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Data Summary

Prepared for:

San Diego Association of Governments

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

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ABSTRACT

We investigated the role of large-scale wildfires on the community composition and structure of foraging bats within San Diego County, California. In October and November of 2003, large–scale wildfires burned nearly 130,000 hectares of San Diego County. To assess the potential impacts of these fires on the native bat communities, we conducted surveys at eleven sites within each of our two study areas, Rancho Jamul Ecological Reserve - Hollenbeck Canyon Wildlife Area and Santa Ysabel Open Space Preserve. At each study area a subset of these sites was sampled before the fires (2001-2003) and a subset after the fires (2005-2006). Our pre-fire sampling efforts included five survey techniques: active-Anabat, mist-netting, roost, visual, and audible. These same five techniques were employed during the first year of post-fire sampling, 2005. In 2006, we altered our survey methods by discontinuing mist-netting and began using passive-Anabat monitoring stations instead of an actively monitored station.

In total, we detected 15 bat species during the study. These include the pallid bat (*Antrozous pallidus*), Townsends' big-eared bat (*Corynorhinus townsendii*), big brown bat (*Eptesicus fuscus*), western mastiff bat (*Eumops perotis*), western red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), western yellow bat (*Lasiurus xanthinus*), California myotis (*Myotis californicus*), western small-footed bat (*Myotis ciliolabrum*), long-eared myotis (*Myotis evotis*), Yuma myotis (*Myotis yumanensis*), pocketed free-tailed bat (*Nyctinomops femorosaccus*), big free-tailed bat (*Nyctinomops macrotis*), western pipistrelle (*Pipistrellus hesperus*), and Mexican free-tailed bat (*Tadarida brasiliensis*). Thirteen of the species were detected at both study areas; the remaining two species were unique to Santa Ysabel.

Community analyses revealed differences in the bat communities between study areas, among survey methodologies, and before and after the wildfires. The higher elevation, more woodland dominated Santa Ysabel supported a difference community of bats than the lower elevation grassland and scrubland Rancho Jamul. Anabat surveys on average detected a richer and more comprehensive bat assemblage than that detected by mist-nets or roost surveys alone. We did not find a measureable difference in community composition between the two Anabat techniques, active versus passive. At both study areas, we detected a shift in bat community structure when comparing the results of Anabat surveys conducted before and after the fire. Although a difference existed between the two sample periods, we did not detect an effect of burn condition on community structure. Within each study area, the bat community was not significantly different between burned and unburned sample locations. Although the detection frequencies of several species changed between sample periods (pre- to post-fire), only one rarely detected species that was found before the fires was absent from post-fire samples.

1. INTRODUCTION

Wildfires have long been a part of the natural and human-altered environments of southern California. Keeley et al. (1999, 2004) has stated that large landscape level fires occurred in the past and will likely persist as long as southern California continues to experience episodes of severe fire weather (e.g., fast, dry winds). Despite fire suppression efforts and management plans, large and small wildfires continue to occur from both natural ignition sources and those associated with an increasing human population (Keeley et al. 2004). The native vegetation communities have evolved with this fire regime and have adapted various survival strategies in response (Vogl and Schorr 1972, Hanes 1971, Keeley and Keeley 1981, 1984, Zedler et al. 1983, Keeley and Fotheringham 2001). However, as fire return intervals decrease to below historic levels, the trend is for shrub lands, including chaparral and coastal sage scrub, to be type converted to grasslands (Zedler et al. 1983, Keeley 2005). As fires alter the composition and structure of vegetative communities, we may expect a concomitant shift in the activity and species diversity of bats.

In October and November of 2003, large-scale fires swept across southern California, burning over 300,000 hectares of wild lands. This included nearly 130,000 ha burned in the Cedar and Otay Fires in San Diego County. In addition to the loss of nearly 5,000 structures and 15 human fatalities (CDF 2003), these large fires potentially impacted the local bat community and their invertebrate prey base in a region already recognized as being one of the most at risk areas for loss of biodiversity (Mittermeier et al. 1997). The first large habitat reserve created in San Diego County, the Multiple Species Conservation Plan (MSCP) (City of San Diego 1997) was directly in the footprints of these two fires. The fires affected half of the protected lands within the MSCP, and some protected habitats were entirely within the fire perimeters. Concern over the recovery of these habitats and the species within them motivated our efforts to conduct this research.

Bats are a diverse group of mammals representing about one-third of the mammals found in San Diego County. Across multiple previous studies, 23 species have been documented in the county (Bond 1977, Constantine 1998, Krutzsch 1948). Bats make use of a wide variety of habitats and typically have large home ranges. Twenty-one of the 23 bat species known to occur in the county are insectivorous, feeding almost exclusively on insects. The other two bat species are nectivorous, helping to pollinate plants as they move from flower to flower in search of nectar. As a group, they are good indicators of ecosystem health at a landscape level because of their diverse life history needs (Ball 2002). At the time of this study, 16 bat species are recognized officially as sensitive by wildlife regulatory agencies within the southcoast ecoregion, that includes parts of San Diego County (Miner and Stokes 2005).

The effects of large-scale wildfires on bats have not been evaluated widely. Boyles and Aubrey (2006) suggest that fires in forested areas may benefit cavity-dwelling bat species but the effects of wildfires on regional bat community structure and detection rates are not well studied.

2. STUDY AREA

Our survey efforts were conducted within two separate study areas within San Diego County, California, 1) Rancho Jamul Ecological Reserve - Hollenbeck Canyon Wildlife Area and 2), Santa Ysabel Open Space Preserve (Figure 1). Portions of both reserves were burned during the 2003 wildfires.

Santa Ysabel Open Space Preserve (SYOSP) was located near the small town of Santa Ysabel in the northern portion of San Diego County. At an average elevation of 1,078 m, the area supported oak and pine woodlands, native and non-native grasslands, chaparral, coastal sage scrub, and riparian woodlands. Dominating the various vegetation communities were coast live oak (*Quercus agrifolia*), annual, non-native grasses (*Avena* and *Bromus*), chamise (*Adenostoma fasciculatum*), Engelmann oak (*Quercus engelmannii*), and white sage (*Salvia apiana*). This 1,500 ha preserve was managed by the Parks and Recreation Department of the County of San Diego. The average July high temperature was 33°C, while the average January daily low temperature was 1°C. The average annual rainfall was 53 cm. Santa Ysabel represents the northeastern extent of the Cedar Fire, which consumed a large portion of the eastern property in 2003. We selected eleven sites within SYOSP to conduct our bat surveys (Table 1). Sites 1 through 5 and 10 were in areas burned by the 2003 Cedar Fire and sites 6 through 9 and 11 were in areas unburned by this fire (Figure 2). We had pre-fire data for all but two of these sites.

Rancho Jamul Ecological Reserve - Hollenbeck Canyon Wildlife Area (collectively referred to as RJER) was located near the international border between the United States and Mexico, between the towns of Jamul and Dulzura in southern San Diego County. The California Department of Fish and Game managed the combined property. Rancho Jamul Ecological Reserve covered nearly 1,500 ha, and its southern portion burned during the Otay Fire of 2003. Hollenbeck Canyon Wildlife Area covered 1,450 ha and was untouched by the 2003 wildfires. The average elevation across RJER was 250 m. The area encompassed a diversity of vegetation communities including native and non-native grasslands, coastal sage scrub, and upland and riparian woodlands dominated by oaks, sycamores, and willows. In addition to natural vegetation communities, there were extensive, fallow agricultural fields. Dominant plant species at the reserve included annual, non-native grasses, California buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), coast live oak, western sycamore (*Platanus racemosa*), laurel sumac (*Malosma laurina*), and San Diego sunflower (*Viguiera laciniata*). Rancho Jamul's average July maximum temperature was 29°C, while the average January low temperature was 5°C. Annual precipitation averaged 31 cm. We selected eleven sites within RJER to conduct our post-fire bat surveys (Table 1). We had pre-fire data at seven of these. Sites 1 through 5 were in areas burned by the 2003 Otay Fire and sites 6 through 11 were located in areas that were unburned (Figure 3).

All temperature and precipitation values reported here are 30-year averages for 1966-1995 (Franklin 2001). We used geographic information system (GIS) tools to extract these values for each study area.

Within each study area, we selected sample sites with habitat components that would support foraging bat activities. These habitat components included open water, riparian forests and scrub vegetation, oak and coniferous forests, non-native woodlands, and certain types of artificial light. Roost surveys were conducted in areas with slightly different environmental characteristics. When establishing roost survey sites, key habitat components included exposed rock outcrops and cliffs, natural and artificial caves, buildings, bridges, and other artificial structures.

3. MATERIALS AND METHODS

3.1 Field Methods

The use of multiple bat survey techniques is important to the development of a comprehensive inventory of bat species (Pierson 1993). For this study, we used both active- and passive-Anabat monitoring (Anabat II bat detectors, Titley Electronics, Ballina, New South Wales, Austrailia), mist-nets, visual, and audible survey techniques to detect, capture, and observe bats. These techniques were used for two types of surveys: 1) foraging bat surveys and 2) roosting bat surveys.

3.1.1 Foraging Bat Surveys

During the 2002 – 2003 pre-fire and 2005 post-fire samples, we conducted surveys for foraging bats using a single active-Anabat monitoring station and one to six mist-nets during each field survey. The active-Anabat monitoring station consisted of an Anabat bat detector used in combination with a laptop computer. These electronics were set up near the riparian vegetation of the selected study site and monitored by the field crew throughout the course of each night's survey effort (Kunz et al. 1996a). The Anabat monitoring station was situated within 30m of an area where we expected a maximum number of bats to be active and there were minimal obstructions between the Anabat and the foraging bats. We recorded bat vocalizations for a period of three hours each sample night beginning at sunset (O'Farrell et al. 1999, Milne et al. 2003). We reviewed the recorded bat vocalizations, attempted to identify each to the species level, and created a list of bat species detected during

Active-Anabat monitoring stations were setup near riparian vegetation.

Mist-nets were set up near bodies of water and checked regularly for captured animals.

Passive-Anabat monitoring stations were used in 2006 to document foraging bat activity.

each survey effort. Not every bat vocalization was identified to the species level; only the best representative vocalizations were used. Identification of bat calls using the Anabat requires experience and access to a reference library of 'known' bat calls for comparative purposes (for examples see Appendix 1). Different species of bats produce calls with different characteristics. Even within a single species, bats produce various calls depending on the situation, for example – exiting from a roost, searching for prey, approaching prey, catching prey, social calls, navigating and hunting in cluttered versus uncluttered habitats. We developed our reference library during various bat research projects beginning in 2002.

In conjunction with the active-Anabat monitoring station, we set up mist-nets in nearby flyways and over small bodies of water in order to intercept and entangle bats as they flew in these relatively confined areas. The mist-nets were set up at sunset and checked regularly for captured bats for three hours. The number and size of mist-nets that we used depended on the availability of suitable locations within a 200m range of each other and the Anabat monitoring station. After a three-hour sample session, the nets were taken down and removed from the field. We processed all captured bats to determine species, age, gender, and reproductive status. All bats were weighed and measured (forearm, foot, and ear). We photographed all animals using a digital camera (Appendix 2). When necessary, we used a small water bottle or eyedropper to re-hydrate the captured bats. After processing, each bat was released at the point of capture. On occasion, we would record the release of the bat using the Anabat in order to further develop our reference library of calls for known bat species (for examples see Appendix 1). Additionally, certain bat species were recognizable in flight (i.e., western red bats, hoary bats, big brown bats) while their vocalizations were simultaneously recorded using the Anabat. When this occurred, the recorded bat calls were copied into a reference library of 'known' bat vocalization sequences (Appendix 1).

In 2006, we altered our survey methods to use passive-Anabat monitoring stations instead of actively monitored stations. Each passive station consisted of an Anabat that recorded and stored bats calls to a compact flash card instead of a laptop computer. The passive-Anabat was programmed to turn 'on' at sunset and 'off' at sunrise. With a 12-volt battery attached to the device, we were able to leave the equipment in the field to record for three to five consecutive nights unattended. We rotated the stations between the sample sites such that each site was surveyed three independent occasions during the months of June through September. This change was made because of the potential cost saving benefit and the ability to collect data over a longer duration.

3.1.2 Roost Surveys

Some bat species are more easily detected at roost sites than foraging sites (i.e., American leaf-nosed bats belonging to the family *Phyllostomatidae,* D. Stokes, pers. obs.), so this technique was used to supplement foraging bat surveys. Locating, characterizing, and monitoring roosts are all important efforts to conserve and manage for bats in a given landscape (Pierson and Rainey 1998, Ball 2002). Roost surveys must be conducted cautiously as many bat species are very sensitive to disturbance at roost sites (Kunz et al. 1996b).

We conducted roost surveys at both natural and artificial sites.

We conducted multiple types of roost surveys, targeting rocky cliffs and outcrops, natural caves, buildings, bridges, and artificial tunnels. At these locations, we performed daytime internal inspections of day roosts, nighttime internal inspections of night roosts, and external surveys of inaccessible roosts. At the inaccessible roost sites, we observed bats as they entered or exited day or night roosts. We made visual observations of roosting bats during internal and external roost surveys. On occasion during internal roost surveys, we determined bat use by observations of guano and/or culled insect parts, which required experience with species-specific bat guano and feeding behaviors. In addition, some bat species could be identified by listening for their unique calls that could be detected by the unaided ear. When appropriate, we used hand-nets to capture bats during internal surveys. We conducted roost survey visits at five potential roost sites, four at RJER and one at SYOSP (Table 1).

3.2 Statistical Analysis

In order to assess the response of bats communities to the 2003 wildfires, we compared the bat community structure by study area, survey technique, sample period, and plot condition. In our analyses we used individual surveys as our replicate. Prior to testing for an effect of study area, sample period, or condition, we tested for an effect of survey technique. Survey techniques included both active- and passive-Anabat monitoring stations, mist-nets, visual, and audible observations. Data collected prior to the 2003 fires were classified as pre-fire samples and samples collected afterwards as post-fire. We categorized each study site as either a reference or an impact site. Survey sites within the fire perimeter were identified as impact sites and experienced some degree of burning. Survey sites outside of the fire were considered reference sites, as the fires did not affect them.

We used a before-after/reference-impact design to test whether there were any changes at the individual site level based on the fire history of each site. Adjusting for any changes in the reference sites would aid in the interpretation of any changes detected at the impact sites. We further reduced the before-after/reference-impact design into a two category variable we called fire condition. We used fire condition in order to investigate whether the post-fire (after) samples from impact sites were any different from all of the other unburned (reference) samples. For this variable, we identified all of the samples collected on study sites that were unburned at the time of the sample as non-razed. This included all pre-fire samples and the post-fire samples from reference sites. Samples from post-fire impact sites were in a separate group called razed.

With the data classified based on these criteria, we used a multivariate statistical program, PRIMER-E (Version 6, Plymouth, UK; Clark 1993), to investigate any changes in the bat communities that may have been related to the 2003 fires. Before analyzing the bat detection data with PRIMER-E, we removed rare species then transformed the data to presence/absence data during each survey sample. We considered a species rare if we detected individuals of the species at ≤ 10% of the samples. Passive-Anabat surveys that failed to detect any species due to mechanical failure were also excluded. Using the transformed data, we created a Bray-Curtis similarity matrix among all samples (Clarke and Green 1988). To generate the Bray-Curtis similarity matrix, PRIMER-E calculated the percentage of similarity between each sample in the dataset by comparing the species that occurred in each (Clarke and Warwick 2001). A similarity of 0% indicates that two samples had no species in common. If all of the same species occur in two samples, the similarity would be 100% (Bray and Curtis 1957). Using the Bray-Curtis similarity matrices, we tested for differences between samples using an analysis of similarity

(ANOSIM) test, a multivariate permutation-based test similar to the analysis of variance (ANOVA) test in univariate statistics (Clarke and Green 1988). We first tested whether the survey methods were significantly predictive of the differences in the bat community structure. If survey method was significant, the effect of the fire was tested separately for each method. In this fashion, we tested for differences between samples based on all of the remaining variables; study area, sample period, plot condition, and finally, fire condition. If study area was significant, it was used as a blocking factor within the second series of ANOSIM tests performed for each survey method that tested for differences between the razed and non-razed sites. The test statistic R from an ANOSIM test reflects the observed differences between groups in comparison to within groups and can range from -1 to 1. An $R = 1$ indicates complete discrimination among groups, while $R \leq 0$ indicates no discrimination. PRIMER-E calculates significance by permutation (Clarke and Green 1988).

We generated non-metric multidimensional scaling (MDS) plots to ordinate the similarities between the samples (Kruskal 1964). These plots are a two-dimensional representation of the multi-dimensional similarity between samples. The only scale in an MDS plot is the relative distance between samples, with similar samples appearing close together and dissimilar samples farther apart (Clarke and Warwick 2001). Because PRIMER-E limited the MDS to two dimensions, there was some level of distortion or stress incorporated into the ordination in order to best represent the data. Stress is a measure of the combined deviation from the ideal distance between all samples. Two-dimensional MDS plots with stress values ≤ 0.1 are considered good representations of the similarity matrix, while MDS plots with stress > 0.3 are considered poor representations of the data (Clarke and Warwick 2001).

In cases where we detected differences in the bat community, we calculated individual species detection rates in an attempt to explain the observed differences. The number of surveys in which a bat species was detected was divided by the total number of surveys completed. We calculated detection rates based on the variables shown to be significant during the multivariate analyses.

4. RESULTS AND DISCUSSION

To evaluate the post burn effects of fire on bats, we applied multiple survey techniques to study sites before and after the 2003 fires at Rancho Jamul Ecological Reserve and Santa Ysabel Open Space Preserve. At RJER, we conducted 54 Anabat surveys, including both active- and passive-Anabat monitoring stations, 30 nights of mist-netting, and 14 roost surveys for a total of 98 surveys at RJER. At SYOSP, we conducted 68 Anabat surveys, 38 nights of mist-netting, and five roost surveys, totaling 111 surveys. We detected 15 species of bats across both study areas and all survey methods. These species include the pallid bat (*Antrozous pallidus*), Townsends' big-eared bat (*Corynorhinus townsendii*), big brown bat (*Eptesicus fuscus*), western mastiff bat (*Eumops perotis*), western red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), western yellow bat (*Lasiurus xanthinus*), California myotis (*Myotis californicus*), western small-footed bat (*Myotis ciliolabrum*), long-eared myotis (*Myotis evotis*), Yuma myotis (*Myotis yumanensis*), pocketed free-tailed bat (*Nyctinomops femorosaccus*), big free-tailed bat (*Nyctinomops macrotis*), western pipistrelle (*Pipistrellus hesperus*), and Mexican free-tailed bat (*Tadarida brasiliensis*) (Appendix 2). Ten of the 15 bats species have legal protection through various agencies (Miner and Stokes 2005, CDFG 2009). Thirteen of these species were documented within both study areas; the remaining two species were unique to SYOSP. Based on the minimum > 10% detection rate, we were able to use data from 12 species to compare patterns in community structure between study areas, the pre- and post-fire periods, and plot condition (reference and impact) of the sample locations. These same 12 species were used to investigate differences between the two categories of fire condition, non-razed and razed.

We found a difference in the bat community structure between the two sample areas. This difference in structure is likely explained by the differences in elevation and habitat composition (e.g., the availability of rock outcrops and crevices, woodland roosting sites, open grasslands, and sources of water) between the two sampled areas. The pallid bat, western red bat, hoary bat, and California myotis were more commonly detected at the higher elevation SYOSP. The long-eared myotis, western small-footed myotis, pocketed free-tailed bat, and western pipistrelle were detected more often at the lower elevation Rancho Jamul.

4.1 Foraging Bat Surveys

Of the 15 bat species that we detected, 13 were found at RJER and all 15 were observed within SYOSP. The two species not detected at RJER were the western yellow bat and big free-tailed bat. The pre-fire portion of this work was completed between May 2002 and December 2003; post-fire efforts ran between May 2005 and September 2006 (Table 2 and Table 3).

Foraging bats were identified and quantified through several techniques; active-Anabat, passive-Anabat, mist-netting, visual, and audible surveys.

4.1.1 Active Anabat Surveys

Using the active-Anabat monitoring stations, we detected all 15 bat species at least one time over the entire course of our study (Table 4). During the 2002-2003 surveys at RJER, we detected 12 bat species at the five survey sites which were sampled a total of 14 times. All 15 species were detected within the nine study sites at SYOSP in the same time period (Table 4) in 22 survey efforts. Post-fire, we detected 13 bat species at eight survey sites at RJER in 22 field surveys (Table 4). One bat species, Townsends' big-eared bat, was detected post-fire at RJER that was not found pre-fire. At SYOSP post-fire, we found 13 bat species at the seven sites that were surveyed 22 times. Townsends' big-eared bat and the big free-tailed bat were not detected at SYOSP post-fire using the active-Anabat technique. In 2006, a limited number of active-Anabat surveys were completed, two at RJER and one at SYOSP (Table 2 and Table 3), eight out of 15 bat species were detected (Table 5).

4.1.2 Passive Anabat Surveys

Passive-Anabat surveys were conducted in 2006 and detected 12 of the 15 bat species previously documented within our study areas. At RJER, we detected 11 bat species at six survey sites during 18 surveys (Table 5). At SYOSP, the passive-Anabat technique produced detections of 12 species of bats at six sample sites during 24 surveys (Table 5). During the passive-Anabat surveys, there were occasions when the unattended electronic systems failed to operate properly, resulting in no data collection between one and five days during the survey (Table 2 and Table 3).

4.1.3 Mist-Net Surveys

Through mist-net surveys at RJER and SYOSP during 2002-2003 and 2005, we captured 110 bats representing 10 species (Table 1 and Table 6). The overall average capture rate was 0.13 bats/mist-net hour (110 bats/876 mist-net hours). During the pre-fire survey seasons, we captured 82 bats representing10 species (Table 6). The average capture rate was 0.19 bats/mist-net hour (82 bats/426 mist-net hours). After the 2003 wildfires, during the 2005 surveys, we captured 28 bats representing six species (Table 6). The average capture rate was 0.06 bats/mist-net hour (28 bats/450 mist-net hours). While these rates may appear low compared to local mist-netting efforts for birds, an average of 0.6 birds/mist-net hour (B. Kus pers. comm.), it is greater than the capture success rate of another recent southern Californian bat study in Orange County, California, which averaged only 0.02 bats/mist-net hour (Remington 2003).

There were differences in the bat species detected using mist-nets compared to Anabat surveys. Five of the fifteen species observed during Anabat monitoring were never detected during our mist-net surveys (Table 6). Mist-netting failed to detect even more species post-fire relative to Anabat detections, only six species were captured. This may be related to changes in the bat community, behavioral responses resulting from the changes in vegetation structure, or fewer post-fire mist-net surveys combined with low detectability rates.

The three species captured in mist-nets in the highest numbers were the big brown bat, Yuma myotis, and California myotis (Table 6). These three species represented 66% of all bats captured in mist-nets.

4.1.4 Audible Surveys

The unaided ear as a survey technique was used at all foraging sites in conjunction with mist-netting and the Anabat (Table 1). Four bat species, the western mastiff bat, big free-tailed bat, pocketed free-tailed bat, and pallid bat are detectable with the unaided ear (Table 7). We heard western mastiff bats at 19 study sites (Table 7) and recorded them with the Anabat at nine sites (Table 4 and Table 5). This suggests that the Anabat, when used with the standard microphone, a division ratio of 16, and sensitivity of ‘8’, was less effective than the unaided ear at detecting western mastiff bat echolocation calls. Remington (2003) made 84 observations of western mastiff bats based on audible detections during research in Orange County, California, but only five using Anabat recordings.

We heard pocketed free-tailed bat echolocation calls at one site (Table 7) and recorded this species with the Anabat at 16 sites (Table 4 and Table 5). The pocketed free-tailed bat appears to be less detectable with the unaided ear than the western mastiff bat. This is most likely due to the fact that this species produces an echolocation call that is higher pitched and of lower perceived intensity.

4.1.5 Visual Surveys

Visual techniques (use of "unaided eyes" and a spotlight) were used at all foraging sites in conjunction with mist-netting, the Anabat, and audible techniques to document foraging bats. Visual observations of bats were made at nine survey sites within RJER and SYOSP (Table 1).

4.2 Roost Surveys

Roosting bats surveys were conducted at five locations, four within RJER and one at SYOSP (Table 1). Eight bat species were detected during these surveys (Tables 7). At RJER, six bat species were observed at Roost #1 (Site 4) pre-fire. This was the most species found at any roost site during our studies. Five species were found at this site post-fire. At the one roost site in SYOSP, we detected two species during roost surveys (Table 7). The same two species were detected pre- and post-fire.

Due to the sensitive nature of roosts and the vulnerability of bats while using them, the locations of these sites should be protected. Human visitation to bat roosts may be detrimental to the continued use of the site, whether or not the visitor has ill intentions or not. We have provided modified tables and figures that purposely do not include names, coordinates, or map locations for these sites (Appendix 3).

4.3 Statistical Results

Based on the results from multivariate analysis, we detected differences in several variables for the bat communities that we observed. Although we detected 15 bat species during the study, we limited our analyses of community structure to the 12 species detected during a minimum of 10% of the surveys.

We first tested for and found a significant difference in the bat community structure among survey methods. Across all surveys, there was a difference between samples based on the survey technique, (ANOSIM: $R = 0.546$, $P = 0.001$). Individual comparisons revealed differences among the community structure detected using Anabat versus mist-net methods ($R = 0.593$, $P = 0.001$) and Anabat versus roost surveys ($R = 0.563$, $P = 0.001$). We did not detect a difference in the community structure between mist-net and roost survey types ($R = -0.002$, $P = 0.504$). Based on these results and the abundance of Anabat surveys, all further tests were limited to the data collected during Anabat surveys.

We found a significant difference in the structure of the bat community between the two sample areas, (R = 0.168, P = 0.001; Figure 4). This difference in community structure is likely explained by the differences in elevation and habitat composition (e.g., the availability of rock outcrops and crevices, woodland roosting sites, open grasslands, and sources of water) between the two sampled areas. The pallid bat, hoary bat, and California myotis were detected more commonly at the higher elevation SYOSP. The long-eared myotis, western small-footed myotis, pocketed free-tailed bat, and western pipistrelle were more often detected at the lower elevation RJER. Based on the differences between the two study areas, we conducted all further tests at the study area level.

Within each study area, we found a difference in the community between pre- and post-fire periods, but saw no effect of plot condition on community structure. At SYOSP, we found a difference in the bat community structure between pre- and post-fire periods (R = 0.128, P = 0.027; Figure 5). Nearly half of difference between pre- and post-fire Anabat samples (53.1%) was attributed to differences in the detection rates of five species. Yuma myotis accounted for 11.6% of the overall dissimilarity between pre- and post-fire samples, Mexican free-tailed bat 10.9%, pocketed free-tailed bat 10.9%, big brown bat 10.1%, and western small-footed bat 9.9% (see Table 8 for detection rates). However, we found no difference among surveys conducted in burned (impact) versus unburned (reference) habitats (R = 0.015, P = 0.291). The absence of a difference between impact and reference sites was consistent in both the pre-fire (R = -0.041, P = 0.562) and post-fire periods (R = -0.008, P = 0.527) at SYOSP. No difference was observed in community structure based on fire condition either, non-razed and razed samples were no different, (R = -0.031, P = 0.697; Figure 6).

At RJER, we also found a difference in bat community structure between pre- and post-fire periods (R = 0.294, P = 0.002; Figure 5). Analyses indicate that differences in the pre- and post-fire detection rates of five bat species account for 58% of the dissimilarity between the two sample periods. Western small-footed bat contributed 13.2% to the overall difference, big brown bat 12.8%, Mexican free-tailed bat 11.6%, western pipistrelle 10.8%, and Yuma myotis 10.5% (see Table 8 for detection rates). We found no difference among surveys conducted in burned versus unburned habitats (R = -0.039, P = 0.805). The absence of a difference between impact and reference sites was consistent in both the pre-fire (R = -0.155, P = 0.758) and post-fire periods (R = 0.00, P = 0.457). Again, no difference was observed in community structure based on fire condition, non-razed and razed samples were no different, (R = -0.065, P = 0.892; Figure 6).

The differences in community structure between pre- and post-fire periods, but not plot condition or fire condition, suggests the bat community may be affected by fire at the spatial-scale of the landscape, but not at the spatial-scale of the sample site. The bat community at both study areas may have changed as a result of the fires. The bat community or assemblage appears to be unresponsive to the local condition (with respect to whether the survey sites are burned or not) of upland areas adjacent to the sampled riparian-upland ecotone. Bats are highly mobile species and often forage over large areas. The wide-ranging nature of bats may eliminate local-effects within the community. If this is true, we may expect to see a similar pattern with large carnivores and raptors.

Because we altered some aspects of the Anabat survey protocol over the course of our efforts, we also looked into the possibility of differences between the bat communities detected by active- versus passive-Anabat monitoring stations. Based on the ANOSIM results, we found no difference in the bat community structure detected between active- and passive-Anabat surveys ($R = 0.023$, $P = 0.333$). The bat community documented by a single, active-Anabat monitoring station, rotated through the sample sites within a study area, was indistinguishable from the community measured by six passive-Anabat monitoring stations collecting data from sunset to sunrise over multiple days. Preliminary review of the Anabat results suggests that this similarity in results does not hold up if the data are compared on a day-by-day bases. A single day of active-Anabat monitoring produced a higher number of species detections than a single day of passive-Anabat monitoring at a single station. Only when we compared the single day of active-Anabat to the multiple day passive-Anabat survey, did the results of the two different methods become comparable. In their review of survey techniques, Milne et al. (2004) found significantly more bat species were detected by active-versus passive-Anabat sampling. The potential cost saving benefits of using passive methods may become blurred when the failure rate that we experienced with the passive-Anabat stations are taken into consideration. Of the potential 78 passive-Anabat sample days at SYOSP (Table 3), the unattended electronics failed to function properly 16 days, representing nearly 20% of the effort. At RJER, we experienced an even higher error rate, 23 out of 72 sample days (32%) failed to produce any data. Subsequent to the survey efforts presented here, we have become more familiar with the nuances of the passive-Anabat units and now experience a much lower rate of failure. Because there are advantages and disadvantages with both techniques, research goals should guide the decision on which technique is most appropriate.

Based on the results of the multivariate analyses of community differences between study areas, sample periods, and plot condition, we calculated species detection rates using only data collected from the Anabat surveys. Detection rates were calculated for individual bat species by study area and sample period. Because detection rates were low for many of the sampled bat species, we limit the discussion to those bat species detected in 10% or more of the pre- or post-fire surveys. Of the 12 species used in the community analysis, we saw increases greater than 0.25 in detection rate from the pre-to post-fire sample period for three species at RJER, the big brown bat, western small-footed myotis, and Yuma myotis (Table 8). Five other bat species increased at RJER, but to a much lesser degree. The long-eared myotis was the only species where we measured a large decline, dropping from a pre-fire detection rate of 0.43 to 0.17 post-fire. Lesser declines were detected for the western mastiff and western pipistrelle, and even smaller declines were seen in two other species. At SYOSP, the largest increase in detection rate that we observed was for the Yuma myotis, 0.53 pre-fire to 0.81 post-fire. The big brown bat was the only other species to increase to any real degree at SYOSP (Table 8). There were more potential declines at SYOSP than we saw at RJER, six bat species showed signs of lower detection rates post-fire. Most notable was the decline in Townsend's big-eared bat. This species was found during nearly 26% of the pre-fire surveys but was not found afterwards. The big free-tailed bat also was not detected post-fire at SYOSP, but due to rather low detection rates over all, it would be difficult to interpret these results. Extremely small declines were measured in five other bat species at SYOSP. Across all of our bat survey efforts, only one species was not detected post-fire, the big free-tailed bat, which was only detected twice at SYOSP in 2002.

5. CONCLUSIONS

We observed changes in the bat communities at Rancho Jamul Ecological Reserve and Santa Ysabel Open Space Preserve. Survey results based on multiple techniques, survey years, and habitat conditions suggest that the bat communities differed between our two study areas and that within each area there was a shift between the pre-fire community structure and that measured post-fire. The bat communities within each study area did not differ at the scale of the individual survey site but only at the larger scale of the entire study area. The highly mobile nature of bats as a group that allows them to forage over a wider area that includes both burned and unburned habitats may help to mitigate the biological impact of fires. With only one exception, all of the bat species that we detected pre-fire were found post-fire. The analyses that we have performed are not intended to test whether or not the bat communities were better or worse as a result of the fires, they can only reveal that there was some difference between the samples. The bat communities that inhabited the post-fire landscapes around Rancho Jamul Ecological Reserve and Santa Ysabel Open Space Preserve were different from those that existed before the 2003 wildfires.

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Table 1. USGS conducted bat surveys at sites within Rancho Jamul Ecological Reserve (RJER) and Santa Ysabel Open Space Preserve (SYOSP) both before and after the wildfires of 2003. Survey methods used to detect foraging bats were Anabat bat detectors (An), audible surveys (Au), mist nets (M), and roost surveys (R). In some instances, bats were also visually identified while in flight (V). Sites correspond with Figures 2 and 3.

Study Area	Site	Burned in 2003	Site Name	Latitude[1]	Longitude[1]	Pre-fire Data	Post-fire Data	Survey Methods
RJER	1	Y	Dulzura Creek	32.66560	-116.83690	N	Y	AnAuM
	2	Y	Jamul Creek (below kiln)	32.66500	-116.86740	Y	Y	AnAuMV
	3	Y	Confluence of Jamul and Dulzura Creek	32.64960	-116.87020	N	Y	AnAuM
	4	Y	Dulzura Creek Hwy 94 Bridge	32.66811	-116.82405	Y	Y	R
	5	Y	Maintenance Shed	32.67945	-116.85658	Y	Y	AnAuR
	6	N	Jamul Mountains	32.67253	-116.76056	Y	N	AnAuR
	7	N	Hollenbeck Canyon Wildlife Area - Jamul Creek Cliffs	32.69813	-116.82170	Y	N	AnAuMR
	8	N	Hollenbeck Canyon Wildlife Area - Hollenbeck Canyon Creek	32.67860	-116.82250	Y	Y	AnAuMV
	9	N	Hollenbeck Canyon Wildlife Area - Jamul Creek	32.69420	-116.82725	N	Y	AnAuM
	10	N	Hollenbeck Canyon Wildlife Area - Honey Springs Creek	32.66824	-116.81330	N	Y	AnAuM
	11	N	Upper Lyons Valley Creek	32.71560	-116.76083	N	Y	AnAuM
SYOSP	1	Y	East Santa Ysabel Creek - East Property	33.12010	-116.61850	N	Y	An
	2	Y	East Santa Ysabel Creek Crossing - East Property	33.12210	-116.62420	Y	Y	AnAuMV
	3	Y	East Santa Ysabel Creek (Wetlands) - East Property	33.12020	-116.61860	Y	Y	AnAuM
	4	Y	Bailey Creek	33.11653	-116.63865	N	Y	AnAuM
	5	Y	Corner Store	33.10967	-116.67393	Y	Y	AnAuRV
	6	N	East Santa Ysabel Creek - West Crossing	33.13180	-116.64740	Y	Y	AnAuMV
	7	N	West Santa Ysabel Creek - East Property	33.12830	-116.67040	Y	Y	AnAuMV
	8	N	West Santa Ysabel Creek - West Property	33.11310	-116.70990	Y	Y	AnAuMV
	9	N	Tributary of Santa Ysabel Creek - East Property	33.13292	-116.64877	Y	N	AnAuMV
	10	Y	East Property Cattle Pond	33.11913	-116.66586	Y	N	AnMV
	11	N	West Property Saddle	33.13155	-116.70383	Y	N	AnAuM

[1]Coordinates recorded in WGS84

Table 2. Anabat surveys at Rancho Jamul Ecological Reserve (RJER). Values presented are the month and day within each year when surveys were conducted. In 2006, the passive Anabat technique was used resulting in a multi-day survey effort. Site numbers follow those used in Table 1.

Site	Sample No.	Pre-fire 2002	Pre-fire 2003	Post-fire 2005	Post-fire 2006
1	1			7-Jun	13-Jun - 15-Jun[3]
	2			27-Jul	14-Jul - 16-Jul
	3			13-Sep	5-Sep - 10-Sep
	4				5-Sep[A]
2	1	6-May		15-Jun	13-Jun - 15-Jun[3]
	2			26-Jul	14-Jul - 16-Jul
	3			15-Sep	5-Sep - 10-Sep[5]
3	1			16-Jun	13-Jun - 15-Jun[2]
	2			19-Jul	14-Jul - 16-Jul
	3			17-Aug	5-Sep - 10-Sep
4	1				
5	1		10-Sep	31-May	
	2			13-Jul	
6	1	18-Jun			
7	1		2-Jul		
8	1	9-May	7-Jan	21-Jun	13-Jun - 15-Jun[3]
	2	25-Jun	13-Mar	9-Aug	14-Jul - 16-Jul
	3	5-Aug	20-May	6-Sep	5-Sep - 10-Sep
	4	23-Oct	30-Jul		
	5		1-Oct		
	6		16-Dec		
9	1			23-Jun	13-Jun - 15-Jun[2]
	2			12-Jul	14-Jul - 16-Jul[3]
	3			7-Sep	5-Sep - 10-Sep
	4				6-Sep[A]
10	1			10-Aug	13-Jun - 15-Jun[2]
	2			14-Sep	14-Jul - 16-Jul
	3				5-Sep - 10-Sep
11	1			28-Jun	
Total Samples Per Year:		6	8	20	20

[2] The passive Anabat detection system failed to function properly during two days of the survey.

[3] The passive Anabat detection system failed to function properly during three days of the survey.

[5] The passive Anabat detection system failed to function properly during five days of the survey.

[A] The active Anabat survey technique was used.

Table 3. Anabat surveys at Santa Ysabel Open Space Preserve (SYOSP). Values presented are the month and day within each year when surveys were conducted. In 2006, the passive Anabat technique was used resulting in a multi-day survey effort. Site numbers follow those used in Table 1.

Site	Sample No.	Pre-fire 2002	Pre-fire 2003	Post-fire 2005	Post-fire 2006
1	1				19-Jun - 21-Jun[3]
	2				11-Jul - 13-Jul
	3				28-Aug - 31-Aug
	4				19-Sep - 21-Sep[3]
2	1	6-Jun	24-Jun	25-May	19-Jun - 21-Jun[3]
	2			20-Jul	11-Jul - 13-Jul
	3			31-Aug	28-Aug - 31-Aug
	4				19-Sep - 21-Sep[3]
3	1	20-Jun		9-Jun	19-Jun - 21-Jun[2]
	2			11-Aug	11-Jul - 13-Jul
	3			25-Aug	28-Aug - 31-Aug[1]
	4				19-Sep - 21-Sep
4	1			30-Jun	
	2			4-Aug	
	3			1-Sep	
5	1	7-Aug	30-Jun	2-Jun	
	2			8-Jun	
	3			21-Jul	
6	1	30-May	7-Jul	29-Jun	19-Jun - 21-Jun
	2	29-Aug		16-Aug	11-Jul - 13-Jul
	3			18-Aug	28-Aug - 31-Aug
	4				19-Sep - 21-Sep
7	1	17-Jul		24-May	19-Jun - 21-Jun[1]
	2			2-Aug	11-Jul - 13-Jul
	3			20-Sep	28-Aug - 31-Aug
	4				28-Aug[A]
	5				19-Sep - 21-Sep
8	1	28-May	23-Jan	26-May	19-Jun - 21-Jun
	2	24-Jul	9-Apr	3-Aug	11-Jul - 13-Jul
	3	10-Sep	28-May	30-Aug	28-Aug - 31-Aug
	4	4-Dec	31-Jul		19-Sep - 21-Sep
	5		30-Sep		
	6		2-Dec		
9	1	12-Jun			
10	1		22-May		
11	1	1-Jul			
Total Samples Per Year:		12	10	21	25

[1] The passive Anabat detection system failed to function properly during one day of the survey.
[2] The passive Anabat detection system failed to function properly during two days of the survey.
[3] The passive Anabat detection system failed to function properly during three days of the survey.
[A] The active Anabat survey technique was used.

Table 4. Active-Anabat survey results from Rancho Jamul Ecological Reserve (RJER) and Santa Ysabel Open Space Preserve (SYOSP). The number of Anabat surveys conducted at each site is shown along with the number of surveys during which each species was detected. The first number represents pre-fire surveys and results, followed by post-fire. "--" indicates that no Anabat surveys were conducted at the site. Site numbers follow those used in Table 1.

Study Area	Site	Burned in 2003	No. of Surveys	Pallid Bat	Townsend's Big-eared Bat	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow Bat	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed Bat	Western Pipistrelle	Mexican Free-tailed Bat	Total Species Per Point
RJER	1	Y	-- /4	-- /2		-- /3	-- /1	-- /1				-- /2	-- /1	-- /4	-- /4		-- /2	-- /4	-- /10
	2	Y	1/3			1/2						1/1		1/3	1/3		1/2	1/1	6/6
	3	Y	-- /3		-- /1	-- /2	-- /1		-- /1		-- /1	-- /2		-- /3	-- /3		-- /3	-- /2	-- /10
	4	Y	--																--
	5	Y	1/2			1/2								1/2			1/0	0/2	3/3
	6	N	1/--				1/--										1/--	1/--	3/--
	7	N	1/--											1/--	1/--		1/--		3/--
	8	N	10/3	1/0	0/1	5/2	3/1	2/0	2/0		1/0	4/0	6/1	5/3	8/2		7/3	6/1	12/8
	9	N	-- /4			-- /4						-- /4	-- /2	-- /4	-- /4		-- /3	-- /3	-- /7
	10	N	-- /2			-- /1						-- /2			-- /1		-- /2	-- /1	-- /5
	11	N	-- /1			-- /1	-- /1							-- /1	-- /1			-- /1	-- /5
		Totals	14/22	1/2	0/2	7/17	4/4	2/1	2/1	0/0	1/1	5/11	6/4	8/20	10/18	0/0	11/15	8/15	12/13
		Total Sites	5/8	1/1	0/2	3/8	2/4	1/1	1/1	0/0	1/1	2/5	1/3	4/7	3/7	0/0	5/6	3/8	

Table 4. Continued

Study Area	Site	Burned in 2003	No. of Surveys	Pallid Bat	Townsend's Big-eared Bat	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow Bat	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed Bat	Western Pipistrelle	Mexican Free-tailed Bat	Total Species Per Point
SYOSP	1	Y	--																--
	2	Y	2/3		1/0	2/2		1/2	2/2	1/0	2/3	0/3		2/3	2/3			1/1	9/8
	3	Y	1/3			1/3	1/1	0/3	0/1	0/1	1/3	0/2		0/2	1/3			1/3	5/10
	4	Y	-- /3			-- /3	-- /1				-- /3	-- /1		-- /3	-- /1		-- /1		-- /7
	5	Y	2/3	1/0							1/0						1/0	1/0	4/0
	6	N	3/3		1/0	2/3		1/2	1/1		1/3	1/2	1/1	2/2	2/0	1/0	1/0	1/1	12/9
	7	N	1/4			1/4	0/1		0/1		0/3	1/3		0/3	1/2		1/2	1/3	5/9
	8	N	10/3	5/2	3/0	4/2	4/0	4/2	3/0		8/2	6/2		6/3	6/3		3/1	6/3	12/9
	9	N	1/--			1/--		1/--	1/--		1/--	1/--		1/--				1/--	7/--
	10	Y	1/--			1/--			1/--		1/--	1/--					1/--	1/--	6/--
	11	N	1/---			1/--						1/--		1/--	1/--		1/--	1/--	6/--
		Totals	22/22	6/2	5/0	13/16	5/3	7/9	8/5	1/1	15/17	12/12	1/1	12/16	13/14	1/0	8/4	14/11	15/13
		Total Sites	9/7	2/1	3/0	8/6	2/3	4/4	5/4	1/1	7/6	6/6	1/1	5/6	6/6	1/0	6/3	9/5	

Table 5. Passive-Anabat survey results from Rancho Jamul Ecological Reserve (RJER) and Santa Ysabel Open Space Preserve (SYOSP). The number of Anabat surveys conducted at each site is shown along with the number of surveys during which each species was detected. The number of surveys is presented as the number attempted followed in parenthesis by the number that failed in part or in whole to produce data. "--" indicates that no Anabat surveys were conducted at the site during this time period. Site numbers follow those used in Table 1.

Study Area	Site	Burned in 2003	No. of Surveys	Species: Pallid Bat	Townsend's Big-eared Bat	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow Bat	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed Bat	Western Pipistrelle	Mexican Free-tailed Bat	Total Species Per Point
RJER	1	Y	3(1)			2	1					2	1	2	2		1	2	8
	2	Y	3(2)			1						1		1	1				4
	3	Y	3(1)			3					3	2		3	3		2	2	7
	4	Y	--																
	5	Y	--																
	6	N	--																
	7	N	--																
	8	N	3(1)	1		2		1			1	2	1	2	2		2	1	10
	9	N	3(2)			3					1	3		2	1		1	2	7
	10	N	3(1)			3						3		2	1		1	1	6
	11	N	--																
		Totals	18(9)	1	0	14	1	1	0	0	5	13	2	12	10	0	7	8	11
		Total Sites	6	1	0	6	1	1	0	0	3	6	2	6	6	0	5	5	

Table 5. Continued

Study Area	Site	Burned in 2003	No. of Surveys	Pallid Bat	Townsend's Big-eared Bat	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow Bat	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed Bat	Western Pipistrelle	Mexican Free-tailed Bat	Total Species Per Point
SYOSP	1	Y	4(2)			2					1			2	2			2	5
	2	Y	4(2)	1		2		1			2		1	2	1				7
	3	Y	4(2)	1		3		1			2			3	1			1	7
	4	Y	--																
	5	Y	--																
	6	N	4			2					3	2		4	2			1	6
	7	N	4(1)	1		4	1				4	3	1	3	1		3	1	10
	8	N	4			4		1	1		2	2		4	1			2	8
	9	N	--																
	10	Y	--																
	11	N	--																
		Totals	24(7)	3	0	17	1	3	1	0	14	7	2	18	8	0	3	7	12
		Total Sites	6	3	0	6	1	3	1	0	6	3	2	6	6	0	1	5	

Table 6. Mist-net survey results from Rancho Jamul Ecological Reserve (RJER) and Santa Ysabel Open Space Preserve (SYOSP). The number of mist-net surveys conducted at each site is shown along with the number of captures by species. The first number represents pre-fire surveys and results, followed by post-fire. "--" indicates that no surveys were conducted at that site. Site numbers follow those used in Table 1.

Study Area	Site	Burned in 2003	No. of Surveys	Pallid Bat	Townsend's Big-eared Bat	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow Bat	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed Bat	Western Pipistrelle	Mexican Free-tailed Bat	Total Species Per Point
RJER	1	Y	-- /3																-- /0
	2	Y	1/3											0/5					0/1
	3	Y	-- /3																-- /0
	4	Y	-- /--																-- /--
	5	Y	-- /--																-- /--
	6	N	-- /--																-- /--
	7	N	1/--																0/--
	8	N	10/3	1/0		18/2		2/0	3/0			8/0	3/1	9/0			3/0		8/2
	9	N	-- /3																-- /0
	10	N	-- /2																-- /0
	11	N	-- /1	-- /1															-- /1
		Totals	12/18	1/1	0	18/2	0	2/0	3/0	0	0	8/0	3/1	9/5	0	0	3/0	0	8/4
		Total Sites	3/7	1/1	0	1/1	0	1/0	1/0	0	0	1/0	1/1	1/1	0	0	0	0	

Table 6. Continued

Study Area	Site	Burned in 2003	No. of Surveys	Pallid Bat	Townsend's Big-eared Bat	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow Bat	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed Bat	Western Pipistrelle	Mexican Free-tailed Bat	Total Species Per Point
SYOSP	1	Y	-- /--																-- /--
	2	Y	2/3			0/1			1/0		1/2	0/3		0/3					2/4
	3	Y	1/3			0/5					0/1	0/1							0/3
	4	Y	-- /3																-- /0
	5	Y	-- /--																-- /--
	6	N	3/3		1/0	4/0		1/0			10/1	1/0		1/0					6/1
	7	N	1/3									0/1							0/1
	8	N	10/3			2/1		1/0	2/0					2/0					4/1
	9	N	1/--			1/--			2/--										2/--
	10	Y	1/--						1/--		1/--								2/--
	11	N	1/--								3/--								1/--
		Totals	20/18	0	1/0	7/7	0	2/0	6/0	0	15/4	1/5	0	3/3	0	0	0	0	7/4
		Total Sites	8/6	0	1/0	3/3	0	1/0	4/0	0	4/3	1/3	0	2/1	0	0	0	0	

Table 7. Audible and Roost survey results from Rancho Jamul Ecological Reserve (RJER) and Santa Ysabel Open Space Preserve (SYOSP). Detections are presented for each species by the indicated method. The first number represents pre-fire surveys and results followed by post-fire surveys and results. "–" indicates that no additional survey methods were conducted. Site numbers follow those used in Table 1.

Study Area	Site	Survey Type	Burned in 2003	Pallid Bat	Townsend's Big-eared Bat	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow Bat	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed Bat	Western Pipistrelle	Mexican Free-tailed Bat	Total Surveys Per Point	Total Species Per Point
RJER	1	Audible	Y				--/3												-- /3	-- /1
	2	Audible	Y				--/1												-- /3	-- /1
	3	Audible	Y				--/3												-- /3	-- /1
	4	Roost	Y	1/1	2/1						2/2	1/--	2/1	3/2					7/2	6/5
	5	Audible	Y				1/--												1/--	1/--
		Roost	Y			1/2								0/2				1/2	1/2	2/3
	6	Audible	N				1/--								1/--				1/--	2/--
		Roost	N									1/--		1/--					1/--	2/--
	7	Audible	N				1/--												1/--	1/--
		Roost	N																1/--	0/--
	8	Audible	N	1/0			6/2												8/3	2/1
	9	Audible	N				--/2												-- /3	-- /1
	10	Audible	N				--/1												-- /1	-- /1
	11	Audible	Y				--/1												-- /1	-- /1
SYOSP	1	--	Y																-- /--	-- /--
	2	Audible	Y				1/2									1/0			1/3	2/1
	3	Audible	Y				1/2												1/3	1/1
	4	Audible	Y				--/3												-- /3	-- /1
	5	Audible	Y				1/--												1/--	1/--
		Roost	Y	2/3														2/2	2/3	2/2
	6	Audible	N				3/2												3/3	1/1
	7	Audible	N				1/2												1/3	1/1
	8	Audible	N	1/0			9/3												9/3	2/1
	9	Audible	N				1/--												1/--	1/--
	10	--	Y																-- /--	-- /--
	11	Audible	N				1/--												1/--	1/--

Table 8. Species detection rates by A) study area and sample period for Anabat surveys and B) survey method only. Rates are shown separately for Rancho Jamul Ecological Reserve (RJER) and Santa Ysabel Open Space Preserve (SYOSP) for both the pre-and post-fire sample periods and also for the combined effort. Detections rates were calculated as the number of survey when a species was detected divided by the total number of surveys conducted.

A.

		Species														
Study Area	Sample Period	Pallid bat	Big Brown bat	Western Mastiff bat	Western Red bat	Hoary bat	California Myotis	Western Small-footed bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed bat	Western Pipistrelle	Mexican Free-tailed bat	Townsend's Big-eared bat[1]	Western Yellow bat[1]	Big Free-tailed bat[1]
RJER	Pre-fire	0.07	0.50	0.29	0.14	0.14	0.07	0.36	0.43	0.57	0.71	0.79	0.57	0.00	0.00	0.00
	Post-fire	0.08	0.86	0.14	0.06	0.03	0.17	0.67	0.17	0.89	0.78	0.61	0.64	0.06	0.00	0.00
	Combined	0.08	0.76	0.18	0.08	0.06	0.14	0.58	0.24	0.80	0.76	0.66	0.62	0.04	0.00	0.00
SYOSP	Pre-fire	0.37	0.63	0.26	0.32	0.32	0.74	0.47	0.05	0.53	0.63	0.32	0.63	0.26	0.05	0.05
	Post-fire	0.17	0.81	0.10	0.29	0.14	0.74	0.45	0.07	0.81	0.52	0.17	0.48	0.00	0.02	0.00
	Combined	0.23	0.75	0.15	0.30	0.20	0.74	0.46	0.07	0.72	0.56	0.21	0.52	0.08	0.03	0.02

B.

Survey Method	Pallid bat	Big Brown bat	Western Mastiff bat	Western Red bat	Hoary bat	California Myotis	Western Small-footed bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed bat	Western Pipistrelle	Mexican Free-tailed bat	Townsend's Big-eared bat[1]	Western Yellow bat[1]	Big Free-tailed bat[1]
Anabat	0.16	0.76	0.16	0.20	0.14	0.47	0.51	0.14	0.76	0.65	0.41	0.57	0.06	0.02	0.01
Mist/Roost	0.11	0.18	0.00	0.05	0.06	0.13	0.12	0.07	0.18	0.00	0.04	0.08	0.05	0.00	0.00

Anabat data is based on 111 surveys (both active and passive).

Mist/Roost data is based on 84 surveys.

[1]Species was not included in the community analysis due to low detection rate.

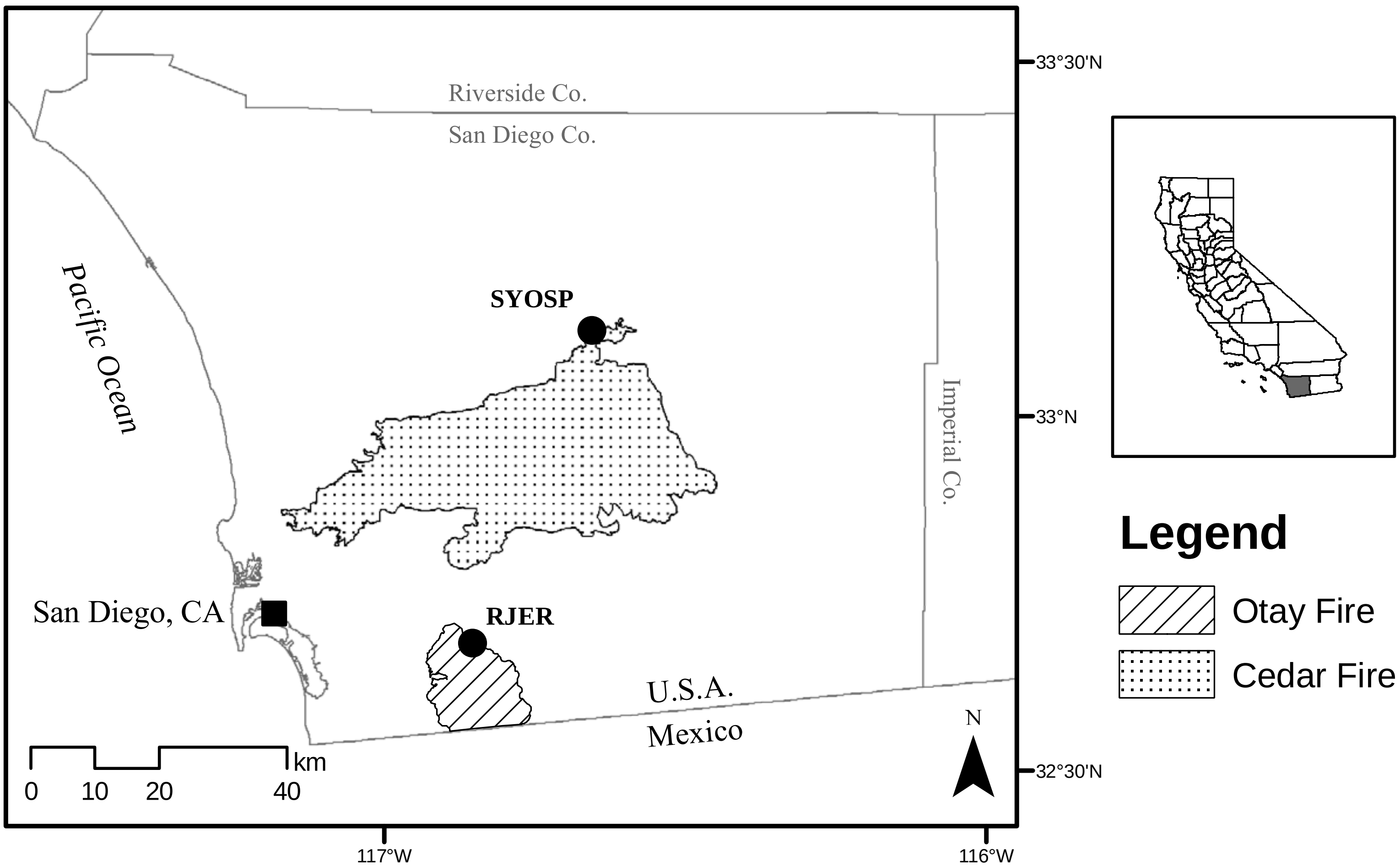


Figure 1. Study area. Bat surveys were conducted at Santa Ysabel Open Space Preserve (SYOSP) and Rancho Jamul Ecological Reserve (RJER).

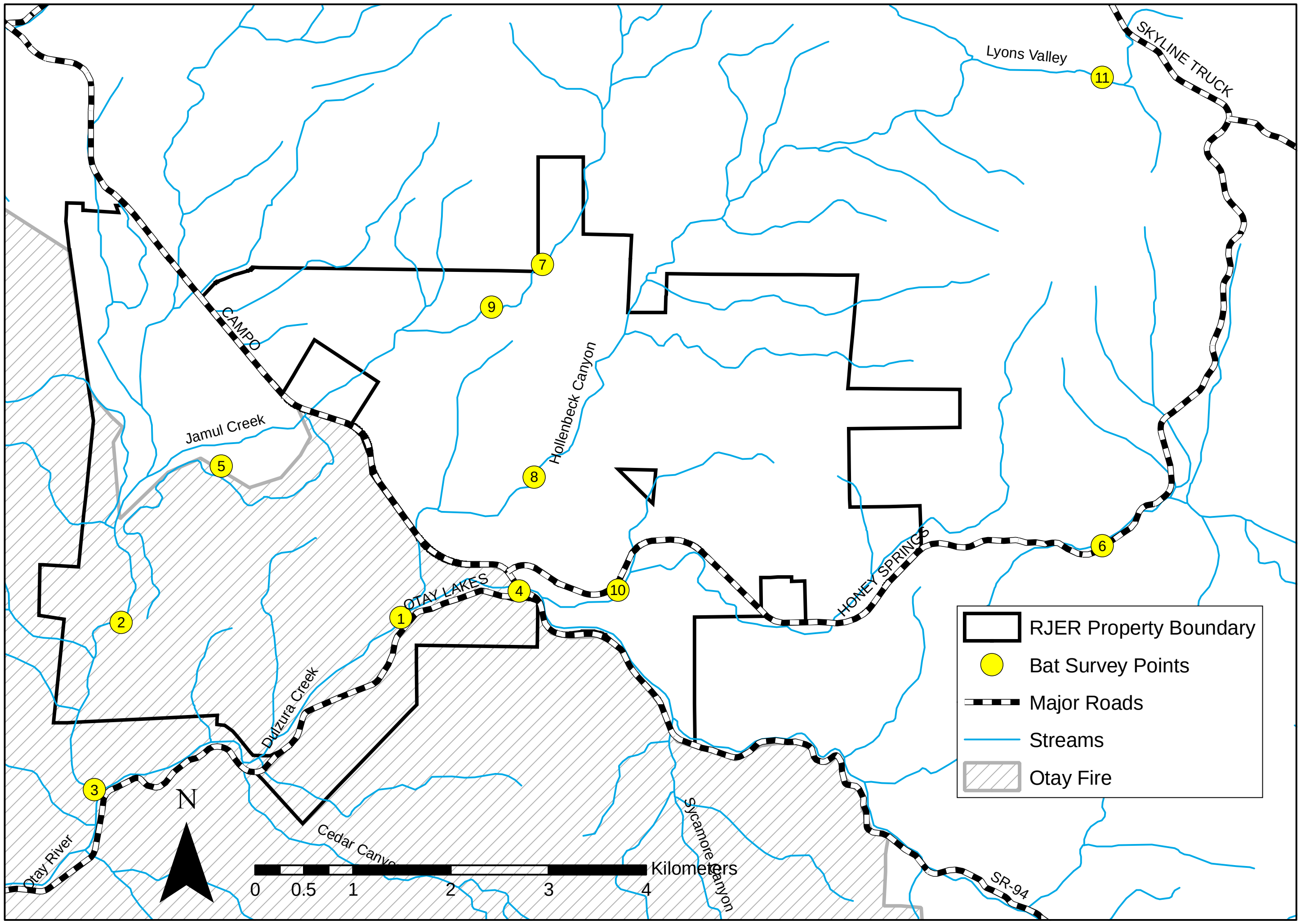


Figure 2. Bat surveys were conducted at 11 sites within Ranch Jamul Ecological Reserve (RJER). Site numbers follow those used in Table 1 for RJER.

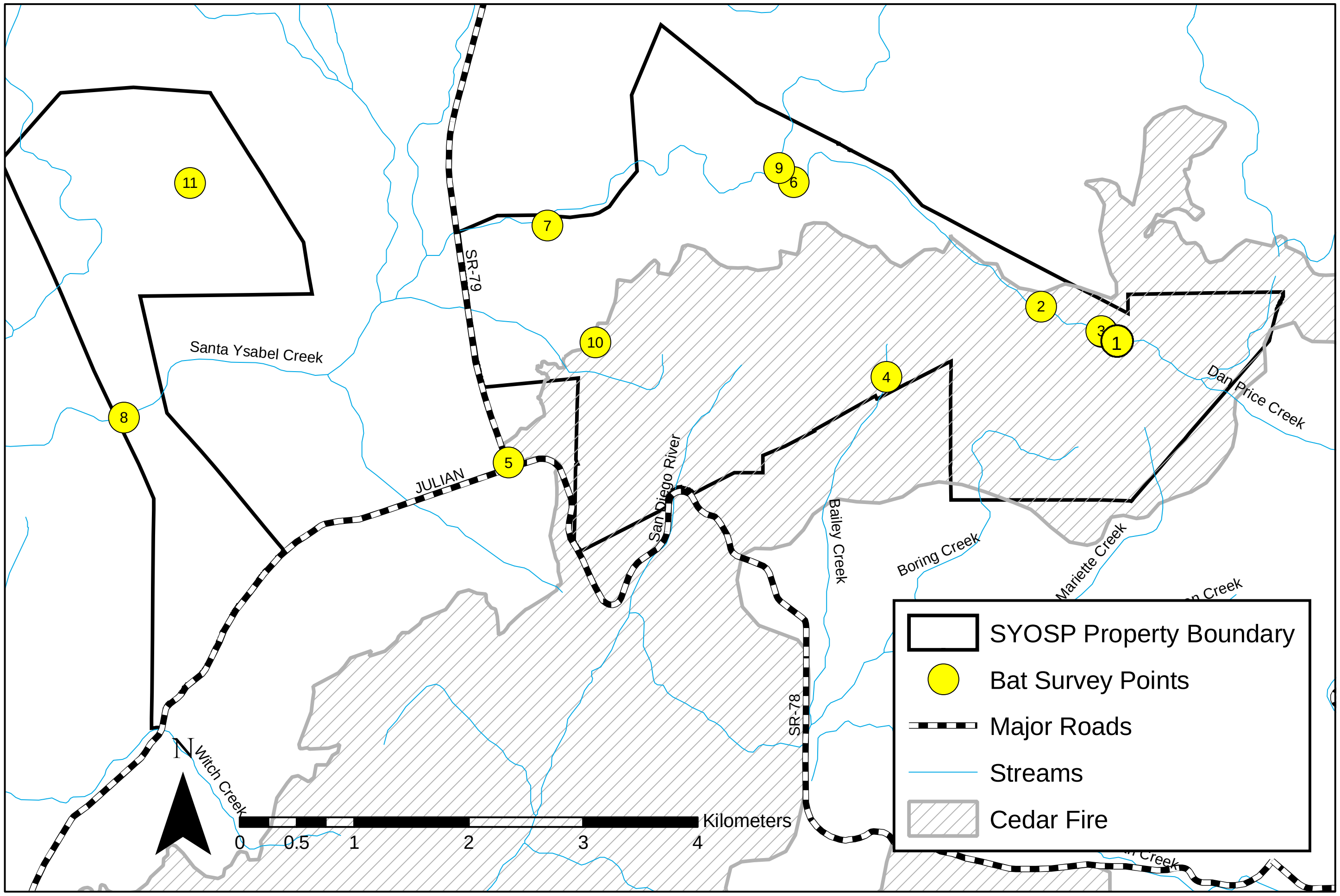


Figure 3. Bat surveys were conducted at 11 sites within Santa Ysabel Open Space Preserve (SYOSP). Site numbers follow those used in Table 1 for SYOSP.

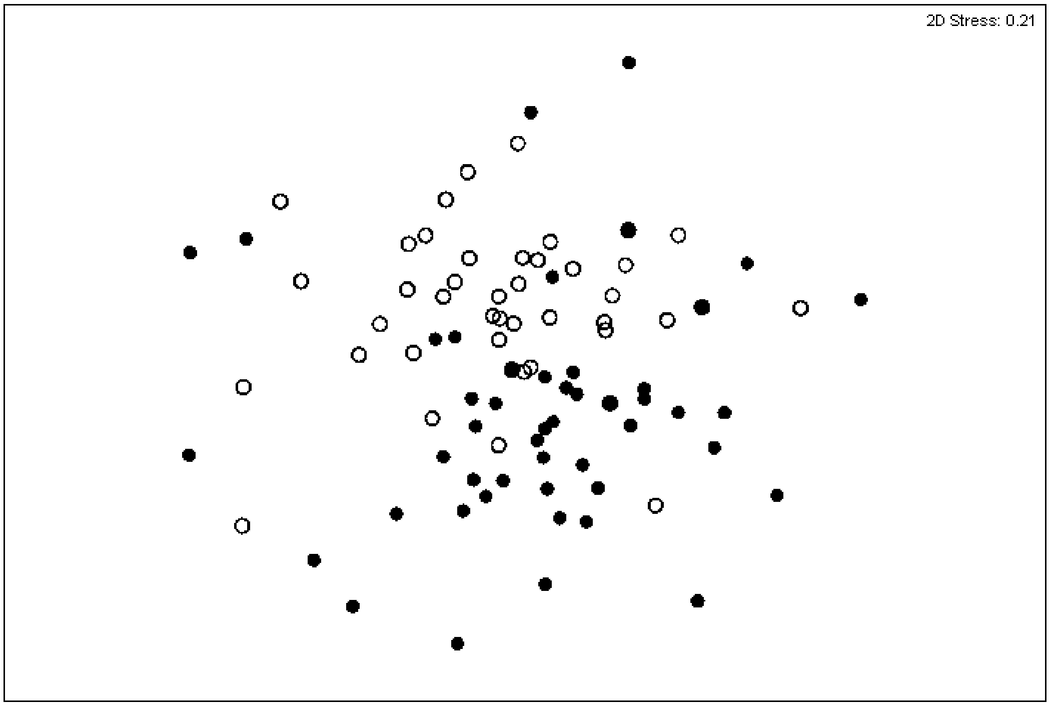
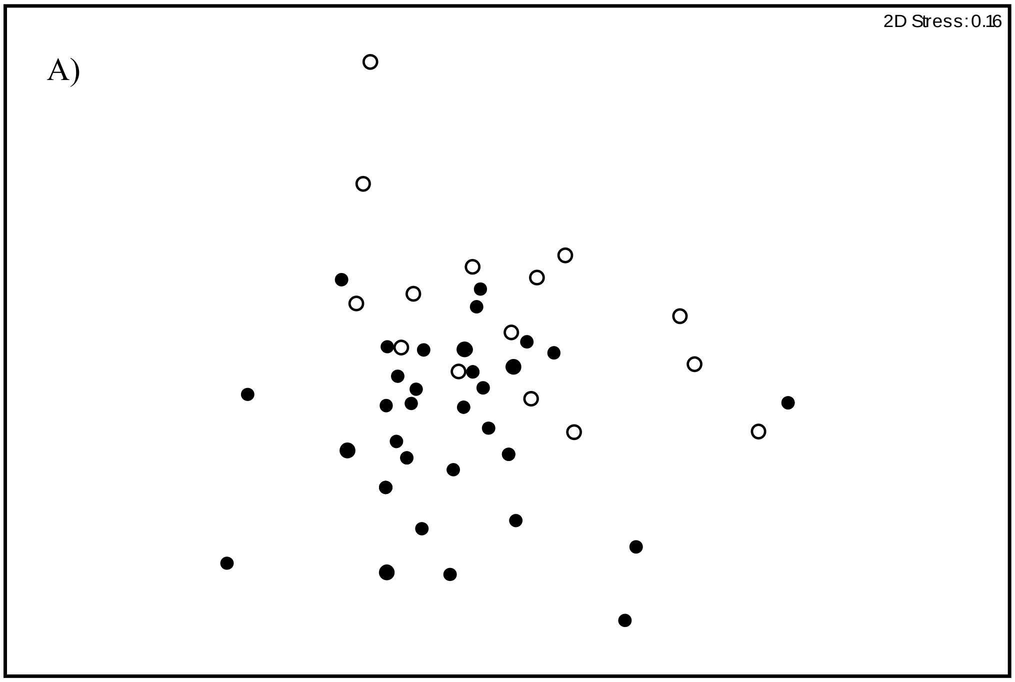


Figure 4. Study area differences: Multidimensional scaling (MDS) plot of the sampled bat assemblage at Santa Ysabel Open Space Preserve (●) and Rancho Jamul Ecological Reserve (○). ANOSIM results indicate that there was a difference in community structure between the two study areas, (R = 0.168, P = 0.001). Relative distances between points represent the relative similarity of sampled bat assemblage.



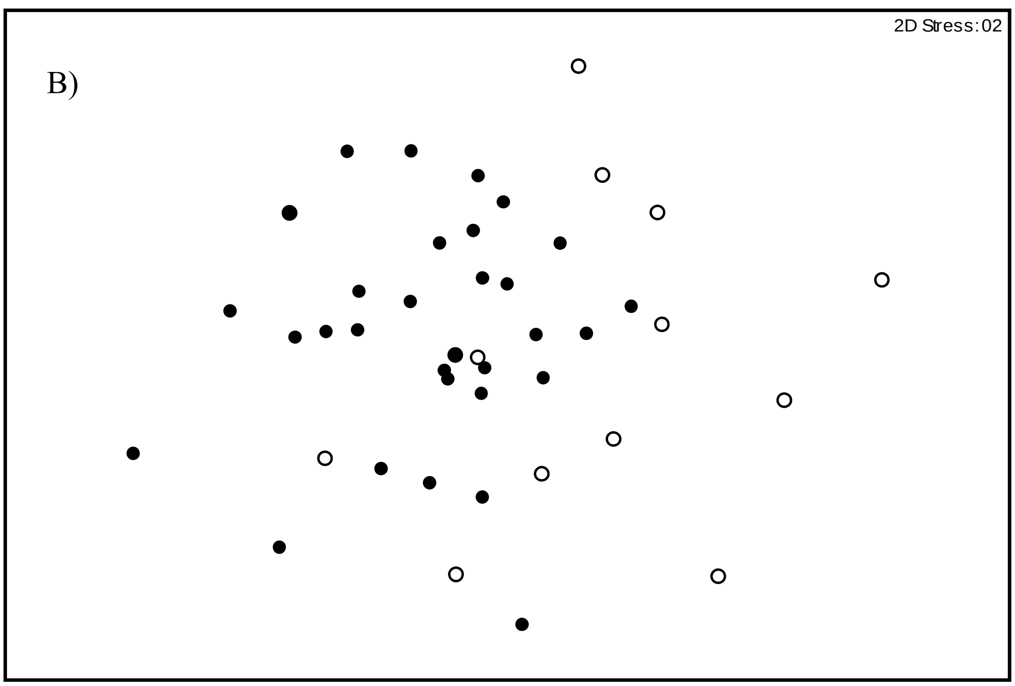


Figure 5. Differences in sample period: Multidimensional scaling (MDS) plot of the sampled bat communities at A) Santa Ysabel Open Space Preserve (SYOSP) and B) Rancho Jamul Ecological Reserve (RJER). ANOSIM results indicate that there was a difference between post-fire (●) and pre-fire (○) samples at SYOSP (R = 0.128, P = 0.027) or RJER (R = 0.294, P = 0.002). Relative distances between points represent the relative similarity of sampled bat assemblage.

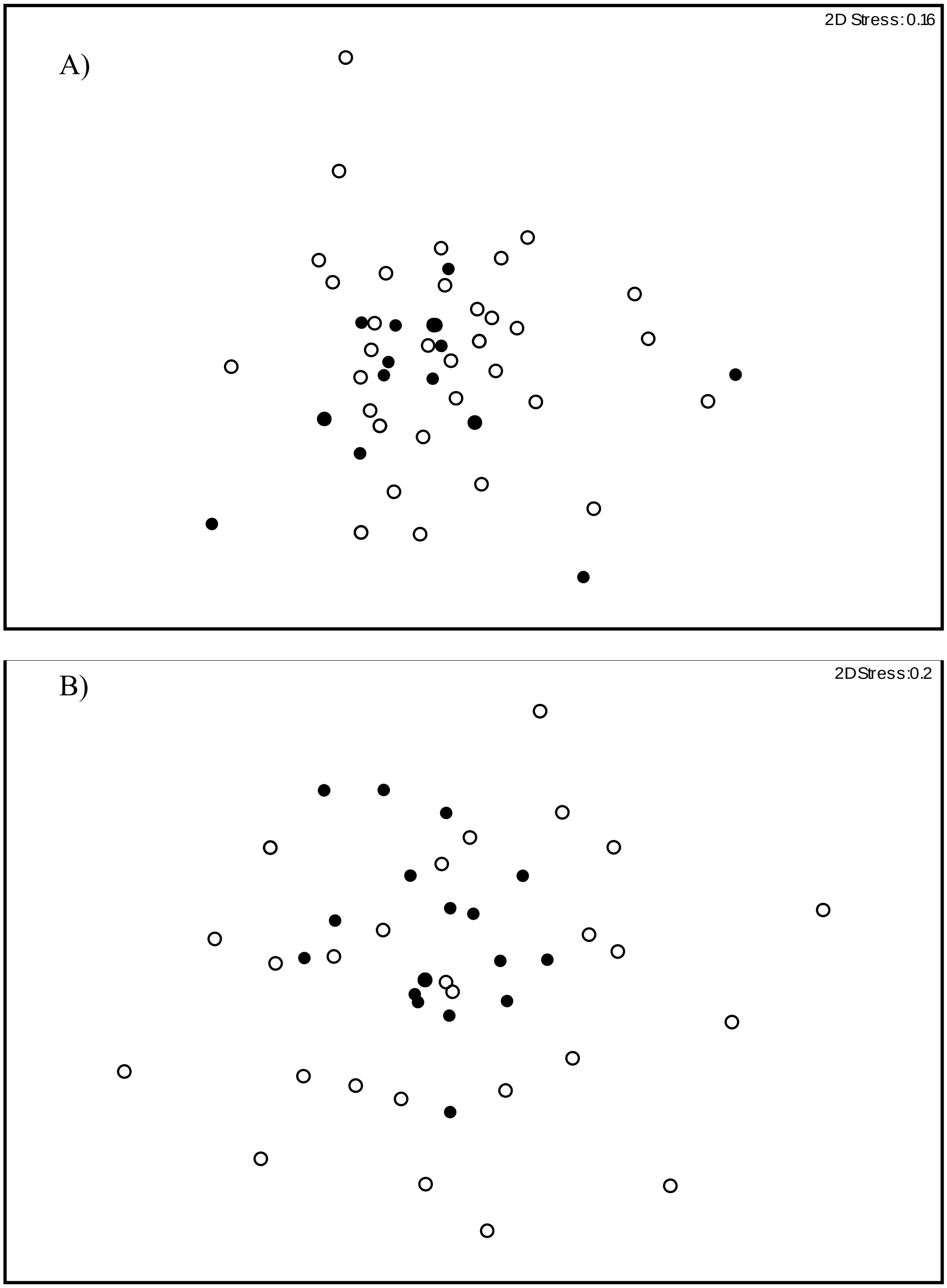
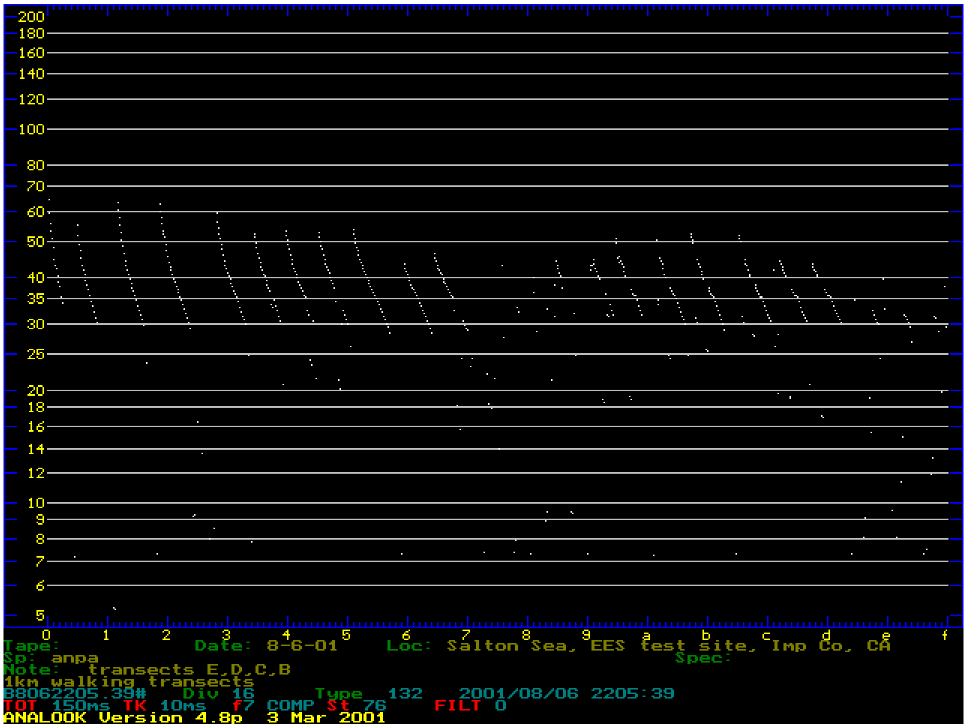
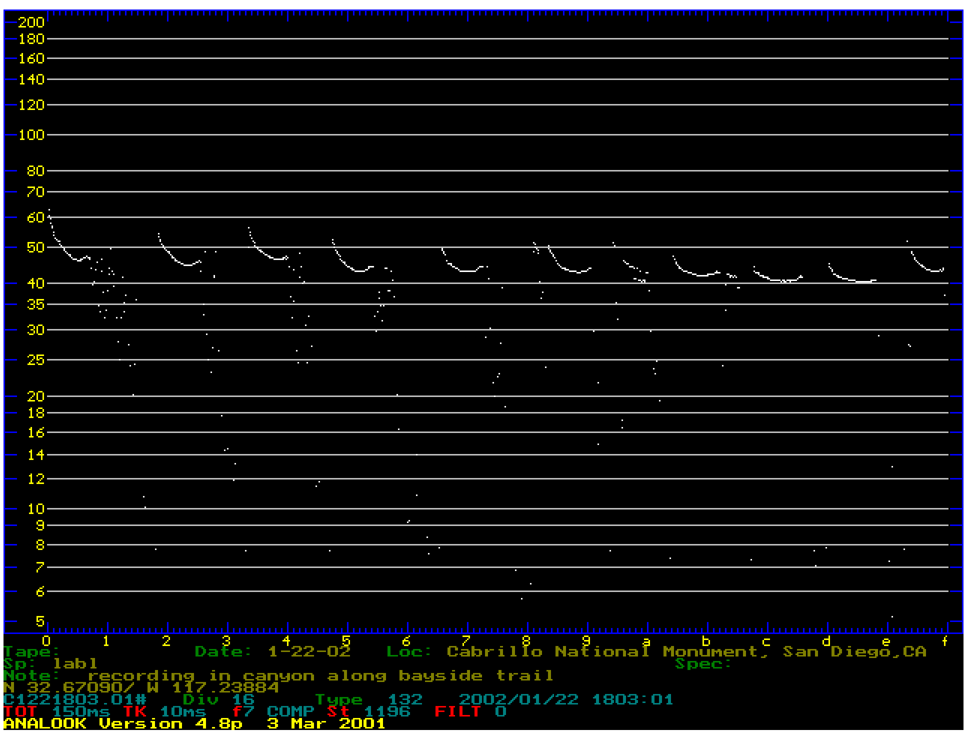


Figure 6. Differences in fire condition: Multidimensional scaling (MDS) plots of the sampled bat communities at A) Santa Ysabel Open Space Preserve (SYOSP) and B) Rancho Jamul Ecological Reserve (RJER). ANOSIM results indicate that there was no difference between razed (●) and non-razed (○) samples at SYOSP (R = -0.031, P = 0.697) or RJER (R = -0.065, P = 0.892). Relative distances between points represent the relative similarity of sampled bat assemblage.

APPENDIX 1. EXAMPLES OF BAT CALLS FROM REFERENCE LIBRARY



Anabat recording of a pallid bat vocalization.



Anabat recording of a western red bat.

APPENDIX 2. SPECIES ACCOUNTS

Pallid bat - *Antrozous pallidus*

Status[1] - BLM:S, DFG:SSC, IUCN:LC, USFS:S, WBWG:H

Call characteristics – Approximate terminal frequency (KHz): 30, Relative call duration: medium, Approximate relative slope: steep, Overlapping species: *Eptesicus fuscus*, *Myotis evotis*.

Forearm: 48-60 mm, Ear: 25-33 mm, Foot: 10-13 mm, Wingspan: 370-410 mm, Wt: 20-35 grams.

A large bat with large ears. Fur color usually dull, pale yellow with brown or grey tips, white or cream below. Ears, face, and wings also typically yellow. Ears broad and widely separated on head. Muzzle broad with conspicuous glands on top sides of muzzle. Eyes fairly large. Similar to *Corynorhinus townsendii* but larger, with broader and more widely spaced ears.

In southern California, found from the coast to the desert but rare in higher elevations. Usually found in flat, sparsely vegetated habitats such as grasslands, oak savannahs, and riparian terraces. Roosts in various crevice and cavity-like situations including in rocky outcrops and caves, tree hollows, buildings, bridges, and mines. Flight is usually slow and low to the ground with large, full wing strokes and occasional glides. Appears very large in flight due to its large, broad wings. Pale color and large ears visible if illuminated by light. Typically forages close to the ground over flat, sparsely vegetated habitats. Often produces audible social calls that are a series of rapid chirps that sound like insects or electronic buzzes. Feeds mainly on terrestrial arthropods such as Jerusalem crickets, camel crickets, scorpions, centipedes, and also feeds on larger flying insects including white-lined sphinx moths and long-horned beetles. The culled parts of their prey items can be found beneath their favored night roosting locations.

Townsend's big-eared bat - *Corynorhinus townsendii*

Status[1] – BLM:S, DFG:SSC, IUCN:LC, USFS:S, WBWG:H

Call characteristics – Approximate terminal frequency (KHz): 25, Relative call duration: short, Approximate relative slope: steep, Overlapping species: none.

Forearm: 39-48 mm, Ear: 33-38 mm, Foot: 10-11 mm, Wingspan: 300-340 mm, Wt: 8-14 grams.

A medium-sized bat with very large ears. Fur color usually light brown above and buff below. Ears and face similar color to fur. Wings slightly darker than fur. Horseshoe-shaped lumps found on both sides of muzzle. Similar to *Antrozous pallidus* but ears appear longer and more narrow and are affixed to the head close together while *A. pallidus*' ears are broader and further apart. Also, remotely resembles *Myotis evotis* but *M. evotis* has dark brown or black ears and membranes while *C. townsendii's* are typically lighter brown.

In southern California, found from the coast to the desert usually in riparian or other forested habitats. Highly associated with caves and mines, its preferred roosting habitat. An obligate cave roosting species that typically roosts in natural caves, tree hollows, and artificial cave-like structures such as buildings, bridges, flumes, and mines. Flight is usually slow, delicate, and maneuverable with full wing strokes. Typically forages along riparian and woodland edges, and around and under the canopies of tree and large shrubs, usually avoiding open habitats. Feeds mainly on moths.

Big brown bat - *Eptesicus fuscus*

Status[1] – None

Call characteristics – Approximate terminal frequency (KHz): 30, Relative call duration: medium, Approximate relative slope: steep, Overlapping species: *Tadarida brasiliensis*, *Antrozous pallidus*.

Forearm: 42-51 mm, Ear: 15-18 mm, Foot: 8-11 mm, Wingspan: 320-400 mm, Wt: 14-21 grams.

A relatively large bat with medium-sized features. Fur usually long and glossy, color ranges from pale to dark brown above, lighter below. Ears and other membranes usually dark brown. Keel present on calcar. Tragus medium length and blunted. Muzzle is broad and robust. Similar to *Myotis* spp. but larger in size, and having blunt tragus compared to pointed tragus in *Myotis*. Also, muzzle is much broader and more robust than *Myotis*.

In southern California, found from coastal forested habitats through transitional habitats down to desert's edge. Mainly found associated with woodland habitats. Roosts in various crevice and cavity-like situations including often in man-made structures such as buildings, bridges, mines, and artificial bat houses. Flight is fairly direct and rapid often interrupted by hard turns and sallies for insects. Large, broad wings give appearance of large size in flight. Forages along woodland edges, around and under tree canopies, over open meadows, and over open water. Feeds mainly on flying beetles, moths, ants, flies, mosquitoes, mayflies, and other flying insects.

Western mastiff bat - *Eumops perotis*

Status[1] – BLM:S, DFG:SSC, WBWG:H

Forearm: 72-82 mm, Ear: 41-47 mm, Foot: 15-17 mm, Wingspan: 530-580 mm, Wt: 60-90 grams.

Call characteristics – Approximate terminal frequency (KHz): 8, Relative call duration: long, Approximate relative slope: flat, Overlapping species: none.

A very large bat with large ears and tail that extends conspicuously beyond the tail membrane. Fur color dark grey or brownish grey, with basal half of hairs nearly white. Ears are very large and are oriented forward nearly covering the eyes and extending beyond the end of the rostrum. Wings are long and narrow. Hind legs and feet are large and powerful. Half of the tail extends beyond tail membrane. Similar to *Nyctinomops macrotis* but larger in size and appears more lanky.

In southern California, found from the coast to the desert. Roosts almost exclusively in steep, rocky cliffs but is known to occasionally roost in buildings. Forages in various habitats including over woodlands, over scrub habitats, over grasslands, and over open water including bays and probably lagoons. Flight is direct and rapid. Typically forages at least at tree canopy height and often higher. Appears large in flight with long, narrow wings with rapid wing beats. Produces an audible echolocation call that is a very loud, high pitched chirp with a cadence of about 1 call per 1-2 seconds. Feeds on various insects including dragonflies, grasshoppers, beetles, true bugs, moths, wasps, and ants.

Western red bat - *Lasiurus blossevillii*

Status[1] – DFG:SSC, IUCN:LC, USFS:S, WBWG:H

Call characteristics – Approximate terminal frequency (KHz): 40, Relative call duration: medium, Approximate relative slope: flat, Overlapping species: none.

Forearm: 38-41 mm, Ear: 10-13 mm, Foot: 7-10 mm, Wingspan: 280-320 mm, Wt: 10-15 grams.

A small to medium-sized bat with small features.

Heavily furred. Fur color light orange to red sometimes with frosted appearance. Ears and face usually similar color to fur. Tail membrane and feet fully furred on top. Wing membranes jet black with orange to red forearms and fingers. Ears and face 'pug-like'. Does not really look like any other bat species but lighter colored individuals may resemble *Lasiurus xanthinus*, which is light grey to pale yellow, has only the anterior portion of the upper side of the tail membrane furred, and is larger in size.

In southern California, found from the coast through transitional habitats down rarely into the desert. Highly associated with riparian habitats but can also be found in areas where large, deciduous broadleaf trees including non-native species are found, such as suburban neighborhoods and urban parks. An obligate foliage roosting species that roosts by hanging like a leaf from the limbs of trees and shrubs. Usually roosts in riparian trees such as sycamores and cottonwoods, but may use other trees and shrubs as roosts. Flight is usually direct and rapid but can also be slow and maneuverable. Obvious in flight if illuminated by light due to combination of red fur and black wings. Typically forages along riparian and woodland edges and over open water. Feeds mainly on moths and other flying insects.

Hoary bat - *Lasiurus cinereus*

Status[1] –IUCN:LC, WBWG:M

Call characteristics – Approximate terminal frequency (KHz): 25, Relative call duration: medium, Approximate relative slope: flat, Overlapping species: *Tadarida brasiliensis*, *Nyctinomops femorosaccus*.

Forearm: 46-58 mm, Ear: 15-18 mm, Foot: 10-13 mm, Wingspan: 340-410 mm, Wt: 25-30 grams.

A large bat with small features. Heavily furred. Body fur color dark or almost black with frosted tips, with conspicuous yellow 'mane' and collar. Ears and face yellow rimmed in black. Tail membrane and feet fully furred on top. Wings dark with patches of yellow or cream colored fur under forearms and at base of thumbs. Similar to *Lasionycteris noctivagans* but has a fully and heavily furred dorsal side of tail membrane while *L. noctivagans* is only sparsely furred, is quite larger in size, and has yellow and/or cream colored areas of fur including on ears and wings.

In southern California, found from the coast through transitional habitats and rarely into the desert. Often found associated with riparian habitats but can also be found in areas where large, deciduous broadleaf trees including non-native species are found, such as suburban neighborhoods and urban parks, as well as in areas dominated by coniferous forests. An obligate foliage roosting species that roosts by hanging like a leaf from the limbs of trees and shrubs. Roosts in various trees and shrubs. Flight is usually direct and rapid but can also be slow and maneuverable. Appears very large in flight, fur and wing color fairly obvious in flight when illuminated, wings appear long, fairly narrow, and pointed. Typically forages along woodland edges and over open water. Can often be seen drinking from large ponds and lakes, where it makes slow, descending approaches to the water but with rapid wing beats. Feeds mainly on moths, true bugs, and other flying insects and may occasionally prey on other, smaller bats.

Western yellow bat - *Lasiurus xanthinus*

Status[1] – DFG:SSC, IUCN:LC, WBWG:H

Call characteristics – Approximate terminal frequency (KHz): 35, Relative call duration: medium, Approximate relative slope: flat, Overlapping species: none.

Forearm: 46-48 mm, Ear: 11-16 mm, Foot: 8-10 mm, Wingspan: 330-370 mm, Wt: 10-15 grams.

A large bat with small features. Fur color light grey to pale yellow. Ears and face color similar to fur. Wings dark. Anterior half of dorsal side of tail membrane furred. Similar to light colored *L. blossevillii*, which is usually orange compared to yellow. Also, *L. blossevillii* has a fully furred dorsal side of tail membrane.

In southern California, found primarily in the desert in association with native palm tree groves. Appears to have more recently moved into western coastal and inland valley and foothill habitats, probably as a result of plantings of non-native trees including non-native palms and possibly due to climate change. An obligate foliage roosting species that roosts primarily in the dead palm frond 'skirts' around the trunks of palm trees. Like other lasiurines, this species probably forages along edges of trees and large clumps of vegetation including within and around palm groves. Feeds primarily on small to medium-sized flying insects.

California myotis - *Myotis californicus*

Status[1] – None

Call characteristics – Approximate terminal frequency (KHz): 50, Relative call duration: short, Approximate relative slope: steep, Overlapping species: *Myotis yumanensis*, *Myotis ciliolabrum*, *Myotis volans*.

Forearm: 29-36 mm, Ear: 9-13 mm, Foot: 5-8 mm, Wingspan: 220-260 mm, Wt: 3-5 grams.

A small bat with small features. Fur pale to dark brown above and pale below. Ears and other membranes variable shades of brown but usually not black. Well developed keel present on calcar. Skull rises abruptly from rostrum to braincase. Can be very difficult to distinguish from *Myotis ciliolabrum* but *M. ciliolabrum* usually has black ears and membranes compared to brown in *M. californicus*, *M. ciliolabrum* has a gently rising skull, usually has a tail tip that extends beyond tail membrane further than *M. californicus*, and usually has larger thumbs than *M. californicus*. Also similar to *Myotis yumanensis*, which lacks a keeled calcar and has larger feet (closer to 10 mm).

In southern California, usually found in oak woodlands and coniferous forests but ranges from coastal riparian and scrub habitats all the way to desert creosote scrub habitats. Roosts in various situations including in rock crevices and caves, in tree hollows and under bark, and in man-made structures such as buildings, bridges, mines, and even artificial bat houses. Flight is relatively slow and erratic. Usually forages over, around and under the canopies of trees and shrubs, over water, and over open ground. Feeds mainly on flies, moths, and beetles.

Western small-footed bat - *Myotis ciliolabrum*

Status[1] – BLM:S, IUCN:LC, WBWG:M

Call characteristics – Approximate terminal frequency (KHz): 40, Relative call duration: short, Approximate relative slope: steep, Overlapping species: *Myotis volans*, *Myotis californicus*.

Forearm: 30-36 mm, Ear: 13-16 mm, Foot: 6-9 mm, Wingspan: 210-250 mm, Wt: 4-6 grams.

A small bat with small features. Fur usually glossy, color ranges from pale to dark brown above, pale below. Ears and other membranes usually black. Well developed keel present on calcar. Skull rises gently from rostrum to braincase. Similar to *Myotis californicus* but ears and other membranes usually black compared to brown in *M. californicus*, skull rises gently rather than abruptly as in *M. californicus*, usually has a tail tip that extends beyond tail membrane further than *M. californicus*, usually has larger thumb than *M. californicus*. Also resembles *Pipistrellus hesperus* but has a long pointed tragus in ear compared to a small, club-like tragus found in *P. hesperus*.

In southern California, usually found in oak and coniferous forests but can be found from coastal habitats through transitional habitats down to the desert's edge. Typically found in and near riparian settings where rocky habitats are found. Roosts mainly in rocky crevices and caves but can be found in other crevice and cavity-like situations including in buildings, bridges, and mines. Flight is slow and erratic. Forages along cliffs and rocky slopes and along riparian and other woodland edges. Feeds mainly on beetles, flies, and moths.

Long-eared bat - *Myotis evotis*

Status[1] – BLM:S, IUCN:LC, WBWG:M

Call characteristics – Approximate terminal frequency (KHz): 30, Relative call duration: short, Approximate relative slope: steep, Overlapping species: *Antrozous pallidus*.

Forearm: 36-41 mm, Ear: 19-25 mm, Foot: 8-11 mm, Wingspan: 250-300 mm, Wt: 5-8 grams.

Relatively small bat with large ears. Long, glossy fur that is brown above and buff below. Ears and other membranes usually dark brown or black. Rudimentary keel is present on calcar. Similar to *Myotis thysanodes* but lacks conspicuous fringe on tail membrane and ears are usually larger than *M. thysanodes*.

In southern California, usually found in coniferous forests in the mountains but can be found in oak woodlands and scrub habitats in the western foothills. Roosts in various situations including rock crevices, hollow trees, under tree bark, and in man-made structures such as buildings, bridges, and mines. Flight is slow and maneuverable. Feeds mainly on moths, beetles, flies, net-winged insects, and true bugs.

Yuma bat - *Myotis yumanensis*

Status[1] – BLS:S, IUCN:LC, WBWG:LM

Call characteristics – Approximate terminal frequency (KHz): 50, Relative call duration: short, Approximate relative slope: steep, Overlapping species: *Myotis californicus*.

Forearm: 32-38 mm, Ear: 12-15 mm, Foot: 8-10 mm, Wingspan: 220-260 mm, Wt: 4-6 grams.

A relatively small bat with medium-sized features. Fur usually dull, color ranges from light to dark brown above, pale below. Ears and other membranes usually brown, usually similar to color of fur. Lacks a keel on the calcar. Similar to *Myotis californicus* but lacks keel on calcar and has obviously larger feet. Also resembles *Myotis volans* but is not as large and lacks a keeled calcar.

In southern California, can be found from coastal habitats up into the mountains but is less commonly seen in transitional and desert habitats. Roosts in various crevice and cavity-like situations including often in man-made structures such as buildings, dams, flumes, bridges, and artificial bat houses. Almost always associated with open water sources including streams, rivers, ponds, and particularly large reservoirs. Flight is usually rapid and direct but also maneuverable. Usually forages close to the surface of open water where it hunts primarily aquatic emergent insects such as midges, mosquitoes, gnats and mayflies, as well as moths and beetles.

Pocketed free-tailed bat - *Nyctinomops femorosaccus*

Status[1] – DFG:SSC, IUCN:LC, WBWG:M

Call characteristics – Approximate terminal frequency (KHz): 15, Relative call duration: long, Approximate relative slope: flat, Overlapping species: *Lasiurus cinereus*, *Tadarida brasiliensis*.

Forearm: 44-50 mm, Ear: 16-23 mm, Foot: 8-14 mm, Wingspan: 340-370 mm, Wt: 10-14 grams.

A small to medium-sized bat with ears joined at midline and a tail that extends conspicuously beyond the tail membrane. Fur color dark brown to grey with basal half of hairs nearly white. Ears and face similar in color to fur. Ears are joined at the base of the midline by a septum that attaches to the rostrum forming a 'Y' shape when viewed from the front. Long hairs protrude from the toes on the feet. Half of the tail extends beyond the tail membrane. Similar to *Tadarida brasiliensis* but ears are joined at the midline unlike *T. brasiliensis*, which has ears completed separated though close together. Also resembles *Nyctinomops macrotis* but is considerably smaller in size and ears are much smaller.

In southern California, found from the coast to the desert. Roosts primarily in steep rocky cliffs and artificial rock quarries, sometimes in man-made structures such as buildings and bridges. Forages in various habitats including over woodlands, over scrub habitats, over grasslands, and over open water. Flight is usually direct and rapid. Typically forages at tree canopy height. Wings appear long and narrow in flight. Produces an echolocation call that is audible to only those with very good high frequency hearing, sounds like a very high pitched chirp with a cadence of about 1 call per second. Feeds mainly on moths but also will eat other insects such as beetles, flying ants, flies, lacewings, crickets, stinkbugs, and grasshoppers.

Big free-tailed bat - *Nyctinomops macrotis*

Status[1] – DFG:SSC, IUCN:LC, WBWG:MH

Call characteristics – Approximate terminal frequency (KHz): 12, Relative call duration: long, Approximate relative slope: flat, Overlapping species: none.

Forearm: 58-64 mm, Ear: 25-32 mm, Foot: 7-11 mm, Wingspan: 420-460 mm, Wt: 25-30 grams.

A large bat with fairly large ears joined at the midline and a tail that extends conspicuously beyond the tail membrane. Fur is glossy, color is light reddish brown to dark brown or black, with basal half of hairs nearly white. Ears, face, and wing membranes dark. Large ears extend well beyond the end of the rostrum when laid forward and are joined basally at the midline. Wings are long and narrow. Half of the tail extends beyond the tail membrane. Similar to *N. femorosaccus* but larger in size and ears appear much larger. Also resembles *Eumops perotis* but is smaller and more compact looking.

In southern California, found from the coast to the desert but appears to be rare and possibly migratory. Roosts mainly in steep rocky cliffs. Probably forages in various habitats including over woodlands, scrub habitats, grasslands, and over open water. Produces an audible echolocation call that is fairly high pitched and with a cadence of about 1 call per second. Feeds mainly on moths but may also feed on crickets, flying ants, stinkbugs, and leafhoppers.

Western pipistrelle - *Pipistrellus hesperus*

Status[1] – None

Call characteristics – Approximate terminal frequency (KHz): 45, Relative call duration: medium, Approximate relative slope: flat, Overlapping species: none.

Forearm: 26-33 mm, Ear: 10-12 mm, Foot: 4-7 mm, Wingspan: 190-230 mm, Wt: 3-6 grams.

A very small bat with small features. Fur from light grey to reddish brown, usually pale yellow. Ears and other membranes black. Keel present on calcar. Tragus is short and blunted, appears club-like. Similar to *Myotis* spp., particularly *M. ciliolabrum* because of black ears and membranes, but lacks long, pointed tragus that all *Myotis* spp. have, and has only one premolar, while *Myotis* have two.

In southern California, found from coastal to desert habitats. Usually highly associated with rocky habitats, its preferred roosting substrate, but can be found in flat desert settings where rocks are mostly absent. Forages primarily in wet canyons but can be found foraging in various habitat settings, usually nearby where rocky outcrops occur. Roosts almost exclusively in rock crevices, but is known to rarely inhabit man-made structures and is thought to utilize rodent burrows as roost sites in flat desert settings. Flight is typically slow and erratic, though this bat often appears to be fast flying due to its small size. Often seen early in the evening and can even be seen on the wing in the late afternoon and early morning hours. Probably the bat species most often observed by people due to being active during lighter hours of the day compared to most bat species.

Mexican free-tailed bat - *Tadarida brasiliensis*

Status[1] – None

Call characteristics – Approximate terminal frequency (KHz): 20, Relative call duration: long, Approximate relative slope: flat, Overlapping species: *Eptesicus fuscus*, *Nyctinomops femorosaccus*, *Lasiurus cinereus*.

Forearm: 36-46 mm, Ear: 17-20 mm, Foot: 9-10 mm, Wingspan: 300-350 mm, Wt: 11-15 grams.

A small bat with a tail that extends conspicuously beyond the tail membrane. Fur color dark grey to dark brown, often with scattered white hairs, lighter below. Ears and face similar in color to fur. Ears close together but not joined at the midline. Long hairs protrude from the toes of the feet. Half of the tail extends beyond the tail membrane. Similar to *Nyctinomops femorosaccus* but ears are not joined at the midline like in *N. femorosaccus*. Also, slightly smaller than *N. femorosaccus.*

In southern California, found from the coast to the desert. Roosts in various crevice and cavity-like situations including often in man-made structures such as buildings, bridges, and artificial bat houses. Flight is usually direct and rapid. Appears small and swift in flight with rapid wing beats. Wings appear long and narrow. Typically forages at tree canopy height. Forages over various habitats including over woodlands, scrub habitats, grasslands, and over open water. Feeds mainly on small moths and beetles.

[1] – California Department of Fish and Game. 2009. Special Animals. Status categories include Bureau of Land management – Sensitive (BLM:S), California Department of Fish & Game – Species of Special Concern (DFG:SSC), IUCN – Least Concern (IUCN:LC), U. S. Forest Service – Sensitive (USFS:S), Western Bat Working Group – High Priority (WBWG:H), Western Bat Working Group – Low-Medium Priority (WBWG:LM), Western Bat Working Group – Medium Priority (WBWG:M), and Western Bat Working Group – Medium-High Priority (WBWG:MH).

APPENDIX 3. ALTERNATE TABLE AND FIGURES FOR PUBLIC RELEASE.

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Table 1. USGS conducted bat surveys at sites within Rancho Jamul Ecological Reserve (RJER) and Santa Ysabel Open Space Preserve (SYOSP) both before and after the wildfires of 2003. Survey methods used to detect foraging bats were Anabat bat detectors (An), audible surveys (Au), mist nets (M), and roost surveys (R). In some instances, bats were also visually identified while in flight (V). Sites correspond with Figures 2 and 3.

Study Area	Site	Burned in 2003	Site Name	Latitude[1]	Longitude[1]	Pre-fire Data	Post-fire Data	Survey Methods
RJER	1	Y	Dulzura Creek	32.66560	-116.83690	N	Y	AnAuM
	2	Y	Jamul Creek (below kiln)	32.66500	-116.86740	Y	Y	AnAuMV
	3	Y	Confluence of Jamul and Dulzura Creek	32.64960	-116.87020	N	Y	AnAuM
	4	Y	Roost #1	32.6####	-116.8####	Y	Y	R
	5	Y	Roost #2	32.6####	-116.8####	Y	Y	AnAuR
	6	N	Roost #3	32.6####	-116.7####	Y	N	AnAuR
	7	N	Roost #4	32.6####	-116.8####	Y	N	AnAuMR
	8	N	Hollenbeck Canyon Wildlife Area - Hollenbeck Canyon Creek	32.67860	-116.82250	Y	Y	AnAuMV
	9	N	Hollenbeck Canyon Wildlife Area - Jamul Creek	32.69420	-116.82725	N	Y	AnAuM
	10	N	Hollenbeck Canyon Wildlife Area - Honey Springs Creek	32.66824	-116.81330	N	Y	AnAuM
	11	N	Upper Lyons Valley Creek	32.71560	-116.76083	N	Y	AnAuM
SYOSP	1	Y	East Santa Ysabel Creek - East Property	33.12010	-116.61850	N	Y	An
	2	Y	East Santa Ysabel Creek Crossing - East Property	33.12210	-116.62420	Y	Y	AnAuMV
	3	Y	East Santa Ysabel Creek (Wetlands) - East Property	33.12020	-116.61860	Y	Y	AnAuM
	4	Y	Bailey Creek	33.11653	-116.63865	N	Y	AnAuM
	5	Y	Roost #11	33.1####	-116.6####	Y	Y	AnAuRV
	6	N	East Santa Ysabel Creek - West Crossing	33.13180	-116.64740	Y	Y	AnAuMV
	7	N	West Santa Ysabel Creek - East Property	33.12830	-116.67040	Y	Y	AnAuMV
	8	N	West Santa Ysabel Creek - West Property	33.11310	-116.70990	Y	Y	AnAuMV
	9	N	Tributary of Santa Ysabel Creek - East Property	33.13292	-116.64877	Y	N	AnAuMV
	10	Y	East Property Cattle Pond	33.11913	-116.66586	Y	N	AnMV
	11	N	West Property Saddle	33.13155	-116.70383	Y	N	AnAuM

[1]Coordinates recorded in WGS84

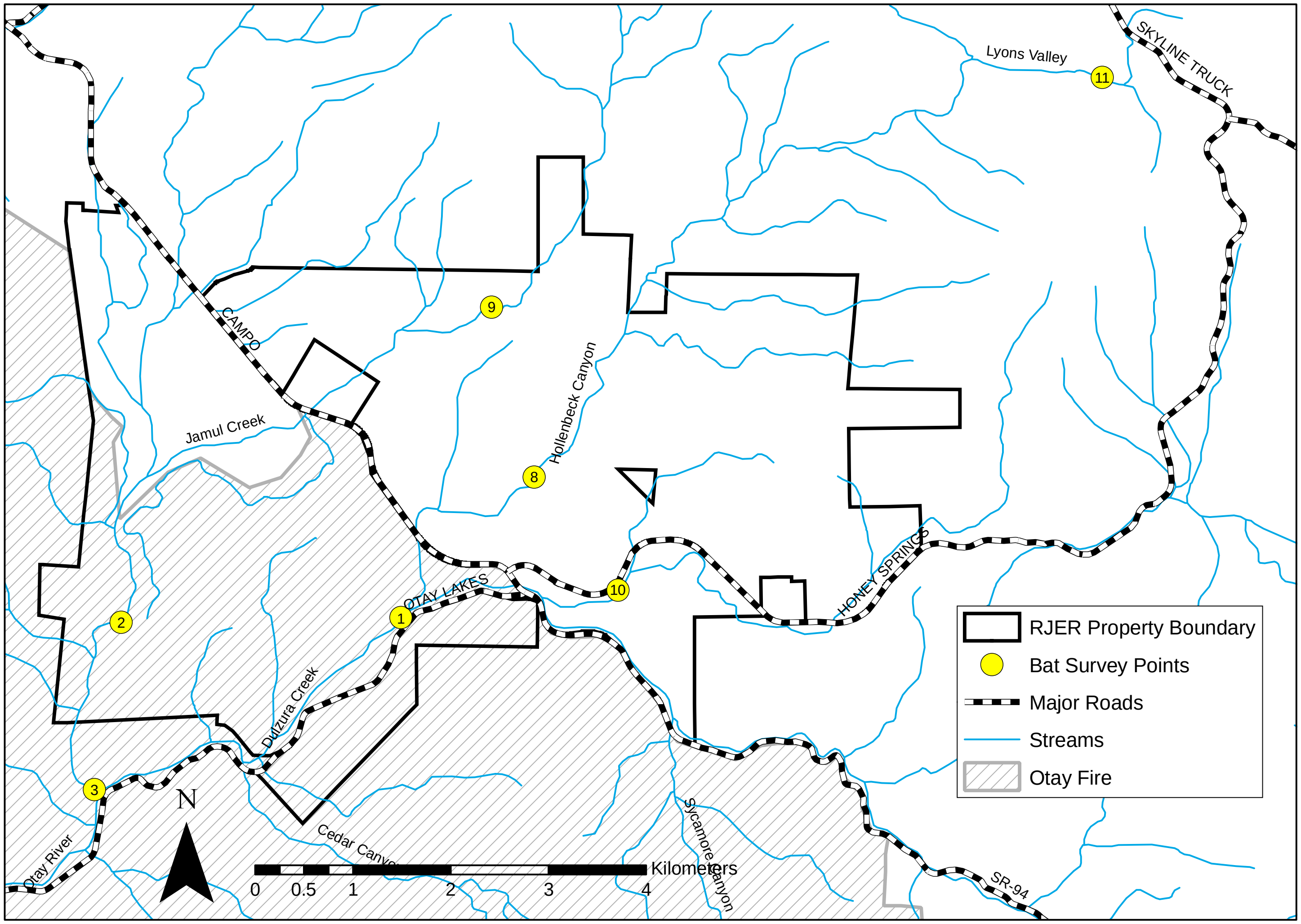

Figure 2. Bat surveys were conducted at 11 sites within Ranch Jamul Ecological Reserve. Site numbers follow those used in Table 1 for RJER. Roost sites are not included in this map.

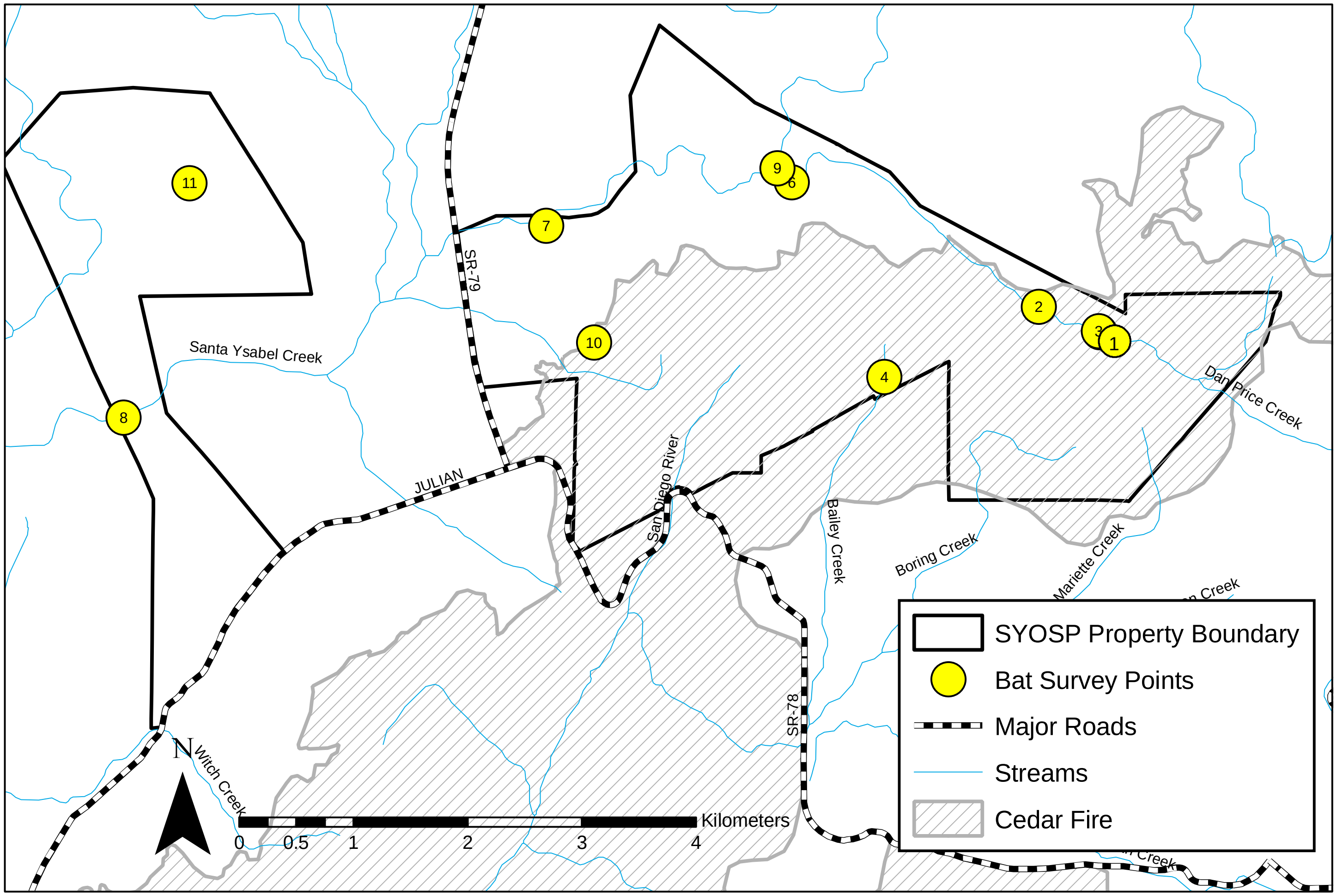

Figure 3. Bat surveys were conducted at 11 sites within Santa Ysabel Open Space Preserve. Site numbers follow those used in Table 1 for SYOSP. Roost sites are not included in this map.

APPENDIX 4. SAMPLE DATA

Study Area	Site	Survey Date	Plot Condition	Fire Condition	Sample Period	Survey Method	Active/Passive	Multivariate	Pallid Bat	Townsend's Big-eared bat*	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow bat*	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed bat*	Western Pipistrelle	Mexican Free-tailed Bat	Count of Species
RJER	1	7-Jun	I	R	Post	An	A	Y	X		X								X	X			X	5
RJER	1	7-Jun	I	R	Post	M		Y																0
RJER	1	27-Jul	I	R	Post	An	A	Y	X		X	X						X	X	X		X	X	8
RJER	1	27-Jul	I	R	Post	M		Y																0
RJER	1	13-Sep	I	R	Post	An	A	Y									X		X	X			X	4
RJER	1	13-Sep	I	R	Post	M		Y																0
RJER	1	13-Jun - 15-Jun[3]	I	R	Post	An	P	N																0
RJER	1	14-Jul - 16-Jul	I	R	Post	An	P	Y			X	X					X	X	X	X			X	7
RJER	1	5-Sep	I	R	Post	An	A	Y			X		X				X		X	X		X	X	7
RJER	1	5-Sep - 10-Sep	I	R	Post	An	P	Y			X						X		X	X		X	X	6
RJER	2	6-May	I	NR	Pre	An	A	Y			X						X		X	X		X	X	6
RJER	2	6-May	I	NR	Pre	M		Y																0
RJER	2	15-Jun	I	R	Post	An	A	Y			X								X	X				3
RJER	2	15-Jun	I	R	Post	M		Y											X					1
RJER	2	26-Jul	I	R	Post	An	A	Y			X								X	X		X		4
RJER	2	26-Jul	I	R	Post	M		Y											X					1
RJER	2	15-Sep	I	R	Post	An	A	Y									X		X	X		X	X	5
RJER	2	15-Sep	I	R	Post	M		Y																0
RJER	2	13-Jun - 15-Jun[3]	I	R	Post	An	P	N																0
RJER	2	14-Jul - 16-Jul	I	R	Post	An	P	Y			X						X		X	X				4
RJER	2	5-Sep - 10-Sep[5]	I	R	Post	An	P	N									X							1
RJER	3	16-Jun	I	R	Post	An	A	Y			X								X	X		X	X	5
RJER	3	16-Jun	I	R	Post	M		Y																0
RJER	3	19-Jul	I	R	Post	An	A	Y		X	X	X				X	X		X	X		X	X	9
RJER	3	19-Jul	I	R	Post	M		Y																0
RJER	3	17-Aug	I	R	Post	An	A	Y						X			X		X	X		X		5
RJER	3	17-Aug	I	R	Post	M		Y																0

APPENDIX 4. SAMPLE DATA (CONTINUED)

Study Area	Site	Survey Date	Plot Condition	Fire Condition	Sample Period	Survey Method	Active/Passive	Multivariate	Pallid Bat	Townsend's Big-eared bat*	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow bat*	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed bat*	Western Pipistrelle	Mexican Free-tailed Bat	Count of Species
RJER	3	13-Jun - 15-Jun[2]	I	R	Post	An	P	Y			X					X			X	X		X	X	6
RJER	3	14-Jul - 16-Jul	I	R	Post	An	P	Y			X					X	X		X	X				5
RJER	3	5-Sep - 10-Sep	I	R	Post	An	P	Y			X					X	X		X	X		X	X	7
RJER	4	10-May	I	NR	Pre	R		Y	X							X			X					3
RJER	4	31-Jul	I	NR	Pre	R		Y		X								X	X					3
RJER	4	29-Oct	I	NR	Pre	R		Y										X	X					2
RJER	4	11-Dec	I	NR	Pre	R		Y																0
RJER	4	7-Jan	I	NR	Pre	R		Y																0
RJER	4	13-Mar	I	NR	Pre	R		Y		X						X	X							3
RJER	4	2-Jul	I	NR	Pre	R		Y																0
RJER	4	31-May	I	R	Post	R		Y	X	X						X		X	X					5
RJER	4	13-Jul	I	R	Post	R		Y								X			X					2
RJER	5	10-Sep	I	NR	Pre	An	A	Y			X								X			X		3
RJER	5	10-Sep	I	NR	Pre	R		Y			X												X	2
RJER	5	31-May	I	R	Post	An	A	Y			X								X				X	3
RJER	5	31-May	I	R	Post	R		Y			X								X				X	3
RJER	5	13-Jul	I	R	Post	An	A	Y			X								X				X	3
RJER	5	13-Jul	I	R	Post	R		Y			X								X				X	3
RJER	6	18-Jun	R	NR	Pre	An	A	Y				X										X	X	3
RJER	6	18-Jun	R	NR	Pre	R		Y									X		X					2
RJER	7	2-Jul	R	NR	Pre	An	A	Y											X	X		X		3
RJER	7	2-Jul	R	NR	Pre	M		Y																0
RJER	7	2-Jul	R	NR	Pre	R		Y																0
RJER	8	9-May	R	NR	Pre	An	A	Y			X			X			X	X				X	X	6
RJER	8	9-May	R	NR	Pre	M		Y			X						X	X						3
RJER	8	25-Jun	R	NR	Pre	An	A	Y			X	X					X		X	X		X	X	7
RJER	8	25-Jun	R	NR	Pre	M		Y			X						X		X			X		4
RJER	8	5-Aug	R	NR	Pre	An	A	Y			X	X				X	X	X		X		X	X	8

APPENDIX 4. SAMPLE DATA (CONTINUED)

Study Area	Site	Survey Date	Plot Condition	Fire Condition	Sample Period	Survey Method	Active/Passive	Multivariate	Pallid Bat	Townsend's Big-eared bat*	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow bat*	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed bat*	Western Pipistrelle	Mexican Free-tailed Bat	Count of Species
RJER	8	5-Aug	R	NR	Pre	M		Y	X		X						X					X		4
RJER	8	23-Oct	R	NR	Pre	An	A	Y										X		X		X		3
RJER	8	23-Oct	R	NR	Pre	M		Y											X					1
RJER	8	7-Jan	R	NR	Pre	An	A	Y					X					X		X				3
RJER	8	7-Jan	R	NR	Pre	M		Y						X										1
RJER	8	13-Mar	R	NR	Pre	An	A	Y										X	X	X			X	4
RJER	8	13-Mar	R	NR	Pre	M		Y									X							1
RJER	8	20-May	R	NR	Pre	An	A	Y	X		X									X		X	X	5
RJER	8	20-May	R	NR	Pre	M		Y			X		X	X								X		4
RJER	8	30-Jul	R	NR	Pre	An	A	Y			X		X				X	X	X			X		6
RJER	8	30-Jul	R	NR	Pre	M		Y																0
RJER	8	1-Oct	R	NR	Pre	An	A	Y				X		X					X	X		X	X	6
RJER	8	1-Oct	R	NR	Pre	M		Y					X					X						2
RJER	8	16-Dec	R	NR	Pre	An	A	Y											X	X				2
RJER	8	16-Dec	R	NR	Pre	M		Y																0
RJER	8	21-Jun	R	NR	Post	An	A	Y			X	X							X	X		X		5
RJER	8	21-Jun	R	NR	Post	M		Y																0
RJER	8	9-Aug	R	NR	Post	An	A	Y		X	X								X			X		4
RJER	8	9-Aug	R	NR	Post	M		Y			X													1
RJER	8	6-Sep	R	NR	Post	An	A	Y										X	X	X		X	X	5
RJER	8	6-Sep	R	NR	Post	M		Y										X						1
RJER	8	13-Jun - 15-Jun[3]	R	NR	Post	An	P	N																0
RJER	8	14-Jul - 16-Jul	R	NR	Post	An	P	Y	X		X		X			X	X	X	X	X		X		9
RJER	8	5-Sep - 10-Sep	R	NR	Post	An	P	Y			X						X		X	X		X	X	6
RJER	9	23-Jun	R	NR	Post	An	A	Y			X						X	X	X	X				5
RJER	9	23-Jun	R	NR	Post	M		Y																0
RJER	9	12-Jul	R	NR	Post	An	A	Y			X						X		X	X		X	X	6
RJER	9	12-Jul	R	NR	Post	M		Y																0

APPENDIX 4. SAMPLE DATA (CONTINUED)

Study Area	Site	Survey Date	Plot Condition	Fire Condition	Sample Period	Survey Method	Active/Passive	Multivariate	Pallid Bat	Townsend's Big-eared bat*	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow bat*	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed bat*	Western Pipistrelle	Mexican Free-tailed Bat	Count of Species
RJER	9	7-Sep	R	NR	Post	An	A	Y			X						X	X	X	X		X	X	7
RJER	9	7-Sep	R	NR	Post	M		Y																0
RJER	9	13-Jun - 15-Jun[2]	R	NR	Post	An	P	Y			X					X	X					X		4
RJER	9	14-Jul - 16-Jul[3]	R	NR	Post	An	P	N																0
RJER	9	5-Sep - 10-Sep	R	NR	Post	An	P	Y			X						X		X	X		X	X	6
RJER	10	10-Aug	R	NR	Post	An	A	Y			X						X			X		X		4
RJER	10	10-Aug	R	NR	Post	M		Y																0
RJER	10	14-Sep	R	NR	Post	An	A	Y									X					X	X	3
RJER	10	14-Sep	R	NR	Post	M		Y																0
RJER	10	13-Jun - 15-Jun[2]	R	NR	Post	An	P	Y			X						X							2
RJER	10	14-Jul - 16-Jul	R	NR	Post	An	P	Y			X						X		X					3
RJER	10	5-Sep - 10-Sep	R	NR	Post	An	P	Y			X						X		X	X		X	X	6
RJER	11	28-Jun	R	NR	Post	An	A	Y			X	X							X	X			X	5
RJER	11	28-Jun	R	NR	Post	M		Y	X															1
SYOSP	1	19-Jun - 21-Jun[3]	I	R	Post	An	P	N																0
SYOSP	1	11-Jul - 13-Jul	I	R	Post	An	P	Y			X								X	X			X	4
SYOSP	1	28-Aug - 31-Aug	I	R	Post	An	P	Y			X					X			X	X			X	5
SYOSP	1	19-Sep - 21-Sep[3]	I	R	Post	An	P	N																0
SYOSP	2	6-Jun	I	NR	Pre	An	A	Y			X		X	X		X			X	X				6
SYOSP	2	6-Jun	I	NR	Pre	M		Y						X		X								2
SYOSP	2	24-Jun	I	NR	Pre	An	A	Y		X	X			X	X	X			X	X			X	8
SYOSP	2	24-Jun	I	NR	Pre	M		Y																0
SYOSP	2	25-May	I	R	Post	An	A	Y			X		X	X		X	X		X	X			X	8
SYOSP	2	25-May	I	R	Post	M		Y								X			X					2
SYOSP	2	20-Jul	I	R	Post	An	A	Y			X					X	X		X	X				5
SYOSP	2	20-Jul	I	R	Post	M		Y									X							1
SYOSP	2	31-Aug	I	R	Post	An	A	Y			X		X	X		X	X		X	X				7

APPENDIX 4. SAMPLE DATA (CONTINUED)

Study Area	Site	Survey Date	Plot Condition	Fire Condition	Sample Period	Survey Method	Active/Passive	Multivariate	Pallid Bat	Townsend's Big-eared bat*	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow bat*	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed bat*	Western Pipistrelle	Mexican Free-tailed Bat	Count of Species
SYOSP	2	31-Aug	I	R	Post	M		Y			X													1
SYOSP	2	19-Jun - 21-Jun[3]	I	R	Post	An	P	N																0
SYOSP	2	11-Jul - 13-Jul	I	R	Post	An	P	Y			X					X			X					3
SYOSP	2	28-Aug - 31-Aug	I	R	Post	An	P	Y	X		X		X			X		X	X	X				7
SYOSP	2	19-Sep - 21-Sep[3]	I	R	Post	An	P	N																0
SYOSP	3	20-Jun	I	NR	Pre	An	A	Y			X	X				X				X			X	5
SYOSP	3	20-Jun	I	NR	Pre	M		Y																0
SYOSP	3	9-Jun	I	R	Post	An	A	Y			X		X			X			X	X			X	6
SYOSP	3	9-Jun	I	R	Post	M		Y																0
SYOSP	3	11-Aug	I	R	Post	An	A	Y			X	X	X			X	X			X			X	7
SYOSP	3	11-Aug	I	R	Post	M		Y			X													1
SYOSP	3	25-Aug	I	R	Post	An	A	Y			X		X	X	X	X	X		X	X			X	9
SYOSP	3	25-Aug	I	R	Post	M		Y			X					X	X							3
SYOSP	3	19-Jun - 21-Jun[2]	I	R	Post	An	P	Y	X										X					2
SYOSP	3	11-Jul - 13-Jul	I	R	Post	An	P	Y			X					X			X					3
SYOSP	3	28-Aug - 31-Aug[1]	I	R	Post	An	P	Y			X													1
SYOSP	3	19-Sep - 21-Sep	I	R	Post	An	P	Y			X		X			X			X	X			X	6
SYOSP	4	30-Jun	I	R	Post	An	A	Y			X					X			X					3
SYOSP	4	30-Jun	I	R	Post	M		Y																0
SYOSP	4	4-Aug	I	R	Post	An	A	Y			X	X				X			X					4
SYOSP	4	4-Aug	I	R	Post	M		Y																0
SYOSP	4	1-Sep	I	R	Post	An	A	Y			X					X	X		X	X		X		6
SYOSP	4	1-Sep	I	R	Post	M		Y																0
SYOSP	5	7-Aug	I	NR	Pre	An	A	Y	X													X	X	3
SYOSP	5	7-Aug	I	NR	Pre	R		Y	X														X	2
SYOSP	5	30-Jun	I	NR	Pre	An	A	Y	X							X							X	3
SYOSP	5	30-Jun	I	NR	Pre	R		Y	X														X	2

APPENDIX 4. SAMPLE DATA (CONTINUED)

Study Area	Site	Survey Date	Plot Condition	Fire Condition	Sample Period	Survey Method	Active/Passive	Multivariate	Pallid Bat	Townsend's Big-eared bat*	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow bat*	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed bat*	Western Pipistrelle	Mexican Free-tailed Bat	Count of Species
SYOSP	5	2-Jun	I	R	Post	An	A	Y	X														X	2
SYOSP	5	2-Jun	I	R	Post	R		Y	X														X	2
SYOSP	5	8-Jun	I	R	Post	An	A	Y	X														X	2
SYOSP	5	8-Jun	I	R	Post	R		Y	X														X	2
SYOSP	5	21-Jul	I	R	Post	An	A	Y																0
SYOSP	5	21-Jul	I	R	Post	R		Y	X															1
SYOSP	6	30-May	R	NR	Pre	An	A	Y			X		X	X		X	X		X	X			X	8
SYOSP	6	30-May	R	NR	Pre	M		Y					X			X	X		X					4
SYOSP	6	29-Aug	R	NR	Pre	An	A	Y			X					X	X	X		X	X	X		7
SYOSP	6	29-Aug	R	NR	Pre	M		Y		X	X					X								3
SYOSP	6	7-Jul	R	NR	Pre	An	A	Y		X	X								X					3
SYOSP	6	7-Jul	R	NR	Pre	M		Y								X								1
SYOSP	6	29-Jun	R	NR	Post	An	A	Y			X					X	X		X					4
SYOSP	6	29-Jun	R	NR	Post	M		Y																0
SYOSP	6	16-Aug	R	NR	Post	An	A	Y			X		X			X		X		X				5
SYOSP	6	16-Aug	R	NR	Post	M		Y								X								1
SYOSP	6	18-Aug	R	NR	Post	An	A	Y			X		X	X		X			X	X			X	7
SYOSP	6	18-Aug	R	NR	Post	M		Y																0
SYOSP	6	19-Jun - 21-Jun	R	NR	Post	An	P	Y								X			X					2
SYOSP	6	11-Jul - 13-Jul	R	NR	Post	An	P	Y			X					X			X	X				4
SYOSP	6	28-Aug - 31-Aug	R	NR	Post	An	P	Y			X						X		X					3
SYOSP	6	19-Sep - 21-Sep	R	NR	Post	An	P	Y								X	X		X	X			X	5
SYOSP	7	17-Jul	R	NR	Pre	An	A	Y			X						X			X		X	X	5
SYOSP	7	17-Jul	R	NR	Pre	M		Y																0
SYOSP	7	24-May	R	NR	Post	An	A	Y											X				X	2
SYOSP	7	24-May	R	NR	Post	M		Y																0
SYOSP	7	2-Aug	R	NR	Post	An	A	Y			X	X				X	X		X	X		X		7
SYOSP	7	2-Aug	R	NR	Post	M		Y									X							1

APPENDIX 4. SAMPLE DATA (CONTINUED)

Study Area	Site	Survey Date	Plot Condition	Fire Condition	Sample Period	Survey Method	Active/Passive	Multivariate	Pallid Bat	Townsend's Big-eared bat*	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow bat*	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed bat*	Western Pipistrelle	Mexican Free-tailed Bat	Count of Species
SYOSP	7	20-Sep	R	NR	Post	An	A	Y			X			X		X	X			X			X	6
SYOSP	7	20-Sep	R	NR	Post	M		Y																0
SYOSP	7	19-Jun - 21-Jun[1]	R	NR	Post	An	P	Y			X					X		X						3
SYOSP	7	11-Jul - 13-Jul	R	NR	Post	An	P	Y	X		X					X	X		X			X		6
SYOSP	7	28-Aug	R	NR	Post	An	A	Y			X					X	X		X			X	X	6
SYOSP	7	28-Aug - 31-Aug	R	NR	Post	An	P	Y			X					X	X		X			X		5
SYOSP	7	19-Sep - 21-Sep	R	NR	Post	An	P	Y			X	X				X	X		X	X		X	X	8
SYOSP	8	28-May	R	NR	Pre	An	A	Y	X		X		X	X		X	X		X				X	8
SYOSP	8	28-May	R	NR	Pre	M		Y			X		X						X					3
SYOSP	8	24-Jul	R	NR	Pre	An	A	Y	X	X	X		X			X	X		X	X		X	X	10
SYOSP	8	24-Jul	R	NR	Pre	M		Y																0
SYOSP	8	10-Sep	R	NR	Pre	An	A	Y	X	X		X	X			X	X			X			X	8
SYOSP	8	10-Sep	R	NR	Pre	M		Y																0
SYOSP	8	4-Dec	R	NR	Pre	An	A	Y				X				X				X				3
SYOSP	8	4-Dec	R	NR	Pre	M		Y																0
SYOSP	8	23-Jan	R	NR	Pre	An	A	Y								X							X	2
SYOSP	8	23-Jan	R	NR	Pre	M		Y						X										1
SYOSP	8	9-Apr	R	NR	Pre	An	A	Y			X	X				X			X					4
SYOSP	8	9-Apr	R	NR	Pre	M		Y			X													1
SYOSP	8	28-May	R	NR	Pre	An	A	Y						X		X	X		X	X				5
SYOSP	8	28-May	R	NR	Pre	M		Y						X										1
SYOSP	8	31-Jul	R	NR	Pre	An	A	Y	X	X	X		X				X		X			X	X	8
SYOSP	8	31-Jul	R	NR	Pre	M		Y																0
SYOSP	8	30-Sep	R	NR	Pre	An	A	Y	X		X	X		X		X	X		X	X		X	X	10
SYOSP	8	30-Sep	R	NR	Pre	M		Y																0
SYOSP	8	2-Dec	R	NR	Pre	An	A	Y												X				1
SYOSP	8	2-Dec	R	NR	Pre	M		Y																0
SYOSP	8	26-May	R	NR	Post	An	A	Y			X								X	X			X	4

APPENDIX 4. SAMPLE DATA (CONTINUED)

Study Area	Site	Survey Date	Plot Condition	Fire Condition	Sample Period	Survey Method	Active/Passive	Multivariate	Pallid Bat	Townsend's Big-eared bat*	Big Brown Bat	Western Mastiff Bat	Western Red Bat	Hoary Bat	Western Yellow bat*	California Myotis	Western Small-footed Bat	Long-eared Myotis	Yuma Myotis	Pocketed Free-tailed Bat	Big Free-tailed bat*	Western Pipistrelle	Mexican Free-tailed Bat	Count of Species
SYOSP	8	26-May	R	NR	Post	M		Y			X													1
SYOSP	8	3-Aug	R	NR	Post	An	A	Y	X		X		X			X	X		X	X		X	X	9
SYOSP	8	3-Aug	R	NR	Post	M		Y																0
SYOSP	8	30-Aug	R	NR	Post	An	A	Y	X				X			X	X		X	X			X	7
SYOSP	8	30-Aug	R	NR	Post	M		Y																0
SYOSP	8	19-Jun - 21-Jun	R	NR	Post	An	P	Y			X								X					2
SYOSP	8	11-Jul - 13-Jul	R	NR	Post	An	P	Y			X					X	X		X					4
SYOSP	8	28-Aug - 31-Aug	R	NR	Post	An	P	Y			X		X	X		X	X		X	X			X	8
SYOSP	8	19-Sep - 21-Sep	R	NR	Post	An	P	Y			X								X				X	3
SYOSP	9	12-Jun	R	NR	Pre	An	A	Y			X		X	X		X	X		X				X	7
SYOSP	9	12-Jun	R	NR	Pre	M		Y			X			X										2
SYOSP	10	22-May	I	NR	Pre	An	A	Y			X			X		X	X					X	X	6
SYOSP	10	22-May	I	NR	Pre	M		Y						X		X								2
SYOSP	11	1-Jul	R	NR	Pre	An	A	Y			X					X	X		X	X		X	X	7
SYOSP	11	1-Jul	R	NR	Pre	M		Y								X								1

[1] The passive Anabat detection system failed to function properly during one day of the survey.

[2] The passive Anabat detection system failed to function properly during two days of the survey.

[3] The passive Anabat detection system failed to function properly during three days of the survey.

[5] The passive Anabat detection system failed to function properly during five days of the survey.

*Species was not included in the community analysis due to low detection rate.

Study area: Rancho Jamul Ecolgical Reserve = RJER, Santa Ysabel Open Space Preserve = SYOSP
Plot Condition: Reference = R, Impact = I
Fire Condition: Non-razed = NR, Razed = R
Time period: Pre-fire = Pre, Post-fire = Post
Survey Method: Anabat = An, Mist-net = M, Roost = R
Active/Passive: Active = A, Passive = P