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Revision 0

Implementing the Bat Protection Plan at the Idaho National Laboratory Site

Natural Resources Group

2025

MARCH 2026

Bryan F. Bybee, Sarah A. Baccus, Terrah M. Owens, Samuel R. Williams, and Kevin T. Claver

Idaho National Laboratory

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Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy

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Foreword

This annual report is a departure from previous editions and is intended to provide specific and actionable information that simultaneously support bat conservation and the mission of the Idaho National Laboratory (INL). Beginning with this annual report, the data are analyzed and presented in a manner that informs land resource management decisions and is intended as a reference for project sighting, INL Site development, and the implementation of Conservation Measures referenced in the Idaho National Laboratory Site Bat Protection Plan. Moreover, the traditional Executive Summary section found in previous editions of this annual report has been replaced with a Plain Language Summary that is intended for a non-technical audience and contains concise information related to the background and implementation of the Bat Protection Plan.

Plain Language Summary

Background

Bats account for nearly 20% of all mammal species, with over 1,400 known species worldwide, 48 of which are found in the United States. They inhabit a wide range of environments, including coastal areas, forests, deserts, grasslands, and wetlands, and rely on diets of insects, fruit, or nectar. Bats play essential ecological roles, such as controlling insect populations (with a single bat capable of eating up to 1,200 insects in one night), pollinating plants, and dispersing seeds.

Bats are nocturnal and require daytime roost sites for shelter and protection. These roosts can be caves, mines, rock crevices, talus slopes, trees (both live and dead), buildings, or other locations that shield them from predators and temperature extremes. During summer, these roosts often serve as maternity sites where females raise their young until they can fly. Some bat species form large colonies, with numbers reaching tens of thousands in the eastern U.S., while western U.S. colonies are typically smaller, ranging from just a few individuals to a few hundred.

In the winter, when temperatures drop and food becomes scarce, some bat species migrate, while others hibernate. Hibernating bats rely on a small amount of stored fat for energy, which may sustain them for up to six months. During hibernation, they enter a state of torpor, drastically reducing their heart rate, breathing, and body temperature. Bats periodically arouse from torpor every few days to weeks to drink water, eliminate waste, or adjust their roosts. However, arousal is energy-intensive, and frequent disturbances during hibernation can initiate arousal more often than necessary which can deplete their fat reserves, leading to starvation before winter's end.

Bat populations in the U.S. have experienced significant declines due to habitat loss from deforestation and land conversion for agricultural, suburban, and urban use; reductions in insect populations caused by pesticide use and water pollution; and the intentional destruction of roosting and hibernation sites. However, the two primary drivers of bat population decline in the past two decades are collisions with wind energy infrastructure and White-nose Syndrome (WNS). Wind energy facilities primarily threaten tree-dwelling, migratory species such as the silver-haired bat and hoary bat, which are present on the Idaho National Laboratory (INL) Site. Across Canada and the U.S., wind energy infrastructure is responsible for over half a million bat deaths annually.

White-nose Syndrome has caused the deaths of nearly seven million bats in the United States over the past 20 years. This disease, caused by a fungus native to Europe, was first identified in New York in 2006. The fungus grows on the skin and fur of bats, and the disease's name derives from the white ring that often forms around the noses of infected individuals. During summer, active bats can groom and remove the fungus, but in winter, when bats are hibernating, the fungus will grow unchecked. Its irritation causes bats to arouse from torpor more frequently than usual, leading to premature depletion of their fat stores and eventual starvation.

The significant decline in bat populations, coupled with their critical roles in insect control, pollination, and seed dispersal, has drawn increased attention from wildlife agencies, researchers, and environmental organizations. Currently, ten bat species are listed as Endangered under the Endangered Species Act, one is listed as Threatened, and another is Proposed Endangered. While none of these species are known to occur on the INL Site, there are two species which commonly occur on the INL Site that are under regulatory consideration; the little brown myotis is Under Review, and the hoary bat is scheduled for review in fiscal year 2028[1]. If either is listed, these species would receive legal protection under the ESA, requiring federal projects to undergo additional environmental reviews and potentially implement mitigation measures, which could increase project costs and timelines. Additionally, eight other bat species with potential presence at the INL Site are designated as Species of Greatest Conservation Need or Species of Greatest Information Need in Idaho's State Wildlife Action Plan[2].

Although the Endangered Species Act affords protections to listed species, an often overlooked, and arguably more important, function of the Act is the goal of recovering species that are listed. This is directly accomplished by

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[1] U.S. Fish and Wildlife Service. 2024. "National Domestic Listing Workplan (FY24-FY28)." Department of the Interior, Fish and Wildlife Service.

[2] Idaho Department of Fish and Game. 2024. "Idaho State Wildlife Action Plan 2023." Idaho Department of Fish and Game. Boise, ID.

establishing recovery plans and recovery criteria for the listed species that include input from the U.S. Fish and Wildlife Service, other Federal, State and/or Tribal agencies, species experts found in academia, and other non-governmental organizations. To further support the recovery of a listed species, the Act also established mechanisms for stakeholders to continue work while providing positive benefits that aid in the recovery of the species.

One of these mechanisms is Voluntary Prelisting Conservation Actions. These actions are established through agreements between the U.S. Fish and Wildlife Service and other participants, including Federal agencies, providing proactive approaches to conserve species that are likely to or are already being considered for listing under the Endangered Species Act. Participants benefit in two key ways: first, widespread adoption of conservation actions may prevent a species from being listed, and second, participants earn credit for their actions, which can streamline environmental reviews and permitting processes if the species is listed.

In response to several listing decisions in the early and mid-2000s, and a status review that recommended emergency listing of the little brown myotis under the Endangered Species Act, the U.S. Department of Energy, Idaho Operations Office, in partnership with the Naval Reactors Facility established the Idaho National Laboratory Site Bat Protection Plan (BPP)[3] with the U.S. Fish and Wildlife Service in 2018 for the conservation of bats and their habitats at the INL Site. This plan established population and habitat monitoring, Best Management Practices, and Conservation Measures that are consistent with other Federal and State agencies. The BPP also positions the INL with the tools, practices, and land management strategies that would be required if a bat species were to be listed under the Endangered Species Act, which will reduce or eliminate delays to INL Site activities.

Summary of 2024 – 2025 BPP Implementation

This BPP annual report documents activities conducted between May 2024 through April 2025 that include results of monitoring tasks designed to track bat species diversity, activity, and habitat indicators, key threats, and the implementation of conservation measures on the INL Site. This report also provides the U.S. Fish and Wildlife Service, the Idaho Department of Fish and Game, and other collaborators with current information concerning bats on the INL Site. For more detailed information regarding the background and purpose of this annual report, see Section 1.0.

Population Monitoring – Hibernacula Surveys

Counting bats at hibernation sites, known as hibernacula, is a standard way to monitor bat populations. Bats are counted at the nine known hibernacula (caves) on the INL Site on a rotational basis. During the winter of 2024/2025 hibernacula counts were conducted at eight caves: Middle Butte, Rattlesnake, East Boundary, Aviators, College, Moonshiners, North Tower Earl, and North Tower Wackenhut. A total of 708 Townsends' big-eared bats, and 57 western small-footed myotis were counted across all caves with most bats counted at the two largest hibernacula, Middle Butte (554) and Rattlesnake (133) caves. Counts of Townsend's big-eared bats were above or within the historical baseline at Middle Butte, North Tower Wackenhut, and East Boundary caves and were below the baseline range at Rattlesnake and Aviators caves. Counts of western small-footed myotis were above the baseline range at Middle Butte Cave and within the baseline range at Rattlesnake Cave. Historical baselines are not available for College, Moonshiners, and North Tower Earl caves due to the small number (0-5) of bats routinely observed at these hibernacula. For more detailed information about hibernacula surveys, see Section 2.1 of this report.

Population Monitoring – Passive Acoustic Monitoring

Bats use echolocation to "see" in the dark. Echolocation is like a natural sonar system, where bats make high-pitched sounds that are often too high for humans to hear. These sounds travel through the environment and bounce off objects back at bats like echoes helping bats to navigate and to capture prey. Echolocation calls can be recorded by units programmed to record in this ultrasonic (high-pitched) sound spectrum, a survey technique called passive acoustic monitoring. Since echolocation calls are unique to each bat species, passive acoustic monitoring can be used as a non-invasive, cost-effective method for monitoring bat populations and activity. Data from passive acoustic monitoring are used to determine the number of species that occur on the INL Site, monitor summer and

[3] U.S. Department of Energy, Idaho Operations Office. 2018. "Idaho National Laboratory Site Bat Protection Plan." U.S. Department of Energy Idaho Operations Office, Idaho Falls, ID, USA, DOE/ID-12002(0).

winter bat activity at facilities and caves, and to identify important, feeding, roosting, hibernation, and breeding sites. This information supports project siting, mitigation planning, and the assessment of Conservation Measures designed to minimize impacts on sensitive bat species.

Acoustic monitoring for bats has occurred on the INL Site since 2012 and was an integral component for assessing threats to bats and creating the Conservation Measures in the BPP. Detectors are deployed following established protocols at all nine known hibernacula during the winter (November–March) and at seven caves and all eight facilities during the summer (May–September). Beginning in 2024, four detectors were also placed around Middle Butte to evaluate the importance of this area to bat species present on the INL Site. Though Middle Butte is not a known hibernaculum, the talus associated with Middle Butte provides unique habitat for bats on the INL Site. While deployed, detectors are checked monthly to ensure that they are recording properly, to change out SD Cards, and to check battery levels. Recordings from the detectors are analyzed with a software called Kaleidoscope, that automatically identifies species from their echolocation call patterns and determines the number of call files recorded for each species on each night the detector recorded. Results from this analysis in the winter, and a subset of results from the summer, are manually vetted to ensure data accuracy. Bat activity is defined as the number of call files per night the detector recorded.

In addition to reporting on annual bat activity at facilities and caves for the summer of 2024 and winter of 2024/2025, we assessed differences in bat activity between pre-implementation (2012–2018) and post-implementation (2019–2024) of the BPP. Comparisons were made between overall (facilities and caves) bat activity on the INL Site in the summer and winter, exclusively at facilities or caves, and for individual months at specific facilities and caves. Additionally, we looked at bat activity trends from 2012–2024 for six species of bats that are prevalent on the INL Site and are of elevated conservation concern.

Annual Activity

During the summer of 2024, acoustic detectors were deployed to monitor bat activity at all eight facilities and at seven caves across the INL Site. The highest activity among facilities was observed at the Idaho Nuclear Technology and Engineering Center (INTEC) and Test Area North (TAN), while the highest activity among cave was observed at Middle Butte and Rattlesnake caves. Across all locations, bat activity peaked in August, though specific sites saw varying monthly highs.

The little brown myotis was the most frequently detected species at seven facilities, followed by the western small-footed myotis. Exceptions included the Naval Reactors Facility (NRF) and the Materials and Fuels Complex (MFC), where the silver-haired bat was the most frequently detected species. At caves, the western small-footed myotis was the most recorded species, followed by the little brown myotis and Townsend’s big-eared bat.

During the winter of 2024/2025, acoustic detectors were deployed at nine caves. Most activity was concentrated at the two largest hibernation sites, Middle Butte Cave and Rattlesnake Cave. The western small-footed myotis was the most frequently detected species, followed by Townsend’s big-eared bat, big brown bat, long-eared myotis, and Yuma myotis. Bat activity across all caves peaked in November and March, with the lowest levels observed in January.

During the summer of 2024, two detectors around Middle Butte recorded seven bat species. The western small-footed myotis was the most frequently detected species, followed by the little brown myotis. In the winter of 2024/2025, four detectors around Middle Butte recorded three species. Townsend’s big-eared bat was the most frequently detected species, followed by big brown bat and western small-footed myotis.

Activity Pre and Post Implementation of the BPP

No differences in summer bat activity across the INL Site were observed between pre- and post-implementation of the BPP when all facilities and caves were analyzed together. However, overall activity at facilities decreased post-implementation with notable differences at individual facilities during specific months. Decreases were observed at the Critical Infrastructure Test Range Complex (CITRC), MFC, NRF, and TAN, primarily due to fewer detections of little brown myotis and western small-footed myotis. It should be noted that activity increased at the

Advanced Test Reactor (ATR) and the Central Facilities Area (CFA), driven by more frequent detections of the same two species. No significant changes were noted at INTEC or the Radioactive Waste Management Complex.

Summer bat activity at caves increased significantly after post-implementation of the BPP, with notable changes at most monitored caves. Activity increased at East Boundary, Jensen's, and North Tower Wackenhut. These increases were driven by higher detections of western small-footed myotis, little brown myotis, and Townsend's big-eared bats, along with additional detections of other species, such as hoary bats, long-eared myotis, California myotis, and silver-haired bats at North Tower Wackenhut. In contrast, decreases were observed at Middle Butte and Rattlesnake caves, likely due to prior detector malfunctions that resulted in missing data. Aviators and Obscenity Snake Pit caves showed no significant changes.

Winter bat activity across all caves showed no significant overall change between the pre- and post-implementation periods. However, specific differences were observed at most caves. Increased detections of western small-footed myotis drove higher activity at College, North Tower Earl, North Tower Wackenhut, and Rattlesnake caves. College Cave recorded more big brown bats, and North Tower Earl saw more Townsend's big-eared bats. Middle Butte and Rattlesnake caves showed a significant increase in western small-footed myotis detections. In contrast, activity at Aviators Cave declined, largely because of an unusually high number of big brown bat detections in 2015, which were not observed in later years. East Boundary, Link Sausage, and Moonshiners caves showed no significant changes.

Long-term Trends in Activity

Long-term trends in summer bat activity showed mixed results. At facilities, no significant changes were observed for little brown myotis or silver-haired bats, but western small-footed myotis and hoary bats showed notable declines. At caves, no clear trends were identified for Townsend's big-eared bat or big brown bat. However, western small-footed myotis showed a moderate decline, while little brown myotis exhibited a significant increase over time.

Long-term trends in winter bat activity across monitored caves showed no significant changes for big brown bats or western small-footed myotis. However, a moderately significant decline was observed for Townsend's big-eared bats, suggesting a potential downward trend for this species over time.

Passive acoustic monitoring at the INL Site has been essential for tracking bat activity, species diversity, and habitat use, providing critical data to guide conservation efforts. Over 12 years of surveys, trends in bat activity have shown potential shifts influenced by environmental changes and human activities, such as habitat loss from the 2019 Sheep Fire and infrastructure development at NRF. Summer bat activity declined at facilities during the post-implementation period of the BPP but increased at caves, suggesting a possible shift in habitat use. Increases in little brown myotis activity, which rely on human structures for roosting in areas that lack natural vertical structures, indicate that INL may be supporting higher populations of this species than the surrounding landscape. However, decreasing activity for western small-footed myotis and hoary bats, may indicate shifts in habitat use to off-site areas or may reflect declining regional population trends.

Winter bat activity remained stable overall, though monthly variations were observed at several caves, largely driven by western small-footed myotis. Warmer temperatures may have influenced increased winter activity, potentially shortening hibernation periods or torpor bouts. Activity at North Tower Wackenhut Cave has increased, prompting concerns about potential impacts from an upcoming Highway 20 expansion, which is in proximity. Despite some fluctuations, the overall stability of bat populations highlights the effectiveness of the BPP and underscores the importance of continued monitoring and adaptive management to protect bat species and their habitats at the INL Site. For more detailed information about passive acoustic monitoring see Section 2.2 and Appendix C of this report.

White-nose Syndrome (WNS) Surveillance

In recent years, the fungus responsible for WNS, known as *Pd*, has been detected in multiple locations across the western United States. First documented in Wyoming in 2018 and 2019, *Pd* was later found in Minnetonka Cave in southern Idaho in 2021, approximately 118 miles southeast of the INL Site. Since then, it has been detected in bats and cave environments in Utah, Montana, Colorado, Washington, and Oregon. As of 2025, *Pd* has been identified in 46 states, with WNS confirmed in 40 of them. The fungus thrives in specific temperature and humidity conditions, with studies showing its optimal growth occurring at temperatures between 54.5–60.4 °F and high relative humidity levels of 81–95%. Understanding temperature and humidity in caves on the INL Site is essential for assessing whether conditions could support the establishment of *Pd*.

We have deployed a total of 15 data loggers within eight known hibernacula on the INL Site to annually monitor temperature and humidity levels from November–March. The three largest hibernacula, Middle Butte, Rattlesnake, and Aviators, have a logger deployed at three different locations within the cave. During the winter of 2024/2025 the mean winter temperature in College Cave and at one location in Rattlesnake Cave was near the lower end of the growth range for *Pd* (41–51.8 °F). Mean relative humidity (RH) was within the growth range of *Pd* (70–81.5%) in the following caves: College, Moonshiners, North Tower Wackenhut, at one location in Aviators and at two locations in Middle Butte.

Long-term monitoring indicates that mean winter temperatures have largely remained below the optimal growth range within most caves since 2014. A few locations have had mean winter temperatures reach the lower end of the growth range for one or more winters including: one location in Aviators, the North Arm of East Boundary, Moonshiners, and one location in Rattlesnake Cave. Mean winter temperatures have consistently remained within the lower end of the temperature range inside College Cave.

Relative humidity (RH) fluctuates more often within monitored hibernacula. Long-term monitoring indicates that all caves, except North Tower Earl, have reached at least the lower end of the RH growth range (70–81.5%) in one or more years since 2014. College Cave has consistently been within the optimal RH range since 2015.

While conditions within a cave are largely shaped by its physical structure (depth, diameter, volume), environmental changes and human activities can and have impacted cave conditions on the INL Site. The above-average snowfall during the winter of 2023/2024 increased subsurface moisture, contributing to higher RH levels in all hibernacula. The installation of a fiberoptic line near North Tower Wackenhut in 2023, may have altered cave features, as hibernacula surveys noted unusual dripping and standing water in the cave during the winter of 2024/2025. Future projects, like a planned Highway 20 expansion, could further disrupt cave environments through blasting and other construction activities that may alter the structure of nearby caves. For more detailed information about white-nose syndrome surveillance, see Section 3.0 of this report.

Additional Monitoring Tasks

North American Bat Monitoring Program

The North American Bat Monitoring (NABat) program is a collaborative effort to standardize bat monitoring and management across North America, using a grid-based sampling framework. Two NABat grid cells were established on the INL Site in 2020, with an acoustic survey point in each quadrant. During the 2024 survey, detectors recorded six bat species: big brown bat, silver-haired bat, hoary bat, western small-footed myotis, long-legged myotis, and little brown myotis. Data collected on the INL Site are sent to the Northwest Bat Hub at Oregon State University and to the Idaho Department of Fish and Game for inclusion in analyses that assess bat populations at state- and continent-wide levels. Results from these analyses provide regional context for understanding changes in bat activity for several species observed on the INL Site. For more detailed information about the NABat program and its data products, see Section 4.1 of this report or visit https://www.nabatmonitoring.org.

Carcass Recovery and Radionuclide Analysis

When bat carcasses are found at INL Site facilities they are collected and sent to a laboratory that specializes in detecting radiological materials. They are tested for radionuclides cobalt-60, cesium-137, plutonium isotopes, americium-241, and strontium-90 and the radiological dose to bats on the INL is estimated using a modeling approach. During 2024, 39 dead bats (27 western small-footed myotis, 4 little brown myotis, 6 silver-haired bats, and 2 big brown bats) were collected.

The following radionuclides were detected in at least one sample during 2024: cesium-137, cobalt-60, strontium-90, and zinc-65. Cesium-137 is ubiquitous in the environment because of fallout from historical nuclear weapons tests. Strontium-90 is present in the environment as a residual fallout from above ground weapons testing, which occurred between 1945 and 1980. Cobalt-60 and zinc-65, which are fission products, may indicate that the bats visited radioactive effluent ponds on the INL Site, such as at the ATR Complex ponds. Over the past seven years the bat population at the INL Site received an absorbed dose that is well below the established DOE standard for the protection of terrestrial animals. Consequently, radionuclide analysis will be discontinued. For more detailed information about radionuclide testing, see Section 4.2 of this report.

Surveys of Bridges and Culverts

Bridges and culverts provide important roosting and potential maternity habitat for bats. The USFWS recommends pre-disturbance surveys are completed before maintenance or replacement of these features to ensure that bat colonies are not present. Negative surveys are considered valid for two years. Bridge and culvert surveys were proactively completed on the INL Site for a second year in 2024 to avoid project delays for upcoming maintenance and replacement activities. From May to September, four daytime and four nighttime visual surveys were conducted for bats at seven bridges and culverts on the INL Site using protocols adopted from the USFWS[4]. No bats were observed at any of the structures during daytime surveys. Nighttime surveys documented nine bats, with the highest number observed in August. Species observed included little brown myotis, western small-footed myotis, and Yuma myotis. No evidence of reproductive activity was observed. Surveys will be completed on a rotational basis as needed to facilitate mission activities. For more detailed information about bridge and culvert surveys, see Section 4.3 of this report.

Implementation of Conservation Measures

The BPP contains an evaluation of the conservation needs of bats and of how any potential impacts from operations at the INL Site can be minimized. This evaluation considered the findings of a status review of the little brown myotis[5], conservation assessments for Townsend's big-eared bat[6,7], the Idaho State Wildlife Action Plan[8], INL Site specific data, and conservation objectives identified by the U.S. Fish and Wildlife Service in recovery plans for already listed species[9,10]. This evaluation led to a list of threats to bats and their habitats that were applicable to INL Site activities and land uses. Working with INL stakeholders, this list of threats led to the development of Conservation Measures that can be used to offset these threats. As an example, destruction or modification of hibernacula and summer roosts, is identified as a threat to bats because it can result in direct mortality and a loss of important breeding and hibernation areas. To offset this threat, multiple Conservation Measures were adopted including identifying hibernacula and restricting access to those features, limiting activities that produce continuous noise within 1-mile of hibernacula and important summer roosts, and completing pre-disturbance surveys during the hibernation and breeding seasons. For a complete list of threats and associated Conservation Measures intended to accommodate the INL mission while proactively managing bat populations and their habitats, see Section 4.0 of the BPP[3].

[4] U.S. Fish and Wildlife Service. 2020. "Bridge/Structure Bat Assessment Form Guidance." U.S. Fish and Wildlife Service.

[5] Kunz, T., and J. Reichard. 2010. "Status review of the little brown myotis (*Myotis lucifugus*) and determination that immediate listing under the Endangered Species Act is scientifically and legally warranted." Boston University Center for Ecology and Conservation.

[6] Pierson, E. D., M. C. Wackenhut, J. S. Altenbach, P. Bradley, P. Call, D. L. Genter, C. E. Harris, B. L. Keller, B. Lengus, L. Lewis, B. Luce, K. W. Navo, J. M. Perkins, S. Smith, and L. Welch. 1999. "Species conservation assessment and strategy for Townsend's big-eared bat (*Corynorhinus townsendii townsendii* and *C. townsendii pallescens*). Idaho Conservation Effort, Idaho Department of Fish and Game, Boise, ID.

[7] Gruver, J. C., and D. A. Keinath. 2006. "Townsend's big-eared bat (*Corynorhinus townsendii*): a technical conservation assessment." United State Department of Agriculture Forest Service, Rocky Mountain Region.

[8] Idaho Department of Fish and Game. 2017. "Idaho State Wildlife Action Plan, 2015." Idaho Department of Fish and Game, Boise, ID.

[9] U.S. Fish and Wildlife Service. 1995. "Ozark big-eared bat revised recovery plan." United States Fish and Wildlife Service.

[10] U.S. Fish and Wildlife Service. 2014. "Northern long-eared bat interim conference and planning guidance." United State Fish and Wildlife Service.

Disturbing Hibernating Bats and Destruction/Modification of Hibernacula and Summer Roosts; White-nose Syndrome

In 2024, no known recreational or unlawful entry occurred at caves. INL biologists obtained permits to enter caves to complete hibernacula surveys and check data loggers. All surveys were completed as quickly and quietly as possible and all personnel followed the most recent U.S. Fish and Wildlife Service WNS protocols. Five pre-disturbance surveys were completed, and no evidence of bats were found. One building relocation and ongoing bridge maintenance activities were completed outside of the breeding and hibernation seasons. No loud noise producing activities occurred within 1-mile and no blasting occurred within 0.75 miles of known hibernacula or important summer roosts. No known summer roosts were disturbed due to construction activities and no pesticide or herbicide application, or mechanical vegetation removal occurred within 150 feet of caves or near important foraging areas.

Loss or Modification of Habitat Around Caves

In 2024, no wildland fires occurred near caves, and no prescribed burns were completed on the INL Site. No modification of native vegetation or disposing of soil occurred near caves.

Environmental Contaminants and Wind-Energy Development

Radionuclide levels in dead bats were below the DOE threshold for terrestrial organisms. 2024 was the final year for this task because radionuclide levels have never reached the DOE threshold since the implementation of the BPP. Pesticides applied around facilities and waste ponds were used in strict accordance with product label instructions to prevent unintended harm to bats. No wind-energy facilities were constructed on the INL Site.

Public Outreach

Public outreach is a central aspect of INL's bat conservation efforts, focusing on educating and engaging the community about the ecological importance of bats and the challenges they face. In 2024, INL personnel held events like Bat Nights at the Idaho Falls Zoo, which attracted 225 attendees, and similar activities at Harriman State Park, engaging an additional 130 participants. These events included educational presentations, interactive activities, and bat-watching demonstrations using acoustic detectors. While data was not collected in 2024, surveys conducted during Bat Nights at the Idaho Falls Zoo in 2023 showed increased awareness among participants about bats' ecological roles and conservation needs, with 69% reporting they had seen or heard bats during the events. INL biologists also collaborated with local institutions, training university students in acoustic monitoring techniques and providing data from summer-long bat activity recordings at the Idaho Falls Zoo.

In addition to public events, INL delivered classroom presentations to 475 students, hosted teacher workshops, and participated in science camps to educate people on bat ecology, conservation, and acoustic monitoring. These outreach activities align with INL's mission by advancing scientific understanding through hands-on learning and collaboration with local organizations. For more detailed information about public outreach, see Section 6.0 of this report.

Recommendations

The BPP is currently under review and is being updated.

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Acronyms

ATR	Advanced Test Reactor
BLM	Bureau of Land Management
BPP	Bat Protection Plan
CFA	Central Facilities Area
CITRC	Critical Infrastructure Test Range Complex
DOE-ID	U.S. Department of Energy, Idaho Operations Office
ESA	Endangered Species Act
IDFG	Idaho Department of Fish and Game
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technical and Engineering Center
MFC	Materials and Fuels Complex
NABat	North American Bat Monitoring Program
NOAA	National Oceanic and Atmospheric Administration
NRF	Naval Reactors Facility
NRG	Natural Resources Group
Pd	*Pseudogymnoascus destructans*
RH	Relative Humidity
RWMC	Radioactive Waste Management Complex
SD	Standard Deviation
TAN	Test Area North
USFWS	U.S. Fish and Wildlife Service
WNS	White-nose Syndrome

Implementing the Bat Protection Plan at the Idaho National Laboratory Site

2025

1. Background

The Idaho National Laboratory (INL) Site is a U.S. Department of Energy, Idaho Operations Office (DOE-ID) reservation encompassing 2,305 km^2 (890 mi^2) on the eastern Snake River Plain approximately 40 km (25 mi) west of Idaho Falls. There are three major drainages that enter or approach the INL Site: Big Lost River, Little Lost River, and Birch Creek. Much of the INL Site landscape is influenced by volcanic activity as evidenced by three prominent buttes that mark the southern boundary of the INL Site. Two of these buttes are on the INL Site (East and Middle Buttes) and the third, and largest of the three, is immediately south of the boundary (Big Southern Butte). Additionally, numerous basalt flows are located throughout the INL Site, contributing to unique subsurface features like lava tubes. A mosaic of high–quality, sagebrush steppe habitat with abundant lava tube caves, fractured rock outcrops, talus-flanked buttes, and juniper uplands provide high quality foraging and roosting habitat for a variety of resident and transient bat species, all of which have elevated conservation concern. To date, there are 23 known caves on the INL Site with some level of bat activity.

Over the past decades, the emergence of newly identified threats to bat populations (e.g. white-nose syndrome [WNS] and large-scale commercial wind energy development) have caused wide-spread mortality events in bats and resulted in precipitous declines of numerous common bat species and elevated conservation concern for bats across the U.S. (O'Shea et al. 2016). Because of these emerging threats and regional agency initiatives to address these threats, DOE-ID recognized the potential for impacts to INL Site development and operations. In October 2018, the DOE-ID and the U.S. Fish and Wildlife Service (USFWS) signed the INL Site Bat Protection Plan (DOE 2018, hereafter BPP).

The BPP provides procedures and methods to track populations, identify important habitats, implement conservation measures, and make adaptive modifications when data or regulatory changes warrant. The Plan also facilitates collaboration with the Idaho Department of Fish and Game (IDFG) for conservation of at-risk bat species and their habitats and functions as a mechanism to implement the conservation actions identified in the Idaho State Wildlife Action Plan (IDFG 2024).

This BPP annual report documents activities conducted between May 2024 through April 2025 that include results of monitoring tasks designed to track bat species abundance and habitat indicators, key threats, and the implementation of conservation measures on the INL Site. This report also provides USFWS, IDFG, and other stakeholders with current information concerning specific bat species on the INL Site (Table 1-1). DOE-ID provides this annual report to USFWS and IDFG and it can be found at https://inl.gov/aser/environmental-publications/ under Conservation Planning.

Table 1-1. Bat species that occur on the Idaho National Laboratory Site and their conservation designations. Definitions for Global and State Ranks can be found in Appendix A.

Scientific Name	Common Name	Global Rank	State Rank	ESA Status	BLM Rank	IDFG Rank
Corynorhinus townsendii	Townsend's big-eared bat	G4	S3	—	Type 2	C
Eptesicus fuscus	big brown bat	G5	S3	—	Type 2	I
Lasionycteris noctivagans	silver-haired bat	G4	S3	—	Type 2	C
Lasiurus cinereus	hoary bat	G3	S3	Scheduled for Review (FY28)	Type 2	C
Myotis californicus	California myotis	G5	S3	—	Type 2	—
Myotis ciliolabrum	western small-footed myotis	G5	S3	—	Type 2	C
Myotis evotis	western long-eared myotis	G5	S3	—	Type 2	I
Myotis lucifugus	little brown myotis	G3	S3	Under Review	Type 2	C
Myotis yumanensis	Yuma myotis	G5	S3	—	Type 2	C

C = Species of Greatest Conservation Need
I = Species of Greatest Information Need

2. Population Monitoring

2.1. Hibernacula Surveys

2.1.1. Introduction

Most bat species in temperate regions either migrate or hibernate. Those that hibernate do so for nearly half the year to cope with seasonal food shortages and to decrease mortality by staying hidden and inactive (Barclay and Harder 2003, Weller et al. 2018). During this critical phase of their annual life cycle, bats are sensitive to disturbances as disruptions are energetically costly during a time of year when food resources are unavailable. Moreover, because bats use the same hibernation sites for decades and are sensitive to environmental changes, monitoring hibernacula attendance is a standard method for estimating population changes (Whiting et al. 2021, Whiting et al. 2024).

There are nine known hibernacula that are monitored on a rotational basis. These hibernacula are primarily used by Townsend's big-eared bats (*Corynorhinus townsendii*) and western small-footed myotis (*Myotis ciliolabrum*) with Rattlesnake and Middle Butte caves having the highest attendance of these species.

2.1.2. Methods

Hibernacula are surveyed by counting the number of bats observed during a single visit. These surveys are conducted between November 1 and March 31 using standardized methods that minimize disturbance of bats (INL 2022a). Counts of bats are then compared to a baseline mean and corresponding standard deviation (SD) that was calculated from historical counts that occurred between 1984 and 2015 for Aviators, Middle Butte, North Tower Wackenhut, and Rattlesnake caves. East Boundary Cave only had two counts during this time so SD could not be calculated. A count in 2024/2025 was considered to be within the expected variation if it overlapped the SD of the historical count for that cave.

2.1.3. Results

In January 2025, hibernacula surveys were conducted once in each of the following caves: Middle Butte, Rattlesnake, East Boundary, Aviators, College, Moonshiners, North Tower Earl, and North Tower Wackenhut. A total of 58 western small-footed myotis and 708 Townsend's big-eared bats were observed in eight of the nine hibernacula surveyed (Table 2-1). Western small-footed myotis, a species that is more difficult to detect during surveys, were primarily found in Middle Butte and Rattlesnake caves with counts falling within (Rattlesnake Cave) or above (Middle Butte Cave) the SD of the population baseline (Figure 2-1).

Townsend's big-eared bats were primarily located in Middle Butte and Rattlesnake caves (Table 2-1). Counts for Townsend's big-eared bats in Middle Butte Cave were above the SD for the population baseline for the third year in a row (Figure 2-2). However, totals for Townsend's big-eared bats in Rattlesnake Cave have been below the population baseline for the past four surveys (Figure 2-2). Counts for Townsend's big-eared bats were also below the population baseline in Aviator's Cave for the second year in a row and were within the expected ranges for East Boundary and North Tower Wackenhut caves (Figure 2-2).

Table 2-1. Number of Townsend's big-eared bats (*Corynorhinus townsendii*; COTO) and the number of western small-footed myotis (*Myotis ciliolabrum*; MYCI) observed during the 2025 hibernacula counts at the Idaho National Laboratory Site.

Cave	COTO	MYCI
Aviators	19	—
College	0	—
East Boundary	23	1
Link Sausage	—	—
Middle Butte	525	29
Moonshiners	1	0
North Tower Earl	3	1
North Tower Wackenhut	30	—
Rattlesnake	107	26
Total	**708**	**57**

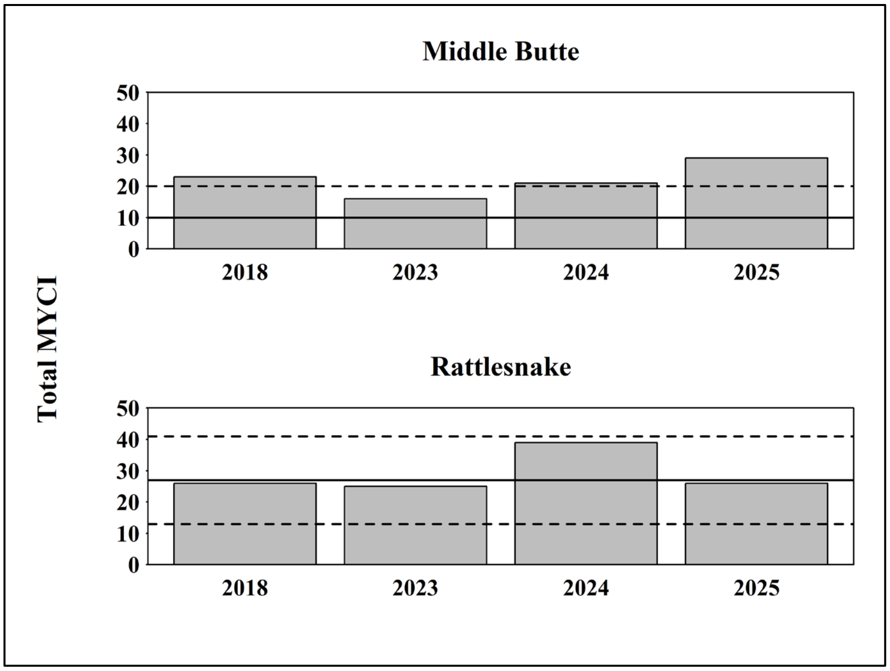

Figure 2-1. Number of western small-footed myotis (*Myotis ciliolabrum*; MYCI) by survey year in Rattlesnake and Middle Butte caves on the Idaho National Laboratory Site. The solid line represents the baseline mean for each cave reported in the Bat Protection Plan (1984-2015) while the dashed lines represent the corresponding reported standard deviation.

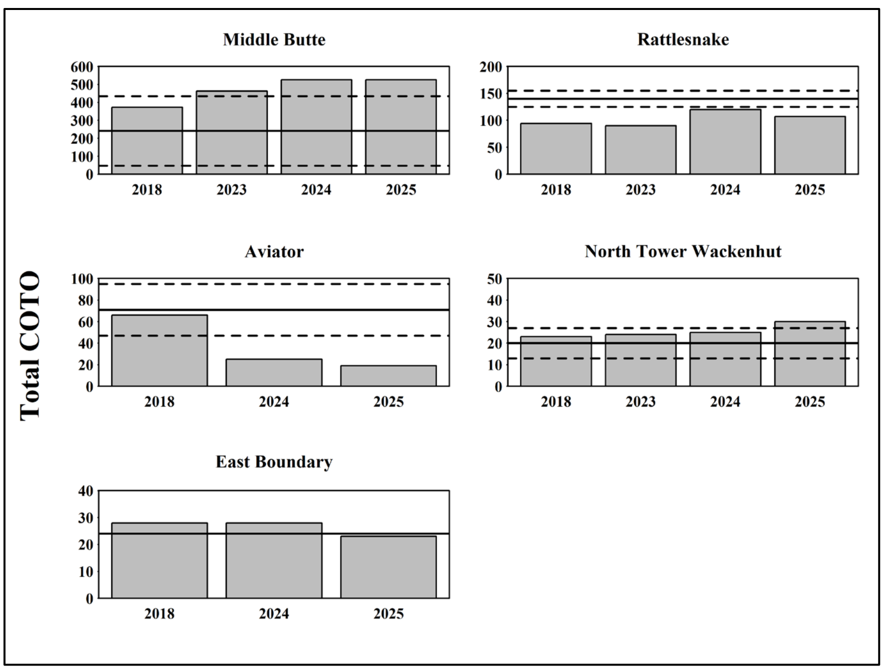

Figure 2-2. Number of Townsend's big-eared bats (*Corynorhinus townsendii*; COTO) by survey year in Middle Butte, Rattlesnake, Aviators, North Tower Wackenhut, and East Boundary caves on the Idaho National Laboratory Site. The solid line represents the baseline mean for each cave reported in the Bat Protection Plan (BPP) (1984-2015) while the dashed lines represent the corresponding reported standard deviation. In the BPP, East Boundary Cave did not have a reported standard deviation.

2.1.4. Discussion

Western Small-footed Myotis

Variation in hibernacula counts of western small-footed myotis is expected due to the bats crawling further up in cracks in cave ceilings, affecting observers' ability to see and count these species accurately. However, the relative stability observed in hibernacula attendance by this species when compared to the population baseline at Middle Butte and Rattlesnake caves (Figure 2-1) suggest that the hibernating population at the INL Site is likely not experiencing any environmental or biological stressors. Moreover, the stability in hibernacula attendance by western small-footed myotis at the INL Site is consistent with hibernacula counts across the Western U.S. (Weller et al. 2018).

Townsend's Big-eared Bat

Hibernacula counts of Townsend's big-eared bats at Middle Butte and North Tower Wackenhut caves were slightly above the expected baseline variation while counts at East Boundary Cave were near the baseline (Figure 2-2, see caption regarding SD for East Boundary Cave). Counts at all three caves were consistent with hibernacula attendance observed across the Western U.S. (Weller et al. 2018). Attendance at Aviator's Cave has been well below the baseline for the past two surveys (Figure 2-2). This lack of attendance may be due to fugitive vegetation blocking the entrance to the cave thereby inhibiting access for bats. In the interim, biologists have begun removing vegetation that is blocking the cave in the fall prior to hibernation. Counts of Townsend's big-eared bats have also been below baseline for the past four surveys at Rattlesnake Cave (Figure 2-2). This decrease in counts may be attributed to a pair of great-horned owls (*Bubo virginianus)* that use the entrance to Rattlesnake Cave as a nesting area (Kosmicki et al. 2025). However, eDNA analysis of pellets at the nesting site will be needed to confirm if owls are a source of bat predation at this site.

2.2. Passive Acoustic Monitoring

2.2.1. Introduction

Passive acoustic monitoring is a non-invasive, cost-effective method for monitoring bat populations. Because echolocation calls used by bats for navigation and prey detection are species-specific, data collected from acoustic monitoring stations can be utilized to quantify species diversity, population trends, and seasonal activity patterns (Geng et al. 2026). Furthermore, this approach provides insights into the spatial distribution of bats across the landscape, including key breeding and roosting sites, foraging areas, and migration routes (Geng et al. 2026). Such information is critical for informing project siting and mitigation strategies by identifying habitats that support bat populations and assessing potential collision risks associated with future infrastructure development (Weaver 2020). Long-term passive acoustic monitoring data can also contribute to tracking the spread of WNS into new areas (Hicks et al. 2020). For example, below-average summer activity, potentially indicative of population declines (Dzal et al. 2010, Ford et al. 2011), or above-average winter activity, suggesting bats are arousing from hibernation, may signal the presence of WNS. These findings can prompt targeted sampling efforts of individual bats or specific hibernacula (Hicks et al. 2020).

At the INL Site, passive acoustic monitoring data is employed to evaluate species diversity and seasonal activity patterns at facilities and known hibernacula. It also aids in identifying significant foraging, roosting, and hibernation areas, as well as potential breeding sites. This information supports project siting, mitigation planning, and the assessment of Conservation Measures designed to minimize impacts on sensitive bat species.

2.2.2. Methods

2.2.2.1. Detector Placement and Call Analysis at Caves, Facilities, and Middle Butte

Seasonal species diversity, activity, and habitat utilization of caves, facilities, and Middle Butte on the INL Site were evaluated using passive acoustic monitoring. Anabat Swift detectors (Titley Scientific, Columbia, MO) were deployed at known hibernacula (caves) during the winter period (November 1 to March 31) and at a subset of caves during the summer period (May 1 to September 30). Anabat SD2 detectors (Titley Scientific, Columbia, MO) were installed at all eight facilities exclusively during the summer season. Additionally, two Anabat Swift detectors were deployed near Middle Butte during the summer of 2024, with two additional detectors installed during the winter of 2024/2025. Detector placement was informed by areas identified as potential roosting and hibernation sites during a

2022 survey of the rock fall surrounding Middle Butte. All four detectors near Middle Butte will remain in place year-round to document bat activity in the area.

All detector deployments adhered to established protocols (Appendix B). Kaleidoscope software (version 5.6.8, Wildlife Acoustics, Inc.) was used to identify species and quantify the number of call files recorded at each location. Species identification was based on the maximum likelihood estimator, with a threshold p-value of < 0.05 indicating species presence on a given night. Detailed analysis methods are provided in Appendix B.

For the winter survey, analyses focused on call files from western small-footed myotis, big brown bat *(Eptesicus fuscus*), western long-eared myotis (*Myotis evotis*), and Townsend's big-eared bat, as these species account for over 99% of bats observed during hibernacula counts on the INL Site (Whiting et al. 2018, Whiting et al. 2021). In contrast, call files for all nine species known to occur, or with suitable habitat on the INL Site, were analyzed during the summer survey.

To ensure data accuracy, all winter call files were manually reviewed. For the summer survey, due to the higher volume of recordings, manual review was conducted on call files from 10% of nights during which detectors were operational at each location.

2.2.2.2. Comparisons and Trends in Activity at Caves and Facilities

Call files were aggregated by species, month, and year for each facility or cave during the summer (May–September) and winter (November–March) survey periods. To standardize bat activity, the total number of call files was normalized by dividing it by the number of nights the detector was operational at the corresponding site, month, and year. For instance, in May 2012, the total number of call files recorded at the Advanced Test Reactor (ATR; 1,176 files) was divided by the 24 nights the detector was active, resulting in 49 files per night. These normalized values, grouped by site, month, and year, were further categorized into two survey periods: 2012–2018 and 2019–2024. This categorization enabled comparisons of bat activity before and after the implementation of conservation measures outlined in the BPP. For the winter survey period, January, February, and March of 2018 were included in the pre-implementation group (2012–2018), while November and December of 2018, as well as January, February, and March of 2025, were included in the post-implementation group (2019–2024) to maintain complete winter-year comparisons.

The distribution of data for each combination of facility or cave, month, and survey period was assessed using a Shapiro-Wilk test. If data from both survey periods were normally distributed, a two-tailed t-test was conducted to evaluate differences. If one or both datasets deviated from normality, a Mann-Whitney U test was applied. Statistical significance was determined using a threshold of $p \leq 0.15$.

Trends in activity for specific bat species were analyzed using linear regression, with the number of call files per night as the response variable and year as a continuous predictor variable. For winter activity, call files were aggregated by species (big brown bat, Townsend's big-eared bat, and western small-footed myotis) and by winter year (November–March) across all caves, then normalized by the total number of nights detectors were operational. A similar analysis was performed for summer activity (May–September), aggregating call files by species and location (facilities and/or caves). The summer analysis included six species: western small-footed myotis (caves and facilities), little brown myotis (*Myotis lucifugus*; caves and facilities), Townsend's big-eared bat (caves only), big brown bat (caves only), silver-haired bat (*Lasionycteris noctivagans*; facilities only), and hoary bat (*Lasiurus cinereus*; facilities only). These species were selected based on their prevalence on the INL Site and/or their elevated conservation status.

2.2.3. Results

2.2.3.1. Caves and Facilities — Summer

Acoustic detectors were deployed at all eight facilities and at the following seven caves during the summer of 2024: Middle Butte, Rattlesnake, East Boundary, Aviators, Jensen's, Obscenity Snake Pit, and North Tower Wackenhut. Detectors operated for a combined total of 744 nights at facilities, recording 125,617 call files (Table 2-2). At caves, detectors operated for a combined total of 1,032 nights, recording 272,602 call files (Table 2-3). The highest number of files at facilities were recorded at the Idaho Nuclear Technology and Engineering Center (INTEC; n = 60,326) and Test Area North (TAN; n = 26,626; Table 2-2), while at caves, Middle Butte (n = 141,100) and Rattlesnake (n = 89,468; Table 2-3) exhibited the highest activity.

The little brown myotis was the most frequently detected species at seven facilities, followed by the western small-footed myotis. Exceptions included the Naval Reactors Facility (NRF), where the silver-haired bat was the second most detected species, and the Materials and Fuels Complex (MFC), where it was the most detected species (Table 2-2). At caves, the western small-footed myotis was the most frequently detected species, followed by the little brown myotis and Townsend's big-eared bat (Table 2-3). Bat activity at facilities peaked at different times: in June at the Central Facilities Area (CFA), in July at INTEC, in August at ATR, the Critical Infrastructure Test Range Complex (CITRC), and TAN, and in September at MFC, NRF, and the Radioactive Waste Management Complex (RWMC; Table C-1). For caves, activity was highest in July at East Boundary and North Tower Wackenhut, in August at Aviators, Jensen's, Middle Butte, and Rattlesnake, and in September at Obscenity Snake Pit (Table C-2). Across all facilities and caves, bat activity was highest in August.

Table 2-2. Total number of call files for seven species and total number of nights detectors functioned at eight facilities at the Idaho National Laboratory Site during passive acoustic surveys during the summer (May–September) of 2024. Species with at least one recorded file during the survey period were big brown bat (*Eptesicus fuscus*; EPFU), silver-haired bat (*Lasionycteris noctivagans*; LANO), hoary bat (*Lasiurus cinereus*; LACI), California myotis (*Myotis californicus*; MYCA), western small-footed myotis (*M. ciliolabrum*; MYCI), little brown myotis (*M. lucifugus*; MYLU), and Yuma myotis (*M. yumanensis*; MYYU). No files of Townsend's big-eared bats (*Corynorhinus townsendii*), or long-eared myotis (*M. evotis*) were recorded at any facilities.

Facility	Detector Nights	Number of Call Files							
		EPFU	LACI	LANO	MYCA	MYCI	MYLU	MYYU	Total
ATR	112	23	288	591	1,126	8,072	11,377	8	21,485
CFA	98	221	99	151	765	3,854	9,210	14	14,314
CITRC	121	0	0	38	0	165	409	376	988
INTEC	66	19	53	160	5,577	19,1924	34,562	15	60,310
MFC	95	0	5	74	1	36	30	0	146
NRF	43	0	88	483	29	126	766	0	1,492
RWMC	58	0	108	565	39	842	1,462	0	3,016
TAN	151	76	258	892	159	6,675	12,722	4	20,780
Total	**744**	**339**	**899**	**2,954**	**7,690**	**39,694**	**70,538**	**417**	**122,531**

Table 2-3. Total number of call files for nine species and total number of nights detectors functioned at seven caves at the Idaho National Laboratory Site during passive acoustic surveys during the summer (May–September) of 2024. Species with at least one recorded file during the survey period were Townsend's big-eared bats (*Corynorhinus townsendii*; COTO), big brown bat (*Eptesicus fuscus*; EPFU), silver-haired bat (*Lasionycteris noctivagans*; LANO), hoary bat (*Lasiurus cinereus*; LACI), California myotis (*Myotis californicus*; MYCA), western small-footed myotis (*M. ciliolabrum*; MYCI), western long-eared myotis (*M. evotis*; MYEV), little brown myotis (*M. lucifugus*; MYLU), and Yuma myotis (*M. yumanensis*; MYYU).

Cave	Detector Nights	Number of Call Files									
		COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU	Total
Aviators	151	2,038	4	18	174	436	4,313	29	2,907	0	9,919
East Boundary	126	1,929	0	1	78	1,099	10,285	150	874	0	14,416
Jensen's	151	195	3	0	69	0	6,366	2	885	0	7,520
Middle Butte	151	9,588	1,078	0	360	7,017	102,109	628	20,580	16	141,376
North Tower Wackenhut	151	1,435	10	35	81	456	6,400	723	280	0	9,420
Obscenity Snake Pit	151	0	0	14	37	0	486	14	67	0	618
Rattlesnake	151	2,072	1,156	8	448	2,930	53,924	55	28,835	40	89,468
Total	**1,032**	**17,257**	**2,251**	**76**	**1,247**	**11,938**	**183,883**	**1,601**	**54,428**	**56**	**272,737**

No significant difference in overall summer bat activity across the INL Site (facilities and caves combined) was observed between the pre- and post-implementation periods of the BPP (W = 83,612, p = 0.49). However, significant differences were detected when analyzing facilities independently (W = 27,516, p = 0.12), with a decrease in call files per night during the post-implementation period. Significant differences in bat activity were observed for at least one month at all facilities except INTEC and RWMC (Figure 2-3, Table C-3). Increases in call files per night during the post-implementation period were noted at ATR in September and at CFA in June and July, driven primarily by higher detections of little brown myotis and western small-footed myotis. Decreases in call files per night during the post-implementation period were observed at CITRC (July), MFC (July), NRF (June–August), and TAN (June–September), which appeared to result from reduced detections of the same two species.

At caves, a significant difference in overall summer bat activity was observed (W = 15,364, p = 0.02), with an increase in call files per night during the post-implementation period. Significant differences in call files per night were observed for at least one month at all monitored caves except Aviators and Obscenity Snake Pit (Figure 2-4, Table C-4). Increases in call files per night during the post-implementation period were observed at East Boundary, Jensens, and North Tower Wackenhut, driven by higher detections of western small-footed myotis, little brown myotis, and Townsend's big-eared bats. Additional increases at North Tower Wackenhut included detections of hoary bats (May, June, and July), long-eared myotis (July and September), California myotis (May, June, and September), and silver-haired bats (May and September). Decreases in call files per night were noted at Middle Butte Cave in June and Rattlesnake Cave in July, likely due to detector malfunctions in 2019 and 2021 at Middle Butte Cave and in 2021 and 2023 at Rattlesnake Cave, during which no files were recorded for any species.

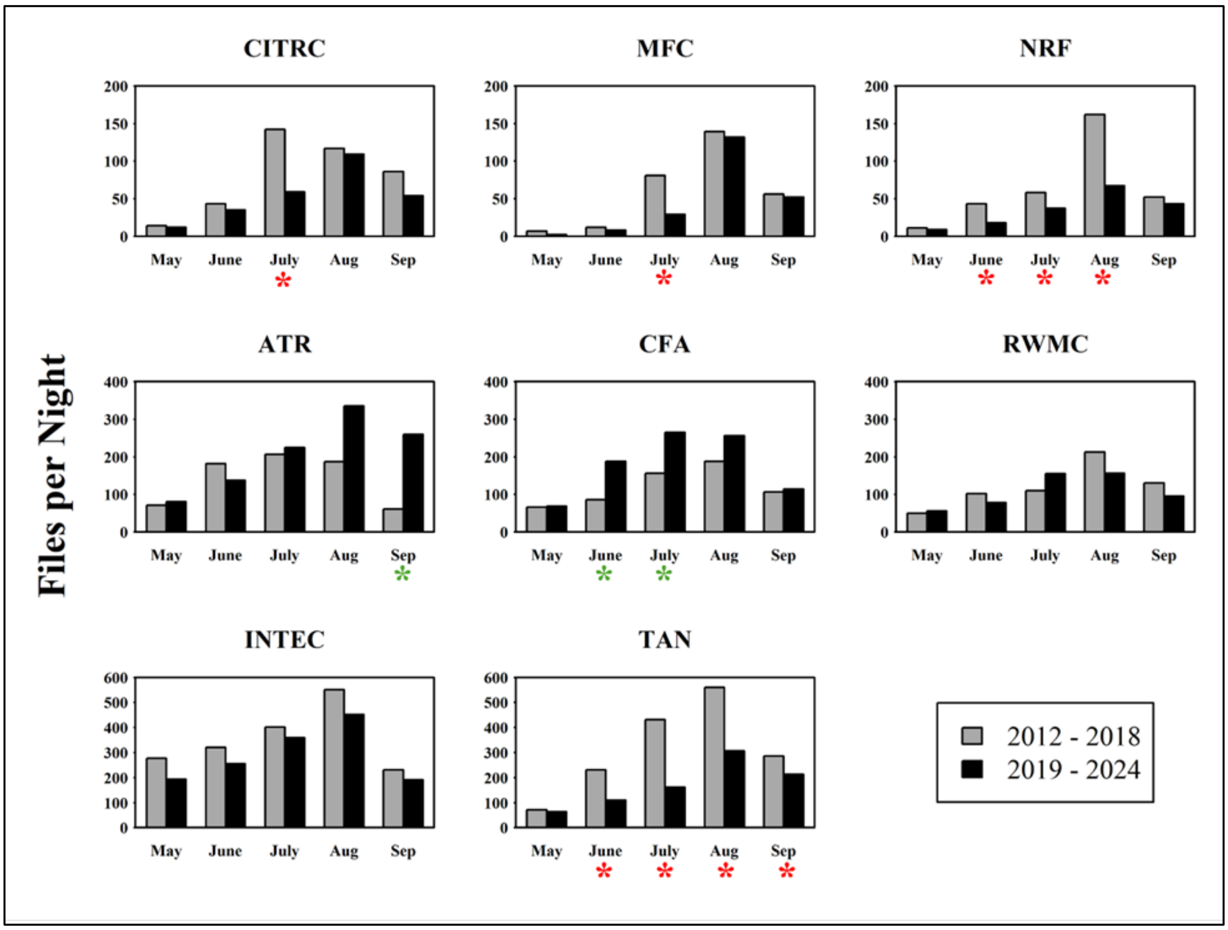

Figure 2-3. Comparison of the number of bat call files recorded per night through passive acoustic monitoring during the summer months (May–September) at eight Idaho National Laboratory Site facilities. Data are presented for the pre-implementation period of the Bat Protection Plan (2012–2018) and the post-implementation period (2019–2024). Asterisks denote months with statistically significant differences in the number of call files between the two periods. Green represents an increase in call files per night during the post-implementation period, while red represents a decrease.

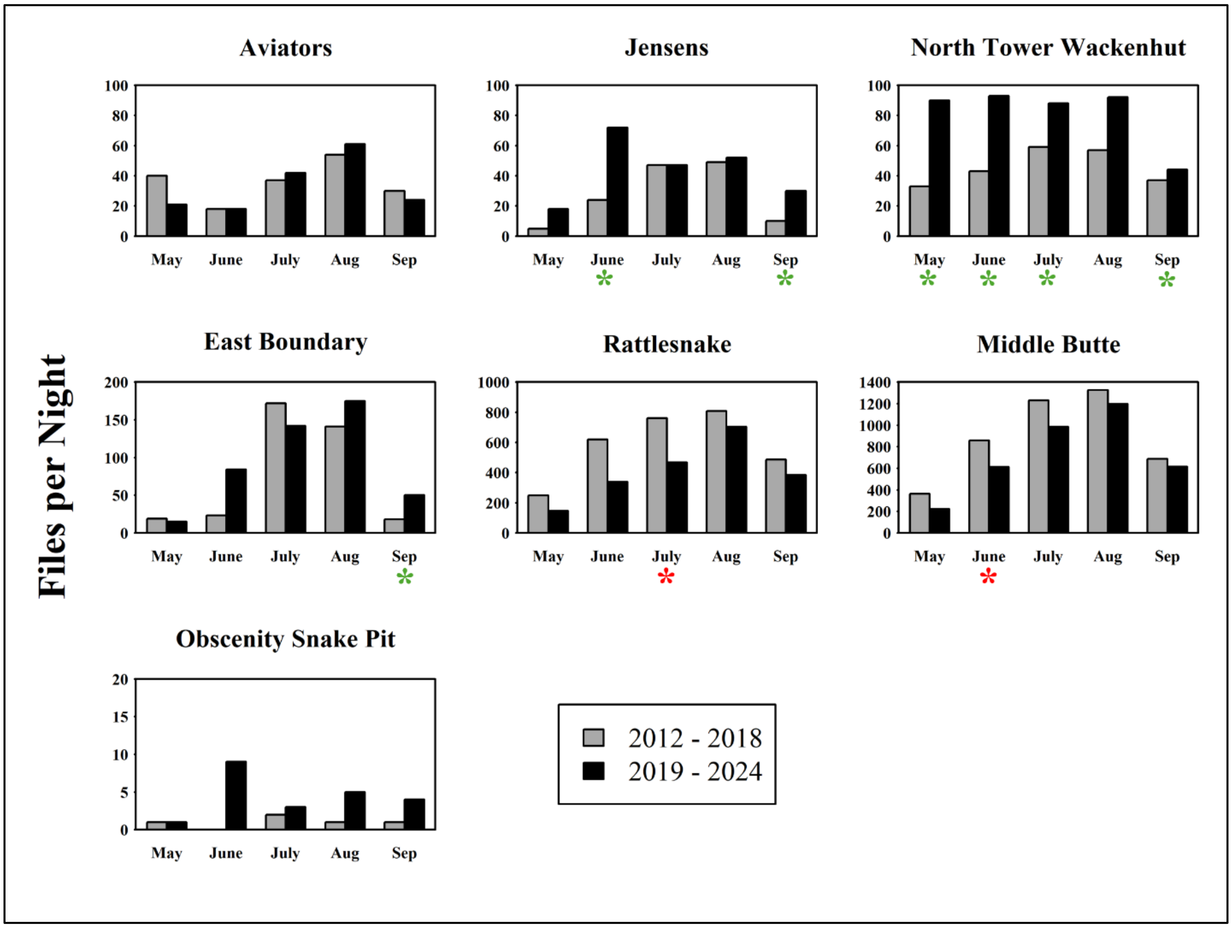

Figure 2-4. Comparison of the number of bat call files recorded per night through passive acoustic monitoring during the summer months (May–September) at seven caves on the Idaho National Laboratory Site. Data are presented for the pre-implementation period of the Bat Protection Plan (2012–2018) and the post-implementation period (2019–2024). Asterisks denote months with statistically significant differences in the number of call files between the two periods. Green represents an increase in call files per night during the post-implementation period, while red represents a decrease.

Linear regression analyses of summer bat activity across all facilities indicated no significant trends for little brown myotis ($p = 0.76$, $R^2 = 0.01$) or silver-haired bats ($p = 0.72$, $R^2 = 0.01$; Figure 2-5). However, significant decreases were observed for western small-footed myotis ($p = 0.02$, $R^2 = 0.39$) and hoary bats ($p = 0.03$, $R^2 = 0.37$; Figure 2-5). At caves, linear regression analyses indicated no discernible trends for Townsend's big-eared bat ($p = 0.91$, $R^2 = 0.001$) or big brown bat ($p = 0.37$, $R^2 = 0.07$; Figure 2-6). However, a moderately significant decreasing trend was observed for western small-footed myotis ($p = 0.07$, $R^2 = 0.27$), while a significant increasing trend was observed for little brown myotis ($p = 0.02$, $R^2 = 0.41$; Figure 2-6).

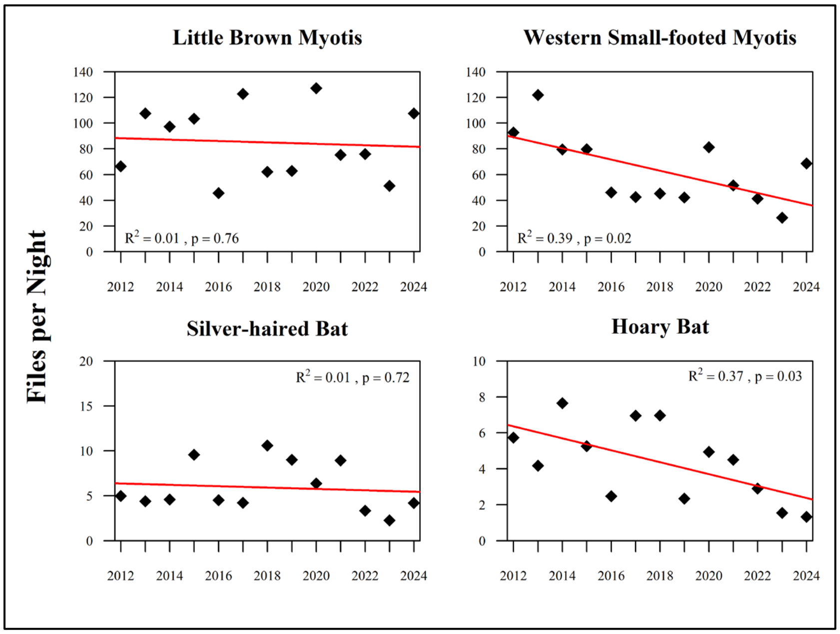

Figure 2-5. Linear regression analysis of summer bat activity (May–September) for little brown myotis (*Myotis lucifugus*), western small-footed myotis (*Myotis ciliolabrum*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*) at Idaho National Laboratory Site facilities from 2012 to 2024. Species were selected based on their prevalence on the Idaho National Laboratory Site and their elevated conservation concern.

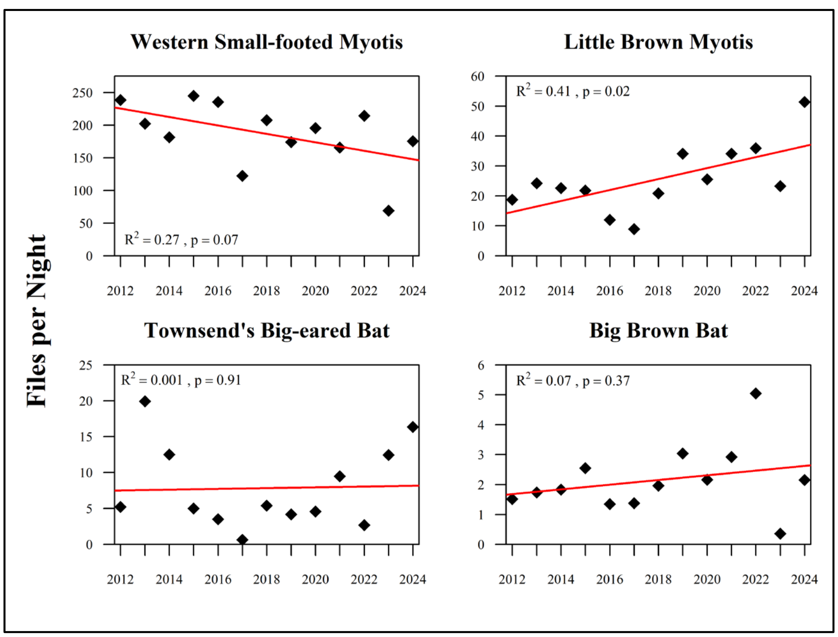

Figure 2-6. Linear regression analysis of summer bat activity (May–September) for western small-footed myotis (*Myotis ciliolabrum*), little brown myotis (*Myotis lucifugus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and big brown bat (*Eptesicus fuscus*) at caves on the Idaho National Laboratory Site from 2012 to 2024. Focal species were selected based on their prevalence on the Idaho National Laboratory Site and their elevated conservation concern.

2.2.3.2. Caves — Winter

Acoustic detectors were deployed during the 2024/2025 winter at Aviators, College, East Boundary, Link Sausage, Middle Butte, Moonshiners, North Tower Earl, North Tower Wackenhut, and Rattlesnake caves, documenting a total of 14,149 call files (Table 2-4). The majority of call files were recorded at the two largest hibernacula, Middle Butte Cave (3,452 files) and Rattlesnake Cave (9,810 files). The western small-footed myotis was the most frequently detected species (12,491 files), followed by Townsend's big-eared bat (1,223 files), big brown bat (387 files), and long-eared myotis (29 files). Manual vetting identified 19 Yuma myotis (*Myotis yumanensis*) call files at Middle Butte and Rattlesnake caves. Across all caves, bat activity peaked in November and March, with the lowest activity recorded in January (Table C-5).

Table 2-4. Total number of call files for five species and total number of nights detectors functioned at nine caves at the Idaho National Laboratory Site during passive acoustic surveys during the winter (November–March) of 2024/2025. Species with at least one recorded file during the survey period were Townsend's big-eared bats (*Corynorhinus townsendii*; COTO), big brown bat (*Eptesicus fuscus*; EPFU), western small-footed myotis (*Myotis ciliolabrum*; MYCI), western long-eared myotis (*M. evotis*; MYEV), little and Yuma myotis (*M. yumanensis*; MYYU).

Cave	**Detector Nights**	**Number of Call Files**					
		COTO	**EPFU**	**MYCI**	**MYEV**	**MYYU**	**Total**
Aviators	151	4	1	35	4	0	44
College	151	1	0	32	0	0	33
East Boundary	151	69	1	181	4	0	255
Link Sausage	151	8	0	21	0	0	29
Moonshiners	151	1	0	18	0	0	19
North Tower Earl	151	21	49	267	0	0	337
North Tower Wackenhut	151	114	11	45	0	0	170
Middle Butte	151	723	198	2,519	8	4	3,452
Rattlesnake	151	282	127	9,373	13	15	9,810
Total	**1,359**	**1,223**	**387**	**12,491**	**29**	**19**	**14,149**

No significant difference in overall winter bat activity was observed between the pre- and post-implementation periods ($W = 2{,}202$, $p = 0.29$). However, significant differences in call files per night were detected for at least one month at all caves except East Boundary, Link Sausage, and Moonshiners (Table C-6). Higher detections of western small-footed myotis during the post-implementation period compared to the pre-implementation period accounted for differences in November at College, North Tower Earl, North Tower Wackenhut, and Rattlesnake caves, as well as in December at North Tower Earl and Rattlesnake. Additionally, increased detections in November of big brown bats at College Cave and Townsend's big-eared bats at North Tower Earl Cave were observed. At Middle Butte Cave, a significant increase in western small-footed myotis detections during the 2019–2024 period was noted in January. Significant differences in February at Rattlesnake Cave were attributed to increased detections of western small-footed myotis, Townsend's big-eared bat, and big brown bat. Conversely, a significant decrease in call files per night was observed at Aviators Cave in January during the 2019–2024 period. This decrease was likely driven by an unusually high number of call files from big brown bats recorded in 2015 ($n = 2{,}447$ files), followed by an absence of detections in subsequent years.

Linear regression analyses of winter bat activity across all monitored caves indicated no discernible trend for big brown bats ($p = 0.50$, $R^2 = 0.04$) or western small-footed myotis ($p = 0.80$, $R^2 = 0.01$; Figure 2-7). However, a moderately significant decreasing trend was observed for Townsend's big-eared bat ($p = 0.11$, $R^2 = 0.20$; Figure 2-7).

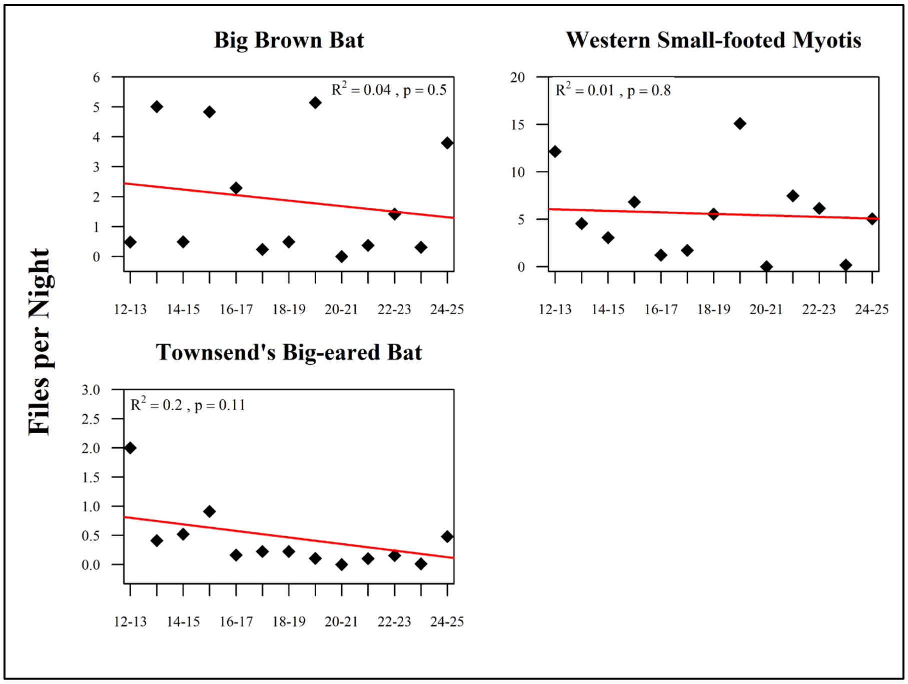

Figure 2-7. Linear regression analysis of winter bat activity (November–March) for big brown bat (*Eptesicus fuscus*), western small-footed myotis (*Myotis ciliolabrum*), and Townsend's big-eared bat (*Corynorhinus townsendii*) at caves on the Idaho National Laboratory Site from 2012 to 2024. Focal species were selected based on their prevalence on the Idaho National Labortatory Site.

2.2.3.3. Middle Butte

The two detectors deployed around Middle Butte during the summer of 2024 recorded for a combined total of 306 nights and documented 19,754 bat calls representing seven species (Table 2-5). The western small-footed myotis (n = 12,202) was the most frequently detected species, followed by the little brown myotis (n = 3,521). The majority of activity for these two species, as well as for big brown bats, was concentrated at the southern detector location. In contrast, detections of Townsend's big-eared bat, silver-haired bat, hoary bat, and western long-eared myotis were relatively evenly distributed between the two detector locations. Neither California myotis nor Yuma myotis were detected during the summer surveys.

During the winter of 2024/2025, the four detectors deployed around Middle Butte recorded for a combined total of 603 nights and documented 26 bat calls (Table 2-6). Townsend's big-eared bat was the most frequently detected species, followed by big brown bat and western small-footed myotis. Western long-eared myotis was not detected during the winter surveys.

Table 2-5. Total number of call files recorded at Middle Butte at the Idaho National Laboratory Site during passive acoustic surveys during the summer (May–September) of 2024.

Scientific Name	Common Name	Total Files by Sampling Location		
		Middle Butte South	Middle Butte West	Total
Corynorhinus townsendii	Townsend's big-eared bat	127	362	489
Eptesicus fuscus	big brown bat	576	34	610
Lasionycteris noctivagans	silver-haired bat	895	660	1,555
Lasiurus cinereus	hoary bat	549	420	969
Myotis californicus	California myotis	0	0	0
Myotis ciliolabrum	western small-footed myotis	10,639	1,563	12,202
Myotis evotis	western long-eared myotis	226	182	408
Myotis lucifugus	little brown myotis	2,534	987	3,521
Myotis yumanensis	Yuma myotis	0	0	0
Total		**15,546**	**4,208**	**19,754**

Table 2-6. Total number of call files recorded at Middle Butte at the Idaho National Laboratory Site during passive acoustic surveys during the winter (November–March) of 2024/2025.

Scientific Name	Common Name	Total Files by Sampling Location				
		Middle Butte East	Middle Butte North	Middle Butte South	Middle Butte West	Total
Corynorhinus townsendii	Townsend's big-eared bat	7	0	0	2	9
Eptesicus fuscus	big brown bat	5	2	4	1	12
Myotis ciliolabrum	western small-footed myotis	2	2	0	1	5
Myotis evotis	western long-eared myotis	0	0	0	0	0
Total		**14**	**4**	**4**	**4**	**26**

2.2.4. Discussion

Passive acoustic monitoring is a vital tool for understanding bat activity, species diversity, spatial distribution, and habitat selection on the INL Site. The data collected through this approach not only informs conservation strategies but also helps identify critical habitats and potential impacts from infrastructure development. Patterns identified from 12 years of survey data highlight significant variations in bat activity at various facilities and caves, revealing trends that may be influenced by environmental changes and anthropogenic factors. The utilization of data from the pre- and post-implementation periods of the BPP allows for an evaluation of the efficacy of conservation measures employed on the INL Site, providing valuable insights for future management and protection efforts.

Differences in summer bat activity at facilities between the pre- and post-implementation periods were primarily influenced by detections of little brown myotis and western small-footed myotis. These differences may reflect changes in site use patterns by these species. For example, reduced activity at CITRC during July may be associated with habitat loss or degradation caused by the 2019 Sheep Fire, while decreased activity at NRF during June, July, and August may be linked to ongoing construction and facility expansion. Given their geographical proximity, individual bats previously using CITRC and NRF may have shifted to CFA and ATR, potentially explaining the increased activity observed at these sites during the post-implementation period.

While overall summer bat activity across all facilities was lower during the post-implementation period, activity at caves was higher. This shift suggests that bats on the INL Site may be transitioning their use from facilities to caves. However, the observed decline in summer activity of western small-footed myotis at both facilities and caves may indicate either a shift in habitat use to areas outside the INL Site or a regional population decline for this species. Unfortunately, as an understudied species, population estimates or supplementary activity data for western small-footed myotis are currently unavailable for comparison.

For little brown myotis, a stable trend in summer activity at caves and a significant increasing trend at facilities were observed from 2012 to 2024. This species is currently under review by the USFWS for potential listing under the Endangered Species Act (ESA) due to severe population declines caused by WNS in the eastern United States (USFWS 2024). As a generalist species, little brown myotis often utilize human structures, such as buildings, for roosting and maternity colonies (Coleman and Barclay 2011; Johnson et al. 2019). Research by Udell et al. (2024) demonstrated a positive correlation between the relative abundance of little brown myotis and increasing building density per 100 km^2, while Coleman and Barclay (2011) highlighted the importance of buildings as maternity roosts in prairie habitats lacking natural roosting structures, such as cliffs and trees. Given the scarcity of natural vertical structures at the INL Site, facilities on the site likely provide critical roosting habitat, supporting higher populations of little brown myotis compared to the surrounding area.

A significant decline in hoary bat activity was observed at the INL Site between 2012 and 2024. Although detected annually, hoary bats are relatively uncommon at the site due to their status as long-distance migratory species that primarily roost and forage in coniferous forests. Hoary bats are scheduled for review by the USFWS in fiscal year 2028 (USFWS 2024) for potential listing under the ESA due to substantial population declines linked to collisions at wind energy facilities (Frick et al. 2017; Friedenberg and Frick 2021). Relative abundance estimates for North American Bat Monitoring Program grid cell US2890 (Figure 4-1; estimates for grid 1866 were unavailable) suggest a stable population trend for hoary bats from 2016 to 2023 (Udell et al. 2025, see Section 4.1 for more details); however, these estimates are based on data collected during the breeding season (June 15 to July 15), when hoary bat detections on the INL Site are lower due to the small amount of suitable breeding habitat. The majority of hoary bat detections on the INL Site occur in late summer and early fall during southward migration, likely using trees planted at facilities as stopover habitat. Therefore, the observed decline in hoary bat activity likely reflects regional population trends rather than being attributable to site-specific activities.

No significant difference in overall winter bat activity was observed between the pre- and post-implementation periods. However, significant differences in bat activity were detected during specific months at individual hibernacula. For instance, increases in activity in November and December at four of the seven monitored hibernacula, largely driven by detections of western small-footed myotis, may indicate changes in site use by hibernating bats. These shifts may not be fully captured during hibernacula counts, as western small-footed myotis frequently occupy cracks and crevices, making them difficult to detect (Weller et al. 2018). Additionally, increased use of these sites may represent temporary stopovers for individuals migrating to offsite hibernacula, supported by the lack of significant differences in bat activity observed in March, when individuals typically emerge from hibernation.

Increases in winter activity from November to March may also be associated with warmer temperatures, which can shorten the hibernation season (Boyles et al. 2023) or reduce the duration of torpor bouts (Barros et al. 2017). Research in Montana has demonstrated year-round flight activity for big brown bats and western small-footed myotis, with winter activity positively correlated with temperature (Hicks et al. 2020). While the observed increase in winter activity on the INL Site is unlikely to indicate the presence of WNS, a comprehensive analysis is recommended to establish baseline expected bat activity. This analysis should incorporate temperature variations to provide more robust conclusions.

A moderately significant decrease in Townsend’s big-eared bat activity during the winter from 2012–2025 may be a reflection of the below baseline hibernacula counts for this species at Aviators and Rattlesnake caves (Figure 2-2). Winter activity of Townsend’s big-eared bat at Aviators Cave was significantly different in the post-implementation period ($W = 36$, $p = 0.13$) and was attributed to fewer call files per night when compared to the pre-implementation period. However, no difference in activity was observed at Rattlesnake Cave ($t = 1.03$, $df = 10.22$, $p = 0.33$) between the two periods. These findings suggest the need for further investigation to better understand the factors influencing Townsend's big-eared bat populations and their hibernation behavior.

Increased summer and winter activity, along with above-average hibernacula counts, indicate that bats are utilizing the North Tower Wackenhut Cave more frequently in the post-implementation period. This trend raises concerns regarding the upcoming Highway 20 expansion project, which may pose potential risks to this cave system. Ongoing discussions with the Idaho Transportation Department aim to develop strategies to mitigate impacts and ensure the continued protection of the bat populations associated with this site.

Results from passive acoustic monitoring around Middle Butte indicate that the area provides important summer habitat, particularly for western small-footed myotis and little brown myotis, which are known to utilize talus for breeding and roosting in the Western U.S. (Blejwas et al. 2023, MNHP 2026). Middle Butte also represents one of the few areas on the INL Site with tree cover, primarily composed of Utah juniper (*Juniperus osteosperma*), which likely supports tree-dwelling species such as silver-haired and hoary bats. In contrast, winter surveys documented low bat activity, suggesting that Middle Butte may not be a high-use area for hibernation; however, additional surveys are needed to confirm this.

In conclusion, the data collected through passive acoustic monitoring indicate that overall bat activity on the INL Site has remained stable, suggesting that the conservation measures implemented under the BPP are effective. Despite some fluctuations in activity levels among specific species and locations, the absence of significant changes in overall summer and winter bat activity reinforces the success of these strategies in maintaining bat populations. The findings highlight the importance of continued monitoring and adaptive management to ensure the ongoing protection of critical habitats and to address any emerging threats to bat species in the region. This sustained effort is vital for supporting both the ecological integrity of the INL Site and the conservation of its diverse bat populations.

3. White-nose Syndrome Surveillance

3.1. Cave Temperature and Humidity Monitoring

3.1.1. Introduction

White-nose syndrome (WNS) is an infectious disease caused by the fungus *Pseudogymnoascus destructans* (hereafter, *Pd*), which disrupts hibernation by causing frequent arousals during torpor, leading to elevated energy expenditure and reduced survival rates in bats (Reeder et al. 2012, Field et al. 2018, Wilcox et al. 2014, Turner et al. 2015). Since its emergence, the fungus has spread across North America through bat-to-bat transmission during hibernation, short- to mid-range movements of infected bats, and via human-mediated transport between hibernacula (Hoyt et al. 2021, USGS 2017). WNS poses a significant and recent threat to many cave-hibernating bat species (Frick et al. 2010, Knudsen et al. 2013), having already caused the deaths of over five million bats across seven species in North America (Bernard and McCracken 2017, Hoyt et al. 2021). As a result, several once-common bat species are now at risk of severe population declines or even extinction (Hammerson et al. 2017, Appendix A). While WNS was initially concentrated in the eastern United States (Ingersoll et al. 2016, Reynolds et al. 2017), it has since spread westward (Lorch et al. 2016).

Pd was documented in Goshen County and Niobrara County, Wyoming, in 2018 and 2019, respectively (Abernethy et al. 2020). In October 2021, the fungus was detected in Minnetonka Cave in southern Idaho, approximately 190 km (118 miles) southeast of the INL Site (IDFG 2022). Additional detections have occurred across the western United States in recent years. Sampling at Canyonlands National Park in Utah confirmed the presence of *Pd* in 2024 (National Park Service 2024). That same year, the fungus was reported in five bat species across 23 counties in Montana, with WNS confirmed or suspected in 10 of those counties (Montana Fish Wildlife and Parks 2024). In April 2025, the National Park Service reported detection of *Pd* in bats from the Holzwarth Historic Site within Rocky Mountain National Park, Colorado (National Park Service 2025). Most recently, in September 2025, the USGS announced that the fungus was found in three bats at San Juan Island National Historical Park in Washington and in guano collected from Lewis and Clark National Historical Park in Oregon (USGS 2025). As of 2025, *Pd* has been documented in 46 states, with WNS confirmed in 40 (White-nose Syndrome Response Team 2025, Hopkins et al. 2025).

The growth of *Pd* is restricted by cave temperature and humidity profiles (Verant et al. 2012, Marroquin et al. 2017). Laboratory studies indicate that the optimal temperature range for *Pd* growth is 12.5–15.8 °C (54.5–60.4 °F; Verant et al. 2012). Frick et al. (2022) demonstrated that *Pd* growth rates increased between 5–11 °C (41–51.8 °F) under high relative humidity (RH) conditions (85–95%), indicating that temperature plays an important role in fungal growth within this suboptimal range. Marroquin et al. (2017) found that *Pd* growth was significantly lower at 70% RH compared to higher levels, with growth increasing up to ~81.5% RH, the optimal RH for *Pd* growth, and then plateauing between 81.5–96.5% RH, when tested at 13°C (55.4 °F). Quantifying temperature and humidity in caves on the INL Site is important for understanding the potential for WNS to become established in caves.

3.1.2. Methods

HOBO U23 Pro v2 data loggers were placed in eight hibernacula on the INL Site following established protocols (Appendix B). Locations for HOBO data logger deployment were selected based on areas where bats have been continuously observed. These HOBO data loggers record temperature (°C) and RH (%) every 30 minutes from at least November 1 to March 31. Some larger hibernacula have multiple HOBO loggers placed at different monitoring points. For example, Aviators Cave has three HOBO loggers placed at 40 m (43.7 yd), 50 m (54.6 yd), and 90 m (98.4 yd) from the entrance of the cave. East Boundary Cave comprises two separate arms, North and South; a single HOBO logger is deployed within each arm. The mean and SD of temperature (°C) and RH (%) for each winter-year from 2014 to 2025 by monitoring point was calculated.

3.1.3. Results

Since 2014, the recorded winter-year mean temperature of each hibernaculum has not reached the optimal temperature range for *Pd* growth (Table 3-1). Data collected from HOBO loggers revealed daily and monthly temperature fluctuations within caves that, on multiple occasions, fell within the suboptimal growth range of *Pd*, even when the mean winter-year temperature did not.

- **Aviators Cave**: At 40 m (43.7 yd) and 50 m (54.6 yd), mean winter temperatures have remained below the suboptimal growth range (5–11 °C [41–51.8 °F]) for *Pd* since 2014 (Table 3-1). At 90 m (98.4 yd), mean winter temperatures have consistently remained within the suboptimal range for fungal growth during every winter recorded since 2014. Mean RH at 40 m (43.7 yd) has been below the lower growth range for *Pd* (70–81.5%) except in winters 2021-2022 (71.0%), 2023-2024 (75.3%), and 2024-2025 (70.9%, Figure 3-2). Mean RH at 50 m (54.6 yd) and 90 m (98.4 yd) has consistently remained below the fungal growth range.

- **College Cave**: Since 2015, mean winter temperatures and RH inside College Cave have consistently remained within the suboptimal temperature range and above the optimal RH threshold (81.5%) for *Pd* growth (Figure 3-1).

- **East Boundary Cave (North and South Arms)**: Mean winter temperatures have remained below the suboptimal growth range since 2014, except in the North Arm during winters 2014-2015 and 2021-2022, when they entered the suboptimal range. Mean RH in both arms has been below the lower growth range since 2014, except in winter 2023-2024, when the North Arm reached 70.6% and the South Arm reached 72.4%.
- **Middle Butte Cave**: Mean winter temperatures at 30 m (32.8 yd), 160 m (174.9 yd), and 370 m (404.6 yd) have consistently been below the suboptimal growth range. With RH fluctuations at 30 m (32.8 yd), this location has been within the growth range for *Pd* since 2014 (73.2–86.8%). During winter 2024-2025, the mean RH was recorded at 80.9%. At 160 m (174.9 yd), the mean RH exceeded the optimal threshold in winter 2024-2025 (82.9%). At 370 m (404.6 yd), the mean RH has consistently been above the optimal level for fungal growth since 2014 (89.2–99.5%).
- **Moonshiners Cave**: Mean winter temperatures have generally been below the suboptimal growth range for *Pd*, except during winter 2014-2015, when they fell within the suboptimal range. Mean RH remained within the lower growth range until winters 2023-2024 (91.3%) and 2024-2025 (85.3%), when it exceeded the optimal threshold.
- **North Tower Earl Cave**: Neither the mean temperature nor mean RH has reached the suboptimal growth range for *Pd* since 2014.
- **North Tower Wackenhut Cave**: Since 2014, mean temperatures have never reached the suboptimal growth range for *Pd*. Fluctuations in mean RH at this location have kept RH within the range for *Pd* growth since 2014 (79.3–91.3%). During winter 2024-2025, the mean RH was recorded at 86.3%.
- **Rattlesnake Cave**: Mean winter temperatures at 0 m and 70 m (76.6 yd) have remained below the suboptimal growth range, while at 160 m (174.9 yd) they entered the suboptimal range in winters 2014-2015 and 2024-2025. Mean RH has not reached the fungal growth range at any monitoring point since 2014.

Table 3-1. Mean temperature (°C) and standard deviation by winter-year (November through March) of 15 HOBO data logger locations in eight hibernacula on the Idaho National Laboratory Site from 2014 to 2025. Bolded numbers indicate mean temperatures that fell within the suboptimal temperature range for *Pseudogymnoascus destructans* growth. The suboptimal temperature range for fungal growth is 5–11 °C (41–51.8 °F) and the optimal temperature range is 12.5–15.8 °C (54.5–60.4 °F). Because the data loggers could not be retrieved between 2017 and 2020, previously recorded data was overwritten and is no longer available. Other missing fields are due to malfunctions in the HOBO data loggers.

Location	**Mean Temperature °C (SD)**					
	2014-2015	**2015-2016**	**2021-2022**	**2022-2023**	**2023-2024**	**2024-2025**
Aviators 40 m	1.6 (2.3)	0.6 (2.7)	2.5 (1.8)	0.7 (1.9)	0.6 (2.5)	-0.4 (3.4)
Aviators 50 m	3.2 (2.2)	2.3 (2.6)	3.9 (1.8)	2.2 (1.7)	2.2 (2.5)	1.3 (3.4)
Aviators 90 m	**7.9 (2.2)**	**8.1 (2.6)**	**8.3 (2.3)**	**7.8 (2.3)**	**7.7 (2.5)**	**—**
College	—	**5.8 (1.4)**	**5.4 (1.8)**	**5.2 (1.2)**	**5.3 (1.6)**	**5.1 (1.8)**
East Boundary North	**5.3 (1.2)**	3.2 (2.9)	**5.0 (1.9)**	1.8 (3.0)	3.4 (2.5)	4.9 (1.4)
East Boundary South	3.7 (2.0)	4.9 (1.8)	2.9 (3.4)	3.1 (2.0)	4.7 (1.5)	3.4 (2.6)
Middle Butte 30 m	1.9 (1.8)	1.2 (2.7)	1.0 (3.1)	0.6 (2.8)	2.2 (2.1)	3.1 (1.1)
Middle Butte 160 m	**—**	3.1 (1.5)	3.0 (1.8)	—	—	1.0 (2.0)
Middle Butte 370 m	4.5 (0.5)	4.1 (0.7)	3.9 (0.9)	3.4 (0.8)	4.4 (0.6)	4.4 (0.6)
Moonshiners	**5.0 (1.8)**	—	4.6 (2.5)	4.6 (2.0)	4.5 (2.1)	4.4 (2.3)
North Tower Earl	2.3 (1.6)	1.9 (2.2)	1.4 (3.0)	0.2 (2.1)	2.3 (1.8)	2.1 (2.3)
North Tower Wackenhut	2.4 (2.0)	1.7 (2.6)	1.5 (3.2)	-0.1 (2.8)	2.3 (2.1)	2.0 (2.4)
Rattlesnake 0 m	2.7 (1.1)	2.1 (1.6)	1.8 (1.9)	0.6 (1.7)	2.5 (1.1)	2.3 (1.3)
Rattlesnake 70 m	3.4 (0.8)	3.0 (1.2)	2.8 (1.5)	1.8 (1.4)	3.2 (0.9)	3.2 (1.0)
Rattlesnake 160 m	**5.0 (0.4)**	4.8 (0.7)	4.5 (0.9)	4.1 (0.9)	4.9 (0.4)	**5.1 (0.6)**

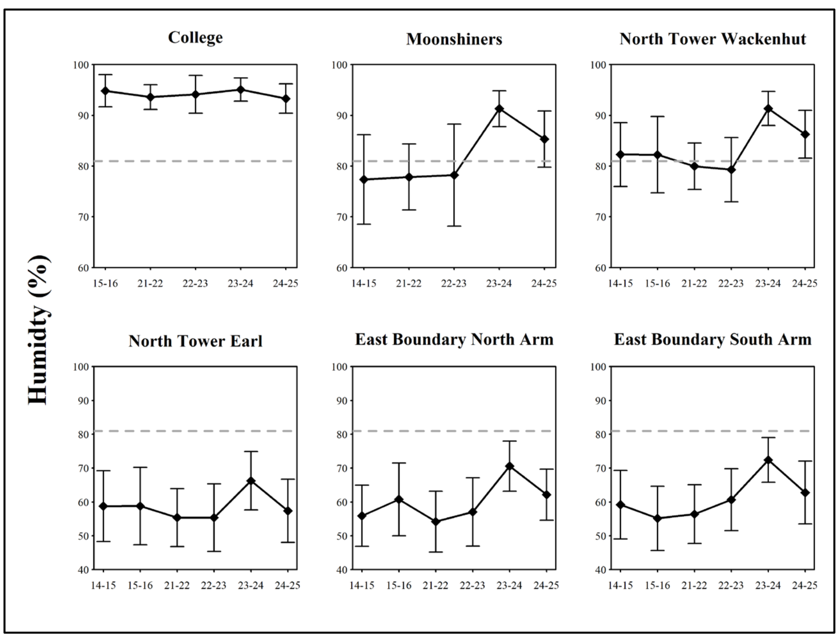

Figure 3-1. Mean (black dot) and standard deviation (error bars) of relative humidity (%) by winter-year (November through March) in the five hibernacula where a single HOBO logger is deployed on the Idaho National Laboratory Site from 2014 to 2025. The dotted gray line represents the optimal relative humidity (81.5%) for growth of *Pseudogymnoascus destructans* (Marroquin et al. 2017). Because the data loggers could not be retrieved between 2017 and 2020, previously recorded data was overwritten and is no longer available. Other missing winter-years are due to malfunctions in the HOBO data loggers.

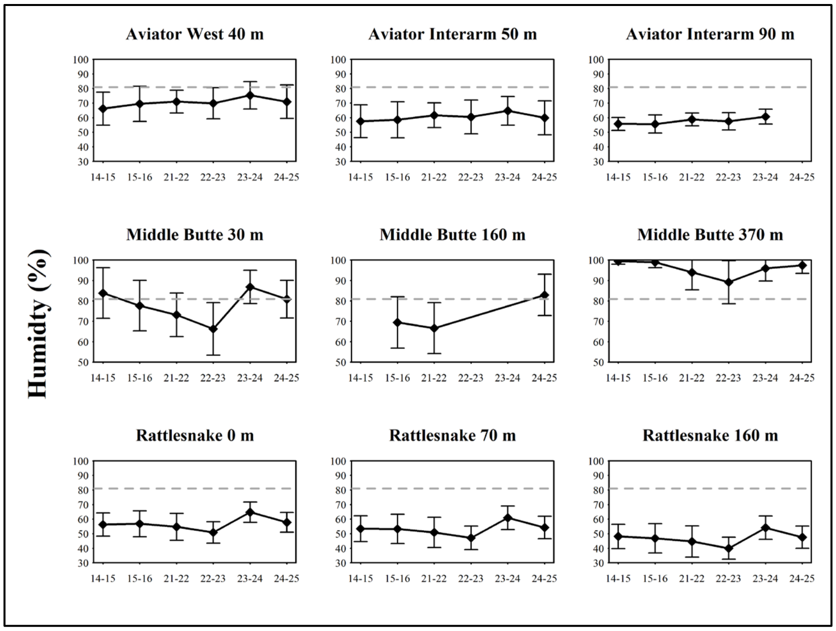

Figure 3-2. Mean (black dot) and standard deviation (error bars) of relative humidity (%) by winter-year (November through March) in the three hibernacula where multiple HOBO loggers are deployed on the Idaho National Laboratory Site from 2014 to 2025. The dotted gray line represents the optimal relative humidity (81.5%) for growth of *Pseudogymnoascus destructans* (Marroquin et al. 2017). Because the data loggers could not be retrieved between 2017 and 2020, previously recorded data was overwritten and is no longer available. Other missing winter-years are due to malfunctions in the HOBO data loggers.

3.1.4. Discussion

Understanding how temperature and humidity profiles inside hibernacula on the INL Site change across years provides important information regarding the potential of *Pd* to become established in caves. Mean winter temperatures inside hibernacula have been consistent throughout the years of monitoring since 2014 (Table 3-1); however, RH has been variable in some hibernacula (Figure 3-1, Figure 3-2). Mean winter temperatures in all hibernacula have remained below the optimal temperature range for *Pd* growth since 2014. However, variability in ambient temperature over the winter season have brought some sites within the suboptimal range for fungal growth. As of 2024-2025, five locations in four hibernacula were all above the optimal RH for fungal growth.

Since 2015 in College Cave and since 2014 at 370 m inside Middle Butte Cave, winter mean RH has remained above the optimal threshold for *Pd* growth during every winter-year recorded (Figure 3-1, Figure 3-2). Across all recorded winter-years, mean temperatures at College Cave have consistently fallen within the suboptimal range for *Pd* growth, whereas mean temperatures at 370 m inside Middle Butte Cave have remained slightly below this range (Table 3-1). Cave microclimate is primarily shaped by its physical structure—including geometry, depth, diameter, and volume—along with spatial context such as landscape position and orientation, the configuration and number of entrances, and the dynamics of air and water movement through infiltration and circulation (Perry 2013; Pflitsch 2003; Medina 2023; Gillies 2014; NCKRI 2021). Caves within the heterothermic zone, typically 0–50 m (0–164 ft) below the surface, exhibit daily or seasonal temperature fluctuations strongly influenced by external conditions (Perry 2013). Average internal cave temperatures generally reflect the mean annual surface temperature, which in our region ranges from 3.0 to 8.9 °C (37.4 to 48.02 °F) (Perry 2013). Wide, funnel-shaped entrances increase susceptibility to cold-air intrusion during winter, allowing dense external air to enter and periodically reduce internal temperatures while increasing thermal variability near the entrance (Perry 2013). Conversely, dead-end passages often support warmer, more humid microclimates and may exhibit vertical temperature stratification, with cooler air near the floor and warmer air near the ceiling (Perry 2013). Perry (2013) notes that caves typically maintain higher RH than external conditions, and that during winter, cool, dry air entering a cave rapidly increases in RH as it equilibrates with the cave's warmer, moisture-rich environment. Generally, RH increases with distance from the entrance, though airflow can shift cave RH toward external conditions (Perry 2013). College Cave is a small cave with a single known entrance and narrow constrictions that trap warmer, more humid air while limiting airflow, resulting in consistently elevated temperature and RH. Similarly, the elevated temperature and RH observed 370 m (404.6 yd) inside Middle Butte Cave can be attributed to features such as constrictions, reduced air movement, and dead-end passages.

Observed increases in RH across all hibernacula during the 2023-2024 winter season were likely influenced by two consecutive winters of above-average snowfall, which increased moisture availability and promoted elevated vapor levels in the subsurface environment. According to data from the National Oceanic and Atmospheric Administration (NOAA) collected from CFA, snowfall during the winters of 2023 and 2024 exceeded the long-term average by 4.93 cm (1.94 in) and 5.59 cm (2.20 in), respectively, whereas all other years from 2014 to 2025 recorded below-average snowfall (NOAA Unpublished Data). A fiberoptic line was put in within the right-of-way of Highway 20 in 2023 that is approximately 40 m (43.7 yd) away from North Tower Wackenhut that included digging and cutting of basalt. Because of its proximity to the cave, there is a potential that this work disturbed features of the cave. During the 2024-2025 hibernacula survey, it was noted that there was dripping and standing water inside which is not typical for this cave. Idaho Department of Transportation's Highway 20 expansion project in 2028 has the potential to impact two hibernacula from blasting that will occur. Changing features of the caves will have an impact on temperature and humidity. The discussions are ongoing with Idaho Department of Transportation to minimize any impacts.

4. Associated Monitoring Tasks

4.1. North American Bat Monitoring Program

The North American Bat Monitoring (NABat) program is a multi-agency; multi-national collaborative effort aimed at standardizing the monitoring and management of bat species across North America (Loeb et al. 2015). This program employs a systematic sampling framework based on 10 x 10 km grid cells distributed throughout the continent (Loeb et al. 2015). Grid cells are prioritized at the state level and subsequently divided into four quadrants. Two NABat grid cells were identified within the INL Site, and stationary acoustic survey points were established in each quadrant (n = 8; Figure 4-1; Loeb et al. 2015). Data is collected between July and August, processed using Kaleidoscope software (Appendix B), and submitted to the Northwest Bat Hub at Oregon State University and the IDFG. These data contribute to regional and range-wide analyses, including relative abundance estimates and occupancy probability modeling for the detected species (Udell et al. 2022; Udell et al. 2024).

During the 2024 survey, Anabat Swift detectors were placed at all eight locations and recorded from July 14–July 18. A total of 656 files were recorded documenting six bat species: big brown bat, silver-haired bat, hoary bat, western small-footed myotis, long-legged myotis (*Myotis volans*), and little brown myotis (Table 4-1).

The most recent Status and Trends of North American Bats Report (Udell et al. 2022) evaluated changes in summer occupancy probabilities over the short term (2016–2019) for seven species that occur on the INL Site and over the long term (2010–2019) for little brown myotis. The report concluded that occupancy rates for little brown myotis (both short- and long-term), long-legged myotis, western long-eared myotis, and Yuma myotis were stable in Idaho, as indicated by 95% credible intervals that overlapped zero. In contrast, occupancy rates for big brown bats, hoary bats, and silver-haired bats increased within the state during the same period.

Relative abundance estimates from 2012 to 2020 for little brown myotis and big brown bats in the Northwest region (Washington, northern Idaho, southern British Columbia, and southwestern Alberta) indicated stable populations over the analysis period (Udell et al. 2024). However, the relative abundance of little brown myotis has declined significantly in the eastern United States due to the impacts of WNS. The analysis did not provide relative abundance estimates specific to southeastern Idaho or southwestern Wyoming.

Occupancy and relative abundance estimates for the period June 15 to July 15 from 2012 to 2023 indicated that hoary bat populations increased over the long term (2012–2023) and remained stable over the short term (2016–2023) within NABat grid cell US2890 (Figure 4-1; Udell et al. 2025). For silver-haired bats, populations were stable during both time periods. At a range-wide scale, the analysis found that the relative abundance of hoary bats declined, while silver-haired bats remained stable (Udell et al. 2025).

Occupancy and relative abundance estimates for California myotis, Townsend's big-eared bat, and western small-footed myotis are not currently available from the NABat program.

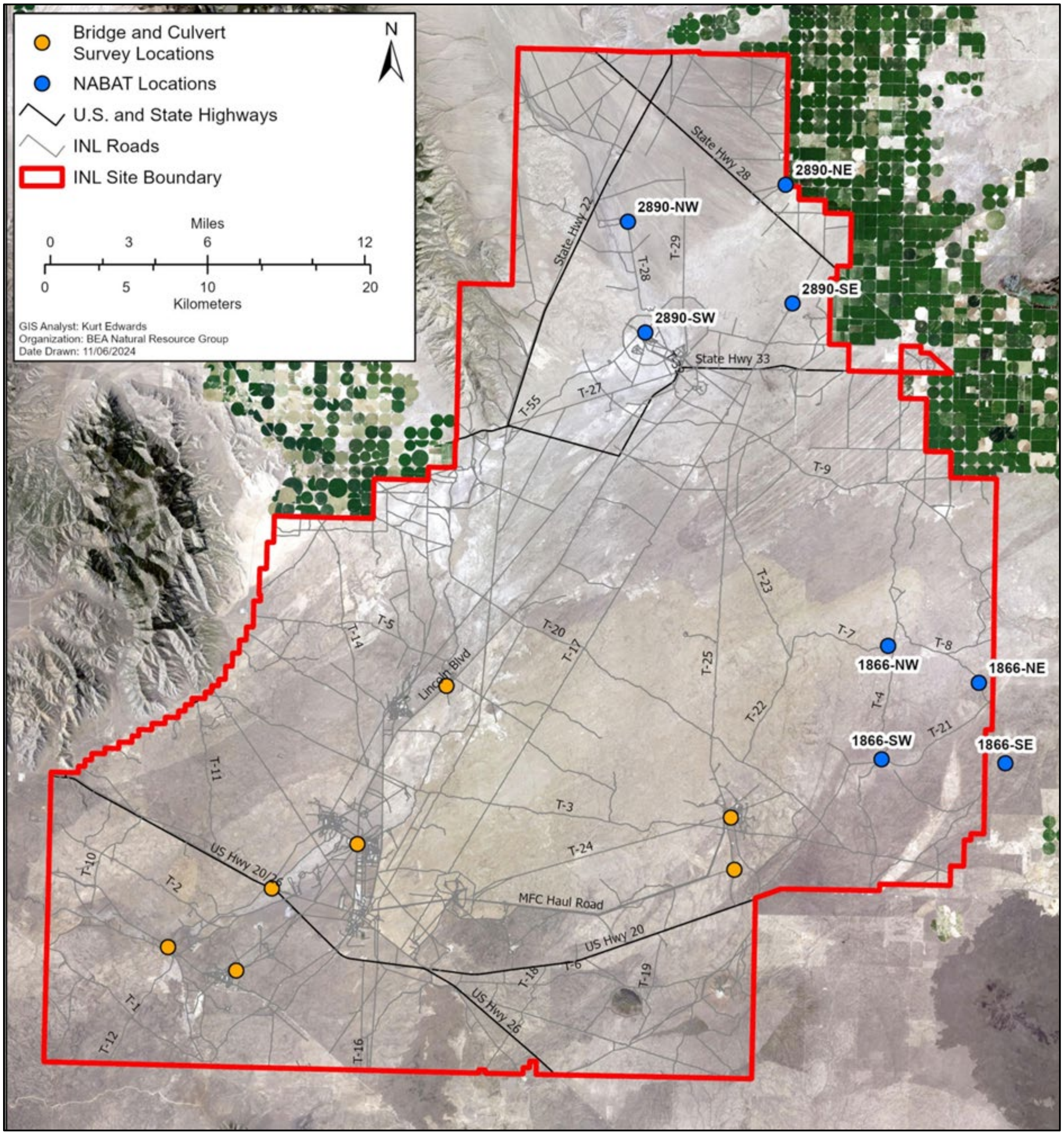

Figure 4-1. Locations of stationary detectors for the North American Bat Monitoring Program and bridges and culverts surveyed to document the occurrence of bat species on and near the Idaho National Laboratory Site between May and September 2024.

Table 4-1. Number of call files from bat species detected during the 2024 North American Bat Monitoring Program acoustic surveys (July 14 –18) on the Idaho National Laboratory Site.

Scientific Name	Common Name	Number of Files by Sampling Location								
		1866 NE	1866 NW	1866 SE	1866 SW	2890 NE	2890 NW	2890 SE	2890 SW	Total
Corynorhinus townsendii	Townsend's big-eared bat	0	0	0	0	0	0	0	0	0
Eptesicus fuscus	big brown bat	0	2	2	0	0	0	0	0	4
Lasiurus cinereus	hoary bat	1	0	1	2	0	0	0	3	7
Lasionycteris noctivagans	silver-haired bat	0	1	2	1	0	0	1	1	6
Myotis californicus	California myotis	0	0	0	0	0	0	0	0	0
Myotis ciliolabrum	western small-footed myotis	27	5	23	5	2	3	1	150	216
Myotis evotis	western long-eared myotis	0	0	0	0	0	0	0	0	0
Myotis lucifugus	little brown myotis	0	1	4	0	4	1	0	368	378
Myotis thysanodes	fringed myotis	0	0	0	0	0	0	0	0	0
Myotis volans	long-legged myotis	4	2	2	1	1	0	0	35	45
Myotis yumanensis	Yuma myotis	0	0	0	0	0	0	0	0	0
Total		**32**	**11**	**34**	**9**	**7**	**4**	**2**	**557**	**656**

4.2. Carcass Recovery and Radionuclide Analysis

Occasionally, bat carcasses are discovered by workers at INL Site facilities, either in a building or nearby outdoor areas. When a carcass is found, NRG is notified for collection of the carcass. The collected carcasses are stored throughout the year, separated by facility and composited into a sample that is sent to a radioanalytical laboratory. The samples are analyzed for gamma-emitting radionuclides (cobalt-60 and cesium-137), specific alpha-emitting radionuclides (plutonium isotopes and americium-241), and for a beta-emitting radionuclide (strontium-90). Analysis results are input into the RESRAD-Biota computer model to determine the dose rate to bats and compared with criteria listed in DOE-STD-1153-2019 (DOE 2019).

During 2024, 39 dead bats (27 western small-footed myotis, four little brown myotis, six silver-haired bats, and two big brown bats) were collected. Five or more bat carcasses of any species at the same time in a single location were never recorded, which would have been classified as a die-off, and would have triggered a notification to local and state biologists from the IDFG to begin investigating the cause of death (DOE 2018).

The following radionuclides were detected in at least one sample during 2024: cesium-137, cobalt-60, Srontium-90, and zinc-65 (Table 4-2). A detection is defined as a result that is greater than or equal to three times the uncertainty. Cesium-137 is ubiquitous in the environment because of fallout from historical nuclear weapons tests. Strontium-90 is present in the environment as a residual of fallout from above ground weapons testing, which occurred between 1945 and 1980. Cobalt-60 and zinc-65, which are fission products, may indicate that the bats visited radioactive effluent ponds on the INL Site, such as at the ATR Complex ponds. The dose rate received by bats at the INL Site was estimated to be 0.0065 rad/d (0.065 mGy/d) in 2024. The calculated dose rate is well below the threshold of 0.1 rad/d (1 mGy/d) (DOE 2019). Based on these results, members of the bat population at the INL Site receive an absorbed dose that is within the DOE standard established for the protection of terrestrial animals. The calculated dose for the past seven years has consistently remained well below the DOE standard established for terrestrial animals (Figure 4-2, DOE 2019). Consequently, radionuclide analysis will be discontinued.

Table 4-2. Radioanalytical results for bats composited by facility at the Idaho National Laboratory Site in 2024.

Facility	Radionuclide	Result ± 1s Uncertainty (pCi/g)	
ATR Complex	Americium-241	1.82E-03	2.23E-03
	Cesium-137	3.15E+00	4.94E-01
	Cobalt-60	1.97E+02	9.21E+00
	Plutonium-238	1.53E-03	2.15E-03
	Plutonium-239/240	1.94E-03	2.59E-03
	Strontium-90	8.65E+01	7.94E+00
	Zinc-65	1.18E+01	1.68E+00
CFA	Americium-241	3.70E-03	2.93E-03
	Cesium-137	7.46E-01	1.82E-01
	Cobalt-60	1.10E+00	2.00E-01
	Plutonium-238	6.84E-04	1.53E-03
	Plutonium-239/240	-6.84E-04	2.47E-03
	Strontium-90	1.08E+00	1.16E-01
	Zinc-65	ND	ND
MFC	Americium-241	3.99E-03	2.82E-03
	Cesium-137	3.54E-02	7.23E-02
	Cobalt-60	ND	ND
	Plutonium-238	0.00E-00	1.80E-03
	Plutonium-239/240	2.54E-03	2.55E-03
	Strontium-90	1.04E-01	2.56E-02
	Zinc-65	ND	ND
NRF	Americium-241	0.00E+00	2.91E-03
	Cesium-137	3.44E-01	1.28E-01
	Cobalt-60	4.18E+00	3.47E-01
	Plutonium-238	1.44E-03	1.77E-03
	Plutonium-239/240	-1.44E-03	2.04E-03
	Strontium-90	7.22E-02	1.69E-02
	Zinc-65	ND	ND
TAN	Americium-241	4.18E-03	3.63E-03
	Cesium-137	-8.83E-02	1.36E-01
	Cobalt-60	ND	ND
	Plutonium-238	-6.90E-04	1.54E-03
	Strontium-90	2.27E-02	1.58E-02
	Zinc-65	ND	ND

ND = Not Detected

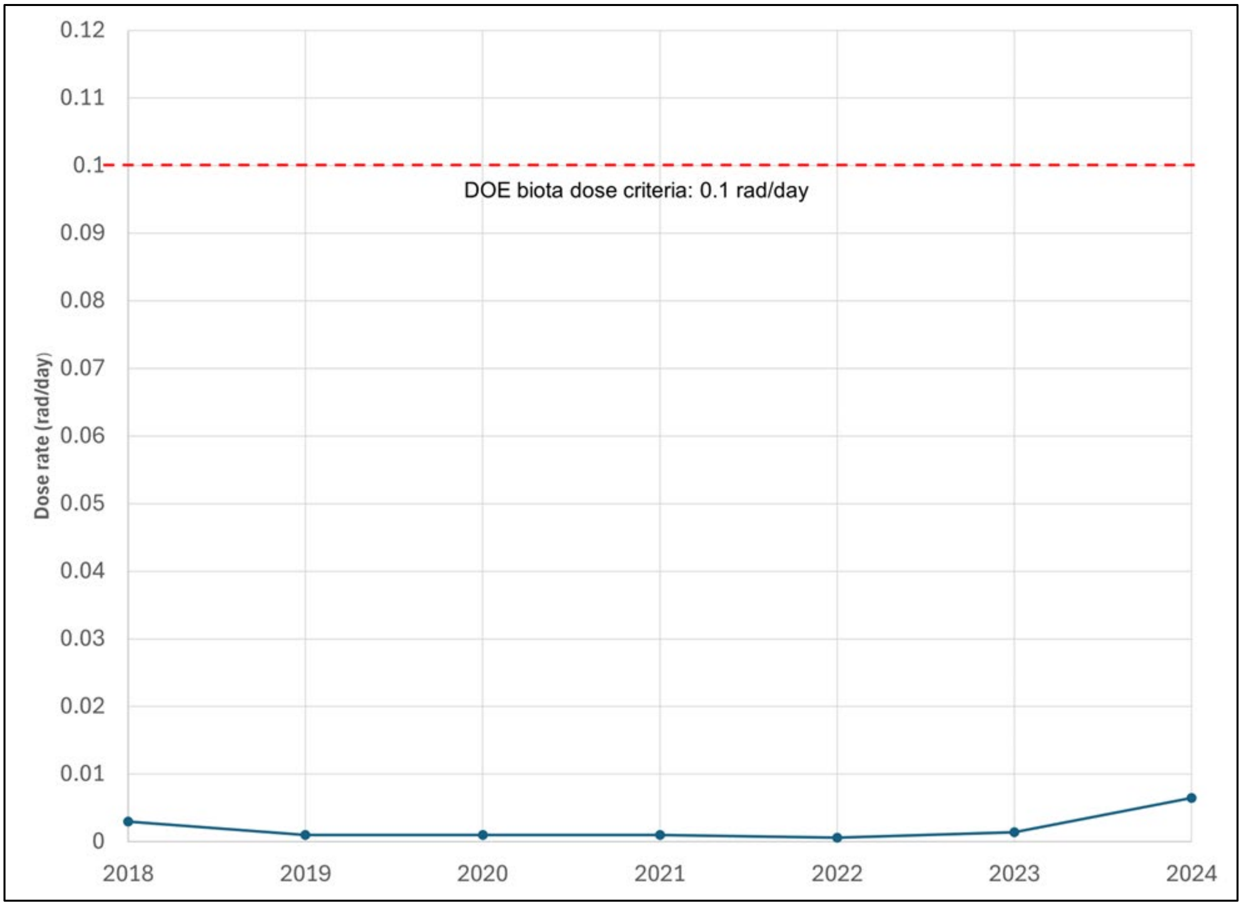

Figure 4-2. Calculated dose rate for bats at the Idaho National Laboratory Site from 2018 to 2024.

4.3. Surveys of Bridges and Culverts

Bridges and culverts provide important roosting habitat for bats (Adams 2003). This was the second-year that surveys of bridges and culverts were conducted for roosting bats. From May to September 2024, four daytime and four nighttime visual surveys were conducted for bats at seven bridges and culverts on the INL Site (Figure 4-1) using protocols adopted from USFWS (USFWS 2020). Day roost surveys were conducted during daylight hours, and night roost surveys starting ½ hour after sunset on separate days, but within one week of each other. Headlamps and flashlights were used to search each feature for roosting bats. An endoscopic camera with a light was used to search cracks and crevices of the cement bridge along the Big Lost River under Lincoln Boulevard northeast of NRF.

No surveys were conducted in June due to water presence in the Big Lost River. No bats were observed at the structures surveyed during the daytime. However, nighttime surveys documented nine bats, with the highest number observed in August (Table 4-3). The most frequently observed species were the little brown myotis and western small-footed myotis (Table 4-3). Additionally, one Yuma myotis was observed flying in one of the culverts southwest of RWMC near the spreading area (Table 4-3). Documenting the use of bridges and culverts by bats provides valuable information for INL workers regarding the times of the year these structures are utilized by bats. This data is crucial for planning maintenance of bridges and culverts. Future surveys will continue to be conducted.

Table 4-3. Location, month of surveys, and number and species of bats observed during surveys of bridges and culverts on the Idaho National Laboratory Site in 2024. Surveys were not conducted in June*. Species are identified as the following: Yuma myotis (*Myotis yumanensis,* MYYU), western small-footed myotis (*M. ciliolabrum,* MYCI), and little brown myotis (*M. lucifugus,* MYLU).

Location	May	June*	July	August	September	Total
Culvert Near INTEC	0	—	0	4 MYLU	0	4MYLU
Rest Stop Bridge	0	—	0	0	0	0
Culverts SW of RWMC (n=4)	0	—	1 MYCI 1 MYYU	0	2 MYCI	3 MYCI 1 MYYU
RWMC Entrance	0	—	0	0	1 MYCI	1 MYCI
MFC Entrance	0	—	0	0	0	0
MFC Bridge	0	—	0	0	0	0

5. Conservation Measures

5.1. Summary of Implementing Conservation Measures for Bats

Conservation measures are used at the INL to mitigate and reduce certain threats identified in the BPP (DOE-ID 2018). The following sections are organized by threat and outline the objective when addressing each threat, Conservation Measures mitigating or reducing the threat, and the accomplishments of DOE-ID, contractors, and stakeholders associated with each Conservation Measure.

5.1.1. Disturbing Hibernating Bats and Destruction/Modification of Hibernacula and Summer Roosts

Mitigation actions for this threat include reducing damage to bat habitats by restricting recreational caving and unlawful cave entry, minimizing disturbances during research, monitoring, and inventory activities, limiting loud noises near hibernacula or roosting sites, and avoiding the removal of active roosting habitats such as buildings, trees, bridges, and culverts.

Identify hibernacula and restrict access to these features.

1) No known recreational or unlawful entry occurred in caves.

Establish a permit process for research required cave entry and bat handling activity.

1) Biologists of the Battelle Energy Alliance, LLC (BEA) NRG program obtained a permit (#2022-2) to enter caves to conduct hibernacula surveys and check data loggers. All personnel followed the most recent USFWS WNS protocols when entering caves and when decontaminating equipment after exiting caves.
2) In 2024, three bats were found in or near facilities and were subsequently relocated to vegetation outside the buildings per established guidelines (INL 2022b, INL 2023, DOE 2018).

Hibernacula surveys should be conducted every other year; surveys should be conducted with caution, quickly, and quietly.

1) Biologists of the BEA NRG program used caution when conducting hibernacula surveys and performed counts quickly and quietly. Hibernacula surveys are conducted no more than once per location per year. To minimize disturbance to bats, biologists adhere to the following protocols: move carefully within the site, keep voices at a minimal level, avoid shining lights directly on bats for longer than 30 seconds, and limit overall survey duration to the minimum necessary—typically not exceeding four hours, depending on the location.

Limit activities that produce continuous noise ≥ 75 decibels within a 1-mile (1.6 km) radius of hibernacula and important summer roosts.

1) No loud noise producing activities were conducted near known hibernacula or important summer roosts.

Avoid blasting within a 0.75-mile (1.2 km) radius of hibernacula and important summer roosts.

1) No blasting occurred within 0.75 miles of known hibernacula or important summer roosts.

Avoid construction activities near summer roosts.

1) No known summer roosts were disturbed because of construction.

Avoid removing living or dead trees.

1) INL biologists were contacted about the ATR Parking Lot Refurbishment and Expansion (ECP INL-22-045) and conducted a survey of trees inside the project footprint for the presence of bats and any signs of bat use. There was no evidence of bat presence at the time of survey in the project area.

If bats are using buildings, sheds, or storage facilities that are proposed to be removed, do such outside of the maternity and hibernation season.

1) INL biologists were contacted about B2-TR-600 RRTR Trailer Relocation R3 (ECP INL-19-049 R3) and did a search of the two trailers that were scheduled to be relocated looking for roosting bats and any signs bat use. There was no evidence of bat presence at the time of survey in or on the trailers. Biologists recommended maintaining awareness for the presence of bats.

2) INL biologists were contacted about MFC-768 D&D for Mock-up Relocation (ERP INL-24-031) and it was determined that a survey was not needed based on the scope of work. Biologists recommended maintaining awareness for the presence of bats.

3) INL biologists were contacted about MFC-768E Building Demolish (ERP INL-24-103) and a survey was completed prior to work being started. There was no evidence of bat presence at the time of survey in or on the building. Biologists recommended maintaining awareness for the presence of bats.

Examine if bats are roosting on bridges, culverts, and underpasses prior to construction activities.

1) INL biologists were contacted about the Adams Blvd. Bridge Replacement (ERP 3839). Surveys for bats were conducted prior to the bridge's removal. There was no evidence of bat presence at the time of survey on the bridge.

2) Site Wide Bridge Maintenance (ECP INL-25-011) was conducted at the end of CY 2025. Maintenance activities conducted during the designated survey period addressed exterior bridge components. These actions included sealing cracks along the apron face, replacing guardrails and hazard markers, and repainting exposed surfaces. Additional bridge work was performed outside the designated survey window.

Avoid or minimize pesticide use and vegetation removal near roosts and important foraging or other bat activity areas.

1) No pesticide or herbicide application or mechanical vegetation removal occurred within 150 feet of caves or near important foraging areas.

5.1.2. White-Nose Syndrome

Mitigation actions for this threat include reducing threats to bats from white nose syndrome caused by introducing *Pd* to hibernacula.

Identify hibernacula and restrict access to these features.

1) No known recreational or unlawful entry occurred in caves.

Minimize the potential spread of WNS.

1) Biologists of the Battelle Energy Alliance, LLC (BEA) NRG program obtained a

permit (#2022-2) to enter caves to conduct hibernacula surveys and check data loggers. All personnel followed the most recent USFWS WNS protocols when entering caves and when decontaminating equipment after exiting caves.

5.1.3. Loss or Modification of Habitat Around Caves

Mitigation actions for this threat include limiting the conversion or removal of vegetation around caves and avoiding the disposal of vegetation or soil near caves.

Limit wildland fires near caves.

1) No wildland fires occurred near caves.

No prescribed burning of native vegetation within a 5-mile (8 km) radius of hibernacula.

1) No prescribed burns occurred on the INL Site.

No large scale (> 10 acres [4 ha]) modification of native vegetation in undisturbed areas within a 1.5-mile (2.4 km) radius of hibernacula.

1) No modification of native vegetation happened within the radius of hibernacula.

Avoid disposing of vegetation or soil within a 33-yard (30 m) radius of a cave.

1) No vegetation or soil was disposed of near caves.

5.1.4. Environmental Contaminants and Wind-Energy Development

Mitigation actions for this threat include reducing threats to bats in foraging and migration habitats by limiting environmental hazards to bats such as environmental radionuclides, pesticides, vegetation removal, and wind energy development.

Assess radionuclide levels in dead bats.

1) Radionuclide levels in dead bats were below the DOE threshold for terrestrial organisms (Section 4.2).

Avoid or minimize pesticide use and vegetation removal near roosts and important foraging or other bat activity areas.

1) Pesticides applied around facilities and waste ponds were used in strict accordance with product label instructions to prevent unintended harm to bats.

Follow the USFWS Land-Based Wind Energy Guidelines.

1) No wind-energy facilities were constructed on the INL Site.

6. Public Outreach

6.1. Summary of Public Outreach Efforts

Public outreach is a key component of bat conservation efforts, aimed at educating and engaging the community about the importance of bats and the challenges they face. In 2024, INL personnel conducted various public outreach activities that included delivering presentations and providing training through collaborations with local universities. These efforts were designed to raise awareness and foster a deeper understanding of bat ecology and conservation among the public and other stakeholders.

Over the course of three Bat Nights events at the Idaho Falls Zoo (Figure 5-1), INL personnel engaged 225 attendees through educational presentations, videos, and interactive activities focused on bat physiology, ecology, and history. INL biologists led a bat watch activity utilizing acoustic detectors connected via Bluetooth to external speakers on the bridge over Idaho Pond, enabling guests to hear amplified bat echolocation calls. Red lighting was installed on the bridge to provide visibility while minimizing disturbance to the bats. Additionally, an Anabat Swift detector was deployed on the Idaho Pond bridge and was programmed to record nightly throughout the summer season to monitor bat activity at the zoo. These recordings provide valuable data to the Zoo on the presence and diversity of bat species in the surrounding area.

Figure 5-1. Photos of Bat Night at the Idaho Falls Zoo.

Each Bat Night, the Idaho Falls Zoo conducts a survey with participants before and after each event to evaluate changes in their perceptions of bats. Unfortunately, data were not collected in 2024. However, during June, July, and August of 2023, a total of 170 participants completed the pre-survey at the beginning of Bat Night, and 123 participants completed the post-survey at the end of the event. The survey included questions on several key areas:

- The importance of bats in controlling insect populations in the United States
- Awareness of diseases affecting bats, including white-nose syndrome
- Perceptions of threats to bats in Idaho, such as habitat loss and human disturbance
- Opinions on protecting bats that roost in buildings

In 2023, scores from the pre-survey to the post-survey showed an increase, indicating that the presentations and activities were effective in improving participants' knowledge and awareness. In 2023, 84 out of 122 participants (approximately 69%) reported seeing or hearing a bat during the event. Participants from Southeast Idaho, California, New Mexico, Iowa, Virginia, Utah, and Texas attended Bat Night at the Idaho Falls Zoo. Note that survey data from the 2024 Bat Nights was not collected.

All About Bats, Idaho Ecology, and Green Energy presentations were given to 475 students in classrooms in Idaho Falls. Those presentations also occurred during a summer science, technology, engineering, and math scholars camp and at a workshop held in conjunction with the Museum of Idaho at Harriman State Park during the bat segment of the wildlife workshop. Twenty teachers were taught during an in-person teacher workshop and 45 teachers were taught during two online courses called "Bring Idaho Alive" workshops about local bats, conservation, and acoustic monitoring. These public outreach activities align with the INL mission by advancing scientific understanding and promoting environmental stewardship. Through collaboration with local institutions, INL provides educational opportunities focused on bat ecology and conservation that are informed by ongoing monitoring and research efforts. Hands-on and observational experiences, such as acoustic monitoring demonstrations and bat foraging observations, help translate scientific data into accessible information for diverse audiences. These efforts support public understanding and transparency while reinforcing INL's role as a responsible steward of biological resources.

7. Other Activities

7.1. Monitoring Recommendations

Little is known about how hoary bats, a migratory species scheduled for ESA listing review in 2028, use the INL Site. It is proposed to deploy acoustic detectors at various locations across the INL Site during fall months (August—November) to capture migration activity and usage of appropriate habitats.

U.S. Highway 20, which crosses the southern portion of the INL Site, is scheduled to be widened to four lanes beginning in 2028. This expansion project will occur near caves on the INL Site and there are plans to check North Tower Wackenhut Cave for reproductive activity.

7.2. Publications

One peer-reviewed paper was submitted to a peer-reviewed journal (Whiting et al. 2025). The paper was written in collaboration with professors at Brigham Young University-Idaho and Idaho State University, as well as with wildlife biologists from the Bureau of Land Management and National Park Service. Two presentations were presented at local and national scientific meetings and three presentations to INL stakeholders.

7.3. Management Actions

As was mentioned in 4.2 Carcass Recovery and Radionuclide Analysis, the calculated dose has consistently remained well below the DOE standard established for terrestrial animals and consequently, radionuclide analysis will be discontinued. Carcasses will still be collected and stored for later analysis, if needed.

7.4. Bat Protection Plan Revisions

The BPP is currently under review and is being updated.

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Appendix A

Conservation Status

Table A-1. Global Conservation Status Rank definitions from NatureServe Explorer.

GLOBAL RANK	GLOBAL CONSERVATION STATUS RANK DEFINITION
G1	Critically Imperiled — At very high risk of extinction or collapse due to very restricted range, very few populations or occurrences, very steep declines, very severe threats, or other factors.
G2	Imperiled — At high risk of extinction or collapse due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
G3	Vulnerable — At moderate risk of extinction or collapse due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
G4	Apparently Secure — At fairly low risk of extinction or collapse due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
G5	Secure — At very low risk or extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats.

Table A-2. Subnational Conservation Status Rank definitions from NatureServe Explorer referred to as State Rank.

STATE RANK	SUBNATIONAL CONSERVATION STATUS RANK DEFINITION
S1	Critically Imperiled — At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.
S2	Imperiled — At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.
S3	Vulnerable — At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.
S4	Apparently Secure — At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.
S5	Secure — At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.

Bat Species Affected by White-nose Syndrome

Table A-1. Bat species and their susceptibility to be infected with the fungus *Pseudogymnoascus destructans* that causes white-nose syndrome.

SCIENTIFIC NAME	COMMON NAME	POTENTIAL OR CONFIRMED WNS SUSCEPTIBLE SPECIES[1]
Corynorhinus townsendii	Townsend's big-eared bat	*Pd* positive
Eptesicus fuscus	Big brown bat	Confirmed
Lasionycteris noctivagans	Silver-haired bat	*Pd* positive
Lasiurus cinereus	Hoary bat	No
Myotis californicus	California myotis	No
Myotis ciliolabrum	Western small-footed myotis	*Pd* positive
Myotis evotis	Western long-eared myotis	Confirmed
Myotis lucifugus	Little brown myotis	Confirmed
Myotis thysanodes	Fringed myotis	Confirmed
Myotis volans	Long-legged myotis	Confirmed
Myotis yumanensis	Yuma myotis	Confirmed

[1]https://www.whitenosesyndrome.org/static-page/bats-affected-by-wns

Appendix B
Methodologies

Detector Setup

Anabat SD2 units have reflector plates oriented at a 45° angle from the center axis of the microphone to minimize echo and clutter noise. Each detector was programmed to record at least from sunset to sunrise, and the division ratio was set at eight. The sensitivity of Anabat detectors was adjusted to exclude ambient noise. When triggered by a bat call, detectors created one, ≤ 15 sec file, labeled with a unique date and time stamp. Anabat SD2 units are deployed during the summer (May—September) at facilities.

Anabat Swift units have microphone housing mounted at a 90° angle to the bat stand. The local time zone is selected and each unit will record a half-hour prior to sunset until half-hour after sunrise. The detector is set to record in zero crossing. When triggered by a bat call, detectors created one, ≤ 15 sec file, labeled with a unique date and time stamp. The Anabat Swift units are deployed at caves during both the summer and winter (November—March).

Acoustic Analysis (Winter)

For the analysis of activity at a facility or a cave, we used Kaleidoscope Pro version 5.6.8 and Bats of North America 5.4.0. to filter noise and for automatic species identification (López-Baucells et al. 2021, Clement et al. 2022, Laverty and Berger 2022, Mallinger et al. 2023). Under the Signal Parameter tab, the minimum and maximum frequency range was set to 14 to 120 kHz. All the other tabs were left at the default setting. In the Auto ID for Bats tab, the 0 Balanced Neutral was selected; this setting produced less identifications and those identifications were more accurate compared with other settings. Idaho was selected in the Select by Region drop-down list. In that list of bats of Idaho, the following species were selected: Townend's big-eared bat, big brown bat, and western small-footed myotis. These species were selected, because they have been documented in southeastern Idahoand observed during hibernacula counts on the INL Site (Genter 1986, Reynolds et al. 1986, Whiting et al. 2015, Whiting et al. 2019, Whiting et al. 2021). Automated acoustic identification is improved by only considering species that are likely to occur in the study area (Fraser et al. 2020, Mallinger et al. 2023). The software-provided nightly maximum likelihood estimate was used as the acceptance threshold to determine nightly occurrence of bat species at each location (i.e., if the p-value was < 0.05 a species occurred on that night at that location) (Hyzy et al. 2020, Deeley et al. 2021, Seewagen and Adams 2021, USFWS 2022, Gaulke et al. 2023), thereby attempting to control for false positive identifications (Deeley et al. 2021, USFWS 2022).

After calls are classified by Kaleidoscope, all calls for all species are manually vetted. Once Kaleidoscope finishes the automated call analyses, the viewer window and the data file table are opened. The viewer window is displayed on one screen and the data file on another. The viewer window settings are adjusted to show all passes as vertical lines, overlay the characteristic frequency of the call, and stretch the frequency scale. A horizontal line at 40 kHz is inserted for reference. Files labeled by Kaleidoscope as CORTOW, MYOCIL, EPTFUS, or NOID are manually vetted and if necessary, relabeled by species or species combinations if more than one species is present. Only files with two or more echolocation pulses are included in the final result to ensure proper identification.

Acoustic Analysis (Summer)

For the analyses of activity at a facility or a cave, we used Kaleidoscope Pro version 5.6.8 and Bats of North America 5.4.0. to filter noise and for automatic species identification (López-Baucells et al. 2021, Clement et al. 2022, Laverty and Berger 2022, Mallinger et al. 2023). Under the Signal Parameter tab, the minimum and maximum frequency range was set to 14 to 120 kHz. All the other tabs were left at the default setting. In the Auto ID for Bats tab, the 0 Balanced Neutral was selected; this setting produced less identifications and those identifications were more accurate compared with other settings. Idaho was selected in the Select by Region drop-down list. In that list of bats of Idaho, the following species were selected: Townend's big-eared bat, big brown bat, hoary bat, silver-haired bat, western small-footed myotis, California myotis, long-eared myotis, little brown myotis, and Yuma myotis. These species were selected, because they have been documented in southeastern Idaho (Genter 1986, Reynolds et al. 1986, Whiting et al. 2015, Whiting et al. 2019, Whiting et al. 2021). Automated acoustic identification is improved by only considering species that occur in the study area (Fraser et al. 2020, Mallinger et al. 2023). The software-provided nightly maximum likelihood estimate was used as the acceptance threshold to determine nightly occurrence of bat species at each location (i.e., if the p-value was < 0.05 a species occurred on that night at that location) (Hyzy et al. 2020, Deeley et al. 2021, Seewagen and Adams 2021, USFWS 2022, Gaulke et al. 2023), thereby attempting to control for false positive identifications (Deeley et al. 2021, USFWS 2022).

For manual vetting, 10% of the nights the detector worked for each cave and facility are randomly selected, then checked using the same methodology used for vetting winter call files.

Hobo Data Loggers

HOBO U23 Pro v2 data loggers record temperature (°C) and humidity (% relative humidity) in caves every 30 minutes and are placed in eight hibernacula in areas where bats have been observed previously during hibernacula surveys (Table B-1). Data loggers are programed to record from at least November 1 to March 31 each winter. To prepare for deploying data loggers in caves, we follow the "Launching Devices" instructions in the HOBOware Pro user manual from the manufacturer. To download data from data loggers we follow the "Reading Out Data" instructions in the HOBOware Pro user manual from the manufacturer.

Table B-1. Locations where HOBO data loggers were deployed in each cave at the Idaho National Laboratory Site.

CAVE	LOCATION
East Boundary north arm	120 m
East Boundary south arm	30 m
Aviators front	38 m
Aviators middle	40 to 50 m
Aviators end	70 to 80 m
Rattlesnake front	5 m
Rattlesnake middle	70 m
Rattlesnake end	164 m
Moonshiners	10 to 20 m
Middle Butte front	20 to 30 m
Middle Butte middle	150 to 160 m
Middle Butte end	370 to 380 m
North Tower Wackenhut	20 m
North Tower Earl	30 m
College	10 m

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Appendix C

Table C-1. Total number of call files by species per month recorded at eight facilities at the Idaho National Laboratory Site during passive acoustic surveys conducted in the summer (May–September) of 2024. Represented species include Townsend's big-eared bats (*Corynorhinus townsendii*; COTO), big brown bat (*Eptesicus fuscus*; EPFU), silver-haired bat (*Lasionycteris noctivagans*; LANO), hoary bat (*Lasiurus cinereus*; LACI), California myotis (*Myotis californicus*; MYCA), western small-footed myotis (*M. ciliolabrum*; MYCI), little brown myotis (*M. lucifugus*; MYLU), long-eared myotis (*M. evotis*; MYEV), and Yuma myotis (*M. yumanensis*; MYYU).

Facility	Total Call Files May 2024								
	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Advanced Test Reactor	0	0	4	49	4	361	0	343	0
Central Facilities Area	0	0	4	18	164	725	0	567	14
Critical Infrastructure Test Range Complex	0	0	0	16	0	52	0	12	0
Idaho Nuclear Technology and Engineering Center	0	3	13	74	1,848	5,970	0	5,054	3
Materials and Fuels Complex	0	0	0	11	0	2	0	1	0
Naval Reactor Facility	0	0	0	0	0	0	0	0	0
Radioactive Waste Management Complex	0	0	2	7	0	30	0	6	0
Test Area North	0	0	0	103	5	1,228	0	497	0
Facility	**Total Call Files June 2024**								
	COTO	**EPFU**	**LACI**	**LANO**	**MYCA**	**MYCI**	**MYEV**	**MYLU**	**MYYU**
Advanced Test Reactor	0	0	0	0	0	0	0	0	0
Central Facilities Area	0	54	19	29	305	1,490	0	1,893	0
Critical Infrastructure Test Range Complex	0	0	0	6	0	15	0	4	0
Idaho Nuclear Technology and Engineering Center	0	2	10	66	1,327	6,294	0	6,562	12
Materials and Fuels Complex	0	0	0	0	0	0	0	0	0
Naval Reactor Facility	0	0	0	0	0	0	0	0	0
Radioactive Waste Management Complex	0	0	0	0	0	0	0	0	0
Test Area North	0	0	11	198	18	2,553	0	1,400	0
Facility	**Total Call Files July 2024**								
	COTO	**EPFU**	**LACI**	**LANO**	**MYCA**	**MYCI**	**MYEV**	**MYLU**	**MYYU**
Advanced Test Reactor	0	5	10	7	0	863	0	954	0
Central Facilities Area	0	158	6	32	210	762	0	2,144	0
Critical Infrastructure Test Range Complex	0	0	0	0	0	31	0	10	0
Idaho Nuclear Technology and Engineering Center	0	19	10	15	1,327	6,260	0	14,811	0
Materials and Fuels Complex	0	0	0	2	0	9	0	8	0
Naval Reactor Facility	0	0	15	0	0	28	0	96	0

Table C-1. Continued.

Facility	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Radioactive Waste Management Complex	0	0	0	0	0	274	0	186	0
Test Area North	0	42	20	4	18	2,083	0	2,651	0

Facility	Total Call Files August 2024								
	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Advanced Test Reactor	0	18	205	156	1,017	6,125	0	7,291	8
Central Facilities Area	0	2	70	60	71	707	0	1,817	0
Critical Infrastructure Test Range Complex	0	0	0	0	0	58	0	38	374
Idaho Nuclear Technology and Engineering Center	0	14	20	5	362	1,400	0	8,135	0
Materials and Fuels Complex	0	0	5	25	0	5	0	21	0
Naval Reactor Facility	0	0	51	117	19	35	0	169	0
Radioactive Waste Management Complex	0	0	71	211	18	93	0	344	0
Test Area North	0	15	195	110	68	4,698	0	4,304	4

Facility	Total Call Files September 2024								
	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Advanced Test Reactor	0	0	65	379	105	723	0	2,789	0
Central Facilities Area	0	7	0	12	15	170	0	345	0
Critical Infrastructure Test Range Complex	0	0	0	16	0	9	0	0	2
Idaho Nuclear Technology and Engineering Center	0	0	0	0	0	0	0	0	0
Materials and Fuels Complex	0	0	0	36	1	20	0	34	0
Naval Reactor Facility	0	0	22	366	10	63	0	501	0
Radioactive Waste Management Complex	0	0	35	347	21	445	0	926	0
Test Area North	0	0	32	482	58	1,977	0	3,870	0

Table C-2. Total number of call files by species per month recorded at seven caves at the Idaho National Laboratory Site during passive acoustic surveys conducted in the summer (May–September) of 2024. Represented species include Townsend's big-eared bats (Corynorhinus townsendii; COTO), big brown bat (*Eptesicus fuscus*; EPFU), silver-haired bat *(Lasionycteris noctivagans*; LANO), hoary bat (*Lasiurus cinereus*; LACI), California myotis (*Myotis californicus*; MYCA), western small-footed myotis (*M. ciliolabrum*; MYCI), little brown myotis (*M. lucifugus*; MYLU), long-eared myotis (*M. evotis*; MYEV), and Yuma myotis (*M. yumanensis*; MYYU).

Cave	Total Call Files May 2024								
	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Aviators	23	0	4	13	20	1,026	0	331	0
East Boundary	28	0	0	4	10	212	2	13	0
Jensen's	9	0	0	45	0	267	0	15	0
Middle Butte	368	48	0	50	595	5,995	59	2,555	0
North Tower Wackenhut	80	0	0	15	7	468	0	1	0
Obscenity Snake Pit	0	0	9	8	0	28	0	3	0
Rattlesnake	19	52	0	108	99	1,792	9	649	0

Table C-2. Continued.

Cave	Total Call Files June 2024								
	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Aviators	217	0	0	9	116	880	0	409	0
East Boundary	107	0	0	3	111	2,135	0	35	0
Jensen's	16	0	0	2	0	1,666	2	167	0
Middle Butte	969	270	0	285	3,310	21,935	225	2,959	0
North Tower Wackenhut	211	0	20	8	186	2,066	0	36	143
Obscenity Snake Pit	0	0	0	0	0	127	3	0	0
Rattlesnake	107	156	0	60	608	11,277	5	3,112	0

Cave	Total Call Files July 2024								
	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Aviators	57	2	0	0	144	1,307	12	838	0
East Boundary	69	0	1	0	494	4,783	70	497	0
Jensen's	32	0	0	0	0	1,439	0	366	0
Middle Butte	785	58	0	0	1,422	29,679	219	4,190	0
North Tower Wackenhut	116	3	3	0	142	2,287	219	133	0
Obscenity Snake Pit	0	0	0	0	0	90	8	12	0
Rattlesnake	110	448	0	0	1,032	14,377	41	7,117	40

Cave	Total Call Files August 2024								
	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Aviators	491	0	14	53	156	918	17	998	0
East Boundary	538	0	0	8	473	2,438	78	259	0
Jensen's	67	3	0	7	0	2,228	0	217	0
Middle Butte	1,089	466	0	0	1,019	30,834	125	5,473	6
North Tower Wackenhut	293	5	12	10	112	1,012	335	91	0
Obscenity Snake Pit	0	0	5	9	0	112	3	28	0
Rattlesnake	327	375	8	137	937	15,240	0	11,756	0

Cave	Total Call Files September 2024								
	COTO	EPFU	LACI	LANO	MYCA	MYCI	MYEV	MYLU	MYYU
Aviators	1,250	2	0	99	0	182	0	331	0
East Boundary	1,187	0	0	63	11	717	0	70	0
Jensen's	68	0	0	15	0	766	0	120	0
Middle Butte	6,377	236	0	25	671	13,666	0	5,133	10
North Tower Wackenhut	735	2	0	48	9	567	169	19	0
Obscenity Snake Pit	0	0	0	20	0	129	0	24	0
Rattlesnake	1,509	125	0	143	254	11,238	0	6,201	0

Table C-3. Results from two-tailed t-tests and Mann-U tests comparing the total number of files across all bat species recorded per night for each month during the summer survey period (May–September) between pre-implementation (2012–2018) and post-implementation (2019–2024) of the Bat Protection Plan at facilities on the Idaho National Laboratory Site. An asterisk (*) indicates results of a Mann-Whitney U test where data was not normally distributed as indicated by a Shapiro-Wilkes test. Bolded values indicate a significant difference between the two time periods where p ≤ 0.15. Green values indicate an increase in files per night in the 2019–2024 survey period when compared to 2012–2018 and red values indicate a decrease in files per night.

Facility	Month	t	W	df	p-value
Advanced Test Reactor	May*	-	22	-	0.59
	June	0.18	-	6.41	0.86
	July*	-	25	-	0.31
	August	-1.18		8.04	0.27
	September*	**-**	**4**	**-**	**0.03**
Central Facilities Area	May	-0.29	-	8.97	0.78
	June	**-1.79**	**-**	**5.41**	**0.13**
	July	**-3.73**	**-**	**9.23**	**0.005**
	August	-1.45	-	9.7	0.18
	September	-0.39	-	9.79	0.71
Critical Infrastructure Test Range Complex	May	1.24	-	7.99	0.25
	June	0.5	-	3.45	0.65
	July	**2.45**	**-**	**8.75**	**0.04**
	August*	-	22	-	0.95
	September	0.95	-	9.58	0.37
Idaho Nuclear Technology and Engineering Center	May	1.19	-	7.28	0.27
	June	1.2	-	6.57	0.27
	July	0.64	-	9.17	0.54
	August	0.23	-	8.12	0.82
	September*	-	24	-	0.34
Materials and Fuels Complex	May	0.86	-	4.99	0.43
	June	0.29	-	5.46	0.78
	July*	**-**	**25**	**-**	**0.08**
	August	0.02	-	10.12	0.99
	September	-0.07	-	5.46	0.95
Naval Reactors Facility	May*	-	8	-	0.63
	June	**1.78**	**-**	**6**	**0.13**
	July	**1.83**	**-**	**8.95**	**0.1**
	August*	**-**	**29**	**-**	**0.07**
	September*	-	20	-	0.43
Radioactive Waste Management Complex	May*	-	8	-	0.73
	June	-0.12	-	6.94	0.91
	July	-1.22	-	6.09	0.27
	August	0.87	-	10.74	0.4
	September	1.39	-	9.73	0.2

Table C-3. Continued.

Facility	Month	t	W	df	p-value
Test Area North	May*	-	25	-	0.63
	June	**-1.95**	**-**	**7.95**	**0.09**
	July*	**-**	**30**	**-**	**0.004**
	August	**2.44**	**-**	**6.01**	**0.05**
	September	**2.49**	**-**	**8.77**	**0.04**

Table C-4. Results from two-tailed t-tests and Mann-U tests comparing the total number of files across all bat species recorded per night for each month during the summer survey period (May–September) between the pre-implementation (2012–2018) and post-implementation (2019–2024) of the Bat Protection Plan at caves on the Idaho National Laboratory Site. An asterisk (*) indicates results of a Mann-Whitney U test where data was not normally distributed as indicated by a Shapiro-Wilkes test. A † indicates there was insufficient data to make a comparison. Bolded values indicate a significant difference between the two time periods where p ≤ 0.15. Green values indicate an increase in files per night in the 2019–2024 survey period when compared to 2012–2018 and red values indicate a decrease in files per night.

Cave	Month	t	W	df	p-value
Aviator	May	1.21	-	6.06	0.27
	June*	-	12	-	0.66
	July	0.53	-	6.92	0.62
	August	-0.18	-	8.97	0.86
	September	0.29	-	8.64	0.78
East Boundary	May	0.3	-	2.29	0.79
	June†	-	-	-	-
	July	1.2	-	6	0.27
	August	-0.48	-	6.77	0.64
	September*	-	**8**	-	**0.15**
Jensen's	May†	-	-	-	-
	June	**-6.09**	**-**	**6.5**	**0.001**
	July	-0.48	-	6.74	0.64
	August	-0.58	-	6.58	0.58
	September	**-1.82**	**-**	**3.47**	**0.15**
Middle Butte	May	0.74	-	6.83	0.48
	June	**1.77**	**-**	**7.56**	**0.12**
	July	1.34	-	5.32	0.23
	August	0.12	-	8.92	0.91
	September	0.21	-	9.18	0.84
North Tower Wackenhut	**May**	**-1.95**	**-**	**5.28**	**0.11**
	June	**-1.86**	**-**	**7.46**	**0.1**
	July	**-1.74**	**-**	**6.56**	**0.13**
	August	-1.41	-	6.9	0.2
	September*	**-**	**8**	**-**	**0.13**

Table C-4. Continued

Cave	Month	t	W	df	p-value
Obscenity Snake Pit	May†	-	-	-	-
	June†	-	-	-	-
	July†	-	-	-	-
	August*	-	6	-	0.26
	September	-0.62	-	2.09	0.59
Rattlesnake	May	1.04	-	9.91	0.32
	June	-0.95	-	6.72	0.37
	July	**2.13**	**-**	**8.89**	**0.06**
	August*	-	18	-	1
	September	0.47	-	9.99	0.65

Table C-5. Total number of call files by species per month recorded at nine caves at the Idaho National Laboratory Site during passive acoustic surveys conducted in the winter (November–March) of 2024/2025. Represented species include Townsend's big-eared bats (*Corynorhinus townsendii*; COTO), western small-footed myotis (*Myotis ciliolabrum*; MYCI), big brown bat (*Eptesicus fuscus*; EPFU), long-eared myotis (*M. evotis*; MYEV), and Yuma myotis (*M. yumanensis*; MYYU).

Cave	Total Call Files November 2024				
	COTO	MYCI	EPFU	MYEV	MYYU
Aviators	4	31	0	0	0
College	1	22	0	0	0
East Boundary	37	77	0	0	0
Link Sausage	3	14	0	0	0
Middle Butte	304	730	44	0	3
Moonshiners	0	11	0	0	0
North Tower Earl	5	81	7	0	0
North Tower Wackenhut	34	20	8	0	0
Rattlesnake	125	2,753	44	0	5
Cave	**Total Call Files December 2024**				
	COTO	**MYCI**	**EPFU**	**MYEV**	**MYYU**
Aviators	0	2	0	0	0
College	0	5	0	0	0
East Boundary	13	36	0	0	0
Link Sausage	3	5	0	0	0
Middle Butte	224	619	49	3	0
Moonshiners	1	2	0	0	0
North Tower Earl	5	36	28	0	0
North Tower Wackenhut	9	12	1	0	0
Rattlesnake	77	2,158	26	1	1
Cave	**Total Call Files January 2025**				
	COTO	**MYCI**	**EPFU**	**MYEV**	**MYYU**
Aviators	0	2	0	0	0
College	0	0	0	0	0
East Boundary	1	2	0	0	0
Link Sausage	0	0	0	0	0
Middle Butte	17	162	52	1	1
Moonshiners	0	0	0	0	0
North Tower Earl	0	18	0	0	0

Table C-5. Continued.

North Tower Wackenhut	2	1	0	0	0
Rattlesnake	2	432	3	1	0
Cave	**Total Call Files February 2025**				
	COTO	**MYCI**	**EPFU**	**MYEV**	**MYYU**
Aviators	0	0	0	0	0
College	0	0	0	0	0
East Boundary	0	2	0	0	0
Link Sausage	0	0	0	0	0
Middle Butte	23	205	11	0	0
Moonshiners	0	3	0	0	0
North Tower Earl	0	17	4	0	0
North Tower Wackenhut	1	2	0	0	0
Rattlesnake	13	1,446	33	1	1
Cave	**Total Call Files March 2025**				
	COTO	**MYCI**	**EPFU**	**MYEV**	**MYYU**
Aviators	0	0	0	0	0
College	0	5	0	0	0
East Boundary	18	64	1	4	0
Link Sausage	2	2	0	0	0
Middle Butte	155	803	42	4	0
Moonshiners	0	2	0	0	0
North Tower Earl	11	115	10	0	0
North Tower Wackenhut	68	10	2	0	0
Rattlesnake	65	2,584	21	10	8

Table C-6. Results from two-tailed t-tests and Mann-U tests comparing the total number of files across all bat species recorded per night for each month during the winter survey period (November–March) between the pre-implementation (2012–2018) and post-implementation (2019–2024) of the Bat Protection Plan at caves on the Idaho National Laboratory Site. An asterisk (*) indicates results of a Mann-Whitney U test where data was not normally distributed as indicated by a Shapiro-Wilkes test. A † indicates there was insufficient data to make a comparison. Bolded values indicate a significant difference between the two time periods where $p \leq 0.15$. Green values indicate an increase in files per night in the 2019–2024 survey period when compared to 2012–2018 and red values indicate a decrease in files per night.

Cave	Month	t	W	df	p-value
Aviator	November*	-	21	-	0.07
	December*	-	20	-	0.81
	January*	**-**	**31.5**	**-**	**0.15**
	February*	-	20.5	-	0.35
	March*	-	26.5	-	0.19
College	**November**	**-1.86**	**-**	**7.95**	**0.10**
	December*	-	10	-	1.00
	January	0.27	-	7.03	0.80
	February*	-	22.5	-	0.46
	March†	-	-	-	-
East Boundary	November	-0.82	-	9.74	0.43
	December*	-	21	-	0.64
	January	-0.77	-	9.92	0.46
	February*	-	15	-	1.00
	March	-1.11	-	6.93	0.30

Table C-6. Continued.

Cave	Month	t	W	df	p-value
Link Sausage	November*	-	8.5	-	0.17
	December*	-	23	-	0.43
	January*	-	12.5	-	0.42
	February*	-	22.5	-	0.46
	March*	-	11	-	0.91
Middle Butte	November*	-	17	-	0.38
	December*	-	21	-	0.70
	January*	**-**	**8.5**	**-**	**0.09**
	February*	-	24	-	0.73
	March	-0.24	-	9.61	0.81
Moonshiners	November*	-	7.5	-	0.19
	December[†]	-	-	-	-
	January*	-	24	-	0.33
	February*	-	18	-	0.72
	March	-0.92	-	6.97	0.39
North Tower Earl	**November***	**-**	**9**	**-**	**0.10**
	December*	**-**	**7**	**-**	**0.10**
	January*	-	22	-	0.95
	February*	-	20	-	0.92
	March*	-	8	-	0.25
North Tower Wackenhut	**November***	**-**	**6**	**-**	**0.07**
	December*	-	14.5	-	0.68
	January	-1.51	-	6.31	0.18
	February*	-	13	-	0.79
	March	-1.55	-	5.46	0.18
Rattlesnake	**November**	**-2.80**	**-**	**8.36**	**0.02**
	December	**-2.48**	**-**	**6.01**	**0.05**
	January	-0.39	-	9.40	0.70
	February*	**-**	**4**	**-**	**0.05**
	March*	-	8	-	0.25