Enhancing urban areas for bat communities: Water quality influences water availability

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Introduction

- Water is a resource that must be available in an area for wildlife to thrive there.
- In urban areas, while water sources are present (most commonly in the form of retention ponds (Haider et al. 2019) and drainage ditches (Shaw et al. 2015)) they are predisposed to contamination.
- As studies have shown that the of water sources by wildlife can be influenced by water quality (Ovalle-Rivera 2020), this poses the question are water sources in an urban area available to wildlife?
- To address this, we conducted a study to determine whether water quality influenced resource use (i.e., foraging and drinking activity) by bats in Fort Worth, TX.
- We hypothesize that lower quality water sources will have little to no bat activity.
- Understanding how water quality impacts bats, may
  1. be an indicator of water availability for wildlife species in urban areas, and
  2. provide insights into the environmental health of local parks and surrounding neighborhoods for wildlife.

Methods

Study Sites

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

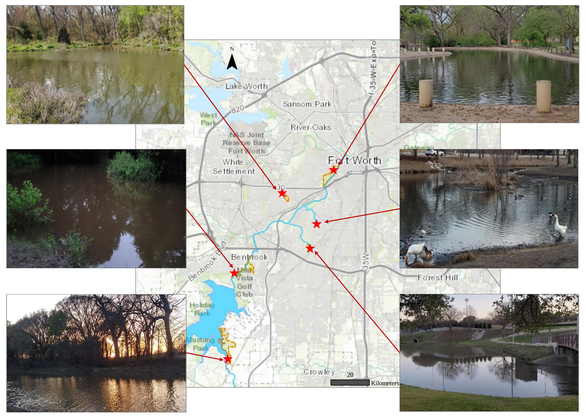


Figure 3: From left to right descending, our study sites included Lake Como, Trinity River, Rocky Creek Tributary, Trinity Duck Pond, Foster Park Retention Pond, Frat Retention Pond on TCU campus.

Behavioral Surveys and Acoustic Monitoring

- We conducted behavioral observation surveys from March to September 2021.
- At the start of each survey, we recorded cloud cover, wind direction, average wind speed (kmph), wind gusts (kmph), temperature (°C), humidity, dewpoint (°C), pressure (mb), moon phase, moon visibility, and moon illumination.
- We used thermal camera technology to record bats drinking at the ponds for 1 hr after dusk.
- We positioned the thermal camera about 10 meters away from the edge of each pond (Fig. 2).
- We used Echometer Touch to identify bat observation to species (where possible).

Data Processing and Analysis

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

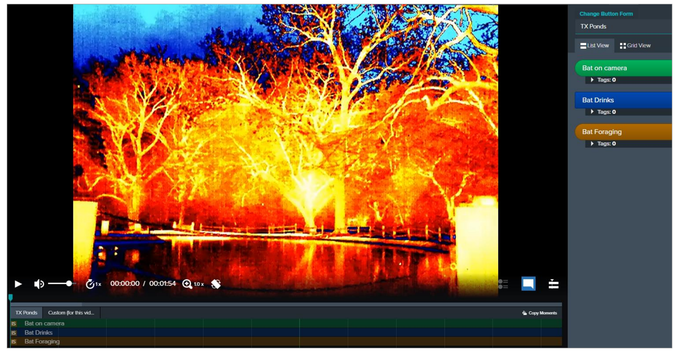


Figure 3: Example of 10 min track of thermal footage in Vosaic software with marked up timeline.

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

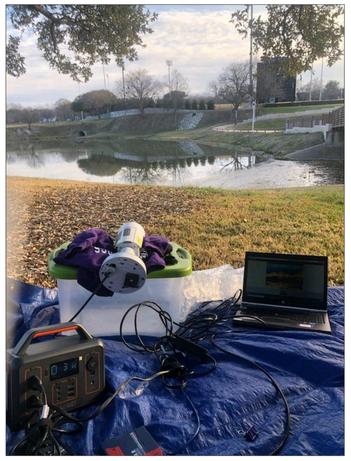


Figure 2: **A)** thermal camera field-of view at each study site and **B)** thermal camera set up.

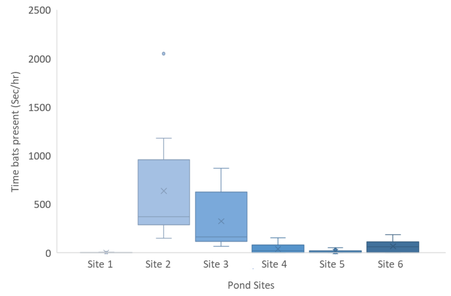
Results

We conducted surveys at the water sources on **39 nights** from **27 March to 27 September 2021** for all 6 ponds.

- Bats were recorded flying at all 6 ponds.
- Overall, the average number of bats in field of view decreased with decreasing water quality (Fig. 4). We confirmed that **bats in the field of view to be significantly different** between the ponds (F=13.22; *df*=5; *p*<0.001).
- Across our ponds, the average time bats were observed foraging decreased with decreasing water quality (Fig. 5). We confirmed that **foraging activity to be significantly different** between the ponds (F=23.04; *df*=5; *p*<0.001).
- Across our sites, the average number of observed drinking was lower in lower quality ponds (Fig. 6). We confirmed that **drinking activity to be significantly differen**t between the ponds (F=5.54; *df*=5; *p*<0.001).
- Evening bats were recorded at all 6 ponds (Figs. 7 and 8)**.** However, hoary, eastern red, silver-haired and tri-colored bats were also recorded, with the 5 species at Sites 3 and 4, and 3 species at Site 5.

Figure 7: Evening bat (*Nycticeius humeralis*).

Figure 4: Average time bats were observed flying in the thermal field of view for each pond ranked by water quality according to the EPA (2022).



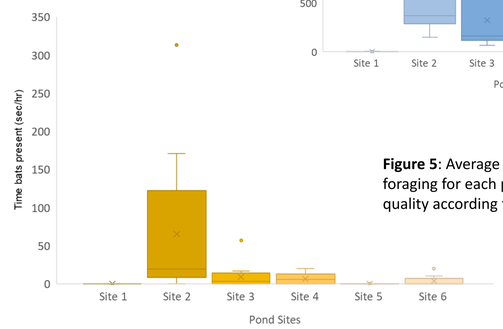
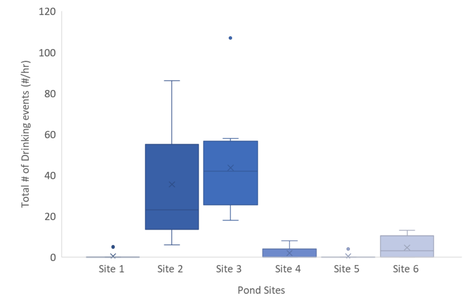


Figure 5: Average time bats were observed foraging for each pond ranked by water quality according to the EPA.

Figure 6: Average number of bats observed drinking for each pond ranked by water quality according to the EPA.



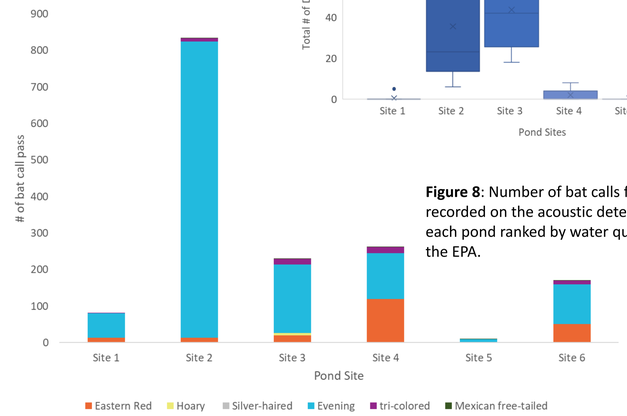


Figure 8: Number of bat calls for each species recorded on the acoustic detector placed at each pond ranked by water quality according to the EPA.

Conclusions

- Our results supported that **water quality influence water resource use by bats**.
- Site 1, the Rocky Creek Tributary was the only water source to be **lentic (moving)** and this may have **deterred bats.**
- Overall, the results suggest that resource use by bats in urban areas could be improved by **improving water quality.**
- It may, therefore, be possible to **better manage urban areas** to not only aid bats, but other wildlife species and the local community.

References

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Acknowledgements

Many thanks to:

- **Bat Lab** – Morgan Washington, Merritt Coleman, Taylor Craig, Gloria Serrano, Halia Eastburn, Aleah Appel, Iris Schmeder, Justyn Wallace, Kaitlyn Rousell, Maddie Rzucido, Kate Davis, Camila Price, Manuel de Oyarzabal, Jake Scruton and Matthew Froehlich.
- City of Fort Worth Parks and Recreation Department
- US Army Core of Engineers
- Depart of Environ & Sust Science and SERC for funding

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