Bat Inventory in Sheboygan River Area of Concern

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The creation of ultrasound detectors have allowed biologists the ability to remotely monitor echolocating bats for the past several decades. Recorded sonograms of high enough quality can be identified to species or species group using a library of known echolocation calls. Since 2007, the Wisconsin Bat Program has used AnaBat SD acoustic detectors (Titley Scientific Inc. Columbia, MO) to survey for bats across the state. Though information such as morphology, sex and health are not obtained during acoustic surveys, recorded sonograms are stamped with a GPS location giving a permanent record of species presence. As well, acoustic surveys are less time consuming and cheaper than actively capturing bats.

In June 2016, the Wisconsin Bat Program (WBP) conducted two surveys on the Sheboygan River encompassing roughly 16.5 km of the Sheboygan Area of Concern (AOC). As well, two surveys in 2011, and one survey in 2010 were completed along the Sheboygan River and included in this inventory. Surveys began at civil twilight (~30 minutes after sunset), and ran on a predetermined route. Acoustic detectors were either held by one person in a two-person watercraft, or attached to the bow of a one-person craft. Detectors were set to "monitor" mode, and all ultrasonic activity was recorded. Sonograms were analyzed to determine species in the office after surveys were completed.

Six species of bat were recorded on the Sheboygan River over three years of surveys. The only Wisconsin bat resident not recorded was the northern long-eared bat. The somewhat surprising encounter of the eastern pipistrelle represents the furthest northeast summer acoustic record for this species in the state, roughly 35 miles northeast of the closest acoustic record. Mean bat passes per detector hour increased from 19.7 bat passes in 2010/2011 to 24.9 bat passes in 2016. Among surveys during all years, big brown bats were the most common at 56.2% of bat passes identified to species, followed by little brown bats at 23.4% and hoary bats and eastern red bats at 9.5%. In the 2016 surveys, the big brown bat was the most common species encountered (82.7%), followed by little brown bats at 7.4% of identifiable bat passes. In contrast, the most common species during the 2011 and 2010 surveys was the little brown bat (46.4%) followed by eastern red bat (21.4%). The proportion of hoary bats encountered decreased from 14.3% in 2010/2011 to 6.2% in 2016. Eastern pipistrelle and silver-haired bat encounters both increased from 0% in 2011/2010 to 1.2% in 2016.

The dramatic decrease in little brown bat encounters from 2010/2011 to 2016 is not fully understood; however, white-nose syndrome (WNS- the bat fungal disease responsible for declines in hibernating bat species in North America) has been present in Wisconsin since 2014. One large, infected hibernaculum within 50 miles of the Sheboygan River Area of Concern is thought to serve the majority of the region's summer little brown bat populations, likely causing observed declines. The reason for the increase in big brown bat encounters is unknown. It is possible a maternity colony moved into the area in the past several years, creating an increase in big brown bats on the river; however, it should be noted that each encounter does not translate to one individual since we cannot control for the fact that it may be one individual recorded several times. Differences in bat encounters (both diversity of species and number

of encounters) may also be due to surveys being conducted at different time periods throughout the summer as well as differences in weather conditions during surveys. Bats travel different distances depending on whether they are pregnant, caring for a pup, or teaching their pup to forage, which may play a role in abundance of bats in a particular area. Though surprising, the eastern pipistrelle encounter is not completely unexpected because very small populations of this species hibernate in newly excavated caves within 40 miles, likely translating to small summer populations in the region.

Table 1. Selected metrics from Sheboygan AOC acoustic bat surveys which illustrate a comparison between data collected in 2010/2011 to data collected in 2016. Also shown are the totals when all AOC data are combined.

Comparison	*2010/2011 Surveys (n=3) [Mean (Range) S.E.]*	*Total*	*2016 Surveys (n=2) [Mean (Range) S.E.]*	*Total*
Time spent surveying (hrs)	2.0 (1.4-2.8) 0.4	6.1	1.9 (1.4-2.5) 0.5	3.8
Surveyor effort	4.1 (2.9-5.9) 0.8	12.2	1.9 (1.4-2.5) 0.5	3.8
Miles surveyed	4.3 (3.0-5.3) 0.7	12.9	5.2 (3.0-7.4) 2.2	10.4
Total Bat Passes/Detector Hr	19.7 (12.6-31.9) 6.1	59.1	24.9 (8.7-41.2) 16.3	49.9
Species Diversity	4.0 (4.0-4.0) 0	4	4.5 (4.0-5.0) 0.5	5

	Total	*Mean (Range) S.E.*	*Total*
	Time spent surveying (hrs)	2.0 (1.4-2.8) 0.3	9.9
	Surveyor effort	3.2 (1.4-5.6) 0.7	16.0
	Miles surveyed	4.6 (3.0-7.4) 0.8	23.2
	Total Bat Passes/Detector Hr	21.8 (8.7-41.2) 6.3	109.0
	Species Diversity	4.2 (4.0-5.0) 0.2	5

It has been well-established that water quality affects riparian vegetation (Holmes & Newbold, 1984) which affects the emergent aquatic insects upon which bats feed (Williams & Feltmate, 1992). Riparian habitats are of great importance to bats because of foraging (Rydell et al., 1994; Walsh & Harris, 1996) and roosting opportunities. It is important to monitor bat activities in areas of concerns because declines in water quality may contribute to declines in bat populations due to limiting foraging opportunities. As insectivorous bats are top predators on riparian and/or emergent stream insects (Kalcounis-Ruppell, M.C., et al., 2007) it will be important to continue to monitor bat activity in concert with on-going mitigation efforts in the Sheboygan AOC. That said the losses recently sustained as well as projected population declines attributed to WNS may prove too great to fully understand the effects of mitigation efforts on the Sheboygan AOC bat population.

Bat survey data was collected by Ross Baker (2010), Richard Novy (2010), Owen Boyle (2011), Anne Reis (2011) and Heather Kaarakka (2016). Bat call analysis was completed by Heather Kaarakka. Funding was provided by state resources.

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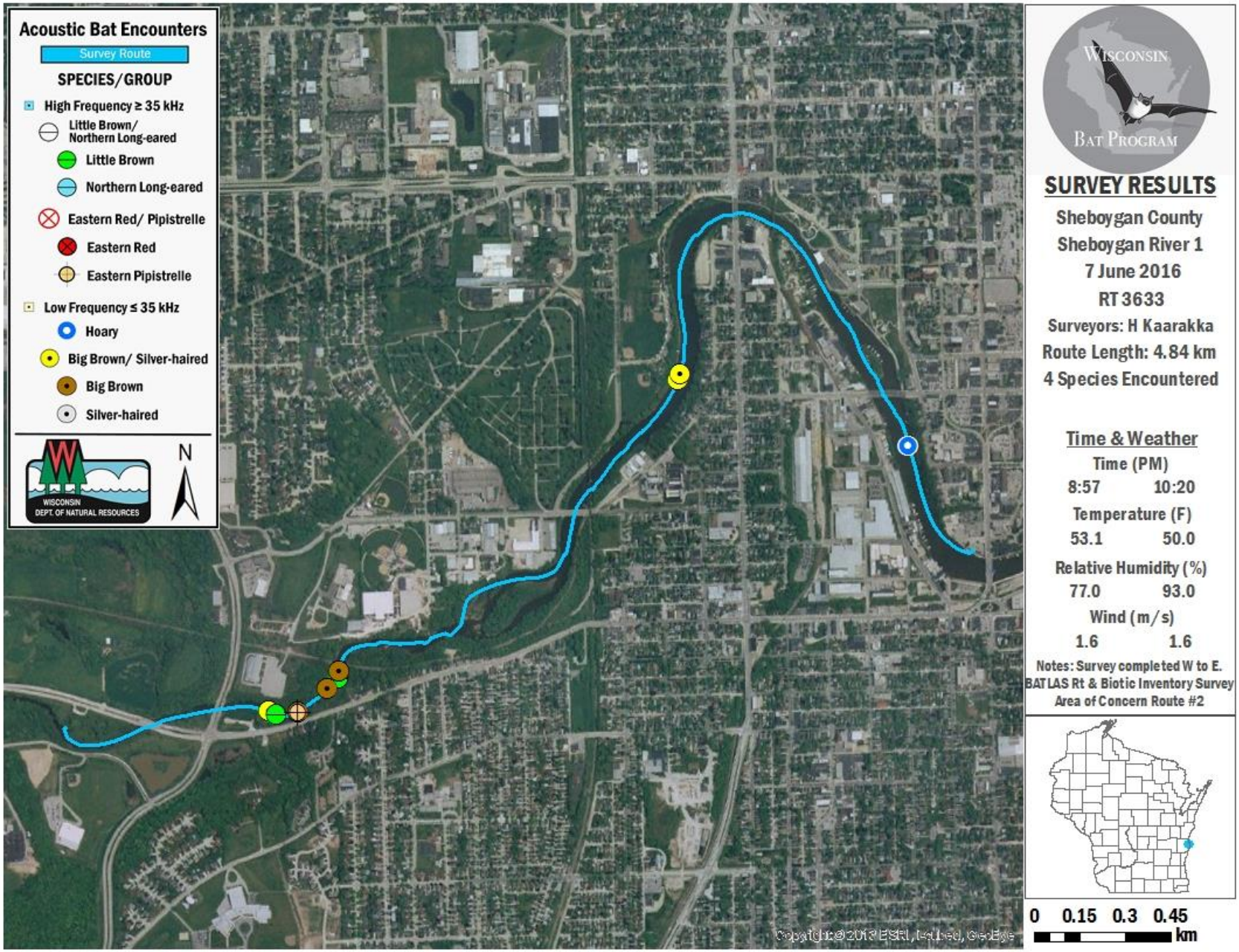
Acoustic Bat Encounters
Survey Route
SPECIES/GROUP
High Frequency ≥ 35 kHz
Little Brown/ Northern Long-eared
Little Brown
Northern Long-eared
Eastern Red/ Pipistrelle
Eastern Red
Eastern Pipistrelle
Low Frequency ≤ 35 kHz
Hoary
Big Brown/ Silver-haired
Big Brown
Silver-haired
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N
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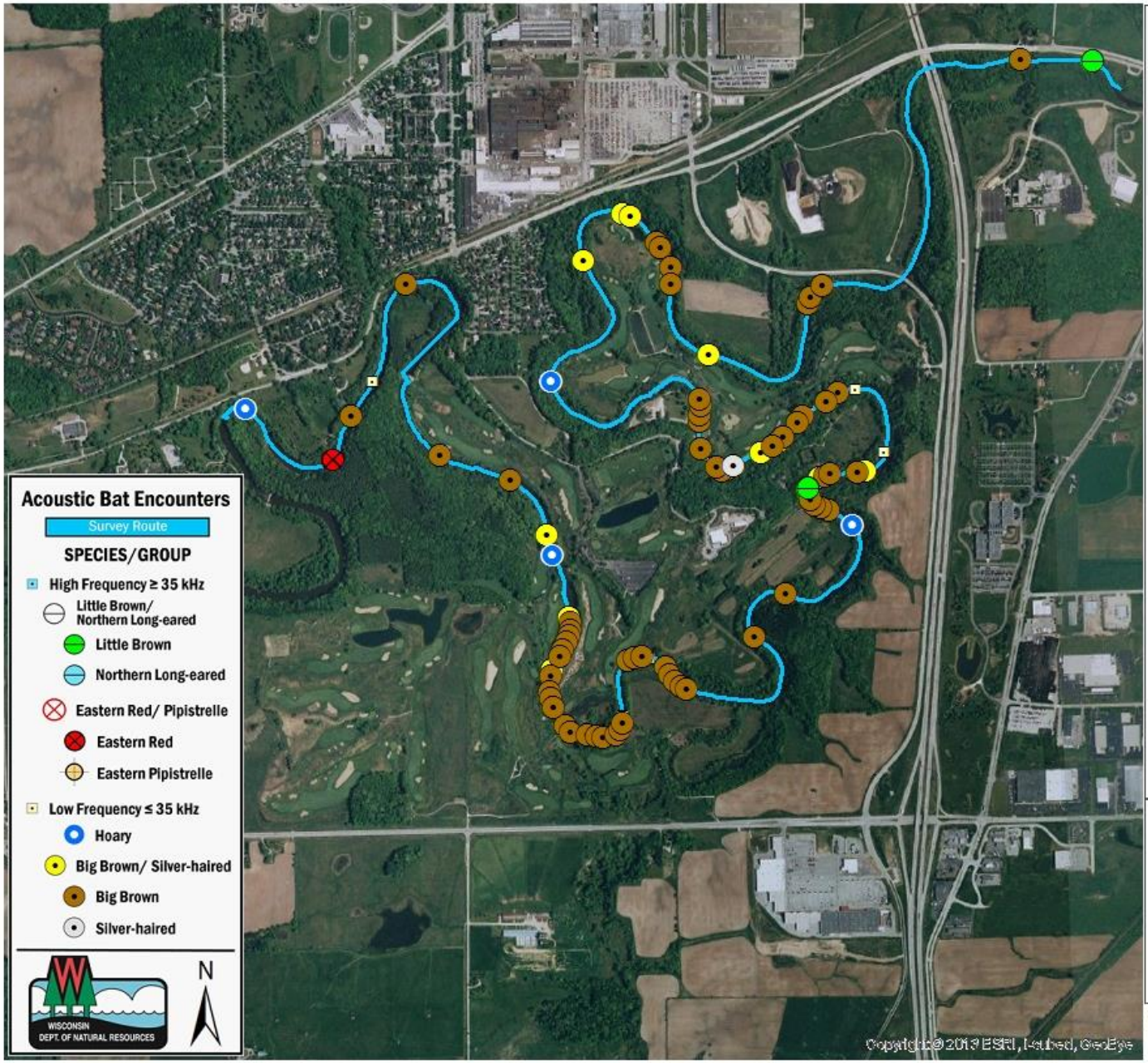
WISCONSIN BAT PROGRAM
SURVEY RESULTS
Sheboygan County
Sheboygan River 1
7 June 2016
RT 3633
Surveyors: H Kaarakka
Route Length: 4.84 km
4 Species Encountered
Time & Weather
Time (PM)
8:57 10:20
Temperature (F)
53.1 50.0
Relative Humidity (%)
77.0 93.0
Wind (m/s)
1.6 1.6
Notes: Survey completed W to E.
BATLAS Rt & Biotic Inventory Survey
Area of Concern Route #2
0 0.15 0.3 0.45
km



WISCONSIN BAT PROGRAM

SURVEY RESULTS

Sheboygan County
Sheboygan River
6 June 2016
RT 3632
Surveyors: H Kaarakka
Route Length: 11.84 km
5 Species Encountered

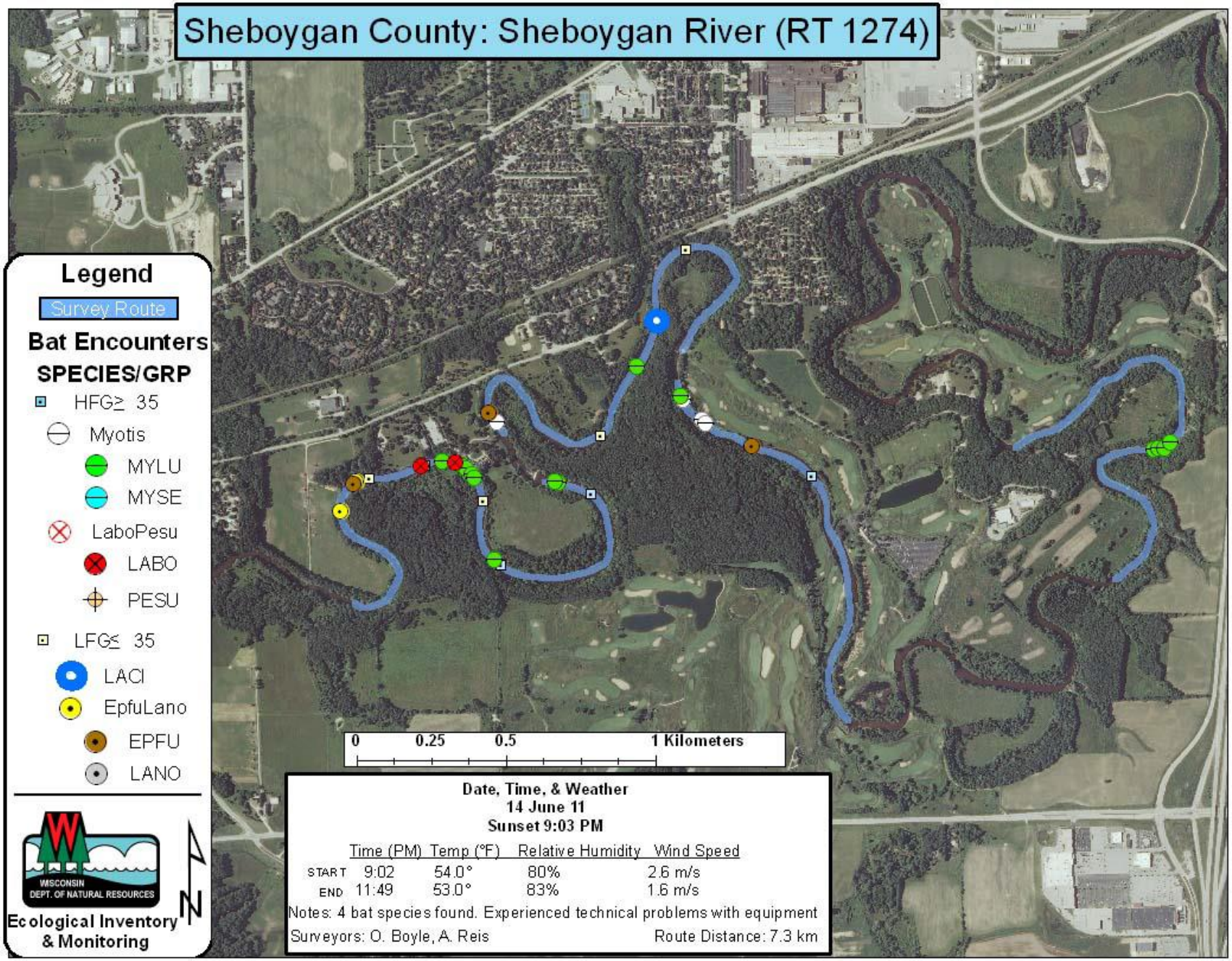
Time & Weather

Time (PM)	
9:00	11:27
Temperature (F)	
57.9	54.0
Relative Humidity (%)	
84.0	76.0
Wind (m/s)	
1.6	3.4

Notes: Survey completed W to E.
Biotic Inventory Survey
Area of Concern Route #1

0 0.2 0.4 0.6 km

Sheboygan County: Sheboygan River (RT 1274)



Date, Time, & Weather
14 June 11
Sunset 9:03 PM

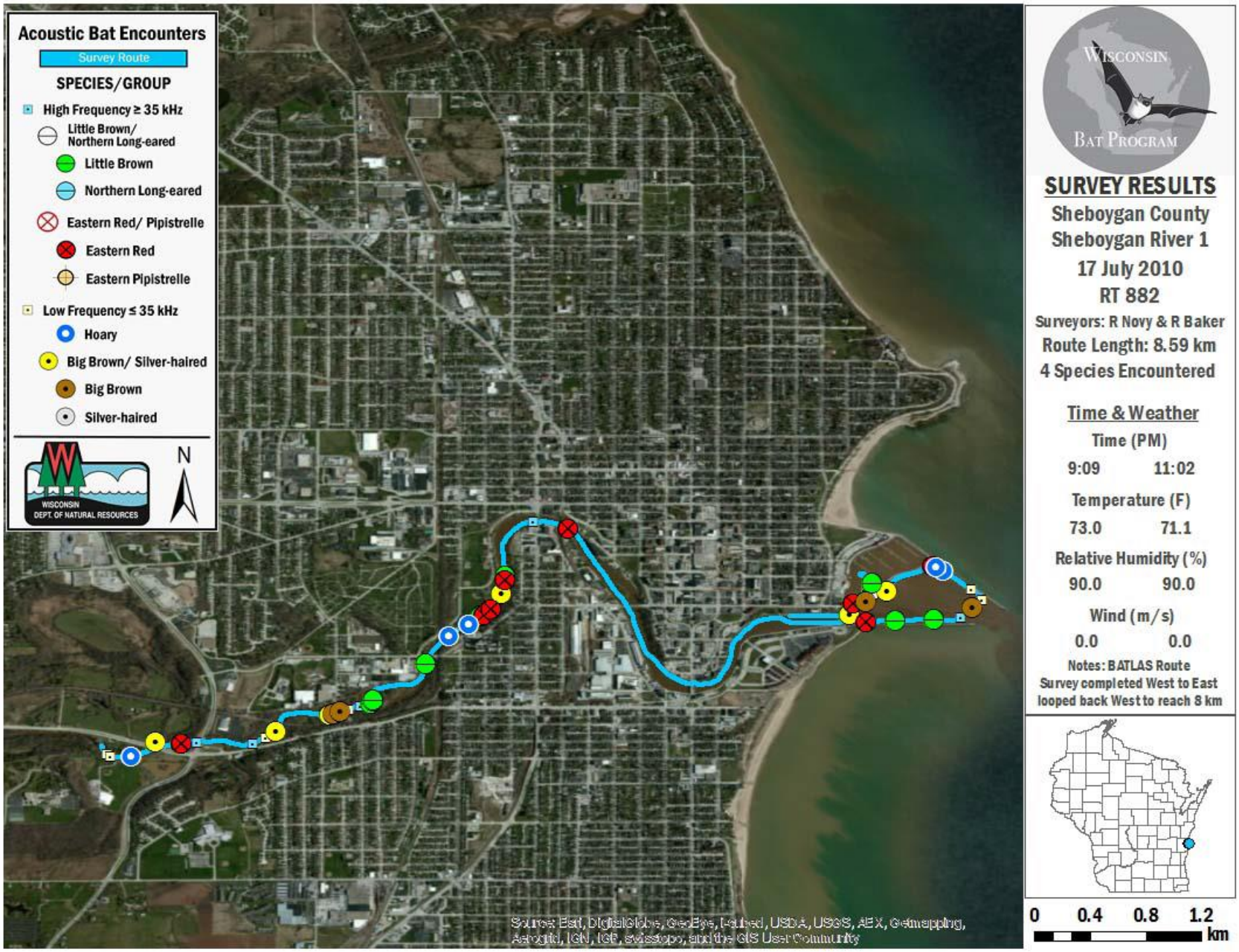
	Time (PM)	Temp (°F)	Relative Humidity	Wind Speed
START	9:02	54.0°	80%	2.6 m/s
END	11:49	53.0°	83%	1.6 m/s

Notes: 4 bat species found. Experienced technical problems with equipment

Surveyors: O. Boyle, A. Reis

Route Distance: 7.3 km


Sheboygan County: Sheboygan River (RT 1350)
Legend
Survey Route
Bat Encounters
SPECIES/GRP
HFG≥ 35
Myotis
MYLU
MYSE
LaboPesu
LABO
PESU
LFG≤ 35
LACI
EpfuLano
EPFU
LANO
WISCONSIN DEPT. OF NATURAL RESOURCES
Ecological Inventory & Monitoring
N
0 0.25 0.5 1 Kilometers
Lake Michigan
Date, Time, & Weather
12 July 11
Sunset 8:33 PM
Time (PM) Temp (°F) Relative Humidity Wind Speed
START 9:05 74.0° 64% 0.0 m/s
END 10:31 76.5° 61% 0.0 m/s
Notes: 4 bat species found.
Surveyors: O. Boyle, A. Reis
Route Distance: 4.8 km



WISCONSIN BAT PROGRAM

SURVEY RESULTS

Sheboygan County
Sheboygan River 1
17 July 2010
RT 882
Surveyors: R Novy & R Baker
Route Length: 8.59 km
4 Species Encountered

Time & Weather

	Time (PM)	
	9:09	11:02
Temperature (F)		
	73.0	71.1
Relative Humidity (%)		
	90.0	90.0
Wind (m/s)		
	0.0	0.0

Notes: BATLAS Route
Survey completed West to East
looped back West to reach 8 km

0 0.4 0.8 1.2 km