Impact of Local Climate on Big Brown/Silver Haired Bat Activity Patterns Using Ultrasonic Audio Recordings in Boone County, Ky

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Introduction

Understanding and monitoring bat species has been essential for the conservation and preservation of their vital ecological services (Jones et al. 2009). For example, spatial ecology, abundance, and presence vs. absence studies help ensure proper bat management and habitat protection (Agosta 2002.) However, bat activity patterns in Northern Kentucky have not been thoroughly investigated. Interpreting bat activity through ultrasonic audio recordings can create solutions for unique and modern conservation issues (Muthersbaugh et al. 2019). Ultrasonic audio was collected at the Earl and Hazel Jones Center for Conservation, a property located along Gunpowder Creek in Burlington, Kentucky and owned by the Boone County Conservation District. Bat species were manually identified and cross referenced with weather data from a nearby Kentucky Mesonet station to analyze daily activity patterns of Big Brown/Silver Haired bats.

Figure 1. Anabat Chorus ultrasonic recording device from Titley Scientific.

Figure 2. Placement of Anabat Chorus in an open field.

Methods

To record calls, an Anabat Chorus with an ultrasonic omnidirectional microphone was placed on a 12-foot extension pole with a ball joint attachment in an open field with the microphone facing away from the forest line. The Chorus was placed on “night mode.” The detector started recording 30 minutes before sunset and stopped 30 minutes after sunrise. Calls recorded were then manually identified using a guide from Alexander Silivis, PhD (Silvis, n.d). Calls that were not determined to be a “quality” call (one bat, >5 search phase calls and presence of harmonics) were marked as noise and not identified. Identification to species level was attempted, however, the calls of big brown bats and silver haired bats are generally indistinguishable. For this reason, big brown bats and silver haired bats were grouped together in this study. Once calls were identified, they were uploaded alongside Kentucky Mesonet weather data to R Studio. Number of pulses (passes) in each recording were used to indicate activity (Fern et al.2018). Figures were created showing the most active big brown/silver haired bat days in comparison to three weather factors: temperature, dew point and average wind speed. A Pearson correlation test was run for each figure.

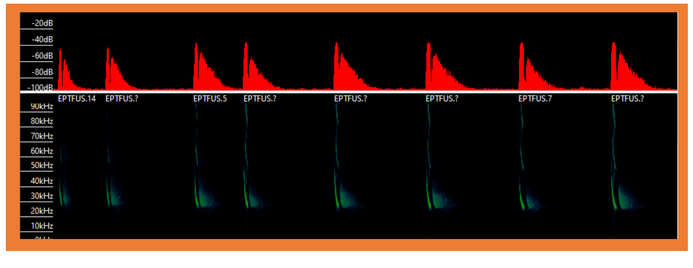

Figure 3. Sonograph of big brown or silver haired bat call produced by Kaleidoscope Pro software.

Results

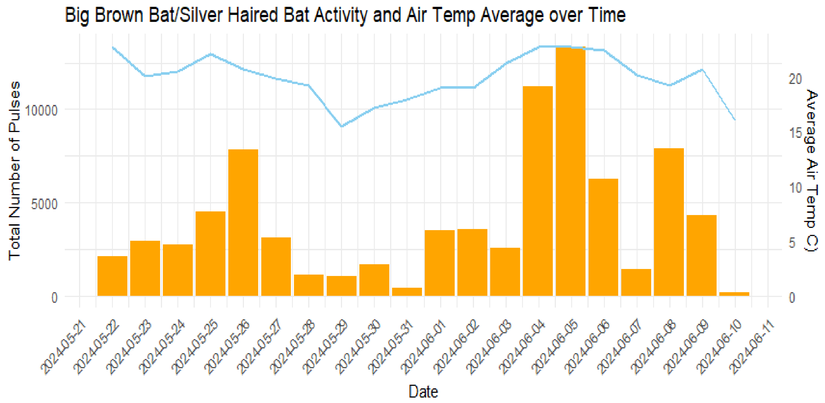

Figure 4. Big brown/silver haired bat activity, measured by pulses, compared to the average air temperature on the same dates

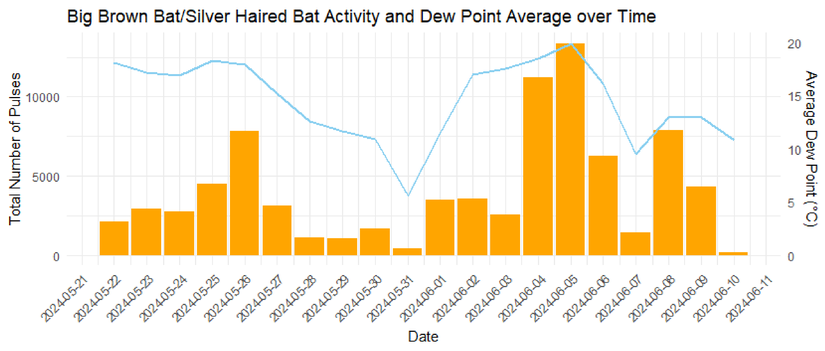

Figure 5. Big brown/silver haired Bat activity measured by pulses compared to average dew point on the same dates.

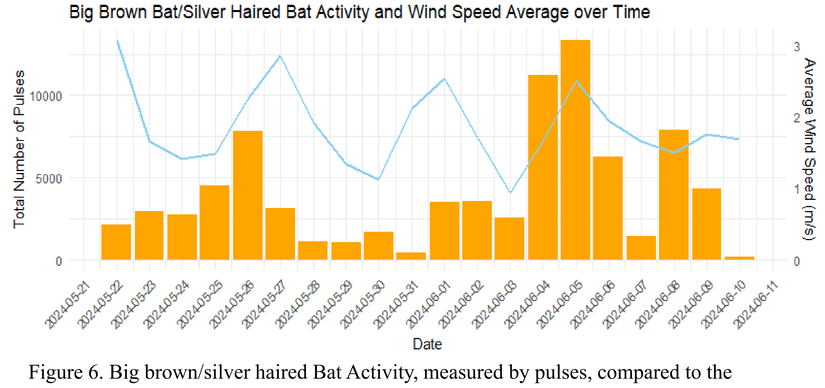

Figure 6. Big brown/silver haired Bat Activity, measured by pulses, compared to the daily average wind speed

Of the three figures the dew point ($t = 3.2347$, $df = 18$, p-value = 0.004598) and air temperature ($t = 3.345$, $df = 18$, p-value = 0.003605) had statistically significant findings. Wind speed was not statistically significant ($t = 0.7549$, $df = 18$, p-value = 0.4601). Bat activity was highest when air temperature and dew point was high.

Discussion

The results of the analysis indicate that bats are most active on nights where the temperature and dew point are high (Figure 4 and Figure 5). There was a significant correlation between activity and weather. Dew point and average air temperature both had a positive correlation with bat activity. When the air temperature and dew point were at their highest on 6/4/24 and 6/5/24 bat passes were also at their highest. There was no correlation between avg wind speed and activity (Figure 6). This could be because wind speed is variable throughout the day and averaging may not provide an accurate measurement in the context of this study. A longer survey period for all three variables could provide better insight into their relationship with bat activity. Also comparing more weather variables such as moon cycle and precipitation could provide interesting results. Finally, applying this methodology to other bat species groups such as hoary bats and myotis bats can give us a wider understanding of these relationships.

Figure 7. Photo of a Big Brown Bat. From Bat Conservation International, July 19th 2023.(https://www.batcon.org/bat/eptesicus-fuscus/)

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