

Wildlife Preservation Fund Large Project Final Report

Grant Project Title: Eastern Massasauga Surveys in Knox and Warren Counties, Illinois

Grant #RC11L20W

Grantee: Eric Smith, IDNR, Division of Natural Heritage, 301 S. Date St., Gibson City, IL 60936

Grant Period: April 2011 – June 30, 2013

Report completed by: Laurel Wilson, IDNR, Laurel.Wilson@illinois.gov
Michelle Simone, IDNR, Michelle.Simone@illinois.gov

Project Objective: To locate any remaining populations of eastern massasauga rattlesnakes in Knox and Warren counties.

Introduction

The eastern massasauga rattlesnake, *Sistrurus catenatus catenatus*, is a cryptic, sit-and wait predator that inhabits wet and mesic prairies. The eastern massasauga is one of the smallest rattlesnakes in North America, and by most accounts, the rarest. The current range of these snakes extends from southern Ontario in the north, southern Illinois in the south, Missouri in the west and Pennsylvania in the east. At the time of European settlement, the eastern massasauga was distributed throughout the upper two-thirds of Illinois. Early inhabitants of the state reported seeing up to 20 or more eastern massasauga rattlesnakes in one season (Hay 1893). Reports of population declines were noted as early as 1866 (Atkinson and Netting 1927). Changes in land use that followed European settlement, such as draining of prairie marshes and intensive agriculture may have contributed to the declining numbers of these rattlesnakes. In 1961 there were reportedly 25 extant populations of the eastern massasauga (Smith 1961). It is now believed that only four or five populations remain. In 1994, the massasauga rattlesnake was listed as an endangered species in Illinois and is protected throughout its range (Herkert 1994). It is now a candidate for listing at the federal level (USFWS 1999).

In Illinois, the eastern massasauga is known to occur in Clinton County, Cook County, Piatt County, Warren County (Figure 1) and Knox County (Figure 2). The Clinton County population at Carlyle Lake is closely monitored by the Illinois Natural History Survey with numerous observations yearly. The Piatt County population occurs at Robert Allerton Park and an old railroad/power line right-of-way near Monticello, with the most recent observation in 2007. Eastern massasaugas have been documented in Knox County at six separate locations and were last seen in 2010. The eastern massasauga was last observed in Warren County at Massasauga Prairie Nature Preserve in 1972. Although no remaining massasaugas could be found while surveying Massasauga Prairie from 1999-2000, it is possible that they still occur at this site, based on analysis in the final report. IDNR Natural Heritage Biologists have conducted limited surveys in suitable habitat in Knox County annually since 2007. The purpose of this project was to contract survey teams to conduct more comprehensive snake surveys in Knox County at locations known to have recent or historic massasauga rattlesnake occurrences as well as areas of adjacent suitable habitat.

Warren County Search Site

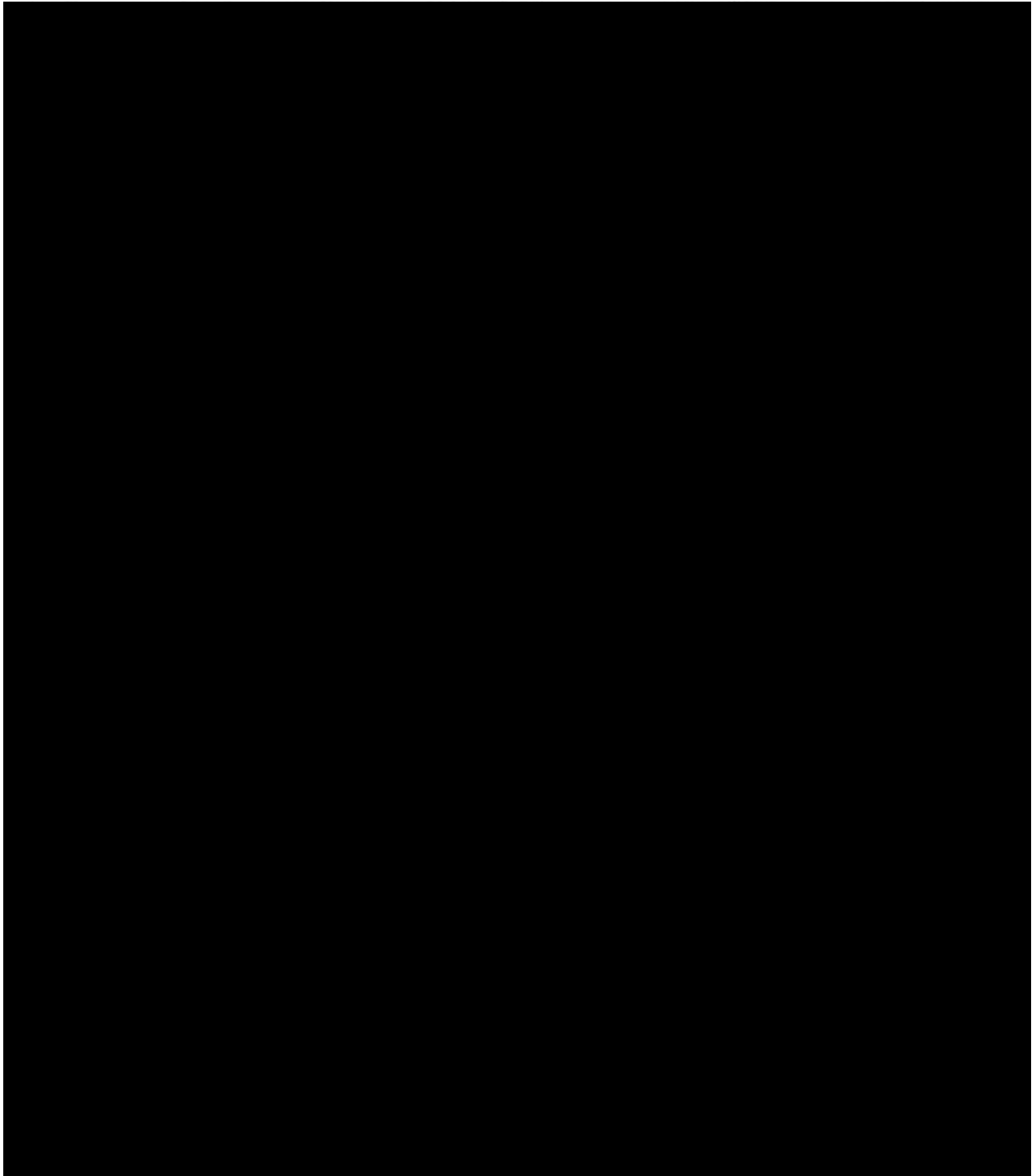


Figure 1. Eastern massasaugas were surveyed at Massasauga Prairie Nature Preserve in Warren County.

Knox County Search Sites

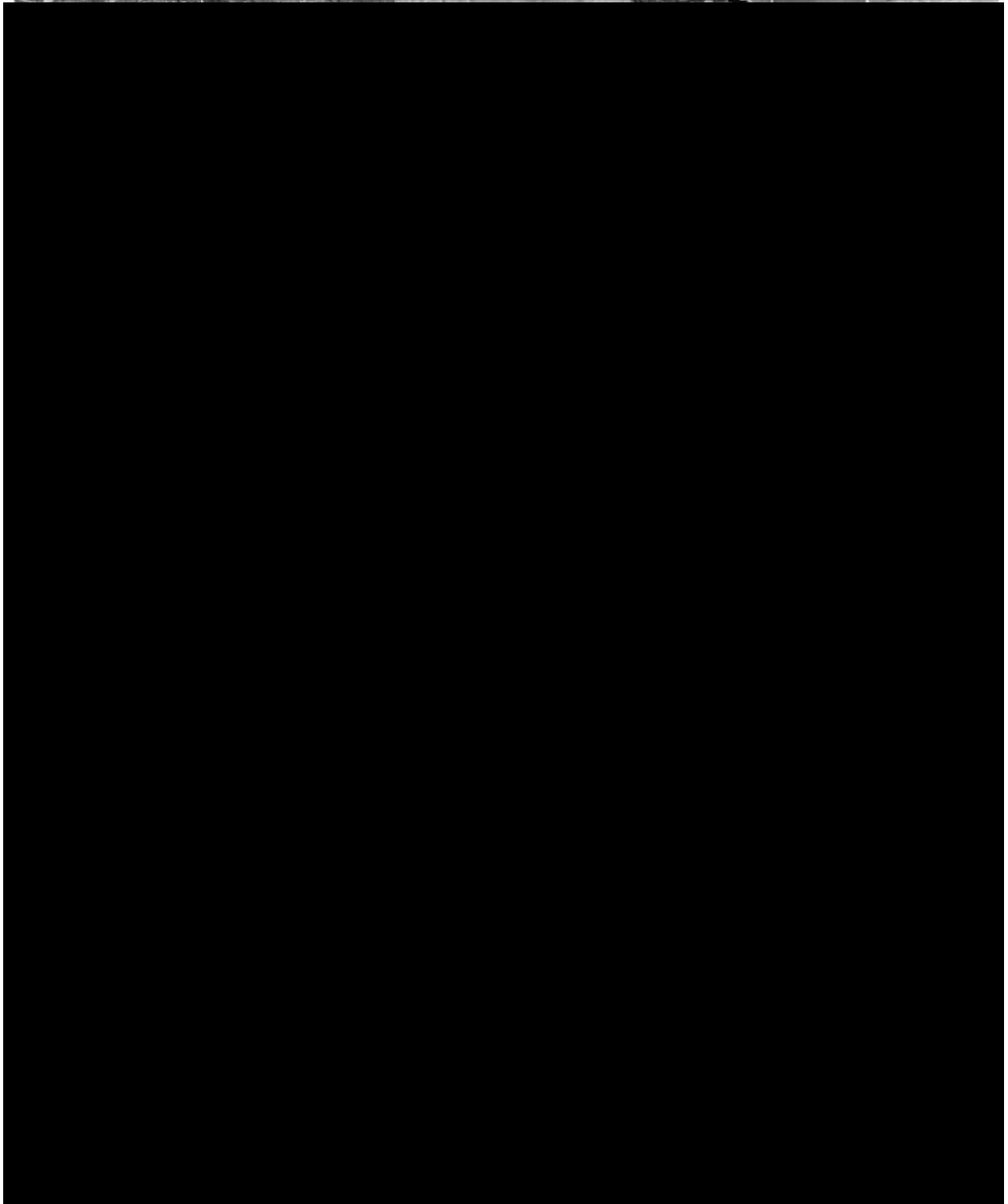


Figure 2. Eastern massasauga search areas SW of Knoxville in Knox County.

Project Methodology:

Survey areas were selected based on habitat type present, the proximity to, or presence of, historic eastern massasauga sightings, and the cooperation of private landowners. Types of habitat that were targeted included upland and bottomland grasslands (cool season grazed and ungrazed pastures and restored prairies), wetlands, and adjacent woodland edges.

Undergraduate biology and environmental sciences students from Knox College, Bradley University, and Carl Sandburg College were hired as hourly employees through the Illinois Natural History Survey to conduct snake surveys during applicable times from Spring 2011 through Spring 2013. Each spring, new students were trained and given educational materials on snake identification and survey methods.

Visual Surveys: Visual encounter surveys took place at Massasauga Prairie Nature Preserve in Warren County and several sites on private property in Knox County (Figure 3). Sites where visual surveys took place were prepared by removal of surface vegetation through the application of prescribed burning to increase detection probability (Figure 4). Visual encounter surveys were conducted between April 23rd and May 31st in 2011 and March 20th and May 27th in 2012. Visual surveys ceased when the herbaceous vegetation became too dense to view secretive snakes on the surface of the ground.



Figure 4. A prescribed burn was conducted on the Liston property on 3/28/2011 to aid in visual searching for snakes.

Visual surveys were mainly conducted during preferred weather conditions which includes an ambient air temperature between 50-75° F, substrate temperature at or over 50° F, sustained wind speeds less than 20 mph, and less than 50% cloud cover. Search time was equal to or greater than 2.0 man hours per acre, over the survey period. Survey crews formed a line with 5-10 ft. between each individual and slowly walked each area in a grid type fashion to cover each site in a systematic and complete manner (Figure5).



Figure 5. James Belanger conducts visual searches on May 18, 2009

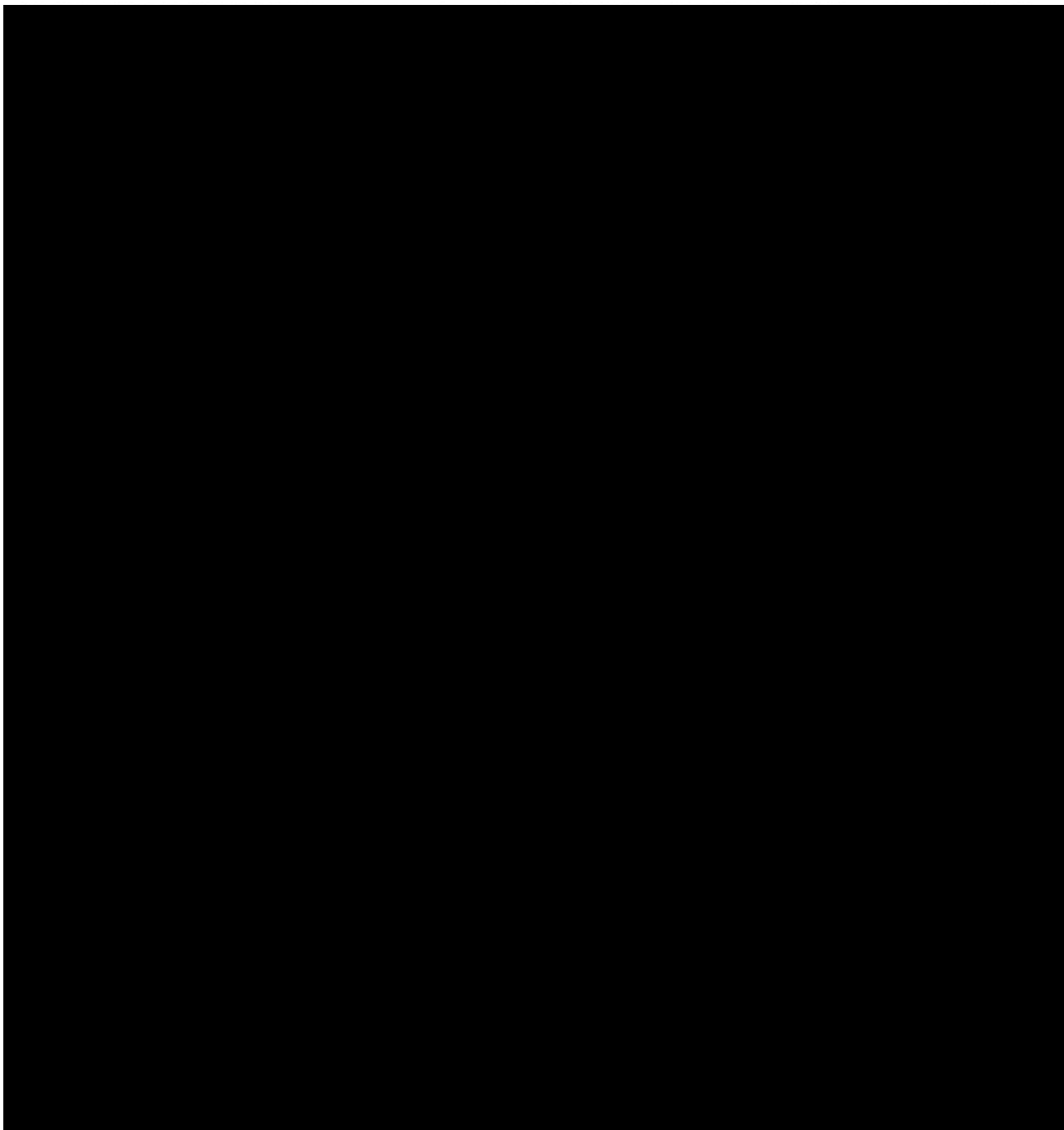


Figure 3. Visual eastern massasauga rattlesnake searches in Knox County. Labels include the name of the land owner and designation as dry, upland community (D) or wet, low-lying community (W).

Coverboard Surveys: In 2011, thirty corrugated metal coverboards, measuring 3 ft. x 3 ft. were installed at six locations on public and private land in Knox County (Appendix A). The area under the boards was cleared of vegetation using a brush cutter and coverboards were placed in late winter of 2011. Surveys were conducted in the morning to avoid hot temperatures under the metal coverboards. Twenty nine coverboards were surveyed in 2012 and only 15 boards were surveyed in 2013.

Coverboard locations included two wetlands (north: boards 6-10; south: board 30), a prairie registered in the Conservation Reserve Program (CRP) (boards 11-15), a wet pasture (boards 16-20), a CRP prairie waterway (boards 21-24), a wet prairie (boards 25-29), and in prairie and reed canary grass at Massasauga Prairie Nature Preserve (boards 1-5). Appendix A shows the locations of the coverboards and their corresponding GPS coordinates. In 2011 coverboards were checked for 12 days from April 23rd to May 31st and 46 days from June 2nd to August 30th. Coverboard surveys in 2012 were conducted for 43 days from March 20th to May 27th and 4 days from June 24th to August 30th. In 2013, coverboards were placed at three new sites on the Liston property, within wetland (boards 1-5), forest (boards 6-10), and prairie (11-15) communities (Figure 8). These boards were checked for 18 days between April 3rd and May 3rd of 2013.

Live Traps: Two 300 ft. drift fences were installed east of the intersection of 600 E Rd and 825 N Rd in Knox County (Appendix B). Drift fences were not erected at Massasauga Prairie Nature Preserve to avoid disturbance to the high quality prairie community. Forty eight modified minnow traps were placed approximately equidistant from one another (25 feet) and in pairs on each side of the fence (Figure 6). The exceptions were the first 2 days of each survey when only 24 and 32 traps were set down. Traps were checked and weather conditions were recorded every morning during the period that the traps were in place. Monitoring was completed in the fall of 2011 and 2012 from September 15th to October 30th and in the spring of 2012 from March 20th to May 27th. In the fall of 2011 there were 42 trap nights, 43 trap nights in the spring of 2012, and 33 in the fall of 2012. The species of snakes trapped, as well as the side of the fence they were trapped on, was recorded. Captured animals were released on the opposite side of the drift fence.



Figure 6. Traps were place in pairs on each side of the silt fence, approximately 25 feet apart.

Results:

Two hundred seventy six snakes were observed during the three years of surveys. It is not known if these were all unique individuals as no captured snakes were marked. Six snake species were recorded, including Dekay's brown snake (*Storeria dekayi*) (N= 38), garter snakes (*Thamnophis* spp.) (N = 207), redbellied snake (*Storeria occipitomaculata*) (N = 25), milk snake (*Lampropeltis triangulum*) (N = 1) western fox snake (*Elaphe vulpina*) (n = 4), and northern water snake (*Nerodia sipedon*) (N = 1). Unfortunately, none of the surveys yielded any eastern massasauga sightings.

Dekay's brown snakes were almost exclusively observed during the coverboard surveys (28/29 = 96%). Similarly, 88% (22/25) of redbellied snakes and 77% (161/207) of garter snakes were observed during coverboard surveys. On the other extreme, milk snakes were observed only in the drift fence live traps and the northern water snakes were only observed through visual searches, albeit both had very small sample sizes (1). The western fox snake was observed during all 3 search methods. Tables 1 and 2 provide a breakdown of the number of species that were observed by a particular method in a given year.

The number of snakes observed in drier uplands was lower (42%) than the number observed in wetter, low lying habitats (58%). Surveys of dry, upland sites resulted in 20 snakes observed under coverboards and 3 snake observations from visual searches over all years and seasons, whereas 28 snakes were found under coverboards and 3 during visual searches in wet, low-lying areas.

Visual Searches: During visual searches in 2011, survey crews found three garter snakes, three redbellied snakes, one northern water snake, and one western fox snake across all sites. In 2012, four garter snakes were recorded across all sites. The study yielded 0.14 snakes/hour in 2011 and 0.03 snakes/hour searched in 2012. These numbers calculate to one snake observation per 17 man hours searching time when averaged over both years. Table 3 provides the capture per unit effort for all search methods.

Coverboard Surveys: In the spring of 2011 and 2012, surveyors reported an average of seven Dekay's brownsnakes and 17 garter snakes. In the summer of 2011 and 2012, 10 Dekay's brownsnakes, 57 garter snakes, and 3 redbellied snakes were recorded on average. At Massasauga Prairie, one Dekay's brownsnake, one garter snake, and three redbellied snakes were found on average in the spring of 2011 and 2012. One garter snake and one western fox snake were found on average in the summer 2011 and 2012.

Live Traps: An average of 13 garter snakes was found per trapping season from fall 2011 to fall 2012. A single milk snake, fox snake, and brown snake were also found in fall 2011. Of the snakes that were noted as having been found on a certain side of the fence, 46% were found on the west side of the fence and 54% were found on the east side.

Unfortunately part of the Knox County data from summer 2012, fall 2012, and spring 2013 were lost when a student moved from one home to another. This resulted in fewer garter and redbellied snakes reported in the final report than were actually documented.

Appendix C provides a breakdown of the number of snakes observed across all detection methods, seasons, years, and location.

Table 1. Snake species encountered during surveys in Knox County 2011-2013.

		Western Fox Snake <i>Elaphe vulpina</i>	Milk Snake <i>Lampropeltis triangulum</i>	Northern Water Snake <i>Nerodia sipedon</i>	Dekay's Brownsnake <i>Storeria dekayi</i>	Red-bellied Snake <i>Storeria occipitomaculata</i>	Garter Snakes <i>Thamnophis</i> spp
Number of Individuals in 2011	Coverboards 58 days Spring & Summer	1	0	0	27	5	112
	Visual Survey 58 man hours	1	0	1	0	3	3
	Drift Fence - Fall 42 trap nights	1	1	0	1	0	12
	Total	3	1	1	28	8	127
Number of Individuals in 2012	Coverboards 43 days Spring & Summer	0	0	0	7	6	37
	Visual Survey 129 man hours	0	0	0	0	0	4
	Drift Fence- Spring 43 trap nights	0	0	0	0	0	21
	Drift Fence- Fall 33 trap nights	0	0	0	0	0	6
	Total	0	0	0	7	6	68
Number of Individuals in 2013	Coverboards 18 days Spring	0	0	0	2	6	10
	Total	0	0	0	2	6	10
TOTAL 2011-2013		3	1	1	37	20	205

Table 2. Snake species encountered during surveys at Massassauga Prairie Nature Preserve, Warren County, 2011-2013.

		Western fox snake <i>Elaphe vulpina</i>	Milk snake <i>Lampropeltis triangulum</i>	Northern water snake <i>Nerodia sipedon</i>	Dekay's brownsnake <i>Storeria dekayi</i>	Redbellied snake <i>Storeria occipitomaculata</i>	Garter snakes <i>Thamnophis spp</i>
Number of Individuals in 2011	Coverboard 58 days Spring & Summer	1	0	0	0	0	1
	Visual Survey	0	0	0	0	0	0
	Total	1	0	0	0	0	1
Number of Individuals in 2012	Coverboard 43 days Spring & Summer	0	0	0	1	5	1
	Visual Survey	0	0	0	0	0	0
	Total	0	0	0	1	5	1
TOTAL 2011-2012		1	0	0	1	5	2

Table 3. Catch per unit effort between years for all survey methods in Knox County, Illinois.

Survey Type	Catch Per Unit Effort (CPUE)			MEAN
	2011	2012	2013	
Coverboards (captures per trap day)	0.83	0.04	0.07	0.06
Live Traps (captures per trap day)	0.007	0.003	N/A	0.005
Visual Surveys (snakes per hour)	0.14	0.03	N/A	0.06

Discussion:

Because of missing survey data, the total number of garter and red bellied snakes is underreported here, making analysis difficult. Nevertheless, there was a low diversity and low total number of snakes found at these sites during the study.

It would be difficult to analyze the coverboard and drift fence data in a meaningful way as there was not much replication from year to year. Coverboard searching received similar intensity in 2011 and 2012 at 58 and 43 respectively. However, a majority of the searches in 2011 occurred during the summer and in 2012 they were conducted in the spring. In addition, spring 2012 coverboard searches occurred a full month earlier than in 2011. Similarly, drift fence numbers are skewed by season; the 2011 results are from the fall only and the 2012 results include both the spring and fall.

Even the visual surveys are difficult to correlate to one another. The 2012 season had more than twice as many hours (129 hours) as the 2011 visual searches (58 hours) because there was an additional warm month earlier in the spring to survey. Many of those late March searches could have been completed before snakes were out and active. In addition, not each site that was burned in 2011 was burned in 2012. And finally, the search intensity differed between sites and years as well.

Weather conditions may have adversely affected searching in some periods of this study. Spring 2011 was unusually wet followed by unusually dry conditions in the summer and fall. Soil was extremely dry, even under coverboards. An unseasonably warm spring early in 2012 caused vegetation to grow quickly which resulted in poor conditions for visual surveys. Drought conditions from below normal rainfall extended from summer 2011 through the end of 2012. Climate observations are from the National Weather Service (<http://www.nws.noaa.gov>).

Other than poor weather sometimes affecting searching conditions, there is no explanation for the low diversity and total number of snakes encountered in Knox County and at Massasauga Prairie Nature Preserve. All habitats in the study area appear to be favorable for snakes and few disturbances were noted in the study areas during the surveys. Small mammals were captured in the live traps which would indicate a good food source for snakes.

One positive aspect of the study is that we had many opportunities to talk to landowners and others who traveled the roads in this area. The drift fence was near a road intersection and many people stopped to talk to us while we were checking live traps. We passed out informational brochures to landowners and gave DNR contact information to anyone to whom we talked. Most

passersby had stories about encounters with eastern massasauga rattlesnakes from 20-40 years ago. Unfortunately, we did not hear of any recent familiar observations. We are hopeful that any additional massasauga rattlesnake encounters will be reported to us because of the public relations effort put forth during the study.

Because of the large amount of habitat available at the Knox County sites, additional rattlesnake surveys should be conducted. There are many acres of marginal wetland and upland areas which have not been searched. Massasauga Prairie Nature Preserve received the least search time during this study and should be surveyed again for massasauga rattlesnakes. Although the protected area in the Nature Preserve is small, it is possible that massasaugas still inhabit the site in low numbers.

Appendix D provides a summary of the budgetary expenditures over the life of the grant.

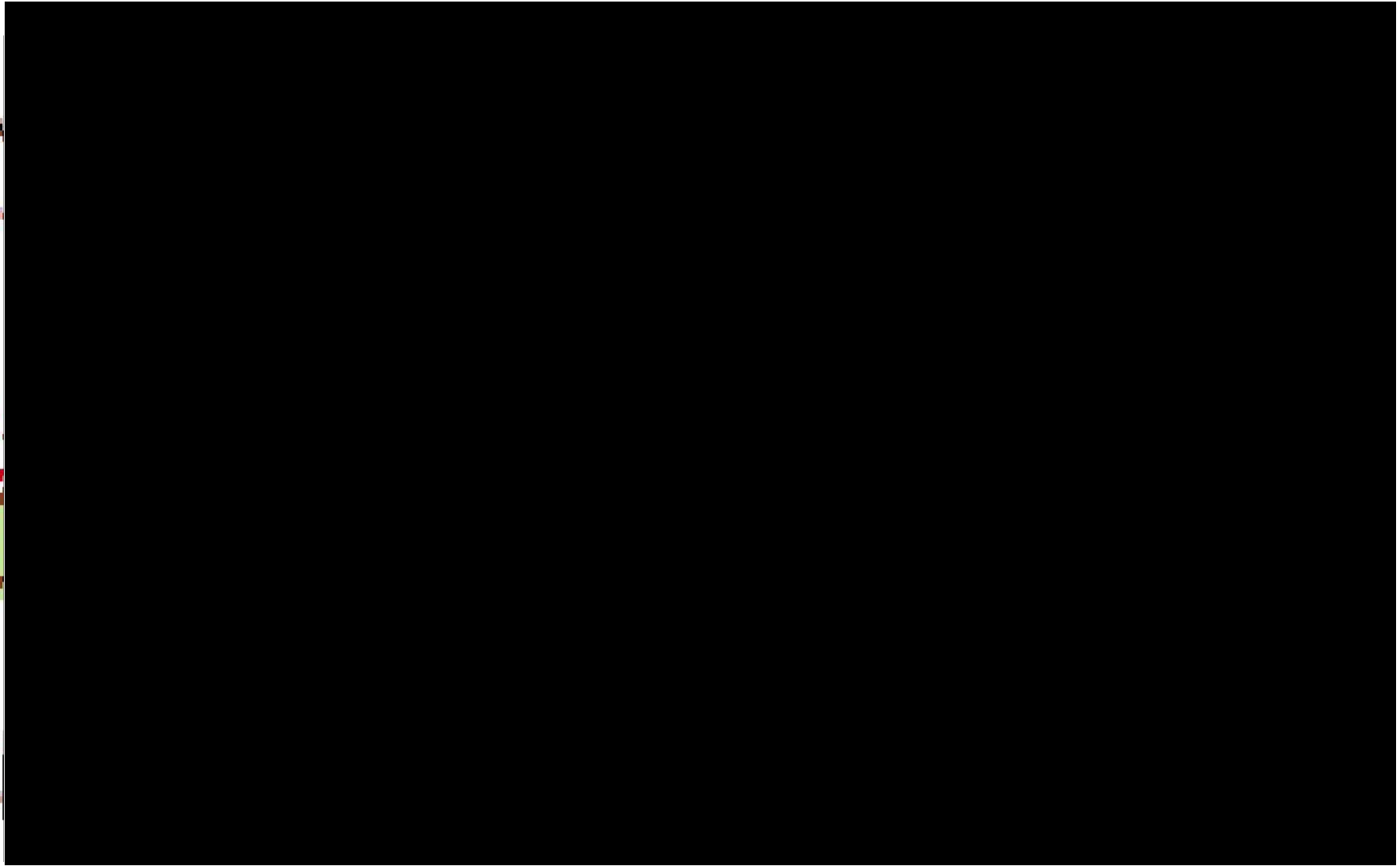
Summary:

Eastern massasaugas have been documented in Knox County at six separate locations and were last seen in 2010. A population of massasaugas also historically occurred at Massasauga Prairie Nature Preserve, with the most recent sighting in 1972. The purpose of this project was to contract survey teams to conduct comprehensive snake surveys in Knox County at locations known to have recent or historic eastern massasauga rattlesnake occurrences and in areas of adjacent suitable habitat. This study included visual surveys, coverboard surveys, and live trapping along 600 feet of drift fence. No massasauga rattlesnakes were located during the study in Knox County or at Massasauga Prairie Nature Preserve. Despite large acreage of appropriate snake habitat, the diversity and total number of snakes encountered were low. Six snake species were recorded, including Dekay's brownsnake (*Storeria dekayi*), garter snakes (*Thamnophis* spp.), redbellied snake (*Storeria occipitomaculata*), milk snake (*Lampropeltis triangulum*) western fox snake (*Elaphe vulpina*), and northern water snake (*Nerodia sipedon*). Further surveys should be conducted for massasauga rattlesnakes at Massasauga Prairie Nature Preserve and in previously unsurveyed locations of appropriate habitat in Knox County.

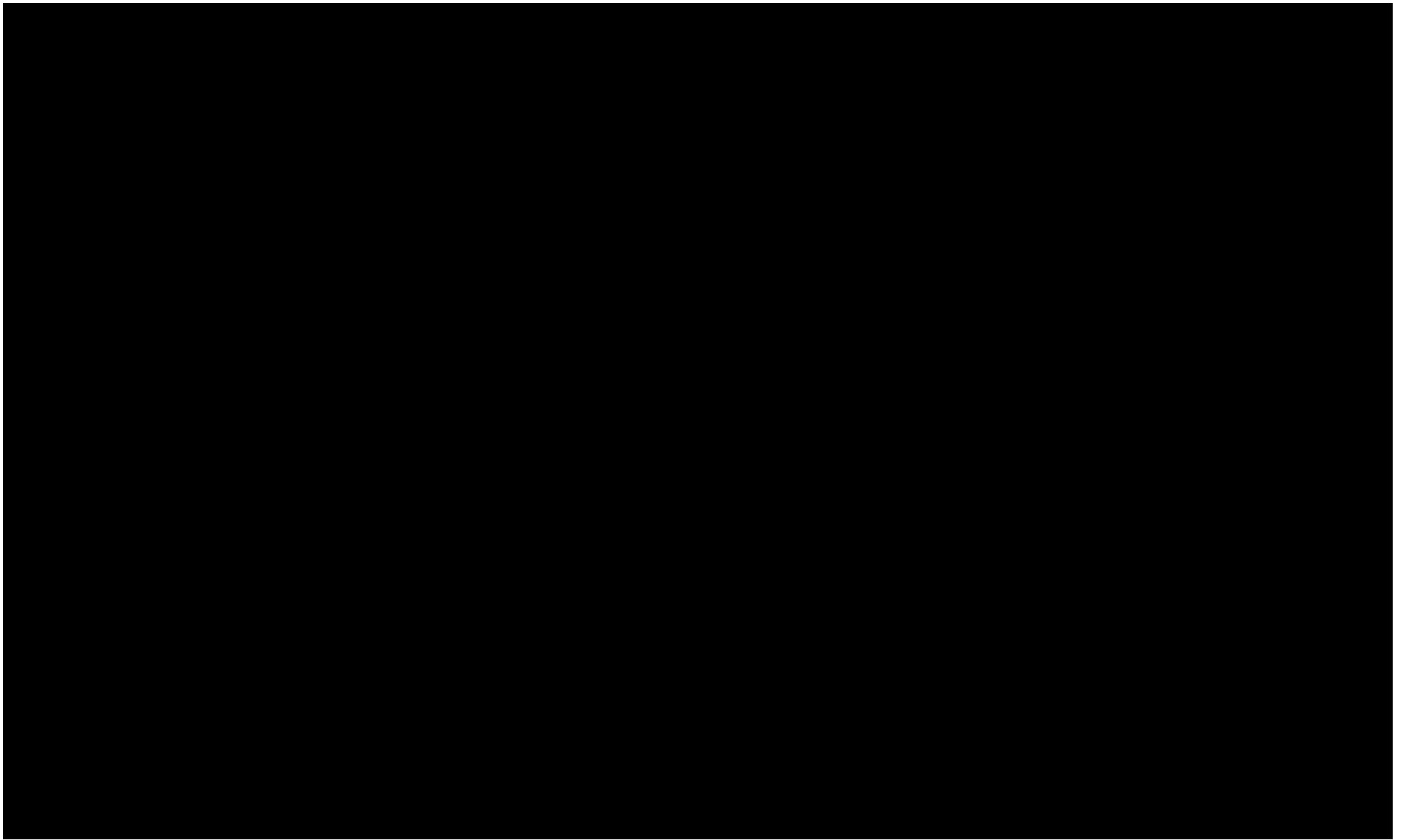
References

- Atkinson, D. A. and M. G. Netting. 1927. The distribution and habits of the massasauga. Bull. Antivenin Inst. America. 1:40-44.
- Brown, W. S., and W. S. Parker. 1976. A ventral scale clipping system for permanently marking snakes (Reptilia, Serpentes). J. Herpetol. 10:247-249.
- Hay, O. P. 1893. The batrachians and reptiles of the state of Indiana. Ann. Rept. Dept. Geol. Nat. Res. of Indiana 17:534-536.
- Herkert, J. R. 1994. Endangered and threatened species of Illinois: status and distribution, Volume 3-1994 Changes to the Illinois list of endangered and threatened species. Illinois Endangered Species Protection Board, Springfield, Illinois.
- Smith, P. A. 1961. The amphibians and reptiles of Illinois. Illinois Natural History Survey Bulletin 28:1-298.

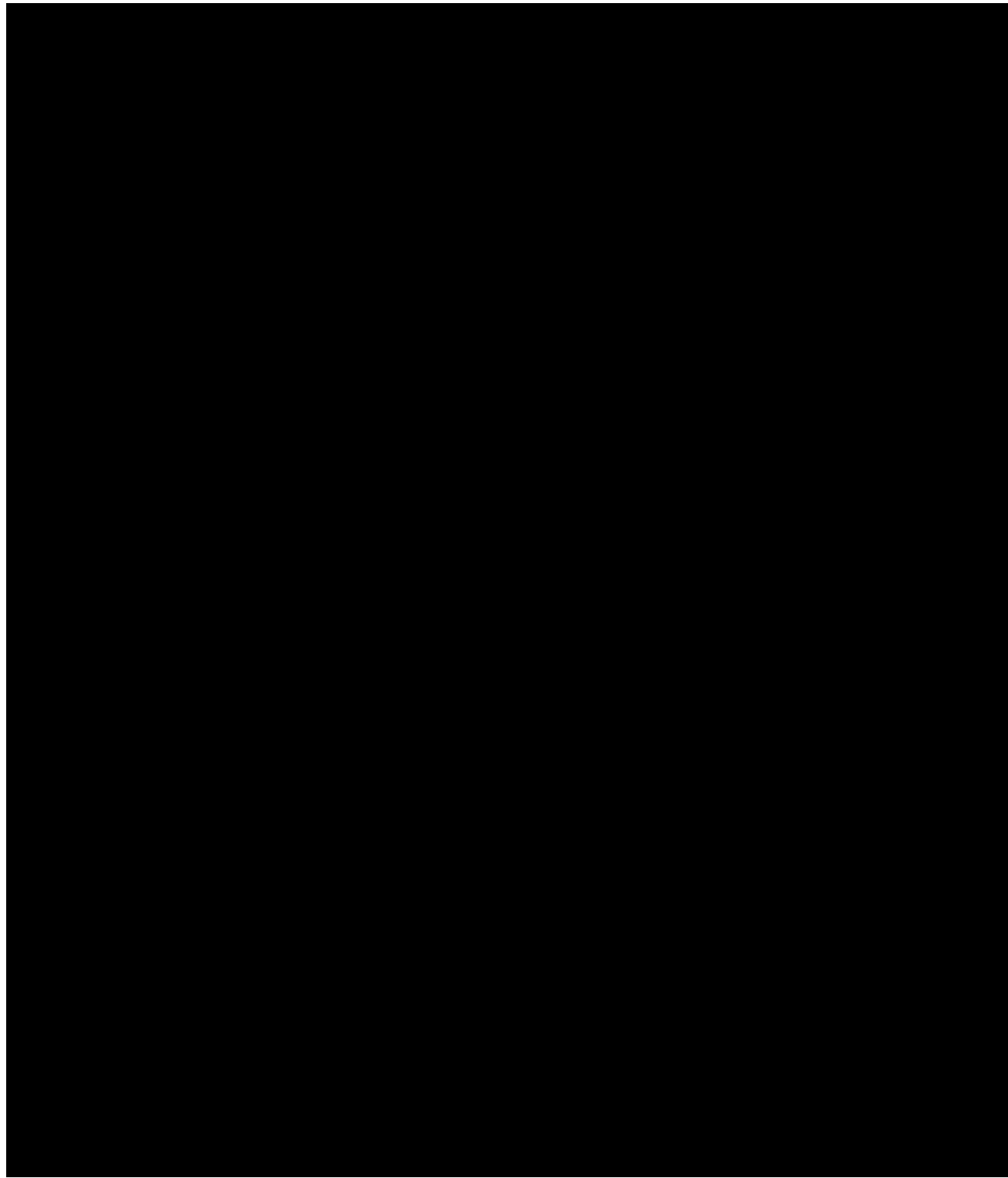
APPENDIX A
Coverboard Placement in Knox and Warren Counties



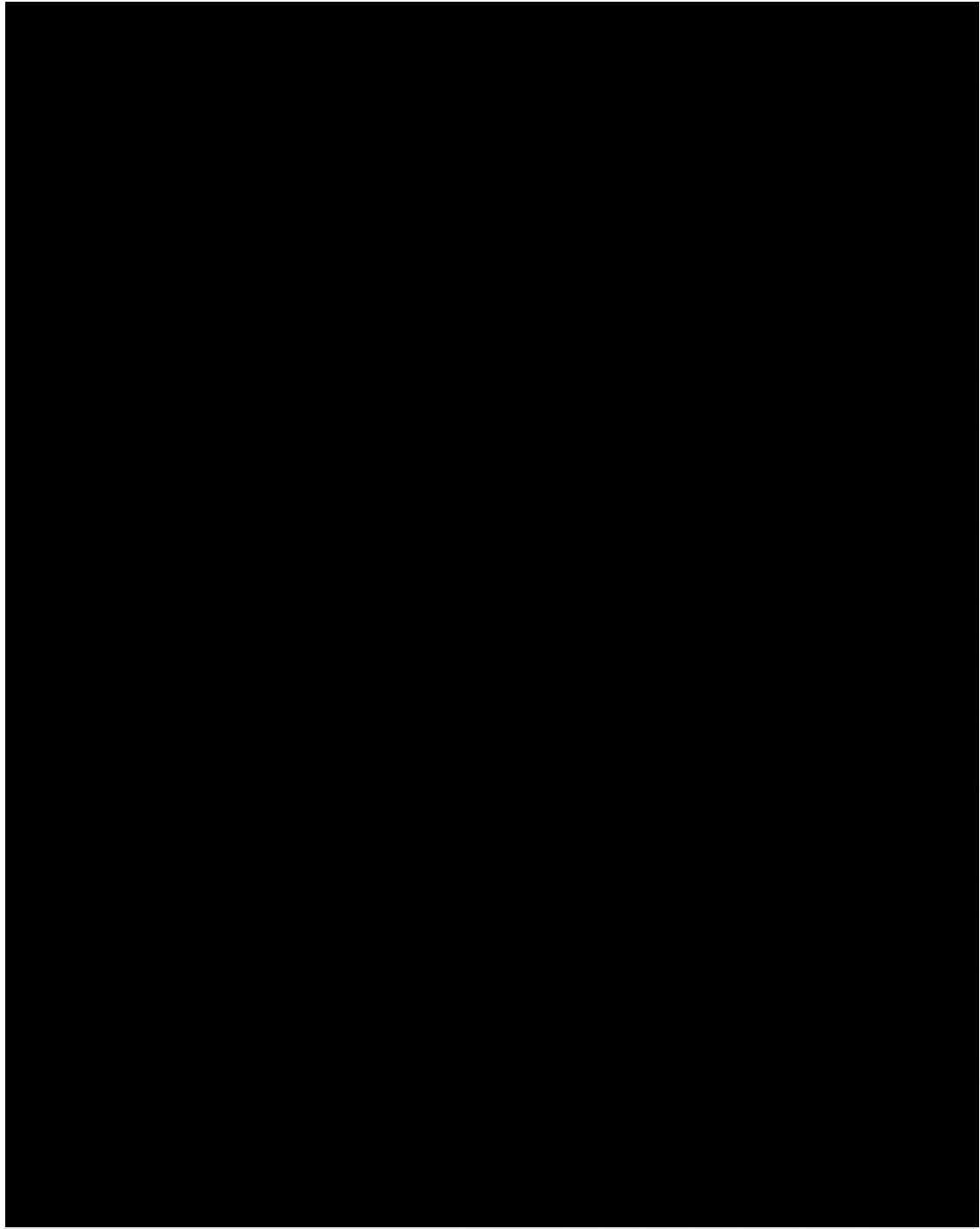
Warren County 2011 and 2012 eastern massasauga rattlesnake coverboard survey locations. [REDACTED].



All Knox County, 2011 and 2012 eastern massasauga rattlesnake coverboard survey locations; [redacted]
[redacted]



Details of Knox County 2011 and 2012 eastern massasauga rattlesnake coverboard survey locations; [REDACTED]



Knox County 2013 eastern massasauga rattlesnake coverboard survey locations. [redacted]
[redacted]

APPENDIX B
Location of Drift Fence

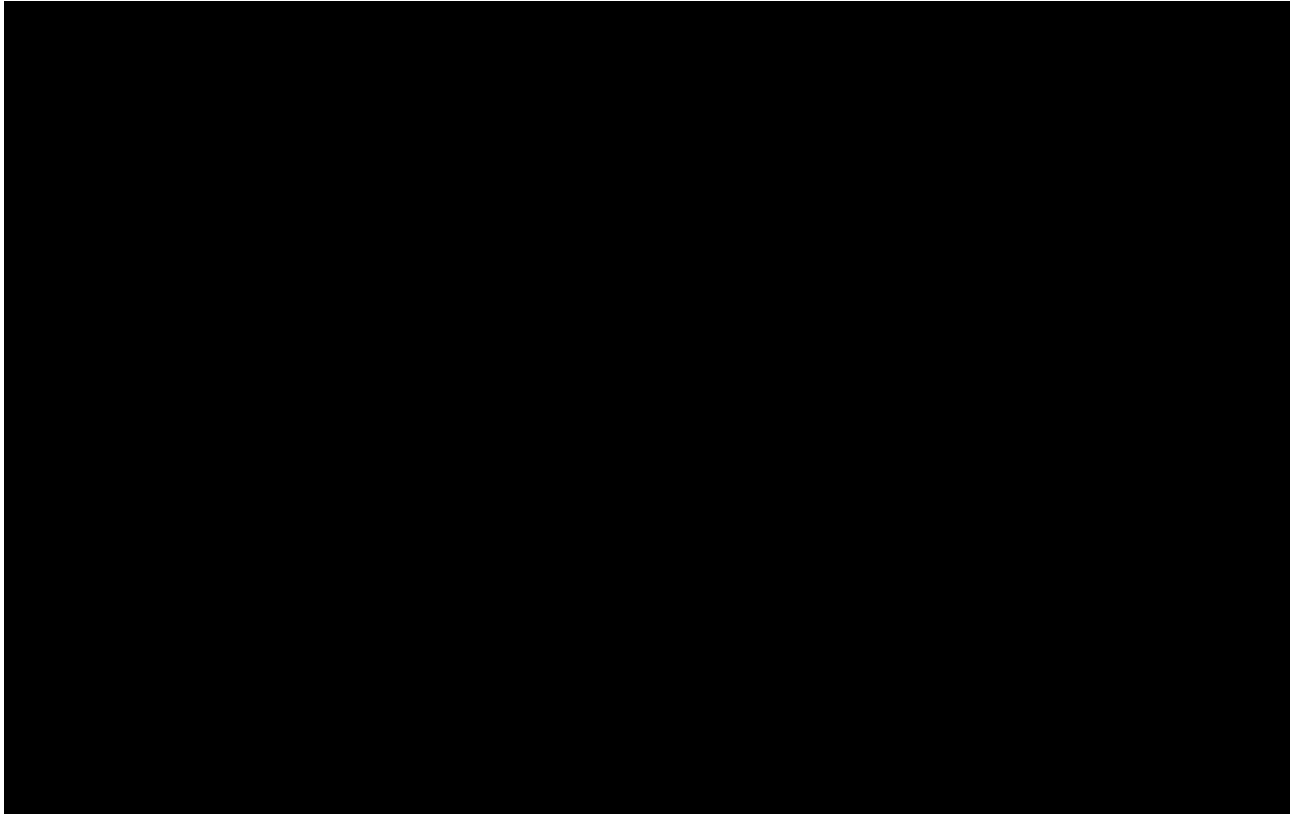


Figure 9. Distant (left) and close up aerial views (right) of the silt fence placement based on recent massasauga sightings (red dots) in Knox County.

APPENDIX C
Summary of the Snakes Observed Across all Detection
Methods, Seasons, Years, and Locations.

Appendix C. Results from 2013 coverboard surveys by site and season.

	Liston Wetland (1-5)	Liston Forest (6-10)	Liston Prairie (11-15)	Knox County Total
Spring 2013 (4/3/13-5/3/13)				
Number of days checked				18
Dekay's Brownsnake (<i>Storeria dekayi</i>)	0	0	2	2
Garter snakes (<i>Thamnophis</i> spp.)	6	1	3	10
Redbellied snake (<i>Storeria occipitomaculata</i>)	6	0	0	6
TOTAL	12	1	5	18
Temperature Range				41-85° F

Appendix C. Results from 2013 live trapping surveys by year and season.

	Fall 2011 (9/15/2011-10/27/11)			Spring 2012 (3/20/12-5/27/12)			Fall 2012 (9/15/12-10/30/12)		
	East Side	West Side	Total	East Side	West Side	Total	East Side	West Side	Total
# Trap Nights			42			43			33
Air Temperature Range			51-85° F			45-87° F			39-75° F
Garter snake (<i>Thamnophis</i> spp.)	7	5	12	10	10	21	2	3	6
Milk snake (<i>Lampropeltis triangulum</i>)	1	0	1	0	0	0	0	0	0
Western fox snake (<i>Elaphe vulpina</i>)	1	0	1	0	0	0	0	0	0
Dekay's brown snake (<i>Storeria dekayi</i>)	0	0	1	0	0	0	0	0	0
American toad (<i>Bufo americanus</i>)	1	0	1	0	0	0	0	0	0
Spring peeper (<i>Pseudacris crucifer</i>)	1	0	1	0	0	0	0	0	0
Other anurans	0	0	0	1	1	2	3	0	5
Voles	4	0	6	0	0	0	1	1	2
Shrews	1	1	3	0	0	0	0	0	2
Mice	0	2	3	0	0	5	0	1	1
SNAKE TOTALS			15			21			6

*Note: If the E/W side columns do not add up to the total, it is because an animal was found, but the fence side was not specified.

APPENDIX D
Budgetary Expenses

Total project expenses for Wildlife Preservation Fund Grant #RC11L20W, Eastern Massasauga Surveys in Knox and Warren Counties, Illinois

	Amount Allocated in Grant	Amount Paid with WPF	Amount paid with IDNR commodities funds	Balance
Salaries and wages w/ fringe benefits	\$ 13,980.00	\$14,551.16	\$0	-\$ 571.16
Materials & Supplies	\$0	\$0	\$768.61	
Travel	\$ 1,020.00	\$448.80	\$0	\$ 571.20
TOTAL DIRECTS	\$ 15,000.00	\$14999.96		\$ 0.04
INDIRECT COSTS	\$ 1,500.00	\$1500.04		-\$ 0.04
TOTAL BUDGET	\$ 16,500.00			\$ 0.00

Commodity expenses paid by IDNR Natural Heritage

Item	Cost
Amphibian and Reptiles of Illinois field guides (2)	\$49.50
Pillowcases, locking tubs, and bucket for transporting snakes	\$41.72
Snake tongs (5)	\$445.00
Drift fence supplies and stakes, top soil for burying fence, and landscape fabric for covering minnow traps	\$232.39
TOTAL OF EXPENSES	\$768.61