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**Utilizing Acoustic Monitoring to Measure Activity and Richness of Bats in Relation to Potential Influences of Pond Characteristics in East-Central, Wisconsin**

**Introduction:** Bats provide a plethora of valuable ecosystem services, including arthropod suppression, seed dispersal, and pollination, which increase human well-being (Kunz et al. 2011). Therefore, they are economically and environmentally important, which makes maintaining healthy and diverse populations invaluable (e.g. Boyles et al. 2011; Kasso and Balakrishnan 2013). However, bats rely heavily on aquatic habitats, predominantly as drinking and foraging sources, which have suffered drastic declines due to human-led intensification of both housing and agriculture development in the United States (Bohn and Kershner 2001). As a result, many studies have begun quantifying characteristics of aquatic habitats and then utilizing acoustic monitoring to investigate complete and species level differences in activity and richness of local bat species at the sites (e.g. Razgour et al. 2011; Straka et al. 2016).

Of the potential aquatic habitats to study in relation to bat conservation, perhaps the most valuable is the pond. Foundationally, ponds are shallow bodies of standing water in which light can penetrate to the bottom sediments. It has been estimated that 90% of all standing waterbodies on earth are ponds, and their artificial prevalence has been increasing rapidly (Downing et al. 2006). Additionally, implementation of artificial ponds has been shown to support bats in both urban and agricultural settings (e.g. Stahlschmidt et al. 2012; Ancilloto et al. 2019). However, much of the literature on pond characteristic preferences of bats has been developed outside of the United States, which necessitates research on the topic internally.

Here, passive acoustic monitoring was used to collect data on individual species activity and overall richness of bats at ponds found throughout Bubolz Nature Preserve and Heckrodt Wetland Preserve in East-Central Wisconsin. With this data, we aimed to quantify how bat species richness and individual activity varied across ponds of the region. Additionally, we recorded pond characteristics, namely canopy cover, surrounding vegetation density, surface water scale, average nightly temperature, and pond size with the aim of relating them to bat preferences through our acoustic data.

However, the quantification of these characteristics is complicated by the fact that bats vary immensely in echolocation behavior and flight morphology (Norberg and Rayner 1987).

For example, of the six species of bats, all within the family *Vespertilionidae*, found in the region, foraging behaviors vary from slow flight with maneuverability in clutter to fast flight open-aired hawking because of adaptive variability in wing-loading and aspect ratio measurements (Figure 1).

Therefore, quantifying habitat preferences throughout

**Sources**

Titley Electronics, Ballina, Australia

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Because of this considerable species variation, formulating one single hypothesis to capture pond preferability was not plausible. Therefore, we developed four hypotheses aimed to capture species specific preferability. The first two hypotheses attempt to capture expected richness differences between sites, while the second two attempt to explain differences in activity levels overall. Firstly, we hypothesize that ponds with low canopy cover, surrounding vegetation density, and surface water scale measurements and high pond size and insect densities would be rich in bat species with high aspect ratios (i.e. *L. cinereus*, *L. borealis, L. noctivigans, & E. fuscus)* because they primarily forage on insects in through open-aired flight. Secondly,