

Investigating Bat Drinking Activity in Response to Variability in Water Surface Area

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Introduction

- Wildlife in urban areas provide essential **ecosystem services**.
- To encourage a diversity of wildlife, the resources wildlife require must be **available and accessible** (Kirk et al. 2021).
- **Water** is an essential resource for wildlife, but the availability and accessibility of water resources can be species-specific.
- For example, **bats access water sources while flying**, having to swoop down to the surface of the water to drink (Nystrom and Bennett 2019).

- Therefore, **water sources with smaller surface areas may be inaccessible to bats**.
- Further, the presence of **clutter**, including plants, rocks, and litter, **may decrease the available surface area** of the water.
- To explore the relationship between surface area and water accessibility, we conducted a study to assess the extent to which variation in water surface area affected bat drinking activity.



Figure 1: Bat drinking in flight.

Results and Discussion

- We conducted 15 surveys at each of our six sites. Bats were recorded drinking at all six sites.
- We identified six bat species: evening (*Nycticeius humeralis*), eastern red (*Lasiurus borealis*), silver-haired (*Lasionycteris noctivagans*), tricolored (*Perimyotis subflavus*), Mexican free-tailed (*Tadarida brasiliensis*) and hoary (*Lasiurus cinereus*).

Como

- Across all our sites, Lake Como **varied the most in surface area due to clutter** from vegetation, algae, and litter.
- These fluctuations in surface area influenced both bat presence and drinking activity.
- In particular, **maximum patch area and longest continuous stretch** had the strongest positive correlations with all five dependent variables (Figs. 6 & 7).

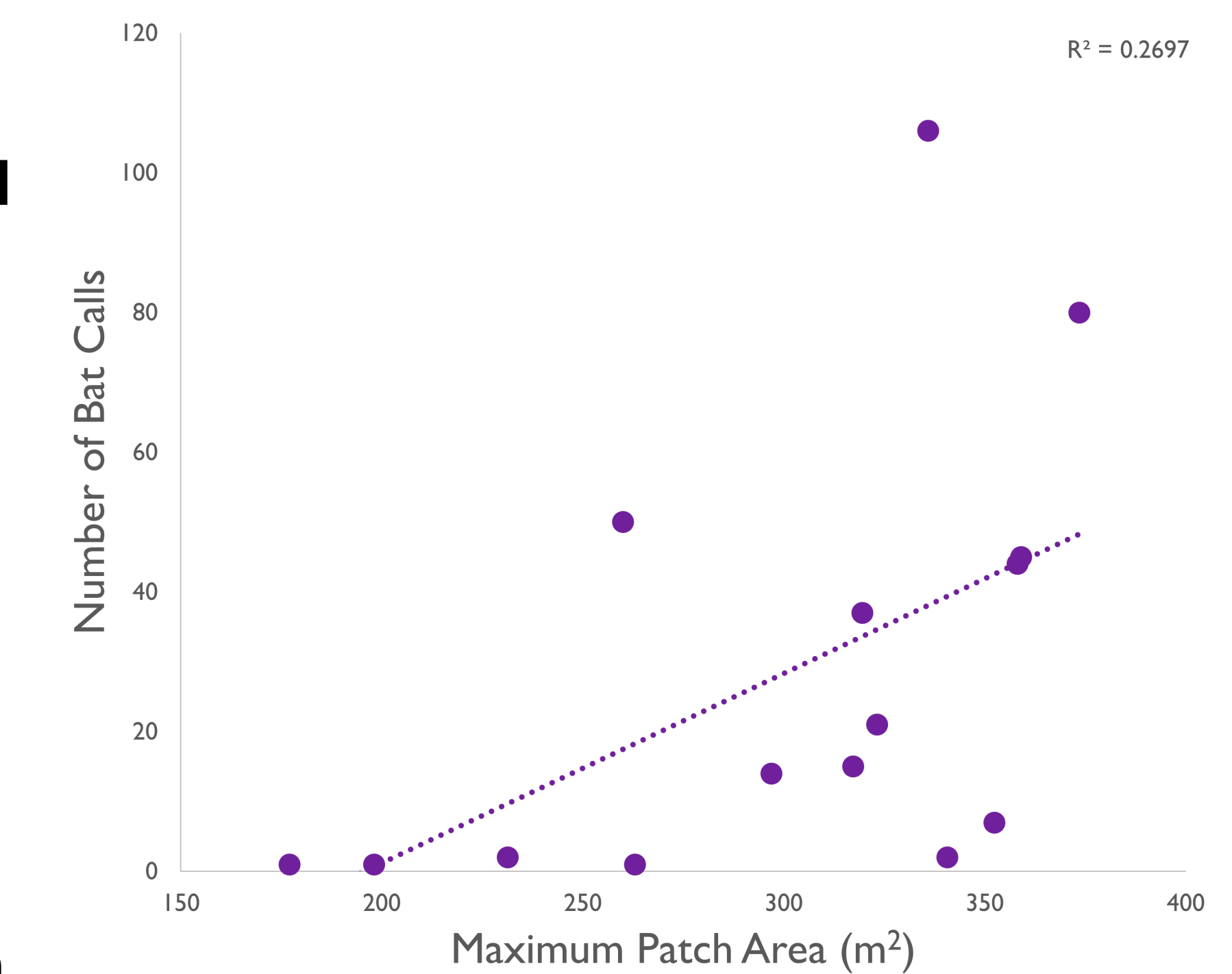


Figure 6: Relationship between number of bat calls and maximum patch area at Lake Como.

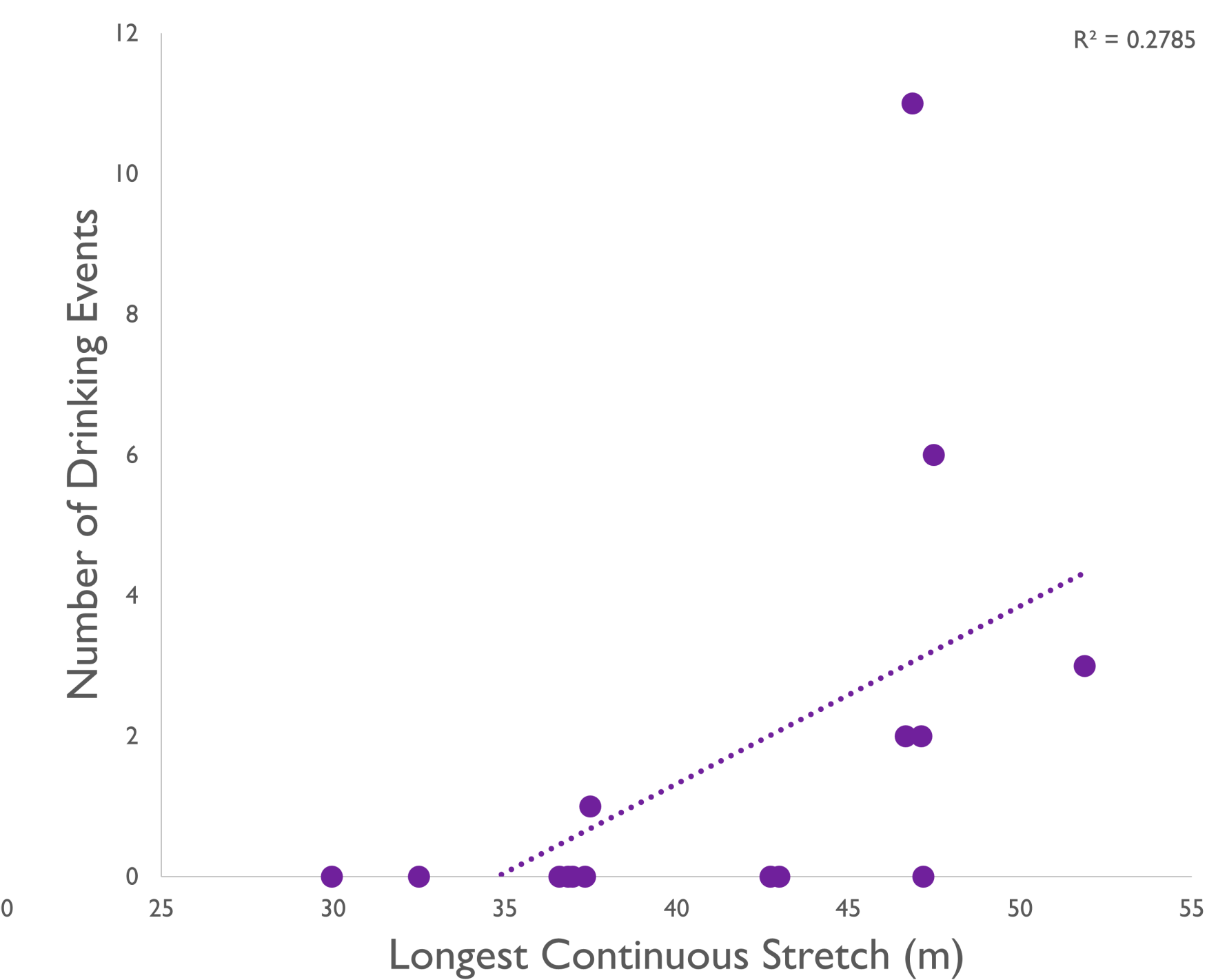


Figure 7: Relationship between number of drinking events and longest continuous stretch at Lake Como.

Foster

- Foster Park showed a **decrease in fundamental surface area** as the water source dried up but had little clutter, leaving maximum patch area constant with fundamental surface area (Fig. 8).

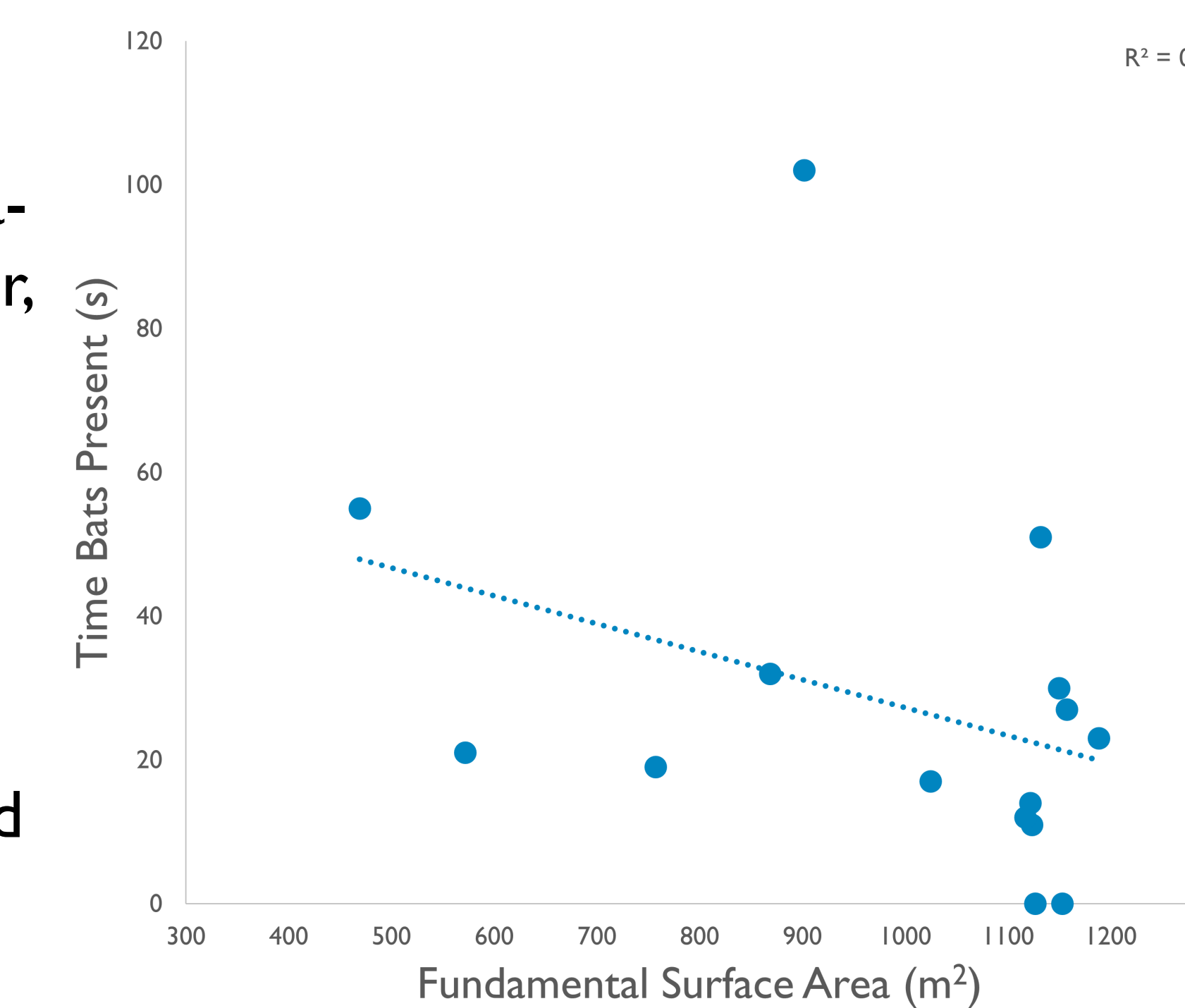


Figure 8: Relationship between time bats present and fundamental surface area at Foster Park.

Oakmont

- Oakmont Park had vegetation clutter along the water's edge, which decreased both fundamental and realized surface area, however there was **little variation in maximum patch size and longest continuous stretch** (Fig. 9).

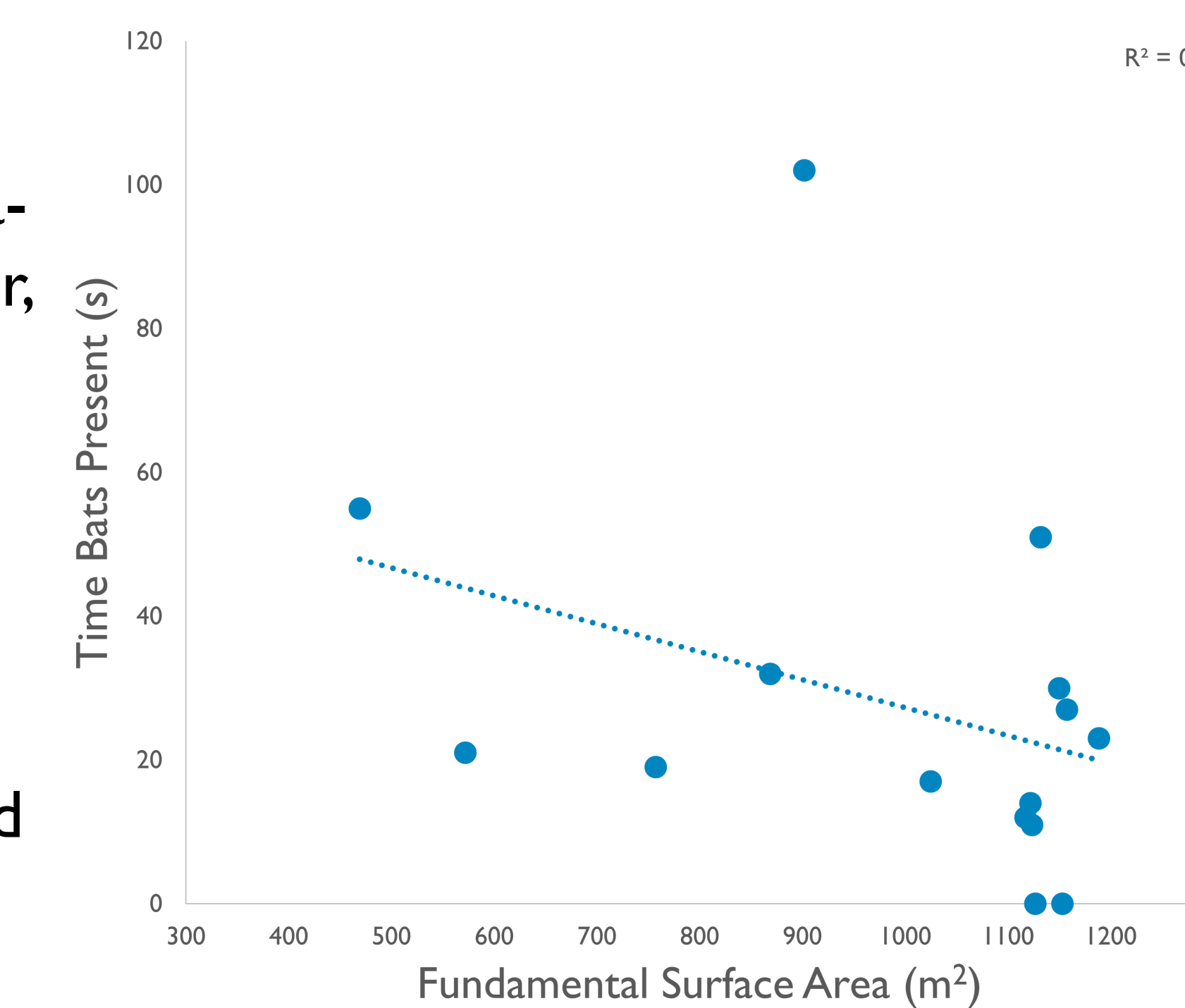


Figure 9: Relationship between time bats present and fundamental surface area at Oakmont Park.

- Our survey sites at Frat Pond and Rocky Creek had very little bat activity and negligible variation in activity. We concluded that bat activity at these sites was influenced by factors other than surface area.
- Trinity Park duck pond is maintained at a constant water surface area. Therefore, this site acted as a control to represent seasonal variation in bat activity.

Methods

Survey Sites

We selected six water sources in local parks in Tarrant County, Texas known to have bats (Fig. 2).

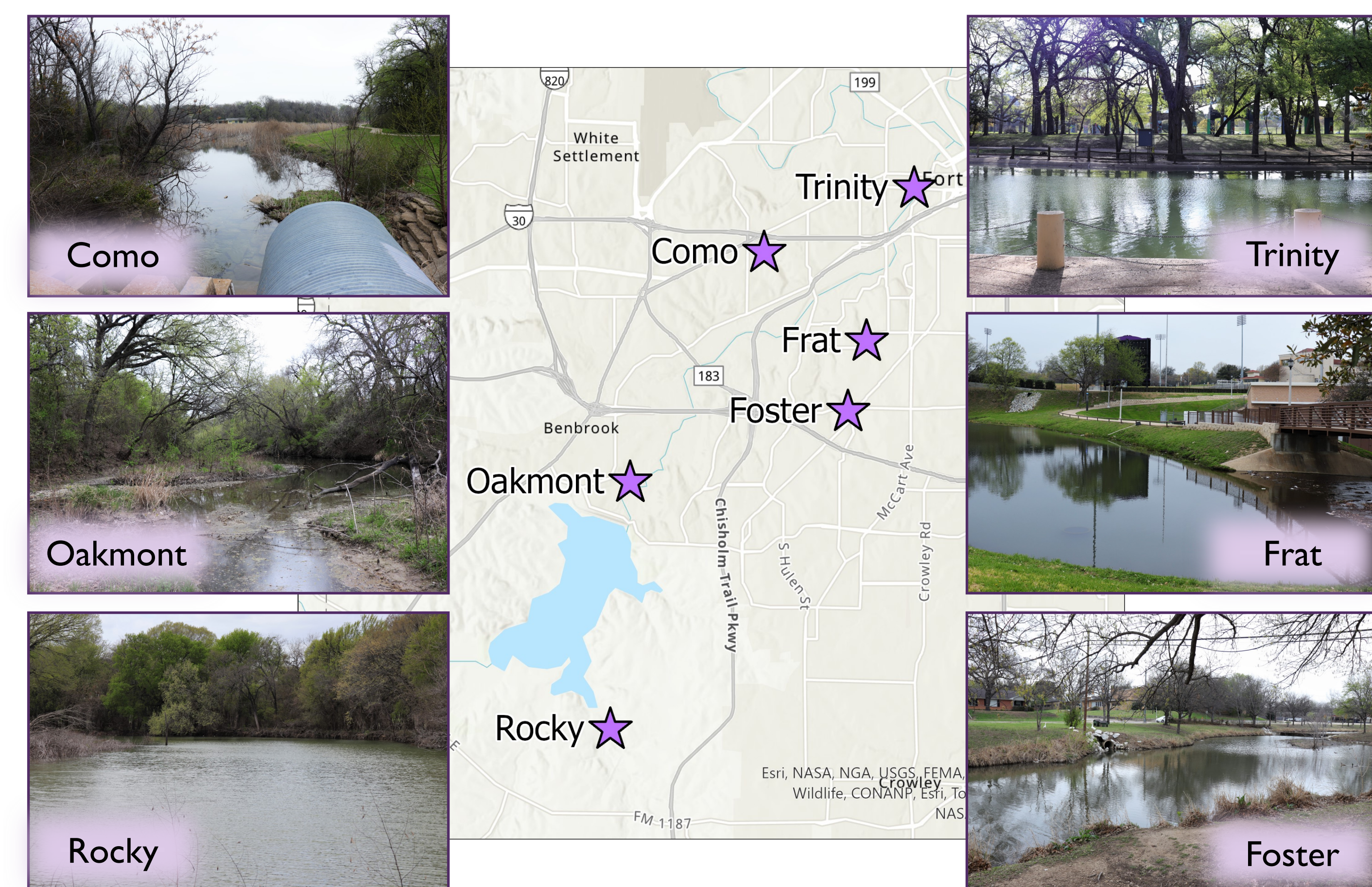


Figure 2: Locations of the six survey sites and associated view of each water source.

Data Processing

- We used Vosaic video analysis software to record bats present and drinking (Fig. 4).



Figure 4: Vosaic software with marked occurrences of bat activity.

- We used SonoBat call analysis software to identify species and drinking buzzes for calls recorded on the acoustic detector.
- We established five dependent variables: time bats present (secs), # drinking events, # bat calls, # drinking calls, and # species.

Surface Area Measurements

- We used a drone to record aerial imagery of each survey site from March to September 2023 (Fig. 5).
- We used Agisoft Metashape software to process drone imagery and measure our four independent surface area variables.
 1. Fundamental surface area (m²)
 2. Realized surface area (m²)
 3. Maximum patch area (m²)
 4. Longest continuous stretch (m)



Figure 5: Surface area measurements of drone imagery.

Behavioral Surveys

- We conducted behavioral surveys from March to September 2023.
- Surveys ran one hour after dusk to encompass the primary time bats are searching for water.
- We used a **thermal camera** to record bats drinking and an **ultrasonic acoustic detector** to record bat echolocation calls (Fig. 3).



Figure 3: Equipment setup for behavioral surveys.

Conclusions

- Our results indicate that available surface area impacts bat drinking.
- More specifically, our study confirmed that as available surface area is fragmented by clutter, it is the size and shape of these fragments that hinders bat drinking activity (i.e., fragments <250 m²).
- Continuous stretches of water uninterrupted by clutter are essential to encourage bat drinking activity.
- Decreases in fundamental surface area as water sources dry up may not influence bat activity when clutter is not present.
- Removing clutter can improve water resource access by bats.

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