



Acoustic Bat Monitoring in Alaska National Parks

2016-2018

Natural Resource Report NPS/AKRO/NRR—2020/2096





ON THIS PAGE

Bat detector and temperature/humidity logger on a building in Brooks Camp, Katmai National Park and Preserve
NPS Photo by Michael Saxton

ON THE COVER

Bat monitoring site at Lost Lake, Klondike Gold Rush National Historical Park
NPS Photo by Jen Larsen

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Executive Summary

The purpose of this study was to use acoustic monitors in multiple national parks in Alaska to determine when and where bats are active. Detectors were placed in the following locations:

- Bering Land Bridge National Preserve (2 locations in 2016)
- Denali National Park (7 locations in 2016 - 2018)
- Glacier Bay National Park and Preserve (2 locations in 2017-2018)
- Katmai National Park (1 location in 2016 - 2018)
- Kenai Fjords National Park (2 locations in 2016 - 2018)
- Klondike Gold Rush National Historical Park (15 locations in 2016 - 2018)
- Lake Clark National Park (2 locations in 2016 - 2017)
- Wrangell-St.Elias National Park (5 stationary sites and two mobile transects in 2017-2018);
three additional sites in Yakutat, just outside of the park

These data will be used to determine the best locations for long-term monitoring of bat activity and to identify promising locations where more detailed studies such as bat capture, radio tracking, and other research may be conducted in the future.

Planned work for 2019 includes deploying the loggers again in the parks that participated in prior years and deploying them early enough and long enough to capture the full season of bat activity at each of these locations. We also hope to expand acoustic monitoring to other locations to further identify places where bats are active and to determine what types of habits they may be using. We also plan to perform additional driving or hiking acoustic transects in Denali and Wrangell-St. Elias to look at bat activity over a wide range of areas and elevations.

Acknowledgments

This work could not have been accomplished without the efforts of individuals in the parks who were willing to set up and maintain the loggers throughout the season. They were key in identifying potential sites and in getting the equipment into the field. Field staff that were vital to this study were J. Belt, P. Brown, J. Capra, G. Colligan, K. Griffin, S. Hayes, J. Hinrichs, A. Johnson, A. Kirby, D. Kurtz, J. Larsen, T. Lewis, K. Lewandowski, K. Mocnik, T. Mullett, M. Saxton, D. Schirokauer, S. Surdyk, C. Turner, D. Young, Klondike Gold Rush NHP Backcountry Rangers and Parks Canada Backcountry Wardens. This project was partially supported by BRMD White Nose Syndrome funds to improve our understanding of bat activity and habitat in Alaska.

Introduction

The purpose of this report is to present the results of the acoustic monitoring for bats during the 2016 and 2017 seasons. It is not meant to be a review of current knowledge with respect to bat habitat and activity in Alaska parks. No extensive review of the literature is presented though there has been an increase in interest and research on bats in Alaska and Canada. Select references are provided at the end of this report.

Equipment and Methods

Parks were provided with Wildlife Acoustics SM3Bat monitors fitted with the SM3-U1 ultrasonic microphone and/or Wildlife Acoustics SM4 full-spectrum detectors with SMM-U1 microphones. The units were programmed to turn on 30 minutes before sunset and turn off one hour after sunrise. Sunset and sunrise are calculated automatically by the unit based on the location entered into the system before deployment. The full programs for both detector types can be found in Appendix A.

Deployment protocols and field data forms were developed to provide instructions and to gather metadata about each deployment site. The detectors were rarely placed in locations that had a coincident complete weather station, so Hobo U23 Pro v2 temperature and humidity loggers were deployed with each of the detectors to gather weather-related information that could have had some influence on bat activity. These loggers were programmed to record a measurement every hour for the entire field season.

Data Processing and Vetting

The raw data from the memory cards were archived into a folder on the computer along with the program information. Copies of those files were put into a separate working folder for processing. SonoBat4 North America (version 4.2.2) was used to filter noise files from the potential bat recordings using liberal settings to maximize the number of detections for further processing, though that can lead to poor-quality detections being moved forward for additional processing.

The remaining detections were then attributed with site data from the field sheets and additional information. The attributed files were then classified using Alaska-specific classifiers. The Southeast Alaska classifier was used on recordings from Klondike Gold Rush National Historical Park, Glacier Bay National Park, and the Yakutat area of Wrangell-St. Elias National Park. The Interior Alaska classifier was used for all of the remaining sites.

Once classified, SonoVet was used to manually vet some of the files. Files that represented unusual classifications such as Hoary bats or other species out of their known range were inspected first and reclassified where appropriate. Files that represented species already known to be in a particular location were not manually vetted for verification. New studies have shown that the Keens Myotis (*Myotis keeni*) reported in Alaska and long-eared myotis (*Myotis evotis*) are the same species (Lausen, et al, 2016), so the software now classifies them as only long-eared myotis (*Myotis evotis*).

Results

Figure 1 shows the locations of the detectors deployed during this study for 2015-2018.

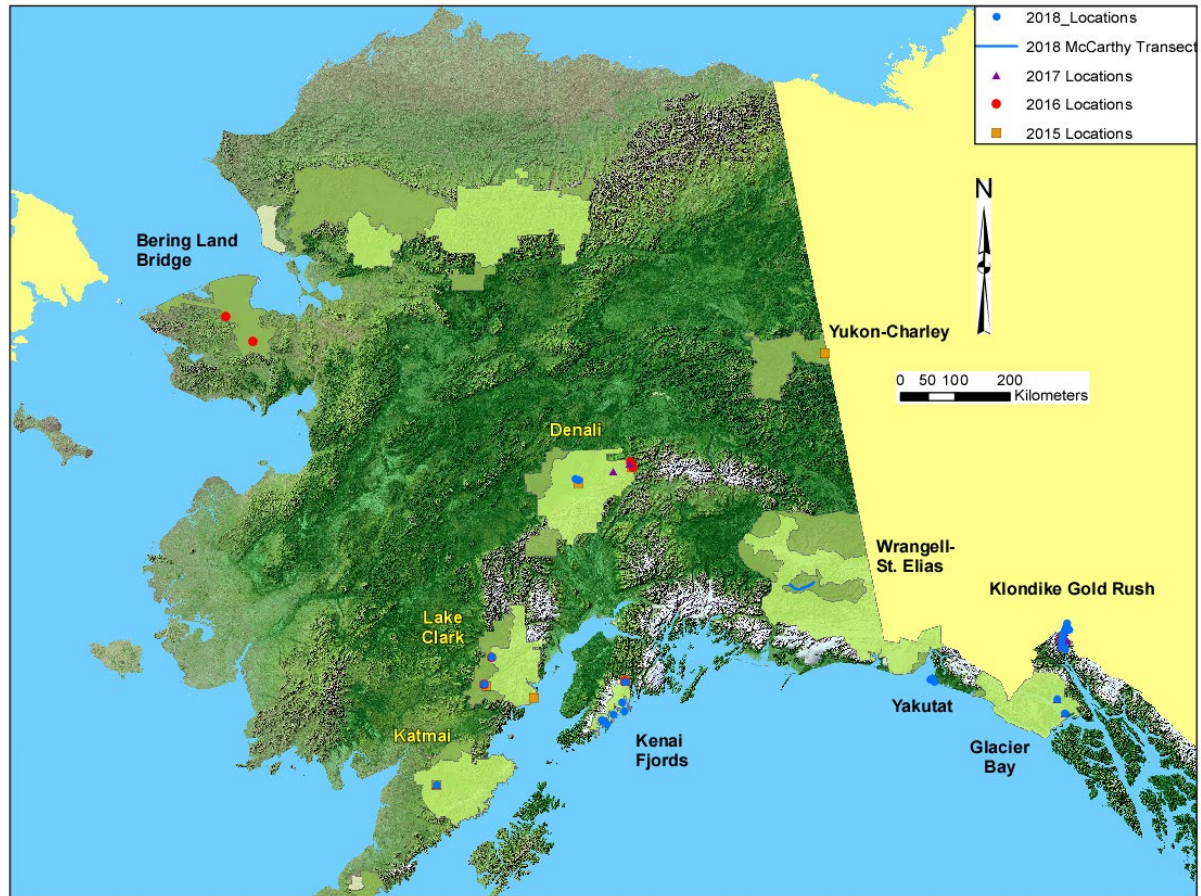


Figure 1. Location of bat detectors deployed in Alaska National Parks 2015-2018

Bering Land Bridge National Preserve

Serpentine Hot Springs – Beaver Pond

Elevation 115m

Deployed 7/7/2016 to 7/11/2016

The detector was placed upstream of the bunkhouse near one of the beaver ponds. The microphone was placed approximately 2 meters above the ground and set up to record detections over the water. No distinct bat detections were recorded.

Lost Jim Lava Field

Elevation 271m

Deployed 9/15/2016 to 9/17/2016

The detector was placed on a large pile of rocks near two cave entrances. The microphone was pointed north, across the top of a collapse feature approximately 20 meters across. No distinct bat detections were recorded. However, the temperatures were typically below 4°C and there were high winds during the entire period of deployment, so the lack of detections could merely be indicative of poor flying conditions.



General area where the bat detector was deployed on the Lost Jim Lava Field near base camp.

Denali National Park and Preserve

Detectors have been deployed in seven different locations in Denali National Park and Preserve (figure 2). To date, no bat detections have been recorded although bats have been reported in the area, including near where detectors have been set out.

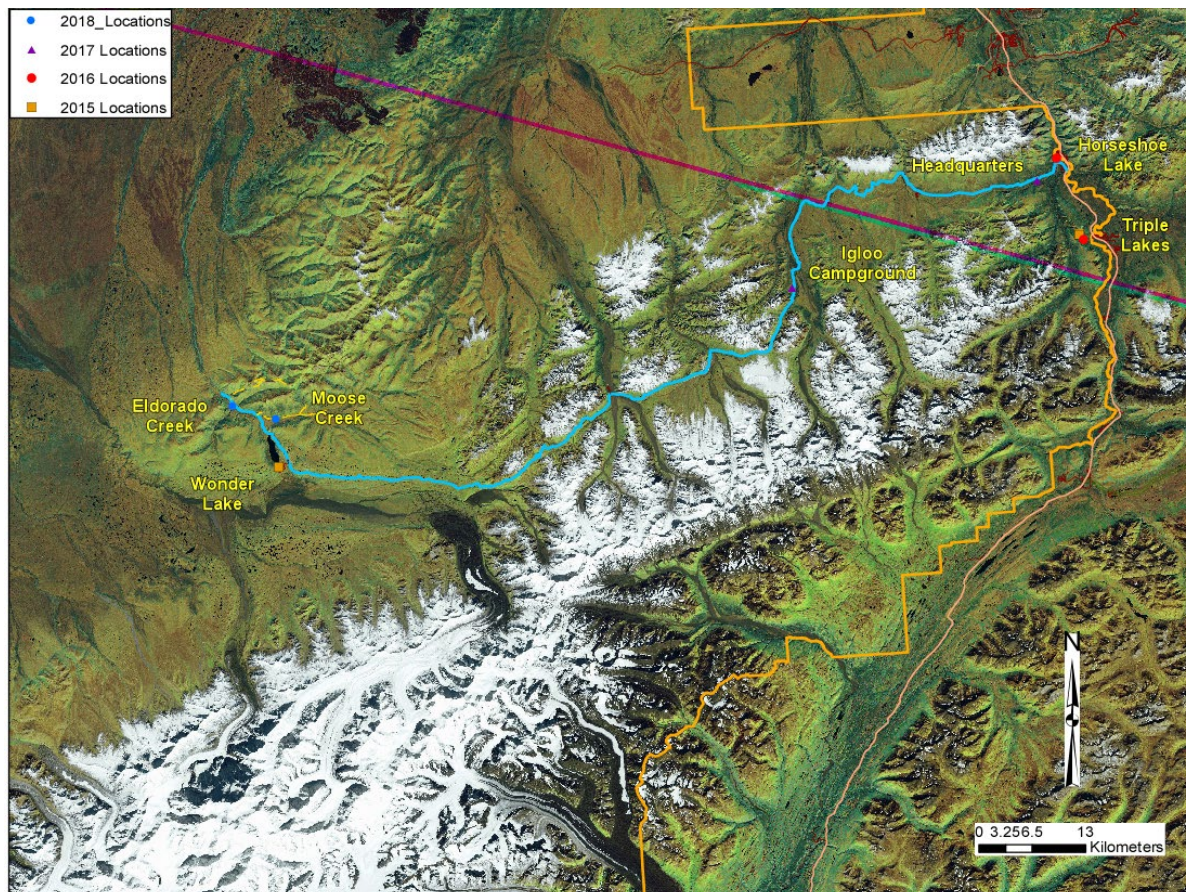


Figure 2. Acoustic bat monitoring locations in Denali National Park and Preserve 2015-2018

Triple Lakes – Lake 1

Elevation 634m

Deployed 8/2/2016 to 9/27/2016 – no detections

The detector was placed on the east side of Lake 1. The microphone was placed in a white spruce with the microphone pointed west, over the water. No distinct bat detections were recorded. However, the detector did record insect sounds and possible amphibian activity, indicating that the microphones and detector were functioning.

Horseshoe Lake

Elevation 472m

Deployed 8/11/2016 to 9/21/2016 – no detections

The detector was placed on the west side of an island on Horseshoe Lake with the microphone pointed west, over the water. No distinct bat detections were recorded. However, the detector did record insect sounds and possible amphibian activity, indicating that the microphones and detector were functioning.

Headquarters Area

Elevation 630m

Deployed 4/29/2017 to 9/28/2017 – no detections



Location of Headquarters detector.

The detector was set up south of the headquarters area in a spruce tree facing a clearing within birch/spruce forest. This location is near to several buildings and about 85m from a perennial stream. No bats were detected, but the detector did pick up other sounds, indicating that the microphones and detector were functioning. Both were tested back in Anchorage after the field season and worked correctly.

Igloo Forest

Elevation 900m

Deployed 6/29/2017 to 9/23/2017 – no detections



View of the Igloo Forest detector site looking north.

The detector was set up in sparse closed low shrub birch and spruce. No bats were detected, but the detector did pick up other sounds, indicating that the microphones and detector were functioning. Both were tested back in Anchorage after the field season and worked correctly.

Eldorado Creek Beaver Pond

Elevation 507m

Deployed 7/20/2018 to 9/18/2018 – no detections



View looking north from Eldorado Creek beaver pond bat detector location

The detector was set up in dense alder looking out over a large pond. No bats were detected, but the detector did pick up other sounds, indicating that the microphones and detector were functioning. Both were tested back in Anchorage after the field season and worked correctly.

Moose Creek Beaver Pond

Elevation 571m

Deployed 7/18/2018 to 9/18/2018 – no detections



View looking past microphone towards Moose Creek beaver pond.

The detector was set up in sparse dwarf birch and willow with tundra ground cover near a large pond. No bats were detected, but the detector did pick up other sounds, indicating that the microphones and detector were functioning. Both were tested back in Anchorage after the field season and worked correctly.

Glacier Bay National Park

Blackwater Pond

Elevation 22m

Deployed 5/31/2017 to 10/20/2017 – 5,022 detections

Deployed 6/13/2018 to 10/4/2018 – 6,285 detections

The detector was set up near Blackwater Pond in the Bartlett Cove area (figure 3). The surrounding vegetation is closed Sitka spruce forest. This location captured 5,022 bat detections in 2017 and 6,285 in 2018 (figure 4). These were identified as California myotis (*Myotis californicus*), long-legged myotis (*Myotis volans*), little brown (*Myotis lucifugus*), and silver-haired bats (*Lasionycteris noctivans*).



Figure 3. Acoustic bat monitoring locations in Glacier Bay, 2017-2018.

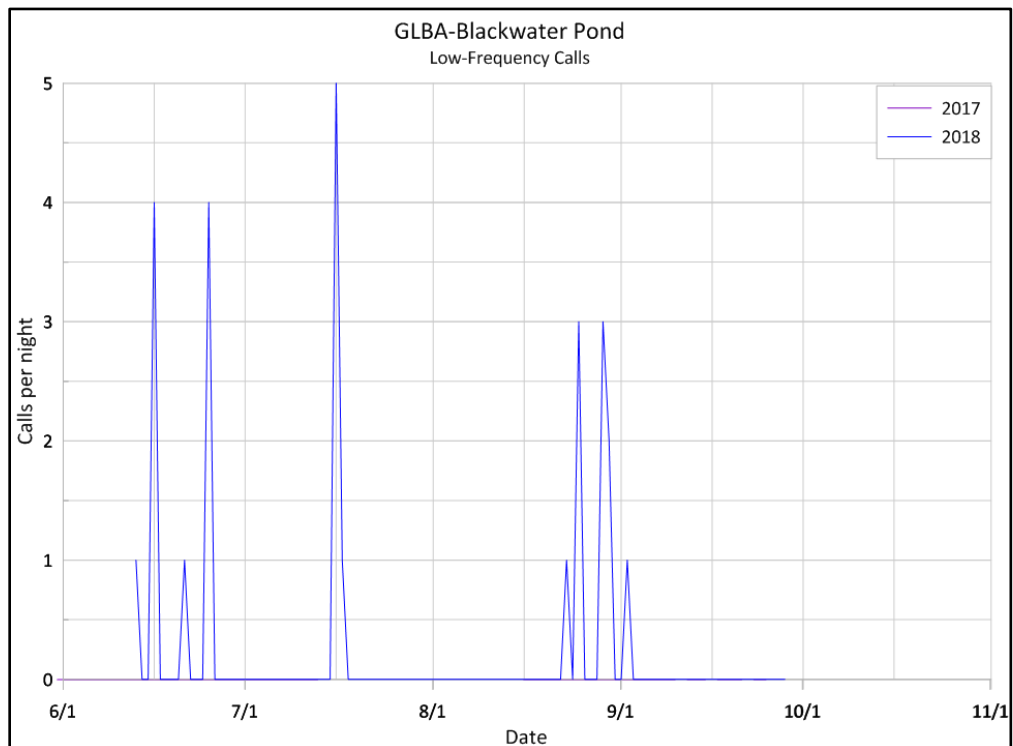
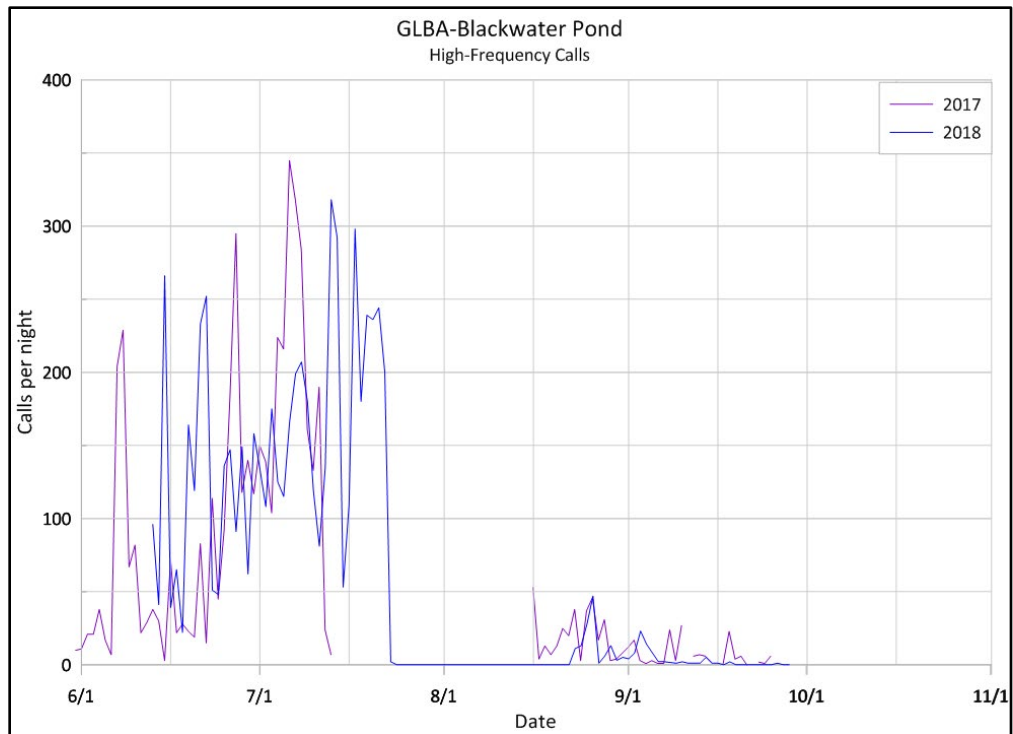


Figure 4. Nightly high-frequency (top) and low-frequency (bottom) bat detections for Blackwater Pond, Glacier Bay National Park 2017-2018

Sandy Cove

Elevation 0m

Deployed 5/24/2017 to 9/15/2017 – 377 detections

Deployed 7/5/2018 to 7/28/2018 – 159 detections

The detector was set up under the porch of a floating ranger station in Sandy Cove (figure 3). The surrounding vegetation is a mix of halophytic herbaceous wet meadow and young, dense Sitka spruce. This location captured 377 bat detections in 2017 and 159 in 2018 (figure 5). These were identified as long-legged myotis (*Myotis volans*) and little brown bats (*Myotis lucifugus*). The low-frequency calls in 2018 were not identified to species. The limited number of detections in 2018 was the result of battery issues that resulted in only one month of data.



Floating cabin in Sandy Cove, Glacier Bay National park

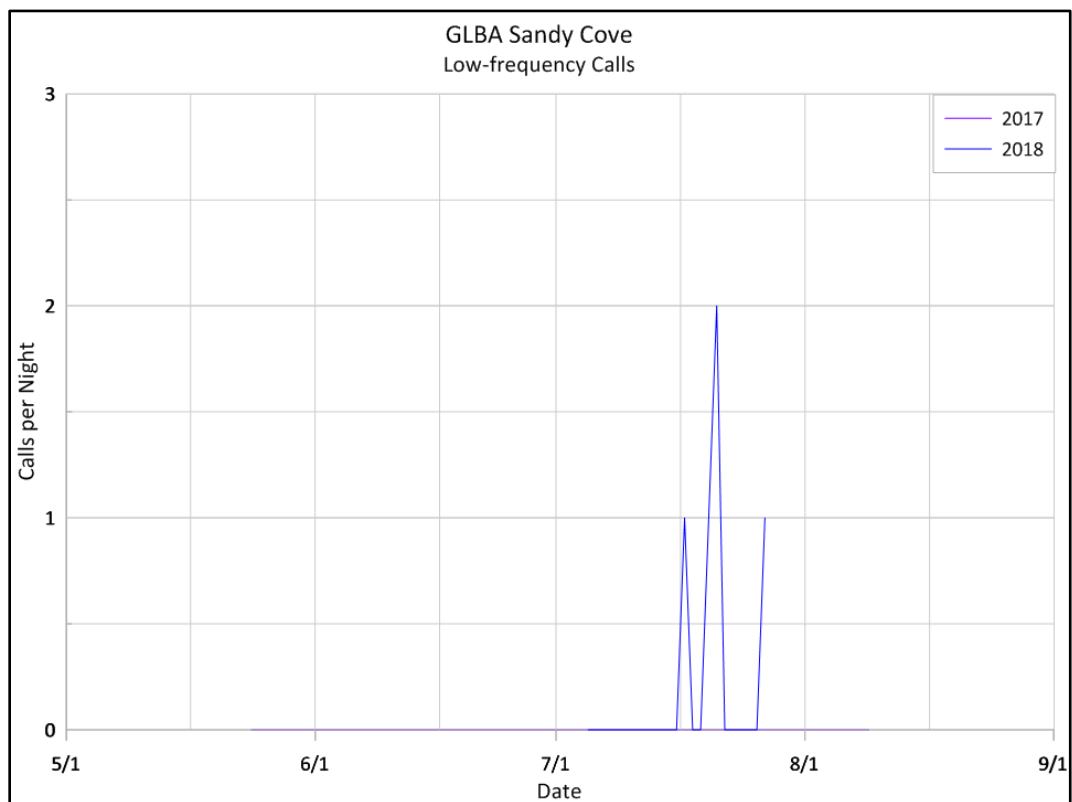
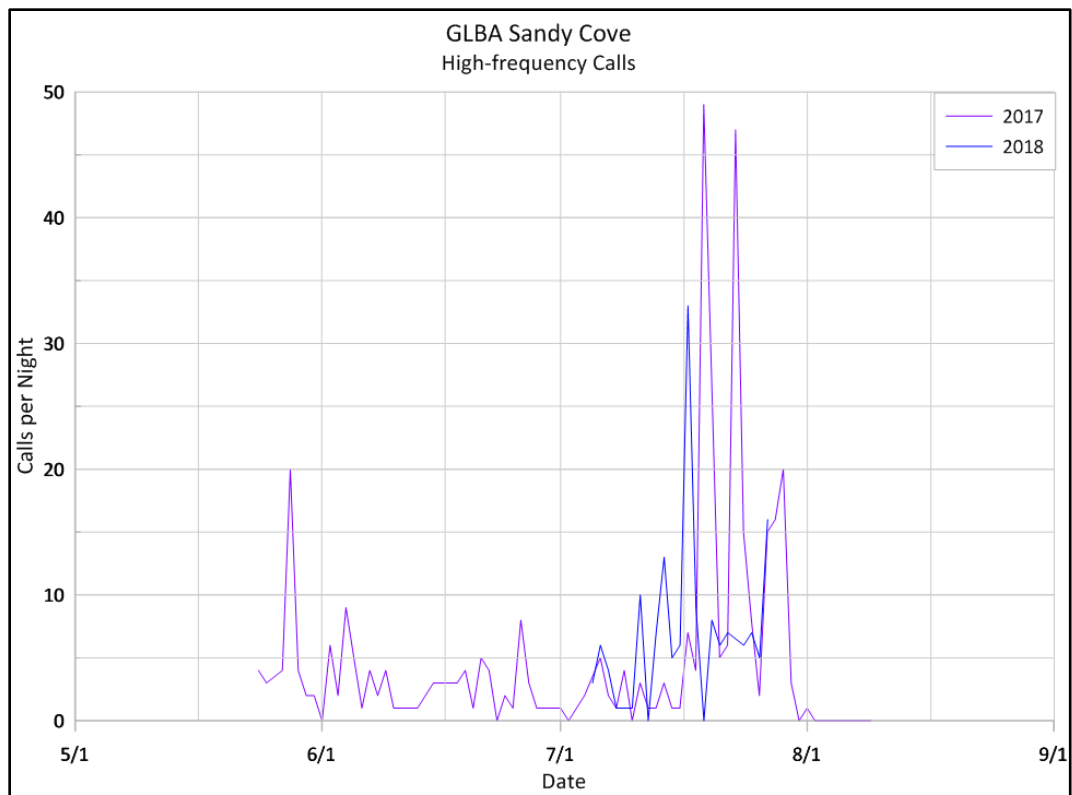


Figure 5. Nightly bat detections (High-frequency, top; Low-frequency, bottom) for Sandy Cove, Glacier Bay National Park

Katmai National Park

Brooks Camp

Elevation 33m

Deployed 6/17/2015 to 10/2/2015 – 3,807 detections

Deployed 5/19/2016 to 9/23/2016 - 17,947 detections

Deployed 6/5/2017 to 10/4/2017 - 28,737 detections

Deployed 6/2/2018 to 10/5/2018 – 6,188 detections

The detector is attached to the side of a building adjacent to a trail in Brooks Camp (figure 6) and the same detector and microphone was used consistently all three years. In 2012, bat houses were attached to the building around the corner, so the site can best be described as a roost monitoring location. The microphone is pointed away from the building towards a forested area across the trail. This detector recorded a record number of detections (28,737) in 2017 even when you take into account the longer deployment. Figure 7 shows the number of bat detections per night.

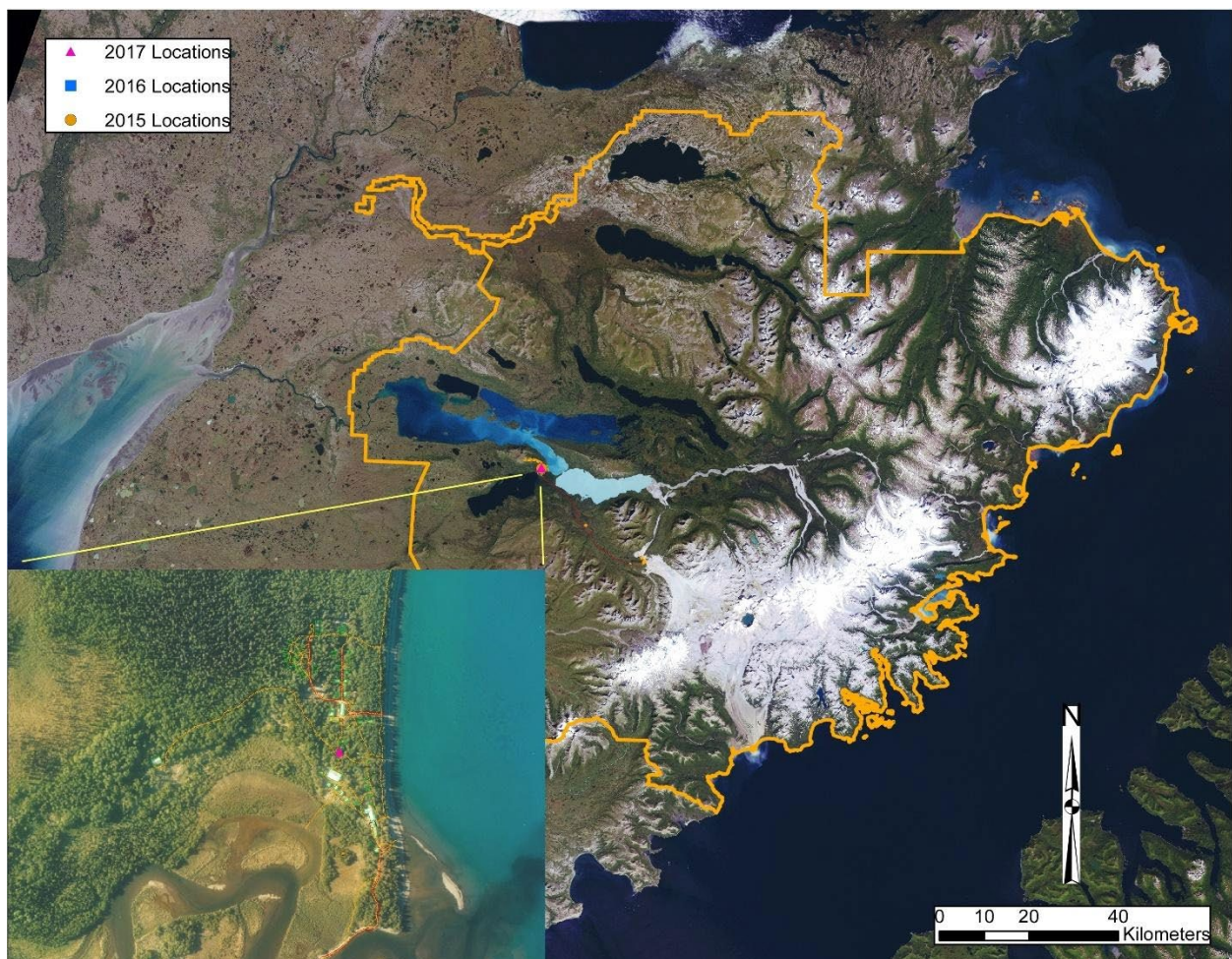


Figure 6. Brooks Camp acoustic bat monitoring location for Katmai National Park 2015-2018

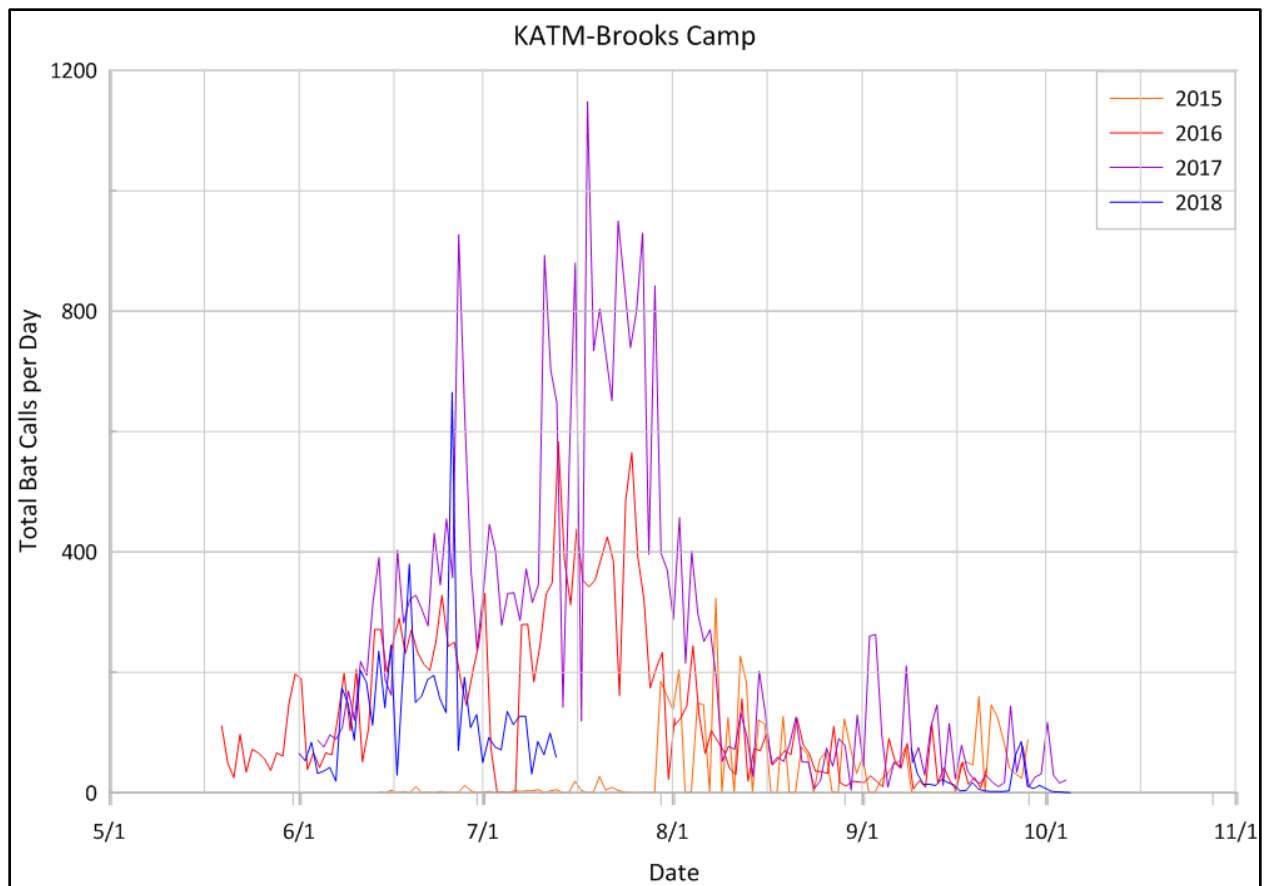


Figure 7. Nightly bat detections per night at Brooks Camp in Katmai National Park and Preserve.



Photo showing the microphone on the structure at Brooks Camp (building corner), the location of the nearby bat houses (black boxes attached to building), and the surrounding vegetation.

The majority of the classified detections were little brown bats (*Myotis lucifugus*) and most of the bat detections were characteristic of myotis species. There were some detections that were lower frequency than the others (Figure 8) and were identified by several outside experts as little brown social calls. The data show that bats were likely active in the area prior to deployment and at the time the detector was removed from the site. Getting the detector to the site earlier and leaving it for longer may be useful for determining when bats arrive in the area (or emerge from hibernation) and when they leave for the season (or go into hibernation). Maintenance staff have observed that they do not encounter bats during building repair prior to May, but frequently do throughout the rest of spring and summer, suggesting that if bats are overwintering in the area, it is not occurring in park buildings.

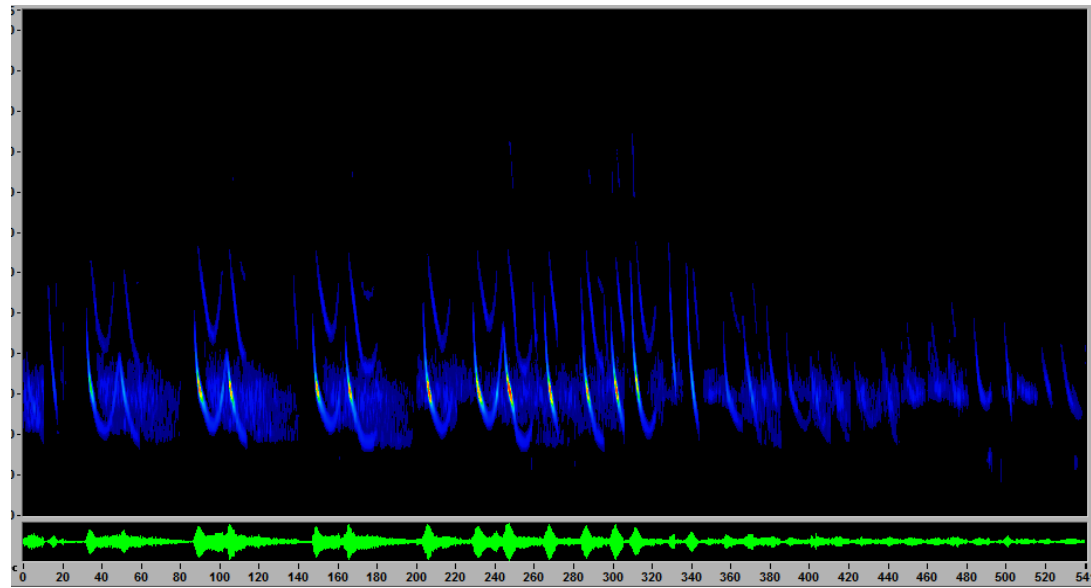


Figure 8. Little brown social call recorded at Katmai National Park.

Kenai Fjords National Park

Exit Glacier Visitor Center Area

2016 location elevation 120m

Deployed 5/23/2016 to 10/31/2016 – 224 detections

2017-2018 location elevation 156m

Deployed 4/18/2017 to 9/20/2017 – 3243 detections

Deployed 4/17/2018 to 11/22/2018 – 287 detections

In 2016, the detector was placed in a clearing southwest of the Exit Glacier Nature Center between the main visitor trail and Exit Creek. The area is vegetated with willow and alder and the clearing is sparsely-vegetated outwash gravels (Figure 9). This detector recorded 224 bat passes during the season (Figure 10).

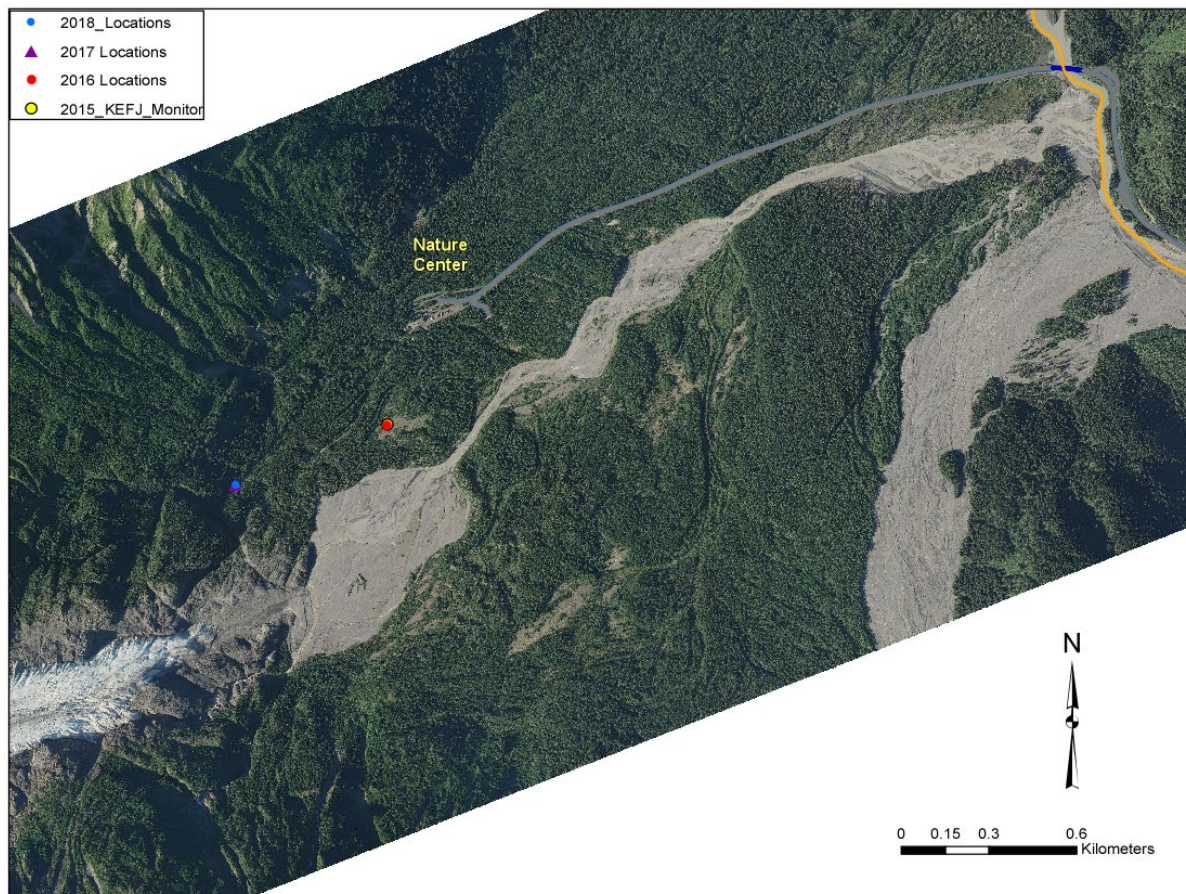


Figure 9. Exit Glacier area acoustic bat monitoring location for Kenai Fjords National Park 2015-2018

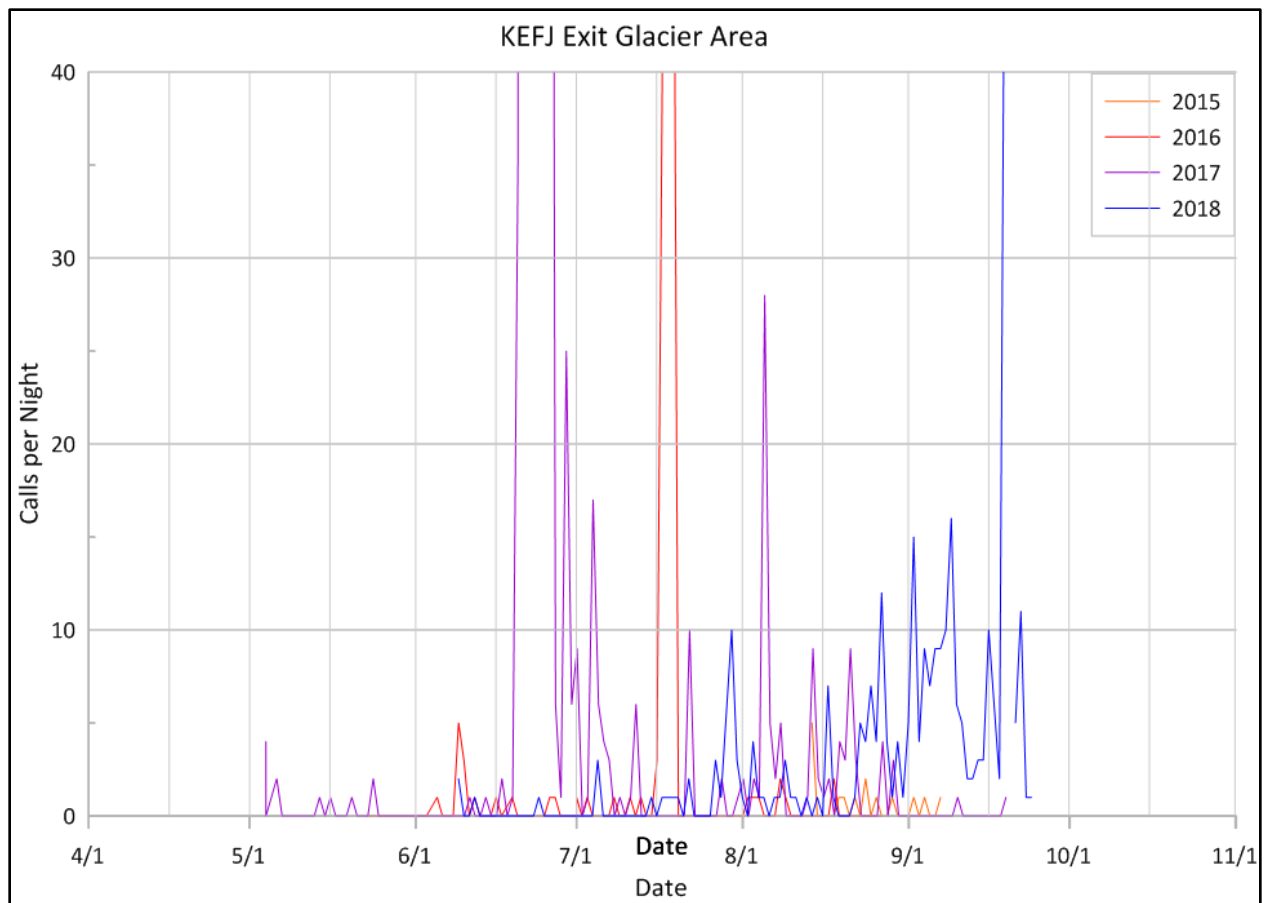


Figure 10. Nightly bat detections per night in the Exit Glacier area of Kenai Fjords National Park

In 2017 and 2018, the detector was placed on a snag in a moderately dense, birch-aspen-alder-willow forest near an intermittent stream. Although the locations changed each year from 2015-2017, the data are presented here to show relative call abundance from year to year in the broad general area. Note, the graph has been clipped at 20 detections per night even though the maximum detections per night exceeded 100 to emphasize the variability throughout the year.

All of the detections from both years were identified as little brown bats (*Myotis lucifugus*), however the Sonobat Interior Alaska classifier was used and is biased to little brown bats versus other potential coastal species.



Photo showing the microphone (arrow) and general vegetation surrounding the clearing where the detector was deployed in 2016 (left) and 2017 (right).

Klondike Gold Rush National Historical Park

Acoustic bat monitoring locations for Klondike Gold Rush National Historical Park are shown in Figure 11.

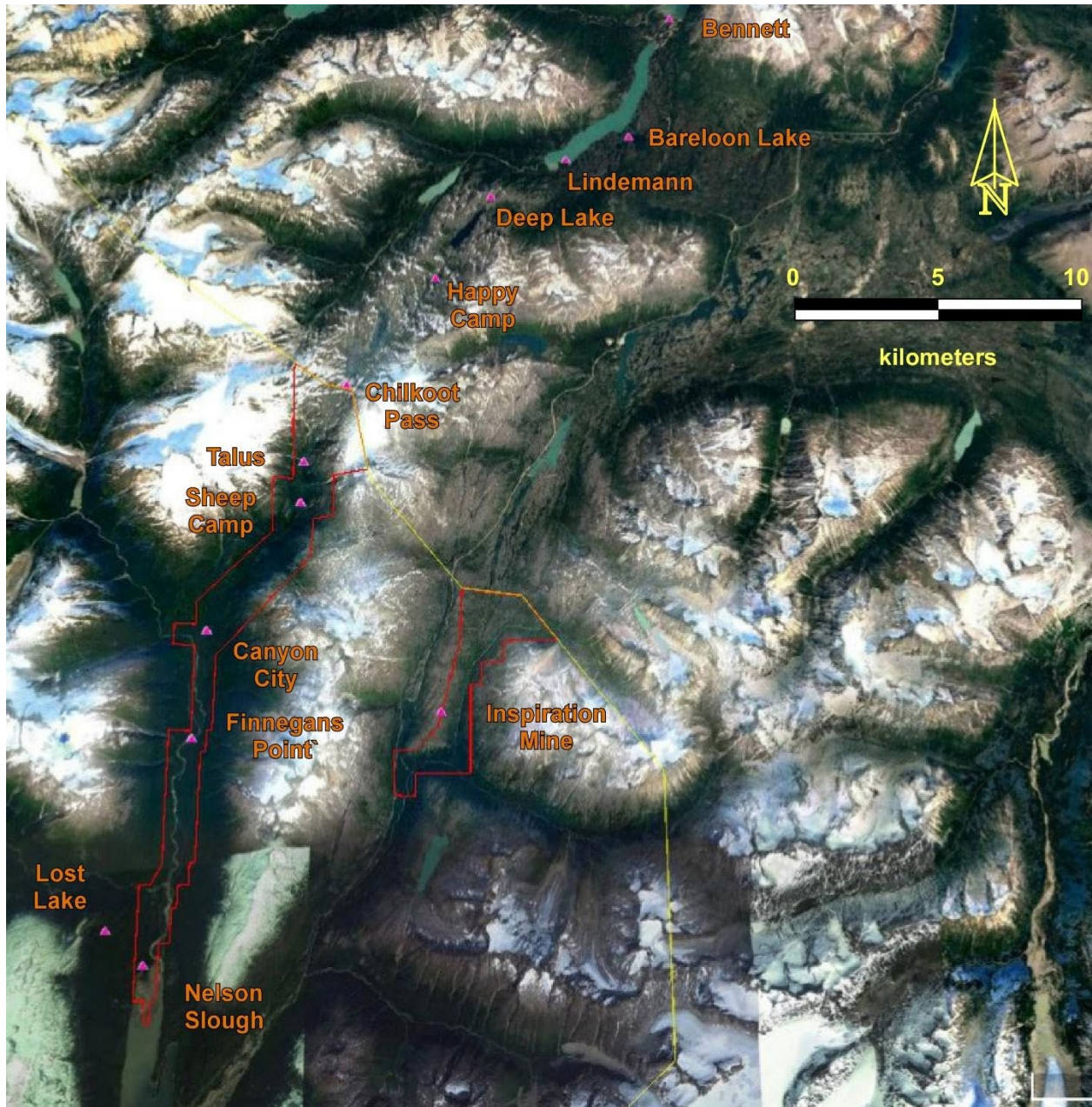


Figure 11. Acoustic bat monitoring location for Klondike Gold Rush National Historical Park, 2015-2018

Nelson Slough

Elevation 12m

Deployed 6/1/2016 to 9/13/2016 – 1,142 detections

Deployed 5/16/2017 to 9/21/2017 – 657 detections

Deployed 6/12/2018 to 9/8/2018 – 1,059 detections

The detector was placed at the edge of a meadow that is occasionally a marginal wetland slough area (Figure 12). At the time of deployment, there was no water in the slough. The microphone was attached to a spruce bough approximately 3m above the ground and pointed northwest, into the open meadow.



Figure 12. Microphone placement (left) and slough area (right) where the detector was placed. Photos by Jen Larsen.

In 2016, this detector recorded 1,142 bat passes (Figure 13), identified as long-legged myotis (*Myotis volans*), little brown (*Myotis lucifugus*), silver-haired (*Lasionycteris noctivans*), and long-eared myotis (*Myotis evotis*).

In 2017, this detector recorded 657 passes (Figure 13), identified as long-legged myotis (*Myotis volans*), little brown (*Myotis lucifugus*), and silver-haired bats (*Lasionycteris noctivans*). We have no obvious indicator for why fewer bats were detected this year over 2016.

In 2018, this detector recorded 1,059 passes (Figure 13), identified as long-legged myotis (*Myotis volans*), little brown (*Myotis lucifugus*), long-eared myotis (*Myotis evotis*) and silver-haired bats (*Lasionycteris noctivans*). We have no obvious indicator for why fewer bats were detected this year over 2016.

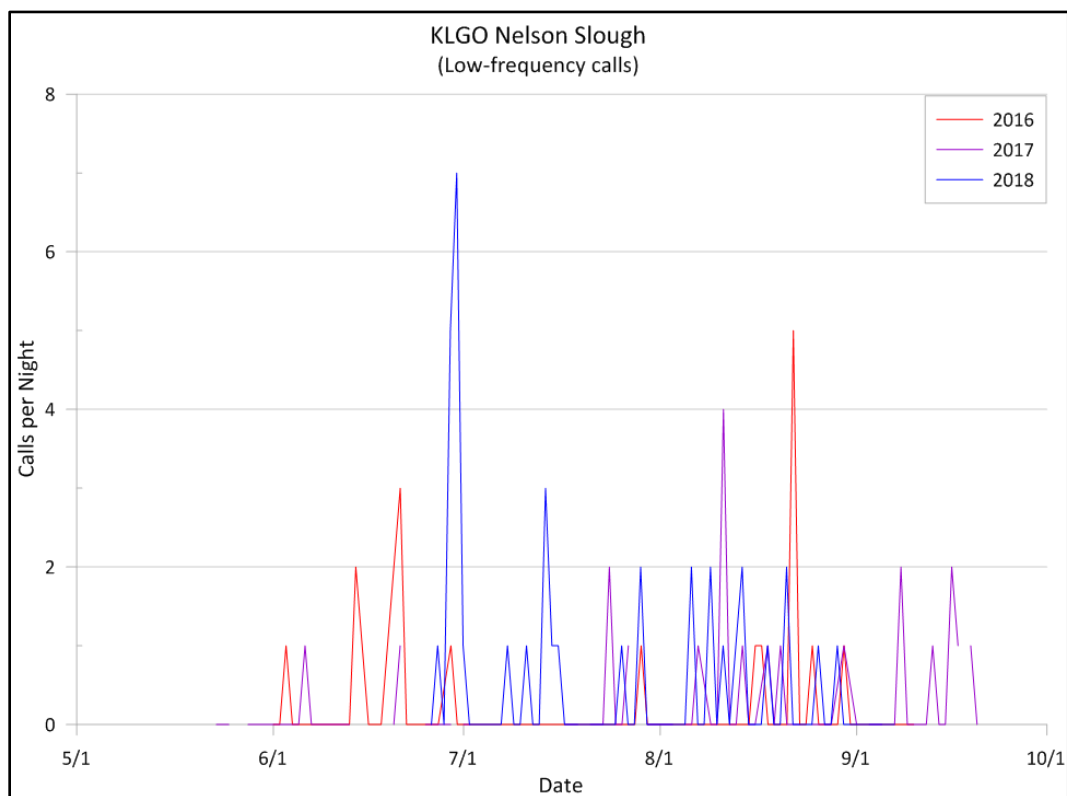
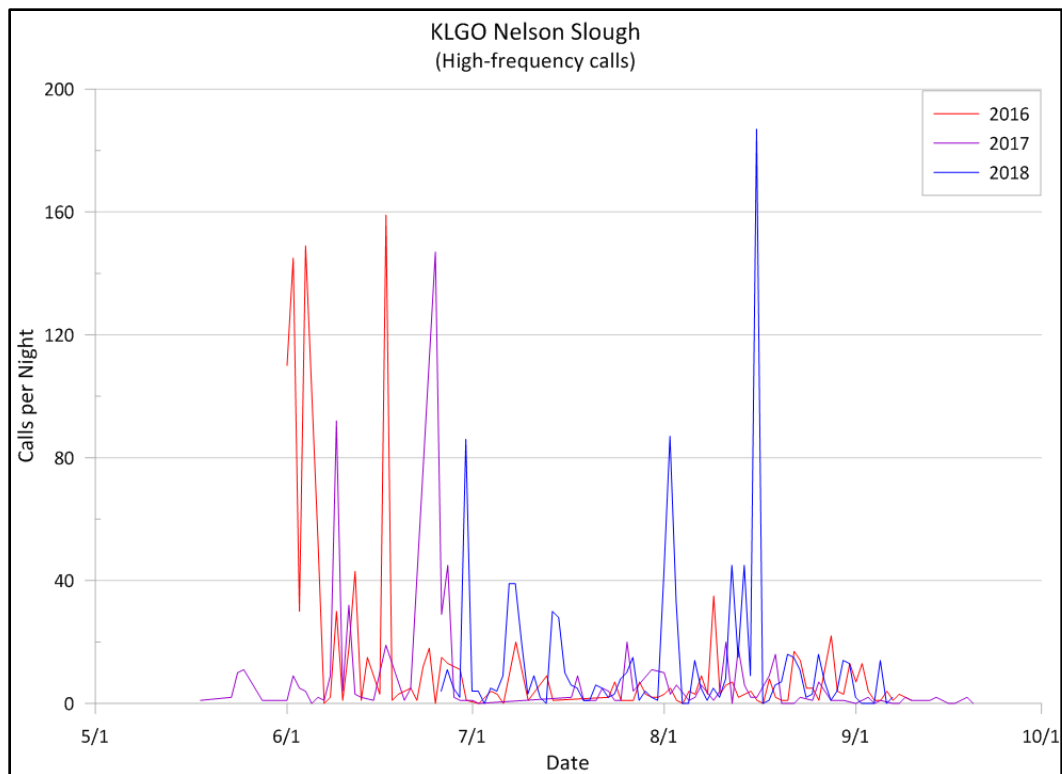


Figure 13. Nightly bat detections (High-frequency, top; Low-frequency, bottom) for Nelson Slough in Klondike Gold Rush National Historical Park.

Lost Lake

Elevation 416m

Deployed 7/9/2016 to 9/8/2016 – 114 detections

Deployed 6/2/2017 to 8/16/2017 – 996 detections

Deployed 7/26/2018 to 8/27/2018 – 482 detections



Figure 14. Microphone placement (left, arrow) and view of Lost Lake (right) where detector was deployed. Photos by Jen Larsen.

The bat detector was deployed at the north end of Lost Lake, along the western shore (Figure 14). The microphone was placed in a 3m Mountain hemlock on a dead branch approximately 2m above the ground pointed roughly southeast along the lake (Figure 10). The lake forms a long corridor 30m wide and 122m long in a dense -hemlock-spruce forest. The lake is formed on a bench on an otherwise steep hillside.

In 2016, this detector captured 111 bat passes (Figure 15), identified as California myotis (*Myotis californicus*), little brown (*Myotis lucifugus*), and long-eared myotis (*Myotis evotis*).

In 2017, this detector captured 996 passes (Figure 15), identified as California myotis (*Myotis californicus*), long-legged myotis (*Myotis volans*), little brown (*Myotis lucifugus*), and silver-haired bats (*Lasionycteris noctivans*).

In 2018, this detector captured 482 passes (Figure 15), identified as California myotis (*Myotis californicus*), long-legged myotis (*Myotis volans*), little brown (*Myotis lucifugus*), long-eared myotis (*Myotis evotis*) and silver-haired bats (*Lasionycteris noctivans*).

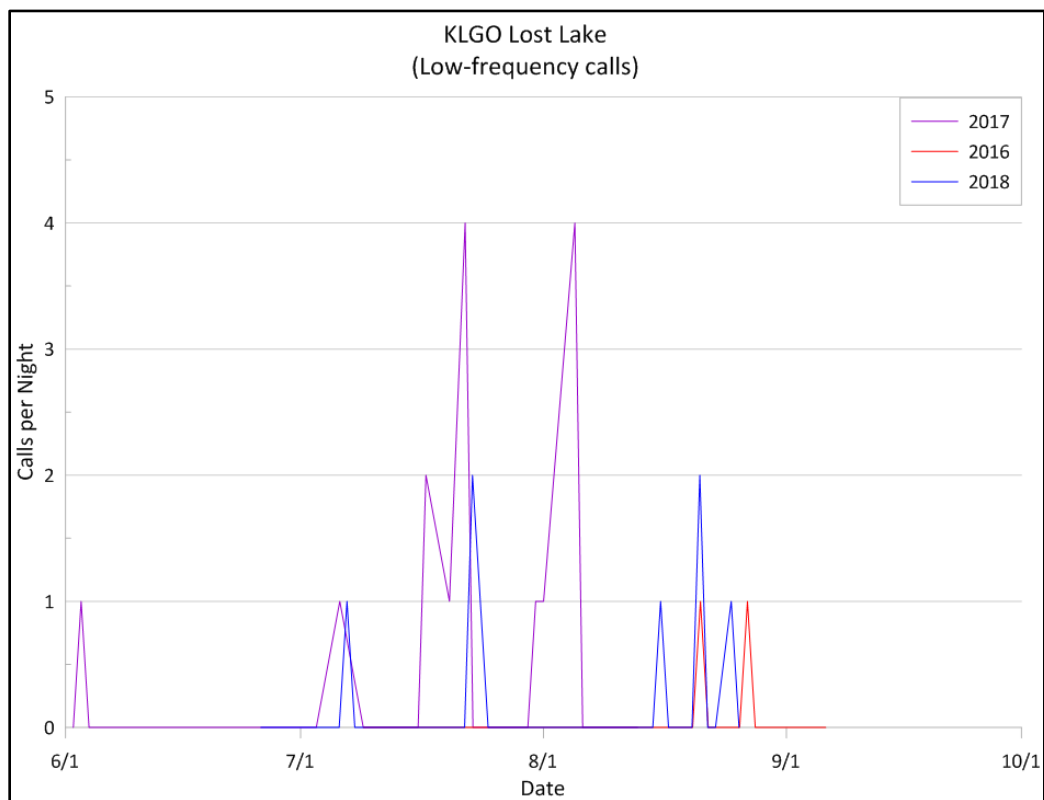
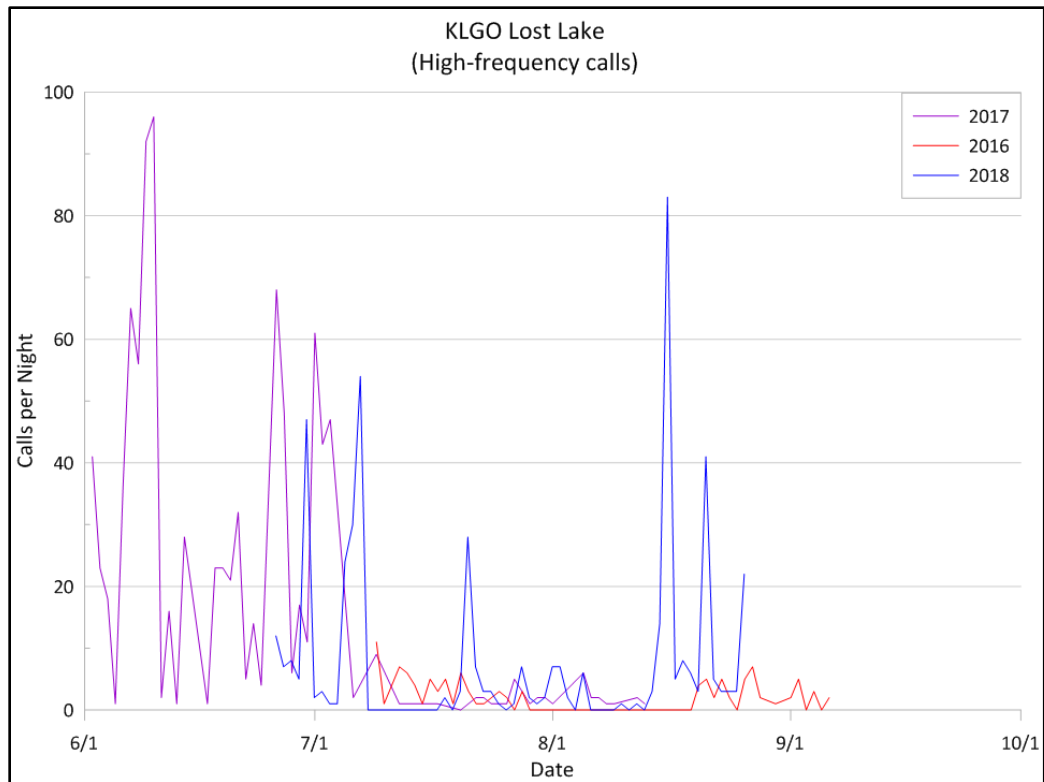


Figure 15. Nightly bat detections for Lost Lake (High-frequency, top; Low-frequency, bottom) in Klondike Gold Rush National Historical Park

Inspiration Mine

Elevation 994m

Deployed 6/28/2017 to 8/19/2017 – 1 call



Microphone near the closed entrance of the Inspiration Mine, Klondike Gold Rush National Historical Park.

The detector was placed near the lower, horizontal entrance of an old mine in an area classified as a mosaic of dwarf shrub (sub-alpine fir), herbaceous species, tundra and rock. Only one high-frequency call was recorded, but no maintenance trips to replace batteries were conducted, so recording time was limited to only about six weeks.

Chilkoot Trail

One of the project focus areas for KLGO in 2016 and 2017 was to examine bat activity across a wide range of elevations and habitats by conducting monitoring up the Chilkoot Trail (Figure 11). A single detector was deployed for several nights at multiple locations traversing up the trail to treeline, over Chilkoot Pass and then back down the Canadian side of the trail to Bennett and back, a traverse of more than 100km. The detector was along the trail from 7/12/2016 to 9/14/2016 and then from 6/2017 to 9/14/2017.

Finnegans Point

Elevation 30m

Deployed 7/12/2016 to 7/18/2016 – 74 detections

Deployed 8/26/2016 to 9/14/2016 – 68 detections

Deployed 5/31/2017 to 6/7/2017 – 24 detections

Deployed 8/31/2017 to 9/14/2017 – no detections

Deployed 6/7/2018 to 6/13/2018 – no detections

In 2016, the first deployment site was about 25 meters downhill from the Finnegans Point warming cabin. It was set back about 5 meters from a small stream corridor in a fairly dense Sitka spruce - black cottonwood forest. The microphone was attached to a large Sitka spruce about 1.5 meters from the ground. The park staff decided that the white noise from the stream may be too much, so moved the detector on July 15, 2016 to a new location. The second location was located approximately 100 meters south of the warming hut to a quieter, more open area. The microphone was deployed in an alder approximately 1.5 meters above the ground and above the understory of devils club. There were 74 detections recorded, but none could be identified to species.

On the return trip in 2016, the detector was deployed on a fallen log approximately 3 meters off the ground in a field of fallen logs and low devils club (figure 16). The microphone was attached to the fallen log and directed over the clear area. The detector recorded 68 detections (Figure 17), but none could be identified to species.



Figure 16. 2016 Location of microphone and general detection area for Finnegans Point on the return trip down

In 2017, the detector was attached to a downed cottonwood in a clearing surrounded Sitka spruce-black cottonwood-alder forest with an understory of devils club. The location was about 50 meters

from the Taiya River. This detector captured 24 passes (Figure 17), identified as long-eared myotis (*Myotis evotis*), little brown (*Myotis lucifugus*), and silver-haired bats (*Lasionycteris noctivans*). No passes were recorded during the second 2017 deployment at this site.

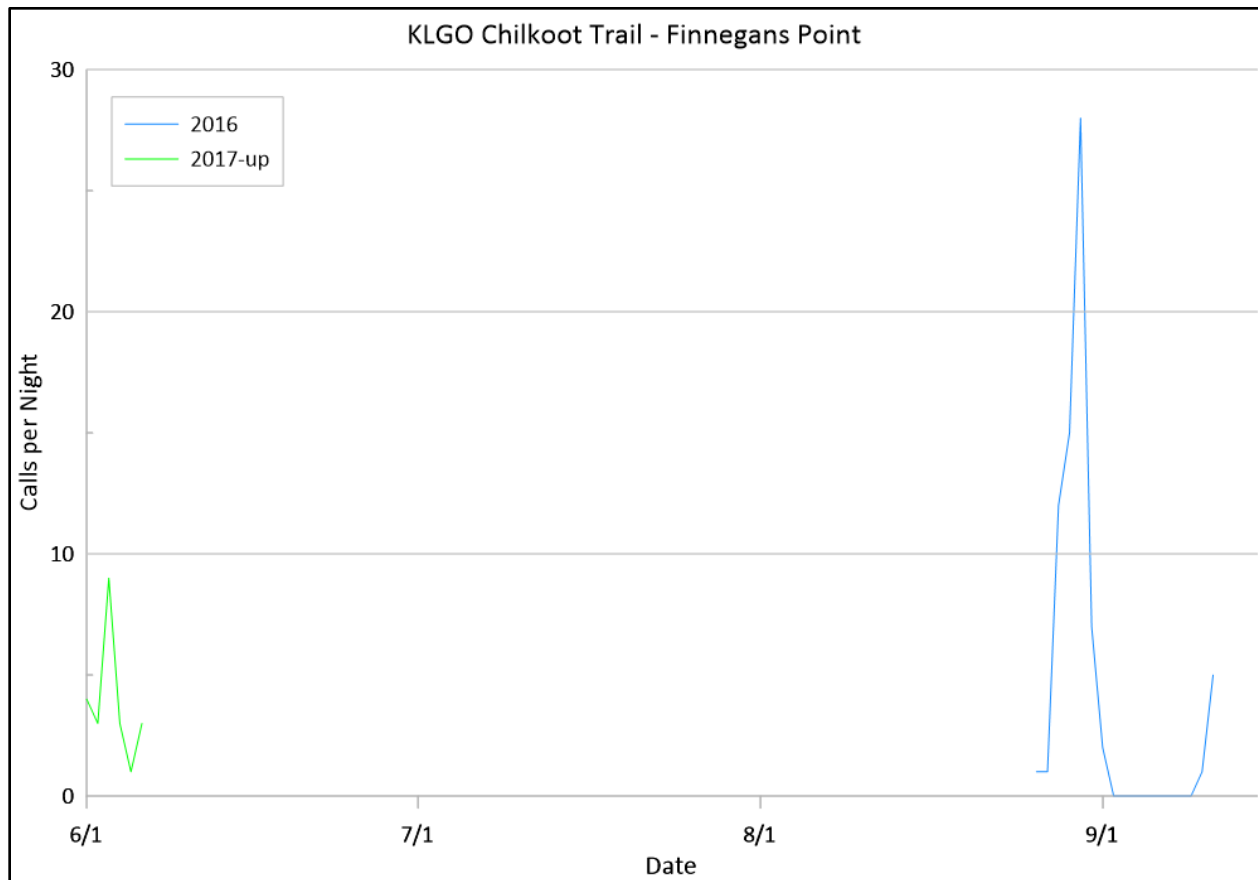


Figure 17. Nightly bat detections for Finnegans Point along the Chilkoot Trail in Klondike Gold Rush National Historical Park

Canyon City

Elevation 95 meters

Deployed 7/18/2016 to 7/27/2016, 8/19/2016 to 8/26/2016 – 5 detections

Deployed 6/7/2017 to 6/14/2017, 8/24/2017 to 8/31/2017 – no detections

Deployed 6/13/2018 to 6/18/2018 – no detections

On the way up the trail in 2016, the detector was deployed about 25 meters south of the Canyon City warming shelter about 25 meters away from a small stream. The microphone was attached to a young alder about 1.5 meters above the ground and facing westward into an open clearing. The bat detector recorded 5 passes that could only be grouped into high-frequency (4) and low-frequency (1).



Microphone placement (left) and general area where the Canyon City detector was deployed (right) on the way up the trail in 2016. Photo by Jen Larsen.



Microphone placement (left, arrow) and general area where the detector was deployed near Canyon City on the return trip down the Chilkoot Trail in 2016.

On the return trip in 2016, the detector was deployed off of the Boiler Loop in an open area dominated by low cranberry bushes. The microphone was attached to a small alder about 1 meter off the ground and facing into an open meadow. The detector recorded 4 passes that could only be grouped into high-frequency (2) and low-frequency (2).

Sheep Camp

Elevation 274 meters

Deployed 7/27/2016 to 8/2/2016 – 57 detections

Deployed 8/11/2016 to 8/19/2016 – 535 detections

Deployed 6/14/2017 to 6/20/2017 – 1 detection

Deployed 8/17/2017 to 8/24/2017 – no detections

Deployed 6/18/2018 to 7/7/2018 – 1 Detection

Deployed 8/20/2018 to 9/7/2018 – 1 Detection



Area where the detector was deployed near Sheep Camp on the return trip down the Chilkoot Trail in 2016. The helipad can be seen in the background.

In 2016, the detector was deployed near the Sheep Camp ranger station between the station and the tent pads. The microphone was placed in an alder about 2 meters off the ground and facing roughly south, into an open meadow. The detector recorded 57 passes (Figure 18), identified as little brown (*Myotis lucifugus*), and silver-haired bats (*Lasionycteris noctivans*). On the return trip, the detector was deployed near the Sheep Camp ranger station, but not in the same location as on the trip up the trail. The microphone was attached to an alder approximately 2 meters above the ground and pointed southward, towards an open meadow. The detector recorded 535 passes, identified as little brown (*Myotis lucifugus*), and silver-haired bats (*Lasionycteris noctivans*).

In 2017, the detector was located in a hedgerow 15m southeast of the ranger station directed towards a clearing 12m from the Taiya River. The area is partially developed open black cottonwood forest. Only one high-frequency call was recorded and was not able to be positively identified to bat type. No detections were recorded on its return trip.

The same location was used in 2018 and resulted in only one recorded pass during each of the two deployments. It is not clear why there have been so few calls in 2017 and 2018 compared to 2016.

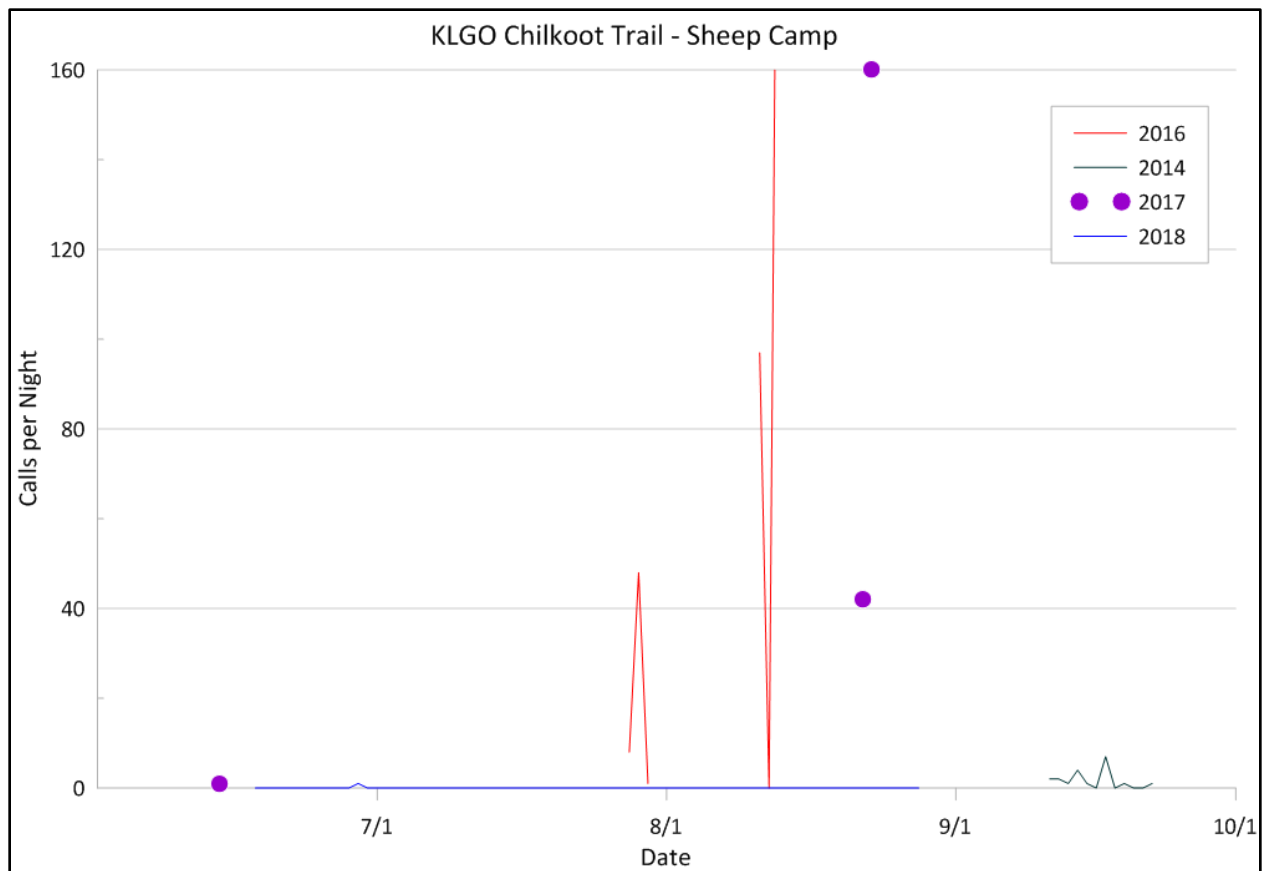


Figure 18. Nightly bat detections at Sheep Camp, Klondike Gold Rush National Historical Park

Treeline Talus

Elevation 471 meters

Deployed 8/2/2016 to 8/11/2016 – 36 detections

Deployed 6/21/2017 to 6/29/2017 – 22 detections

Deployed 6/8/2018 to 8/7/2018 – 218 detections

In 2016, the detector was located right at treeline where the large vegetation ends and the landscape becomes dominated by talus. The microphone was attached to an alder approximately 2 meters off the ground and facing north towards the talus field. The detector recorded 36 passes (Figure 19), identified as long-eared myotis (*Myotis evotis*) and little brown bats (*Myotis lucifugus*).

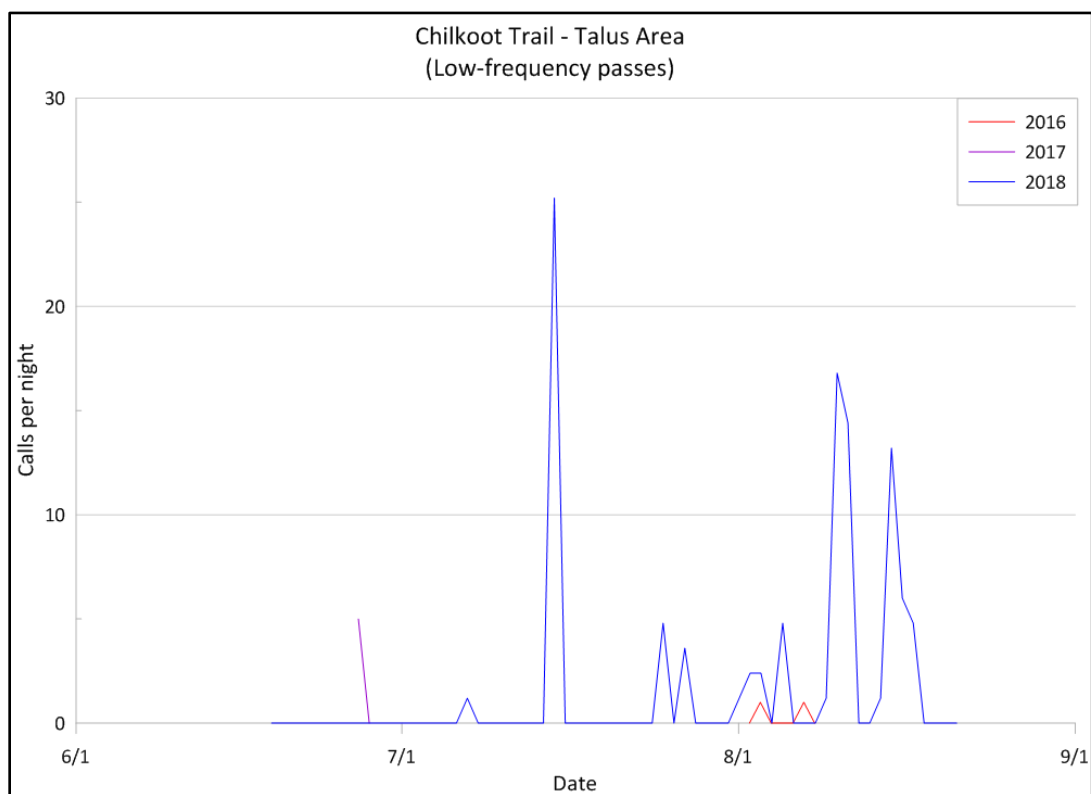
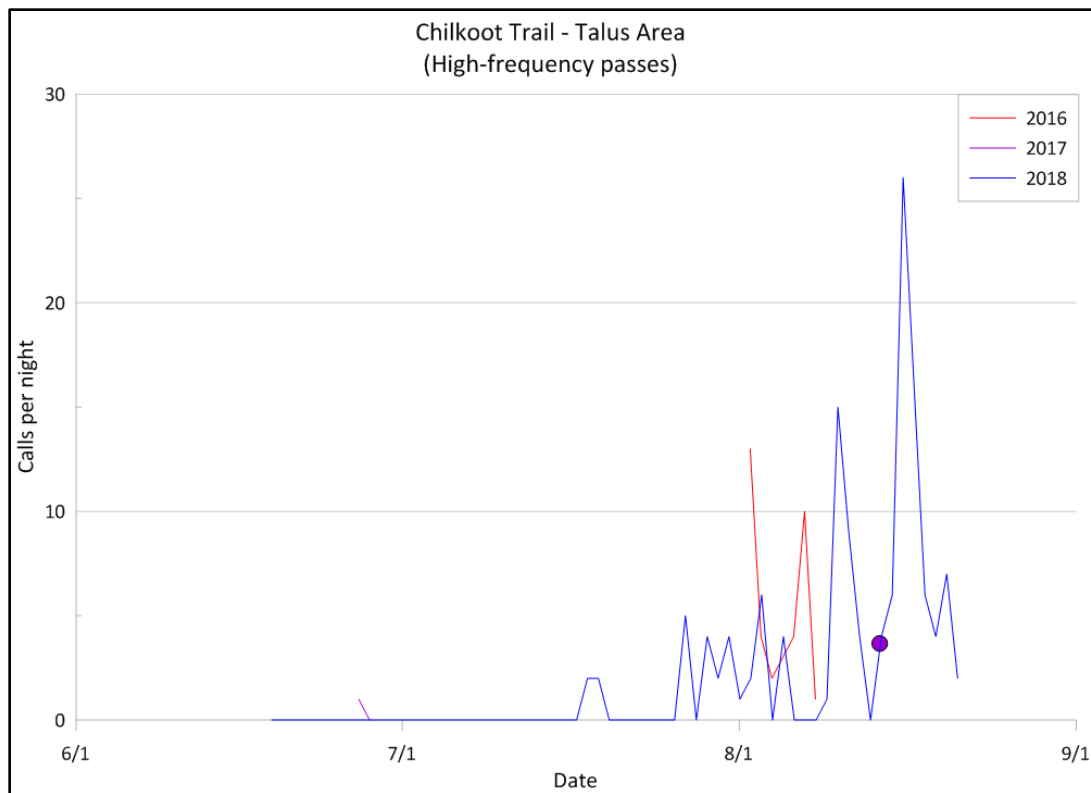
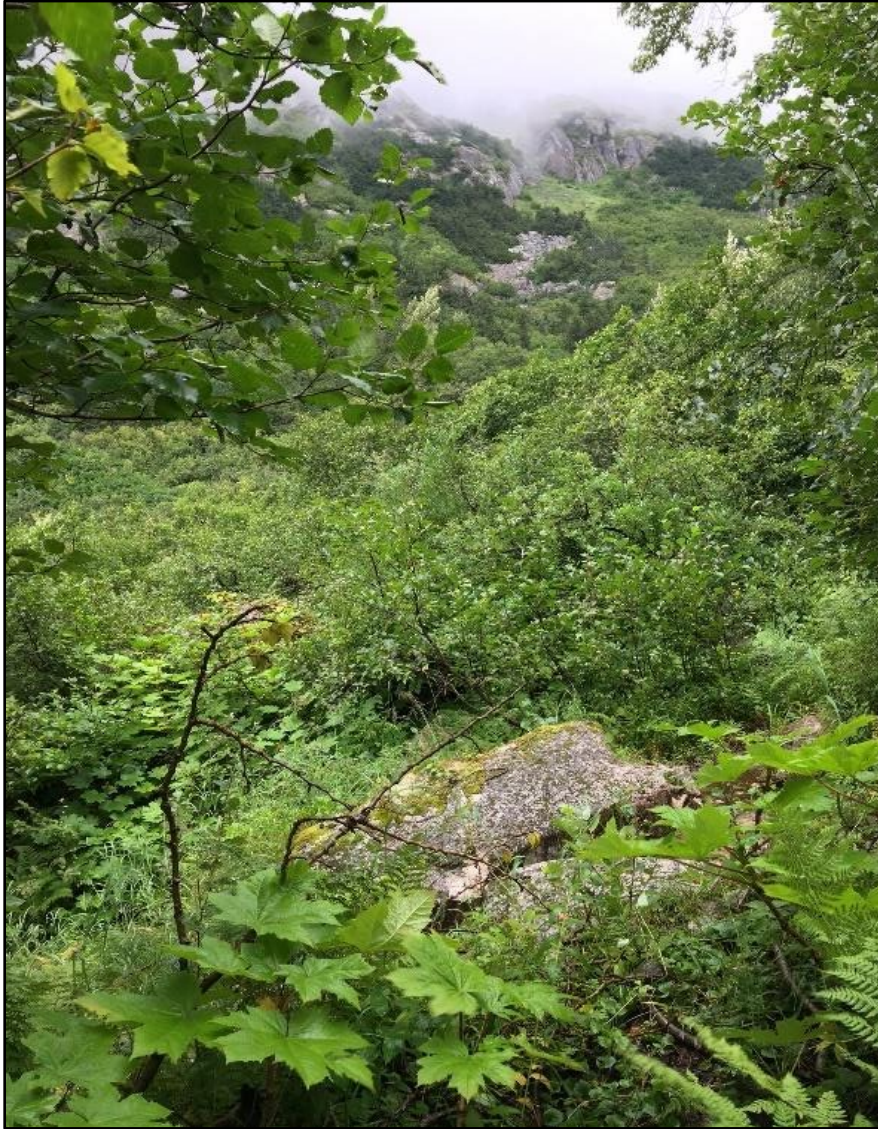


Figure 19. Nightly bat detections at treeline detectors along the Chilkoot Trail (High-frequency, top; Low-frequency, bottom).



General area where detector was deployed along Long Hill above Sheep Camp, Klondike Gold Rush National Historical Park in 2016.

In 2017, the detector was located further up the trail roughly 15m east of the Chilkoot Trail attached to a young alder. The detector recorded 12 passes (Figure 19), identified as long-eared myotis (*Myotis evotis*) and silver-haired bats (*Lasionycteris noctivans*). On the return trip, the detector was set up higher along the trail where talus is more dominant and 20m from the Taiya River. The detector recorded 2 passes, identified as long-eared myotis (*Myotis evotis*) and one call that could not be differentiated into type.

In 2018, the detector was placed in about the same location as on the return trip in 2017, but was left out for the whole season. The detector recorded 218 passes, identified as long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), and silver-haired bats (*Lasionycteris noctivans*).

Chilkoot Pass

Elevation 1070 meters

Deployed 6/30/2017 to 7/4/2017 – 2 detections

Deployed 8/9/2018 to 8/18/2018 – No detections

The detector was attached to the patrol cabin at the top of the Chilkoot Pass. The area is a sparse mosaic of dwarf shrub, lichen, tundra and rock. Two detections were detected on 6/30/2017 and classified as long-legged myotis (*Myotis volans*) and silver-haired bats (*Lasionycteris noctivans*).

Happy Camp

Elevation 897 meters

Deployed 8/4/2017 to 8/13/2017 – no detections

Deployed 8/2/2018 to 8/9/2018 – 1 detection

The detector was placed in an open meadow 75m from the camping area. The area is generally sparse subalpine meadow and rock. No classifiable detections were recorded.

Deep Lake

Elevation 857 meters

Deployed 7/5/2017 to 7/11/2017 – 6 detections

Deployed 7/7/2018 to 7/14/2018 – No detections

The detector was set up in an open clearing of alpine tundra 50 m from a small creek and 5m from a small pool and only 100m west of Deep Lake. The surrounding area is sparse conifer shrub. The detector recorded 6 high-frequency bat passes that could not be classified to type (Figure 20).

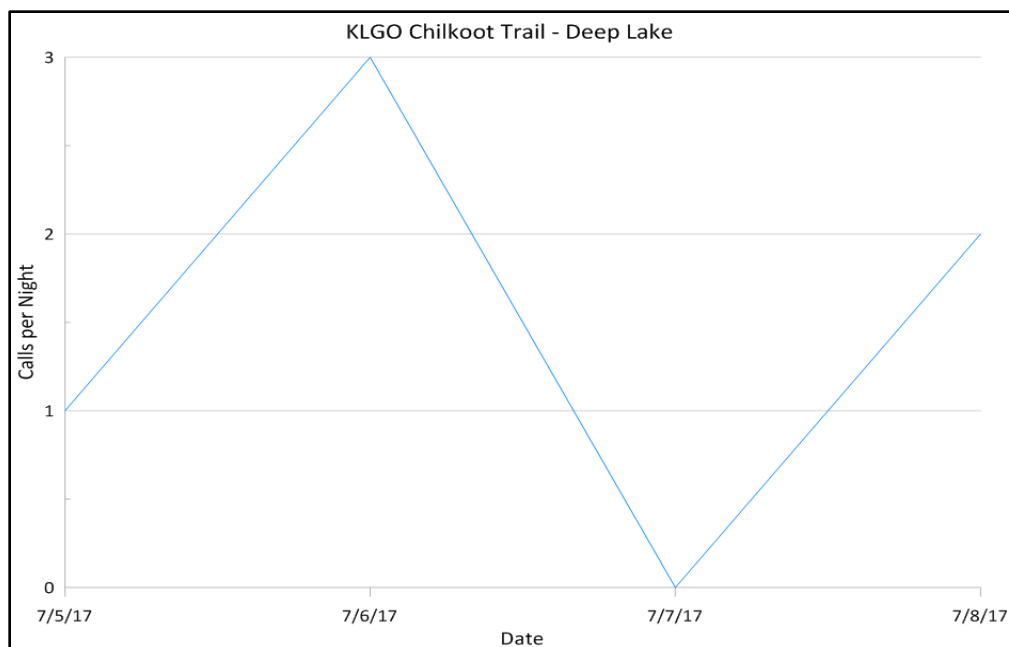


Figure 20. Nightly bat detections at Deep Lake.

Lindeman City

Elevation 640 meters

Deployed 7/28/2017 to 8/4/2017 – 2 detections

Deployed 7/21/2018 to 7/25/2018 – 28 detections

In 2017, the detector was set up in dense conifer forest adjacent to the rocky shoreline of Lindeman Lake. The detectors recorded 2 passes (Figure 21), classified as only high-frequency bats.

In 2018, the detector was set up in about the same location as in 2017. The detectors recorded 28 passes (Figure 21), classified into just high-frequency calls (27) and low-frequency calls (1).



Figure 21. Nightly bat detections at Lindeman Lake.

Bareloon Lake

Elevation 746 meters

Deployed 7/11/2017 to 7/19/2017 – no detections

Deployed 7/14/2018 to 7/21/2018 – 11 detections

The detector was set up in sparse conifer shrub near the camping area, but in a sheltered side of the lake in both 2017 and 2018. No bat passes were recorded in 2017. In 2018 11 passes were recorded, classified as only high-frequency (10) and low-frequency (1).

Bennett

Elevation 663 meters

Deployed 7/19/2017 to 7/28/2017 – 6 detections

Deployed 7/26/2018 to 8/1/2018 – No detections

The detector was set up in a grassy area near a pond/marsh area surrounded by an open tree-shrub forest 400m from the camping area. The detector recorded 6 passes (Figure 22), classified only as high-frequency (4) and low frequency (2). No positive identification could be made from the sound files.

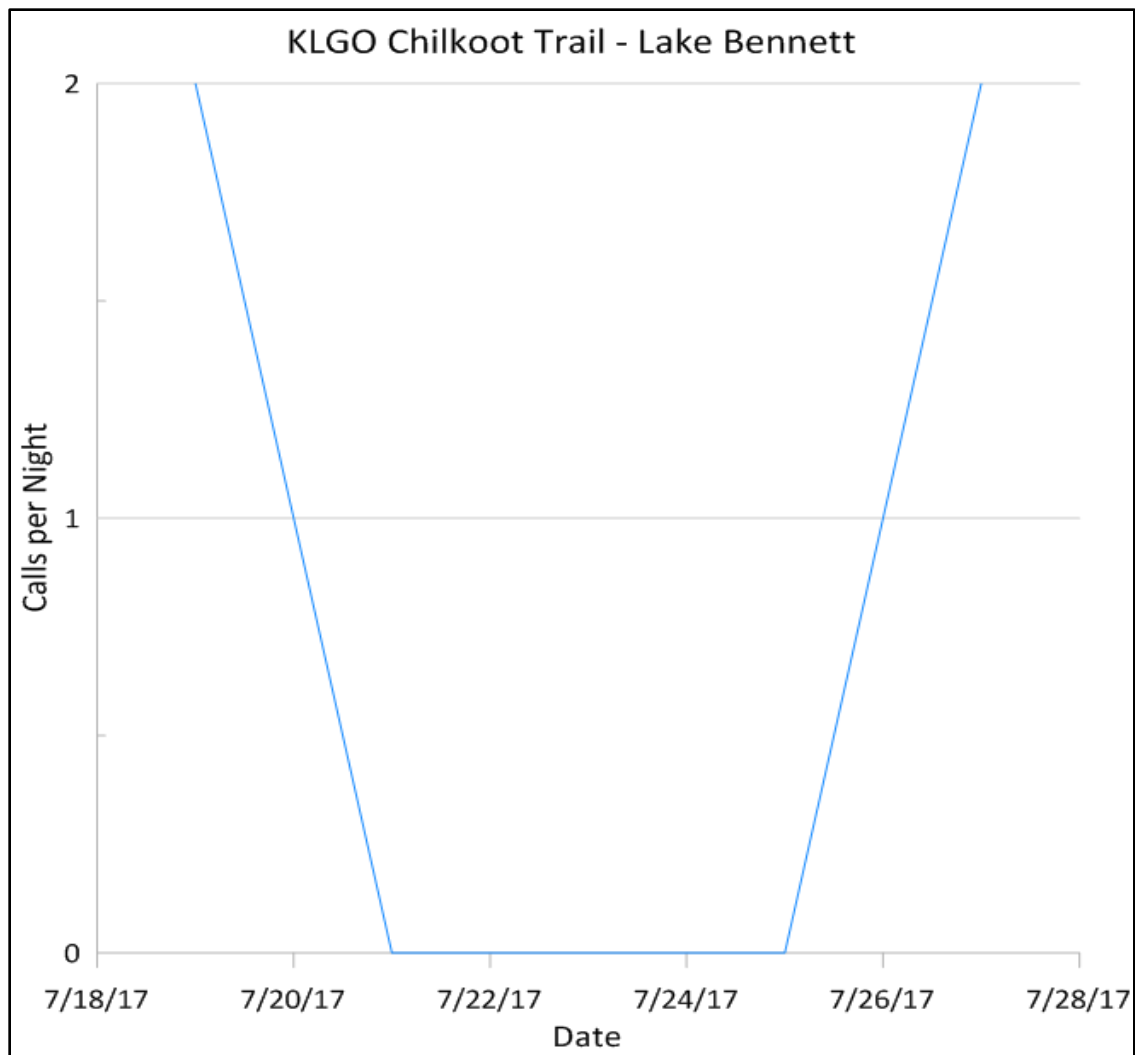


Figure 22. Nightly bat detections at Lake Bennett.

Lake Clark National Park

Acoustic bat monitoring locations for Lake Clark National Park are shown in Figure 23.

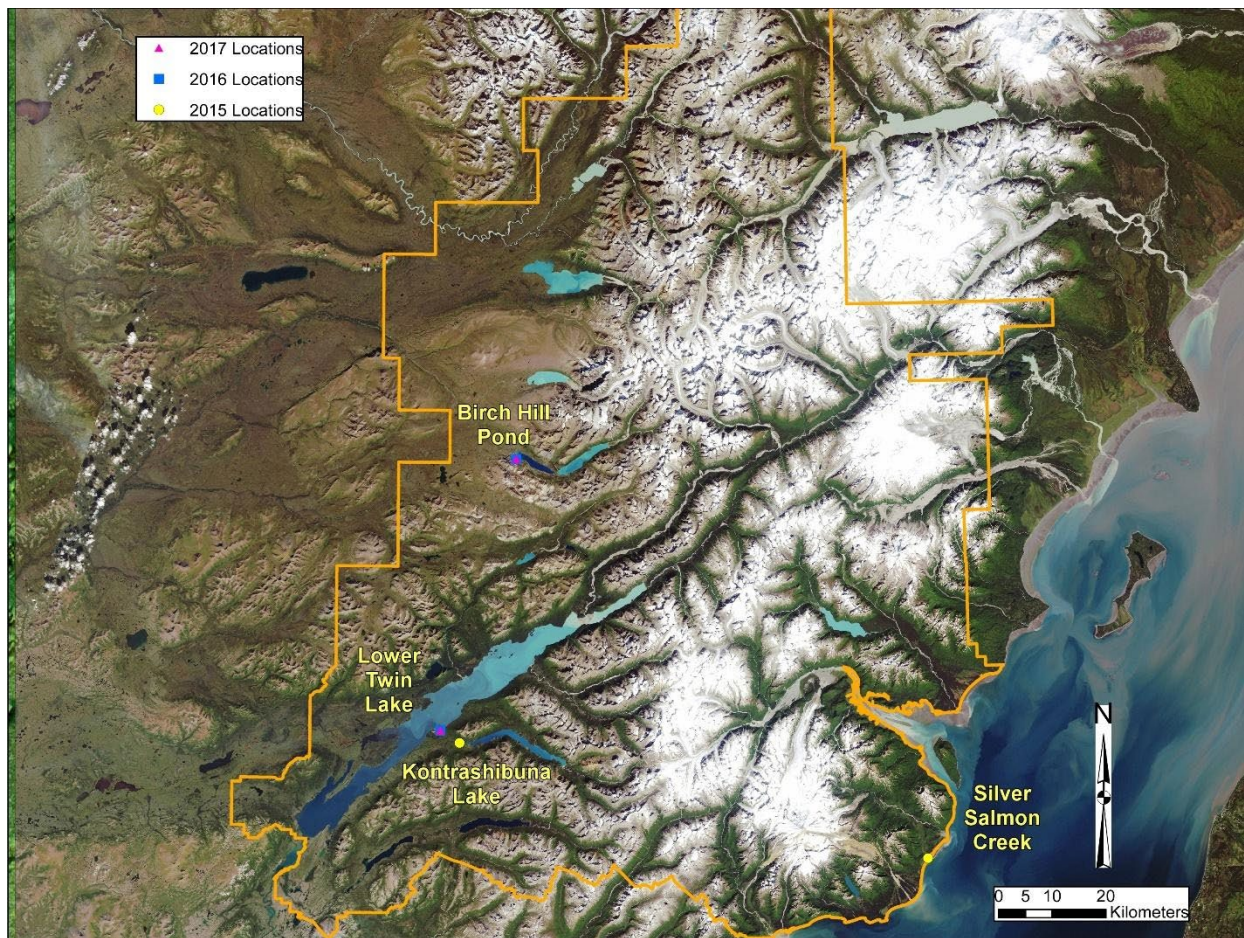


Figure 23. Acoustic bat monitoring locations for Lake Clark National Park, 2015-2017

Birch Hill Pond

Elevation 82 meters

Deployed 4/27/2016 to 10/28/2016 – 4745 detections

Deployed 5/18/2017 to 11/8/2017 – 130 detections

Deployed 6/11/2018 to 10/11/2018 – 565 detections

The detector was placed along the Birch Hill Pond midway down the western shore. The site is mixed spruce-birch forest. The microphone was mounted on a branch of a 30 cm DBH spruce tree facing due east and overhanging the water. There were 4745 detections in 2016, only 130 in 2017, and 565 in 2018 (Figure 24). All of the identifiable calls were classified as little brown bats (*Myotis lucifugus*). There was no obvious factors in the variability in detections between 2016 and 2018.

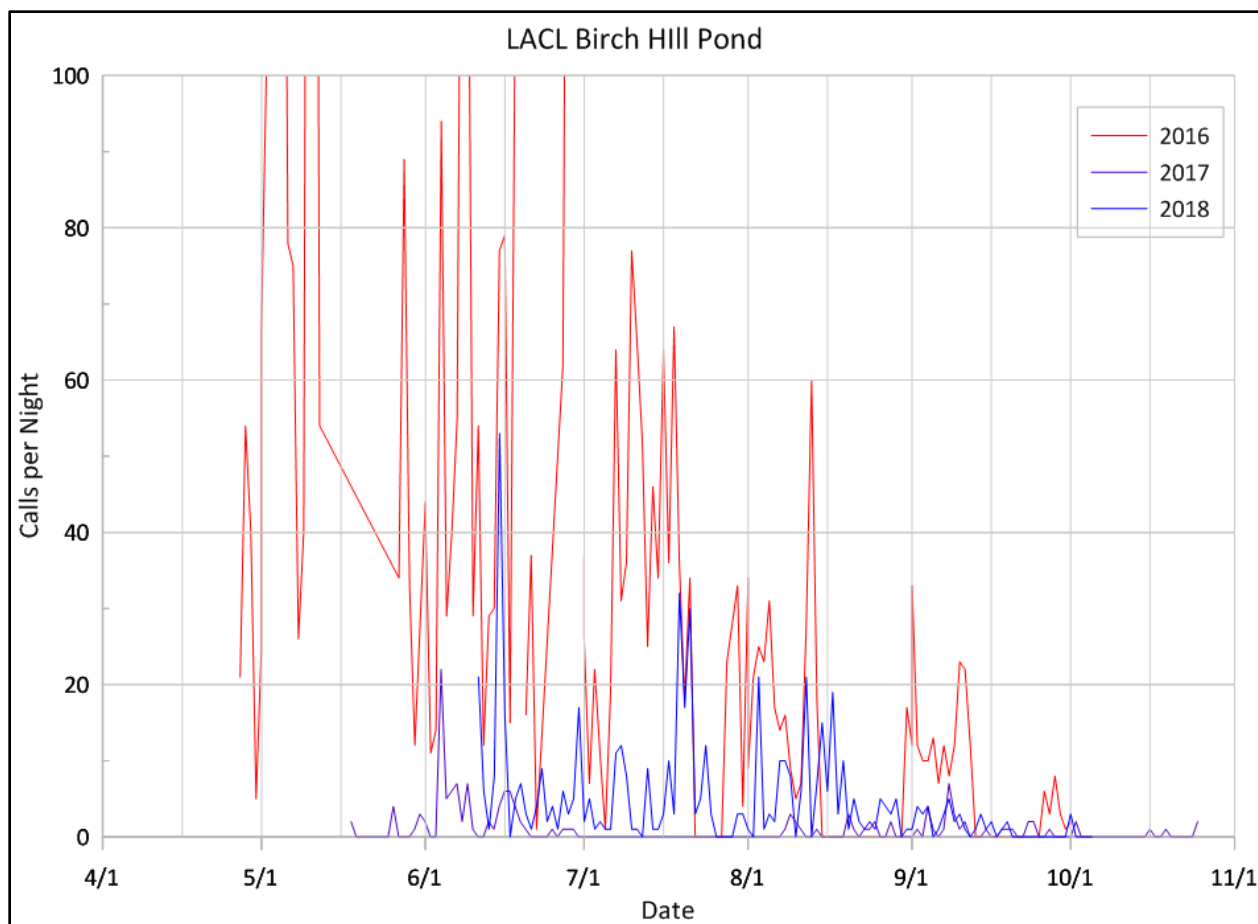


Figure 24. Nightly bat detections at Birch Hill Pond in Lake Clark National Park and Preserve 2016-2018.

Lower Twin Lake

Elevation 608 meters

Deployed 5/16/2016 to 10/06/2016 – 453 detections

Deployed 4/21/2017 to 9/27/2017 – no detections

Deployed 6/28/2018 to 9/26/2018 – 6 detections

The detector was deployed near a small pond northwest of the ranger cabin. The overall landscape is dominated by gravel drumlins with a nearby pond complex with lakes and rivers in a mountain valley. The microphone was mounted on a willow tree about 2 meters off the ground and pointed 230 degrees over the water. The detector recorded 453 passes in 2016 and 6 passes in 2018 (Figure 25). In 2017, the detector was placed in the same location, but did not record any passes, only noise. Upon removal from the site, the microphone cable fell off easily. This suggests that the microphone had not been attached correctly and was not receiving signals, not that there were no bats present. It is not known why there were so few detections in 2018. All of the identifiable calls were classified as little brown bats (*Myotis lucifugus*).

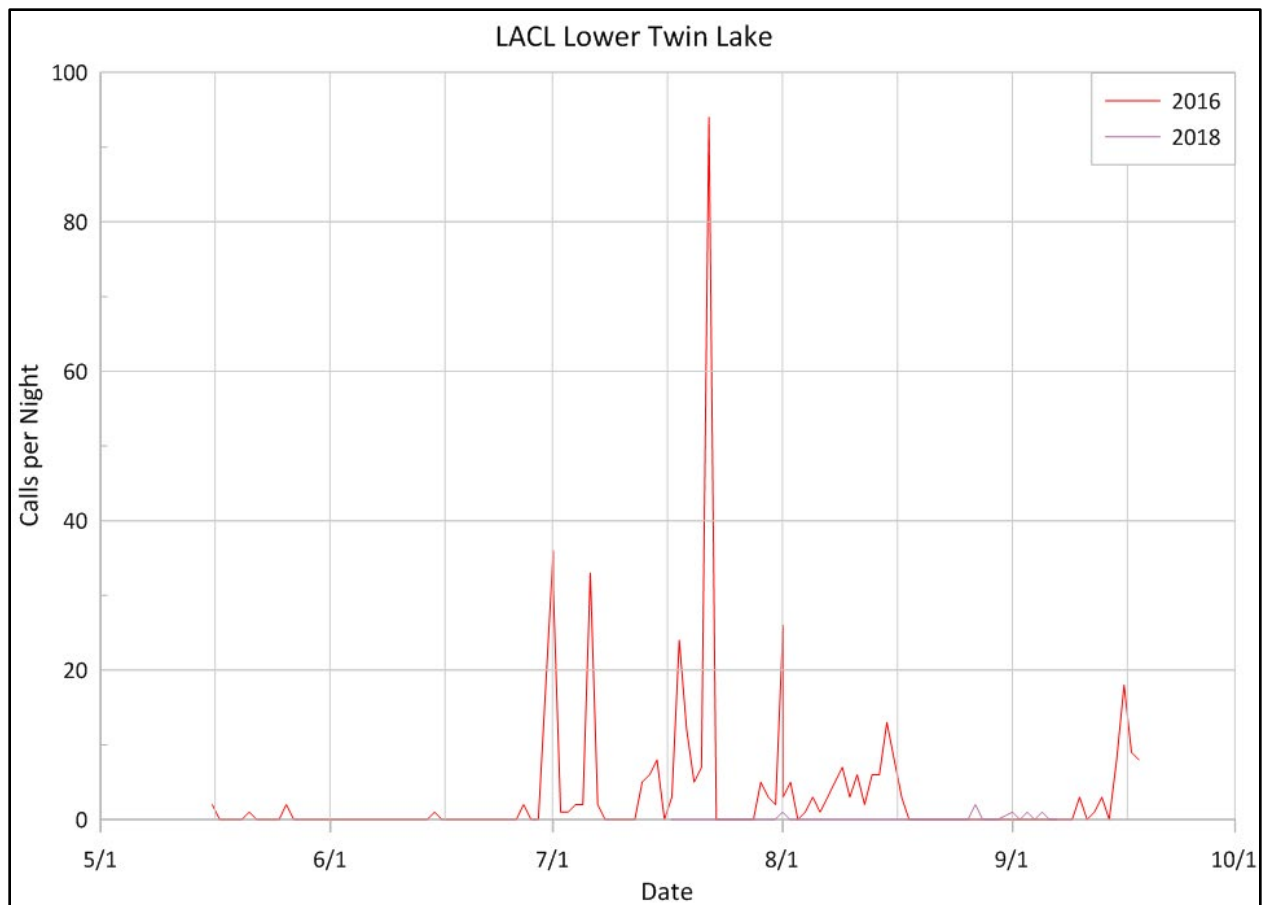


Figure 25. Nightly bat detections at Lower Twin Lake in Lake Clark National Park and Preserve in 2016 and 2018.

Wrangell-St. Elias National Park

Acoustic bat monitoring locations for Wrangell-St. Elias National Park are shown in Figure 26.

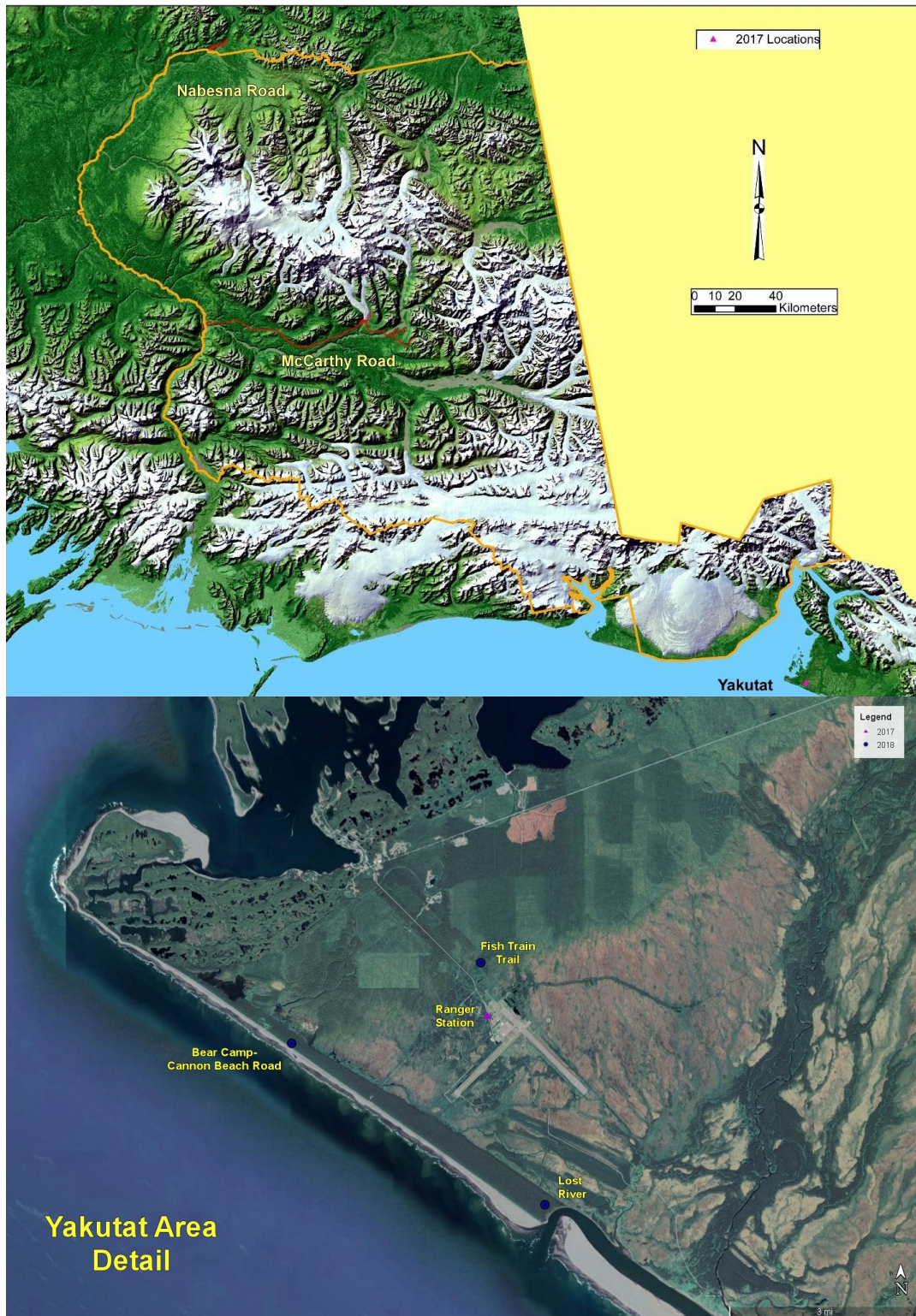


Figure 26. Acoustic bat monitoring locations for Wrangell-St.Elias National Park, 2017-2018

Yakutat

Ranger Station

Elevation 10 meters

Deployed 5/14/2017 to 7/23/2017 – 12,543 detections

The detector was set up in an area of tall and low shrubland with some development in the surrounding area. The detector recorded 12,543 passes (Figure 27), identified as California myotis (*Myotis californicus*), long-legged myotis (*Myotis volans*), little brown (*Myotis lucifugus*), and silver-haired bats (*Lasionycteris noctivans*).

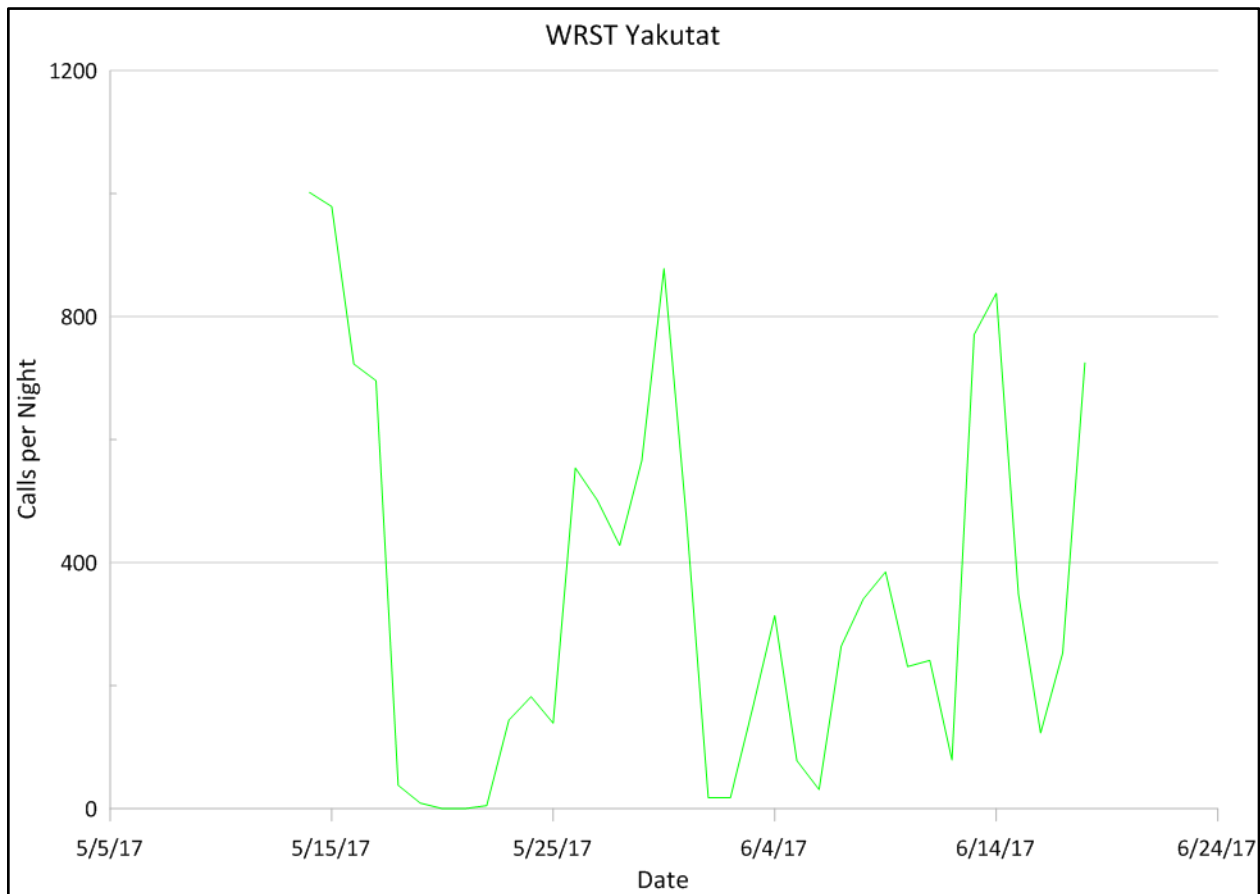


Figure 27. Nightly bat activity for Yakutat Ranger Station near Wrangell-St.Elias National Park, 2017

Lost River

Elevation 4m

Deployed 8/10/2018-8/12/2018 - 177 detections



Location of Lost River microphone site (in spruce tree at far left center) with open water corridor in the background.

The site is along the Lost River Road, a gravel/dirt road that acts as a nice corridor between a cottonwood/willow forest to the west and a stream/muskeg to the east. The detector recorded all high-frequency calls, identified as long-legged myotis (*Myotis volans*) and little brown bats (*Myotis lucifugus*).

Bear Camp - Canon Beach Road

Elevation 4m

Deployed 8/10/2018 to 8/12/2018 – 103 detections (46 high-frequency, 57 low-frequency)



View of junction where Bear Camp detector was set up (next to person).

The detector was set up at a junction of the road paralleling the beach and a roughly perpendicular road that leads to a campground and beach area. The detector recorded both high-frequency and low frequency calls, but only the high-frequency calls were classified by the autoclassifier. These were identified as long-legged myotis (*Myotis volans*) and little brown bats (*Myotis lucifugus*). One MYLU was captured during mist netting on 8/10/2018.

Fish Train Trail

Elevation 15m

Deployed 8/10/2018 to 8/12/2018 – 106 detections (47 high-frequency, 59 low-frequency)

The detection site was at the junction of the Fish Train Trail and a secondary road that joins the main road at Cannon Beach turnoff. The site is a corridor within a mixed cottonwood/spruce forest with willow and cottonwood shrubs. There are numerous streams and pools in the area. The high-frequency calls were classified as long-legged myotis (*Myotis volans*) and little brown bats (*Myotis lucifugus*). One low-frequency call was identified as a silver-haired bat (*Lasionycteris noctivans*). This ID was also accompanied by the sighting of a large-bodied bat that was also identified by a portable detector as a silver-haired bat. All captured bats from this location were little-brown bats.



Detector location along the Fish Train Trail (microphone on horizontal branch just past backpack).

Driving Transects

McCarthy Road

A driving transect was conducted along the McCarthy Road from the park boundary to end of the road on the night of August 15, 2017 from 2200 to 0125. The starting temperature was 14°C and ending temperature was 3°C with clear skies and light winds. The road is a mix of macadam, dirt, and gravel. Even though the road was driven between 5 and 10 mph, the tires on the road surface generated significant high-frequency noise and kept triggering the detector. Six passes were recorded (Figure 28), four were only classified as high frequency detections, and two as little brown bats (*Myotis lucifugus*).



Figure 28. Locations of bat detections along the McCarthy road in 2017. The overall road location is shown on the Wrangell-St. Elias map, Figure 26 above.

Nabesna Road

A driving transect was conducted along the McCarthy Road from the park boundary to end of the road on the night of August 16, 2017 from 2130 to 2247. The starting temperature was 11°C and ending temperature was 1°C with clear skies and slight winds. The road begins as macadam, but turns to gravel at mile 15. Even though the road was driven between 5 and 10 mph, the tires on the road surface generated significant high-frequency noise and kept triggering the detector. One call was recorded (Figure 29) and classified as a little brown bat (*Myotis lucifugus*).



Figure 29. Locations of bat detections along the Nabesna road in 2017. The overall road location is shown on the Wrangell-St. Elias map, Figure 26 above.

Recommendations and Future Work

The 2016-2017 field seasons went very well for region-wide bat work. There were some sites that did not have complete metadata collected and photos were not taken for each site.

From discussions with other bat researchers working in Alaska and the Yukon, they recommend getting acoustic monitors into the field in early April to ensure we capture the first appearance of bats into various areas.

We are receiving additional funding for bat work in 2018, so should be able to not only re-deploy the detectors from this year, but should be able to expand into other locations and parks. We have also received funding to conduct additional driving transects in DENA and WRST (the only parks with long, accessible roadways).

We hope to conduct some mist netting in cooperation with the Alaska Department of Fish and Game and the University of Alaska Anchorage to verify some of the species that were detected acoustically. Captured bats would also be banded with unique numbered bands so migration patterns can be better determined.

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Appendix A Wildlife Acoustics Programs

Figures A1 and A2 are screenshots of Wildlife Acoustics SM3 and SM4 Programming 2016–2017.

The screenshot displays the SM3 Configurator software interface, divided into two main sections: Configuration settings and Program.

Configuration settings:

- Prefix:** ☒ AKTEST1
- Timezone:** ☒ UTC-09 :00
- Position:** ☒ Lat: 31.88 N Lon: 109.21 W
- Solar mode:** ☐ Sunrise/Sunset
- Cutoff voltage:** ☐ 0.0 V
- Sensitivity:** ☐ 0: 0.1 dB 1: 0.1 dB
- Deployment scenario:**
 - Start dd/mm/yy hh:mm:ss: 25/05/2015 06:44:24
 - A: 64GB B: 64GB C: 64GB D: 64GB
 - Mic 0: SMM-U1/SM3-U1 Mic 1: Internal
 - Trig Ratio (%): 10% Battery (Wh): 72 Wh

Program:

Channel	Function	CH 0	CH 1
1	HPF	1 kHz	1 kHz
2	GAIN	Specify	12.0 dB
3	FS	WAV Format	AUTO
4	ZC	OFF	DIV 8
5	FRQMIN	Specify	5 kHz
6	FRQMAX	Specify	192 kHz
7	DMIN	Specify	2.0 ms
8	DMAX	Specify	300.0 ms
9	TRGLVL	Specify	18 dB
10	TRGWIN	1.0 s	1.0 s
11	TRGMAX	Specify	5.0 s
12	NAP	Specify	1 min
13	REPEAT		
14	AT SSET	-	00 : 30 : 00
15	REPEAT		
16	RECORD	01	00 : 00 : 00

Figure A-1. Screen shot of wildlife acoustics SM3 Programming 2016–2017.

SM4 Configurator --- C:\Users\PABurger\Documents\Bats-WNS\WildlifeAcoustics\GLBA2_2017_SM4.SM4S

File Help

Deployment Scenario

SM4BAT-FS ▾	Simulation Start yyyy/mm/dd hh:mm:ss	2016/07/05	09:35:00	NOTE: Remember to select the correct model of SM4 recorder e.g. SM4, SM4BAT-FS, or SM4BAT-ZC NOTE: Run time estimates assume power-efficient flash cards and high quality batteries at room temperature. Run times can vary significantly (by as much as 50%) otherwise.
Slot A:	64GB ▾	Slot B:	64GB ▾	
Mic 0:	SMM-U1 ▾			
Trig Ratio (%):	10%	Battery (Wh):	72 Wh	

Settings

☒ Prefix:	GLBA2	Gain:	12 dB ▾
☒ Timezone:	UTC-09 ▾	:00 ▾	16k High Filter: off ▾
☒ Position:	Lat: 58.45000 N	Lon: 135.90000 W	Sample Rate: 256 kHz ▾
	sunrise/sunset ▾		Min Duration: 2.0 ms
	Delay Start (yyyy/mm/dd): ☐	2000/01/01	Max Duration: 300 ms
	LED always ▾		Min Trig Freq: 5 kHz
☐ Battery Cutoff:	0.0 V		Trigger Level: 18 dB ▾
	Schedule Mode daily ▾		Trigger Window: 1 s
	Do Not Sleep: no ▾		Max Length (mm:ss): 00:05
			Compression: none ▾

Figure A-2. Screen show of Wildlife Acoustics SM4 Programming 2016-2017.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 953/167335, March 2020

National Park Service
U.S. Department of the Interior



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