Supplementary material for current distribution of the California vole (*Microtus californicus*) in Baja California, Mexico

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SUMMARY

Twenty-eight historical collection sites for *Microtus californicus* (California vole, CAVO) in Baja California, Mexico, are georeferenced; historical collections and descriptions are summarized; and, when possible, sites were visited to evaluate habitat and possible continued presence of CAVO. When the habitat indicated that detection of CAVO seemed possible, we trapped for up to 3 nights to try to confirm the presence of voles.

RESUMEN

Veintiocho sitios históricos de colecta para *Microtus californicus* (Meteoro de California, CAVO) en Baja California, México son georreferenciados, se resumen colectas y descripciones históricas, y cuando fue posible, los sitios fueron visitados para evaluar el hábitat y la posible presencia de CAVO. Cuando el hábitat indico la posible detección de CAVO, trampeamos hasta 3 noches para intentar confirmar la presencia de meteoros.

METHODS

Historical collections of CAVO were compiled using online databases (AMNH 2018, Arctos 2018, NMNH 2018, VertNet 2018) and queries to curators (FMNH and SDNHM). We used publications and available field notes to georeference (basis WGS 84; elevation from Google Earth) historical collection sites. Note that place names are routinely reused in Baja California, and some have changed since the historical collection was made. We have added descriptors—"La Grulla (Las Ánimas canyon)" *vs.* "La Grulla (SSPM)"—as necessary, and use the current place name when it has changed. We visited all but 2 of these sites and evaluated the habitat for, and looked for signs of, CAVO; and, at sites with favorable habitat or sign, we trapped for up to 3 nights to try to confirm the presence of CAVO. Handling of live animals was in accord with the recommendations of Sikes et al. (2016).

Habitat (present, absent) was evaluated on the basis of (1) presence of *Eleocharis*, which appeared to be an important food plant for CAVO in the Sierra San Pedro Mártir (Harper et al. 2016); (2) presence of green grasses and saltgrass (*Distichlis* spp.); (3) presence of pools or slowly flowing fresh or brackish (salinity ≤ 3‰, when possible to measure it) water; and (4)

presence of tules (*Schoenoplectus* sp.), which can also be a food plant of CAVO (Pesapane et al 2018).

Grazing impact (high, moderate, absent) was evaluated by noting (1) the presence of cattle and other domestic grazing animals, (2) torn plants and short grass, and (3) sparse or absent vegetation and open spaces that could not be explained otherwise.

Signs of CAVO included runways (especially runways with clipped grasses), piles of cut sticks, and feces.

At sites with favorable signs or habitat, we trapped for up to 3 nights, using 9-inch and 12-inch Sherman traps that were baited with oats mixed with peanut butter and that we placed in the most favorable locations possible (in runways and in front of holes, when present). On cold nights, cotton balls were added. Trapping intensity varied from 20 to 100 traps/night, though usually it was around 50 traps. Ear clips for genetic analysis were taken from all specimens. Trapping was terminated (at 2 sites) if we captured 11 specimens, the maximum allowed by our permit. In those cases, we collected 1 animal for deposit at a permanent collection.

Note that no modern specimens (collected since 2013) have been identified to subspecies; subspecies attribution for these specimens, including in this paper, is based on historic identifications for that site or a nearby site.

RESULTS

The following are recorded for each locality: name; historical name if different; latitude, longitude, and elevation (WGS84 datum); known collections; historical descriptions; and current

status (habitat and presence of CAVO). Locations are sorted by subspecies and latitude (N–S). Locations are numbered, corresponding with Fig. 1. Symbols are the following: –, not visited; †, no viable habitat seen; **?**, habitat seen (usually heavily impacted and no sign of CAVO), presence not confirmed; and ✓, presence confirmed since 2013.

Microtus californicus sanctidiegi

1 †. Macho Güero Valley (Nachogüero Valley; 32.597°, −116.360°, 1040 m). 1927 MVZ.

This site is shown on modern maps as Macho Güero (Baja Almanac Publishers 2009), but all references from the 1930s and earlier refer to it as "Nachogüero." Possibly the modern toponym is a rebracketing of an earlier, perhaps native, word. It is about 10.5 km SW of Boulevard, CA.

Mearns (1907) described the location as follows:

> Station No. 88.—Ojo, in Nachoguero Valley, Lower California, 0.16 kilometer (0.1 mile) south of the International Boundary. Nearest Monument No. 237. This station, which is 146 kilometers (91 miles) west of the Colorado River and 71 kilometers (44 miles) east of the Pacific Ocean, has an altitude of 1,045 meters (3,429 feet). Occupied by my party from May 31 to June 7, 1894.

Lamb (1927 [15 November 1927]) said:

> North end of Nachogüero Valley, 3400 ft. Lower Calif. Mexico.

> This place is locally called Aguaje del Nat. It is the Ojo of Mearns in the Mammals of the Mexican Boundary Survey situated at the north end of Nachogüero Valle at the International Line, about 1.5 miles west of Monument 236. The R.R. Arizona and Eastern runs about half a mile north of the International Fence.

The site was georeferenced by using the monument locations (USIBWC No date) and landforms that indicate the historical occurrence of a wetland.

Lidicker (1973–1974 [10–11 December, 1974]) visited this site without finding CAVO. He described 2 adjacent valleys, the western being Macho Güero and the eastern being a stream bed perhaps 4 km NNE of Cienega Redonda. The western valley was described as follows:

> [A] dry stream bed and an abandoned house. There were a few scattered willows along the creek bottom & a small grove of oak trees… [Farther along there] were a few additional willows but no marsh or sedges & of course no water even though there had been a lot of rain in the past few weeks.

The eastern valley had similar habitat:

> This location is 20 mi. E, 1 mi. S Tecate, 1000 m. In several places the valley widens out and there is a meadow but all was heavily overgrazed. We can imagine that these meadows and stream course could have had cover suitable for *Microtus* in the past, but not now. There is no willow or sedges & of course no flowing water.

Lidicker set 39 traps at the second site and caught no *Microtus*. We visited Macho Güero on 11 June 2017 and found no habitat or sign of CAVO. We talked to a local, Fidel Cisñeros, who said

that there was a pond here ~20 years ago, but it dried up. He thinks that this happened because a dam was built on the U.S. side of the border. No dam can be seen in the vicinity.

2 †. Tecate Valley (32.560°, –116.648°, 500 m). 1894 AMNH; 1894 & 1903 USNM.

E.A. Mearns and F. X. Holzner collected CAVO from Tecate Valley on 26–27 June 1894 (NMNH 2018). The collection sites are listed in online databases as "Tecate Valley"; "Tecate Mts., Tecate Valley"; and "Tecate Mt., SE, Tecate River." We assume that these are all the same site.

Mearns (1907) described the site as follows:

> "STATION No. 93.—Tecate River, Lower California, 1.6 kilometers (1 mile) south of Monument No. 245, 175 kilometers (109 miles) west of the Colorado River, and 43 kilometers (27 miles) east of the Pacific Ocean. Altitude 520 meters (1,701 feet). This station, which is located on the right bank of the Tecate River, at the foot of Tecate Mountain (altitude 1,185 meters, or 3,888 feet), was occupied by my party from June 23 to 27, 1894."

F. Stephens collected 1 CAVO at "Tecate Valley" in 1903 (NMNH 2018).

We visited the site on 6 December 2018. It is now a channelized stream within the urban limits of Tecate, with constructed walls of soil and fieldstone, although areas downstream might still have habitat and could be searched.

3 †. Real del Mar (Tahiti Beach; 32.449°, –117.105°, 2 m). 1927 MVZ.

Lamb (1927) camped at Real del Mar from 23–31 December 1927, describing the locality as "5 miles south of Monument 258, west coast of Lower California, Mexico." He calls this site "Tahiti Beach" (a toponym that is no longer in use). P. Meigs has a photo of this location*.

We visited on 17 July 2018. Because the stream is fast-flowing, deeply incised, and formed by raw sewage, we did not enter it to look for habitat. No favorable habitat was seen nearby.

4 †. La Misión (La Salina, Arroyo Martínez; 32.097°, –116.863°, 2 m). 1958 PSM, 1974 MVZ.

This site is near the mouth of the river that flows through La Misión. The river has various names; we use "Río La Misión."

The 1958 specimen (PSM Mammal-07628; Vertnet 2018) was collected at "Ensenada, 26 mi N," which corresponds to this location if it is measured by road miles along the "old" highway 1.

Lidicker (1973–1974) trapped here on 12 December 1974 and collected CAVO a few days later at the same location. He says of it, "This locality we are calling Mouth Arroyo Martinez (although our maps are ambiguous as to whether this is the correct name), 22 mi. NW Ensenada." This site is 22 miles NW straight line from Ensenada. We have found no reference to "Arroyo Martínez" on any map.

We visited on 12 June 2017 and searched for habitat and sign near the bridge of Highway 1D, and found nothing that looked favorable, nor sign of CAVO; Tamarisk was the dominant plant in

*http://library.ucsd.edu/dc/object/bb6042679q

the wetland. We measured salinity of 1.26‰ in an area seemingly above tidal flow, suggesting that the flow is composed, at least in part, of waste agricultural water.

5 †. Planicie de Maneadero (31.778°, –116.603°, 10 m). 2013 Universidad Autónoma de Baja California at Ensenada.

This is the toponym used by Erickson et al. (2019) to refer to the area at the entrance to Estero Beach Resort. These authors report that the habitat has been destroyed for recreational vehicle use since the specimen was collected. We visited the site on 7 December 2018 and confirmed the absence of habitat. It appears that the site was the only remnant vegetation of a large (> 50 km^2) coastal plain formed by the arroyos Maneadero and El Zorillo, much of which may have been productive habitat for CAVO. Subsequent to the termination of our study, 2 of the authors have trapped a CAVO about 2 km WSW of this site on a barrier beach.

6 †. Boca del Río Santo Tomás (31.535°, –116.659°, 2 m). 1947 LACM.

One collection in 1947, no information other than what is found in Vertnet (2018). A lagoon fed by fresh water flow occurred here in 1926 (Meigs 1926 [10 July 1926]).

We visited on 23 May 2017 and found a terminal lagoon (salinity of 7.59‰with no habitat and no sign.

Microtus californicus grinnelli

7 ✓. El Rayo (31.980°, –115.979°, 1560 m), and **Laguna Seca** (31.930°, –115.917°, 1690 m). 1905 USNM.

Nelson (1921) trapped at El Rayo in 1905. He describes the location as "a small meadow in an open ravine near the top of the range at 4,800 feet, … about a mile below the El Rayo ranch on top of the mountain." We assume that the modern El Rayo ranch is in the same place as when Nelson visited.

We visited El Rayo on 26 September 2017, where we found some favorable habitat but no sign of CAVO. The area was very heavily grazed, and we did not trap here. Many meadows nearby are now fenced and difficult to access.

We found a nearby site named Laguna Seca (31.930°, –115.917°, 1690 m) about 7.5 km SE of El Rayo, which had more favorable (wetter, less grazed) habitat and sign of CAVO. We trapped 3 CAVO over 2 nights (150 trap-nights), 26–27 September 2017.

8 ✓. Sangre de Cristo (31.874°, –116.144°, 820 m). 1927 SDNHM.

A tightly delimited and well-known location that appears on many maps. In the 18th century, this place was referred to as "Jesús María" (Arrillaga 1969). Huey (1916–1953) collected CAVO here on 26 June 1927. When Lidicker (1973–1974) visited on 16 December 1974, he saw few sign of CAVO and did not collect any animals. Lidicker speculated in his field notes that perhaps *Microtus californicus grinnelli* was extinct.

We visited for 2 nights (250 trap-nights), 25–26 September 2017, and found a tule (*Schoenoplectus* sp.) wetland with no open water similar to that described and photographed by Huey, and we trapped more than 11 CAVO. Habitat and sign looked ideal. Sheep and cattle were present, but grazing impact seemed limited in the wetland.

9 †. La Grulla (Las Ánimas canyon) (near Upper La Grulla Gun Club; 31.631°, –116.428°, 210 m). 1925 SDNHM.

Specimens from this trip are annotated "La Grulla, Las Animas Canyon." Huey's (1916–1953) field notes do not give a lot of information:

> June 26th 1925
>
> In the company of W.S. Wright, curator of Insects of the Natural History Museum, I left San Diego about 11 a.m., bound for the canyon in which the La Grulla Gun Club grounds are situated, below Ensenada, where there a few days were to be spend [sic] collecting insects and checking up the population of breeding birds.
>
> …
>
> After having driven to Ensenada we drove on to the campus after dark & pitched camp under a large line of oak trees.

Two days later, Huey's entry makes it clear that he is in a canyon (La Grulla) that flows north towards Ensenada:

> June 28th 1925
>
> After getting up the two skins we packed up & left going down canyon towards Ensenada.
>
> We stopped when near the mouth for I thought we had the opposite lowest manzanita that Dr. Swingle had spoken of at least specimens were taken (sic).

Sixteen years later, Huey returned to the same site:

> October 6, 1941
>
> We drove to Ensenada where we had dinner and then on to the end of the graded road a few miles north of Santo Tomas. The exact campsite was made near the old La Grulla Gun Club house.

The La Grulla Gun Club is today on the shore of Estero Punta Banda (31.700°, –116.628°, 5m), but in 1925, there were 2 "Gun Clubs." The second was called the "upper" club (Goldbaum 1925; Salisbury & McLean 1925). Using these documents and contemporaneous photographs, we have located the upper club at 31.625°, –116.434°, 230 m in Ejido Uruapán.

Huey probably collected in the stream to the northeast of the gun club, at the coordinates shown above. A contemporary photo by P. Meigs shows abundant riparian habitat at that site[†]. We

† http://library.ucsd.edu/dc/object/bb2697926w

visited on 7 December 2018, when we found the stream dewatered and full of Tamarisk (*Tamarix* sp.); no CAVO habitat was seen.

10 †. Valle de la Trinidad, west end (31.388°, –115.783°, 730 m) and **López Mateos** (31.410°, –115.735°, 830 m). 1927 SDNHM.

Huey's field notes (1916–1953 [27 June–9 July 1927]) make clear that specimens were collected at 2 different, nearby, sites, even though the labels use identical location descriptions. Two specimens were collected on 4 July 1927 near the Newhouse ranch house (which is the "Campbell's" ranch mentioned by Mearns and Nelson). A local informant, José Cota Álvarez, told us that this ranch house was at approximately 31.390°, –115.780°; Sr. Cota Álvarez's house was adjacent to the hot springs mentioned by many visitors to the valley (31.388°, –115.784°). Huey's notes indicate that he trapped in this area on the night of 3 July 1927.

We visited this area on 26 October 2015 and 14 June 2017, and while there is still a small stream passing by the hot spring and some heavily grazed vegetation, we did not see sign of CAVO, and did not trap there. However, on a later visit we noted potential habitat (but no sign of CAVO) 15 km SW and downstream at San Isidro, Cañada Los Llanitos (31.289°, –115.892°, 720 m), leading us to believe that if this population originally extended along the arroyo (which it must have done), it could still survive here.

Huey collected 3 more specimens on 9 July 1927 at "a small spring three miles east of the ranch house and on the north side of the valley." This site seems to have been the same place that he referred to as Aguajito Spring (or Aguajicito Spring) in his March 1936 trip with C. F. Harbison. We have not located this site exactly, but it was near where the modern road (Hwy 3) descends

to the valley—probably inside the settled area of the town of López Mateos, where there is no habitat.

Microtus californicus huperuthrus

11 †. Rancho Las Tinajas (El Piñón, Piñonal; 31.172°, –115.545°, 1695 m). 1905 USNM.

Both Nelson and Goldman (Nelson 1921) and Heller (1902 [13 October 1902]) stopped at "Piñon," and Nelson collected 2 CAVO at this site (NMNH 2018). We have not found any modern or contemporaneous maps or other references with this place name. Nelson's (1921) map of his journey does not show this site and lacks detail (and has some errors) for this portion of his journey. He was lost for 24 hours after leaving Piñon, and so he was not able to record this part of his route accurately.

Heller's journal gives travel times from other sites and an altitude of 5000 ft for Piñon. Nelson (1921, p. 20) and Goldman (1951, p. 96) give detailed descriptions. Nelson's description from 1905 says the following:

> July 10 I followed Goldman's trail southeasterly across low brushy hills for about 12 miles to the mouth of a canyon in the basal foothills of the San Pedro Martir Mountains, at an altitude of 5,300 feet. Here he was camped by a small stream which flows through the flat at the mouth of the canyon and into the sand just below. This place is known as El Piñon, and the flat and adjacent hillsides are covered with pinyon trees, making it a favorite resort for Indians during the harvest of pinyon nuts. An Indian village was once located here, but water became scarce and it was abandoned years ago.

A local informant, José Melchiades, Sr., took us to a ranch now called "Rancho Las Tinajas" and told us that it is also referred to as "Piñonal". We were able to use a photo from Nelson and Goldman's expedition to confirm this location (Nelson and Goldman 1873–1946 [image ru7364_8345]).

No water or habitat was seen at this site when we visited on 22 June 2018, and we were told that no surface or subsurface water is available for domestic use.

12 ✓. Río de San Rafael (31.087°, –115.620°; 1295 m). 2013 Universidad Autónoma de Baja California at Ensenada. Subspecies was assigned by continuity with the known sites to the north and south.

A dead immature CAVO was found at Río de San Rafael in 2013 (Guevara-Carrizales et al. 2016). We searched much of the stream from Mike's Sky Ranch (31.110°, –115.635°, 1200 m) to Rancho Garet (= Rancho Las Truchas; 31.074°, –115.602°, 1370 m). Habitat appeared favorable, but heavily grazed, with possible but not certain sign of voles. We trapped at the location where the specimen was previously found and at Rancho Garet for 3 nights, with a total of 175 trap-nights, starting 29 April 2018, without success.

13 –. Aguaje de las Fresas (31.069°, –115.544°, 1970 m). 1902 FMNH.

Heller (1902) stopped at Aguaje de las Fresas on 6 and 8 October 1902, where he collected 7 CAVO. This location does not appear on any map, but the mountain peak "La Fresa" is on many maps (31.076°, –115.553°, 2040 m; Sohn 2007).

José Melchiades, Sr. and Alfredo Mancillas (employee at Sierra San Pedro Mártir National Park) both confirmed the location of the Aguaje to be a small woodland in a depression surrounded by chaparral near the peak. The altitude, 6470 ft, and vegetation correspond to that reported by Heller—Heller's notes show an elevation of 6500 ft, later published as 6000 ft (Elliot 1903).

We were not able to visit this location due to security concerns.

14 †. Vallecitos (31.018°, –115.489°, 2425 m). 1902 FMNH, 1905 USNM, 1925 MVZ.

It appears that most of the trapping was at the lower end of Vallecitos, where the meadow transitions into a valley. Heller (1902 [23 September–6 October 1902]) described the site, "*Microtus* common along the creek in grassy places & soft earth." Nelson's (1921, p. 20) description from 12 July 1905 is as follows:

> Thence we crossed several rounded ridges covered with an open growth of yellow pines, and about 10 miles from our camp [on the Río San Rafael], at about 7,200 feet altitude, found two log cabins and a corral built on the banks of a small stream in a flat near the upper end of a small canyon.
>
> …[W]e moved camp to the lower end of the Vallecitos, where in the arroyo a little water comes to the surface."

Lamb's (1925a) description from 31 May 1925 is as follows:

> Thru its center there is a creek which at this time only comes to the surface at a few places. There are many piles of granite on the floor of the valley and tamarack pine trees. The ridges around the valley have no brush on them but are well wooded.

> At the north end of the valley the creek flows down thru a narrow canyon.

This area is now near the park visitor center. We searched the area on 19 June 2018 and found no flowing water or habitat or sign of CAVO.

15 ?. Rancho Concepción (Dark Sky Inn; 31.005°, –115.615°, 1460 m). 1925 MVZ.

This ranch is private property (not part of an *ejido*). The toponym has been used since at least 1792 (Longinos Martínez 1961). On 12 November 1925, Lamb (1925b) said,

> The creek in places has a very deep bed and is a jungle of nettles, vines and weeds. Looks very favorable for *Microtus* but almost impossible to get to. A Band-tailed Pigeon I shot fell in that jungle and I was unable to get nothing but a dose of nettles.

When we visited on 18–20 June 2018, the undergrowth along the stream was quite sparse, probably due to cattle grazing. The habitat was similar to that seen along the Río San Rafael—potentially favorable to CAVO, but heavily grazed, with no sign. We trapped here for 3 nights (~250 trap nights) without success.

16 ?. La Corona (La Joya; 30.962°, –115.603°, 1750 m) and **La Canoa creek near La Jolla** (La Joya, Valladares Creek; 30.928°, –115.583°, 1560 m). 1923 AMNH, 1923 SDNHM.

Following Huey's (1916–1953) notes for 9 June 1923, a party that included A.W. Anthony left the mines at El Socorro and climbed, camping about 1/2 mile after the "first small stream." This place would be the meadow now called La Corona (Baja Almanac Publishers 2009). Huey's field notes say that he caught 5 CAVO on the night of June 9 and morning of June 10, which corresponds to 5 animals recorded in the San Diego catalog of specimens. Huey labeled this

locality as "San Pedro Martir Mts., La Joya." Huey does not list any captures of CAVO by Anthony on this night.

Returning from camping in the high sierra on the evening of 22 June 1923, Huey says:

> We pitched our camp under several large Yellow Pines in the fork of a canyon down which ran a tiny stream. This place was about 2 miles south of La Joya where we had spent the night of June 4th and the north fork of the canyon ran right up to the old camp.

This description corresponds to the modern location where the Ríos (or Arroyos) La Corona, El Potrero, and La Canoa meet, now called "La Jolla." The largest of these watercourses is the El Potrero, which changes its name to "Valladares" a few miles farther downstream.

According to Huey's notes, Huey and Anthony then set traps about 1/2 mile up the trail from this location (*i.e.*, about 800 m to the SE along Arroyo La Canoa), where Huey collected 2 CAVO on *each* of the 2 following mornings, 23–24 June 1923. Huey does not mention any captures by Anthony on the first morning, and specifically says that Anthony did not capture any CAVO on the second (and last) morning, the 24th.

Yet only 2 specimens are recorded at SDNHM by Huey for these days, 1 each on the 23rd and 24th at "San Pedro Martir Mts., Valladares Creek." Anthony, who according to Huey did not catch any CAVO at either of these locations, deposited 2 specimens at AMNH dated 6 June 1923 and 24 June 1923, both from "La Joya." It should be noted that Huey's notes clearly place Anthony miles away from these sites on the night of June 6. We suspect that Huey shared 2 specimens from these nights with Anthony, Anthony used a slightly different place name when sending them to AMNH, and the date was confused for 1 specimen.

A local informant, Saul Martorell, confirmed that the original trail to La Grulla passed along today's road from La Corona to La Jolla and then along La Canoa creek, exactly as described by Huey.

Because we did not understand the details of these locations when we were in the field, we trapped at La Jolla and ~500 m downstream from that location along the El Potrero creek and did not visit La Corona. Habitat at La Jolla seemed favorable but heavily grazed (similar to San Rafael and Concepción). We trapped for 3 nights, beginning 11 July 2018, with 300 trap-nights, and no animals were captured.

17 ?. La Encantada (30.900°, –115.410°, 2125 m). 1893 AMNH & UCM.

The only collections for CAVO for this location date from 1893, by A.W. Anthony (Allen 1893). The dates are recorded as 25–26 May 1893, and the specimens are deposited at AMNH and UCM (Vertnet 2018). Localities for these specimens are given as "Sierra San Pedro Mártir."

Anthony (1893) does not give many place names, but he does say that the expedition "turned around" on 27 May, and that on 25 May they were at 8500 ft altitude—about 300 feet higher than the altitude, 8200 ft, that he records for La Grulla meadow.

Allen (1893) quotes a letter from E. C. Thurber, who travelled with Anthony:

> I think we went up six of these benches before we reached 'La Grulla' (a large meadow, about three miles long, where we made our third camp); from there to our last camp was about three miles, with a gradual rise of about 300 feet. From our last camp it was about

> two miles to a pass in the hills from which we could look down into the Gulf of California, distant about 25 miles.

Allen also quotes Anthony, saying that the CAVO were found in a "large meadow on the extreme eastern side of the mountains."

The above notes confirm that the CAVO were collected in La Encantada: the specimens were collected on the last 2 days of the expedition, La Encantada is the most eastern of the large meadows, it is about 3 miles east of La Grulla, it is a further 2 miles to the escarpment, and La Encantada is about 200 ft higher in elevation than La Grulla (actual elevation is about 7000 ft, not 8500 ft).

On 13 October 1925, Joseph Grinnell (1925) visited La Encantada. Because he was actively searching for CAVO and did not trap there, we suspect that he found no sign or favorable habitat.

We were only able to trap 1 night at La Encantada (60 traps on 12 July 2017), in willows at about 30.913°, –115.415°, and in grass along the exit stream at 30.891°, –115.414°. Both places had favorable habitat, were heavily grazed, and had no clear sign of CAVO. Trapping was unsuccessful.

18 ✓. La Grulla (SSPM) (30.984°, –115.480°, 2060 m) and **Rancho Viejo** (30.918°, –115.474°, 2100 m). 1902 FMNH; 1923 AMNH, MCZ & SDNHM; 1925 MVZ & UCLA.

Huey's (1916–1953) field notes for 10 June 1923 and Borell's (1925) notes for 9–28 May 1925 indicate that they trapped for CAVO at the east end of La Grulla and along the stream that flows

from La Encantada to La Grulla. Both noted overgrazing and an absence of sign on the western side of La Grulla. Grinnell (1925), on 4 October 1925, states that sign of CAVO was only seen along the same stream, near La Encantada (~30.891°, –115.417°, 2125 m). Interestingly, both Anthony in 1893 and Nelson in 1905 did not capture CAVO when they were camped at La Grulla, even though they were presumably searching and trapping for it. Heller (1902 [5–22 September 1902]) did collect CAVO at La Grulla, but he did not describe the relevant habitat. Nelson, Huey, and Grinnell all mention severe overgrazing at this meadow. In 2011, E. Mellink did not find any CAVO during 9 d of field work targeted to detect this species.

Harper et al. (2016) report the rediscovery of CAVO at Rancho Viejo meadow, adjacent to La Grulla. Because this toponym is not used in any historic description, probably it was not in use in the past, and both meadows were referred to as La Grulla, but no records support that CAVO were ever previously found at Rancho Viejo.

On 11–13 July 2017, we visited these meadows. In both this year and the previous year, practically no cattle were grazing in the meadow. (In 2015 and 2016 there was a ban on grazing, and in 2017 cattlemen lacked the capital to restock their herds; Rolando Arce, *pers. comm.*) The grass in the meadow was knee-high. We were able to capture 13 in 1 night, 12 July 2017, at the west end of La Grulla (80 traps), and 2 more in Ranch Viejo (160 trap nights) on that and the following day. We believe that before 2017, grazing depleted the habitat at La Grulla and made CAVO populations too sparse to detect in the meadow itself.

19 ✓. Rancho Santo Tomás (SSPM) (30.772°, –115.389°, 1775 m). 1905 USNM.

This is a valley that drains from Santa Rosa meadow, at the south end of the Sierra San Pedro Mártir, to the Río San Simon at San Quintín. Nelson gives no details of where he trapped. We visited on 12 June 2016 and found extensive habitat, moderate grazing, and sign of CAVO. One night's trapping (130 traps) resulted in 2 captures. Heller (1902 [25 August–2 September 1902]) mentions sign of CAVO at nearby Santa Eulalia (30.692°, –115.325°, 1790 m), but he was unsuccessful in trapping them.

Microtus californicus aequivocatus

20 ?. Rancho San José (Meling Ranch; 30.971°, –115.742°, 635 m). 1925 MVZ, 1926 SDNHM.

Huey (1916–1953) gives no notes about where he set traps on 1 October 1926, while Grinnell says that his specimen was "Bro't to house by cat!" The habitat at the nearby pond seemed poor and was very heavily grazed, with no sign. One night's trapping (25 traps) on 2 August 2016 was unsuccessful.

21 –. Las Cabras (30.950°, –115.882°, 210 m). 1923 SDNHM.

Huey (1916–1953), on 4 June 1923, trapped among the willows, finding 3 CAVO the same evening as he set the traps and 2 more the following morning. We were unable to gain access to this site.

22 ✓. San Telmo (San Telmo Arriba; 30.949°, –115.972°, 142 m). 1905 USNM, 1925 MVZ, 1925 UCLA, 1926 UMMZ.

Goldman (1951) collected CAVO here in 1905, but he gives no description of the location or habitat. Lamb (1925a) indicates that the MVZ expedition trapped in the upper valley (approx. 30.958°, –116.017°, 140m), above the narrows, all of which habitat has been destroyed by agriculture. Downstream from this site, and about 500 m upstream of the single-lane bridge (30.977°, –116.096°, 80 m), we found degraded habitat (salinity 3‰, invaded by Tamarisk, but seemingly not grazed, and with *Eleocharis* present) and sign of CAVO. Three nights of trapping starting on 20 February 2018 (200 trap-nights) resulted in 3 CAVO.

23 ✓. San Antonio (San Antonio Murillo; 30.818°, –115.630°, 555 m). 1902 FMNH, 1905 USNM.

San Antonio is an ~1 km reach along the Río San Antonio, which flows into the Río Santo Domingo. Benson (1949) trapped unsuccessfully for CAVO on 16 July 1949. We found favorable habitat, no sign of recent cattle grazing, and possible sign of CAVO. Two nights of trapping on 24–25 July 2016 (190 trap-nights) resulted in 1 CAVO.

24 †. Boca del Río Santo Domingo (San Ramón; 30.720°, –116.040°, 2 m). 1925 MVZ.

Lamb (1925a) on 15 March and 8 December 1925, and Borell (1925), on 14 March 1925, describe a large fresh-water lagoon with tules and where their mammal traps even caught a Virginia Rail. Today there is no fresh water or habitat (salinity 8.7‰).

25 †. Laguna Santa María (Mouth of Río San Simón, Pinta Pond; 30.402°, –115.909°, 2 m). 1902 FMNH, 1905 USNM, 1953 SDNHM.

All of these collections were made when the location of this site was the mouth of the Río San Simón (Allen 1887; Meigs 1935, Fig. 2; Gerhard & Gulick 1956, Map 5). By 1970, the river had shifted its mouth to empty into San Quintín Bay, leaving a freshwater pond (Coleman 1973, Palacios and Alfaro 1991). The pond has now disappeared, and no freshwater or even salt marsh habitat remains. Historical photography available at Google Earth shows intensive agriculture at this site starting about 2005, which has now been abandoned.

26 †. El Socorro (30.317°, –115.822°, 2 m). 1905 USNM.

There was a wetland at the mouth of the Río Socorro (Nelson 1921). Huey (1964) trapped here "several" times, targeting *Sorex*, but presumably for CAVO as well, without success. Maldonado (1999) reports that the marsh had disappeared by 1986. We found no habitat.

27 †. El Rosario (1 mi E El Rosario; 30.054°, –115.725°, 20 m). 1906 MCZ, 1925 SDNHM, 1926 LACM, 1930 MVZ.

No details are available on where W.W. Brown collected his specimens for MCZ (Thayer & Bangs 1907). At the time that the SDNHM and MVZ specimens were collected (at "1 mi E El Rosario"), the town center was at the church (30.041°, –115.739°, 25 m). We searched along the (mostly dry) river course at that historical collection site, and at other sites nearby, and found no favorable habitat or sign. Given the areal extent of the river valley (> 40 km^2), there may be other areas of potential habitat that we did not encounter.

28 ?. San Fernando Velicatá (Misión San Fernando; 29.970°, –115.238°, 455 m). 1930 MVZ.

This was the most southerly location known for CAVO. Lamb (1930–31 [29 December 1930]) described the location immediately in front of the mission, where an ~3 km reach of the stream comes to the surface. Although today the habitat looks similar, with moderate grazing, we found no sign of CAVO, and 3 nights of trapping starting on 11 September 2016 (90 trap-nights) failed to capture any animals.

APPENDIX — SPECIMENS COLLECTED

Three specimens were collected and deposited at the Universidad Autónoma de Baja California:

CVUABC 1168: *Microtus californicus* from La Grulla, SSPM (July 2017)

CVUABC 1169: *Microtus californicus* from Rancho Viejo (July 2017)

CVUABC 1170: *Microtus californicus* from Sangre de Cristo (September 2017)

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