Western Canada Bat Network Newsletter - Spring 2021 (Issue No. 36)

In this newsletter:

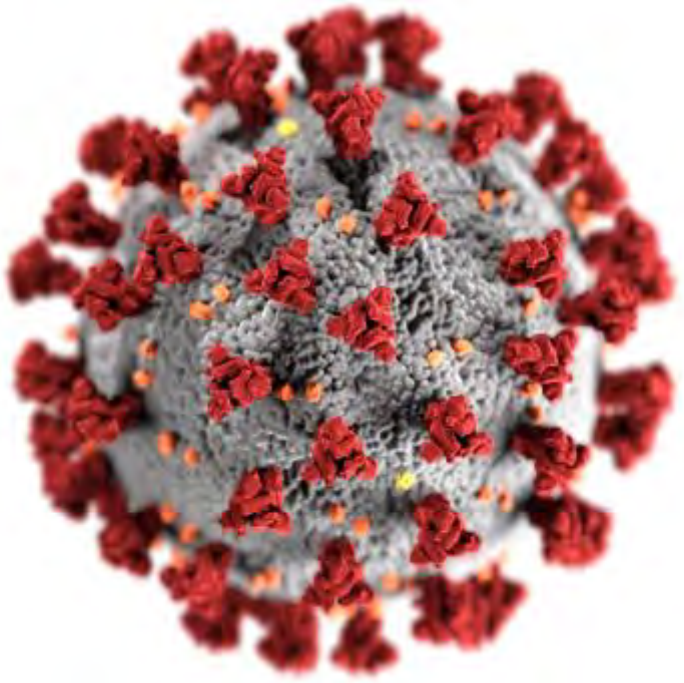
WBCN newsletter submissions

Please submit all newsletter submissions to Inge-Jean Hansen: *Western.canada.bat.network@gmail.com* Submissions can be made at any time. The two yearly submission date deadlines are: - April 15th for inclusion in the Spring Newsletter, published May 1 - November 15th for inclusion in the Fall Newsletter, published December 1

Archived newsletters

This newsletter first started in Fall 2002. It is produced two times per year and until recently was housed by the Alberta Sustainable Resource Development on the Alberta Bat Action Team website. Changes to government procedures has resulted in the need for a change of host. Thanks very much to the Alberta Community Bat Program and Cory Olsen for hosting all past issues. They can be accessed at the following links: *https://www.albertabats.ca/newsletters* or at *http://bcbat.ca/links*

Covid-19 update



On March 30 2021, the World Health Organization indicated in a press release about their to-be-published study that transmission of SARS-CoV-2 may have passed from bats to humans via another animal. The exact chain of transmission that resulted in COVID-19 may never be established.

"This research emphasizes the fact that we are a healthier and safer world when we conserve wildlife and natural habitats. When we destroy habitats and exploit wildlife, we increase the chances of human-wildlife conflict, including the potentially dangerous transmission of viruses. Conservation, including the conservation of bats, are part of the solution. When we protect bats, we stay safer, too."

- Mike Daulton, Executive Director, Bat Conservation International

Alberta

Alberta Bat Program Update

Cory Olson (*colson@wcs.org*) & Susan Holroyd (*susanlholroyd@hotmail.com*), Wildlife Conservation Society Canada

The last year has been a rollercoaster of plans and cancellations but was nonetheless a productive year for both the Alberta Community Bat Program and the Alberta BatCaver program. We started our outreach initiatives off with great gusto in 2020, with lots of events planned, which of course came to a screeching halt as Covid-19 restrictions were implemented. We soon adapted to online conferencing and the fall turned out to be busy with virtual events.

We were delighted to receive the Alberta Chapter of the Wildlife Society's Outreach Award! Given to organizations that have made outstanding contributions in outreach that supports Alberta wildlife. We thank Lisa Wilkinson for the nomination.

Social Media Our social media following has increased over the last year to 3,558 users on Facebook (@albertabats), 3,294 on Twitter (@albertabats), and 649 on Instagram (@abcommunitybatprogram). Our separate Facebook discussion group (https://www.facebook.com/groups/albertabats) reached 1,000 users — a special thank you to Trudy Mills for keeping this group lively! We added a YouTube account (https://www.youtube.com/channel/UCpAfmBQgaQe_Cgg1LLGUDTw) last year that currently has fewer than 100 subscribers, but we hope with the addition of some new content we can grow the subscriber base for the account (and qualify for an easier-to-remember URL!).

Hot Bat Topics The ACBP will be debuting a series of short videos on several "hot bat topics" that we will be promoting and making available on our YouTube channel. These gorgeous video shorts run

between 2-3 minutes long and have been beautifully produced by our own Jason Headley. Funding for the videos and other initiatives in the Edmonton area was provided by the Edmonton Community Foundation.

Illustrated Activity Booklet In cooperation with Alberta Environment and Parks, we produced an illustrated activity booklet that is now available on our website www.albertabats.ca/resources. We thank local graphics designer Jeremy Vanderweide, who we contracted for the many amazing designs in this booklet.

Bat Friendly Farming Initiative We received funding from the Calgary Foundation to support a new project called the "Bat-friendly Farming Initiative" (to run between September 2020 to September 2021). Our plan is to survey farmers in Alberta to determine what their opinions and practices are regarding bats and to determine if there are better ways of engaging this group. Included in the project will be outreach events and materials (a brochure to be made available online) and a campaign to collect bat guano for studies of bat diets and other projects planned for the next few years. An offshoot to this project is our "Bats and Cows" project that has already started in cooperation with the University of Calgary (UofC). A DVM student under the supervision of Dr. Mathieu Pruvot (Faculty of Veterinary Medicine) will be monitoring bat activity near cattle for the summer of 2021 at a university research ranch (W.A. Ranches) north of Cochrane. The project is coordinating equipment and expertise from the bat program, with additional support from Dr. Robert Barclay of the University of Calgary and equipment loaned from the Alberta Biodiversity Monitoring Institute. A third professor from the UofC plans to be involved in a side project to sample insects in the vicinity of bat acoustic monitoring stations.

Pest Control Operators Survey and Brochure The ACBP was contracted late in 2020 by Environment and Climate Change Canada (ECCC) to conduct a survey of Pest Control Operators (PCOs) in Alberta and Saskatchewan. The objectives were to determine the types of practices used by PCOs, evaluate the level of support for bat conservation efforts, and to identify if there was need for new training opportunities, guidelines, and outreach specific to the industry. The results of this survey have been completed and the report has been submitted to ECCC. The project also produced an 8-page brochure for PCOs in Alberta and Saskatchewan and a narrated slide presentation on bat basics and how to conduct a bat-friendly bat exclusion. These will all be made available on our website under www.albertabats.ca/pco.

Guano Submissions and Roost Database Results are now in for the genetic analysis of 2020 submissions of guano to the citizen science program. A total of 47 samples were analyzed in 2020, which now brings the database of roosts in Alberta with species confirmed via DNA barcoding to over 220. Little Brown Myotis consistently dominate submissions, being present at about 86% of reported roosts. Big Brown Bats comprise most of the remaining observations (present at about 14% of reported roosts), although Long-legged Myotis (in the west) and Silver-haired Bats are also occasionally detected. We would especially like to thank Highway 2 Conservation, Edmonton and Area Land Trust, Waterton Biosphere Reserve, Ellis Bird Farm, Darcey Shyry and the Lakeland College Environment Club, and many individual contributors for submitting these observations. Results have been summarized in a poster presented at the Alberta Chapter of the Wildlife Society conference in March 2021 (available at

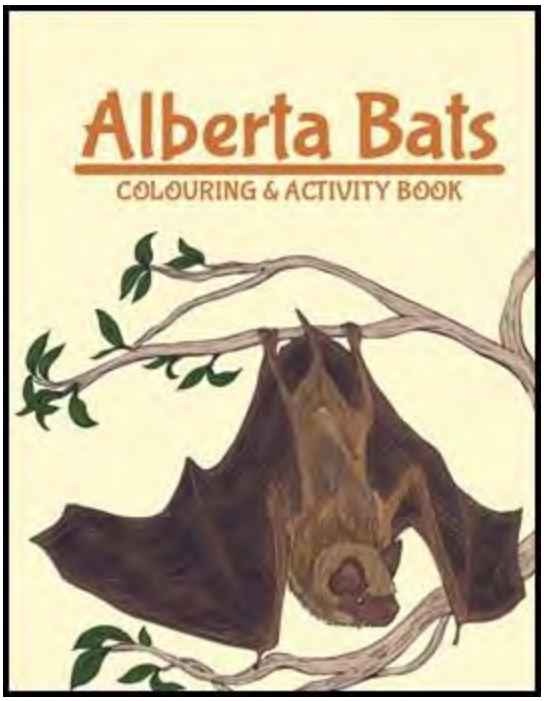
www.albertabats.ca/resources). Additional bat observations are reported through iNaturalist and the Neighbourhood Bat Watch Project (batwatch.ca).

The roost database has proven invaluable for enabling several projects that have been ongoing over the last few years, as well as additional projects we plan to start in the next year or two. New in 2021, we are going to sample guano at a subset of these roosts for Pd (*Pseudogymnoascus destructans*) surveillance, as well as additional samples for dietary analysis and other projects. We will also continue temperature and relative humidity monitoring at bat boxes, bat condos, and building roosts, which we have been conducting over the last several years.

Bats and Bridges In 2021, we will begin an exciting project examining use of bridges by bats in both Alberta and Saskatchewan. This project is running as a collaboration with many different government agencies, organizations and volunteers. Bridges are potentially important roosting habitat for bats, yet have received little attention as priority sites for bat conservation. The results of this project are expected to provide insight into how bats are using bridges and what bridge characteristics are attractive to bats. Sites with bats are expected to be important for white-nose syndrome surveillance and can be ideal targets for monitoring programs. DNA barcoding of guano found at bridge sites is expected to provide insight into bat distributions across western Canada, which could include a wide range of species given the likely use of these features as night roosts. Even though we are just beginning to survey bridges, we have already found several with obvious signs of bats, and we anticipate that many more will be discovered over the next year or two. Pending funding, the project will occur across Alberta and Saskatchewan (and a similar project is occurring in BC), but will prioritize the mountain parks, the far south, and other regions with gaps in species inventories. **BatCaver** The Alberta BatCaver program is continuing to identify caves in Alberta that are being used by bats. Roost Loggers were deployed at three cave systems in Alberta's Rocky Mountains over the last year. Two of these had guano, but not previously known to have overwintering bats. Roost logger data will be retrieved in the next year to determine if overwintering bats are present. During 2021, we plan to make a return visit to a newly discovered cave hibernaculum in the Rocky Mountains to collect additional data needed to confirm prior genetic detection of Californian Myotis or Western Small-footed Myotis. These two species cannot currently be differentiated using DNA barcoding, although we are hoping this can be resolved soon. A return trip to a boreal cave in northern Alberta is also planned so that we can retrieve monitoring equipment already deployed. We are tremendously grateful to the volunteers and partnering organizations that we have worked with over the last several years. Funding for 2020 was provided by the Edmonton Community Foundation, Calgary Foundation, Environment and Climate Change Canada (Habitat Stewardship Program), Chawkers Foundation, Alberta Environment and Parks, the Alberta Conservation Association, and public donations.

*1 - **'Batsby' a Hoary Bat rescued by a local wildlife rescue society cannot fly but is now an ambassador for bat conservation as part of the Alberta Community Bat Program.***

*2 - **Jason Headley filming old building roosts east of Edmonton for the bat video project.***



*3 - **Alberta's new activity booklet for bats.***

*4 - **One of several Bat Houses in Dillberry Lake Provincial Park installed and monitored by the Lakeland College Environment Club (photo contributed by Darcey Shyry).***

*5 - **A bridge site used by Big Brown Bats north of Edmonton.***

*6 - **Big Brown Bats using a bridge site north of Edmonton.***

*7 - **A large Little Brown Myotis maternity colony roosting between the expansion joints of a bridge in Saskatchewan. As many as 500 mature bats were estimated to be using this bridge during summer counts.***

*8 - **A roost logger deployed by Greg Horn and Dave Critchley at a cave in Alberta's Rocky Mountains as part of the Alberta BatCaver Program.***

Alberta Provincial Update

Lisa Wilkinson, Species at Risk Biologist, Alberta Environment and Parks
(lisa.wilkinson@gov.ab.ca)

As with most jurisdictions, bat field work has been halted for the last year due to Covid concerns, so it was a quiet year. High priority bat work will be allowed in 2021 provided appropriate precautions are taken. Projects are being assessed on a case-by-case basis.

Fortunately, there have been no detections of *Pd* in Alberta, although testing has been limited to suspicious bat carcasses (of which there have been few). Pending funding, we hope to do some guano and environmental testing in the future. We continue to support outreach to caution people about accidentally transporting bats.

We have been working to review and update protocols for windfarm pre-and post-construction bat monitoring based on the latest science and are making progress, albeit slowly. It won't be long before the provincial hoary bat detailed status report is ready.

Big thanks to the Alberta Community Bat Program (ACBP) for continuing their excellent work to support bats. Covid didn't slow them down, and they have some exciting projects planned which you will no doubt read about in this issue.

Bats in my backyard: a citizen science project using the Echo Meter Touch 2 in Peace River, Alberta

*Courtney Hughes, *Alberta Environment and Parks, Grande Cache, AB,* Catherine Brown, MSc, *Edmonton, AB,* Natalka A. Melnycky, MSc*, Alberta Environment and Parks, Peace River, AB*Rolanda J. Steenweg, *Alberta Environment and Parks, Hinton, AB (*corresponding author: courtney.hughes@gov.ab.ca)*

Introduction

The boreal forest is a circumpolar ecosystem, spanning across the northern hemisphere. Boreal landscapes range from upland forests to lowland peatland areas, and are rich in resources such as coal, timber, and oil. Human population density in boreal Canadian communities are low compared to southern parts of the country, and economic activities are primarily based around natural resource developments, including forestry harvest, petroleum industry and agricultural expansion. These activities, in addition to disease risk from white nose syndrome, future renewable energy development (i.e., wind; Frick et al., 2017), and even climate change impacts (Cadieux et al., 2020), provide compelling rationale to collect robust data to monitor boreal bat species and support decision-making. Certainly, effective land management decisions are crucial to strike a balance between maintaining healthy and functioning populations and ecosystems, social wellbeing, current economies, and future resource availability.

While it is the responsibility of the Government of Alberta to deliver on evidence-based species management and land use decisions, the vast and remote boreal landscape and financial and human resource needs make monitoring boreal bat populations difficult. However, local citizens have increasingly expressed interest in helping scientists collect data and participate in stewardship activities (Aristeidou et al., 2017; Government of Alberta, 2020). Indeed, citizen science projects have increased over the years, particularly with the advent of smartphone-based applications and easy-to-use software (Blackburn and Unger, 2019; Zandstra et al., 2016).

Here, we outline key learnings from piloting a community-based citizen science project in Peace River, Alberta. Our goals were to spark curiosity and develop a greater public interest in boreal bat species, engage the public in data collection, and encourage active bat stewardship.

Methods

Peace River is a small community with a population of approximately 6,500 located 500 Km northwest of Edmonton, AB. There is little empirical evidence on boreal bat species in the region, though efforts led by Alberta Environment and Parks (AEP) staff are underway to contribute to base line data through the NA Bat program (Burgar, 2019). In addition to this, a partnership was formed between local staff with AEP, the Center for Boreal Research and Peace River Municipal Library to develop and test whether or not a citizen science bat project would be of interest in the community. This included developing and implementing public educational outreach sessions and loaning out Echo Meter Touch 2 (Wildlife Acoustics, 2021) acoustic recording devices.

Our first step in encouraging public interest in boreal bats, and launch the project, was to deliver two separate outreach presentations in May and July 2019, at the Northern Lakes College (NLC) Peace River campus through the Centre for Boreal Research, and at the Peace River Municipal Library. Each presentation was approximately 45 minutes long, with a 15 minute question period. Each presentation shared information on bat biology and ecology, local bat species and their habitat needs, conservation threats and actions, and a hands-on session describing how to use the Echo Meter Touch 2 devices. We also shared the contact information of the three regional AEP biologists leading the project, to encourage the public to connect with us at their leisure or need. By making ourselves accessible, we helped build positive relationships with community members, and were able to directly answer any questions about bats, including concerns regarding bat exclusion from infrastructure, responding to calls to physically remove bats from buildings, report deceased bats, and construct and install bat houses.

Seven smartphone compatible Echo Meter Touch units (four for iPhones and three for Android devices) were made publicly available to borrow from the library in a kit. This kit also included user instructions for the device, download instructions for the smartphone application, a data sheet to record species identified and their location, bat species information cards, and a headlamp to assist in nighttime work (Figure 1). Participants were encouraged to send recording data via email to organizers, and upon return of the kits to the library to pin their sampled location on a physical map posted at the main entrance and whether or not they recorded or observed bats. The pilot project ran between July to end of September, 2019.

Results

We engaged 83 participants during both information sessions, with 11 different participants signing out the kits at the library (Table 1). Of the signed out kits, three datasheets were returned with six observations of bats reported. However, no participants submitted the data collected using the Echo Meter Touch 2 units and smartphone application. That said, we did have 21 different bat monitoring locations pinned by participants at the library, of which included 18 sightings of flying bats (Figure 2).

As a result of this project, AEP biologists experienced a direct increase in calls from the public about bats and active engagement in bat conservation actions. This included 25 phone calls from community members seeking more information about bats and how to build and install bat houses; six calls resulting in site visits to physically remove live bats from structures; four calls seeking advice on

excluding bats from structures; three calls and two emails asking how and where to submit bat guano samples for DNA analysis for the Alberta Community Bat Program; and, the deployment of ten single chamber bat houses and five multi-chamber houses across the community. There was also one call asking for assistance to retrieve a dead bat from a home, which was submitted to the Federal Wildlife Health Unit in Edmonton, Alberta for disease testing. Prior to this project, local biologists were only sporadically contacted regarding bats in the Peace Region.

Discussion

Results from participation at the bat public outreach event (n = 83) and the number of kits signed out (n = 11) indicates that our project was of interest to community members, including the opportunity for hands-on engagement using data collection devices and active participation in stewardship and conservation actions. We consider our outreach event successful when compared to participation information on the Centre for Boreal Research's public science outreach series, where 20 participants at any one event was considered a success. We also suspect our outreach event increased public interest in bats and their conservation given the number of phone calls we received about live bats in homes or structures and interest to protect them, as well as reporting found dead bats and requests for information, construction or installation of bat houses across residences and the broader community.

While our two public outreach presentations were well attended, with high levels of interest expressed to participate, we did not experience high success in citizen scientists using the Echo Meter Touch 2 devices properly or at all, despite being signed out. One possible reason is that while the Echo Meter Touch 2 devices were of interest to citizen scientists, they were not available to use when people came to the library to sign them out due to limited number of kits available. Indeed, despite their keen interest, citizen scientists indicated they wished more kits were readily and more frequently available. In future, if finances allow, we will aim to purchase more Echo Meter Touch 2 units and kit materials, to address accessibility concerns and mitigate volunteer frustration and possible discontinuance of participation. Also, despite the devices and associated smartphone application being easy to use, this technology does not necessarily have a data collection and submission process that is simple to follow for all citizen scientists. Indeed, despite our training efforts, data was not properly recorded on the devices nor submitted for analysis. We suggest that in future training, a project-specific, clear and user-friendly graphic based manual is developed to clearly explain how the technologies work, and include comprehensive, plain language guidelines on storing, exporting and emailing recorded data. We also suggest that having one dedicated contact person act as direct and ongoing technical support for citizen scientists would be valuable, to follow-up with users as they sign out data, and assist in any troubleshooting. While we made ourselves available, citizen scientists may not have known whom to specifically contact if they experienced difficulties. Additionally, we suggest that future efforts engage with people periodically throughout data collection activities, such as organizing bat walks in specified locations, in order to model desired behaviors and provide technical assistance. Lastly, while we did include datasheets and instructions in the kits, for participants to record their observations, only three datasheets were returned (27% return rate). Based on discussions with library staff, they felt this may be attributed to younger participants taking the datasheets and not understanding what their purpose was. In future, we will suggest using a simplified datasheet that could be used by younger participants and ensure that training and consistent technical support are better understood and accessed.

Without the partnership between the Peace Regional Public Library, Center for Boreal Research, and Alberta Environment and Parks, this project would not have been successful. Together, we increased awareness, appreciation and active citizen engagement in boreal bat species and data collection, as well as encouraged bat stewardship actions. The local library was a particularly important partner, providing a family-friendly space for educational outreach, display of bat reading materials, storage, sign-out and coordination of kits, and a local map to pin observation locations (Figure 2). There is great potential for expansion of this program into other libraries, or into local schools.

Ultimately, our project was successful at garnering interest and active participation, albeit with limitations, in bat citizen science and conservation efforts. We learned that for citizen science projects to be successful, continued public engagement with strong project coordination and leadership, and specific and relevant guidelines and materials, are necessary (Government of Alberta, 2020; Phillips et al., 2018). We recommend that future initiatives similar to ours develop a plan of action for ongoing outreach beyond the initial project launch, with clear identification of roles, responsibilities, key contacts and participant expectations, and include ongoing hands-on demonstrations and engagement with citizen scientists. Indeed, we found of those citizen scientists that did actively participate were keen to continue to do so in future, and expressed interest in other bat-related activities (i.e., bat house construction and monitoring). It would therefore be prudent to capitalize on this interest and perhaps seek opportunities for keen citizen scientists to become community champions for the project.

We do note that the Covid-19 pandemic posed a significant challenge in 2020 project implementation, particularly related to conducting any in-person outreach events and even kit use (i.e., sanitation needs, public library closures). In the future, considerations should include the routine sanitation of kits (including laminating paper forms), wearing masks, and physical distancing. That said, we do acknowledge the benefits that outdoor activities can have on mental and physical well-being, and suggest that our bat citizen science project is one way to positively contribute to this.

Overall, our project has provided local AEP staff and partners an excellent opportunity to engage the public and collect information on the elusive but important boreal bat species across the Peace Region. Additionally, we demonstrate that citizen science can be used to help achieve bat conservation goals. Now more than ever, with the increasing risks to bat species across North America, we need to dispel myths and work together to conserve and maintain these special animals and their habitat.

Acknowledgements

We would like to thank Centre for Boreal Research for providing the Echo Meter Touch 2 units and the kits, as well as to thank Rielle Massey-Leclerc, Center for Boreal Research and Cindy Roy, Peace River Municipal Library for their contributions to the project.

*9 - **Figure 1.** The bat kit, including Echo Meter Touch 2 unit, user instructions, bat keyring, datasheet, headlamp, and biologist contact information. Smartphone not included but shown for illustration purposes. Photo courtesy of the NAIT Centre of Boreal Research.*

Program Component	Timeline	Location	Community Engagement
Community Presentation "Bats in the boreal"	May	NLC Campus	35 attendees
Community Presentation "Bats in my backyard"	July	Peace River Library	48 attendees
Kit Sign-out	July - September	Peace River Library	11 Sign-outs
Pinned Map Data Collection	July – September	Peace River Library	21 pins (18 sightings, 3 non-sightings)
Data Sheets Submitted	July - September	Peace River Library	3 sheets returned, 6 observations
App Data Emailed	July - October	NA	0

*10 - **Table 1.** Community engagement of throughout each component of the project.*

*11 - **Figure 2.** Public bat sightings in the Peace Region, as indicated by participants on a pin-map at the Peace River Library. Yellow pins indicate sightings, gray 'X' indicates no sightings during a search. Image courtesy of the Centre for Boreal Research.*

Literature Cited

Aristeidou, M., Scanlon, E., and Sharples, M. 2017. Profiles of engagement in online communities of citizen science participation. Computers in Human Behavior, 74: 246-256. DOI: 10.1016/j.chb.2017.04.044.

Blackburn, A.G. and Unger, S. 2019. Smartphones as a Non-Invasive Surveying Tool to Monitor Bats. *Journal of Young Investigators, 37*(3): 24-30. DOI:10.22186/jyi.37.3.24-30.

Burgar, J.M. 2020. North American Bat Monitoring Program, Alberta 2019. Alberta Environment and Parks, Government of Alberta, Canada.

Cadieux, P., Boulanger, Y., Cyr, D., Taylor, A.R., Price, D.T., Sólymos, P., Stralberg, D., Chen, H.Y.H., Brecka, A. and Tremblay, J.A. 2020. Projected effects of climate change on boreal bird community accentuated by anthropogenic disturbances in western boreal forest, Canada. *Diversity and Distributions, 26*: 668-682. DOI: 10.1111/ddi13057.

Frick, F., Baerwald, E.F., Pollock, J.F., Barclay, R.M.R., Szymanski, J.A., Weller, T.J., Russell, A.L., Loeb, S.C., Medellin, R.A. and McGuire, L.P. 2017. Fatalities at wind turbines may threaten population viability of a migratory bat. *Biological Conservation, 209*: 172-177. DOI: 10.1016/j.biocon.2017.02.023.

Government of Alberta, Ministry of Environment and Parks. 2020. Citizen Science Principles of Good Practice. Accessed April 1, 2021. Available: https://open.alberta.ca/publications/9781460146514.

Phillips, T., Porticella, N., Constas, M. and Bonney, R., 2018. A Framework for Articulating and Measuring Individual Learning Outcomes from Participation in Citizen Science. *Citizen Science: Theory and Practice*, *3*(2). DOI: http://doi.org/10.5334/cstp.126.

Zandstra, A.M, Devilee.,J.L.A., Snik, F., Burrmeijer, F. and van den Broek, J.M. 2016. Citizen science on a smartphone: Participants' motivations and learning. Public Understanding of Science 2016, Vol. 25(1) 45–60. DOI: 10.1177/0963662515602406.

Bats helping pasture-raised cattle

submitted by **Grant Smith,** *grantallansmith@gmail.com*

I built bat houses this winter for a fun project. I have 4 Bat boxes up around my yard to help with automatic and natural bug population control. I built these boxes to go further out in my pastures. I raise beef cattle and I believe putting these boxes up will give my cattle more comfort and therefore better gains. Win win for the bats and the cows. I will send some pics once I get them put up. I hope to put a couple next to a couple ponds we are developing. My goal is to take bat houses to each of the pastures I rent or own. I believe a well constructed bat box will last 20 Years. I could imagine the amount of bugs that would be eaten in that time.

I live in Bentley Alberta and if you are ever looking for someone to work with I would be happy to help in any way I can. I am on twitter as @brushhills

12 - Bat houses being constructed this winter by Grant Smith in Bentley, Alberta

British Columbia

BMN Bat Conservation Program Update

Article and photos submitted by John Saremba (*johnsaremba@gmail.com*), Burke Mountain Naturalists Bat Program Coordinator

Over the winter and early spring, preparations have continued for the upcoming emergence of bats and their return to our area. Although formal events conducted through our Burke Mountain Naturalists (BMN) club were suspended due to COVID-19 health restrictions, several volunteers and I have been able to continue with various bat conservation-related tasks. These have been done on an informal basis as individual activities and independent of BMN. And going forward, until the COVID-19 restrictions ease, our bat program activities will be conducted on an individual basis or at most as informal, non-BMN small group sessions with the appropriate health measures.

Bat Program Highlights

Highlights of our recent bat conservation activities are noted as follows:

- In early March 2021, Metro Vancouver Regional Parks (MVRP) staff and volunteers modified the major bat box structure at Colony Farm as part of a roost management plan for this maternity bat colony. The modifications involved replacement of two of the seven-chamber boxes on this structure with two new bat boxes. One of the original bat boxes and a new bat box were installed on the structure's back side. This was done to provide more microclimates for the bats

to choose from during different weather conditions. And the existing bat boxes were re painted in a brown color with additional ventilation added to reduce potential concerns with overheating in the boxes (see Photos 1 and 2).

- And this year, we partnered with a local school in Coquitlam in a very rewarding nature project. Since last November, we have supported development of a bat conservation project for the Coquitlam S.D. #43 Grade 9-12 Encompass alternate school program. This support enabled the school to receive a $500 grant from the WWF Canada Living Planet@School Project program to cover some of the expenses for this conservation project. Gord Mayenburg and I have really enjoyed collaborating with school officials (i.e., Karin Leathwood and Scott Romano) in helping them to develop this project, which includes bat education materials. As well, we were able to support their plans to have students directly involved in the construction and installation of bat boxes at a site on their school property.

- Based on extensive discussions and several field trips with Karin and Scott, we determined a suitable location for the bat boxes installation in a small forested area at the school grounds. On March 10th and 17th, with special permission from the school, Gord and I had the pleasure of working with a group of very enthusiastic Grade 9 to 12 Encompass program students. The students did a great job in installing the artificial bat roost structure at the Vanier Centre school grounds in Coquitlam. They first attached two bat boxes to a tall yellow cedar post, which they then helped erect near their school (see Photo 3). During the second work session, the students attached predator guards and bat guano trays to complete the roost installation (see Photo 4). As part of the project, we also provided the school with 26 wooden bat cut-outs for the art class students to paint and then mount on the school fence.

- The value of this type of collaboration and partnership extends well beyond the creation of new bat habitat. Our club received praise from school officials for contributing to the overall wellness of the Encompass program students – by inviting and supporting them in working with their hands, setting goals and achieving them, getting outdoors, collaborating with their peers and the community, and generally just coming together for the greater good of the students, community, and all of its creatures.

- Even though the COVID-19 pandemic has limited our ability to do outreach activities for bat conservation, we have been able to conduct another education activity. In mid-April, I had the pleasure to conducting an outdoor nature session with two different elementary classes, which were held at Blakeburn Lagoons Park in Port Coquitlam. One of the wonderful of this nature park is the ability to use it as an amazing outdoor classroom for a wide range of students - all the way from elementary school-age children to university graduate students. Doing the outdoors sessions on one of the large observation platforms at the park enabled the students and me to maintain safe physical distance while talking about bats, bees and bats. Bringing along props such as a mason bee box, Flicker bird nest box and our program's take-apart bat box seemed to attract the students' interest in the discussions.

- So a big thank you to the teachers at Blakeburn Elementary and Terry Fox Secondary School for taking the initiative to have their classes visit the park and experience its amazing wildlife and vegetation at this nature space. This is truly a very important benefit and value in having such a feature in our community.

- I have also continued to respond to requests regarding technical advice and support in the design, installation, and maintenance of bat boxes from other organizations and individuals in the Metro Vancouver area. This has enabled the planned installation of several new artificial bat roosts in the Tri-Cities area and elsewhere.
- In preparation for the return of bats to our local area, we have been inspecting various artificial bat roosts to check on their condition and performing any required maintenance. To date, we have examined bat roosts at Blakeburn Lagoons Park, Mundy Park, Coquitlam River Park, and a private residence in Pitt Meadows.
- As part of roost surveys, where required, we have repaired or enhanced the bat boxes to improve their functionality. At Blakeburn Lagoons Park in Port Coquitlam, early this year with approval from Port Coquitlam Parks and Recreation department, Gord Mayenburg and I repaired a bat rocket box, which was extensively damaged by a Northern Flicker. Pieces of cedar board were put overtop the damaged sections of the rocket boxes (see Photo 5). We also tested a new method of installing predator guards on a bat box post with polycarbonate material put on narrow wood strips to create a narrow gap and reduce the accumulation of moisture between the bat post and the polycarbonate material (see Photo 6).
- Another example of such roost enhancement was the addition of two braces for a major bat roost at a private residence in Pitt Meadows. This should help stabilize this roost structure, particularly with a custom-built awing placed on top of the post to reduce potential overheating of this series of bat boxes (see Photo 7).

13 - Photo 1: Front-facing side of Colony Farm bat box array

14 - Photo 2:Front-facing side of Colony Farm bat box array

15 - Photo 3: Initial work session to install bat boxes at Vanier School

16 - Photo 4: Completion of bat structure installation at Vanier School

17 - Photo 5: Bat box repair to cover up holes created by Northern (Blakeburn)

18 - Photo 6: Predator guard strips mounted on narrow wood material (Blakeburn)

19 - Photo 7: Braces attached to bat post (Pitt Meadows)

UPDATE FROM WCS CANADA's BC BAT CONSERVATION PROGRAM

Submission by Cori Lausen (*clausen@wcs.org*)

WCS Canada's Bat Program Communications

One year ago, we launched our **WCSbats.ca** website -- a big thank you to WCS Canada's Dana Blouin for designing and updating this. We are grateful to all of our partners and funders who make our bat research and conservation program possible.

Also a big thank you to Dana for acting as webmaster for the bcbat.ca website. This site now posts all WCBN newsletters here: https://bcbat.ca/links/

In Feb. 2021, WCS Canada welcomed Cory Olson on as official WCS Canada staff – Cory has been developing and administering the Alberta Community Bat Program as a contractor now for several years. Cory will continue to work on the ACBP as part of this larger Alberta Bat Conservation Program (see Alberta section of newsletter).

In the past year, WCS Canada delivered several webinars on use of bat boxes. You can check these out here.

Follow us on Facebook @wcsbatscanada or Twitter @wcscanadabats

NABAT in BC – Five Years of Monitoring Yields Solid Baseline Data

Despite COVID, and thanks to a growing number of dedicated Grid Leaders and multiple partners (including substantial participation from BC Parks), there were 51 NABat grid cells monitored in 2020. For the grid cells that started in 2016, we now have 5 years of monitoring! This is a milestone worth celebrating!

The North American Bat Monitoring Program was designed in 2015 (www.nabatmonitoring.org) with the goal of assessing the state of the bats in US and Canada beginning 5 years after data collection. Five years is likely to provide a robust baseline and facilitate detection of trends amongst interannual variation. Here in BC more than 20 grid cells have 5 years of data, and working with statistician Carl Schwarz, we have preliminary trend analyses completed. Final species diversity and relative abundance

analyses are anticipated in May 2021, which may influence some methodology starting in 2021. Stay tuned for more!

In the meantime, the NABat data are informing other projects and updating provincial resources. WCS Canada's Jason Rae worked with BC's Conservation Data Centre to update range maps based on NABat data. The most noteworthy range expansions have been: Spotted Bat, with new records in the Skagit and Rock Creek areas; Fringed Myotis with detections in Kimberley and Premier Lake, extending this species into the East Kootenay, and a detection of Coastal Fringed Myotis in Stave Lake area; and Eastern Red Bat, which continues to pop up all over the province, the most western to date are recordings near Terrace and several detections near the Washington border in South Okanagan and Skagit. Updated range maps will be included in the new BC Bats book (2nd Edition).

Are partners in NABat are too many to list here, but you can find a list on our website and we thank our major funders Environment Canada and Climate Change, Fish and Wildlife Compensation Program, Habitat Conservation Trust Foundation, Forest Enhancement Society of BC and BC MOECSS and BC Parks.

Publication of WNS Survivorship Modelling Work

After several winters of recording arousal rates and metabolic rates of bats in late fall and early winter, we have finished all analyses and models! Thanks to partners at Western University (Liam McGuire), Texas Tech University (Nathan Fuller), Conservation Science Partners (Meredith McClure), Massey University in New Zealand (Reed Hranac and David Hayman), WCS (Sarah Olson), Montana State University (Raina Plowright, Katie Haase), and University of Winnipeg (Yvonne Dzal). Two papers have been published (see Publications section of newsletter), 2 are in press and 2 in review. Stay tuned!

Continental Bat Box Best Management Practices and Critical Investigation of Bat Boxes

This project continued through 2020 although field work was restricted to remote sensing, in particular logging temperature and humidity conditions in bat boxes and building roosts, along with a measure of occupancy (eg. acoustic roostloggers and break-beam occupancy monitors). Emily deFreitas, Heather Gates and Susan Dulc maintained equipment in West Kootenay and Okanagan, and collected guano samples. Bat captures will resume this summer, to inform not only the Bat Box BMP but complete her final field season for her MSc at Thompson Rivers University. Sue will continue to examine health of bats in bat boxes and buildings, comparing body weights, growth of pups, reproductive success, bat box types, and more.

The continental Bat Box BMP is a collaborative effort of a large US-Canada committee. This is one of a series of BMPs produced as part of the Conservation and Recovery Working Group, and is being co-led by Cori Lausen and Jordi Segers. Individuals have contributed sections of the BMP, and the final draft is now being produced by Susan Holroyd. A document for review by the committee is anticipated to circulate in early summer, and the goal of finalizing by December. In the meantime, Cori Lausen has delivered a couple of webinars about the use of bat boxes and how 'context' may be more important than style, with this take home message about use of bat boxes post-eviction: "One is not enough. One bat box is like one tree. The building roost that bats are being evicted from is the forest. A single tree cannot replace a forest, just as a single bat box cannot replace a lost building roost." To hear webinars on this topic visit our website.

This bat box work and guidance document is being funded largely by the US Fish and Wildlife Service and ECCC's Habitat Stewardship Program, with local contributions from Kootenay Lake Local Conservation Fund, and Columbia Basin Trust.

New in 2021 is the National Bat Box Project. This is a collaboration between Canadian Wildlife Federation and WCS Canada. Karen Vanderwolf developed and is leading this project. She will be joining WCS Canada as a postdoc later in 2021, but is not wasting any time in launching her project! Would you like to participate? …Learn more on our website, fill out the survey, or read the first project newsletter here.

Probiotic as a Prophylaxis for WNS

Field work continued in the greater Vancouver area in 2020. Aimee Mitchell and Chris Currie were passed the baton from Leah Rensel, who is finishing up her MSc at UBCO this spring. Although it was a late start due to concerns over the risk of reverse zoonosis of SARS-CoV2, Chris and Aimee were able to capture nearly 300 bats in late summer 2020, to continue PIT tagging and swab sampling bats' wings. They applied probiotic into roosts at the two 'test' sites – Colony Farm Regional Park and BC Hydro's Stave Lake. These sites each house large Little Brown – Yuma myotis colonies. Some of the roosts used by these colonies are bat boxes, and probiotic is easily sprayed into the chambers of these boxes using a light mist of water followed by a spray of bacteria-laden clay powder. This year's application was modified slightly from the pilot in 2019 – instead of using a can of compressed air (like what you'd spray a computer keyboard with), Chris and Nicolas Fontaine (MSc student, TRU) decided to try a bicycle tire hand pump, and it worked really well! More environmentally friendly and ultimately this might be cheaper for this WNS mitigation to be upscaled, assuming that some of the bat box owners or citizen scientists who deploy this probiotic will already have bicycle tire pumps that can be used.

The probiotic consists of 4 bacteria that inhibit the growth of *Pseudogymnoascus destructans, Pd.* The 4 we have selected are all members of the *Pseudomonas fluorescens* complex. They are found in soils and have been shown by others to be effective at reducing the mortality caused by WNS during winter (see Hoyt et al. 2019).

The strains cultured by Thompson Rivers University (N. Cheeptham's lab) and shown by McMaster University (JP Xu's lab) to have synergistic activity against Pd, were discovered among wing swabs from more than 300 bats of 13 species in BC. Although 2020 data are still being analyzed, to date we have determined that one of the bacterial components of the probiotic cocktail does extremely well in bat boxes and on bat wings in summer, and another increases thousands of fold on wings of bats in hibernation, suggesting this is an effective combination for the prevention of WNS. However, what is still missing from our analyses is a measure of efficacy. Nicolas is working with our collaborator Dr. Kevin Keel from UC Davis to measure Pd spore germination rate on 'live bat skin' with and without probiotic bacteria present. Using tissue explant chambers invented by Keel's lab, many small pieces of a freshly euthanized bat can allow skin cells to remain alive for testing. We are taking this approach in lieu of needing to infect many bats in captivity with Pd. This explant experiment is slated to be competed in late spring 2021.

In the meantime, our question of how well our probiotic reduces WNS-caused mortality is a trickier one to get at, since we do not yet have WNS in our Vancouver study area. Bats from 4 colonies are being PIT-tagged so that survival rates of treatment versus control colonies can be compared, but in the meantime,

we are working with the Washington Department of Fish and Wildlife to start monitoring Pd positive colonies in Washington with the goal of receiving US permitting to apply probiotic there in 2021. This may also be used in combination with the WNS vaccine (Rocke et al. 2019), as our clay application method would work for both of these prophylaxis approaches and between the two of them, may provide a greater level of protection to a large portion of a maternity colony.

This project's success to date is due to the efforts of a large team of people that I can't possible list here, but would like to acknowledge some of the major contributions in the field and lab from: Chris Currie, Aimee Mitchell, Leah Rensel, Patrick Burke, Danielle Dagenais, Robyn Worcester, Greg Michalowski, John Saremba, Nicolas Fontaine, Adrian Forsythe, Heather Yoell, Ann Cheeptham, JP Xu, and many more. Major funders of the probiotic project have been US Fish and Wildlife Service, National Fish and Wildlife Foundation (Bats for the Future Fund), Environment and Climate Change Canada, Habitat Conservation Trust Foundation, BC MOECSS, and Fish and Wildlife Compensation Program. We are grateful to the project advisory committee that helps us to navigate this novel and time-sensitive research: Dr. Glenna McGregor, Dr. Helen Schwantje, Orville Dyer, Dr. Leigh Anne Isaac, Mandy Kellner, Dr. Purnima Govindarajulu, Dr. David Sedgman, Dr. Craig K.R. Willis, Dr. Yvonne Dzal. We thank Helen for all of her help and wish her the best in retirement, and welcome Dr. Caeley Thacker to the committee starting in April 2021.

Bat-friendly Forestry Projects

A bit eclectic in our beginning phases, WCS Canada is starting to incorporate more forestry projects into our program. For example, Darcie Quamme and Erin McLeod discovered there were long-eared Myotis bats sometimes found in the pheromone funnel traps for monitoring Douglas-fir beetle. Luckily there is an easy solution to this – wire mesh over the traps to keep large creatures out but still allow beetles to enter. To learn more, see the presentation here.

While bat boxes are commonly deployed as roost enhancement or mitigation for habitat loss, few species use these structures (mainly the building-roosting Little Brown, Yuma Myotis and Big Brown bats). However, because bark provides natural habitat for at least 9 species of bats in BC, it stands to reason that simulating bark roosting habitat could enhance habitat or mitigate for habitat loss, benefiting many more bat species. Emily de Freitas, UNBC MSc student under supervision of Dr. Erin Baerwald, will be examining use of Branden Bark by bats, with focus on use by silver-haired bats. This research is a collaboration with WCS Canada, and Okanagan Nation Alliance, and will begin in May 2021. We also installed and will monitor bark pole roosts in the Golden area – details in the Kootenay Connect section below.

Emily de Freitas is also conducting a radio-telemetry project in the Smallwood/Garrity area above Beasley. In her first winter field season Emily tracked 13 silver-haired bats, some of which used rock crevices, some used trees and some used the Queen Victoria mine for hibernation. In total, she located 13 tree hibernacula, and four rock crevice hibernacula. Emily will radiotrack silver-haired bats in this same location this summer to determine if they select similar trees in summer as in winter. This work is being funded in part by Habitat Conservation Trust Foundation, Forest Enhancement Society of BC, and Fish and Wildlife Compensation Program.

Kootenay Connect

The Kootenay Connect project is a giant collaborative project in the East and West Kootenay involving 31 species at risk, including Little Brown and Northern Myotis. As part of our contributions to thanks project in 2020 and 2021, WCS Canada established 3 new North American Bat Monitoring (NABat) grid cells – one in Bonanza Wetland Corridor and two in the Columbia Wetlands. We have now established at least one NABat grid cell in all four of the major Kootenay Connect wetland corridors (Hills Bonanza, Wycliffe, Columbia Wetlands, and Creston), in addition to one cell in a minor Kootenay Connect corridor (north end of Kootenay Lake).

We also installed two pilot bark pole roosts north of Golden as potential habitat enhancement for Northern Myotis. These pole roosts were erected by local landowner Sigi Liebmann in collaboration with WCS Canada and Integrated Ecological Research's Darcie Quamme. A mistnet inventory will be needed to confirm presence of Northern Myotis in the region, and is tentatively scheduled for 2021, pending the lifting of COVID restrictions. Species at risk captures will inform siting of at least 8 more pole Branden Bark roosts in the Columbia Wetlands. To learn about this project, check out the project video here.

Editor's Note: **Cori Lausen submitted a list of new articles. Please visit the Recent Literature and Resources section of this newsletter for the full references.**

20 - Emily de Freitas scoops bat guano from under a bat box in Creston area in summer 2020 as part of the bat box research being conducted by MSc student Susan Dulc, Thompson Rivers University. Photo by Heather Gates.

21 - Silver-haired bats hibernate with Californian Myotis in late winter inside Queen Victoria mine near Beasley. Photo by Heather Gates.

22 - Emily de Freitas (MSc, UNBC) radiotracks a silver-haired bat to locate its tree hibernaculum near Beasley, January 2021. Emily found bats moved from bark into hollow cavities during periods of extreme cold. Photo by Heather Gates.

23 - In October 2020, Cori Lausen and Darcie Quamme worked with local landowners and volunteers to install two bark pole roosts. This one is made of large overlapping slabs of Douglas-fir bark, designed and constructed by Sigi Liebmann, owner of International Timberframes. Another pole roost (not shown) was commercial BrandenBark fake bark (Copperhead Consulting). Read more about this installation in the Golden Star.

Winter and summer tree roost use by the silver-haired bat in Southern British Columbia

Emily de Freitas, MSc student, University of Northern British Columbia and the Wildlife Conservation Society of Canada (*emdefreit@gmail.com*)

I am working on a Masters in bat ecology under the supervision of Dr. Erin Baerwald at the University of Northern British Columbia and in partnership with Dr. Cori Lausen at the Wildlife Conservation Society of Canada. My project aims to investigate seasonal changes in roosting ecology in silver-haired bat (*Lasionycteris noctivagans*). We hope to characterize differences in tree roosts used in the winter to those used in the summer by this species.

Starting in December, 2020, a primary season of data collection was conducted outside of Nelson, British Columbia. Free-flying bats were captured exiting an abandoned mine in which they hibernate and fitted with temperature sensitive transmitters. Bats were then tracked to trees in the adjacent forest. Lotek datalogging receivers were placed outside of tree roosts to measure skin temperature, and HOBO temperature and humidity sensors were placed in tree roosts to assess microclimates. These data, along with tree roost habitat assessments will be used to analyze roost preference.

A replicate summer field season will begin in mid-May, where we hope to put out more transmitters and identify summer tree roosts. With the support of the Okanagan Nation Alliance, we will be installing Brandenbark™ in the recently logged forest adjacent to the mine. We will compare microclimate of the artificial roosting structures with natural roosts used by silver-haired bats and assess suitability as habitat compensation.

This project was made possible by financial and technical support from the Wildlife Conservation Society of Canada, and the University of Northern British Columbia. I would like to thank Heather Gates, Tory Rhoads, and the volunteers who made this first field season a success, and who agreed to carry heavy batteries through the snow.

24 - A large ponderosa pine used by a silver-haired bat. This individual stayed in this tree despite -15°C ambient temperatures.

25 - A silver-haired bat being fitted with a transmitter.

Surveillance for the Brazilian Free-tailed Bat in Canada

Peter Ommundsen, Salt Spring Island Community Bat Program (*saltspring@bcbats.ca*)

Presence of the Brazilian Free-tailed Bat (*Tadarida brasiliensis,* TABR) at several locations in British Columbia has been inferred from visual examination of acoustic spectrograms, and there is interest in plotting the changing distribution of this species, which may be driven by climate change (McCracken *et al*. 2018). This bat is a fast flyer and may disperse hundreds of kilometres (Genoways *et al*. 2000).

Methods of screening for this species include acoustic surveys, camera trapping, mist-netting, and e-DNA sampling. The observations reported below pertain to acoustic methods.

Unique TABR search phase echolocation calls have a frequency upswing into the call and a frequency downswing out of the call, often with maximum amplitude near the start (Szewczak 2018). However, TABR may also emit quasi-constant frequency (QCF) pulses that mimic calls of the silver-haired bat, *Lasionycteris noctivagans* (LANO) (for example, Figure 2 of Jung *et al*. 2014).

Auto-ID software may fail to discriminate between the overlapping QCF call type of TABR and LANO, as is evidenced from recordings in which pulses attributed to both species occur within a single call sequence. There may be significant disagreement among software packages in species assignments among LANO, TABR, and the Hoary Bat (*Lasiurus cinereus*, LACI). The claimed precision of auto-ID based upon the manufacturer's training data may not apply to a novel field site (Clement *et al*. 2014).

I examined the auto-ID output of a sample of 639 British Columbia full spectrum acoustic files, all of which had received TABR sequence identifications by either or both of Sonobat 4.4.5 and Kaleidoscope Pro 5.14. Sonobat identified 429 sequences as TABR and Kaleidoscope Pro identified 251 sequences as TABR, with agreement on only 41 files (6.4 percent).

If Sonobat were 100 percent accurate, Kaleidoscope Pro would have missed 90 percent of true TABR files. If Kaleidoscope Pro were 100 percent accurate, Sonobat would have missed 84 percent of true TABR files. If the bats are scarce, their presence could entirely be masked by false negatives.

Software vendors are emphatic that automated identification is intended only to provide suggestions for visual vetting. To this end, the batch output of these programs flags not only the TABR sequence identifications, but also other files that may contain TABR pulses, and these files can be visually scrutinized. Also, if an acoustic survey were to show an unexpectedly high number of LANO and/or LACI automated sequence identifications, visual screening for TABR diagnostic calls may be fruitful.

Literature Cited

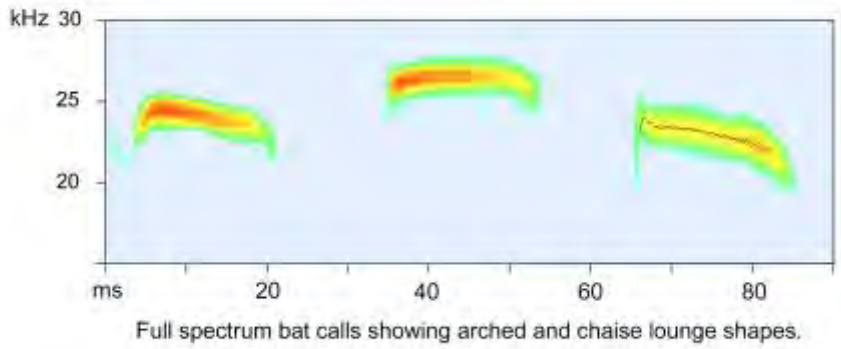
Clement, M.J., Murray, K.L., Solick, D.I. and Gruver, J.C. 2014. The effect of call libraries and acoustic filters on the identification of bat echolocation. Ecology and evolution 4:3482-3493.

Genoways, H.H., Freeman, P.W. and Grell, C. 2000. Extralimital records of the Mexican free-tailed bat (*Tadarida brasiliensis mexicana*) in the central United States and their biological significance. Transactions of the Nebraska Academy of Sciences 26:85-96.

Jung, K., Molinari, J. and Kalko, E.K. 2014. Driving factors for the evolution of species-specific echolocation call design in new world free-tailed bats (Molossidae). PloS one 9(1) p.e85279.

McCracken, G.F., Bernard, R.F., Gamba-Rios, M., Wolfe, R., Krauel, J.J., Jones, D.N., Russell, A.L. and Brown, V.A. 2018. Rapid range expansion of the Brazilian free-tailed bat in the southeastern United States, 2008–2016. Journal of Mammalogy 99:312-320.

Szewczak, J. 2018. Echolocation call characteristics of California bats. Humboldt State University Bat Lab.



26 - Full spectrum Brazillian Free-tailed Bat sonogram

Bat Habitat Restoration at Salt Spring Island, BC

Carrina Maslovat and Peter Ommundsen (*saltspring@bcbats.ca*)

During 2020, bat stewardship visits to landowners by the Salt Spring Island Community Bat Program were reduced due to the COVID-19 pandemic, and resources were diverted to habitat restoration on publicly accessible lands. Here we describe restoration of riparian habitat at the Coast Salish Xwaaqw'um Village on Salt Spring Island.

Historically, some 68 hectares of natural habitat at the Xwaaqw'um site were converted to agricultural fields and wetlands were drained. A long-term conservation goal is to restore much of the natural landscape.

An initial project in 2019 involved creation of a 660 square metre pond in a large fenced exclosure. The pond was designed by biologist Robin Annschild and constructed through cooperative efforts of the Stqeeye' Learning Society, Cowichan Tribes, BC Parks, BC Wildlife Federation, and numerous volunteers. Some planting of native sedges, rushes, shrubs, and trees occurred in the fall of 2019.

A seven-day bat acoustic survey in July 2020 by the community bat program detected nine bat species at the pond, and bat activity (number of acoustic files) recorded at the pond was 18 x that recorded in an adjacent pasture.

In the fall of 2020, the community bat program supported the work of a biologist (Carrina Maslovat) to manage the planting of emergent and riparian vegetation to maximize the value of the habitat for bats. Low profile plantings on an east-west axis allow a flyway for pond access, and north and south plantings provide optimum architecture for insect productivity. We will continue to monitor bat activity in future years.

Tree and shrub nursery stock was planted along with seeds collected from five species of native sedges and rushes. Species planted include Black Cottonwood, Black Hawthorn, Hardhack, Oceanspray, Salmonberry, and Snowberry. Thirty bales of barley straw were applied as mulch around plantings and on weeded areas where invasive species were removed.

This project could not have been completed without generous volunteer time contributed by many community members (156 volunteer hours), and without a Park Enhancement Fund grant to the Stqeeye' Learning Society for the purchase of native plants.

Acknowledgements

The Salt Spring Island Community Bat Program is funded by community donations and by the Habitat Stewardship Program of the Government of Canada, the Habitat Acquisition Trust Foundation, and the Forest Enhancement Society of British Columbia.

27 - Saltspring Island Bat Wetland Habitat Restoration, photo credit: Carrina Maslovat

BC Community Bat Program Spring 2021 Update

Mandy Kellner, BC Community Bat Program (*bcbats@gmail.com*)

For anyone not familiar with the BC Community Bat Program, our core goal is to promotes bat conservation through: *1) education and outreach to raise awareness of threats to bats and to recruit local bat stewards; 2) detection, protection and monitoring of bat roosts; 3) province-wide Citizen Science involvement to engage the public and detect population declines due to White-nose Syndrome and other threats; and 4) enhancement of habitat, including installation of bat boxes*. Funded by HCTF, FESBC, HSP, BC ENV, and many regional funders, we are excited to have already received some financial support for 2020/21 to continue this work!

Last year was a busy one – program partners responded to ~ 2000 inquiries on topics from managing bats in buildings to bat walks to COVID-concerns. A total of 997 bat counts were done in 2020. From Nov through now (and up until May) we are assisting with WNS surveillance through soliciting reports of dead bats, for submission for WNS/Pd testing. We also worked with a wonderful te am to host the BatMatters 2020 Virtual conference on Bat-friendly Communities, and celebrated Delta as BC's newest BFC.

This year will also be busy with our regular activities, but a few items to **highlight for 2021** are:

- Our refreshed website has launched! Still at www.bcbats.ca – but expect some reorganization in the year ahead. Comments and suggestions welcome.
- Continuing development of the Bat-friendly Community initiative – let us know if you are interested in learning more about this approach for your area.
- Completion of the BC Bat EduKit and sharing across BC. Find parts here: https://bcbats.ca/bat-basics/bat-resources-for-teachers-and-educators/ and/or email info@bcbats.ca
- Promotion of the 'Bats: Out of the Darkness Travelling Museum Exhibit' (In Peachland June-August!). https://www.kelownamuseums.ca/exhibits/bats-out-of-the-darkness/
- A Bat Ambassador Training Kit! Developed by the KCBP, this package has all you need to develop a Bat Ambassador Program in your area. Contact info@bcbats.ca

Getting more than we asked for – reports of hibernating bats in BC

Mandy Kellner, BC Community Bat Program (*bcbats@gmail.com*)

Sometimes there are unexpected benefits from targeted conservation efforts – in this case, learning about winter bats in BC. The BC Community Bat Program facilitates surveillance for white-nose syndrome by requesting reports of dead bats and unusual activity in winter months. This program receives ~200 calls and emails, including 20-30 dead bat reports, from November through early March.

What we also get are many interesting reports when people find bats hibernating on their properties. So little is known about where our bats spend the winter that each of these reports is of great value.

- In 2019/20, there were fifteen reports of bats that were hibernating in woodpiles in southern and coastal BC (data from 2020/21 will be available soon).
    - Reports were all from southern and coastal BC - Bella Coola (1 bat), Fraser Valley/Vancouver (3), Vancouver Island / Gulf Islands (5), and Sunshine Coast (6).
    - While bats in woodpiles are often Silver-haired Bats, in 2019/20 there were four Myotis reported, on the Sunshine Coast, Pender Island and in Bella Coola.
- There were eight reports of bats roosting for multiple days/hibernating in or on a house.

- These were in the Fraser Valley/Vancouver area, on Vancouver Island, on the Sunshine Coast, and in the Columbia/Shuswap.
- Locations included under roofing or flashing (2 bats), in basement or crawlspace (3), on a window (1), or in an exterior walkway (2).
- Bats in and on buildings were likely Myotis species, with one confirmed Townsend's. All of these reports add to the growing body of information that bats in BC do not use 'traditional' hibernacula in BC. Instead, bats may roost for the winter singly or in small numbers in cracks and crevices across the province. For example, ongoing research by WCSC/UNBC in the West Kootenay has found that Silver-haired Bats use mines, rock crevices, wood piles and trees (live trees and snags) as roosts during winter. Of course, finding bats in winter roosts that seem likely to be quite variable in temperature and humidity brings up questions. For example, how do the bats handle changing weather conditions? Do they stay for an extended period in these more exposed hibernacula, or shift roosts with the weather? We will look forwards to reviewing the bat reports from this winter and spring and to new research that helps shed light on winter bat behaviour.

28 - Silver-haired bat in a wood shed. Credit: Habitat Acquisition Trust.

Assessing Bat Use of Artificial Rock Roosts in Southwestern BC

Lorraine Andrusiak (*Lorraine.Andrusiak@snclavalin.com*) and Mike Sarell (*ophiucon@vip.net*)

Bat inventory and habitat enhancement was carried out in the Buntzen, Alouette, and Lower Stave areas in southwestern British Columbia in 2011, with funding provided by the Bridge Coastal Restoration Project (Andrusiak et al. 2011). The 2011 work included construction and installation of nine experimental artificial rock roosts (ARRs). The ARRs (approximately 40 cm wide and 51 cm tall) were designed and created by Mike Sarell, and were constructed from a mixture of concrete and fibre (Photo 1). Crushed rock was added to the inner surfaces to provide surface irregularities for bats to grip. Two of the ARRs had narrow wooden shelves glued under the entrance to catch guano so use of the roosts could be easily documented. The nine ARRs were installed on warm-aspect natural rock faces and on hydroelectric dams and associated infrastructure.

The objectives of the Projects described in this article are to:

› Assess whether the ARRs installed in 2011 have been used by bats;

› Establish the species of bats using the ARRs via DNA analysis:

› Describe the thermal regime of the ARRs and compare it to that of other artificial and natural roost types as described in the literature;

› Provide recommendations on modifications to the ARR design, installation methods and monitoring for future programs.

Nine bat species known or potentially present in the Buntzen, Alouette and Lower Stave areas in southern British Columbia could potentially use the ARRs, including the little brown myotis (*Myotis lucifugus*), a species listed as Endangered under the federal Species at Risk Act (*SARA*).

The ARRs were installed in the Alouette, Buntzen (Coquitlam), and Stave watersheds, in the Lower Mainland of BC. Four of the ARRs were installed on natural rock sites; including one on the side of a boulder on a talus slope. The remaining five ARRs were attached to manmade features (powerhouse wall, spillway, concrete buildings, retaining wall).

Each of the nine ARRs was visited at least once and its condition assessed. Guano samples were collected if available. A temperature logger (Hobo MX2300) was installed in each ARR where access was possible. The loggers were programmed to record temperature every thirty minutes.

Temperature data were downloaded from each logger after it was retrieved. Metrics calculated included the daily maximum and minimum temperature recorded by each logger and the daily temperature fluctuation (difference between daily minimum and daily maximum). A rough approximation of ambient temperature was obtained from Environment Canada (2018) temperature data (June 18 to September 29) recorded at the Malcolm Knapp Research Forest in Haney (station ID 1103332), which is located approximately 5 km southwest of the south end of Alouette Lake. Daily temperature maxima and minima for each ARR were plotted against the temperature maxima and minima for Haney to assess the thermal properties of the ARRs.

Each hour in which a temperature exceeding 40oC was recorded was termed an 'overheating event'. The number of days with overheating events was summed for each ARR. Temperatures above 40oC have been reported as critical for most temperate bat species as the temperature above which thermoregulation is energetically expensive (reviewed in Smith and Stevenson 2013).

The initial inspections of the ARRs were carried out on June 5-7, 2018. Eight of the nine structures were still in place; one had fallen from its attachment point and was reattached at its original location. All of the ARRs were in good condition. Temperature loggers were placed in the seven ARRs that were accessible. Two of the ARRs had guano shelves (narrow strips of wood mounted horizontally below the entrance; Photo 2) and guano samples were collected, indicating use of the ARRs by bats. Guano shelves were attached to the five remaining accessible ARRs on a subsequent visit.

The ARRs were visited on October 4-5, 2018 to remove the temperature loggers. Guano samples were collected from the guano shelves of five of the seven ARRs that were accessible.

Subsequent laboratory analysis of the guano samples was not highly successful at extracting DNA. DNA analysis of the guano identified bat species at three of the five ARRS at which DNA was collected; big brown bat (*Eptesicus fuscus*) and Yuma myotis (*Myotis yumanensis*) were identified at one ARR each and both species were detected at a third ARR.

Maximum temperature recorded within any ARR was over 58oC (ARR 2). The minimum daily temperatures within the ARRs generally exceeded the minimum daily temperatures recorded at Haney

by 1-5oC. Maximum temperatures within the ARRs could exceed the maximum daily temperature recorded at Haney by up to 28oC (ARR 2).

Days with overheating events (a day in which temperatures exceeded a critical temperature defined as 40 oC) were recorded at 6 of the 7 ARRs monitored. ARRs 2, 4, 6 and 8 had daily temperature fluctuations that exceeded 25oC at times, while smaller daily fluctuations were recorded at the remaining ARRs. Sample sizes were not sufficient to correlate height or aspect to temperature.

The design of the ARRs is successful at providing roost opportunities for bats. The structures installed in 2011 are being used by bats, based on the collection of guano at 5 of the 7 ARRs at which guano collection was possible (i.e., had guano shelves). Of those 7 ARRS, one of the roosts that had no guano was the structure that had fallen and was reattached.

Concrete boxes on concrete walls or rock faces with southern exposures clearly provide very warm roost sites, but there is risk of bats in these roosts overheating during high summer temperatures. The ARRs may be most useful to bats at the beginning and end of the bat active season when ambient temperatures are cool. Overheating of bat boxes has been reported in several locales and has also been documented in natural rock crevice roosts used by big brown bats (Lausen and Barclay 2002). Currently, it is not known whether overheating in bat boxes – or natural roosts - could be an actual threat to local bat populations or whether bats are usually able to switch roosts to escape high temperatures (Flaquer et al. 2014). Installing ARRs on both warm and cool aspects at a site should provide opportunities for roosting throughout the active season.

The ARRs were effective at moderating daily temperature fluctuations. The artificial rock roosts cooled slowly and remained warmer than ambient. Sudden drops in ambient temperatures did not result in comparable cooling of the roosts. This is likely due to the substrate that they were mounted on. Natural rock outcroppings and thick concrete have thermal inertia that resists sudden temperature changes. This property may be especially important for bats during spring and fall. Most wooden roost boxes are placed on sheds or trees and would not have a high degree of thermal inertia to protect the roost from sudden cooling.

The current ARRs are heavy (13-15 kg) and thus are cumbersome to install and difficult to transport to installation sites that must be accessed on foot. The weight of the ARRs also limits their size for easy installation without the need for lifting equipment and special attachment methods. Constructing ARRs of concrete mixed with Styrofoam ('styrocrete') would produce lighter structures (Good et al. 2013) easier to carry and to install, and may have increased insulative properties. Styrocrete is not as strong as regular concrete and must be reinforced with heavy gauge wire mesh. Adding additional chambers to the ARRs may provide a wider temperature gradient inside them and may lower the risk of overheating.

All of the nine ARRs remained in excellent structural condition although one mounting failed. Wooden bat boxes have a limited life span – especially in wet climates – as use of wood preservatives on bat boxes is not recommended (Tuttle et al. 2013). Concrete ARRs are watertight and draft-proof and do not require periodic caulking or painting. The useful lifespan of concrete ARRs is likely to far exceed that of wooden bat boxes as long as they are securely mounted to the substrate. Constructing ARRs out of lighter weight concrete mixes as discussed above would make them easier to attach and less likely to become detached from the substrate. A design that incorporates a vent may be needed for installation

sites in very warm climates in full sun exposure. Additional mounts on the frame would be useful for passage of bolts to anchor the box to concrete and possibly to rock.

This project was completed with financial support of the Fish and Wildlife Compensation Program on behalf of its program partners BC Hydro, the Province of BC, Fisheries and Oceans Canada, First Nations and Public Stakeholders. The full version of the project report is available at: https://www.researchgate.net/publication/334068038_Evaluation_of_Experimental_Artificial_Rock_Roosts_for_Bats

29 - ARR made of concrete fibre and rock crush

Literature Cited

Andrusiak, L., D. Nagorsen, and M. Sarell. 2011. Bat Habitat Enhancement Planning and Inventory at Buntzen, Alouette, and Lower Stave/Hayward Lakes. BCRP Project Number 10.W.SFN.01 Report to BC Hydro Bridge Coastal Fish and Wildlife Restoration Program.

Bideguren, G., A. Lopez-Baucells, X. Puig-Montserrat, M. Mas, X. Porres and C. Flaquer. 2018. Bat boxes and climate change: testing the risk of over-heating in the Mediterranean region. Biodiversity and Conservation https://doi.org/10.1007/s10531-018-1634-7.

Environment Canada. 2018. Historical Climate Data. http://climate.weather.gc.ca/historical_data/search_historic_data_e.html (accessed October 2018).

Flaquer, C., X. Puig, A. López-Baucells, I. Torre, L. Freixas, M. Mas, X. Porres and A. Arrizabalaga. 2014. Could overheating turn bat boxes into death traps? Barbastella 7:46–53.

Good, M., L. Raine, A. Sana and A. Wilkins. 2013. Materials Testing for an Innovative Green Product Aiming to Protect Endangered Species. Student project, Engineering Department, Lancaster University Faculty of Science and Technology.

Lausen, C., and R. M. R. Barclay.2002. Roosting behaviour and roost selection of female big brown bats (*Eptesicus fuscus*) roosting in rock crevices in southeastern Alberta. Canadian Journal of Zoology 80(6): 1069-1076.

Speakman, J., and D. Thomas. 2003. Physiological ecology and energetics of bats. Ch. 10 in T. Kunz and M. Brock Fenton (eds). Bat Ecology. University of Chicago Press.

Tuttle, M., M. Kiser, and S. Kiser. 2013. The Bat House Builder's Handbook. Revised. Bat Conservation International, Austin, TX.

Bat Matters 2020 Conference – Bat-friendly Communities

Danielle Dagenais for the BC Bat Matters Planning Committee - *article originally submitted to CWHC Bat Monthly*; (*dagenaisdanielle@hotmail.com*)

The second Bat Matters Conference, virtually centered in Richmond, BC, happened in September/October 2020 and was a huge success. The theme this year was Creating Bat-Friendly Communities. The conference was conceived to celebrate the City of Richmond becoming BC's third certified bat-friendly community, raise awareness of the program, and provide guidance and tools to help other communities become more bat-friendly. It also provided an avenue to inform local partners about bats and bat work being conducted in the region. The Bat Matters conference was originally planned as a 2-day event to be held in May 2020; however, COVID-19 restrictions on indoor events resulted in moving to an online platform. This change had a positive side by allowing more people to attend the event. The planning committee reached out to groups including bat biologists, government staff, bat enthusiasts, local environmental organizations, community groups, and residents living with bats to sign on to the conference and learn from one another. In the end this small conference grew to 137 registrants and 17 guests! The virtual conference was held September 28th to October 9th. It included 10 pre-recorded presentations (8-20 minutes in length), with featured daily presentations, and two moderated 90-minute online discussions on October 2nd and October 9th to review and discuss the material presented during the week. The presentations were delivered by specialists in the field

of bat research, conservation, and stewardship in BC. All presenters were available to answer participant questions. PDFs of the presentations are available on the BC Community Bat Program web site. The first week focused on bat-friendly communities and bat conservation. It provided a forum for local government staff and land managers from around the region to learn about the program, share information about bats, and identify work being done in the province to support bats, and discuss solutions that can address some of the challenges that bats face by developing bat-friendly communities. The second week focused on providing tools and information for becoming bat-friendly, and focussed on topics that receive many inquiries through the BC Community Bat Program. Presentations discussed living with bats, health risks associated with bats, bat boxes, and where to locate bat data. The BatMatters 2020 conference was hosted by South Coast Bat Conservation Society, BC Community Bat Program, Metro Vancouver Regional Parks, and Burke Mountain Naturalists Society, and supported by the City of Richmond, BC Environment, and BC Nature. It was modelled on the first BatMatters conference, hosted by Peachland BEEPS (the Bat Education and Ecological Protection Society in Peachland, BC) following their designation as a Bat-friendly Community in 2019.
Both Bat Matters conferences were very successful we hope to continue holding conferences approximately every two years to share current bat research and highlight local stewardship efforts. For more information, contact Mandy Kellner, Provincial Coordinator, BC Community Bat Program (info@bcbats.ca).

Peace Region Northern Myotis Maternal Roosting Study

After an hiatus in 2020 d, it looks like things are back on track (with a few changes to safely work with the threat of Covid) to resume Year 2 of the Northern Myotis maternal roosting project started in the Peace Region with funding from HCTF and the Peace Region FWCP. In Year 1, we identified an area used by reproductive female Northern Myotis near the Kiskatinaw River outside of Dawson Creek. Affixing VHF transmitters to eight reproductive female Northern Myotis led to 15 maternal roost trees, including several which were used by various combinations of our tagged bats. In 2021, we are hoping to identify additional maternal colonies and continue to collect habitat data (including control plots) to begin to understand the critical maternal roosting habitat of Northern Myotis in the Peace Region of BC. So far that bats we have tagged seem to prefer longitudinal openings in trembling aspen trees, often started as

fire scars or frost cracks, but more samples from additional colonies will hopefully shed some more light on these preferences.

31 - Inge-Jean Hansen beside a crack in an aspen used by radio-telemetered lactating or pregnant female Northern myotis

Saskatchewan

Winter Bat Work in Saskatchewan's National Parks

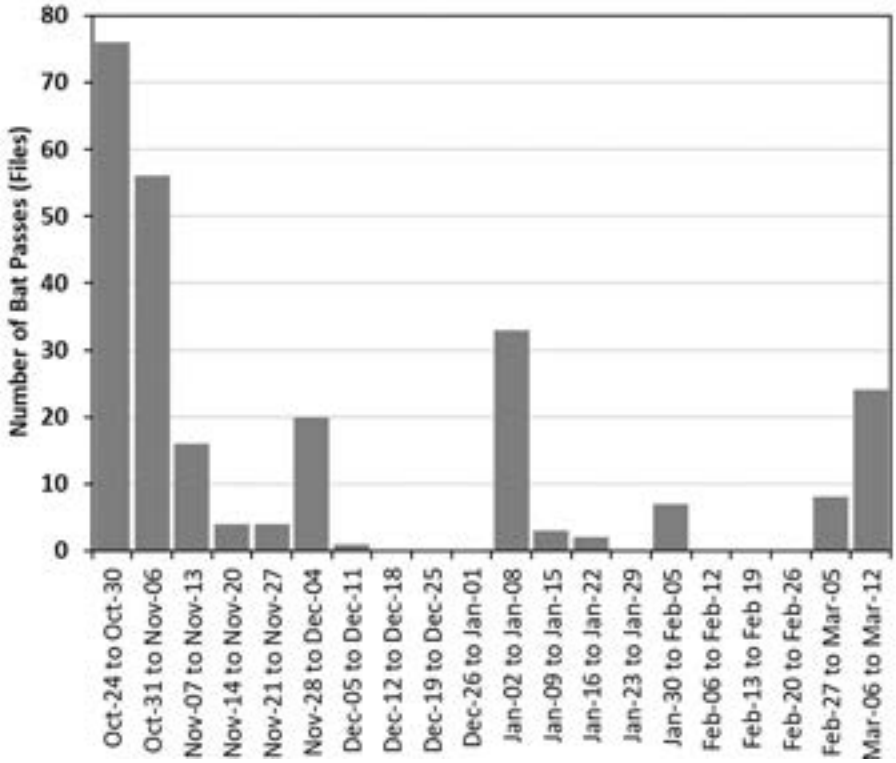
Cory Olson, Sky Ecological (*crolson@outlook.com*) and Stefano Liccioli, Grasslands National Park (*stefano.liccioli@canada.ca*)

Where most bats are spending the winter has long been a mystery in western Canada. Two projects in Saskatchewan's National Parks were completed over the last few years that continue to shed light on this question. In Grassland's National Park an Anabat Roost Logger was deployed by park staff during the winter of 2019/20 outside a rattlesnake hibernaculum that was in a coulee erosion hole. Prior to the deployment of the detector, bats resembling Long-eared Myotis and Western Small-footed Myotis were observed crawling from this hole during the spring using trail cameras. Acoustic detections confirmed the presence of bats outside the rattlesnake hibernaculum during winter (in February), but whether they were using that specific hole, or another crevice nearby, has yet to be determined. Recorded calls were consistent with Western Small-footed Myotis, Big Brown Bats, and possibly Long-eared Myotis, but additional work will be needed to confirm species identity. These three species are also known to overwinter in similar coulee systems in Alberta. In Prince Albert National Park, bat detectors were deployed during the winter of 2020/21 at various locations in the hamlet of Waskesiu as part of a bat inventory for the park (by C.O.). Bat detections consistent with the call profiles of Big Brown Bats were detected on warm nights throughout the winter, and all three detectors recorded winter activity, suggesting there was a prominent over-wintering bat population. These bats were most likely hibernating in nearby buildings, some of which were already known to support bats during the summer months. The coldest temperature bats were active was -7.8°C (logged by the detector), but most winter activity occurred at temperatures closer to the freezing point. Winter activity within Waskesiu is not surprising given winter reports of Big Brown Bats in other Saskatchewan communities, but highlights that even small communities could provide structures suitable for Big Brown Bats to spend the winter. Schowalter and Gunson (1979, Canadian Field-Naturalist 93:48-54) commented that, for Edmonton, Big Brown Bats appear to move into the city during the winter to hibernate. This raises the prospect that buildings are important for overwinter survival, especially in regions where natural crevice habitat is not available, and could have an influence on their present distributions.

*32 - **Anabat Roost Logger placed outside a coulee erosion hole used by bats (Photo: Parks Canada)***

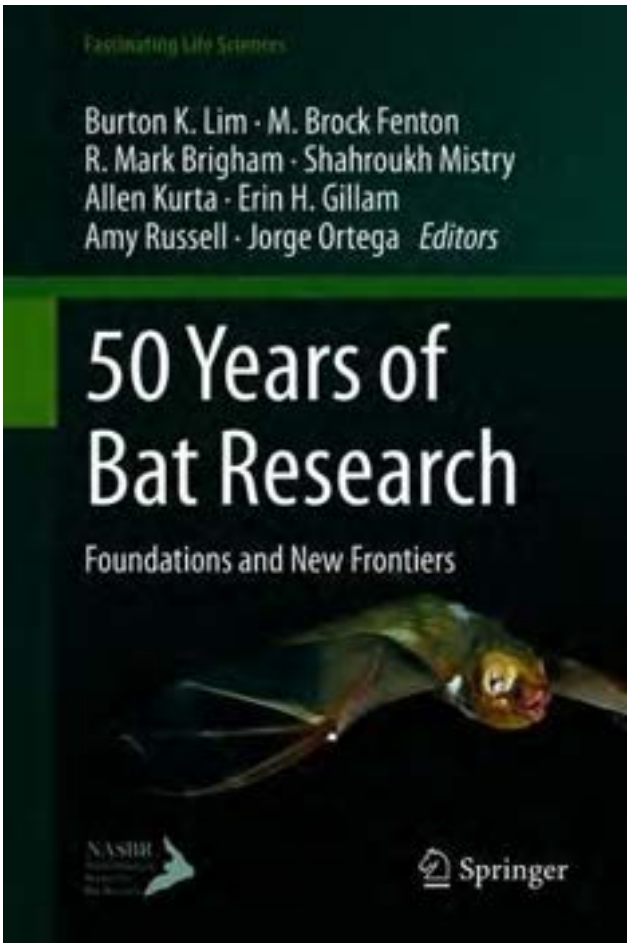
*33 - **Suspected Long-eared Myotis crawling from a rattlesnake hibernaculum during spring (Photo: Parks Canada)***

*34 - **Suspected Western Small-footed Myotis crawling from a rattlesnake hibernaculum during spring (Photo: Parks Canada)***



*35 - **Winter detections at one detector site in Waskesiu near the shore of Waskesiu Lake.***

University of Regina Bat Lab Update

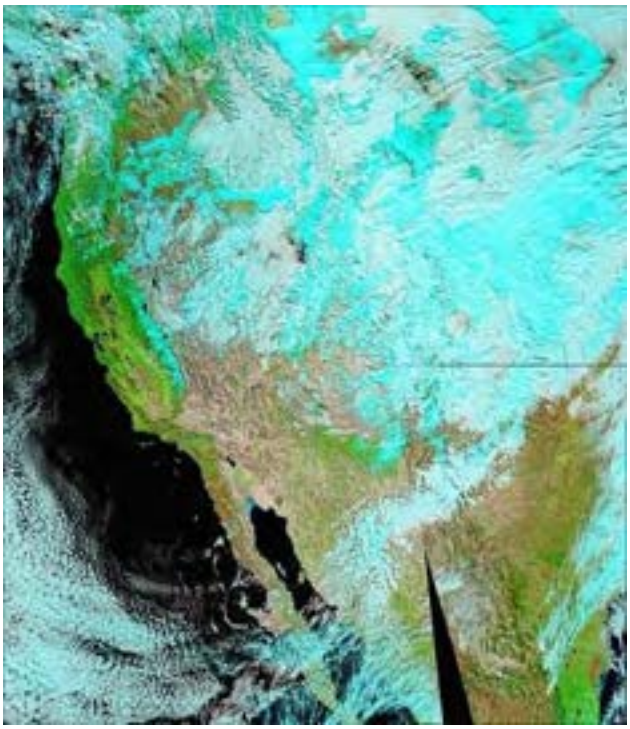


Mark Brigham (*Mark.Brigham@uregina.ca*)

Adam Sprott and Erin Swerdfeger are both nearing the end of their MSc programs (nearing the end, right you two!). They just have a thesis to produce. Both have jobs that are providing fun distractions. Dana Green will be back in Cypress Hills this summer (hopefully COVID allows this) for a final field season towards her PhD on the ecology of hoary and silver-haired bats. She will be ably assisted by Josh Christiansen who is a summer NSERC scholar and Hannah Wilson who will formally be joining the lab as a MSc student in September. With a colleague from UNB-Saint John (Kurt Samways), we are also undertaking a project in Cypress on Little brown bats foraging movements along the Battle Creek. Finally, Amy Bernier-Desmarais, has been accepted to do her MSc at Rhodes University in South Africa under my co-supervision (with Prof. Ben Smit). She will be studying hibernation. ***Editor's Note:*** **Mark Brigham submitted a list of new articles, books and book reviews. Please visit the Recent Literature and Resources section of this newsletter for the full references.**

Alaska

Western

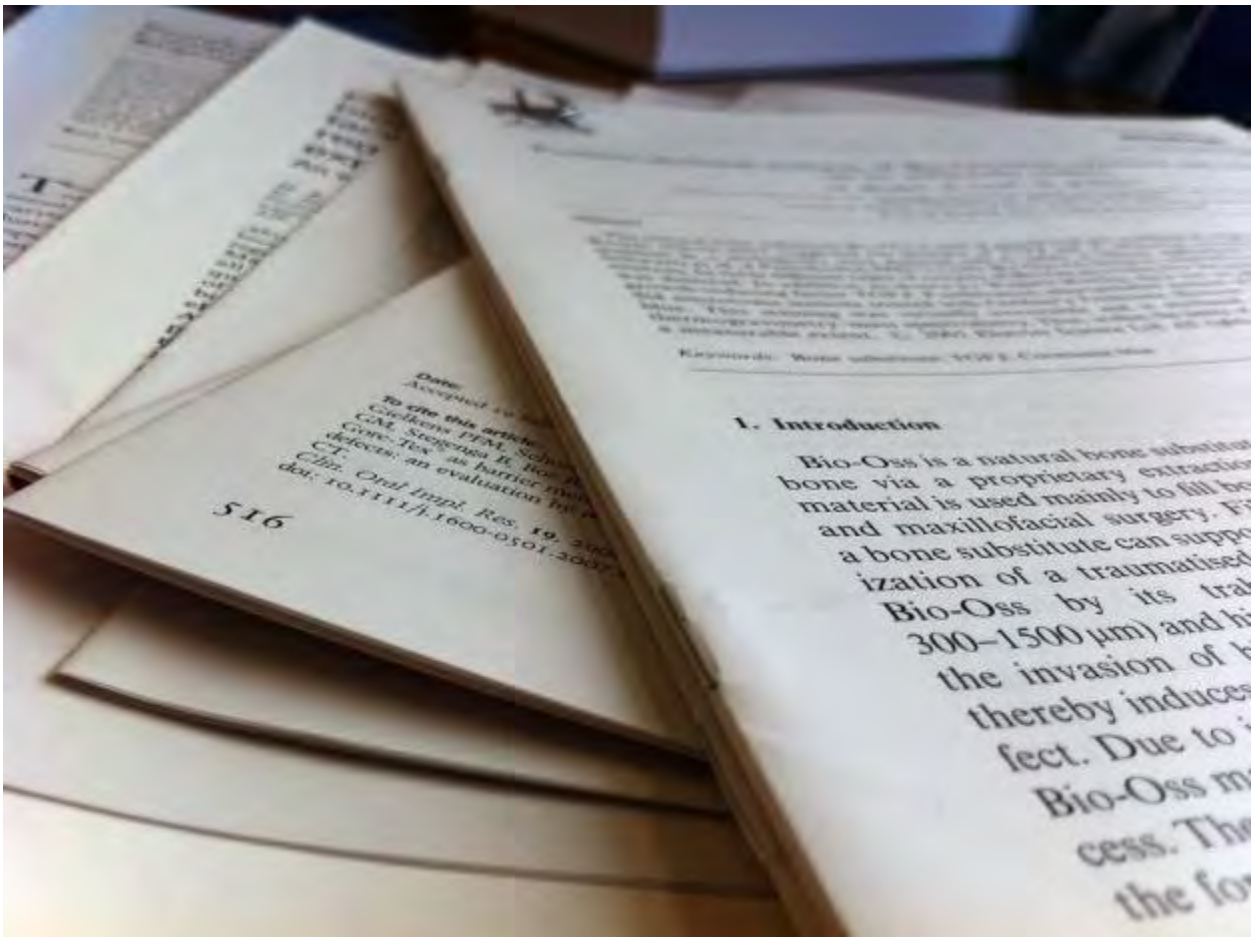


International

White nose syndrome

For the latest North American updates and WNS spread map click here. Recently WNS has been confirmed for the first time in Montana.

Recent literature and Resources



Journal Articles:

Bergeson, S., R.M. Brigham and J. O'Keefe. Free-ranging bats alter thermoregulatory behavior in response to reproductive stage, roost type, and weather. In press Journal of Mammalogy. Geiser, F., A. Bondarenco, S. E. Currie, A.C. Doty, G. Körtner, B.S. Law, C.R. Pavey, A. Riek, C. Stawski, C. Turbill, C.K.R. Willis and R.M. Brigham. 2020. Hibernation and daily torpor in Australian and New Zealand bats: Does the climate zone matter? Australian Journal of Zoology https://doi.org/10.1071/ZO20025.

Green, D.M., L.P. McGuire, M.C. Vanderwel, C.K.R. Willis, M.J. Noakes, S.J. Bohn, E.N. Green and R.M. Brigham. 2020. Local trends in abundance of migratory bats across 20 years. Journal of Mammalogy 101:1542-1547. Haase, C.G., N.W. Fuller, Y.A. Dzal, C.R. Hranac, D.T.S. Hayman, C.L. Lausen, L.P. McGuire, K.A. Silas, S.H. Olson, and R.K. Plowright. 2020. Body mass and hibernation microclimate may predict bat susceptibility to white-nose syndrome. Ecology and Evolution. Ecology and Evolution: https://doi.org/10.1002/ece3.7070.

Hranac, C. Reed, Catherine G. Haase, Nathan W. Fuller, Meredith L. McClure, Jonathan C. Marshall, Cori L. Lausen, Liam P. McGuire, Sarah H. Olson, David T. S. Hayman. 2021. What is winter? Modelling spatial

variation in bat host traits and hibernation and their implications for overwintering energetics. Ecology and Evolution, in press.

McClure, Meredith L., Catherine G. Haase, Carter Reed Hranac, David T. S. Hayman3, Brett G. Dickson, Liam P. McGuire, Daniel Crowley, Nathan W. Fuller5, Cori L. Lausen, Raina K. Plowright, Sarah H. Olson. 2021. A hybrid correlative-mechanistic approach for modeling winter distributions of western North American bat species. Journal of Biogeography, in press: https://doi.org/10.1111/jbi.14130 McClure, Meredith L., Daniel Crowley, Catherine G. Haase, Liam P. McGuire, Nathan W. Fuller, David TS Hayman, Cori L. Lausen, Raina K. Plowright, Brett G. Dickson, and Sarah H. Olson. 2020. Linking surface and subterranean climate: implications for the study of hibernating bats and other cave dwellers. Ecosphere 11(10): e03274.

Noakes, M.J., A.E. McKechnie and R.M. Brigham. 2021. Interspecific variation in heat tolerance and evaporative cooling capacity among sympatric temperate-latitude bats. In press. Canadian Journal of Zoology.

Reichert, B.E., M. Bayless, T.L. Cheng, J.T.H. Coleman, C.M. Francis, W.F. Frick, B.S. Gotthold, K.M. Irvine, C. Lausen, H. Li, S.C. Loeb, J.D. Reichard, T.J. Rodhouse, J.L. Segers, J.L. Siemers, W.E. Thogmartin, and T.J. Weller. 2021. NABat: A top-down, bottom-up solution to collaborative continental-scale monitoring. The Royal Swedish Academy of Sciences: https://doi.org/10.1007/s13280-020-01411-y.

Solick, D., R.M.R. Barclay, L. Bishop-Boros, Q.R. Hays, C. L. Lausen. 2020. Updated Distributions of Eastern and Western Red Bats in Western North America. Western North American Naturalist 80: 90-97.

Books:

Fraser, E.E., A. Silvis, R.M. Brigham and Z.J. Czenze (eds.). 2020. Bat Echolocation Research: A handbook for planning and conducting acoustic studies. Second Edition. Bat Conservation International. Austin, TX. 122 pp.

Lim, B.K., M.B. Fenton, R.M. Brigham, S. Mistry, A. Kurta, E.H. Gillam, A. Russell and J. Ortega (eds.). 2021. Fifty Years of Bat Research: Foundations and New Frontiers. Fascinating Life Sciences Series. 376 pp. Springer. ISBN 978-3-030-54726-4.

Lausen, C.L., D.W. Nagorsen, R.M. Brigham and J. Hobbs. 2022. Bats of British Columbia 2nd Edition. Royal British Columbia Museum Handbook. In Press.

Book review:

Burns, S.M. and R.M. Brigham. 2020. Is that a bat? Middleton, N. 2020. Pelagic Press. 272 pp.

Acta Chiropterologica 22: 491–492.

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