AVIAN MONITORING FOR SPECIES AT RISK
NAVAL AIR WEAPONS STATION CHINA LAKE, CA, 2021

Final Report

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Under contract with:

Gulf South Research Corporation
8081 Innovation Park Drive
Baton Rouge, LA 70820

for

Naval Air Weapons Station China Lake
Environmental Management Division
429 E. Bowen Road, Stop 4014
China Lake, CA 93555

and

Naval Facilities Engineering Systems
Command, Southwest
750 Pacific Highway
San Diego, CA 92132-5190

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January 2022

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ABSTRACT

Avian monitoring was conducted at Naval Air Weapons Station China Lake (NAWSCL) consisting of spot-mapping for Inyo California towhee (*Melozone crissalis eremophilus*) and other breeding bird territories on four plots, and establishing point count stations on four plots to monitor avian migration and breeding during the spring and fall seasons.

A total of 81 species (42 breeding and 39 nonbreeding migrant) were recorded within the spot-mapping sites during five visits from March to mid-May 2021. The Crow Canyon and Mountain Springs sites contained the greatest species diversity (33) and possessed the most breeding territories (39 for Crow Canyon and 33 for Mountain Springs). Spot-mapping results highlighted the importance of the Crow Canyon site, which contained the largest number of Inyo California towhee territories, as well as many other sensitive and declining species such as black-throated sparrow (*Amphispiza bilineata*), Bell's sparrow (*Artemisiospiza belli*), yellow warbler (*Setophaga petechia*), and black-headed grosbeak (*Pheucticus melanocephalus*).

A total of 64 species during spring migration and 54 species during fall migration were detected at the point count sites. The Wildrose and Joshua Spring sites had the highest species richness of all sites as well as the greatest number of birds in fall. The location with the second highest species richness and the greatest number of birds in the spring was the Mountain Springs and Mammoth Mine sites. Overall, species richness was higher in the spring than the fall; although, it was higher in the fall at the Wildrose and Joshua Spring site, and did not change at the Mountain Springs and Mammoth Mine site.

Spot-mapping was effective for detecting Inyo California towhee territories and will provide a good baseline for future work. In most cases, estimates of towhee populations were higher than those reported by LaBerteaux (2021); which was expected due to a higher intensity of effort. The only exception was the Mountain Spring site where LaBerteaux detected six individuals compared to two territories (4 individuals) detected during this survey. Additionally, greater levels of breeding activity were detected during this survey, which was expected as a result of repeated survey effort.

INTRODUCTION

Bird populations in the Mojave Desert have experienced a severe decline over the past century indicating a collapse of desert bird communities (Iknayan and Bessinger 2018). This discovery was only possible due to a long-term dataset collected in the early to mid-1900s, underscoring the importance of wide-ranging, long-term monitoring. Creating effective conservation actions to recover or at least stabilize endangered and sensitive avian populations and to prevent other species from declining requires a long-standing monitoring program.

The Naval Facilities Engineering Systems Command, Southwest (NAVFAC SW) funded a multi-faceted field effort to support the establishment of a long-term avian monitoring program. NAVFAC SW contracted Gulf Southwest Research Corporation (GSRC) to conduct this work. Data collected under this project will support continued management of avian species at Naval Air Weapons Station (NAWSCL) and supports federal requirements for avian conservation under the Migratory Bird Treaty Act, and species listed under the Endangered Species Act.

The Southern Sierra Research Station (SSRS), as a subcontractor to GSRC, conducted the avian monitoring work at NAWS China Lake in accordance with the Scope of Work (SOW), Contract # N62473-20-D-0022, Task Order # N6247320F5396. This project included spot-mapping for Inyo California towhee (*Melozone crissalis eremophilus*) and other breeding bird territories on four plots located on NAWS China Lake. It also included establishing point count stations on four plots to monitor avian migration and breeding during the spring and fall seasons.

STUDY AREA

The study area is in the southern Argus Mountain Range, Inyo County, California; which is located east of the Sierra Nevada and Coso Range, and west of the Slate and Panamint Ranges in the northern Mojave Desert (Figure 1). When selecting sites, preference was given to areas previously occupied by Inyo California towhees.

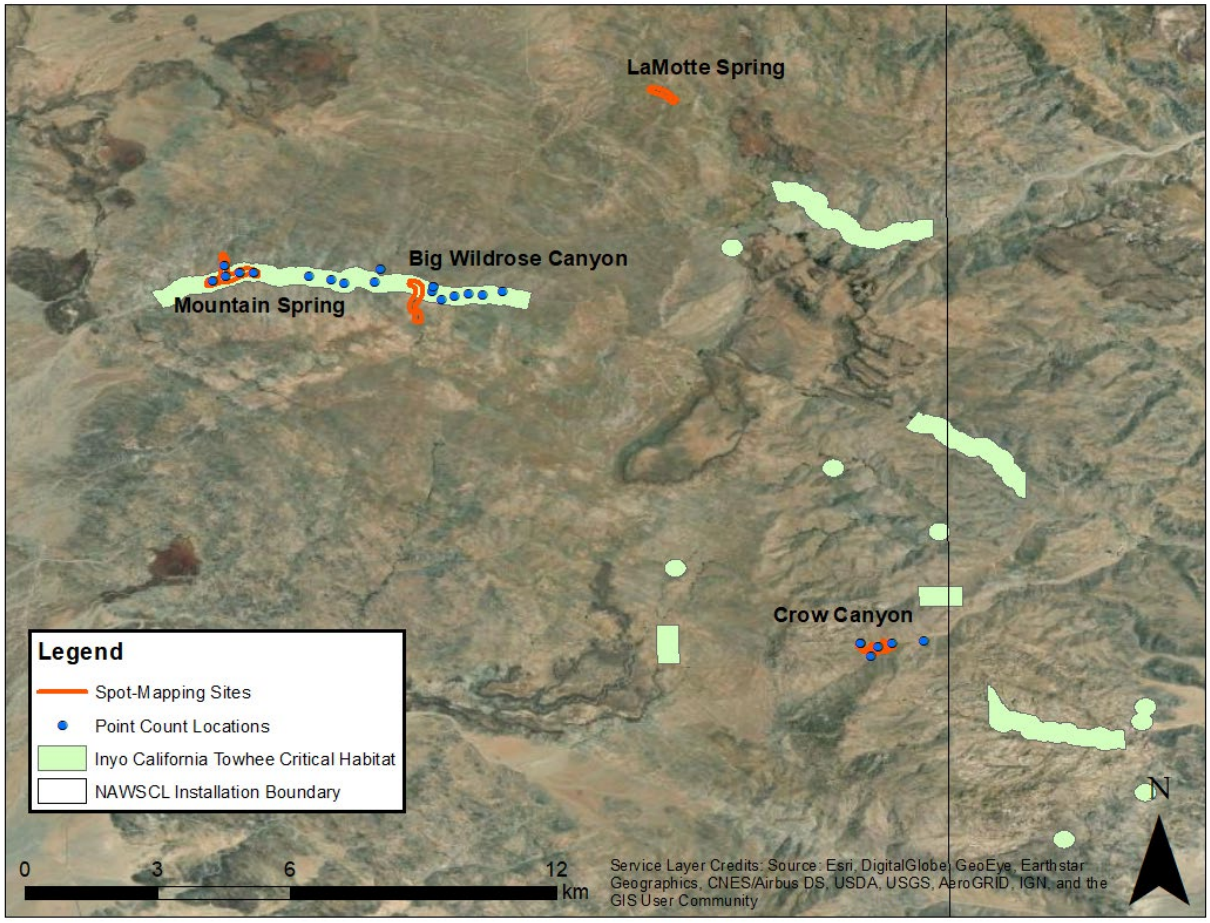

Figure 1. Location of spot-mapping and point count areas within China Lake Naval Air Weapons Station.

Four survey sites were selected for spot-mapping Inyo California towhees and other avian species, and four point count stations were established to document avian use during migration (Figure 1, Table 1, Appendices A and B).

Table 1. Avian Monitoring Sites on Naval Weapons Station China Lake surveyed. Coordinates are given for sites from past reports from D. LaBerteaux that are encompassed within our study sites.

Site Name[1]	UTM (NAD 83) Easting	UTM (NAD 83) Northing
Spot-mapping Locations		
Mountain Spring	448953	3978338
Big Wildrose Canyon		
Big Wildrose Canyon Site 1	452153	3977698
Big Wildrose Canyon Site 2	452255	3977353
Big Wildrose Canyon Site 3	452309	3976887
LaMotte Spring	456562	3982444
Crow Canyon		
Crow Canyon Site 1	460741	3969979
Crow Canyon Site 2	460902	3969909
Crow Canyon Site 3	460663	3969919
Crow Canyon Site 4	460336	3969900
Crow Canyon Site 5	460506	3969732
Migration Point Count Locations		
Mountain Springs and Mammoth Mine		
Mountain Springs Site 7	450247	3978307
Mountain Springs Site 8	450802	3978155
Mountain Springs Site 9	451458	3978128
Lower Mammoth Mine	451609	3978444
Upper Mammoth Mine	451900	3978925
Wildrose and Joshua Spring[2]		
Mountain Springs Site 12	452667	3977678
Mountain Springs Site 15	453373	3977825
Joshua Spring	453814	3977977
Mountain Spring Site	448953	3978338
Crow Canyon		
Crow Canyon Site 1	460741	3969979
Crow Canyon Site 2	460902	3969909
Crow Canyon Site 3	460663	3969919
Crow Canyon Site 4	460336	3969900
Crow Canyon Site 5	460506	3969732

[1]These sites are broken down to cross-reference names from past reports by D. LaBerteaux and are not survey points within the area.

[2] This location is near Wildrose Spring, but we are cross-referencing names from past reports by D. LaBerteaux

METHODS

Spot-Mapping Surveys

Spot-mapping was conducted at four plots, five times each during the 2021 breeding season (March-May) (Table 1, Appendices A and C). Surveys started at sunrise and had no definite end

time, though they ended when bird activity was low (i.e., including when temperatures exceeded 100 degrees Fahrenheit). Biologists endeavored to spend enough time conducting area searches to detect > 90 percent of all individual birds present on the plot during each survey. The survey starting point was alternated in consecutive visits to account for bias created by daily bird activity patterns. All birds detected were recorded using the ArcGIS Collector app (ESRI, 2018) on a tablet carried by surveyors. Each observation of individual birds, pairs or groups of birds of the same species, dependent young, and nests was recorded on the map. For each bird detected, sex and age was recorded when possible. Additionally, behavioral data, including counter singing, territorial displays, territorial disputes, and courtship, were collected to determine territoriality and breeding status.

Breeding and non-breeding status was established for all detected birds. This status was determined either through direct observation, or through a synthesis of the surveyor's cumulative knowledge of the observed birds at the end of the field season. The following factors were considered when designating detected birds as breeding:

- If confirmed breeding evidence was detected on one or both (spot map, point count) of the surveys.
- If probable or possible evidence was detected on both surveys for species that may be either resident breeders or migrants.
- If probable or possible evidence was detected on one survey for known local breeders.

Territories were delineated for breeding species by updating and revising estimated individual territory boundaries after each visit. Within each plot, territories for each species were mapped in ArcGIS with a sequential numbering system.

Point Count Surveys

Point count surveys were conducted at four plots during 2021, three times during spring migration and three times during fall migration (Appendices D and E). Point count stations were separated by at least 200 meters and by 250 meters when possible. Point count surveys were conducted at each site for 10 minute intervals with surveys commencing 15 minutes prior to sunrise. All birds seen and heard within a 100-m (328-ft) radius were recorded. The detection method for each individual (visually and/or aurally), age (adult, local nestling, juvenile, or unknown), sex (if known), and the estimated distance (using a rangefinder) were recorded. Any associated behaviors for each individual (singing, calling, perched, etc.) were also recorded. To account for differences in bird activity throughout the morning, the starting point for each consecutive survey was alternated on each repeated transect (i.e. first round began at point 1, second round began at point 8, etc.).

RESULTS

Spot-mapping

A total of 81 species (42 breeding and 39 nonbreeding migrant) were recorded within the spot-mapping sites (Table 2, Appendices A and B) during five visits from March to mid-May. The Crow Canyon and Mountain Springs sites contained the greatest species diversity (33 species) and possessed the most breeding territories (39 Crow Canyon and 33 Mountain Springs).

Table 2. Species richness and territory numbers at spot-mapping sites on Naval Air Weapons Station China Lake.

	Crow Canyon	Mountain Spring	Big Wildrose Canyon	LaMotte Spring	Total
Breeding Species Territories	39	33	18	20	110
Breeding Species Richness	33	33	24	23	40
Migrant Species Richness[1]	28	26	22	21	40
Total Species Richness	61	59	40	41	81

[1]Includes two unknown status (breeding or migrant) species: Downy woodpecker and Hooded Oriole.

All spot-mapping sites contained at least one breeding territory. House finch (*Haemorhous mexicanus*) was the most abundant species across all sites, followed by black-throated sparrow (*Amphispiza bilineata)*, Inyo California towhee (*Pipilo crissalis eremophilus*), and Bewick's wren (*Thryomanes bewickii)* (Table 3). Bell's sparrow (*Artemisiospiza belli*) was common at Crow Canyon and was also present at the other three sites. At least one yellow warbler (*Setophaga petechia*) territory was present at Crow Canyon as well as other detections (possibly migrants) at other sites. There were no willow flycatcher (*Empidonax traillii*) territories, though some migrants were detected in Wildrose Canyon and LaMotte Spring. Crow Canyon possessed the highest abundance of Inyo California Towhee territories (7), followed by La Motte Springs (3), and Mountain Springs (2) (Table 3, Appendix D).

Table 3. The number of territories of the top eleven species at each spot-mapping location at Naval Air Weapons Station China Lake in 2021 (d= detected).

Species	Crow Canyon	Mountain Spring	Big Wildrose Canyon	LaMotte Spring	Total
house finch	6	6	1	4	17
Black-throated Sparrow	5	7	2	d	14
Inyo California Towhee	7	2	1	3	13
Bewick's Wren	1	4	5	3	13
Bell's Sparrow	7	d	1	1	9
Blue-gray Gnatcatcher	3	1	d	3	7
Mourning Dove	d	3	1	1	5
Spotted Towhee	d	d	2	3	5
Black-headed Grosbeak	1	3	1	d	5
Costa's Hummingbird	1	2	1	d	4
Say's Phoebe	2	2	d	d	4

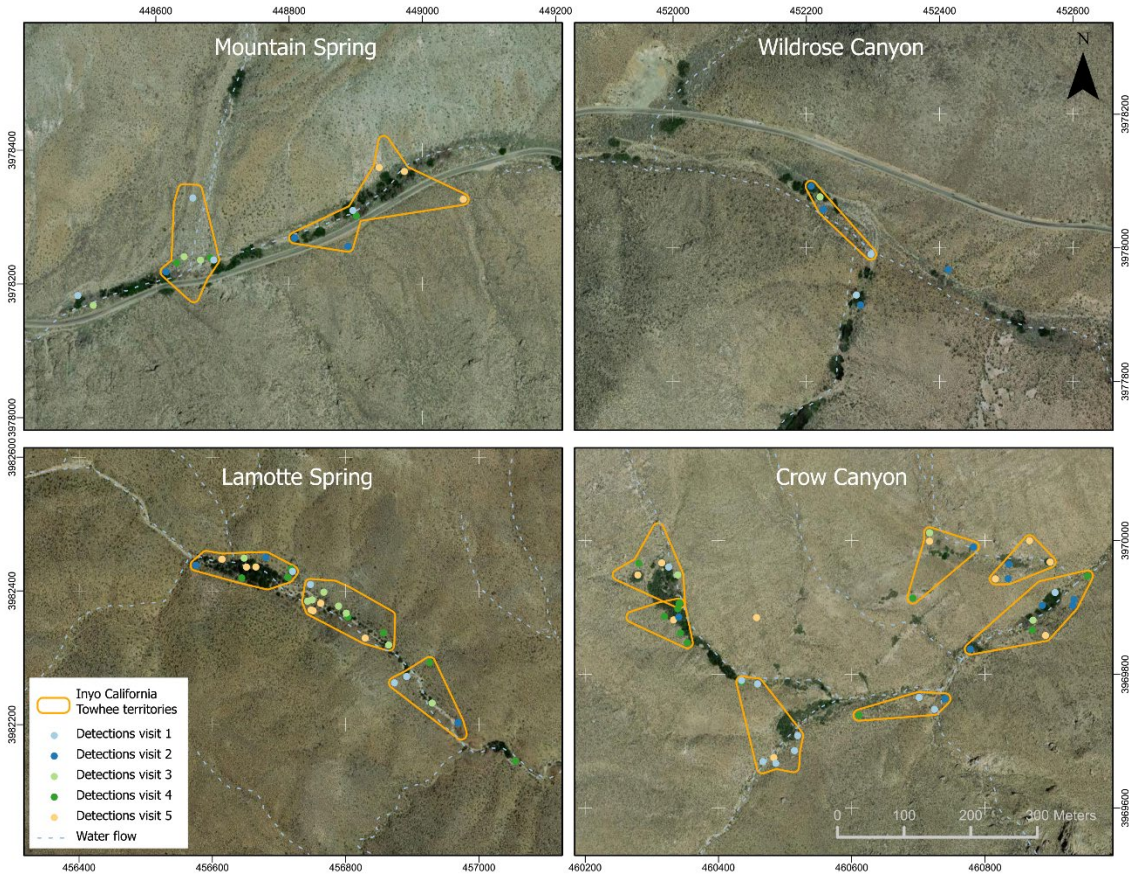

Figure 2. Inyo California towhee territories at the four spot-mapping sites.

Point Count Surveys

A total of 64 species during spring migration and 54 species during fall migration were detected at the point count sites (Table 4, Appendices E and F). The Wildrose and Joshua Spring site had the highest species richness of all sites as well as the greatest number of birds in the fall. The location with the second highest species richness and the greatest number of birds in the spring was the Mountain Springs and Mammoth Mine site (Table 4). Overall, species richness was higher in the spring than in the fall; although it was higher in the fall at the Wildrose and Joshua Spring site and was the same at the Mountain Springs and Mammoth Mine site. Total bird abundance was similar during both spring and fall migration (Table 4); however, it was higher at three of the four sites during the spring migration.

Table 4. Species richness and abundance (average no. individuals per survey round) of birds detected during spring and fall migration.

	Crow Canyon	**Mountain Spring**	**Mountain Springs and Mammoth Mine**	**Wildrose and Joshua Spring**	**Total**
Spring bird abundance	37.2	36.4	64.0	41.7	179.3
Spring species richness	25	31	33	37	64
Fall bird abundance	20.8	29.3	55.3	59.8	165.2
Fall species richness	14	22	33	39	40
Total species richness	26	36	40	41	66

Similar to the spot-mapping results, the house finch was the most abundant species for the point counts, followed by black-throated sparrow and white-crowned sparrow (*Zonotrichia leucophrys*) (Table 5). Inyo California towhee was the fifth most abundant species with 49 detections over the six rounds of point count surveys. These detections were fairly evenly spread across the four sites. Black-throated sparrow was mostly detected at the Crow Canyon and Mountain Spring sites, with moderate numbers at the Mountain Springs and Mammoth Mine sites. Bell's sparrow was the eighth most abundant species, with the majority of its population occurring at the Crow Canyon (32%) and Mountain Springs (37.5%) sites, and a modest number (18.8%) detected at Wildrose and Joshua Spring site.

Table 5. Top ten species detected by number of individuals at each location.

Species	Crow Canyon	Mountain Spring	Mountain Springs and Mammoth Mine	Wildrose and Joshua Spring	Total
House Finch	18	23	26	23	90
Black-throated Sparrow	18	25	12	5	60
White-crowned Sparrow	6	11	15	22	54
Bewick's Wren	1	12	20	18	51
Inyo California Towhee	13	14	10	12	49
Ruby-crowned Kinglet	4	13	9	9	35
Blue-gray Gnatcatcher	7	7	10	10	34
Bell's Sparrow	11	12	3	6	32
Western Tanager	1	10	13	7	31
Wilson's Warbler	4	5	7	8	24

DISCUSSION

Spot-mapping

Spot-mapping results indicate the importance of the Crow Canyon site, which contained the largest number of Inyo California towhee territories, as well as many other sensitive and declining species including black-throated sparrow, Bell's sparrow, yellow warbler, black-headed grosbeak, and black-chinned sparrow. The Crow Canyon site also possesses the highest species richness and breeding abundance of all sites surveyed. The Mountain Springs site also possessed a high species richness and breeding abundance. Although it had fewer towhee territories than the Crow Canyon site, the area has contained larger towhee populations in the past (LaBerteaux 2015). Migrant willow flycatchers were detected at two spot-mapping sites, Wildrose Canyon and LaMotte Spring. As peak migration for willow flycatchers does not typically occur until early June, it is likely that most (if not all) of the spot-mapping sites are used by this species.

Other late migrants/breeders may have been missed as a result of spot-map visits concluding in mid-May. For example, Costa's hummingbird (*Calypte costae*) territories may have been more prevalent than actually recorded, but this species was not observed until the last two surveys and protocols precluded creating territories with only two detections.

Spot-mapping was effective for detecting Inyo California towhee territories and will provide a good baseline for future work. In most cases, estimates of towhee populations were higher than LaBerteaux (2021), which was expected due to a higher intensity of effort. The only exception was the Mountain Springs site where LaBerteaux reported six individuals, compared

to the two territories (4 individuals) detected during these surveys. Additionally, greater levels of breeding activity were also detected, which was expected as a result of repeated survey effort.

Laberteaux (2021) reported that the Inyo California towhee population in the study area is still at significantly lower levels than in 2007, likely due to the historic drought conditions of 2012-2016. This hypothesis is supported by Ikanayan and Bessinger (2018), who reported that drying (mostly lack of precipitation), caused by climate change was the most important driver of site-level persistence of bird populations in the Mojave Desert. They documented a severe decline of Mojave bird populations; an average of 43% of species were lost across the various sites. Populations located in nearby Death Valley experienced the strongest declines; thus, bird populations on NAWS China Lake have likely undergone similar declines.

Point Count Surveys

Point count surveys provide a good baseline for gathering much needed information on stopover sites for migrating birds in addition to collecting data on breeding birds. The birds detected in the surveys were a mix of resident and migrant breeders, migrating birds, and wintering birds.

Species richness and species abundance varied across sites with differences found between seasons. Fewer birds were detected during the fall than the spring at most sites. These differences may be due to increased water availability in the spring. The importance of water to birds is well documented, and its importance is even more critical in desert climates (Faaborg et al. 1984, Hinjosa-Huerta 2008, Iknayan and Bessinger 2018).

Another possible explanation for the lower number of birds detected during fall surveys may have been the presence of several active wildfires in the surrounding areas. Smoke produced by nearby fires may have affected surveys in three ways: the ability to visibly observe bird activity may be diminished; a reduction in the overall level of avian activity may occur; and the topography of the survey sites may increase smoke retention in the canyon bottoms, thereby acting as a repellant to migratory birds. Although it is not fully understood how birds respond to active wildfires, it has been documented that birds can temporarily stop migration or modify their migratory route to avoid high concentrations of smoke (Overton et al. 2021).

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

The recognition of the precipitous decline of birds in North America has underscored the need for more research into the full life-cycle of declining species so limiting factors can be identified and effective conservation actions can be devised (Faaborg et al. 2010, Rosenberg et al. 2019). Too often, research is focused on the breeding season which makes it difficult to identify limiting factors during the non-breeding season, as well as understand how seasonal interactions drive population change. This project will help fill in this gap by providing essential

information on critical migration stopover sites in a desert region. After many years of work, this data may help identify and prioritize conservation of important stopover sites in the area. These sites are important not only to migrants, but also to breeding species as well. In addition, they provide water and/or food to species that breed in upland sites away from the riparian areas.

Desert springs are important resources for wildlife and may become even more essential as water resources becomes more limited in the region as a result of climate change. Areas with water may act as refugia during this period (Iknayan and Bessinger 2018), increasing the importance of protecting these areas. Water sources and the habitat around them can be damaged by feral equines (i.e., horses and donkeys). Signs of equine activity were observed in most of the study sites (especially Crow Canyon) and damage from them degrades the habitat for birds and other wildlife. We recommend continuing and possibly increasing the feral equine removal program on the base. Continued monitoring also can provide information to assess the effectiveness of the feral equine removal program.

While this project provides a foundation or monitoring migrating birds, there currently are no programs to monitor wintering birds which is also a critical component of full life-cycle research. We recommend initiating a project to monitor wintering birds as well. This could be achieved through point counts or automated recording units (ARUs) (Darras et al. 2018). ARUs are more convenient, typically take less labor, and may be able to detect more species because they are monitoring areas for longer periods. However, accurate abundance estimates cannot be obtained through ARUs; thus, it's important to assess the goals of the project. We recommend a combination of point counts and ARUs for avian monitoring on the base. It may be possible to merge the results of the point counts to ARUs to identify correlations with bird abundance and ARUs. As many of the sites in the study area are located in small desert springs, finding effective methods for deploying ARUs makes it possible to cover more areas for less money. Research is currently ongoing on this topic, and better methods are rapidly being developed.

Another potential method of monitoring bird (and other wildlife) use on the base is through the Motus Wildlife Tracking System (Motus, motus.org). Motus is an international collaborative research network of automated radiotelemetry receiving stations. Spearheaded by Bird Studies Canada (BSC), Motus facilitates landscape-scale research and education on the ecology and conservation of migratory animals. The current receiver station array comprises more than 1,200 sites from the Canadian Arctic to South America, and is operated by more than 1,000 collaborators. Since 2013, more than 30,000 individuals of more than 250 species have been monitored using this system. The Motus system is well established in the east and is growing exponentially in the west; the probability of detecting tagged birds increases every month.

Although our spot-mapping was successful in identifying Inyo California towhee territories and detecting breeding, it was not as effective at finding territories of birds that breed later in the season. We recommend that the number of visits be increased from five to seven, or alternatively, to six with additional time in between visits (i.e., 12 to 14 days).

Lastly, the two methods (spot map versus point count) indicated different areas of importance. For example, Crow Canyon was the most important area for spot-mapping; however, when examining point count results (during migration periods), Crow Canyon did not stand out. This illustrates the importance of using different techniques and evaluating the information that they provide. Finally, constant effort mist-netting has the potential to provide another layer of information on avian use in the area. We recommend reestablishing the MAPS station at Mountain Springs.

ACKNOWLEDGMENTS

NAVFAC SW provided funding for this project. The contract for the project was awarded to GSRC, who subcontracted SSRS for this work. Lauren Solomon and Josh McEnany of GSRC provided guidance, support, and oversight for this project. Thanks goes to the individuals that contributed to this study: Edwin Jacobo, Nidia Jaime, Denise Laberteaux, Sean Rowe, and Kristie Stein, for their dedicated work in the field; John Stanek for designing the spot-mapping database in ArcGIS Collector; Maggie Pasanen for data entry and other support work. Cindy Hopkins and Ericka Buckreis of the NAVFAC Environmental Management Division, NAWS China Lake, provided logistical support and valuable information.

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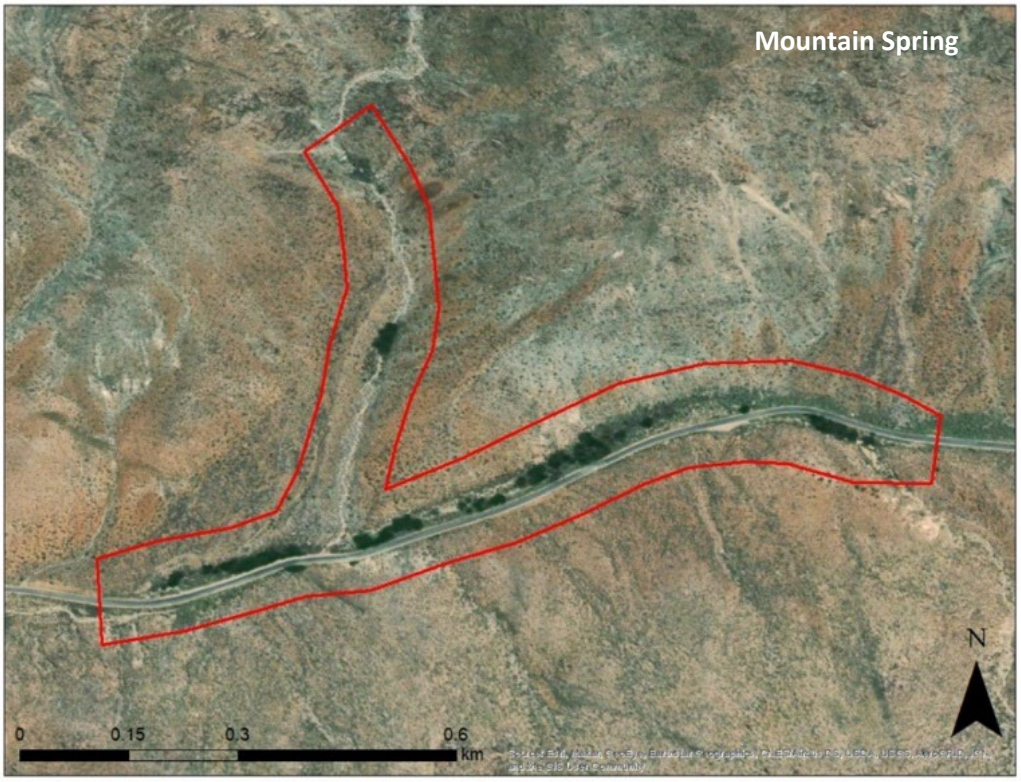
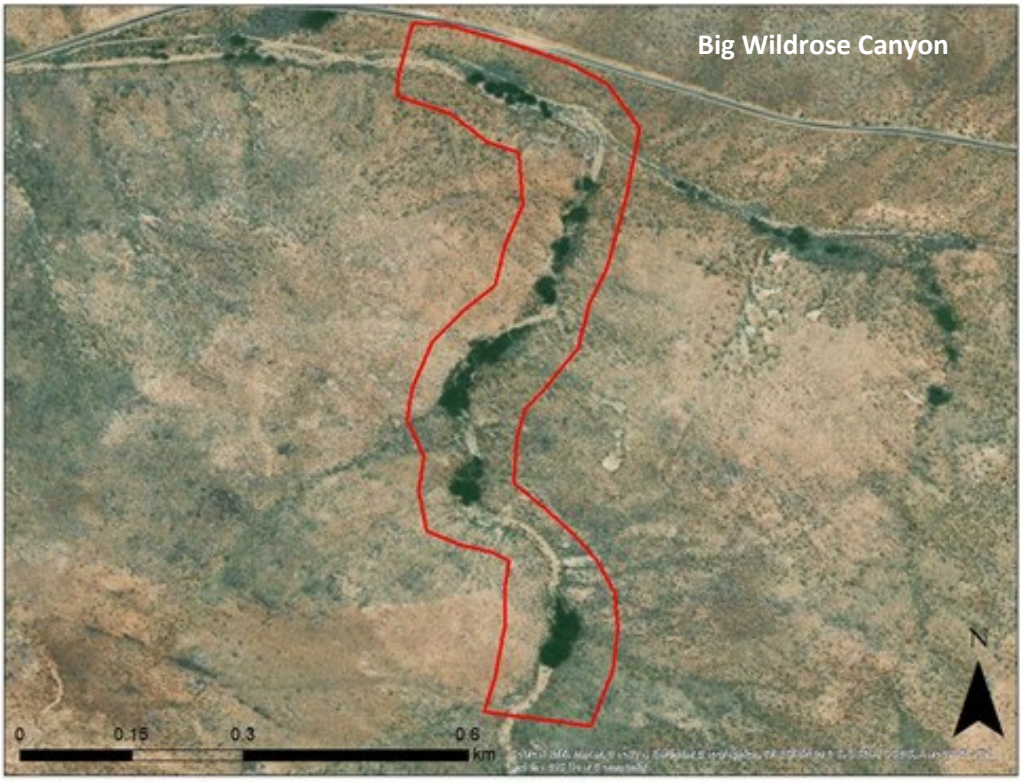
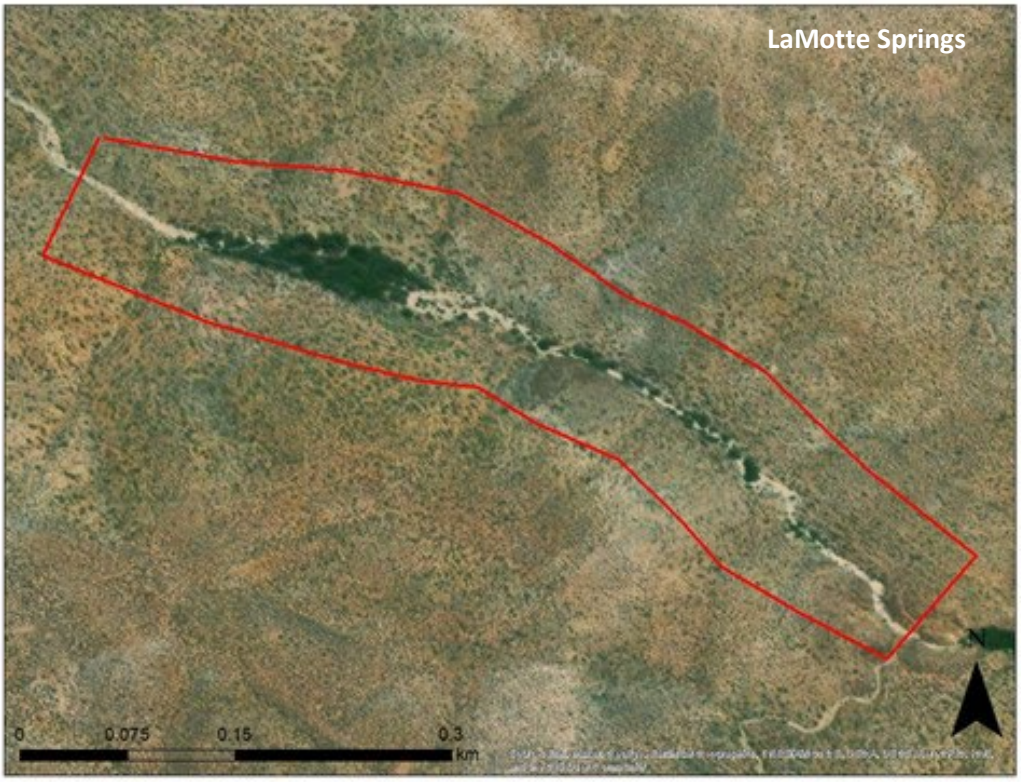
Appendix A. Spot-mapping sites and boundaries.






LaMotte Springs
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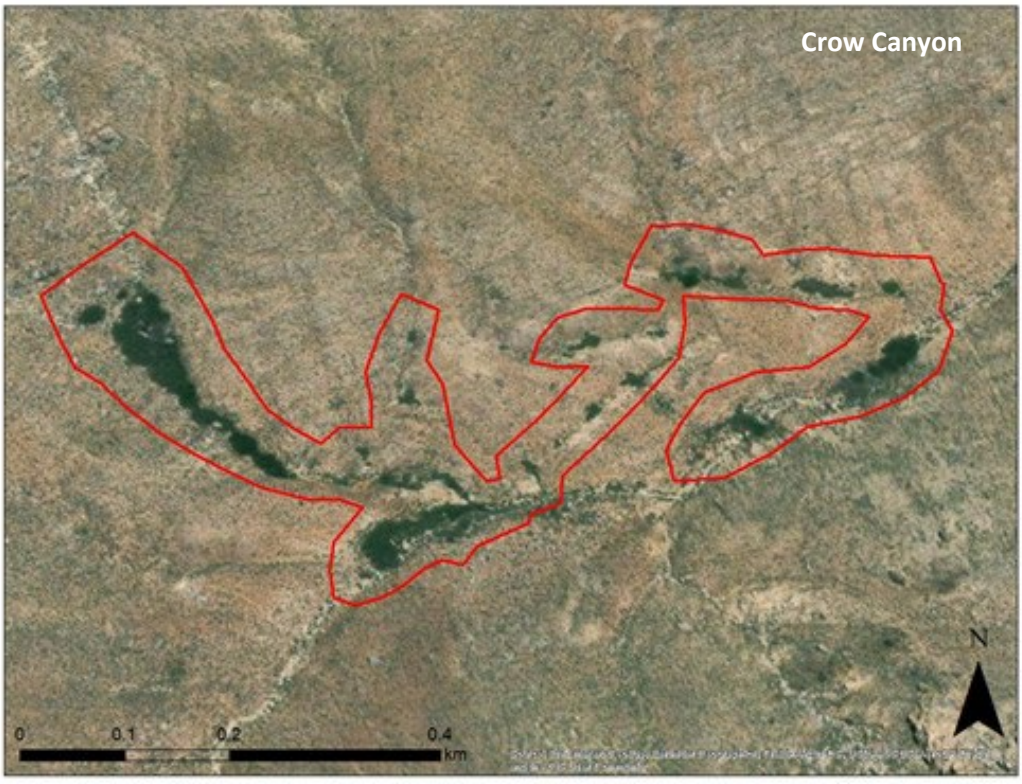
0.15
0.3
km
N


Crow Canyon
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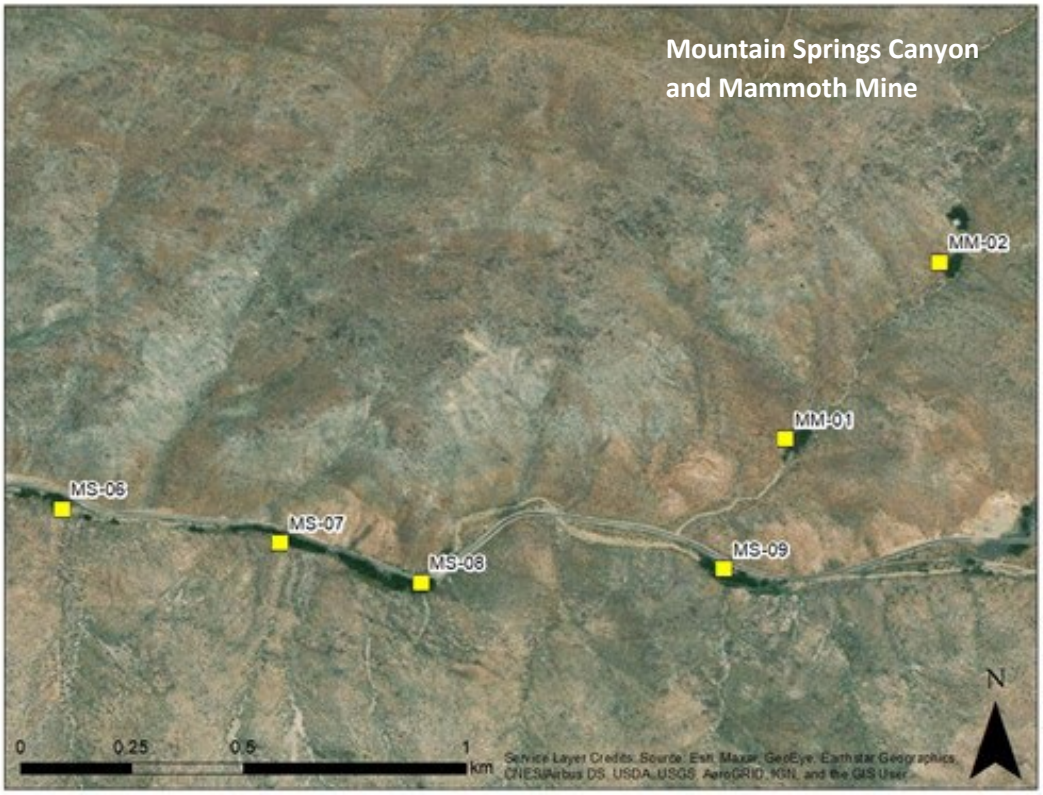
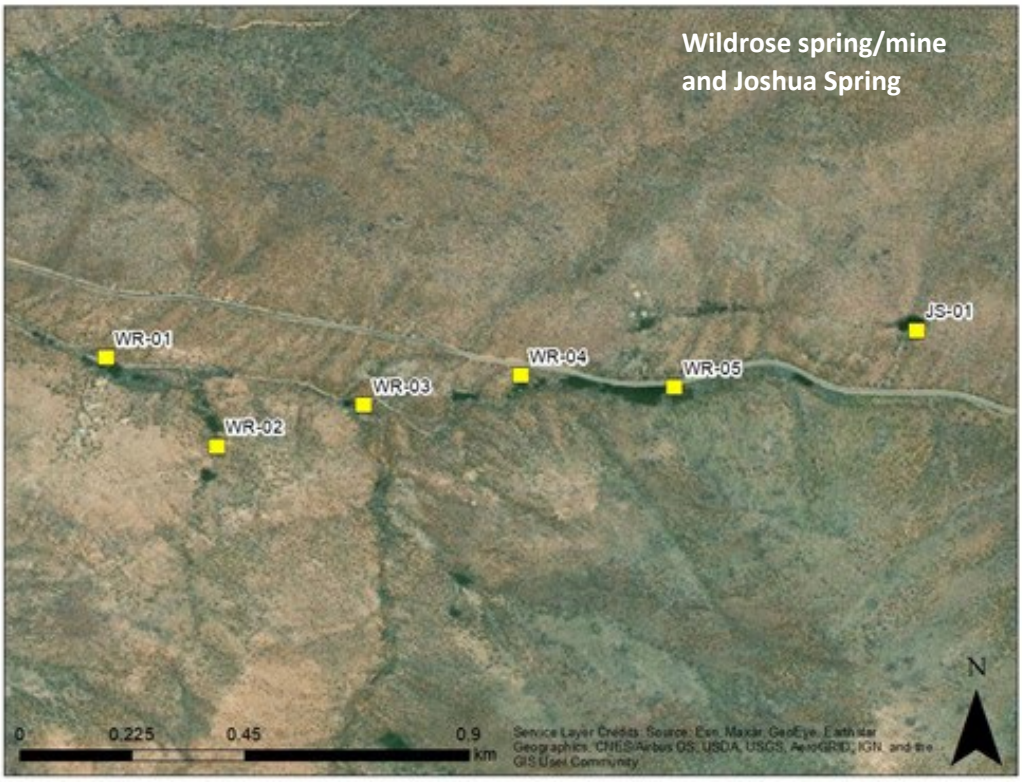
0.1
0.2
0.4
km
N

Appendix B. Point count station locations.




Wildrose spring/mine
and Joshua Spring
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WR-02
WR-03
WR-04
WR-05
JS-01
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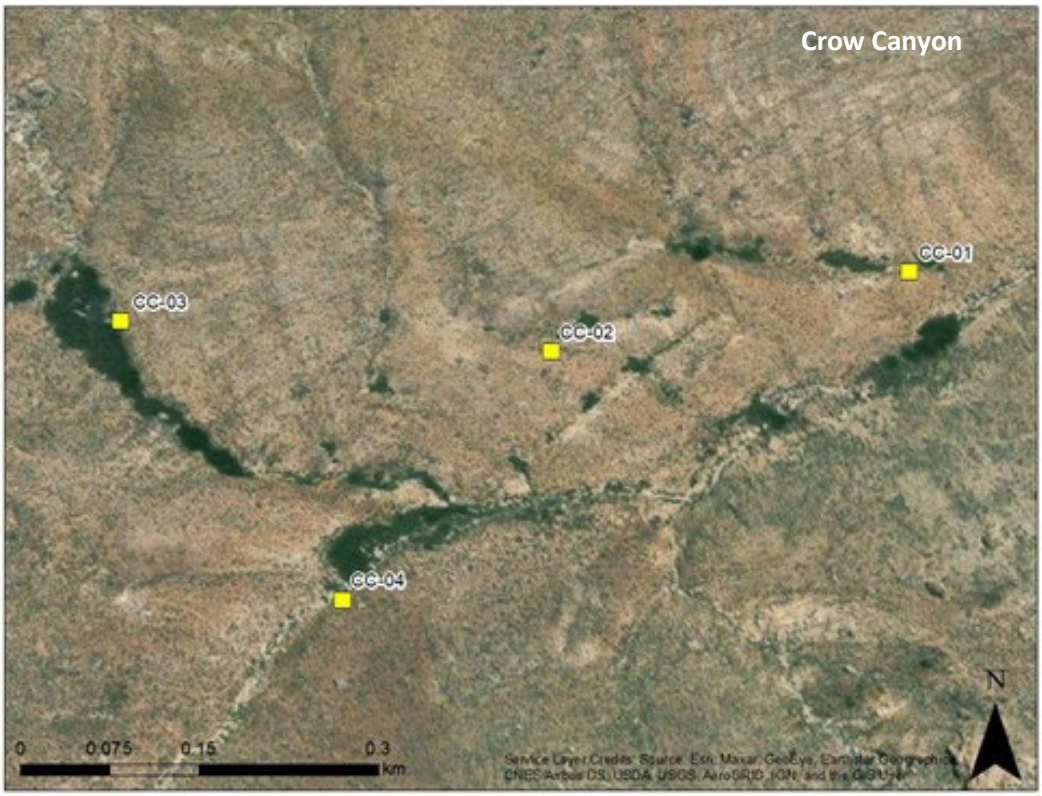
0.45
0.9
km
N


Crow Canyon
CC-01
CC-02
CC-03
CC-04
0
0.075
0.15
0.3
km
N

Appendix C. Spot-mapping Survey dates and surveyors.

Date	Site	Surveyor
3/20/2021	Mountain Spring	Kristie Stein
3/20/2021	Big Wildrose Canyon	Sean Rowe
3/21/2021	Crow Canyon	Sean Rowe
3/21/2021	LaMotte Spring	Kristie Stein
4/5/2021	Mountain Spring	Kristie Stein
4/6/2021	Big Wildrose Canyon	Kristie Stein
4/8/2021	Crow Canyon	Nidia Jaime
4/13/2021	LaMotte Spring	Kristie Stein
4/21/2021	Crow Canyon	Edwin Jacobo
4/23/2021	LaMotte Spring	Nidia Jaime
4/25/2021	Mountain Spring	Nidia Jaime
4/25/2021	Big Wildrose Canyon	Kristie Stein
5/4/2021	Mountain Spring	Kristie Stein
5/4/2021	Big Wildrose Canyon	Sean Rowe
5/5/2021	LaMotte Spring	Kristie Stein
5/6/2021	Crow Canyon	Nidia Jaime
5/18/2021	Big Wildrose Canyon	Edwin Jacobo
5/18/2021	Mountain Spring	Nidia Jaime
5/19/2021	Crow Canyon	Edwin Jacobo
5/19/2021	LaMotte Spring	Nidia Jaime

Appendix D. Number of territories, detections, and breeding status of all birds detected (d=detected) in China Lake NAWS Spot map locations in 2021.

Species	Breeding Status	Crow Canyon	Mountain Spring	Big Wildrose Canyon	Lamotte Spring	Total Territories
Chukar	Breeding	d	d	d	d	
California Quail	Breeding	1			d	1
Turkey Vulture	Breeding	d	d			
Sharp-shinned Hawk	Breeding	1		d		1
Cooper's Hawk	Breeding	d				
Red-tailed Hawk	Breeding	d			d	
American Kestrel	Breeding		d			
Merlin	Migratory	d				
Peregrine Falcon	Breeding		d			
Mourning Dove	Breeding	d	3	1	1	5
Greater Roadrunner	Breeding	1	d			1
Costa's Hummingbird	Breeding	1	2	1	d	4
Rufous Hummingbird	Migratory	d	d			
Ladder-backed Woodpecker	Breeding	d	d		1	1
Downy Woodpecker	Unknown			d		
Northern Flicker	Migratory			d		
Olive-sided Flycatcher	Migratory		d			
Western Wood-pewee	Migratory	d	d		d	
Willow Flycatcher	Migratory			d	d	
Hammond's Flycatcher	Migratory	d		d		
Gray Flycatcher	Migratory	d	d	d	d	
Dusky Flycatcher	Migratory	d	d	d		
Pacific-slope Flycatcher	Migratory	d	d	d		
Black Phoebe	Breeding	d	d			
Say's Phoebe	Breeding	2	2	d	d	4
Ash-throated Flycatcher	Breeding	1	d	d		1
Western Kingbird	Breeding	d	d	d		
Loggerhead Shrike	Breeding				d	
Plumbeous Vireo	Migratory	d	d	d	d	
Cassin's Vireo	Migratory	d	d		d	
Warbling Vireo	Migratory	d	d		d	
California Scrub-Jay	Breeding	d		d		
Pinyon Jay	Breeding	d				
Common Raven	Breeding	d	2	d		2
Violet-green Swallow	Migratory	d				
Oak Titmouse	Breeding	d				
Bushtit	Breeding	1	d	1	1	3

Appendix D. Continued

Species	Breeding Status	Crow Canyon	Mountain Spring	Big Wildrose Canyon	Lamotte Spring	Total Territories
Canyon Wren	Breeding		1			1
Rock Wren	Breeding		d	1	d	1
Bewick's Wren	Breeding	1	4	5	3	13
House Wren	Migratory	d	d	d		
Ruby-crowned Kinglet	Migratory	d	d	d	d	
Blue-gray Gnatcatcher	Breeding	3	1	d	3	7
Mountain Bluebird	Migratory	d			d	
Townsend's Solitaire	Migratory		d			
Swainson's Thrush	Migratory	d	d	d	d	
Hermit Thrush	Migratory		d	d	d	
Phainopepla	Breeding	d	d	d		
Orange-crowned Warbler	Breeding	d	d	d	d	
Nashville Warbler	Migratory			d		
Yellow Warbler	Breeding	1	d		d	1
Yellow-rumped Warbler	Migratory	d	d	d	d	
Black-throated Gray Warbler	Migratory	d		d		
Townsend's Warbler	Migratory	d		d	d	
Hermit Warbler	Migratory	d	d		d	
Magnolia Warbler	Migratory	d	d	d	d	
Common Yellowthroat	Migratory	d	d		d	
Wilson's Warbler	Migratory	d	d	d	d	
Spotted Towhee	Breeding	d	d	2	3	5
Inyo California Towhee	Breeding	7	2	1	3	13
Chipping Sparrow	Migratory		d			
Black-chinned Sparrow	Breeding	d		1	d	1
Black-throated Sparrow	Breeding	5	7	2	d	14
Bell's Sparrow	Breeding	7	d	1	1	9
Fox Sparrow	Migratory	d	d			
Lincoln's Sparrow	Migratory	d	d	d	d	
White-crowned Sparrow	Migratory	d	d	d	d	
Dark-eyed Junco	Migratory	d	d	d	d	
Black-headed Grosbeak	Breeding	1	3	1	d	5
Lazuli Bunting	Breeding		d	d		
Western Meadowlark	Migratory		d			
Brown-headed Cowbird	Breeding		d			
Hooded Oriole	Unknown				d	
Bullock's Oriole	Breeding	d	d			
Scott's Oriole	Breeding		d			

Western Tanager	Migratory	d	d	d	d	

Appendix D. Continued

Species	Breeding Status	Crow Canyon	Mountain Spring	Big Wildrose Canyon	Lamotte Spring	Total Territories
Pine Siskin	Breeding	d	d		d	
Lesser Goldfinch	Breeding	d	d	d	d	
Lawrence's Goldfinch	Migratory	d				
Cassin's Finch	Migratory	d				
House Finch	Breeding	6	6	1	4	17

Appendix E. Point Count Survey dates and surveyors.

Date	Site	Surveyor	Season
4/01/2021	Mountain Spring	Sean Rowe	Spring
4/01/2021	Wildrose Spring/Mine and Joshua Spring	Kristie Stein	Spring
4/02/2021	Mountain Springs Canyon and Mammoth Mine	Kristie Stein	Spring
4/02/2021	Crow Canyon	Sean Rowe	Spring
4/28/2021	Mountain Spring	Nidia Jaime	Spring
4/28/2021	Wildrose Spring/Mine and Joshua Spring	Edwin Jacobo	Spring
4/29/2021	Mountain Springs Canyon and Mammoth Mine	Nidia Jaime	Spring
4/29/2021	Crow Canyon	Kristie Stein	Spring
5/25/2021	Mountain Spring	Kristie Stein	Spring
5/25/2021	Wildrose Spring/Mine and Joshua Spring	Sean Rowe	Spring
5/26/2021	Mountain Springs Canyon and Mammoth Mine	Kristie Stein	Spring
5/26/2021	Crow Canyon	Sean Rowe	Spring
8/24/2021	Wildrose and Joshua Spring	Nidia Jaime	Fall
8/24/2021	Mountain Spring	Denise LeBerteaux	Fall
8/25/2021	Mountain Spring and Mammoth Mine	Nidia Jaime	Fall
8/25/2021	Crow Canyon	Denise LaBerteaux	Fall
9/15/2021	Mountain Spring	Nidia Jaime	Fall
9/15/2021	Wildrose	Denise LeBerteaux	Fall
9/16/2021	Mountain Spring and Mammoth Mine	Denise LeBerteaux	Fall
9/16/2021	Crow Canyon	Nidia Jaime	Fall
10/05/2021	Wildrose Spring/Mine and Joshua Spring	Nidia Jaime	Fall
10/05/2021	Mountain Spring	Sean Rowe	Fall
10/06/2021	Mountain Spring and Mammoth Mine	Nidia Jaime	Fall
10/06/2021	Crow Canyon	Sean Rowe	Fall

Appendix F. Number of detections, total and average number of detections per species of all birds detected during China Lake NAWS Point Count survey locations in 2021.

Species	Crow Canyon	Mountain Spring	Mountain Springs and Mammoth Mine	Wildrose	Joshua Spring	Total	Average
American Crow			1			1	0.2
Ash-throated Flycatcher		1	4		1	6	1.2
Audubon's Warbler		4				4	0.8
Black-chinned Hummingbird				1		1	0.2
Black-chinned Sparrow			1			1	0.2
Bell's Sparrow	11	12	3	3	3	32	6.4
Bewick's Wren	1	12	20	6	12	51	10.2
Blue-gray Gnatcatcher	7	7	10		10	34	6.8
Brown-headed Cowbird					1	1	0.2
Black-headed Grosbeak	1	7	6		6	20	4
Black Phoebe				1		1	0.2
Black-tailed Gnatcatcher			1		1	2	0.4
Black-throated Sparrow	18	25	12		5	60	12
Bullock's Oriole		1				1	0.2
Bushtit	1		9	1	2	13	2.6
Cactus Wren	1					1	0.2
Canyon Wren		1				1	0.2
California Quail	10				1	11	2.2
California Scrub-Jay					2	2	0.4
Chipping Sparrow		3				3	0.6
Chukar		1	1			2	0.4
Costa's Hummingbird	4	4	6		3	17	3.4
Common Raven		1			3	4	0.8
Dark-eyed Junco			1			1	0.2
Great Horned Owl			1			1	0.2
Gray Flycatcher	2	1	7		1	11	2.2
Green-tailed Towhee		1	1			2	0.4
Hairy Woodpecker			1			1	0.2
Hermit Thrush					3	3	0.6
Hermit Warbler		1				1	0.2
House Finch	18	23	26	1	22	90	18
House Wren		3			2	5	1
Inyo California Towhee	13	14	10	4	8	49	9.8
Lark Sparrow			1			1	0.2
Lazuli Bunting	1	1				2	0.4

Appendix F. Continued

Species	Crow Canyon	Mountain Spring	Mountain Springs and Mammoth Mine	Wildrose	Joshua Spring	Total	Average
Ladder-backed Woodpecker		1	5		1	7	1.4
Lesser Goldfinch		6		2	1	9	1.8
Lincoln's Sparrow		1				1	0.2
Loggerhead Shrike	1				2	3	0.6
Lucifer Hummingbird					1	1	0.2
Mourning Dove		1			1	2	0.4
Northern Flicker			1			1	0.2
Orange-crowned Warbler		1	1	1	4	7	1.4
Phainopepla					2	2	0.4
Pinyon Jay					2	2	0.4
Pacific-slope Flycatcher					1	1	0.2
Red-breasted Nuthatch			1			1	0.2
Ruby-crowned Kinglet	4	13	9		9	35	7
Rock Wren			1			1	0.2
Sagebrush or Bell's Sparrow	2					2	0.4
Say's Phoebe	2			1	2	5	1
Spotted Towhee	1	1	6	1	8	17	3.4
Sharp-shinned Hawk	1	1				2	0.4
Swainson's Thrush			4		1	5	1
Townsend's Solitaire		1	1			2	0.4
Townsend's Warbler					1	1	0.2
Unknown Bird	1	11	7		9	28	5.6
Unknown Empidonax	5	1	5		2	13	2.6
Unknown Goose			1			1	0.2
Unknown Hummingbird					1	1	0.2
Unknown Owl					1	1	0.2
Unknown Warbler		1			2	3	0.6
Unknown Woodpecker			1		1	2	0.4
Warbling Vireo		2	2		1	5	1
White-crowned Sparrow	6	11	15	10	12	54	10.8
Western Bluebird			1			1	0.2
Western Flycatcher		1	3			4	0.8
Western Tanager	1	10	13	3	4	31	6.2
Western Wood-Pewee	1	1	5		4	11	2.2
Wilson's Warbler	4	5	7	4	4	24	4.8
White-throated Swift			1			1	0.2

Appendix F. Continued

Species	Crow Canyon	Mountain Spring	Mountain Springs and Mammoth Mine	Wildrose	Joshua Spring	Total	Average
Yellow Warbler	1	1	1	1		4	0.8
Yellow-rumped Warbler	3		11		9	23	4.6