

Citizen Scientist-Naturalist Training on Bats at Mount Auburn Cemetery

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What are bats?

- Bats are mammals of the order Chiroptera
- Forelimbs form webbed wings, making them the only mammals naturally capable of true and sustained flight.
- Second largest order of mammals
- The less specialized and largely fruit-eating megabats, or flying foxes, and the highly specialized and echolocating microbats
- About 70% of bat species are insectivores. Most of the rest are frugivores, or fruit eaters. A few species, such as the fish-eating bat, feed from animals other than insects, with the vampire bats being hematophagous, or feeding on blood.



Giant golden-crowned flying fox, *Acerodon jubatus* (source: Wikipedia)

Myotis lucifugus (the little brown myotis)



•Photo by Thomas Kunz





What do bats do?

- Bats are present throughout most of the world, performing vital ecological roles of pollinating flowers and dispersing fruit seeds.
- Many tropical plant species depend entirely on bats for the distribution of their seeds.
- Bats are economically important, as they consume insect pests, reducing the need for pesticides.

Why study bats?

- In general, bats are ideal **models** for investigating factors related to **variation** in **BMR**
- Bats are **facultative endotherms** that are capable of physiological temperature regulation, but they do not consistently maintain an elevated body temperature.
- Seasonally, heterothermic temperate bats like *E. fuscus* and *M. lucifugus*, which **hibernate**, experience **physiological changes** due to changes in hormone levels and energy use for maintenance metabolism, reproduction, immune function and thermoregulation
- When including the effects of flight and reproductive changes like pregnancy, the range of physiological and metabolic changes that a small temperate zone bat like *E. fuscus* and *M. lucifugus* undergoes is great
- Making it a useful species for the study of studying variability in metabolic rate and related physiological variables including immune function and response to diseases like white

Urban Wildlife Refuges

80% of the world's population currently living in urban areas

Models for successful urban wildlife refuges are desperately needed

Cemeteries are an overlooked potential wildlife refuge common to most cities



Mount Auburn Cemetery

175-acre site

“Silent City” : 98,000 people buried or commemorated

Founders envisioned it as a garden cemetery

Unique and iconic urban ecosystem

Commitment to sustainability



Biodiversity survey: Bats

- Acoustic detection
- Mist netting
- Identifying flight corridors



Mist Net



•Photo by Bat Conservation and Management

Harp Trap



•Photo by Bat Conservation and Management

Evidence of bats at Mt Auburn Cemetery

- **Big brown bat:** acoustic detection, visual confirmation, live capture
- **Eastern red bat:** acoustic detection, visual confirmation
- **Hoary bat:** acoustic detection
- **Little brown myotis:** acoustic results

eastern red bat (*Lasiurus borealis*)





Hoary Bat (*Lasiurus cinereus*)



White-Nose Syndrome

- Millions of bats have died since 2007.
- A fungus, *Pseudogymnoascus destructans*, is the cause.
- The following pictures show its impact at an important hibernaculum in Vermont.
- WNS Research done in Thomas Kunz lab by Jon Reichard, Marianne Moore, Nate Fuller and me (Biology Department, Boston University)



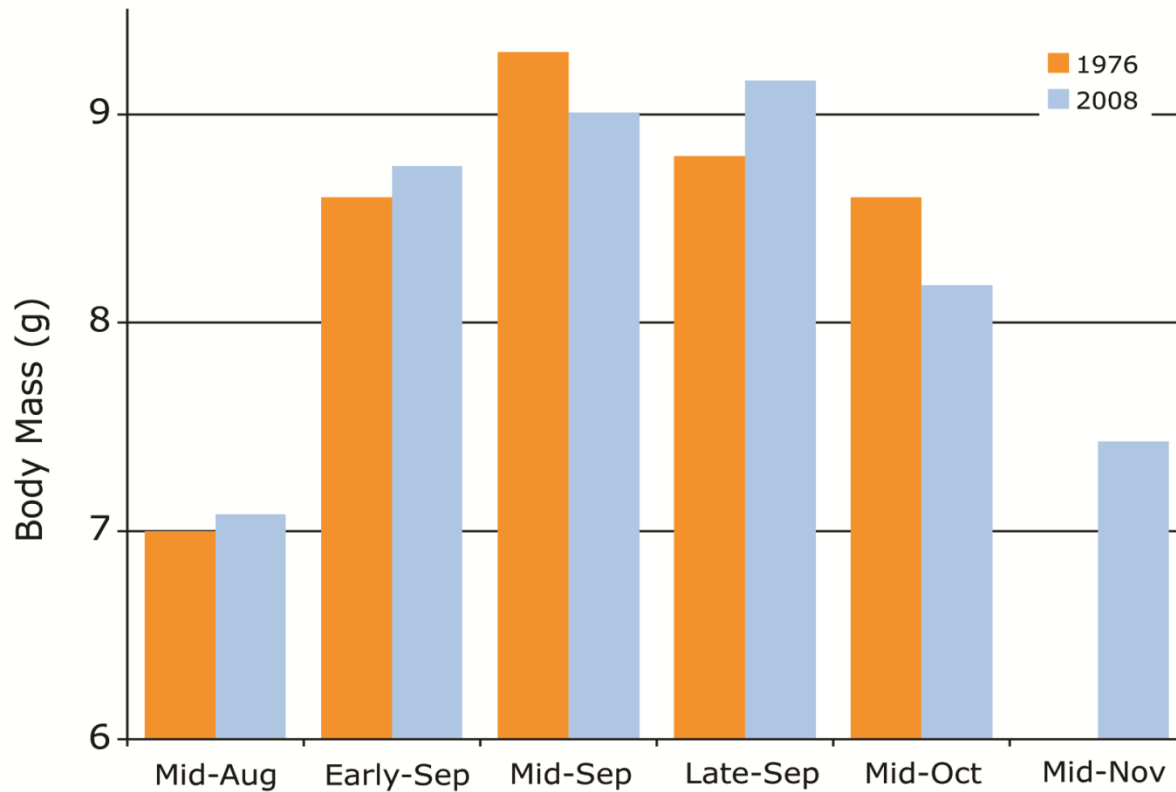




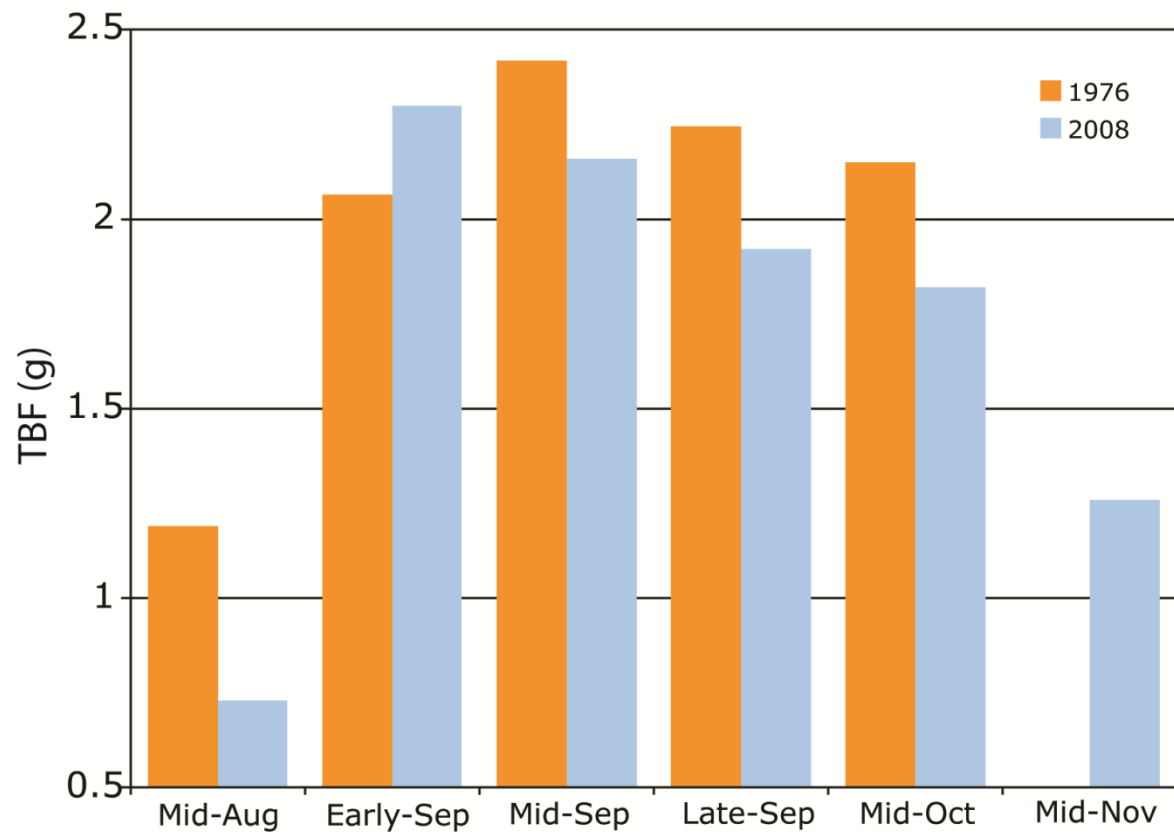




Mt. Aeolus, Vermont



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Ecological Immunology

- Examines the **underlying** causes of variation in immune function between individuals or populations
- Examines life history **trade offs**
- **Costs of Immunity**
- Role of Environment: Impact of **Urbanization?**
- Trade offs among immune components