

**Acoustic Bat Survey at Carnegie  
State Vehicular Recreation Area - 2016**



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A reconnaissance level bat survey was conducted at the Carnegie State Vehicular Recreation Area in August/September 2016. The purpose of the survey was to determine if bats, and in particular, special-status species were currently using the site, or were believed to use the site on a seasonal basis. Additionally, biologists at Carnegie were hoping to increase the understanding of site use, species diversity, and changes year-to-year.

The site was composed of rolling to steep hills covered in non-native annual grasslands, montane hardwood, blue oak woodland, blue oak-grey pine, valley foothill riparian, mixed chaparral, chamise-redshank chaparral, and barren soil habitat types. Elevations ranged from approximately 175 meters to over 650 meters. Some portions of the site were heavily degraded by off highway vehicle use. This included deep ruts along ridgelines, slopes, and connections between existing trails. The level of habitat degradation has contributed to the mobilization of soils such that lower elevation siltation was evident within detention basins. Other portions of the site (western and southern) were closed to most access and remained intact. Non-native annual grasslands, within closed areas of the recreation area, were grazed by cattle. Historic land uses have created changes in otherwise natural conditions, which has increased or created habitat for bats in the area. These sites included historic mines and cattle stock ponds. Numerous stock ponds are distributed widely around the park and provide freshwater to cattle and to wildlife.

## **Methods**

Due to the variety of habitat types, the expansive study site, and the potential for numerous species' microhabitat requirements that could be investigated, we elected to conduct visual encounter surveys and passive acoustic surveys at selected locations. A site visit was conducted on 24 August 2016 by a biologist from The Wildlife Project, and a staff biologist from Carnegie SVRA. Visual encounter surveys were conducted on foot during each site visit, including potential roosting sites in and around areas where acoustic detectors would be deployed. Passive acoustic surveys were initiated by selecting appropriate sites (i.e., highest priority placed on drinking sites and sites with known bat activity) and deploying Wildlife Acoustics SM2 or SM3 acoustic bat detectors in four locations. Sites varied in habitat type (e.g., oak woodland, cattle stock pond, mine adits in coastal scrub habitat, and in elevation (i.e., 230 meters to 640 meters). Detectors were placed with microphones mounted on PVC poles adjacent to a drinking location or a known flight pathway. Recordings were allowed to continue continuously for a 5-week period.

Each unit was set to collect data beginning at one hour before sunset and continue until 1 hour after sunrise. Data were analyzed using Kaleidoscope 4.0.1 software (Wildlife Acoustics). We analyzed data using the software at its most precise setting, and then confirmed the analysis through direct visual confirmation of the data by an experienced bat biologist. Acoustic

signatures that were not identifiable, were ambiguous, or which overlapped significantly with another species were discarded.

## Results

No bats were visually detected at the Carnegie SVRA during bat surveys. The staff biologist (Tara de Silva), however, reported several pallid bats consistently roosting on a covered wall of a concrete composting toilet. Visual signs or both guano and urine stains were obvious during acoustic surveys for bats. Passive acoustic surveys resulted in detections of bats at three of the four locations where units were deployed in 2016 (Table 1). Seven individual bat species were detected with nearly 100% certainty; with three species identified as special-status (western red bat [*Lasiurus blossevillii*], western mastiff bat [*Eumops perotis*], and pallid bat [*Antrozous pallida*] (Table 1). Two species (pallid bat and canyon bat [*Parastrellus hesperus*] were detected in both the 2014 survey effort and efforts conducted in 2016. Three species (hoary bat [*L. cinereus*], little brown bat [*Myotis lucifugis*], and Mexican free-tailed bat [*Tadarida brasiliensis*]) were detected during the 2016 survey effort but not during the 2015 acoustic surveys. Bat species diversity was slightly higher in 2016 ( $n=7$ ) than in 2015 ( $n=6$ ), with a total of 11 different species detected to date; three of which are special-status species.

## Discussion

The timing of our survey effort (i.e., August/September), the dry conditions of the site, and other factors may have contributed greatly to the results that we were able to collect. Some bat species use sites seasonally, yet that site may provide very critical short-term roosting habitat for migratory movements. Other bats may remain in the same general region for the majority of the year, making only short movements or short duration bouts of torpor.

All bats generally leave a roosting site and head immediately to water bodies to drink. As water bodies dry and secondary drinking areas lie further from roosting sites, habitat suitability may decrease, particularly in dry years. Therefore, the timing of bat surveys should be based on site conditions rather than the calendar year. In 2016 we found the site to be fairly dry. Our strategy was to collect repeat acoustic data collection from site where we collected data in the previous year, but also at sites that continued to support drinking opportunities. During years where water is more abundant and widely distributed the species detected may be very different.

The variety of bats species utilizing drinking sites, mines, and caves at Carnegie State Vehicular

Recreation Area is indicative of the variety and diversity of habitat types available at the site. The species ranged from cave and crevice roosting bats to tree roosting species. The majority of

the species detected were found at drinking sites. Among those sites, Tyson's Pond included the greatest diversity in species (Table 1). The majority of the drinking sites included the detection of multiple bat species (up to 5).

We witnessed a dramatic decline in site use as the surveys progressed. Individual site visits detected by acoustic devices dropped steadily as drier condition increased, particularly at Tyson's Pond. Lime Kiln Cave appears to have year-round water but may not be accessible to all bat species due to vegetation obscuring the cave entrance. Hidden Pond (in 2016) was perennial, as were adjacent ponds. Although Tyson's Pond dried early in the year, other water sources were able to be utilized by bats. Available drinking water appears to be a limiting factor for many bat species at this site. Improving the availability, longevity, and predictability of drinking water sites may improve site suitability for bat species in the area.

Table 1. Results of acoustic detections at 4 sites in the Carnegie State Vehicle Recreation Area, Summer 2016. Bold type indicates species detected; all others include potential bats species in California that may be detected during surveys.

SPECIES	Status	Tesla Mine (cavern)	Lime Kiln Cave (surface water/ cavern)	Hidden Pond (surface water)	Tyson's Pond (surface water)
<b>Pallid Bat</b>	CSC	~	detected	~	detected
Townsend's big-eared Bat	ST*, CSC	~	~	~	~
Spotted Bat	CSC	~	~	~	~
Western Yellow Bat	CSC	~	~	~	~
<b>Western Red Bat</b>	CSC	~	~	~	detected
<b>Hoary Bat</b>		~	~	detected	~
Silver-haired Bat		~	~	~	~
Big-brown Bat		~	~	~	~
Arizona Bat	CSC	~	~	~	~
California Bat		~	~	~	~
Western Small-footed Bat		~	~	~	~
Cave Bat	CSC	~	~	~	~
Long-eared Bat		~	~	~	~
<b>Little Brown Bat</b>		~	detected	detected	~
Fringed Bat		~	~	~	~
Long-legged Bat		~	~	~	~
Yuma Bat		~	~	~	~
<b>Canyon Bat</b>		~	~	detected	detected

Pocketed Free-tailed Bat	CSC	~	~	~	~
<b>Mexican Free-tailed Bat</b>		~	~	~	detected
<b>Western Mastiff Bat</b>	CSC	~	~	~	detected
Mexican Long-tongued Bat	CSC	~	~	~	~
Lesser Long-nosed Bat	FE	~	~	~	~
California leaf-nosed Bat	CSC	~	~	~	~

\* *candidate*

GPS location (10S)	623180.3 E; 4167136.4 N	629160.4 E; 4164932.0 N	624061.6 E; 4164671.8 N	627337.7 E; 4166198.1 N
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General habitat condition	Deep mine adit with a curve leading to undisturbed roosting	An historic mine adit with surface water for the entire length	Stock pond with annual grassland and oak woodland	Wet silt detention basin with Fremont cottonwood
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The Tesla Mine entrance currently includes a bat-friendly gate, which allows bats to enter but excludes humans and large carnivores (i.e., coyote [*Canis latrans*], bobcat [*Lynx rufus*], etc.). Historically and recently, the Tesla Mine provided roosting habitat for Townsend's big-eared bat (*Cornorhinus townsendii*) but no individuals of any species were detected during our survey in 2016. Periodic disuse of a site is not indicative of a site no longer being used. Townsend's big-eared bats and other species make regional movements based on availability of resources, but also make longitudinal migrations when resources are scarce. The absence of Townsend's big-eared bats during this survey in 2016 may suggest that this species uses the site during annual migrations, during regional site shifting activities, for winter estivation, or for other less well understood time periods. Although the extent of use of the site is unclear, any available roosting site that is used by this species should be maintained and protected.

It appears clear that Carnegie State Vehicular Recreation Area supports at least 12 species: six species detected during previous survey work, one detected by the staff biologist, and 5 additional species detected during 2016. The value of the site may change seasonally, and species abundance and composition may change through the year as site conditions change. Monitoring the bats that occur on the site, in particular, the special-status bats, may allow land managers to manage the site for the recreational opportunities that it offers, while also supporting bats that already utilize the site.

### **Recommendations**

Bats that occur at Carnegie likely use the site for the seasonally available resources that it provides, after which time, they likely shift to other areas. The following recommendations may increase site suitability for a longer period, with a minimum amount of effort. However, to determine if these recommendations are increasing site use, monitoring recommendations are also included.

1. Trim small-scale vegetation outside of Lime Kiln Cave. This recommendation is specific to the small, dead branches ( $\geq 1$  inch), which should be removed from a level that is 5 feet above the ground. The goal is to allow a clear flyway for bats that are approaching the mouth of the cave, but not to increase visibility of the cave entrance to site visitors (i.e., recreationists).
2. On occasions when mine entrance closures are conducted or upgrades to older mine exclusion devices are made, exclusion devices should be bat-friendly. This includes horizontally oriented bars that are spaced no closer than 6 inches.
3. To extend the hydroperiod of drinking sites, when appropriate, encourage stock animal lessees to remove silt from dry ponds. Methods for conducting this practice can be obtained from the Alameda County Resource Conservation District. Special care should

be considered when working in aquatic breeding habitat for California tiger salamander (*Ambystoma californiense*) or California red-legged frog (*Rana draytonii*), both of which can benefit from silt reduction in stock ponds. Consider installing one or more cattle troughs ( $\geq$  8 foot diameter, or 6 foot long [if oblong]) at sites where permanent water is available; this can include adjacent to anthropogenic structures. Water levels must be maintained at a near 100% level with a self-filling device. A wildlife escape ramp is also a mandated requirement.

4. Conduct annual acoustic surveys at Tyson's Pond and Hidden Pond during a period between June 1 and August 1. Additional ponds (e.g., Small Pond) can and should be added if time, budget, and hydroperiod allows. The onset of acoustic sampling should be initiated after Corral Hollow Creek is dry and at least 50% of the existing stock ponds and water detention basins are dry. This will focus bat drinking-sites to those that appear to maintain water for the latest date. If the structure or condition of Tyson's Pond and Hidden Pond changes over time, a surrogate pond should be selected.
5. Conduct acoustic and visual encounter surveys at Tesla Mine. Ideally, visual encounter surveys should be conducted in winter (December/January; visual encounter surveys will be focused on hibernating bats) and late spring (June; acoustic surveys). If Townsend's big-eared bats, or other bat species are detected hibernating, a bat biologist should be sought to identify the animals to species.
6. Conduct a single visual encounter survey of buildings and structures within Carnegie State Vehicular Recreation Area between May 1 and August 1. This survey should identify guano piles, urine stains, dead bats, live bats, and other evidence of bat use. Survey data can be used when maintenance activities are planned for State-owned structures.
7. Maintain and regularly update the locations of bat roosting sites on Carnegie State Vehicular Recreation Area. These data should also be reported to the California Natural Diversity Data Base when the species observed is of special-status.