WISCONSIN BAT PROGRAM- Driving Acoustic Bat Survey Report 2015

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In Brief

- There were 83 acoustic bat driving surveys conducted by staff from Wisconsin Department of Natural Resources, Bad River Department of Natural Resource (Tribal), U.S. Forest Service and 48 volunteers.
- For three consecutive years, Central Sand Hills region had the highest average bat calls per detector hour (2013: 81.2, 2014: 75.4, 2015: 100.8) and the Southern Lake Michigan Coastal region had the lowest average bat calls per detector hour (2013: 12.8, 2014: 10.4, 2015: 14.1).
- Two bat species experienced declines in mean encounters frequency across all ecological regions from 2014 to 2015; little brown bat (-8.8%) and eastern red bat (-8.5%).
- Although declines in hibernating bat populations from white-nose syndrome (WNS) have been observed in winter hibernacula in Wisconsin (2015), driving transect data has yet to see appreciable differences from the baseline information. If the trend continues as it did in the east, where WNS has been established since 2007, declines will be noticeable in the coming acoustic survey seasons.

Introduction

In 2013, the Wisconsin Bat Program (WBP) expanded its acoustic surveys by including 37 predetermined driving bat surveys (transects). The 2015 survey season marks the third year utilizing driving bat surveys. This report summarizes the methods and results from the driving survey transects that were conducted in Wisconsin in 2015 and compares this year's data to those of 2013 and 2014.

Methods

In order to better understand statewide changes in bat populations over time, emphasis was placed on repeating the 37 driving transects developed in 2013 by WBP in each of the 16 ecological landscapes (Appendix 1). In coordination with national bat monitoring efforts, the following protocols were adopted to ensure standardization and quality control of data. Each acoustic driving transect ranged from 20 to 30 miles per survey and used an acoustic detection system that passively records bat activity by detecting ultrasonic echolocation calls emitted as bats forage and navigate across the landscape. These echolocation calls are saved on either a hand-held computer (personal data assistant) or directly to a CompactFlash™.

Surveyed routes in 2015 were driven one to three times across a six-week window, beginning June 1 and ending July 15**.** Surveys began approximately 30 minutes after local sunset time and were driven at a target speed of 20 miles per hour. Routes were to be completed at least once during the three primary survey periods: June 1 - June 15, June 16 - June 30 and July 1- July 15, and a minimum of five days were required between replicates of the same transect. Routes were surveyed on evenings with weather conditions suitable for bat activity which included low wind (<30 mph), no precipitation, and a daytime temperature of 50F° or above. Survey equipment included the roof-mounted microphone, an AnaBat SD1/2 bat detector, a hand-held computer to interface with the AnaBat SD1/2, a compact flash GPS unit to record the location of each acoustic file, and other appropriate items (instructions, route maps, datasheets, batteries and cables).

Acoustic files were analyzed using Titley Scientific AnalookW (version 3.8.17). Surveys were manually filtered to separate files containing bat encounters and ignore those with only extraneous noise from insects, birds, wind, road noise, and other sources of static. All acoustic data was processed through manual examination by one staff member who has >5 years of experience in identifying Wisconsin bat species and has an extensive call library from which to reference. Files with bat encounters were then categorized into one of the following seven species or species group categories: (1) hoary-LACI (*Lasiurus cinereus*), (2) big brown-EPFU (*Eptesicus fuscus*), (3) silver-haired-LANO (*Lasionycteris noctivagans*), (4) eastern red-LABO (*L. borealis*), (5) eastern pipistrelle-PESU (*Perimyotis subflavus*), (6) little brown-MYLU (*Myotis lucifugus),* (7) northern long-eared-MYSE (*M. septentrionalis*), (8) big brown/silver-haired, (9) eastern pipistrelle/eastern red, (10) little brown/northern long-eared, (11) low frequency and (12) high frequency. Low and high frequency bat passes were later grouped as unclassified encounters because one of the following scenarios: there were too few calls recorded to further separate, the calls were of low quality recording (fragmented), the bat pass did not contain search-phase calls, or general uncertainty. In order to compare our results year to year and to other state-wide acoustic inventories, results were evaluated using a bat encounters-per-detector-hour metric to mitigate for variations in driving speeds among surveyors.

Results

There were 83 surveys conducted by 48 individuals from Wisconsin Department of Natural Resources, Bad River Department of Natural Resource (Tribal), U.S. Forest Service and citizen volunteers. Of those surveys, 77 (93%) returned complete acoustic results, equal to 2014's effort (77) and down from 92 in 2013. Of the 77 routes, mean driving length was 30.72 miles, with the greatest distance being 45.48 miles (NCF4) and the shortest distance being 20.77 miles (WCR1). At least one route was driven in each ecological landscape with the exception of the Northeast Sands region. Due to technical difficulties, six surveys were incomplete and were not included in the results, leaving valid data for 29 of the 37 routes. Technical issues ranged from loss of GPS data to surveyor error when setting the record options. 14,681 files were recorded on 77 surveys, 4,912 files (33.5%) were identified as bat encounters. Surveys had a mean of 38.5 bat calls per detector-hour, up from 34.6 in 2014 and 35.1 in 2013, with a minimum of 7.6 (NH1 on 30 June) and a maximum of 120.0 (CSH1 on 11 July). For three consecutive years, Central Sand Hills region had the highest average bat calls per detector hour (2013: 81.2, 2014: 75.4, 2015: 100.81) and the Southern Lake Michigan Coastal region had the lowest average

2015 Mean Bat Calls Per Detector Hour

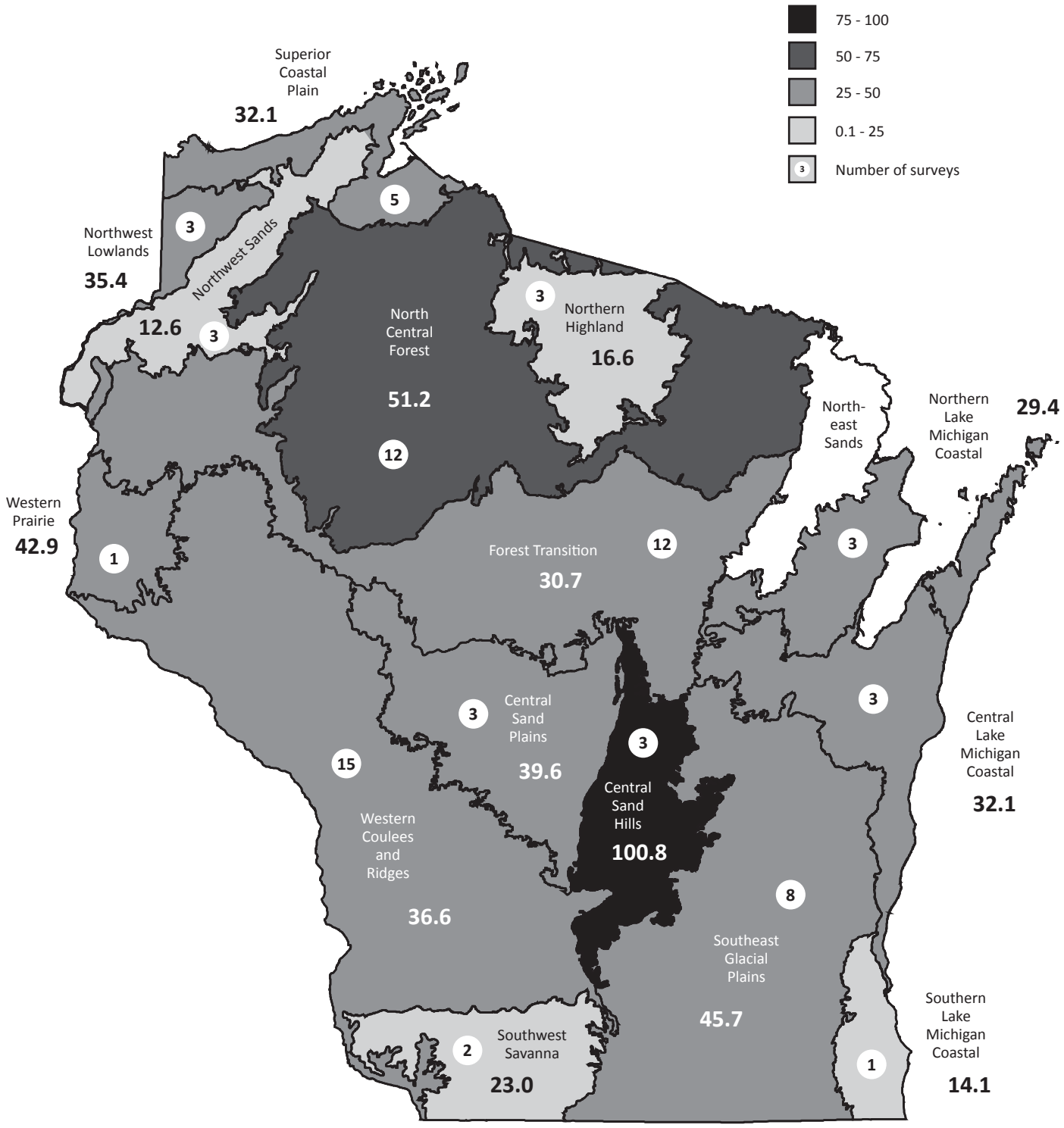


Figure 1. For the third year in a row, the highest mean bat calls per detector hour was the Central Sand Hills at 100.81 calls/detector/hour.

bat calls per detector hour (2013: 12.8, 2014: 10.4, 2015: 14.1) (Figure 1). The number of call files per completed survey had a mean of 63.8 and ranged from 14 (NWS2 on 26 June) to 182 (CSH1 on 11 July). The number of bat calls per survey trended upward from the beginning of the survey window in early June, but dipped slightly upon the completion of surveys in mid-July (Figure 2). Nearly a third of completed surveys (28.6%) had between 26-50 bat encounters detected, while 27.3% of completed surveys had between 51-75 bat encounters detected (Figure 3).

There was an increase in species abundance for the majority of the species throughout the survey period from June 1 through July 15. The exceptions were the northern long-eared bat and eastern pipistrelle observations (Figure 4). A comparison of mean calls per detector hour over time from 2013 through 2015 yielded a similar trend of increased abundance (Figure 5).

Only the big brown bat (11.3%) and hoary bat (2.4%) experienced increases in mean encounter frequency across all ecological regions from 2014 to 2015, while the remaining species experienced negligible change (eastern pipistrelle, northern long-eared and silver haired bat) or a decrease in frequency (eastern red bat -8.5% and little brown bat -8.8%)(Figure 6).

Of the 4,912 encounters, 2,513 (51.2%) were classified into species groups: high frequency group (1038), low frequency group (634), big brown/silver-haired (517), eastern red/eastern pipistrelle (132) and little brown/northern long-eared (192) because the bat passes have similar characteristics to two or more species. The remaining 2,399 (48.8%) files were classified as little brown (32.8%), big brown (26.9%), hoary (18.7%), eastern red (17.8%), silver-haired (3.3%), eastern pipistrelle (0.5%) and the northern long-eared bat (0.0%). For two years in a row little brown bats were the most frequent species encountered. Among the 15 ecological regions that were surveyed (missing Northeastern Sands), the little brown bat (n=5) and the big brown bats (n=5) were the most commonly encountered species of the 15 ecological regions, followed by the eastern red bat (n=3) and hoary bat (n=2) (Figure 7) (Table 2).

Figure 2. Total number of surveys by week and average number of bat calls per survey by week, 2015. Partial surveys (n=6) excluded.

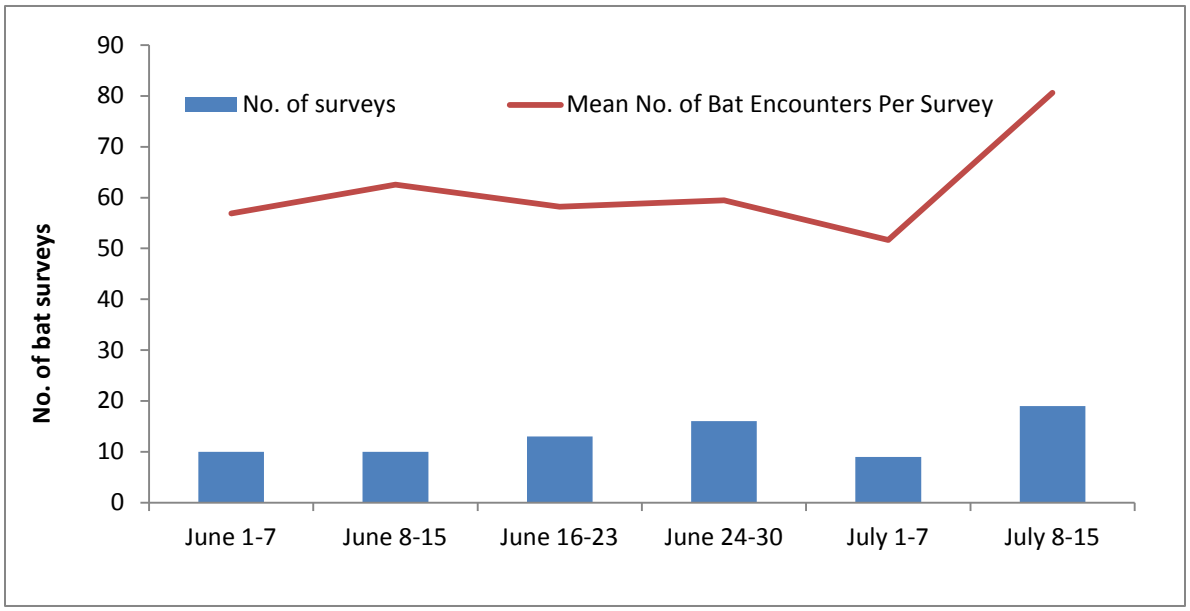


Figure 3. A comparison of the number of bat calls detected from 2013-2015.

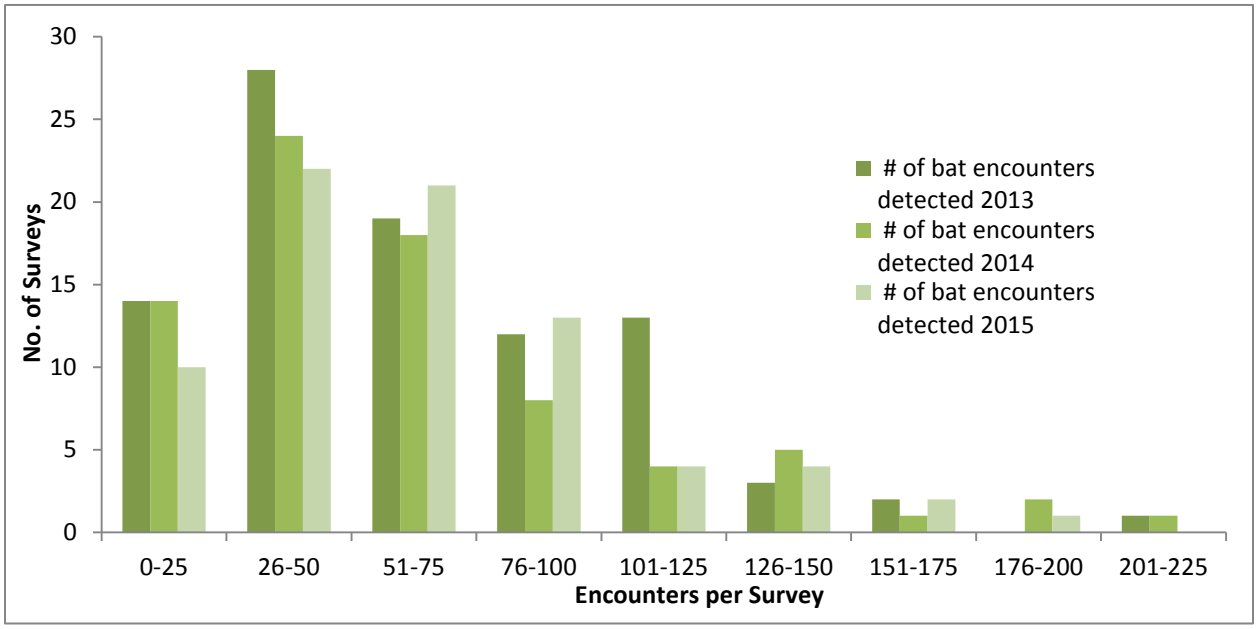


Figure 4. Change in bat species abundance over three acoustic driving transect periods (2015).

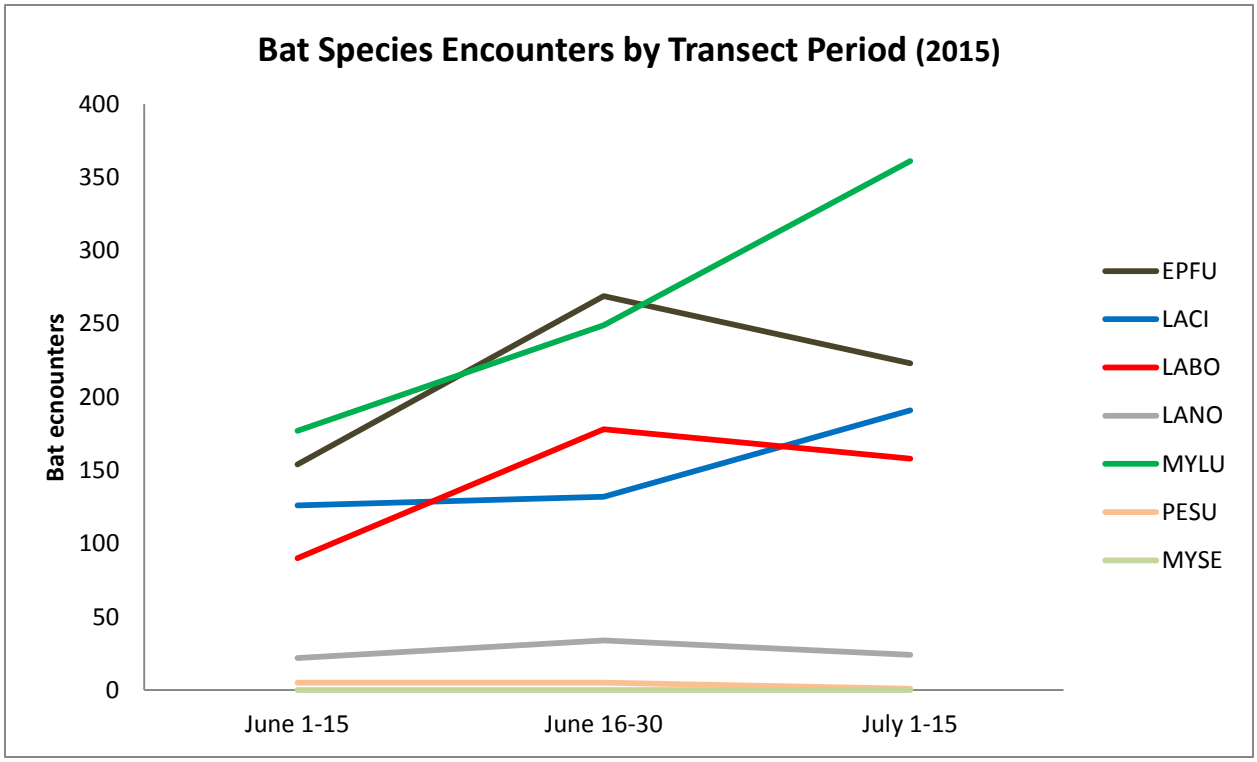


Figure 5. Comparison of mean calls per detector hours over sampling period from 2013, 2014 and 2015 driving routes.

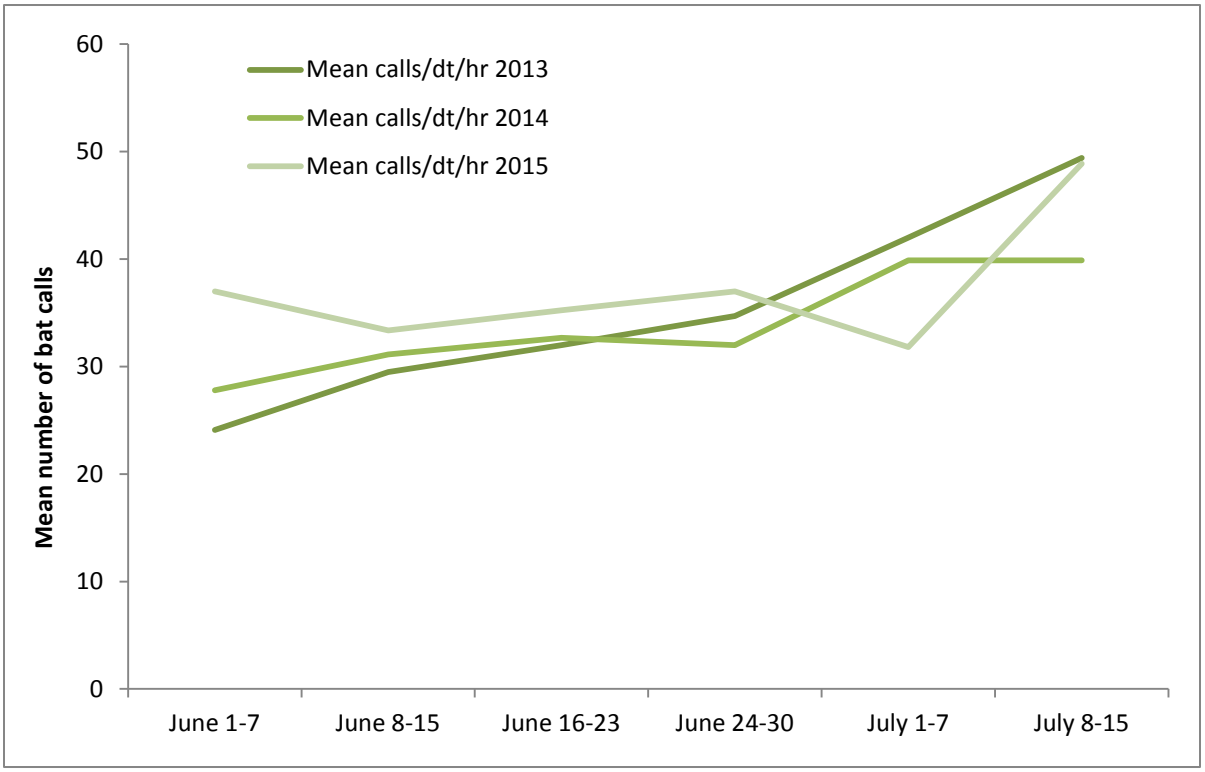
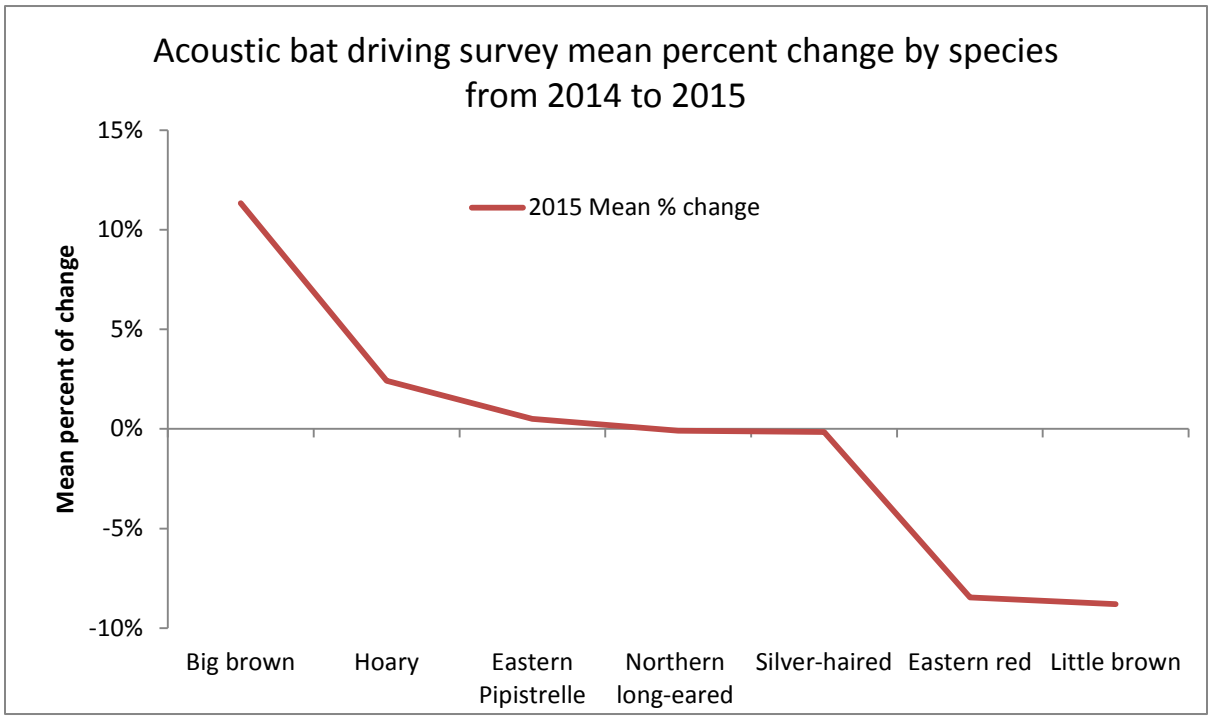


Figure 6. Mean change in frequency of species across all ecological regions from 2014 to 2015.



2015 Most Common Bat Species by Ecological Region

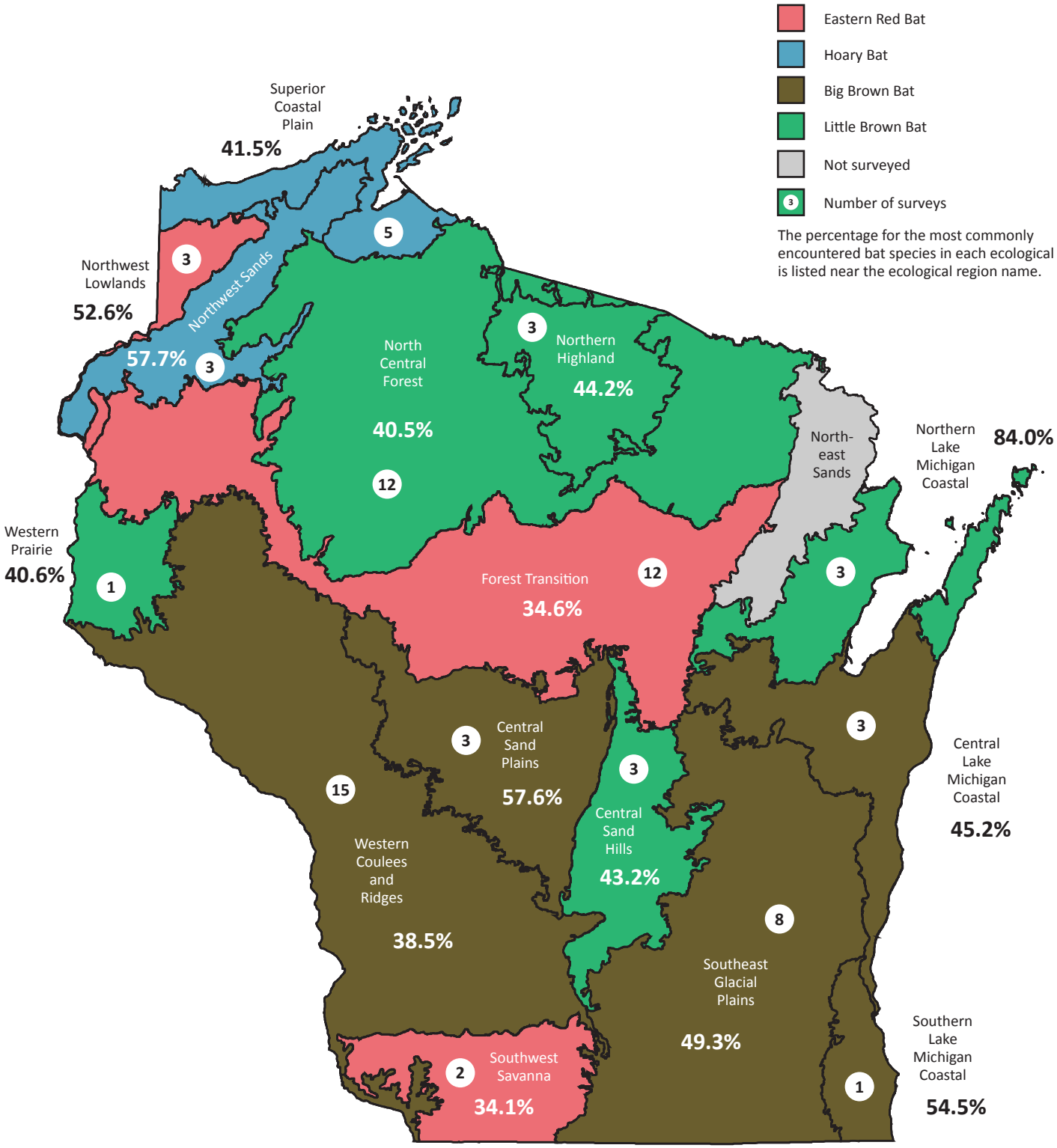


Figure 7. The most commonly encountered bat species by ecological region were the little brown bat (5) and the big brown bat (5).

Figure 8. Mean bat calls per detector hour by ecological landscape (2013-2015). Boxes depict 50th and 75th percentiles, lines within boxes mark the median.

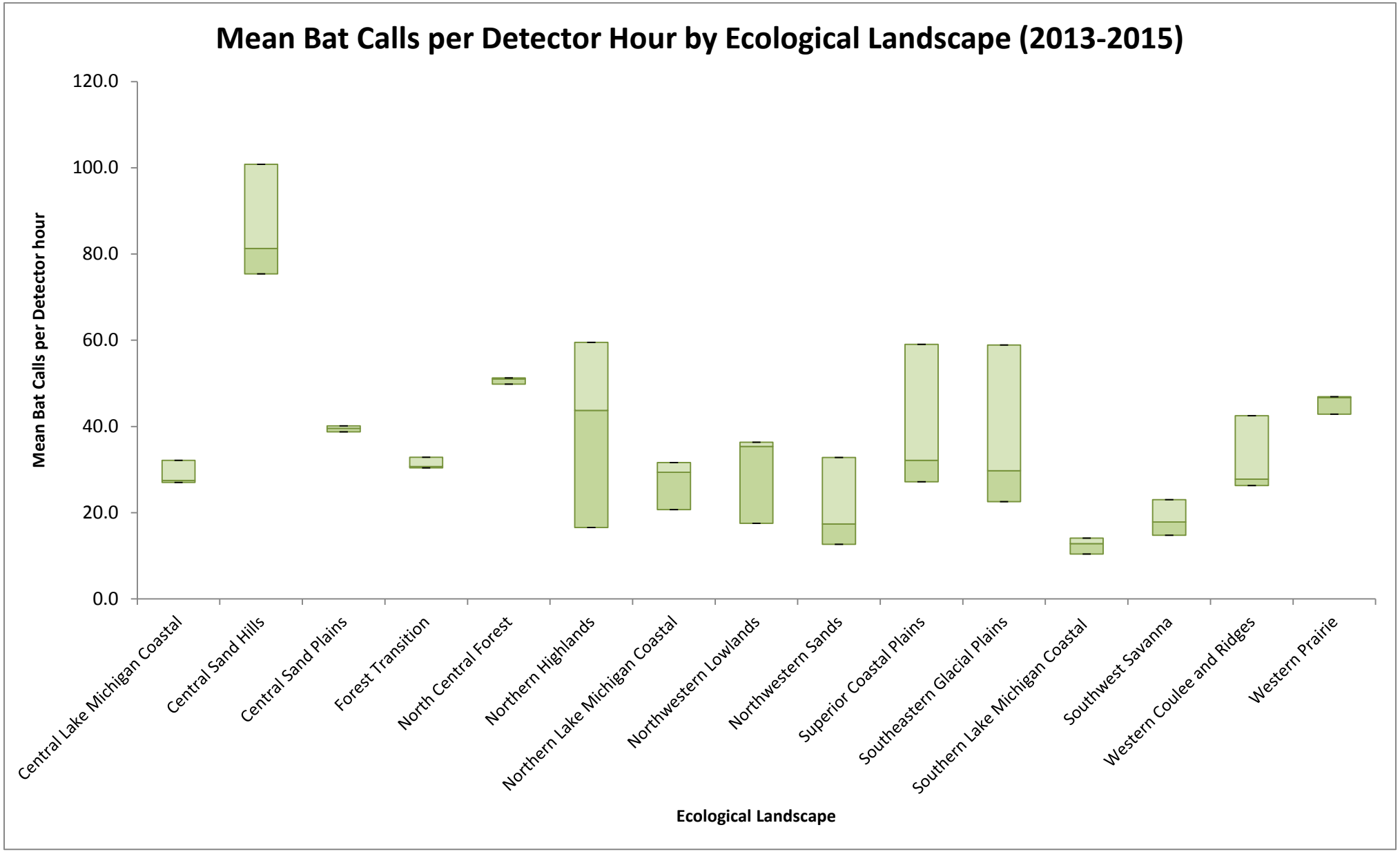


Table 1. Driving acoustic bat surveys (n=77) conducted in Wisconsin, June-July 2015. Incomplete surveys (n=6) excluded.

Ecological landscape	No. Surveys	Total Miles	Total detector-mins	Total detector-hours	Mean detector-hours	Mean Speed (mph)	Total Calls detected	Mean Calls per detector-hour
CLMC1	2	59.0	162	2.7	1.4	21.9	115	42.6
CLMC2	1	34.0	102	1.7	1.7	20.0	19	11.2
CSH1	3	89.3	273	4.6	1.5	19.6	458	100.9
CSP1	3	84.8	282	4.7	1.6	18.5	185	39.6
FT1	4	113.9	369	6.2	1.5	18.5	219	38.8
FT2	2	56.2	191	3.2	1.6	17.6	100	31.8
FT3	3	93.7	295	4.9	1.6	19.1	129	26.5
FT4	3	107.6	323	5.4	2.2	20.0	127	23.4
NCF1	3	93.2	374	6.2	2.1	15.0	253	42.6
NCF2	3	101.4	326	5.4	1.8	18.7	209	39.2
NCF3	3	91.2	267	4.5	1.5	20.6	386	87.3
NCF4	3	136.3	440	7.3	2.5	18.6	263	35.9
NH1	3	93.2	367	6.1	2.0	15.2	103	16.6
NLMC2	3	88.7	338	5.6	1.9	15.8	165	29.4
NWL2	3	86.3	263	4.4	1.5	19.7	155	35.4
NWS2	3	88.7	334	5.6	1.9	16.0	70	12.6
SCP1	2	65.7	228	3.8	1.9	17.3	116	30.6
SCP2	3	110.1	383	6.4	2.7	17.3	211	33.2
SGP1	3	77.5	238	4.0	1.3	19.5	350	88.3
SGP2	3	73.0	237	4.0	1.3	18.5	93	31.0
SGP5	2	69.1	234	3.9	1.9	17.7	57	14.8
SLMC1	1	30.5	98	1.6	1.6	18.7	23	14.1
SWS1	2	57.1	202	3.4	1.7	17.2	80	23.0
WCR1	3	62.5	307	5.1	1.7	12.2	303	59.3
WCR2	3	99.8	358	6.0	2.0	16.7	197	33.1
WCR3	3	91.2	306	5.1	1.7	17.9	155	30.8
WCR4	3	90.5	282	5.5	1.6	19.3	190	40.4
WCR5	3	88.7	328	5.5	2.4	16.2	106	19.4
WP 1	1	31.9	105	1.8	1.8	18.2	75	42.9
Totals	**77**	**2365.1**	**8012**	**134**			**4912**	
Mean	**2.7**	**81.6**	**276.3**	**4.6**	**1.8**	**18.0**	**169.4**	**38.5**

Table 2. Mean number of encounters by species or species group per route during driving acoustic surveys in Wisconsin, June-July 2015. The category "All bats" represents total mean encounters of all species and species groups per route. Data are listed in an approximated north-to-south direction by, and within, ecological region. Incomplete surveys (n=6) excluded.

Location	No. Surveys	Big brown	Hoary	Eastern red	Silver-haired	Little brown	Eastern Pipistrelle	Northern long-eared	Little brown/Northern long-eared	Eastern red/Eastern pipistrelle	Big brown/Silver-haired	Unclassified	All Bats
Central Lake Michigan Coastal													
CLMC1	2	13.00	4.50	6.00	0.00	4.00	0.00	0.00	1.00	1.50	4.00	11.75	**57.50**
CLMC2	1	2.00	2.00	2.00	0.00	1.00	0.00	0.00	1.00	1.00	2.00	4.00	**19.00**
Central Sand Hills													
CSH1	3	25.33	5.00	6.00	0.00	27.67	0.00	0.00	6.67	2.33	17.00	31.33	**152.67**
Central Sand Hills													
CSP1	3	19.00	1.67	4.00	0.00	7.33	1.00	0.00	1.00	3.00	2.67	11.00	**61.67**
Forest Transition													
FT1	4	0.75	3.25	15.75	0.50	11.50	0.00	0.00	2.25	0.25	5.57	7.38	**54.75**
FT2	2	7.00	3.00	8.50	0.00	6.00	0.00	0.00	3.00	0.50	3.50	9.25	**50.00**
FT3	3	6.33	2.67	3.33	1.67	4.00	0.00	0.00	1.33	1.67	4.67	8.67	**43.00**
FT4	3	8.33	0.67	2.67	1.00	5.00	0.00	0.00	0.00	0.67	5.00	9.17	**42.33**
North Central Forest													
NCF1	3	0.33	15.00	8.00	0.33	31.00	0.00	0.00	3.67	1.00	4.33	10.33	**84.33**
NCF2	3	10.33	7.33	6.67	2.33	7.67	0.00	0.00	1.67	2.67	6.00	12.50	**69.67**
NCF3	3	4.33	8.67	23.00	0.00	24.67	0.00	0.00	3.67	1.00	15.00	24.17	**128.67**
NCF4	3	1.00	19.67	11.00	0.67	17.33	0.00	0.00	2.33	0.67	10.33	12.33	**87.67**
Nothern Highland													
NH1	3	2.00	4.67	1.33	1.67	7.67	0.00	0.00	1.00	2.33	0.67	6.50	**34.33**
Northern Lake Michigan Coastal													
NLMC2	3	1.00	2.00	2.33	0.00	28.00	0.00	0.00	8.33	0.00	0.67	6.33	**55.00**
Nortwest Lowland													
NWL2	3	13.33	0.67	6.67	1.33	3.33	0.00	0.00	1.33	3.33	5.00	8.33	**51.67**
Northwest Sands													
NWS2	3	0.67	5.00	1.00	0.00	2.00	0.00	0.00	1.33	0.33	5.67	3.67	**23.33**
Superior Coastal Plains													
SCP1	2	6.50	10.00	0.50	6.50	1.00	0.00	0.00	0.00	0.00	18.50	7.50	**58.00**
SCP2	3	0.33	15.33	2.33	10.33	8.33	0.00	0.00	2.33	1.00	15.33	7.50	**70.33**
Southeast Glacial Plains													
SGP1	3	23.00	2.00	0.67	0.00	20.00	1.00	0.00	8.67	2.00	10.00	24.67	**116.67**
SGP2	3	9.33	2.00	0.67	0.00	1.33	0.33	0.00	2.00	1.00	3.33	5.50	**31.00**
SGP5	2	1.50	2.50	4.00	0.00	3.00	0.00	0.00	3.50	1.00	4.00	4.50	**28.50**
Southern Lake Michigan Coastal													
SLMC1	1	6.00	2.00	3.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	3.50	**23.00**
Southwest Sands													
SWS1	2	3.50	6.00	7.50	0.00	4.00	1.00	0.00	0.50	1.00	2.00	7.25	**40.00**
Wester Coulee and Ridge													
WCR1	3	0.00	3.67	2.67	0.33	6.67	29.67	0.00	19.00	6.33	6.33	52.00	**0.39**
WCR2	3	15.67	6.33	3.67	0.00	7.33	0.00	0.00	1.67	1.33	12.67	8.50	**65.67**
WCR3	3	12.00	2.00	5.00	1.33	6.67	0.00	0.00	0.33	3.00	5.33	8.00	**51.67**
WCR4	3	0.00	2.67	3.00	0.00	2.00	16.00	0.00	11.67	5.67	9.33	32.32	**0.14**
WCR5	3	4.00	9.00	7.00	0.33	1.33	0.33	0.00	0.33	2.67	2.00	4.17	**35.33**
Western Prairie													
WP1	1	11.00	4.00	2.00	2.00	13.00	0.00	0.00	2.00	1.00	15.00	12.50	**75.00**

Discussion

Surveyors drove over 2,300 miles throughout Wisconsin while surveying acoustic bat driving transects. Species encounter rates varied by ecological region with the highest mean encounter rate of little browns (27.7 MYLU/detector/hr) in the Central Sand Hills (Table 2). The most commonly encountered species on driving transects when combing ecological regions were little brown (6.0/detector/hr), eastern red (3.3/detector/hr), big brown (4.9/detector/hr) and hoary bats (3.4/detector/hr). The percentage of encounters per species also varied by ecological region as seen in figures 9-15.

The eastern pipistrelle acoustic encounters remained extremely low (0.5% or 11 of 2399), all located in the southern half of the state. The northern long-eared bat was undetected by acoustic driving transects in 2015, which could be a result of poor-quality echolocation calls, low intensity of calls of the species and habitat surveyed.

In general, the standard deviation remained low (<10.0) for the mean bat calls per detector hour, indicating the three years (2013-2015) of data were close to the mean (Table 3). The Northern Highland region experienced the highest fluctuation in mean bat calls per detector hour (21.7 SD), although the number of successful surveys varied by year which would likely affect the distribution of values.

Table 3. A comparison of mean number of bat calls per detector by ecological landscape (2013-2015), including total number of surveys completed in each year.

Ecological Landscape	2013 Mean Bat Calls/det/hr (# of surveys)	2014 Mean Bat Calls/det/hr (# of surveys)	2015 Mean Bat Calls/det/hr (# of surveys)	Standard Deviation
CLMC	27.0 (4)	27.5 (3)	32.1 (3)	2.8
CSH	81.3 (3)	75.4 (3)	100.8 (3)	13.3
CSP	40.2 (3)	38.8 (3)	39.6 (3)	0.7
FT	30.4 (12)	32.9 (10)	30.7 (12)	1.3
NCF	51.0 (8)	49.8 (12)	51.2 (12)	0.8
NH	59.5 (1)	43.7 (2)	16.6 (3)	21.7
NLMC	20.7 (4)	31.6 (4)	29.4 (3)	5.8
NWL	36.3 (4)	17.5 (3)	35.4 (3)	10.6
NWS	32.8 (5)	17.4 (1)	12.6 (3)	10.6
SCP	27.2 (4)	59.1 (4)	32.1 (5)	17.2
SGP	29.7 (15)	22.6 (9)	45.7 (8)	11.8
SLMC	12.8 (3)	10.4 (3)	14.1 (1)	1.9
SWS	14.8 (3)	17.8 (3)	23.0 (2)	4.2
WCR	42.5 (19)	26.3 (16)	36.6 (15)	8.2
WP	46.7 (3)	46.9 (2)	42.9 (1)	2.3
Mean (Total)	***36.9 (91)***	***34.5 (78)***	***38.5 (77)***	***7.5***

The spatial distribution of bats has been important for understanding where certain species occur and what habitat features are essential for foraging and commuting opportunities. This understanding of distribution will continue to be increasingly important as white-nose syndrome (WNS) moves through bat populations in Wisconsin. From the first detection of WNS in 2014 (one site in the county), WNS has quickly spread to an additional 14 sites and 7 counties (as of winter 2015), with no signs of slowing or containment. Once a hibernaculum is infected with the deadly fungus, changes to the local hibernating bat population are usually seen within years two to three post-infection. It is too soon to understand how these winter declines may affect the spatial distribution of bat assemblages throughout Wisconsin; in fact the overall mean bat call per detector hour has gone up since beginning the surveys (Table 3). If past evidence from WNS-infected eastern states is any indication, drastic declines in species such as little brown bats will likely be observed both in winter and summer populations. States such as Vermont and New York showed significant declines in summer foraging activity in post-WNS years which Ford et al. (2011) contributed to a probable decrease in reproductive success of surviving individuals, leading to a reduction in juvenile recruitment. Acoustic surveys, now in the shadow of WNS, will help inform private landowners, land managers, biologists and lawmakers on changes to bat communities on a local and regional scale while dictating the future of bat conservation.

Acknowledgements

The Wisconsin Bat Program would like to thank the following surveyors for their dedication to this acoustic bat driving project: N. Schutt, S. Dibble, C. Nelson, T. & T. Jay, N. Bossenbroek, W. Mueller, R. Holrichter, T. & L. Ludwig, L. Johnson, N. Bentley, M., R. & M. Berg, J. Jorgensen, J. Scott, J. Lund, N. Gremban, J. Lust, T. Leigh, A. Ledin, J. Miller, A. Ziobro, B. & C. Scriver, K. Luukkonen, H. Kaarakka, N. Kilger, B. Heeringa, R. Bultman, B. Lenz, M. Schlotfeldt, J. Clements, D. Boyle, B. Paulan, B. Johnston, A. Dassow, R. & J. Summers, K. Overn, C. Treiber, J. Scharhag, N. Bouley and C. & K. Hayes. We would also like to recognize Andrew Badje for his mapping services, Tyler Brandt for the interpretive maps, along with Heather Kaarakka who individually analyzed each of the >14,000 calls submitted to the program in 2015. Mobile acoustic bat surveys in Wisconsin were funded by WNS Grants to States Program (S-1TW-1) and public contributions to the Wisconsin Bat Conservation fund.

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2015 Encounters by Ecological Region

Eastern Red Bat

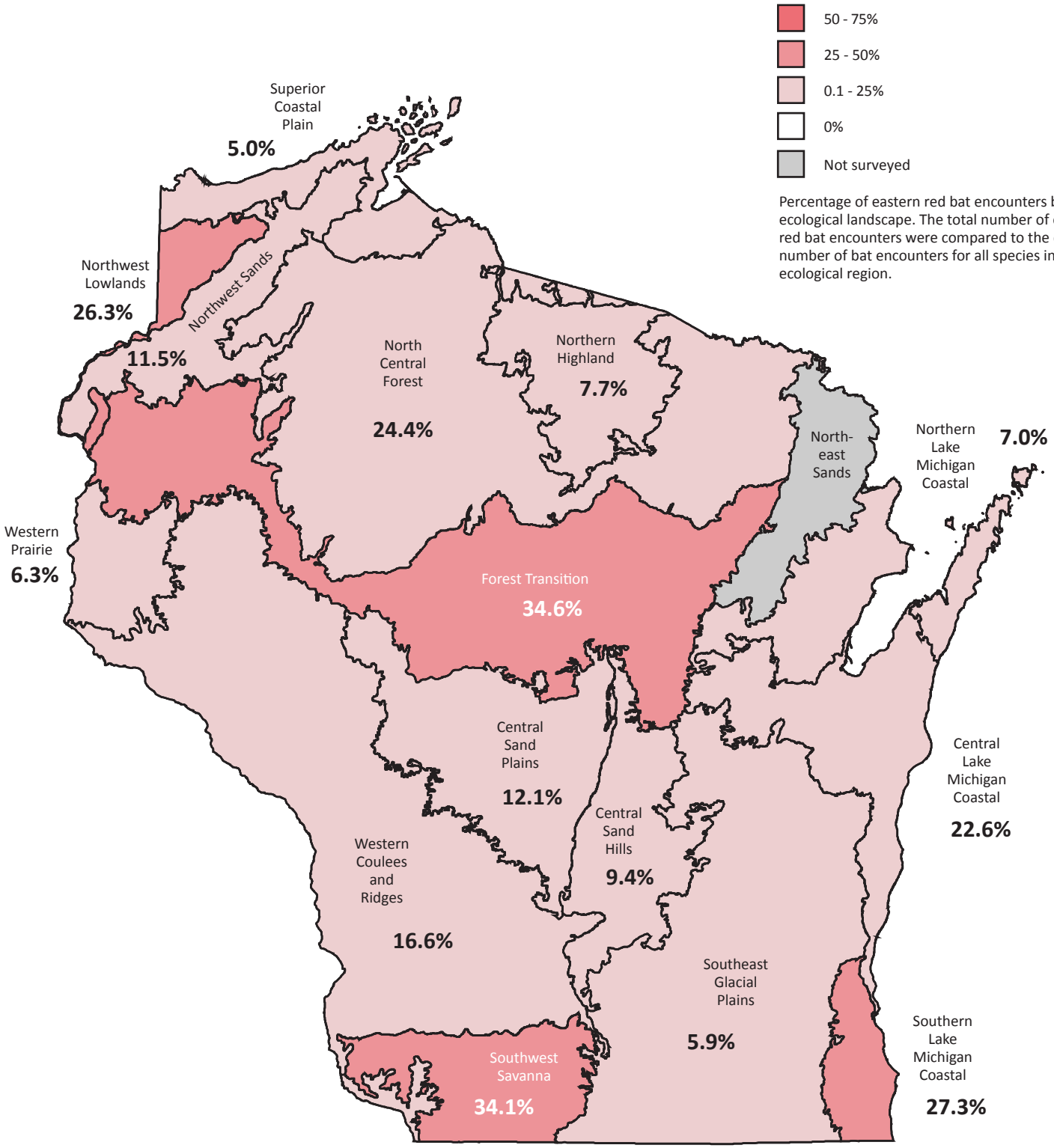


Figure 9. The eastern red bat encounters accounted for 34.6% of all encounters in the Forest Transition region.

2015 Encounters by Ecological Region

Hoary Bat

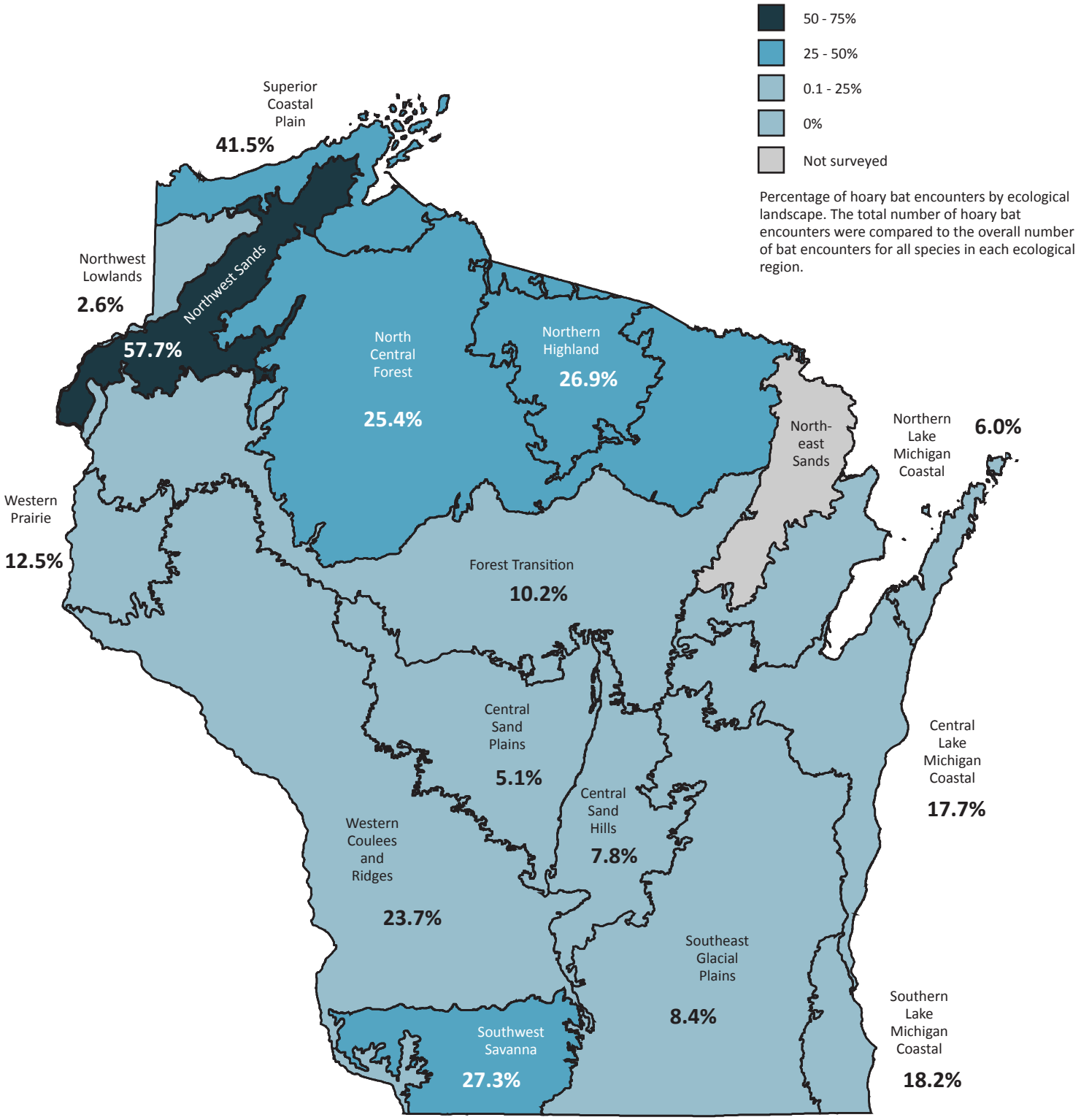


Figure 10. The hoary bat accounted for 57.7% of all encounters in the Northwest Sands region.

2015 Encounters by Ecological Region

Silver-haired Bat

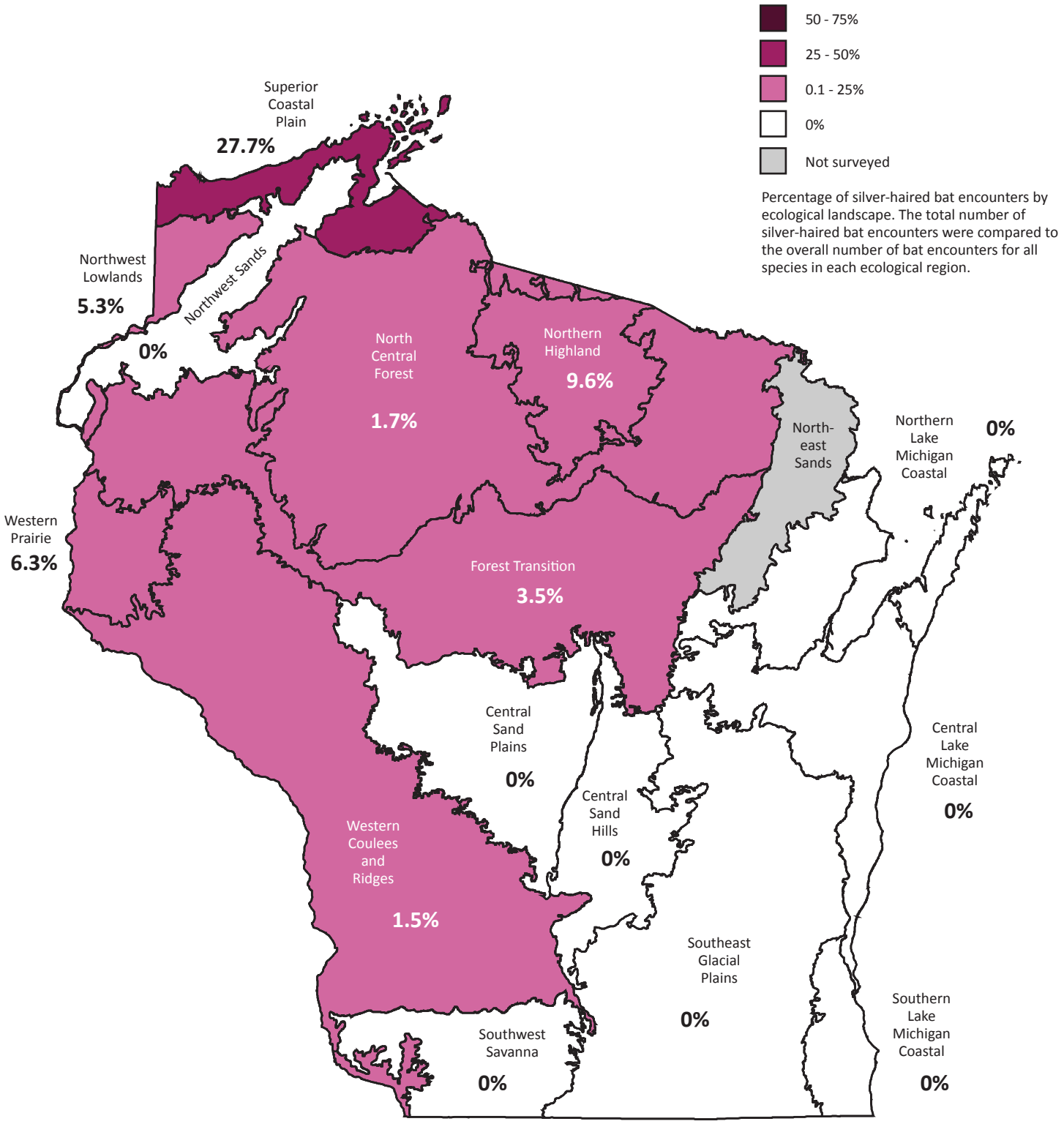


Figure 11. Silver-haired bat encounters accounted for 27.7% of all encounters in the Superior Coastal Plain region.

2015 Encounters by Ecological Region

Little Brown Bat

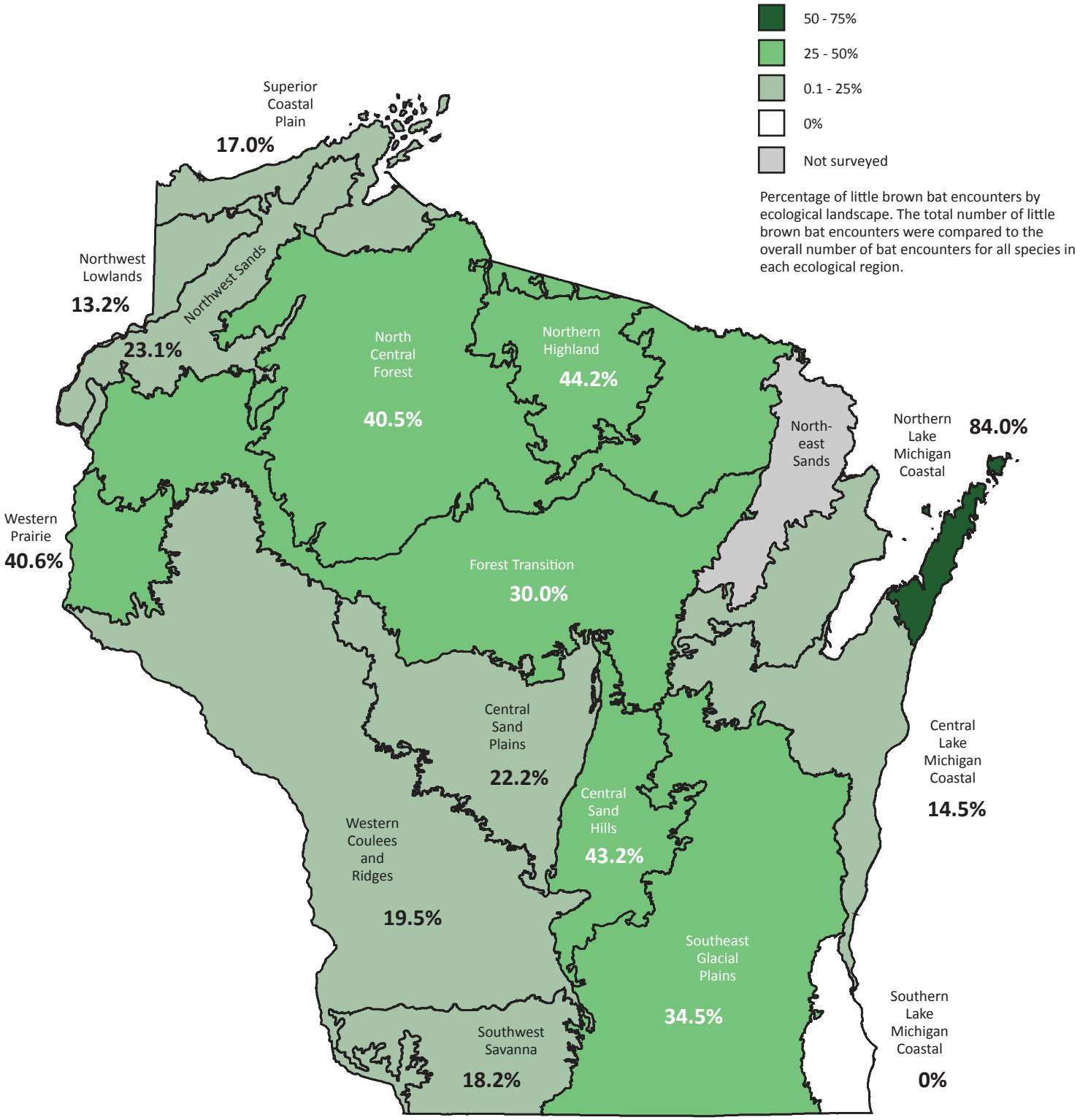


Figure 12. The little brown bat encounters accounted for 84.0% of all encounters in the Northern Lake Michigan Coastal region.

2015 Encounters by Ecological Region

Big Brown Bat

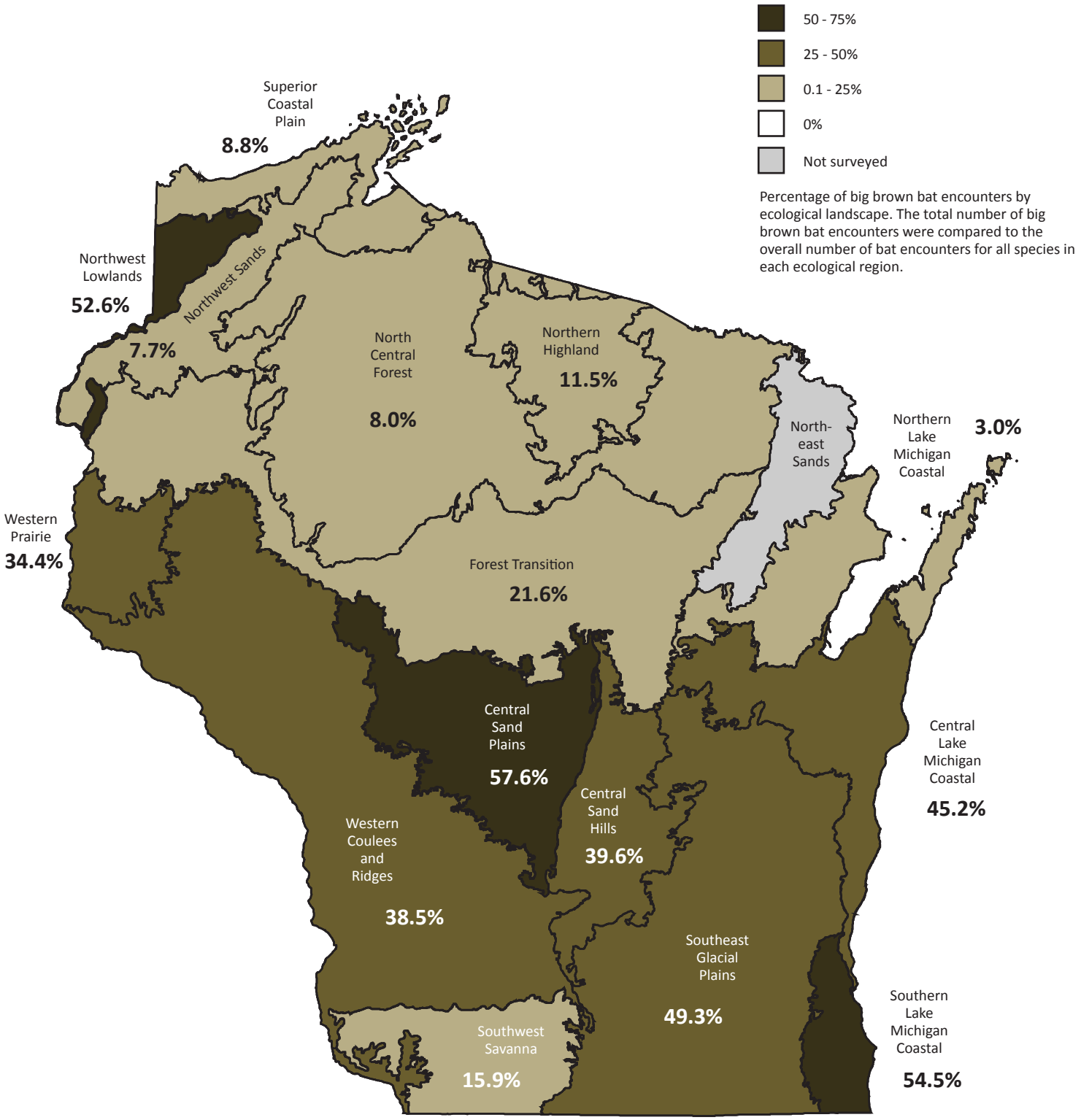


Figure 13. The big brown bat had high encounter rates in three regions: Central Sand Plains (57.6%), South Lake Michigan Coastal (54.5%) and Northwest Lowlands (52.6%).

2015 Encounters by Ecological Region

Eastern Pipistrelle

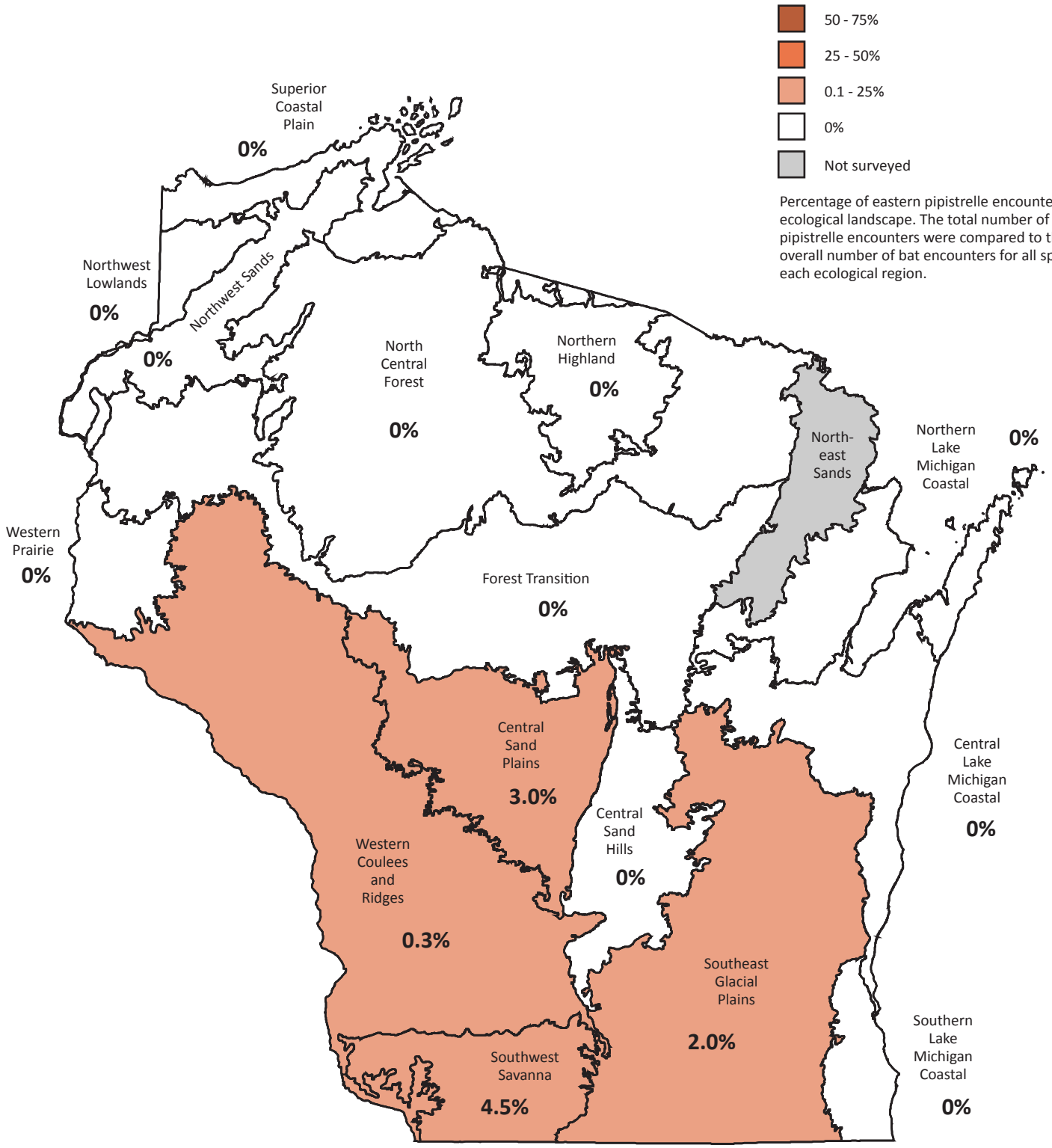


Figure 14. The eastern pipistrelle accounted for 4.5% of all encounters in the Southwest Savanna compared to data from 2014, where it was not observed in this ecological region.

2015 Encounters by Ecological Region

Northern Long-eared Bat

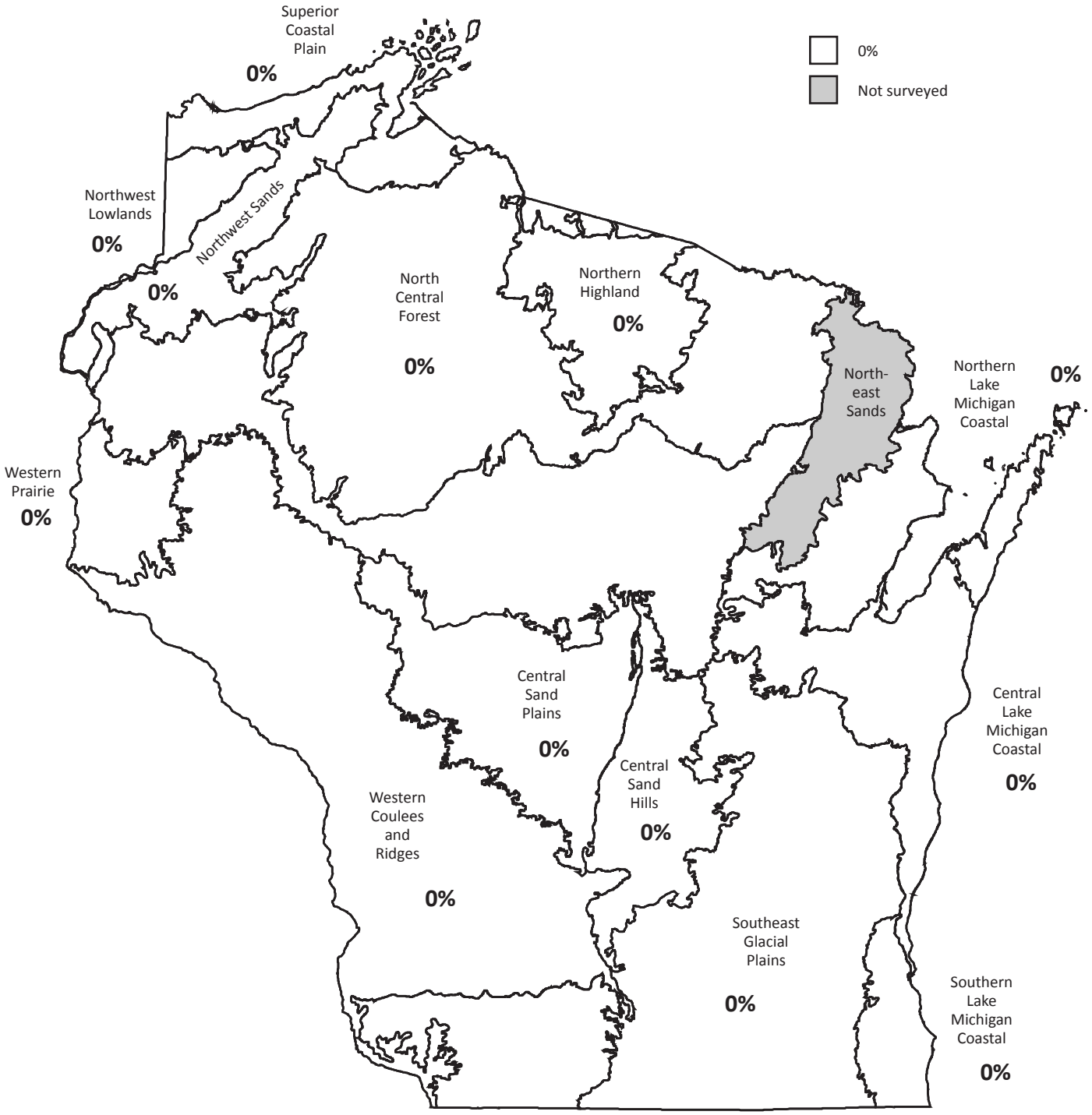
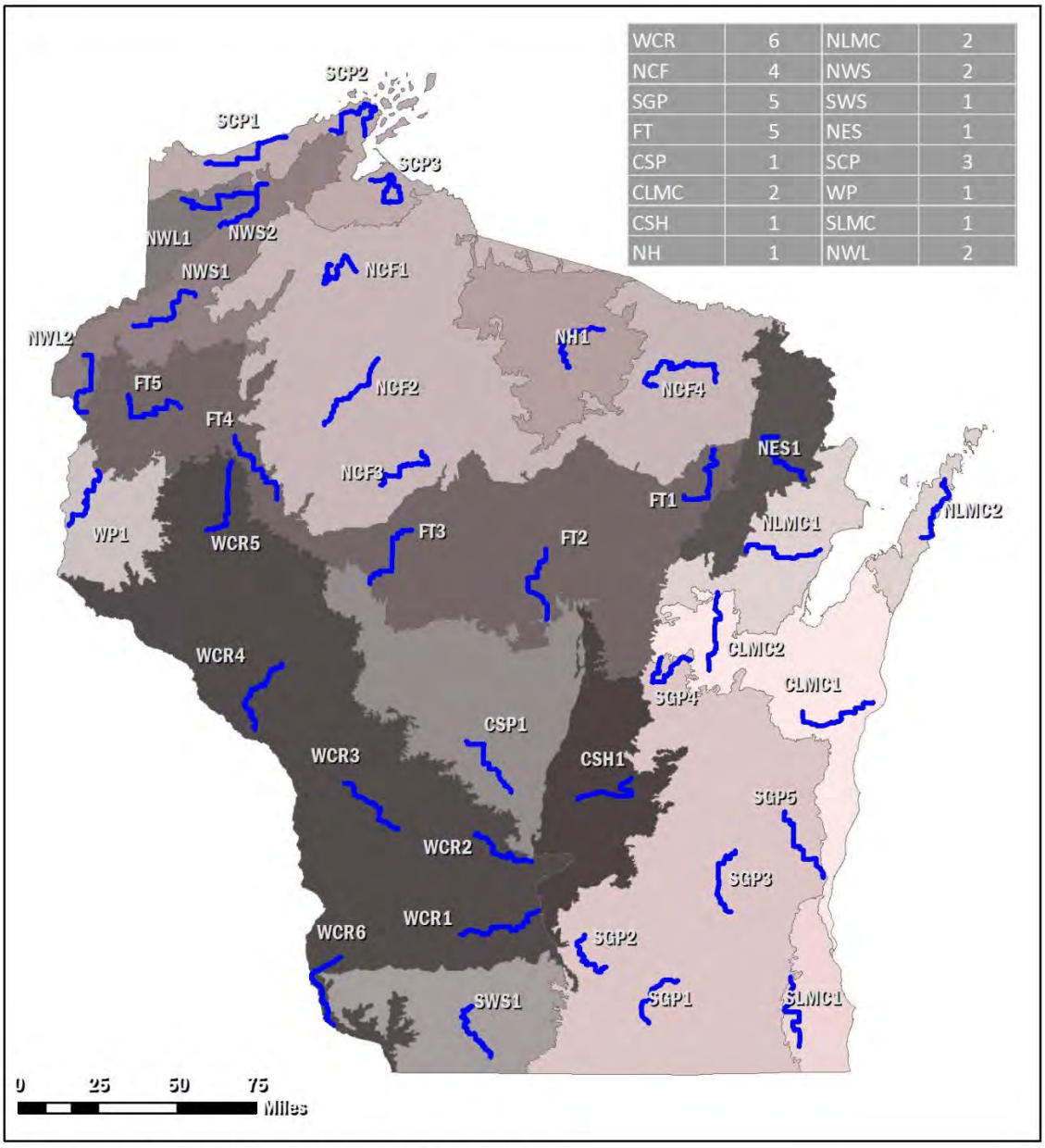


Figure 15. The northern long-eared bat was not observed during acoustic driving surveys in 2015.

Appendix 1 Acoustic Bat Driving Transects by Ecological Landscape



Ecological Landscapes: Central Lake Michigan Coastal (CLMC), Central Sand Hills (CSH), Central Sand Plains (CSP), Forest Transition (FT), North Central Forest (NCT), Northeast Sands (NS), Northern Highland (NH), Northern Lake Michigan Coastal (NLMC), Northwest Lowlands (NL), Northwest Sands (NS), Southeast Glacial Plains (SGP), Southern Lake Michigan Coastal (SLMC), Southwest Savanna (SWS), Superior Coastal Plain (SCP), Western Coulees and Ridges (WCR) and Western Prairie (WP).