

# **Pocket gophers of conservational concern in Utah**

**George V. Oliver,  
Theresa L. Pope,  
Kimberly Asmus Hersey,  
and  
Liz Moore**

**Utah Division of Wildlife Resources  
1594 W. North Temple  
Salt Lake City, Utah 84116**

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Pocket gophers are distributed very patchily throughout Utah, from the lowest to almost the highest elevations. Because of their dependence on particular soil characteristics (texture, moisture) and food sources (roots of certain kinds of plants, especially forbs), pocket gophers exhibit extreme specialization and extremely localized distributions (highly fragmented ranges), which have resulted in local genetic divergences and a great number of named subspecies. Their highly localized distributions and their dependence on particular ecological features, such as the plants and moist soils in the vicinity of springs, constrain the population sizes of many of the isolated, evolutionarily distinct taxa of pocket gophers and make them highly vulnerable to both natural and anthropogenic disturbances. Threats to the small, isolated populations of certain pocket gophers include droughts, wild fires, diseases, invasive plant species, agricultural practices, grazing practices, hydrologic alterations, various kinds of infrastructure development, and manifold effects of climate change.

Three full species and 35 valid subspecies of pocket gophers are known to occur in Utah, but nothing is known concerning their population trends and thus their conservation and management needs. Twenty-three of the 35 subspecies of pocket gophers that occur in Utah are strictly endemic to Utah, occurring nowhere else. Nine of these Utah-endemic subspecies of pocket gophers are known only from single localities. Eight Utah subspecies of pocket gophers were former Category 2 Candidates for federal listing as Endangered or Threatened under provisions of the Endangered Species Act by the U. S. Fish and Wildlife Service, until Category 2 was eliminated by the Service on 28 February 1996. Two pocket gophers—a full species and a Utah-endemic subspecies—are currently included as species of greatest conservation need (SGCN) in the Utah Wildlife Action Plan (2015), and two other Utah-endemic subspecies of pocket gophers are included in the Utah Sensitive Species List (proposed, currently pending approval and formal adoption). At least one Utah-endemic subspecies of pocket gopher appears to be extinct, and others could follow. Susceptibility of the various taxa (species and subspecies) of pocket gophers that occur in Utah to being petitioned for federal listing is high. Recently, four subspecies of pocket gophers have been federally listed as Threatened in western Washington with resulting regulations affecting agriculture, housing, and infrastructure development. Three full species of pocket gophers and 40 additional subspecies of pocket gophers are currently under consideration for federal listing as Threatened or Endangered by the U. S. Fish and Wildlife Service.

The purpose of the current project is to begin monitoring of pocket gopher populations (their distributions and relative abundances) in order to detect trends, especially reductions of numbers and shrinkage of ranges, both of which may be affected by climate change, invasive plant species, and other anthropogenic stressors. Such understanding is necessary to guide UDWR's management of pocket gophers in Utah and to position the state to respond to the U. S. Fish and Wildlife Service in the event of proposed federal listings.

As part of UDWR's continuing efforts to understand, manage, and conserve pocket gophers in Utah, and thus to avoid federal listings of the species and subspecies of pocket gophers that occur in Utah, especially those that occur *only* in Utah, the Utah Division of

Wildlife Resources (UDWR) in 2019 began a new and cost-effective method of monitoring pocket gopher populations statewide. This was simply to add the recording of detections of pocket gopher sign, at no additional cost, to on-going bird surveys. UDWR and partners have been conducting statewide bird surveys as part of the larger Integrated Monitoring in Bird Conservation Regions (IMBCR) program since 2016 (<https://birdconservancy.org/what-we-do/science/monitoring/imbcr-program/>). In 2019, Utah and Colorado developed a bird survey (PIJA) specifically designed to locate pinyon jays and colonies. The presence or absence of pocket gopher sign was recorded at each surveyed point in both types of bird surveys. Pocket gopher sign consists of two forms, both of which are easily recognizable by field technicians with minimal training. One kind of pocket gopher sign is mounds, small hillocks of soil that is brought to the surface vertically by the gophers as they excavate their burrows horizontally below the surface. The other kind of pocket gopher sign is eskers, which are long, cylindrical, soil (or mud) casts of their horizontal burrows made through snow or at the soil–snow interface aboveground in winter that, after the snow melts in spring, lie conspicuously on the surface.

In 2019, 298 IMBCR plots and 53 PIJA plots were surveyed in Utah. Pocket gopher sign was detected on 45 (15.1%) of the IMBCR plots and on 13 (24.5%) of the PIJA plots, or, overall, on 58 (16.5%) of all plots, as shown in Figure 1 and summarized in Table 1. The considerably higher incidence of pocket gopher sign on the PIJA plots, ~25%, as opposed to ~15% of the IMBCR plots, is probably due largely to the constraints applied in the selection of the PIJA plots. Although both the PIJA and the IMBCR plots were randomly selected, the IMBCR plots were essentially unconstrained and thus potentially included all habitats in Utah, whereas the PIJA plots were randomly selected within habitats that are potentially suitable for nesting pinyon jays—i.e., woodlands composed of piñon, juniper, or both. Such woodlands exist in Utah mainly at middle elevations and in places with soil and moisture characteristics that are favorable for, or at least are not inhospitable to, pocket gophers. The completely random IMBCR plots included a much wider range of habitats and more extreme elevations and soil conditions, some of which are inhospitable to pocket gophers, being too dry, too rocky, or too barren or lacking adequate food resources (especially forbs). Thus, it is not surprising that pocket gopher sign was detected more frequently on the PIJA survey plots than on the IMBCR plots.

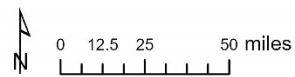
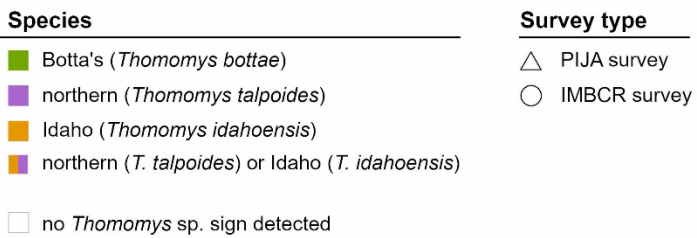
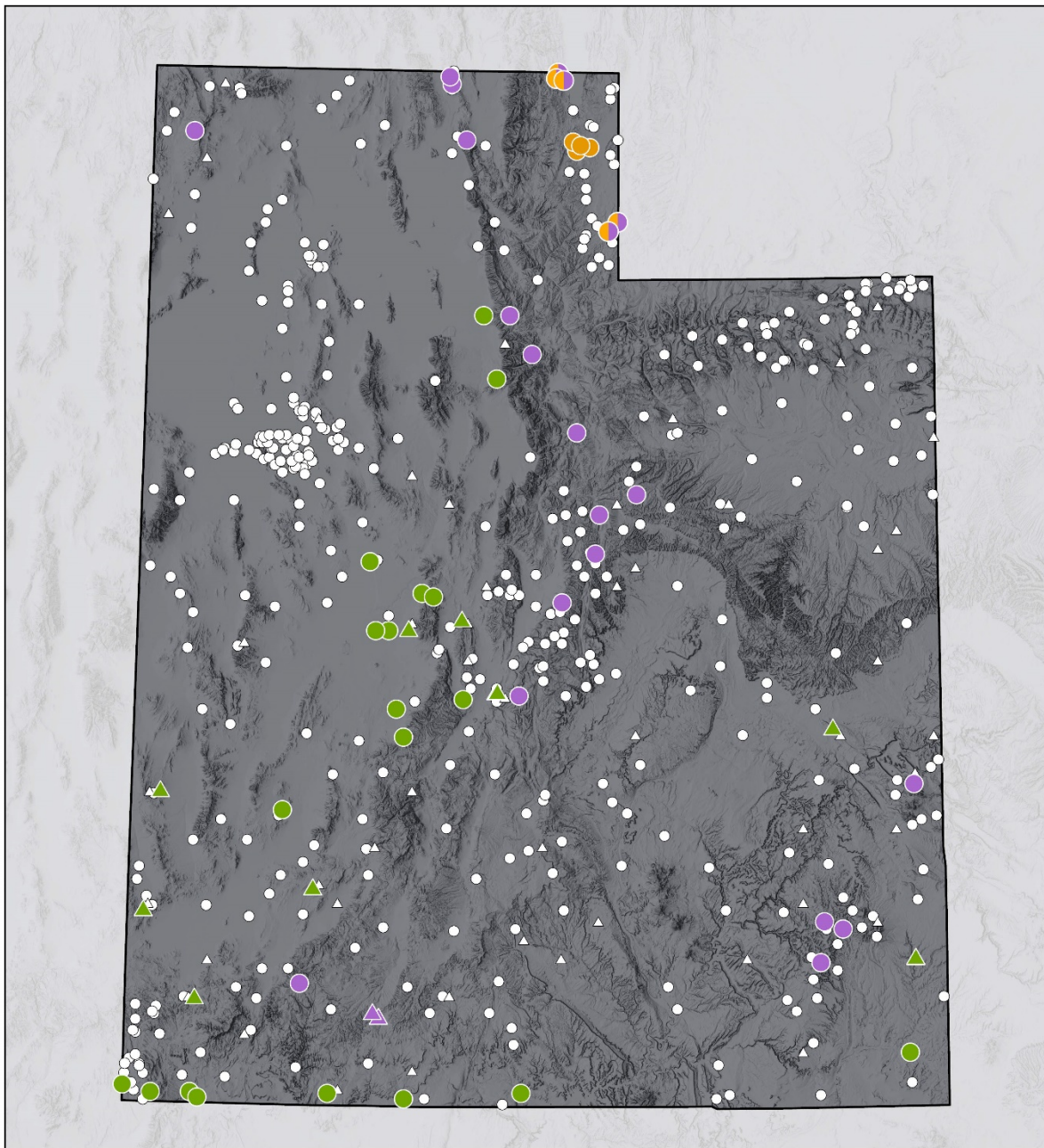


Figure 1. Detections of pocket gopher sign in conjunction with Utah bird surveys in 2019.

**Table 1. Numbers of Utah bird survey plots with and without pocket gopher detections in 2019**

bird survey	total number of plots surveyed	plots without gopher detections	percent of plots without detections	plots with gopher detections	percent of plots with detections
IMBCR	298	253	84.9%	45	15.1%
PIJA	53	40	75.5%	13	24.5%
<b>combined</b>	351	293	83.5%	58	<b>16.5%</b>

Pocket gopher occupancy was analyzed from IMBCR and PIJA survey data in 2019. Each occupancy estimate was analyzed separately due to the different sampling frame used to select survey locations. For IMBCR, each transect was surveyed once per season. Each point surveyed (of up to 16) was considered a sampling occasion for occupancy. Points that were not surveyed due to access, time, or safety issues were treated as missing data. The number of points surveyed on a transect was used as a site covariate. For PIJA, each grid cell was surveyed 1–3 times (visits) in 2019. Each visit was considered a sampling occasion for occupancy. For sites with fewer than 3 visits, the 2<sup>nd</sup> and/or 3<sup>rd</sup> visits were treated as missing data when not sampled. The number of visits to a grid cell was used as a site covariate.

The software package PRESENCE was used to estimate occupancy and detection probability for pocket gophers in Utah (IMBCR) and in predicted pinyon jay habitat in Utah (PIJA). Three single-season models were chosen to compare for model fit using AIC: one where detection probability was the same for each occasion, one where detection probability varied for each occasion, and one where detection probability varied based on a site covariate (e.g., number of visits or number of points surveyed). Each model was run with 1,000 bootstraps to calculate the estimated occupancy.

As part of the IMBCR surveys in 2019, 298 transects were surveyed, resulting in 3,694 unique sampling occasions. The model that included number of points surveyed as a covariate for detection probability had the most support and was >2  $\Delta$ AIC from the next most-supported model. The estimated occupancy of pocket gophers in Utah is  $\psi = 0.1539$  (95% CI = 0.1168–0.2000). This estimate is very close to the naïve estimate of 15.1%.

As part of the PIJA surveys in 2019, 53 grids were surveyed, resulting in 102 unique sampling occasions. The model that included number of visits as a covariate for detection probability had the most support and was >2  $\Delta$ AIC from the next most-supported model.

The estimated occupancy of pocket gophers in predicted pinyon jay habitat is  $\psi = 0.5636$  (95% CI = 0.1092–0.9315). Although the confidence interval is notably wide, possibly due to the sample size and varying number of survey visits, it includes the naïve estimate of 24.5%.

The results of the pocket gopher occupancy analyses are summarized in Table 2, and more detailed comparisons of the best models with the two next-best models for each bird survey type are shown in Table 3.

**Table 2. Summary of pocket gopher occupancy analyses**

bird survey	number of transects or grids	unique sampling occasions	most supported model (covariate)	$\Delta AIC$	estimated occupancy ( $\psi$ )	95% confidence interval
IMBCR	298	3,694	number of points	>2	0.1539	0.1168–0.2000
PIJA	53	102	number of visits	>2	0.5636	0.1092–0.9315

Detections of pocket gopher sign from the bird surveys were compared with existing knowledge of the distributions (Durrant 1952, Hall 1981) of the three species and the 35 subspecies, currently recognized as valid by mammalogists (Patton 2005), that occur in Utah. Based on the geographical locations and elevations of the detections of pocket gopher sign, the detections were assigned to pocket gopher species and subspecies, at least to the extent possible.

Two of the species of pocket gophers that occur in Utah, Botta's pocket gopher (*Thomomys bottae*) and the northern pocket gopher (*Thomomys talpoides*) are segregated both geographically and to a considerable extent ecologically. They are allopatric or parapatric (adjunctly allopatric) in Utah and elsewhere, their ranges forming a complex, somewhat interdigitated, jigsaw-puzzle-like network (see Durrant 1946, Figure 1), and together they occur, patchily, throughout most of Utah. The only very large area in Utah that is believed to be uninhabited by any kinds of pocket gophers is the Bonneville Basin—that is, the lower elevational parts of the basin, many of the isolated mountain ranges within the Bonneville Basin being inhabited by distinct subspecies of pocket gophers. Generally, Botta's pocket gopher (*Thomomys bottae*) occurs at lower elevations (usually below 6,000 ft in Utah), and the northern pocket gopher (*Thomomys talpoides*) occurs at higher elevations (usually above 6,000 ft in Utah), but one or both species may exhibit ecological release in places that are far from areas inhabited by the other species (Rickart 2001, p. 93 and Table 5, p. 89).



Typically, Botta's pocket gopher (*Thomomys bottae*) inhabits areas with deeper, finer soils and denser vegetation, and the northern pocket gopher (*Thomomys talpoides*) occupies areas with shallower, rockier soils and sparser vegetation (Durrant 1952, pp. 162–163). It has also been suggested by some authors (e.g., Miller 1964, p. 267) that Botta's pocket gopher (*Thomomys bottae*) is ecologically (competitively) or even behaviorally dominant over the northern pocket gopher (*Thomomys talpoides*).

We have used elevation and geographical location as predictors of the species and the subspecies of Botta's pocket gopher (*Thomomys bottae*) and the northern pocket gopher (*Thomomys talpoides*) in the current study. However, some of the detections of pocket gopher sign were in places between known occurrences of subspecies.

The third species of pocket gopher that occurs in Utah, the Idaho pocket gopher (*Thomomys idahoensis*), is sympatric with the northern pocket gopher (*Thomomys talpoides*), and assignment of detections of pocket gopher sign to species has been uncertain in some places where these two species may co-occur (see Figure 1).

**Table 3. Pocket gopher occupancy statistics**  
**comparing the best model (in red) with the 2 next-best models for each of the 2 bird survey types**

survey	model	AIC	$\Delta$ AIC	AIC weight	model likelihood	number of parameters	$-2*\text{LogLike}$	$\Psi$	95% CI
IMBCR	psi(.),p(points)	938.12	0.00	0.9945	1.0000	2	934.12	0.1539	0.1168–0.2000
	psi(.),p(.)	948.50	10.38	0.0055	0.0056	2	944.50	0.1560	0.1184–0.2028
	psi(.),p(ident)	973.36	35.24	0.0000	0.0000	17	939.36	0.1561	0.1184–0.2029
PIJA	psi(.),p(visits)	70.54	0.00	0.5758	1.0000	2	66.54	0.5636	0.1092–0.9315
	psi(.),p(.)	72.82	2.28	0.1841	0.3198	2	68.82	0.4340	0.0771–0.8755
	psi(.),p(ident)	76.59	6.05	0.0280	0.0486	4	68.59	0.4670	0.0610–0.9219



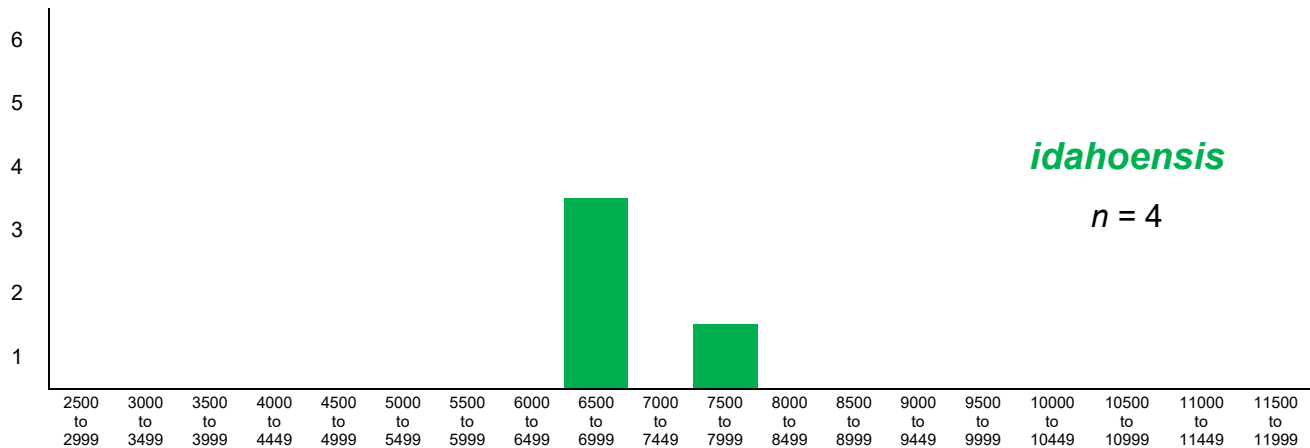
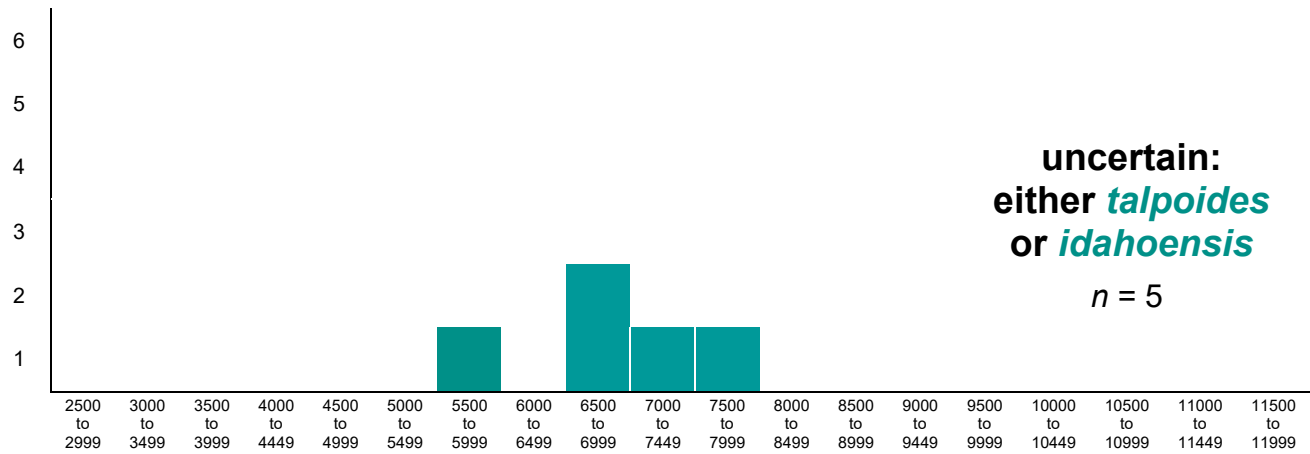
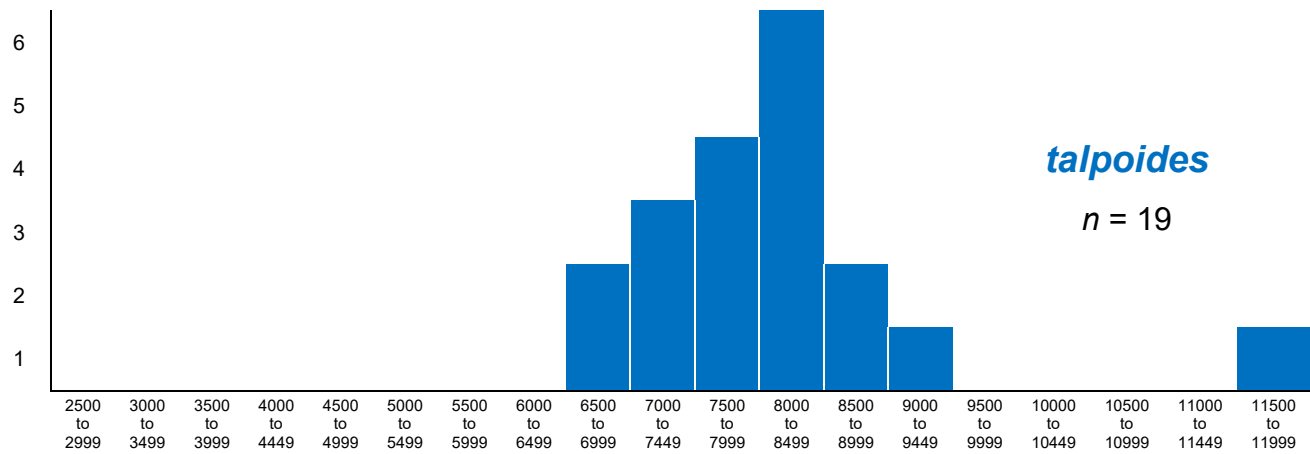
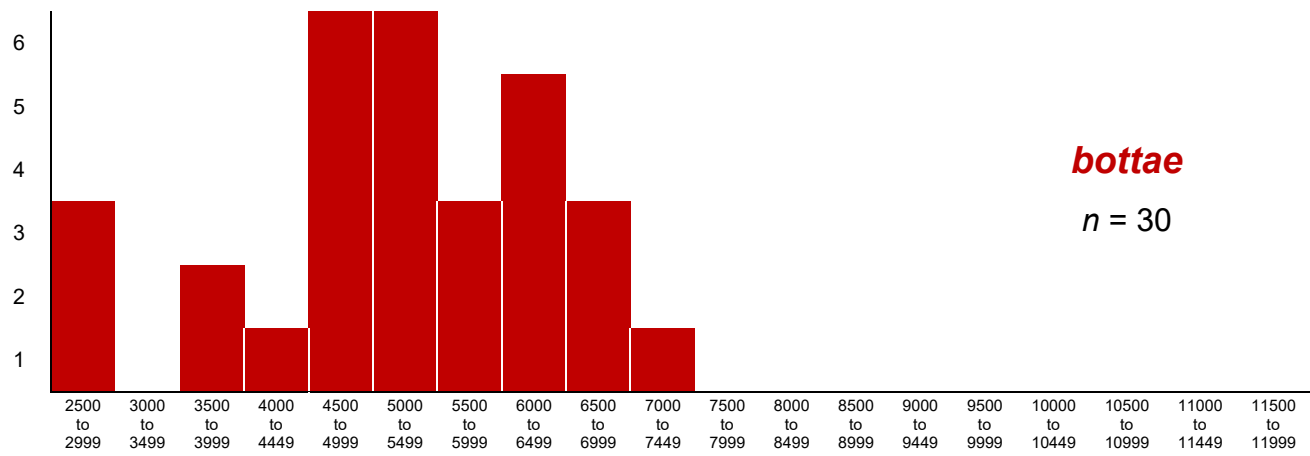


Figure 2. Numbers of detections (y axis) by 500-ft intervals of elevation (x axis).

## Species and subspecies detected in bird surveys

### Species

As previously mentioned, the detections of pocket gopher sign were assigned to species and subspecies based on geographical location and elevation. Figure 2 shows the species assignments by elevation.

We consider four of the detections of sign to represent the Idaho pocket gopher (*Thomomys idahoensis*), 19 to represent the northern pocket gopher (*Thomomys talpoides*), and 30 to represent Botta's pocket gopher (*Thomomys bottae*). Additionally, five of the detections of pocket gopher sign in Rich County, Utah, represent either the Idaho pocket gopher (*Thomomys idahoensis*) or the northern pocket gopher (*Thomomys talpoides*) and could not be confidently assigned to one or the other of these two species, which will necessitate future field work (trapping) in this area.

### Subspecies

Only one subspecies of the Idaho pocket gopher (*Thomomys idahoensis*) occurs in Utah, namely *Thomomys idahoensis pygmaeus*. Thus, the four detections of sign of the Idaho pocket gopher represent this subspecies.

Of the 19 detections of sign representing the northern pocket gopher (*Thomomys talpoides*), 14 are assignable to five of its subspecies:

*Thomomys talpoides gracilis* (1 detection),  
*Thomomys talpoides wasatchensis* (3 detections),  
*Thomomys talpoides moorei* (3 detections),  
*Thomomys talpoides parowanensis* (3 detections), and  
*Thomomys talpoides durranti* (4 detections).

However, five of the detections of the northern pocket gopher (*Thomomys talpoides*) were from locations approximately mid-way between the known ranges of two subspecies and could represent either of the two,

*Thomomys talpoides bridgeri* or *Thomomys talpoides wasatchensis* (2 detections),  
*Thomomys talpoides wasatchensis* or *Thomomys talpoides uinta* (1 detection),  
*Thomomys talpoides uinta* or *Thomomys talpoides moorei* (1 detection), and  
*Thomomys talpoides levis* or *Thomomys talpoides moorei* (1 detection),

or these could represent intergrades between such pairs of subspecies.

Of the 30 detections that are assignable to Botta's pocket gopher (*Thomomys bottae*), 23 represent eight of its subspecies:

*Thomomys bottae albicaudatus* (2 detections),  
*Thomomys bottae contractus* (3 detections),  
*Thomomys bottae lenis* (4 detections),  
*Thomomys bottae centralis* (2 detections),  
*Thomomys bottae howelli* (1 detection),  
*Thomomys bottae birdseyei* (1 detection),  
*Thomomys bottae planirostris* (7 detections), and  
*Thomomys bottae aureus* (3 detections).

Seven of the detections of Botta's pocket gopher (*Thomomys bottae*) were from between known ranges of subspecies:

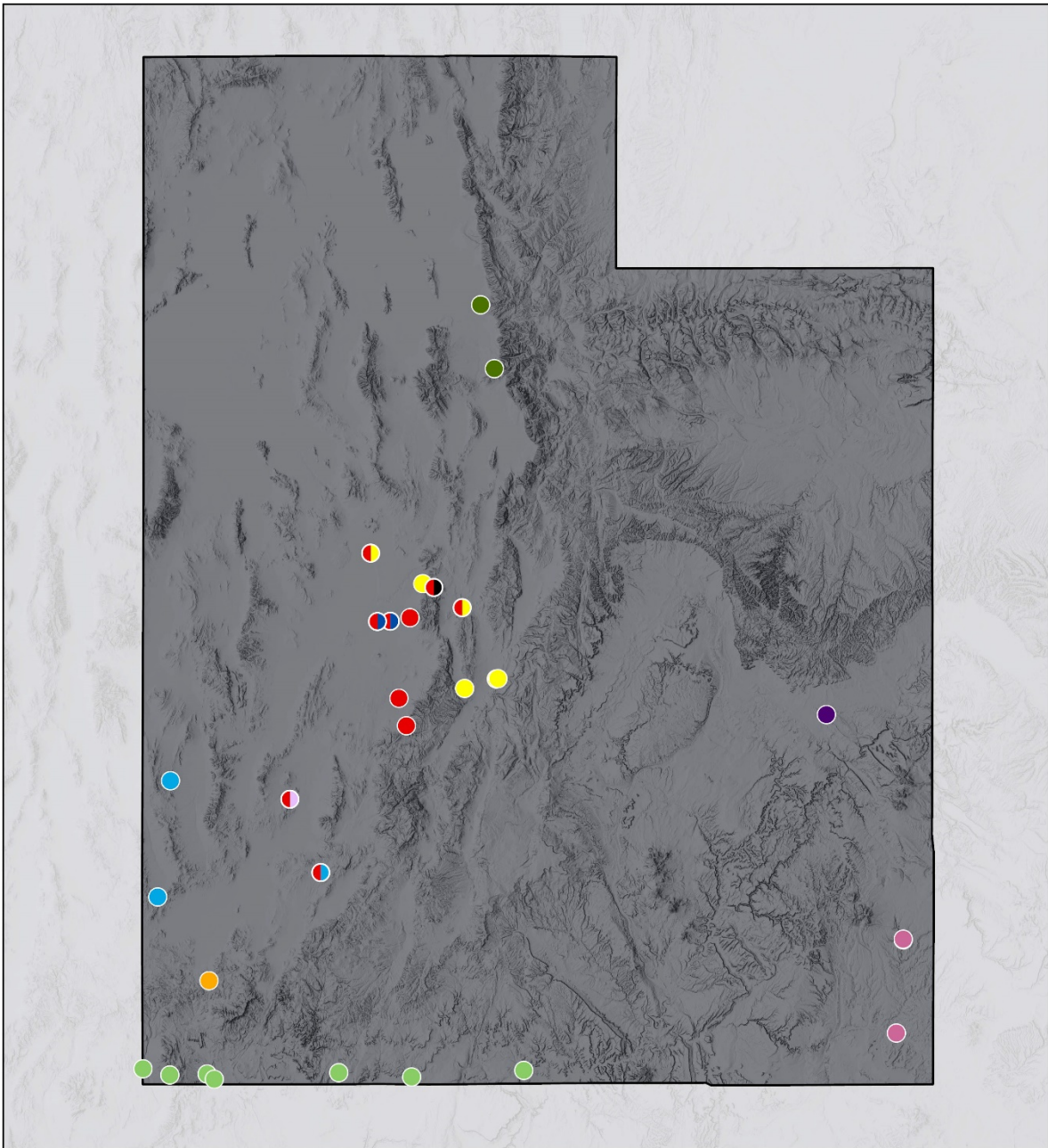
*Thomomys bottae tivius* or *contractus* (1 detection),  
*Thomomys bottae wahwahensis* or *contractus* (1 detection),  
*Thomomys bottae convexus* or *contractus* (2 detections),  
*Thomomys bottae lenis* or *contractus* (2 detections), and  
*Thomomys bottae centralis* or *contractus* (1 detection).

These subspecific assignments of detections of pocket gopher sign are summarized in Table 4 and are mapped in Figures 3–6.

**Table 4. Summary of detections of pocket gopher sign, by subspecies, during bird surveys**

taxon	endemic?	detects.
<i>Thomomys idahoensis</i> (4 detections)		
<i>T. i. pygmaeus</i>	no	4
<i>Thomomys idahoensis</i> or <i>T. talpoides</i> (5 detections)		
<i>T. i. pygmaeus</i> or <i>T. t. wasatchensis</i>	no / <b>yes</b>	5
<i>Thomomys talpoides</i> (19 detections)		
<i>T. t. gracilis</i>	no	1
<i>T. t. wasatchensis</i>	<b>yes</b>	3
<i>T. t. moorei</i>	<b>yes</b>	3
<i>T. t. parowanensis</i>	<b>yes</b>	3
<i>T. t. durranti</i>	<b>yes</b>	4
<i>T. t. bridgeri</i> or <i>wasatchensis</i>	no / <b>yes</b>	2
<i>T. t. wasatchensis</i> or <i>uinta</i>	<b>yes</b> / <b>yes</b>	1
<i>T. t. uinta</i> or <i>moorei</i>	<b>yes</b> / <b>yes</b>	1
<i>T. t. levis</i> or <i>moorei</i>	<b>yes</b> / <b>yes</b>	1
<i>Thomomys bottae</i> (30 detections)		
<i>T. b. albicaudatus</i>	<b>yes</b>	2
<i>T. b. contractus</i>	<b>yes</b>	3
<i>T. b. lenis</i>	<b>yes</b>	4
<i>T. b. centralis</i>	no	2
<i>T. b. howelli</i>	no	1
<i>T. b. birdseyei</i>	<b>yes</b>	1
<i>T. b. planirostris</i>	no	7
<i>T. b. aureus</i>	no	3
<i>T. b. tivius</i> or <i>contractus</i>	<b>yes</b> / <b>yes</b>	1
<i>T. b. wahwahensis</i> or <i>contractus</i>	<b>yes</b> / <b>yes</b>	1
<i>T. b. convexus</i> or <i>contractus</i>	<b>yes</b> / <b>yes</b>	2
<i>T. b. lenis</i> or <i>contractus</i>	<b>yes</b> / <b>yes</b>	2
<i>T. b. centralis</i> or <i>contractus</i>	no / <b>yes</b>	1

At least 28 of the sites with detections of pocket gopher sign represent Utah-endemic subspecies, and 12 additional sites with detections possibly represent endemic subspecies (Table 4). In other words, at least 48% and possibly as much as 69% of the pocket gopher detections were of Utah-endemic subspecies.



Subspecies of *Thomomys bottae*

- |                       |                                    |                       |
|-----------------------|------------------------------------|-----------------------|
| ● <i>albicaudatus</i> | ● <i>contractus or centralis</i>   | ● <i>howelli</i>      |
| ● <i>aureus</i>       | ● <i>contractus or convexus</i>    | ● <i>lenis</i>        |
| ● <i>birdseyei</i>    | ● <i>contractus or lenis</i>       | ● <i>planirostris</i> |
| ● <i>centralis</i>    | ● <i>contractus or tivius</i>      |                       |
| ● <i>contractus</i>   | ● <i>contractus or wahwahensis</i> |                       |

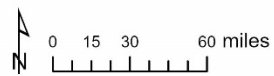


Figure 3. Detections of subspecies of *Thomomys bottae*.



Subspecies of *Thomomys talpoides*

- |                   |                            |
|-------------------|----------------------------|
| ● durranti        | ● uinta or moorei          |
| ● gracilis        | ● wasatchensis             |
| ● levis or moorei | ● wasatchensis or bridgeri |
| ● moorei          | ● wasatchensis or uinta    |
| ● parowanensis    |                            |

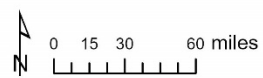


Figure 4. Detections of subspecies of *Thomomys talpoides*.





Subspecies of *Thomomys idahoensis*

● *pygmaeus*

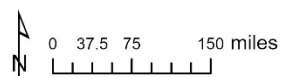
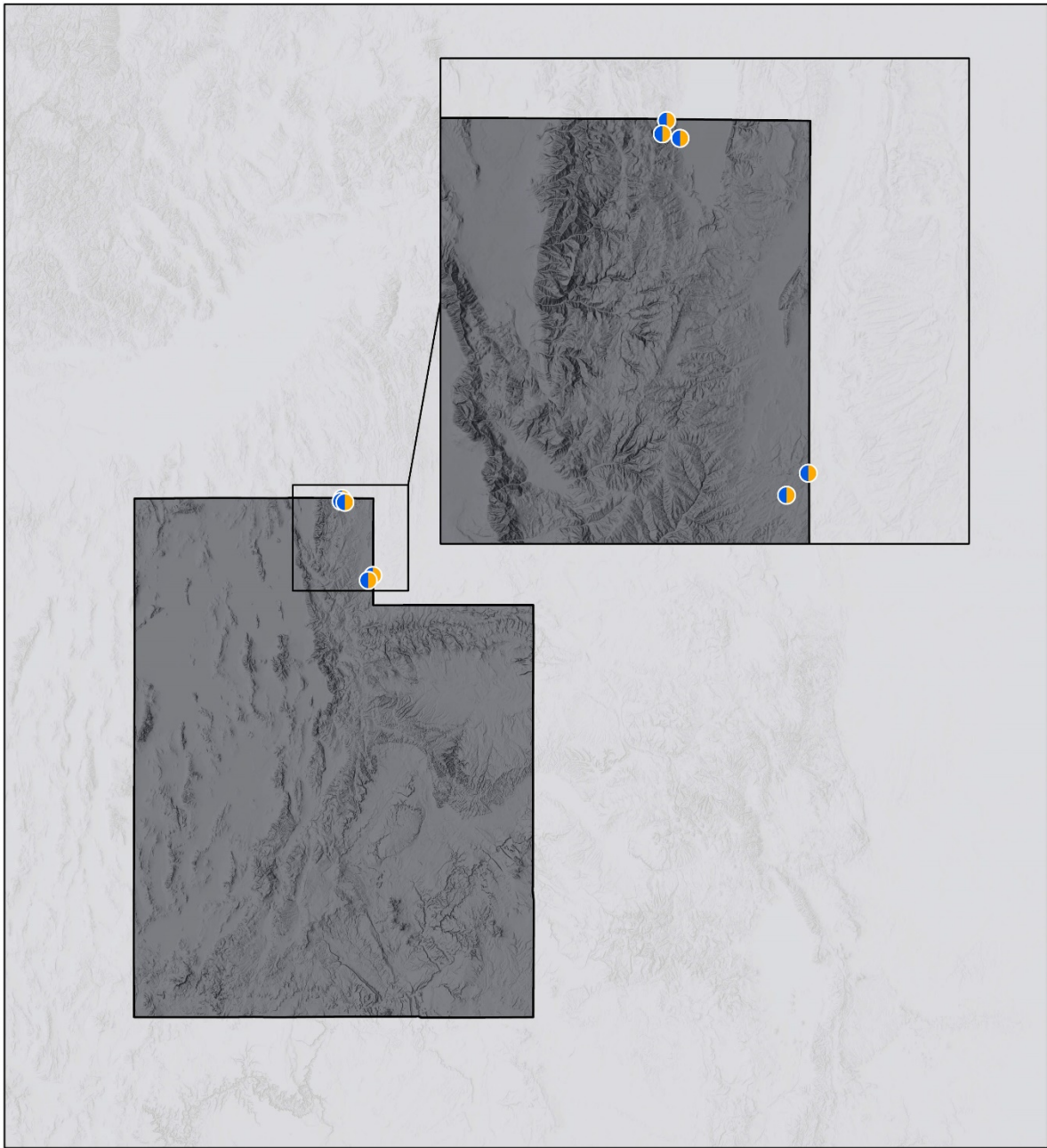



Figure 5. Detections of subspecies of *Thomomys idahoensis*.





Subspecies of *Thomomys talpoides* or *Thomomys idahoensis*

 *T. t. bridgeri* or *T. i. pygmaeus*

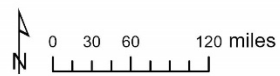


Figure 6. Detections of either *Thomomys talpoides* or *Thomomys idahoensis* (uncertain).

## Species and subspecies detected in other field work

In addition to detections of pocket gopher sign found in the course of the bird surveys, other field efforts were made to find pocket gophers, particularly certain subspecies of conservational concern, and these efforts resulted in the detections of fresh sign of two Utah-endemic subspecies of *Thomomys talpoides* and four Utah-endemic subspecies of *Thomomys bottae*. These are summarized in Table 5.

**Table 5. Summary of detections of pocket gopher sign, by subspecies, during other field work**

subspecies	date	site	county
<i>Thomomys talpoides</i>			
<i>T. t. parowanensis</i>	1–2 June 2020	Markagunt Plateau	Kane County
<i>T. t. moorei</i>	22 June 2020	Mount Nebo	Utah County
<i>Thomomys bottae</i>			
<i>T. b. powelli</i>	4–5 May 2020	Salt Gulch	Garfield County
<i>T. b. wahwahensis</i>	26–27 May 2020	Wah Wah Mountains	Beaver County
<i>T. b. sevieri</i>	27–28 May 2020	Swasey Spring	Millard County
<i>T. b. tivius</i>	2–3 June 2020	Big Spring	Millard County

Of particular concern are *Thomomys bottae powelli* and *Thomomys bottae sevieri*, both of which have extremely limited distributions. Both were former Category 2 Candidates for federal listing as Endangered or Threatened. Our field observations in 2020 indicate that existing populations of these two subspecies are extremely small.

### ***Thomomys bottae powelli***

*Thomomys bottae powelli* occurs only in Salt Gulch in central Garfield County (Figure 7), isolated from all other known populations and subspecies of *Thomomys bottae*. Most—in fact, probably all—of the habitat suitable for pocket gophers in Salt Gulch is in private ownership and has been developed for agriculture and pasture. Sign of *Thomomys bottae powelli* was detected in 2020 field work only in two very small areas, about a mile apart (by road) and together totaling only about 1,000 m<sup>2</sup> (0.1 ha or ~0.25 acre), in pastures in Salt Gulch; one of these is illustrated in Figure 8.



Figure 7. Distant view of Salt Gulch (the area enclosed in the red ellipse), Garfield County, 5 May 2020. Sign of *Thomomys bottae powelli* was found in two very small areas in Salt Gulch, about a mile apart, one near the far left and the other near the far right of the area indicated in photograph. *Thomomys bottae powelli* is strictly endemic to Salt Gulch.





Figure 8. Salt Gulch, Garfield County, 5 May 2020. Mounds made by *Thomomys bottae powelli* were observed on private land (through binoculars, from the public road) in the area shown in the middle right of photograph (the area enclosed in the red oval). Notice cattle, irrigation equipment, and cleared pasture.

### ***Thomomys bottae sevieri***

*Thomomys bottae sevieri* occurs only in the immediate vicinity of Swasey Spring in central Millard County (Figures 9 and 10), and like *Thomomys bottae powelli* it is isolated from all other known populations and subspecies of *Thomomys bottae*. The total area in which sign of *Thomomys bottae sevieri* was detected around Swasey Spring was only about 1,000 m<sup>2</sup> (0.1 ha or ~0.25 acre).



Figure 9. Distant view of Swasey Spring, Millard County, 27 May 2020. The spring and the area inhabited by *Thomomys bottae sevieri* are in the area within the red oval. The galvanized steel housing of the spring head, though barely discernible, is near the center of the red oval.





Figure 10. Swasey Spring, Millard County, 27 May 2020. Mounds and eskers made by *Thomomys bottae sevieri* were found in the area shown in the lower two-thirds of the photograph, especially in the middle right of photograph, in the area enclosed in the red oval. The mounds and eskers are hidden by the vegetation and are not clearly visible in this photograph. The spring run is in the very heavily vegetated area (dark green thicket of wild roses, *Rosa* sp.) above and to the right of the galvanized steel housing of the spring head and above and to the left of the red oval. Scarcely any sign of gophers was found in the soggy, thickly vegetated area along the spring run. *Thomomys bottae sevieri* is strictly endemic to the immediate vicinity of Swasey Spring shown in this photograph. Swasey Spring also is inhabited by a springsnail of conservational concern.

## Conservational assessments of detected subspecies

### ***Thomomys idahoensis pygmaeus***

The Idaho pocket gopher, *Thomomys idahoensis*, is included in the Utah Wildlife Action Plan (2015) as a species of greatest conservation need (SGCN), defined (UWAP, p. 234) as a species that is potentially “a candidate for Endangered Species Act (ESA) listing”, a species that does or could “present the possibility of an ESA listing.” *Thomomys idahoensis pygmaeus* is the only subspecies of *Thomomys idahoensis* that occurs in Utah. Thus, in Utah and in the Utah Wildlife Action Plan this subspecies is equivalent to the species and is an SGCN. Its conservational priority is high.

### ***Thomomys talpoides gracilis***

This subspecies, though not endemic to Utah, occurs in Utah only in the extreme northwestern part of the state (Raft River Mountains, Goose Creek Mountains, and vicinity), where it is previously known from five localities (Durrant 1952, Hall 1981). It is found throughout much of northeastern Nevada, marginally in extreme southwestern Idaho, and hypothetically in extreme southeastern Oregon. It is not considered to be of conservational concern (i.e., its conservational priority is very low).

### ***Thomomys talpoides wasatchensis***

This subspecies occurs in montane settings (the Wasatch Mountains) from Cache County to Utah County, Utah. Although it has been hypothesized also to range into extreme southeastern Idaho, this has not been confirmed, and *Thomomys talpoides wasatchensis* remains, so far as is known, a Utah endemic. It has been found at many localities within its moderately large range. It appears currently to be conservationally secure, and its conservational priority is medium.

### ***Thomomys talpoides moorei***

This subspecies is strictly endemic to Utah, occurring in mountainous areas in southeastern Utah County, extreme northeastern Juab County, and northern Sanpete County. It was previously known from eight localities (Durrant 1952). Its conservational priority is high.



### ***Thomomys talpoides parowanensis***

This subspecies is strictly endemic to Utah, previously known (Durrant 1952) from nine localities in the mountains (Tushar Mountains and Markagunt Plateau) of extreme eastern Beaver County, extreme eastern Iron County, extreme southwestern Garfield County, and extreme northwestern Kane County. Its conservational priority is medium.

### ***Thomomys talpoides durranti***

This subspecies probably is strictly endemic to Utah and is here so considered, although some authors have assigned populations of *Thomomys talpoides* elsewhere (west-central Colorado) to this subspecies. As understood here, *Thomomys talpoides durranti* occurs only in the Abajo Mountains and the La Sal Mountains of San Juan County and extreme southeastern Grand County, Utah, at seven previously known localities (Durrant 1952). Occurrences of *Thomomys talpoides* in northern Grand County, Utah, and in western Colorado are not here regarded as *Thomomys talpoides durranti* (based on diploid numbers). Chromosomally, *durranti* is a highly distinctive taxon. Its conservational priority is medium or high.

### ***Thomomys talpoides bridgeri***

The status of this subspecies in Utah—including whether it actually occurs in the state—is uncertain. Hall (1981) mapped it as hypothetically occurring in eastern Rich County and barely into extreme northwestern Summit County. Its known range is southwestern Wyoming, where it has been collected at 29 localities in Lincoln, Sublette, and Uinta counties (Long 1965), and in southeastern Idaho, where it has been taken at ~22 localities in 8 counties (Davis 1939, Hall 1981). Its conservational priority is very low. However, the questions of its occurrence in Utah and its possible or probable distribution in Utah deserve to be resolved.

### ***Thomomys talpoides uinta***

This subspecies is strictly endemic to Utah. It occurs in Summit, Duchesne, Wasatch, and Carbon counties as is previously known from at least 10 localities (Durrant 1952, Hall 1981). Its conservational priority is medium.

### ***Thomomys talpoides levis***

This subspecies is strictly endemic to Utah, known previously from at least 12 localities in Sevier, Wayne, and Garfield counties (Durrant 1952, Hall 1981). Its conservational priority is medium.

### ***Thomomys bottae albicaudatus***

This subspecies is strictly endemic to Utah, occurring in the valleys of western Salt Lake County, western Utah County, northeastern Juab County, and eastern Tooele County. Although endemic, it is abundant and occurs (patchily) at many localities. Its conservational priority is medium.

### ***Thomomys bottae contractus***

This subspecies is strictly endemic to Utah and is previously known from only three localities, one in eastern Beaver County and two in extreme northeastern Millard County (Durrant 1952). Its conservational priority is high.

### ***Thomomys bottae lenis***

This subspecies is strictly endemic to Utah, previously known from only five localities, all in the Sevier River valley—three of these being in western Sevier County, one in extreme southeastern Juab County, and one in extreme northeastern Millard County (Durrant 1952). Its conservational priority is high.

### ***Thomomys bottae centralis***

This subspecies has a wide range in southeastern Nevada and in southwestern Utah (Iron and Millard counties; Durrant 1952, Hall 1981). It is not considered to be of conservational concern (i.e., its conservational priority is very low).

### ***Thomomys bottae powelli***

This subspecies is strictly endemic to Utah, occurring at only a single locality, Salt Gulch, Garfield County (Hall 1981, Patton 2005). Its conservational priority is very high.

### ***Thomomys bottae howelli***

Though not endemic to Utah, this subspecies has a very limited distribution. It is previously known from only one locality in Utah (in southern Grand County, north and west of the Colorado River [Durrant 1952]) and two localities in west-central Colorado (western Mesa County [Armstrong 1972]). Its conservational priority is high.

### ***Thomomys bottae birdseyei***

This subspecies is strictly endemic to Utah, previously known from only five localities in the Pine Valley Mountains and vicinity, four of these being in northern Washington County and one in extreme southern Iron County (Durrant 1952). Its conservational priority is medium or high.

### ***Thomomys bottae planirostris***

This subspecies has a moderately wide range in south-central and southwestern Utah (13 localities in Washington, Kane, and Garfield counties), northwestern Arizona (27 localities in Mohave and Coconino counties [Hoffmeister 1986]), and southeastern Nevada (one locality in Clark County [Hall 1946]). Its conservational priority is very low.

### ***Thomomys bottae aureus***

This subspecies has a wide range in northeastern Arizona (five localities in Coconino and Navajo counties [Hoffmeister 1986]), southeastern Utah (four localities in San Juan County [Durrant 1952]), southwestern Colorado (20 localities in Montrose, Miguel, Montezuma, La Plata, and Archuleta counties [Armstrong 1972]), and northwestern New Mexico (at least 20 localities in four or five counties [Findley et al. 1975, Hall 1981]). Its conservational priority is very low; it is not of conservational concern.

### ***Thomomys bottae sevieri***

This subspecies is strictly endemic to Utah, occurring at only a single locality, Swasey Spring, Millard County (Durrant 1952, Hall 1981, Patton 2005). Its conservational priority is very high.

***Thomomys bottae tivius***

This subspecies is strictly endemic to Utah, previously known from only a single locality, the vicinity of Big Spring in Oak Creek Canyon, extreme northeastern Millard County (Durrant 1952, Hall 1981, Patton 2005). Its conservational priority is high.

***Thomomys bottae wahwahensis***

This subspecies is strictly endemic to Utah and is previously known from only two localities in the Wah Wah Mountains, Beaver and Millard counties (Durrant 1952, Hall 1981). Its conservational priority is high.

***Thomomys bottae convexus***

This subspecies is strictly endemic to Utah, previously known from only a single locality, Clear Lake, Millard County (Durrant 1952, Hall 1981, Patton 2005). It was a former Category 2 Candidate for federal listing. Its conservational priority is high.

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