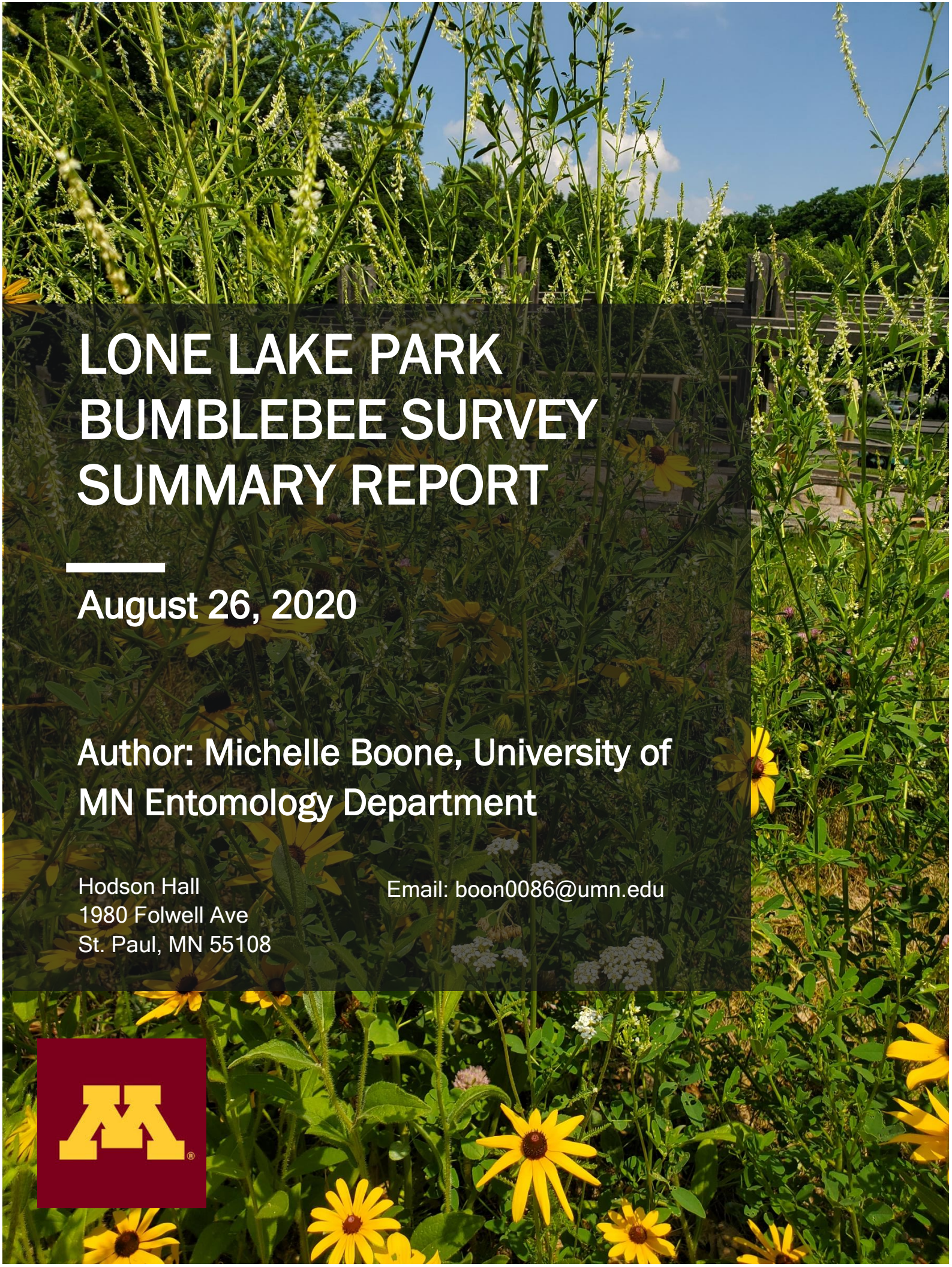

LONE LAKE PARK BUMBLEBEE SURVEY SUMMARY REPORT

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Background photo on cover page is a prairie restoration in progress near the pickleball court in Lone Lake Park, Minnetonka, MN. Photo credit: Michelle Boone.

Executive Summary

This report summarizes the findings of bumble bee surveys conducted in Lone Lake Park, Minnetonka, MN during the summer of 2020. The surveys were conducted at two areas within the park by a University of Minnesota bee researcher. The purpose of the surveys was to document the bumble bee community within the park, including the federally endangered rusty-patched bumble bee, *Bombus affinis*. Surveys were conducted six times between June 15-August 25, 2020. There were 1,033 bumble bees documented during the surveys, including one male rusty-patched bumble bee. Rusty-patched bumble bees represented less than 1% of the observed bumble bees throughout the surveys. At least nine bumble bee species were confirmed within Lone Lake Park. The flowers on which bees were observed foraging were also documented. There is not enough data on the rusty-patched bumble bee population in Minnesota to assess the proportion of the population present in Lone Lake Park. The rusty-patched bumble bee documented during these surveys confirms that this species uses the park for foraging, but there is not enough evidence to show whether the species uses the park for nesting or overwintering.

Introduction

Rusty-patched bumble bee (*Bombus affinis*) is a federally endangered species found in the Eastern United States, ranging from eastern North Dakota to the Atlantic coast, and south to Tennessee and Georgia (figure 1). Once a relatively common species, the rusty-patched bumble bee has experienced a drastic decline and has been extirpated from much of its previous range since the 1990's[1]. The species was listed as endangered under the Endangered Species Act[2] in 2017, becoming the first listed bee in the continental U.S.

The U.S. Fish and Wildlife Service (USFWS) delineates areas where rusty-patched bumble bees are likely to be present in suitable habitat (high potential zones), primary dispersal zones (low potential zones), and uncertain zones (low potential zones)[3]. The high potential zones are based on recent (2007-current) sightings of rusty-patched bumble bees, while primary dispersal zones are areas surrounding the high potential zones. Uncertain zones represent slightly older records (2000-2006). Lone Lake Park, Minnetonka, MN is located within the high potential zone for rusty-patched bumble bees.

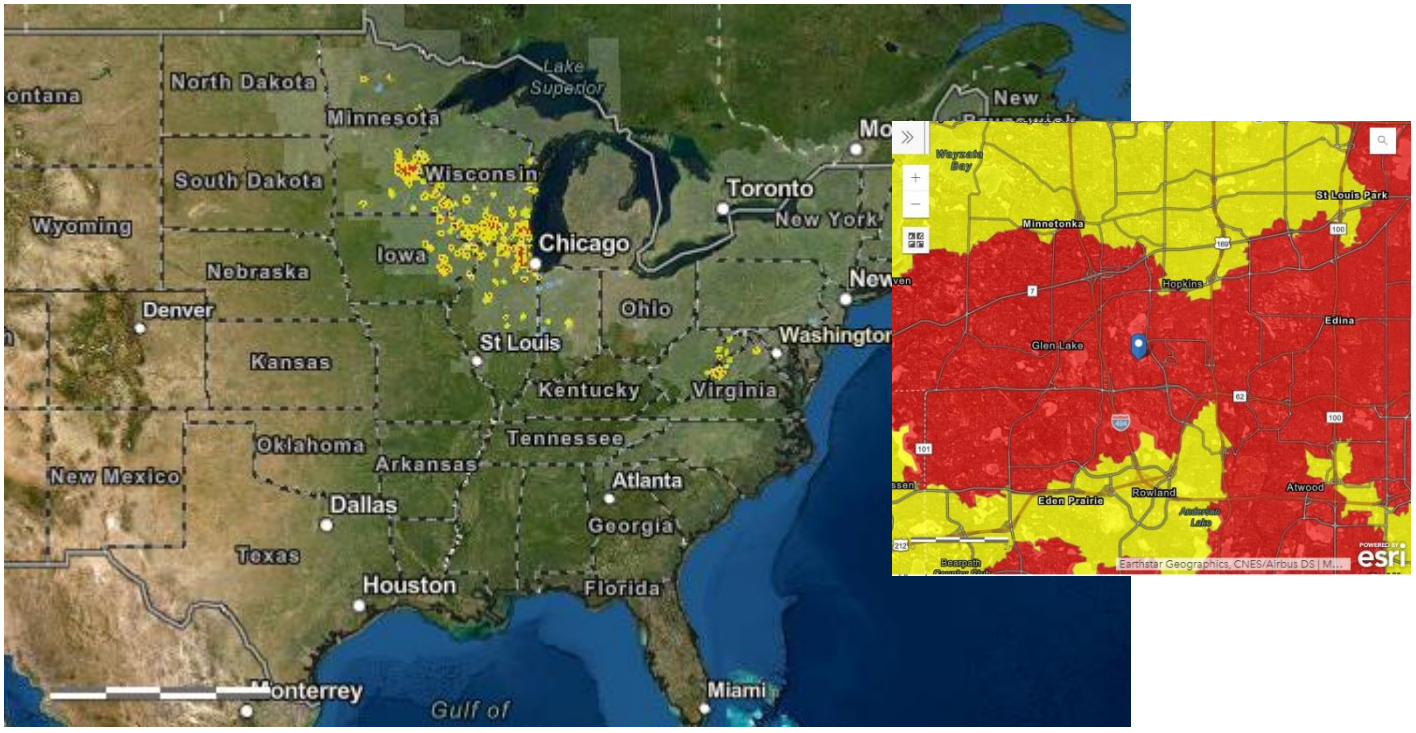

Figure 1. Rusty-patched bumblebee range map. High potential zones are red, primary dispersal zones are yellow, uncertain zones are blue, and the historic range is light greenish-gray. The map on the right shows Lone Lake Park, represented by the blue arrow. Maps courtesy of USFWS[3].

[1] Colla, S.R. and L. Packer (2008) Evidence for decline in eastern North American bumblebees (Hymenoptera: Apidae), with special focus on *Bombus affinis* Cresson. Biodivers Conserv, 17:1379-1391. DOI 10.1007/s10531 008-9340-5

[2] United States. (1983) The Endangered Species Act as amended by Public Law 97-304 (the Endangered Species Act amendments of 1982). Washington: U.S G.P.O).

[3] Range map can be found online at https://www.fws.gov/midwest/endangered/insects/rpbb/rpbbmap.html Last updated Feb. 19, 2020.

The bumble bee surveys conducted in Lone Lake Park during the summer of 2020 were completed on behalf of Minnetonka Parks by a contractor from the University of Minnesota Entomology Department. The contractor is permitted to conduct presence-absence surveys under Scientific Recovery Permit TE30472C-1 (Principal Investigator Dr. Elaine Evans). The objectives were to survey the bumble bee community in the park and document the presence of rusty-patched bumble bees.

Bumble bees require foraging habitat (i.e. blooming flowers), nesting habitat, and overwintering habitat. Rusty-patched bumble bees have been documented foraging on a wide variety of flowers. Foraging areas should be within the typical foraging range of the nest site. The maximum documented foraging distance of bumble bees is 9.8 km[4], but they typically forage within 1 km of the nest[5,6,7]. The nesting requirements of *Bombus affinis* are not well documented but there is evidence that they primarily nest underground, typically in abandoned rodent nests located from six to eighteen inches below the surface[8,9]. Occasionally nests will be constructed on the surface in areas such as clumps of grass on the ground[10] (Macfarlane *et al.* 1994). Due to the variability in their nesting habits and the lack of thorough documentation it is difficult to predict where nesting will occur. Overwintering habitat requirements are not known for rusty-patched bumble bees but are assumed to be similar to those of other bumble bees, burrowing underground or in rotting logs[11].

Survey Methods

The methodology used in these surveys can be found in the U.S. Fish and Wildlife Survey Protocols for the Rusty Patched Bumble Bee. The "Project Review" protocol for High Potential Zones was followed. The protocol recommends 1 person-hour per 3 acres of habitat and 4 equally spaced sampling periods from mid-June to mid-August[12]. Surveys were only conducted when temperatures were above 60^{o} F and there was no precipitation. Survey dates were June 15, July 2, July 17, July 31, August 11, and August 25, 2020.

Two areas of suitable habitat were surveyed within Lone Lake Park (figure 2). These areas will be referred to as the east side (or rain garden site), located between the pickleball and tennis courts, and the west side (or nine-mile creek site), located north of Rowland Rd. Each site was surveyed for one hour on each date. A timer was started at the beginning of each survey. During each survey at both sites, one individual of each bumble bee species observed was netted, chilled on ice, photographed, and released for identification verification. All rusty-patched bumble bees were netted and photographed for documentation. The timer was paused during these activities so that one hour of

[4] Goulson, D., & Stout, J. C. (2001). Homing ability of the bumblebee *Bombus terrestris*(Hymenoptera: Apidae). *Apidologie*, *32*(1), 105–111. https://doi.org/10.1051/apido:200111
[5] Dramstad, W.E. (1996) Do bumble bees (Hymenoptera: Apidae) really forage close to their nests? Journal of Insect Behavior. 9:163-182.
[6] Osborne, J.L., S.J. Clark, R.J. Morris, I.H. Williams, J.R. Riley, A.D. Smith, D.R. Reynolds, and A.S. Edwards. 1999. A landscape-scale study of bumble bee foraging range and constancy, using harmonic radar. Journal of Applied Ecology 36:519-533.
[7] Rao, S., & Strange, J. P. (2012). Bumble bee (Hymenoptera: Apidae) foraging distance and colony density associated with a late-season mass flowering crop. *Environmental Entomology*, *41*(4), 905–915. https://doi.org/10.1603/EN11316
[8] Plath, O.E. 1922. Notes on the nesting habits of several North American bumble bees. Psyche 29(5-6):189-202.
[9] Plath, O. E. 1927. Notes on the nesting habits of some of the less common New England bumblebees. Psyche 34: 122-128.
[10] Macfarlane, R. P., K. D. Patten, L. A. Royce, B. K. W. Wyatt, and D. F. Mayer. 1994. Management potential of sixteen North American bumble bee species. Melanderia 50: 1-12
[11] Macfarlane, R.P. 1974. Ecology of *Bombinae* (Hymenoptera: Apidae) of Southern Ontario, with emphasis on their natural enemies and relationships with flowers. PhD, thesis, University of Guelph, Guelph, ON, Canada.
[12] USFWS (2019) Survey Protocols for the Rusty Patched Bumble Bee (*Bombus affinis*). Version 2.2.

active surveying occurred. Surveys were conducted along a meandering path in which the observer searched for bees on blooming flowers. The species and sex of all bumble bees observed during the surveys were recorded (appendix A). Two species, the black and gold bumble bee (*B. auricomus*) and the American bumble bee (*B. pensylvanicus*), appear similar and are challenging to differentiate in the field, so these two species were grouped together. The floral species on which bumble bees were foraging was also recorded (appendix B).

Survey Locations

Two locations were surveyed in the park. Each location was surveyed 6 times during the summer. The east side location (or rain garden site) is approximately 3.09 acres and includes suitable habitat near the basketball court, parking lot, pickleball court, and the field leading to the tennis court (figure 2). The west side location (or nine-mile creek site) is located north of Rowan Rd. It is approximately 2.28 acres and includes suitable habitat near the parking lot, along the trail, and within the prairie restoration running parallel to the south fork of nine-mile creek (figure 2).

Figure 2. Map of the two areas that were surveyed within Lone Lake Park in 2020. The red outline shows the area on the west side of the park, while the blue outline shows the area on the east side of the park that was surveyed. The location of the rusty-patched bumble bee observation and a bumble bee nest sighting (species not identified) are also shown. Map created using Esri ArcGIS Pro.

Findings

A total of 1,033 bumble bees were documented, representing nine to ten species (table 1, figure 3). The black and gold bumble bee and American bumble bee are difficult to distinguish in the field, so these two species were grouped together, thus there could be nine species (only one of these two species present) or ten species (both of these species present). Both species are present in this region of

Minnesota. One male rusty-patched bumble bee was observed foraging on beebalm, *Monarda fistulosa*, on July 17th in the parking lot rain garden on the East side of the park. There was also one bumble bee nest found on a slope near the pickleball court on the west side of the park. Multiple bumble bees were observed flying in and out of a hole in the ground, but the species was not identified. Bumble bee workers, males, and queens were present in the park.

Table 1. Bumble bee species observed foraging in Lone Lake Park between June 15-August 25, 2020. Unidentified species represent individuals which the observer was unable to identify because they flew away too quickly or were missing most of their abdominal hair.

***Bombus* Species**	**Common Name**	**Number of Observations**	**Proportion of Total Observations**
B. affinis	Rusty-patched bumble bee	1	<0.001
B. auricomus/*B. pensylvanicus*	Black and gold/American bumble bee	179	0.173
B. bimaculatus	Two-spotted bumble bee	294	0.285
B. citrinus	Lemon cuckoo bumble bee	76	0.073
B. fervidus	Yellow bumble bee	1	<0.001
B. griseocollis	Brown-belted bumble bee	122	0.118
B. impatiens	Common Eastern bumble bee	279	0.270
B. rufocinctus	Red-belted bumble bee	15	0.015
B. vagans	Half-black bumble bee	60	0.058
unidentified	-	6	0.006

Figure 3. Bumble bee species documented in Lone Lake Park. From right to left, top to bottom: Rusty-patched bumble bee, black and gold/American bumble bee, two-spotted bumble bee, lemon cuckoo bumble bee, brown-belted bumble bee, yellow bumble bee, common eastern bumble bee, red-belted bumble bee, half-black bumble bee, and an unidentified bumble bee.

Conclusion

This bumble bee survey, along with previous observations[13], have confirmed the presence of rusty-patched bumble bees in Lone Lake Park. The rusty-patched bumble bee represented less than 1% of the total bumble bees observed during these surveys of Lone Lake Park. For comparison, rusty-patched bumble bees were less than 1% of the observed bumble bees in the Minnesota Bumble Bee Survey[14] in parks in the Twin Cities from 2007-2019 overall. Individual parks ranged from 0-6% of observations. A roadside survey conducted by the University of Minnesota[15] in 2018 found that rusty-patched bumble bees comprised less than 1% of all bumble bee observations. Although there are current bee survey efforts in Minnesota through the University of Minnesota and Minnesota Department of Natural Resources, as well as sightings documented through community science programs such as Bumble Bee Watch and iNaturalist, there are not enough systematic studies to assess the proportion of the rusty-patched bumble bee population represented in Lone Lake Park, as the total population size is unknown at this time. There is, however, evidence that rusty-patched bumble bees forage in the park. Given typical foraging ranges of bumble bees of 1 km, it is possible that rusty-patched bumble bees may also nest within the park. The USFWS compiles data on rusty-patched bumble bees and should be contacted for inquiries regarding current known distribution.

Acknowledgements

I would like to thank Leslie Yetka, City of Minnetonka, for coordinating the bumble bee surveys. A special thank you to Dr. Elaine Evans, University of Minnesota, for the helpful feedback on this report and for providing data from the Minnesota Bumble Bee Survey. Lastly, I would like to thank Dr. Dan Cariveau for providing feedback on this report.

Appendix A: Bumble bee observations

Survey	*Bombus* species	Female count	Male count	Queen count	Total
1	*bimaculatus*	45	0	2	47
1	*auricomus_pensylvanicus*	11	0	0	11
1	*impatiens*	4	0	0	4
1	*griseocollis*	2	0	0	2
1	*vagans*	0	0	1	1
1	unknown	1	0	0	1
1	*bimaculatus*	2	0	1	3
1	*vagans*	0	0	1	1

[13] There have been 11 verified sightings of rusty-patched bumble bees in Lone Lake Park reported to the citizen science project Bumble Bee Watch since 2015. https://www.bumblebeewatch.org/ Accessed August 8, 2020.
[14] Evans, E. (2019) Minnesota Bumble Bee Survey. http://www.befriendingbumblebees.com/survey.html
[15] Evans, E., Boone, M., & Cariveau, D. (2019). Monitoring and Habitat Assessment of Declining Bumble Bees in Roadsides in the Twin Cities Metro Area of Minnesota.

2	*bimaculatus*	2	0	0	2
2	*vagans*	2	0	0	2
2	*auricomus_pensylvanicus*	4	0	0	4
2	*bimaculatus*	1	0	0	1
3	*impatiens*	39	0	1	40
3	*auricomus_pensylvanicus*	10	0	0	10
3	*bimaculatus*	43	27	2	72
3	*griseocollis*	12	7	0	19
3	*vagans*	14	1	0	15
3	*fervidus*	0	1	0	1
3	unknown	1	0	0	1
3	*citrinus*	2	0	0	2
3	*affinis*	0	1	0	1
3	*vagans*	12	0	0	12
3	*bimaculatus*	50	85	0	135
3	*impatiens*	5	0	0	5
3	*griseocollis*	8	5	0	13
3	*auricomus_pensylvanicus*	5	0	0	5
3	*citrinus*	0	8	0	8
3	*rufocinctus*	7	0	0	7
3	unknown	2	0	0	2
4	*impatiens*	98	5	1	104
4	*bimaculatus*	9	1	1	11
4	*griseocollis*	23	8	0	31
4	*vagans*	7	0	0	7
4	*auricomus_pensylvanicus*	70	0	0	70
4	*citrinus*	0	19	0	19
4	*rufocinctus*	1	1	0	2
4	*impatiens*	21	0	0	21
4	*bimaculatus*	12	7	0	19
4	*griseocollis*	0	40	0	40
4	*auricomus_pensylvanicus*	19	0	0	19
4	*vagans*	6	0	0	6
4	*citrinus*	0	39	0	39
4	unknown	2	0	0	2
5	*impatiens*	25	4	0	29
5	*bimaculatus*	1	1	0	2
5	*griseocollis*	1	6	0	7
5	*vagans*	2	0	0	2
5	*auricomus_pensylvanicus*	42	1	0	43
5	*citrinus*	0	2	0	2
5	*rufocinctus*	3	0	0	3
5	*impatiens*	12	12	0	24
5	*bimaculatus*	0	2	0	2

5	*griseocollis*	0	8	0	8
5	*vagans*	2	0	0	2
5	*citrinus*	0	4	0	4
5	*auricomus_pensylvanicus*	5	0	0	5
5	*rufocinctus*	1	0	0	1
6	*impatiens*	4	21	0	25
6	*auricomus_pensylvanicus*	5	1	0	6
6	*griseocollis*	0	2	0	2
6	*citrinus*	0	0	1	1
6	*rufocinctus*	0	0	1	1
6	*vagans*	2	1	0	3
6	*impatiens*	5	22	0	27
6	*auricomus_pensylvanicus*	6	0	0	6
6	*vagans*	5	4	0	9
6	*citrinus*	0	1	0	1
6	*rufocinctus*	0	0	1	1

Appendix B: Floral species on which bumble bees were seen foraging

Scientific name	Common name	Native or non-native to MN
Agastache foeniculum	Blue giant hyssop	Native
Baptisia australis	Blue false indigo	Non-native
Chelone lyonii	Pink turtlehead	Non-native
Cirsium discolor	Field thistle	Native
Cornus racemosa	Gray dogwood	Native
Erigeron sp.	Fleabane	Native
Eupatorium perfoliatum	Common boneset	Native
Eutrochium maculatum	Joe-pye weed	Native
Helenium autumnale	Common sneezeweed	Native
Helianthus occidentalis	Fewleaf sunflower	Native
Lotus corniculatus	Birds-foot trefoil	Non-native
Melilotus officinalis	Yellow sweet clover	Non-native
Monarda fistulosa	Beebalm	Native
Penstemon digitalis	Foxglove beardtongue	Native
Persicaria pensylvanica	Pennsylvania smartweed	Native
Rosa blanda	Smooth wild rose	Native
Rubus sp.	Raspberry	Native
Rudbeckia hirta	Black-eyed Susan	Native
Securigera varia	Crown vetch	Non-native
Solidago canadensis	Canada goldenrod	Native
Trifolium pretense	Red clover	Non-native
Trifolium repens	White clover	Non-native
Verbena hastata	Blue vervain	Native
Vicia cracca	Tufted vetch	Non-native