

State of California  
THE RESOURCES AGENCY  
Department of Fish and Game

THE DISTRIBUTION AND HABITAT PREFERENCES OF THE MOHAVE  
GROUND SQUIRREL IN THE SOUTHEASTERN PORTION OF ITS RANGE<sup>1/</sup>

by

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ABSTRACT

From April through July, 1977, surveys were undertaken to study the distribution of the Mohave ground squirrel (Spermophilus mohavensis Merriam) in the southern and eastern extremities of its geographic range. The species was found to occur 40 miles east of the formerly known eastern edge of the range in the vicinity of Fort Irwin and the Avawatz Mountains; the extension adds approximately 1,800 square miles to the known range. A possible loss of historical range was noted in the south in the Lucerne Valley and Rabbit Springs areas. The possible loss may be related to one or more factors, such as agricultural and urban development and expansion of Beechey and round-tailed ground squirrel populations. Several possible areas of contact between the Mohave and closely related round-tailed ground squirrel (S. t. tereticaudus Baird) were discovered near the Tiefort Mountains, Coyote Dry Lake, and Helendale.

<sup>1/</sup> Wildlife Management Branch Administrative Report No. 77-5 (August 1977).  
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## RECOMMENDATIONS

1. Censuses should be conducted to determine population densities of Mohave ground squirrels in every habitat type in selected portions of the range. This is especially important in determining the status of the species and making recommendations on future management.
2. Further studies should be undertaken on habitat analysis of known Mohave ground squirrel range to determine exactly what habitats Mohave ground squirrels are found in and why. Information has been acquired in the western and southern portions of the range, and the same kinds of data should be collected in north and east sections.
3. The relationship of the Mohave and round-tailed ground squirrel needs to be clarified. Particular emphasis should be placed on possible contact areas from the southern portion of the Fort Irwin Military Reservation south and west along the Mojave River to Helendale and possibly Rabbit Springs (Lucerne Valley). Answers should be sought for such subjects as determining: the taxonomic relationship of the two species; habitat and/or niche separation of the species; whether round-tailed ground squirrels are invading areas inhabited by Mohave ground squirrels; degree of hybridization and intergradation.
4. The possible interaction between Mohave and Beechey ground squirrels needs to be examined in the Victorville to Lucerne Valley area. Emphasis should be placed on possible competition for habitat and interspecific interactions. Also, studies should be conducted to determine the effects of agricultural development (alfalfa fields) on local populations of Beechey ground squirrels; in particular, agricultural developments may act as a reservoir for expanding Beechey populations into natural habitats.
5. The northeastern edge of the geographic range of the Mohave ground squirrel in the southern Panamint Valley and Owlshhead Valley area needs to be defined.
6. The effects of urbanization and agricultural development in the Victorville to Lancaster area should be examined in conjunction with studies in the Victorville-Lucerne Valley area in order to determine the exact extent of probable range loss.
7. The Mohave ground squirrel should be retained on the state Rare Species List until the above studies have clarified the status of the Mohave ground squirrel.

## INTRODUCTION

The Mohave ground squirrel (Spermophilus mohavensis Merriam) occurs only in a restricted portion of the Mojave Desert in California. Hall and Kelson (1959) show records from Inyo, eastern Kern, northeastern Los Angeles, and northwestern San Bernardino counties. Since the printing of Hall and Kelson's book "The Mammals of North America" in 1959, little work has been done on the range or habitat preferences of the species. Burt (1936) recorded some behavioral observations based on only three animals. Bartholomew and Hudson (1960; 1961) studied estivation and behavior, and Adest (1972) studied interspecific and intraspecific behavior in Mohave and antelope ground squirrels. In 1971, the California Fish and Game Commission placed the Mohave ground squirrel on the state Rare Species List due to urban development in prime habitat areas and apparent declines in populations (Leach and Fisk, 1972). A year later in 1972, Hoyt undertook a small-scale survey of historical Mohave ground squirrel sites to determine if these populations still existed (Hoyt, 1972). His survey was funded by the California Department of Fish and Game. In 1974, the Desert Planning Staff of the Bureau of Land Management (BLM) conducted extensive biological surveys in the El Paso and Red Mountain regions in eastern Kern and northwestern San Bernardino counties. During these surveys, the known range of the Mohave ground squirrel was extended west into the foothills of the southern Sierra Nevada Mountains and east to the vicinity of Harper Dry Lake and Searles Dry Lake (Wessman and Berry, in press). Information on habitat preference and altitudinal distribution was also obtained.

In April of 1977, the California Department of Fish and Game and BLM Desert Planning Staff initiated a study of the species in the eastern and southern portions of the range. The author was contracted to undertake an investigation to clearly identify the boundaries of the range in this area; to establish the point at which the range of the Mohave ground squirrel contacts the range of the round-tailed ground squirrel (Spermophilus t. tereticaudus Baird); and to investigate the effects of urban development on Mohave ground squirrel habitat in the Apple Valley and Lucerne Valley area.

The surveyed area included the Fort Irwin Military Reservation and the area to the immediate west, the Mojave River Valley from the vicinity of Yermo to Victorville, and Apple and Lucerne Valleys. The survey was divided into three parts: Superior Valley, east to the Avawatz Mountains; the Mojave River Valley, and Apple and Lucerne Valleys (Fig. 1).

### Description of Study Sites

#### Superior Valley to the Avawatz Mountains

This large area lies north of the Mojave River Valley (Fig. 1) and is composed of broad, flat valleys and rugged mountain ranges. The average elevation exceeds 3,000 feet, even in valley bottoms. Valleys are dominated by diverse creosote and shadscale scrub communities. The dominant plant species are creosote (Larrea tridentata), burrobrush (Ambrosia dumosa), shadscale (Atriplex confertifolia), winterfat (Eurotia lanata), hop sage (Grayia spinosa), Nevada Mormon-tea (Ephedra nevadensis), and two perennial grasses, Indian rice grass (Oryzopsis hymenoides) and galleta grass (Hilaria rigida). Joshua tree (Yucca brevifolia) occurs in the Superior Valley region, but gradually disappears to the east in the Fort Irwin Military Reservation.

[illegible]

A number of dry lakes occur here in the form of small playas, all of which have some aeolian sand deposits associated with them. Elsewhere, soils tend to be gravelly to rocky. Desert pavement is common in some areas, particularly near the Avawatz Mountains. The mountain ranges in this area are steep and rocky and include the Tiefert, Granite, Calico, and Avawatz Mountains, along with Lane Mountain. The highest peaks exceed 6,000 feet (Avawatz Mountains).

### Mojave River Valley

The Mojave River Wash forms a valley about 14 miles wide in the vicinity of Coyote Dry Lake in the north, narrowing to less than one half mile wide near Victorville in the south. Between Coyote Dry Lake Valley and Helendale the wash is wide and sandy, with dune and blowsand common around the south end of Coyote Dry Lake, Barstow, and Lenwood. Vegetation in this area is mostly creosote, burrobush, and honey mesquite (Prosopis glandulosa). Near Helendale, the character of the wash changes. Soils remain sandy and fine, but riparian vegetation in the form of cottonwood (Populus fremontii), willow (Salix sp.), arrowweed (Pluchia sericea), and four-wing saltbush (Atriplex canescens) becomes the dominant feature, stabilizing the soils. Water flows in the river here part of the year. The riparian habitat is continuous between Helendale and Victorville.

Agriculture dominates much of the Mojave River Valley. Alfalfa and wheatgrass fields are common at the south end of Coyote Dry Lake and between Barstow and Victorville. Barstow (pop. 18,000), is the main population center in the area, with resultant urban development. The small towns of Yermo, Lenwood, Helendale, Silver Lakes, and Oro Grande are stretched along the river at intervals of five to ten miles (Fig. 1).

### Apple and Lucerne Valleys

This area includes lands between Victorville and Lucerne Dry Lake (Fig. 1). Large, flat valleys at elevations from 2,800 to 3,500 feet predominate, with rocky mountain ranges dividing the valleys. Soils in the valleys are gravelly. Aeolian sand deposits ring Lucerne Dry Lake and generally dominate Lucerne Valley, which forms the eastern boundary of the survey area. The desert side of the San Bernardino Mountains form the steep southern boundary, while the Ord and Stoddard Mountains rise along the northern boundary (Fig. 1). The dominant plant species include Joshua tree, creosote, Mormon tea (Ephedra sp.), hop sage, Indian rice grass, galleta grass, and desert needle grass (Stipa speciosa).

The cities of Victorville, Hesperia, Apple Valley, and Lucerne Valley are interspersed through the region; Victorville is the largest with a population of 15,000 (Fig. 1). Many housing tracts are spread throughout the area, and some agriculture in the form of alfalfa fields is present, particularly around Lucerne Dry Lake and Hesperia.

## MATERIALS AND METHODS

Fieldwork began on an informal basis in March, 1977, when surveys were undertaken to choose potential trap sites. Trapping began April 4, 1977, and continued until July 29, 1977. A total of 59 days was spent in the field, and over 16,000 trap days logged. Trap sites were chosen on the basis of proximity to known Mohave ground squirrel range and habitat. Valleys with diverse creosote or shadscale habitats were trapped at first, because these kinds of habitats support good Mohave ground squirrel populations in the El Paso and Red Mountain regions. As the study progressed, it became apparent that these squirrels could be found in areas with

low diversity of perennial shrubs (only two or three species), so these areas also were sampled. An average of 200 (range five to 400) Sherman 3 x 3 x 9-inch noncollapsible live traps were set at each site, usually in parallel rows of 25. Rows were 20 to 30 yards apart, and distance between individual traps varied from three to ten yards, depending on the type of habitat and availability of cover for the traps. Traps were set under bushes in such a way as to provide shade for the trap through as much of the morning as possible. Rolled oats were used for bait.

Traps were generally set and baited in the late afternoon and left during the night to collect nocturnal rodents. In the early morning the traps were checked and rebaited. They were checked again between 11:00 a.m. and noon. If no Mohave or round-tailed ground squirrels were taken during the morning, the traps were left and the procedure outlined above was repeated the next morning. If a specimen was taken, the traps were moved to a new locality. Traps were removed after two mornings in most cases, even if no Mohave or round-tailed squirrels were taken. In some cases, Mohave ground squirrels were collected with a .22 caliber revolver using shot shells. All trap sites were recorded on a map (Fig. 2) and in Appendix I. All vertebrate specimens collected were sent to the Los Angeles County Museum of Natural History for identification and deposition.

Data on composition of perennial plant species, percent cover, percent litter and soil surface factors were collected at each trap site by using 100 pace toe-point transects. Photographs were also taken. Table 1 contains a summary of vegetative data and habitat types. Four habitat types were described in the area (Appendix II).

## RESULTS

A total of 51 sites was recorded, consisting of 45 trapping and six miscellaneous sites (Appendix I). Thirty-seven Mohave ground squirrels and 24 round-tailed ground squirrels were collected. In addition, over 350 antelope ground squirrels and 1,250 nocturnal rodents were collected (Appendix I).

In order to analyze the data, the region was subdivided into the three major areas described above: Superior Valley to the Avawatz Mountains in the north; the Mojave River Valley in the central portion; and Apple and Lucerne Valleys in the south (Fig. 1).

### Superior Valley to the Avawatz Mountains

A total of 20 trapping sites was located here (sites 1-4, 24-29, 35-51) and 6,770 trap-days were logged (Fig. 2; Appendix I). In addition to the regular trap sites, specimens were collected at four sites by shooting and one specimen was found dead on the road. Mohave ground squirrels were taken at sites 24, 26, 27, 28, 36-43, 50 and 51 (18 specimens); one was observed at site 2 (Fig. 2; Appendix I). Habitat types ranged from creosote-high diversity and shadscale scrub to low elevation creosote-wind blown sand and creosote-burrobush types (Table 1). Elevations ranged from 2,030 to 3,800 feet (Appendix I). The easternmost collection point for the Mohave ground squirrel was located in this area (site 43), approximately 40 miles east of the previously known eastern record (15 miles west of Barstow, Fig. 2).

This map depicts the San Bernardino County area, highlighting various military and civilian locations. Key features include:

- Geographical Features:** Death Valley, National Monument, Camp Irwin Military Reservation, Naval Weapons Center, China Lake Center, Ridgecrest, Kramer Jct, Barstow, Victorville, and Marine Corps Training Center.
- Roads:** Major roads are marked with numbers in circles: 127, 40, 15, 178, 395, 58, and 15.
- Military Installations:** Numerous locations are marked with stars and numbers, indicating specific military sites or bases.
- Other Labels:** "NAVAL WEAPONS CENTER", "CHINA LAKE CENTER", "RIDGECREST", "KRAMER JCT", "BARSTOW", "VICTORVILLE", "MARINE CORPS TRAINING CENTER", "DEATH VALLEY", "NATIONAL MONUMENT", "CAMP IRWIN MILITARY RESERVATION", "NAVAL WEAPONS CENTER", "CHINA LAKE CENTER", "RIDGECREST", "KRAMER JCT", "BARSTOW", "VICTORVILLE", "MARINE CORPS TRAINING CENTER".

MOJAVE GROUND SQUIRREL

★ NEW RECORDS

**\* OLD RECORDS**

1977 TRAP SITES WHERE NEITHER  
MOJAVE OR ROUND-TAILED GROUND  
SQUIRRELS WERE CAPTURED

● NEW RECORDS

HYBRIDS - MOJAVE & ROUND-TAILED  
GROUND SQUIRRELS

⑪ Trapsite Numbers- See Appendix I

Round-tailed ground squirrels were taken at sites 35, 46, and 48 (Fig. 2). Habitat at these sites was creosote-windblown sand, except at site 48, which was dominated by coarse sand and creosote-burrobush (Table 1). Elevations ranged from 1,760 to 2,320 feet (Appendix I).

Neither Mohave nor round tailed ground squirrels were observed or collected at sites 1, 3, 4, 25, 29, 44, 45, 47, and 49 (Fig. 2). No Beechey ground squirrels (Spermophilus beecheyi parvulus A. H. Howell) were seen in this area.

#### Mojave River Valley

A total of 12 sites were located in this area (sites 5-15; 18), and 5,675 trap-days were logged (Fig. 2; Appendix I). Mohave ground squirrels were taken only at sites 12 (12 specimens) and 14 (4 specimens), both of which are on the west side of the Mojave River (Fig. 2). The specimens from site 12 exhibited some characteristics of round-tailed ground squirrels in that they had rather long, narrow tails; thus they may be hybrids or intergrades. Habitat at site 12 was creosote-high diversity; site 14 was creosote-burrobush (elev. 2,500 feet). Both sites bordered alfalfa fields (Table 1). Beechey ground squirrels were also common around these fields, although the Sherman traps were too small to catch this species in most cases. The Beecheys did not extend into natural habitats in this area but stayed close to the alfalfa fields and haystacks.

Round-tailed ground squirrels were taken on both the east and west sides of the Mojave River at sites 5, 6, 9, 10, and 11, with a total of nine specimens collected (Fig. 2; Appendix I). All sites had fine, sandy soils dominated by creosote and burrobush (creosote-windblown sand) (Table 1).

Neither Mohave nor round-tailed ground squirrels were taken at sites 7, 8, 13, 15, and 18 (Appendix I). Beechey ground squirrels were observed at sites 8, 9, and 13 and were common around alfalfa fields from Lenwood to Victorville.

#### Apple and Lucerne Valleys

A total of 12 sites was located in this area (sites 16, 17, 19-23 and 30-34), and 4,030 trap-days were logged (Fig. 2; Appendix I). Mohave ground squirrels were taken only at sites 31 and 33 (1 specimen each). Habitat at site 31 was creosote-burrobush with a trace of Joshua tree present, while site 33 was in a creosote-high diversity area (Table 1). Soils at both sites were gravelly-sandy types.

Round-tailed ground squirrels were taken at sites 20, 21, and 22, with a total of eight specimens collected (Fig. 2; Appendix I). Habitat at site 20 was creosote-windblown sand (Table 1). No vegetation transects were made at sites 21 and 22, but site 21 had sandy creosote hummocks and site 22 had gravelly soil with creosote and allscale (Atriplex polycarpa) (Table 1).

Neither Mohave nor round-tailed ground squirrels were taken at sites 16, 17, 19, 23, 30, 32, and 34 (Appendix I).



Table 1. Habitat types recorded at 51 study sites in the Mohave ground squirrel investigation (key to symbols and numbers at end of table).

Site Number	1	2	3	4	5	6	7	8	9	10	11	*12	13	*14	15	16	17	18	19	20	21	22	23
Ground Cover (%)	70	75	60	33	40	37	41	46	No Data	43	62	69	No Data	59	37	63	51	16	24	57	No Data	No Data	3
Bare Ground	10	12	20	11	16	36	28	17	No Data	10	25	16	No Data	28	16	28	30	19	29	19	No Data	No Data	31
Litter	9	7	7	46	40	25	24	29	No Data	35	10	12	No Data	7	40	0	6	60	36	13	No Data	No Data	63
Small Rock (1/8-3")	0	0	0	2	0	0	0	4	No Data	0	0	0	No Data	0	1	0	0	1	0	0	No Data	No Data	0
Rock (>3")	11	6	13	8	4	2	7	4	No Data	12	3	3	No Data	6	6	9	3	4	11	11	No Data	No Data	3
Vegetative Cover																							
Vegetative Composition (%)																							
<i>Larrea tridentata</i>	31		tr		49	25	54	26		34	16	21		7	33	66	28	94	39	25			40
<i>Ambrosia dumosa</i>	29			32	25	49	46	50		3	57	28		85	tr		69	6	44	44			34
<i>Hymenoclea salsola</i>												tr			4	5	1	tr	3				tr
<i>Ephedra nevadensis</i>				15						3		1			22	4	1	tr	tr	23			2
<i>Acamptopappus sphaerocephalus</i>											4	2		tr		20	tr		6				5
<i>Eurotia lanata</i>	tr	33							No Data				No Data		9	2			1	tr	No Data	No Data	1
<i>Grayia spinosa</i>	2	3	1								2	3		tr	12	1			1		No Data	No Data	5
<i>Lycium andersonii</i>	tr							1							10	1	tr				No Data	No Data	11
<i>Yucca brevifolia</i>																							tr
<i>Atriplex polycarpa</i>	4		9		30	20		10		tr	18	15			tr	1	1		tr	6			tr
<i>Oryzopsis hymenoides</i>											tr	15		2					5	tr			1
<i>Stipa speciosa</i>															2								1
<i>Happlopappus cooperi</i>																							
<i>Lycium cooperi</i>										tr									tr				
<i>Atriplex confertifolia</i>	38	60						11		2	tr	12		6			tr			1			
<i>Salazaria mexicana</i>																							
<i>Atriplex canescens</i>					1	6		2												1			
<i>Eriogonum fasciculatum</i>																							
<i>Dalea fremontii</i>										5													
<i>Hilaria rigida</i>														tr									
<i>Tetradymia axillaris</i>												3											
<i>Thamnosma montana</i>											1				3								
<i>Krameria parviflora</i>																							
<i>Sphaeralcea ambigua</i>															5								
<i>Suaeda torreyana</i>			80																				
<i>Cassia armata</i>										53													
Other			10	4		tr					2	tr			tr		tr		tr	tr	tr		1
Habitat Types	2	4	**	2	1	1	2	2	-	3	2	3	-	2	3	2	2	2	2	1	-	-	2

[illegible]

Site Number		Ground Cover (%)	
47	49	Bare Ground	
48	23	Litter	
49	2	Small Rock (1/8-3")	
*50	5	Rock (> 3")	
*51	NO	Vegetative Cover	
	DATA		
		Vegetative Composition (%)	
		<i>Larrea tridentata</i>	
		<i>Ambrosia cumosa</i>	
		<i>Hymenoclea salsola</i>	
		<i>Ephedra nevadensis</i>	
		<i>Acamptopappus sphaerocephalus</i>	
		<i>Eurotia lanata</i>	
		<i>Grayia spinosa</i>	
		<i>Lycium andersonii</i>	
		<i>Yucca brevifolia</i>	
		<i>Atriplex polycarpa</i>	
		<i>Oryzopsis hymenoides</i>	
		<i>Stipa speciosa</i>	
		<i>Happlopappus cooperi</i>	
		<i>Lycium cooperi</i>	
		<i>Atriplex confertifolia</i>	
		<i>Salazaria mexicana</i>	
		<i>Atriplex canescens</i>	
		<i>Eriogonum fasciculatum</i>	
		<i>Dalea fremontii</i>	
		<i>Hilaria rigida</i>	
		<i>Tetradymia axillaris</i>	
		<i>Thamnosma montana</i>	
		<i>Krameria parviflora</i>	
		<i>Sphaeralcea ambigua</i>	
		<i>Suaeda torreyana</i>	
		<i>Cassia armata</i>	
		Other	
		Habitat Types	

# LEGEND

\*-Mohave Ground Squirrel locality

tr-Less than 1% present

Habitat Types

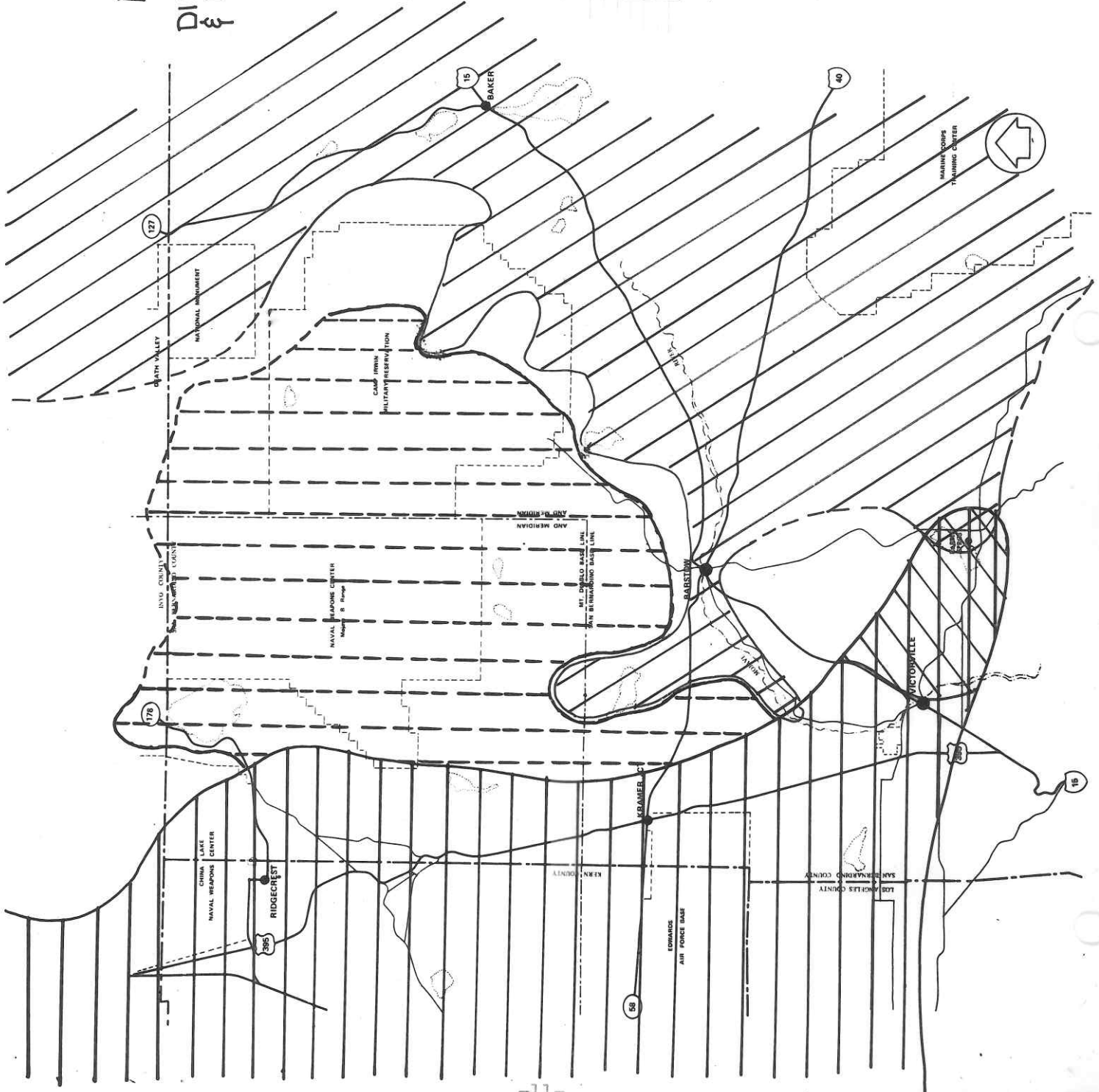
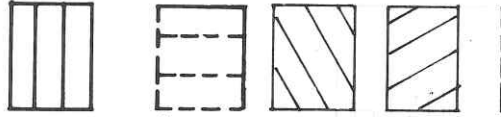
1. Creosote-windblown sand
  2. Creosote-burrobush
  3. Creosote-high diversity
  4. Shadscale scrub
- \*\* Non-typical habitats (washes, alkali sinks, etc)  
(See Appendix II )



# FIGURE 3

## DISTRIBUTION OF MOJAVE & ROUND-TAILED GROUND SQUIRREL

- KNOWN RANGE OF THE MOJAVE GROUND SQUIRREL PRIOR TO 1974 (Hall and Kelson, 1959)
- MOJAVE GROUND SQUIRREL RANGE EXTENSION 1974 - 1977
- AREA WHERE MOJAVE GROUND SQUIRREL MAY NO LONGER OCCUR (as per 1977 study)
- RANGE OF THE ROUND-TAILED GROUND SQUIRREL (Hall and Kelson, 1959; Howell, 1958)
- ASSUMED BOUNDARIES



Beechey ground squirrels were commonly observed throughout this area. They were most abundant around agricultural fields, but also were observed in areas far from agriculture.

## DISCUSSION

This study has contributed new and substantial information for the eastern portions of the range of the Mohave ground squirrel. The overall picture of the geographic range and factors governing distribution have been brought into focus. In addition, several questions have been raised about the taxonomic, behavioral, and ecological relations of the Mohave ground squirrel to the round-tailed ground squirrel, a species whose geographic range borders that of the Mohave on the east.

### The Relationship of Mohave and Round-tailed Ground Squirrels

The Mohave ground squirrel is closely related to the round-tailed ground squirrel. The two species are the only members of the subgenus Xerospermophilus (Hall and Kelson, 1959), and are similar physically and behaviorally. Habitat preferences appear to separate the ranges of the two species.

The Mohave ground squirrel exists in a wide variety of habitats, from creosote-burrobush and saltbush communities at low elevations to rich Joshua tree and monotypic blackbrush (Coleogyne ramosissima) habitats at elevations over 5,000 feet (Wessman and Berry, in press). In contrast, the round-tailed ground squirrel, which has a much more extensive range that includes the central and eastern portions of the Mojave Desert and large portions of the Sonoran Desert, appears to be limited to low elevation habitats with fine, windblown sand (Hall and Kelson, 1959; Ingles, 1965).

### Distribution of Mohave and Round-tailed Ground Squirrels

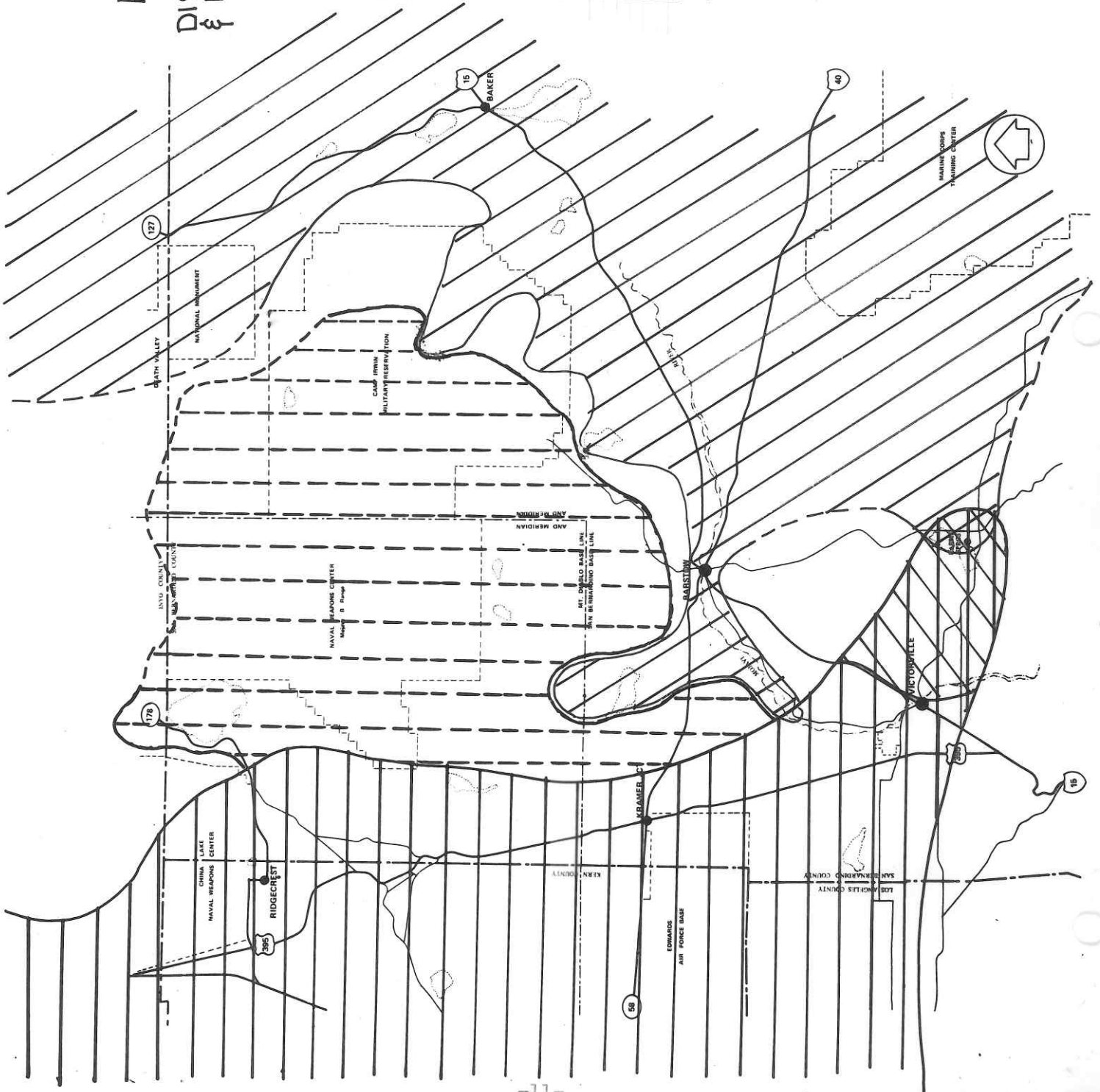
Until this spring, the two species were believed to be allopatric. The range of the Mohave ground squirrel was assumed to end west of Barstow, and the range of the round-tailed squirrel near to and east of Barstow (Hall and Kelson, 1959) (Fig. 3). As the eastern boundaries of the range were surveyed, it was anticipated that Mohave ground squirrels would be found to the east of the known range due to similarities in habitat supporting the species in the vicinity of Fremont Peak and the Cuddeback Dry Lake area. Indeed, this was the case; Mohave ground squirrels were found further to the east, as far as the Avawatz Mountains. It was also expected that sites where Mohave ground squirrels contact round-tailed ground squirrel would be found. Contact points were found in at least three areas (north of the Tiefort Mountains, north of Coyote Dry Lake, and near Helendale).

In the Apple Valley-Lucerne Valley area, it was desired to find both the point at which the range of the Mohave ground squirrel reached its eastern boundaries and the effects that urbanization has had and may have in the future on populations there. No Mohave ground squirrels were found east of Victorville and an apparent increase in other species of Spermophilus has occurred in the area since the late 1800s.

# FIGURE 3

## DISTRIBUTION OF MOJAVE & ROUND-TAILED GROUND SQUIRREL

- KNOWN RANGE OF THE MOJAVE GROUND SQUIRREL PRIOR TO 1974 (Hall and Kelson, 1959)
- MOJAVE GROUND SQUIRREL RANGE EXTENSION 1974 - 1977
- AREA WHERE MOJAVE GROUND SQUIRREL MAY NO LONGER OCCUR (as per 1977 study)
- RANGE OF THE ROUND-TAILED GROUND SQUIRREL (Hall and Kelson, 1959; Howell, 1958)
- ASSUMED BOUNDARIES



## Range Extensions

The range of the Mohave ground squirrel was extended over 40 miles east of the previous record (Hall and Kelson, 1959; Wessman and Berry, in press). Suitable habitat for the species extends in a "bulge" between Searles Dry Lake and Harper Dry Lake to the vicinity of the Owlhead and Avawatz Mountains (Fig. 3). These mountains, along with Death Valley on the north and the sandy dry lakes on the south end of Fort Irwin Military Reservation (Coyote, Red Pass, and Langford Dry Lakes), form the new eastern boundary of the range. The total area of this additional range is 1,800 square miles, although perhaps 30-50 percent of this area is unsuitable habitat (Appendix III). No new range extensions were found in the Mojave River Valley area.

In Apple and Lucerne Valleys an apparent decrease in the range of the Mohave ground squirrel was noted. No Mohave ground squirrels were observed or collected east of Victorville, although historical records show that they once occurred east of Victorville to Lucerne Valley (Fig. 2). In 1889, the type specimens of the Mohave ground squirrel were taken at Rabbit Springs in Lucerne Valley (Merriam, 1889; Grinnell and Dixon, 1919). In 1977, round-tailed ground squirrels were found at Rabbit Springs and throughout Lucerne Valley (Fig. 2). Apparently there has been some westward expansion of the range of the round-tailed ground squirrel in the Rabbit Springs area. However, to the west of the Lucerne Valley neither Mohave nor round-tailed ground squirrels were taken, even though six trap-sites were established and 2,600 trap days were logged (between Lucerne Valley and Victorville, Fig. 2). The habitat in this area appears to be suitable for Mohave ground squirrels, but none could be caught. If they still occur, populations must be extremely small or localized.

Agricultural development and urbanization may have contributed to growth and expansion of Beechey ground squirrel populations in Apple and Lucerne Valleys. The Beechey ground squirrel, a large and aggressive species, may not have occurred here prior to human settlement and land development. Beecheys are now widespread throughout Apple Valley in both natural and agricultural habitats. They may compete with Mohave ground squirrels.

## Mohave and Round-tailed Ground Squirrel Contact Areas

Mohave ground squirrel range borders round-tailed ground squirrel range in at least two areas in the Superior Valley to the Avawatz Mountains area in the vicinity of the north end of the Tiefert Mountains and north of Coyote Dry Lake (Fig. 3). At the north side of the Tiefert Mountains, round-tailed ground squirrel habitat extends from Red Pass Dry Lake Valley along the base of the Tiefert Mountains to at least as far as the divide between Red Pass Valley and Bicycle Dry Lake Valley (site 48). The habitat is similar (creosote-burrobush with sandy soils) between this divide and Bicycle Dry Lake, gradually changing to creosote-windblown sand near Bicycle Dry Lake. A single Mohave ground squirrel was collected in creosote-windblown sand near Bicycle Dry Lake (site 42), a habitat normally associated with round-tails. Somewhere between the divide where the round-tailed ground squirrel was collected and the Bicycle Dry Lake site, the two species may meet. A similar situation exists to the north of Coyote Dry Lake. Here, round-tailed ground squirrels are common in a belt of creosote-windblown sand which surrounds the lake (site 35). To the north of the lake, the habitat gradually changes to creosote-burrobush with more gravelly soils. A Mohave ground squirrel was taken here (site 39), about two miles from the nearest known round-tailed ground squirrel locality (Fig. 2). Somewhere between these two points, the two species can be expected to meet.

The Mohave River Valley area presents a complex picture concerning the distribution of Mohave and round-tailed ground squirrels. The ranges of the two species come

together near Helendale (site 12). At site 12, squirrels had white under the tail, typical of Mohave ground squirrels, but the tail was longer and narrower, similar to round-tailed ground squirrels. A total of 12 specimens was collected and sent to the Los Angeles County Museum for serological tests and cranial measurements. The possibility exists that these are hybrid squirrels. The habitat here has sandy to gravelly soil, with creosote-burrobush scrub; it is immediately adjacent to the Mojave River Wash, which is inhabited by round-tailed ground squirrels.

Mohave ground squirrels do not live in or cross the Mojave River Wash from Helendale north. In this area, round-tailed ground squirrels are common in the sandy habitat of the wash. South of Helendale, Mohave ground squirrels cross the Mojave River and there are no round-tailed ground squirrels.

In the Apple Valley-Lucerne Valley region, the only known site where Mohave and round-tailed ground squirrel populations may contact each other is in the Rabbit Springs area, where Mohave ground squirrels formerly existed but now may have been replaced by round-tailed ground squirrels (site 22). If Mohave ground squirrels still occur to the west of Rabbit Springs, they must be close to the range of the round-tailed ground squirrel.

#### Agricultural Development

There is no agricultural development from Superior Valley to the Avawatz Mountains.

In the Mojave River area there is agricultural development in the form of alfalfa and wheatgrass fields around the southern end of Coyote Dry Lake and between Barstow and Victorville. Around the south end of Coyote Dry Lake, round-tailed ground squirrels are common in alfalfa fields. Between Barstow and Victorville round-tailed and Beechey ground squirrels are common around alfalfa fields and haystacks. Round-tailed ground squirrels appear to drop out south of Helendale, however, and Mohave ground squirrels are found with Beechey ground squirrels. A rancher near Helendale stated that there are many "small, white squirrels" around his haystacks, along with "big, bushy-tailed" ones. The "small, white" ones are probably Mohave ground squirrels, and the large ones Beechey ground squirrels. Squirrel populations around alfalfa fields are probably high due to abundant food.

In Apple and Lucerne Valleys, alfalfa fields are scattered throughout from Lucerne Valley to Hesperia. Round-tailed ground squirrels are found around alfalfa fields in Lucerne Valley; Beechey ground squirrels are common around alfalfa fields to the west of Lucerne Valley, and have spread extensively into surrounding habitats.

Agricultural development between Lucerne Valley and Victorville may be a factor contributing to the abundance of Beechey ground squirrels in this area. Growth and expansion of Beechey populations may have created problems for the Mohave ground squirrel.

#### SUMMARY

The geographic range of the Mohave ground squirrel extends at least 40 miles east of the previously known eastern boundary of the range. The total area of this increase is 1,800 square miles, forming a bulge of the eastern boundary between Searles Dry Lake and Harper Dry Lake. However, a possible decrease in the range of Mohave ground squirrel has apparently occurred in the area between Lucerne Valley



and Victorville where the species historically occurred. The Beechey ground squirrel may be a factor in the absence of Mohave ground squirrels in the Apple Valley-Lucerne Valley area. Beechey ground squirrels are abundant in this one area around alfalfa fields and have spread into surrounding natural habitats. They may compete with Mohave ground squirrels.

The entire eastern portion of the geographic range of the Mohave ground squirrel is bordered by the range of the round-tailed ground squirrel. In some areas, such as north of the Tiefert Mountains, north of Coyote Dry Lake, and near Helendale, the ranges of the two species apparently come into contact. Hybridization between the two species may occur near Helendale. At Rabbit Springs, in the Lucerne Valley, the type specimens of the Mohave ground squirrel were collected in 1889. During this study, two round-tailed ground squirrels were collected at Rabbit Springs and no Mohave ground squirrels were collected. Apparently, round-tailed ground squirrels now occur where Mohave ground squirrels once were found.

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# APPENDIX I

1. Vicinity of Murphy's Well, 12.0 mi. N., 3.5 mi. E. of Hinkley, SE $\frac{1}{4}$  Sec. 35, T. 32 S., R. 45 E. MDBM, San Bernardino Co., Calif., 2770 ft.  
April 5 and 6, 1977.  
 800 trap days  
 2 Ammospermophilus leucurus  
 27 Perognathus longimembris  
 1 Dipodomys merriami
2. Superior Valley, 19.0 mi. N., 5.0 mi. E. of Hinkley, SW $\frac{1}{4}$  Sec. 30, T. 31 S., R. 45 E., MDBM, San Bernardino Co., Calif., 3050 ft.  
April 7, 8, and 9, 1977.  
 600 trap days  
 1 Spermophilus molaviensis (observed)  
 28 Perognathus longimembris  
 2 Dipodomys merriami  
 8 Dipodomys microps  
 1 Peromyscus maniculatus  
 1 Onychomys torridus
3. Coyote Dry Lake, 11.5 mi. N., 2.0 mi. E. of Yermo, SW $\frac{1}{4}$  Sec. 5, T. 11 N., R. 2 E., SBBM, San Bernardino Co., Calif. 1720 ft.  
April 20, 21, and 22, 1977.  
 650 trap days  
 1 Ammospermophilus leucurus  
 2 Perognathus longimembris  
 1 Dipodomys deserti  
 17 Dipodomys merriami  
 2 Onychomys torridus
4. Coyote Dry Lake, 11.0 mi. N., 2.0 mi. E. of Yermo, NW $\frac{1}{4}$  Sec. 8, T. 11 N., R. 2 E., SBBM, San Bernardino Co., Calif., 1740 ft.  
April 20, 21, and 22, 1977.  
 600 trap days  
 2 Perognathus longimembris  
 4 Dipodomys merriami
5. North of Harvard, 6.5 mi. N., 9.0 mi. E. of Yermo, SE $\frac{1}{4}$  Sec. 33, T. 11 N., R. 3 E., SBBM, San Bernardino Co., Calif., 1790 ft.  
May 11 and 12, 1977.  
 400 trap days  
 7 Ammospermophilus leucurus  
 4 Spermophilus tereticaudus  
 7 Perognathus longimembris  
 11 Dipodomys deserti  
 28 Dipodomys merriami  
 1 Neotoma lepida

6. South of Coyote Dry Lake, 6.5 mi. N., 7.5 mi. E. of Yermo, SW $\frac{1}{4}$  Sec. 32, T. 11 N., R. 3 E., SBBM, San Bernardino Co., Calif., 1795 ft.  
May 12 and 13, 1977.  
400 trap days  
2 Spermophilus tereticaudus  
6 Perognathus longimembris  
1 Perognathus sp.  
26 Dipodomys merriami  
5 Neotoma lepida
7. Sidewinder Rd., 5.5 mi. N., 0.5 mi. E. of Lenwood, SW $\frac{1}{4}$  Sec. 9, T. 8 N., R. 2 W., SBBM, San Bernardino Co., Calif., 2700 ft.  
May 17 and 18, 1977.  
600 trap days  
12 Ammospermophilus leucurus  
15 Perognathus longimembris  
21 Dipodomys merriami  
2 Peromyscus crinitus  
6 Neotoma lepida
8. South of Lenwood, 1.4 mi. S. of Lenwood, NE $\frac{1}{4}$  Sec. 20, T. 9 N., R. 2 W., SBBM, San Bernardino Co., Calif., 2320 ft. May 19 and 20, 1977.  
400 trap days  
7 Ammospermophilus leucurus  
19 Perognathus longimembris  
1 Perognathus formosus  
10 Dipodomys merriami
9. East of Hinkley, 3.2 mi. N., 2.0 mi. W. of Lenwood, SE $\frac{1}{4}$  Sec. 25, T. 10 N., R. 3 W., SBBM, San Bernardino Co., Calif., 2180 ft. May 19, 1977.  
5 trap days  
1 Spermophilus tereticaudus  
1 Dipodomys merriami  
2 Onychomys torridus
10. Hodge Rd., 5.4 mi. S., 6.2 mi. W. of Lenwood, SW $\frac{1}{4}$  Sec. 8, T. 8 N., R. 3 W., SBBM, San Bernardino Co., Calif., 2360 ft. May 24, 25 and 26, 1977.  
600 trap days  
25 Ammospermophilus leucurus  
1 Spermophilus tereticaudus  
48 Perognathus longimembris  
32 Dipodomys merriami  
3 Peromyscus maniculatus
11. Near the Helendale Airport, 14.5 mi. N., 2.6 mi. E. of Oro Grande, SE $\frac{1}{4}$  Sec. 3, T. 8 N., R. 4 W., SBBM, San Bernardino Co., Calif., 2450 ft.  
May 24 and 25, 1977.  
400 trap days  
10 Ammospermophilus leucurus  
1 Spermophilus tereticaudus  
13 Perognathus longimembris  
6 Dipodomys merriami

12. Near Helendale, 11.5 mi. N., 0.5 mi. W. of Oro Grande, SE $\frac{1}{4}$  Sec. 19, T. 8 N., R. 4 W., SBBM, San Bernardino Co., Calif., 2440 ft, May 26 and 27; June 2 and 3, 1977,  
     750 trap days  
     16 Ammospermophilus leucurus  
     12 Spermophilus mohavensis X tereticaudus  
     15 Perognathus longimembris  
     9 Dipodomys merriami  
     2 Peromyscus eremicus  
     2 Peromyscus maniculatus
13. Helendale, 1.0 mi. N., 0.4 mi. E. of Helendale, SE $\frac{1}{4}$  Sec. 29, T. 8 N., R. 4 W., SBBM, San Bernardino Co., Calif., 2380 ft. June 1 and 2, 1977.  
     325 trap days  
     3 Ammospermophilus leucurus  
     23 Perognathus sp.  
     12 Dipodomys merriami  
     20 Peromyscus eremicus  
     20 Peromyscus maniculatus  
     1 Onychomys torridus  
     12 Neotoma lepida
14. Near Silver Lakes, 1.5 mi. N., 1.3 mi. W. of Helendale, NE $\frac{1}{4}$  Sec. 25, T. 8 N., R. 5 W., SBBM, San Bernardino Co., Calif., 2500 ft. June 1, 2, and 3, 1977.  
     600 trap days  
     15 Ammospermophilus leucurus  
     4 Spermophilus mohavensis  
     39 Perognathus longimembris  
     2 Perognathus sp.  
     3 Dipodomys merriami
15. Northern Sidewinder Valley, 10.0 mi. N., 1.5 mi. W. of Apple Valley, NW $\frac{1}{4}$  Sec. 30, T. 7 N., R. 3 W., SBBM, San Bernardino Co., Calif., 3320 ft. June 7 and 8, 1977.  
     400 trap days  
     19 Ammospermophilus leucurus  
     14 Perognathus formosus  
     23 Dipodomys merriami  
     1 Peromyscus crinitus  
     6 Neotoma lepida
16. Fairview Mountain, 5.0 mi. N., 3.5 mi. E. of Apple Valley, NW $\frac{1}{4}$  Sec. 24, T. 6 N., R. 3 W., SBBM, San Bernardino Co., Calif., 3300 ft. June 7 and 8, 1977.  
     400 trap days  
     17 Ammospermophilus leucurus  
     1 Spermophilus beecheyi  
     10 Perognathus longimembris  
     1 Dipodomys panamintinus  
     22 Dipodomys merriami  
     3 Peromyscus crinitus  
     1 Onychomys torridus

17. Fairview Valley, 2.0 mi. N., 6.5 mi. E. of Apple Valley, NW $\frac{1}{4}$  Sec. 4, T. 5 N., R. 2 W., SBBM, San Bernardino Co., Calif., 3200 ft. June 9 and 10, 1977.  
400 trap days  
8 Ammospermophilus leucurus  
18 Perognathus longimembris  
1 Dipodomys panamintinus  
25 Dipodomys merriami  
1 Peromyscus eremicus  
1 Peromyscus truei  
1 Onychomys torridus
18. Bonanza Rd., 1.0 mi. N., 4.0 mi. E. of Helendale, NW $\frac{1}{4}$  Sec. 36, T. 8 N., R. 4 W., SBBM, San Bernardino Co., Calif., 2530 ft. June 9 and 10, 1977.  
400 trap days  
3 Ammospermophilus leucurus  
7 Perognathus longimembris  
11 Perognathus formosus  
40 Dipodomys merriami  
2 Peromyscus crinitus  
3 Neotoma lepida
19. Fifteenmile Valley, 0.8 mi. N., 5.5 mi. W. of Lucerne Valley, NW $\frac{1}{4}$  Sec. 12, T. 4 N., R. 2 W., SBBM, San Bernardino Co., Calif., 2980 ft. June 14, 15, and 16, 1977.  
600 trap days  
22 Ammospermophilus leucurus  
29 Perognathus longimembris  
39 Dipodomys merriami  
4 Peromyscus crinitus  
7 Peromyscus maniculatus  
10 Onychomys torridus  
3 Neotoma lepida
20. Lucerne Dry Lake, 6.0 mi. N., 3.3 mi. E. of Lucerne Valley, SW $\frac{1}{4}$  Sec. 9, T. 5 N., R. 1 E., SBBM, San Bernardino Co., Calif., 2925 ft. June 14 and 15, 1977.  
400 trap days  
7 Ammospermophilus leucurus  
4 Spermophilus tereticaudus  
7 Perognathus longimembris  
19 Dipodomys merriami  
8 Dipodomys deserti  
1 Peromyscus eremicus  
5 Neotoma lepida
21. Lucerne Valley, 0.2 mi. N., 0.3 mi. E. of Lucerne Valley, SW $\frac{1}{4}$  Sec. 12, T. 4 N., R. 1 W., SBBM, San Bernardino Co., Calif., 2950 ft. June 14, 1977.  
5 trap days  
2 Spermophilus tereticaudus

22. Near Rabbit Springs, 1.2 mi. N., 1.0 mi. W. of Lucerne Valley, SE $\frac{1}{4}$  Sec. 3, T. 4 N., R. 1 W., SBBM, San Bernardino Co., Calif., 2900 ft. June 15, 1977.  
25 trap days  
2 Spermophilus tereticaudus
23. Near Fifteenmile Point, 0.4 mi. N., 7.5 mi. W. of Lucerne Valley, SW $\frac{1}{4}$  Sec. 10, T. 4 N., R. 2 W., SBBM, San Bernardino Co., Calif., 3100 ft. June 16 and 17, 1977.  
400 trap days  
23 Ammospermophilus leucurus  
10 Perognathus longimembris  
31 Dipodomys panamintinus  
7 Dipodomys merriami  
1 Peromyscus eremicus  
2 Peromyscus maniculatus  
1 Onychomys torridus
24. NW of Lane Mountain, 14.4 mi. N., 8.5 mi. W. of Yermo, SE $\frac{1}{4}$  Sec. 30, T. 32 S., R. 47 E., MDBM, San Bernardino Co., Calif., 3600 ft. June 20, 1977.  
21 trap days  
4 Ammospermophilus leucurus  
1 Spermophilus mohavensis
25. NW of Coyote Dry Lake, 15.7 mi. N., 3.0 mi. W. of Yermo, SE $\frac{1}{4}$  Sec. 17, T. 12 N., R. 1 E., SBBM, San Bernardino Co., Calif., 2720 ft. June 21 and 22, 1977.  
400 trap days  
15 Ammospermophilus leucurus  
2 Perognathus longimembris  
34 Perognathus formosus  
6 Dipodomys merriami
26. West of William's Well, 16.2 mi. N., 7.5 mi. W. of Yermo, NE $\frac{1}{4}$  Sec. 20, T. 32 S., R. 47 E., MDBM, San Bernardino Co., Calif., 3550 ft. June 21, 1977.  
200 trap days  
15 Ammospermophilus leucurus  
3 Spermophilus mohavensis  
9 Perognathus longimembris
27. South of Goldstone, 26.5 mi. N., 5.2 mi. W. of Yermo, SW $\frac{1}{4}$  Sec. 30, T. 14 N., R. 1 E., SBBM, San Bernardino Co., Calif., 3300 ft. June 22, 1977.  
200 trap days  
13 Ammospermophilus leucurus  
2 Spermophilus mohavensis  
7 Perognathus longimembris  
32 Dipodomys merriami  
17 Dipodomys deserti  
7 Onychomys torridus  
1 Neotoma lepida

28. South of Superior Valley, 18.5 mi. N., 3.0 mi. W. of Yermo, SE $\frac{1}{4}$  Sec. 33, T. 13 N., R. 1 E., SBBM, San Bernardino Co., Calif., 2900 ft. June 23, 1977.  
200 trap days  
8 Ammospermophilus leucurus  
2 Spermophilus mohavensis
29. South of Lane Mountain, 9.5 mi. N., 6.5 mi. W. of Yermo, SW $\frac{1}{4}$  Sec. 13, T. 11 N., R. 1 W., SBBM, San Bernardino Co., Calif., 3200 ft. June 24, 1977.  
200 trap days  
5 Ammospermophilus leucurus
30. Rock Springs Rd., 1.0 mi. S., 3.3 mi. E. of Hesperis, NW $\frac{1}{4}$  Sec. 30, T. 4 N., R. 3 W., SBBM, San Bernardino Co., Calif., 2920 ft. June 28 and 29, 1977.  
400 trap days  
11 Ammospermophilus leucurus  
1 Spermophilus beecheyi  
1 Dipodomys panamintinus
31. North of Victorville, 2.5 mi. N., 0.5 mi. E. of Victorville, SW $\frac{1}{4}$  Sec. 27, T. 6 N., R. 4 W., SBBM, San Bernardino Co., Calif., 2840 ft. June 28, 1977.  
200 trap days  
9 Ammospermophilus leucurus  
1 Spermophilus mohavensis  
8 Perognathus longimembris  
29 Dipodomys merriami  
4 Neotoma lepida
32. West of Hesperia, 1.0 mi. N., 3.8 mi. W. of Hesperia, NE $\frac{1}{4}$  Sec. 14, T. 4 N., R. 5 W., SBBM, San Bernardino Co., Calif., 3400 ft. June 29 and 30, 1977.  
400 trap days  
28 Ammospermophilus leucurus  
31 Dipodomys panamintinus
33. Near Mountain View, 4.2 mi N., 4.0 mi. W. of Hesperia, NE $\frac{1}{4}$  Sec. 35, T. 5 N., R. 5 W., SBBM, San Bernardino Co., Calif., 3180 ft. June 30 and July 1, 1977.  
400 trap days  
24 Ammospermophilus leucurus  
1 Spermophilus mohavensis  
1 Perognathus longimembris  
32 Dipodomys panamintinus  
12 Dipodomys merriami



34. Near Bell Mountain, 5.0 mi. N., 1.8 mi. W. of Apple Valley, NE $\frac{1}{4}$  Sec. 24, T. 6 N., R. 4 W., SBBM, San Bernardino Co., Calif., 2980 ft. July 1, 1977.  
200 trap days  
7 Ammospermophilus leucurus  
2 Perognathus longimembris  
12 Dipodomys merriami
35. NE of Coyote Dry Lake, 13.5 mi. N., 1.0 mi. E. of Yermo, SW $\frac{1}{4}$  Sec. 29, T. 12 N., R. 2 E., SBBM, San Bernardino Co., Calif., 1760 ft. July 7 and 8, 1977.  
125 trap days  
5 Ammospermophilus leucurus  
4 Spermophilus tereticaudus
36. Near William's Well, 16.2 mi. N., 6.5 mi. W. of Yermo, NE $\frac{1}{4}$  Sec. 21, T. 32 S., R. 47 E., MDBM, San Bernardino Co., Calif., 3500 ft. June 20, 1977.  
1 Spermophilus mohavensis (shot)
37. NE of William's Well, 17.0 mi. N., 6.0 mi. W. of Yermo, SW $\frac{1}{4}$  Sec. 15, T. 32 S., R. 47 E., MDBM, San Bernardino Co., Calif., 3430 ft. June 21, 1977.  
1 Spermophilus mohavensis (shot)
38. Eastern Superior Valley, 25.6 mi. N., 7.2 mi. W. of Yermo, SE $\frac{1}{4}$  Sec. 5, T. 31 S., R. 47 E., MDBM, San Bernardino Co., Calif., 3090 ft. June 21, 1977.  
1 Spermophilus mohavensis (shot)
39. NW Coyote Dry Lake Valley, 12.0 mi. N., 1.5 mi. W. of Yermo, NW $\frac{1}{4}$  Sec. 2, T. 11 N., R. 1 E., SBBM, San Bernardino Co., Calif., 2030 ft. June 23, 1977.  
1 Spermophilus mohavensis (shot)
40. Ft. Irwin Rd., 6.5 mi. N., 6.5 mi. W. of Yermo, SW $\frac{1}{4}$  Sec. 36, T. 11 N., R. 1 W., SBBM, San Bernardino Co., Calif., 2620 ft. June 24, 1977.  
1 Spermophilus mohavensis (trapped)
41. Near Nelson Dry Lake, 13.25 mi. N., 6.25 mi. W. of Ft. Irwin, NW $\frac{1}{4}$  Sec. 32, T. 16 N., R. 2 E., SBBM, San Bernardino Co., Calif., 3070 ft. July 19, 1977.  
200 trap days  
4 Ammospermophilus leucurus  
1 Spermophilus mohavensis

42. Near Bicycle Dry Lake, 5.25 mi. N., 5.25 mi. E. of Ft. Irwin, SE $\frac{1}{4}$  Sec. 6, T. 14 N., R. 4 E., SBBM, San Bernardino Co., Calif., 2440 ft.  
July 20, 1977,

200 trap days

- 1 Perognathus longimembris
- 3 Dipodomys deserti
- 1 Spermophilus mohavensis

43. Granite Mountains, 12.25 mi. N., 7.75 mi. E. of Ft. Irwin, SE $\frac{1}{4}$  Sec. 28, T. 16 N., R. 4 E., SBBM, San Bernardino Co., Calif., 3900 ft.  
July 20, 1977.

200 trap days

- 6 Ammospermophilus leucurus
- 1 Spermophilus mohavensis
- 1 Perognathus longimembris
- 2 Dipodomys merriami

44. Avawatz Pass, 20.0 mi. N., 14.0 mi. E. of Ft. Irwin, San Bernardino Co., Calif., 2800 ft. July 21 and 22, 1977.

400 trap days

- 5 Ammospermophilus leucurus
- 31 Perognathus formosus
- 4 Dipodomys merriami
- 5 Peromyscus crinitus
- 4 Onychomys torridus
- 3 Neotoma lepida

45. South of Cave Springs, 17.5 mi. N., 14.5 mi. E. of Ft. Irwin, NW $\frac{1}{4}$  Sec. 3, T. 16 N., R. 5 E., SBBM, San Bernardino Co., Calif., 4000 ft. July 21 and 22, 1977.

300 trap days

- 7 Ammospermophilus leucurus
- 15 Perognathus formosus
- 10 Dipodomys merriami
- 1 Peromyscus maniculatus
- 3 Onychomys torridus

46. Near Red Pass Dry Lake, 3.5 mi. N., 19.25 mi. E. of Ft. Irwin, NE $\frac{1}{4}$  Sec. 16, T. 14 N., R. 6E., SBBM, San Bernardino Co., Calif., 1960 ft.  
July 26, 1972.

- 1 Spermophilus tereticaudus
- 1 Perognathus longimembris
- 6 Dipodomys deserti

47. Avawatz Mountains, 14.25 mi. N., 16.0 mi. E. of Ft. Irwin, NW $\frac{1}{4}$  Sec. 24, T. 16 N., R. 5 E., SBBM, San Bernardino Co., Calif. 3550 ft. July 26 and 27, 1977.

400 trap days

- 4 Ammospermophilus leucurus
- 58 Perognathus formosus
- 5 Dipodomys merriami

- 1 Peromyscus crinitus
- 1 Neotoma lepida

- 48.. North of the Tiefert Mountains, 6.75 mi. N., 10.25 mi. E. of Ft. Irwin, SE¼ Sec. 25, T. 15 N., R. 4 E. SBBM, San Bernardino Co., Calif. 2320 ft. July 27 and 28, 1977.

400 trap days

- 4 Ammospermophilus leucurus
- 1 Spermophilus tereticaudus
- 8 Perognathus longimembris
- 5 Dipodomys merriami

49. South of Drinkwater Valley, 13.25 mi. N., 10.5 mi. E. of Ft. Irwin, NW¼ Sec. 30, T. 16 N., R. 5 E., SBBM, San Bernardino Co., Calif., 3280 ft. July 28 and 29, 1977.

400 trap days

- 3 Ammospermophilus leucurus
- 8 Perognathus longimembris
- 5 Dipodomys merriami

50. Drinkwater Dry Lake, 16.5 mi. N., 6.5 mi. E. of Ft. Irwin, SE¼ Sec. 5, T. 16 N., R. 4 E., SBBM, San Bernardino Co., Calif., 3400 ft. July 29, 1977.

200 trap days

- 3 Ammospermophilus leucurus
- 2 Spermophilus mohavensis
- 2 Perognathus longimembris
- 10 Dipodomys merriami

51. West of Lane Mountains, 11.0 mi. N., 10.8 mi. W. of Yermo, SE¼ Sec. 4, T. 11 N., R. 1 W., SBBM, San Bernardino Co., Calif., 3880 ft. May 25, 1977.

- 1 Spermophilus mohavensis (Dead on road)

Total trap days = 16,000 +

## APPENDIX II

### Habitats Occuring in the Study Area

1. Creosote-windblown sand. This habitat is usually associated with dry lakes or old riverbeds, and is characterized by fine, loose, sandy soils, usually aeolian in nature. Perennial species diversity is low. Grasses such as Indian rice grass (Oryzopsis hymenoides) and galleta grass (Hilaria rigida) are common in some areas.

2. Creosote-burrobush. This habitat is most common at elevations below 3,000 ft and is characterized by low perennial species diversity. Creosote (Larrea tridentata) and burrobush (Ambrosia dumosa) are the dominant perennials, and make up more than 50% of the species composition.

3. Creosote-high diversity. A rich, diverse habitat with creosote being the most conspicuous perennial species. This habitat usually occurs above 3,000 ft and is widespread east of Victorville and throughout the Superior Valley-Fort Irwin Military Reservation area. A number of perennial species occur here, including Joshua tree (Yucca brevifolia), Nevada Mormon tea (Ephedra nevadensis), Anderson thornbush (Lycium andersonii), hop sage (Grayia spinosa), and desert needle grass (Stipa speciosa). Creosote and burrobush make up less than 50% of the perennial species composition.

4. Shadscale scrub. This habitat contains low-growing shrubs and is usually associated with dry lake valleys over 3,000 ft. The most common perennial species here are shadscale (Atriplex confertifolia), allscale (Atriplex polycarpa), winterfat (Eurotia lanata), hop sage, Nevada Mormon tea, and Anderson thornbush. Creosote and burrobush may be present in small amounts.

### Appendix III

Estimated Acreages of Potential Mohave Ground Squirrel Habitats in the Recently Discovered Eastern Portion of the Range (Fig. 3).

1. Creosote - Windblown Sand - 6,400 acres
2. Creosote - burrobrush - 179,200 acres
3. Creosote - High Diversity - 224,000 acres
4. Shadscale Scrub - 192,000 acres