

Does City Light Pollution Affect Migratory Bats?

Signature

Assignment

Trisha Melton + Jack Locker,
Rubenstein School of Environment
and Natural Resources, University
of Vermont

Hypothesis

We hypothesize that light pollution from major cities directly impacts nocturnal, migratory bats by forcing a shift in migratory patterns and altering diets.



Figure 1. photo by gizmodo.com

Predictions

- we predict that bats will avoid the LED lights (see figure 3).
- the LED will also alter the diet of the bats as bugs are drawn to the brighter lights where bats cannot go

Motivation

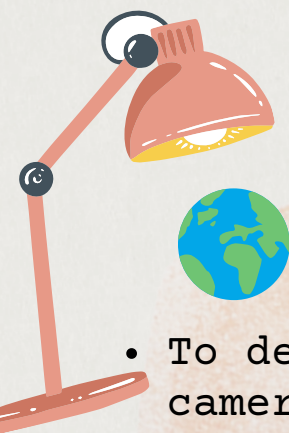
- As humans continue to develop and urbanize it is vital to accommodate for bat species losing their homes or landmarks. Not all light affects bats the same so experimenting with different colors determine what works best for the bats.
- **We propose to evaluate the best light option for migratory bats using multiple locations and light sources**

Background

- Migratory bats travel at night because they are nocturnal and therefore affected by light pollution (Mizon, 2012).
- Cities that exist along migration paths pose a challenge to bats especially, when energy saving LED lights are used (Stone et. al, 2012).

- It is important to start work now on combining sustainability and prevention of biodiversity loss (Stone et. al, 2012)
- Bugs have different attraction to the lights that will lead to a change in diet (Bollinger et. al, 2020)





Study Design

- To determine what lights bats prefer cameras will be set up in multiple locations, near LED lights, yellow (older lights), red lights and dark areas as a control along typical migration patterns.
- samples of types of bugs and amount of bugs will be measured at each light section during various times at night.
- we will set up three cameras for each light type (red, yellow, LED, no light) for a total of 12 cameras in each different locations (see figure 2).
- cameras will be located in **Frio Cave, Texas** and **Tuxtla Gutiérrez, Mexico** "Mexican freetail bat" (wiederholt et. al, 2013), **Copenhagen, Denmark** and **Kiel, Germany** "Soprano Bat" (Voight et. al, 2018), **London, England** and **Tangier, Morocco** "pipistrelles" (Voight et. al, 2018)
- this is an observational study aimed at collecting large amounts of data for statistical analysis through the use of replication

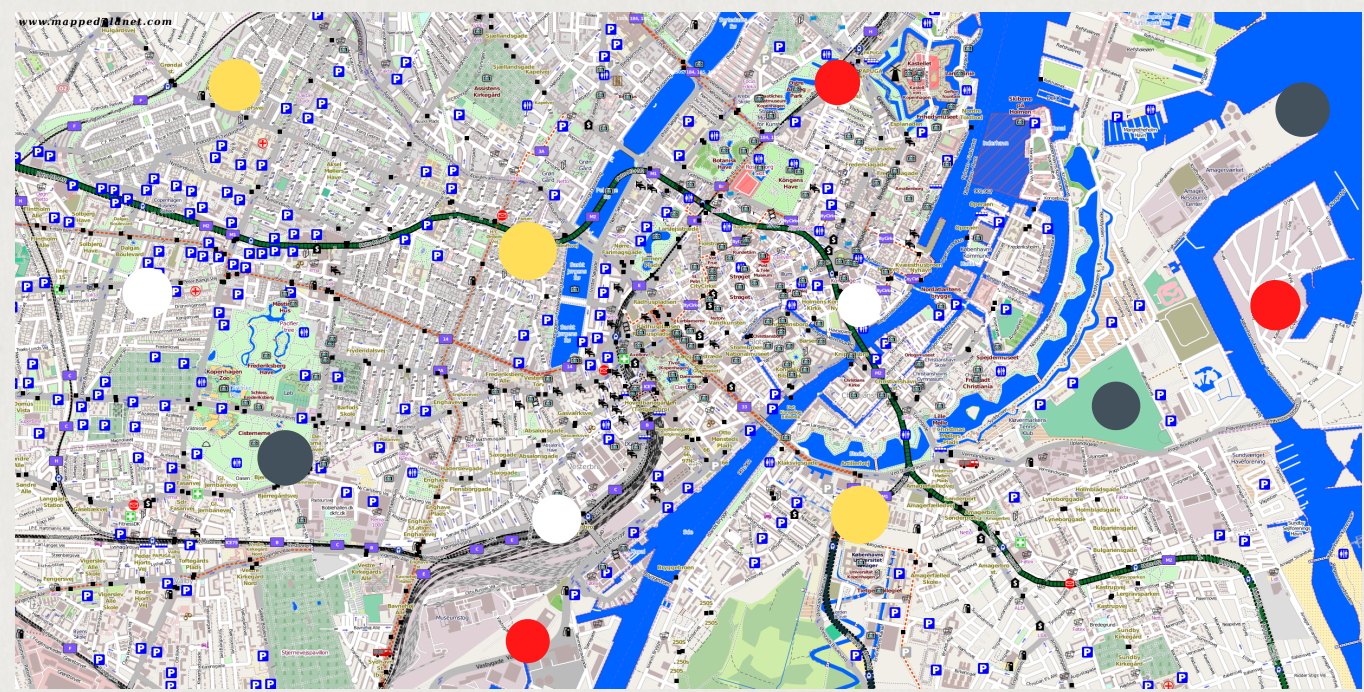
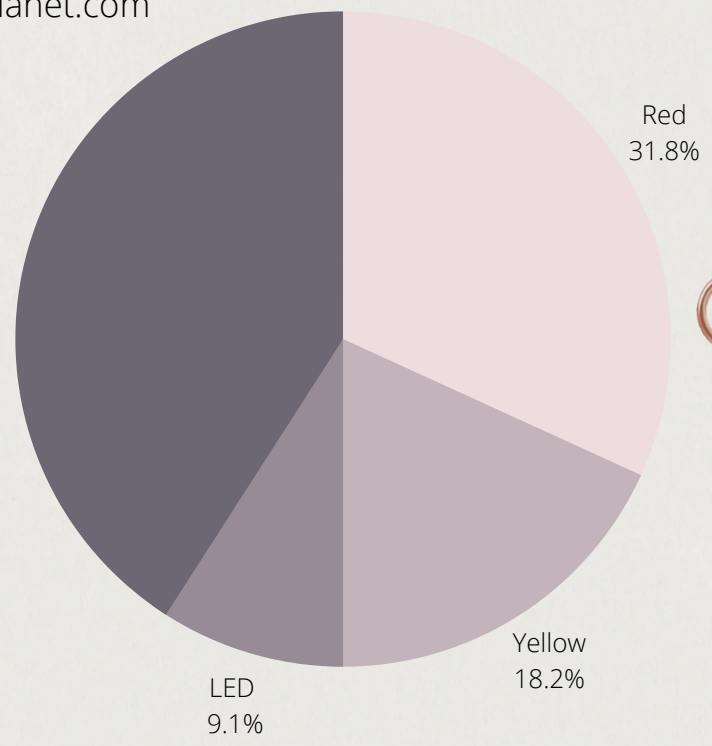


Figure 2: The city of Cohagen demonstrating where lights will be monitored. Each color circle on the map corresponds with the light that is being observed. photo by mappedplanet.com



Figure 3: A bat flies past a street lamp, demonstrating that bats do interact in urban scapes. photo by phys.org



Prediction of Bats Favorability Towards Various Lights

Figure 4; This pie chart demonstrates how we believe how much bats will enteract with the lights.

Intended Analysis

The independent variable (color of light) is categorical and the response variable (the amount of bats visiting each light) is continuous. To study the statistics, ANOVA will be used to accommodate for the multiple categories and determine the best light option. This study focuses on the correlation of bats behavior and light sources. The use of multiple locations and various species allows our study to be strong and able to make inferences about the general bat population.

Expected Benefits

Bats are extremely important to ecosystem because they control bug populations and help with pollination. It is essential to preserve migration routes and accommodate nocturnal bats globally. Our study will help to learn more about the growing problem of light pollution from cities around the world.

Literature Cited: Bolliger, J., Hennet, T., Wermelinger, B., Bösch, R., Pazur, R., Blum, S., Haller, J., Obrist, M.K. Effects of traffic-regulated street lighting on nocturnal insect abundance and bat activity. Basic and Applied Ecology 2020; 47: 44–56. Mizon, B. (2012). Light pollution: responses and remedies. Springer Science & Business Media. Stone, E. L., Jones, G., & Harris, S. (2012). Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. Global change biology, 18(8), 2458–2465. Voigt, C. C., Rehnig, K., Lindecke, O., & Petersons, G. (2018). Migratory bats are attracted by red light but not by warm-white light: Implications for the protection of nocturnal migrants. Ecology and evolution, 8(18), 9353–9361. Wiederholt, Ruscena & Cline, Jon & Cryan, Paul & Russell, Amy & Mccracken, Gary & Diffendorfer, Jay & Semmens, Darius & López-Hoffman, Laura & Medellín, Rodrigo & Cryan, P. (2013). Moving across the border: Modeling migratory bat populations. Ecosphere. 4. e114. 10.1890/ES13-00023.1. (Wiederholt et. al, 2013)