Bat Vegetation Associations of the Hassayampa River Preserve, Sonoran Desert, AZ

Prepared November 2021 for the Hassayampa River Preserve Maricopa County Regional Park
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Introduction

This project examined bat usage of five different vegetation associations located within the Hassayampa River Preserve outside of Wickenburg, AZ within the Sonoran Desert. Bat usage of vegetation associations were examined utilizing echolocation recordings made on a Wildlife Acoustics Song Meter Mini Bat in May and June of 2020. The detector was set in each vegetation type for seven consecutive days during this time period. Echolocation recordings were analyzed and classified utilizing Wildlife Acoustics Kaleidoscope Pro Software. The vegetation associations examined were 1. Cottonwood-willow (*Populus fremontii*, *Salix gooddingii*) riparian forest along a stream (known as Stream1 and Stream sites), 2. cottonwood-mesquite (*P. fremontii*, *Prosopis velutina*) woodland (known as the Cottonwood site), 3. mesquite bosque (*P. velutina*, known as the Mesquite site), 4. pond shore lined with willow (*S. gooddingii*), cottonwood(*P. fremontii*), and mesquite (*P. velutina*, known as the Lake site), and 5. willow (*S. gooddingii*), palm (*Washingtonia filifera*), mesquite (*P. velutina*), and cottonwood *(P. fremontii*) forest (known as the Palm site). Each of these vegetation associations are overall described as Deciduous Riparian Forest and are contained within semi-mountainous Arizona Uplands Sonoran Desert. The uplands surrounding the Hassayampa riparian area are dominated by *Carnegiea gigantea*, *Ambrosia deltoidea*, *Encelia farinosa*, and *Parkinsonia microphylla*. The upland environment surrounding the riparian area was not sampled for this project.

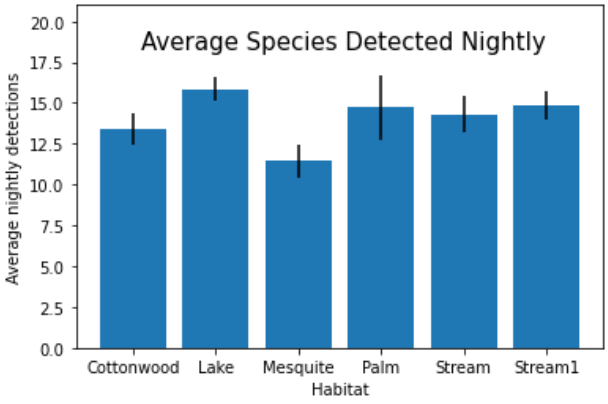
Results

A total of 16 species were able to be verified through the manual examination of echolocation sonograms in Wildlife Acoustics Kaleidoscope Pro software. Additional species may have been detected but could not be verified through manual examination of the call sonograms. The following species were verified: Desert pallid bat (ANTPAL), Townsend's big-eared bat (CORTOW), Big brown bat (EPTFUS), Western red bat (LASBLO), Hoary bat (LASCIN), Silver-haired bat (LASNOC), Western yellow bat (LASXAN), California myotis (MYOCAL), Western small-footed bat (MYOCIL), Cave myotis (MYOVEL), Long-legged myotis (MYOVOL), Yuma myotis (MYOYUM), Pocketed free-tailed bat (NYCFEM), Big free-tailed bat (NYCMAC), Canyon bat (PARHES), and Brazilian free-tailed bat (TADBRA). Additional species that possibly were found but could not be verified were Long-eared myotis (MYOEVO), and Arizona myotis (MYOOCC).

The cottonwood-willow pond shore (Lake) had overall most bat detections with over 1500 average nightly detections, which was significantly greater than the vegetation association with the second most detections. The abundance of detections at the lake site is likely a reflection of this site being a feeding area where many bats congregate and individual bats likely being detected multiple times. The vegetation with the second most detections was the willow-palm-cottonwood-mesquite (Palm) site with approximately 750 detections per night. Mesquite bosque (Mesquite) had the least number of total nightly detections with less than 100 per night. Nightly species abundance was relatively

consistent between vegetation types with the lake site having the highest average species abundance (15) and the mesquite site having the lowest average species abundance (11). The remaining sites had approximately 13 species on average nightly (see figure 1 below).

Figure 1. Species Abundance by Vegetation Association



Data analysis was carried out on the seven most abundant species which were the Mexican Free-Tailed Bat (TADBRA), Big Brown Bat (EPTFUS), Silver-Haired Bat (LASNOC), Western Yellow Bat (LASXAN), Western Small-footed Myotis (MYOCIL), Cave Myotis (MYOVEL), and Canyon Bat (PARHES). Of these species the Mexican Free-Tailed bat was the most abundant. Due to non-normal distribution of data as indicated by Shapiro–Wilks test for normality, Kruskal-Wallis one-way analysis of variance was carried out to compare individual species across the six sampling sites. Pairwise comparison of habitats (sampling sites) was carried out after the overall Kruskal-Wallis test (K-W). Overall K-W indicated a statistically significant difference between sampled sites for all of the tested species. Pairwise comparison also indicated strong preference of individual vegetation associations for specific species (refer to analysis on Github for details). No statistically significant difference was found for the two forested stream sites for individual species, as would be expected being these two habitats were identical. See figure 2 below for species graphs by habitat.

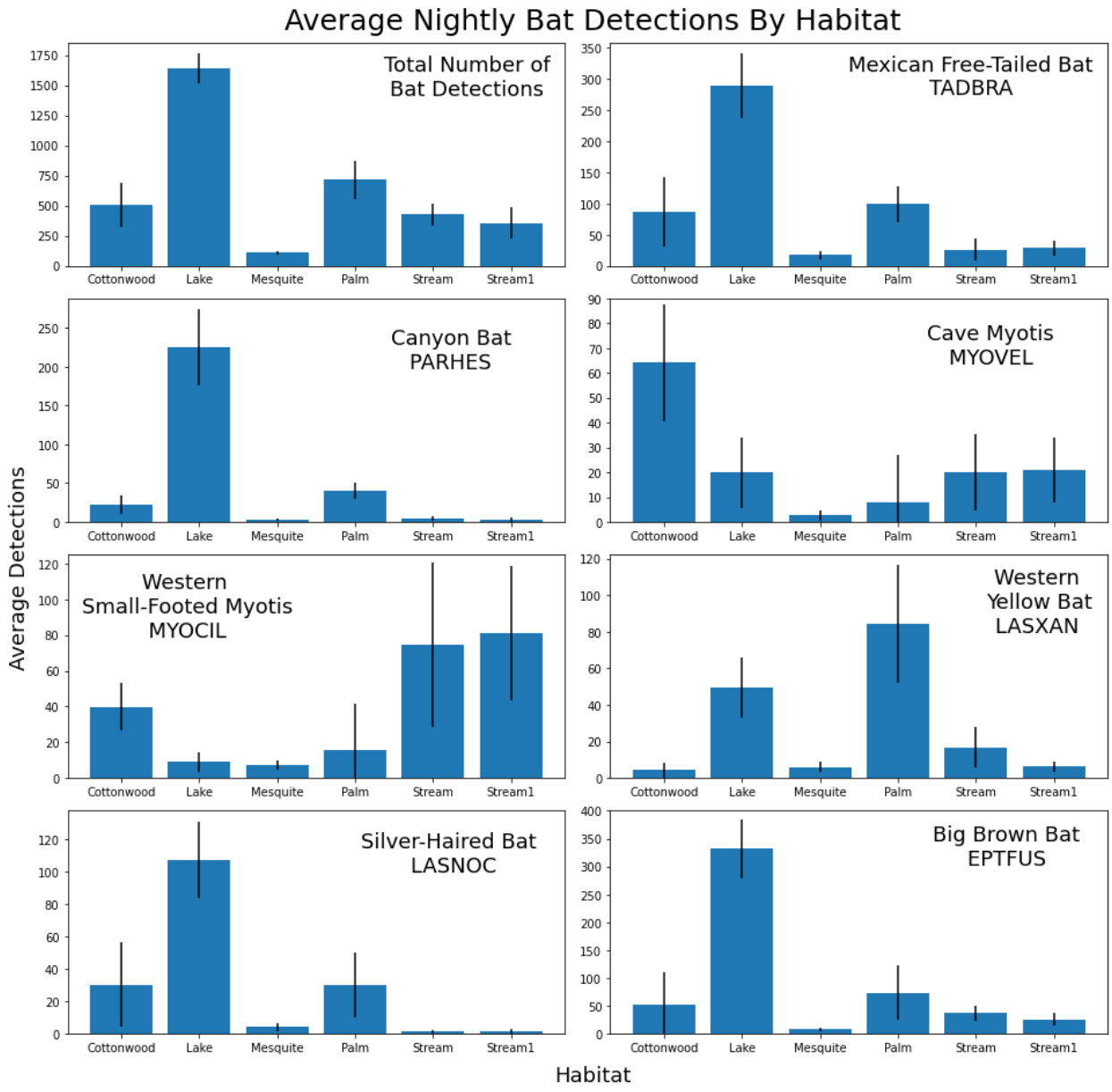
Rank-MANOVA and pairwise sampling site comparison was carried out on bat detected at the different sampling sites. Each vegetation association was found to have a statistically significant different bat usage (refer to analysis on Github for details). Only the two forested stream sites were not found to have a statistically significant difference between each other, as would be expected for two sites of identical vegetation associations.

Conclusion

The Hassayampa River Preserve contains at least five unique vegetation associations utilized by different combinations of bats. Each of these vegetation types is utilized by a unique association of bats with each bat species having a specific vegetation preference. The combination of largely intact habitats and diversity of vegetation types within the preserve likely increases the overall abundance of bats within each individual habitat. Overall, it appears that the lake or pond habitat plays an extremely important role in the bat community and with the bat populations in the preserve. Additional exploration of vegetation types on and surrounding the preserve could also be carried out to identify patterns of bat use. Additional habitat influencing factors that could be examined are the

effects of development in the surrounding area and on the preserve, bat communities in upland desert habitat outside of the preserve, effect of distance from standing water on bat usage, and the effects of Highway 60 along the northeast side of the preserve. Additionally, a more in depth examination of bat habitat and vegetation use may aid in the identification of important roosting areas and areas in need of protection.

Figure 2. Bat Species by Vegetation Association



Github repository for data and analysis:
https://github.com/haberkornm/Hassayampa_bat_communities