

BC Bat Action Team

2016 -2020 BC Bat Action Plan Updated for 2021



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Cover photo: Little Brown Myotis. Peace region, BC Credit: J. Hobbs

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BC Bat Action Team (BCBAT)

The British Columbia Bat Action Team (BCBAT) is a group of professional biologists, academic researchers, veterinarians, environmental educators, students, naturalists, wildlife rehabilitators, government biologists, and other people that are interested in bat conservation in British Columbia (BC).

What does BCBAT do?

BCBAT promotes the conservation of bats in BC. The BC Ministry of Environment and Climate Change Strategy (ENV) and BC Ministry of Forest, Lands, Natural Resource Operations and Rural Development (FLNR) are responsible for the management and conservation of bats and bat habitat in the province. BCBAT provides valuable input into development of provincial bat survey standards, best management practices for various sectors that have impacts on bats and bat habitat, conservation and recovery of bat species at risk, education and outreach, and identification of bat research and conservation priorities.

Executive Summary

The BC Bat Action Plan was developed in 2016 to inform and prioritize the activities of multiple groups working for bat conservation in BC. The impetus for the action plan was largely in response to the emerging threat of White Nose Syndrome (WNS) in western North America. Reviewed in 2019, the original 5-year plan was intended to be revised and updated in April 2021 at an in-person workshop. Travel restrictions due to COVID-19 resulted in cancelling the meeting. Instead, an online workshop was held in December 2020, to review and revise the plan with any new information and extend its guidance through 2021. BCBAT intends to develop a new 5-year plan for 2022-2027. Key priorities for 2021 were identified from the existing prioritized actions. These are:

- maintain the cooperative approach and multiple partnerships that current exist to facilitate/deliver projects,
- remain responsive to new information on bats and habitat requirements in the province and incorporate into guidance documents where relevant,
- continue effectiveness monitoring work underway for the Kootenay Wildlife Habitat Features project,
- focus on conducting engagement/outreach with professionals to communicate key information in government guidance material,

- update the BC CDC listings for bats as a high priority, as these listings influence the inclusion of bats in future FRPA updates and affect legal protections afforded to bats,
- continue passive surveillance for WNS as our key tool to detect WNS or Pd in the province,
- promote submission of data, identification of important areas for bats, and ecologically unique areas important to bats in order to inform land use decisions and conservation actions,
- continue the BC Community Bat Program – this program is essential to contribute to WNS surveillance and monitoring, as well as increase stewardship of bats across BC, and
- continue the NABAT program across BC to contribute to population monitoring.

Background

British Columbia is the most bat-diverse province in Canada. The numbers of bat species in the province is currently in flux due to genetic findings (Lausen et al. 2019) and new acoustic records (Ommundsen et al 2017, North American Bat Monitoring Program in BC – www.wcsbats.ca; nabatmonitoring.org). Fifteen (15) of the 19 Canadian bat species occur in BC (BC Conservation Data Centre 2020), and a new provincial species checklist has recently been developed which includes acoustics records (Table 1); seven of these species are found nowhere else in Canada. Over half of the bat species in BC are of conservation concern.

One of the key goals of this BC Bat Action Plan is to bring awareness of white-nose syndrome (WNS) to BC citizens and governments and communicate the urgency of immediate action to minimize the imminent spread of this disease, and the cascading ecological and economic ramifications that may follow if nothing is done to address this unprecedented wildlife crisis. While this Plan was motivated by the threat of WNS, bats also face cumulative effects from the primary historical threats of habitat loss and degradation, and mortality arising from urban and industrial activities. There are large knowledge gaps that constrain effective conservation of most species. The evolution of the COVID-19 pandemic, and the bat origins of the SARS-CoV-2 coronavirus, have increased the negative publicity around bats, potentially reducing people’s tolerance for bats in human-altered environments, and affected bat research and WNS surveillance.

Given the limited opportunity to directly treat WNS-infected bats, it is essential that reducing other threats to bats, conserving and enhancing habitats, and filling knowledge gaps for future recovery efforts must play a large role in BC’s WNS strategy.

Table 1. List of BC bat species and their provincial and federal status as of 2020. Species that are not found in other Canadian provinces or territories are indicated with an asterisk (*). Two species have only been confirmed acoustically and are currently considered accidental.

Common Name	Scientific Name	BC / COSEWIC Status	Acoustic records only
Pallid Bat*	<i>Antrozous pallidus</i>	Red / T	
Townsend's Big-eared Bat*	<i>Corynorhinus townsendii</i>	Blue	
Big Brown Bat	<i>Eptesicus fuscus</i>	Yellow	
Spotted Bat*	<i>Euderma maculatum</i>	Blue / SC	
Eastern Red Bat	<i>Lasiurus borealis</i>	Unknown	
Hoary Bat	<i>Lasiurus cinereus</i>	Yellow	
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	Yellow	
Californian Myotis	<i>Myotis californicus</i>	Yellow	
Dark-nosed Small-footed Myotis* ¹	<i>Myotis melanorhinus</i>	Blue	
Long-eared Myotis	<i>Myotis evotis</i>	Yellow	
Little Brown Myotis	<i>Myotis lucifugus</i>	Yellow / E	
Northern Myotis	<i>Myotis septentrionalis</i>	Blue / E	
Fringed Myotis	<i>Myotis thysanodes</i>	Blue / DD	
Long-legged Myotis	<i>Myotis volans</i>	Yellow	
Yuma Myotis*	<i>Myotis yumanensis</i>	Yellow	
Canyon Bat*	<i>Parastrellus hesperus</i>	Accidental	yes
Brazilian Free-tailed Bat* ²	<i>Tadarida brasiliensis</i>	Accidental	yes
Big Free-tailed Bat*	<i>Nyctinomops macrotus</i>	Accidental	

*species not found in other provinces/territories in Canada.

¹This replaces Western Small-footed Myotis (*Myotis ciliolabrum*; BatNames.org) in western North America.

²*Tadarida brasiliensis* is commonly known as both Brazilian and/or Mexican Free-tailed Bat (BC CDC 2020).

The recent discovery of WNS caused by the fungus *Pseudogymnoascus destructans* (Pd) in nearby Washington state in 2016 is the most imminent threat to bat populations in BC. The disease has killed millions of bats across eastern North America and is one of the major wildlife crises of our times. The urgency for bat conservation in BC continues to increase as spread in Washington continues (WDFW 2020). Colony declines are now being documented in Washington (Tobin 2020). New research shows that the fungus can be present cryptically for several years in an area (Thapa et al. 2021) before bats with signs of the disease are discovered. Active testing for Pd by swabbing a bridge roost substrate in Montana (2020), and a wing swab of a healthy bat in California (2019; see press releases USFWS 2020) detected the fungus in areas where the disease is not yet known. This lag between detecting species infections and environmental presence, which is now known to have occurred in eastern North America (Thapa et al. 2021), is occurring in the West, and may contribute to the lack of detection of bats affected by WNS in BC to-date. Currently, in BC we primarily conduct passive WNS surveillance by testing submitted carcasses and swabs from live bats.

WNS affects bats in the winter because the fungal agent causing the disease thrives at cooler temperatures and high humidity often found in hibernacula. As a result, extensive mortality in some hibernating bat species in eastern North America has occurred (USFWS 2020). In affected colonies, mortality rates can exceed 90% (USFWS 2020). At least thirteen species are thought to hibernate in winter in BC and are potentially at risk of WNS mortality. In response to mortality in the eastern provinces, three species of bats, two of which are present in BC (Little Brown Myotis (*Myotis lucifugus*) and Northern Myotis (*M. septentrionalis*)) were listed as Endangered under the *Species at Risk Act* (SARA; ECCC 2017). We do not know how most western species of bats will be affected by Pd; however as of 2020, WNS has been documented in five western bat species including: *Myotis ciliolabrum* (no longer considered conspecific with the Dark-nosed small-footed Myotis in BC, but likely possesses similar ecology and physiology), *M. thysanodes*, *M. evotis*, *M. lucifugus*, and *M. yumanensis* (USFWS 2020).

Bats can be considered a “valued component” in the provincial environmental assessment framework (Environmental Assessment Office 2013), depending on the project, and it has been suggested they can be bioindicators in changing ecosystems (Russo and Jones 2015). Bats provide significant economic value to ecosystem services including pest control. As the primary consumers of night-time insects, bats play significant roles in many ecosystems. By providing natural pest control services, bats are important to forestry, agriculture, organic farming, gardening and mosquito-control. Boyles et al. (2011) estimated that bats provide US\$3.7–\$53 billion per year in pest control for agricultural crops in the United States (calculated as the cost of pesticide materials and application services).

Moths are an important dietary component of many BC bats, and research suggests that at least some bat species provide important pest control of forest insects during insect outbreaks (Wilson and Barclay 2006). For example, the Long-eared Myotis (*M. evotis*) eats spruce budworm caterpillars and moths, a significant forest pest (Wilson and Barclay 2006). Bats are also major consumers of biting and pest insects in urban environments.



Spotted bat in Okanagan. Photo: M. Proctor.

If WNS causes significant declines in bat populations in BC, as has occurred in eastern North America, there are likely to be far-reaching and long-lasting impacts on other wildlife such as birds and fish, arising from a trophic cascade of changing insect diversity and relative abundances. Loss of functional biodiversity is a concern for BC given the large number of bat species in the province (nearly 20% of small mammal diversity), each with different ecologies and fulfilling unique niches.

Cumulative threats could hinder the recovery of some bat populations post-WNS die-back. While evolutionary rescue has been documented among WNS survivors in some eastern locations (e.g.,



Gignoux-Wolfsohn et al. 2019), there is much concern that threats other than WNS could reduce the success of repopulation by survivors, especially in light of small population numbers and stochastic events, such as climate change effects. Lessons learned from eastern North America highlight the importance of preparing not only to reduce the impacts of WNS if possible, but to reduce the myriad of other threats to bats to promote adaptive change and facilitate evolutionary rescue. This includes filling critical baseline information that will be necessary to inform effective recovery strategies.

The impending potential catastrophic decline in bats necessitated a consolidated provincial strategy to address bat conservation, which led to our first 2016 – 2020 Action Plan. Here we present an interim Action Plan for 2021, with plans to revisit prior to 2022, after what may be a more intensive WNS surveillance season, postponed from 2020 to 2021 due to bat capture restrictions associated with COVID-19.

Silver-haired bat hibernating in mine in West Kootenay. Photo: C. Lausen

Development of the Action Plan

In September 2016, following the discovery of WNS in Washington, and motivated by the urgency of impending high mortality rates for BC bats, and the limited capacity and funding invested in this issue by the provincial government, members of BCBAT came together to develop an Action Plan. The group that met in Chase, BC in September was diverse, bringing expertise from conservation and stewardship groups, academia, and biologists that work closely with industry (Appendix I - A).

In this facilitated meeting, the group developed a list of goals and then described actions that would be needed to achieve each goal. The actions were then prioritized based on the expert opinion of the members of the group. Each attendee was given a limited number of “points” (as a proxy for limited

resources) to distribute to the actions under each goal. Actions that the group thought were the most important and urgent received the most points.

Prioritization of actions under each goal was determined based on the number of individual points they received, and 3 categories of points were delineated to establish Level I, II, and III priorities. Receiving a large number of points meant that an action was the most important (Level I). In a final consolidation, the initial list of goals (not listed here), were grouped into six main action categories (Table 3). The raw data (goals, action, points) that underpinned this prioritization exercise have been archived by BCBAT and can be accessed upon request.

In September 2019, a subsection of the BC Bat Action Team (Appendix I - B) convened at Blue Lake Lodge in the East Kootenay of BC to re-evaluate the Plan and update it based on information to date, including the fact that WNS was not yet detected in the province. One of the other main goals and accomplishments of this meeting was development of a formal WNS Response Plan. An updated 2016-2020 Plan was issued in Fall 2019 which included some changes to priorities, a change in the way that Levels I, II and III were referred to (now Essential, Necessary and Beneficial).

In December 2020, due to COVID-19 limitations an in-person meeting of the BC Bat Action Team could not take place. Instead, a small group of BC Bat Action Team members (Appendix I - C) volunteered to once again review priorities and make updates, issuing this one year interim Plan until a quorum of the BC Bat Action Team could reconvene in person to develop another 5-year plan to commence in 2022.



Townsend's Big-eared Bat Photo: C. Lausen

Vision, Goals and Objectives

Our vision is: ***Abundant, healthy and resilient bat species and populations in British Columbia.***

Goal 1: Address primary threats to bats

- Objective 1: Respond to the threat of White Nose Syndrome
- Objective 2: Identify, prioritize and mitigate other threats

Goal 2: Understand BC bats

- Objective 3: Identify, prioritize and address other knowledge gaps

Goal 3: Support bat conservation

- Objective 4: Improve and expand outreach and stewardship
- Objective 5: Develop and implement policy and tools
- Objective 6: Build capacity for actions promoting bat conservation

Prioritized Actions

Prioritized actions for the six core objectives:



Actions are listed as Essential, Necessary and Beneficial (originally listed as Priority I, II, and III, respectively; Essential (Level I) being the highest priority) according to the weightings provided by members during the Chase meeting and reviewed during subsequent revisions in 2019 and 2020. Actions within each level are generally listed in no particular order and are grouped according to topic.

Table 2. Defining priority levels and abbreviations.

Action items are listed by priority in Table 3 below. Action items were prioritized as follows:

Essential	Highest priority; these actions are critically important for bat conservation in BC and should be addressed immediately; funding and capacity development is considered essential for these tasks. This was Level I in the original plan.
Necessary	Do soon, within 5-10 years. These actions were Level II in the original plan.
Beneficial	Do as funding and someone to champion these actions arises. This was Level III in the original plan.

ABAT	Alberta Bat Action Team
ABCBP	Alberta Community Bat Program
ABCF	Association of BC Forest Professionals
BCBAT	British Columbia Bat Action Team
BCCBP	British Columbia Community Bat Program
BCCF	British Columbia Conservation Foundation
BCIA	British Columbia institute of Agrologists
BMP	Best Management Practices
Bt	<i>Bacillus thuringiensis</i> (biocide for insect control)
CAB	College of Applied Biology (registered professional biologists)
CI-WHF	Commission-Identified Wildlife Habitat Feature (Oil and Gas Commission)
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWHC	Canadian Wildlife Health Cooperative
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
ENV	BC Ministry of Environment and Climate Change Strategy
FORREX	Forum for Research and Extension in Natural Resources (<i>under revision</i>)
FLNR	BC Ministry of Forest Lands and Natural Resource Operations
FRPA	Forest and Range Practices Act
FSC	Forest Stewardship Council
EMPR	Ministry of Energy, Mines and Petroleum Resources
MLA	Member of Legislative Assembly

TRAN	Ministry of Transportation and Infrastructure
MP	Member of Parliament
NABat	North American Bat Monitoring Program (Loeb et al. 2015)
NSERC	Natural Sciences and Engineering Research Council
OGAA	Oil and Gas Activities Act
P.I.T.	passive integrated transponder
PARF	Protected Areas Research Forum
Pd	<i>Pseudogymnoascus destructans</i> [the fungus that causes WNS]
QA/QC	Quality Assurance/Quality Control
QEP	Qualified Environmental Professional
RBCM	Royal British Columbia Museum
RISC	Resources Information Standards Committee
SARA	Species at Risk Act
SOP	Standard Operating Practices
UBCM	Union of BC Municipalities
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WBWG	Western Bat Working Group
WCSC	Wildlife Conservation Society Canada
WHA	Wildlife Habitat Area
WHF	Wildlife Habitat Feature
WNS	white-nose syndrome

Table 3. Prioritized Actions.

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Objective 1: WNS response					
Essential	WNS Funding	1.01	Lobby government to provide funds for WNS surveillance and response. Write to Ministers (ENV, FLNR, TRANS, AGRI, EMPR, BC Premier, ECCC) to raise awareness.	In progress. E.g, WCSC MOU	n/a
Essential	WNS Monitoring	1.02	Conduct direct and indirect Pd and WNS surveillance (e.g. swabbing, emergence netting, acoustic surveys, collection of dead bats, guano, substrate) prioritized by region ([sentinel]site identification and prioritization, coordinate surveillance site selection with adjacent jurisdictions)	In progress.	High ² Essential ³
Essential	WNS Outreach	1.03	Encourage the public and others (e.g., Wildlife Rehabilitator's Network of BC) to submit dead bats to track WNS spread.	In progress. BCCBP and ENV	Not specified for Three Bats, but linked to high priority

¹ Priority language for Federal Strategies: High, Medium, Low
Priority language for Provincial Strategies: Essential, Necessary, Beneficial

² Three Bats (Federal) Table 5: Knowledge gaps

³ Pallid Bat (Provincial) Table 5: Knowledge gaps

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
					surveillance actions above Essential ⁴
Essential	WNS Fill Knowledge Gaps	1.04a	Continue to identify hibernacula and characterize winter habitat for bats and register as Wildlife Habitat Features, where appropriate.	In progress. WCSC/UNBC	High ⁵
Necessary	WNS Outreach	1.12	Communicate locations of important bat habitats (e.g., hibernacula) to facilitate coordinated protection	Enter data in SPI or other site (e.g., WHF database)	High ⁶
Necessary	WNS Outreach	1.04b	Continue BatCaver program to reduce risk of human-mediated accidental spread of WNS, and potentially apply mitigation methods.	In progress. WCSC (M. Davis is key contact)	n/a
Essential	WNS Monitoring	1.05	Conduct annual bat counts at roosts to monitor declines, effectiveness of mitigation if applied, and recovery of populations.	In progress. BCCBP	High ⁷ Essential ⁸ Necessary ⁹

⁴ Pallid Bat (Provincial) Table 5: Knowledge gaps

⁵ Three Bats (Federal) Table 6: Schedule of Studies; Pallid Bat (Federal) Table 1: Schedule of Studies; Spotted Bat (Federal) Table 2: Recommended Management Actions

⁶ Three Bats (Federal) Table 6: Schedule of Studies

⁷ Three Bats (Federal) Table 6: Schedule of Studies

⁸ Pallid Bat (Provincial) Table 5: Recovery action table

⁹ Spotted (Provincial) Table 2: Recommended Management Actions

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Essential	WNS Fill Knowledge Gaps	1.06	Implement and support/develop current research on methods of WNS disease management (e.g., anti-fungal treatments, safe hibernacula).	In progress. WNS Probiotic: WCSC/TRU	High ¹⁰ Essential ¹¹ Beneficial ¹²
Essential	WNS Fill Knowledge Gaps	1.07a	Model for prediction of WNS spread; model post WNS recovery, survivorship (differential species vulnerability), and resilience; model landscape requirements, effects of climate change, connectivity and support for rebuilding of populations;	In progress. WCSC has models for some species.	High ¹³
Essential	WNS Fill Knowledge Gaps	1.07b	collect microclimate data for use in models re: Pd growth rates.		
Necessary	WNS Communication SOPs/BMPs/ Protocols	1.08a	Require adherence to Pd decontamination protocols; refer to CWHC for updated protocols as new information is available	In progress.	High ¹⁴ Essential ¹⁵

¹⁰ Three Bats (Federal) Table 6: Short-term SoS; Long-term SoS; Table 5: Recovery Planning – Research

¹¹ Pallid (Provincial) Table 5: Recovery Action Table

¹² Spotted (Provincial) Table 2: Recommended Management Actions

¹³ Three Bats (Federal) Table 5: Recovery Planning – Research

¹⁴ Three Bats (Federal) Table 5: Recovery Planning

¹⁵ Pallid (Provincial) Table 5: Recovery Action Table

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Essential	WNS Communication SOPs/BMPs/ Protocols	1.08b	Require adherence to COVID-19 animal handling protocols; refer to BC ENV for updated protocols as new information is available	Complete	
Essential	WNS Communication	1.09	Engage Washington State, USFWS, USGS and Canadian WNS Coordinators [CWHC].	Ongoing.	High ¹⁶ Essential ¹⁷
Beneficial	WNS Communication	1.10	Lean heavily on US models and programs for WNS coordination to ensure a coordinated international response.	In progress.	n/a
Beneficial	WNS Outreach	1.11	Conduct outreach to audiences that may spread WNS (e.g. shipping, transportation, recreational vehicles [RVs], BC Parks, etc.)	In progress. Consider raising in priority?	High ¹⁸ Essential ¹⁹
2. Threats (other than WNS) - identify, prioritize, and mitigate					
Essential	Quantify threats	2.01a	Describe and attempt to quantify impacts of forest practices (e.g., clear-cut logging, salvage logging, rotation logging, other fire prescriptions) on bats.	In progress. ENV/ Conservation Priorities and Species Listing Project. May include bats on Species at Risk,	Medium ²⁰

¹⁶ Three Bats (Federal) Table 5: Recovery Planning

¹⁷ Pallid (Provincial) Table 5: Recovery Action Table

¹⁸ Three Bats (Federal) Table 5: Recovery Planning – Research

¹⁹ Pallid (Provincial) Table 5: Recovery Action Table

²⁰ Three Bats (Federal) Table 5: Recovery Planning – Research; Appendix B: Additional Research Needs

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
				Regionally Important Lists. Explore synergies with other species e.g., Fisher, birds	
Essential	Filling knowledge gaps	2.01b	Describe and attempt to quantify impacts of fuel reduction and fire-salvage practices on bats.	In progress – forestry BMP describes potential impacts	Medium ²¹
Essential	Filling knowledge gaps	2.01c	Work with forestry professionals to evaluate and revise BMPS	Need to workshop BMPs and WHF to forestry professionals	High ²²
Essential	Quantify threats	2.02	Determine effects of wind farm siting on all bat species.	In progress UNBC/ COSEWIC status report	Medium ²³ Beneficial ²⁴
Necessary	Quantify threats	2.03	Determine effects of pesticide and biocide use (e.g. neonicotinoids, <i>Bt</i>) on bat prey populations and/or bat populations.	In progress in AB. Lynne Burns/ ABAT Consider implications of single-product bans	Medium ²⁵ Medium ²⁶ Beneficial ²⁷

²¹ Three Bats (Federal) Table 5: Recovery Planning – Research; Appendix B: Additional Research Needs

²² Three Bats (Federal) Table 5: Recovery Planning – Outreach

²³ Three Bats (Federal) Table 5: Recovery Planning – Research; Appendix B: Additional Research Needs

²⁴ Spotted (Provincial) Table 2: Recommended Management Actions

²⁵ Three Bats (Federal) Table 5: Recovery Planning – Research; Appendix B: Additional Research Needs

²⁶ Pallid (Provincial) Table 5: Recovery Action Table

²⁷ Spotted (Provincial) Mentioned in threats, but not specified in Table 2

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Beneficial	Quantify threats	2.04	Determine impact of habitat disturbance (e.g. fire, beetle, catastrophic events, development, fuel reduction forestry practices) on bat populations.	MSc research on bat habitat use in winter will contribute to determining impacts of winter logging	Medium ²⁸ Beneficial ²⁹
Beneficial	Quantify threats	2.05	Quantify other sources of bat mortality such as mining, roads, predation of bats by cats, eviction-related mortality (e.g., pest control), forest insect sampling (reported mortality of gleaning bats), etc.; and work to reduce these threats.	Underway: CWS (Tanya Luszczyk and Amy Wilson) looking at urban cats in Vancouver	Medium ³⁰ Beneficial ³¹ Beneficial ³²
Beneficial	Quantify threats	2.06	Identify potential impacts of climate change on roosting habits and habitats, diversity, drinking and foraging habitats, hibernation, Pd virulence, prey availability and potential timing mismatches, etc.		Medium ³³

²⁸ Three Bats (Federal) Table 5: Recovery Planning – Research; Appendix B: Additional Research Needs

²⁹ Pallid (Provincial) Table 5: Recovery Action Table

³⁰ Three Bats (Federal) Table 5: Recovery Planning; Appendix B: Additional Research Needs

³¹ Pallid (Provincial) Table 5: Recovery Action Table

³² Spotted (Provincial) Table 2: Recommended Management Actions

³³ Three Bats (Federal) Table 5: Recovery Planning ; Appendix B: Additional Research Needs

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
3. Knowledge gaps - Identify, prioritize, communicate as needed, and address					
Essential	Baseline data	3.01	Identify locations, and physical and microclimate characteristics of hibernacula (via radiotracking, acoustics, etc.). Communicate to federal authorities for Critical habitat tracking. Characterize habitat features in roost area. Priorities being species at risk, other species suspected to be highly susceptible to WNS, or species for which risk/vulnerability is completely unknown.	In progress; new strategies being employed.	High ³⁴ Essential ³⁵ Essential ³⁶
Essential	Baseline data	3.02	Develop integrated long-term bat monitoring program for BC (e.g. merging data from NABat, annual bat counts, Community Bat Program and BatCaver.org). Develop species-specific, situation-specific or site-specific monitoring as appropriate.	In progress. USGS trying to incorporate databases; this would lead to developing unified program	High ³⁷ Essential ³⁸ Necessary ³⁹
Essential	Monitoring	3.03	Work with statisticians in advance to ensure adequate power and scale to detect changes of	In progress. WCSC, BCCBP, potential CWS	Not mentioned.

³⁴ Three Bats (Federal) Table 6: Schedule of Studies

³⁵ Pallid Bat (Provincial) Table 5: Recovery Action Table

³⁶ Spotted Bat (Federal) Table 2: Recommended Management Actions

³⁷ Three Bats (Federal) Table 5: Recovery Planning Table

³⁸ Pallid Bat Table 5: Recovery Action Table

³⁹ Spotted Bat (Federal) Management Plan Table 2: Recommended Management Actions.

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
			interest in all monitoring efforts for baseline and trend analysis.		
Essential	Monitoring	3.04	Define "important roosts": determine criteria and then select sentinel sites for long-term monitoring using pit tags, bands, etc. Incorporate long-term tagging methods at sentinel sites (e.g., for age class/sex/population numbers through capture, banding and/or P.I.T.-tagging to support WNS surveillance, monitoring, and modelling).	In progress: PIT tags deployed at select roosts. Necessary to define and separate into more specific actions in 2022.	Essential ⁴⁰
Essential	Baseline data	3.05a	Fill knowledge gaps regarding bats and insects. i. Quantify and publicize ecological services provided by bats in BC (e.g., economic value of pest control services to agriculture) - apply a \$ value.	In progress. SCBAT, ENV/AGRI/SFU, ABAT	
Necessary	Baseline data	3.05b	Fill knowledge gaps regarding bats and insects. ii. Document pre-WNS insect abundance	In progress in USA? Amy Ray? Suggest investigating how other industries (Agri, forestry) and researchers are monitoring	
Necessary	Baseline data	3.05c	Fill knowledge gaps regarding bats and insects. iii. Insect abundance as a covariate for NABAT		

⁴⁰ Pallid Bat Recovery Plan (Provincial) Table 5. Recovery Action Table.

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
			bat activity (e.g. insect sampling during NABAT grid cell transects).		
Beneficial	Baseline data	3.06	Examine genetics and movement to determine connectivity of bat populations across landscape and to better understand disease spread patterns.	And see 1.07.	
Essential	Data access	3.07	Develop process to access private data and analysis (i.e. through EA commitments).	In progress – ENV (capture data, mortality) Not in progress for acoustic data – only analyzed reports get submitted to EA NABAT and other data available from USGS with data sharing agreement	
Essential	Monitoring	3.08	Continue, expand and strengthen NABat and more intensive monitoring at local and regional scale within BC.	In progress and pending results of 5-year statistical analyses WCSC	
Essential	Monitoring	3.09	Determine migratory characteristics of short and long distance migrating bat species, and determine route [across elevations and geography], stopover locations, and destinations (e.g. tie into Motus Wildlife Tracking.)	In progress CWS, UNBC, ABAT, FWCP/BSC. Consider larger focus for this topic and western regional coordination.	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Essential	Mitigation Effectiveness	3.10	Research whether bat boxes of different designs affect reproductive success, disease transmission, and population recovery and risks like over-heating.	In progress. WCSC/TRU/ACBP	
Essential	Mitigation Effectiveness	3.11	Ensure that municipal, provincial and federal EAs consider bats in all aspects of the EA process.	In progress. BCCBP, ENV Need ongoing efforts to raise bat awareness Bat 'course' for govt regional bios?	
Essential	Baseline data	3.12	Research bat roosting ecology (seasonally) (trees, human structures, caves, etc.) BY SPECIES. Characterize key habitat parameters for each environment (e.g., anthropogenic, forest, mine, cliff, rock, house, bridge, barns, etc.).	In progress. UNBC / WCSC/ BCCBP/ ACBP	
Necessary	Baseline data	3.13	Examine urban bat ecology by species (particularly effect of evictions, cats).	In progress. Some information through Community Bat Programs WCSC/ BCCBP/ ENV / CWS	
Beneficial	Monitoring	3.14	Determine site specific relationship between acoustic recordings vs counts at hibernacula and roosts -- to identify population (colony) trends, if any.		

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Essential	Monitoring	3.15	Archive bat specimens, bat guano, and DNA tissue at RBCM and others. Support collection of carcasses.	In progress. RBCM collections currently suspended (2021)	
Necessary	Baseline data	3.16	Test thresholds and profiles of noise and vibrations currently in BMPs to provide feedback, and refine numbers (ie. during disturbances to habitat around roosts, measure parameters and report behaviour of bats).	Evaluate this in 2021 meeting. Necessary for improving BMP guidance	
4. Outreach and Stewardship - improve and expand					
Essential	Public Outreach	4.01	Continue, expand and strengthen outreach programs in BC: BC Community Bat program, BatCaver	In progress. Consider increased social media efforts? Seek funding for western regional media outreach	
Essential	Public Outreach	4.02	Continue "Bats and Buildings" outreach to pest control companies, builders (send link with building permits), roofers, realtors, tree removal companies, including permitting for removal.	In progress. ACBP, BCCBP, CWS	
Essential	Public Outreach	4.03	Engage citizen scientists, volunteers, bat ambassadors; encourage public reporting (e.g. batwatch.ca) and interact with engaged citizens (eg. report back information, consider iNaturalist). This includes involving local	In progress.	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
			naturalist groups (e.g. BC Nature), and First Nations.		
Essential	Public Outreach	4.04	Engage with First Nations. E.g., traditional knowledge of roost locations, capacity-building to implement monitoring, building-roosting bats on federal lands, etc.	In progress. BCCF/ENV/BCCBP	
Essential	Stewardship	4.05	Do outreach to identified audiences who may destroy roost sites (forestry, bridgers, agriculture, mining, private land owners, urban municipalities, builders, architects, pest control companies, painters, movers, MOTI). Require that fuel reduction practices follow the WHF guidelines to retain bat habitat. E.g., brief BMP summaries for extension	In progress. See 4.02, 5.02 FLNR – wildlife culling permits. ENV - BMPs	
Necessary	Stewardship	4.06	Encourage local municipalities, regions and neighbourhoods to strive for Bat-Friendly designations; develop criteria for Bat-Friendly Community designations.	In progress. BCCBP, ENV	
Beneficial	Public Outreach and Communication	4.07	Initiate a media campaign (e.g. marketing, community-based social marketing) with branding, etc. to raise awareness and funds. (e.g., develop a Wiki page for BC bats, commercials, social media, marketing, t-shirts, brand, logo). Use social and traditional media		

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
			(hard hitting press releases) to communicate what is being done and needs to be done.		
Necessary	Public Outreach	4.08	Create curriculum of bat material for schools targeting Learning Outcomes for specific grades.	In progress - see BC EduKit on bcbats.ca	
Beneficial	Public Outreach	4.09	Emphasize that bat species are different: Introduce and reinforce species-specific awareness. Encourage use of species names/guilds (e.g., migratory bats, colonial roosting bats) when possible, in place of 'bats'		
5. Policy and Tools -develop and implement conservation tools					
Essential	SOPs/ BMPs/ Protocols	5.01	Engage QEPs to assess BMPs for effectiveness of mitigation and compensation actions by threat to determine which are most useful/effective; identify highest priority items (given that they can't do it all); follow up with outreach to QEPs through professional associations (e.g., FORREX).	Consider broadening this, and not specify 'engage QEPs'? Break this out in future and include Mitigation Effectiveness Topic. See 3.16	
Essential	Legal protection	5.02a	Encourage bat conservation to Council of Forest Industries, and Coastal Forest Products Association. Promote consideration of bats into forest certification standards (e.g. FSC) as a way to improve forest management for bats (get	See 4.05	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
			someone from BCBAT on the council for certification and review of biodiversity indicators).		
Essential	Legal protection	5.02b	Encourage bat conservation to Forest Practices Board and appropriate BC Ministries.	Engage with Fisher group about how to input into 5-year forest development plans. See 4.05	
Essential	Legal protection	5.03	Improve WHF legislation (under FRPA) to increase effectiveness so that bat roosts are able to be identified and protected. This also applies to OGAA.	In progress – implemented in Kootenay/Boundary; expected to be rolled out provincially. FRPA requires update of listed species, also underway 2021	
Essential	Legal protection	5.04	Improve FRPA/OGAA protection (to have parity with SARA). E.g., recognize critical habitat, buffer forest cutting around rock roost features used by bats, etc.	In progress (IWMS list is currently being reviewed; protections in FRPA and OGAA pertain to IWMS)	
Essential	Conservation status assessment	5.05	Update CDC ranks for all BC bat species. Develop research task team to prioritize species- specific knowledge gaps. Run bat species through IUCN Threat calculator to	Recommend in future to split these two items into separate actions. Threat Calculator was voted to	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
			identify main threats and gaps to fill, examine, and manage.	downscale to Beneficial in Sept. 2019	
Essential	SOPs/ BMPs/ Protocols	5.06	Complete BMPs; update RISC standards, using other protocols/practices (e.g., decontamination protocol, BMPs) as guidance.	In progress. ENV. See 5.01, 3.16	
Essential	SOPs/ BMPs/ Protocols	5.07	Outreach responsible agencies and industry to adopt and implement existing conservation tools (i.e., BMPs for Mining, Wind Energy, Caving, and more as they are developed).	In progress. Multiple cross-references are possible. Need bridge database for highways and roads projects. Check cross-links with outreach.	
Essential	Legal protection	5.08	Protect hibernacula, roosts, swarming sites etc. to aid recovery (i.e., WHAs, WHFs). For designated CH, it is a federal and provincial responsibility to do this. Support a Cave and Karst Protection Act for BC (proposed).	In progress. Will benefit from getting more bat species on new provincial Species at Risk lists and Regionally important wildlife lists. Cross reference with site identification.	
Essential	Conservation status assessment	5.09	Assess bat species federally (COSEWIC) and provincially as necessary.	In progress for migratory bats. Redundant with other action for assessments.	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Essential	Legal protection	5.11	Hold non-EA projects to the same standards as EA projects. Write letter to MOECC.	In progress. Check in with Jared Hobbs.	
Essential	Oversight; Direction	5.12	Support the development of a Canadian Federal Bat Working Group	In progress	
Beneficial	Legal protection	5.10	Look for synergies with existing protective legislation (e.g., migratory bird nest protection).		
6. Capacity - build capacity for actions promoting bat conservation					
Essential	Communication	6.01	Create a single website as a go-to location for bat info in BC. (BCBAT → bcbat.ca, WNS info, and public health info-links, tie in with batwatch.ca) include resources like current research, outreach materials, document library.	Complete. Ongoing work required.	
Necessary	Communication	6.02	Identify and solicit MLAs and MPs and council members to be bat champions; BCBAT, WCSC, BC Community Bat Program to write to Ministers/premier. Individuals, regional programs, landowners to write to MLAs.	Reach out to MLAs	
Essential	Communication	6.03	Continue communication within BCBAT, ABAT and western provinces, territories, and states, including quarterly conference calls, , and invite national, international, and First Nations representatives. Host an in-person meeting every one to two years.	In progress.	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Essential	Training/ Education	6.04	Publish new Bats of BC book (ie. updated Nagorsen, Brigham, Lausen, Hobbs).	In progress.	
Essential	Training/ Education	6.05	Promote technical training workshops for professionals and govt workers (provincial and FN)(e.g. acoustic analysis, mist-netting, modelling, WNS detection, BioBlitz, updated RISC, etc.).	In progress. Consider mixed delivery model (virtual, field)	
Essential	Training/ Education	6.06	Increase involvement of universities in bat research. Create a Chair position for BC (long-term). Identify currently available supervisors in BC (e.g., create a Bat Lab for BC) to train graduate students; recruit more grad students doing bat research. Promote multi-disciplinary involvement.	Bat Lab achieved! UNBC (Erin Baerwald). Increase involvement at UBCO, TRU others	
Necessary	Communication	6.07	Engage industry, creating the bottom-up support from stakeholders.	Need to cross-reference with other actions and reduce redundancy	
Necessary	Communication	6.08	Attend key meetings (UBCM, PARF, WBWG biannual, WNS USFWS, BC caving), and present when possible about the plight of bats.	In progress.	
Essential	Communication	6.09	Work with health authorities to ensure accurate and consistent messaging regarding rabies and histoplasmosis and COVID-19.	In progress. ENV/AGRI/FNRO WNS task team, BC CDC links	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Essential	Communication	6.10	Identify and support representatives within BCBAT who will lead communication and articulate goals from the team, sitting in on applicable committees and calls with BC Community Bat Program, NABat, WBWG, universities, national WNS committee, ABAT, governments, etc.	In progress. Could use larger involvement and coordination across BCBAT Raise awareness at BCBAT calls and recruit new people Create calendar or social media option of meeting options, key contacts, and post minutes	
Necessary	Data access	6.11	Identify funding, means, and location for long-term archiving of bat acoustic data (permissions, access).	In progress. Cross reference to action already identified.	
Essential	Data access	6.12	Create one data portal for submission of all BC bat data (where data are held). Make user-friendly data portals for sharing and storing data; develop protocols for how to use and submit data.	In progress. SPI is being updated and can serve this function.	
Beneficial	Funding	6.13	Create a conservation grant fund (guided by BCBAT and administered by a charitable organization) and recruit donations to the fund from industry and private sources.		
Necessary	Funding	6.14	Coordinate funding and applications. Identify, list and make available to the BCBAT group all	In progress. Needs work.	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
			of the existing funding sources for bat conservation, including federal, provincial, regional, local, private, philanthropy, crown source, industry, forestry, cattleman's, hydro, academic sources (e.g., NSERC).		
Essential	Training/ Education	6.15	Find capacity/funding for dedicated provincial bat biologist (in provincial government).	In progress.	
Necessary	Training/ Education	6.17	Make resources available to professional associations (e.g. BCIA, CAB, ABCFP, etc.), including information, training (e.g., FORREX outreach). Track access/use.	In progress. BCCBP, BMPs through govt.	
Beneficial	Communication	6.18	Identify reliable reps for all key organizations (e.g., to sit on committees, conference calls, etc.); connect with the adjacent jurisdictions. Work with WBWG to promote awareness of WBWG (e.g., WildLinks Conference).		
Beneficial	Communication	6.19	Coordinate with ABAT, and whitenose.org for sharing documents and information.	In progress.	
Beneficial	Communication	6.20	Create an organizational chart of groups and clarify mandate of key bat groups (e.g. WBWG).	Completed, see Appendix III.	
Beneficial	Communication	6.21	Develop annotated bat bibliography of all existing research papers and make accessible to group.		

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
Beneficial	Data access	6.22	Develop a reliability index (specifically acoustic ID and spatial metadata), including QA/QC requirements and standardized data collection protocols. This can accompany acoustic records in provincial database.	In progress.	
Essential	Funding	6.23	Increase provincial funding for bat conservation through various methods.	In progress. Cross reference.	
Essential	Funding	6.24	Recruit new funders to support bat conservation (e.g., by giving presentations to potential funders, creating a funders page on the BCBAT website, and leveraging ecosystem services as a way to engage industry.)	In progress.	
Essential	Funding	6.26	Send BCBAT Action Plan (summary high level) to funding organizations and government as guidance for their funding decisions.	In progress.	
Beneficial	Funding	6.27	Identify opportunities to collaborate with other taxonomic groups / projects to gain access to additional funding sources, collaborate, and streamline landscape/resource management.	In progress.	
Beneficial	Funding	6.28	Develop bursaries or funding or volunteers to assist landowners with roost mitigation.		
Beneficial	Funding	6.29	Build a bat equipment inventory (detectors, nets etc.) within government that can be shared	In progress.	

Priority	Topic	Action	Description	Status and Notes (as of Dec 15, 2020)	Federal/Provincial recovery strategy priority ¹
			across province to provide in-kind support for monitoring and research projects.		
Beneficial	Training/ Education	6.30	Lobby Health Authorities to provide free (or discounted) rabies shots as they do with other fields (e.g., for field of veterinary medicine).		
Beneficial	Training/ Education	6.31	Provide training workshops/materials for citizen scientists, including naturalist groups so they may better participate in monitoring.	In progress. BCCBP	
Beneficial	Training/ Education	6.32	Support bat educator workshops to increase public outreach, e.g. camp counsellors, park interpreters, conservation officers.		
Beneficial	Training/ Education	6.33	Define skill sets of BCBAT.		
Essential	Training/ Education	6.34	Train wildlife rehabbers to swab bats and send samples/carcasses to Animal Health Centre.	In progress. ENV	
Beneficial	Training/ Education	6.35	Provide media training for bat professionals.		
Essential	Communication	6.36	Re-establish monthly focus groups within BC BAT – topic-specific Working Groups – to report back to larger group.	In progress.	

Further Detail and Future Iterations

This Action Plan will remain a living document and will be revisited by BCBAT in subsequent years. Priorities and details of actions will undoubtedly evolve to respond to changing threats, in particular the spread of WNS, to changes in funding sources, policies, and more. In particular, further details for Table 3, especially Essential actions, will be further developed to include the following information:



Piecing Together the Details: Implementation

The immediate goal following the posting of this Action Plan is to populate details for accomplishing Essential activities, and to address lower priority actions over the coming months and years, as organizations/agencies and funding sources are identified to champion each task. Such detailed planning will enable coordination among BCBAT members and others engaged in carrying out action items identified in this plan.

This document and details relating to the action items will be posted and updated on BCBAT's website: www.bcbat.ca, under the Publications Section. This Action Plan and the progress made on this plan will be reviewed annually by BCBAT until 2022 when a new plan may need to be written.

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APPENDIX I. Meeting attendees.

- A. Inaugural 2016 meeting in Chase where the Action Plan was initially developed.



Group Photo: Members of BCBAT present at the Action Planning meeting in Chase, BC on 16-17 Sept. 2016.

Back row left to right: Jared Hobbs, Purnima Govindarajulu, Mandy Kellner, Doug Burles, Karen Hodges, Jason Rae, Christian Engelstoft, Tanya Luszcz, Fawn Ross, Michelle Evelyn, Chris Currie, Lorraine Andrusiak. Front row left to right: Felix Martinez, Cori Lausen, Aimee Mitchell, Juliet Craig, Susan Holroyd, Susan Dulc, Patrick Burke. Laying at front: Leigh Anne Isaac.

B. BCBAT/ABAT Joint Meeting, Blue Lake, where this document was reviewed and revised, Sept. 2019.



Group Photo: Members of BCBAT present at the Action Plan Review meeting in Blue Lake, BC on 13-15 Sept. 2019.

From Left to right: Elodie Kuhnert, Erin Baerwald, Shari Willmott, Mandy Kellner, Cory Olson, Susan Holroyd, Juliet Craig, Leah Andresen, Trudy Chatwin, Purnima Govindarajulu, Orville Dyer, Jordi Segers, Leigh Anne Isaac, Mike Kelly, Dana Blouin, Nicole Besler, Aimee Mitchell, Lisa Wilkinson, Cody Fouts, Barb Johnston, Chris Currie, Jason Headley, Glenna McGregor, Heather Gates, Susan Dulc, Jared Hobbs, Jeff Shatford, Jason Rae, Erin Lowe, Cori Lausen.

C. Zoom screenshot of the small group that volunteered in Dec. 2020 to review and update the BC Bat Team's Action Plan, issuing this one year 2021 Plan.



Starting from top-left by row: Leigh Anne Isaac (ENV), Cori Lausen (WCSC), Jason Rae (WCSC), Tanya Luszc (CWS), Mandy Kellner (ENV), Susan Holroyd (ABAT), Brian Paterson (Zonal Ecosystems).

Missing from photo: Lorraine Andrusiak (SNC Lavalin), Kim Dohms (CWS).

APPENDIX II. Acknowledgements.

A. Individuals who developed this initial 2016 Action Plan, attended the 2019 BCBAT/ABAT joint meeting, and the 2020 virtual meeting where revisions were made; **B.** Sponsors of the 2016 Chase meeting and other acknowledgements

Name	Meeting Attended (2016 initial development or 2019 revision)	Affiliation
Lorraine Andrusiak	2016; 2020 comments submitted	SNC-Lavalin
Carita Bergmann	2016	Parks Canada, Gwaii Haanas
Patrick Burke	2016	South Coast Bat Conservation Society
Doug Burles	2016	Coordinator Thompson Region Community Bat Program, independent researcher
Juliet Craig	2016, 2019	Silverwing Ecological Consulting, BC Community Bat Program and Kootenay Community Bat Project
Chris Currie	2016, 2019	South Coast Bat Conservation Society
Susan Dulc	2016, 2019	Aurora Consulting
Christian Engelstoft	2016	Habitat Acquisition Trust
Michelle Evelyn	2016	Sunshine Coast Wildlife Project
Purnima Govindarajulu	2016, 2019	BC Min. of Environment
Ingebjorg Jean Hansen	2016	Independent Biologist
Jared Hobbs	2016, 2019	Hemmera Consulting
Karen Hodges	2016	University of British Columbia - Okanagan
Susan Holroyd	2016, 2019; 2020	Alberta Community Bat Program, Calgary, AB
Leigh Anne Isaac	2016, 2019; 2020	VAST Resource Solutions & Kootenay Community Bat Project (2016, 2019); BC Min of Environment (2020)
Mandy Kellner	2016, 2019, 2020	BC Community Bat Program (2016, 2019, 2020); BC Min of Environment (2020)
Cori Lausen	2016, 2019, 2020	Wildlife Conservation Society Canada
Tanya Luszc	2016, 2020	Partners in Flight, CWS
Felix Martinez	2016	South Coast Bat Conservation Society
Laura Matthias	2016	Salt Spring Island Conservancy
Aimee Mitchell	2016, 2019	Athene Consulting
Peter Ommundsen	2016	Salt Spring Island Conservancy

Brian Paterson	2016, 2020	Independent Biologist
Jason Rae	2016, 2019, 2020	Wildlife Conservation Society Canada
Fawn Ross	2016	Associated Environmental Consultants Inc.
Mike Sarell	2016	Ophiuchus Consulting
Elizabeth Thunstrom	2016	Wildlife Rescue Association BC (emeritus)

Leah Andresen	2019	Keefer Ecological Services
Erin Baerwald	2019	University of Regina
Nicole Besler	2019	VAST Resource Solutions Kootenay Community Bat Program
Dana Blouin	2019	Wildlife Conservation Society
Trudy Chatwin	2019	Emeritus BC Ministry of Environment
Susan Dulc	2019	Thompson Rivers University
Orville Dyer	2019	Ministry of Environment and Climate Change Strategy
Cody Fouts	2019	VAST Resource Solutions Kootenay Community Bat Project
Heather Gates	2019	Wildlife Conservation Society Canada
Jason Headley	2019	Alberta Community Bat Program
Jared Hobbs	2019	Hobbs Consulting
Barb Johnston	2019	Parks Canada
Mike Kelly	2019	Alberta Community Bat Program
Elodie Kuhnert	2019	Kootenay Community Bat Program (KCBP)
Erin Low	2019	Alberta Community Bat Program
Glenna McGregor	2019	BC Ministry of Agriculture
Cory Olson	2019	Alberta Community Bat Program
Linda Pfeiffer	2019	Bat Ambassador
Jordi Segers	2019	Canadian Wildlife Health Cooperative
Jeffrey Shatford	2019	Species at Risk Recovery Branch, Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)
Jan Veroti	2019	Kootenay and BC Community Bat Program
Lisa Wilkinson	2019	Alberta Environment and Parks
Shari Willmott	2019	FLNRORD - Wildlife Health Program

B. 2016 Sponsors and Special Acknowledgements

The BC Bat Action Team would like to acknowledge the organizations and individuals who made the 2016 Chase meeting possible: Fish and Wildlife Compensation Program who provided funding for meeting space and food;

Blair Acton owner of Squilax Shuswap Hostel who provided free accommodation for participants and catered the event at cost; the Adams Lake Indian Band who provided a discounted rate on the meeting facility rental; Dr. Cori Lausen with Wildlife Conservation Society of Canada who initiated the meeting and finalized the action plan; Fawn Ross who coordinated the meeting details; Juliet Craig who facilitated the meeting; Sarah Bennett of Origin Brand for graphic design of the final document; and the following members who worked to re-bin the plan categories in the final consolidation – Lorraine Andrusiak, Dr. Karen Hodges, Carita Bergmann, Mike Sarell, and Dr. Leigh Anne Isaac. We are particularly grateful to all the meeting participants who provided their time in-kind to attend this meeting and develop the action plan, and to all of the individuals who provided review and edits during its final stages. More than 360 hours of volunteer time was donated to the creation of this Action Plan.



Photo credit: Purnima Govindarajulu

c. 2019 Sponsors and Special Acknowledgements

BCBAT would like to acknowledge the following organizations for financially contributing to the success of the 2019 inter-provincial meeting. Our invaluable meeting sponsors included the following:

- Fish and Wildlife Compensation Program – Columbia, Coastal and Peace regions
- BC Ministry of Environment and Climate Change Strategy
- VAST Resource Solutions
- Cranbrook Pest Control

Thank you also to Blue Lake Camp for hosting us and to Over Time Beer Works for providing some delicious beverages.

The joint meeting would not have been made possible without the time, effort and energy of our organizing team, which included:

- Leigh Anne Isaac
- Elodie Kuhnert
- Orville Dyer
- Cori Lausen
- Nicole Besler
- Cody Fouts
- Susan Holroyd
- Lisa Wilkinson

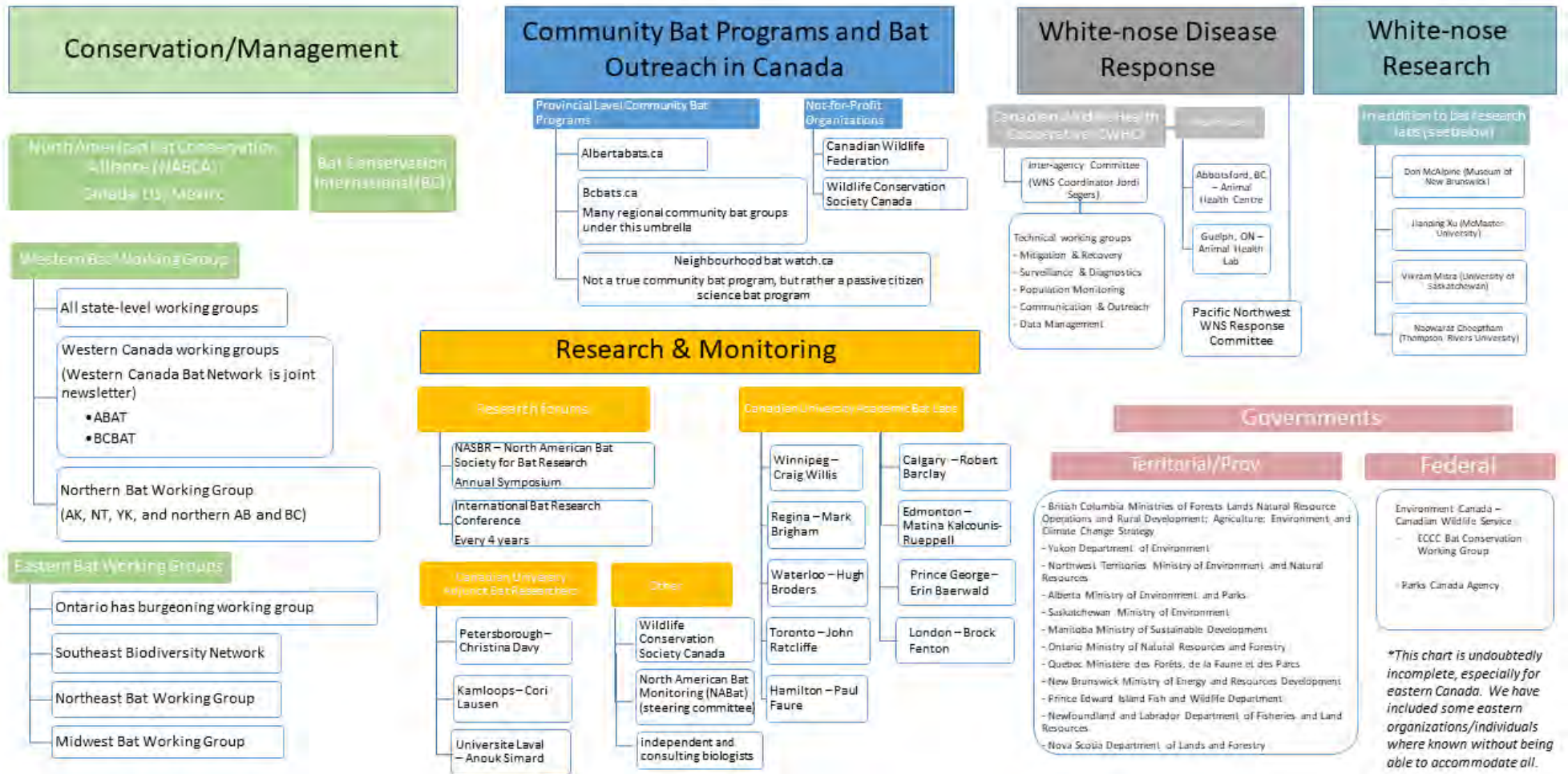
And finally, the concurrent sessions were lead by a team of individuals that included the following:

- Orville Dyer
- Lisa Wilkinson
- Jordi Seegers
- Cori Lausen
- Mandy Kellner
- Cory Olson
- Susan Holroyd
- Glenna MacGregor
- Jason Rae
- Jared Hobbs (and Charlie Palmer for sending contribution)
- Leigh Anne Isaac
- Erin Baerwald

Thank you also to Juliet Craig for facilitating our WNS response session.

APPENDIX III. Organizations applicable to bat research, conservation, outreach.

Bat Organizations, With Focus on Western Canada*



**This chart is undoubtedly incomplete, especially for eastern Canada. We have included some eastern organizations/individuals where known without being able to accommodate all.*

APPENDIX IV. Selected Session Summaries from ABAT/BCBAT Joint Meeting, Sept. 13-15, 2019.

Session: Environmental Assessment

Leaders: Susan Holroyd, Charlie Palmer/Jared Hobbs and Leigh Anne Isaac

Outcome objectives for the session:

1. Determine how the Environmental Assessment process can be used to improve both our understanding of bat ecology and how bats interact with projects. Discuss how baseline data collection, mitigation, monitoring and observation reporting from this sector can be effectively and predictably be directed to accessible provincial databases.
2. Capture recommendations for improving the EA process for both regulators and consultants/proponents
3. Clearly communicate what “tools” (e.g., guidance documents, standards) are available from the province and what “expectations” exist from regulators.

What are the existing tools?

- Resource Inventory Committee Standards for Bat Inventory (Capture/Handling/Data Collection and Submission). The current standards are from 1998 and are under review to update methods especially for:
 - o Methods for collecting, analyzing and submitting acoustic data; and,
 - o Methods for live captures (including DNA analysis)
- British Columbia Best Management Practices for Bats
 - o Published chapters include:
 - Introduction to BC Bats
 - Mining
 - Cave/Crevice
 - Wind Energy Developments
 - o Chapters in development (final drafts):
 - Hydro
 - Forestry
 - Bridges
 - Bat Houses
 - o Additional resources available from the Community Bat Programs include:
 - Management of bats in buildings
 - Best Practices for Pest Control Operators, Builders, Roofers and Realtors
 - Bat-friendly Communities and
 - Recommendations for Bat House installations

- Wildlife Habitat Features Guidance (produced by FLNRORD)
 - o Focused on specific features on the landscape but provide a means to assess areas for potentially high value bat habitat (nursery roosts and hibernation sites)
 - o These guidebooks are meant for use by Forestry, especially Timber Cruisers prior to block layout. Identification of habitats initially requires no technical equipment but subsequent flagging of particular sites may require follow up by a qualified professional with experience with bats.
 - o This guidance should be available by October 2019

- Wildlife Habitat Areas (WHAs) under the BC Forest and Range Practices Act
 - o WHAs are area-based legal designations that can be established to manage habitat for bat species listed on the Category of Species At Risk.
 - o Currently only Spotted Bat and Fringed Myotis are listed, but more species can be added by MoE. To be eligible, a species must be SARA listed and have potential to be affected by forest and range regulated activities.
 - o Once a WHA is established General Wildlife Measures are used to prescribe species-specific conservation to elements of the habitat used by the focal taxa.
 - o Anyone can advance a WHA proposal to government for consideration.

- Environmental Assessment Act (provincial) – the process involves (as contributed by C. Palmer):
 1. Scoping – understand the issues, the interactions, know the scope and study area, understand seasonal variations,
 2. Understand existing conditions – baseline knowledge of the existing environment and values and trends.
 3. Effects assessment –the evaluation of the effects of the change (project or activity) giving consideration for the interactions and the existing values.
 4. Mitigation development – using the classic three-tier hierarchical approach to mitigation – (1) avoid, (2) control, (3) offset. Options to mitigate include project design changes, alteration to construction techniques, temporal or spatial setbacks, etc.
 5. Significance determination uses pre-determined thresholds to assess impacts. Significance thresholds may be published in govt. guidance or scientific standards.
 6. Follow-up - compliance monitoring and adaptive management

The purpose of environmental impact assessments (EIA) is to understand, evaluate and mitigate the effects of a project or activity or policy BEFORE a decision is made. The goal is to systematically build an understanding of project effects and build a project that responds to the issues raised. EIA improves the outcomes of projects and activities through systematic application of considerations that examine the current conditions, identifies potential effects, proposes mitigation to reduce the severity of those effects, and assesses the significance of the resulting effects. It can be used to improve the outcomes of projects, activities and policies.

There are also specific policies and EIA permitting processes for bats such as Alberta's Utility Commission / AEP approval process for wind energy. This is a framework for bat baseline data collection, data currency, setbacks, effects monitoring protocols and thresholds.

What are the primary guidance items from each tool?

BMPs

- o Timing windows
- o Distance buffers
- o High/medium/low impact activities

WHF

- o Timing windows
- o Distance buffers
- o Guidance on how to assess “high value” features on the landscape using a simplified assessment process.

List of recommendations for regulators

- It is not reasonable to ask for a ‘relative abundance’ estimate for bats
- Use BMPs as guidance and not rules
- Itemize what is adequate survey effort
- Suggest questions that can be answered given survey methods, current knowledge

Action: Purnima will update the Glossary in the BMP to capture the “intent” behind asking for “relative abundance”. It was agreed that asking for actual “relative abundance” measures for bats is, in most cases, unrealistic. Reporting from acoustic detectors can only give an index of activity at a site. However, review of available information from an area using previous assessments in conjunction with current site assessments may allow for an assessment of species present and whether they would be expected to be rare or common in that area. If actual relative abundance measures are available, it was agreed that those should be reported.

Action: Outreach/communication with regulators will be made a priority. The BC BMPs for bats have clearly stated in the documents that they are intended to be guidance, not legislation, and that the qualified professionals should be using the documents to support their efforts to assess project areas for bats but it is understood that all techniques/recommendations may not be employable at all sites. The overall objective for BMPs is good conservation practices for bats.

Action: Purnima to follow-up on status of data submission requirements from any assessment work to BC Environment to support future assessments and long-term monitoring.

Developing a central repository for bat data

-As an example, there is a database, developed jointly by the Canadian Wind Energy Association and Bird Studies Canada, to hold wind energy monitoring data. It encourages proponents to be a part and share data, and the provision of data into it is standardised.

If data sharing is desired, building on the CanWEA / BSC model (or similar models in the USA from the American Wind Energy Association).

- ✓ Use the information available in the current guidance documents
 - o Species specific information is available in the Introductory Chapter of the BMPs for Bats (flight distances, flight heights, diet variation, variability in habitat use by species); Use WHF guidance to produce descriptive assessments of high value features for bats.
 - o As a QP, tailor recommendations for an area based on your knowledge, resources available and site-specific data. Create “by species” recommendations or “lump” bats into ecologically functional groups to produce better conservation recommendations.
- ✓ Be realistic about survey effort required by summarizing:
 - o Size of the development footprint
 - o Type of habitat in the footprint
 - o Current state of knowledge for that area regarding bat species/abundance
 - o Intensity and duration of impact (low, medium or high)

Impacts from projects not triggering the federal/provincial EA process

We posit that non-major projects in total have greater effects than the small number of major projects that get federal/ provincial scrutiny through formal EIA. That is why BMP acknowledgement/ compliance and new tools are crucial. Too many activities and projects occur without ANY consideration for bats, and that is where effort will have most benefit to bats and bat habitats.

For best benefit look to those activities and projects that currently DO NOT get any scrutiny. Activities such as forestry, peri-urban land clearing for residential, and transportation collision effects are unquantified but predicted to occur. Unfortunately, there are many landscape scale projects that do not trigger the current provincial and federal EA processes within the forestry sector.

- The impact of forestry could be argued to have equal if not more detrimental impacts to bat/bat habitat than individual, standalone projects based on the total area impacted
 - More attention needs to focus on forestry impacts to bats

Action: A letter will be drafted, distributed for review and then submitted to the BC FLNRORD to describe and highlight the wider impacts of forestry on bats/bat habitat and that impact assessments due to forestry practices need to be completed prior to harvesting activities.

Additional Priority Action Items to support impact assessment processes

These action items were not put into any order of priority by the group but were drafted as important and to be used to drive future actions:

- ✓ Check to see if updated RISC Standards (soon to be released) can be shared
- ✓ Check to see if Forestry BMPs (currently in draft) can be shared
- ✓ Will extension program be offered to provide training in WHF guidance

Session: LOCATING BAT HIBERNATION HABITAT IN B.C.

Session Leader: Cori Lausen

To date, BatCaver.org has focused on identifying caves and mines where bats overwinter. It has also quantified hibernation conditions (temperature, humidity) which could inform a model to predict use of an underground cavity as a bat hibernaculum, and has already been contributing to development of predictive WNS survivorship models.

Few significant hibernacula have been identified in BC. Large ones that have been identified (in West Kootenay and Boundary) are being monitored, however, these do not house species thought to be of highest vulnerability to WNS. Specifically, known cave/mine hibernacula in BC have these confirmed species: Townsend's Big-eared bat, Silver-haired bat, Californian Myotis, Long-eared Myotis, and Western Small-footed Myotis. Other overwinter roost structures have been identified for Long-legged Myotis (concrete basement of house), Yuma myotis (houses), and Big Brown bat (house). Rock crevice use has also been identified based on acoustic recordings of these same species flying during winter, in addition to Pallid Bat. Acoustic records in some areas provides evidence of "40kHz" species of bats flying late in fall and early in spring and in some cases, during the winter, but capture would be required to know the species; depending on the area this could be Northern Myotis, Little Brown Myotis, Western Small-footed Myotis, or Long-legged Myotis.

Recent findings that Little Brown Myotis uses root wads and talus slopes in southeastern Alaska (Karen Blejwas, pers. comm.) to overwinter, suggests that these common landscape features could be overlooked hibernacula features for bats in BC. It appears that some bat species do not regularly fly during winter, while others do. This might be because some species do not need to fly in winter, or that their selected hibernation features differ in the space they offer for flights (e.g. cave vs crevice). Winter flights outside of hibernacula have been well documented as far north as Terrace, Prince Rupert, and Dawson Creek. Species active in winter are largely Big Brown bat, Silver-haired bat, Townsend's Big-eared Bat, and Californian Myotis.

We have little to no data about winter hibernacula for the following species (see below), although in the case of Myotis, there are many unconfirmed records of bats in caves in winter. Some reports suggest Little Brown Myotis for example, and yet a lack of photos, measurements, descriptions or genetic data precludes confirmation of species.

FOCUS OF FUTURE WINTER MONITORING

Natural underground winter roosts not known for:

Little Brown Myotis – a handful of records from caves suggest this species might have been observed in singles or small numbers, but species could not be confirmed. A building roost in West Kootenay was

found to house two Little Brown Myotis who were active in winter, along with the Yuma myotis that overwintered in this same building, however, these were not healthy adults.

Yuma Myotis – other than 2 building roosts in West Kootenay (maternity roosts), it is not known where this species hibernates. A boulder roost was located by C. Lausen and T. Hill in early Nov. in West Kootenay (6000 ft elevation) using radiotracking; however, it is not certain if this bat remained in this roost for the winter.

Fringed Myotis – no winter records in BC

Northern Myotis – no confirmed winter records in BC

Spotted Bats – no confirmed winter records in BC

Pallid Bats – acoustically detected in winter in Vaseux, but no roosts identified

Moving forward, emphasis should be on locating where these 6 species roost during winter, because they have not been confirmed, but also because 4 of these species are federally listed, with 2 being Endangered.

How to target these species:

Of the 6 target species 4 could be identifiable using acoustics:

Yuma Myotis - as long as deployments are made in such a way as to capture echolocation produced by Yuma that are at flying least 10 m from an object such as tree branches, and the ground, this species can be differentiated from Californian Myotis. If the recording location is rather 'cluttered' which is often the case in front of rock crevices, or mine openings, for example, then differentiating Yuma from Californian using will be nearly impossible.

Little Brown Myotis – if a deployment can be made in such a way as to capture echolocation produced by Little Brown Myotis that are at flying least 10 m from an object such as tree branches, and the ground, this species can be differentiated from other "40 kHz" Myotis which produce very similar echolocation calls (Western Small-footed, Long-legged, Northern Myotis). If the recording location is rather 'cluttered' which is often the case in front of rock crevices, or mine openings, for example, then differentiating Little Brown from other Myotis using will be nearly impossible.

Fringed Myotis – 25 kHz bat that can be differentiated from Townsend's Big-eared bat providing that recordings are not processed using Kaleidoscope Pro which can mask amplitude differences, an important parameter in differentiating these two species.

Spotted Bat – the only audible bat in BC

The other 2 bats present challenges to identify acoustically.

Northern Myotis – this 40 kHz bat species is hard to confirm acoustically because other 40 kHz bats, under ‘cluttered’ recording scenarios will have similar looking sonograms. Generally, bat detectors are placed close to potential underground roost features such as rock crevices or talus slopes and thus these areas elicit high clutter types of echolocation calls. This species does start its echolocation calls very high (120 kHz) and so if the bat was close enough to the microphone, this may help differentiate it from other Myotis that are less likely to use such high frequencies.

Pallid Bat – because this bat is acoustically similar to Big Brown bats, the production of a unique social call (‘directive’) would be required to conclusively identify this species. It is not known under what conditions this type of social call is produced, but it has been in all seasons.

The proposed plan to locate hibernacula for these species:

1. Continue BatCaver program opportunistically, but focussing on:
 - a. northern areas of BC where bats may be more likely to use caves. BatCaver has more successfully located cave hibernacula in northern BC. Bats may be more likely to use caves in northern locations possibly because crevice roosts are not as insulating or because the crevices do not allow space for flight and ambient temperatures are less conducive to mid-winter flights. Given that large numbers of Myotis are found in caves on the east side of the Rocky Mountains, monitoring in NE BC may be fruitful in locating significant hibernacula.
 - b. Columbia Basin – many significant hibernacula have been found in mines in this area and cavers have reported late fall bat activity at 2000 m elevation in the Bad Shot Range, suggesting this may be an area to focus future monitoring.
 - c. Other areas of the province if cavers alert us to underground features with high probability of being hibernaculum.
2. Identify areas where very late and very early acoustic bat activity has been documented for Yuma, Little Brown, Fringed, Spotted, Pallid or Northern (or 40 kHz Myotis calls in general).
 - a. To identify these target areas, the NABAT grid cell framework could be used. Detectors that are already placed in areas of potential hibernation habitat (ie. Rock crevice habitat, talus slopes, open south facing slopes of trees with substantial root wad cavities, etc.) could be deployed late in summer and early in spring, and where possible, continue to record throughout winter. Most important will be to track ambient conditions to know when winter hibernation conditions likely begin and end, and monitor accordingly so that when bats are detected, it is likely to signal hibernation habitats in the immediate vicinity.
 - b. Driving transects in early spring in areas of potential hibernation habitats may help locate pockets of overwintering bats for follow-up. For example, areas with a lot of south-facing talus, or rock bluffs would be strategically monitored (either with passive bat detectors, or regular driving transects). Driving transects in early spring in SE Alaska

have proven effective for identifying rock bluff areas used by Little Brown Myotis in winter (K. Blejwas, pers. comm.).

3. Shift focus of winter bat monitoring to these areas identified as likely to house winter bats based on late fall and early spring detections.
 - a. Areas with late fall detections of 40 kHz Myotis should be monitored with some sort of follow up such as winter passive unit(s), early spring driving transects, scent dogs, capture and radiotracking, etc. Recall that radiotelemetry is difficult with rock-roosting bats as the signal dissipates quickly as the bat moves underground, and this is even more difficult if the bat is using a mine or cave that is a non-linear tunnel. 40 kHz Myotis could be several species, including Northern, Little Brown, Long-legged and Western Small-footed Myotis, depending on the region being monitored. Because 40 kHz species are rarely recorded in winter, it is assumed that they do not fly outside hibernacula often and any information on their hibernation habitats and behaviour will be useful.

Session Name: NABat and Beyond

Session Leaders: Jason Rae (Wildlife Conservation Society Canada), Orville Dyer (Forests, Lands and Natural Resource Operations), and Cori Lausen (Wildlife Conservation Society Canada)

Discussion objectives (list what you intending to focus on in your discussion:

Highlight current weaknesses of NABat, provide feedback and brainstorming to NABat implementers for how to move forward with NABAT in BC as a long term sustainable program.

- Inventory gaps in BC distribution maps
 - o Suggested ways of filling gaps and Identify specific high priority sites - brainstorm sites, persons, organizations
 - o Strategies to maintain and possibly expand funding
 - o Strategies to maintain/expand participation from staff/volunteers
 - o Possible contractors/researchers to do statistical analyses?
- Is current approach (often lumping 40k bats) enough or do we need additional genetic, capture data?

Develop a protocol for a comprehensive bat inventory and monitoring framework, to be used by Parks and others participating in NABat to inform trends as NABat monitoring continues.

- Annual Bat Count area and species representation, variation, statistics, and methods (pre vs post pup counts or both), how many replicate counts, how many observers, how many sites
- Winter acoustics - currently being done but not coordinated or consistent goals, objectives and methods for collection and reporting
- Mass movements (spike in activity rates late summer) of species not thought to be 'migratory'
- Migration Monitoring (note that migratory tree bats have upcoming COSEWIC assessment due to cumulative impacts of windfarms)
- Threats to migratory bats beyond turbines (identifying "high use bat migration areas")

Develop NABat guidance/protocol to include:

- Strategies or alternatives for monitoring rare species
- Potential role of climate change?
- Strategies to include Annual Bat Count in formal NABat approach, and specifically using counts to inform relative abundance trends based on acoustics
- Where is winter monitoring a high priority for additional work and, if so, what strategies are needed to develop it – learning from BatCaver model?
- Where is migration monitoring likely to be most beneficial; strategies to develop this monitoring process
- Identifying high priority areas for "Beyond NABat" actions

Summary of discussion (A brief summary of what the group discussed):

We began the discussion with a quick overview of the current state of NABat where we described the goals of the program, its sampling method, strengths and drawbacks of acoustic ID, then summarized current results. We began the discussion by highlighting the current weaknesses of NABat sampling, showing the current species range extent and gaps of species records and raised the following topics:

- Ideas to fill gaps in our data collection network including asking for participants to highlight any high priority locations that are unmonitored.
- Ideas to expand or continue funding given the long-term nature required by a monitoring project, and the usual hesitance to fund these types of projects.

- o Funding sustainability
- o Cost cutting measures
- o Equipment replacement and consistency
- Dealing with participant burn-out, maintaining participation and interest in currently established grid cells.

Beyond NABat discussion was focused on four main questions:

- Developing a protocol for a comprehensive bat inventory and monitoring framework that can be applied by NABat participants to inform trends as monitoring continues
- Annual bat count integration with NABat
 - o Effectiveness of pre-post pup counts
- Winter acoustic monitoring
 - o Target specific cells for associated winter monitoring as part of “Beyond NABat”
 - o Target likely hibernacula
- Migration monitoring
 - o Extend monitoring season in specific cells to capture elements of migration

Anticipated deliverables (what you thought you would produce by the end of the discussion), actual deliverables highlighted in italics:

Identify critical areas to establish new grid cells and if possible identify new partners or specific sites for new grid cells

Gather information on other important data to record along with NABat cells

Design strategies to procure additional funding for NABat program, including reapplying for current funders with “updated” NABat monitoring

Identify additional data that are most important to collect to supplement NABat baseline (bat roost counts, winter monitoring, migration monitoring, mass movements)

- Design procedures to collect baseline data on these topics and integrate them as part of NABat monitoring in BC

Ideas to promote participation in NABat program for longer time-period and combat grid leader turnover/burnout

Integrate bat count data with NABat monitoring where possible, relying on pre-pup counts because they are less variable

Threats to migratory bats beyond turbines (identifying “high use bat migration areas”)

Design strategies to adjust NABat monitoring to target rare species, supplementing with other data collection (mist netting, etc) where appropriate

Action items (Please list items that require followup):

Design standard procedure for winter sampling at an NABat grid cell and identify candidate cells with suitable detectors and interested grid leaders

Design strategies to adjust NABat monitoring to target rare species, and highlight cells where additional information (mist netting, etc) would be helpful

Identify critical areas to establish new grid cells, particularly with new partners