Can litter removal in urban parks improve water accessibility for bats?

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Introduction

- Despite bats providing essential ecosystem services, such as pollination (Flores-Abreu et al. 2019), seed dissemination (Sugiyama et al. 2018), and pest control (Tuneu-Corral et al. 2023), bat populations are facing a global decline due to habitat loss from human activities, including urbanization (Pretorius et al. 2021).
- We can, however, enhance urban areas to support bat communities by ensuring that suitable resources, such as water, are available and accessible.
- While, availability is associated with the abundance of water sources in an area, accessibility dictates whether bats can physically get to and drink from the surface of a water source (Torrent et al. 2018).
- One factor that can influence accessibility is level of clutter.
- Clutter represents any physical obstruction present on the surface of the water or in immediate surrounding area, including vegetation, exposed rock, and debris.
- Yet, not all forms of clutter are natural. The presence of litter can negatively hinder water accessibility.
- Thus, in urban areas where litter is more prevalent, a simple litter or trash clean up scheme could potentially represent an effective restoration activity that community groups could undertake to increase water availability and accessibility for bats in their neighborhoods.
- To explore this concept, we assessed whether such a community-based clean-up scheme could effectively improve water resource accessibility for bats.

Methods

Study Sites

- Behavioral surveys were conducted at 6 water sources in urban parks and greenspaces in Fort Worth, Texas (Fig. 1).

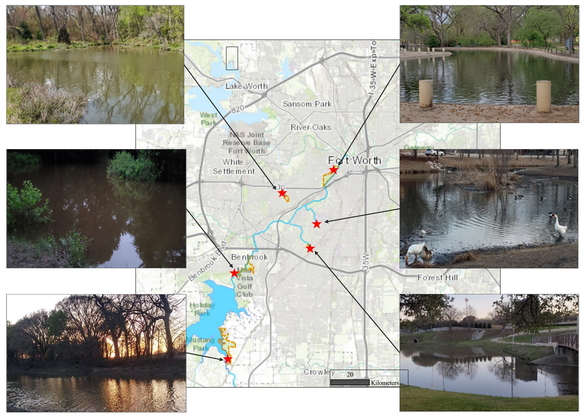

Figure 1: From left to right descending, our study sites included **Lake Como**, Trinity River, Rocky Creek Tributary, Trinity Duck Pond, Foster Park retention pond, **Frat retention pond on TCU campus**.

Behavioral Surveys and Acoustic Monitoring

- We conducted behavioral observation surveys at each site every 2 weeks from March to September 2021-2023.
- We used Axis Q1942-E 19mm ThermNetCam 30 FPS thermal surveillance camera along with Song Meter SM4Bat acoustic detector to record bat activity.
- We positioned the thermal camera about 10 meters away from the edge of each water sources, while the acoustic detector was placed at the edge with mic angled towards the surface (Fig. 2).
- Both thermal and acoustic surveys started 20 min after sunset and continued for ~1 hr to incorporate the primary period when local bats were actively searching for and drinking water.

Data Processing and Analysis

- All thermal footage processed using Vosaic software (v 1.1.3686; Fig. 3) and SonoBat bat call analysis software (version 3.03) to identify species.
- We identified 1) the total time bats were observed in the field of view, 2) number of drinking events observed, and 4) number of species (all per hour).

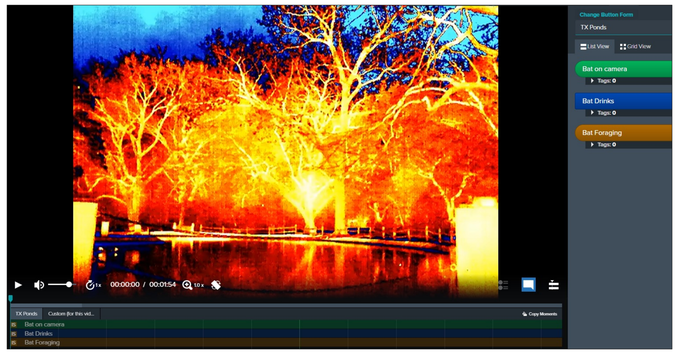

Figure 3: Example of 10 min track of thermal footage in Vosaic software with marked up timeline.

Clean-up

- We cleared **Lake Como** and **Frat Pond** of trash monthly during the bat activity season in 2023.
- We then compared bat drinking activity recorded at ponds from 2021-2022 prior (i.e., no clean-up) with activity post clean-up in 2023 to establish if more bats drank.

A

Study Site	Field-of-view
Site 1: Rocky Creek	
Site 2: Trinity Duck Pond	
Site 3: Foster Park Pond	
Site 4: Oakmont Creek	
Site 5: Frat Pond	
Site 6: Lake Como	

B

C

Figure 2: **A)** thermal camera field-of view at each study site, **B)** thermal camera set up, and **C)** microphone set up.

Results

- We conducted surveys at the water sources on **13-15 nights per year** in **2021, 2022, and 2023** for all 6 ponds.
- Bats were **present at all 6 water sources** every year and their activity varied annually across all sites (Fig. 4).
- We observed bats **drinking at all 6 water sources** every year and their activity varied annually across all sites (Fig. 5).
- From 2021 to 2022, **we observed a decline in both bat presence and drinking activity** (Figs 5 & 6). Amongst Foster and Trinity ponds, we saw that decrease persist in 2023. Note that these sites had the greatest amount of bat activity compared to the other four (Figs. 6,& 7).
- Despite their lower activity overall, **we did not see a similar decline in presence at ponds Frat, Como,** Oakmont, or Rocky Creek in 2023 (Figs. 4 & 6), and we did see an increase in drinking at **Como, Frat**, and Oakmont sites – at least double (Figs. 5 & 7).
- Thus, we observed **2x increase in drinking activity at the clean-up sites,** and an increase at Oakmont could be attributed to a fallen tree present in 2022 that was removed by 2023 (Fig. 7).

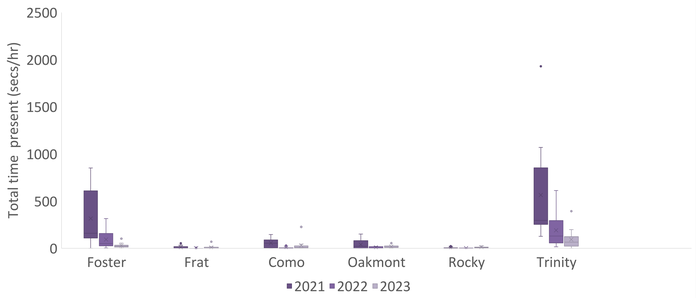

Figure 4: Average time bats were observed flying in the thermal field of view for each water source from 2021-2023.

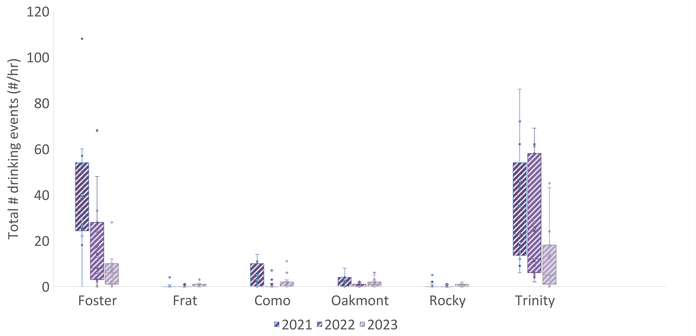

Figure 5: Average number of bat drinking events observed drinking at each water source from 2021-2023.

Figure 8: The large surface for drinking and clean-up at **Frat Pond.**

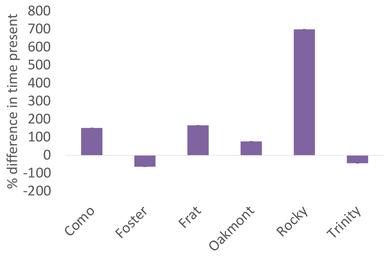

Figure 6: Percent difference in bat presence observed at each water source pre- (2021, 2022) and post-cleanup (2023).

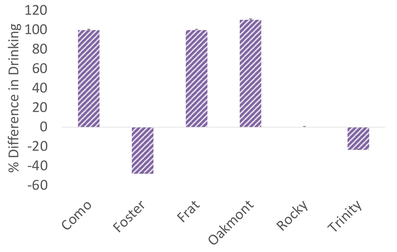

Figure 7: Percent difference in bat drinking events observed at each water source pre- (2021, 2022) and post-cleanup (2023).

Conclusions

- Overall, the results suggest that **litter removal increased drinking activity**.
- This supported our hypothesis that **litter removal could enhance water resources for bats** (Fig. 8).
- We are currently undertaking a second year of clean-ups at **Frat and Como** to account for the annual variation in bat activity and confirm our current results.
- With this study, we hope to inform not only local wildlife conservation programs, but also efforts to improve community health.

References

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