Environment and Climate Change Canada

Canada Nature Fund: Community-Nominated Priority Places for Species at Risk

Kootenay Connect: Bat Conservation in Kootenay Connect Focal Areas

March 15, 2023 Final Report

Kootenay Connect is a project facilitated by the Kootenay Conservation Program

Environment and Climate Change Canada | Environnement et Changement climatique Canada

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Project ***Kootenay Connect- BAT-YR4, Year 4 (Kootenay Centre for Forestry Alternatives)***

Executive Summary

The bat conservation component of Kootenay Connect consists of 3 main activities: monitoring, inventory, and roost habitat enhancement. We track species diversity and relative abundance through annual acoustic monitoring of bat echolocation calls using bat detectors. This sampling is an effective tool for evaluating changes to habitats over time and is part of a large-scale standardized monitoring program (North American Bat Monitoring Program, NABat) led by WCS Canada in BC. The unit of monitoring is a 10 km x 10 km grid cell monitored for at least one week during the same time period each year.

In 2022, we once again acoustically recorded bats in all four of the Kootenay Connect focal regions for a total of 6 NABat grid cells: Creston Valley (1), Bonanza Biodiversity Corridor (2), Kimberley/Wycliffe (1), and Columbia Valley (2). In 2022, we recorded more than 20,000 bat passes detecting a total of 11 species confirmed, with a 12th potentially detected in the Kimberley/Wycliffe and Creston cells – small-footed myotis. This species, either *Myotis melanorhinus* or *M. ciliolabrum*, is difficult to acoustically differentiate from Little Brown Myotis, *Myotis lucifugus*. Capture inventories will be needed to verify presence of this species.

We also conducted our second summer of monitoring two old-growth mimic tree roosts that we created in fall 2020 in the North Columbia area near Donald and our first summer of monitoring the 12 tree roosts we created in 2021. We installed an additional 15 roosts in 2022: 6 BrandenBark™ (an artificial flexible bark material) poles, 3 BrandenBark™ trees, and 3 wildlife trees in the Creston Valley Wildlife Management Area; and 3 BrandenBark™ poles at Nature Conservancy's Lot 48 at Columbia Lake.

In addition, we conducted a 9-night capture inventory at multiple sampling locations across the Columbia Valley ranging as far north as Kinbasket Reservoir. As our roost enhancements target species at risk, our goal was to determine where the nearest Northern Myotis could be located, given that this is one of two endangered Myotis in the Columbia Basin. Despite substantial effort over 15 nights of capture inventory in the Kootenay Connect area of the Columbia Valley, we did not capture any Northern Myotis. We therefore extended our capture efforts to the Kinbasket Reservoir where this species has been previously documented in the 1990s and where there has been widespread substantial timber harvest. Here we captured 1 individual on each of 2 nights of inventory effort at different locations. We radiotracked these bats, locating 2 roost trees for each.

Background and Overview

Bats face unprecedented levels of threats. The Wildlife Conservation Society Canada's Western Bat Conservation program focusses on establishing baseline data for measuring impacts or efficacy of mitigation strategies; filling knowledge gaps to inform effective conservation strategies; and building resiliency into bat populations through habitat recovery and enhancement. There are important areas for multiple species at risk in the Columbia Basin, where conservation efforts are being focussed. Protecting and enhancing these areas to establish linkage corridors, promote biodiversity, and ensure suitable habitat exists for species at risk is the goal of Kootenay Connect.

The bat conservation component of Kootenay Connect consists of 3 main activities: monitoring, inventory, and roost habitat enhancement. We acoustically monitor bats by recording their echolocation calls using bat detectors, thereby documenting changes in species diversity and relative abundance through annual recording and analysis. Acoustic sampling is a strategic tool for tracking the impact of habitat manipulations over time. As habitats degrade or are enhanced, and other threats continue to impact bat populations, long term monitoring of bat activity is being used to inform conservation and management across the continent -- this large-scale standardized monitoring program is called the North American Bat Monitoring Program (NABat); WCS Canada has led the BC program for the past 7 years. A large sampling grid across US and Canada is based on 10 km x 10 km grid cells monitored, and for at least one week during the same time period each year we record bats using bat detectors in 54 cells across the province, and 15 across the Columbia Basin, 6 of which occur in Kootenay Connect focal areas: Creston Valley (1), Bonanza Biodiversity Corridor (2), Wycliffe (1), and Columbia Valley (2).

Two Endangered Myotis bat species are found in BC, one of which (Little Brown Myotis) is found across the Columbia Basin, and the other (Northern Myotis) is found only in the northern part of the Basin. The East Kootenay has had little bat inventory effort, and timber harvest in many upland areas surrounding the northern portion of the Columbia wetland/river has undoubtedly reduced the availability of tree roosts for many species. There is little guidance available for how to mitigate for lost tree roosts, but there has been some use of artificial bark in parts of US and Canada (e.g., Adams et al. 2015; Mering and Chambers 2012), and most recently an initiative in BC to create crevice roosts in trees using chainsaws (Todd Manning, pers. comm.) building on work of others (e.g., Griffiths et al. 2018). We employ these promising techniques in areas where species at risk are likely to benefit. The two endangered species of bats differ dramatically in their ecology and ecological niches. Little Brown Myotis typically forms large colonies of females (hundreds) to give birth, often in buildings or bat boxes where available, and will typically forage above standing water, but as a generalist they also forage in other habitats. Northern Myotis typically roosts and forages within the forest interior and is closely associated with old growth/mature forest. This species typically does not fly far into the open, following forest edges or within 100 m of a forest edge (Henderson and Broders 2008), and reproductive females roost alone or in small colonies in trees (<60 individuals; Foster and Kurta 1999). Unlike Little Brown Myotis, Northern Myotis hunts for insects under canopy and regularly gleans insects by picking them off of leaves or other vegetative surfaces. These different foraging styles means they must be targeted differently for capture inventories.

Although we are creating tree roosts that will benefit both of these species at risk, our goal was to try to locate areas in the East Kootenay's Columbia drainage where this species is found in order to focus habitat enhancement. Ideally we would like to identify patches of suitable habitat that can be

connected via constructed roost trees, or patches where this species is found that could benefit from an expanded roost selection/area.

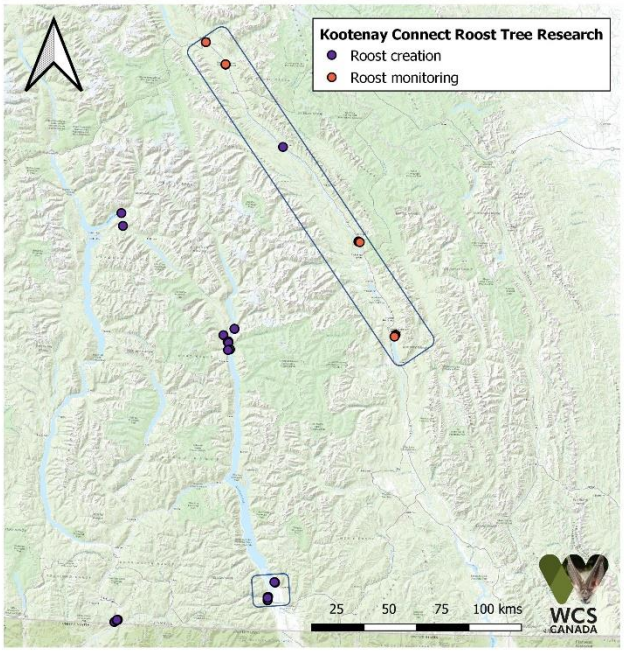
Details of Activities

Locations of our Basin-wide activities that include and/or inform our Kootenay Connect project are summarized in Figure 1 (map).

Section 1: Capture Inventory and Locating Northern Myotis

The goal of our roost enhancement work is to create habitat for Little Brown and Northern Myotis, both of which are listed as endangered in Canada (ECCC 2018). In 2022 we continued our search for Northern Myotis, a species that is typically associated with mature and old growth trees (CDC 2022). In our 2021 inventory, we were unable to locate this species in the areas that we sampled in the Columbia Valley. Our goal in 2022 was to expand our search to locate a source population that might inform how to establish a habitat corridor for this species. We conducted further inventory work in August 2022 (Table 1). We thus started in the area of Kinbasket Reservoir, as close to the previously known Northern Myotis range as possible (Revelstoke/Glacier National Park region; summarized in CDC 2022), including the only old growth cedar patch that we could locate in the Upper Columbia. This old growth cedar patch (Giant Cedars Interpretive Trail) was used heavily by bats for roosting. We sampled this site one night in 2021 and 2022, but did not capture nor acoustically detect Northern Myotis. This species used to be present at this site decades ago (Susan Holroyd, pers. comm.). The following 2 nights we sampled on the south end of the Kinbasket Reservoir and captured one Northern Myotis each night. We radiotracked these bats (1 male, 1 female; Figure 2), identifying 2 roost trees for each, all 4 roosts located in a residual patch of old growth cedar along the reservoir. The capture nights and radiotracking on the Kinbasket Reservoir are part of a collaborative project with BC Ministry of Environment and Climate Change.

In our first 3 nights of inventory (Giant Cedars Interpretive Trail, opening of the Gold River into the Kinbasket Reservoir, and Bush Harbour Island in south Kinbasket) we captured 28 bats of at least 5 species (Table 1): California Myotis, Little Brown Myotis, Northern Myotis, Long-legged Myotis, and Long-eared Myotis. Two captures are suspected of being Yuma Myotis (Figure 3), and the genetic results are pending. Although known from the Revelstoke area and found throughout the West Kootenay, Yuma Myotis has never been captured in the East Kootenay Columbia Valley (Lausen et al. 2022), and the eastern-most range of this species in SW BC has not been delineated. We genetically confirmed this species at Nicholson from a guano sample that we took from under the Nicholson town bridge in 2021 (Table 2). Yuma Myotis and Little Brown Myotis are experiencing similar mortality rates from white-nose syndrome in the only western location where this disease has been documented to date, in Washington (Abigail Tobin, WNS Coordinator, Washington Department of Fish and Wildlife, pers. comm., March 2023).



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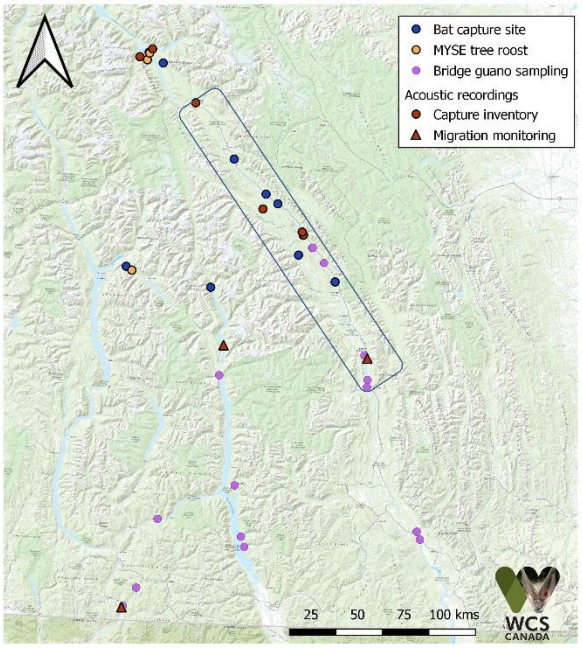

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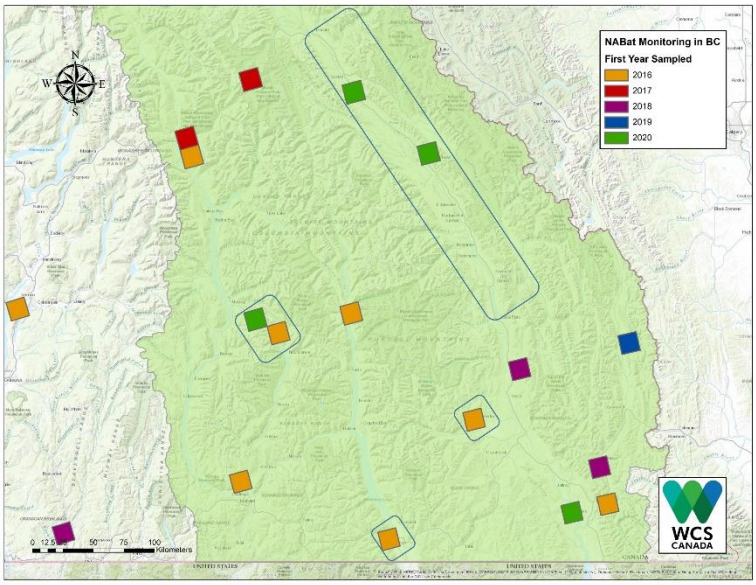

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Figure 1. Kootenay Connect bat enhancement, monitoring, sampling and inventory sites. Squares roughly delineate current Kootenay Connect Areas in which our work took place as part of larger initiatives. **A.** Newly created trees in 2022 and roosts that created in previous years and monitored in 2022. **B.** Inventory sites (capture and acoustics, bridges where guano were sampled for genetic analyses, and 3 migration monitoring sites. Outside of the Kootenay Connect areas, but informative of the range of Northern Myotis, are the 2 locations where this species was radiotracked to old growth tree roosts. Maps by E. Low. **C.** NABAT grid cells in the Columbia Basin. Map by J. Rae.

We then conducted a further 6 nights of capture inventory in the Kootenay Connect region of the Columbia Valley, targeting different capture locations than the previous year. The exception to this was one site in the Spillimacheen which we targeted in both years to sample a colony of Little Brown Myotis that had been located the year before. Our goal was to describe reproductive status and inventory for Yuma Myotis which we suspected based on 2021 acoustic records. Over the 6 nights we captured 108 bats of six species (Table 1): Hoary Bat, Silver-haired Bat, California Myotis, Little Brown Myotis, Long-legged Myotis, and Long-eared Myotis. As Little Brown Myotis and Yuma Myotis are difficult to differentiate (Figure 3), we submitted 70 samples for genetic species confirmation. We await 2022 results. As our 2021 samples had not been analyzed at the time of our year 3 reporting, here we report that all 4 of our wing biopsies submitted for genetic analyses were determined to be Little Brown Myotis.

In a project not directly related to locating Northern Myotis as part of Kootenay Connect, we additionally captured bats at two building roosts in the Parson area (Table 1). The bats are being excluded from one of the roosts, where the other roost is being left as is. The goal of this project, led by BC Ministry of Environment and Climate Change, is to understand the impact of eviction on Little Brown Myotis. This federally endangered species is not well studied in BC and it is unknown the effects that eviction have on reproductive success. This fills a knowledge gap in the Schedule of Studies and so we include mention of this project here as it directly impacts the Columbia Wetland species at risk. This was the second year of captures at these two building roosts. We captured 86 Little Brown Myotis, 2 of which were recaptures from 2021. The remaining 84 bats were PIT tagged. Further capture work will ensue in coming years.

To supplement capture work, we have also sampled guano under bridges for genetic analyses (Table 2). Guano samples are genetically analyzed by Northern Arizona University lab (Species for Feces). In 2022 we sampled 8 bridges in the Columbia Valley, and genetic results are pending.

To supplement data collection during our inventory, we also recorded bat activity acoustically at 5 sites. Four of these sites were also capture locations (Table 3). Detector was deployed for one night at each site. We acoustically recorded 2 additional species to what we captured: Eastern Red Bat and big brown bat. We detected no Northern Myotis, but this species is extremely quiet when it echolocates and must typically approach within a few metres of the microphone to be recorded.

Table 1. Bat captures using misnets (Figure 4) in 2022 East Kootenay Columbia bat inventory. Species codes: MYCA Californian Myotis; MYLU Little Brown Myotis; MYVO Long-legged Myotis; MYEV Long-eared Myotis; MYYU Yuma Myotis; MYSE Northern Myotis; LANO Silver-haired bat; LACI Hoary bat. These results summarize all captures, which included 2 associated projects that were administered by BC MoECCS and informed the Columbia Valley inventory results: Little Brown Myotis Eviction Project near Parson and Northern Myotis Roost Selection on the Kinbasket Reservoir.

Date	Associated Project (funding source)	Capture Site Name	# bats captured	# species captured	Species list
13-Aug-22	Kootenay Connect/BC MoECCS	Giant Cedars Interpretive Trail	11	4 (*5)	MYCA, MYLU, MYVO, MYEV (*potential MYYU)
14-Aug-22	BC MoECCS	Bush Harbour Island	7	3 (*4)	MYLU, MYVO, MYSE (*potential MYYU)
15-Aug-22	BC MoECCS	Gold River Kinbasket	10	4	MYVO, MYLU, MYEV, MYSE
16-Aug-22	Kootenay Connect	Nicholson Bridge	17	2	MYLU, MYVO
18-Aug-22	Kootenay Connect	Cartwright Lake FSR	12	4	MYEV, MYLU, MYCA, LANO
19-Aug-22	Kootenay Connect	Columbia-Bugaboo intersection (Brisco)	25	3	MYEV, MYLU, LACI
20-Aug-22	Kootenay Connect	Spillimacheen Swing Bridge & NWA	59	2	MYLU, LACI
21-Aug-22	Kootenay Connect	Wilbur Lake Rec Site	2	1	MYLU
22-Aug-22	Kootenay Connect	NTBC Edgewater*	13	2	MYLU, MYEV
11-Aug-22	BC MoECCS	Pickering's (private residence)	42	1	MYLU
12-Aug-22	BC MoECCS	Valente's (private residence)	44	1	MYLU

*heavy rain shortly after emergence prevented a full night of inventory at this location.

Table 2. Bridge guano samples from 2021. Genetic results from Northern Arizona University (Speces from Feces). Nd = not detected. See Table 1 for species codes. EPFU = *Eptesicus fuscus*, big brown bat. MYTH = *Myotis thysanodes*, Fringed Myotis. ND = not detected.

Bridge	EPFU	MYCA*	MYEV/ MYTH**	MYLU	MYVO	MYYU
Brisco	ND	1	1	1	ND	ND
Canal Flats (Overhead and Kootenay River)	ND	ND	1	1	ND	ND
Donald	ND	ND	1	1	1	ND
Nicholson	ND	ND	1	1	ND	1
Spillimacheen	ND	ND	1	1	ND	ND
	0	**1**	**4**	**4**	**1**	**1**

** mtDNA sequences of MYCA are identical to that of Myotis melanorhinus, thus this latter species cannot be ruled out as potentially present. Currently, the difference between M. melanorhinus and M. ciliolabrum is not known (Lausen et al. 2022). Collectively this species is referred to as small-footed Myotis. Although small-footed Myotis have not been detected previously in the East Kootenay, there is abundant suitable habitat in the southern part of the Columbia Valley and Kootenay Trench.*

*** mtDNA sequences of MYEV are identical to that of MYTH. Both species are potentially present as they are both known from East Kootenay. MYEV is known from throughout the Columbia Valley and Kootenay Trench, but MYTH has only recently been discovered in the latter area.*

There is a paucity of suitable old/mature forest habitat along the west side of the Columbia Valley made up largely of the Spillimacheen and Bugaboo drainages. This upland bench area has experienced substantial widespread timber harvest. There are numerous lakes in the area providing foraging habitat for all species of bats. Many of these lakes have associated public recreation sites and some degree of tree cover remaining along the shores. Few lakes have retained mature trees, necessary for most species of bats to successfully raise young. This includes Northern Myotis, a species that tends to use larger diameter trees with greater canopy closure than other bats (e.g., Caceres 1998). While this species may have once roosted in the historic intact forests in these western Columbia Valley benchlands, we found few candidate sites to sample, and were unsuccessful at capturing or recording this species. Over the course of our 2-year inventory, we found only 2 areas where bats are retaining a stronghold in these Columbia Valley western benchlands: Cartwright Lake area (this report) and McClaren Lake (see 2021 Kootenay Connect report). We will be communicating our results to local First Nations and regional BC Government biologists with the goal of trying to prevent future logging of these areas. Other lakes in these benchlands should be considered in future restoration efforts, such as creation of roost trees using synthetic bark and modifying younger trees using chainsaws to create crevices for bats, simulating mature trees (see Section 2).

Table 3. Acoustic recordings made during capture inventory. See Table 1 for species codes. Species recorded but not captured, or potentially captured, in this inventory: LABO, *Lasiurus borealis*, Eastern Red Bat, EPFU = *Eptesicus fuscus*, big brown bat.

Recording Night:	19-Aug-22	20-Aug-22	17-Aug-22	15-Aug-22	14-Aug-22	
Acoustic Category/ Species	**Columbia-Bugaboo intersection**	**Spillimacheen Bridge**	**Blue Water Rec Site**	**Gold River Kinbasket**	**Bush Harbour Island**	**Grand Total**
High Frequency Bat	456	182	15	78	37	**768**
Low Frequency Bat	15	17	9	36	5	**82**
UnId_Bat	90	20	37	98	79	**324**
Mix of High and Low Frequency Species	12	8	0	4	1	**25**
EPFU	1					**1**
LABO		1			2	**3**
LACI	5	7	7	10	5	**34**
LANO	4	7	5	5	2	**23**
MYCA	2	1				**3**
MYEV	6	2	1			**9**
MYLU	150	11	1	2	15	**179**
MYYU		1				**1**
Grand Total	**741**	**257**	**75**	**233**	**146**	**1452**

Figure 2. A. Northern Myotis with radiotransmitter. This is one of the two Endangered Myotis bats in Canada. This bat was captured in this inventory along the south of Kinbasket Reservoir, the only stronghold that we could locate in the Columbia Valley drainage over our 2 year inventory. Photo by Jared Hobbs.

B. Left is Little Brown Myotis, right is Northern Myotis. These 2 species are similar morphologically with the latter having slightly longer ears and a more pointed tragus (arrow). Photo by Lindsay Smith, Kinbasket Reservoir, BC.

Figure 3. Yuma Myotis. This species is morphologically similar to Little Brown Myotis (see Figure 2 left bat). Previously unknown from the East Kootenay's Columbia Valley, we verified the presence of this species as part of our 2021 bat inventory. Photo by Cori Lausen.

Figure 4. A mistnet string at the Columbia National Wildlife Area. This is three 15m long nets tied together and hoisted up a pole using a pulley system. In addition to capturing bats, this net also captured a Northern Hawk Owl. Photo by Heather Gates.

Section 2: Habitat Enhancement – Roost Creation through BrandenBark and Tree Modifications, and Condo Construction

Over the past 4 years we have been working to enhance and restore bat habitat for tree roosting bats in the Columbia Basin as part of a larger project which includes several Kootenay Connect areas. Thanks to multiple partners and funders, in 2022 in the Basin we constructed 51 new tree or tree-like roosts for bats – 12 wildlife trees created using chainsaws (Figure 5) with crevices of strategic depth, size and aspect for bats; 39 BrandenBark™ roosts (Figure 6) – either poles or trees wrapped with synthetic bark meant to last several decades to provide immediate habitat to bats in forests where trees are not yet mature enough to provide the sloughing bark, hollows and cavities that bats need for raising young.

The BrandenBark™ enhancement site from 2020 (Spike Farm near Golden, BC) continued to be monitored via temperature loggers, roost logger, and guano traps in 2022. In addition, 2 more sheets of BrandenBark™ were installed on the poles in May 2022. Guano presence revealed that this BrandenBark™ roost was used almost immediately in spring, throughout summer, and even into late fall, as evidenced by the presence of guano on top of the snow in November. A mid-summer emergence count confirmed use of one of the newly installed BrandenBark™ sheets. The 2021 genetics results confirmed that the BrandenBark™ was being used by Little Brown Myotis, but more samples were submitted in 2022 to determine if there is evidence of other species using the roost now too. The ‘natural Doug-fir’ bark roost designed by landowner Sigi Liebmann was modified in spring of 2022 with more pieces of bark to decrease the cavity size. Guano collected in the guano trap indicates there was some use by bats in 2022. Guano analysis is currently being conducted to determine species.

Specific to year 4 of the Kootenay Connect project, in September 2022, at the Creston Valley Management Area, we created 9 more BrandenBark™ structures: 6 on poles, and 3 on trees (where BrandenBark™ is mounted on trees that were made into snags through topping and ringing). In addition, 3 wildlife tree snags were created where live trees were topped and ringed and then crevices were created specific for bats. Each tree received 3 chainsaw cuts consisting of a simulated lightning strike and 2 plunge cuts. This work was done by Todd Manning and arborists. Furthermore, we created 3 BrandenBark™ poles in Nature Conservancy of Canada's Lot 48 at Columbia Lake. These installations were by Nupqu, under the leadership of Mark Fjeld (Figure 7).

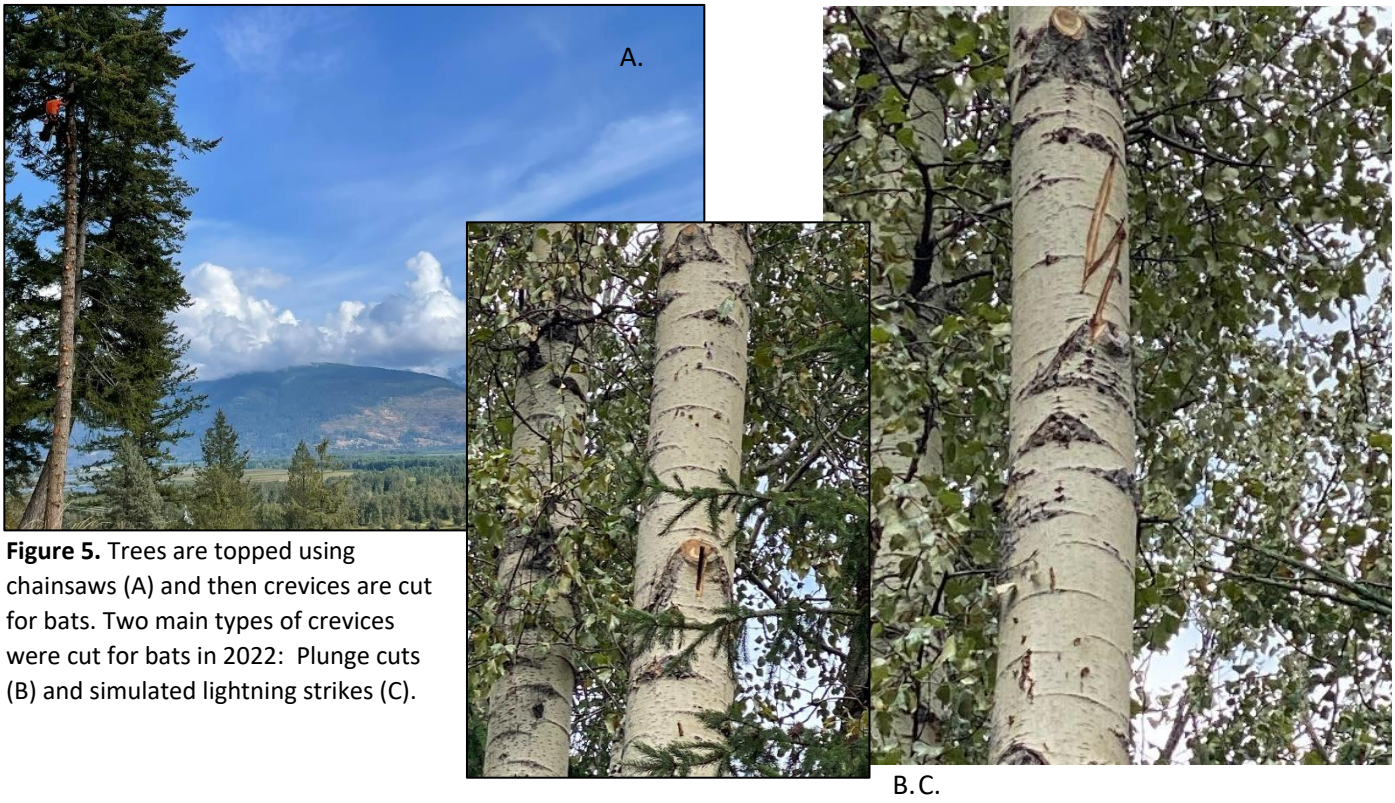

Figure 5. Trees are topped using chainsaws (A) and then crevices are cut for bats. Two main types of crevices were cut for bats in 2022: Plunge cuts (B) and simulated lightning strikes (C).

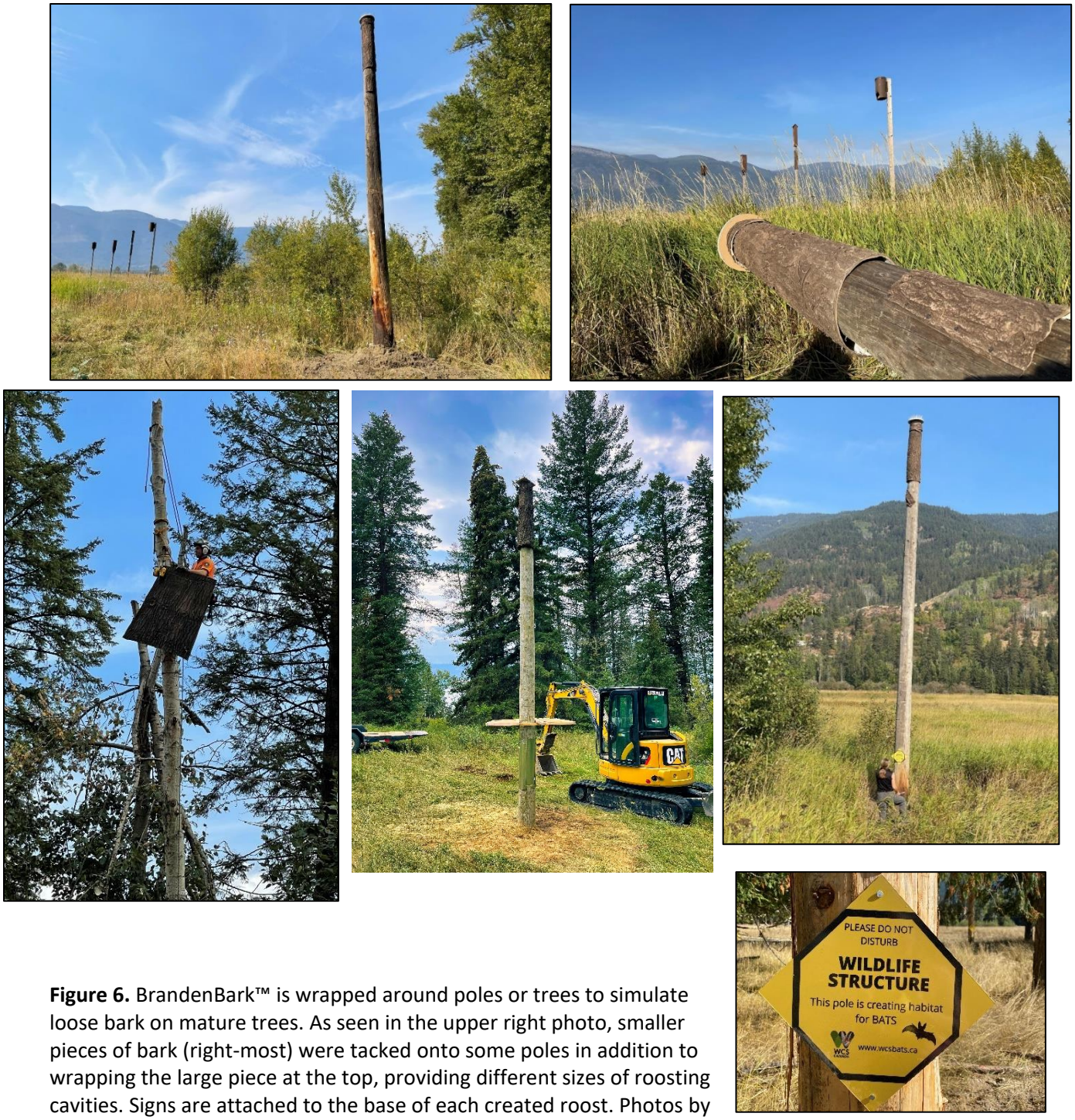

Figure 6. BrandenBark™ is wrapped around poles or trees to simulate loose bark on mature trees. As seen in the upper right photo, smaller pieces of bark (right-most) were tacked onto some poles in addition to wrapping the large piece at the top, providing different sizes of roosting cavities. Signs are attached to the base of each created roost. Photos by C. Lausen, H. Gates, and Mark Fjeld.

An integral component of monitoring the use of our created roosts is the collection of guano. At the bases of trees and poles guano traps are installed (Figure 7). Presence of guano on the mesh is evidence of bats occupying the new roosts. We have found most BrandenBark roosts are used in their first season, and we also have evidence of first season use of the chainsaw created wildlife trees.

We are monitoring effectiveness of all bark-mimic roosts and wildlife trees created in this project through use of guano traps. In spring of 2022, these traps were installed at the 12 tree roosts which were created in 2021. Guano collected from all sites indicates use by bats of both BrandenBark™ roosts and chainsaw modified wildlife trees. A total of 12 samples from 5 roosts at Marl Creek Provincial Park and Burges James Gadsden Park were submitted to WGI and 2 pooled samples from the BrandenBark™ roosts at Edgewater (on Nature Trust of BC conservation land) were submitted to NAU for genetic analysis in fall of 2022, and species results are pending.

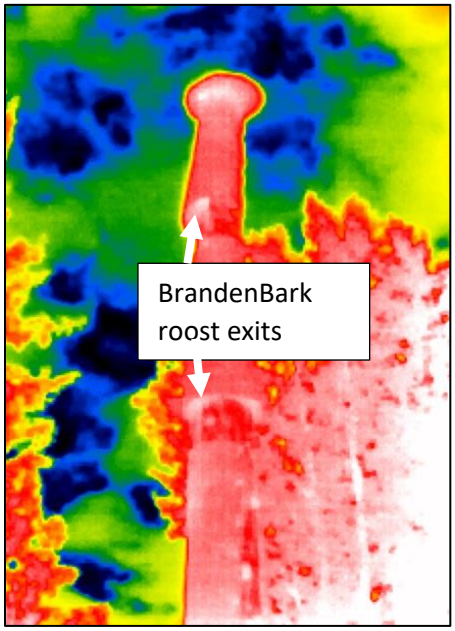

Figure 7. Guano traps are built of wood around the base of each tree/pole. Guano is placed on a cottonball and into an envelope and submitted for genetic analysis of bat species. Emergence counts are sometimes aided by thermal imaging (bottom left photo). Photos by C. Lausen and H. Gates.

We also constructed 2 bat condos: Kuskanook Bat Chalet was completed in May 2022 and is located just to north of CVWMA, and the other one, which targets both endangered Little Brown Myotis bats and species at risk swallows, is awaiting completion at Parson. This latter structure was created in collaboration with Wildsight Golden (partnership with Rachel Darvill), and is designed to provide nesting sites for at-risk species of swallows. This structure, dubbed the "Bat-Swallow AirBnB" (Figure 8), will be hoisted onto poles in spring 2023 on Columbia Valley Wildlife Management area following final First Nation consultation. A pole wrapped in BrandenBark™ will also be erected adjacent to this condo.

Figure 8. Parson bat condo, ready to install at Parson. A swallow nesting component will be built around the base of this structure once it is hoisted onto poles on site. This structure is being dubbed the "Parson AirBnB" due to its position it will have on poles, providing habitat for both bats and birds.

Section 3: Acoustic Monitoring: North American Bat Monitoring (NABat) and Migration Monitoring

NABat

As part of our monitoring in Kootenay Connect areas, we deployed bat detectors in 6 North American Bat Monitoring grid cells. We also sampled bats along a driving transect (Figure 9) in 5 of these cells. Acoustic monitoring has been strategically aligned in areas where tree roosts have or will be created including Creston Valley Wildlife Management area, Bonanza Marsh, Summit Lake, and Wycliffe. We recorded more than 20000 bat passes in 2022 at these 4 locations, and 13 species have been identified (Table 4). This rich dataset is facilitating regional trend analyses for species diversity and indicators of relative abundance. Through regional trend analyses, we have detected a slight population decline has been discovered for Big Brown bats in the West Kootenay, a species that is somewhat uncommon despite the fact that it will roost in buildings in the absence of natural tree roosts.

Figure 9. Driving transect at Spillimacheen grid cell – left picture is the microphone attached to the roof of the vehicle ready to record bats starting a half hour after dusk. A transect takes approximately 1 – 2 hours to complete and a vehicle is driven at ~30 km/h for the duration. Unique in 2022 was the addition of an insect sticky paper that is used to sample insects during the night-time driving. Relative insect 'density' each year will be used as a covariate in models to help explain some of the variation in bat activity among nights and years.

Table 4. Summary of species acoustically detected in Columbia Basin North American Bat (NABat) Monitoring Grid cells (Loeb et al. 2015). ND = not detected.

Grid Cell Name	*Hills*	*Spilli-macheen*	*Nicholson*	*CVWMA*	*Summit Lake*	*Kimberley*	*Baynes Lake*	*Slocan/ Robson*	*Revelstoke*	*Meadow Creek*	*Fort Shepherd*	*Elko Elk River/ SE Col Trench*	*Premier Lake*	*Mount Revelstoke*	*Fernie*	*Glacier National Park*
Area	*New Denver*	*Columbia Valley*	*Columbia Valley*	*Creston*	*West Kootenay*	*East Kootenay*	*East Kootenay*	*Castlegar*	*Revelstoke*	*North Kootenay Lake*	*Trail*		*South Columbia Trench*	*Revelstoke Area*	*Fernie*	*Revelstoke Area*
NABat Cell ID	**1194**	**60586**	**70250**	**147306**	**218282**	**243562**	**5994**	**20330**	**77162**	**79018**	**89962**	**127850**	**145578**	**241002**	**268521**	**271731**
ANPA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
COTO	y	ND	ND	y	y	y	y	y	y	y	y	y	y	ND	ND	y
EPFU	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
EUMA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LABO	y	y	y	ND	ND	ND	y	ND	ND	ND	**y**	y	y	ND	ND	ND
LACI	y	y	y	y	y	ND	y	y	y	y	y	y	y	y	y	y
LANO	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
MYCA	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
MYME	ND	ND	ND	possibly	ND	possibly	possibly	ND	ND	ND	possibly	ND	possibly	ND	ND	ND
MYEV	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
MYLU	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
MYSE	ND	ND	ND	ND	ND	ND	ND	ND	y	ND	ND	ND	ND	ND	ND	Y
MYTH	ND	ND	ND	y	ND	y	ND	ND	ND	ND	y	y	y	ND	ND	ND
MYVO	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
MYYU	y	y	y	y	y	y	y	y	y	y	y	y	y	ND	y	ND
TOTAL BAT PASSES	**2752**	**1488**	**2015**	**6763**	**9362**	**1487**	**562**	**1681**	**8086**	**6450**	**7121**	**1622**	**4707**	**586**	**1256**	**352**
	Total bat passes in Current Kootenay Connect Areas 23867															
	GRAND TOTAL BAT PASSES IN COLUMBIA BASIN 56290															

Migration Monitoring

Because the 3 species of migratory bat species are currently being reviewed by COSEWIC (2021; e.g., hoary bat, Figure 10), we have begun to monitor long term to determine if the Columbia Valley is a seasonal migration corridor for bats. We installed a bat detector on solar power at Columbia Lake starting in late summer 2022 and this unit currently remains deployed in Columbia Lake Provincial Park (Figure 10).

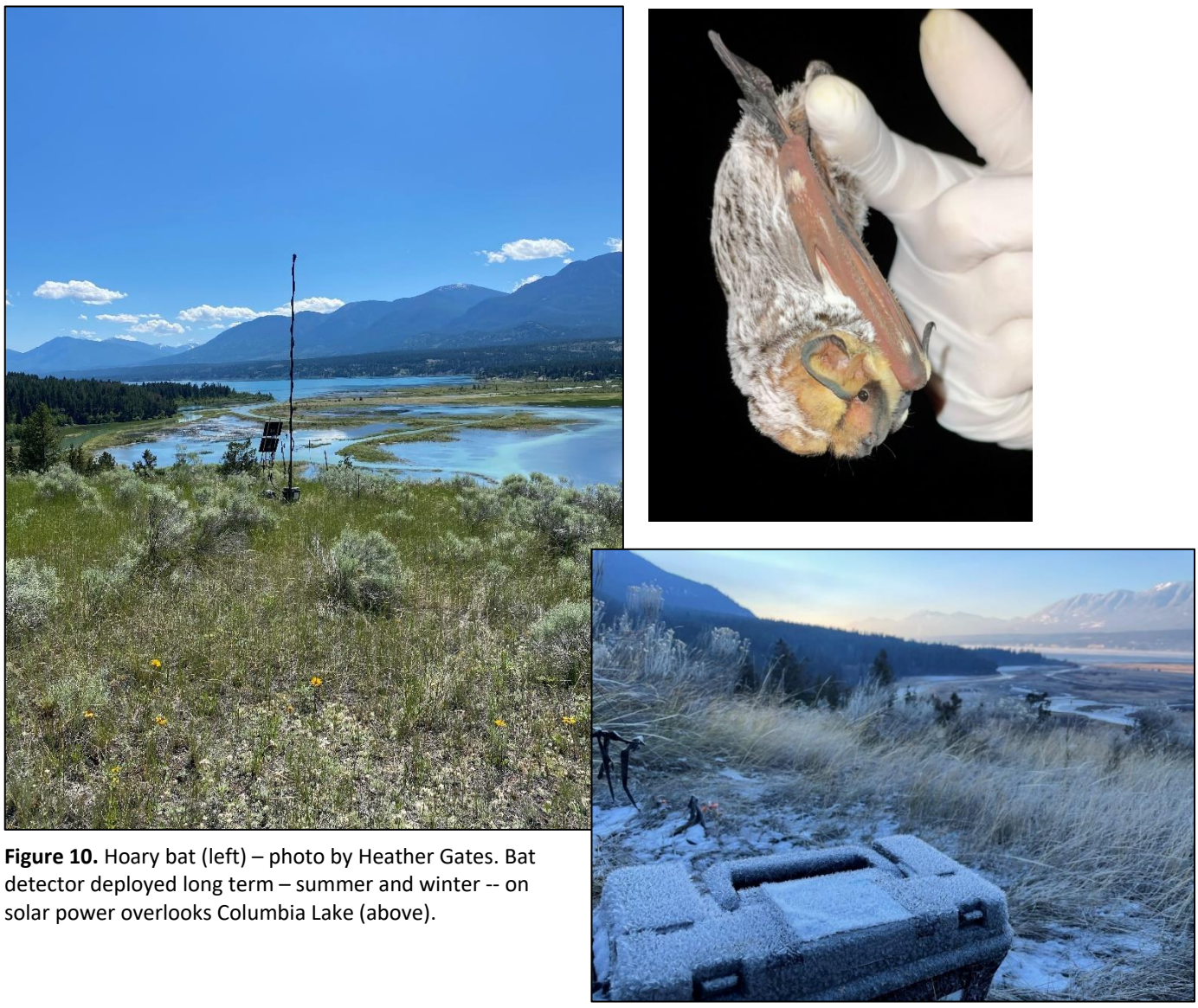

Figure 10. Hoary bat (left) – photo by Heather Gates. Bat detector deployed long term – summer and winter -- on solar power overlooks Columbia Lake (above).

Table 5. Summary of species acoustically detected from June 26, 2022 to October 27, 2022 at Columbia Lake. File identifications are based on auto-identifications from Kaleidoscope (version 5.5.0, Bats of North America Classifier 5.4.0) and SonoBat (version 4.4.5 South Central British Columbia) and manual identification. Species confirmed to be in the study area (i.e., at least one file was manually verified to confirm presence) include hoary bat (LACI), eastern red bat (LABO), silver-haired bat (LANO), long-eared myotis (MYEV), big brown bat (EPFU), little brown myotis (MYLU), long-legged myotis (MYVO), dark-nosed small-footed myotis (MYME), Yuma myotis (MYYU), Californian myotis (MYCA), and Townsend's big-eared bat (COTO). All hoary bat (LACI) and eastern red bat (LABO) files were manually verified. Species potentially in the study area but could not be confirmed include northern myotis (MYSE) and fringed myotis (MYTH).

Species	**Passes detected**
COTO	1
EPFU	42
HighF	7
HighF,LowF	1
LABOMYLU	135
LABO	20
LACI	3
LANO	24
LowF	2
MYCA	24
MYME	27
MYEV	8
MYLU	997
MYVO	5
MYYU	1
NoID	474
Total	**1771**

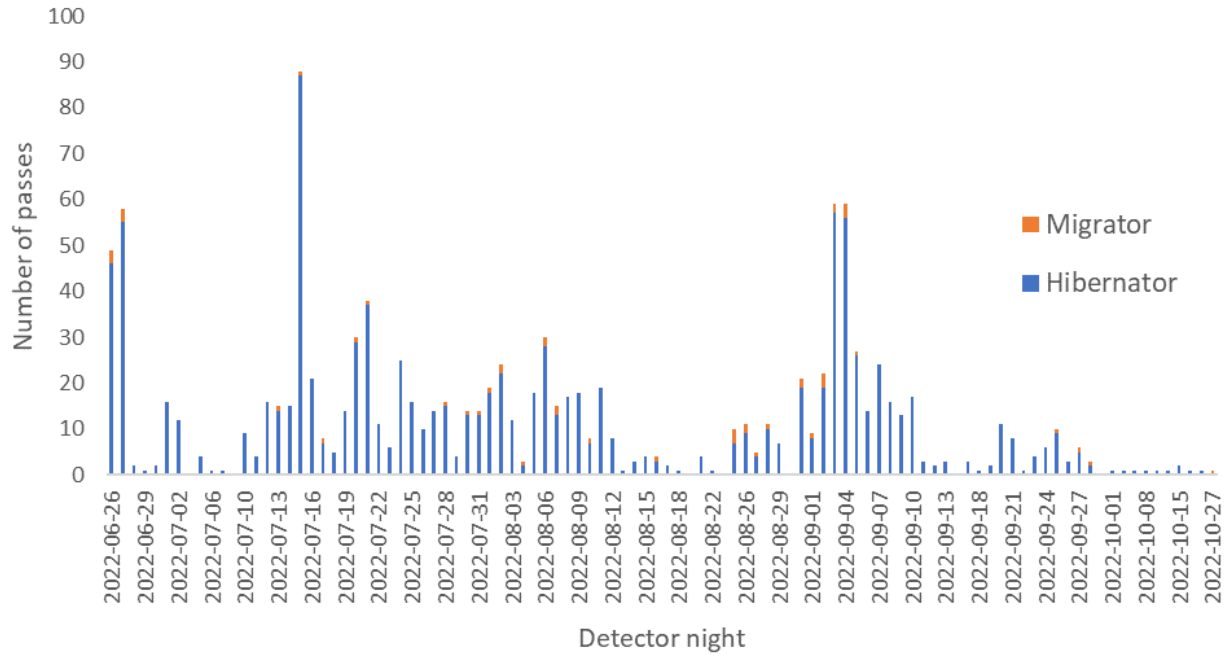

Figure 11. Timeline of bat activity detected from June 26, 2022 to October 27, 2022 at Columbia Lake. "Migrators" include LANO, LACI, and LABO. "Hibernators" include MYEV, EPFU, MYLU, MYVO, MYME, MYYU, MYCA, and COTO. Note, ambiguous groupings were not included (i.e., HighF, LowF, LABOMYLU, and NoID). See Table 5 for species codes.

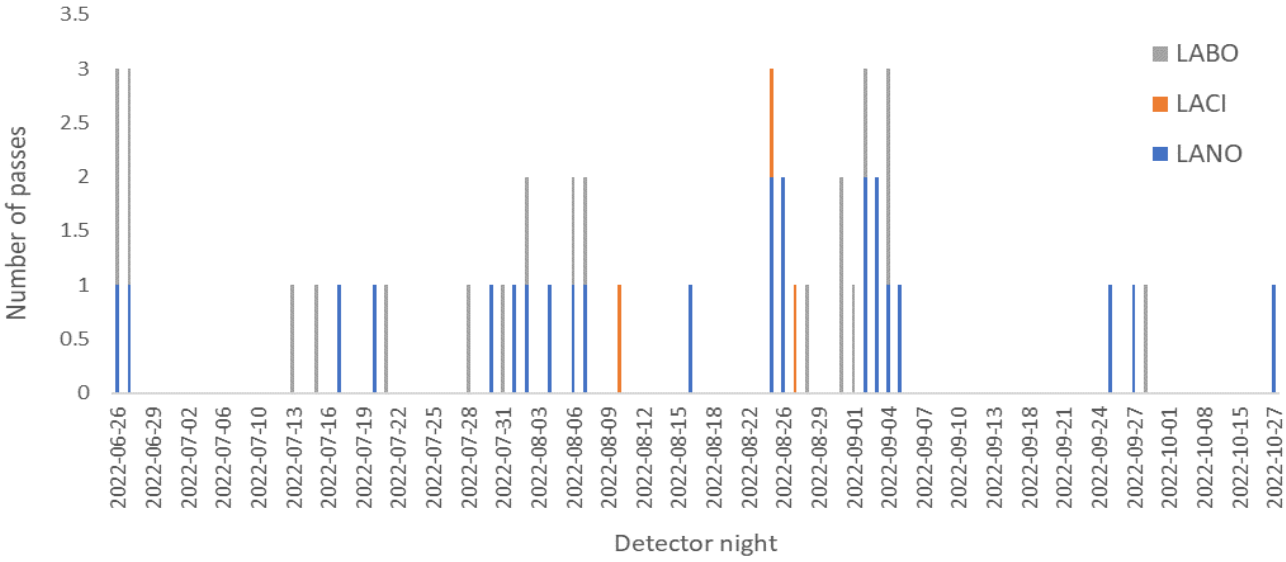

Figure 12. Timeline of when migrating species were detected at Columbia Lake. See Table 5 for species codes.

Future Work

Roost Enhancement

We will be installing additional pieces of BrandenBark™ on poles and/or trees, and creating more wildlife trees in summer or early fall 2023. The main areas we will be working in are: New Denver (4 BrandenBark™ trees in the Bonanza Corridor), Creston (3 BrandenBark™ trees and 3 wildlife trees), NTBC Edgewater (2 BrandenBark™ trees and 2 wildlife trees), Wycliffe/Bummers Flats (4 BrandenBark™ poles, 9 BrandenBark™ trees, and 9 wildlife trees), and NCC Lot 48 (3 more BrandenBark™ poles in partnership with Nupqu).

Monitoring BrandenBark and Wildlife Trees

We will install guano traps on all 84 existing roost structures for periodic guano collection throughout the summer of 2023. We will collect guano throughout the summer for genetic analysis of species.

NABat Monitoring

We will be continuing to record bats for at least one week in each of the 6 grid cells that we monitor in Kootenay Connect areas. We will be statistically analyzing relative abundance trend and changes in species diversity and expect to continue to find positive changes in areas where habitats have been enhanced through ours and other's recovery/enhancement efforts as part of the larger Kootenay Connect project (including wetland enhancement activities that are taking place in Creston and Bonanza areas).

Migration Monitoring

We anticipate locating additional monitoring sites in several Kootenay Connect linkage areas in 2023.

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