Bats *and* Mines

Evaluating Abandoned Mines for Bats: Recommendations for survey and closure

NRCS Natural Resources Conservation Service

Bat Conservation International

Abandoned underground mines provide important roosting habitat for more than half of the 45 bat species in the United States. And their use of abandoned mines is as complex as the varied environments the mines provide. Bats use mines for rearing young in the summer, hibernating, gathering for social activities such as courtship and mating, night roosting, and for crucial rest stops during spring and fall migrations. The process of determining whether bats are using a specific mine is not simple, but it can be accomplished reliably by following these recommendations.

The assessment begins with a preliminary survey to describe all mine openings and record all information that can be gathered at each opening without underground entry. These data should include: entrance dimensions; elevation relative to other openings; airflow direction and temperature; ambient air temperature; obstacles such as rocks, vegetation, limbs, trash, portal or headframe timbers in the opening; potential hazards; estimated vertical or horizontal depth; presence of internal complexity, such as drifts, crosscuts, raises, winzes, or stopes; and observations of any wildlife or wildlife sign. If a mine cannot be eliminated as wildlife habitat by the initial survey, an external and/or internal survey is warranted.

A field crew collects preliminary survey data at an abandoned mine shaft in California's Joshua Tree National Park.

Stained roosting surfaces often provide important clues regarding bat use in mines.

Internal surveys may be needed where:

- *Large, complex underground mines may have multiple openings.*
- *Areas with many scattered openings may have unknown underground interconnections.*
- *Time or funding is too limited for multiple external surveys.*
- *An understanding of interconnections is essential to maintaining the airflow required by bats.*

External surveys may also be necessary to:

- *Determine which entrances bats are using.*
- *Conduct counts for monitoring population size or trends.*
- *Minimize disturbances to resident colonies.*
- *Augment incomplete internal inspections.*

Acquiring complete knowledge of bat use of abandoned mines often requires a combination of both external and internal surveys. The following simplified guide suggests approaches that have proven effective for conditions and situations typically encountered when surveying abandoned mines. It can be used as a starting point to develop a specific program that suits local conditions. (When a statement applies to your situation, proceed to the indicated section.)

Conducting a Bat Survey

Complete Internal Survey Possible

An internal survey should cover most of the mine before concluding that neither bats nor bat signs are present. Generally, however, if bat use of a mine is significant, bats or evidence of bats will be encountered well before the entire mine has been evaluated. It is seldom possible to examine all areas of a large and complex mine, but it is also seldom necessary.

Proceed to Section A

Complete Internal Survey Not Possible

If no evidence of bats is apparent, but the mine has potentially important inaccessible areas (such as large stopes or dangerous shafts), or authorities will not permit internal evaluation, additional external observations at entrances may be required.

Proceed to Section B

Section A: Internal Surveys

A.1 Winter Survey

No guano, other sign, or resident bats C.2
Guano or other sign A.2, C.1
Resident bats C.1
Internal conditions (e.g., water) obscure sign A.2
All, or enough, of the mine cannot be seen B.1

A.2 Summer Survey

No residents (possible night roost, migratory use, specialized reproductive behavior, undocumented use) A.3
Residents C.1

A.3 Fall or Spring Survey

No residents or sign of bat use C.2
Residents and/or sign C.1

Section B: External Surveys

B.1 Summer, Fall, or Spring Survey

All entrances observed; no activity found (multiple surveys performed) C.2
Bats observed C.1

Section C: Conservation Recommendations

C.1 Decision to Construct a Bat Gate

- Is a threatened or endangered species involved?
- Is use significant (as determined regionally)?
- Are alternative roosting features nearby and used in the same way?
- How feasible is bat-compatible gating?
- Will preservation of an abandoned roost provide habitat or mitigate habitat destruction elsewhere?
- Is it likely the survey missed evidence of periodic use?

C.2 Closure by Any Means

- Was the survey method adequate?
- Could the survey have missed periodic use?
- If closure is based only on external surveys, their limitations must be understood. For example, while multiple external surveys may be required to detect the presence of bats, a single internal survey might be enough to confirm their presence.
- If there is any concern that bats might be present, conduct a final internal inspection. Schedule exclusions and mine closures when the fewest bats would be using the mine; avoid maternity and hibernation seasons.

Internal Surveys

- Anyone entering an abandoned mine must have appropriate training and experience.
- When properly conducted, internal surveys are the most reliable and least labor-intensive type of survey for evaluating roost presence and quality.
- Internal surveys allow better-informed decisions than external observations in choosing appropriate mine-closure strategies.

Cold Season Surveys

- Unless pre-hibernation swarming (when bats first appear at hibernation sites) is witnessed, internal surveys are the only way to detect hibernating bats.
- Hibernating bats must be identified with minimal disturbance. Repeated arousal causes bats to use fat reserves they need to survive the winter.
- Inspecting even tiny cracks and crevices may be required to find hibernating bats. Guano, roost staining, bat remains, and insect parts indicate use during other seasons.

Warm Season Surveys

- The timing of warm season surveys varies by local climate, but they are generally conducted during May through June in southern states and July through August in the north.
- Mine must be explored quietly because many bat species cannot tolerate disturbances at roost sites, especially when they are giving birth or caring for pups.
- Maternity colonies may use multiple roosts during a single season, so do not assume that because bats are not present at one roost, a mine is not being used.
- Guano containing discarded insect remains can indicate night roosting, even if no bats are seen in daytime surveys. If night roosting is suspected, the mine can be checked at night to observe the species and numbers.
- Identifying other kinds of use, such as courtship or migratory stopovers, can be difficult, but multiple visits to the site or using drop cloths (a light-colored sheet or piece of plastic) to collect guano may help clarify use.

Townsend's big-eared bats (*Corynorhinus townsendii*) are frequent occupants of abandoned mines throughout the western United States and rely on them year-round.

External Surveys

- External surveys are especially useful when combined with internal surveys at large, complex mines.
- Set up quietly at least 30 minutes before dark and continue observations for at least two hours after sunset. Observers should be as far from the entrance as feasible to minimize disturbance.
- All entrances to a complex mine should be surveyed on the same night, and surveys should be conducted on nights without rain or heavy wind.
- Specialized equipment (night-vision goggles or infrared cameras) may be needed. If not available, position observers toward the setting sun so exiting bats are silhouetted or shine a light with a red filter across the mine entrance.
- When conducting external evaluations, remember that an absence of evidence should not automatically be interpreted to mean that bats do not use the site at other times of the year.
- With external survey techniques, significant kinds of use — hibernation, reproductive behavior, migratory stopover — are often missed. This is a severe limitation that must be considered if mine closures are to be based on external surveys.

Considerations for Closure

- Are threatened or endangered species affected? If so, a bat-friendly closure is probably warranted.
- Is the bats' use of the mine especially significant within the geographical region? Maternity or important bachelor colonies of any species justify installation of bat-compatible closure.
- Are suitable alternative habitats available nearby? These may be good candidates for mitigation and bat-compatible closure.
- Could the site become an acceptable habitat in the future? If so, a bat-compatible closure would be warranted.
- All closures must be weighed against the complexity, feasibility, cost, and reliability of comparable, more easily gated features nearby.
- Destructive closure activities should be coordinated with local bat biologists to avoid trapping unseen bats.
- Bat-compatible closures should minimize disturbance to bat residents. For example, a bat gate should not be built during the maternity period.
- The timing of a mine closure must take into account the type of use, species present, and region of the country.

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