Ohio Division of Wildlife
Mobile Bat Acoustic Survey
2014 Report

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INTRODUCTION

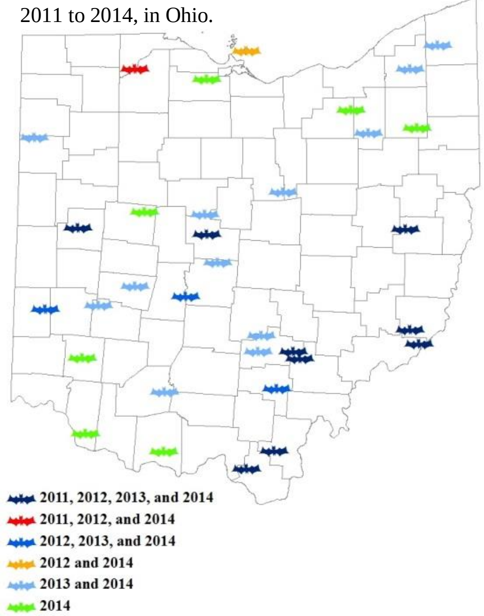
Ohio has 11 native species of bats, all of which are state-listed. Indiana bats (*Myotis sodalis*) are Endangered, Evening bats (*Nycticeius humeralis*) are Species of Interest, and the remaining 9 species are listed as Species of Concern. Despite the listing status, bat populations continue to be impacted by destruction and degradation of winter hibernacula (i.e., caves and mines) and summer habitat (i.e., forests). Additionally, threats that have been identified as long-standing and ongoing threats to bat populations include: quarrying and mining operations (McCracken 2003), loss of habitat (summer, migration, swarming, and hibernating; Kunz and Lumsden 2003, Henderson et al. 2008), loss of forest habitat connectivity (Perry et al. 2008, Scott et al. 2009), disease (i.e., white-nose syndrome; Frick et al. 2010), predation (Wilkinson and South 2002), environmental contaminants (Driscoll et al. 2007, O'Shea and Johnston 2009), and collisions with man-made objects (e.g., wind turbines; Arnett et al. 2008).

While it is often easy for us to document the mortality of these factors at particular site, the cumulative impact of these sources of mortality on bat populations is currently unknown. For example, a large number of bats are dying from white-nose syndrome (WNS) at affected hibernacula (Ford et al. 2011), but it is unknown if some bats are leaving the hibernacula and dying in the surrounding landscape or if the bats are relocating to other sites and surviving until typical emergence (Ehlman et al. 2013). Furthermore, since it is unlikely all bat hibernacula are being surveyed, agencies cannot assess the impacts to all hibernating bats from a population perspective.

Hibernacula counts however can provide indices of changes in bat populations. In Ohio, two hibernacula contain what is believed to be approximately 90% of Ohio's winter bat population and have been surveyed for over 25 years. Assessing hibernacula survey results at these hibernacula from pre-WNS (pre-2011) to the most current (2014, post-WNS) results, I have reported approximately an 85% decline in the winter bat population. Species-specific declines from Ohio hibernacula have included Indiana bat (-48%), little brown bat (*Myotis lucifugus*; -97%), northern long-eared bat (*Myotis septentrionalis*; -94%), tri-colored bat (*Perimyotis subflavus*; -98%), and big brown bat (*Eptesicus fuscus*;-74%; unpublished data). However, I cannot determine from these results what is occurring to Ohio's summer bat populations.

Given the biologic, economic, and intrinsic value of bats (Boyles et al. 2011), it is prudent that the Division of Wildlife monitor both winter and summer bat populations in Ohio to aid in future conservation efforts. It is also important to evaluate bat populations statewide. Therefore, in addition to hibernacula surveys, mist-netting surveys, and post-construction mortality surveys at wind-power sites, the Division needed a supporting method to assess the impacts to multiple species on a broad geographic scale. Thus, in 2011 the Division conducted a pilot project using mobile acoustic surveys for summer bat populations. Since 2011, the project has expanded to include nearly 40 routes across the state. The project objectives are to monitor summer bat populations, and further assess (and potentially correlate) the declines that have been recorded in the winter data. This report summarizes four years of statewide bat acoustic monitoring.

Figure 1. Mobile bat acoustic survey locations from 2011 to 2014, in Ohio.



METHODS

In 2011, the Division developed a standardized protocol for bat acoustic surveys. The standardized protocol included 30- mile driven loops, driving at low speeds (15 mph), surveying at night starting at 30 minutes after sunset, and surveying each route on 3 different nights in July. Predominately, busy (e.g., interstate highways) roads were avoided, but all road types (paved and non-paved) were used. An important assumption with the mobile surveys was that as the acoustic equipment is moving at the 15 miles per hour; only one bat will be detected for each detection (Hayes and Hounihan 1994). To reduce any potential weather variability surveys were conducted only when temperatures were greater than 50 degrees Fahrenheit, wind speeds less than 11 miles per hour, and no rain or fog. Bat calls were recorded using Anabat SD II units (Titley Scientific, Columbia MO). Routes were surveyed annually. Each year, prior to the season, the Anabat SD II units were calibrated to reduce variability in microphones. To maintain consistency, I used a Titley developed calibration system which included an Anabat Chirper (MK II) with a jig holding system, and the Anabat Equalizer software. Calibrating the Anabat units reduced the variance in the detectors and microphones by internally programing each Anabat to the reference sensitivity. During each survey, microphones were attached to car mounts (on the top exterior roof of the vehicle), above the passenger seat. Microphones were titled at a 75 degree angle toward the back of the vehicle. The microphone was connected to the Anabat SD II detector which was connected to a Personal Digital Assistance (PDA) with an inserted CF card GPS receiver. This set-up allowed for detections to be time and date stamped, as well as spatially referenced (i.e., spatial coordinates collected for each detection). Prior to the start and at the completion of each survey the odometer, temperature, wind speed, moon phase, cloud cover, and moon visibility, as well as a time were recorded.

To reduce any differences in bat activity throughout the night, each route was driven (surveyed) in the reverse direction every other night it was surveyed. However, six sites surveyed on the Wayne National Forest (Hocking 1, Hocking 2, Gallia, Washington, Monroe, and Lawrence) did not reverse the direction of the survey because of the standard Forest Service acoustic monitoring protocols which required the routes surveyed same direction. Additionally, it should be noted that some surveys were adjusted at times when there were equipment issues (28 surveys), road closures (18 surveys) or detours (32 surveys), and weather changes (9 surveys; e.g., rain). Any slight changes in routes would have been compensated for these adjustments by the detection rates.

From 2011 to 2014, the numbers of routes increased from 10 to 37. Routes were located in 39 counties (Figure 1). The same routes were surveyed annually, thus allowing for analyses of population trends at both spatial and temporal scales. Fourteen of the routes were not surveyed 3 times because of time restrictions, while 12 were surveyed more than 3 times (Table 1). Additionally, due to personnel time constraints, 49 were completed prior to July as early as 2 June (2011 = 13 surveys, 2012= 5 surveys, 2013 = 7 surveys, and 2014 = 9 surveys), and 8 were surveyed in August as late as 6 August (2012 = 1 survey, 2013 = 2 surveys, and 2014 = 5 surveys). Surveys that were completed outside of July time frame were included in most evaluations, but were truncated in our analysis of detections by day.

The Division was able to increase the number of routes because of the many individuals who volunteered their time. To maintain a standardized survey procedure, all volunteers were trained by the Division on the acoustic monitoring equipment and the Ohio standardized protocols. Volunteers were provided with a step-by-step instruction booklet as a reference guide during the survey. After each route was completed by a volunteer or the Division, the acoustic detections and associated spatial files were downloaded from each unit to a centralized acoustic file for analyses and storage.

Table 1. The number of bat acoustic surveys conducted in 37 routes (in 39 counties) from 2011 to 2014.

Route	2011	2012	2013	2014
Adams				3
Ashland/Richland			4	3
Ashtabula			3	1
Belmont				3
Clark			3	3
Clermont				3
Cuyahoga (Central)		2	2	3
Cuyahoga (East)		1		3
Cuyahoga (West)		2	1	3
Delaware/Franklin			3	3
Delaware/Marion	3	3	3	3
Erie		1		3
Fairfield/Hocking			3	3
Franklin		3	3	3
Gallia	4	4	3	3
Geauga/Portage			3	3
Hardin/Logan				3
Harrison	3	3	3	3
Highland			2	3
Hocking 1	3	3	2	3
Hocking 2	2	3	2	3
Hocking 3			2	4
Lawrence	5	4	4	3
Marion/Morrow			3	3
Medina/Summit				3
Monroe	2	3	4	3
Montgomery/Greene			2	3
Portage/Mahoning/Stark				3
Preble		3	3	3
Sandusky				3
Shelby	3	3	3	3
Summit			3	4
Van Wert/Paulding			4	3
Vinton		3	3	3
Warren/Clinton/Greene				3
Washington	4	3	4	4
Wood	3	3		3
Total Surveys:	**32**	**47**	**75**	**112**

Acoustic files were evaluated using a quantitative automated identification software (Bat Call ID East, version 2.6a) to identify frequency category (Table 2), and to assess relative numbers of bats. Within the Bat Call ID software, I developed an Ohio-specific filter that included selecting Ohio specific species and the frequency ranges for Ohio bats. In addition, filters were adjusted to include feeding buzzes and search phase calls. The Ohio-specific filters were developed and used to provide the maximum amount of coverage for identifying bats while eliminating noise and interference. Files with bat calls were separated by species or species frequency categories (Table 2). Specific *Myotis* species were never separated from the frequency category and identified because of software limitations in the accuracy of this category.

Table 2. Ohio bat species, abbreviations, and corresponding frequency categories (low, mid, *Myotis*).

Species	Abbreviation	Category
Eptesicus fuscus	EPFU	LOW
Lasiurus noctivagans	LANO	LOW
Lasiurus cinereus	LACI	LOW
Lasiurus borealis	LABO	MID
Nycticeius humeralis	NYHU	MID
Perimyotis subflavus	PESU	MID
Myotis lucifugus	MYLU	MYOTIS
Myotis septentrionalis	MYSE	MYOTIS
Myotis sodalis	MYSO	MYOTIS
Myotis leibii	MYLE	MYOTIS

To compare between and among surveys (nights, routes, and/or years), I standardized the number of calls from Bat Call ID by effort. Because the minutes and miles surveyed were recorded, bat detections were standardized by minute/mile (here forward, detection rate). The bat detection rate was used as a surrogate for relative abundance of bats, acknowledging the limitations of the road-based surveys (e.g., species-specific detection probabilities, habitat preferences), as well as the assumption of the methodologies. I evaluated the mean number of bat detections combining detections of all species in each year, to assess trends in bat populations occurring statewide from 2011 to 2014. Similarly, I assessed if statewide trends existed by frequency categories. Within the standard survey timeframe (July) and using data from all sites surveyed in each year, I assessed if bat activity was different throughout the month and if there were any peak activity timing thresholds. For the nine routes that have been surveyed in each year from 2011 to 2014 (Delaware, Gallia, Harrison, Hocking 1, Hocking 2, Lawrence, Monroe, Shelby and Washington; Table 1), I assessed the mean number of detections for each route through time (from 2011 to 2014). To assess bat abundance and species-specific variations in routes, I used only 2014 detections which included 37 routes (total surveys =112). In addition to relative abundances among routes, species-specific information (combining all *Myotis* spp.) was assessed for the 2014 dataset which included 37 routes surveyed in 39 counties across the state.

RESULTS

From 2011 to 2014, 266 total surveys (2011: n = 32; 2012: n = 47; 2013: n = 75; and 2014: n=112) were conducted in 39 counties in Ohio (Figure 1). This effort yielded 65,100 acoustic files; of which 24,561 contained echolocation calls of bats (the remaining files may have contained noise from insects, machinery, birds, or static).

The mean bat detection rate for all surveys 2011-2014 was 24.05 detections/min/mi, however from 2011 to 2014, there was a 47% decline in bat detection rate. Variation among year to year was noted. For instance, from 2011 to 2012 bat detections increased by 14%, decreased by 33% from 2012 to 2013, and decreased again from 2013 to 2014 by 31% (Figure 2). Comparing all surveys from different routes and different years, the bat detection rates varied from 1.1 detections/min/mi (Erie Route 2014) to

186.7 detections/min/mi (Harrison Route 2013). No trend or pattern occurred among average numbers of detections and locations of routes regionally in Ohio. Comparing the detection rate of categorized calls into mid, low, or *Myotis* I recorded a 56% decrease in *Myotis* bat detections, a 40% decrease in low frequency bat detections, and 53% decrease in mid-frequency bat detections from 2011 to 2014 (Figure 3).

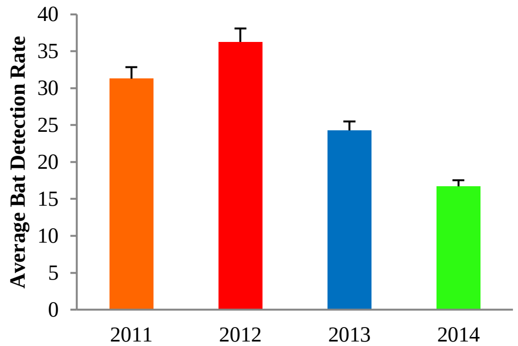


Figure 2. Bat detection rate for four years of standardized mobile bat acoustic surveys, from 2011 to 2014 in Ohio.

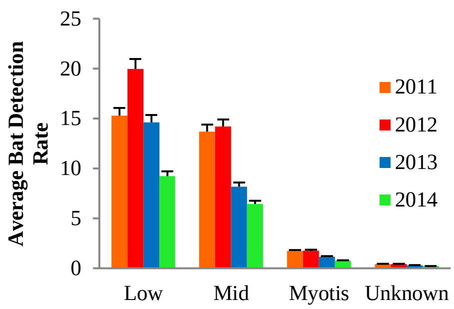


Figure 3. Bat detection rates separated by frequency categories (low, mid, and *Myotis*) for standardized mobile bat acoustic surveys in Ohio from 2011 to 2014.

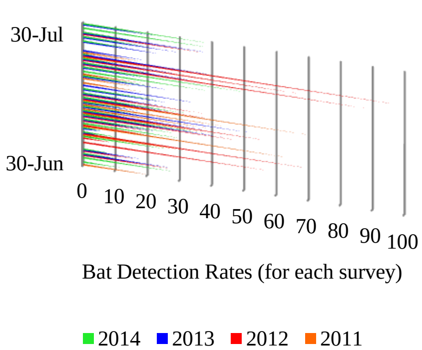


Figure 4. A temporal depiction of the bat detections for standardized mobile bat acoustic surveys in Ohio from 2011 to 2014.

An assessment of the timing of bat activity throughout the survey period (June 30 to August 1) each year, suggested consistency in the number of bats detected throughout the survey period with a few peaks in number of bat detections at the end of the month during each year (Figure 4).

Nine routes were surveyed all years and similar the statewide results, all nine routes decreased in the number of bats detected from 2011 to 2014 (Delaware decreased detections by 64%, Gallia by 57%, Harrison by 42%, Hocking 1 by 2%, Hocking 2 by 46%, Lawrence by 52%, Monroe by 80%, Shelby by 23%, and Washington by 39%). Again, echoing the statewide trends, 6 of these 9 routes each increased in 2012, then decreased. The remaining three routes did not have similar trends. For instance, Washington decreased annually from 2011 to 2014 (39%; Figure 5).

Similar to previous years, I recorded differences among routes in 2014 (Figure 6). In 2014, the routes with the three greatest mean detection rates were central Cuyahoga County (39.7 detections/min/mi), Vinton County (32.4 detections/min/mi), and Washington (31.8 detections/min/mi). Whereas, the greatest mean detections in previous years (2011-2013) were always above 52 detections/min/mi. Prior to 2014 the routes with the lowest detection rates were 16.5, 8.7, and 5.3 detections/min/mi, whereas in 2014 the route with the lowest mean detection rate was 1.5 detections/min/mi (Erie). Furthermore in 2014, most (24 of the 37) routes had mean detection rates that were less than 16.5 detections/min/mi (the lowest detection rate in 2011).

Species composition varied by route in 2014 (and in previous years). No regional trends in species composition were observed. In 2014, 15 routes recorded consistently low frequency bats as the most abundant group, 8 routes consistently recorded mid-frequency as the most abudant group, and 14 routes did not have a frequncy group that was consistently more abundant (Appendix A).

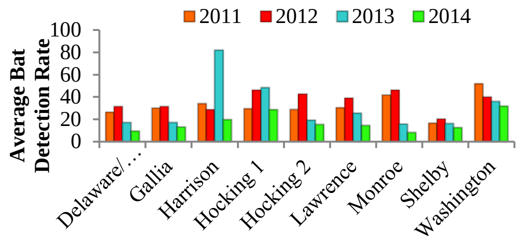


Figure 5. The number of bat detection rates for nine mobile bat acoustic routes surveyed in Ohio every year from 2011 to 2014.

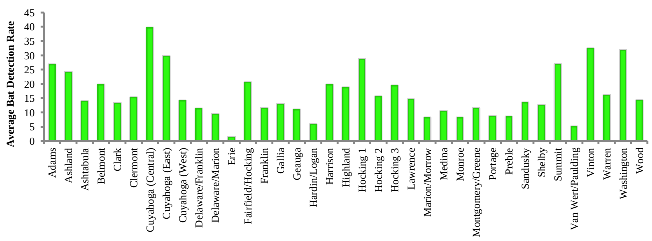


Figure 6. The number of bat detection rates for each of the mobile bat acoustic routes surveyed in Ohio during 2014.

DISCUSSION

From 2011 and 2014, there has been a declining trend in the number of bat detections recorded during the mobile acoustic surveys. Although these observations are derived from only 4 consecutive summers, it is potentially indicative of declining numbers of bats as a result of WNS, which have been noted in hibernacula surveys in Ohio. Post-WNS declines in Ohio winter hibernacula surveys were estimated to be 85%, whereas results from this study suggested a reduction of 47% in the number of bats detected during summer acoustic surveys. Both surveys only provide estimates, however it should be noted that both suggest declining numbers of bats. The acoustic surveys may underestimate the level of decline, as well as number of bats by the limitations of the methodologies— roadway surveys will not detect forest interior species and only survey species that may be passing by as surveys are been conducting.

With 37 routes now established in Ohio, there is good spatial representation of the state. However, several of these sites have only been surveyed for one or two years (Table 1). I did not detect any trends in species composition by region within the state, the predominate habitat associated with each route or any consistency in annual number of detections within a route. However, additional data are needed to make more meaningful interpretations of long-term trends in summer bat populations in Ohio.

Despite bat call characteristics that overlap and automated acoustic software that is not completely accurate for species identification, the use of Ohio-specific filters enabled greater accuracy in the identification of bat calls compared to using just the software. Furthermore, grouping species into frequency categories, provides more accurate interpretation of the data. There are limitations to use of acoustic surveys and the associated software. For instance the software cannot isolate a single bat call if there are multiple calls at the same exact time. Because of this there is a potential for a slight bias for lower-frequency calls because the software selects the lowest frequency first. The quality of the recorded calls are also important, and may vary substantially depending on the environment in which the bat is flying (e.g., forest versus agriculture), as well as the behavior of the bat (e.g., search phase call versus feeding buzz). Another limitation of mobile acoustic monitoring is that it relies on road networks. Bat activity is thought to decrease near road systems (Berthinussen and Altringham 2011). Activity near roads could decrease due to noise pollution (Schaub et al. 2008), light pollution (Stone, et al. 2009), or a combination. There are also species specific differences in bat calls that may cause detection probability to be different among species.

Regardless of these limitations, the use of mobile acoustic surveys and the automated software is necessary due to the large scale of the statewide surveys and number of total calls to evaluate. Furthermore, it should be clearly noted, that the results represent not populations of bats, but rather provide trends and are indicative of what is likely occurring within bat populations. This report provides preliminary results of only four years of data.

ACKNOWLEDGEMENTS

I am grateful for the dedication and thank the over 100 volunteers who have participated in these surveys from 2011 to 2014 in Ohio. The increase in survey effort and number of routes in 2013 and 2014 would not have been possible without the efforts of specifically, Sarah Elliott. For her efforts and persistence, I am sincerely appreciative.

Literature Cited

Arnett, E.B., W.K. Bron, W/P Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connell, M.D. Piorkowski, and R.D. Tankerslep, Jr. 2008. Patterns of bat fatalities at wind energy facilities in North America. The Journal of Wildlife Management 72(1): 61-78.

Berthinussen, A. and J. Altringham. 2011. The effect of a major road on bat activity and diversity. Journal of Applied Ecology 49: 82-89.

Boyles, J.G., P.M. Cyran, G.F. McCracken, and T.H. Kunz. 2011. Economic importance of bats in agriculture. Science 332 (6025): 41-42.

Driscoll, C.T. Y.J. Han, C.Y. Chen, D.C. Evers, K.F. Lambert, T.M. Holsen, N.C. Kamman, and R.K. Munson. 2007. Mercury contamination in forest and freshwater ecosystems in the northeastern United States. BioScience 57(1): 17-28.

Ehlman, S.M., J.J. Cox, and P.H. Crowley. 2013. Evaporative water loss, spatial distributions, and survival in white-nose syndrome- affected little brown myotis: a model. Journal of Mammology 94(3): 572-583.

Frick, W. F., J. F. Pollock, A. C. Hicks, K. E. Langwig, D. S. Reynolds, G. G. Turner, C. M. Butchkoski, and T. H. Kunz. 2010. An emerging disease causes regional population collapse of a common North American bat species. Science 329: 679-682.

Ford, W.M., E.R. Britzke, C.A. Dobony, J.L. Rodrigue, and J.B. Johnson. 2011. Patterns of acoustical activity of bats prior to and following white-nose syndrome occurrence. Journal of Fish and Wildlife Management 2(2): 125-134.

Hayes, J.P. and P. Hounihan. 1994. Field use of the Anabat II bat detector system to monitor bat activity. Bat Research News 35: 1-3.

Henderson, L. E., L. J. Farrow, and H. G. Broders. 2008. Intra-specific effects of forest loss on the distribution of the forest-dependent northern long-eared bat (*Myotis septentrionalis*). Biological Conservation 141:1819-1828.

Kunz, K.H. and L.F. Lumsden. 2003. Ecology of cavity and foliage roosting bats. Pages 3-89 in T.H. Kunz and M. B. Fenton, editors. Bat Ecology. The University of Chicago Press, Chicago IL.

McCracken, G. F. 2003. Estimates of population sizes in summer colonies of Brazilian free-tailed bats (Tadarida brasiliensis). Secondary Estimates of Population Sizes in Summer Colonies of Brazilian Free-Tailed Bats (*Tadarida brasiliensis*): 21-30.

O'Shea, T.J. and J.J. Johnston. 2009. Environmental contaminants and bats: investigating exposure and effects. U.S.D.A. peer-reviewed articles. Accessed on October 5, 2014 at http://handle.nal.usda.gov/10113/38177

Perry, R.W., R.E. Thill, and D.R. Leslie, Jr. 2008. Scale-dependent effects of landscape structure and composition on diurnal roost selection by forest bats. Journal of Wildlife Management 72(4): 913-925.

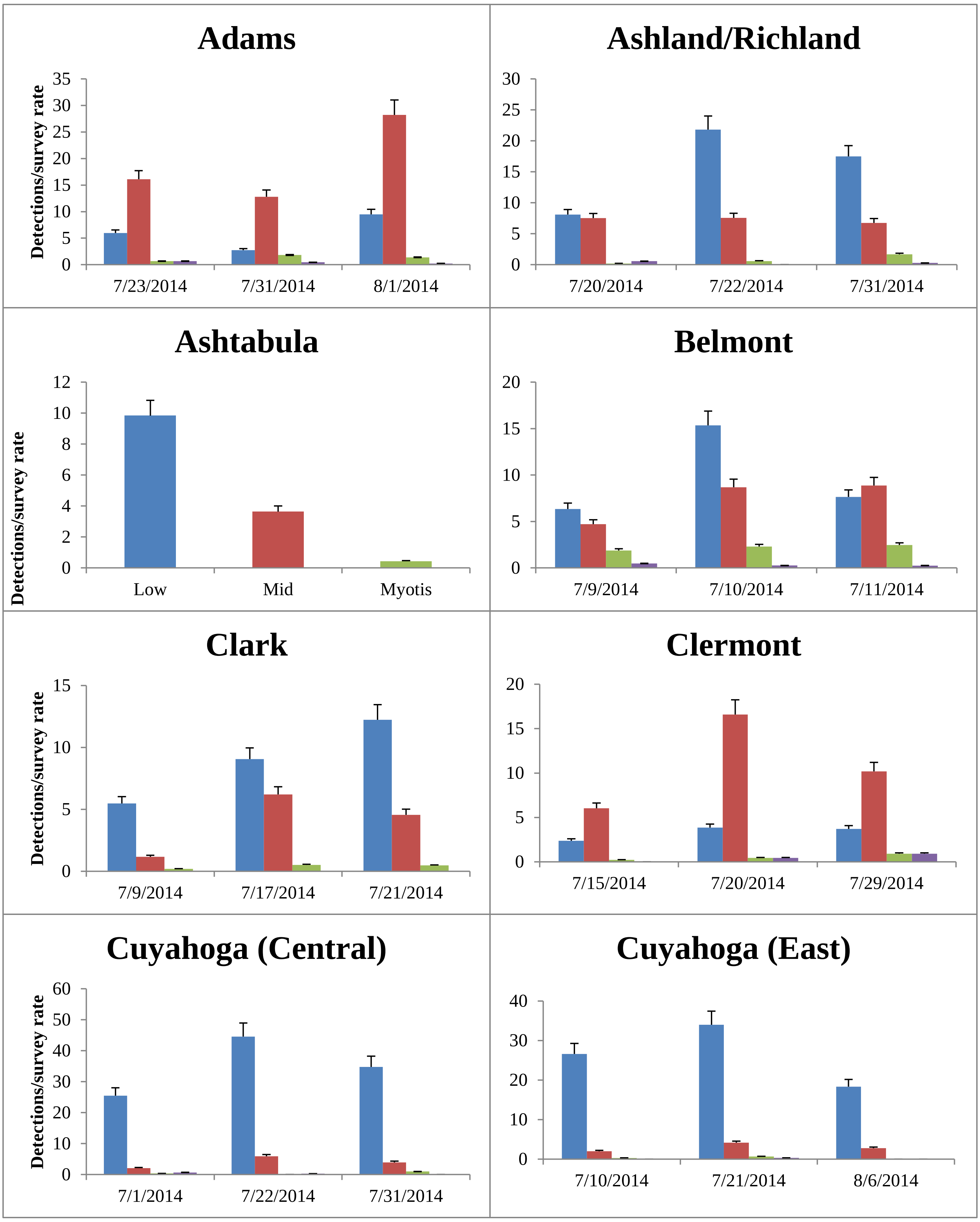
Schaub, A., J. Ostwald, and B.M. Siemers. 2008. Foraging bats avoid noise. The Journal of Expermental Biology 211: 3174-3180.

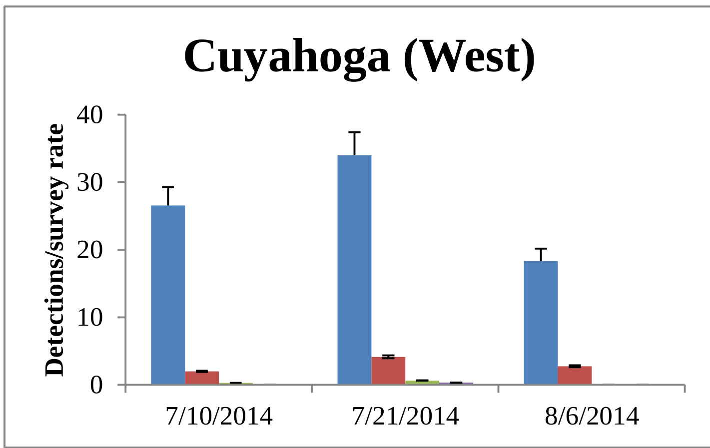
Scott, S. J., G. McLaren, G. Jones, and S. Harris. 2009. The impact of riparian habitat quality on the foraging and activity of pipistrelle bats (Pipistrellus spp.). Journal of Zoology 280 (4): 371-378.

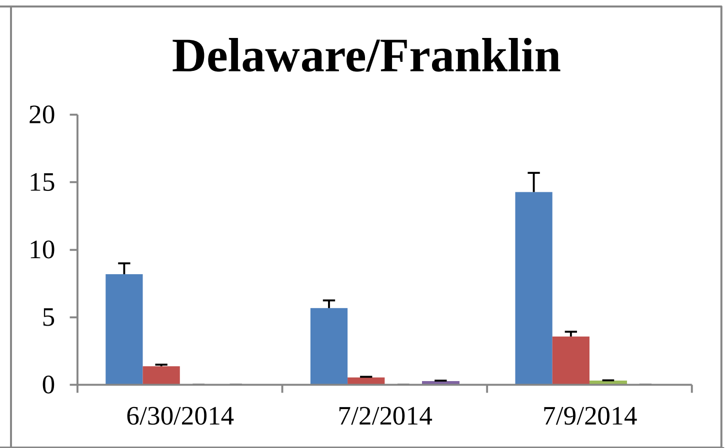
Stone, E.L., G. Jones, and S. Harris. 2009. Street lighting disturbs commuting bats. Current Biology 19: 1123-1127.

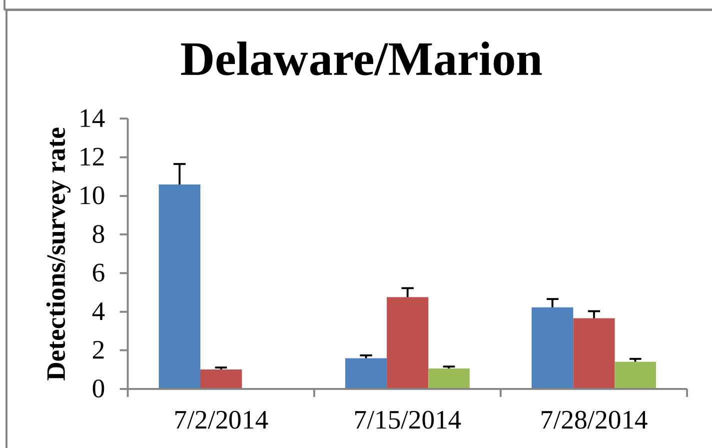
Wilkinson, G. S., and J.M. South. Life history, ecology and longevity in bats. 2002. Aging cell 1(2): 124-131.

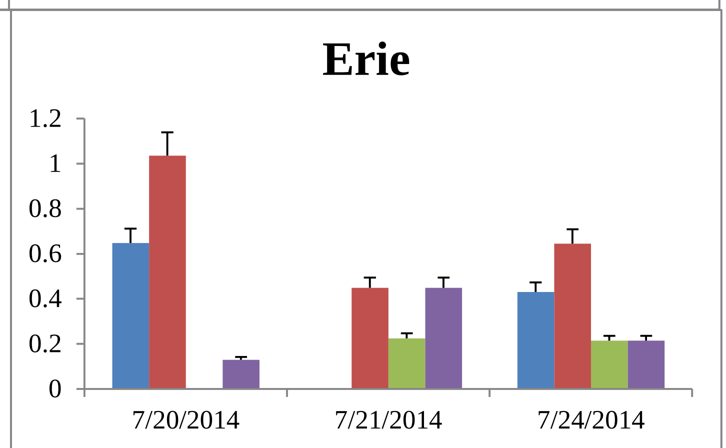
Appendix A. The 2014 routes surveyed with site-specific and date-specific bat detections by frequency category with 95% confidence intervals. Low frequency are indicated in blue, mid frequency are indicated in red, Myotis are in green, and the unknowns are purple.

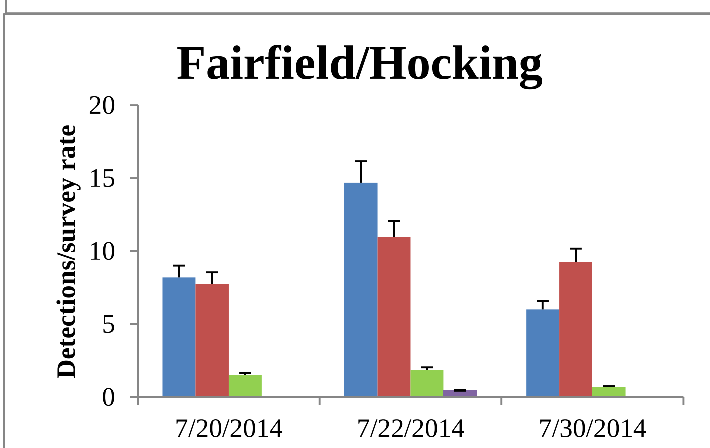


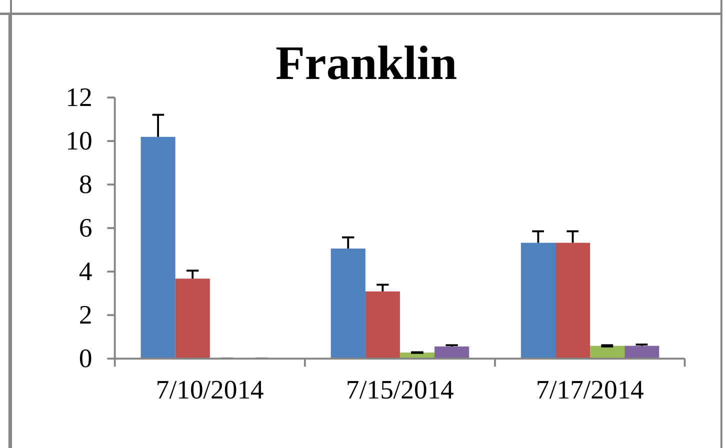

Cuyahoga (West)
Detections/survey rate
0
10
20
30
40
7/10/2014
7/21/2014
8/6/2014


Delaware/Franklin
0
5
10
15
20
6/30/2014
7/2/2014
7/9/2014


Delaware/Marion
Detections/survey rate
0
2
4
6
8
10
12
14
7/2/2014
7/15/2014
7/28/2014


Erie
0
0.2
0.4
0.6
0.8
1
1.2
7/20/2014
7/21/2014
7/24/2014


Fairfield/Hocking
Detections/survey rate
0
5
10
15
20
7/20/2014
7/22/2014
7/30/2014


Franklin
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2
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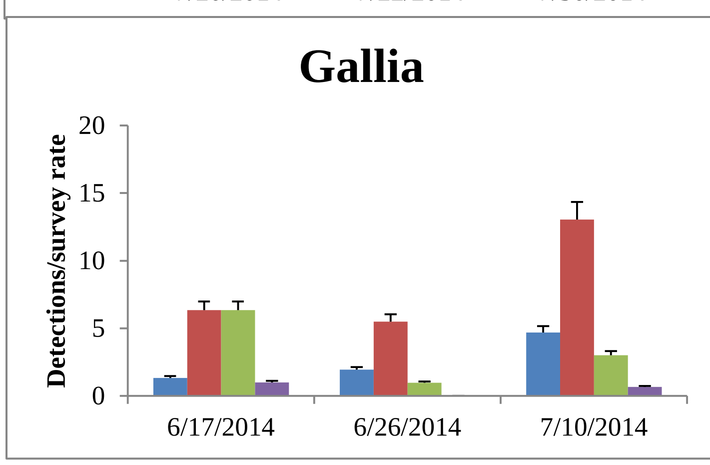
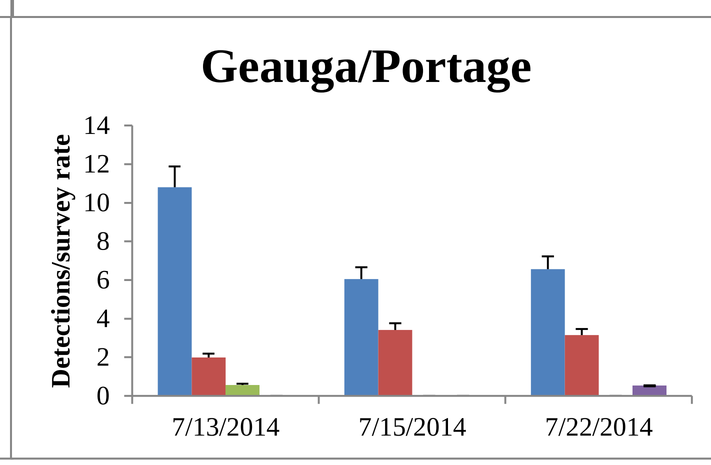
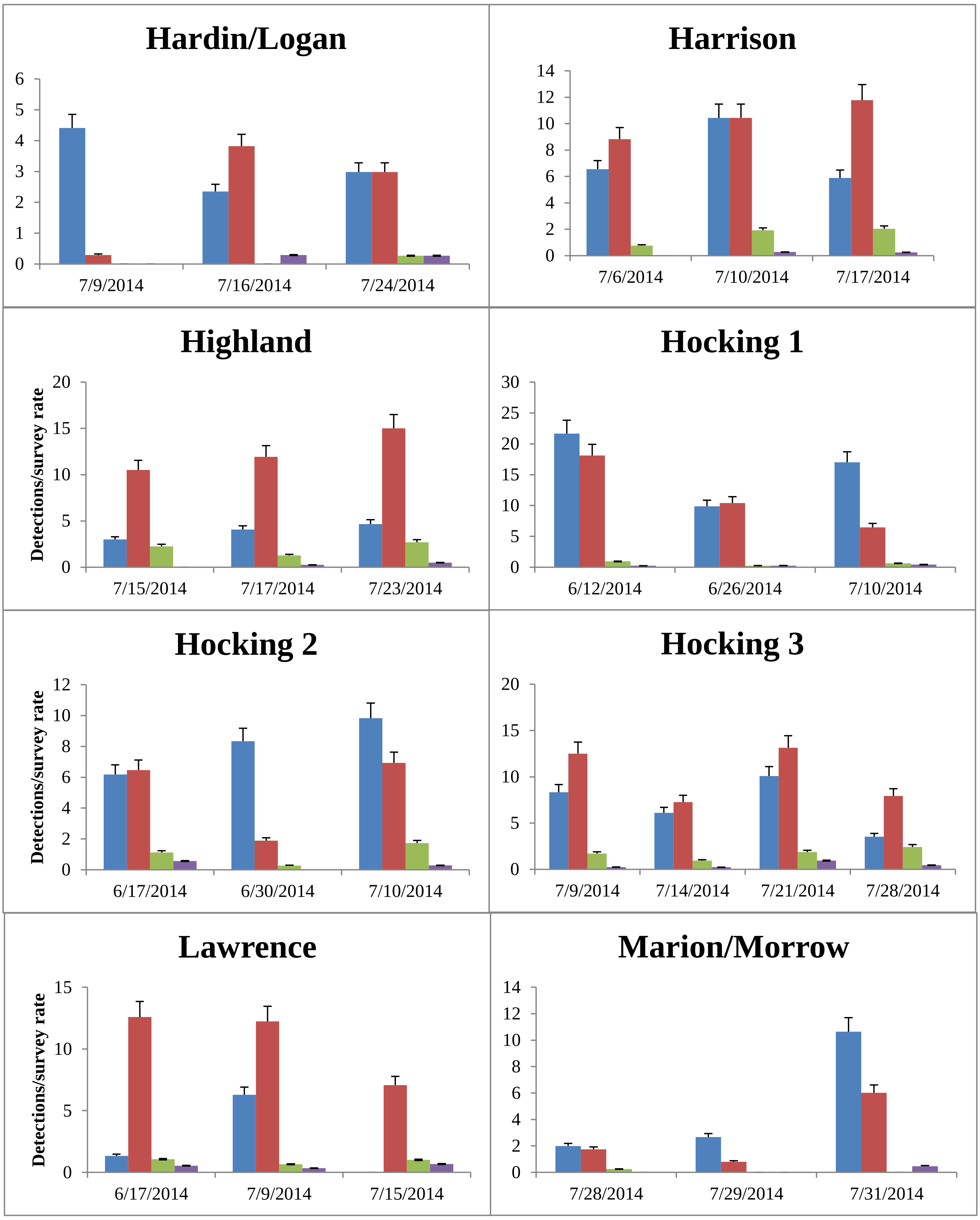
7/10/2014
7/15/2014
7/17/2014


Gallia
Detections/survey rate
0
5
10
15
20
6/17/2014
6/26/2014
7/10/2014


Geauga/Portage
Detections/survey rate
0
2
4
6
8
10
12
14
7/13/2014
7/15/2014
7/22/2014


Hardin/Logan
0
1
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3
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5
6
7/9/2014
7/16/2014
7/24/2014
Harrison
0
2
4
6
8
10
12
14
7/6/2014
7/10/2014
7/17/2014
Highland
Detections/survey rate
0
5
10
15
20
7/15/2014
7/17/2014
7/23/2014
Hocking 1
0
5
10
15
20
25
30
6/12/2014
6/26/2014
7/10/2014
Hocking 2
Detections/survey rate
0
2
4
6
8
10
12
6/17/2014
6/30/2014
7/10/2014
Hocking 3
0
5
10
15
20
7/9/2014
7/14/2014
7/21/2014
7/28/2014
Lawrence
Detections/survey rate
0
5
10
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6/17/2014
7/9/2014
7/15/2014
Marion/Morrow
0
2
4
6
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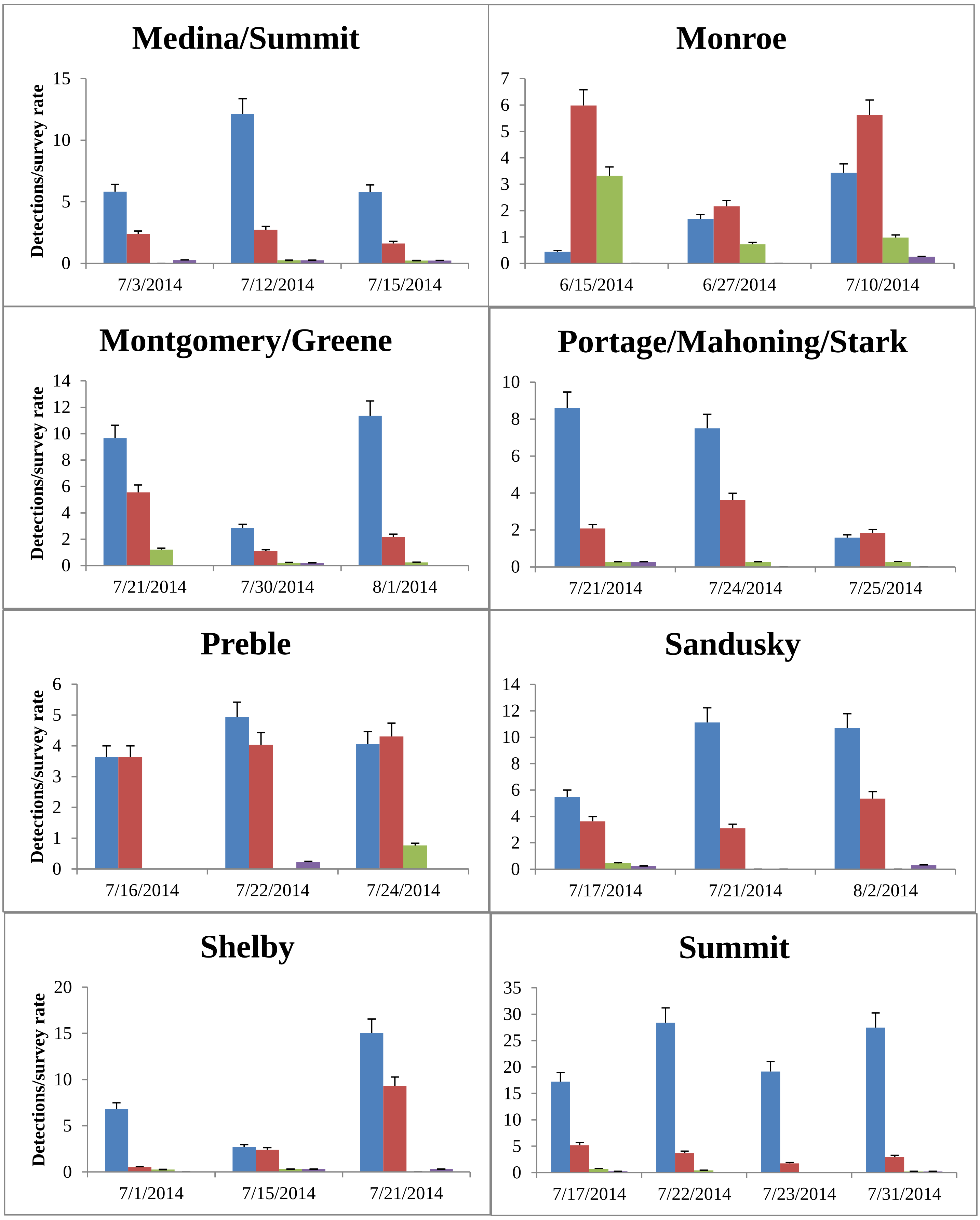
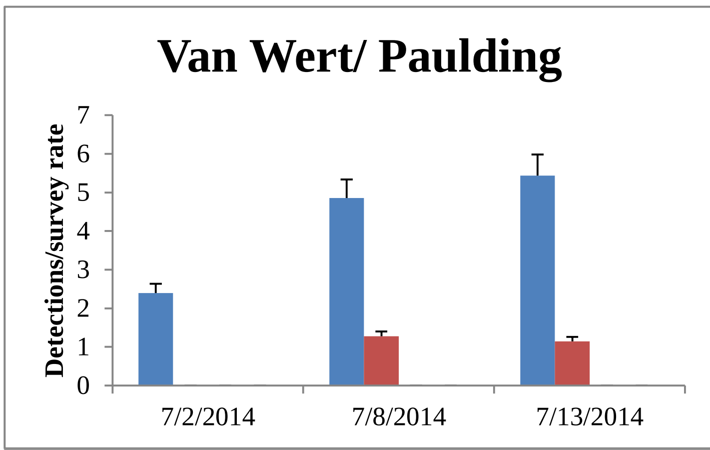
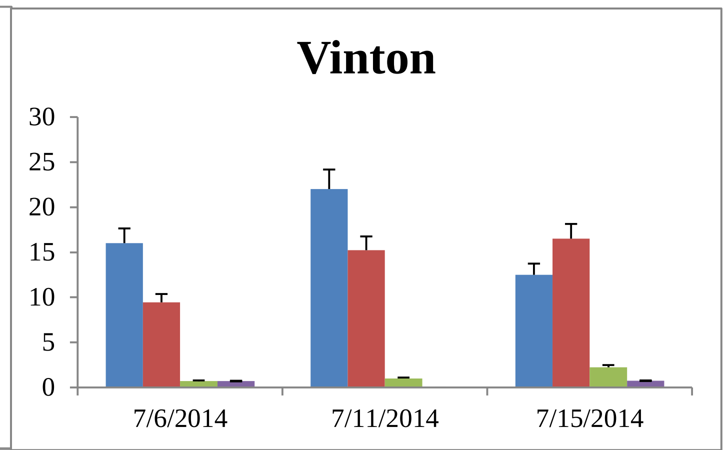
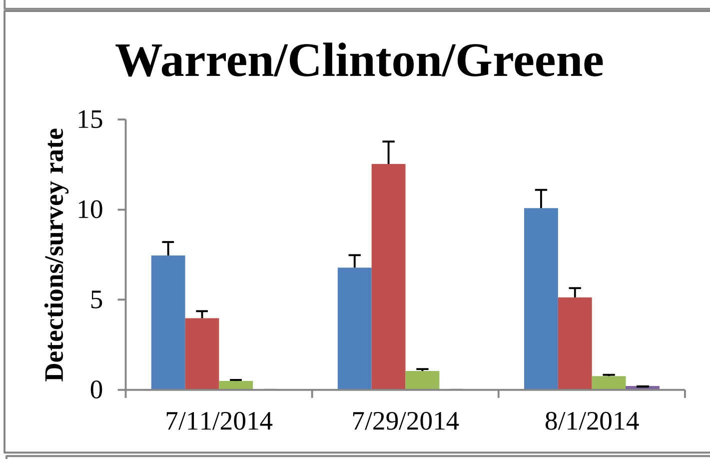
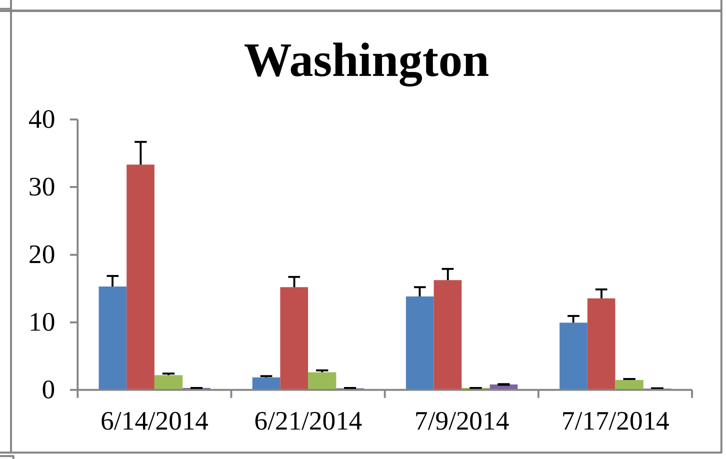
14
7/28/2014
7/29/2014
7/31/2014

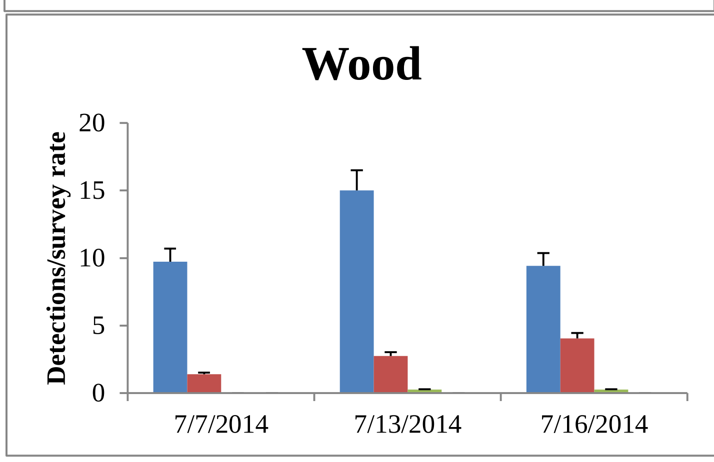

Medina/Summit
Detections/survey rate
15
10
5
0
7/3/2014
7/12/2014
7/15/2014
Monroe
7
6
5
4
3
2
1
0
6/15/2014
6/27/2014
7/10/2014
Montgomery/Greene
Detections/survey rate
14
12
10
8
6
4
2
0
7/21/2014
7/30/2014
8/1/2014
Portage/Mahoning/Stark
10
8
6
4
2
0
7/21/2014
7/24/2014
7/25/2014
Preble
Detections/survey rate
6
5
4
3
2
1
0
7/16/2014
7/22/2014
7/24/2014
Sandusky
14
12
10
8
6
4
2
0
7/17/2014
7/21/2014
8/2/2014
Shelby
Detections/survey rate
20
15
10
5
0
7/1/2014
7/15/2014
7/21/2014
Summit
35
30
25
20
15
10
5
0
7/17/2014
7/22/2014
7/23/2014
7/31/2014


Van Wert/ Paulding
Detections/survey rate
0
1
2
3
4
5
6
7
7/2/2014
7/8/2014
7/13/2014


Vinton
0
5
10
15
20
25
30
7/6/2014
7/11/2014
7/15/2014


Warren/Clinton/Greene
Detections/survey rate
0
5
10
15
7/11/2014
7/29/2014
8/1/2014


Washington
0
10
20
30
40
6/14/2014
6/21/2014
7/9/2014
7/17/2014


Wood
Detections/survey rate
0
5
10
15
20
7/7/2014
7/13/2014
7/16/2014