

Structure and movements of bat populations among hibernacula in Atlantic Canada

2010 Progress Report

**For The Nova Scotia Habitat Conservation Fund (contributions from
hunters and trappers)**



Project Researchers:

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Background:

Bats are an important component to the wildlife complement of an area although they remain in general as a poorly understood group. Bats that are year-round residents of temperate areas begin to vacate summering areas in mid August and migrate to hibernation sites (caves and abandoned mines) to engage in swarming. During swarming, which starts in late summer, mating activity occurs and it is believed that during this time bats undertake movements over tens and possibly hundreds of kilometers among different swarming sites. The dynamics of these activities and movements is poorly understood despite the large implications of how these contribute to the structure and management of bat populations.

In Atlantic Canada there are three species of bats that have confirmed populations, little brown, northern long-eared and tri-colored bats. Data on these bats in this area are limited to over-wintering occurrence records at hibernacula in both Nova Scotia and New Brunswick or as studies on their summer ecology. As such there is little information on how these bat populations are distributed among these swarming and hibernation sites. Other bat banding studies suggest that there is the potential for bats in the region to easily move between known swarming sites in different provinces within the region. If such regular and large scale movements occur it might mean that all resident bats in Nova Scotia and SE New Brunswick represent one single breeding population split among many hibernacula.

Project goal and objectives:

The goal of this project is to gain insight into the demographics, fall movement dynamics, and population genetic structuring of bats in Atlantic Canada. Our study species are little brown (*Myotis lucifugus*) and northern long-eared bats (*M. septentrionalis*). We have five research objectives:

- 1). To assess the distribution of bats among overwintering sites by automated tracking of PIT tagged bats
- 2). To characterize movement patterns and fidelity of bats among hibernacula by deploying automated PIT recorders at the entrance of several known overwintering sites to record previously tagged bats.
- 3). To describe the hierarchical genetic structuring of bats within and among swarming sites in order to determine if there is gene flow among these sites.
- 4). To monitor any changes in demographics (e.g., age structure & sex ratios) at individual hibernacula over several years.

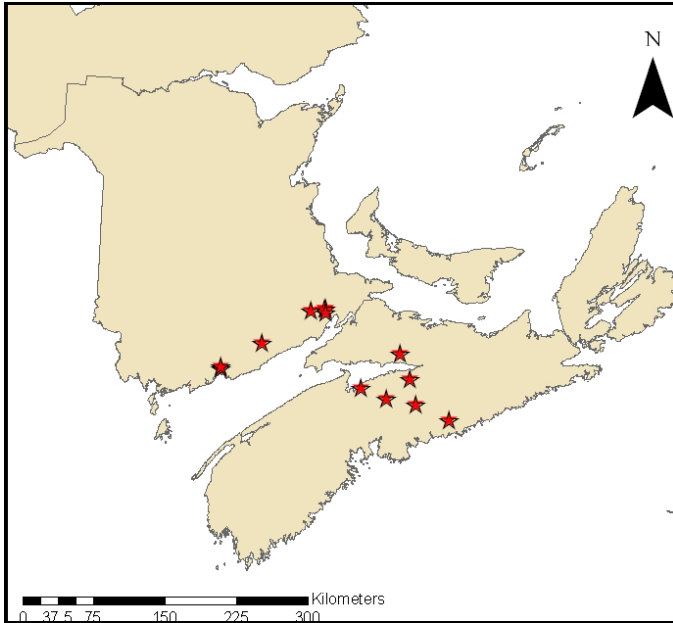


Figure 1. Locations of bat hibernacula for the project in Atlantic Canada showing the six sites surveyed in Nova Scotia in 2009 and sites added in New Brunswick in 2010.

Summary of work completed to date:

2009

Spring:

Trapping surveys were conducted from 02 May to 30 May 2009 over 15 nights. Six sites in total were surveyed in mainland Nova Scotia (Figure 1) including three natural caves and three abandoned mines. A total of 311 bats were captured with captures dominated by little brown bats (*Myotis lucifugus*; 247) followed by northern long-eared bats (*M. septentrionalis*; 61) and lastly tri-colored bats (*Perimyotis subflavus*; 3). Thus little browns composed 79% of all spring captures for 2009. Sex ratios were male biased with $\geq 80\%$ male captures for little brown and northern long-eared bats, and all tri-colored bats captured were male. Three hundred and seven bats captured were tagged with passively-integrated transponder tags (PIT-tags) including 244 little brown, 60 northern long-eared and the three captured tri-colored bats.

Fall:

Fall trapping surveys were conducted from 15 August to 06 October 2009 over 30 nights. The same six sites surveyed in the spring were visited in the fall. A

total of 1182 bats were captured with captures again dominated by little brown bats (681) followed by northern long-eared bats (497) and lastly tri-colored bats (4). Sex ratios were also again male biased although less so than the spring. For little brown bats the percent males ranged from 52 to 76%, northern long-eared bats ranged from 50 to 71% with and again and all tri-colored bats captured were male. Overall the average percent males for little brown bats was 63% and 62% for northern long-eared bats. Five hundred and nine bats captured were tagged with PIT-tags including 252 little brown, 256 northern long-eared and one tri-colored bat.

Recaptures of tagged bats:

In addition to the bats tagged in 2009 we have also tagged bats at a few sites since 2007 making the total number of tagged bats 854. A summary of the number of bats tagged by species (*Myotis* species only), at each site, is provided in Table 1. We recaptured a total of 15 bats in 2009 and all of these were recaptured at their site of initial capture. All of the recaptures were males except one female little brown bat. One male little brown marked in the fall of 2008 was recaptured in the early spring of 2009 which likely represents an overwintering record of that individual at the site. Overall our recapture rate approximates 1% which is similar to other bat recapture studies using banding.

Table 1. Total number of PIT-tagged bats from 2007 to 2009 by species, sex and site at six swarming sites in Nova Scotia. Numbers of recaptures of tagged bats at each site are in brackets.

Site	<i>Myotis lucifugus</i>		<i>Myotis septentrionalis</i>	
	Males	Females	Males	Females
Cave 1	35 (3)	8	20	16
Cave 2	24 (1)	11	14	14
Cave 3	89(1)	50	31	21
Mine 1	36 (1)	16	27	5
Mine 2	48	15 (1)	36	23
Mine 3	164 (7)	24	87 (1)	40

2010

Spring:

Trapping surveys were conducted from 30 April to 31 May 2009 over 14 nights. The same six sites surveyed in 2009 were surveyed in mainland Nova Scotia. A total of 215 bats were captured with 187 little brown bats (*Myotis lucifugus*) and 28 northern long-eared bats (*M. septentrionalis*) captured. Similar to the previous spring, little browns dominated captures in composing 87% of all captures which is slightly higher than the 79% in 2009. Sex ratios were male

biased with 82% male captures for northern long-eared bats, and 67% little brown bats. Little brown male capture bias is lower than the previous spring reflecting a lower percentage of males captured at Cave 3 where we captured 102 of a total 215 bats this spring. To supplement our initial tagging effort in 2009, we tagged 149 bats with passively-integrated transponder tags (PIT-tags) including 133 little brown and 16 northern long-eared bats.

In addition to our active harp trap surveys, this spring we implemented passive plate-antenna PIT-tag readers at the entrances to Mine 2 and Mine 3 in the later half of May. We also tested (successfully) and deployed harp traps with PIT-tag ring antenna embedded in the bag (2 per harp trap) which facilitated animals being trapped and then passively read as they escaped out the sides of the bag (termed PIT-harp readers). Therefore, recaptures for the spring includes bats either captured in hand and scanned, read passively via plate readers at entrances, or from reads on PIT-harp readers.

Recaptures of tagged bats:

From fall 2007 to spring 2010 the total number of bats tagged was 1003. A summary of the number of bats tagged by species (*Myotis* species only) at each site, up to spring 2010, is provided in Table 2. We recaptured a total of 17 bats at two sites (Table 3) and all of these were recaptured at their site of initial capture. All recaptures were of adult male bats. We recorded two instances of individuals being tagged together on the same night and recaptured together on a different night. At Mine 2, the two male little browns were tagged on 02-Sep-2009 and were recaptured together on 29 May 2010. At Mine 3, two male little brown bats were initially tagged on 19 May 2009 with another male little brown that was initially tagged on 04-May-2009. These three bats were then recaptured together on 19 May 2010. Overall our recapture rate for spring 2010 is 1.6% which is similar to other bat recapture studies using banding.

Table 2. Total number of PIT-tagged bats from 2007 to spring 2010 by species, sex and site at six swarming and hibernation sites in Nova Scotia.

Site	<i>Myotis lucifugus</i>		<i>Myotis septentrionalis</i>	
	Males	Females	Males	Females
Cave 1	42	9	20	16
Cave 2	25	11	14	14
Cave 3	121	83	34	23
Mine 1	45	18	28	5
Mine 2	49	16	36	23
Mine 3	207	27	97	40
Total	489	164	229	121

Table 3. Recaptures of bats by species in Spring 2010 of bats at two swarming and hibernation sites in Nova Scotia. Recapture intervals reflect the initial season individuals were tagged in followed by the season recaptured in. All recaptured bats were males.

Recapture interval	Mine 3		Mine 2
	<i>M. septentrionalis</i>	<i>M. lucifugus</i>	<i>M. lucifugus</i>
Spring 2009 – Spring 2010	2	10	0
Fall 2008 - Spring 2010	0	2	0
Fall 2009 – Spring 2010	0	0	2
Within Spring 2010	0	1	0

Fall:

Fall trapping surveys were conducted from 14 August to 03 October 2010 over 28 nights. In addition to the six sites in Nova Scotia, we also surveyed three sites in New Brunswick however this data is not presented. A total of 1000 bats were captured in Nova Scotia with captures dominated by little brown bats (565) similarly to 2009 (Fall 2009 58%, Fall 2010 57%; Table 4). This is followed by northern long-eared bats (430) and lastly tri-colored bats (5). Sex ratios were also again male biased. For little brown bats the percent males ranged from 46 to 67%, northern long-eared bats ranged from 50 to 67% and all tri-colored bats captured were male. Overall the average percentage of males for little brown bats was 54% and 59% for northern long-eared bats compared with fall 2009 with values of 63% and 62% respectively. This fall we PIT-tagged 215 bats including 120 little brown, 91 northern long-eared and 4 tri-colored bats. From 2007 to fall 2010 we have PIT-tagged a total of 1218 bats (Table 5).

Table 4. Total number of bats captured by sex and species at six swarming sites in Nova Scotia during fall 2010.

Site	<i>Myotis lucifugus</i>		<i>Myotis septentrionalis</i>		<i>Perimyotis subflavus</i>
	males	females	males	females	males
Cave 1	8	8	40	23	2
Cave 2	15	16	6	6	0
Cave 3	56	52	8	4	0
Mine 1	79	81	11	11	0
Mine 2	44	51	35	20	0
Mine 3	103	52	178	88	3
<i>Total</i>	305	260	278	152	5

Table 5. Total number of PIT-tagged bats from 2007 to fall 2010 by species, sex and site at six swarming sites in Nova Scotia.

Site	<i>Myotis lucifugus</i>		<i>Myotis septentrionalis</i>	
	males	females	males	females
Cave 1	49	9	27	18
Cave 2	33	21	16	15
Cave 3	135	98	34	24
Mine 1	53	22	29	6
Mine 2	54	23	42	25
Mine 3	241	35	143	62
<i>Total</i>	<i>565</i>	<i>208</i>	<i>291</i>	<i>150</i>

Recaptures of tagged bats:

We recaptured a total of 98 bats in 2010 at the 6 sites and all of these were recaptured at their site of initial capture except for 2 bats. The first exception is a female northern long-eared bat that was initially tagged on 02-Sep 2010. Tagging occurred at another swarming site (mine entrance) in a large mine complex that includes our site at Mine 2. This new swarming site was discovered as part of another student's research project in our lab that is inventorying new swarming sites on mainland NS. This bat was then later recaptured on 09 Sep 2010 at Mine 2 having moved an approximate 2.5 km from the initial site of capture and tagging. The second exception is a male northern long-eared bat that was tagged during the summer on 28 July 2010 along a forested trail in the vicinity of Mine 3 but away from the swarming site. This male was then recaptured on 04 October 2010 at the Mine 3 swarming site and therefore this represents a summer to fall movement.

Similar to spring 2010, recaptures in the fall encompass bats captured in hand and scanned, read passively via plate readers at entrances, or from reads on PIT-harp readers.

Table 6. Recaptures of bats by species in Fall 2010 of bats at three swarming sites in Nova Scotia. Recapture intervals reflect the initial season individuals were tagged in followed by the season recaptured in.

Recapture interval	Mine 3		Mine 2		Cave 3
	MYSE	MYLU	MYSE	MYLU	MYSE
Fall 2008 – Fall 2010	1	5	0	1	0
Spring 2009 – Fall 2010	6	10	0	1	0
Fall 2009 – Fall 2010	10	13	0	0	1
Spring 2010 – Fall 2010	1	10	0	0	0
Within Fall 2010	31	6	1	0	0

Note MYSE = *Myotis septentrionalis*: northern long-eared bat
MYLU = *Myotis lucifugus*: little brown bat

Recaptures in the fall were predominantly males at 91% and 75% for little brown and northern long-eared bats respectively. This is not unexpected as we consistently capture and therefore tag more males in both the spring and fall. We recorded seven instances of individuals being tagged together on the same night and subsequently recaptured together on a different night. This included 4 pairs of male northern long-eared bats (1 pair of adults, 2 pairs of juveniles, 1 pair of a juvenile and an adult). A mixed sex pair of late stage juveniles of northern long-eared bats was also recaptured together 6 nights after they were tagged together. Two pairs of adult male little brown bats were also recaptured with one pair tagged in fall of 2008 and the other tagged in spring of 2010 thus representing associations that span intervals of greater than a year. Overall our recapture rate for fall 2010 increased to 8.0% from 1% in the fall 2009.

Presentations:

Results of the work on the project were presented at the 39th Annual North American Symposium on Bat Research in November (2009) in Portland, Oregon.

Future Work:

We plan to conduct active trapping surveys again in the spring and fall (2011) to continue to accrue recapture records of tagged bats. PIT-harp readers will be installed again at a subset of sites to facilitate passive recording of individuals to increase our recapture success. We will also take additional DNA samples from captured bats and may tag more individuals at sites during the trapping surveys. In the fall of 2011 we will again trap at 3-4 sites in New Brunswick to obtain additional DNA samples to include into the regional genetic study. We may include additional surveys in Nova Scotia at new swarming sites identified from work this past year to enhance the geographic scope of the genetic study.

Laboratory work has begun on the genetic portion of the study with DNA extractions currently in progress. This work is being carried out in the Frasier Molecular Lab at Saint Mary's University. In the 2011 we will begin developing multiplex polymerase chain reactions to efficiently genotype individuals at 8-12 microsatellite loci.

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