2005-2006 Bat Survey of the Middle Red Deer and Battle Rivers

Prepared by: Cori L. Lausen
Department of Biological Sciences
University of Calgary
Calgary, Alberta T2N 1N4
corilausen@netidea.com

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Prepared for: Alberta Natural Heritage Information Centre
Parks and Protected Areas Division
2nd floor, Oxbridge Place
9820 - 106 St.
Edmonton, Alberta T5K 2J6

Cover Photos: Red Deer River at Dry Island Buffalo Jump (by Cori Lausen); Bat inset is *Eptesicus fuscus* (by John Acorn)

ABSTRACT

The goal of this survey was to determine bat species diversity in a region of the Parkland in Central Alberta. Bat diversity in the Parkland Zone is poorly undestood. I conducted a survey of 3 sites along the middle Red Deer River and 2 sites on the Battle River, including Dry Island Buffalo Jump and Big Knife Provincial Parks. A total of 126 bats, 7 species (*Eptesicus fuscus*, *Myotis lucifugus*, *M. evotis*, *M. ciliolabrum*, *M. septentrionalis*, *Lasiurus cinereus*, *Lasionycteris noctivagans*) were captured using mistnets. Acoustic surveys were carried out, adding one more species (*Lasiurus borealis*) to the survey results.

Based on this survey, distributional ranges of *M. ciliolabrum* and *M. evotis* have been extended north a small distance (~ 40 km and ~75 km, respectively), and the range of *M. septentrionalis* was extended south approximately 125 km. This is the first record of both *M. evotis* and *M. septentrionalis* being captured at the same location in Alberta, suggesting an overlap zone for these species across central Alberta. Additional surveys in the Parkland of Alberta will be necessary to better delineate species ranges.

An acoustic winter survey was conducted in Dry Island Buffalo Jump Provincial Park (DIBJ) from October through February 2006, and bats were detected in the park each month, providing the first evidence that this park is a hibernation area for bats. This park is the third location along the Red Deer River that I have identified as a hibernation area for bats. As with Dinosaur Provincial Park, and East Coulee, winter activity in DIBJ was that of *E. fuscus*, *M. evotis* and *M. ciliolabrum.*

Genetic analyses of *M. lucifugus* from these Parkland regions revealed samples were of the subspecies *M. l. lucifugus*. This same subspecies has recently been confirmed in southern Alberta also; only a few specimens genetically typing out as *M. l. carissima* have been found in Alberta so far (at Onefour, along the Milk River). Whether these subspecies designations are biologically relevant is currently under investigation (C.L.L. unpublished data).

In 2006 spring and summer sampling determined that *M. ciliolabrum* does not seem to be present (or may be rare) on the Battle River; the Red Deer River seems to be the northern-most extent of this bat's range in Alberta. Lactating *L. cinereus* were captured in 2 locations on the Battle River, this being the most southerly maternity area known for this migratory species in Alberta (with the exception of Cypress Hills). *Lasiurus borealis* was recorded in Big Knife Provincial Park in late June, suggesting that this species may also be raising young along the Battle River.

ACKNOWLEDGEMENTS

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INTRODUCTION

Six of the nine species of bats in Alberta have a conservation status other than "secure" (Table 1): western small-footed, *Myotis ciliolabrum* (Status: Sensitive), northern long-eared, *M. septentrionalis* (Status: May be at risk), long-legged, *M. volans* (Status: Undetermined), eastern red bat, *Lasiurus borealis* (Status: Sensitive), hoary bat, *L. cinereus* (Status: Sensitive), silver-haired bat, *Lasionycteris noctivagans* (Status: Sensitive). Range limits of these species are uncertain due to lack of sampling in some areas, especially in the Parkland Zone of Alberta. Bat distribution is limited by natural roosts, and availability of water. Given the availablility of water and suitable roosting habitat for bats along the Middle Red Deer and Battle Rivers, I hypothesized that *M. ciliolabrum*, *M. septentrionalis* and *M. volans* distributions may extend into Central Alberta and may even overlap. Given the abundance of trees, I also hypothesized *L. borealis* may be present, especially later in the summer and early in the spring when migration would be occurring. The main purpose of this survey was to begin the process of determining bat diversity in the Parkland Zone of Central Alberta, and in doing so, fill in distributional range map gaps. In July – August, 2005, using mistnets and acoustic detection, I surveyed Dry Island Buffalo Jump Provincial Park (DIBJ) on the Middle Red Deer River and Big Knife Provincial Park on the Battle River, and river valley locations between and near these parks. Because a thorough sampling could not be done of all sampling locations in 2005, in June and August, 2006 I mistnetted and acoustically sampled 2 of these locations again. This report outlines the results of this spring/summer survey.

In addition to spring/summer work, I carried out acoustic surveys in late fall and winter. The goal of this sampling was to determine whether DIBJ was used by bats as winter habitat. Where bats hibernate in Alberta is not well understood. With the exception of several caves (e.g. cave in Wood Buffalo National Park, Cadomin Cave near Hinton, etc.) housing up to a few thousand bats, natural hibernacula for bats in Alberta are yet to be discovered. In 2002, I detected substantial bat activity during the winter in Dinosaur Provincial Park, and went on to discover rock roost hibernacula, document winter flights at temperatures well below freezing, and locate another hibernation area along the Red Deer River near East Coulee Atlas Coal Mine (Lausen and Barclay 2006). Because DIBJ has extensive badland features, similar to Dinosaur Park and East Coulee, I hypothesized that DIBJ would also provide natural rock crevice

hibernacula for bats. To test this, I acoustically monitored DIBJ from October, 2005 to February, 2006.

Table 1. The status of Alberta Chiroptera (Alberta Sustainable Resource Development 2000). All species except *Myotis volans* were detected in this survey.

Common Name	Scientific Name	Status Rank (as of 2006*)
Little Brown Myotis	*Myotis lucifugus*	Secure
Western Long-eared Myotis	*Myotis evotis*	Secure
Northern Long-eared Myotis	*Myotis septentrionalis*	May be at Risk
Long-legged Myotis	*Myotis volans*	Undetermined
Western Small-footed Myotis	*Myotis ciliolabrum*	Sensitive
Silver-haired Bat*	*Lasionycteris noctivagans*	Sensitive
Big Brown Bat	*Eptesicus fuscus*	Secure
Hoary Bat*	*Lasiurus cinereus*	Sensitive
Eastern Red Bat*	*Lasiurus borealis*	Sensitive

* In December 2005 the Alberta Bat Action Team officially requested the status of these species be reviewed (R.M.R. Barclay, University of Calgary, pers. comm.). In 2006 Alberta Sustainable Resource Development officially changed the Alberta status listings of the migratory bat species silver-haired bat, hoary bat, and red bat to Sensitive from Secure, Secure and Accidental/vagrant, respectively (R. Gutsell, ASRD, pers. comm.).

SECTION ONE:

Report Compiled March 2006

METHODS

This survey involved the capture of bats using mistnets and recording of bat ultrasound using AnaBat detectors (Titley Electronics, Australia). While some species of bats are difficult to capture, their presence can be detected using echolocation detectors. Not all bats are identifiable through echolocation analysis, therefore, using both acoustic and capture techniques was necessary to ensure a thorough survey.

AnaBat detectors were attached to digital compact flash ZCAIM units which recorded ultrasound. Bat passes were analyzed in AnaLook 4.9j (Corben 2004), and the call characteristics allowed for assignment to the species' categories. *Eptesicus fuscus*, the big brown bat, and *Lasionycteris noctivagans*, the silver-haired bat, were considered one category (EPFU/LANO) because their 20-30 kHz calls cannot be differentiated. Good quality Myotis calls that were not the steep-sloped calls of long-eared bats (*M. evotis, M. septentrionalis*), were categorized as MYLU/MYCI (*M. lucifugus/M. ciliolabrum*) making the assumption that were no other Myotis spp. in the study area. While *L. cinereus* and *E. fuscus/L. lasionycteris* are generally differentiable, in some cases call characteristics overlap, and it is possible that some *L. cinereus* passes are incorrectly categorized as *E. fuscus/L. lasionycteris* (full acoustic category descriptions are found in Table 3. A).

Bats were captured by placing mist-nets across flyways between trees or in coulees, or over slow-moving water. Nets ranged in length from 2.6 to 18 m, and were strung on poles ranging from 3 to 6 m high. Acoustic surveys were completed using an AnaBat detector attached to a CFZCaim recording onto a high capacity CompactFlash memory card.

The 2005 summer survey took place over a period of 13 nights, although weather was conducive to capturing bats on 10 nights only. There were 5 survey locations (Figure 1). Netting took place at Dry Island Buffalo Jump Provincial Park (12U 0365050 5755834; 3 nights), McKenzie Crossing Recreation Area (12U 0366277 5765649; 1 night), Content Bridge Campground (12U 0358373 5797285; 1 night), near Donalda on Meeting Creek (12U 0395945 5826600; 1 night) and Big Knife Provincial Park (12U 0417028 5816359; 4 nights). Acoustic

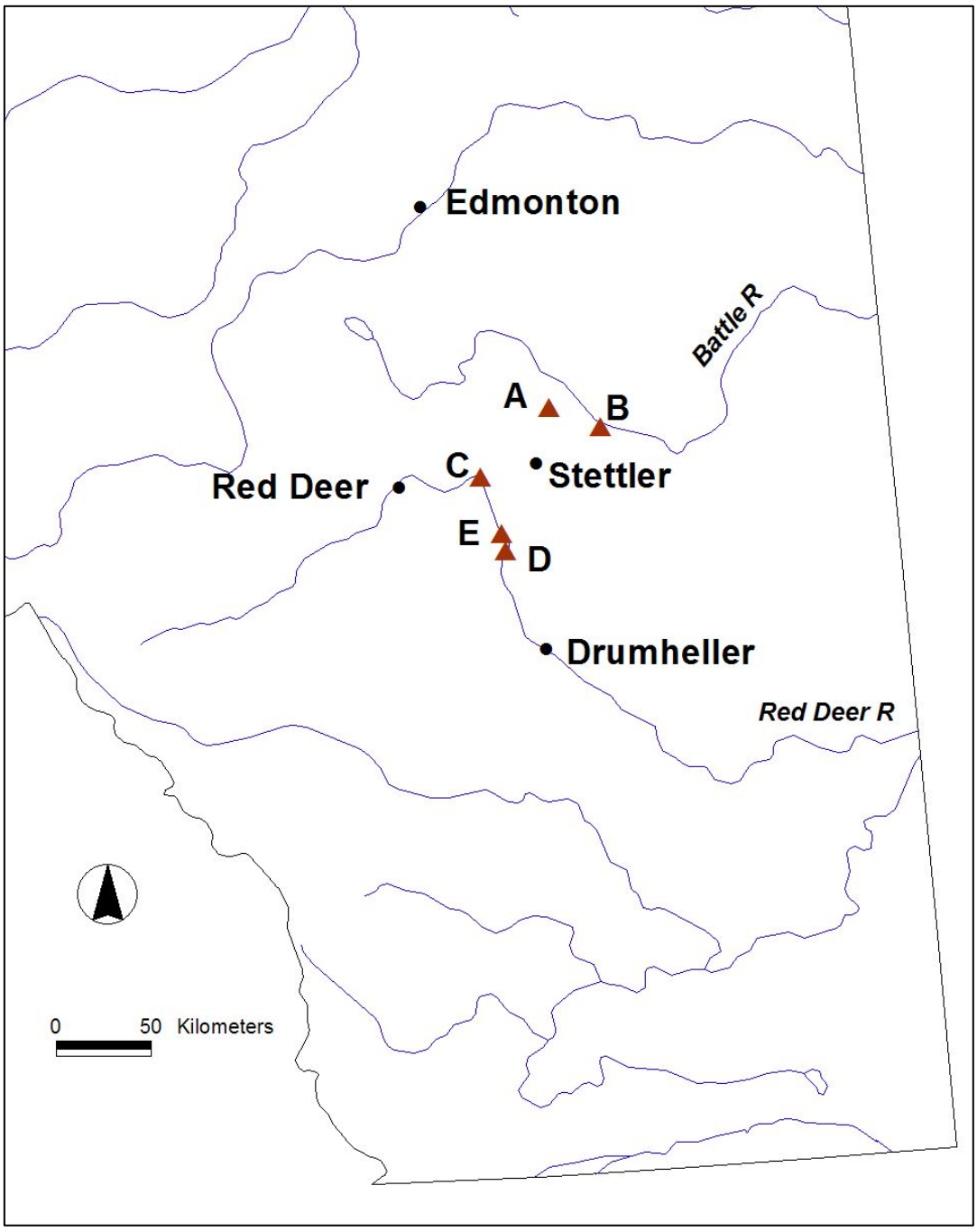

Figure 1. Map of Central and Southern Alberta showing areas surveyed as triangles: A. Near Donalda on Meeting Creek (not shown), a tributary of the Battle River, B. Big Knife Provincial Park, C. Content Bridge, D. Dry Island Buffalo Jump Provincial Park and E. MacKenzie Crossing Recreation Area.

surveys were conducted at Dry Island Buffalo Jump (5 nights), and Big Knife (1 night) Provincial Parks, and at Donalda (1 night).

Individuals were identified to species. Adult bats were distinguished from juvenile bats by examining the joints in the fingers; adults have fully ossified epiphyses. I classified females as reproductive if they were pregnant, lactating, or post-lactating. The following measurements were made: forearm length, mass, ear length (*M. evotis* and *M. septentrionalis* only). A portable digital scale was used to take mass after the bat had been held for a minimum of one hour. Relative age was obtained by looking at the degree of toothwear (class 1 reserved for juveniles and class 7 representing the most worn category, Holroyd 1993).

Additionally, tissue was sampled for genetic analysis. A 2 mm diameter disposable biopsy punch was used to take a sample of wing tissue from each plagiopatagium. The biopsy sample was taken by spreading the wing of the bat over a soft plastic cutting board until taut. The membrane is carefully examined to avoid cutting blood vessels. The excised piece of tissue is placed in 90% ethanol. Biopsy punches are flamed and dipped into ethanol, and the cutting board is also washed with ethanol to sterilize equipment between individuals. Ten tissue samples were genetically analyzed using mitochondrial sequencing of the cytochrome *b* gene (T. Dewey, University of Michigan Museum of Zoology) and of the 16S ribosomal gene (J. Zinck, Portland State University, Portland, OR) to confirm species and determine subspecies.

The winter acoustic survey was conducted in Dry Island Buffalo Jump Park using an AnaBat/CFZCaim unit powered by a solar-charged 12 V battery. The unit was placed in the day use area facing the river where it detected and recorded ultrasound each night from 29 October 2005 to 9 February 2006. Recorded passes (consisting of >1 call) were analyzed by visually identifying *E. fuscus* passes, and performing Discriminant Function Analysis (DFA) on the *Myotis* passes. DFA was done using S.A.S. Version 9.1, using Proc DISCRIM on echolocation call parameters (minimum frequency [fmin], mean frequency, characteristic slope, and [fmax-fmin]/duration) extracted using Analook. *Myotis* calls (i.e. those with minimum frequency > 30 kHz) that were of sufficient quality to analyze, were classified as *M. ciliolabrum*, *M. evotis* or *M. lucifugus*, because these were the species captured in this location. Quadratic discriminant function analysis was performed (Tabachnick and Fidell 2001) using reference calls from locally captured *M. ciliolabrum* (n = 64), *M. evotis* (n = 26), and *M. lucifugus* (n = 168). We recorded reference calls using an AnaBat and audio tape recorder; all *M. ciliolabrum* and *M. evotis* were

recorded after hand-release, while most (148) *M. lucifugus* call sequences were of free-flying individuals outside known roosts. Overall cross-validation error was 0.085 (range 0.078 - 0.100), and only passes that could be identified to species with ≥96% probability were accepted.

RESULTS

2005 Summer Captures and Acoustic Detection

I captured 103 individuals and seven species (Table 2): Big brown (*Eptesicus fuscus*), Little brown (*Myotis lucifugus*), western small-footed (*M. ciliolabrum*), western long-eared (*M. evotis*), northern long-eared (*M. septentrionalis*), hoary (*Lasiurus cinereus*), and silver-haired (*Lasionycteris noctivagans*). No long-legged bats (*M. volans*) were captured. I acoustically detected one additional species, the red bat (*Lasiurus borealis*; Table 3). Five of the bat species found in this survey have a "non-secure" status designation in Alberta (*M. ciliolabrum*, *M. septentrionalis*, *L. cinereus*, *L. borealis*, *Lasionycteris noctivagans*; Table 1). Greatest species diversity was at DIBJ where 6 bat species were detected/captured (Table 2. A.).

Table 2. Bats in this survey, by location. Males (M), females (F), Juveniles (Juv), Adults (Ad) together with total captures are listed. Reproductive stage are indicated: P - pregnant, L - lactating, ES - early scrotal, S - scrotal, NP - nulliparous/nonreproductive. Forearm measurements (F.A. Avg.) and ear length are presented as mean values of 3 averaged values per individual, and units are in mm. Mass is given in units of grams and range of toothclass (TC) is presented on scale of 1 - 7 (1 for juveniles, no wear to 7 for older adults, extensive wear). Species abbreviations are: EPFU (*Eptesicus fuscus*), MYLU (*Myotis lucifugus*), MYCI (*Myotis ciliolabrum*), MYEV (*Myotis evotis*), MYVO (*Myotis volans*), MYSE (*M. septentrionalis*), LABO (*Lasiurus borealis*), LACI (*Lasiurus cinereus*), and LANO (*Lasionycteris noctivagans*).

A. Dry Island Buffalo Jump Provincial Park (3 nights of sampling)

Bat Species at Survey Site	Age/Sex	Number captured	Reproductive Stages	F.A. Avg. (mm)	Mass (g)	TC	Ear Length (mm)	Total number per species
EPFU	Ad M	2	ES	46.6	16.3	3-5	N/A	2
MYLU	Ad M	6	ES	38.3	8.4	2-6	N/A	6
MYCI	Ad M	7	NS	31.1	4.9	2-7	N/A	8
	Ad F	1	P	33.1	6	3	N/A	
MYEV	Ad M	7	ES	37.6	6.8	2-6	17.15	15
	Ad F	8	P, L, NR	38.1	7.3	2-6	17.3	
LACI*	undetermined	N/A	N/A	N/A	N/A	N/A	N/A	≥2
LANO	Ad F	1	NR	40.7	12.4	2	N/A	1
Total		32						

* detected acoustically , and 1 carcass observed, but species not captured

B. McKenzie Crossing Recreation Area (1 night of sampling)

Bat Species at Survey Site	Age/Sex	Number captured	Reproductive Stages	F.A. Avg. (mm)	Mass (g)	TC	Ear Length (mm)	Total number per species
EPFU	Ad F	1	NR	48.6	20.5	2	N/A	1
MYLU	Ad M	1	NS	39.6	8.5	2	N/A	1
MYEV	Ad M	1	NS	37.3	6	3	16.5	6
	Ad F	5	L, P	38.7	8.4	2-7	16.5	
LACI	Ad M	1	NS	25.4	54.2	3.5	N/A	1
LANO	Ad F	2	L	43.2	12.4	2	N/A	2
Total		11						

C. Content Bridge Campground (1 night of sampling)

Bat Species at Survey Site	Age/Sex	Number captured	Reproductive Stages	F.A. Avg. (mm)	Mass (g)	TC	Ear Length (mm)	Total number per species
MYLU	Ad M	6	NS, ES	38.4	8.9	2-5	N/A	14
	Ad F	8	P, L, NR	38.6	9.2	2	N/A	
MYEV	Ad F	3	NR, P	39.1	7.2	2-3	17.1	3
MYSE	Ad M	1	ES	37.6	N/M	3	15.3	1
LANO	Ad M	1	NS	41.3	9.9	2	N/A	1
Total		19						

D. Big Knife Provincial Park (4 nights of sampling)

Bat Species at Survey Site	Age/Sex	Number captured	Reproductive Stages	F.A. Avg. (mm)	Mass (g)	TC	Ear Length (mm)	Total number per species
MYLU	Ad M	2	NS, ES	38.3	9.2	4	N/A	15
	Ad F	8	NR, L, PL	39.2	10.0	2-3	N/A	
	Juv M	2	N/A	36.6	7.7	1	N/A	
	Juv F	3	N/A	39.2	9.2	1	N/A	
MYEV	Ad M	1	NS	38.3	7.9	6	17.5	7
	Ad F	3	L	38.1	8.1	2-4	18.2	
	Juv M	1	N/A	37.4	6.0	1	17.7	
	Juv F	2	N/A	37.7	6.2	1	18.5	
LABO*	undetermined	N/A	N/A	N/A	N/A	N/A	N/A	≥ 1
LACI	Ad F	3	NR, L	53.7	32.4	3-5	N/A	8
	Juv M	3	N/A	53.7	21.7	1	N/A	
	Juv F	2	N/A	55.7	25.5	1	N/A	
LANO	Ad F	5	NR, P, L	41.7	12.6	2-5	N/A	7
	Juv M	2	N/A	40.3	10.6	1	N/A	
Total		37						

*detected acoustically, but not captured

E. Near Donalda, on Meeting Creek (1 night of sampling)

Bat Species at Survey Site	Age/Sex	Number captured	Reproductive Stages	F.A. Avg. (mm)	Mass (g)	TC	Ear Length (mm)	Total number per species
MYLU	Ad M	1	ES	37.6	8.8	3	N/A	4
	Ad F	2	NR, PL	38.8	11.4	2-5	N/A	
	Juv M	1	N/A	39.2	8.1	1	N/A	
MYEV*	undetermined	N/A	N/A	N/A	N/A	N/A	N/A	≥ 1
Total		4						

*detected acoustically, but not captured.

Table 3. Acoustic results.

A. Definitions used to assign calls to species categories. Call characteristics used to determine species category for echolocation calls. Overall shape and patterns of calls were used in conjunction with minimum frequency (Fmin), slope and duration parameters. The slope of the shallowest part of the call was measured using AnaLook software, adjusting the body of the call where necessary.

Acoustic Category	Species	Call Characteristics
MYLU/ MYCI	*Myotis lucifugus/M. ciliolabrum*	Fmin > 35, shallow to medium slope
Myotis spp.	*M. septentrionalis*, *M. evotis*, *M. lucifugus,*or other unidentified high frequency bat	Fmin >35, but calls too poor to analyze
EPFU/ LANO	*Eptesicus fuscus/Lasionycteris noctivagans*	Fmin between 20-30 kHz with shallow slope and generally short call duration
LACI	*Lasiurus cinereus*	Fmin <20 *or* call duration >15ms
MYEV	*M. evotis*	Fmin <35 kHz, steep
Long-eared spp.	*M. septentrionalis* or *M. evotis*	Fmin 35-39, steep
LABO	*Lasiurus borealis*	Fmin 35-45, very shallow slope, may have characteristic upturn

B. Summer acoustic detection at 3 locations.

		SPECIES CATEGORIES							
Location	Time monitored	MYLU/ MYCI	Myotis spp.	EPFU/ LANO	LACI	MYEV	Long-Eared spp.	LABO	**Total Passes**
Dry Island Buffalo Jump, Day Use Trees by Red Deer River	4 nights (22.5 h)	65	10	242	37	44	6	0	404
Big Knife, Boat Launch by Battle River	Partial night (3.5 h)	11	3	21	4	2	0	4	45
Near Donalda, where highway 53 crosses Meeting Creek	1 Night (6.8h)	16	0	2	0	5	0	0	23
	TOTAL	92	13	265	41	51	6	4	472

These survey results extend the species ranges for 3 species: *M. ciliolabrum* and *M. evotis* ranges extended north a small distance (~ 40 km and ~75 km, respectively), and the range of *M. septentrionalis* is extended south approximately 125 km. This is the first record of *M. evotis* and *M. septentrionalis* being captured in the same location in Alberta, creating a distinct overlap zone across central Alberta (Figure 2).

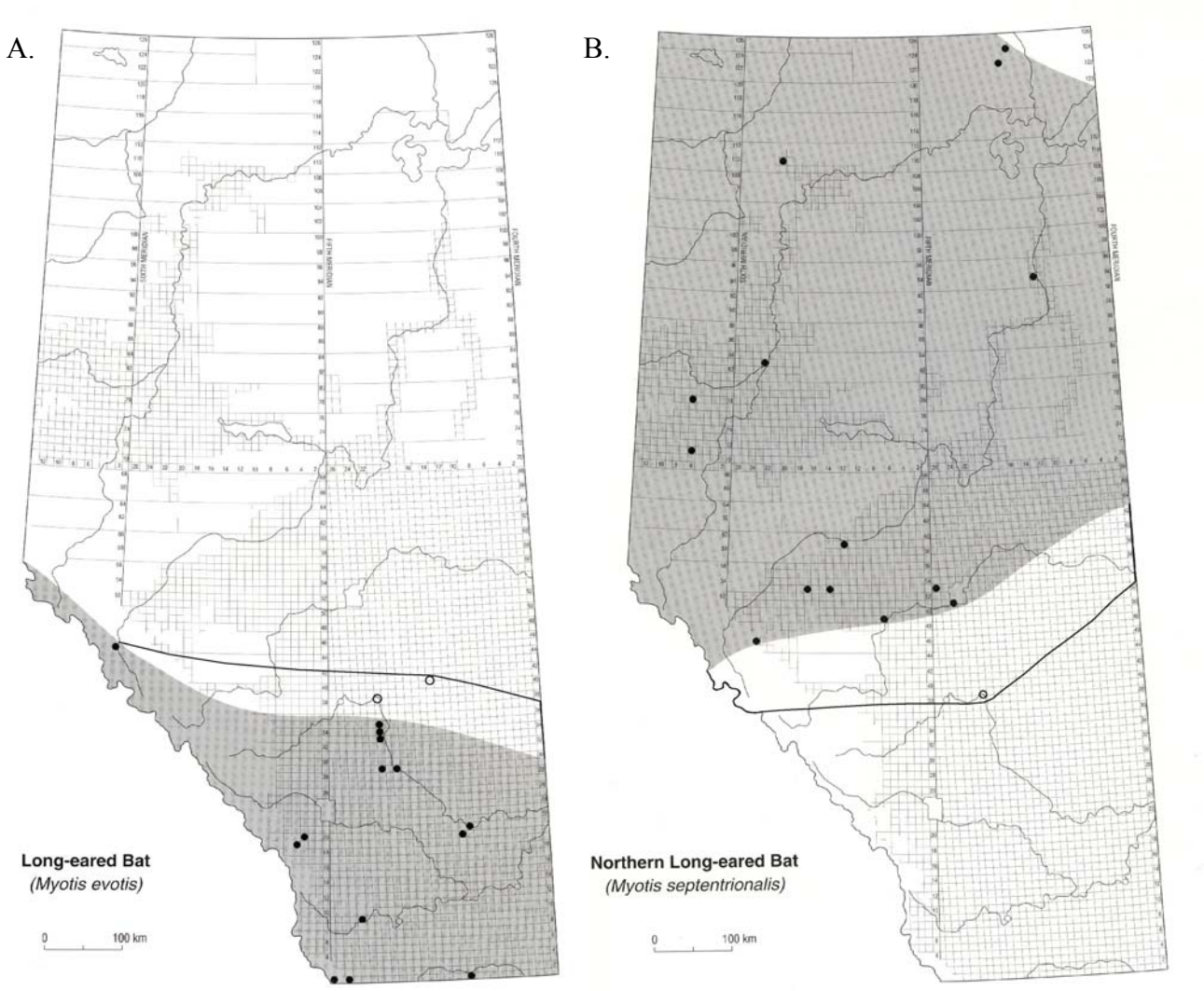

Figure 2. Provincial distribution maps for *M. evotis* (A) and *M. septentrionalis* (B). Hollow circles are capture locations from this survey. Dark outlined area is suggested range extension based on these captures. Maps adapted from Smith (1993).

Genetic Results

Mitochondrial DNA sequencing confirmed the identification of *M. septentrionalis* (T. Dewey, University of Michigan Museum of Zoology, pers. comm.). Despite morphological features suggesting *M. lucifugus* in this central region of Alberta may comprise two different subspecies, *M. lucifugus* from this study all produced mitochondrial sequence of *M. l. lucifugus* (T. Dewey, University of Michigan Museum of Zoology, pers. comm.). *M. lucifugus* samples from the Milk River in southern Alberta were concurrently sequenced and *M. l. lucifugus* was found here also, corroborating the findings of M. Vonhof (Western Michigan University, pers. comm.). However, a few samples from a maternity colony in Onefour typed out as *M. lucifugus carissima* (J. Zinck, Portland State University, pers. comm.; C.L.L. unpublished data).

2005-2006 Winter Acoustic Results

Dry Island Buffalo Jump Park had bat activity in each month from October through February, with ambient temperatures reaching a low of -30^{o}C in late November. Activity immediately before and after this cold period suggests that this riparian habitat is used by bats for winter hibernation. A total of 68 passes were detected on 25 (of 103) days. Through visual inspection of calls and discriminate function analysis, I determined that 30 passes were by *Eptesicus fuscus*, and 38 were *Myotis* species. Of these latter passes, 27 passes were analyzable; one hundred and forty-eight calls were used to determine species identification. Twenty-three of the 27 passes could be identified with >96% probability: 17 passes were *M. evotis* and 6 passes were *M. ciliolabrum*. No passes were *M. lucifugus*.

DISCUSSION

Dry Island Buffalo Jump

I determined that the following bat species reside in this park: *Eptesicus fuscus, Myotis lucifugus, M. ciliolabrum, M. evotis, Lasiurus cinereus, Lasionycteris noctivagans.*

This is the first record of *M. ciliolabrum* occurring north of Tolman Bridge. DIBJ therefore represents the new northern-most range for this species. I suspect that their range goes further north on the Red Deer (Mackenzie Crossing for example has suitable *M. ciliolabrum* roosting habitat; see below), however, to date I have been unable to capture any *M. ciliolabrum* north of DIBJ.

The first 4 species on the list are cavity-roosting bats, and I am confident they are roosting in the rock crevices of the park, as they were captured emerging from these areas. In the treed area along the river, these first 4 species were also captured, and based on their ecology, it is possible that *E. fuscus* and *M. lucifugus* could be using older trees for roosting (cavities in trees and under loose bark), but it is more likely that the trees are simply being used as a foraging area for all species.

I acoustically detected *L. cinereus*, an obligate foliage-roosting species. A very dessicated specimen was also found under a tree near the river. This species is migratory and tends to raise young in northern Alberta, travelling into the mid-United States for the winter. *L. cinereus* will undoubtedly move through the park along the Red Deer River in spring and fall. I detected this species acoustically in early July, suggesting that this species is likely residing in the park for the summer, using the trees along the river at DIBJ for roosting and may raise young here. Captures of this species in late June or early July would be necessary to confirm the use of the park by females as a maternity area. If this is indeed a maternity area, this would represent the southern-most boundary of the maternity range for this species in Alberta, with the exception of the Cypress Hills.

Bat Species Not Captured or Detected at DIBJ

i. Likely to be present:

Lasiurus borealis, the eastern red bat, is a migratory species thought to be uncommon in Alberta ("Accidental/Vagrant"). There have been a number of recent captures on the Red Deer River (4 at Drumheller in August 2005, J. Gruver, University of Calgary, pers. comm.), and I have acoustically detected this species further downstream on the Red Deer River in spring and fall 2005, suggesting that this species may use the Red Deer River as a movement corridor during migration. Very little is known about this species. Because DIBJ is a treed area along the north-south section of the Red Deer River, this park is likely to be important in the southern migration of this species. It is also possible that they use trees in the park to raise young. More extensive long-term acoustic monitoring in DIBJ is necessary to test these hypotheses.

ii. May be present:

The range of *M. septentrionalis*, the northern long-eared bat, in Alberta is thought to be restricted to northern areas, with the most southerly capture occurring near Edmonton (Smith 1993). However, in July 2005, I captured *M. septentrionalis* on the Red Deer River (Content Bridge), which is further south than this species was thought to range. This species may be in other treed areas of the Red Deer River, however, this bat is not likely to be very abundant. Unfortunately the echolocation call of this species is very similar to the other long-eared bat on the Red Deer River, *M. evotis*. Now that I have found them both on the Red Deer River we know that they have overlapping ranges in Alberta, and capture will be necessary to confirm species identification in central Alberta.

Further work to consider:

More extensive summer netting along the treed areas of the river should be done to establish whether or not *L. cinereus*, *L. noctivagans* and possibly *L. borealis*, are reproducing in the park. This would establish a new southern boundary for the reproduction of these species in Alberta, with the exception of Cypress Hills, where *L. cinereus* is known to raise young (C. Willis, University of Regina, pers. comm.).

Search for migratories via acoustic detection in spring, summer and fall. I believe that being a part of a heavily treed north-south corridor, DIBJ is likely to be a very important area for migratory bats. Acoustic monitoring in the spring, and most importantly in late summer would allow this hypothesis to be tested.

Big Knife Provincial Park and Nearby Meeting Creek Area

This survey confirms the presence of 5 species of bats on the Battle River (Table 2. D and E). Rock-roosting habitat is less available on the Battle River than on the Red Deer River. As such one expects to find a lower occurrence and perhaps absence of *M. ciliolabrum*. However, in the Donalda region of Meeting Creek, a tributary of the Battle River, there are badlands features suitable for *M. ciliolabrum*. Whether this species is found north of the Red Deer River, however, has still not been tested sufficiently, because cool weather prevented proper sampling of this area, and it should therefore be re-sampled.

Bat Species Not Captured on the Battle River

Likely to be present:

The acoustic detection of *L. borealis* at Big Knife in early August, indicates this park is on the migratory route of the red bat. Further acoustic detection in July and August is necessary to determine whether this species uses the park all season, potentially raising young among the cottonwoods, or whether it is merely a migratory corridor. For the latter, it would be important to determine the importance of this corridor. The Alberta Bat Action Team has initiated a move to try to determine major corridors for migratory bat movement in the province; as wind energy development continues in this province, identification of such migratory routes will become increasingly important.

The capture of *M. septentrionalis* on the Red Deer River (Content Bridge), suggests that this species may be in treed areas between the Red Deer and North Saskatchewan Rivers. In the Donalda area, lack of trees in the riparian areas make finding this species there unlikely, however, suitable treed habitat exists at Big Knife Provincial Park. More extensive netting effort would be necessary to determine this species' presence, as it is cannot be reliably distinguished from *M. evotis* acoustically.

Further Work to Consider

More extensive summer netting along the treed areas of the river should be done to establish its use by migratory species. Because *L. borealis* is thought hard to capture, more extensive acoustic monitoring for this species should be done. Given that the provincial status listing for this species is likely to change in the near future (no longer considered accidental in the province), it is important that as much information as possible is gathered about this species to make an informed decision regarding its new listing category.

A northern flying squirrel (*Glaucomys sabrinus*) was captured in mistnets on 2 occasions during the 4 nights of bat surveying at this park. Because little is known about this species in Alberta, one may also consider doing an opportunistic study of this species if the opportunity arose again.

Areas North of DIBJ on the Red Deer River

As one moves upriver from Dry Island Buffalo Jump to Content Bridge, the riparian area becomes more treed, and in some places (e.g. MacKenzie Crossing Recreation Area, Trenville Park), suitable badlands terrain also exists for rock-roosting bats. Six species were captured upriver of DIBJ on the Red Deer River (Table 2. B and C). Trees upriver of Tolman Bridge provide roosting opportunities for the migratory species *L. cinereus*, *L. noctivagans*, and *L. borealis*, and for *M. septentrionalis*; because I captured one individual of this latter species on the Red Deer, further netting of the Upper and Middle Red Deer River cottonwoods to target this species would be informative.

Bat Species Not Captured or Detected North of DIBJ on Red Deer River

i. Likely to be present:

M. ciliolabrum was not captured, but given the presence of suitable roosting habitat (badlands terrain), I believe this species will be found upriver of DIBJ; more intensive capture effort will be needed to confirm the presence of this species.

ii. May be present:

L. borealis was not detected or captured but is likely to use this north-south river corridor for migration, and perhaps for raising young, given the treed terrain.

M. volans, the long-legged bat, was not captured in this survey. Little is known about the roosting requirements/behaviour of this species. It is found mainly in the Rocky Mountains, and along the Milk River. Sampling the Upper Red Deer River may unveil this species on the Red Deer River; if found there, more intensive netting efforts for the upper part of the Middle Red Deer should follow.

Further Work to Consider

More intensive summer netting, and spring and fall acoustic monitoring should be done to establish use of this area by migratory species. This could be a very important north-south corridor for migratory bats. More intensive netting effort should also be done to better define northern and southern species distributions for *M. ciliolabrum* and *M. septentrionalis*, respectively.

Genetics

Based on morphological differences, both subspecies of *Myotis lucifugus* are thought to reside in Alberta: *M. l. lucifugus* in the north and *M. l. carissima* in the south (Smith and Schowalter 1979). Anderson (1946), Hall and Kelson (1959), and Soper (1964) report a third subspecies, *M. l. alascensis*, in Alberta, although Banfield (1974) did not consider this subspecies to exist. During the course of the 2005 bat survey between Dry Island Buffalo Jump and Big Knife Provincial Parks, it was noticed that two distinct morphological variations of *M. lucifugus* seemed to exist in this region; individuals appeared to differ in fur colour and length, in addition to some having slightly keeled calcars and obvious behavioural differences. Because no genetic analysis had been done for *M. lucifugus* in central Alberta, and because there is the possibility of an overlap zone for *M. lucifugus* subspecies in the province, samples of *M. lucifugus* were genetically sequenced. Mitochondrial DNA (mtDNA) sequence of cytochrome *b* (T. Dewey, pers. comm.) was that of *M. l. lucifugus* suggesting that observed morphological variation among samples in this study was not reflected in this locus. This same subspecies was found in southern Alberta (C.L.L.'s Milk River *M. lucifugus* samples) using cytochrome oxidase subunit (M. Vonhof, pers. comm.) and cytochrome *b* (T. Dewey, pers. comm.) mtDNA sequence. However, using the 16S ribosomal subunit gene of the mtDNA, two samples from the Onefour Community Hall maternity colony of *M. lucifugus*, typed out to be *M. l. carissima* (J. Zinck, pers. comm.). This suggests that both subspecies occur in the province, but *M. l. carissima* seems to be restricted to southern AB while *M. l. lucifugus* occurs throughout. That both subspecies are found roosting together in one maternity colony is noteworthy; nuclear DNA suggests the 2 subspecies interbreed and therefore the subpsecies designation may not be warranted (C.L.L. unpublished data). Genetic differences in the mtDNA may instead reflect residual distinct haplotypes from the last glaciation.

SUMMARY

To my knowledge, this bat survey is the first of its kind in the Parkland Zone of Alberta. As I predicted, the Parkland Zone is an overlap region for some bat species. Of the 9 species of bats recorded in Alberta, 8 were detected/captured in this survey. This was the first time that *M.*

evotis and *M. septentrionalis* were captured at the same location, suggesting overlapping ranges across central Alberta; this survey extended the range of *M. septentrionalis* south, and the range of *M. evotis* northeast. This survey also extended the northern boundary of *M. ciliolabrum*, although I believe this species to be further north yet. Cool weather precluded a proper sampling of this species due to their small body size.

The only Alberta bat species not detected/captured in this survey was *M. volans*. I believe this species may be present in some of the areas surveyed, but recommend that sampling start on the Upper Red Deer River, working down river from where it is detected.

As wind energy development continues in Alberta, understanding bat migration will be critical to minimizing bat mortalities at wind farms. Because the Middle Red Deer River is a treed north-south corridor, it may be a major migratory route for *L. borealis, L. cinereus,* and *L. noctivagans*. Bat surveys of the Middle Red Deer River during spring and fall may help to elucidate bat migration in Alberta.

Dry Island Buffalo Jump Provincial Park, like Dinosaur Provincial Park and East Coulee, are badland regions where bats hibernate, and I suggest that badlands habitat found along much of the lower Middle and Lower Red Deer River provide important winter roosts for bats. This may also be true of the South Saskatchewan and Milk Rivers, where badlands features are prominent.

SECTION TWO:

Report Compiled September 2006

METHODS

Refer to Methods in Section One for complete bat handling protocols and acoustic methods.

Spring 2006

To determine whether the north-south stretch of the Red Deer River, of which Dry Island Buffalo Jump Park (DIBJ) is a part, is a movement corridor for migratory bats in the spring, I monitored the park with an AnaBat detector continuously during the winter of 2005-6, ending 25 June 2006. Due to large numbers of bat passes in May and throughout June, passes up to and including 15 May were analyzed only. The goal was to determine when migratory bats move into the park in the spring. Because *Lasiurus cinereus* and *L. borealis* are the only migratory species that are acoustically distinct, only passes of these species were extracted from the data. All passes for the winter and spring data up to 30April were analyzed (winter data are presented in Section One); for 1 – 15 May, due to the large number of bat passes recorded, only migratory bat passes were extracted.

Summer 2006

To determine whether *M. ciliolabrum* makes use of the suitable mudstone habitat found along the Meeting Creek (a tributary of the Battle River) near Donalda, AB, I mistnetted this area on 21 June 2006. Because *M. ciliolabrum* have a distinct flight pattern and small body size, extensive observations were also conducted by walking close to the mudstone valley walls at emergence light levels.

Mistnetting and acoustic data collection also took place 22 June 2006 at Big Knife Provincial Park to determine whether the migratory species *L. cinereus* and *L. borealis* use the park in the summer to raise young. Opportunistic acoustic analysis also took place in Big Knife Park 12 August 2006.

RESULTS

Spring 2006

Bat passes from 9 Feb. – 30 April 2006 totaled 1088, of which 28% were *E. fuscus* (although some of the passes later in April could have possibly been *L. noctivagans*), 38% were *M. evotis*, 34% were other Myotis (*M. lucifugus* and *M. ciliolabrum* most likely based on capture records for the park) and only a single *L. cinereus* pass on 29 April. From 1 – 15 May, only passes of the migratory species *L. cinereus* and *L. borealis* were tallied: thirty-five *L. cinereus* passes and 2 *L. borealis* passes (both passes were on 7 May) were recorded out of a total of 2006 bat passes.

Summer 2006

Bat captures at Donalda (Table 4) were mostly *M. lucifugus*, as had been the case in 2005. Weather was ideal for mistnetting (calm, clear and warm), unlike in 2005. *M. ciliolabrum* was not seen despite ideal conditions for viewing bats along the mudstone valley walls, and they were not captured. Few bats were seen and detected in the area at emergence light levels suggesting that most bats detected and captured later in the evening were not roosting in the mudstone valley walls.

Bats captured and detected at Big Knife Provincial Park (Table 4) were mostly *L. cinereus. L. borealis* was acoustically detected. On both 22 June and 12 August there was a rainstorm early in the night that likely impacted the number and species of bats that were active.

Table 4. Summer 2006 capture and acoustic data.

A. Capture data. Reproductive states are: lactating (L), pregnant (P), non-scrotal (NS), not obviously pregnant (NOP), early scrotal (ES), and scrotal (S).

Capture Date	Location:	Species	Sex	Age	Repro. state	Mass (g)	Mean forearm length (mm)	Ear length
21-Jun-06	near Donalda 12U 0394552, 5826425	*L. cinereus*	F	Adult	L	33.6	55.50	
		M. evotis	F	Adult	P	7.3	38.27	not measured
		M. evotis	M	Adult	NS	7.9	37.50	17.6 mm
		M. evotis	M	Adult	NS	6.5	35.20	16.0 mm
		M. lucifugus	F	Adult	NOP	8.8	38.60	
		M. lucifugus	M	Adult	NS	7.2	38.55	
		M. lucifugus	M	Adult	NS	6.5	38.10	
		M. lucifugus	F	Adult	P	9.3	39.40	
		M. lucifugus	M	Adult	NS	7.1	39.00	
		M. lucifugus	F	Adult	P	11.2	39.80	
		M. lucifugus	M	Adult	NS	8.3	39.00	
		M. lucifugus	M	Adult	NS	8.5	37.80	
		M. lucifugus	M	Adult	NS	6.6	37.70	
		M. lucifugus	F	Adult	P	10.8	38.90	
		M. lucifugus	M	Adult	NS	7.85	37.95	
		M. lucifugus	F	Adult	P	11.7	40.50	
		M. lucifugus	F	Adult	NOP	8.2	37.70	
		M. lucifugus	M	Adult	NS	8.4	37.50	
		M. lucifugus	M	Adult	NS	7.7	36.40	
		M. lucifugus	M	Adult	NS	7.7	38.80	
		M. lucifugus	M	Adult	ES	8.6	38.50	
		E. fuscus	M	Adult	S	19.4	49.30	
22-Jun-06	Big Knife Prov. Park 12U 419418, 58160668	*L. cinereus*	F	Adult	L	27.4	53.58	

B. Acoustic data for summer 2006. Sampling on 21 June was near Donalda (12U 0394552, 5826425); on 22 June and 12 August sampling took place at Big Knife Provincial Park at the Boat Launch.

		MONITORING		SPECIES CATEGORIES							
2006 Date	Site	% of night	mins.	EPFU/ LANO	MYLU/ MYVO	MYEV	Myotis spp.	LACI/ EPFU	LACI	LABO	Total Bat Passes
21-Jun	Near Donalda	100	360	4	13	12	1	0	0	0	30
22-Jun	Big Knife PP.	100	360	1	45	0	12	3	104	9	174
12-Aug	Big Knife PP.	25	120	1	6	0	16	0	9	2	34
	TOTAL:		840	6	64	12	29	3	113	11	238

DISCUSSION

Dry Island Buffalo Jump is part of the treed north-south corridor of the Red Deer River. This area may be important for migratory bat species that roost in trees and move from southern areas to northern Alberta each spring and back south each fall. Migratory routes are unknown in Alberta, although it is hypothesized based on acoustic data and wind turbine carcass counts in southern Alberta that spring routes of migratory bats are different from those of fall routes. Migratory bats have been detected in the province early in the spring (as early as late March, C.L.L., unpublished data) when deciduous trees are usually not in full leaf yet. This lack of leaves may affect the south-north migration route that these bats follow. In DIBJ, I detected *L. cinereus* and *L. borealis* in spring 2006, increasing the number of bat species found in this park to 7. That 7 of the 9 Alberta bat species are found in this park indicates its suitability and importance to bats in this province. It is interesting to note, though, that I did not detect *many* migratory bat passes at Dry Island Buffalo Jump in the spring of 2006 suggesting that this river corridor may not be important for the *spring* bat migration. This park may be more important for the late summer north-south bat migration when trees are in full leaf, but this has yet to be determined. Late summer (i.e. August) acoustic monitoring is required to determine this.

At Donalda, highly suitable mudstone roosting habitat exists along the banks of the Meeting Creek. This habitat is very similar to parts of the Red Deer River where *M. ciliolabrum* is found. This area was surveyed in 2005, but weather was very cold. Given that *M. ciliolabrum* is a small-bodied species which tends not to fly in cool conditions, another sampling session was carried out in 2006. Weather was ideal for bat activity and for mistnetting, and nets were well-placed near potential mudstone roosts and nearby foraging/watering areas. The absence of *M. ciliolabrum* suggests that this species is rare, or absent north of the Red Deer River.

The capture of lactating *L. cinereus* on the Battle River and Meeting Creek is evidence that this species uses this Parkland zone not just as a migration route, but for reproduction. To the best of my knowledge, this area respresents the southern-most boundary of the maternity range for this species in Alberta, with the exception of the Cypress Hills. While *L. borealis* was not captured, it was detected acoustically during the summer portion of this survey providing evidence that this migratory species is also spending the summer in Big Knife Provincial Park. Without the capture of a reproductive female, one can not say conclusively that this species uses Big Knife Park as a maternity area, but this is highly likely given that male migratory bats tend to

remain in more southerly areas of the province and continent (pers. obs.; P. Cryan, USGS, New Mexico, pers. comm.).

The capture of *M. evotis* confirms that this species' is present north of the Red Deer River, a fact that was established in the 2005 portion of this survey. While northern Alberta has generally been considered *M. septentrionalis* habitat, this survey has shown an overlap zone for the two long-eared species in central Alberta, and given that these two species have just recently been found to be sympatric in the Northwest Territories (Lausen 2006), it is possible *M. evotis* continues further north in Alberta than previously thought; those doing survey work in the Parkland and Boreal Zones should be careful to measure and fully describe long-eared bats to be sure of the correct identification. Because there are very few reference calls of *M. septentrionalis* anywhere in North America, any captures of this species should ideally involve the recording of echolocation calls so that a library of calls can be assembled. This is a soft-echolocating species and may require zip-lining to ensure a recording. It is likely that these 2 long-eared species can be differentiated using echolocation, but until more reference calls of *M. septentrionalis* have been acquired, the certainty of this will remain unknown.

SUMMARY

The 2006 work summer work concludes this first Alberta Parkland bat survey. The goal was to initiate bat survey work in the Parkland Zone, an area of Alberta where bat diversity has received little attention. A large area of central Alberta remains unsampled. It is important to keep in mind that bat distributions may change over time; for example, based on increased capture and acoustic records, *L. borealis* may be moving west and north in Canada. As climate and human disturbance changes, bat diversity and distribution may also change. Establishing baseline data in the province will provide a starting point for understanding distributional shifts over time.

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