WISCONSIN BAT PROGRAM- Driving Acoustic Bat Survey Report 2014

Wisconsin Department of Natural Resources
Bureau of Natural Heritage Conservation
101 South Webster Street
Madison, WI 53703

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 38 volunteers.
- In consecutive years, Central Sand Hills region had the highest average bat calls per detector hour (2013: 81.2, 2014: 75.4) and the Southern Lake Michigan Coastal region had the lowest average bat calls per detector hour (2013: 12.8, 2014: 10.4).
- Big brown bats were the only species to experience a decline (-13.23%) in mean encounters frequency across all ecological regions from 2013 to 2014.
- With white-nose syndrome detected for the first time in Wisconsin in March 2014, perpetual records in the form of acoustic recordings on a statewide scale are not only invaluable permanent observations but they will eventually help define WNS-affected areas while revealing conservation priority areas.

Introduction

In 2013, the Wisconsin Bat Program expanded its offering of bat surveying opportunities by adding 38 predetermined driving bat surveys (transects). The 2014 survey season marks the second year of operation for the driving bat surveys. This report summarizes the methods and results from the driving survey transects that were conducted in Wisconsin in 2014 and also compares this year's data to those of 2013.

Methods

In order to better understand statewide changes in bat populations, emphasis was placed on repeating the 38 driving transects which were developed in 2013 by WDNR in each of the 16 ecological landscapes. In coordination with national bat monitoring efforts, the following protocols were adopted to ensure standardization and quality controlled 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 compact flash card.

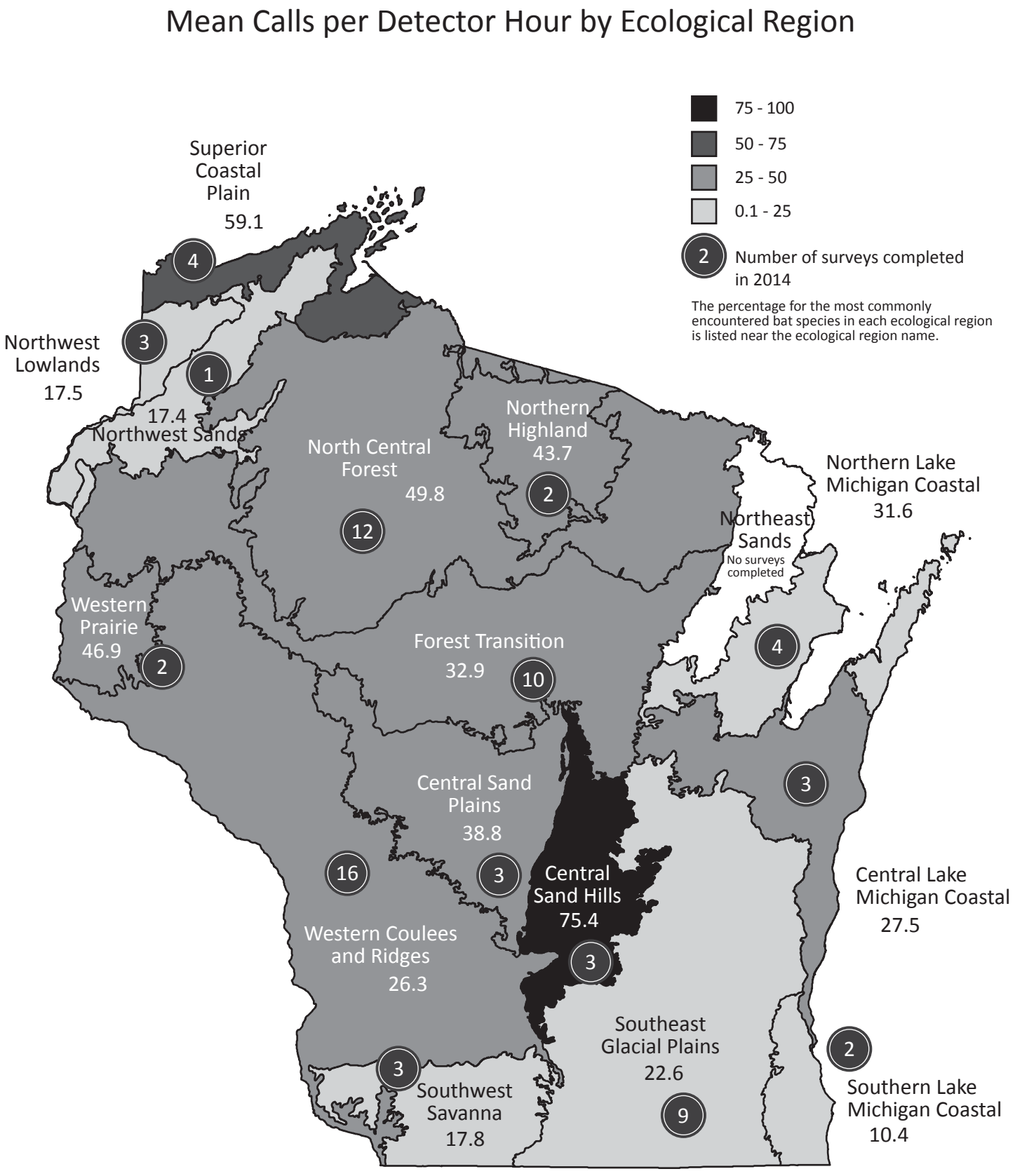


Figure 1. For the second year in a row, the highest mean bat calls per detector hour was the Central Sand Hills at 75.4 calls/detector/hour.

Surveyed routes in 2014 were driven one to four 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 is 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 (*Myotis 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 staff from Wisconsin Department of Natural Resources, Bad River Department of Natural Resource (Tribal), U.S. Forest Service and 38 volunteers. Of those surveys, 77 returned complete acoustic results, down from 92 (-16%) in 2013. Of the 38 routes, 31.41 miles was the mean driving length, with the greatest distance being 47.40 miles (NCF4) and the shortest distance being 19.75 miles (SLMC1). There was at least one route 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 32 of the 38 routes. Technical issues ranged from loss of GPS data to surveyor error when setting the record options. 18,194 files were recorded on 77 surveys, 4,861 files (26.7%) were identified as bat encounters. Surveys had a mean of 34.6 bat calls per detector-hour down slightly from 35.1 in 2013, with a minimum of 6.3 (SGP3 on 22 June) and a maximum of 126.8 (CSH1 on 13 July). In consecutive years, Central Sand Hills region had the highest average bat calls per detector hour (2013: 81.2, 2014: 75.4) and the Southern Lake Michigan Coastal region had the lowest average bat calls per detector hour (2013: 12.8, 2014: 10.4) (Figure 1). The

number of call files per completed survey had a mean of 63.1 and ranged from 15 (SLMC1 on 27 June) to 211 (SCP3 on 6 July). The number of bat calls per survey trended upward from the beginning of the survey window in early June, until dipping slightly upon the completion of surveys in mid-July (Figure 2). Nearly a third of completed surveys (31.2%) had between 26-50 bat encounters detected, while 23.7% of completed surveys had between 51-75 bat encounters detected (Figure 3) (Table 1).

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, which both remain at very low detection rates (Figure 5). A comparison of mean calls per detector hour over time from 2013 and 2014 driving transect data yielded a similar trend of increased abundance (Figure 4).

Only big brown bat experienced decline (-13.23%) in mean encounters frequency across all ecological regions from 2013 to 2014, while the remaining species experienced negligible change (eastern pipistrelle, northern long-eared and silver haired bat) or an increase in frequency (little brown, hoary and eastern red bat) (Figure 6).

Of the 4,861 encounters, 2,737 (56.3%) were classified into species groups: high frequency group (1092), low frequency group (671), big brown/silver-haired (638), eastern red/eastern pipistrelle (61) and little brown/northern long-eared (275) because the bat passes have similar characteristics to two or more species. The remaining 2,124 (43.7%) files were classified as little brown (41.9%), big brown (30.0%), eastern red (23.1%), hoary (15.5%), silver-haired (3.8%), eastern pipistrelle (0.2%) and the northern long-eared bat (0.1%). In contrast to this year's data, big brown bats were the most frequent species encountered in 2013. Among the 16 ecological regions, the little brown bat was the most commonly encountered in 8 of the 16 ecological regions, followed by the eastern red bat (n=4), hoary bat (n=2) and the big brown bat (n=1) (Figure 7) (Table 2).

Figure 2. Total number of surveys by week and average number of bat calls per survey by week, 2014. Partial surveys (*n*=6) excluded.

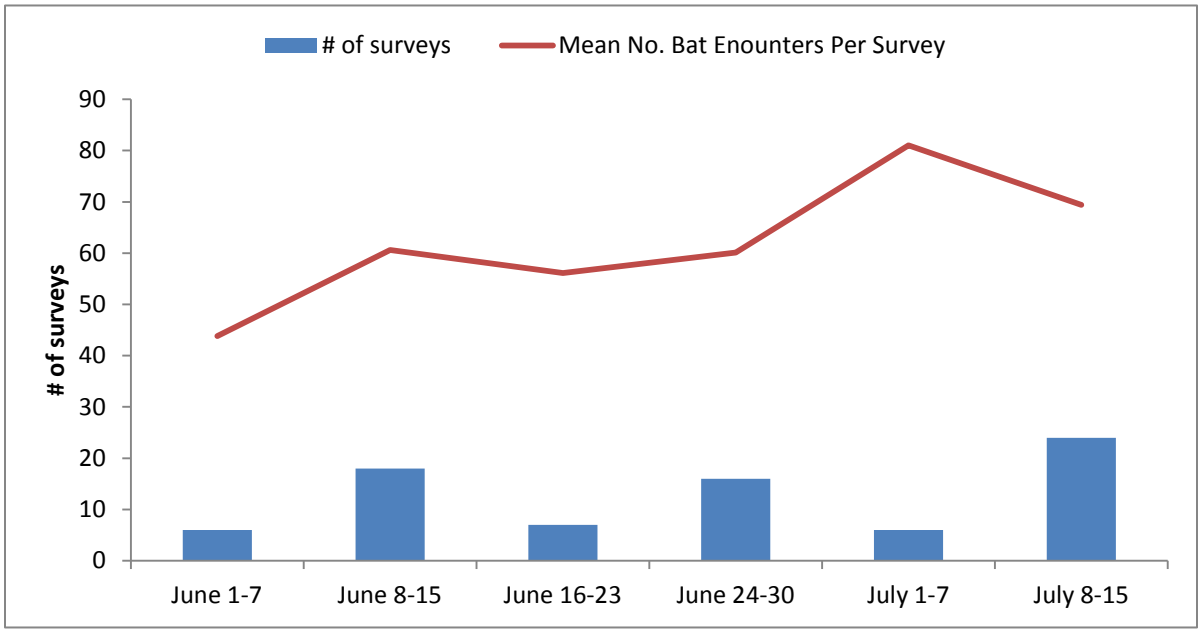


Figure 3. A comparison of the number of bat calls detected in 2013 and 2014.

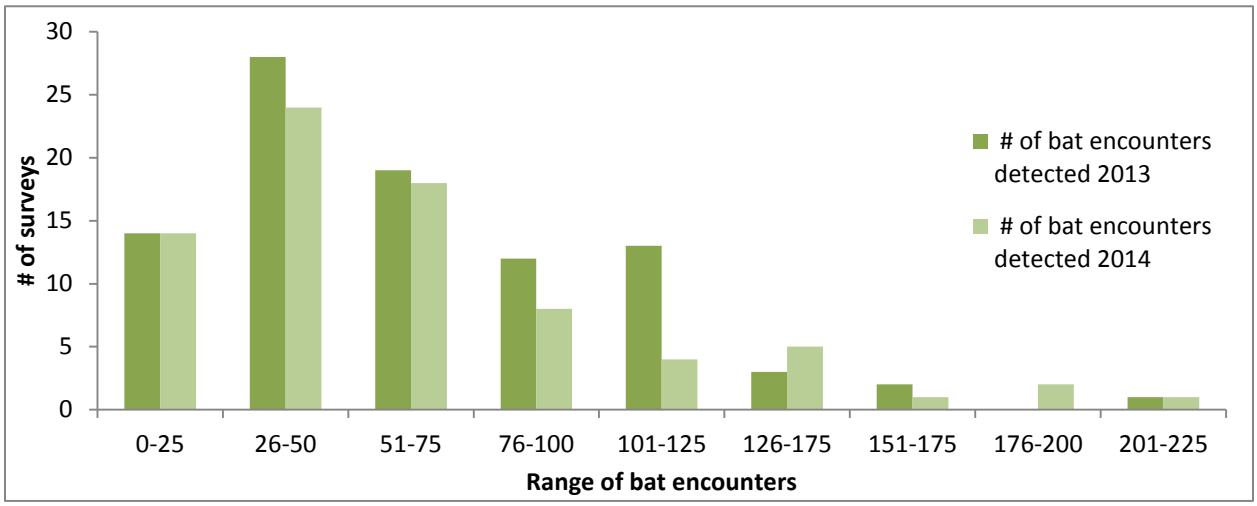


Figure 4. Comparison of mean calls per detector hours over time from 2013 and 2014 driving transect data.

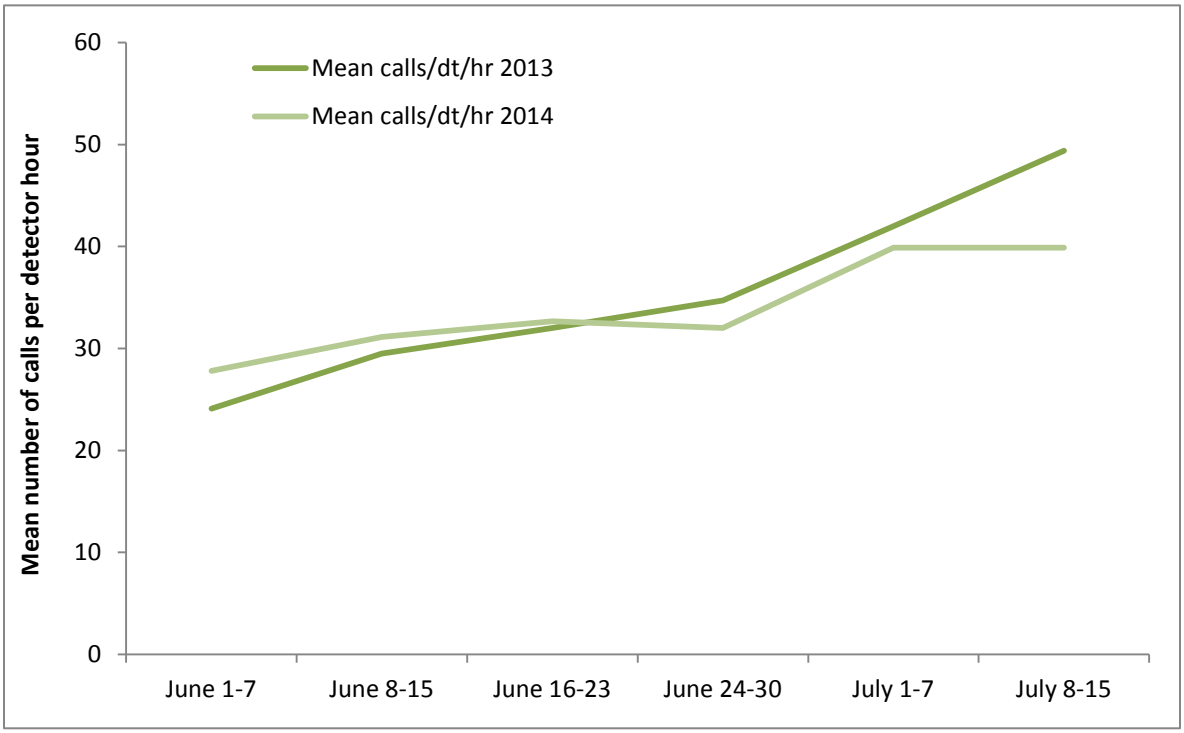


Figure 5. Change in bat species abundance over three acoustic driving transect periods (2014).

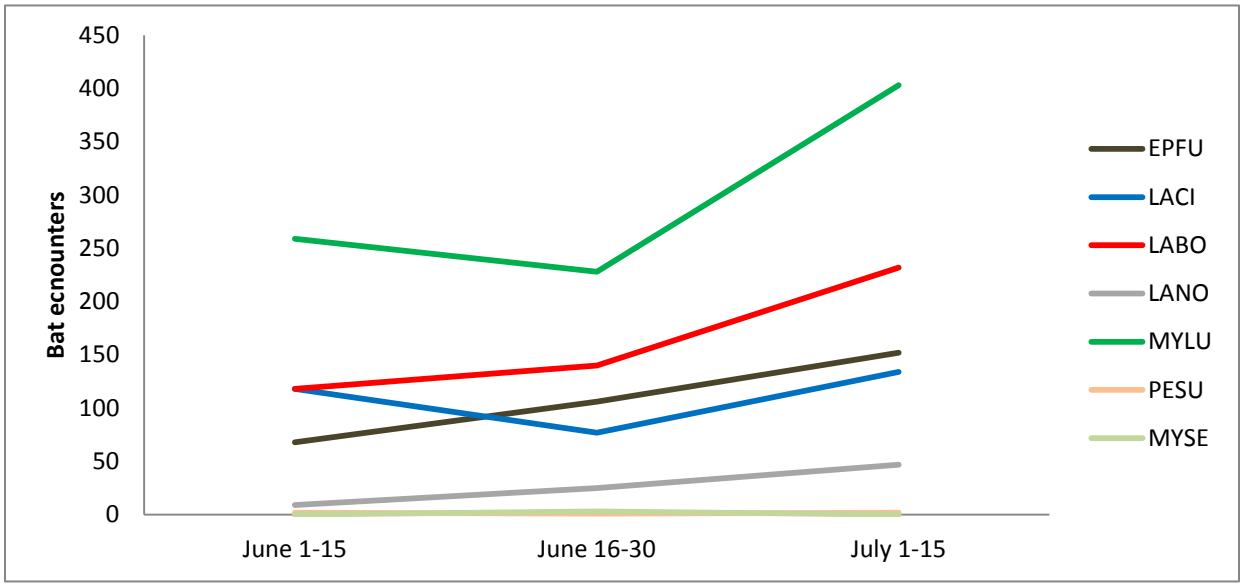
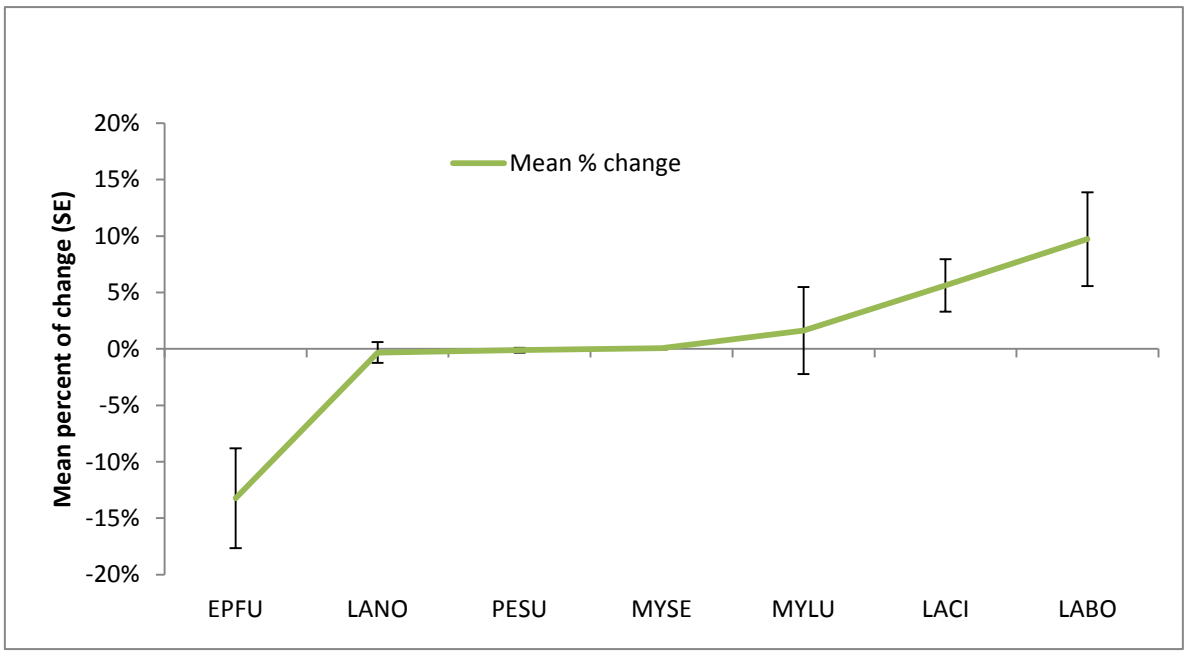


Figure 6. Mean change in frequency of species across all ecological regions from 2013 to 2014.



Discussion

Surveyors drove over 2,400 miles throughout Wisconsin while surveying acoustic bat transects. Species encounter rates varied by ecological region with the highest mean encounter rate of little browns (16.6 MYLU/detector/hr) in the Central Sand Hills. The most commonly encountered species on driving transects when combing ecological regions were little brown (6.1/detector/hr), eastern red (3.0/detector/hr), big brown (2.6/detector/hr) and hoary bats (2.3/detector/hr). The percentage of encounters per species also varied by ecological region as seen in figures 8-14.

The silver-haired bats' encounter rate was higher (1.0/detector/hr; SD 1.14) north of the tension zone, while below it was noticeably less (0.2/detector/hr; SD 0.55). The tension zone stretches across Wisconsin from northwest to southeast in an S-shape; it often forms the boundary of many species' ranges, both plants and animal (Curtis 1959). It has long been suggested that silver-haired bats are not as common south of the tension zone in summer because of the northern habitat preferences of the species. This data is indicative of that suggestion (WDNR unpublished data).

Similar to 2013, the northern long-eared bat and eastern pipistrelle remained virtually undetected by acoustic driving transects in Wisconsin, which could be a result of poor-quality echolocation calls, low intensity of calls of the species and habitat surveyed. The detection frequency is misleading as other data sources (capture data, historical records) indicate these species' ranges are much greater than acoustic driving transects would imply. Additional acoustic sampling using passive (unmanned) and mobile (water and walking surveys methods) are needed to adequately determine the summer range of the northern long-eared and eastern pipistrelle.

When considering management and conservation measure for bat species, it is critical to recognize the spatial distribution. Acoustic bat driving transects allow the Wisconsin Bat Program (WBP) to collect data on all bat species known to occur in Wisconsin over broad geographic areas, this is adding to our knowledge base of species range and distribution. With white-nose syndrome detected for the first time in Wisconsin in March 2014, perpetual records in the form of acoustic recordings on a statewide scale are not only invaluable permanent observations but they will eventually help define WNS-affected areas while revealing conservation priority areas.

Acknowledgements

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Literature cited

Curtis, John T. The Vegetation of Wisconsin: An Ordination of Plant Communities. Madison: University of Wisconsin Press, 1959.

Jackson H. Mammals of Wisconsin. 1961. The University of Wisconsin Press. Madison, WI.

Kurta, Allen. 1995. Mammals of the great lakes region. University of Michigan Press, Ann Arbor, MI.

Wisconsin Department of Natural Resources WNS Surveillance and Response Implementation Strategy 2011.

Table 1 Driving acoustic bat surveys (n=77) conducted in Wisconsin, June-July 2014. 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
CLMC 1	3	89.20	269	4.48	1.49	19.91	122	20.44
CSH 1	3	88.09	335	5.58	1.86	16.77	379	75.42
CSP1	3	83.10	272	4.53	1.51	18.14	176	38.75
FT1	3	91.81	303	5.05	1.68	18.19	327	28.86
FT2	1	37.67	135	2.25	2.25	16.74	20	8.89
FT3	3	94.03	294	4.9	1.63	19.2	118	24.23
FT4	3	104.88	331	5.51	1.84	19.05	95	17.09
NCF 1	3	95.25	436	7.26	2.42	13.25	422	57.28
NCF 2	3	101.71	299	4.98	1.66	20.61	201	41.41
NCF 3	3	90.87	401	6.68	2.23	13.62	383	56.86
NCF 4	3	141.44	441	7.35	2.45	19.25	320	43.68
NH1	2	50.7	127	2.12	1.06	28.57	87	43.71
NLMC2	4	119.23	368	6.13	1.53	19.48	197	24.7
NWL2	3	85.69	285	4.75	1.58	18.04	83	12.27
NWS 2	1	29.55	131	2.18	2.18	13.53	38	10.99
SCP 2	2	71.7	264	4.4	2.2	16.34	246	246
SCP 3	2	66.72	270	4.5	2.25	14.87	291	291
SGP 1	3	86.15	288	4.8	1.6	18.28	155	26.65
SGP 2	3	74.01	248	4.13	1.38	17.91	101	18.92
SGP 3	1	33.27	144	2.4	2.4	13.86	15	5.42
SGP 5	2	67.66	218	3.63	1.82	18.62	48	10.99
SLMC1	2	52.31	223	3.71	1.86	13.9	39	10.39
SWS 1	3	91.2	292	4.87	1.62	18.75	86	11.36
WCR 1	3	103.71	333	5.55	1.85	18.68	246	33.61
WCR 2	2	67.15	228	3.8	1.9	17.68	69	13.41
WCR 3	3	91.66	294	4.9	1.63	18.71	85	14.26
WCR4	3	90.48	310	5.17	1.72	17.54	153	21.15
WCR5	3	90.14	325	5.42	1.81	16.73	76	7.62
WCR 6	2	65.73	220	3.67	1.83	17.93	124	23.98
WP 1	2	60.93	202	3.36	1.68	18.11	159	46.91
Totals	**77**	**2416.04**	**8286**	**138.08**			**4861**	
Mean	**2.57**	**80.53**	**276.20**	**4.60**	**1.83**	**17.74**	**162.03**	**34.61**

Table 2 Mean number of encounters by species or species group per route during driving acoustic surveys in Wisconsin, June-July 2014. 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													
CLMC 1	3	0.33	3.33	6.67	0.00	2.33	0.00	0.00	0.67	0.67	9.33	8.67	**40.67**
Central Sand Hills													
CSH1	3	9.67	2.67	2.33	0.33	28.33	0.00	0.00	12.00	0.00	27.00	22.00	**126.33**
Central Sand Hills													
CSP1	3	6.67	1.00	4.33	0.00	8.33	0.00	0.00	2.33	0.00	13.67	8.5	**53.33**
Forest Transition													
FT 1	3.67	8.00	16.67	3.00	17.33	0.00	1.00	6.00	4.33	10.00	34.67	19.50	**109.00**
FT 2	1	0	0	2	0	1	0	0	1	2	5	4.50	**20.00**
FT3	3	2.00	1.00	5.00	0.00	7.33	0.00	0.00	1.00	0.67	6.67	7.83	**39.33**
FT4	3	2.67	2.00	2.67	0.67	5.00	0.00	0.00	1.67	0.33	3.33	6.67	**31.67**
North Central Forest													
NCF1	3	2.33	10.67	13.67	3.00	44.67	0.00	0.00	9.67	0.33	8.67	23.83	**140.67**
NCF2	3	1.67	5.33	8.33	1.00	7.00	0.00	0.00	4.33	0.67	10.67	14.00	**67.00**
NCF3	3	9.00	8.00	23.00	1.33	20.67	0.00	0.00	8.67	0.00	11.33	22.83	**127.67**
NCF4	3	6.00	7.00	14.33	0.67	37.67	0.00	0.00	8.33	0.00	7.67	12.50	**106.67**
Nothern Highland													
NH1	2	2.50	6.50	3.50	1.00	12.00	0.00	0.00	1.00	0.00	1.50	7.75	**43.50**
Northern Lake Michigan Coastal													
NLMC2	4	7.00	9.00	9.00	3.00	65.00	0.00	0.00	24.00	0.00	12.00	34.00	**49.25**
Nortwest Lowland													
NWL2	3	2.33	0.33	4.33	1.33	3.67	0.00	0.00	0.33	0.33	3.67	5.67	**26.67**
Northwest Sands													
NWS 2	1	0	4	8	2	5	0	0	0	0	5	7.00	**38.00**
Superior Coastal Plains													
SCP2	2	0.00	16.00	8.00	6.00	11.00	0.00	0.00	8.00	0.00	32.00	23.50	**123.00**
SCP3	2	3.00	26.50	15.50	10.00	20.00	0.00	0.00	1.00	0.50	22.50	23.25	**145.50**
Southeast Glacial Plains													
SGP1	3	6.67	1.67	0.00	0.00	7.33	0.00	0.00	4.00	0.67	11.67	9.83	**51.67**
SGP2	3	3.67	2.33	1.67	0.00	4.67	0.33	0.00	1.33	0.33	4.67	7.33	**33.67**
SGP3	1	0.00	0.00	2.00	0.00	0.00	0.00	0.00	1.00	0.00	3.00	4.50	**15.00**
SGP5	2	2.00	1.00	1.00	0.00	2.00	0.00	0.00	0.50	0.00	6.50	5.50	**24.00**
Southern Lake Michigan Coastal													
SLMC1	2	0.50	1.50	2.00	0.00	1.00	0.00	0.00	1.00	0.00	3.50	5	**13**
Southwest Sands													
SWS1	3	2.67	4.33	3.33	0.00	1.00	0.00	0.00	0.67	1.33	2.67	6.33	**28.67**
Wester Coulee and Ridge													
WCR1	3	7.67	4.33	7.67	0.00	17.33	1.00	0.00	4.67	2.33	3.33	16.83	**82.00**
WCR1	2	6.50	0.50	2.00	0.00	3.00	0.50	0.00	1.00	1.50	7.50	6.00	**34.50**
WCR3	3	2.67	0.33	2.00	0.00	2.67	0.00	0.00	1.00	0.00	4.67	7.50	**28.33**
WCR4	3	10.00	0.67	4.00	0.00	7.33	0.00	0.00	1.00	2.67	3.67	10.83	**51.00**
WCR5	3	1.33	5.00	5.67	0.00	0.67	0.00	0.00	0.67	0.33	4.33	3.67	**25.33**
WCR6	2	2.00	2.00	14.00	0.00	6.50	0.00	0.00	5.50	3.00	5.00	12.00	**62.00**
Western Prairie													
WP1	2	20.00	0.00	0.50	2.50	16.00	0.00	0.00	6.50	6.50	2.00	12.75	**79.50**

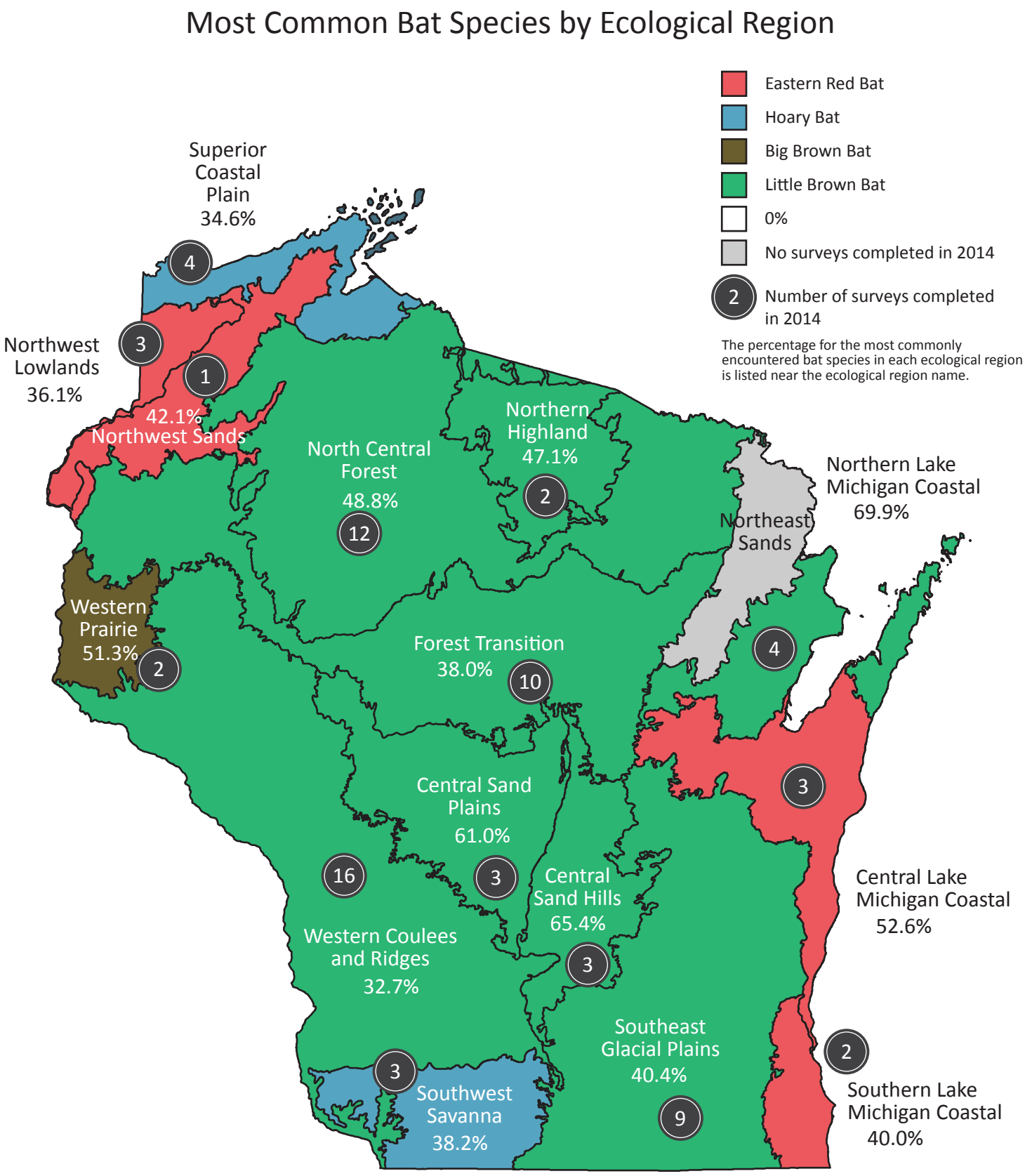

Figure 7. The most commonly encountered bat species by ecological region was the little brown bat (8), eastern red bat (4), hoary (2), and finally the big brown bat (1).

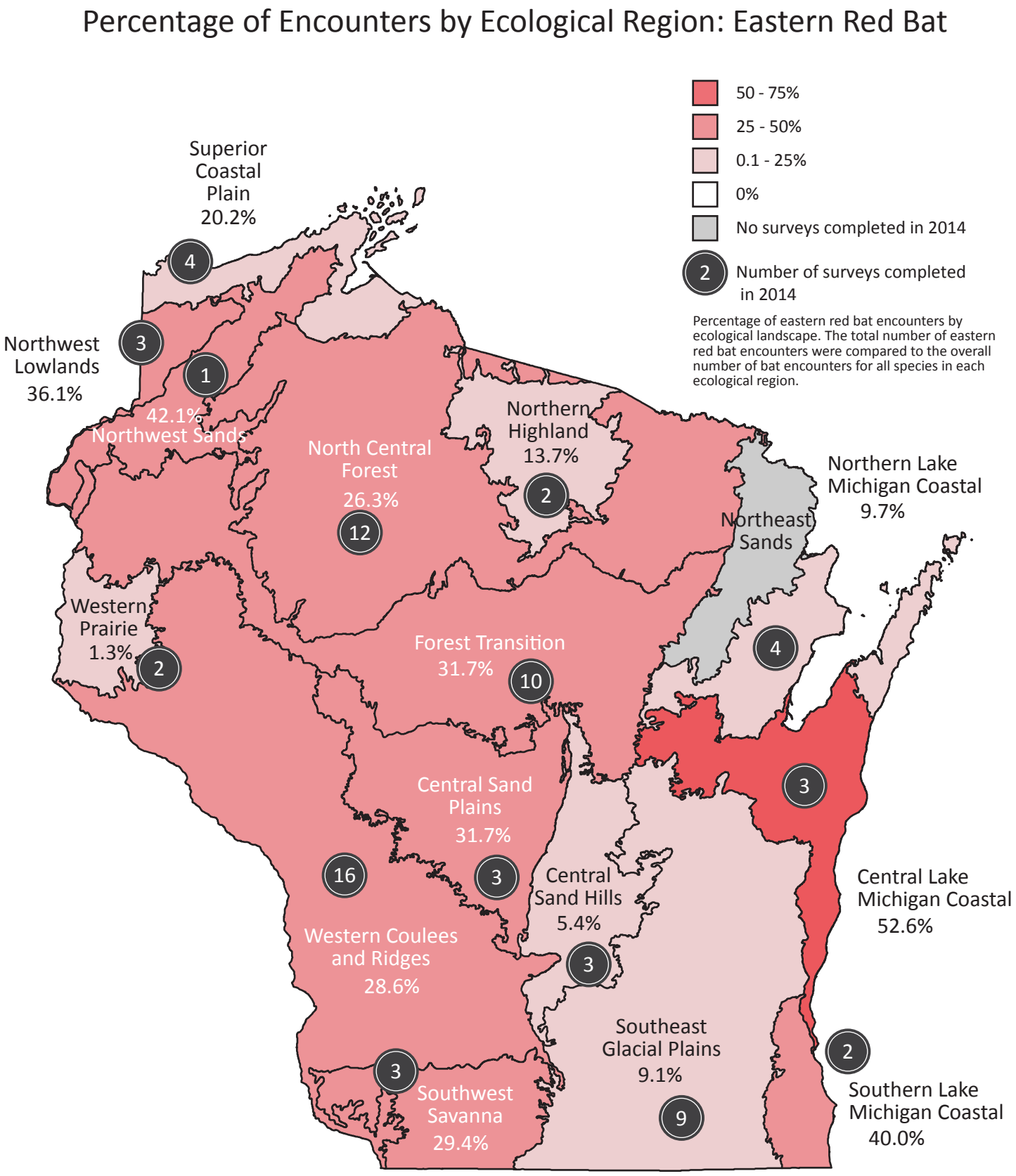

Figure 8. Eastern red bat encounters accounted for 52.6% of all encounters in the Central Lake Michigan ecological region.

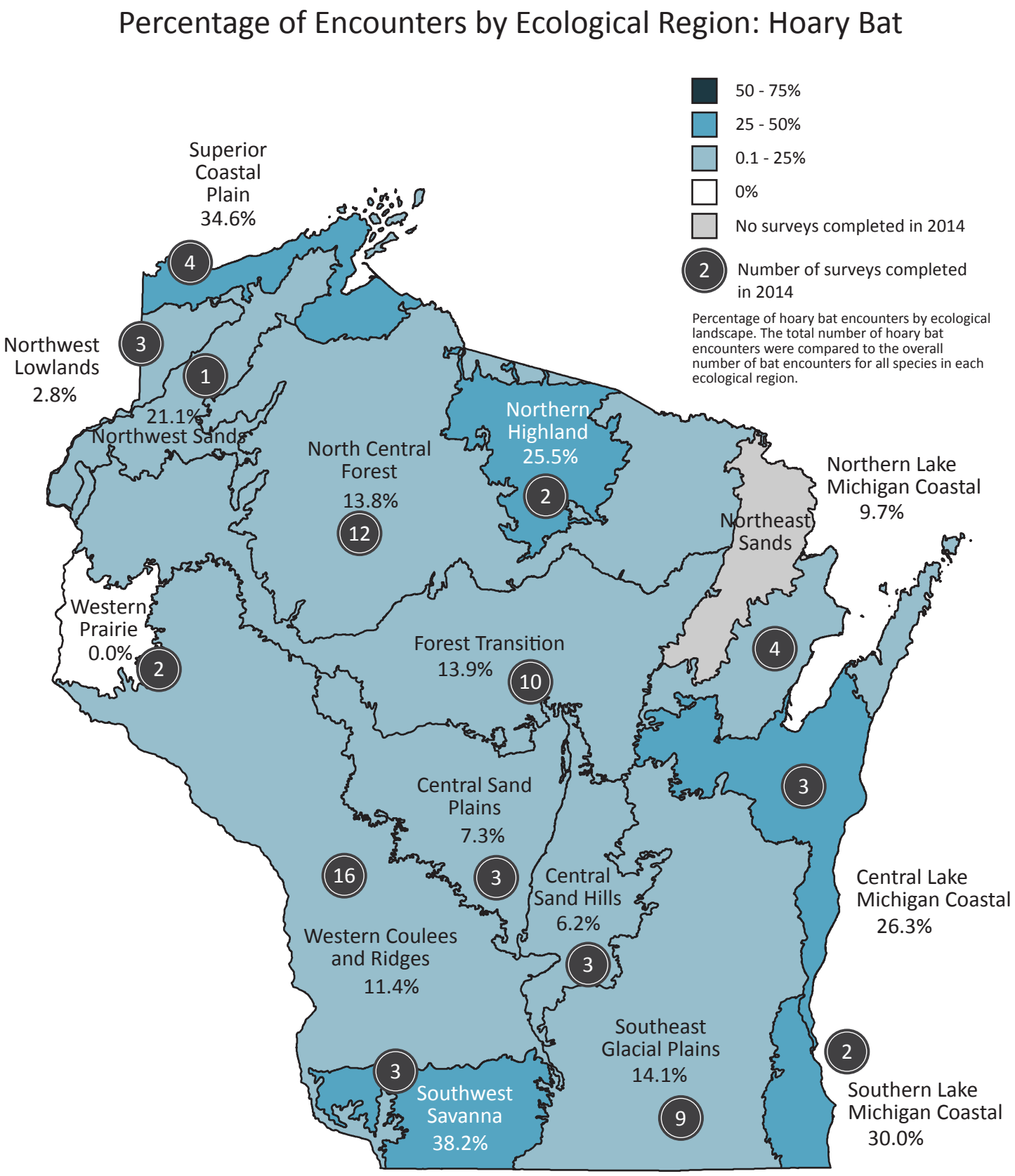

Figure 9. Hoary bat encounters accounted for 38.2% of all encounters in the Southwest Savanna region.

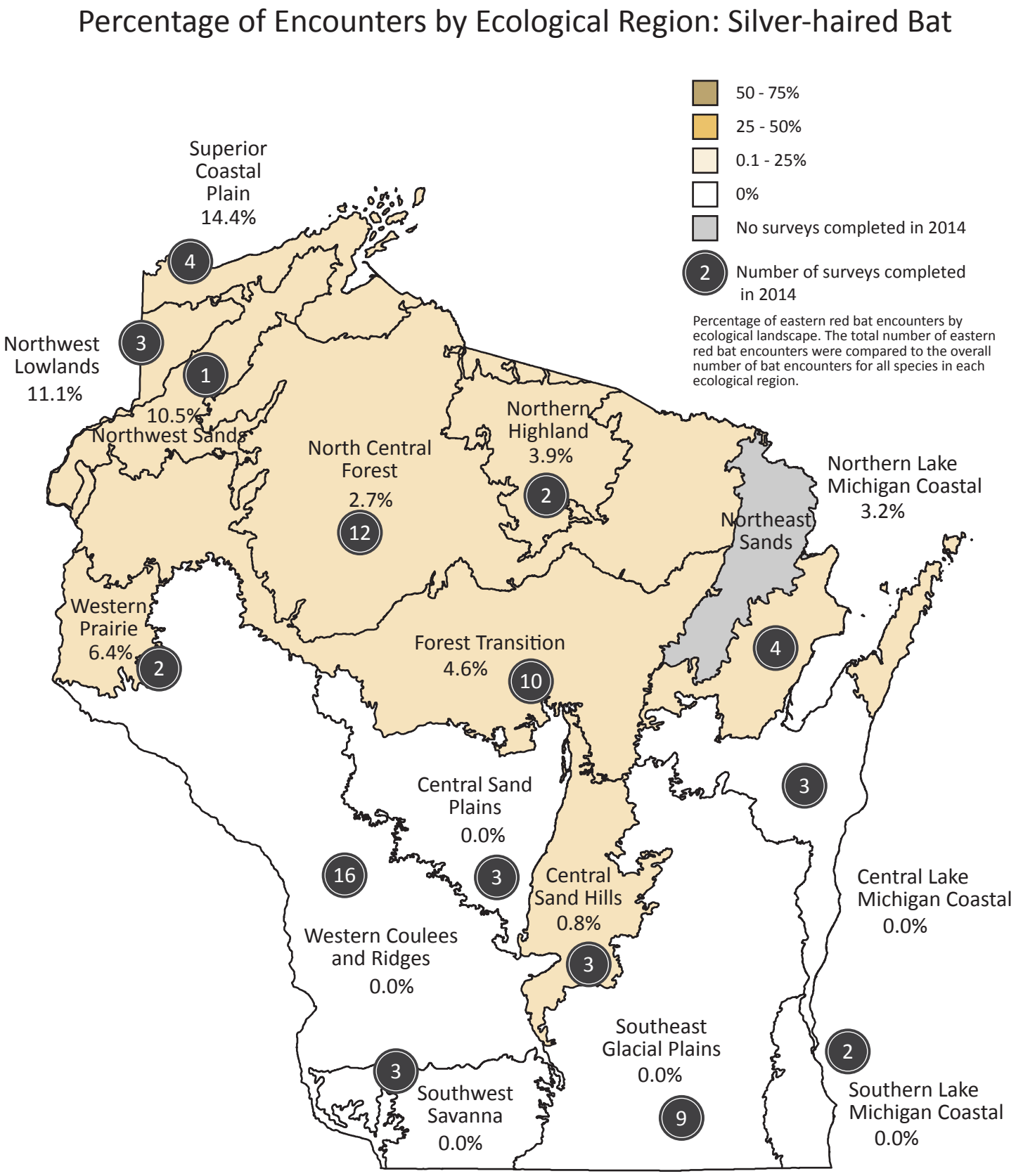

Figure 10. Eastern red bat encounters accounted for 14.4% of all encounters in the Superior Coastal Plain ecological region.

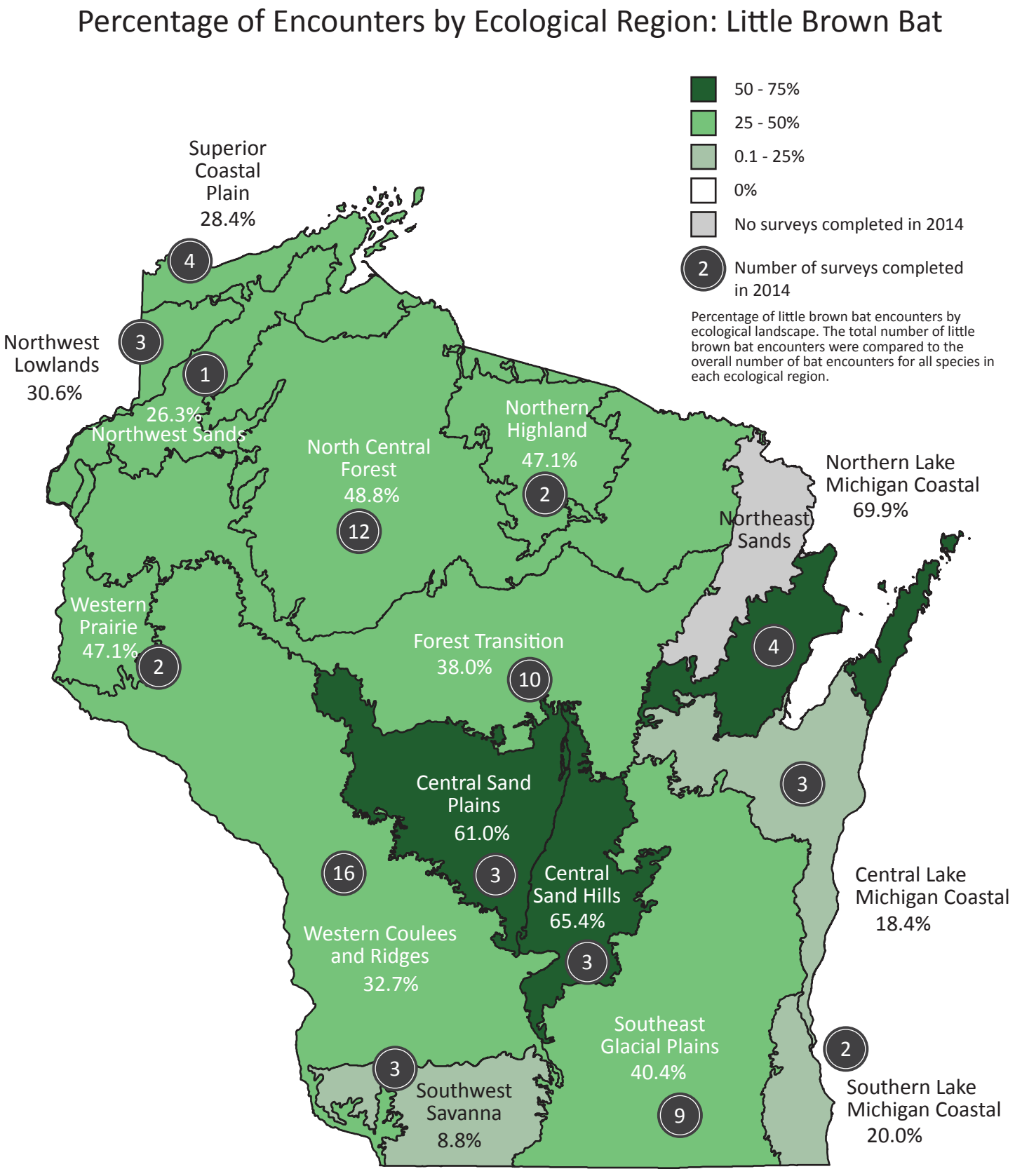

Figure 11. Little brown bat encounters accounted for 69.9% of all encounters in the Northern Lake Michigan Coastal region.

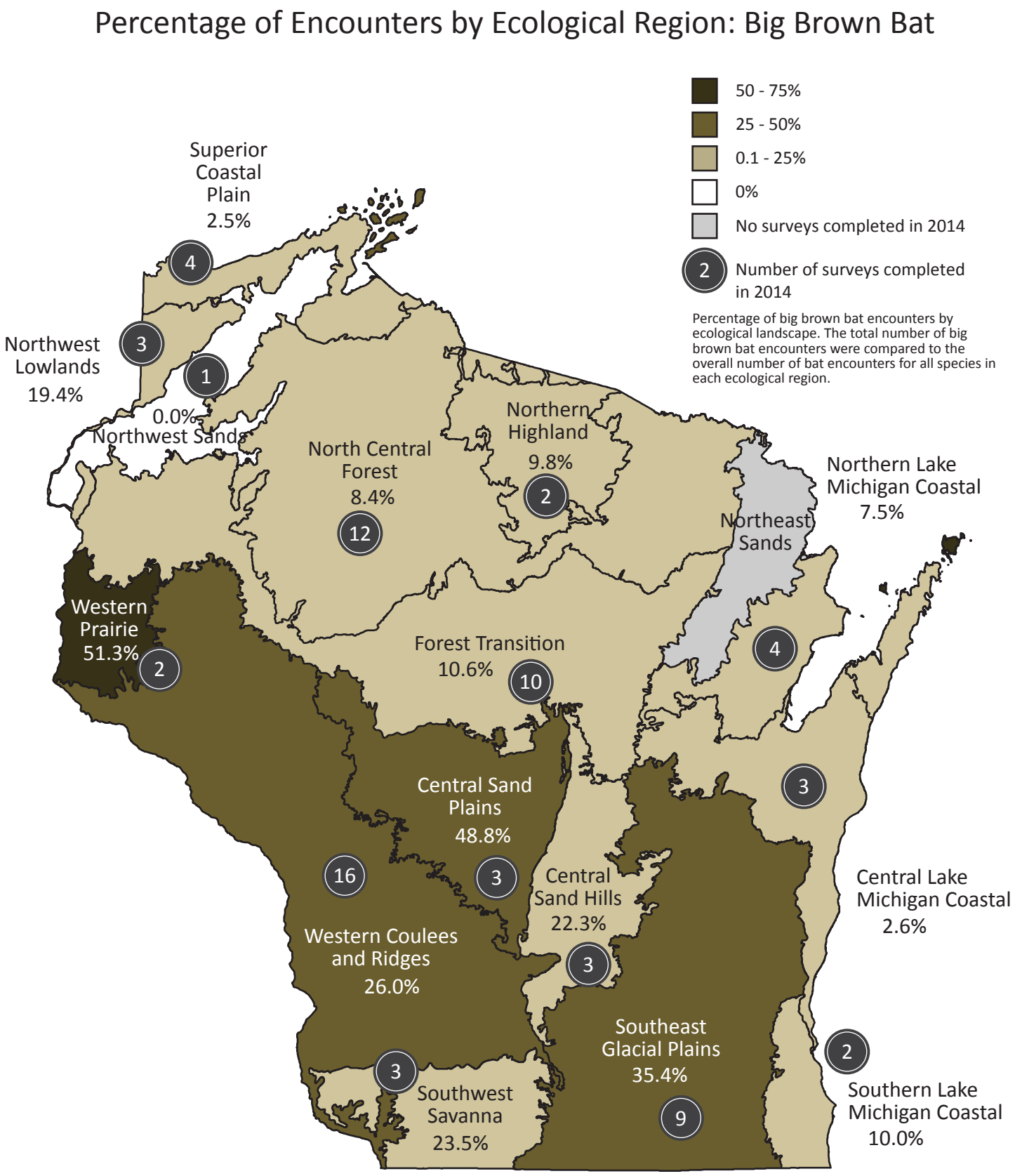

Figure 12. Big brown bat encounters accounted for 51.3% of all encounters in the Western Prairie region.

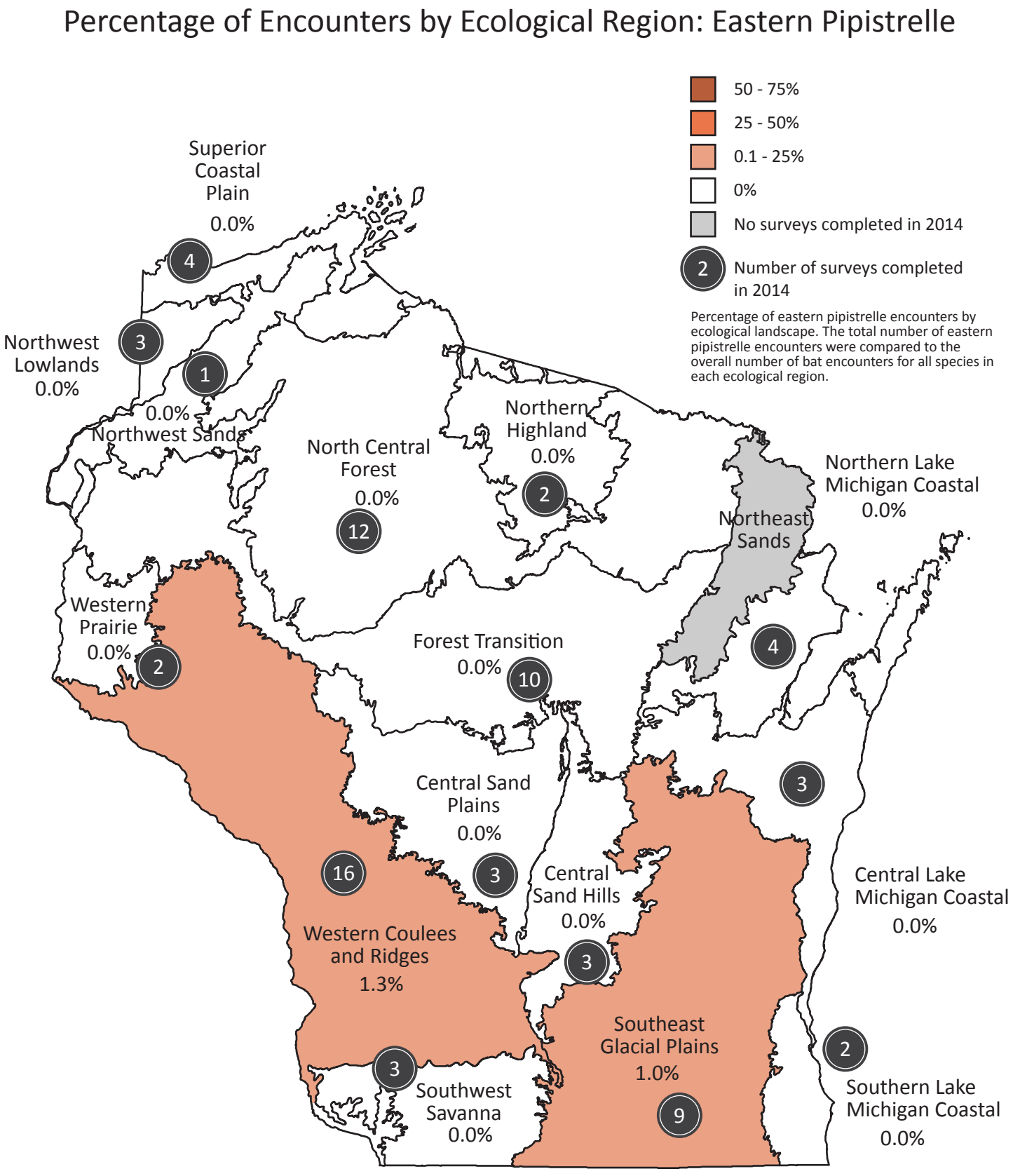

Figure 13. Eastern pipistrelle encounters accounted for 1.3% and 1.0% of all encounters in the Western Coulees and Ridges region and Southeast Glacial Plains regions, respectively. This species remained undetected in the remaining regions that were surveyed.

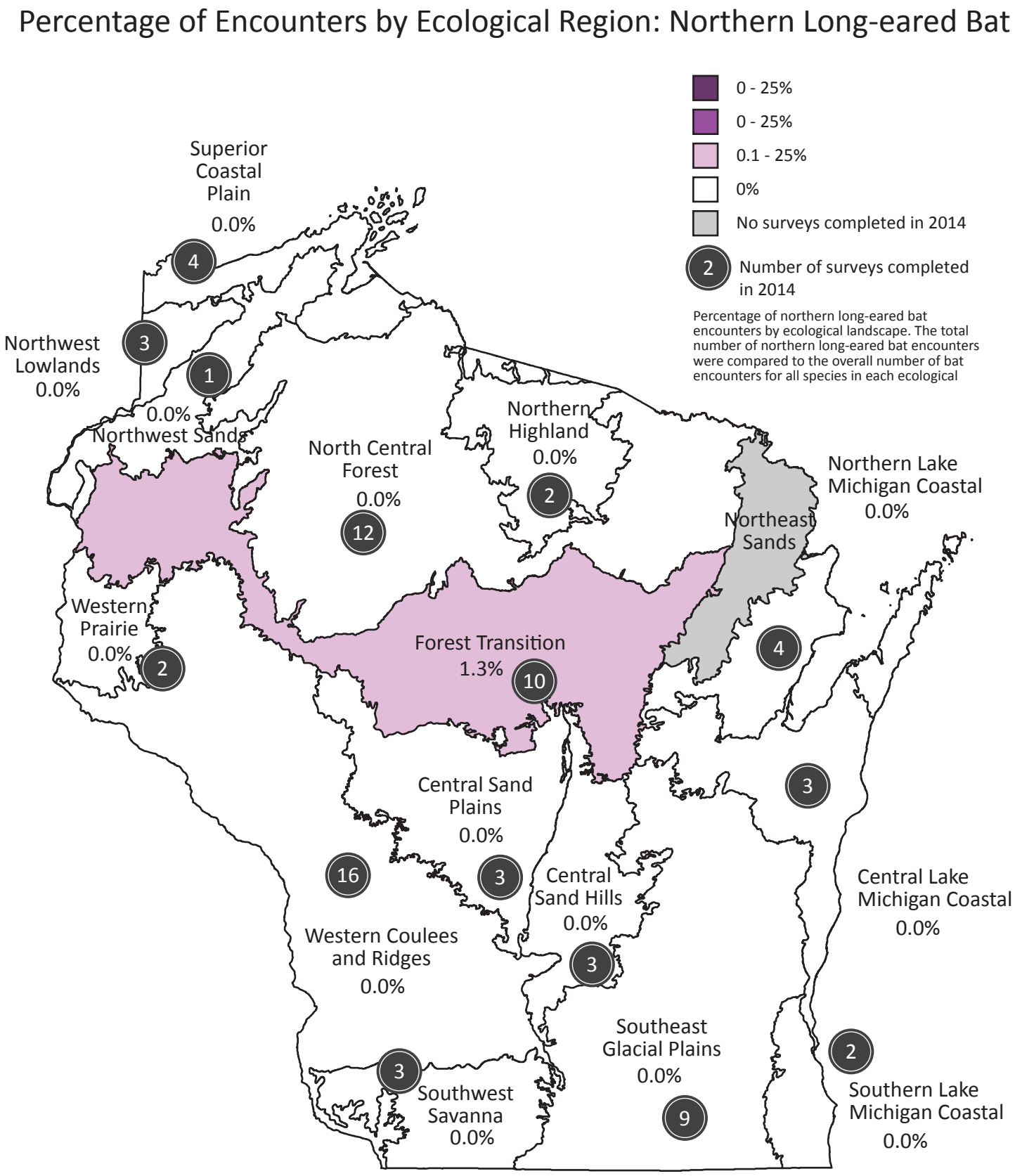

Figure 14. Northern long-eared bat encounters accounted for 1.3% of all encounters in the Forest Transition region, while it remained undetected in all other areas surveyed.