



[Western Ecological Research Center \(WERC\)](#)

## Bat Research in California

The primary goal of this bat research program is to develop projects that increase our understanding of basic ecology and natural history of western bat species, while simultaneously providing needed data to inform conservation measures and management decisions in the West. Dr. Brian Halstead, together with Gabriel Reyes, studies the habitat and resource selection, movement ecology, demography, and basic ecology and natural history of bats throughout the West. He also studies the winter ecology of bats in the west, which remains a poorly understood aspect of natural history which is hampering conservation and management.

Bats are a poorly understood group of mammals, despite their acknowledged importance for insect control, pollination, and other ecosystem services. Many bat species are rare, declining, or have unknown population sizes and trajectories, and without better information, it is difficult or impossible to develop effective bat conservation strategies. Bats in the western U.S. face historical and ongoing challenges, including habitat loss and alteration and disturbance, as well as emerging threats including increased wind energy development, climate change, and emerging invasive diseases such as white-nose syndrome (*Pseudogymnoascus destructans*, Pd). Addressing these historical and emerging conservation threats requires developing our understanding of natural



Status - Active

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history (e.g., behavior, ecology, habitat use and selection), baseline population trends (which species are currently increasing or declining or stable), and focused study of how bats respond to emerging threats (e.g., fatality rates from wind-energy development, how western bats may respond to arrival of Pd). Because so little is known about the majority of bats, resource managers often must make management decisions with inadequate data which can result in poor use of scarce monetary resources, costly energy and environmental policy decisions, and unintended consequences for bats. However, as awareness of bat conservation is increasing, there are many opportunities to provide better information to resource managers that results in improved bat conservation. Our monitoring and surveillance of bats in the west will be integrated with larger bat monitoring efforts including the USGS NABAT monitoring program. Obtaining this information is imperative for resource managers to conserve bats and maintain their role in functioning ecosystems.



Dr. Brian Halstead, gestures to the Randall House, now abandoned, constructed in the early 20th century. The house is now maintained by the National Park Service as a maternity roost for Townsend's Big-Eared bats. (Credit: Xochitl Rojas-Rocha, USGS Western Ecological Research Center. Public domain.)

and open spaces in Marin County. Roosting ecology is poorly understood for the majority of bat species, which hampers management and conservation efforts. We are continuing work initiated by Gary Fellers on bat distributions and expanding our research of roosting ecology of Townsend's big-eared bats to a larger suite of species in the region. Roosts of many forest dwelling bats are poorly described, and are an important limiting

Julia Ersan and Gabe Reyes process a bat after retrieving it from a mist net.

### Townsend's Big-eared Bats

We use roost counts to estimate the abundance and annual reproduction of two maternal roosts of Townsend's big-eared bats (*Corynorhinus townsendii*) at Point Reyes National Seashore and Golden Gate National Recreation Area. At each roost, bats can only enter and exit through a single small (15 cm x 60 cm) opening to facilitate counting bats as they exit the roost. To count bats, a trained observer counts bats using night vision technology and a handheld computer with tactile buttons specifically programmed by Gary M. Fellers to create a time stamp for each individual bat exit from or entry into the roost. Counts in the spring, especially May and June, are indexes to the abundance of females in the maternity roost; those in late summer and fall, especially July and August, include volant young in addition to adult females.

### Marin County Bats

We are studying the roosting ecology and distribution of California bats in national, state and county parks

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resource for most bat species. Bat roosts are vital habitat components for reproduction, social behavior, overwintering, and survival. However, tree-roosts are also often ephemeral, and extremely difficult to identify, leading to difficulty describing the roost requirements necessary to identify and protect potential roosts. . Expanding our knowledge of the roosting ecology of California bats will help with management and conservation efforts, and will also tie into efforts to understand the potential effects of roosting ecology on susceptibility to white-nose syndrome.

We have joined [OneTam](#), a group of multiple agencies and landowners, in an effort to fill information gaps identified in the 2016 One Tam health assessment. The Mount Tamalpais area of Marin County potentially supports 13 species of bats. This study focuses on documenting the occurrence, habitat relationships, and roosting sites of these bats, Gabriel Reyes leads an effort (with a lot of agency and volunteer help) to document bat occupancy with acoustic monitoring and mist netting. Future plans to add a radio telemetry to track bats and better understand maternity and winter roost selection of bats. The roost sites are important, because they are often a finite resource limiting maternity roost establishment and overall bat populations, and are a large contributor to the vulnerability of bat populations to white-nose syndrome.

We are also conducting acoustic monitoring across Marin County to document nocturnal foraging habitat associations and distributions of bats. Bat detectors record ultrasonic vocalizations which we can identify to species or species group using software and visual comparisons to reference calls.

Bats produce a variety of vocalizations that are used for navigation, feeding, and social communication. Most vocalizations are pitched well above the range of human hearing and are referred to as ultrasonic. These calls are often known as echolocation calls since bats use the echoes produced when a sound bounces off a bug or a building to determine what is in the area. Select a vocalization type from the list below to hear examples of the calls.



This device collects vocalization emitted by bats. Scientists use the recordings from these devices to determine what species are using the area. (Credit: Gabe Reyes, USGS, WERC. Public domain.)

### White-nose Syndrome (Pd)

White-nose syndrome (*Pseudogymnoascus destructans*, Pd) was recently detected in the West in Washington State, and resource managers are realizing how little we know about hibernacula, and how this lack of knowledge is hampering monitoring and management decisions. Studying winter ecology and hibernacula use of bats, and how habitat conditions may affect exposure and survival of western bats may help us understand the potential effects of Pd on bats throughout California and the West Coast. We will rely on field data collection, including radio-tracking bats to hibernacula, use of data loggers to monitor environmental conditions, and lab work in collaboration with the [USGS National Wildlife Health Center](#) to study Pd survival and growth under varying conditions. In addition, we will aid other agencies with Pd surveillance in the West by capturing and swabbing bats on their lands. This research will help identify which bat species and in which regions will be most affected by Pd, and develop management plans to address potential effects.



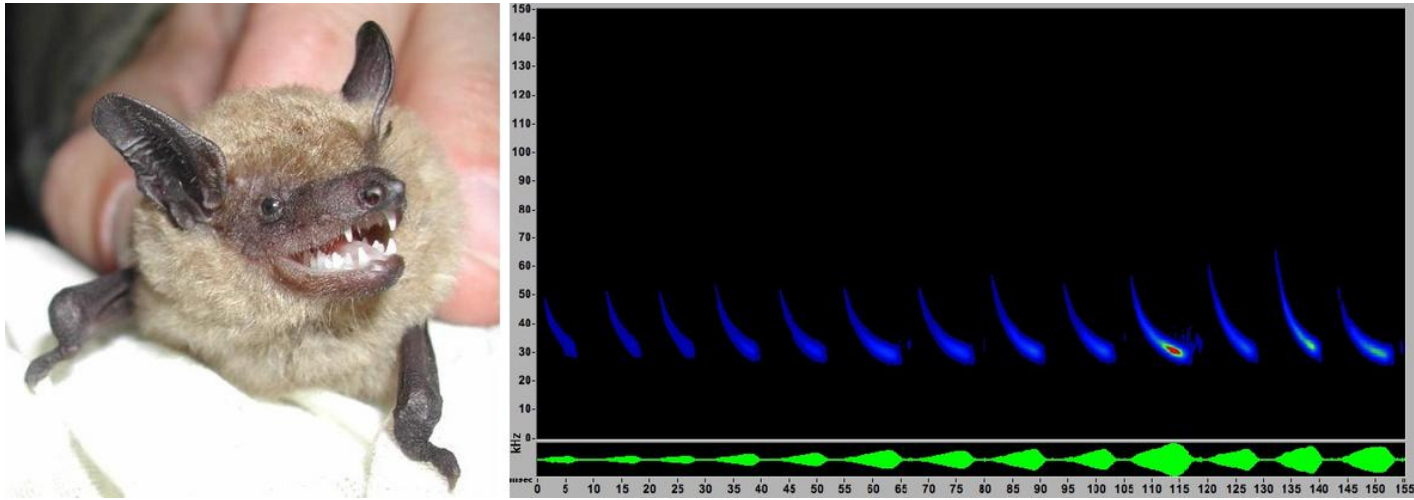
### Migration

Migratory bats are poorly understood, and have been suffering high fatality rates at wind energy facilities. Understanding the effects on populations, developing mitigation and operational strategies to reduce fatality rates, and ensuring bat conservation has been hampered by a general lack of understanding of the basic ecology, behavior, and distribution and movement patterns of migratory bats of the genera *Lasiurus* and *Lasionycteris*. Developing effective mitigation and management strategies will become even more important as wind energy is expected to dramatically increase in the future.

**Bat calls, below, are time expanded to 10 times slower and at a lower frequency than normal since the calls are outside of our hearing range.**

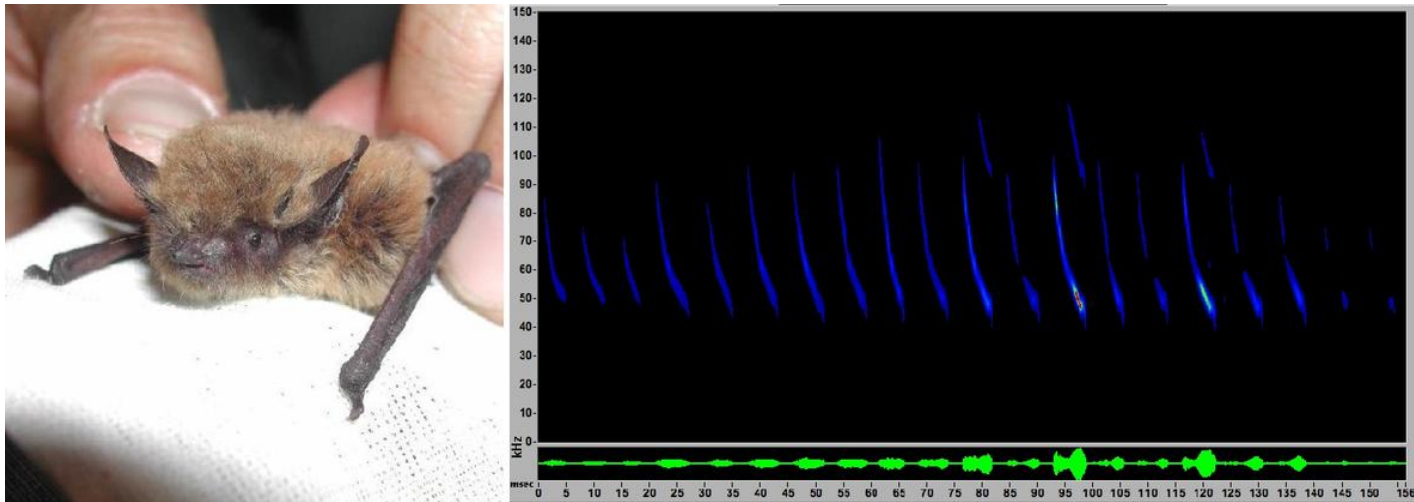
### Big Brown Bat (*Eptesicus fuscus*) Search Call

- [Audio file](#)



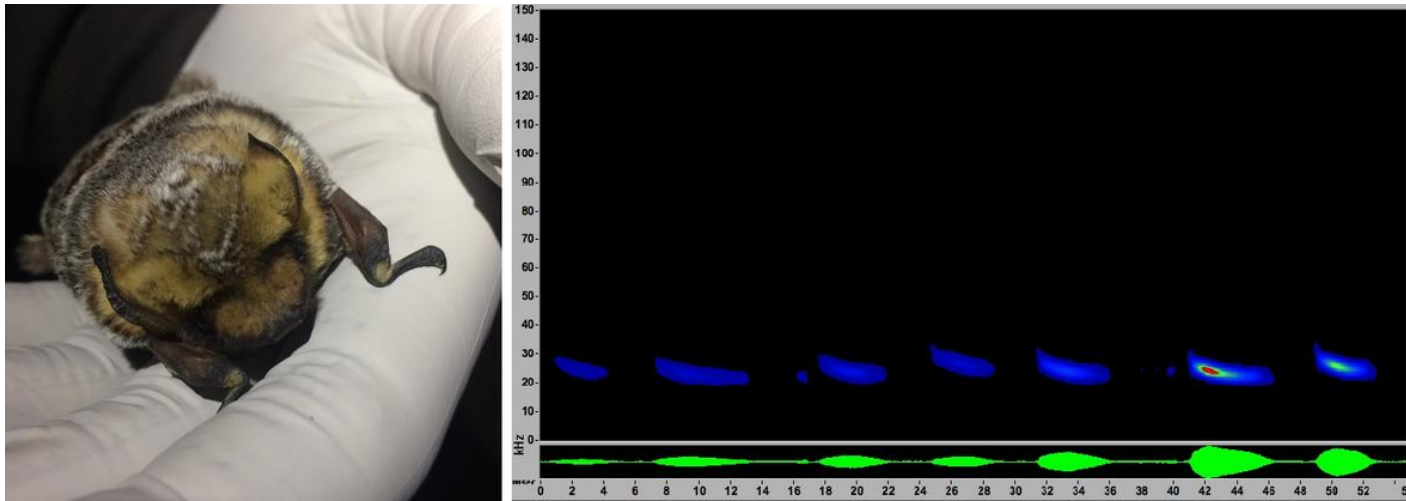
### California Myotis (*Myotis californicus*) Search Call

- [Audio file](#)



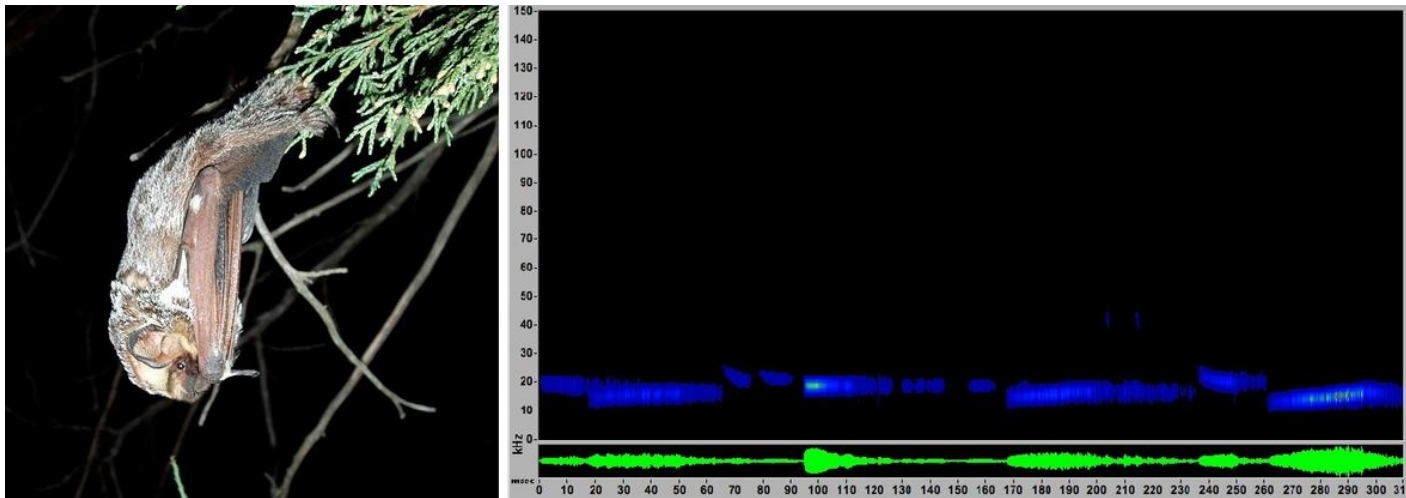
### Hoary Bat (*Lasiurus cinereus*) Ecolocation

- [Audio file](#)



### Hoary Bat (*Lasiurus cinereus*) Social Call

- [Audio file](#)



### Yuma Myotis (*Myotis yumanensis*) Search Call

- [Audio file](#)

