2023

NABAT WILLISTON EXPANSION YEAR 1

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WCS CANADA

Executive Summary

The main objective of Wildlife Conservation Society Canada's (WCSC) North American Bat Monitoring (NABat) program in BC is to establish a robust baseline of bat presence and activity data to enable the quantitative evaluation of the impacts of stressors, such as White-nose Syndrome (WNS), habitat loss, and fatalities to migratory tree bats from wind energy projects. It is critical that we collect this data across BC immediately given the recent confirmations of *Pseudogymnoascus destructans* (Pd), the invasive fungus responsible for WNS, in southern BC and Alberta, and the recent COSEWIC assessment of "endangered" for our three species of migra6tory tree bats (Eastern Red, Hoary, and Silver-haired Bat). Five of the eight bat species that occur in the Peace Region of BC have either been listed or assessed as endangered and there is a federal recovery strategy in place for two of these, Little Brown and Northern Myotis.

Our proposal addresses the FWCP Peace Region Priority Level 2 Action PEA.UPD.SO3.RI.05 "Research bat populations, distribution, and identify important habitat features" and the secondary Level 2 Action PEA.CRE.SO5.RI.12 "Conduct stewardship and education related to aquatic and terrestrial conservation" by building, maintaining, and improving relationships with Indigenous Nations and local stakeholders that support conservation and sustainable use projects in the FWCP's Peace Region.

In the first year of WCSC's NABat Williston expansion project, we accomplished all stated milestones. We expanded our monitoring network by establishing three new NABat grid cells with partner First Nations (Tsay Keh Dene, Kwadacha, and Saulteau) in unsampled areas of the province. We collaborated with our First Nation partners to select grid cells, detector locations, and conduct the first year of monitoring within each Nation's traditional territory.

Four bat detectors were deployed to passively record bat activity in each 10 km x 10 km grid cell for a period of seven nights. Two driving transects were completed in each grid cell during the seven-night monitoring period. Classification of the collected acoustic data was completed in winter 2023 in conjunction with all other provincial data collected for the NABat program, following our established NABat processing protocols. All data collected through this expansion project have been incorporated into the provincial (SPI) and North American NABat (BPD) databases.

In the process of establishing these grid cells, we conducted community engagement, knowledge sharing, and capacity building activities with partner nations. Engagement began upon project inception as we presented NABat monitoring objectives and methods to project partners. We delivered additional formal and informal presentations within the partner communities and provided on-the-ground training to field assistants from each. First Nations Land Guardians and community members took part in all field activities associated with this project.

Opportunistic bat trapping in Tsay Keh Dene and Kwadacha First Nations territories to confirm the presence of Northern Myotis also provided additional outreach opportunities for Land Guardians, technicians, and community members.

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1 INTRODUCTION

The main objective of Wildlife Conservation Society Canada's (WCSC) North American Bat Monitoring (NABat) program in BC is to establish a robust baseline of bat presence and activity data to enable the quantitative evaluation of future impacts of stressors to provincial bat populations. Some of these stressors include White-nose Syndrome (WNS), which has caused massive population declines in several species of *Myotis*, habitat loss, which affects all bat species, and fatalities to migratory tree bat from wind energy projects. The invasive fungus that causes WNS, *Pseudogymnoascus destructans* (Pd), was recently confirmed from guano samples collected in 2022 from southern BC and WCSC researchers previously detected the fungus in guano samples from Alberta in 2021. COSEWIC recently assessed the three species of migratory tree bats, Hoary Bat (*Lasiurus cinereus*), Silver-haired Bat (*Lasionycteris noctivagans*), and Eastern Red Bat (*Lasiurus borealis*),) as endangered, based on substantial population declines due in large part to fatalities from wind turbines. Five of the eight bat species that occur in the Peace Region of BC now qualify as endangered under international criteria. Both the recent Pd detections and COSEWIC assessments enhance the urgency of our efforts to collect baseline bat data across BC against which to monitor future population changes.

Home to at least 15 species of bats, British Columbia is the province with the greatest bat diversity in Canada. Twelve of these species are hibernating bats that are at risk of population die-offs due to WNS. In the Williston Basin, eight bat species are known to occur (Paterson *et al*., 2020), three of which likely leave the area during winter and five that hibernate locally. Two of these hibernating species, Northern Myotis (*Myotis septentrionalis*) and Little Brown Myotis (*M. lucifugus*), are listed as endangered under Canada's *Species at Risk Act* (*SARA*) and have recovery strategies (ECCC 2018). WNS has already caused a decline of greater than 90% and in many cases up to 99% to eastern Canadian populations where the fungus is present (Nova Scotia, New Brunswick, Ontario, and Quebec) compared to baseline data collected prior to WNS establishment (Vanderwolf and McAlpine 2021). The three remaining hibernating species found in the Williston Basin, Long-eared Myotis (*M. evotis*), Long-legged Myotis (*M. volans*), and Big Brown Bat (*Eptesicus fuscus*), also have a demonstrated susceptibility to WNS.

The three migratory bat species in northern BC are expected to experience lower mortality from WNS but may harbour the fungus without showing diagnostic signs of WNS. Unfortunately, these three migratory species were recently assessed by COSEWIC as Endangered in Canada due to population declines largely associated with collisions with wind turbines (COSEWIC 2023).

2 BACKGROUND INFORMATION

The following sections provide background information about WNS and rationale for the NABat monitoring program.

2.1 WHITE-NOSE SYNDROME

WNS is a deadly fungal disease that kills bats while they hibernate. It has been described as 'one of the most devastating infectious disease outbreaks in wild mammals to emerge over the past century'

(Hoyt et al. 2021). WNS became a high-profile conservation concern when enormous numbers of dead bats were discovered outside large caves and hibernation sites in eastern North America beginning in 2007. The invasive fungus that causes WNS, Pd, was first detected in 2006 in New York State and has been spreading westward at a rate of approximately 200 – 250 km per year (ECCC 2018). In 2016 WNS was found in Washington State, after a jump of nearly 2000km from the previously western-most detections (in Nebraska and Minnesota). WNS is currently found in 39 US states and eight Canadian provinces (White-Nose Syndrome Response Team 2023). Pd, detected from guano samples is present in four additional states and two provinces including Alberta and British Columbia. Guano samples taken from bridges in BC and Alberta in 2022 and 2021 respectively, tested positive for Pd using qPCR techniques.

As of fall 2022, Pd had spread in all directions in Washington, including to the north and east, into the Columbia River Basin (near Lake Chelan State Park, WDFW 2020). Based on WCS Canada's guano sampling under bridges, Pd is also known to be in Saskatchewan and Alberta and was detected in southern BC in spring 2023 (near Grand Forks). The continuous spread of the fungus across areas of western US and Canada suggests this fungus will continue to spread throughout BC as bats move during seasonal migrations. Mass mortality of bats at some locations nearest the epicenter of discovery in Washington State has confirmed that WNS is impacting western bat populations (Abby Tobin, WDFW, pers. comm.).

Bordering southeastern BC, Montana, is also WNS positive. Pd was first detected in spring 2020 and WNS was confirmed in at least six counties by spring 2021. A 98% decline in bat numbers has been observed at the largest Little Brown Myotis cave hibernaculum in the western US (located in Montana) due to WNS (MFWP 2022).

In contrast to the large cave hibernacula that often support thousands of hibernating bats in eastern North America, hibernacula in western North America are not well known, are often remote, and generally do not appear to house large congregations of bats with the exception of some caves such as Azure Cave in Montana. This suggests the arrival of WNS in BC will be difficult to observe directly, as mortalities may be scattered over large and remote geographies. Therefore, in western Canada, monitoring programs like NABat fill a critical role of documenting species-specific declines and changes in occupancy and distributions at regional and local spatial scales that can reveal the impacts and patterns of WNS spread.

Our efforts establishing new NABat monitoring grid cells in unsampled areas and continuing monitoring of existing grid cells are imperative to document the effects of Pd and WNS as it inevitably expands within the province. This report summarizes results from NABat grid cells established in 2022 in and near the Williston Basin with help from partner First Nations Tsay Keh Dene, Kwadacha, and Saulteau.

2.2 NABAT

Prior to the arrival of Pd in BC, WCSC and partners have worked diligently since 2016 to establish the North American Bat Monitoring program (NABat) in the province. NABat (see Loeb et al. 2015 for full background and methods) is a continental, multi-agency, monitoring program designed by US and Canadian biologists and statisticians, including WCS Canada's Dr. Cori Lausen. The program is administered by the US Geological Survey (USGS), coordinated across Canada by the Canadian Wildlife Health Cooperative (CWHC) and implemented in BC by WCSC with the assistance of our expanding network of partners and volunteers. In BC, the program is directed by a provincial steering committee consisting of WCS Canada, BC Parks, Ministry of Environment and Climate Change Strategy, USGS, and CWHC biologists.

NABat consists largely of acoustic monitoring, both stationary (passive detectors) and active (driving transects), but also entails summer maternity colony and winter hibernacula monitoring. Our NABat monitoring collects trend information on species presence and distribution, relative activity, and relative abundance of bats throughout BC. These trends are providing a benchmark to estimate the effects of WNS and other threats to bats in the Basin, such as climate and habitat changes.

Transect surveys allow us to monitor the relative activity/abundance and richness of resident bat communities to confirm species presence/absence and document year-to-year variation. By recording bats via mobile monitoring, each recording can be assumed to be a different individual, and from this, trends and changes in relative abundance can be estimated.

The NABat Williston Expansion project provides a great opportunity to add important baseline data from underrepresented areas of BC in traditional First Nations territories to an established and successful continent-wide program. Additional benefits include First Nations engagement and capacity building that will lead to increased awareness of the risks to bat populations regionally, provincially, and on a continent-wide scale and increased capacity to undertake future conservation efforts.

3 GOALS AND OBJECTIVES

The main objective of Wildlife Conservation Society Canada's (WCSC) North American Bat Monitoring (NABat) program in BC is to establish a robust baseline of bat presence and activity data to enable the quantitative evaluation of future impacts of stressors to provincial bat populations.

Our proposal addresses the FWCP Peace Region Priority Level 2 Action PEA.UPD.SO3.RI.05 "Research bat populations, distribution, and identify important habitat features" tPreparing for WNS includes establishing baseline data, filling knowledge gaps, and identifying mitigation strategies and on-the-ground conservation actions that can build resiliency in bat populations prior to WNS infection.

This project also addresses the secondary Level 2 Action PEA.CRE.SO5.RI.12 "Conduct stewardship and education related to aquatic and terrestrial conservation" by building, maintaining and improving relationships with Indigenous Nations and local stakeholders that support conservation and sustainable use projects in the FWCP's Peace Region.

To accomplish this, we are establishing standardized grid cells in unsampled areas of BC and partnering and engaging with First Nations and others to promote bat ecology and conservation.

With the confirmation of Pd in southern BC in April 2023, and the assessment of all three migratory bat species found in northern BC as Endangered by COSEWIC in May 2023, our window to act is closing. Presently five of the eight bat species occurring in NE BC qualify as endangered. It is unknown how quickly WNS will spread throughout BC, but our baseline data will be highly informative to track its impact and help guide the implementation of further conservation actions. Baseline data are vital for planning, measuring, and mitigating impacts and establishing a benchmark for recovery. This work may inform stewardship and conservation actions that can build resiliency in bat populations and/or inform mitigation strategies such as WCS Canada's WNS probiotic, a prophylactic tool intended to reduce mortality rates of bats from WNS (funded in part by FWCP Coastal).

Implementing standardized survey/monitoring protocols, specifically NABat, is also considered a high priority in the recovery strategy for Little Brown and Northern Myotis (ECCC 2018). Since 2016 our team has developed a broad network of partners and participants to implement NABat protocols and monitor bats across BC and we are working to expand this network further throughout northern BC where few grid cells are being monitored. Community engagement, education and awareness, partnerships, and stewardship are also identified as high priority actions in the federal recovery strategy and our activities address these needs through continued outreach over social media and building working partnerships within local communities. Expanding awareness of the stressors facing our bat populations and increasing the capacity to determine population changes and implement mitigation is a critical part of our program. Our implementation of new grid cells in northern BC that are led by First Nation communities, is a strong step towards further developing a diverse and resilient network of partners that has and will continue to improve education and awareness about regional bats, bat conservation, and increase the capacity for more First Nations led bat programs.

In addition to addressing these high priority actions identified in the federal recovery strategy, continuing, expanding, and strengthening the NABat program is an essential priority (Action 3.08) of the BCBat Action Plan (2021). Bat monitoring provides a benchmark for ongoing surveillance of WNS and Pd, quantification of differential impacts on the bats in BC including the eight species found in the Peace Region, and future evaluation of mitigation strategies.

4 PROJECT AREA

NABat is a continent-wide program aimed at establishing baseline bat presence and activity data across North America. We have conducted NABat monitoring with partners throughout BC since 2016, adding additional grid cells as opportunities arise. There are presently 61 grid cells monitored annually throughout BC with approximately one third of these cells having seven years of monitoring data completed. The NABat Williston Expansion added an additional three grid cells in 2022 in traditional territories of Saulteau, Tsay Keh Dene, and Kwadacha First Nations (**Figure 1**). These are primarily unsampled areas that are poorly represented in existing data collection.

Further details on grid cell and monitoring site selection are provided in **Section 4.1**.

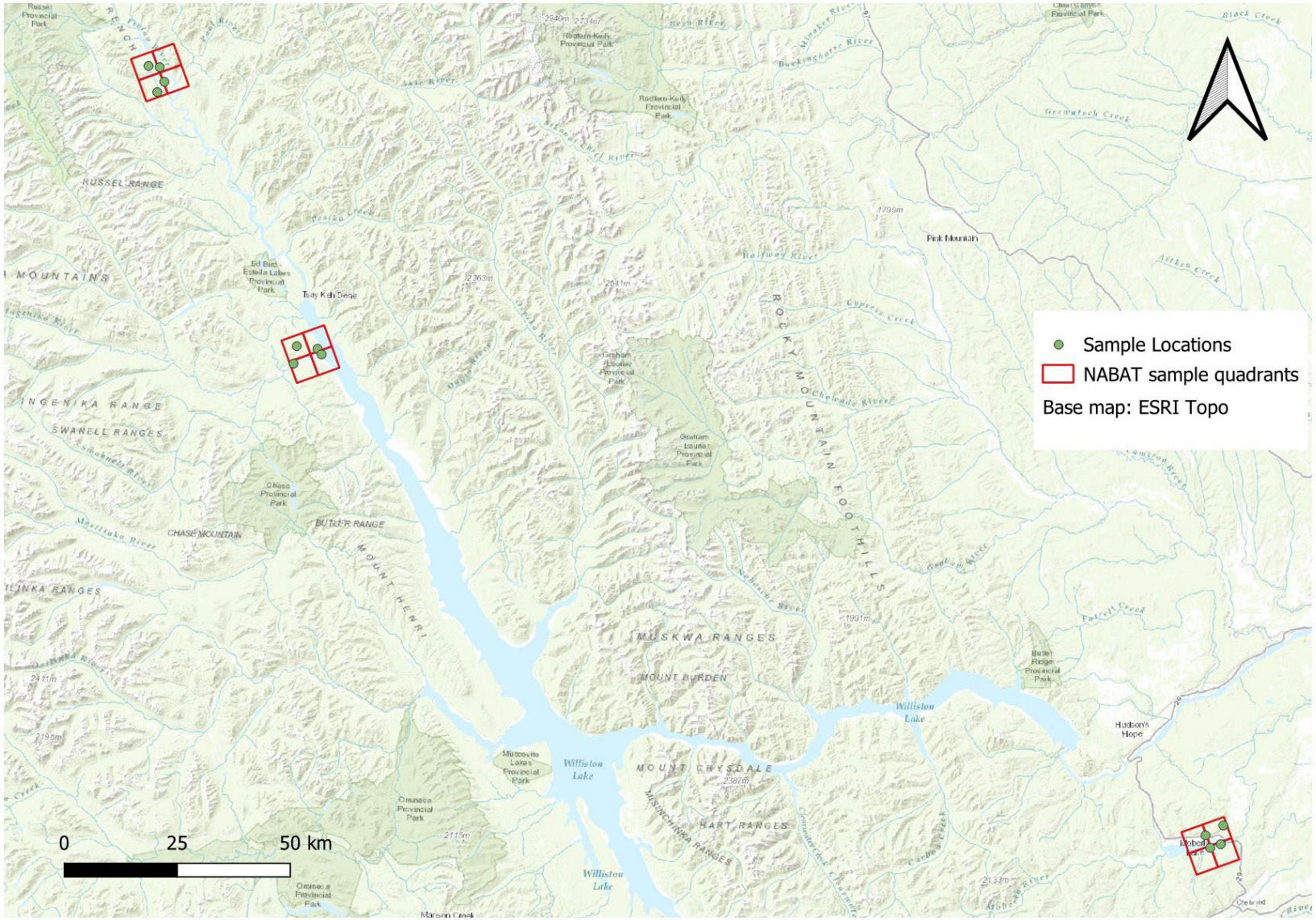

Figure 1. Grid cell locations sampled as part of the Williston NABat expansion project in 2022.

5 METHODS

The following sections outline the methods used for this project.

5.1 GRID CELL SELECTION

As part of the NABat protocol (Loeb et al. 2015), we overlaid a layer of 10km x 10km, numbered "grid cells" across North America to identify high priority locations to sample. To provide some measure of randomness to the cells selected for monitoring, grid leaders were tasked with selecting the lowest number grid cell feasibly monitored within their focal area.

In the winter and spring of 2022, we worked with partners from Saulteau, Tsay Keh Dene, and Kwadacha First Nations to confirm which high priority grid cells near their location were feasible to sample annually for a minimum of five years.

5.2 PASSIVE MONITORING

Within each grid cell, we deployed four passive acoustic bat detectors for at least one week during the pre-volancy (pups not yet flying) period of summer. In northeastern BC, this aligns with sampling throughout the month of June until about mid-July. Monitoring at the three expansion cells in Saulteau (Moberly Lake), Tsay Keh Dene (Ingenika), and Kwadacha (Fort Ware) First Nations territories, occurred between June 13 and June 28 over a period of seven nights at each location (**Table 1**). Project biologist Brian Paterson was accompanied by at least two participants from each partner First Nation during setup and retrieval.

Table 1. Locations, start and end dates, detector type, and habitat information for all quadrants monitored as part of the Williston Reservoir NABat expansion in 2022.

Location	Start Date	End Date	Latitude	Longitude	Detector Type	Description
Fort Ware						
9466-NE	2022-06-20	2022-06-26	57.34435226	-125.50932233	Anabat Swift	Brushy, adjacent to Finlay River
9466-NW	2022-06-20	2022-06-26	57.34589600	-125.55037388	Anabat Swift	Adjacent to lake
9466-SE	2022-06-20	2022-06-26	57.31574876	-125.49037412	Anabat Swift	Along access road with pines
9466-SW	2022-06-20	2022-06-26	57.29482850	-125.51473778	Anabat Swift	Adjacent to lake
Ingenika						
20730-NE	2022-06-22	2022-06-28	56.7952475	-124.9005858	Anabat Swift	Open water with riparian
20730-NW	2022-06-22	2022-06-28	56.79948362	-124.9761373	Anabat Swift	Wetland
20730-SE	2022-06-22	2022-06-28	56.7845655	-124.8854358	Anabat Swift	High bank along Finlay Arm
20730-SW	2022-06-22	2022-06-28	56.76456457	-124.985882	Anabat Swift	High bank along Ingenika
Moberly Lake						
42026-NE	2022-06-13	2022-06-19	55.85526785	-121.6534502	Songmeter Bat+	Powerline RoW below bluffs and near lake
42026-NW	2022-06-13	2022-06-19	55.83615996	-121.7169091	Songmeter Bat+	Rodeo grounds (mature aspen)
42026-SE	2022-06-13	2022-06-19	55.81796825	-121.6640549	Songmeter Bat+	South side Moberly Lake
42026-SW	2022-06-13	2022-06-19	55.81130793	-121.7013079	Songmeter Bat+	South side Moberly Lake - Provincial Park

Photos of the installed detectors are provided in **Figures 2**, **3**, and **4**. SM2Bat+ detectors (Wildlife Acoustics Inc.) were used for monitoring the Saulteau First Nation grid cell, while Anabat Swift detectors (Titley Scientific Inc.) were used for the Tsay Keh Dene and Kwadacha grid cells. Acoustic bat detectors automatically detect and record

the ultrasonic echolocation sounds (pulses) that bats make as they search for prey and navigate the landscape at night.

Our bat detectors were programmed to record ultrasound ranging from 16 kHz to approximately 200 kHz. Normal human speech occurs between 300 and 3,400 Hz, well below the recording range of the bat detector microphones. We recorded the serial numbers of the bat detectors and microphones deployed at each site so that the same units can be redeployed in subsequent years to maintain consistency in detection radius between years. This detection radius also depends on the echolocation characteristics of the bat species being recorded. Longer wavelength (lower frequency) search phase echolocation pulses produced by a Hoary Bat may be detectable up to 50 m, while the high frequency pulses that a Long-eared Myotis produces would be detectable only at closer distances. Bat echolocation pulses that were made within the detection radius of our microphones were automatically recorded and saved to SD cards for subsequent classification. Our bat detectors were programmed to stop each recording after a 2 second gap between bat pulses, so most recordings only contained pulses from a single bat as it passed the microphone. Occasionally recordings did capture pulses from multiple bats if they passed the microphone in close proximity to one another.

Detector setup followed provincial NABat guidance provided in Lausen *et al.,* (2021). All recordings were made in full spectrum (FS), beginning 30 minutes prior to sunset, and ending 30 minutes after sunrise. Microphones were installed on extended painters poles at least 3m from clutter (vegetation, water, structure, or topography that could affect echolocation and /or introduce echoes to recordings). Temperature and humidity loggers were placed in one quadrant of each cell.

Figure 2. Bat detectors installed in Tsay Keh Dene traditional territory near Ingenika Point. Photos (clockwise) represent the NE, NW, SE, and SW quadrants.

Figure 3. Bat detectors installed in Saulteau First Nation traditional territory around and near Moberly Lake. Photos (clockwise) represent the NE, NW, SE, and SW quadrants.

Figure 4. Bat detectors installed in the Kwadacha First Nation traditional territory just south of Fort Ware. Photos (clockwise) represent the SW, NE, NW, and SE quadrants.

5.3 DRIVING TRANSECTS (ACTIVE MONITORING)

During the seven-night passive monitoring period, participants also drove mobile transects on two nights. An Echometer Touch Pro bat detector (Wildlife Acoustics Inc.) was attached to the top of the survey vehicle with a suction mount and driven slowly (~30km/hr) just after sunset on a road without tight switchbacks. Each transect crossed through at least two of the grid cell quadrants. The Echometer Touch Pro bat detector is essentially an ultrasound microphone that plugs into an iOS or Android device (different models are available for each operating system) via an extension cable. The device functions similarly to the passive bat detectors above to record ultrasound within a specific detection range, but the microphone is affixed to the roof of the survey vehicle at an angle of 45 degrees facing backwards and up. The Echometer Touch Pro saves the recordings of bat pulses to the iOS or Android device, paired with a transect track and point location data.

To document relative insect activity as an explanatory variable for nightly bat activity, 8" x 10" glue pads were affixed to the front of the transect vehicle. Dates of transect surveys are provided in **Table 2**.

Table 2. Dates and distances of driving transects established for the NABat Williston expansion project, June 2022.

Location	Transect 1	Transect 2	Transect Distance (km)
Fort Ware	2022-06-20	2022-06-25	29.2
Ingenika	2022-06-22	2022-06-25	24.9
Moberly Lake	2022-06-14	2022-06-15	25.6

5.4 ACOUSTIC CLASSIFICATION AND ANALYSIS

Acoustic analysis starts with noise filtering and bat auto-identification in Kaleidoscope Pro software (Wildlife Acoustics Inc.), selecting for species known to occur, or with potential to occur within the focal region. Initial auto-identification is followed by processing through a second auto-identification program (Sonobat Bat Call Analysis Software). Both programs utilize differing call libraries to underpin their identification algorithms. Therefore, the use of both programs informs the final step of manual verification. Following auto-identification, recordings may be labelled with matching species identifications, non-matching species identification, identification from a single program only, or no identification. Despite the use of two forms of auto-identification, many recordings will still be mislabeled. This is due to a number of factors including the presence of multiple bats, noise, other animals that utilize ultrasound, and / or clutter that produces poor recordings.

Our lead analyst manually verified all bat recordings that received a species label from Kaleidoscope Pro or Sonobat as well as high-quality recordings that remain unidentified (non-species-specific identification through the auto-identification software). We are currently working with project partners at the US Geological Survey (USGS) to develop an analysis methodology that will allow us to manually verify a subset of these acoustic recordings but still

correct a sufficient number of the auto-identification software misclassifications to maintain high quality data with reduced manual effort.

We then conducted our annual statistical trend analyses using the fully analyzed acoustic data. These statistical analyses are designed to estimate trends in stationary activity and transect data to establish baseline data pre-WNS, reveal changes in distributions and population trends for each bat species, and facilitate and guide mitigation measures and recovery efforts should these be required. As more data and grid cells are added to the northern regions of BC our analyses can begin to produce conclusions more relevant to these sparsely sampled areas. These data will also provide a benchmark for other non-stationary conditions in the Basin, such as climate change, habitat restoration, resource development, etc. Covariate data including temperature, humidity, precipitation, and habitat data was collected at all stationary detectors and mobile transects and included in our models to help explain nightly and annual variability. These habitat and climate data are collected within each grid cell using HOBO data loggers or equivalent.

5.5 COMMUNITY ENGAGEMENT AND KNOWLEDGE SHARING

Our efforts expanding the NABat program into the Williston Basin provide opportunities for Indigenous grid leaders and assistants to receive training and gain experience with acoustic bat monitoring techniques, learn about bat ecology and conservation, and contribute to bat monitoring and conservation at local, regional, and continental scales. In 2022, we trained Indigenous leaders from three participant First Nations (Saulteau, Tsay Keh Dene, and Kwadacha). All participants were trained in-person, in aspects of bat ecology, monitoring site selection, and equipment deployment. Site selection is extremely important as sites should represent available habitat and detectors should be installed to have minimal clutter effect (important to maximize the ability to record diagnostic echolocation sequences).

Prior to project commencement and our first-year proposal submission, we consulted with the First Nations that indicated interest in participating in the project through the Notice of Intent (NOI) process facilitated by the FWCP, Saulteau, Tsay Keh Dene, and Kwadacha. During initial discussions, we described the existing NABat program and our desire to expand to unsampled areas of northern BC and provide an opportunity to partner with local First Nations. A presentation was provided to land managers in each First Nation to convey key elements of the project. As previously explained, monitoring grid cells are typically selected by choosing the lowest numbered 10 km x 10 km grid cell that can be feasibly sampled near the target area / community. We identified these areas and discussed site selection with the partner Nations who helped to identify potential monitoring locations within the grid cells. Field technicians and Land Guardians helped with project implementation in the three communities.

Prior to the field project, formal and informal presentations and information sessions occurred to share objectives, basic bat biology and ecology, and identify roles and responsibilities.

Throughout all stages of the project, site selection, detector setup and takedown, and driving transects, a WCSC bat biologist was present in communities to provide training and ensure consistency with data collection. Talking with members of these communities and providing opportunities to learn more about bat ecology and conservation while taking part in a

continent-wide program is an important part of this project. This engagement portion will continue for the foreseeable future of this project as it is critical to building a successful program that includes strong relationships with well-trained partners. We were also able to further engage with our project partners last year through some bat trapping activities in the Tsay Keh Dene and Kwadacha areas and we propose to do the same in 2023 on nights when no NABat transects were being conducted. This will involve up to five nights of trapping with the focus on confirming the presence of Northern Myotis, a species that is challenging to identify through acoustics alone.

For each grid cell, field work included a day to find locations and set up detectors (four in each cell equating to one per pre-defined quadrant), two nights to drive transects for relative abundance and insect sampling, a day for takedown, and a day for equipment maintenance / data organization as needed. We believe the opportunity to engage and learn from an experienced bat biologist (who visited each partner FN community) was and will remain an essential component of this project and helps maintain enthusiasm and support.

5.6 BAT CAPTURE

Five nights of bat capture were completed in the Tsay Keh Dene and Kwadacha traditional territories with help from Chu Cho Environmental and Tsay Keh Dene Nation (**Figure 5**). Bat capture was completed under provincial permitting obtained by biologist Brian Paterson. The focus of capture efforts was to confirm the presence of Northern Myotis. Mainly small trails near riparian areas and along small streams in Boreal White and Black Spruce (BWBS) forest with appropriately sized aspen and cottonwood were targeted using small nets, as has been successful elsewhere in the Peace Region (B. Paterson pers. obs.). One night of trapping along the wetland margins of Blue Lake in Tsay Keh territory was also completed. Provincial WNS safety and decontamination protocols were followed during trapping efforts.

Captured bats were only handled by B. Paterson. All bats were identified to species, measured, weighed, and genetic material (wing punch and / or guano) were collected to confirm identification if needed. MOTUS transmitters designed specifically for bats were provided by Amie MacDonald (Birds Canada) to trial the effectiveness of locally installed MOTUS stations (TKD school and Ingenika Point) to detect tagged bats. Temporary transmitters were affixed to the back of bats using OstoBond latex-based adhesive after trimming a small amount of fur between the shoulder blades of the bats. Transmitters typically fall off in about seven days.

Selected photos from the capture program are provided in **Figure 6**.

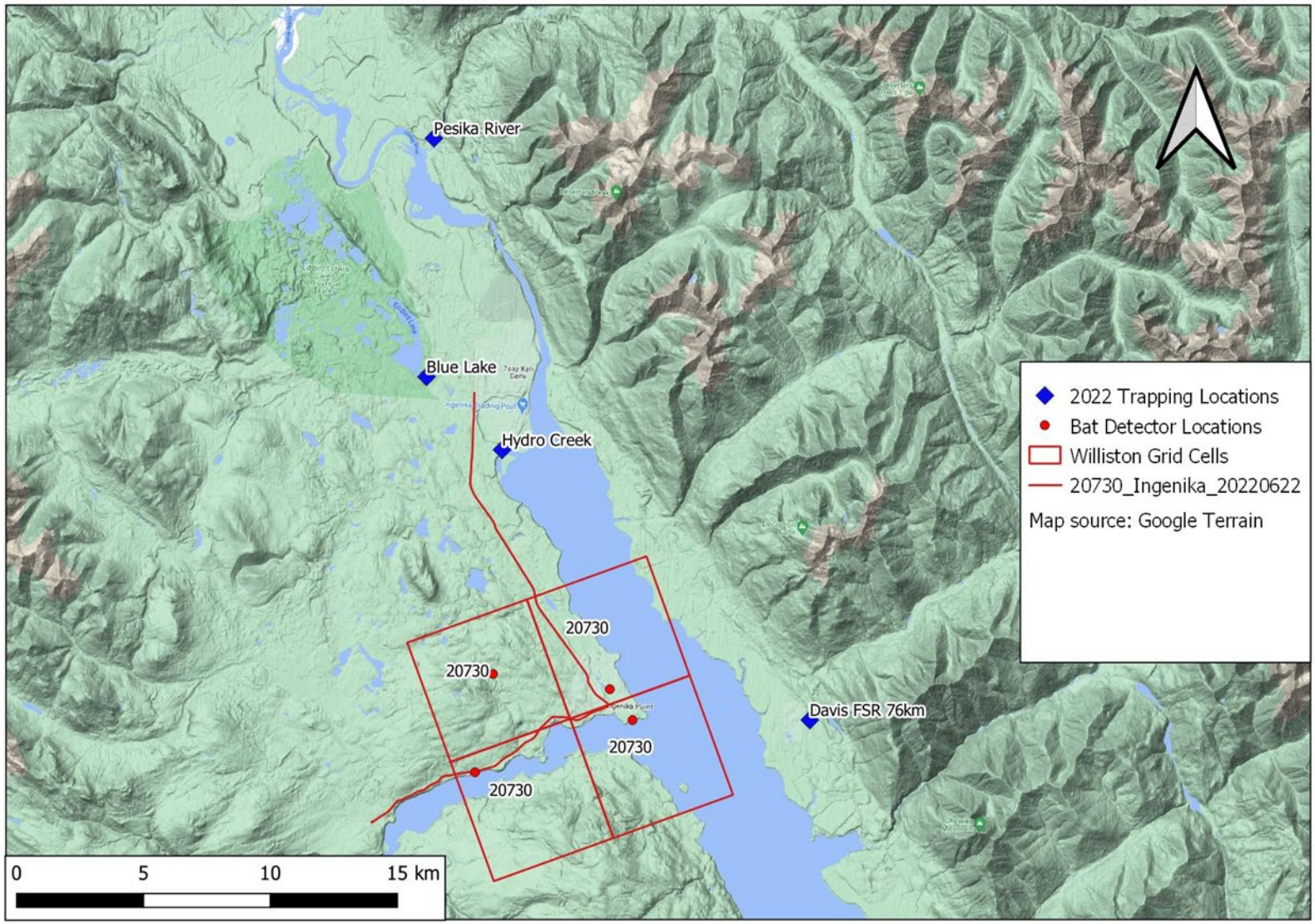

Figure 5. Mist-netting locations for bat capture in July 2022.

Figure 6. Selected photos of bat trapping efforts conducted in June 2022.

6 RESULTS AND OUTCOMES

In the first year of our NABat Williston expansion project, we accomplished all stated milestones. We established three new grid cells with partner First Nations in unsampled areas of the province to expand the provincial NABat network. In the process of establishing these grid cells, WCSC was able to conduct community engagement, knowledge sharing, and capacity building activities with partner nations.

Engagement began with project inception as WCSC presented NABat monitoring objectives and methods to project partners. Additional formal and informal presentations were delivered within the partner communities and on-the-ground training was provided to field assistants from each Nation by a WCSC bat biologist. Grid cells in each traditional territory were selected for monitoring and First Nation partners helped to identify potential detector locations within each quadrant.

During the project, we had field assistance from two Saulteau Land Guardians, two Kwadacha Land Guardians and one community member, one biologist from Chu Cho Environmental, one TKD technician / community member, and a 16-year-old student from TKD that used the opportunity to gain extra school credits through an arrangement with his school, Chu Cho Environmental, and the TKD community.

Classified acoustic recordings were then provided to WCSC analyst Jason Rae for statistical analyses and incorporation into the larger NABat dataset. Given this is the first year of monitoring in these cells, no trend data is possible; however, presence data is provided in **Table 3**. Additional analyses will be completed with the collected data in future years of the project.

Bat species confirmed in the Ingenika and Fort Ware cells were identical which is not unexpected given their proximity to each other. Species detected in these cells include Eastern Red Bat, Silver-haired Bat, Long-eared Myotis, Little Brown Myotis, and Long-legged Myotis. In the Moberly Lake grid cell, the same species were detected; however, Big Brown Bat was also detected in this grid cell.

Driving transects through the Ingenika grid cell only confirmed Little Brown and Long-legged Myotis. Transects in Fort Ware detected all bat species detected during passive monitoring. Transects through the Moberly Lake grid cell confirmed Eastern Red Bat, and Little Brown and Long-legged Myotis.

In conjunction with this project, bat trapping was conducted on several nights while in TKD and Kwadacha territory with assistance from Chu Cho and TKD. Netting locations and bats captured are summarized in **Table 4**. Bat species captured and sex are provided in **Table 5**.

Over five nights of netting at the north end of Williston Lake in 2022, we captured a total of 15 bats, all from trapping efforts along and adjacent to Hydro Creek just south of the TKD community. Of these, seven were Long-eared Myotis, five were Little Brown Myotis, and three were Long-legged Myotis. MOTUS tags / transmitters were placed on two of the bats to determine whether they would be detected by the MOTUS towers installed in the TKD community and south of TKD at Ingenika Point. Two of the Long-eared Myotis females captured were noticeably pregnant. Three of the netting locations attempted yielded no bat captures.

Table 3. Presence / not detected bat data at each of the three grid cells established in 2022 for the Williston NABat expansion.

Grid Cell Name	Ingenika					Kwadacha					Moberly Lake				
GRTS ID	20730					9466					42026				
Quadrant	NE	NW	SE	SW	Transects	NE	NW	SE	SW	Transects	NE	NW	SE	SW	Transects
Big Brown Bat											●	●	●		
Eastern Red Bat	●						●			●		●	●	●	●
Hoary Bat															
Silver-haired Bat	●	●	●			●	●			●	●	●	●	●	
Long-eared Myotis	●	●	●	●		●	●	●	●	●	●	●	●	●	
Little Brown Myotis	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Northern Myotis															
Long-legged Myotis	●	●	●	●	●	●	●	●	●	●	●		●	●	●
Total Bat Recordings	427	47	35	70	10	8	84	50	42	14	270	81	893	1239	14

Table 4. Bat trapping locations, dates, number of nets deployed, and bats captured at each site.

Site Name	Zone	Easting	Northing	Date	Site Description	Nets	Bats Captured
Davis FSR 76km	10V	391794	6294993	2022-06-23	Trail in aspen forest	4	0
Pesika River	10V	376993	6317874	2022-06-24	Trail in aspen forest	3	0
Blue Lake	10V	376701	6308493	2022-06-26	Lake / wetland	6	0
Hydro Creek Crossing	10V	379675	6305620	2022-06-27	Small creek / riparian	4	2
Hydro Creek Upstream	10V	379675	6305620	2022-06-28	Creek and trails	4	13
Totals						**21**	**15**

Table 5. Bat species and sex captured during mist-netting efforts in June 2022.

Species / Sex	Hydro Creek Crossing	Hydro Creek Upstream	Bats Captured
Long-eared Myotis	**1**	**6**	**7**
F		4	4
M	1	2	3
Little Brown Myotis	**1**	**4**	**5**
M	1	4	5
Long-legged Myotis		**3**	**3**
M		3	3
Totals	**2**	**13**	**15**

It is uncertain if any of the MOTUS tags were read at the towers near Tsay Keh and Ingenika Point. These towers require a manual download and that has not occurred yet for 2023.

7 DISCUSSION

The initial year of the NABat Williston Expansion project was successful on several fronts. We established new grid cells for long-term bat monitoring with partner First Nations at three locations with no previous sampling effort. We also implemented driving transects in each grid cell and contributed this data to both provincial and continent-wide NABat programs. Given this is the first year of monitoring in these cells, only species presence / absence data were reported here. We can begin to examine trends in relative activity / abundance after roughly five years of monitoring, These presence records add resolution to the habitat use maps for each of the six species detected and the absence of species that were expected to occur in this range can also be equally informative.

In particular, the absence of definitive Big Brown Bat recordings in the Ingenika and Kwadacha grid cells and Northern Myotis recordings in all three grid cells are worth continued investigation, given the presence of acoustic recordings suggesting the uncommon presence of both species within the northern extent of the Williston Basin (Paterson and Hansen, 2019). Should continued acoustic monitoring and trapping fail to produce detections of these two species, range maps will be updated and reasons for the gap in presence should be further explored. Northern Myotis have been genetically confirmed within 25 km of the Moberly Lake grid cell (B. Paterson unpublished data); therefore, the absence of definitive Northern Myotis recordings from this area

combined with the continuity of suitable habitat would not merit an adjustment to provincial Northern Myotis range mapping in this area.

The main purposes of bat trapping were to capture Northern Myotis within the northern extent of the Williston Reservoir and provide an opportunity for outreach and knowledge sharing with project partners. Some suitable habitat is available in the Boreal White and Black Spruce biogeoclimatic zone at lower elevations around the Finlay Arm and northern part of Williston Reservoir. The presence of Northern Myotis has been confirmed genetically in both Mackenzie and the Dinosaur Reservoir of Williston Reservoir through previous FWCP funded research (Paterson *et al*. 2020, Paterson and Hansen 2019, and unpublished data). Acoustic recordings with characteristics of Northern Myotis have been recorded from the Peace Reach of Williston Reservoir and the Akie and Pesika Rivers near Tsay Keh Dene and Fort Ware (Paterson and Hansen 2019); however, genetic confirmation of this difficult to survey species in the Finlay Arm is desired. Nagorsen and Lausen (2008) also have confirmed genetic samples from Northern Myotis collected from Hazleton BC. It is suspected that Northern Myotis are present in the lower elevation hardwood forests at the north end of Williston Reservoir but to date there has been no confirmation via capture and genetics.

Bat trapping was a unique way to share information with Land Guardians and technicians about bat ecology and conservation. Explaining behavioural patterns of target species and setting nets in different locations to target these species was a great way to engage community members in bat ecology. It was also a great way to utilize local knowledge of habitat features, forest types, and trails to work towards a common objective. Seeing bats close-up is a mind opening experience for most people and helps to dispels many myths that people have about bats. This was shown to be the case during trapping on Hydro Creek when Tsay Keh members/Chu Cho technicians gained understanding for why nets were set in certain areas for certain species and to see their excitement in contributing to successful capture efforts and talking about habitat and site selection. Assistants also conducted data recording which is a critical part of the capture effort.

No Northern Myotis were captured at the sites where we conducted bat trapping in 2022, but this species is highly maneuverable and difficult to capture. Further effort and additional sites may result in successful captures for this species, but if we are unable to detect this species in future years, its absence from the area would also be a result that could inform our understanding of this endangered species' habitat needs.

The method we employed of conducting bat capture during nights when no NABat transects are being driven was successful and will be continued in 2023. This maximizes the education and outreach benefit of having a bat biologist present in the communities for 7 – 10 days, and it is important to confirm, genetically, whether Northern Myotis is present in at the northern end of Williston Reservoir.

The opportunity to share knowledge and engage First Nation members and technicians regarding bat ecology and conservation was an equally important part of this project. With the goal of transferring leadership of the project at some point, we believe there is an ongoing education and outreach benefit to providing a project biologist to travel to each community on an annual basis. Within Fort Ware, project biologist Brian Paterson became known as "Batman" on the truck

radio and there were numerous occasions when he was able to informally engage with community members while sitting in the Band Office, driving around, or camping within the territory. Witnessing the way that information is exchanged in these communities is an important lesson for this project. Simply arriving in Fort Ware or Tsay Keh Dene for a single night or two and expecting things to happen in a clearly scheduled fashion is not realistic. Being present for an extended period and providing flexibility to work with the local community is critical for relationship building and the overall success of the project.

Given the recent detection of Pd in southern BC and the COSEWIC assessment of the three species of migratory tree bats (Eastern Red, Hoary, and Silver-haired Bat), collecting baseline bat data in unsampled areas of the province and engaging with local partners including First Nations, is a critical step to promoting stewardship and conservation of declining bat populations. Bats are facing unprecedented stressors and it is a very important time to gather baseline data and engage with First Nations to spur conservation efforts for these species. The first year of our NABat Williston Expansion project has successfully completed all projected milestones and the new NABat grid cells we have established with our First Nations partners are providing data in critical areas of Northern BC that have previously been sparsely surveyed or monitored.

8 RECOMMENDATIONS

To establish baseline data prior to the arrival of WNS, we recommend continued monitoring of the grid cells initiated in Year 1 of this program. If feasible, additional cells may be established in the Williston Reservoir in subsequent years. These cells should be monitored annually for a minimum of five years to establish baseline conditions that could allow us to detect population trends locally and contribute to regional, provincial, and continent-wide trend data.

We feel it is a necessity to have a WCSC bat biologist present to help setup detectors and help with driving transects. Given we have only completed a single year of survey and some personnel have already changed at our partner Nations for the 2023 field season, it could take several years of effort to develop consistent and trained personnel from the partner Nations. This has the benefit of providing more opportunities for outreach and knowledge sharing about bat ecology and conservation. Remote communities such as Tsay Keh Dene and Fort Ware have limited opportunities for researchers to share ecological knowledge and to participate in studies in their territories; therefore, we believe there is good value in continuing the program even with changes to First Nations project personnel.

During the time that is spent in the partner communities, it is an efficient use of time to conduct additional bat-related activities in the time not needed for the acoustic monitoring portion of the program. Using off-nights for bat trapping is a good use of time as it is important to obtain genetic confirmation of Northern Myotis in this area for provincial range mapping and to determine habitat use. We have successfully collected data on Northern Myotis maternal roosts near the Peace River and Kiskatinaw River (Paterson and Hansen, unpublished data), and there is some information available regarding maternal roost selection in the Fort Nelson area (Vonhof and Wilkinson 1999). Determining presence and habitat use in the lower elevation boreal forest of the Williston Reservoir will help with ongoing conservation and habitat management of this federally endangered bat species. Results from the Peace and Kiskatinaw River study areas have already

been used in forest harvesting layouts, guided the creation of artificial roost cavities, and have helped with provincial threat assessments.

Future projects could include habitat creation, especially where bats are present in buildings with the communities. Bat box and bat house creation, couple with standardized annual monitoring by First Nation partners is one idea that has been discussed with the partner Nations. Ideally, such proposals would be led by the interested Nations with some guidance as needed from WCSC bat biologists.

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10 REFERENCES

BC Bat Action Team (BCBAT). 2021. 2016 – 2020 BC Bat Action Plan Updated for 2021.

COSEWIC. 2023. Seeing conservation solutions for unseen species. May 2023 Press release. Available: https://www.cosewic.ca/index.php/en-ca/news-and-events/press-release-may-2023.html.

Environment and Climate Change Canada (ECCC). 2018. Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (P*erimyotis subflavus*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. ix + 172 pp

Hoyt, J.R., Kilpatrick, A.M. and Langwig, K.E., 2021. Ecology and impacts of white-nose syndrome on bats. Nature Reviews Microbiology, 19(3), pp.196-210. https://kilpatrick.eeb.ucsc.edu/wp-content/uploads/2021/03/Hoyt-et-al-2021-Nat-Rev-Micro.pdf

Lausen, C., Craig, J., and J. Rae. 2021. NABAT Program Field Guide for British Columbia.

Loeb, S. C., Rodhouse, T. J., Ellison, L. E., Lausen, C. L., Reichard, J. D., Irvine, K. M., Ingersoll, T. E., Coleman, J. T.H., Thogmartin, W. E., Sauer, J. R., Francis, C. M.,Bayless, M. L., Stanley, T.R., and D.H. Johnson. A Plan for the North American Bat Monitoring Program (NABat).

Montana Fish, Wildlife, and Parks (MFWP). 2022. Biologists find drastic reduction of bats at azure cave, likely due to WNS. Press release. Available: https://fwp.mt.gov/homepage/news/2022/june/0609---biologists-find-drastic-reduction-of-bats-at-azure-cave-likely-due-to-wns

Nagorsen, D. and C. Lausen. 2008. Identification of long-eared myotis bat species in British Columbia: An essential tool for developing management recommendations for bat species at risk. FSP Project Y092135

Paterson, B., Hansen, I.J., and C. Lausen. 2020. Williston Reservoir Bat Ecology Program. FWCP project No. PEA-F18-W-2319.

Paterson, B., and I.J. Hansen. 2019. Northern Myotis maternal roost study. FWCP project No. PEA-F19-W-2668

USFWS, US Fish and Wildlife Service. 2021. White-noseSyndrome.org, a coordinated response to the devastating bat disease. Available: www.whitenosesyndrome.org

Vanderwolf KJ., and D.F. McAlpine. 2021. Hibernacula microclimate and declines in overwintering bats during an outbreak of white-nose syndrome near the northern range limit of infection in North America. Ecol Evol. 2021 Jan 20;11(5):2273-2288. doi: 10.1002/ece3.7195. PMID: 33717454; PMCID: PMC7920769.

White-nose Syndrome Response Team. 2023. Where is WNS now? Retrieved from: https://www.whitenosesyndrome.org/where-is-wns.