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

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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 103 bats, 7 species (*Eptesicus fuscus*, *Myotis lucifugus*, *M. evotis*, *M. ciliolabrum*, *M. septentrionalis*, *Lasiurus cinereus*, *Lasionycteris noctivagan*s) were captured using mistnets. Acoustic summer surveys were carried out at one location on each river, adding one more species (*Lasiurus borealis*) to the survey results. This species has been considered accidental in Alberta, but I acoustically detected it in substantial numbers across southern Alberta. Its status is currently being reviewed.

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, suggesting *M. l. lucifugus* may be the only subspecies of little brown bat in the province, despite the hypothesized presence of *M. l. carissima*.

INTRODUCTION

Four 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), and eastern red bat, *Lasiurus borealis*, (Status: Accidental). Range limits of these species are uncertain due to lack of sampling, especially in the Parkland Zone of Alberta. 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 when migration would begin. 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.

Where bats hibernate in Alberta is not 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 (unpublished data). 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
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*	Secure
Big Brown Bat	*Eptesicus fuscus*	Secure
Hoary Bat*	*Lasiurus cinereus*	Secure
Eastern Red Bat*	*Lasiurus borealis*	Accidental/Vagrant

* In December 2005 the Alberta Bat Action Team officially requested the status of these species be reviewed and potentially changed to sensitive (R.M.R. Barclay, University of Calgary, pers. comm.).

METHODS

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 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 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

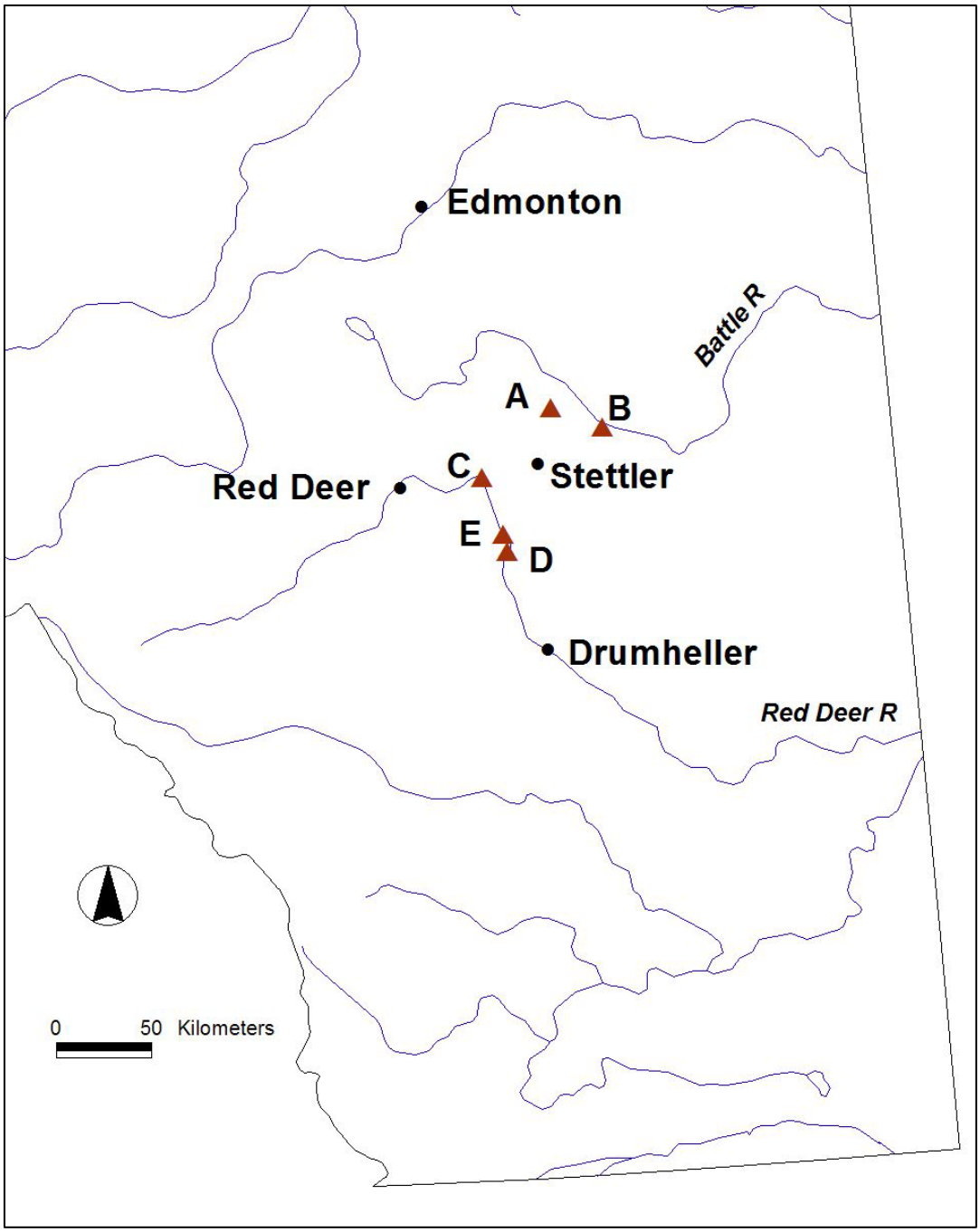

Figure 1. Map of Central and Southern Alberta showing areas surveyed as triangles: A. Near Donalda on Meeting Creek (not shown), a tributary of the Battle River, B. Big Knife Provincial Park, C. Content Bridge, D. Dry Island Buffalo Jump Provincial Park and E. MacKenzie Crossing Recreation Area.

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 (Tanya Dewey, University of Michigan Museum of Zoology) using mitochondrial sequencing of the cytochrome *b* gene, 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

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). Three of the bat species found in this survey have a "non-secure" status designation in Alberta (*M. ciliolabrum*, *M. septentrionalis*, and *L. borealis*; Table 3). 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 three 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								

*detected acoustically, but not captured. Possibility pass could be MYSE given the similarity of the long-eareds' echolocation calls.

Table 3. Summer acoustic detection at 3 locations.

Location	Time monitored	Number of passes at specified F_{min}				
		35-45 kHz (*Myotis* sp.)	20-34 kHz (EPFU/ LANO)	< 20 kHz (LACI)	30-38 kHz, steep (MYEV*)	35-40 kHz, shallow, upturn (LABO)
Dry Island Buffalo Jump, Day Use Trees by Red Deer River	4 nights (22.5 h)	74	231	24	63	0
Big Knife, Boat Launch by Battle River	Partial night (3.5 h)	14	21	4	2	4
Near Donalda, where highway 53 crosses Meeting Creek	1 Night (6.8 h)	16	2	0	5	0

*Echolocation calls of MYSE and MYEV are difficult to differentiate

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).

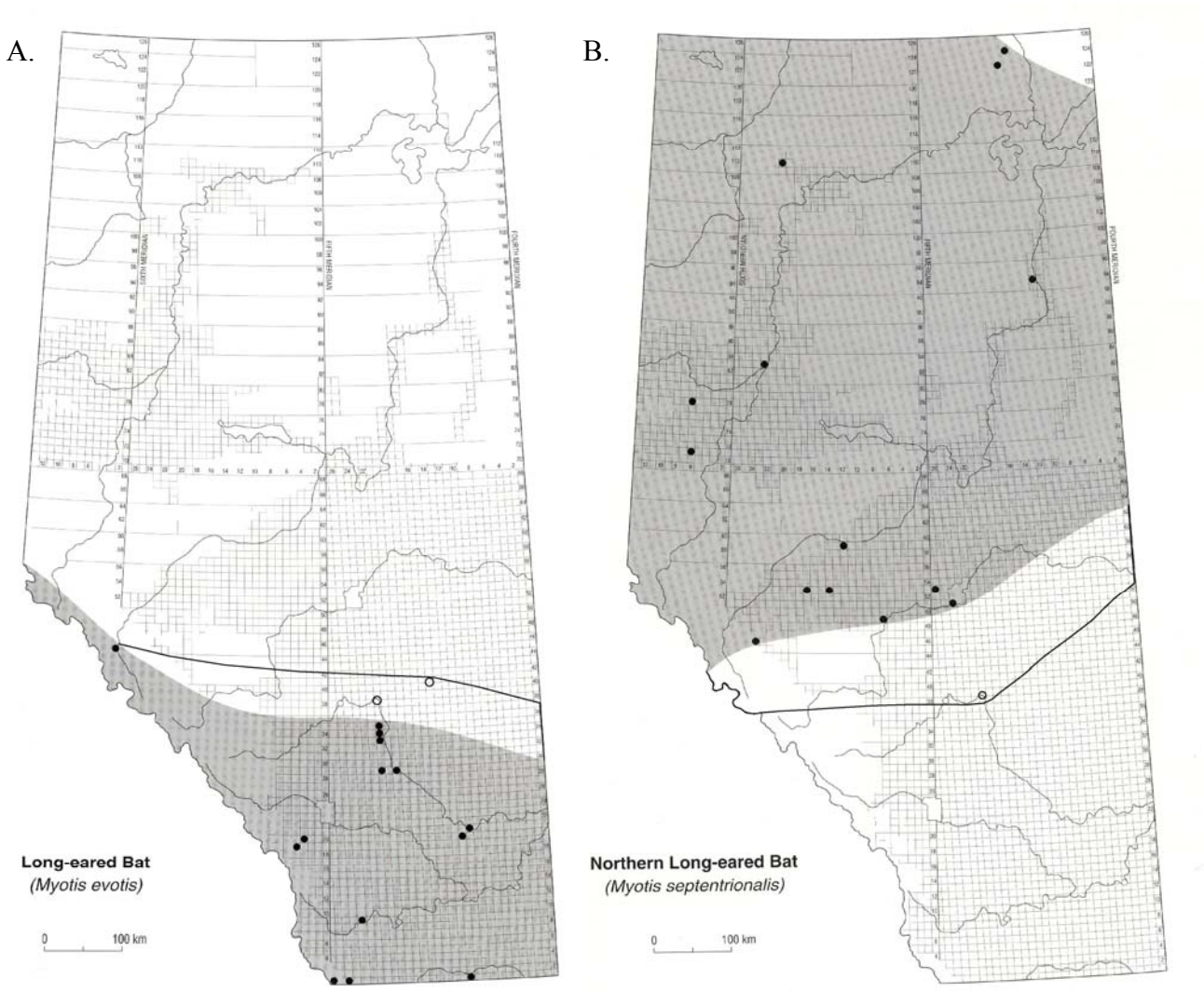

Figure 2. Provincial distribution maps for *M. evotis* (A) and *M. septentrionalis* (B). Hollow circles are capture locations from this survey. Dark outlined area is suggested range extension based on these captures. Maps adpated from Smith (1993).

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 also found to be *M. l. lucifugus*, corroborating the findings of M. Vonhof (Western Michigan University, pers. comm.).

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 raising 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. It is a difficult area to net for bats, and therefore I suggest that acoustic sampling be done first to determine whether further netting is warranted.

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 four 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 could 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

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 has 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*. This same subspecies was found in southern Alberta (C. Lausen's Milk River *M. lucifugus* samples) using cytochrome oxidase subunit (M. Vonhof, pers. comm.) and cytochrome *b* (T. Dewey, pers. comm.) mtDNA sequence. This suggests that *M. l. lucifugus* may be the only subspecies of little brown bat in Alberta.

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.

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