North American Bat Monitoring Program in Banff National Park

Manual Verification Data Summary

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Biodiversity Pathways

PARTNERS IN MONITORING

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Executive Summary

Banff National Park conducts annual acoustic monitoring of bats as part of the North American Bat Monitoring Program (NABat). In 2024, the monitoring consisted of 3 stationary acoustic deployments operating between June-26 and July-09, and 2 mobile transects conducted on the nights of June-30 and July-01. These data were submitted to SENSR for processing and manual vetting. The processing focused on seven bat species known to inhabit the region.

In total 3 stationary detectors operated for a total of 42 recorder nights and in total collected 15129files. Of these, 894 were manually reviewed and vetted. Mobile transect surveys collected 529 files, of which 337 were identified as noise by the auto id software and were not manually vetted. The species most recorded and identified was Little Brown Bat (*Myotis lucifugus*) with a total of 101 recordings manually verified.

Key recommendations for the future include modifying the mobile transect route to prevent switchbacks, which compromises abundance measurements, and adjusting the Golf Course and Fenlands sites to be 5-10m away from open water to prevent multiple bats in a single recording.

Land Acknowledgement

Biodiversity Pathways respectfully acknowledges that this work takes place on the territories of Treaties 6, 7, 8, and the Métis homeland, traditional and ancestral lands of First Nations and Métis Peoples, whose histories, languages, and cultures are directly linked to the biodiversity that we monitor.

We acknowledge the traditional teachings of the lands that we work on, and that reciprocal, meaningful, and respectful relationships with Indigenous peoples make our work possible. We are deeply grateful for their stewardship of these lands, and we are committed to supporting Indigenous-led monitoring programs, while learning Indigenous ways of knowing, being, and doing.

Introduction

Overview of NABat and the NNW Bat Hub

The North American Bat Monitoring Program (NABat) is a large-scale coordinated effort to monitor bat species across North America using standardized protocols and a unified sample design (Loeb et al. 2015). NABat was established to address the gaps in knowledge and lack of long-term studies of bat species across Mexico, USA, and Canada. The program is administered by the US Geological Survey (USGS), coordinated by the Canadian Wildlife Health Cooperative (CWHC) in Canada, and implemented by the North by Northwest Bat (NNW) Hub in British Columbia, Alberta, and S.E. Alaska.

As part of contributing to the NABat program, Banff National Park has monitored one sampling cell (GRTSID: 148842) within the park since 2020. This monitoring has occurred using three stationary acoustic detectors and a driving transect.

2024 NABat Monitoring in Banff National Park

In the field season of 2024, `3` separate stationary bat acoustic deployments and `2` mobile transects were made in Banff National Park (Figure 1). The stationary monitoring recorders collected data between `June-26` and `July-09`, mobile transects were made on the nights of `June-30` and `July-01`. The recordings were submitted to SENSR for processing and manual vetting to determine species presence or absence at the sites.

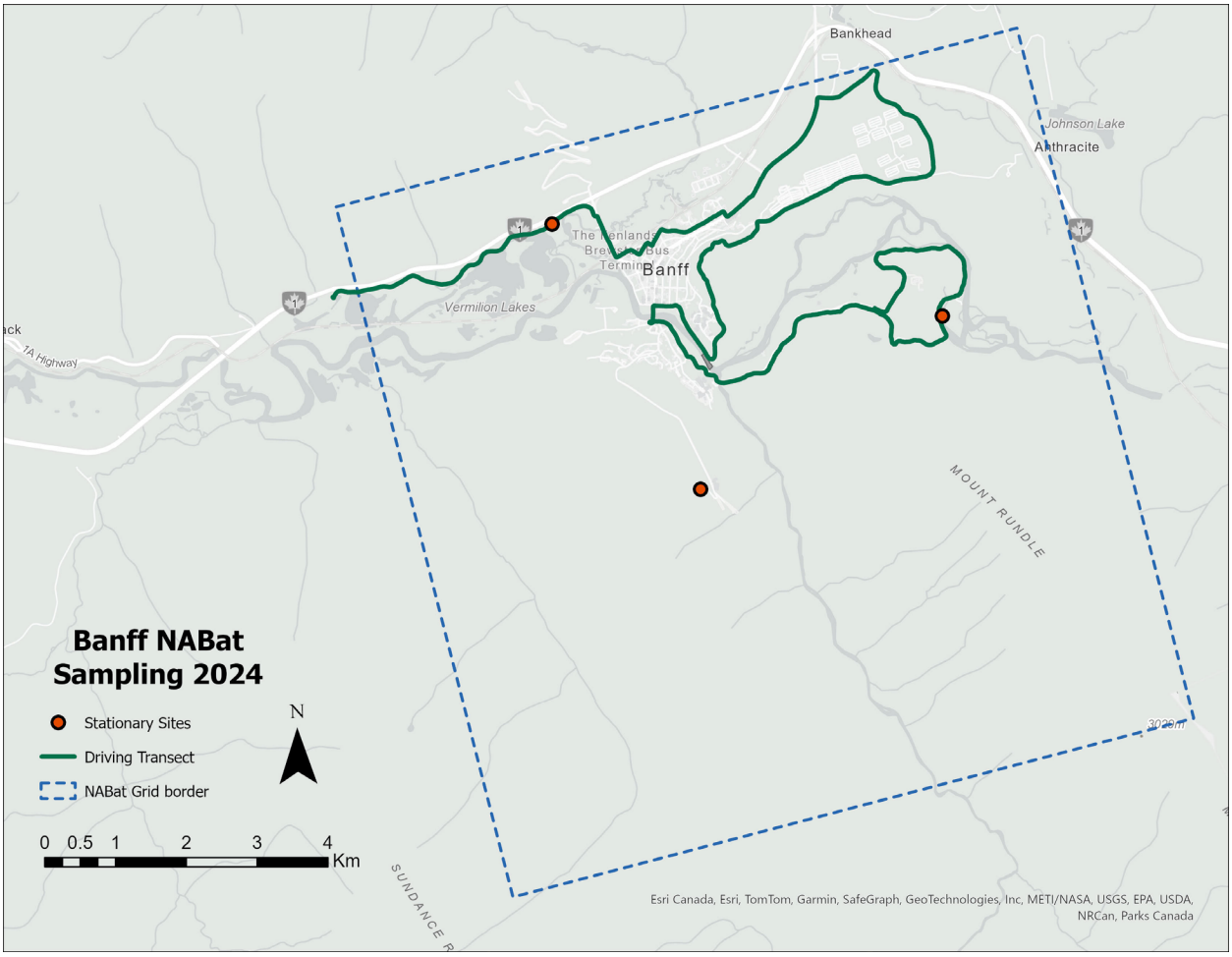


Figure 1: NABat sampling grid (GRTSID: 148842) in Banff National Park for the 2024 field season. The map shows the three stationary acoustic monitoring sites (red dots) and the mobile driving transect (green line) which was conducted twice during the sampling period. The blue dashed line represents the NABat grid cell boundary.

Methods

Full-spectrum recordings from the sampling periods were collected and processed using two automatic classifiers: Kaleidoscope's Bats of North America 5.4.0 classifier and Sonobat 3.0's Northwestern British Columbia classifier. Based on documented species ranges and prior detection data (Olson n.d.), manual identification efforts focused on seven species: Big Brown Bats (*Eptesicus fuscus*), Eastern Red Bats (*Lasiurus borealis*), Silver-haired Bats (*Lasionycteris noctivagans*), Hoary Bat (*Lasiurus cinereus*), Little Brown Bats (*Myotis lucifugus*), Long-legged Myotis (*Myotis volans*) and Long-eared Myotis (*Myotis evotis*).

The analysis workflow followed processing standards established by the North American Bat Monitoring Program (NABat) (Reichert et al. 2018). Only recordings that received automated species classifications from either Kaleidoscope or Sonobat were selected for manual verification. For stationary acoustic monitoring sites, recordings were manually vetted until at least one recording per species per site per night was confidently identified. For mobile transects, all recordings with automated classifications underwent complete manual verification. Species identifications were validated using reference call parameters described by Szewczak (2018), Slough et al. (2022), and Solick (2022), in accordance with NABat manual vetting protocols.

Results

The stationary detectors ran for a total of 42 recorder nights and collected 15129 files in total. Of these, 1054 were classified as noise files, with no distinguishable bat present. Of the remaining files, a total of 894 were reviewed and manually vetted, following the minimum standards set by NABat to manually verify recordings until at least one recording per species per site per night was confidently identified (Reichert et al. 2018). The manual ID codes used for species identification follow standard NABat conventions and are detailed in Appendix A.

For driving transects, a total of 529 files were collected, of which 337 were noise files. All files that were not classified as noise were manually verified for the mobile transects.

The most recorded and identified species was Little Brown Bat (*Myotis lucifugus*) with a total of 101 recordings identified, followed by Silver-haired Bats (*Lasionycteris noctivagans*) and Big Brown Bat (*Eptesicus fuscus*) both of which had a total of 32 recordings identified across the sites and transects (Table 1).

Table 1: Summary of manually verified bat acoustic recordings (n=1,247) across species and monitoring locations in Banff National Park (2024). Species codes in the Manual ID column represent individual bat species or acoustic groupings where species-level identification was not possible. Location columns include one mobile transect route (BANFF-MOBILE) and three stationary detector sites (FENLANDS, GOLF-COURSE, and UPPER-HOTSPRINGS)

Manual ID	BANFF-MOBILE	FENLANDS	GOLF-COURSE	UPPER-HOTSPRINGS	Total
EPFU	1	19	10	2	**32**
LABO	0	14	10	0	**24**
LACI	0	10	3	2	**15**
LANO	1	23	5	3	**32**
MYEV	0	8	5	3	**16**
MYLU	2	69	27	3	**101**
MYVO	0	11	8	0	**19**
EPFULANO	7	99	14	2	**122**
LABOMYLU	3	110	40	4	**157**
MYLUMYVO	1	23	16	0	**40**
MYOTIS	0	0	8	2	**10**
HIF	13	260	130	7	**410**
LOF	4	100	10	0	**114**
NOID	2	3	1	0	**6**
NOISE	164	2	0	0	**166**
40KMYO	5	80	64	0	**149**
TOTAL	**39**	**829**	**351**	**28**	**1247**

Recommendations

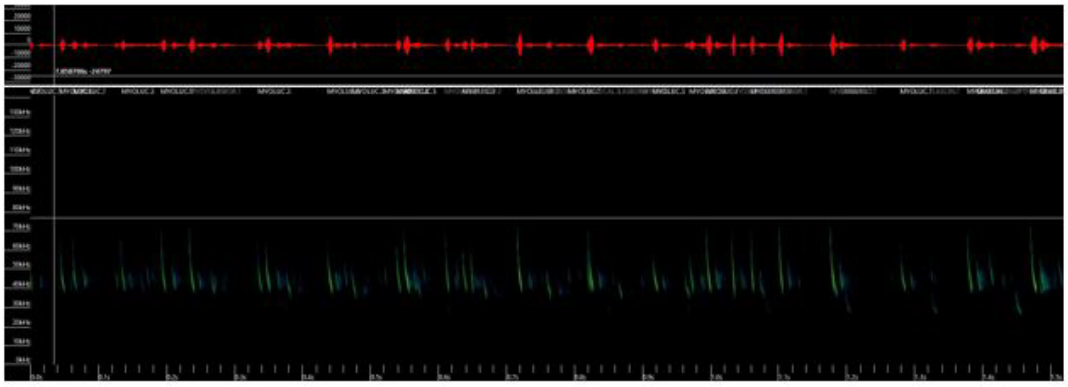
Equipment set up

The current setup has microphones attached directly to the detector (Figure 2). This creates a flat surface that bounces sound back into the microphone, producing echoes in the recordings (Figure 3). These echoes reduce recording quality and complicate both automated and manual identification of bat calls. We recommend getting an extension cord so that the microphone can be mounted at the top of the bat pole by itself, while the recorder is at the base. This will reduce the amount of echo recorded improving recording quality.

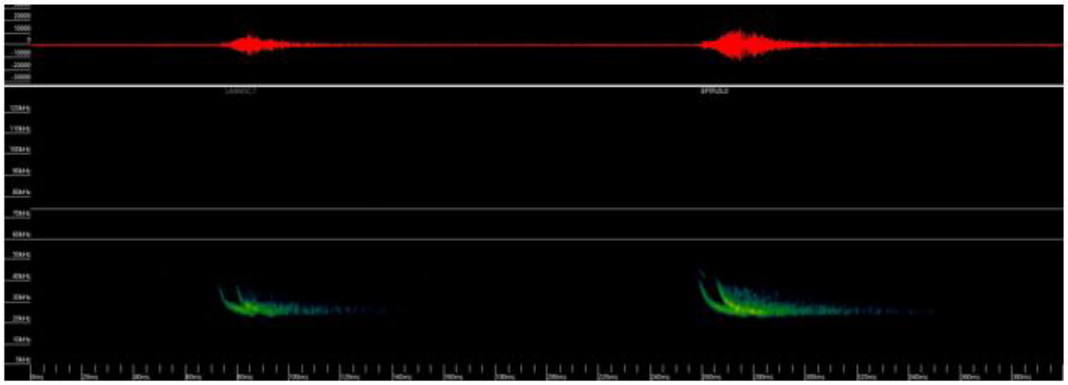
Figure 2: Bat monitoring station at Fenlands site demonstrating suboptimal deployment techniques. The detector is positioned over open water, resulting in multiple bat passes recorded in single files. The microphone mounted directly on the recorder creates echo artifacts from the flat surface, compromising both automated and manual identification of bat calls

Site Placement

There was a high number of files with multiple bats recorded in the Golf Course and Fenlands sites (Figure 3). This is likely due to the proximity to the water at both sites. We recommend moving these sites 5-10m away from open water to minimize the occurrence of multiple bats in single recordings. This change will make species identification more reliable.



Multiple bats recorded in a single file from Fenlands site.



Echo produced from microphone placement.

Figure 3: Sample spectrograms demonstrating common recording issues. Top: Multiple bat calls captured in a single file from water-adjacent deployment site. Bottom: Echo artifacts overlapping with bat calls due to microphone placement on flat recorder surface, complicating species identification.

Route Design for Transects

The current route contains sections that curve back on themselves (Figure 1). Switchbacks in the route undermines the accuracy of abundance measurements by potentially recording the same bats multiple times. We recommend updating the route to minimize the number of switchbacks, even if this requires the route to go outside of the grid cell being sampled.

Literature Cited

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Appendix A

Definitions for manual identification used while processing Banff National Park bat bioacoustic data

Manual ID	Definition
EPFU	Calls that have diagnostic features identifying it as *Eptesicus fuscus*
LABO	Calls that have diagnostic features identifying it as *Lasiurus borealis*
LACI	Calls that have diagnostic features identifying it as *Lasiurus cinereus*
LANO	Calls that have diagnostic features identifying it as *Lasyonicteris noctivagans*
MYEV	Calls that have diagnostic features identifying it as *Myotis evotis*
MYLU	Calls that have diagnostic features identifying it as *Myotis lucifugus*
MYVO	Calls that have diagnostic features identifying it as *Myotis volans*
EPFULANO	Calls that could be attributed to either *Eptesicus fuscus* or *Lasyonicteris noctivagans*
LABOMYLU	Calls that could be attributed to either *Lasiurus borealis* or *Myotis lucifugus*
MYLUMYVO	Calls that could be attributed to either *Myotis lucifugus* or *Myotis volans*
40KMYO	Various species of *Myotis* that have a characteristic frequency in the range of 35-40kHz.
MYOTIS	Various species of *Myotis* with no clear characteristic frequency
HIF	Various species with pulses having a characteristic frequency higher than ~35kHz
LOF	Various species with pulses having a characteristic frequency lower than ~30kHz
NOID	Bat call but no grouping category applies
NOISE	No bat recorded