CONSERVING AND MONITORING LITTLE BROWN BAT (*MYOTIS LUCIFUGUS*) COLONIES IN YUKON: 2013 ANNUAL REPORT

Prepared by: Thomas S. Jung and Piia M. Kukka

Yukon Environment

26 March 2014

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Yukon Department of Environment
Fish and Wildlife Branch
PR-14-03

Acknowledgements

We thank the Yukon Parks Branch and a private landowner on Little Atlin Lake for allowing access on lands they own or manage. We would also like to thank Kyra Chambers, Alex Davidge, Linea Eby, Michelle Henley, Dawna Hope, Lars Jessup, Kaz Kuba, Carrie McClelland, Kyle Russell, Heidi Schindler, Kelcy Tousignant and Brian Slough for providing excellent field assistance. We thank Rudy Boonstra and Jane Harms for leading the stress response sampling with assistance from Kyla Johnson, Meghan Larivee, Kristenn Magnusson and Candace Stuart.

Copies available from:
Yukon Department of Environment
Fish and Wildlife Branch, V-5A
Box 2703, Whitehorse, Yukon Y1A 2C6
Phone (867) 667-5721, Fax (867) 393-6263
Email: environmentyukon@gov.yk.ca
Also available online at www.env.gov.yk.ca

Suggested citation:
JUNG, T. S., AND P. M. KUKKA. 2014. Conserving and monitoring little brown bat (*Myotis lucifugus*) colonies in Yukon: 2013 Annual Report. Yukon Fish and Wildlife Branch Report PR-14-03. Whitehorse, Yukon, Canada.

SUMMARY

Little Brown Bats (*Myotis lucifugus*) are currently assessed in Canada as an *Endangered* species. The key threats are disease, climate change, loss of roosting habitat, and persecution by property owners and managers. Environment Yukon has been monitoring Little Brown Bat colonies at key locations in southern Yukon since 2007.

- We focused our work at 6 maternity colonies. The main goal of the 2013 work was to band additional bats in the colonies and collect data useful for analyses of population trends.
- We also collected biological samples (blood, hair, feces, DNA) for analyses of stress, diet, migratory movements, and population genetics. Sample collection was intended to contribute to larger-scale projects on Little Brown Bats at a regional or continental scale that are being conducted by university-based researchers.
- We captured and processed 1,111 bats in 2013, compared to 1,035 in 2012. Biological samples were taken from less than 20% of these bats.

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Introduction

Little Brown Bats (*Myotis lucifugus*) are currently assessed in Canada as an *Endangered* species. The fungal disease, White Nose Syndrome, is the main threat to populations across North America (Frick et al. 2010, Foley et al. 2011). While the fungus is not yet recorded in western Canada, it is anticipated to affect Little Brown Bat populations across the continent in the near future. In addition, the distribution and abundance of Little Brown Bats is likely determined to a large degree by climate, and changes in climate may have large consequences for Little Brown Bats in northern regions (Humphries et al. 2002). Other threats to Little Brown Bats include loss of roost-sites and persecution by humans.

Monitoring of bat houses by local biologists for the collection of scientific data began in the late 1990s (Slough and Jung 2008). Environment Yukon began monitoring bat houses in 2004 and established a limited number of bat houses in key locations in 2007. Bats are long-lived mammals, with maximum reported life spans of 30-40 years; consequently, long time series of data are needed to assess changes in population size and demographic parameters. By developing a time series of data on bat colonies at key locations, we can track changes in colony size, reproduction, and survival.

These data may be used to assess the conservation status and demographic response of Little Brown Bats to changes in weather and climate. Indeed, the Little Brown Bat time series of data in southern Yukon are among the most valuable in western Canada, where the species has generally been less monitored than in eastern North America.

In fiscal year 2012/2013, our overall goals were to establish a number of new bat houses at key locations (Jung and Kukka 2013) and evaluate a mark-recapture protocol for inventorying bat colonies (Jung 2013). For this reporting year (2013/2014), our main goals were to increase our sample size of banded bats and to add to our time series of data on Little Brown Bat survival and reproduction. These data may form the basis of a broader analysis on the population ecology of Little Brown Bats in northwestern Canada, and are invaluable with regards to informing conservation status assessments and recovery/management planning for the species.

In addition to the main goals of our work this year, we attempted to accomplish several ancillary goals, which included providing samples from captured bats for analyses in several university-based laboratories. Specifically, we aimed to contribute samples to larger-scale studies investigating Little Brown Bat diet, migration, population genetics, and stress factors.

Methods

Our work in 2013 was focused on 6 bat colonies in southern Yukon, namely: Chadburn Lake, Dalton Post, Drury Creek, Little Atlin Lake, Salmo Lake, and Squanga Lake (Table 1, Figure 1). Maternal bat colonies at each site are housed in bat houses that were established to offer alternative roosts for bats that roosted in nearby buildings, where bats were not wanted, or where they were excluded (see Slough and Jung 2008, Jung and Kukka 2013).

We used harp traps (Kunz and Anthony 1977; Figure 2) to capture bats from bat houses at dusk. Captured bats were measured, and the sex, age-class, and reproductive condition were determined, where possible. Each individual was banded with a uniquely numbered forearm band (2.9 mm lipped alloy band; Porzana Limited, Icklesham, United Kingdom). The band identification numbers of previously banded bats were recorded. Mass (± 0.1 g) and forearm length (± 0.1 mm) were obtained with a digital scale and digital calipers, respectively. The reproductive status of adult female bats was determined from palpation and/or visual inspection of the teats (non-reproductive, pregnant, lactating, post-lactating, or unknown). We took a small (2 mm) biopsy of tissue from each wing for genetic analyses. Research shows that in most cases the tissue heals within 12 days (Faure et al. 2009).

We collected a small tuft of hair from 14–28 bats at each colony to provide samples for stable isotope analysis, with the goal of using these samples to provide information on diet and, possibly, migration routes. Fecal samples were collected to provide information on diet. These were collected during capture sessions and at select colonies by placing a guano trap (Brigham et al. 2002) underneath the bat house and collecting the contents 1–2 weeks thereafter. Finally, we collected serum (blood) from up to 22 bats during each night of captures. These samples will be used to establish a baseline of stress hormones in bats, and their hormonal response to capture.

In addition to our focused work at the 6 bat colonies above, we visited most of the remaining bat houses in our monitoring program (Figure 1) to assess their structural condition and occupancy by bats. Structural condition of bat houses may be compromised by weather events (e.g. strong winds), human activities (e.g. vehicles, snow removal equipment, vandalism), or wildlife (e.g. woodpeckers). Other wildlife (e.g. birds; Jung and Kukka 2013) may occupy bat houses and displace bats. We assessed occupancy by knocking on the support structure and listening for bats. If there was no response, we briefly shone a flashlight into the bat house to visually determine occupancy. Finally, we searched the ground underneath the bat house for bat guano (droppings).

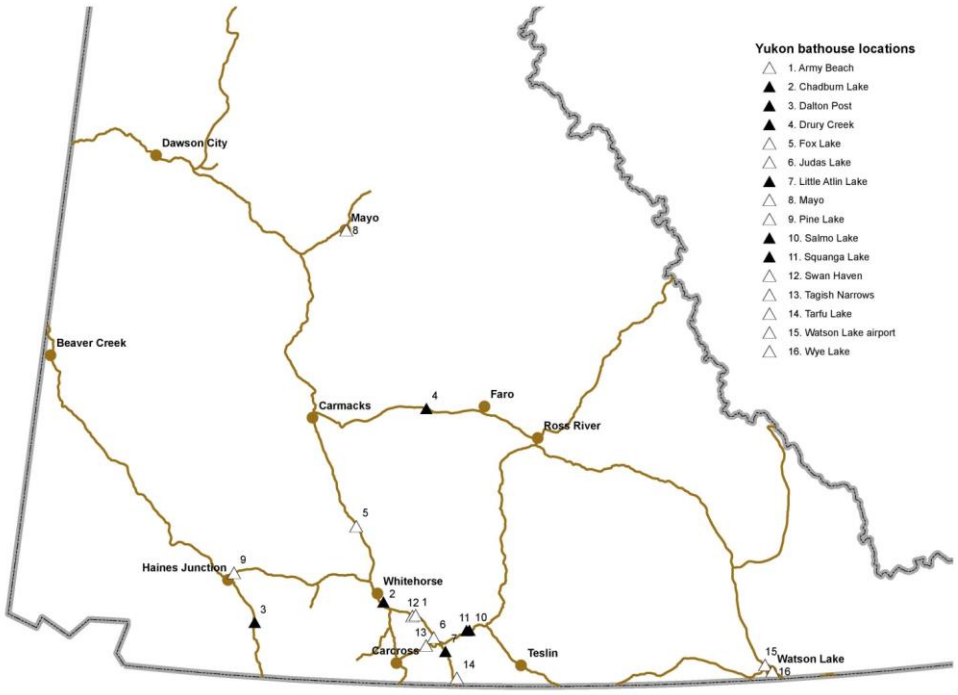

Figure 1. Location of bat houses in Yukon, Canada. Closed (black) triangles represent the bat colonies that were the focus of our monitoring in summer 2013.

Results

Bat Captures & Banding

We visited each of the 6 focal colonies 1–4 times between 27 May and 9 August 2013.

Altogether, we captured and processed 1,111 bats in 2013, compared to 1,035 in 2012 (Jung and Kukka 2013). The largest number of bats per session (n = 148; Table 1) was handled in Little Atlin Lake, which is the largest of the colonies (Jung 2013).

The number of previously banded bats varied between colonies. Bats in the Squanga Lake and Salmo Lake colonies, which have been banded intensively over the years (Slough and Jung 2008), had recapture rates from 52% to 90% (Table 1). In contrast, all of the 90 bats captured at the Drury Creek colony were newly banded because this was the first year of banding in that area.

Most bats captured were reproductive adults. We determined the reproductive status with the most confidence in late June and July, when pregnancy or lactation was visually obvious. We started to see juveniles in our captures from mid-July onward. The sex ratio of juveniles was 1.3 males to 1 female.

A brief narrative of the results of bat captures at each colony in 2013 is provided as an Appendix.

Table 1. Summary results of Little Brown Bat (Myotis lucifugus) captures at 6 focal colonies in Yukon, Canada, summer 2013.

Colony	Capture Date (2013)	Total Number of Bats Captured	Number and Percent of Individuals Newly Captured	Number and Percent of Individuals Recaptured	Percent of Adult Females that were Reproductively Active (%)
Chadburn Lake	10 July	37	14 (38%)	23 (62%)	78%
	9 August	15	13 (87%)	2 (13%)	unknown
Dalton Post	24 June	25	21 (84%)	4 (16%)	96%
	6 August	16	15 (94%)	1 (6%)	75%
Drury Creek	8 August	90	90 (100%)	0 (0%)	61%
Little Atlin Lake	4 July	148	116 (78%)	32 (22%)	64%
	18 July	101	73 (72%)	28 (28%)	77%
	7 August	85	72 (85%)	13 (15%)	77%
Salmo Lake	30 May	129	31 (24%)	98 (76%)	unknown
	13 June	80	16 (20%)	64 (80%)	unknown
	8 July	124	46 (37%)	77 (62%)	72%
Squanga Lake	27 May	82	26 (32%)	56 (68%)	unknown
	12 June	70	7 (10%)	63 (90%)	93%
	3 July	77	37 (48%)	40 (52%)	93%
	17 July	32	8 (25%)	24 (75%)	79%

Figure 2. A harp trap set to a bat house near Salmo Lake, Yukon, provides an ideal site to monitor little brown bat (Myotis lucifugus) populations.

Sample Collection

We obtained blood samples from 183 bats: 54, 66, and 63 samples from the Salmo Lake, Squanga Lake, and Little Atlin Lake colonies, respectively (Table 2).

These samples were shipped to the University of Toronto and hormone assays will be conducted to assess baseline and comparative stress levels.

DNA samples (wing punches) were taken from 164 bats, representing all 6 of the focal colonies sampled in 2013 (Table 2).

These samples have been shipped to Trent University where they will contribute important point source data to a larger scale study on gene flow and population connectivity among Little Brown Bats in northwestern North America.

We collected hair samples from 260 bats, taken from all focal colonies except Little Atlin Lake (Table 2).

These samples have been shipped to the University of Alaska Fairbanks where they will be used to examine diet and migratory patterns, using stable isotope analyses.

Fecal samples were taken from all colonies, at various times throughout the summer breeding season (Table 2). We shipped some of these samples to the University of Alaska Fairbanks where they will be used in conjunction with similar samples from Alaska to examine seasonal and local differences in diet of Little Brown Bats.

Bat House Monitoring

Bat houses provide key habitat for maternity colonies of Little Brown Bats (Brittingham and Williams 2000). During the 2013 summer season, we visited all of the bat houses in our monitoring program, except those at Pine Lake, Wye Lake and Mayo (Figure 1). The bat house in Pine Lake was set up in 2008; however, the bat house remains unoccupied.

It was inspected in 2012 and was deemed to be in good condition. Wye Lake and Mayo bat houses were set up in 2012, and may not yet have been discovered by bats.

Several bat houses were established in 2012 (Dezadeash Lake, Fox Lake, Tarfu Lake, Judas Lake, and Tagish Narrows; Jung and Kukka 2013). None of these bat houses are occupied yet; however, we found traces of guano at the Fox Lake and Tagish Narrows bat houses, which have been used by a few bats at least temporarily. Bat houses at Swan Haven and Watson Lake airport were set up in 2009 and 2008, respectively, and they have had some sign of temporary use.

Bats are unlikely to move to a new location if their traditional roost, such as the control tower at Watson Lake airport, remains available.

Similarly, the bat house in Army Beach is used by some bats, but majority of the colony continues to roost in the nearby picnic shelter.

Outreach and Deliverables

Bat viewing events occurred on 3 July 2013 at Squanga Lake and 9 August 2013 at Chadburn Lake, as part of the wildlife viewing program's events.

Two scientific papers reporting on earlier bat work were prepared and sent for peer-review in April 2013. These will appear as part of a 2014 special issue of the *Northwestern Naturalist* on bats. The citations for these papers are:

Randall, L.A., T.S. Jung, and R.M.R. Barclay. 2014. Roost-sites and movements of little brown myotis (*Myotis lucifugus*) in southwestern Yukon. *Northwestern Naturalist* 95: in press.

Slough, B.G., T.S. Jung, and C.L. Lausen. 2014 Acoustic surveys reveal hoary bat (*Lasiurus cinereus*) and long-legged myotis (*Myotis volans*) occurrence in Yukon. *Northwestern Naturalist* 95: in press.

Table 2. Summary of samples collected during captures of Little Brown Bats (Myotis lucifugus) at six colonies in southern Yukon, Canada, summer 2013.

Colony	Capture Date (2013)	Blood Samples	Hair Samples	DNA Samples	Fecal Samples
Chadburn Lake	10 July	-	28	37	yes
	9 August	-	-	-	-
Dalton Post	24 June	-	20	-	yes
	6 August	-	14	16	yes
Drury Creek	8 August	-	34	33	yes
Little Atlin Lake	4 July	23	-	33	-
	18 July	22	-	-	yes
	7 August	18	-	-	yes
Salmo Lake	30 May	19	20	-	yes
	13 June	16	16	-	yes
	8 July	19	32	33	yes
Squanga Lake	27 May	14	22	-	yes
	12 June	12	20	-	yes
	3 July	21	54	-	yes
	17 July	19	-	12	yes

Recommended Future Directions

- Bat houses have proven useful for monitoring bat populations. Yukon-based studies on bats should continue to make use of the easily monitored colonies in our bat houses. Specifically, studies on the population trends and demography of bats in relation to White Nose Syndrome or climate change may be possible at these sites.
- Analyses of population data obtained during bat house monitoring should continue to move forward, in order to provide insight on population trends and life history strategies of Little Brown Bats in Yukon. For example, changes in colony size can be conducted for the 2013 monitoring data at Salmo Lake and Squanga Lake colonies, using mark-recapture methods, as outlined by Jung (2013).

- Lab analyses of samples collected in 2013 should be statistically examined and reported.
- Effort should be made to check each of the bat houses established by Environment Yukon for occupancy by bats. Checks should be made in mid-summer when they may be used by maternity colonies, and again in the early fall when they may be used by migrating bats. In addition to checking for bat use, annual inspections are useful to ensure that there is no damage to the structures from wind, wildlife, vandalism, or other.
- New bat houses should be considered where there is an urgent conservation concern, such as an important maternity colony that will be excluded or the building they roost in will be demolished.
- Another priority for considering additional bat houses would be at, select Yukon government campgrounds and recreation sites. Bat houses at these campgrounds provide an excellent opportunity for wildlife viewing, natural mosquito control, and a site to monitor populations. In addition, they may discourage use of picnic shelters by bats (a common problem in campgrounds in southern Yukon).
- Several habitat protection areas encompass large wetlands, which are likely important habitats for bats. Bat houses could be established at select habitat protection areas (e.g. Lewes Marsh HPA) to enhance their use by bats.
- Interpretative signs should be placed at bat houses established at easily accessible sites where they are currently absent.
- Wildlife viewing events should continue to use existing bat house sites as the focus of their events, given that a number of bats are readily viewable in a safe environment. Where possible, wildlife viewing events should be timed to when biologists are capturing and monitoring bats so that the public can see the animals up close.

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Appendix

Results of bat captures at each colony visited in 2013:

Chadburn Lake

- Visited 31 May, 10 July, 9 August and 16 August.
- A total of 52 bats were captured.
    - 37 bats were captured 10 July; they were predominantly lactating.
    - 15 bats, mostly juveniles, were captured 9 August. The colony had likely started to disperse at this point.
    - A visit to the site 16 August showed that most bats had departed.

Dalton Post

- Visited 24 June and 6 August.
- A total of 41 bats were captured.
    - 25 bats were captured 24 June. Most bats were pregnant.
    - 16 bats, both adults and juveniles, were captured 6 August. It is likely that there is an alternative roost nearby, because many more bats were observed feeding in the area.

Drury Creek

- Visited 8 August.
- 90 bats were processed, but the number of total captures was estimated at 130. This was the first visit to this colony; thus, there were no previously banded bats.
- The captured bats were predominantly juveniles and post-lactating adults.
- Many juvenile bats had difficulty flying after release, which may indicate that they had become independent only very recently.
- Interestingly, no bat bugs were observed in this colony. Bat bugs are commonly found in bats in the other colonies that we monitor.

Little Atlin Lake

- Visited 4 July, 18 July and 7 August.
- A total of 335 bats were captured.
- 148 bats were captured 4 July.
    - This appeared to be the transition time between gestation and parturition; both pregnant and lactating bats were common.
- 102 bats were captured 18 July.
    - Most bats were lactating, but we also caught 11 juveniles.
- 85 bats were captured 7 Aug, many of them juveniles.

Salmo Lake

- Visited 30 May, 13 June and 8 July.
- Total of 333 bats were captured.
- 129 bats were captured 30 May. All bats were adult females.
    - Reproductive status of individuals was mostly unknown, because pregnancy was not obviously visible this early in the breeding season.
- 80 bats were captured 13 June. Approximately 50% of them were visibly pregnant.
- 124 bats were captured 8 July. Most bats were pregnant, but some were already lactating.

Squanga Lake

- Visited 27 May, 12 June, 3 July and 17 July.
- A total of 261 bats were captured.
- 82 adult female bats were captured 27 May. The reproductive status of individuals was mostly unknown, because pregnancy was not obviously visible this early in the breeding season.
- 70 female adult bats were captured 12 June. Most bats (93%) were visibly pregnant.
- 77 adult female bats were captured 3 July. Most bats (94%) were pregnant.
- 32 female adult bats were captured 17 July; most of them were lactating.
    - We did not capture juvenile bats, which were presumably not independent yet on this date.