State of California
The Resources Agency
Department of Fish and Game

MOHAVE GROUND SQUIRREL SURVEY, 1972 1/

by

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ABSTRACT

A search of literature revealed a scarcity of knowledge concerning the Mohave ground squirrel (Citellus mohavensis). Based on knowledge gained from museums and interviews and contact with the few informed scientists, areas of known species occurrence were live trapped. Eight localities sampled resulted in the trapping and/or sighting of 33 Mohave ground squirrels in 4 locations. Further search of the Mohave Desert was discontinued because of lack of information regarding sites historically occupied by this rare mammal.

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George Bartholomew

The Mohave ground squirrel is distinguished from the Antelope ground squirrel by its larger size, uniform-grizzled grayish brown back and lack of white stripe on each side. The round-tailed ground squirrel resembles the Mohave ground squirrel but has a round uniformly colored tail and does not normally hold its tail over its back.

INTRODUCTION

In addition to its value as an endemic California species, the Mohave ground squirrel (Citellus mohavensis) is of interest to scientists for several reasons. It has one of the most restricted distributions of any species of ground squirrels. A satisfactory explanation of this fact is still lacking, but is of interest to zoogeographers and population ecologists alike. Its strategy for survival in a severe environment and in the face of competition with one of the most successful species of ground squirrels, the antelope ground squirrel (Ammospermophilus leucurus) has been partially elucidated, but is of potential further interest to ecologists, physiologists and behaviorists. As a member of a vast complex of variously related species of ground squirrels, the Mohave ground squirrel is of potential interest to scientists studying physiological and haematological correlates of evolution and hibernation, and to population ecologists. Numerous local investigators have recently noticed an increasing scarcity of this species in areas where, previously, it has been moderately easy to trap. Accordingly, on May 21, 1971, the California Fish and Game Commission officially designated the Mohave ground squirrel a rare species.

DESCRIPTION

The Mohave ground squirrel is somewhat larger than the antelope ground squirrel and shorter, but heavier, than the round-tailed ground squirrel (Citellus tereticaudus). These are the two species with which it is most likely to be confused. The Mohave ground squirrel averages 224 mm. total length as opposed to 247 mm. for the round-tailed ground squirrel and 213 mm. for the antelope ground squirrel (Howell, 1938). Adults captured in the course of this study averaged 140 grams; but one individual weighing 198 grams was captured, and under artificial conditions weights of nearly 300 grams have been reported (Pengelley and Kelley, 1966). Antelope ground squirrels are reported to average 104 grams (Hall and Kelson, 1959), and the round-tailed ground squirrel is reported to average 120 grams (Hudson, 1964). The Mohave ground squirrel is colored a uniformly-grizzled grayish brown above and a soiled white below. When clearly seen, it is easily distinguished from the antelope ground squirrel which has a white stripe on each side of its body. The round-tailed ground squirrel is uniformly brown colored, much like the Mohave ground squirrel. Both the antelope and Mohave ground squirrels have short, flat tails which are brown above and whitish below. The tail of the round-tailed ground squirrel is longer, round, and uniformly colored. Both the antelope and Mohave ground squirrels usually hold their tails up over their backs, thereby displaying the white ventral side, while the round-tailed ground squirrel normally does not do so. The antelope ground squirrel is said to flick its tail nervously back and forth much more frequently than the Mohave ground squirrel.

SCOPE OF STUDY

The present study was undertaken to: (1) Determine the distribution and abundance of the Mohave ground squirrel; and (2) Evaluate its current status and factors threatening its survival.

RESULTS

Library Search

A complete literature search was conducted using the Zoological Record and Science Citation Index. The following 10 articles comprise the entire scientific literature on Citellus mohavensis:

Adest, Gary. 1972. Intraspecific and interspecific behavior of Ammospermophilus leucurus and Citellus mohavensis. Masters Thesis, California State College at Los Angeles. (Mohave ground squirrels exhibit greater Interspecific and Intraspecific Agression.)

Bartholomew, G.A. and Hudson, J.W. 1960. Aestivation in the Mohave ground squirrel Citellus mohavensis. Bull. Mus. Comp. Zool. 124:193. (The Physiology of hypothermia.)

Bartholomew, G.A. and Hudson, J.W. 1961. Desert ground squirrels. Sci. Am. 205:107. (Summary of role of thermoregulation and behavior in reducing competition between Mohave ground squirrel and antelope ground squirrel.)

Burt, W.H. 1936. Notes on the habits of the Mohave ground squirrel. J. Mammalogy 17:221. (Only published observations of behavior under natural conditions. Based on 2-3 animals.)

Grinnell, J. and Dixon, J. 1918. Natural history of the ground squirrels of California. Monthly Bull. of the State Commission of Horticulture 7:667. (An early description of distribution and taxonomy.)

Howell, A.H. 1938. A revision of the ground squirrels of North America. North American Fauna #56:30. (Taxonomic characteristics and relationships.)

Merriam, C.H. 1889. Description of a new spermophile from Southern California. North American Fauna 2:15. (Original description of species.)

Pengelley, E.T. 1966. Differential developmental patterns and their adaptive value in various species of the genus Citellus. Growth 30:137-142. (Reproductive information; length of gestation, time and size of litter, growth rate.)

Pengelley, E.T. 1969. Influence of light on hibernation in the Mohave ground squirrel (Citellus mohavensis). In Physiological Systems in Semi-Arid Environments, Ed. C.C. Hoff and M.L. Riedesel. Univ. of New Mexico Press. (Investigation of a theory relating to endogenous rhythms.)

Pengelley, E.T. and Kelley, K.H. 1966. A "Circannian" rhythm in hibernating species of the genus Citellus with observations on their physiological evolution. Comp. Biochem. Physiol. 19:603. (Demonstration of endogenous annual rhythms of torpor and weight.)

Museum Survey

Fifteen American museums with the largest mammal collections were surveyed for specimens of the Mohave ground squirrel. Fifty-five specimens were reported from

TABLE 1 (Continued)

Museum	Specimen No.	Locality Collected
University of Kansas	63,589	Victorville - 15 Mi. S.E.
American Museum of Natural History	1,177-1,181 13,844	Mohave River Sears Cattle Ranch, Kern Co

Scientists and Trappers

The following scientists and trappers were interviewed to discover localities where the animals have been trapped in recent years:

George A. Bartholomew
Department of Biology
University of California
Los Angeles, California 90024

Eric T. Pengelley
Department of Zoology
University of California
Riverside, California

Richard E. MacMillen
Department of Population and Environmental Biology
University of California
Irvine, California 92644

William Wertz
Department of Zoology
Pomona College
Claremont, California 91711

Bruce Kenyon
3177 Tapa Canyon
Simi Valley, California

Carl Tegan
38639 33rd Street
Palmdale, California

All localities suggested by these individuals were trapped in the course of the study.

Trapping

Eight different localities were visited within the area of distribution reported in Hall and Kelson (1959). An average of 100 Serman Live Traps were set for two days at each location. A combination of peanut butter, shredded coconut, and coconut extract appeared to be the most effective bait; but, one animal was trapped using

8 collections. None of the curators knew of any other collections which might contain additional specimens of this species. The data collected is summarized in Table 1:

TABLE 1

Mohave Ground Squirrel Collections

Museum	Specimen No.	Locality Collected
D.R. Dickey Collection	18,645	Palmdale
University of California	18,646	
Los Angeles	18,661	
	18,669	
Los Angeles County Museum	---	Palmdale
	---	Walker Pass-East Side
	---	Ridgecrest - 6 Mi. West
Museum of Vertebrate Zoology	31,515	Oro Grande
University of California	99,826	Kramer Jct. - 2 Mi. West
Berkeley	81,813	Barstow - 15 Mi. West
	125,679	Palmdale - 18 Mi. East
	31,158	Palmdale - 2 Mi. North
	31,160	Palmdale - 2 Mi. North
	31,960	Palmdale - 1 Mi. North
	44,285	Lovejoy Spr. - 1 Mi. North
	31,967	Lancaster - 2 Mi. S & 1/2 Mi. E.
	28,674	Little Lake
	28,675	Little Lake
University of Michigan	77,651	Palmdale - 2 Mi. North
San Diego Natural History Museum	402	Mohave Desert
	403	Rabbit Spr.
	404	Mohave R.
	9,381	Trona - 10 Mi. North
	9,516	Freeman
	9,629	Palmdale - 1 Mi. East
	9,623	Palmdale - 2 Mi. East
	9,624	Palmdale - 2 Mi. East
	9,708-9,710	Palmdale - 2 Mi. East
	9,726	Palmdale - 2 Mi. East
U. S. National Museum	28,740	Haiwee Meadows
	135,838	Mohave Desert
	192,752	Mohave Desert
	192,753	Mohave Desert
	15,974	Mohave River
	15,975	Mohave River
	192,754-192,756	Rabbit Spr.
	186,469	Rabbit Spr.
	---	Victorville
	28,741-28,747	Salt Wells Valley

bird seed, and other workers have been successful using bird seed, bacon, or oranges. Mohave ground squirrels were trapped at four locations. At two locations sightings of several animals augmented the trapping record, but at the other locations only three animals were trapped and no others were sighted. The trapping record is summarized below:

Location	Number Trapped	Number Sighted (Approx.)
Shadow Mountains	1	0
Boron County Dump	2	0
China Lake	5	5-10
Keel's Ranch	1	10-15

(The exact locations and trapping records are detailed in the appendix.) At two of the four localities where no animals were trapped, populations were known to have existed in the past but to have declined in recent years. Populations at these localities may no longer exist.

Preferred Habitat

A conscious effort was made to evaluate the habitat at each trapping location in order to gain more specific information about the animals' habitat preference. All animals were located within or immediately adjacent to Creosote Scrub. With the exception of areas immediately associated with dry lake beds, this plant community is nearly ubiquitous in the Mohave Desert; but, it shows considerable variability in its composition and density. The localities where the Mohave ground squirrels were trapped represented the same range in composition and density of the Creosote Scrub Community as the Western Mohave Desert as a whole. It is not possible, therefore, to specify any distinctive habitat requirements other than the moderately variable Creosote Scrub.

Distribution and Abundance

Due to the extreme difficulty encountered in trapping the animals, it is not possible at this time to make any exact or quantitative statements about the animal's present distribution or abundance. However, a few qualitative generalizations can be made.

Adest's study of aggressive behavior indicates that the animals may be found at low densities due to intense intraspecific aggression and not declining population levels. Maintenance of low population densities may be part of the animal's strategy of optimal resource utilization.

While the significance of negative evidence is doubly questionable, due to the difficulty in trapping animals in an area where several have been sighted, it still appears that the population is very discontinuously distributed. One possible explanation of this might be that the species may be in the final stages of extinction due to competition with the closely related, more abundant, antelope ground squirrel. Such a natural occurrence would probably be happening

on such a long-time scale that it would be hard to detect. The effect of human disturbances would also be hard to determine and make the interpretation of any data more difficult.

An alternate hypothesis might be that the animal has an, as yet undetermined, stringent habitat requirement which is only discontinuously satisfied in the Mohave Desert. No direct evidence for this is presently available, but it remains a possibility.

It is not possible at this time to decide whether the species is truly endangered. Two of the known extant populations are in the immediate vicinity of human habitation. The population at China Lake is probably quite secure due to the Navy's protection of its land. The animals associated with alfalfa fields were seen to make frequent trips to the fields. They seem to be dependent on the fields and could be easily exterminated by the State Rodent Control Program. The population at Boron may be fairly secure if it occupies very much of the Edwards Air Force Base, Rocket Test Site. Both of the populations which have apparently recently gone extinct were in the southern end of the Mohave Desert. This appears to be the area of the Mohave Desert which is being most extensively developed, and this may mean the eventual loss of much favorable habitat.

RECOMMENDATIONS

1. The Mohave ground squirrel be retained on the rare species list.

2. A program be established whereby information is actively sought from people working in the Mohave Desert. This be done by providing field workers as well as local zoology departments with a survey form requesting that they report Mohave ground squirrel sightings to the Department of Fish and Game.

3. Studies be initiated immediately to more closely identify those areas reported to be populated by the Mohave ground squirrel and how these can best be preserved.

REFERENCES CITED

Hall, E. R. and Kelson, K. R. 1959. The mammals of North America. The Ronald Press Co. New York.

Hudson, J. W. 1964. Temperature regulation in the round-tailed ground squirrel, Citellus tereticaudus. Ann. Acad. Sci. fenn A IV 71: 217-233.

Pengelley, E. T. and Kelley, K. H. 1966. A "Circannian" rhythm in hibernating species of the genus Citellus with observations on their physiological evolution. Comp. Biochem. Physiol. 19:603.

APPENDIX

TRAPPING RECORD

Locality: Shadow Mountains, San Bernardino County. Three and one-half miles west of U. S. Highway 395, the Shadow Mountain Road is intersected by a small dirt road which runs to the south. Traps were set in a broad wash which crossed this road about 0.8 miles south of the Shadow Mountain Road.

Description: One animal was caught at the edge of the wash. Only a few plants of the Creosote Scrub Community were present and they were fairly stunted and widely spaced. Plants present in the desert immediately adjacent to the wash included: Creosote Bush, Joshua Tree, *Atriplex canescens*, *Hymenoclea salsola*. No plants grew in the bed of the wash, but several cacti and *Atriplex canescens* were on the edge of the wash and on small islands in the middle of the wash.

Date: March 29, 1972

Trap Days: 200

Results: 1 trapped, 0 sighted

Observations: When released, the animal entered a burrow under a Creosote bush.

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Locality: Boron County Dump, San Bernardino County. A dirt road extends into the desert south of the dump. Traps were set all around the perimeter of the dump. Two animals were caught south of the dump and east of the road, in an area currently being used for dirt and large debris.

Description: There was very little, if any, organic matter in the dump, so it probably does not represent an artificially augmented food source.

The desert appeared very productive. All of the major components of the Creosote Scrub Community were present and at least six different species of annuals were in bloom. The perennials were large, fairly closely spaced and very healthy in appearance.

Date: May 21, 1972

Trap Days: 80

Results: 2 trapped, 0 sighted

Observations: Burrows appeared to be located at the bases of Creosote bushes. One knowledgeable individual contacted in the area stated that the Mohave ground squirrels frequently climb the Joshua Trees.

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ocation: China Lake, Naval Weapons Center, San Bernardino County. Traps were set unning east of the dirt road on the eastern side of the golf-course, about 0.15 iles from its intersection with Knox Road. Traps were also set running North of he road at the northwest corner of the Stables. Information and permission to rap were provided by Mrs. Tilly C. Barling, Public Works Department, Code 70026, hina Lake, California 93555, phone number (714) 939-2349.

escription: The desert was moderately productive with abundant, fairly large reosote and a limited number of the other plants of the Creosote Scrub Community. annuals were in bloom.

ate: June 14 and 15, 1972

rap Days: 200

esults: 5 trapped, 10 sighted

bservations: One animal was observed sitting upright and motionless with its ack to the sun for 45 minutes one morning. The air was cool, the sun quite warm, nd a slight breeze was blowing. The back of the animal appeared darker than ormal, and the animal may have been "basking."

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ocation: Keels Ranch, Palmdale, California, Los Angeles County. Traps were set n the south and west sides of an alfalfa field located south of Avenue P and bout 1 mile east of the road to El Mirage Soaring School. They were also set long another dirt road, about 1/4 mile east of the first field. This road ordered the land of a factory run by Anadite Inc.

escription: The Creosote Scrub Plant Community was moderately productive but he animals were closely associated with the alfalfa fields and probably were eriving their food from the fields, and not the desert.

ate: June 25, 1972

rap Days: 80

esults: 1 trapped, 15 sighted

bservations: Numerous animals were noted running back and forth between the lfalfa fields, and their burrows on the desert side of the dirt road.

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ocalities Where Populations Apparently No Longer Exist

ob's Gap: 165th Street, Palmdale, California. George A. Bartholomew reported hat a significant population existed in about 1960, just above and just below he place where 165th Street passed through Bob's Gap. On February 12th and 13th, 40 trap days yielded no Mohave ground squirrels.

ovejoy Butte: E. T. Pengelley reported that a significant population had existed round the southern edge of Lovejoy Butte in the mid 1960's, but that recent ttempts to trap in the same locality had been unsuccessful. On February 19th and 0th, 240 trap days yielded no Mohave ground squirrels.