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## The altitudinal distribution of mammals of the La Sal Mountains, Utah

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THE ALTITUDINAL DISTRIBUTION OF MAMMALS OF  
THE LA SAL MOUNTAINS, UTAH

L-2

A Thesis  
Presented to the  
Department of Zoology  
Brigham Young University

In Partial Fulfillment  
of the Requirements for the Degree  
Master of Science

by  
Stephen Robert Bradley

May 1971

This thesis by Stephen Robert Bradley is accepted in its present form by the Department of Zoology of Brigham Young University as satisfying the thesis requirement for the degree of Master of Science.

## ACKNOWLEDGMENTS

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## INTRODUCTION

This study deals with the distribution of the mammals of the La Sal Mountains, Grand and San Juan Counties, Utah. The distribution of the mammals has been correlated with the distribution of the vegetation zones of the mountains which varies with the elevation. The study points out which of the various mammals are found in the various vegetational communities and how the distribution varies from community to community.

The La Sal Mountains were chosen for this study because all life zone types from Pinus-Juniperus at 4,000 feet elevation to Alpine Tundra at 11,000 feet elevation are represented and because the mountains are well isolated from surrounding ranges. They are small enough to make this type of study readily feasible. In addition to this, there has been no completed comprehensive study of the mammals of the region.

The La Sal Mountains are a distinctive group of mountains on the western border of the Colorado Plateau in southern Utah. The Utah-Colorado border lies seven miles

to the east of the mountains. The mountains, composed of about 20 peaks, are almost bisected by the meridian of 109 degrees and 15 minutes west longitude and its north-south borders are 30 degrees and 20 minutes and 30 degrees and 35 minutes north latitude. The range, the second highest in Utah, has its highest point in Mt. Peale, which is 13,087 feet in elevation.

The range has rather well defined vegetational communities. As one ascends the mountains, the various vegetational communities are evident. There is an Atriplex community at the base of the mountains on the north, south and west sides. The Atriplex community is immediately adjacent to the mountains on the south and west. The Colorado River flows at the foot of the range on the north side and to the north of the river there is an Atriplex community. To the east of the mountains is the Colorado Plateau which is higher and slopes more gently than the areas at the base of the mountains on the other sides. The eastern side of the mountains is continuous with the Pinus-Juniperus community of the Colorado Plateau.

Ascending the mountains, one passes through a forest community composed mainly of Pinus edulis and



and Juniperus osteosperma. Above this pygmy forest is located a Quercus community which grades into a Populus tremuloides forest. The next community up the mountains is a Picea engelmannii and Abies lasiocarpa dominated community and above the conifers is an Alpine Tundra community. These communities are readily discernible and in some places there are distinct ecotones dividing one community from another.

There have been a number of people who have trapped in the La Sal Mountains and some have reported, in part, their findings. In 1907, Cary (1911) took a trip into the region as part of the preparations for his biological survey of Colorado. He mentioned three species (Sorex palustris, Perognathus apache, Eutamias quadrivittatus) which were found on the extreme eastern portion of the mountains. Tanner and Hayward (1934) made a biological survey of the mountains and although numerous mammal collections were made, they did not include reports of their results in their paper. They worked in the region in 1927 and 1934. Special attention was given to the mammals of the region in 1934. They prepared numerous skins which are housed in the Brigham Young University collection and are included with the specimens examined for this study. M.

Raymond Lee (1960) did considerable trapping in 1955, 1956 and 1957. His trapping was limited almost exclusively to the higher elevations. The material prepared by him is housed in the collection of the University of Utah and was also examined by me. Durrant (1952) in his comprehensive work on the mammals of Utah has indicated those species which occur in the region. There have been several recent changes in the list he compiled, all of which are incorporated in this paper. I have also found a species previously unreported for the region.

My own study endeavors to make a contribution to our knowledge of the mammals of the La Sal Mountains with particular emphasis on their distribution. In addition, I have compiled an annotated list of all the species known to be present and indicated those which may be expected to be found but for which there exist no records.

### Geology

The La Sal Mountains are divided into three basic regions: northern, central and southern. The northern region and the central region are separated by Geysers Pass; the central and southern regions are divided by La Sal Pass. The peaks of the entire region range from

10,000 to 13,087 feet. The peaks of the southern portion are not as high as those of the other two areas of the mountains.

The age of the mountains is probably Tertiary Period (Gould, 1926). They are certainly post-Cretaceous Age as the youngest rocks exposed near the mountains are of this age. Cross (1893) suggests that the West Mountains in Colorado are certainly Tertiary in origin and that everything suggests that other groups, including the La Sals, are of the same age.

During the Pleistocene Epoch, the La Sals were glaciated. The glaciers were small and there is doubt as to whether the southern group was glaciated. In the northern groups, there are several prominent cirques which include areas in Miner's Basin, Deepcreek Basin, Beaver Basin and Bachelor Basin. None of the glaciers in these basins extended far enough from the cirques to form the U-shaped valleys typical of glaciated areas, but there are rounded morainal deposits. In Dark Canyon and Gold Basin, however, glaciers did extend far enough to form U-shaped valleys. The largest glacier appears to have been in Dark Canyon. In addition to leaving the most extensive U-shaped valley, there are large enough morainal deposits to dam up

the valley and to form morainal lakes. There are three morainal lakes: Dark Canyon Lake, the largest, Pratt's Lake, and Little Blue Lake. There are also bogs whose origins were also glacial. The three lakes are east of Mt. Peale and Mt. Mellenthin and are all at an elevation of about 10,500 feet.

## METHODS

The field work for this project was conducted during the summers of 1968 and 1969. During this time, each of the communities was observed and at least one trapline was operated for a minimum of seven consecutive days. The traplines were set in straight lines in areas representative of five vegetational communities. The traps were set about 30 feet apart and varied from 30 to 147 traps per line. Four types of traps were used. The two most extensively used were Museum Special snap traps and Sherman live traps. Young traps and Hubbard traps were also used when live animals were desired.

In the basic traplines, the traps were alternated Museum Special trap - Sherman live trap. Additional lines were set out which contained snap traps only, Young traps only or Hubbard and snap traps together. When the Hubbard and snap traps were used together, the lines contained twice as many snap traps as live traps because instead of alternating the traps the traps were set out three together, one Hubbard and two snap traps. At least two lines were



Fig. 1. Map of La Sal Mountains. Stars indicate areas in which specimens were collected.

maintained at the same time in all except one week of trapping in Castle Valley. Sometimes three or four traplines were used concurrently. The traps were baited with rolled oats. The traps were checked three times daily except for one of the lines in the Pinus-Juniperus community during 1968 in which the line was only visited twice daily. Collections and rebaiting occurred in the morning before sunrise, shortly after noon, and again in the late afternoon about an hour and a half before sunset. In addition to the traps used in the traplines, there were certain other traps used to catch muskrats, gophers and weasels.

In 1968, there were 2,138 trap nights and 1,131 trap nights in 1969, making a total of 3,269 trap nights for this study--a trap night being defined as one trap set for one 24 hour period. There was a total of 523 collections made, including recapture in the live traps. Most of the animals taken in the live traps were released after recording information about them. Some of the specimens taken in the snap traps were prepared as study skins and skulls.

The basic traplines for each community were maintained for seven consecutive days. The additional traplines

which were used in each of the communities were maintained three to six days. There was one trapline which ran from the Pinus-Juniperus community into the Quercus community. This trapline was the longest of the traplines used. It was about 800 yards long, whereas the length of most of the other lines was 300-400 yards; these lines were restricted to one community. The lines which were near Warner Lake and just below Warner Ranger Station within the Populus community were about 200 yards long. While I was camped at Warner Lake, these lines were generally maintained in hopes of collecting shrews or jumping mice.

In addition to trapping, a number of animals were shot and a number were sighted or counted as present after tracks or scat were observed. Two to four hours daily were spent in walking or hiking in areas adjacent to the campsite. Work was conducted in four different localities, Warner Ranger Station, Geyser Pass, one and one-half miles northeast of La Sal Junction and in Castle Valley.



## RESULTS

### Biotic Communities

The biotic communities are variable in their position on the mountains. The variation is due to the interaction of a number of factors, including slope exposure and steepness, soil conditions and moisture. The biotic communities tend to be arranged in definite belts. Although each of the communities will be generally characterized, it must be remembered that there is great variation within each general community, and there are subdivisions of each.

#### Pinus-Juniperus Community

The Pinus-Juniperus community (see Fig. 2, 3, 4, and 5) is found on the lower slopes and foothills which surround the mountains. The Pinus-Juniperus community extends from the valley floor, where the elevation is about 4,000 feet, up to as high as 7,500 feet on the southern exposure of the southern portion of the range. On the eastern side of



Fig. 2. Rocky terrain of the Pinus-Juniperus community

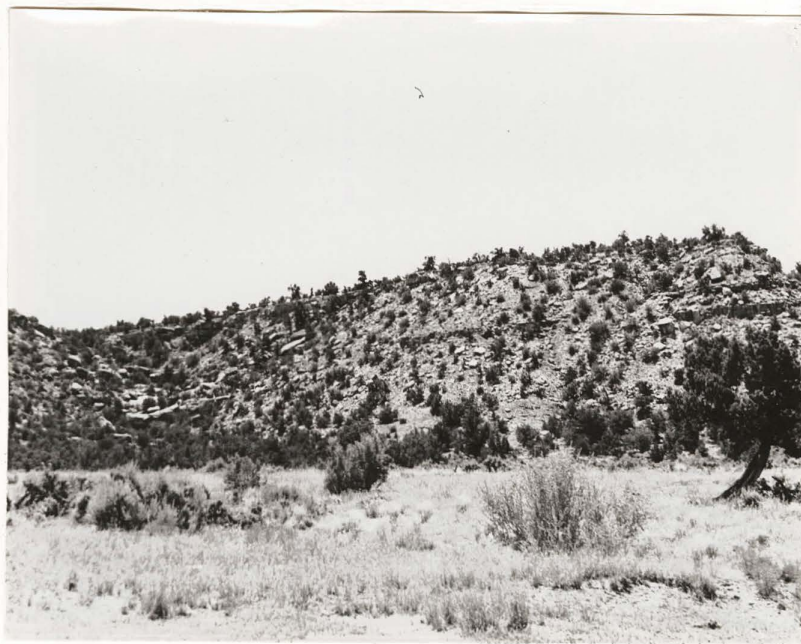


Fig. 3. Lower limits of the Pinus-Juniperus community

the mountains, the community extends eastward into Colorado. Much of this community is found in moderately steep and rocky canyons near the base of the mountains. There are flat areas on some of the foothills of the western edge of the mountains which are included within this community.

The predominant plants include Pinyon Pine, Pinus edulis and Utah Juniper, Juniperus osteosperma. Big Sagebrush, Artemesia tridentata, Mountain Mahogany, Cercocarpus montanus, Rabbitbrush, Chrysothamnus sp., and Brigham Tea, Ephedra viridis. Several species of Yucca and Opuntia are also present in this community. There is abundant Indian Rice Grass, Oryzopsis hymenoides, and lesser amounts of Sandberg Bluegrass, Poa secunda, and Sand Dropseed, Sporobolus cryptandrus.

There are several species of mammals that appear to be confined to this community, or at least are most abundant here. Nearly limited to this community is the pinyon mouse, Peromyscus truei. Longhurst (1940) and Rasmussen (1941) have reported that in other areas the pinyon mouse is also found in oakbrush and sometimes in montane areas above the Pinus-Juniperus community. This, however, was not the case in my study area in which pinyon mice were present only in the Pinus-Juniperus community. A trapline which ran from the



Fig. 4. Near view of the Pinus-Juniperus community



Fig. 5. Far view of the Pinus-Juniperus community

Pinus-Juniperus community up into the Quercus community yielded pinyon mice only in that portion of the transect which was part of the Pinus-Juniperus community. The Mexican wood rat, Neotoma mexicana, was limited to the rocky areas of this community as was the canyon mouse, Peromyscus crinitus. Although Durrant (1934) found Neotoma albigula, the white-throated wood rat, to be from "nests which occurred abundantly on the sagebrush covered valley," the specimens which I collected were trapped on very steep rocky slopes. Durrant's specimens all came from Castle Valley and those which I collected were from the southern end of the mountains.

There were a number of species which were found only in the lower limits of the Pinus-Juniperus community. Some of these are limited by the type of habitat. Ord's kangaroo rat, Dipodomys ordii, and the Apache pocket mouse, Perognathus apache, are both limited to sandy areas. The western harvest mouse, Reithrodontomys megalotis, and the northern grasshopper mouse, Onychomys leucogaster, were both at the lower limits of this community. The Colorado chipmunk, Eutamias quadrivittatus, was found in the middle and lower limits of the Pinus-Juniperus community as was the antelope ground squirrel, Ammospermophilus leucurus.

The rock squirrel, Spermophilus variegatus, and the deer mouse, Peromyscus maniculatus, were found throughout this community. The frequency of P. maniculatus decreased markedly in the transition from the Quercus community to the Pinus-Juniperus community. Also found throughout the Pinus-Juniperus community were the coyote, Canis latrans, and the porcupine, Erethizon dorsatum.

In the upper elevations of the Pinus-Juniperus community, the least chipmunk, Eutamias minimus, was found. Least chipmunks were often found in the trapline which ran from the Pinus-Juniperus into the Quercus community. In a trapline which was located 200-300 yards from the Quercus community, they were found less frequently and none were collected in a trapline three-fourths of a mile below the Quercus community.

The Nuttall cottontail, Sylvilagus nuttallii, is an inhabitant of this community and Audubon's cottontail, S. audubonii, probably extends into this community also. Durrant (1952) examined specimens of S. audubonii which were collected in the valleys around the mountains and states that they are not inhabitants of mountains. I did not collect any specimens to verify or disprove this.

## Quercus Community

The Quercus community (see Fig. 6) generally is located about midway up the mountains and occupies a zone 1,200 to 1,800 feet in width. The upper limits of this community are usually between 8,000 and 9,000 feet and varies in its position and extensiveness with the same factors which influence all of the communities. The dominant plant is Quercus gambelii, Gambel's Oak. In the lower limits of this community, there are Mountain Mahogany, Cercocarpus montanus. Some plants of Blue Flag, Iris missouriensis, were found in open swampy areas at the upper limits of this community.

There are additional plants in an undergrowth consisting of grasses and forbs. The undergrowth is most dense in the small open areas which are present between the clumps of Gambel's Oak.

Extensively found in the Quercus community were the ubiquitous deer mouse, Peromyscus maniculatus, and the least chipmunk, Eutamias minimus. The porcupine, Erethizon dorsatum, occurred in this community. Also occurring within this and extending down towards the base of the mountains was the cottontail, Sylvilagus nuttallii, and the



Fig. 6. Quercus community



Fig. 7. Populus community



rock squirrel, Spermophilus variegatus. The coyote, Canis latrans, extended into this community. During the period of my study, this was the area in which the mule deer, Odocoileus hemionus, was most commonly observed, but their distribution varies greatly with the time of year as they move up and down the mountains. One shrew, Sorex vagrans, was collected within this community about one-half mile from water.

Populus tremuloides  
Subclimax Community

The Populus community (see Fig. 7) is subclimax to the coniferous forest Picea-Abies community and there is evidence of coniferous invasion at the upper limits. The subclimax community is typified by Quaking Aspen, Populus tremuloides. There is a dense undergrowth among the aspens of broad-leafed plants, grasses and sedges. Some of these include Geranium sp., Poa curta, several species of Stipa and Carex. At the elevation of the Populus community, which may occur between 8,000 and 10,500 feet, there are some moist and flat areas in which the Blue Flag, Iris missouriensis, is found in abundance. The bogs where the Blue Flag is found also contain willow, Salix sp., and sedge, Carex sp., in

addition to other plants. In some areas, the aspen stands are dense while in other situations they are sparse and well interspersed with invading conifers.

Among the mammals most commonly found within this community were the deer mouse, Peromyscus maniculatus, and the least chipmunk, Eutamias minimus. The wet portions were the only areas in which the long-tailed vole, Microtus longicaudus, was found; but this species also extends into similar habitats of the Picea-Abies community and the alpine meadows as well. Two other inhabitants of the wet portions of the Populus community were the vagrant shrew, Sorex vagrans, and less frequently the water shrew, Sorex palustris. The western jumping mouse, Zapus princeps, occurred only rarely. At Warner Lake within the Populus community, some muskrats, Ondatra zibethicus, were collected.

A long-tailed weasel, Mustela frenata, was collected within the Populus community, but the weasel occurs in other communities also. Also found was the striped skunk, Mephitis mephitis, which also ranges into other communities. There were numerous deer, Odocoileus hemionus, observed in the Populus community, but they were not as commonly observed as in the Quercus community.

The rock squirrel, Spermophilus variegatus, ranges into the Populus community. Pocket gophers, Thomomys talpoides, were collected in the open areas and in the fringes of the Populus forest surrounding the open areas. In some areas, large amounts of earth displacement were seen as evidence of the activity of pocket gophers. The largest amount of activity appeared to be within the open areas, but there was also evidence of activity within the forest. Marmots, Marmota flaviventris, were found within the Populus community; and it appeared that they preferred burrows on the perimeter of open areas, although they were present both in the open areas and the forested areas of the Populus community.

#### Picea-Abies Community

This coniferous forest community is found at elevations varying from 10,000 up to 12,000 feet. The dominant trees are Engelmann's Spruce, Picea engelmannii, and the Alpine Fir, Abies lasiocarpa. The trees are usually in dense uniform stands, and there is often a great deal of fallen timber on the forest floor. There is a varying amount of undergrowth in this community; but it is seldom as dense as the undergrowth of the Populus community, although there

are many plants common to the two communities such as Geranium spp., Carex spp., and species of Stipa. There are also large subalpine meadows which are part of this community. They are open areas which are often wet and have streamlets running through them. These subalpine meadows contain numerous sedges, Carex spp., some willows, Salix spp., and other plants.

The red squirrel, Tamiasciurus hudsonicus, is restricted to this community due to its habit of feeding on cones. Most of the mammals of the Populus community were found in the Picea-Abies community also. I saw no rock squirrels, Spermophilus variegatus, and found no evidence of pocket gophers, Thomomys talpoides, but there is a skin of one in the Brigham Young University collection from Geyser Pass, which is well within the Picea-Abies community.

#### Alpine Tundra Community

The Alpine Tundra community occupies the rocky areas and meadows above timberline and is characterized by low growing plants such as Salix sp., the grasses Poa sp. and Agropyron sp., and sedges, Carex sp. Some other plants

which are found in this community are Silene acaulis, Polemonium sp. and Claytonia megarrhiza.

The pika, Ochotona princeps, was found in the rocky areas of this community as well as in the talus slopes that extend down into other communities in some areas. Also found within the Alpine Tundra were marmots, Marmota flaviventris, which use the rocks to provide shelter and dens. The deer mouse, Peromyscus maniculatus, the least chipmunk, Eutamias minimus, and the long-tailed vole, Microtus longicaudus, were also present in some areas where the conditions were moist in the case of the vole or there was taller vegetation in the case of the deer mouse and least chipmunk.

#### Accounts of the Species

The following list of species of mammals found in the La Sal Mountains is taken from the 968 specimens examined. Of the specimens examined, 523 were collected by me, 122 were in the Brigham Young University collection, and 323 were in the University of Utah collection. In addition to these specimens, there are included records by sightings or other proof of presence. Where there is an endemic subspecies or a subspecies which was first described

FIGURE 8

The distribution of species within and between the plant communities.

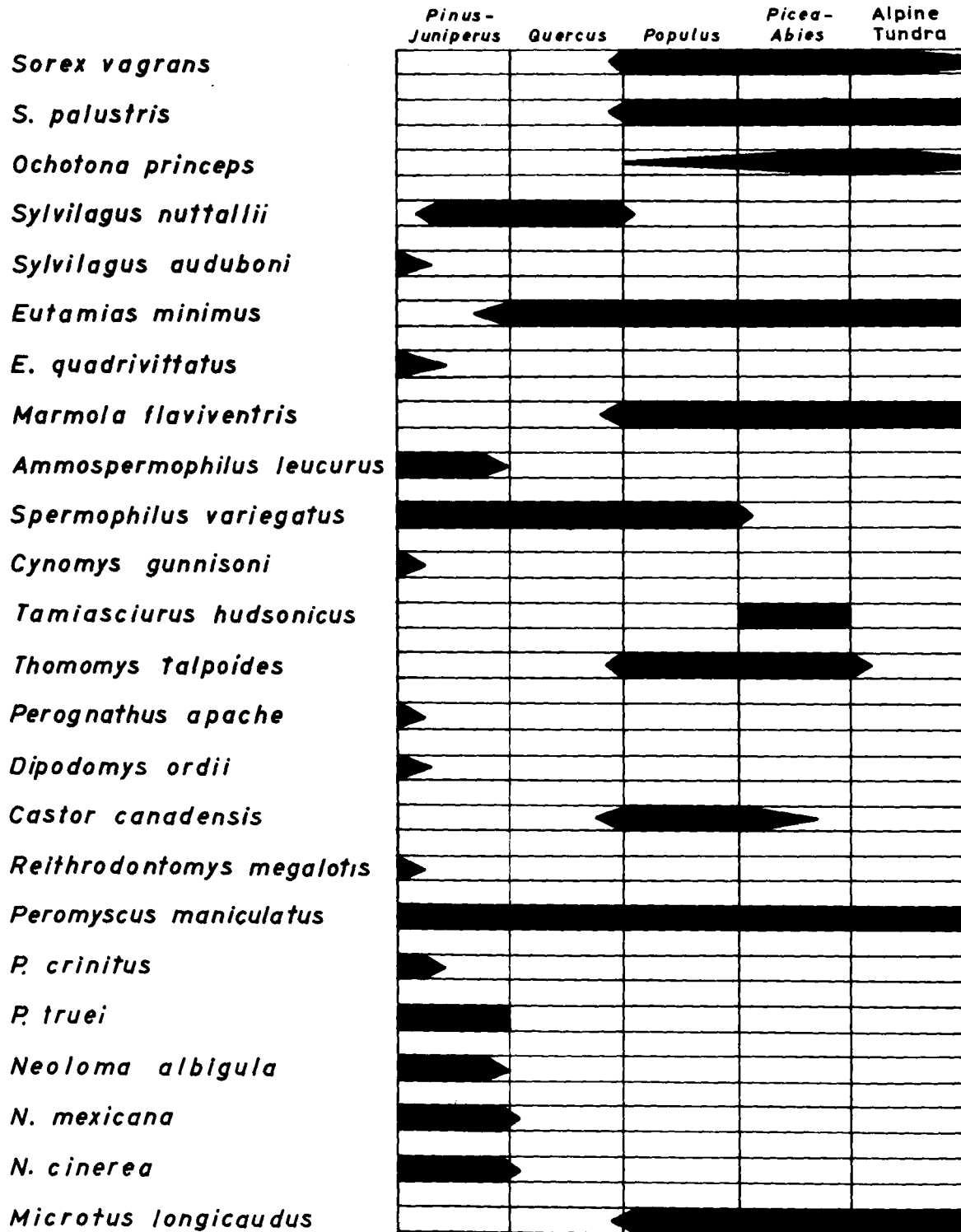
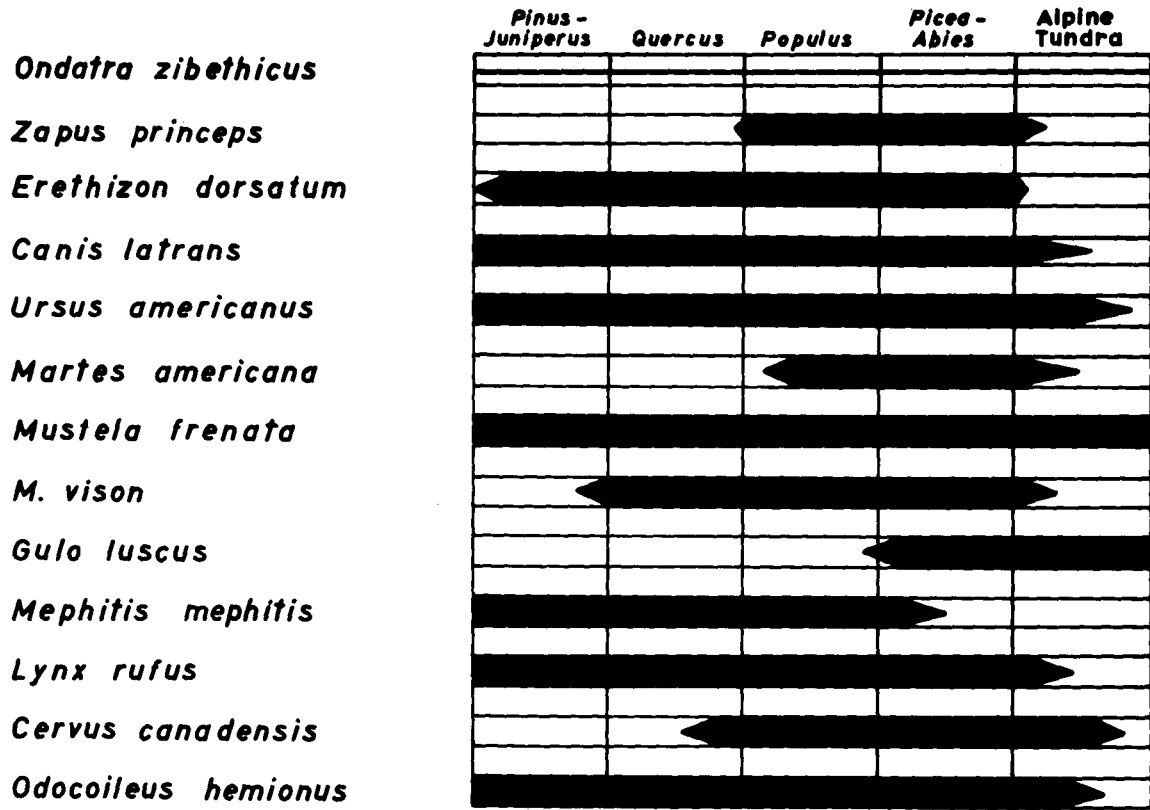


FIGURE 8 (Continued)



from the mountains, then the original reference is given. Those specimens from the Brigham Young University collection are denoted (BYU) and those from the collections of the University of Utah are denoted (UU).

Sorex vagrans obscurus Merriam  
Vagrant Shrew

Thirty-five specimens examined: Warner Ranger Station 9,750 feet, 9 (BYU); 1.5 miles west Warner Ranger Station, 4; Geyser Pass, 2 (BYU); 2.5 miles northeast of La Sal Peak, 6 (UU); Beaver Creek, 20 (UU).

The vagrant shrew is found close to water. They usually live along streambanks or along the banks of ponds in the litter and under the grasses and sedges adjacent to streams and ponds. I collected one specimen, however, which was more than half a mile from the nearest water. They are active day and night and specimens were collected during the day as well as at night.

Sorex palustris navigator (Baird)  
Water Shrew

Ten specimens examined: Warner Ranger Station 9,750 feet, 5 (UU); .5 mile west Warner Ranger Station, 1; Beaver



Creek 2 miles northeast Mt. Mass 8,720 feet, 1 (UU); Beaver Creek 1.5 miles east La Sal Peak 9,200 feet, 3 (UU).

The water shrew is less common in distribution in the La Sals than the vagrant shrew. I collected only one specimen. They are more restricted to water habitats than the vagrant shrew.

Ochotona princeps lasalensis Durrant and Lee  
Pika

1955. Ochotona princeps lasalensis Durrant and Lee. Proc. Biol. Soc. Washington 68:4, May 20 type from Warner Ranger Station, 9,750 feet, La Sal Mountains, Grand County, Utah.

Twenty-eight specimens examined: Warner Ranger Station, 1 (BYU), 9,750 feet 1 (UU), 9,200 feet 3 (UU); Geyser Pass, 7 (6 BYU); 2 miles north Geyser Pass, 1; Beaver Basin 10,400 feet, 12 (UU); Mt. Maas 10,800 feet, 3 (UU); Mt. Peale (south), 1 (UU); Mt. Mellentine (Mellenthin) 12,280 feet, 2 (BYU).

Pikas are found in the rocky areas above timberline and in the talus slopes which extend down through the Picea-Abies community and into the Populus subclimax community. I did not observe any pikas away from the rocks. They are

active throughout the day but seem to be most active during the first two hours of sunlight. They live in areas where the rocks are big enough to allow them underneath the rocks in the empty spaces.

Sylvilagus nuttallii pinetis (J. A. Allen)  
Nuttall Cottontail

Eleven specimens examined: 3 miles west Warner Ranger Station, 2; 2 miles northeast La Sal Peak 9,000 feet, 2 (UU); Fisher Mesa 4 miles northeast La Sal Peak 7,500 feet, 1 (UU); 5 miles northeast La Sal P. O. 8,000 feet, 1 (UU); Black Canyon 19 miles southeast Moab 5,400 feet, 4 (UU).

The Nuttall cottontail is found on the mountains in the two lower communities. They seem to prefer portions of these communities where there is dense undergrowth, and when disturbed they run into this undergrowth. They are not very fast runners and the undergrowth provides protection. They appeared to be most active in the evening, when they were often observed along the roads. They were occasionally observed during the day.

Sylvilagus audubonii warrenii Nelson  
Desert Cottontail

Five specimens examined: 22 miles south Moab, 1 (BYU); Castle Valley, 1 (BYU); 8 miles south Moab 4,500 feet, 1 (UU); Black Canyon 19 miles southeast Moab 5,400 feet, 2 (UU).

The Desert cottontail is believed to be a more desert species while the Nuttall cottontail is believed to be a mountain dwelling species. There is some overlap in the ranges in which they are to be found as is evidenced by the fact that there are specimens of each species from the same area in the University of Utah collection. The Desert cottontail is probably only found in the very lower limits of the Pinus-Juniperus community.

Eutamias minimus operiarus Merriam  
Least Chipmunk

Ninety-seven specimens examined: Warner Ranger Station, 12 (8 BYU); 1.5 miles west Warner Ranger Station, 13; Geyser Pass, 14 (8 BYU); .5 mile east Geyser Pass, 1; Beaver Creek .5 mile east of Beaver Basin, 2 (UU); Beaver Basin northeast of Waas Peak 8,720 feet, 2 (UU); Beaver Basin northwest of Waas Peak 10,400 feet, 3 (UU); Beaver

Basin 1.5 miles east La Sal Peak 9,000 feet, 11 (UU); 3 miles northeast La Sal Peak 8,500 feet, 3 (UU); Bromley Ridge 7.5 miles west Geysers Pass, 21; 1 mile southeast Mesa Ranger Station, 11 (UU); Mt. Tukuhiwivatz, 1 (BYU); near La Sal, 2 (BYU); La Sal Mountains, 1 (BYU).

The least chipmunk is found over much of the mountains from the upper portions of the Pinus-Juniperus community up to the Alpine Tundra community. They are diurnal and appear to be active throughout all the daylight hours. They are reproductively active during all of the summer months at least. Lactating females were found in June, July, and August, and females with embryos were collected as late as August.

Eutamias quadrivittatus hopiensis Merriam  
Colorado Chipmunk

Five specimens examined: 1.5 miles northeast La Sal Junction, 4; Castle Valley, 1.

The Colorado chipmunk is limited to the lower limits of the Pinus-Juniperus community and is found in the Atriplex community below it. They were often seen along the road from Moab to Castle Valley. There were no specimens collected in the trapline which was located about midway

through the Pinus-Juniperus community. They are active during the day and their activities seem to be restricted to the daylight hours.

Marmota flaviventris luteola A. H. Howell  
Yellow-Bellied Marmot

Five specimens examined from Geysers Pass (BYU).

Marmots were often observed in the Populus community and up to the Alpine Tundra community. They appear to be active throughout the day and no sign of nocturnal activity was observed. They used burrows in the Populus community and several burrows were observed at the edge of open meadows within this community. In the Alpine Tundra community, they were most often observed at the interface between rockslides and meadows where they used open spaces under the rocks instead of burrows for their dens.

Ammospermophilus leucurus cinnamomeus Merriam  
Antelope Ground Squirrel

One specimen collected near Back Creek 10 miles southeast of Moab.

There were a few of these ground squirrels seen periodically along the road in the lowermost portions of the Pinus-Juniperus community. There were no observations

made nor any collections made in the trapline located midway through the Pinus-Juniperus community.

Spermophilus variegatus grammurus Say  
Rock Squirrel

Six specimens examined: 3 miles east Warner Ranger Station 8,000 feet, 1 (UU); Millcreek 6 miles west Geyser Pass, 1; 1.5 miles northeast La Sal Junction, 2; La Sal, 2 (BYU).

Rock squirrels were often seen during the day over much of the mountains. They were collected in the lowest traplines in the Pinus-Juniperus community and were often observed at Warner Ranger Station within the Populus community.

Cynomys gunnisoni zuniensis Hollister  
Zuni Prairie Dog

Two specimens were examined: La Sal, 1 (BYU); 8 miles east of La Sal, 1.

The only area in which I was able to find prairie dogs was in the valley between Pine Ridge and the rest of the La Sal Mountains. There was a small colony present in the eastern end of the valley. I spent several hours observing them. This valley is under cultivation and I

assume that the distribution of this species was more extensive in previous years as is indicated by the specimen collected at La Sal in 1934.

Tamiasciurus hudsonicus fremonti (Audubon and Bachman)  
Red Squirrel

Eighteen specimens were examined: 1 mile west Geyser Pass 11,000 feet, 1 (UU); 1 mile east Geyser Pass, 1 (UU); 3 miles west Geyser Pass, 3 (UU); Geyser Pass, 1; Clark Lake, 8 (4 BYU) (4 UU); 1 mile north Clark Lake, 1; Beaver Basin 10,400 feet 1 mile northeast of Waas Peak, 1 (UU); Beaver Basin 10,500 feet 1 mile northwest of Waas Peak, 1 (UU); La Sal Mountains, 1 (BYU).

The distribution of the red squirrel is limited to the Picea-Abies community. I did not observe them outside of this community. They are diurnal and begin activity as soon as it is light. I observed a pair of red squirrels in a nest in a tree next to my camp at Geyser Pass. I observed another pair in a nest in a hollow tree stump which was about 10 feet off the ground. I searched the nest in hopes of finding young, but there were none. The pair was not observed to return to this nest after having been disturbed. The nest was observed daily for a week.

Thomomys talpoides durranti Kelson  
Northern Pocket Gopher

Thirty-four specimens examined: Warner Ranger Station, 13 (5 BYU) (8 UU); Geyser Pass, 2 (BYU); 3 miles west Geyser Pass 10,400 feet, 4 (UU); 3 miles northeast La Sal Peak 8,500 feet, 4 (UU); Beaver Creek 2 miles northeast Mt. Maas 8,720 feet, 3 (UU); 1 mile southeast Mesa Ranger Station 9,200 feet, 3 (UU); La Sal Mountains, 1 (BYU).

Pocket gopher diggings were frequently seen in the Populus community and in the Picea-Abies community. The frequency of diggings appeared to be greater within the Populus community than in the Picea-Abies community. Fresh diggings were often observed in the mornings when the soil was still moist. The activity of the pocket gophers did not seem to be limited to any one part of the day. Soil was not always removed from the tunnel system at the same point. Freshly removed soil was found in the same pile two or three days in a row and then there would be inactivity for some period of time.

Perognathus apache caryi Goldman  
Apache Pocket Mouse

Seven specimens examined: 22 miles south Moab, 4 (BYU); 1.5 miles northeast La Sal Junction, 1; Castleton, Grand County, 2 (BYU).



The Apache pocket mice were found only in the lower limits of the Pinus-Juniperus community and are probably limited to the sandy areas of this community. The sandy areas in which they are found often grade into the Atriplex community.

Dipodomys ordii nexilis Goldman  
Ord Kangaroo Rat

Fourteen specimens examined: 22 miles south Moab, 11 (BYU); 20 miles south Moab, 2 (BYU) Castle Valley, 1 (BYU).

I was unable to collect any of this species in the traplines. They are limited to the sandy areas of the lower portions of the Pinus-Juniperus community.

Castor canadensis Kuhl  
Beaver

One dead specimen was observed in Lake Oowah in July, 1968, and fresh tracks were observed in Beaver Basin in June 1969. C. L. Hayward reported that he had observed an active lodge near Warner Ranger Station in 1966. There are numerous old beaver dams in the mountains, especially in Beaver Basin.

Reithrodontomys megalotis axtecus Allen  
Western Harvest Mouse

One specimen from 22 miles south of Moab was examined.

I believe the western harvest mouse is essentially an inhabitant of the Atriplex community with occasional movement into the Pinus-Juniperus community of the mountains.

Peromyscus maniculatus rufinus (Merriam)  
Deer Mouse

One hundred fourteen specimens examined: Warner Ranger Station, 23 (13 BYU) (6 UU); 1.5 miles west Warner Ranger Station, 5; .5 mile north Warner Ranger Station 9,200 feet, 1 (UU); Geysers Pass, 6; 3 miles west Geysers Pass 10,000 feet, 2 (UU); Beaver Basin northwest Waas Peak 10,400 feet, 2 (UU); Beaver Creek 1 mile east Beaver Basin 9,500 feet, 12 (UU); Beaver Creek 1.5 miles east La Sal Peak 9,000 feet, 23 (UU); 2.5 miles northeast La Sal Peak 8,500 feet, 6 (UU); 3 miles northeast La Sal Peak 8,500 feet, 15 (UU); 1.5 miles northeast La Sal Peak 9,000 feet, 8 (UU); Bromley Ridge 8 miles west Geysers Pass, 6.

Deer mice were found within every community and were the most abundant animal collected. The frequency of deer mice appeared to decrease with an apparent increase in pinyon mice, Peromyscus truei, in the Pinus-Juniperus community. In the Alpine Tundra community, there were some specimens collected in talus slopes 30 yards from the nearest vegetation. In the alpine meadow, they were more often collected near the edge of the meadows than in the middle of the meadows. They are nocturnal and reproductively active during all the summer months as verified by the fact that lactating females were collected in June and females with embryos were collected in August.

Peromyscus crinitus auripectus Allen  
Canyon Mouse

Eight specimens examined: 22 miles south Moab, 1 (BYU); 1.5 miles northeast La Sal Junction, 7.

All of the specimens collected were found in the lower limits of the Pinus-Juniperus community and were collected only along very rocky canyon walls. The mice are nocturnal.

Peromyscus truei truei Schufeldt  
Pinyon Mouse

Twenty-six specimens examined: 22 miles south Moab, 1 (BYU); 1.5 miles northeast La Sal Junction, 6; Bromley Ridge 7.5 miles west Geyser Pass, 5; Bromley Ridge 8.5 miles west Geyser Pass, 6; 15 miles southeast Moab 6,000 feet, 6 (UU); Castle Valley 18 miles northeast Moab, 3.

The pinyon mouse was limited to the Pinus-Juniperus community. The increase in the frequency which occurred as I trapped farther from the Quercus community and into the Pinus-Juniperus community was accompanied by an apparent decrease in the frequency of Peromyscus maniculatus.

Onychomys leucogaster pallescens Merriam  
Northern Grasshopper Mouse

One specimen from 22 miles south of Moab was examined. This species is limited on the mountains to the lower part of the Pinus-Juniperus.

Neotoma albigula brevicauda Durrant  
White-Throated Wood Rat

1934. Neotoma albigula brevicauda Durrant, Jour. Mamm. 15:65, February 16, type from Castle Valley, about 15 miles northeast Moab, Grand County, Utah.

Twenty-one specimens examined: Castle Valley, 1 (BYU); Castle Valley 18 miles northeast Moab 6,000 feet, 7 (UU); Castle Valley 18 miles northeast Moab 4,500 feet, 5 (UU); 10 miles northeast Moab 4,500 feet, 5 (UU); Little Castle Valley, 2 (UU); 1.5 miles northeast La Sal Junction, 2.

The specimens I collected came from the southern portion of the mountains on steep rocky slopes although Durrant (1934) describes the species as occurring around sagebrush on the valley floor. The species is limited on the mountains to the Pinus-Juniperus community and probably to the lower limits of this community.

Neotoma mexicana inopinata Goldman  
Mexican Wood Rat

Two specimens examined: 1.5 miles northeast La Sal Junction, 1; Bromley Ridge 8.5 miles west Geyser Pass, 1.

Both of the specimens were collected on rocky slopes in the Pinus-Juniperus community and the species is limited on the mountains to this community.

Neotoma cinerea arizonae Merriam  
 Bushy-Tailed Wood Rat

I examined no specimens, but Durrant (1952) reported them to be in Castle Valley.

Microtus longicaudus alitcola Merriam  
 Long-Tailed Vole

Sixty-eight specimens examined: Warner Ranger Station, 11 (BYU); .5 mile west Warner Ranger Station, 8; .5 mile north Warner Ranger Station 9,000 feet, 2 (UU); Geyser Pass, 1 (BYU); 1 mile east Geyser Pass 9,700 feet, 2 (UU); 2.5 miles northeast La Sal Peak 8,500 feet, 21 (UU); 1.5 miles east La Sal Peak 9,000 feet, 11 (UU); Beaver Creek 1.5 miles east La Sal Peak, 10 (UU); Beaver Creek .5 mile east La Sal Peak 9,500 feet, 1 (UU); Beaver Basin 10,400 feet northwest Waas Peak, 3 (UU); Beaver Creek .5 mile east La Sal Peak 9,000 feet, 1 (UU); .5 mile east Beaver Basin, 1 (UU); 3 miles northeast La Sal Peak 8,500 feet, 1 (UU).

The long-tailed vole was found only within the wet portions of the Populus and Picea-Abies communities. There were specimens collected during the day as well as at night. The areas in which I collected specimens were wet and covered with grasses with willows nearby.

Ondatra zibethicus (Linnaeus)  
Muskrat

Three specimens from Warner Lake were collected. In the lake, there were channels visible where the muskrats had the entrances to their burrows. The burrows were in the bank of the lake which was originally placed there to create the artificial lake. I found four entrances along the bank to two or three lodges. It appeared that at least two of the entrances led to the same lodge.

Zapus princeps chrysogenys Lee and Durrant  
Western Jumping Mouse

1960. Zapus princeps chrysogenys Lee and Durrant, Proc. Biol. Soc. Washington 73:172, December 30, type from 2.5 miles northeast La Sal Peak, La Sal Mountains, 8,500 feet, Grand County, Utah.

Five specimens examined: Warner Ranger Station, 1; Beaver Creek 2 miles northeast Mt. Maas 8,720 feet, 2 (UU); Beaver Creek 1.5 miles east La Sal Peak 9,000 feet, 2 (UU).

The specimens were all collected within the Populus community. They have not been collected often in these mountains. The only specimen I did collect was trapped along the bank of Warner Lake in an area abundant with

grasses and sedges and was a lactating female. Their habitat preference seems to include an area near water. The rarity of the species in the La Sals is perhaps due to population cycling or due to the limit of the range of this species or a combination of the two.

Erethizon dorsatum couesi Mearns  
Porcupine

Two specimens from Clark Lake were examined (BYU). There were numerous sightings of the animals and the sign of them was evident in a number of communities. I observed porcupines within the Populus, Quercus and Picea-Abies communities. There were trees within the Pinus-Juniperus community which showed the presence of porcupines in this community also. They were often sighted at dusk in the Quercus community. I observed an adult and a half-grown immature together in mid-July.

Canis latrans Say  
Coyote

I examined one skin without a skull from La Sal (UU). I heard them howling one night from Bromley Ridge. It is likely that they extend up to at least the Populus community.



Ursus americanus amblyceps (Baird)  
Black Bear

No specimens were examined, but Barnes (1927) reported them to be in the area. Mr. Redd, a rancher familiar with the mountains, related to me that he had observed a bear in the summer of 1966.

Martes americana (Turton)  
Marten

Barnes (1927) reported the marten to be in the mountains.

Mustela frenata nevadensis Hall  
Long-tailed Weasel

Three specimens were examined: Warner Ranger Station, 1; Fisher Mesa 7,500 feet, 1 (UU); 1.5 miles east La Sal Peak, 1 (UU).

The specimen collected at Warner Ranger Station was collected right in the campgrounds. I also observed an animal twice at Lake Oowah.

Mustela vison energumenos (Bangs)  
Mink

Barnes (1927) reported mink to be in the La Sal National Forest.

Gulo luscus (Linnaeus)  
Wolverine

Wood (1958) reported having seen a wolverine near Geyser Pass on July 6, 1958.

Mephitis mephitis (Schreber)  
Striped Skunk

I observed a striped skunk about .5 mile east of Warner Ranger Station in July 1968.

Lynx rufus (Schreber)  
Bobcat

I saw no bobcats in the mountains, but Mr. C. Perkins, a forest ranger, and Mr. Redd, a rancher, both reported to me that they had seen them in the mountains in all of the various communities up to and including the Picea-Abies community.

Cervus canadensis (Erxleben)  
Wapiti

I saw no wapiti or elk, but there is a small native herd in the mountains. The herd is so small that only 10 big game permits for elk are issued yearly for the La Sal herd by the Utah State Fish and Game Commission.

Odocoileus hemionus (Rafinesque)  
Mule Deer

I observed numerous deer in the Populus and Quercus communities. They were most often seen in the early morning or evening. During the day, they were sometimes startled in the areas in which they were lying down. I observed only one deer in the Picea-Abies community and none in the Pinus-Juniperus community, although they undoubtedly occur there during parts of the year.

Hypothetical List of Species

The following is a list of species which may be found in the mountains but for which I can find no evidence.

1. Felis concolor True
2. Vulpes fulva (Desmarest)
3. Urocyon cinereoargenteus (Schreber)
4. Bassariscus astutus (Lichtenstein)
5. Mustela erminea Linnaeus
6. Spilogale gracilis Merriam
7. Taxidea taxus (Schreber)

## DISCUSSION

This study has noted the variation in the occurrence of certain mammals in the different biotic communities (see Fig. 8) of the La Sal Mountains. The Pinus-Juniperus community is characterized by the pinyon mouse, Peromyscus truei and the wood rats, Neotoma mexicana, N. albigula and N. cinerea. In addition, there are numerous species which occur only in the lower limits of this community. They are the Colorado chipmunk, Eutamias quadrivittatus; the Apache pocket mouse, Perognathus apache; Ord's kangaroo rat, Dipodomys ordii; the canyon mouse, Peromyscus crinitus; the western harvest mouse, Reithrodontomys megalotis; the northern grasshopper mouse, Onychomys leucogaster; and the desert cottontail, Sylvilagus audubonii. The least chipmunk, Eutamias minimus, is found in the uppermost portions of the Pinus-Juniperus community; and Nuttall's cottontail, Sylvilagus nuttallii, is also present.

The Quercus community does not have any species limited to it. The least chipmunk, Eutamias minimus, and the deer mouse, Peromyscus maniculatus, are both found often

in this community and are the dominant mammals. The Nuttall cottontail has its upward limits at the upper edge of this community.

The Populus subclimax community is characterized by a wide variety of rodents, none of which is limited in its distribution to this community; this is what would be expected of a subclimax community. The dominant forms are the deer mouse, Peromyscus maniculatus, and the least chipmunk, Eutamias minimus. The long-tailed vole, Microtus longicaudus, and the shrews, Sorex vagrans and S. palustris, appear to be more abundant in this community; but, they are also found at higher elevations in the Picea-Abies and Alpine Tundra communities.

The Picea-Abies community is the only community in which the red squirrel, Tamiasciurus hudsonicus, is found. The dominant forms in this community are the same as in the Populus community, Peromyscus maniculatus and Eutamias minimus. All of the species of the Populus community, with the exception of the rock squirrel, Spermophilus variegatus, extend up into the Picea-Abies community.

The Alpine Tundra community is characterized by the pika, Ochotona princeps. The marmot, Marmota flaviventris, is found also in this community but is also found

in the Picea-Abies and the lower limits of the Populus communities.

There are some species which are ubiquitous or nearly so. The deer mouse, Peromyscus maniculatus, is found within every community of the mountains. The least chipmunk, Eutamias minimus, is found from the upper limits of the Pinus-Juniperus community to the Picea-Abies community. The porcupine, Erethizon dorsatum, occurs in all the communities except the Alpine Tundra. The carnivores--the bobcat, Lynx rufus; the black bear, Ursus americana; the coyote, Canis latrans; and, the weasel, Mustela frenata--are widely distributed throughout the communities. The mule deer, Odocoileus hemionus, is found over the entire mountain range.

The mammals of the La Sal Mountains exhibit closer affinities to the mammals of Colorado than they do to the mammals of Utah west of the Colorado and Green Rivers. There are three subspecies which are endemic to the La Sal Mountains and the surrounding areas: Zapus princeps chryso-  
genys, Ochotona princeps lasalensis, and Neotoma albigula  
brevicauda. All of these subspecies exhibit closer affinities to the subspecies occurring in Colorado than they do to the mammals west of the Colorado River.

The western jumping mouse, Zapus princeps chryso-  
genys, is most closely related to the Z. p. princeps--Z. p.  
luteus complex which are found in Wyoming and Colorado (Z.  
p. princeps) and in New Mexico and Arizona (Z. p. lateus)  
than with Z. p. utahensis, which is found in Utah, Idaho  
and Colorado (Lee and Durrant, 1960).

According to Durrant and Lee (1955), the pika,  
Ochotona princeps lasalensis, is morphologically most  
related to O. p. saxatilis, which is found in Colorado and  
less closely related to the other eight subspecies which are  
found in Utah.

The third endemic subspecies, Neotoma albigula  
brevicauda, is the northernmost extension of a basically  
southern species. According to Durrant (1934), N. a. lap-  
tatensis, which occurs in extreme southwestern Colorado and  
extreme southeastern Utah, is intermediate in some charac-  
teristics between N. a. brevicauca and N. a. albigula, which  
is found in most of Arizona and New Mexico.

The principle reason for the closer affinities to  
the Coloradan, Arizonan and New Mexican mammals is the  
Colorado River. The Colorado River serves as an effective  
barrier to isolate the portion of the state of Utah to the  
east of the river from the portion of the state to the west

of the Colorado River. Of the 29 mammals in the mountains in which the subspecies is known, there are 12 subspecies for which the Colorado River acts as a total barrier, i.e., there are no specimens of these subspecies found on the west side of the Colorado River. These subspecies are: Ochotona princeps lasalensis, Sylvilagus nuttallii pinetis, Marmota flaviventris luteola, Cynomys gunnisoni zuniensis, Reithrodontomys megalotis aztecus, Peromyscus maniculatus rufinus, Neotoma albigula brevicauda, N. mexicana inopinata, N. cinerea arizonae, Zapus princeps chrysogenys, Erethizon dorsatum couesi, Ursus americana amblyiceps. There are seven other subspecies of the mountains for which the Colorado River acts as a partial barrier, i.e., it acts as a barrier in some places. For three of these--Ammospermophilus leucurus cinnamoneus, Eutamias minimus operarius, Dipodomys ordii nexilis--the Colorado River acts as a barrier in the region adjacent to the La Sal Mountains. For the four other subspecies--Perognathus apache caryi, Peromyscus crinitus auripectus, Onychomys leucogaster pallescens and Microtus longicaudus alticola--the Green River and the Colorado act as the barrier.

This study has shown the distribution of mammals on the La Sal Mountains with regard to the vegetational



communities present, and it shows the variation between the communities. The study is a synthesis of the knowledge of the mammals of the La Sal Mountains. A species list has been compiled which shows, where determinable, which subspecies of mammals occur in the region. The study verifies that Neotoma albigula brevicauda is also found on the southwest of the mountains and is not just found in Castle Valley as Durrant (1952) states, or just on the east and north of the mountains as Hall and Kelson (1959) indicate. The study possibly extends the known range of Ondatra zibethicus. No specimens had previously been taken south of central Utah with the exception of one skull reported upon by Hall (1931) from Bluff, San Juan County, which is about 100 miles south of the La Sal Mountains. It is possible that this species has been introduced to the mountains. The chief forest ranger from the La Sal National Forest, Mr. D. Zohner, knew nothing about any introduction nor did any of the three ranchers of the region with whom I spoke.

## SUMMARY

This study was conducted on the La Sal Mountains, located in southeastern Utah, during the summers of 1968 and 1969. The purpose of this study was to note the variations in the mammalian fauna in the vegetational communities which are distributed altitudinally on the mountains and to compile a list of the mammalian species known to be present in the region. In addition, it has been shown that the affinity of the mammals of the La Sal Mountains is to the Colorado mammalian fauna rather than to the mammals of Utah west of the Colorado and Green Rivers.

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THE ALTITUDINAL DISTRIBUTION OF MAMMALS OF  
THE LA SAL MOUNTAINS, UTAH

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ABSTRACT

The mammals of the La Sal Mountains of Utah were studied with special regard to their altitudinal distribution in reference to vegetational communities. Mammals were trapped within the various communities represented on the mountains to ascertain the species present.

The mammals which occurred within each vegetational community have been listed. A list of all species known to exist on the mountains has been compiled, and additionally a list of species hypothetically occurring on the mountains has been included. The known distributional range of two species, Neotoma albigula and Ondatra zibethicus, has been extended by this study. The mammals of the La Sal Mountains have been shown to be more closely related to the mammals of Colorado than to the mammals of Utah west of the Colorado River.

COMMITTEE APPROVAL:

VITA

Stephen Robert Bradley