INL/RPT-24-82177
Revision 0

Idaho National Laboratory Site Bat Protection Plan Annual Report 2024

December 2024

Idaho National Laboratory

*INL is a U.S. Department of Energy National Laboratory
operated by Battelle Energy Alliance, LLC*

INL/RPT-23-75900
Revision 0

Idaho National Laboratory Site Bat Protection Plan Annual Report 2024

December 2024

Prepared for the
U.S. Department of Energy
Contract DE-AC07-05ID14517

Page intentionally left blank

EXECUTIVE SUMMARY

The 2024 annual report provides updated information on bat population monitoring, white-nose syndrome surveillance, implementation of conservation measures, collaborative partnerships, and public outreach at the Idaho National Laboratory (INL) Site from March 2023 until March 2024. This report will ensure that the U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, and other collaborators have current information concerning bats on the INL Site, especially for those species of conservation concern. Such information will help contractors at the INL Site with project planning and construction and will allow U.S. Department of Energy, Idaho Operations Office to continue its mission with minimal delays in the event a bat is listed under the Endangered Species Act.

Hibernacula counts of western small-footed myotis (*Myotis ciliolabrum*) in 2024 fell within the normal variation of historical population counts on the INL Site. The counts of Townsend's big-eared bats (*Corynorhinus townsendii*) were also consistent with historical counts in all caves except at Middle Butte where counts were higher and at Rattlesnake and Aviators caves where counts were lower than historical variation. Acoustic detectors documented 8,118 call files in the winter of 2023/2024. The number of Townsend big-eared bat and western small-footed myotis call files/cave was consistent with previous winters. The results of summer acoustic analyses indicated the presence of eight species at facilities and nine species at caves. Little brown myotis (*M. lucifugus*) and western small-footed myotis were the most common species recorded at all facilities, except for the Materials and Fuels Complex where silver-haired bats were the most common. Western small-footed myotis and Townsend's big-eared bats were the most recorded bats at caves. All caves on the INL Site had temperatures that were below the optimal growth for *Pseudogymnoascus destructans,* especially during January to March. College (95%), Middle Butte (90%), Moonshiner (91%), and North Tower Wackenhut (91%) caves had humidity levels that would support optimal growth of the fungus. Additional 2024 activities included summer bridge and culvert surveys, acoustic data collection for the North American Bat Monitoring program, carcass recovery and assessment, as needed relocation of live bats, and public outreach.

This annual report appends the 2023 annual report (DOE 2023). In conjunction with this update, the U.S. Department of Energy, Idaho Operations Office, U.S. Fish and Wildlife Service, Idaho Department of Fish and Game, the INL contractor, and the Naval Reactors Facility will meet to discuss changes in any section of the plan, changes in the conservation status of bats that occur on the INL Site, or new policies that will benefit the conservation and management of sensitive bat species or their habitat.

ACKNOWLEDGEMENTS

We thank biologists from the Idaho Department of Fish and Game and the U.S. Fish and Wildlife Service. This report was authored by Battelle Energy Alliance, LLC (BEA), and subcontractor staff from the Natural Resources Group. Bryan F. Bybee and Jericho C. Whiting conducted the fieldwork and authored many of the sections of the report. Colby J. Kramer authored the section on Assess Conservation Measures for Bats. Kevin Claver authored the section on Carcass Recovery and Assessment. Gregg M. Losinski conducted and provided information about interacting with local schools. Kurt T. Edwards supported all authors by archiving data, providing quality assurance, and producing figures. Brenda Pace assisted with North American Bat Monitoring program and hibernacula counts surveys. George J. Krauszer II, Samuel R. Williams, Terrah M. Owens, Sarah Baccus, and Brande Hendricks assisted with editing and document formatting.

CONTENTS

1.0 Background 1

2.0 Population Monitoring 3

2.1 Hibernacula Counts 3

2.1.1 Methods 3

2.1.2 Results 3

2.1.3 Discussion 5

2.2 Winter Passive Acoustic Monitoring 5

2.2.1 Methods 5

2.2.2 Results 5

2.2.3 Discussion 6

2.3 Spring, Summer, and Autumn Passive Acoustic Monitoring 6

2.3.1 Methods 6

2.3.2 Results 7

2.3.3 Discussion 9

3.0 White-Nose Syndrome Surveillance 11

3.1 Cave Temperature and Humidity 11

3.1.1 Methods 11

3.1.2 Results 11

3.1.3 Discussion 12

4.0 Additional Monitoring Tasks 13

4.1 Surveys of Bridges and Culverts 13

4.2 Participation in The North American Bat Monitoring Program 16

4.3 Carcass Recovery and Assessment 17

5.0 Associated Tasks 21

5.1 Implementing Conservation Measures for Bats 21

5.2 Relocating Live Bats 24

5.3 Public Outreach 24

6.0 Recommendations for Additional Monitoring Activities, Management Actions, and Plan Revisions 27

6.1 Additional Studies 27

6.1.1 Hibernacula Surveys around Middle Butte 27

6.1.2 Establishing a Method to Determine the Index of Abundance from 2011 to Present 27

6.1.3 Setting Mist Nets at Facilities and Caves 27

6.1.4 Management Actions 28

6.1.5 Plan Revisions 28

7.0 Literature Cited 29

Appendix A. Conservation Status A-1
Appendix B. Detector Setup B-1
Appendix C. Acoustic Analysis C-1
Appendix D. Bat Species Affected by White-Nose Syndrome D-1
Appendix E. HOBO Data Loggers E-1

FIGURES

Figure 2-1. Number of western small-footed myotis (MYCI) by survey years in the two largest western small-footed myotis hibernacula (Rattlesnake and Middle Bute caves) on the Idaho National Laboratory Site. The solid line represents the baseline mean for each cave reported in the BPP (1984-2015) while the dashed lines represent the corresponding reported standard deviation. 4

Figure 2-2. Number of Townsend's big-eared bats (COTO) by survey years in (Middle Bute**,** Rattlesnake, Aviators, and North Tower Wackenhut caves) on the Idaho National Laboratory Site. The solid line represents the baseline mean for each cave reported in the BPP (1984-2015) while the dashed lines represent the corresponding reported standard deviation. 4

Figure 2-3. Proportion of nights that bat species were documented at Idaho National Laboratory Site facilities during May to September 2023. The number of nights sampled is denoted by the n after the facility name. Species are identified as the following: Townsend's big-eared bat (COTO), big brown bat (EPFU), hoary bat (LACI), silver-haired bat (LANO), California myotis (MYCA), western small-footed myotis (MYCI), little brown myotis (MYLU), and Yuma myotis (MYYU). 7

Figure 2-4. Proportion of nights that bat species were documented at Idaho National Laboratory Site caves during May to September 2023. The number of nights sampled is denoted by the n after the facility name. Species are identified as the following: Townsend's big-eared bat (COTO), big brown bat (EPFU), hoary bat (LACI), silver-haired bat (LANO), California myotis (MYCA), western small-footed myotis (MYCI), long-eared myotis (MYEV), little brown myotis (MYLU), and Yuma myotis (MYYU). 8

Figure 2-5. Proportion of nights that bat species were documented at Idaho National Laboratory Site facilities during May to September 2022. In 2022, INTEC isn't shown due to the detector malfunctioning. The number of nights sampled is denoted by the n after the facility name. Species are identified as the following: Townsend's big-eared bat (COTO), big brown bat (EPFU), hoary bat (LACI), silver-haired bat (LANO), California myotis (MYCA), western small-footed myotis (MYCI), little brown myotis (MYLU), and Yuma myotis (MYYU). 8

Figure 2-6. Proportion of nights that bat species were documented at Idaho National Laboratory Site caves during May to September 2022. In 2022, Aviators Cave isn't shown due to the microphone malfunctioning. The number of nights sampled is denoted by the n after the facility name. Species are identified as the following: Townsend's big-eared bat (COTO), big brown bat (EPFU), hoary bat (LACI), silver-haired bat (LANO), California myotis (MYCA), western small-footed myotis (MYCI), long-eared myotis (MYEV), little brown myotis (MYLU), and Yuma myotis (MYYU). 9

Figure 3-1. Mean (black dot), minimum, and maximum (error bars) temperatures (°C) by month in eight caves on the Idaho National Laboratory Site from November 2023 to March 2024. The solid blue lines represent the optimal range of temperatures for growth of P. destructans, while the dashed blue lines represent the range of temperatures for active growth of P. destructans (Verant et al. 2012). 12

Figure 4-1. Locations of bridges and culverts and stationary detectors for NABat monitoring to document the occurrence of bat species on and near the Idaho National Laboratory Site between May and September 2023. 14

Figure 4-2. Number of bats observed by month during nighttime surveys of bridges and culverts in 2023 on the INL Site. Surveys were not conducted in June. 15

Figure 4-3.Calculated dose for bats over the past six years. 19

Figure 5-1. Photo of Bat Night at the Idaho Falls Zoo. 25

TABLES

Table 1-1.Bat species that occur on the Idaho National Laboratory Site and their conservation designations. 2

Table 2-1.Number of nights detectors functioned, and number of Townsend's big-eared bats (COTO) and western small-footed myotis (MYCI) call files counted in caves sampled with acoustic detectors in winter 2023/2024. 6

Table 4-1.Location, month of surveys, and number and species of bats observed during surveys of bridges and culverts on the Idaho National Laboratory Site in 2023. Surveys were not conducted in June. Species are identified as the following: silver-haired bat (LANO), western small-footed myotis (MYCI), and little brown myotis (MYLU). 15

Table 4-2.Number of bat files from each species during the 2023 NABat acoustic surveys on the Idaho National Laboratory Site. 16

Table 4-3.Radioanalytical results for bats composited by facility in 2023. 17

Table 4-3. continued. 18

Table 5-1.Threats affecting bats and their habitat that are most likely to occur on the Idaho National Laboratory Site, recommended conservation measures (DOE 2018), and assessment of those measures on the INL Site from March 2023 until March 2024. 22

Table 5-1.continued. 23

Table 6-1.Additional studies, when they were proposed and when they were adopted. 28

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

Table A-2.Subnational Conservation Status Rank definitions from NatureServe Explorer referred to as State Rank. A-1

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

Table E-1. Locations where HOBO data loggers were deployed in each cave. E-1

ACRONYMS

ATR	Advanced Test Reactor
BEA	Battelle Energy Alliance, LLC
BLM	Bureau of Land Management
BPP	Bat Protection Plan
DOE-ID	U.S. Department of Energy, Idaho Operations Office
ECP	Environmental Compliance Permit
ESA	Endangered Species Act
IDFG	Idaho Department of Fish and Game
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MFC	Materials and Fuels Complex
NABat	North American Bat Monitoring
NRF	Naval Reactor Facility
NRG	Natural Resource Group
RWMC	Radioactive Waste Management Complex
TPOC	Technical Points of Contacts
USFWS	U.S. Fish and Wildlife Service
WNS	White-nose Syndrome

1.0 BACKGROUND

The Idaho National Laboratory (INL) Site is a U.S. Department of Energy, Idaho Operations Office (DOE-ID), reservation encompassing 890 mi^2 (230,509 ha) on the eastern Snake River Plain approximately 25 mi (40 km) west of Idaho Falls. In October 2018, the DOE-ID and the U.S. Fish and Wildlife Service (USFWS) signed the INL Site Bat Protection Plan (BPP, DOE 2018). The BPP provides procedures and methods to track populations, identify habitat, and implement conservation measures, and make adaptive modification for bats and their habitat on the INL Site, as data or regulatory changes warrant. That plan also provides a mechanism for collaborating 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 conservation actions identified in the Idaho State Wildlife Action Plan (IDFG 2024, DOE 2018).

The BPP annual report documents activities conducted between March 2023 to March 2024 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 the USFWS, IDFG, and other collaborators with current information concerning bats on the INL Site, especially for those species of conservation concern (Table 1). DOE-ID provides the annual report to the USFWS and IDFG and can be found at: https://inl.gov/environmental-publications/ under Conservation Planning.

This annual report appends the 2023 annual report (DOE 2023) and contains data from the monitoring program from March 2023 to March 2024. In conjunction with this update, the DOE-ID, USFWS, IDFG, the INL contractor, and the Naval Reactors Facility (NRF) will meet to discuss changes in any section of the plan (e.g., fluctuations in trends of bat abundance on the INL Site or white-nose syndrome [WNS] monitoring), changes in the conservation status of bats that occur on the INL Site, or new policies that will benefit the conservation and management of sensitive bat species or their habitat.

Table 1-1. Bat species that occur on the Idaho National Laboratory Site and their conservation designations.

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK[1]	STATE RANK[1]	USFWS RANK	BLM RANK[2]	IDFG RANK[3]
Corynorhinus townsendii	Townsend's big-eared bat	G4	S3	Species of Concern	Type 2	C
Eptesicus fuscus	big brown bat	G5	S3	Species of Concern	Type 2	I
Lasionycteris noctivagans	silver-haired bat	G3, G4	S3	Species of Concern	Type 2	C
Lasiurus cinereus	hoary bat	G3, G4	S3	-	Type 2	C
Myotis californicus	California myotis	G5	S3	Species of Concern	Type 2	-
Myotis ciliolabrum	western small-footed myotis	G5	S3	-	Type 2	C
Myotis evotis	western long-eared myotis	G5	S3	-	Type 2	-
Myotis lucifugus	little brown myotis	G3	S3	Petitioned for Listing	Type 2	C
Myotis thysanodes	fringed myotis	G4	S3	Species of Concern	Type 2	I
Myotis volans	long-legged myotis	G4, G5	S3	Species of Concern	Type 2	I
Myotis yumanensis	Yuma myotis	G5	S3	-	Type 2	C

[1]See NatureServe for a description of rankings (Appendix A, Tables A-1 and A-2)
[2]Type 2 - Idaho Bureau of Land Management (BLM) Sensitive Species, including United States Fish and Wildlife Service (USFWS) Proposed and Candidate species, Endangered Species Act (ESA) species delisted during the past five years, and ESA Experimental Nonessential populations (BLM 2008).
[3]See IDFG State Wildlife Action Plan for a description of rankings (IDFG 2024).
C = Species of Greatest Conservation Need
I = Species of Greatest Information Need

2.0 POPULATION MONITORING

2.1 Hibernacula Counts

2.1.1 Methods

Estimating long-term population changes of bats is critical for implementing conservation measures and providing important information for habitat management (Whiting et al. 2018a, 2018b). Population estimates are determined by counting bats in caves during hibernation (Whiting et al. 2018b). These counts are one of the best ways to estimate population changes, because bats use the same hibernation sites for decades (Whiting et al. 2018a, Whiting et al. 2021). Counts of hibernating bats on the INL Site were conducted between November 1 and March 31 using established protocols and care to minimize disturbing bats (INL 2022a). The baseline mean and the corresponding standard deviation were calculated from historical counts between 1984 and 2015 for Aviator, Middle Butte, North Tower Wackenhut, and Rattlesnake caves. East Boundary cave only had two counts during this time period so these baseline metrics could not be calculated. College, Link Sausage, Moonshiner, and North Tower Earl caves had low numbers of hibernating bats (0-12) during the historical period, therefore counts from 2023/2024 were not compared to historical baselines. A count in 2023/2024 that overlapped the standard deviation of historical counts was considered not different than historical counts.

2.1.2 Results

On January 2-3, 2024, hibernacula surveys were conducted in Middle Butte, Rattlesnake, East Boundary, Aviators, College, Moonshiners, North Tower Earl, and North Tower Wackenhut caves. During those surveys, the INL contractor counted a total of 59 western small-footed myotis and 718 Townsend's big-eared bats. The number of western small-footed myotis counted in Middle Butte and Rattlesnake caves did not differ between the winter of 2023/2024 and historical counts (Figure 2-1), and this species was not observed in any other caves. The count of Townsend's big-eared bats in Middle Butte Cave was higher than historical counts and in North Tower Wackenhut Cave counts of that species were consistent with historical counts. The count of Townsend's big-eared bats in Rattlesnake and Aviators caves during the winter of 2023/2024 was lower than during historical counts (Figure 2-2). During the 2023/2024 hibernacula surveys at College (COTO = 1, MYCI = 0), Moonshiners (COTO = 0, MYCI = 0), North Tower Earl (COTO = 3, MYCI = 0), North Tower Wackenhut (COTO = 25, MYCI = 0), and East Boundary (COTO = 28, MYCI = 0) caves were comparable to other years.

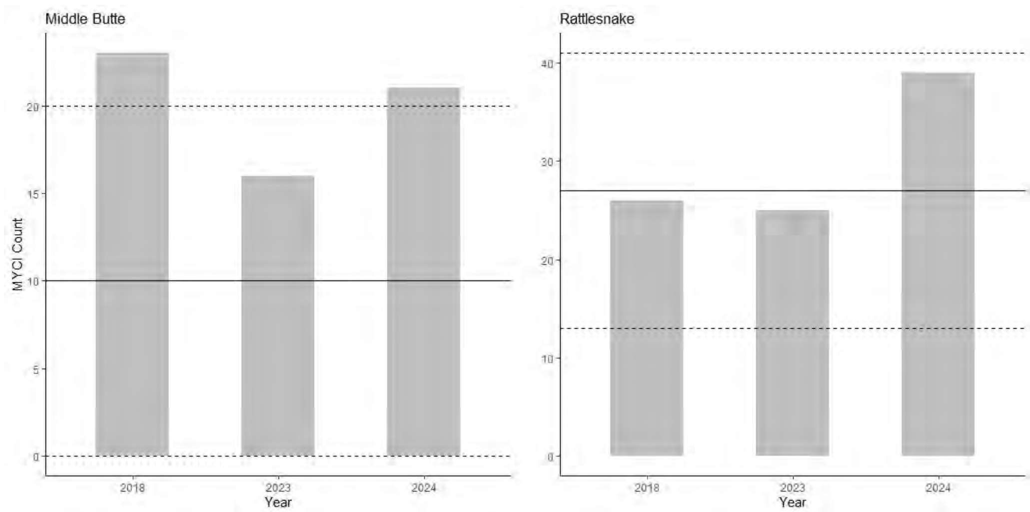

Figure 2-1. Number of western small-footed myotis (MYCI) by survey years in the two largest western small-footed myotis hibernacula (Rattlesnake and Middle Bute caves) on the Idaho National Laboratory Site. The solid line represents the baseline mean for each cave reported in the BPP (1984-2015) while the dashed lines represent the corresponding reported standard deviation.

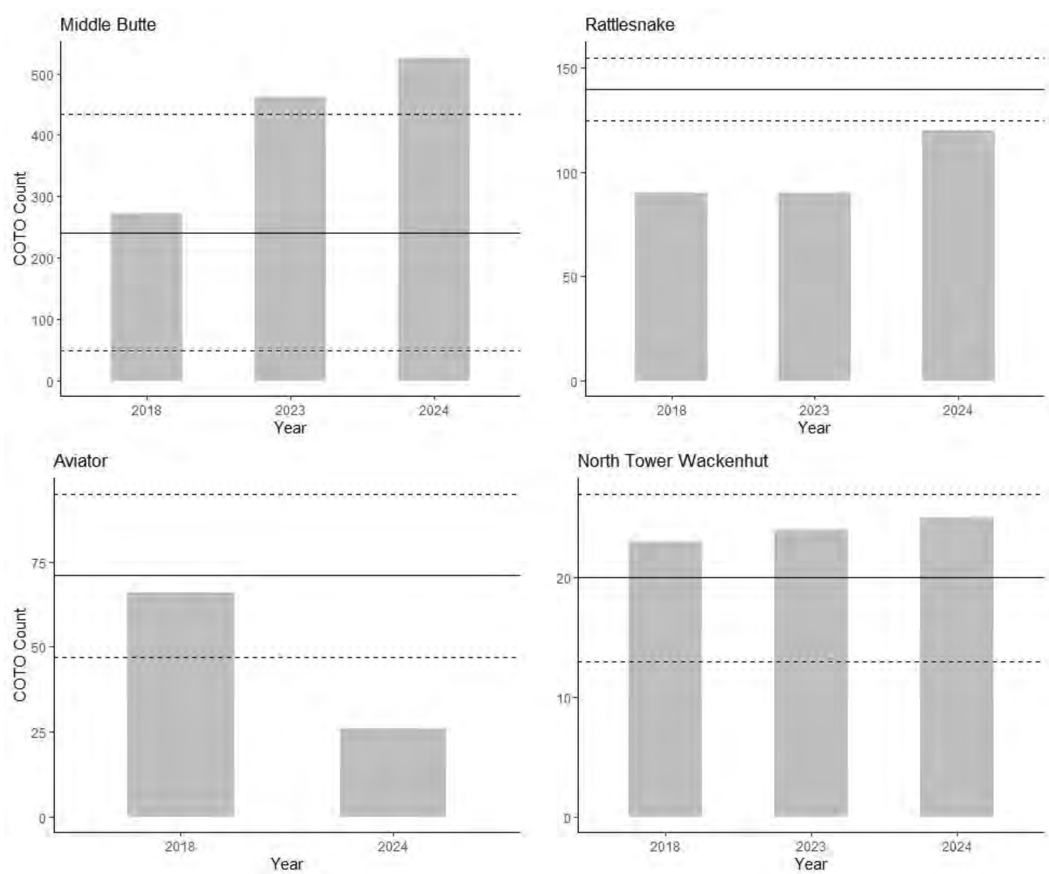

Figure 2-2. Number of Townsend's big-eared bats (COTO) by survey years in (Middle Bute, ***Rattlesnake, Aviators, and North Tower Wackenhut caves) on the Idaho National Laboratory Site. The solid line represents the baseline mean for each cave reported in the BPP (1984-2015) while the dashed lines represent the corresponding reported standard deviation.***

2.1.3 Discussion

The counts of western small-footed myotis were consistent with historical counts, and the counts of Townsend's big-eared bats in the winter of 2023/2024 were higher in Middle Butte Cave, but lower in Rattlesnake and Aviators caves than historical counts. Hibernacula counts of Townsend's big-eared bats and western small-footed myotis on the INL Site often exhibit large amounts of variation across years (Whiting et al. 2018b). That variation is normal as bats likely use different caves for hibernation and different locations inside caves, which influences observers seeing and counting those species. The number of Townsend's big-eared bats in Aviators Cave will continue to be monitored to verify if the low counts observed in the winter of 2023/2024 were an anomaly.

2.2 Winter Passive Acoustic Monitoring

2.2.1 Methods

Acoustic detectors are effective at identifying bat species and quantifying bat activity, because bat calls are consistent in structure and have species-specific characteristics (Whiting et al. 2022). These devices have been used extensively to study bat winter ecology (Whiting et al. 2019, Lausen and Barclay 2006). Anabat Swift detectors were set at nine hibernacula on the INL Site between 1 November and 31 March. Detectors were powered by external batteries and solar panels. All detectors were set using established protocols (Appendix B).

Kaleidoscope software (version 5.6.8, Wildlife Acoustics, Inc.) was used for species identification and to analyze number of call files at caves during the winter (Appendix C). Only call files of western small-footed myotis, big brown bat, and Townsend's big-eared bats were analyzed, because those species represent >99% of bats observed during hibernacula counts (Whiting et al. 2018a, Whiting et al. 2021). All call files were subsequently manually vetted. Total number of call files by cave were documented for winter of 2023/2024.

2.2.2 Results

Acoustic detectors documented 8,118 call files in winter of 2023/2024 (Table 2-1). In the two largest hibernacula, Middle Butte and Rattlesnake caves, we recorded 1,267 and 5,593 call files of western small-footed myotis, respectively. For Townsend's big-eared bats, detectors recorded 410 call files in Middle Butte Cave and 177 files in Rattlesnake cave, these results are consistent with historical data from the INL Site during 2011 to 2018 (Whiting et al. 2021).

Table 2-1. Number of nights detectors functioned, and number of Townsend's big-eared bats (COTO) and western small-footed myotis (MYCI) call files counted in caves sampled with acoustic detectors at the Idaho National Laboratory Site in winter 2023/2024.

CAVE	NIGHTS DETECTORS FUNCTIONED	NUMBER OF CALL FILES	
		COTO	MYCI
East Boundary	124	39	120
College	152	3	14
Aviators	152	25	47
Link Sausage	152	8	27
Moonshiners	152	15	41
North Tower Earl	148	29	233
North Tower Wackenhut	143	32	38
Middle Butte	152	410	1,267
Rattlesnake	152	177	5,593

2.2.3 Discussion

During the hibernacula counts, Townsend's big-eared bats were the most prevalent species seen in all the caves, but acoustically were out recorded by western small-footed myotis. Difficulty exists when comparing winter activity of bat species using acoustic recordings, because of species-specific differences in intensity of echolocation calls and atmospheric attenuation, especially for Townsend's big-eared bats as their calls are lower intensity compared with calls of western small-footed myotis. Such differences need to be considered when comparing acoustic activity between species.

Our results provide insight into cave-exiting activity after arousal from torpor of these species and provide a long-term baseline dataset of that activity prior to the arrival of WNS. Such data can help biologists when quantifying the potential impact of WNS on these species.

2.3 Spring, Summer, and Autumn Passive Acoustic Monitoring

2.3.1 Methods

Monitoring bats acoustically throughout the year is important and can provide data on how WNS and wind-energy development affect bat populations. If a decrease is noticed in bat calls, it may indicate that WNS or wind-energy development is affecting bat populations. Anabat SD2 and Anabat Swift detectors were placed from 1 May to 30 September 2023 at eight facilities (Advanced Test Reactor [ATR] - Complex, Central Facility Area, Critical Infrastructure Test Range Complex, Idaho Nuclear Technology and Engineering Center [INTEC], Material and Fuels Complex [MFC], NRF, Radioactive Waste Management Complex [RWMC], and Test Area North) and at the following seven caves: Middle Butte, Rattlesnake, East Boundary, Aviators, Jensen's, Obscenity Snake Pit, and North Tower Wackenhut caves. Those detectors were set using established protocols (Appendix B) and documented the occurrence of bat species at those features during the non-hibernation season.

Kaleidoscope software (version 5.6.8, Wildlife Acoustics, Inc.) was used for species identification and to analyze bat occurrence at a facility or a cave (Appendix C). After the files were filtered by facility and cave in Kaleidoscope, the nights during which a species was present was quantified using the maximum likelihood estimator produced by Kaleidoscope (i.e., if the *p*-value was < 0.05 that species occurred on that night). Each species' nightly presence was divided by the number of nights detectors functioned for each facility and cave and then were plotted.

2.3.2 Results

During 2023, Anabat units functioned for a mean of 41 nights (*SD* = 32.4, range = 4 to 107 nights) at facilities and 64 nights (*SD* = 52.5, range = 20 to 153 nights) at caves. Kaleidoscope documented 331 detector nights that species were present across all facilities and 446 detector nights that species were present across all caves. The presence of eight species was recorded predominately at facilities (Figure 2-3), and the presence of nine species was recorded at caves (Figure 2-4). Little brown myotis and western small-footed myotis had the highest number of nights of occurrence at all facilities, except for MFC. Silver-haired bats were the most recorded bat at MFC (Figure 2-3). Western small-footed myotis or Townsend's big-eared bats were the most recorded bats at caves (Figure 2-4).

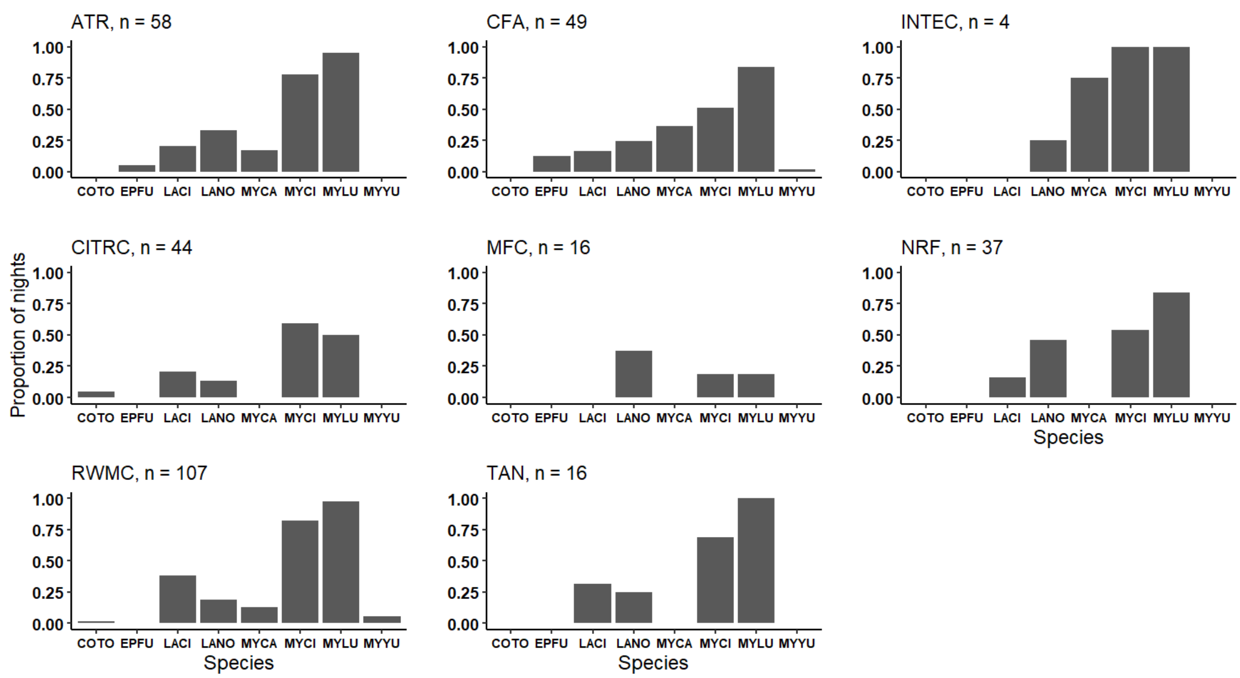

Figure 2-3. Proportion of nights that bat species were documented at Idaho National Laboratory Site facilities during May to September 2023. The number of nights sampled is denoted by the n after the facility name. Species are identified as the following: Townsend's big-eared bat (COTO), big brown bat (EPFU), hoary bat (LACI), silver-haired bat (LANO), California myotis (MYCA), western small-footed myotis (MYCI), little brown myotis (MYLU), and Yuma myotis (MYYU).

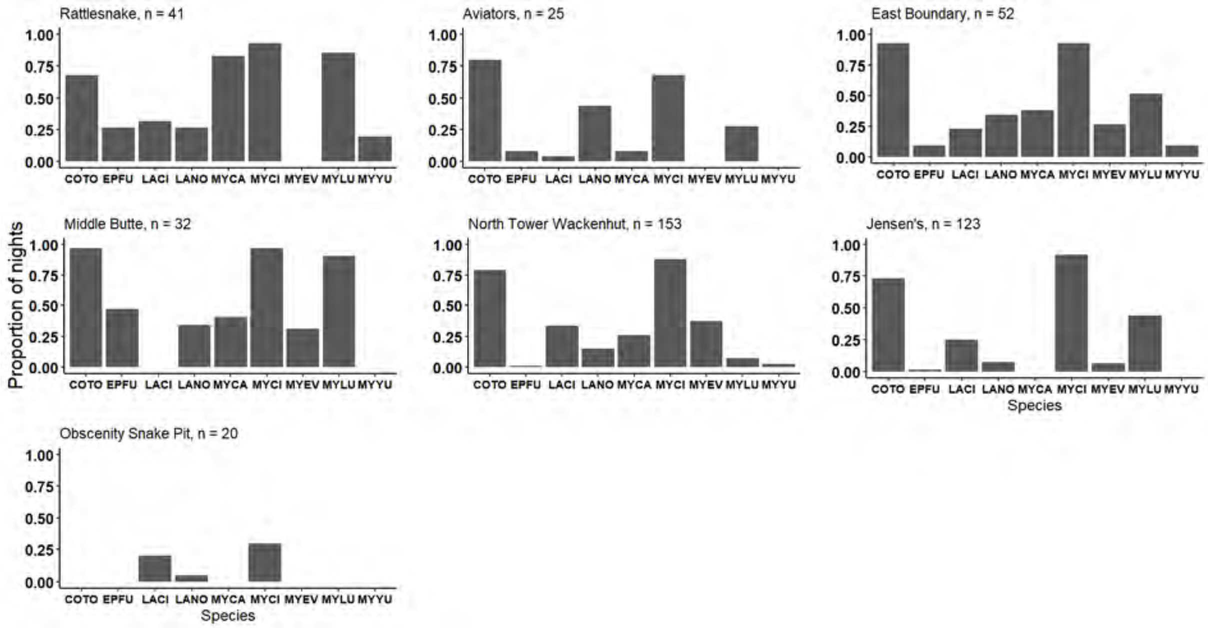

Figure 2-4. Proportion of nights that bat species were documented at Idaho National Laboratory Site caves during May to September 2023. The number of nights sampled is denoted by the n after the facility name. Species are identified as the following: Townsend's big-eared bat (COTO), big brown bat (EPFU), hoary bat (LACI), silver-haired bat (LANO), California myotis (MYCA), western small-footed myotis (MYCI), long-eared myotis (MYEV), little brown myotis (MYLU), and Yuma myotis (MYYU).

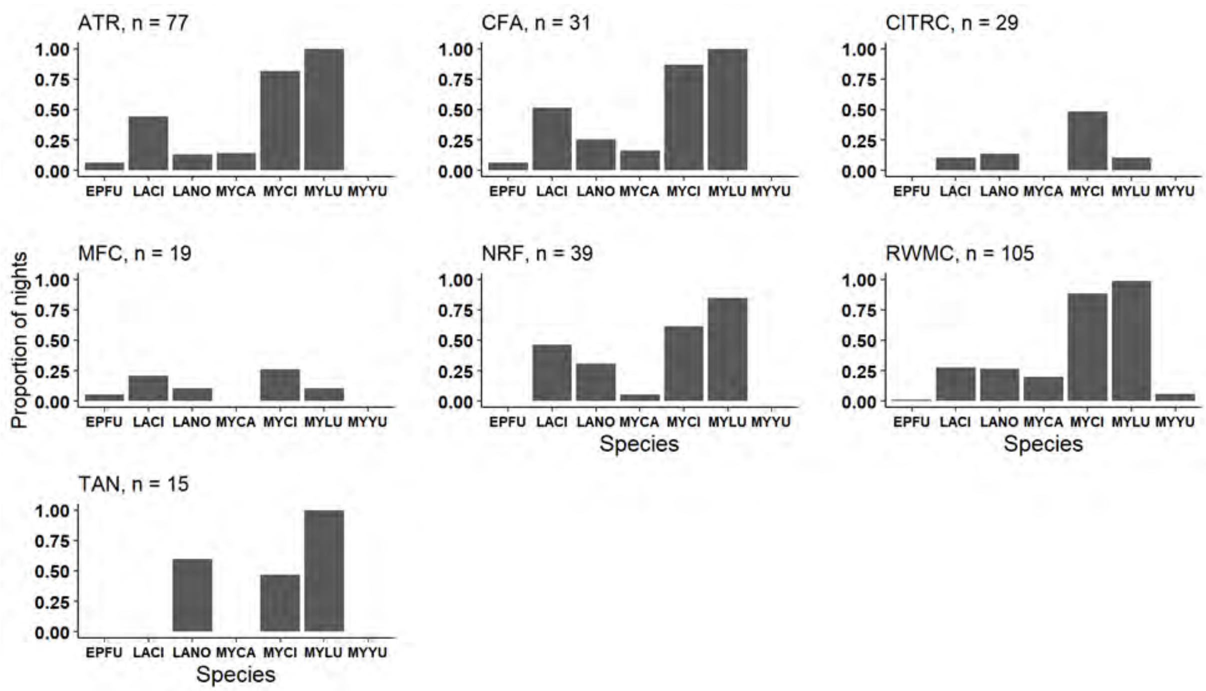

Figure 2-5. Proportion of nights that bat species were documented at Idaho National Laboratory Site facilities during May to September 2022. In 2022, INTEC isn't shown due to the detector malfunctioning. The number of nights sampled is denoted by the n after the facility name. Species are identified as the following: Townsend's big-eared bat (COTO), big brown bat (EPFU), hoary bat (LACI), silver-haired bat (LANO), California myotis (MYCA), western small-footed myotis (MYCI), little brown myotis (MYLU), and Yuma myotis (MYYU).

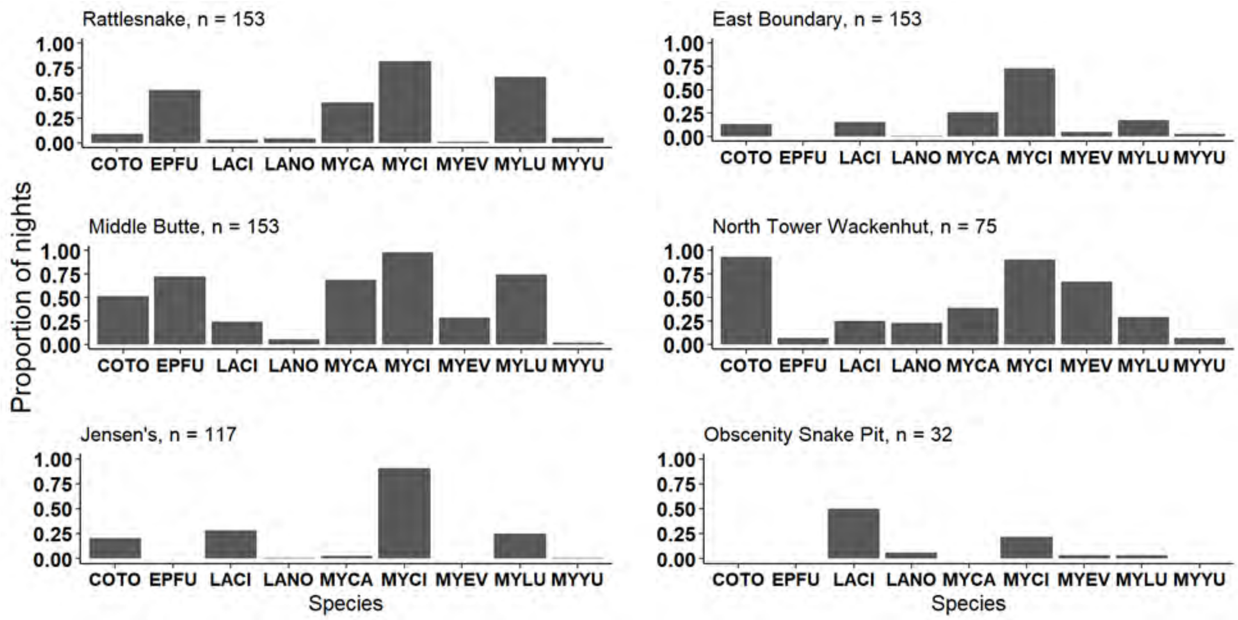

Figure 2-6. Proportion of nights that bat species were documented at Idaho National Laboratory Site caves during May to September 2022. In 2022, Aviators Cave isn't shown due to the microphone malfunctioning. The number of nights sampled is denoted by the n after the facility name. Species are identified as the following: Townsend's big-eared bat (COTO), big brown bat (EPFU), hoary bat (LACI), silver-haired bat (LANO), California myotis (MYCA), western small-footed myotis (MYCI), long-eared myotis (MYEV), little brown myotis (MYLU), and Yuma myotis (MYYU).

2.3.3 Discussion

Results for 2023 at facilities (Figure 2-3) indicate little brown myotis and western small-footed myotis were two of top three species that occurred at all of the facilities, which is comparable to 2022 results (Figure 2-5). Caves results in 2023 (Figure 2-4) indicate they were two of the top three species that occurred at Rattlesnake, Middle Butte, East Boundary, and North Tower Wackenhut caves. Those results were comparable to the results in 2022 (Figure 2-6). Combining and analyzing data across management agencies can provide important insights into fluctuations of regional bat populations. Moreover, data regarding the occurrence of bat species at facilities in summer can facilitate INL Site planning, development, and building maintenance.

Page intentionally left blank

3.0 WHITE-NOSE SYNDROME SURVEILLANCE

3.1 Cave Temperature and Humidity

3.1.1 Methods

WNS is a recent threat to many bats that hibernate in caves (Frick et al. 2010, Knudsen et al. 2013) and has killed over five million bats in seven species (Bernard and McCracken 2017, Hoyt et al. 2021). Many common bat species could be at-risk of significant declines or extinction due to this disease (Hammerson et al. 2017, Appendix D). WNS has primarily been a disease occurring in the eastern USA (Ingersoll et al. 2016, Reynolds et al. 2017), however, WNS is now in the western USA (Lorch et al. 2016). In October 2021, *Pseudogymnoascus destructans,* the fungus that causes WNS, was documented in Minnetonka Cave in southern Idaho, which is about 118 miles (190 km) southeast of the INL Site (IDFG 2022).

The growth of *P. destructans* is restricted by cave temperature and humidity profiles (Verant et al. 2012, Marroquin et al. 2017). Quantifying temperature and humidity in caves on the INL Site are important for understanding the potential for WNS to become established in caves. HOBO data loggers were placed in eight hibernacula on the INL Site following established protocols (Appendix E). A mean, minimum, and maximum temperature for each month by cave was then computed, as well as a mean humidity level across months for each cave.

3.1.2 Results

All caves on the INL Site had temperatures that were below the optimal growth for *P. destructans,* especially during January to March (Figure 3-1). The fungus also needs high levels of relative humidity for optimal growth (> 81%). College (95%), Middle Butte (90%), Moonshiner (91%), and North Tower Wackenhut (91%) caves had humidity levels that would support optimal growth of the fungus. All other caves did not have humidity levels that would support growth of *P. destructans.*

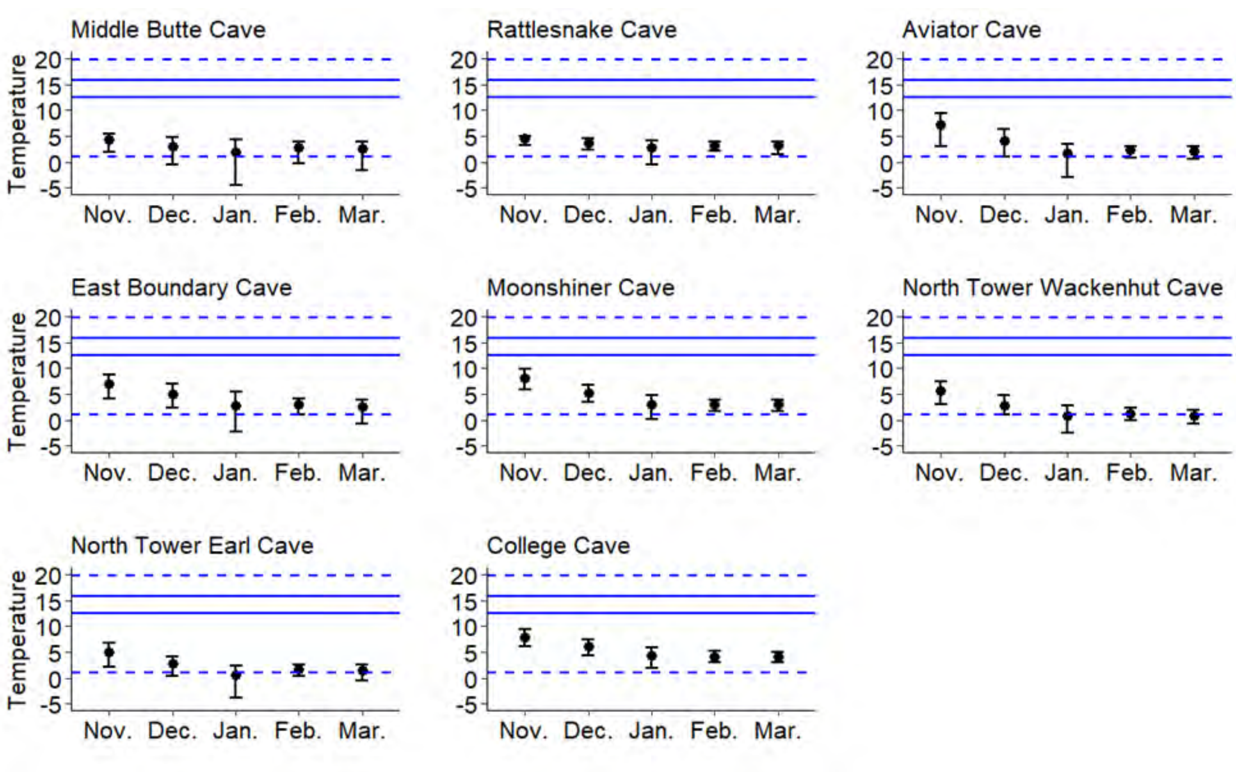

Figure 3-1. Mean (black dot), minimum, and maximum (error bars) temperatures (°C) by month in eight caves on the Idaho National Laboratory Site from November 2023 to March 2024. The solid blue lines represent the optimal range of temperatures for growth of P. destructans, while the dashed blue lines represent the range of temperatures for active growth of P. destructans (Verant et al. 2012).

3.1.3 Discussion

Understanding how cave temperature and humidity profiles on the INL Site differ by cave and change across years provides important information regarding the potential of *P. destructans* to become established in caves. Cave temperatures have been consistent throughout the years of monitoring. However, in 2022, only College Cave had humidity levels > 80%. In 2023, humidity levels in three more caves have shifted to a level that would support optimal growth of the fungus. Under the direction of the IDFG, swabbing in these four caves should be prioritized and surveillance for optimal growth condition should be continued.

4.0 ADDITIONAL MONITORING TASKS

4.1 Surveys of Bridges and Culverts

Bridges and culverts provide important roosting habitat for bats (Adams 2003). This was the first year surveys of bridges and culverts were conducted for roosting bats. From May to September 2023, 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 by the 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 in the Big Lost River. Of the structures surveyed during the day, one little brown myotis was observed in the three metal culverts along the Big Lost River under Lincoln Boulevard west of INTEC in August, and one little brown myotis was observed in the four metal culverts along the Big Lost River northwest of RWMC in September. During nighttime surveys, 26 bats were documented, with the most bats being observed in August (Figure 4-2). Western small-footed myotis were observed in all months and little brown myotis were the second most observed bat (Table 4-1). Notably, one silver-haired bat was observed roosting under a bridge (Table 4-1). Documenting the use of bridges and culverts by bats can inform INL workers about the time of the year that bats use these structures. Such data can be used when planning maintenance of bridges and culverts. These surveys will continue to be conducted in the future.

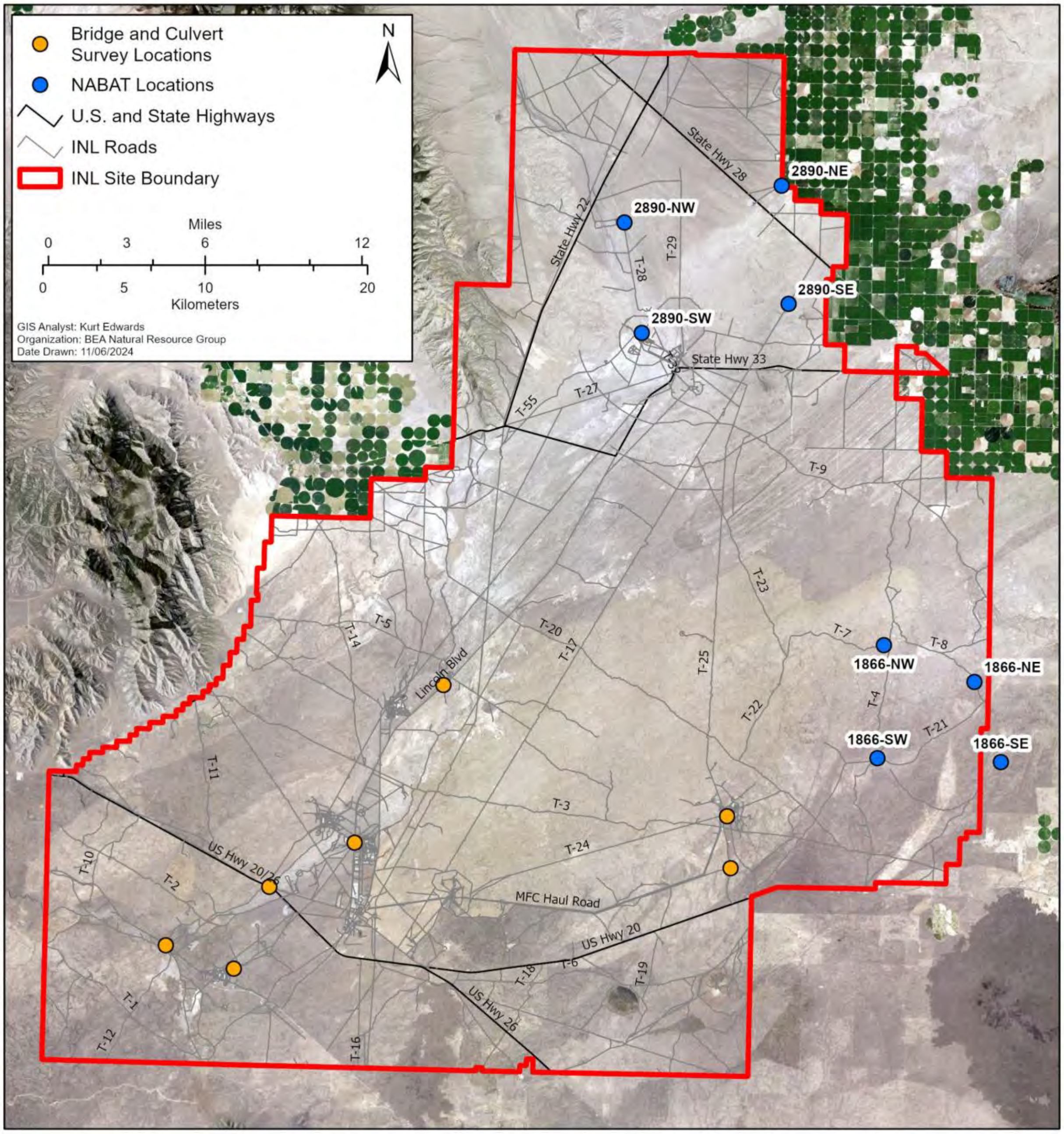

Figure 4-1. Locations of bridges and culverts and stationary detectors for NABat monitoring to document the occurrence of bat species on and near the Idaho National Laboratory Site between May and September 2023.

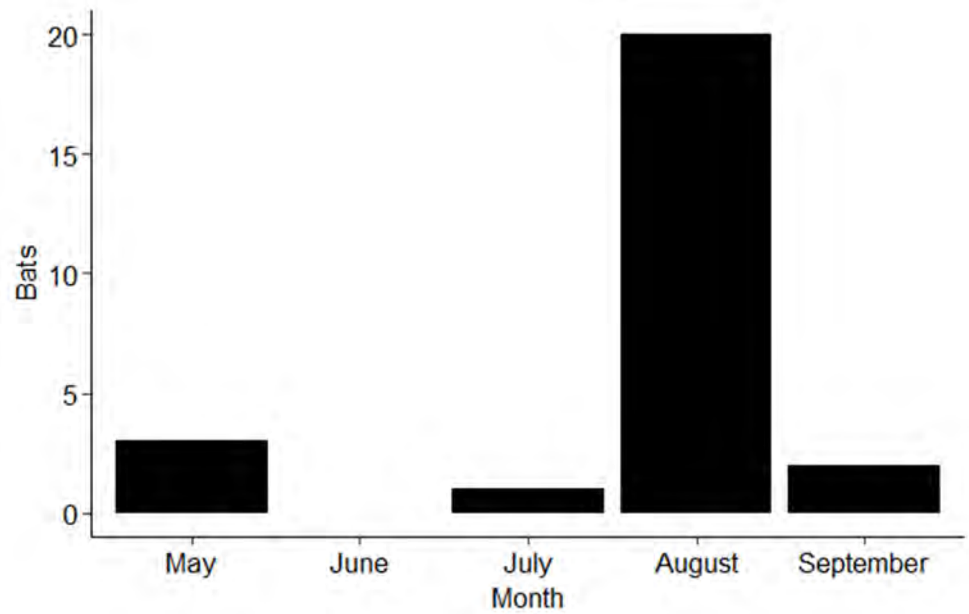

Figure 4-2. Number of bats observed by month during nighttime surveys of bridges and culverts in 2023 on the INL Site. Surveys were not conducted in June.

Table 4-1. Location, month of surveys, and number and species of bats observed during surveys of bridges and culverts on the Idaho National Laboratory Site in 2023. Surveys were not conducted in June. Species are identified as the following: silver-haired bat (LANO), western small-footed myotis (MYCI), and little brown myotis (MYLU).

LOCATION	MAY	JULY	AUGUST	SEPTEMBER
Culvert near INTEC	2 MYCI	0	1 MYCI 4 MYLU 3 Unk	0
Rest stop bridge	1 MYCI	1 MYCI	1 Unk	0
Four culverts SW of RWMC	0	0	2 MYCI 1 MYLU 3 Unk	1 MYCI
RWMC entrance	0	0	1 MYCI 2 Unk	0
MFC entrance	0	0	1 MYCI	1 LANO
MFC bridge by building	0	0	1 MYCI	0

4.2 Participation in The North American Bat Monitoring Program

The North American Bat Monitoring (NABat) program is a multiagency, multinational effort to standardize monitoring and management of bat species across several taxa (Loeb et al. 2015). NABat sampling and monitoring is divided across North America as a series of 10 x 10 km grid cells (Loeb et al. 2015), grid cells are then prioritized at a state level and each grid cell is subsequently split into four quadrants. Two grid cells are located on and near the INL Site and a stationary acoustic survey point was identified within each of those quadrants (Loeb et al. 2015). Anabat Swift detectors were set at eight locations on and near the INL Site during 2023 (Figure 4-1). Files were filtered by sampling location in Kaleidoscope, and the number of nights in which a species was present was quantified using the maximum likelihood estimator produced by Kaleidoscope (Appendix D).

During 2023, detectors recorded the presence of big brown bats, silver-haired bats, hoary bats, western small-footed myotis, and little brown myotis at the eight sampling locations (Table 4-2). These data have been sent to the Bat Hub at Oregon State University and to the IDFG to help with producing range-wide occupancy probability predictions for those bat species. The NABat data that is collected is sent to the Northwest Bat Hub and the data is analyzed and is included in the Status and Trends of North American Bats report (Udell et al. 2022, https://www.nabatmonitoring.org/get-data).

Table 4-2. Number of bat files from each species during the 2023 NABat acoustic surveys on the Idaho National Laboratory Site.

NABAT ACOUSTICAL SURVEYS									
SCIENTIFIC NAME	COMMON NAME	NUMBER OF BAT FILES BY SAMPLING LOCATION							
		1866 NE	1866 NW	1866 SE	1866 SW	2890 NE	2890 NW	2890 SE	2890 SW
Antrozous pallidus	pallid bat	0	0	1	0	0	0	0	0
Corynorhinus townsendii	Townsend's big-eared bat	0	0	0	2	0	0	0	0
Eptesicus fuscus	big brown bat	2	0	0	3	1	2	1	2
Lasiurus cinereus	hoary bat	3	0	2	1	1	1	4	2
M. californicus	California myotis	0	0	0	0	0	0	0	2
M. ciliolabrum	western small-footed myotis	24	1	12	23	32	3	0	217
M. evotis	western long-eared myotis	0	0	0	0	0	0	0	0
Myotis lucifugus	little brown myotis	0	0	1	1	3	0	1	302
M. thysanodes	fringed myotis	0	0	0	0	0	0	0	0
M. volans	long-legged myotis	1	0	0	0	0	0	0	43
M. yumanensis	Yuma myotis	0	0	0	0	0	0	0	0

4.3 Carcass Recovery and Assessment

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 in order to make arrangements 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 2023, 30 dead bats (15 western small-footed myotis, 8 little brown myotis, 4 silver-haired bats, 2 big brown bats, and 1 unknown bat) 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 2023: cesium-137, cobalt-60, and strontium-90 (Table 4-3). 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, which is a fission product, 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 0.0014 rad/d (0.014 mGy/d) in 2023. 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 (DOE 2024). Calculated dose for the past six years has been well below the DOE standard established for terrestrial animals (DOE 2019) (Figure 4-3).

Table 4-3. Radioanalytical results for bats composited by facility at the Idaho National Laboratory Site in 2023.

Facility	Radionuclide	Result ± 1s Uncertainty (pCi/g)	
ATR Complex	Americium-241	6.52E-03	3.14E-03
	Cesium-137	1.52E+00	2.91E-01
	Cobalt-60	1.74E+01	1.09E+00
	Plutonium-238	6.04E-03	2.18E-03
	Plutonium-239/240	2.26E-03	2.42E-03
	Strontium-90	1.48E+01	1.36E+00
CFA	Americium-241	1.64E-03	2.48E-03
	Cesium-137	2.98E+00	2.38E-01
	Cobalt-60	nd[a]	nd
	Plutonium-238	3.13E-03	1.78E-03
	Plutonium-239/240	1.04E-03	2.30E-03

Table 4-3. continued.

Facility	Radionuclide	Result ± 1s Uncertainty (pCi/g)	
	Strontium-90	1.08E+00	1.16E-01
MFC	Americium-241	1.56E-03	2.36E-03
	Cesium-137	4.09E-02	5.21E-02
	Cobalt-60	nd	nd
	Plutonium-238	1.38E-03	1.99E-03
	Plutonium-239/240	5.52E-03	1.99E-03
	Strontium-90	6.39E-02	2.37E-02
NRF	Americium-241	1.42E-03	2.15E-03
	Cesium-137	3.54E-01	9.67E-02
	Cobalt-60	1.38E+00	1.52E-01
	Plutonium-238	4.91E-03	2.08E-03
	Plutonium-239/240	4.90E-03	2.07E-03
	Strontium-90	8.53E-01	9.71E-02
RWMC	Americium-241	1.67E-02	5.03E-03
	Cesium-137	-1.19E-02	1.08E-01
	Cobalt-60	nd	nd
	Plutonium-238	1.57E-02	5.38E-03
	Plutonium-239/240	2.39E-02	6.94E-03
	Strontium-90	5.78E-02	6.99E-0
TAN	Americium-241	1.74E-03	2.63E-03
	Cesium-137	8.72E-02	8.86E-02
	Cobalt-60	nd	nd
	Plutonium-238	5.13E-03	1.84E-03
	Plutonium-239/240	-2.56E-03	2.48E-03
	Strontium-90	-5.51E-04	1.94E-01

nd = not detected

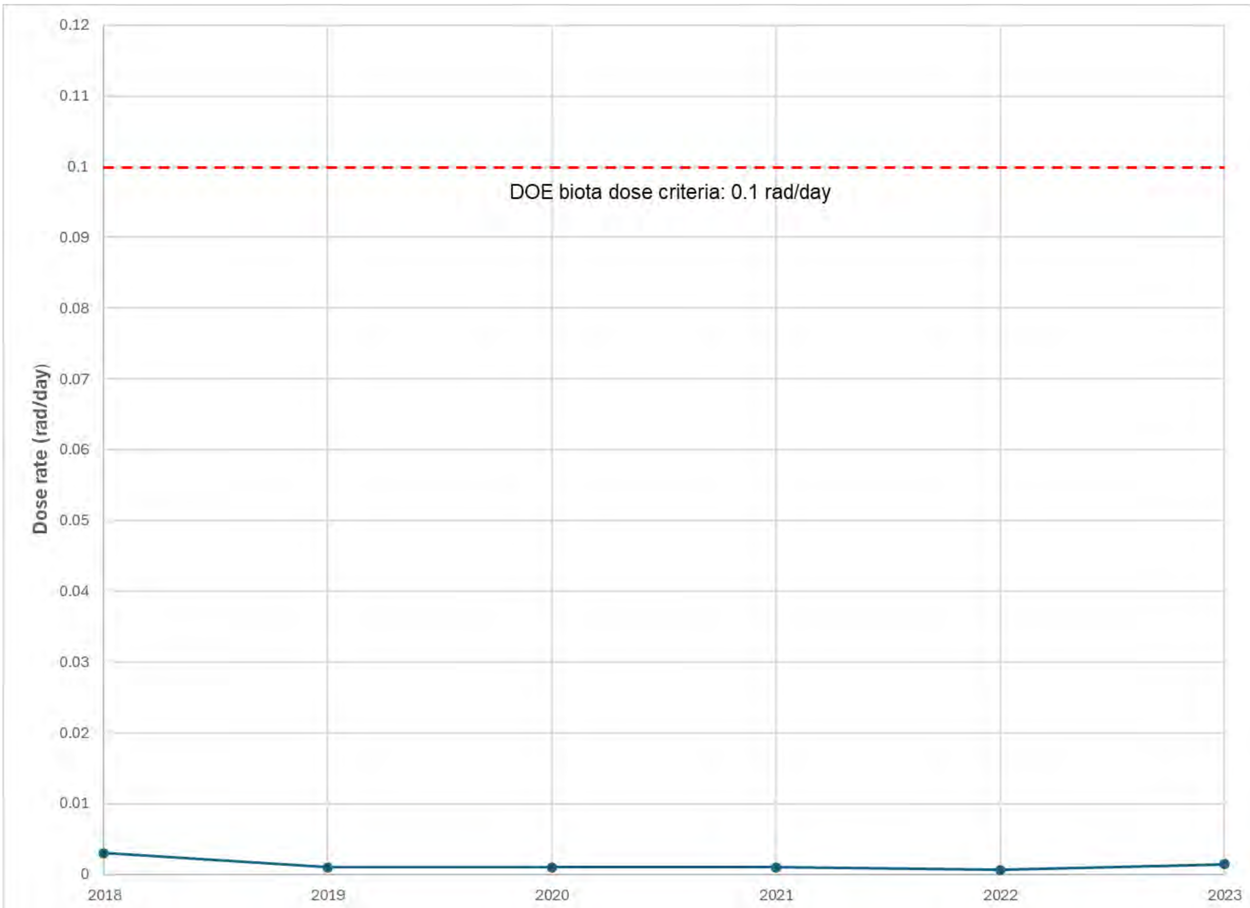

Figure 4-3. Calculated dose for bats at the Idaho National Laboratory Site over the past six years.

Page intentionally left blank

5.0 ASSOCIATED TASKS

5.1 Implementing Conservation Measures for Bats

The INL Site BPP ensures protection of sensitive bat resources through adherence to recommended conservation measures (Table 5-1). Conservation measures in the BPP were developed in collaboration with IDFG and USFWS bat biologists. Those measures have been considered during project planning and National Environmental Policy Act analysis on the INL Site. After the BPP was finalized in 2018, INL contractors began implementing management recommendations into planning and daily work activities. Procedural documents have utilized the BPP to provide guidance to INL managers and personnel regarding encounters with live or dead bats. Those documents also address seasonal activities that may affect summer roosts.

The BPP also provides guidance in the form of conservation measures for certain activities proposed under recent National Environmental Policy Act evaluations. The Environmental Review Process at the INL determines the level of review for every proposed action and provides directions for compliance with all associated environmental aspects. Most proposed actions at the INL only meet the threshold for a categorical exclusion and are analyzed using an Environmental Compliance Permit (ECP). Each ECP is reviewed by Technical Points of Contacts (TPOCs) to ensure all aspects relating to their field are addressed appropriately. The Natural Resource Group (NRG) TPOCs who review ECPs, are responsible for including language associated with the conservation measures outlined in the BPP. There were eight ECPs reviewed by NRG TPOCs that included language associated with BPP conservation measures and one search was conducted for the presence of maternity bat colonies. The actions covered by the other seven ECPs either took place outside of the necessary timeframes or have not been started yet.

Table 5-1. Threats affecting bats and their habitat that are most likely to occur on the Idaho National Laboratory Site, recommended conservation measures (DOE 2018), and assessment of those measures from March 2023 until March 2024.

	THREATS	RECOMMENDED CONSERVATION MEASURES	ASSESSMENT OF CONSERVATION MEASURES
	DISTURBING HIBERNATING BATS AND DESTRUCTION/MODIFICATION OF HIBERNACULA AND SUMMER ROOSTS		
1	Recreational caving/unlawful entry into caves	• Identify hibernacula and restrict access to these features.	• No known recreational or unlawful entry occurred in caves.
2	Research, monitoring, and inventory	• Establish a permit process for research required cave entry and bat handling activity. • Hibernacula surveys should be conducted every other year; surveys should be conducted with caution, quickly, and quietly.	• Biologists of the Battelle Energy Alliance, LLC (BEA) NRG program obtained a permit (#2022-2) to enter caves to conduct hibernacula surveys. • Biologists of the BEA NRG program used caution when conducting surveys and performed counts quickly and quietly.
3	Activities that produce loud noises near hibernacula and important summer roosts	• Limit activities that produce continuous noise ≥ 75 decibels within a 1-mile (1.6 km) radius of hibernacula and important summer roosts.	• No loud noise producing activities were conducted near known hibernacula or important summer roosts.
4	Explosives near hibernacula and important summer roosts	• Avoid blasting within a 0.75 mile* (1.2 km) radius of hibernacula and important summer roosts.	• No blasting occurred within 0.75 miles of known hibernacula and important summer roosts.
5	Facility construction activities	• Avoid construction activities near summer roosts.	• No known summer roosts were disturbed because of construction around facilities.
6	Removing roost trees	• Avoid removing living or dead trees.	• No known roost trees near facilities, or outside of facilities, were removed.
7	Removing anthropogenic roosting structures	• If bats are using buildings, sheds, or storage facilities that are proposed to be removed, do such outside of the maternity and hibernation season.	• No buildings, sheds, or storage facilities were removed. BEA Biologists were contacted about the decommissioning and demolition of S1W at NRF. A BEA Biologist did a search of S1W looking for roosting bats and any signs bat use. The biologist also advised conducting weekly searches.
8	Removing or modifying bridges, culverts, and underpasses	• Examine if bats are roosting on these features prior to construction activities.	• No bridges, culverts, or underpasses were removed or modified.
9	Pesticides, herbicides, and vegetation removal	• Avoid or minimize pesticide use and vegetation removal near roosts and important foraging or other bat activity areas.	• No pesticide and herbicide application or mechanical vegetation removal occurred within 150 feet of caves and near important foraging areas.

Table 5-1. continued.

	THREATS	RECOMMENDED CONSERVATION MEASURES	ASSESSMENT OF CONSERVATION MEASURES
		WHITE-NOSE SYNDROME	
10	Recreational caving/unlawful entry into caves	• Identify hibernacula and restrict access to these features.	• No known recreational or unlawful entry occurred in caves.
11	Research, monitoring, and inventory	• Minimize the potential spread of WNS.	• Biologists of the BEA NRG program obtained a permit (#2022-2) to enter caves to conduct hibernacula surveys. All personnel followed the most recent USFWS WNS protocols when entering caves and when decontaminating equipment after exiting caves.
		LOSS OR MODIFICATION OF HABITAT AROUND CAVES	
12	Conversion or destruction of vegetation	• Limit wildland fires near caves. • No prescribed burning of native vegetation within a 5-mile (8 km) radius of hibernacula. • 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.	• No wildland fires occurred near caves. • No prescribed burns occurred on the INL Site. • No modification of native vegetation happened near hibernacula.
13	Disposing of vegetation or soil near caves	• Avoid disposing of vegetation or soil within a 33-yard (30 m) radius of a cave.	• No vegetation was disposed of near caves.
		ENVIRONMENTAL CONTAMINANTS AND WIND-ENERGY DEVELOPMENT	
14	Environmental radionuclides	• Assess radionuclide levels in dead bats.	• See section 3.5 of this report.
15	Pesticide, herbicides, and vegetation removal	• Avoid or minimize pesticide use and vegetation removal near roosts and important foraging or other bat activity areas.	• No pesticides or herbicides were used around buildings and wastewater ponds.
16	Wind-energy development	• Follow the USFWS Land-Based Wind Energy Guidelines.	• No wind-energy facilities were constructed on the INL Site.

5.2 Relocating Live Bats

Live bats are occasionally located in buildings, sheds, or storage facilities on the INL Site, especially during summer when bat pups are becoming independent and during fall migration when bats are shifting from summer to winter habitats. When a bat was found in an area where it was safe and not creating a nuisance to INL Site workers or disrupting work, the bat was left alone and allowed to leave on its own accord. If a bat was found in an area where it was at-risk of injury or was disrupting work, it was relocated from the area following approved guidelines (INL 2022b, INL 2023, DOE 2018). In 2023, three bats were in or near facilities. The bats were relocated to vegetation outside of the building.

5.3 Public Outreach

Outreach is a great way to help educate the public about bats, their conservation, and the threats that affect bats. In 2023, the INL contractor conducted public outreach through writing publications, providing presentations and training while collaborating with local universities.

Two peer-reviewed papers were published, and one manuscript is in preparation (Whiting et al. 2023a, Whiting et al. 2023b, Whiting et al. *In Prep*). Those documents were written in collaboration with professors at Brigham Young University-Idaho and Idaho State University, as well as with a wildlife biologist from the IDFG. Two presentations were presented at local and national scientific meetings.

The INL contractor also presented to over 400 people at four Idaho Falls Zoo Bat Nights (Figure 5-1). A website was developed that discussed bat initiatives at the INL Site's with the Idaho Falls Zoo. Two bat nights were conducted at Harriman State Park for more than 60 people to discuss bat research, as well as bat acoustic monitoring and conservation on the INL Site and throughout Idaho. In collaboration with the Idaho Falls Zoo an Anabat Swift bat detector was deployed to monitor bat activity at the zoo. *All About Bats*, *Idaho Ecology*, and *Green Energy* presentations were given to 150 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 120 teachers were taught during two online courses called "Bring Idaho Alive" workshops about local bats, conservation, and acoustic monitoring. Training was provided on the basics of bat acoustic detectors to 45 biology students at Brigham Young University-Idaho. Fundamental skills were taught for analyzing bat call files using the Kaleidoscope software.

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

A collaboration occurred with a student and professor on an M.S. project at Idaho State University. Efforts included acoustic monitoring with stationary detectors from June to September along the South Fork of the Snake River, and in the Sand Creek Desert, for little brown myotis, as well as for the other six bat species in that area—all of which are species of conservation concern in Idaho (IDFG 2024)—to quantify peaks and hot spots of bat activity. Data from those surveys will be provided to the IDFG, USFWS, Bureau of Land Management, DOE-ID, and other collaborators for the management and conservation of bats and their habitat.

Page intentionally left blank

6.0 RECOMMENDATIONS FOR ADDITIONAL MONITORING ACTIVITIES, MANAGEMENT ACTIONS, AND PLAN REVISIONS

6.1 Additional Studies

6.1.1 Hibernacula Surveys around Middle Butte

Acoustic detectors are effective at identifying bat species across habitat types (Britzke and Murray 2000, Miller 2001), and these devices have been used extensively to study bat winter ecology (Bernard and McCracken 2017, Klüg-Baerwald et al. 2016, Whiting et al. 2022). Little is known about bat hibernation behavior, especially in natural, rock-crevice hibernacula (Johnson et al. 2017, White et al. 2020). Middle Butte is an elevated block of basalt flows (Spear and King 1982) that provides a diverse area of potential bat habitat and hibernation locations in the rock fall. The rock fall in the butte consists of large elevation and aspect gradients that may comprise temperature and humidity regimes that can be suitable for hibernation. In summer 2022, a search was conducted around Middle Butte for potential roosting and hibernation habitat for bats in the rock fall. Several areas were identified that could be used for roosting and hibernation sites on the north, northeast, and west sides of the butte. During the Summer of 2023 two Anabat detectors were set near Middle Butte. It is proposed to set Anabat detectors around Middle Butte during winter 2024/2025 (November 1 to March 31) in those areas to document if the rock fall around the butte is used by hibernating bats (Table 6-1). It is also proposed to set Anabat detectors around Middle Butte in those areas during maternity season (June 1 to August 31) to document if the rock fall around the butte is used by lactating females.

6.1.2 Establishing a Method to Determine the Index of Abundance from 2011 to Present

Interest exists in developing long-term acoustic monitoring of bats (Frick 2013, Nocera et al. 2019), and deploying several stationary detectors is valuable for understanding bat activity at a landscape scale (Stahlschmidt and Bruhl 2012). With the arrival of WNS in western North America (Lorch et al. 2016), and with the fungus that causes WNS now documented in Minnetonka Cave in southern Idaho, it is important to understand winter cave-exiting behavior of bats (Bernard and McCracken 2017, Reynolds et al. 2017). These data potentially could be coupled with hibernacula counts of bats to provide multiple lines of evidence for trends in bat abundance in the INL Site caves. Such data will provide a long-term baseline dataset of bat cave-exiting behavior, which can be used in future analyses to quantify the potential impact of WNS on these species when this disease arrives on the INL Site (Whiting et al. 2021). In collaboration with a biostatistics professor at Idaho State University (Ken Aho), preliminary analyses using non-linear regression models were conducted to investigate if the mean number of files/night could be used as an index of abundance for bats at Middle Butte Cave from 2011 to 2024. If such methods work, in the annual report for 2024 the mean number of files/night will be used as an index of abundance for bats at on the INL Site.

6.1.3 Setting Mist Nets at Facilities and Caves

Capturing bats in mist nets is an important way to gather information on species confirmation, richness, and diversity in an area, as well as to determine sex, age, and reproductive status of bats (O'Farrell and Gannon 1999, Francl et al. 2012). Mist netting for bats has occurred historically on the INL Site (Whiting et al. 2015). Current data for bat species occurring around facilities and caves are needed, this is especially true with the impending decision regarding little brown myotis and the potential for this species to be listed under the ESA. In 2025, it is proposed to mist net around the eight facilities and three caves—Middle Butte, Rattlesnake, and Aviators caves (the three largest hibernacula on the INL Site) (Table 6-1). This trapping will occur from 1 June to August 31 on nights with suitable moon phase. When capturing bats, a determination will be made on sex, species, and if females are lactating (Gruver and Keinath 2006, Krochmal and Sparks 2007). Doing such will provide important data for the different species occurring around facilities and caves and will help biologists at the INL Site understand the use of facilities and caves by lactating females.

6.1.4 Management Actions

With the potential listing of the little brown myotis under the ESA, an INL Site-wide training may need to be produced regarding the awareness of the ESA, the management regulations of a listed species under that Act, and the handling and transporting of little brown myotis that are found on the INL Site. With the arrival of the fungus that causes WNS in Idaho, training will be conducted to provide updated information of WNS and its arrival in Idaho and reinforce the need to eliminate unlawful entry into caves on the Site to help limit the spread of WNS.

Table 6-1. Additional studies, when they were proposed, and when they were adopted at the Idaho National Laboratory Site.

PROPOSED ACTION	YEAR PROPOSED	YEAR ADOPTED
Bridge and Culvert Survey	2022	2023
Collaborating with Agency Partners in Southeastern Idaho WNS Surveys	2020	2020
Hibernacula Surveys around Middle Butte	2020	Winter 2024/2025
Setting Mist Nets at Facilities and Caves	2020	Planned for Summer 2025
Establishing a Method to determine the Index of Abundance from 2011 to present	2023	2024
Yearly Hibernacula Surveys	2023	Winter 2024/2025

6.1.5 Plan Revisions

There is a need to go through the BPP and make the appropriate updates.

7.0 LITERATURE CITED

Adams, R. A., 2003, “Bats of the Rocky Mountain West: Natural History, Ecology, and Conservation,” *University Press of Colorado*, Boulder, CO, USA.

Bernard, R. F., and G. F. McCracken, 2017, “Winter behavior of bats and the progression of white-nose syndrome in the southeastern United States,” *Ecology and Evolution*, Vol. 7, No. 5, pp. 1487-96.

BLM, 2008, “Special Status Species Management,” Manual 6840, 47 pp.

Britzke, E. R., and K. L. Murray, 2000, “A quantitative method for selection of identifiable search-phase calls using the Anabat system,” *Bat Research News*, Vol. 41, No. 2, pp. 33-36.

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

DOE, 2019, “A Graded Approach for Evaluating Doses to Aquatic and Terrestrial Biota,” DOE-STD-1153-2019, U.S. Department of Energy, Washington, D.C., https://resrad.evs.anl.gov/docs/technicalStandard.pdf.

DOE, 2023, “Idaho National Laboratory Site Bat Protection Plan Annual Report 2023,” U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID, USA, INL/RPT-23-75900.

2022-2, “Cave Permit #2022-2,” U.S. Department of Energy, Idaho Operations Office, Idaho Falls, ID, USA.

Francl, K. E., W. M. Ford, D. W. Sparks, and V. Brack Jr, 2012, “Capture and reproductive trends in summer bat communities in West Virginia: Assessing the impact of white-nose syndrome,” *Journal of Fish and Wildlife Management*, Vol. 3, No. 1, pp. 33-42.

Frick, W. F., 2013, “Acoustic monitoring of bats, considerations of options for long-term monitoring,” *Therya*, Vol. 4, No. 1, pp. 69-78.

Frick, W. F., J. F. Pollock, A. C. Hicks, K. E. Langwig, D. S. Reynolds, G. G. Turner, C. M. Butchkoski, and T. H. Kunz, 2010, “An emerging disease causes regional population collapse of a common North American bat species,” *Science*, Vol. 329, No. 5992, pp. 679-82.

Gruver, J. C., and D. A. Keinath, 2006, “Townsend's big-eared bat (*Corynorhinus townsendii*): a technical conservation assessment,” *USDA Forest Service*, Rocky Mountain Region, Lakewood, CO, USA.

Hammerson, G. A., M. Kling, M. Harkness, M. Ormes, and B. E. Young, 2017, “Strong geographic and temporal patterns in conservation status of North American bats,” *Biological Conservation*, Vol. 212, pp. 144-52.

Hoyt, J. R., A. M. Kilpatrick, and K. E. Langwig, 2021, “Ecology and impacts of white-nose syndrome on bats,” *Nature Reviews Microbiology*, Vol. 19, pp. 196-210.

IDFG, 2022a, *Fungus that causes white-nose syndrome detected in three Idaho bat species at Minnetonka Cave* [Press release], https://idfg.idaho.gov/press/fungus-causes-white-nose-syndrome-detected-three-idaho-bat-species-minnetonka-cave.

IDFG, 2024, Idaho state wildlife action plan. 2023 rev. ed. Boise (ID): Idaho Department of Fish and Game, https://idfg.idaho.gov/.

Ingersoll, T. E., B. J. Sewall, and S. K. Amelon, 2016, "Effects of white-nose syndrome on regional population patterns of 3 hibernating bat species," *Conservation Biology*, Vol. 30, No. 5, pp. 1048-59.

INL, 2022a, LI-1143, "Natural Resources Cave Entry," Idaho National Laboratory, Idaho Falls, ID.

INL, 2022b, LI-1165, "Handling Nuisance Animals," Idaho National Laboratory, Idaho Falls, ID.

INL, 2023, LI-1201, "Preventing Disease from Rodents, Birds and Bats," Idaho National Laboratory, Idaho Falls, ID.

Johnson, J. S., J. J. Treanor, M. J. Lacki, M. D. Baker, G. A. Falxa, L. E. Dodd, A. G. Waag, and E. H. Lee, 2017, "Migratory and winter activity of bats in Yellowstone National Park," *Journal of Mammalogy*, Vol. 98, No. 1, pp. 211-21.

Klüg-Baerwald, B. J., L. E. Gower, C. L. Lausen, and R. M. Brigham, 2016, "Environmental correlates and energetics of winter flight by bats in southern Alberta, Canada," *Canadian Journal of Zoology*, Vol. 94, No. 12, pp. 829-36.

Knudsen, G. R., R. D. Dixon, and S. K. Amelon, 2013, "Potential spread of white-nose syndrome of bats to the Northwest: epidemiological considerations," *Northwest Science*, Vol. 87, No. 4, pp. 292-306.

Krochmal, A. R., and D. W. Sparks, 2007, "Timing of birth and estimation of age of juvenile *Myotis septentrionalis* and *Myotis lucifugus* in west-central Indiana," *Journal of Mammalogy*, Vol. 88, No. 3, pp. 649-56.

Lausen, C. L., and R. M. R. Barclay, 2006, "Winter bat activity in the Canadian prairies," *Canadian Journal of Zoology*, Vol. 84, No. 8, pp. 1079-86.

Loeb, S. C., T. J. Rodhouse, L. E. Ellison, C. L. Lausen, J. D. Reichard, K. M. Irvine, T. E. Ingersoll, J. T. H. Coleman, W. E. Thogmartin, and J. R. Sauer, 2015, "A plan for the North American bat monitoring program (NABat)," *Gen. Tech. Rep. SRS-208. Asheville, NC: US Department of Agriculture Forest Service,* Southern Research Station, Vol. 208, No. 1-100.

Lorch, J. M., J. M. Palmer, D. L. Lindner, A. E. Ballmann, K. G. George, K. Griffin, S. Knowles, J. R. Huckabee, K. H. Haman, C. D. Anderson, P. A. Becker, J. B. Buchanan, J. T. Foster, and D. S. Blehert, 2016, "First detection of bat white-nose syndrome in Western North America," *mSphere*, Vol. 1, No. 4, pp. e00148-16.

Marroquin, C. M., J. O. Lavine, and S. T. Windstam, 2017, "Effect of humidity on development of *Pseudogymnoascus destructans*, the causal agent of bat white-nose syndrome," *Northeastern Naturalist*, Vol. 24, No. 1, pp. 54-64.

Miller, B. W., 2001, "A method for determining relative activity of free flying bats using a new activity index for acoustic monitoring," *Acta Chiropterologica*, Vol. 3, No. 1, pp. 93-105.

Nocera, T., W. M. Ford, A. Silvis, and C. A. Dobony, 2019, "Patterns of acoustical activity of bats prior to and 10 years after WNS on Fort Drum Army Installation, New York," *Global Ecology and Conservation*, Vol. 18, pp. e006333.

O'Farrell, M. J., and W. L. Gannon, 1999, "A comparison of acoustic versus capture techniques for the inventory of bats," *Journal of Mammalogy*, Vol. 80, No. 1, pp. 24-30.

Reynolds, D. S., K. Shoemaker, S. von Oettingen, and S. Najjar, 2017, "High rates of winter activity and arousals in two New England bat species: implications for a reduced white-nose syndrome impact?" *Northeastern Naturalist*, Vol. 24, No. B188-B208.

Spear, D. B., and J. S. King, 1982, "The geology of Big Southern Butte, Idaho," *Cenozoic geology of Idaho: Idaho Bureau of Mines and Geology Bulletin*, Vol. 26, pp. 395-403.

Stahlschmidt, P., and C. A. Bruhl, 2012, "Bats as bioindicators - the need of a standardized method for acoustic bat activity surveys," *Methods in Ecology and Evolution*, Vol. 3, No. 3, pp. 503-08.

Udell, B. J., B. R. Straw, T. Cheng, K. D. Enns, F; Winfred, B. S. Gotthold, K. M. Irvine, C. Lausen, S. Loeb, J. Reichard, T. Rodhouse, D. A. Smith, C. Stratton, W. E. Thogmartin, A. M. Wiens, and B. E. Reichert, 2022, "Status and Trends of North American Bats Summer Occupancy Analysis 2010-2019 Data Release: U.S. Geological Survey data release," https://doi.org/10.5066/P92JGACB.

USFWS, 2020, "Federal Transportation Agency/State Department of Transportation (DOT) Preliminary Guidelines for Using the Bridge/Structure Bat Assessment Form," chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.fws.gov/sites/default/files/documents/appendix-d-bridge-structure-bat-assessment-form-guidance-april-2020.pdf

Verant, M. L., J. G. Boyles, W. Waldrep, G. Wibbelt, and D. S. Blehert, 2012, "Temperature-dependent growth of *Geomyces destructans*, the fungus that causes bat white-nose syndrome," *PloS ONE*, Vol. 7, No. 9, pp. e46280.

White, J. A., P. W. Freeman, H. W. Otto, and C. A. Lemen, 2020, "Winter use of a rock crevice by northern long-eared myotis (Myotis septentrionalis) in Nebraska," *Western North American Naturalist*, Vol. 80, No. 1, pp. 114-19.

Whiting, J. C., B. Doering, J. Lowe, D. K. Englestead, Justin A Frye, S. Earl, A. Earl, and B. Bybee, 2015, "Ecology, conservation, and management of bats in southeastern Idaho," Idaho Falls, ID, USA: U.S. Bureau of Land Managment.

Whiting, J. C., B. Doering, G. Wright, D. K. Englestead, J. A. Frye, and T. Stefanic, 2018a, "Bat hibernacula in caves of southern Idaho: implications for monitoring and management," *Western North American Naturalist*, Vol. 78, No. 2, pp. 165-73.

Whiting, J. C., B. Doering, G. Wright, D. K. Englestead, J. A. Frye, T. Stefanic, and B. J. Sewall, 2018b, "Long-term bat abundance in sagebrush steppe," *Scientific Reports*, Vol. 8, No. 1, pp. 12288.

Whiting, J. C., B. Doering, and D. Pennock, 2019, "Acoustic surveys for local, free-flying bats in zoos: an engaging approach for bat education and conservation," *Journal of Bat Research and Conservation*, Vol. 12, pp. 94-99.

Whiting, J. C., B. Doering, and K. Aho, 2021, "Long-term patterns of cave-exiting behavior of hibernating bats in nine caves in western North America," *Scientific Reports*, Vol. 11, pp. 8175.

Whiting, J. C., B. Doering, and K. Aho, 2022, "Can acoustic recordings of cave-exiting bats in winter estimate bat abundance in hibernacula?," *Ecological Indicators*, Vol. 137, pp. 108755.

Whiting, J. C., B. Doering, and K. Aho, 2023a, "How many nights should acoustic detectors be set to estimate cave-exiting behavior of hibernating bats?" *Mammal Research* 68:647-652.

Whiting, J. C., M. C. Wackenhut, and B. Doering, 2023b, "Overwinter mass loss of Townsend's big-eared bats in five caves" *Northwest Science* 96:55-62.

Whiting, J. C., B. Doering, and K. Aho, In preparation, "Disturbance of hibernating bats due to researchers entering caves to conduct hibernacula surveys" *Scientific Reports*.

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.

Page intentionally left blank

APPENDIX B. DETECTOR SETUP

Anabat SD2 units have reflector plates oriented at 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 the 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 through October) at facilities.

Anabat Swift units have microphone housing mounted at a 90° angle to the bat stand. Each detector has selected the local time zone and 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 through March).

Page intentionally left blank

APPENDIX C. ACOUSTIC ANALYSIS

Summer

For the analyses of activity at a facility or a cave, we used Kaleidoscope Pro version 5.6.3 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 preset under the Signal Parameters tab. 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).

Winter

For the analyses of activity at a facility or a cave, we used Kaleidoscope Pro version 5.6.3 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 preset under the Signal Parameters tab. 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 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).

After calls were classified by Kaleidoscope, all calls for all species were manually vetted (López-Baucells et al. 2021, Richardson et al. 2021). To do this, when Kaleidoscope finishes with the automated call analyses, the viewer window and the data file table were opened. Then the viewer window was displayed on one screen and the data file on another screen. In the viewer window, drag the horizontal bar separating the two windows to eliminate the upper window, press the Compressed Time View button, so that all passes show as adjacent, vertical lines. Also, select the three dots tab, so that the characteristic frequency of the call is overlaid in pink on the call pulses and select the Zoom to Fit on Frequency Access tab, so that the frequency scale (y-axis) is stretched. In that window, insert a horizontal line at 40 kHz. Manually insert names of species and species combinations (C) in the boxes at the bottom under the Auto next file tab. Select the Auto next file box, and manually vet only those rows of data in the data file table that Kaleidoscope labeled as CORTOW, MYOCIL, EPTFUS, or NOID, and label each file by species or species combinations if > 1 species is in the file or noise. Only manually label files that have ≥ 2 echolocation pulses (Whiting et al. 2021). Save and close the id data file to save the manual ID classifications. Reopen the id data file in Kaleidoscope under the File and Open Results tabs. In the viewer window, sort by MANUAL ID and go through each file labeled as C, CORTOW, MYOCIL, EPTFUS, and noise to verify that the file was correctly identified. Save and close the id data file to save any changes.

Navigate to the id file and open this file in Excel and save this file as id_analyses. In that file, delete columns A to L, R to AJ, and AL to AR at the same time. Delete the -12 in columns A, B, C, and the MANUAL and * in column F (for R sake). Import the id_analyses file in R and calculate the number files and sum the number of pulses by date. Navigate to the results folder, open the id_analyses. In the viewer window and R date files locate the species combination files. Have one person write down the number pulses for each species file. Then input the values for files and pulses into the appropriate columns in the data_for_analyses.winter Excel file. Repeat these steps for western small-footed myotis and big brown bats. Then manually vet the files labeled as no id the software-provided nightly maximum likelihood estimate 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).

Literature Cited

Clement, M. J., J. A. Royle, and R. J. Mixan. 2022. Estimating occupancy from autonomous recording unit data in the presence of misclassifications and detection heterogeneity. Methods in Ecology and Evolution 13:1719–1729.

Deeley, S. M., N. J. Kalen, S. R. Freeze, E. L. Barr, and W. M. Ford. 2021. Post-white-nose syndrome passive acoustic sampling effort for determining bat species occupancy within the mid-Atlantic region. Ecological Indicators 125:107489.

Fraser, E. E., A. Silvas, R. M. Brigham, and Z. J. Czenze. 2020. Bat echolocation research: a handbook for planning and conducting acoustic studies. Bat Conservation International, Autin, Texas, USA.

Gaulke, S. M., A. B. Cable, T. C. Hohoff, B. A. Rogness, and M. A. Davis. 2023. One model to rule them all: identifying priority bat habitats from multi-species habitat suitability models. The Journal of Wildlife Management 87:e22351.

Genter, D. L. 1986. Wintering bats of the upper Snake River Plain: occurrence in lava-tube caves. Great Basin Naturalist 46:241-244.

Hyzy, B. A., R. E. Russell, A. Silvis, W. M. Ford, J. Riddle, and K. Russell. 2020. Occupancy and detectability of northern long-eared bats in the Lake States Region. Wildlife Society Bulletin 44:732-740.

Laverty, T. M., and J. Berger. 2022. Indirect effects of African megaherbivore conservation on bat diversity in the world's oldest desert. Conservation Biology 36:e13780.

López-Baucells, A., N. Yoh, R. Rocha, P. E. Bobrowiec, J. M. Palmeirim, and C. F. Meyer. 2021. Optimizing bat bioacoustic surveys in human-modified Neotropical landscapes. Ecological Applications 31:e02366.

Mallinger, E. C., K. R. Goodwin, A. Kirschbaum, Y. Shen, E. H. Gillam, and E. R. Olson. 2023. Species-specific responses to white-nose syndrome in the Great Lakes region. Ecology and Evolution 13:e10267.

Reynolds, T. D., J. W. Connelly, D. K. Halford, and W. J. Arthur. 1986. Vertebrate fauna of the Idaho National Environmental Research Park. Great Basin Naturalist 46:513-527.

Richardson, S. M., P. R. Lintott, D. J. Hosken, T. Economou, and F. Mathews, 2021, "Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats," *Scientific Reports*, Vol. 11, No. 1, pp. 1-6.

Seewagen, C. L., and A. M. Adams. 2021. Turning to the dark side: LED light at night alters the activity and species composition of a foraging bat assemblage in the northeastern United States. Ecology and Evolution 11:5635-5645.

USFWS. 2022. Range-wide Indiana bat & northern long-eared bat survey guidelines. U.S. Fish and Wildlife Service.

Whiting, J. C., B. Doering, and K. Aho. 2021. Long-term patterns of cave-exiting behavior of hibernating bats in nine caves in western North America. Scientific Reports 11:8175.

Whiting, J. C., B. Doering, J. Lowe, D. K. Englestead, J. A. Frye, S. Earl, A. Earl, and B. Bybee. 2015. Ecology, conservation, and management of bats in southeastern Idaho. U.S. BLM report, Idaho Falls, ID.

Whiting, J. C., B. Doering, and D. Pennock. 2019. Acoustic surveys for local, free-flying bats in zoos: an engaging approach for bat education and conservation. Journal of Bat Research and Conservation 12:94-99.

Page intentionally left blank

APPENDIX D. BAT SPECIES AFFECTED BY WHITE-NOSE SYNDROME

Table D-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
https://www.whitenosesyndrome.org/static-page/bats-affected-by-wns		

Page intentionally left blank

APPENDIX E. 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 E-1). Data loggers were programed to record from at least 1 November to 31 March 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. We exported data from each HOBO logger as a csv file.

Table E-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