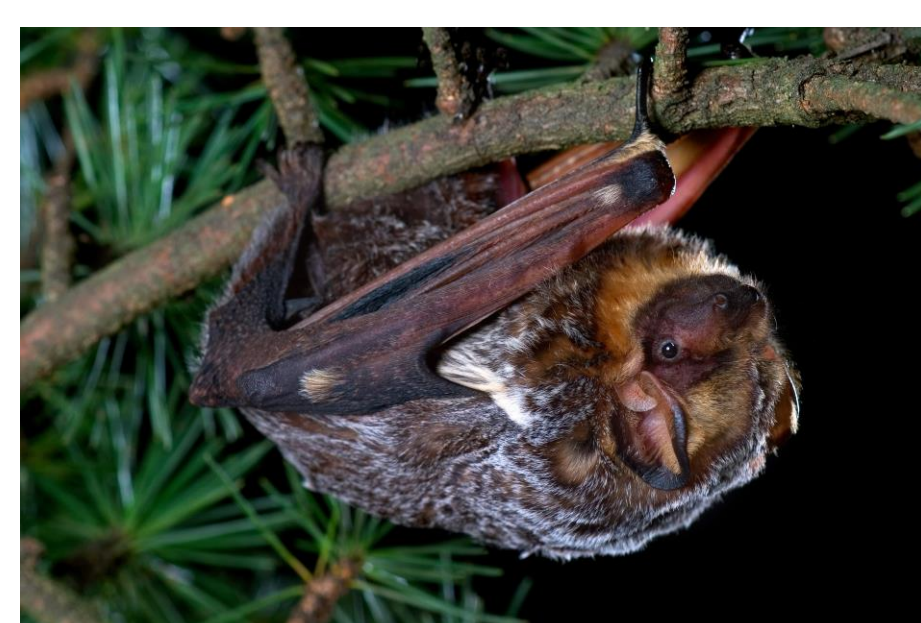


Utilizing Bioacoustics to Study the Elusive Habits of Bats in North-Temperate Forests

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Hoary Bat
(*Lasiurus cinereus*)



Eastern Red Bat
(*Lasiurus borealis*)



Big Brown Bat
(*Eptesicus fuscus*)



Little Brown Bat
(*Myotis lucifugus*)



Northern Long-eared Bat
(*Myotis septentrionalis*)



Tri-colored Bat
(*Perimyotis subflavus*)



Introduction

Bat research and conservation have become a focus of attention in New England as our insectivorous bats face many challenges (human impacts, disease, climate change).

This project aims to monitor the seasonality and relative abundance of bats at forested ponds with passive acoustic recorders, providing a novel long-term dataset for analysis of echolocation and communication signals to answer new questions regarding bat behavior and ecology.

Methods

Beginning 2015, I deployed a high frequency acoustic recorder on Mirror Lake. Every night, 6pm-6am, from early May to mid-November. The detector would record 20 sec recordings containing bat sounds.

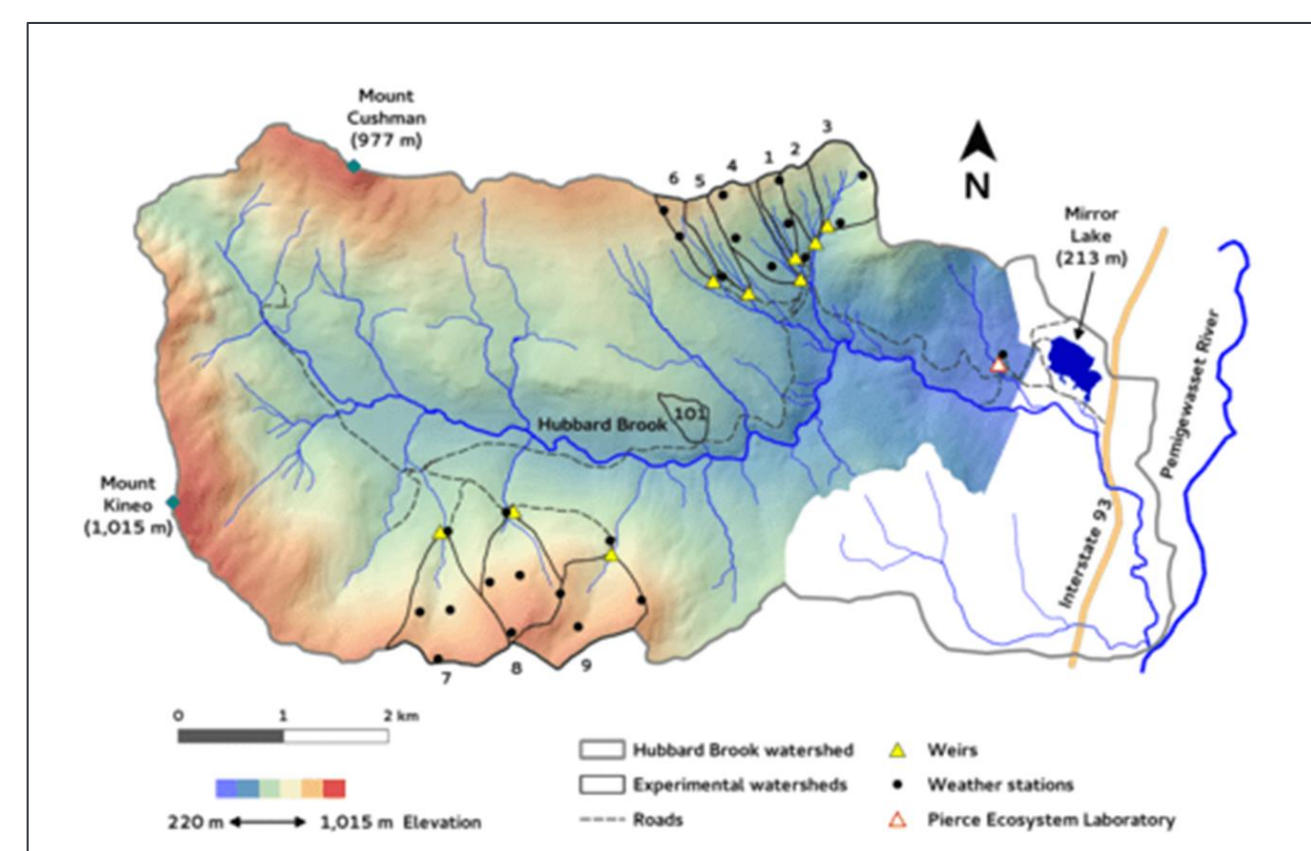


Figure 1 (right). Map of Hubbard Brook Experimental Forest (HBEF)

Acoustic Data & Analysis

Bat echolocation calls were species identified using SonoBat & quantified on a nightly scale.

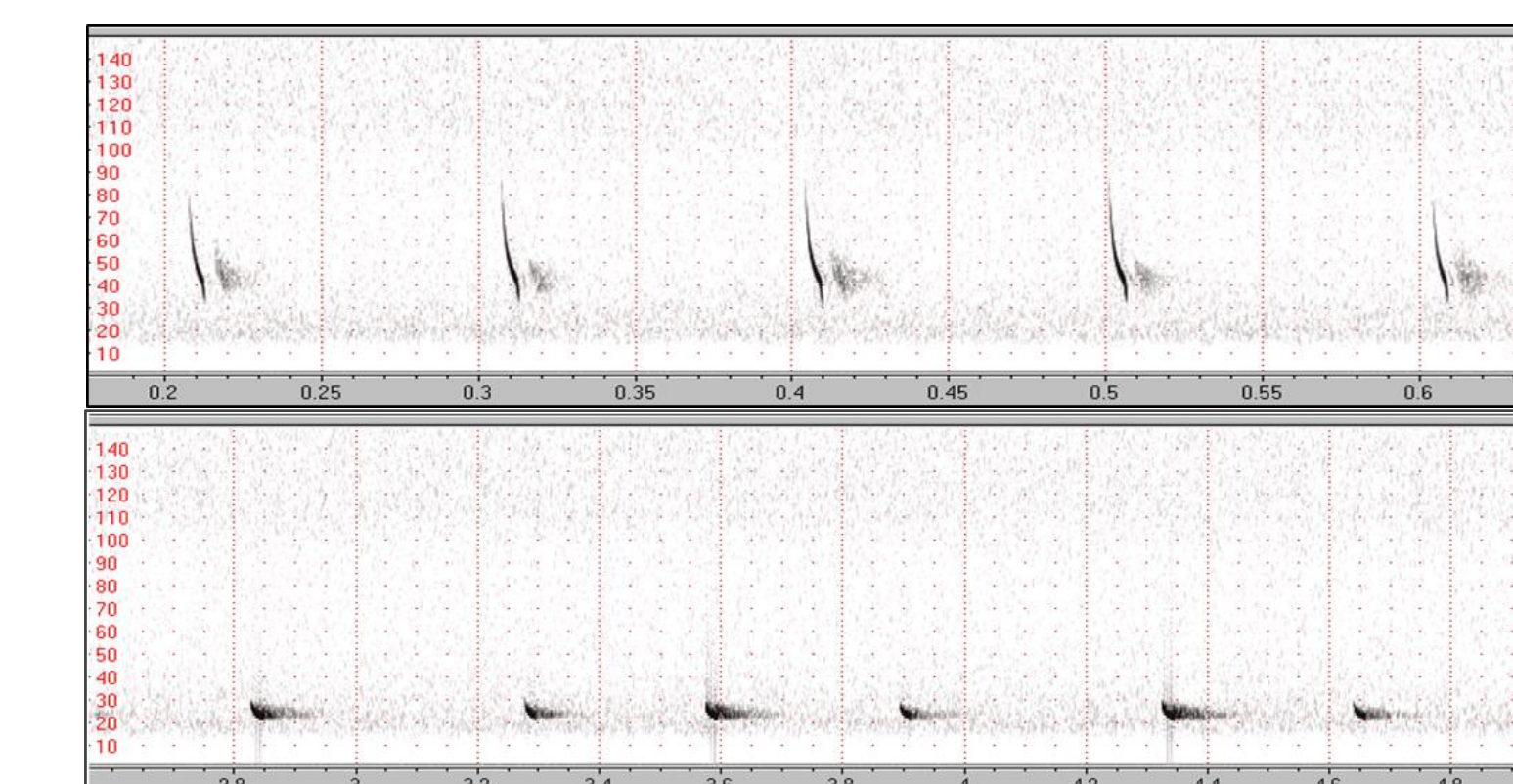


Figure 2 (left). Echolocation calls for Little Brown bat (above) and Hoary bat (below).

Main findings on bat activity over a forested pond in NH White Mtns:

1. All **8 bat species** were detected
2. Activity levels **varied interannually** but showed **predictable seasonal** (intra-annual) **patterns**.
3. Some species use the pond more at distinctly different times of the year.

Results

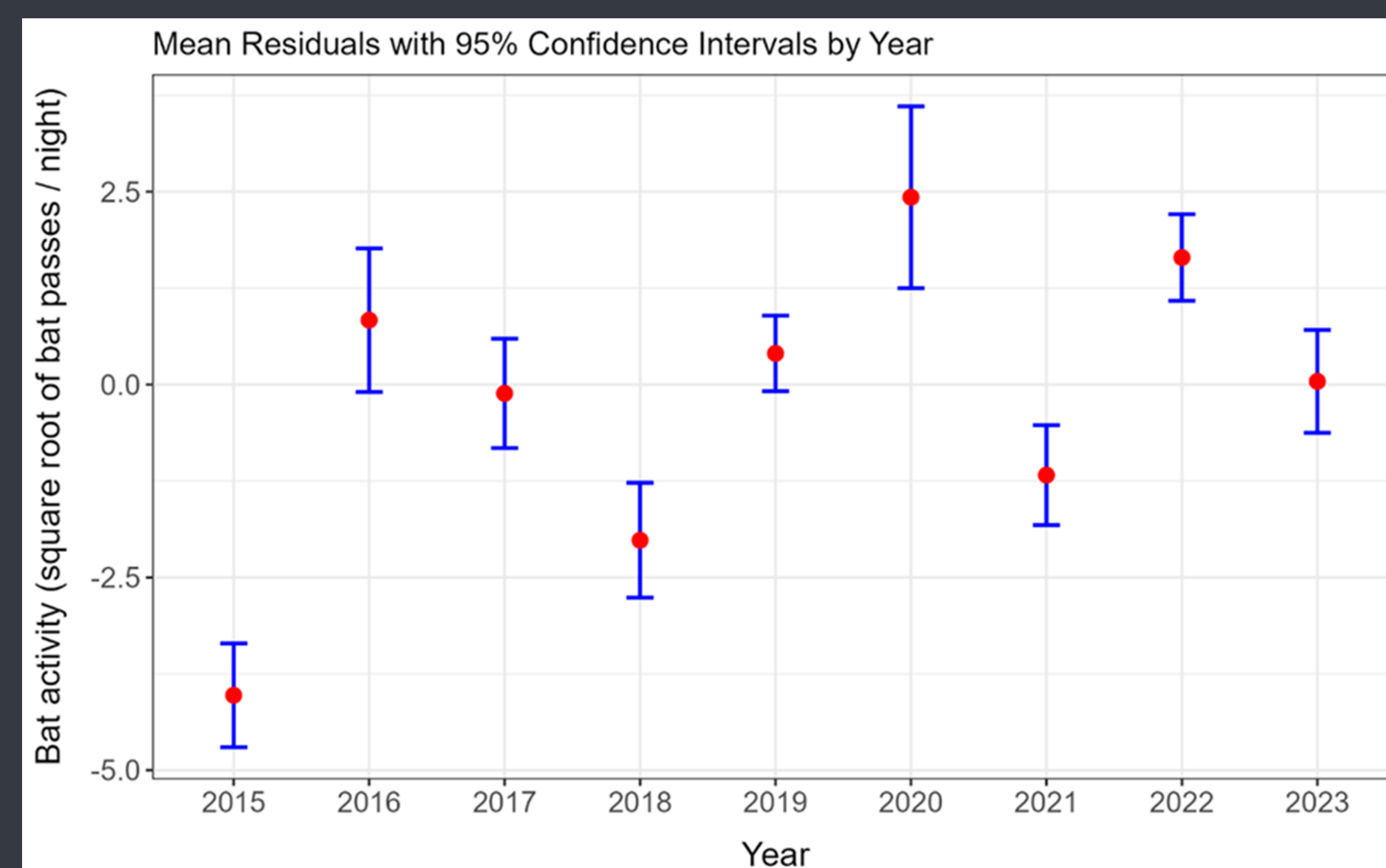


Figure 3 (above). Residuals derived from nightly means in comparison to the model line in **Figure 4 (below)**. Big Brown bat phenology.

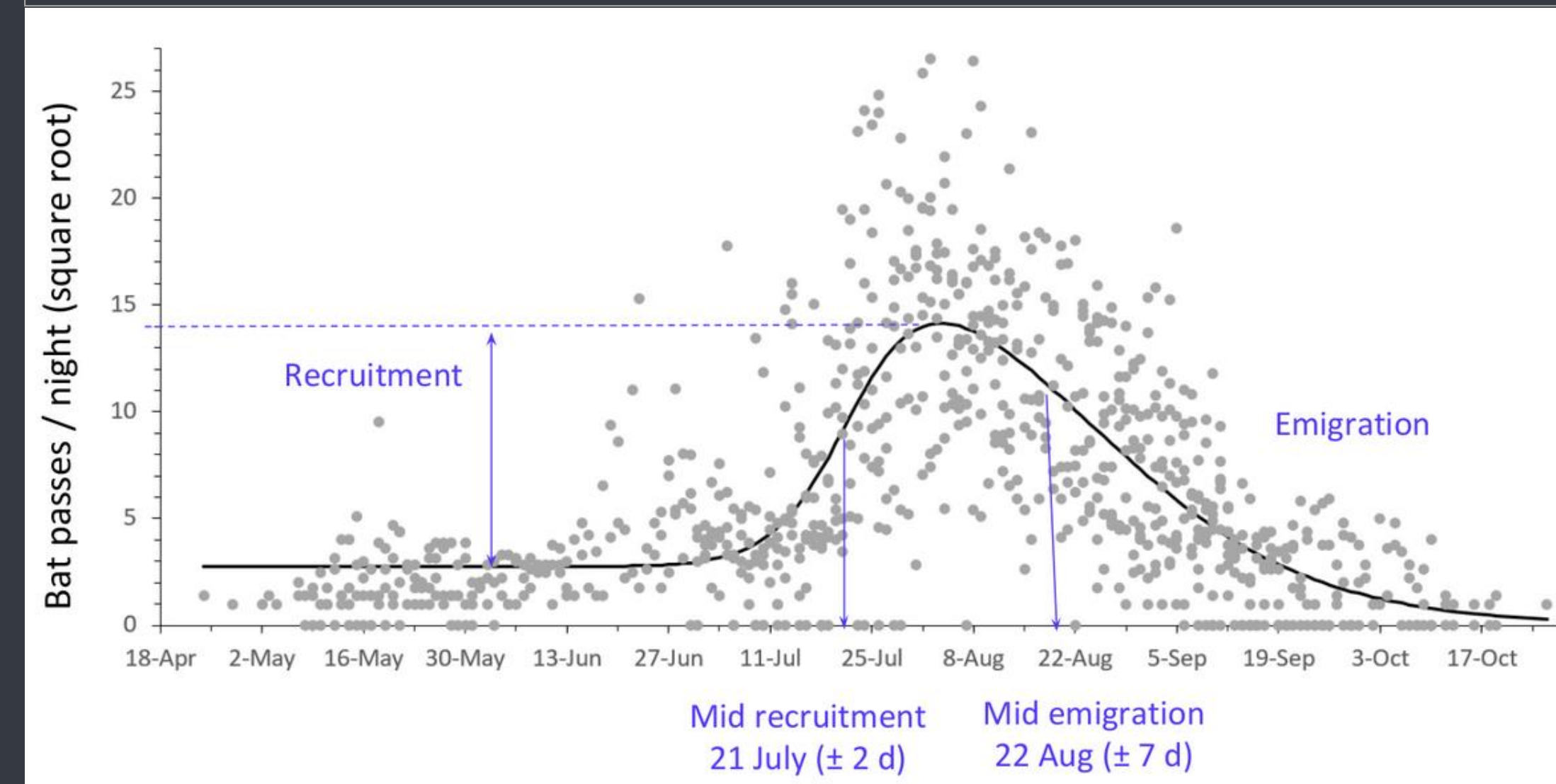
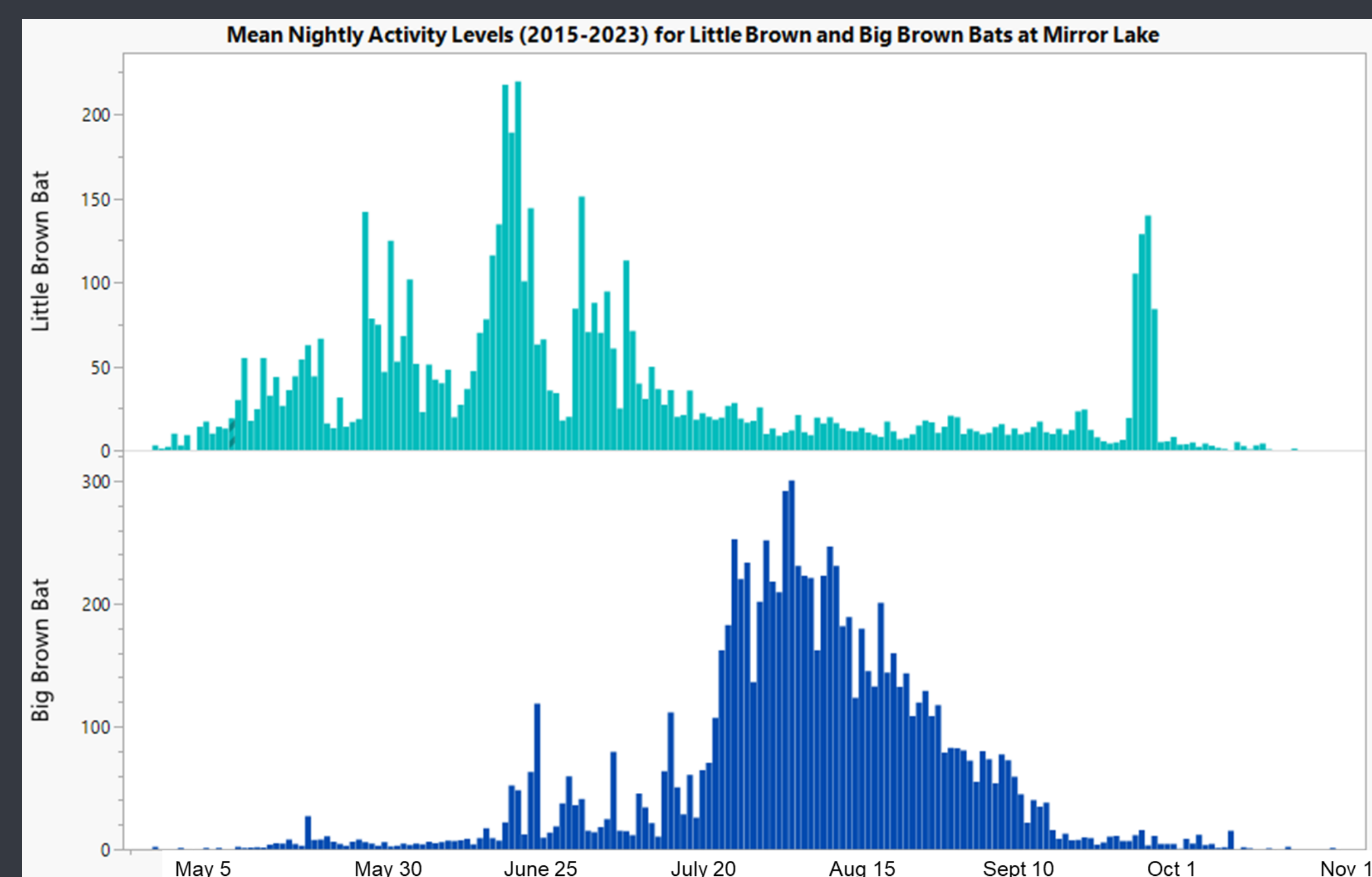


Table 1. Leaderboard for number of files with confirmed species ID in 2015-2023 acoustic dataset from Mirror Lake in HBEF.

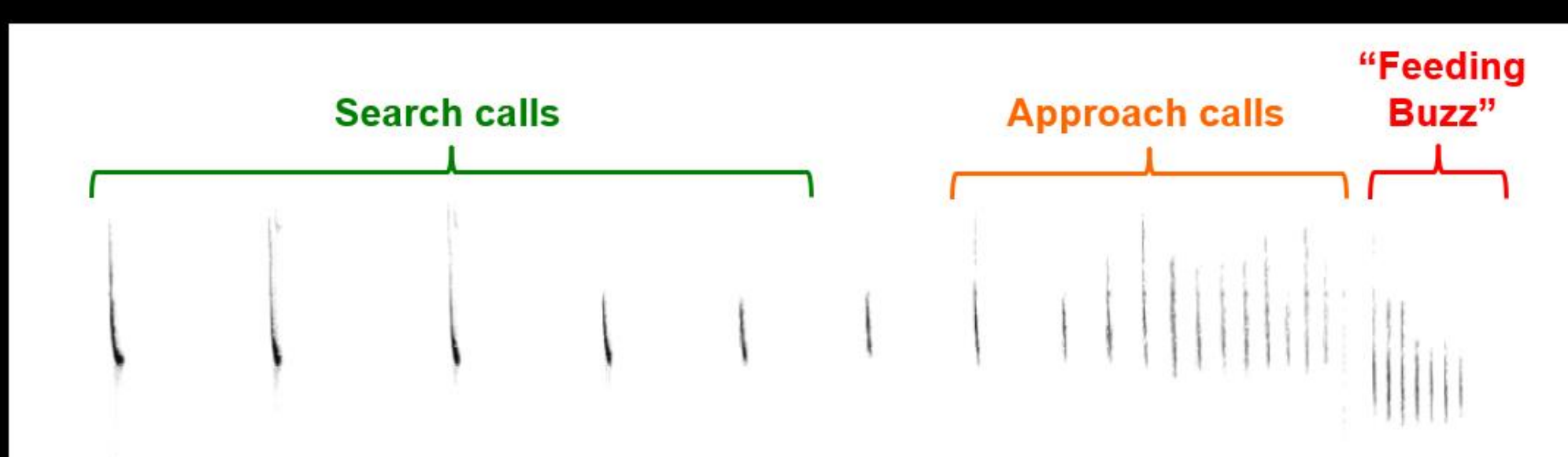
| Rank | Species CODE | Common Name | Total Rec (#) |
|------|--------------|-------------------------|---------------|
| 1 | EPFU | Big Brown bat | 60683 |
| 2 | MYLU | Little Brown bat | 22992 |
| 3 | LANO | Silver-haired bat | 15964 |
| 4 | LACI | Hoary bat | 11554 |
| 5 | LABO | Eastern Red bat | 3068 |
| 6 | PESU | Tri-colored bat | 948 |
| 7 | MYLE | Small-footed bat | 384 |
| 8 | MYSE | Northern long-eared bat | 145 |



Key Terms

- **Phenology:** the study of the annual timing of biological events.
- **Migratory bats:** are species that go south in the fall to overwinter and return to NE in the spring.
- **Hibernating bats:** are species that go dormant in hibernacula during the winter.
- **Niche partitioning** refers to the process by which different species in the same habitat divide resources (food, time, space).

Example of a slowed-down recording of the echolocation calls produced by a bat catching an insect in flight



Future Directions

- Determining the potential drivers to the differential temporal patterns found across bat species at the pond:
 - Movement ecology
 - Roosting ecology
 - Foraging ecology
- Does seasonality of species vary across ponds?
- What does bat seasonality look like at other habitats? Forests? Farms?
- Integration of insect (prey) data
- How can we better understand the strategies used by bats to forage optimally in heterogenic landscapes across changing seasons with dynamic resource waves?

References
Brooks (2011), Fenton (1997), Ford et al (2011), Jones et al (2009), Loeb et al (2015)

Jones et al. (2025) Calling activity of Bats in the White Mountain National Forest: Manifest of ###,### high frequency acoustic recordings from various habitats in and nearby Hubbard Brook Forest: 2015 – 2023. In prep.

Photos originated from the following: BCI, NABat, USFWS