about 4.7 miles. At UTM 400110, 3907870, turn right to stay on Jawbone Canyon Rd (sign for Kelso). The road winds uphill and along ridge for a while. Turn right at UTM 398550, 3916490, there is a sign for Butterbrecht Springs Preserve and a cattle guard. Continue past Butterbrecht Springs to get to the plots. There are several primitive camping pullouts near the plots, we recommend the one near the springs at UTM 398670, 3916050 and there is another just south of the plots. 4wd recommended but it is possible to get at least to Butterbrecht Springs with 2wd.

Centennial Flat (CEFL): From I-395, head east on CA-190 for 24.6 miles. Turn right on Centennial Rd and head south 1.5 miles, then left at the Y and head south another 1 mile to site. Camping is possible on any of the side roads.

Chemehuevi Wash (CHWA 1-8): From Needles, head south on highway 95. Just north of crossing the wash, there is a jeep trail that goes east from highway 95 at 715790, 3813390. Use this to head east along the north side of wash. Road is very sandy in places, 4wd necessary but you could park a 2wd vehicle on the side of Hwy 95 and plan on a longer walk.

Chemehuevi Wash Upper (CHWA 9-13): From Needles, head south on highway 95 for 21.5 miles. Turn right onto Turtle Mountain Road and head southwest for 5.3 miles to where the road crosses Chemehuevi Wash. Drive across the wash and take a left on the far side of the wash on an unmarked dirt road. Park off the road. This is a good place to camp. 4WD and high clearance recommended.

China Lake N.W.S. – Main Base (CHMB): From Ridgecrest, drive east on E. Inyokern to the main gate. Prior to conducting a survey, you will need to get an identification badge and authorization from China Lake N.W.S. Authorization could take a couple weeks. Badging could take a couple hours. An escort will need to be arranged beforehand, who can drive you to the survey plots. 4WD is not required.

China Lake N.W.S. – South Range (CHSR): Prior to conducting a survey, you will need to get an identification badge and authorization from China Lake N.W.S. Authorization could take a couple weeks. Badging could take a couple hours. An escort will need to be arranged beforehand, who can drive you to the survey plots. 4WD is required. From Ridgecrest, drive 30 miles south on hwy 395 and head east on Cuddleback Road. Drive 8.5 miles east to the dry lakebed of Cuddleback Lake. From here, you will need to figure out where to go on your own.

Dome Fire A (DOFA): From Cima Rd exit on I-15, head SE for 7.2 miles and turn right on Deer Spring Road (an unmarked dirt road) and head south for 1 mile to where the road crosses a dry wash. Park in the dry wash and hike to the site. You can camp in the wash or camp at the Valley View Ranch (if it is still abandoned), which is 2.2 miles south of the wash. 4WD and high clearance recommended.

Dome Fire B (DOFB): From Cima Rd exit on I-15, head SE for 10.1 miles. Turn right on unmarked dirt road and head SW for 1.7 miles and park at abandoned ranch. 4WD and high clearance unnecessary.

Dome Fire C (DOFC): From Cima Rd exit on I-15, head SE for 0.4 miles and turn right on unmarked dirt road and head SW toward Rock Tank (Shadow Valley site). Drive past Rock Tank. heading SW. In 2 miles bear left at the fork. Head south for another 5 miles until you get to the Aiken Mine Road intersection. There is an abandoned ranch here. Park here. 4WD and high clearance recommended.

Dome Fire D (DOFD): From Cima Rd exit on I-15, head SE for 15 miles. Turn right on unmarked dirt road and head west for 0.3 miles. You can camp here at the clearing. You can either hike from here to the site, or drive the dirt road north and park closer if you have 4WD.

Donaldson Road (DORO): From CA-247, head south on Santa Fe Fire Rd for 1.3 miles. Road becomes Donaldson Rd and continue south for another 0.8 miles. Turn left and head ESE for 0.2 miles and park. Camping can be done here.

Coolgardie Mesa (COME): From I-15, exit in Barstow at E. Main St and head NW for 0.4 miles. Take a right on Yucca Ave and head NNE for 0.5 miles. Turn left as road becomes Riverside Dr. and continue west for 1.1 miles. Turn left onto Lawrence Dale Dr. and then turn right on N 1st Ave and head NE 0.2 miles. Turn left onto Irwin Rd and head north for 6.9 miles. Turn left onto Copper City Rd and head north 6 miles. Turn left onto Coolgardie Rd. and head NW 1.8 miles to pullout on left by large Joshua tree. This spot can be used for parking or camping.

Copper City (COCI): From I-15, exit in Barstow at E. Main St and head NW for 0.4 miles. Take a right on Yucca Ave and head NNE for 0.5 miles. Turn left as road becomes Riverside Dr. and continue west for 1.1 miles. Turn left onto Lawrence Dale Dr. and then turn right on N 1st Ave and head NE 0.2 miles. Turn left onto Irwin Rd and head north for 6.9 miles. Turn left onto Copper City Rd and head north 9.3 miles. Turn left on unmarked dirt road and head SW 0.2 miles, where you will see a pullout on the left that can be used for parking or camping. Copper City road is bumpy, but 2WD should suffice.

Cottonwood Basin (COBA): This site is within the Sweeney Granite Mountains Reserve, a University of California reserve. From I-40, head north for 9.9 miles. Turn left on unmarked dirt road (just beyond the Tortoise Warning sign and before the Soft Shoulder sign) and head SW for ~1.7 miles. Don't take immediate left. Head straight and slightly to the left toward the gate just 120 meters from the first fork. Use gate code (request code from Granite Mts) to access Yucca Bajada camp road. Drive SW 0.5 miles to Yucca Bajada camp. You could camp outside the gate.

Hart Mine (HAMI): This site is located within the Castle Mountain National Monument on the west side of the Castle Mountain Range. From Searchlight, NV, drive 7.0 miles WNW on Hwy 164. Turn left onto Walking Box Ranch Rd and drive SSW for 13.5 miles. Turn left on unmarked dirt road and drive 0.5 miles (DO NOT DRIVE FARTHER UP THIS ROAD) and turn left. The road will immediately fork. You can camp at this fork, but don't block the road going left (north). This road leading north from camp will take you to plot 2. Camp coordinates are E673313, N3910379).

High Tower (HITO): From I-40, take exit 120 and head south on Water Road. Paved road will curve to east. After pavement ends, continue straight for 200 m and turn right on High Tower Rd. Continue southeast on High Tower Rd for 8 miles to the site. Road will bisect plot 3. Camp in pullout for electrical tower. 4WD not necessary.

Ivanpah Cima (IVCI): From I-15, take exit 296 and head southeast on Nipton Rd and go 3.6 mi. Turn right (south) onto Ivanpah Rd and go 3.2 mi. Turn right (southwest) onto Morning Star Mine Rd and go 8.5 mi. Turn left at abandoned corral (Sixmile Tank) and head east on rugged dirt road for 3 miles to abandoned ranch. Abandoned corral (Tenmile Tank) is on plot 7. 4WD and high clearance recommended.

Kelbaker Road A (KERA): From Baker, drive ESE ~22.5 miles to site which is along the road. See KERB for camping location.

Kelbaker Road B (KERB): From Baker, drive ESE ~23.5 miles and turn right on Powerline Road and drive SW 0.95 miles. Turn right on power tower access road to a good camping spot. This camp is just north of the west side of plot 3.

Kelso Wash (KEWA): From I-15, take exit 272 and head southeast on Cima Rd for 17.6 miles. Turn right on Kelso Cima Rd and head southwest for 4.6 miles. Turn right on Mojave/Old Government Rd and head west for 4.6 miles. Plot 7 will be a 1 km hike to the north of road. There are some small pullouts along road to camp, or you can camp 3 miles west of site by large hill. 4WD and high clearance are recommended.

Kingston Peak (KIPE): From I-15, exit on Cima Rd and head north 0.4 miles. Continue straight onto Excelsior Mine Rd for another 12 miles. At Y, keep left and head another 6.8 miles to site. Park along roadside, and make sure vehicle is completely off the road. For camping, I recommend staying a good distance from the paved road due to the mining trucks making frequent trips at night. A good spot to camp is west of the Excelsior Mine-Kingston Rd Y (located 3.2 miles south of the MEMO site). From the Y, head north on Excelsior Mine Rd 50 meters and turn left on gravel road and head west for ~350 meters to a gate where there is parking for camping (E 614260, N 3941347).

Lee Flat (LEFL): From I-395, head east on CA-190 for 31.5 miles. Turn left and head north on Saline Valley Rd for 13.3 miles. At the Y intersection, keep left to turn onto White Mountain Talc Rd and head NNW for 1.8 miles. Turn right and head east for ~100 m and camp in pullout on left. Once you leave the pavement of CA-190, the dirt roads are bumpy, but should be passable with 2WD.

National Trails (NATR): From I-40, head southwest on National Trails Highway for 4.3 miles to wash crossing and park in pullout on northwest side of bridge. The highway bisects plot NATR02. You could camp at pullout next to the bridge, or 2.3 miles northeast of bridge is a paved pullout behind some large creosote shrubs. 4WD not necessary.

Old Woman Mountains (OWMT): From Essex, take Sunflower Springs Rd southeast out of town. Stay on Sunflower Springs Rd all the way to the plots. There are a number of other roads, marked and unmarked, but Sunflower Springs Rd is well-signed. Sunflower Springs Rd gets within about 2.5-3 km of the plots, the more direct road is closed due to wilderness area designation. Park (and camp) at 672450, 3829160 and walk in along closed access road. The drive in is almost an hour from Essex, 4wd and high clearance necessary.

Rainbow Wells (RAWEL): From I-15, take exit 272 for Cima Rd and head southeast for 17.6 miles. Turn right on Kelso Cima Rd and head south for 4.6 miles. Turn right on Mojave/Old Government Rd and head west for 7.4 miles. Turn right on unmarked dirt road and head north for 3 miles. This road bisects plot 7. There is a good camp site at Rainbow Wells 1 km southeast of plot 7. 4WD and high clearance are recommended.

Rattlesnake Mine (RAMI): From I-40, take exit 133 and head north on US-95 for 6.4 miles towards Searchlight/Las Vegas. Turn left on Goffs Rd and head west for 14 miles. Turn right on Lanfair Rd and head north for 16.3 miles. Turn right on dirt road and head east for 3.7 miles. Veer right at fork in road and continue 2.1 miles. Turn right at unmarked dirt and head south for 0.6 miles. This road will bisect plot 3 of this site. There is a good camp spot in the center of the plot where road crosses dry wash. 4WD and high clearance are recommended.

Shadow Valley (SHVA): From I-15, take exit 272 for Cima Rd and head 0.3 miles south. Turn right on Aiken Mine Rd and head southwest for 4 miles to the abandoned Rock Tank Ranch. This road bisects plots 3, 6, and 9. Camp at Rock Tank Ranch. 4WD and high clearance are recommended.

Sidewinder Mountain (SIMO): From Barstow, head south on I-15 for ~21 miles and get off on Dale Evans Pkwy and head SE for 2.4 miles. Turn left on Quarry Rd and head east 2 miles. Turn right onto Central Rd and head south 1 mile. Turn left onto Johnson Rd and head east ~6 miles to T intersection (a road in Google Maps that turns off Johnson Rd and heads SSE directly to plots 1 & 2 should be avoided). Turn right at the T intersection at end of Johnson Rd and head SE for ~50 meters and turn right again. Head SW ~200 meters and take next right. Continue SW for ~400 more meters (do not take any intermediate turns) to a T intersection. Turn right and go ~400 meters west to get to plots 1 & 2. Or turn left and head east ~1.3 miles to plots 4 & 5. From plot 2, poorly defined roads head south for ~1.7 miles where a crossroad can take you to plots 6-8. 4WD and high clearance vehicle required for this site to get thru sand and rocks. Reviewing unmarked dirt roads in Google Earth/Maps before you arrive is recommended as cell service is limited.

Soledad Mountain (SOMO): From the town of Mojave, head south on CA-14 for 3.4 miles and take a right turn on Silver Queen Rd. Head west on Silver Queen Rd for ~2.7 miles and then south on Mojave-Tropico Rd for ~1 mile to the site. There are dirt roads west of the site where you can find places to camp.

Stoddard Mountain (STMO): From I-15 in Barstow, head south on CA-247 for 21.7 miles. Turn right on Lucerne Valley Cutoff and head northwest for 6.6 miles to survey site. Camping is available behind a large rock that is a few hundred meters SE of site at these coordinates (E494897, N3835779). Lucerne Valley Cutoff is a bumpy dirt road but should be passable with 2WD.

Vontrigger Hills (VOHI): From I-40, take exit 133 and head north on US-95 for 6.4 miles towards Searchlight/Las Vegas. Turn left on Goffs Rd and head west for 14 miles. Turn right on Lanfair Rd and head north for 12.4 miles. Turn right on unmarked road and head northeast for 760 meters to large pullout on right. This is a good camping site. Plot 1 is ~1 km southeast of pullout. 4WD and high clearance are recommended.

Watson Wash (WAWA): From I-40, take exit 133 and head north on US-95 for 6.4 miles towards Searchlight/Las Vegas. Turn left on Goffs Rd and head west for 14 miles. Turn right on Lanfair Rd and head north for 16.3 miles. Turn left onto Cedar Canyon Rd and head west for 6.1 miles. Turn left on unmarked dirt road where Cedar Canyon Rd makes 90 degree turn to right. Follow this road for 5.4 miles to gate designating wilderness boundary. Hike south from gate ~2 km along sandy road to site. Road bisects plot 4. Good camping at gate. Or 600 meters to east of gate is a turn to south that goes to a nice camp too. 4WD and high clearance are required.

Appendix D

Bird species and numbers of individuals detected during area-search surveys in 2022. Site specific lists and numbers available in the California Avian Data Center.

Species	Number	Species	Number	Species	Number
Northern Shoveler	2	Say's Phoebe	26	Chipping Sparrow	3
Mallard	2	Ash-throated Flycatcher	215	Brewer's Sparrow	519
California Quail	6	Western Kingbird	57	Black-throated Sparrow	1879
Gambel's Quail	23	Warbling Vireo	1	Lark Sparrow	6
Eurasian Collared-Dove	3	Loggerhead Shrike	74	Dark-eyed Junco	7
White-winged Dove	1	Pinyon Jay	1	White-crowned Sparrow	731
Mourning Dove	91	Common Raven	238	Sagebrush Sparrow	20
Greater Roadrunner	30	Horned Lark	1117	Bell's Sparrow	301
Lesser Nighthawk	5	Tree Swallow	13	Vesper Sparrow	1
Common Poorwill	3	Violet-green Swallow	15	Lincoln's Sparrow	2
Vaux's Swift	16	N. Rough-winged Swallow	1	Spotted Towhee	1
White-throated Swift	14	Verdin	65	Yellow-headed Blackbird	1
Black-chinned Hummingbird	1	Rock Wren	66	Western Meadowlark	1
Costa's Hummingbird	3	Marsh Wren	2	Bullock's Oriole	4
Rufous Hummingbird	2	Bewick's Wren	2	Scott's Oriole	35
Turkey Vulture	25	Cactus Wren	70	Red-winged Blackbird	11
Sharp-shinned Hawk	1	Blue-gray Gnatcatcher	39	Brewer's Blackbird	1
Cooper's Hawk	1	Black-tailed Gnatcatcher	42	Great-tailed Grackle	4
Red-tailed Hawk	25	Ruby-crowned Kinglet	19	Orange-crowned Warbler	10
Barn Owl	1	Bendire's Thrasher	29	Lucy's Warbler	5
Great Horned Owl	6	LeConte's Thrasher	19	Nashville Warbler	1
Burrowing Owl	1	Crissal Thrasher	3	MacGillivray's Warbler	10
Ladder-backed Woodpecker	101	Sage Thrasher	16	Common Yellowthroat	1
Northern Flicker	4	Northern Mockingbird	27	Yellow Warbler	1
Gilded Flicker	3	Mountain Bluebird	13	Yellow-rumped Warbler	68
Northern x Gilded Flicker	1	Townsend's Solitaire	1	Black-throated Gray Warbler	6
American Kestrel	10	American Robin	1	Townsend's Warbler	5
Merlin	1	Phainopepla	177	Wilson's Warbler	11
Olive-sided Flycatcher	1	House Finch	405	Western Tanager	4
Western Wood-Pewee	3	Pine Siskin	1	Black-headed Grosbeak	2
Hammond's Flycatcher	4	Lesser Goldfinch	22	Lazuli Bunting	2
Gray Flycatcher	35	Lawrence's Goldfinch	3	Unidentified birds	64
Dusky Flycatcher	3				