Census Route Study of Regal Fritillary (Speyeria idalia) At Sand Ridge State Forest, Mason County, Illinois

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ABSTRACT: An assessment of occurrence of state-endangered Speyeria idalia, the Regal fritillary butterfly, was conducted at Sand Ridge State Forest in Mason County, Illinois. Different grassland communities throughout Sand Ridge that were determined by LaGesse et al. 2004 as Regal fritillary use areas were surveyed. Eleven transects were sampled fifteen times during the growing season in 2005. 1717 total sightings of Regal fritillary butterflies were documented. The adult male population peaked at 491 individuals on 19 June. The adult female population peaked at 83 individuals on 3 July. Regal fritillaries most often occurred in wildlife plantings (61.8% of sightings) and degraded sand prairie (33% of sightings).

INTRODUCTION

Butterflies dependent on prairie have declined nationwide due to habitat destruction. Habitat loss is one of the leading factors causing the decline of the Regal fritillary *Speyeria idalia* (Drury) in the Great Plains. On a national level, the Regal fritillary has experienced dramatic declines throughout its historic range, and only three populations currently exist in states east of Illinois (NatureServe 2004).

Regal fritillary populations have also declined in Illinois, causing this butterfly to be listed as endangered by the Illinois Endangered Species Protection Board (Herkert 1992). Currently, Mason and Cass counties contain the largest known metapopulations (Wiker, 2004, Hess 2004, pers. com.). One population exists at Sand Ridge State Forest (SRSF) in northern Mason County.

Habitat loss has also reduced native violet populations, the larval food of this insect (LaGesse, et al. 2004). Larvae of Lepidoptera, in general, are very specific in their feeding requirements and, in many cases, require a specific species within a genus (Ehrlich and Raven 1964). The purpose of this study was to establish land usage requirements for Regal Fritillary Butterflies at SRSF and to start to develop baseline population studies for the SRSF Regal Butterfly population .

Description of the Study Site

SRSF is located in Mason County in west central Illinois within the Illinois River Section of the Mississippi and the Illinois Rivers Sand Areas Natural Division (Schwegman et al. 1973). Glacial melt waters formed this extensive sand deposit at the end of the last glacial epoch

approximately 11,000 years ago. Subsequent wind action created dune and swale topography, known as the Parkland Formation, that typifies much of Mason County (Willman and Frye 1970).

The climate of SRSF is continental, characterized by hot summers and cold winters. Based upon data from Havana approximately 15 km to the west, the mean annual precipitation is 96.0 cm, most of which falls as precipitation during spring months. May, with a mean average of 11.3 cm, is usually the month of greatest rainfall. July, with a mean annual temperature of 24.6 degrees C, is usually the warmest while January, with a mean annual temperature of –5.0 degrees C, is usually the coldest. The average number of frost-free days per year is 173, but this figure varies from 140 to as much as 206 days per year (Midwest Regional Climate Center 2002).

The Mason County soil survey places most soils within SRSF in the Plainfield-Bloomfield Soil Association. One of the primary soil types within this association, Plainfield fine sandy loam, is a major soil within SRSF. This soil may contain up to 98 % sand, and is known to occur on gently sloping to steep areas such as dunes. This soil is excessively drained, and often subject to wind erosion when the vegetative cover is removed. Bloomfield Fine Sandy Loam is also an excessively drained soil that contains a high percentage of sand. It occurs along terraces and gently rolling dunes. Like Plainfield soils, this soil is also subject to wind erosion. The native vegetation is scrub oaks and hickories (Calsyn 1995).

The most common plant community within SRSF is deciduous woodland that is comprised of black oak (*Quercus velutina* Lam.), blackjack oak (*Quercus marilandica* Muench), mockernut

hickory (*Carya tomentosa* (Poir.) Nutt.), and small numbers of black hickory (*Carya texana* Buckl.). Mature dry sand prairie, present in swales and other sites, consists of little bluestem (*Schizachyrium scoparium* (Michaux.) Nash), eastern prickly pear cactus (*Opuntia humifusa* (Raf.) Raf.), western ragweed (*Ambrosia psilostachya* DC), and panic grass (*Dichanthelium villosissimum* (Nash.) Freckm.). Fragrant sumac (*Rhus aromatica* Ait.) sometimes forms copses within these dry sand prairie communities. Red and white pine (*Pinus resinosa* Ait. and *P. strobus* L.) plantations are present throughout SRSF, and pine seedlings have naturalized in deciduous woodland throughout much of the forest. The invasive exotic garlic mustard (*Allaria petiolata* (Bieb.) Cavara & Grande) is also firmly established in the understory.

Hart and Gleason (1907) described plant communities and insect life of the sand areas of Illinois, including portions of SRSF. Maier (1976) compiled a list of vascular plants, and Jenkins et al. (1991) conducted a study of the woody vegetation of Bishop's Woods in the southern part of SRSF. McClain et al. (2005) described plant communities of the H. A. Gleason Nature Preserve, within SRSF.

Few studies of butterfly populations of Sand Ridge are available. Though Hart and Gleason (1907) documented insect life of the sand areas, no butterflies were included. In 1913 A. G. Vestal wrote *An Association of Illinois Sand Prairies*. The only comprehensive study of butterfly populations was conducted by Sedman and Hess (1985). They documented the presence of numerous butterfly species, including the Regal fritillary, and described their habitat.

During the spring of 2004, LaGesse et al. studied the *Viola* spp. at SRSF. Populations were mapped, counted and/or plots sampled to determine density estimates and locations of violets. Regal fritillary larvae were documented feeding on *Viola rafinesquii*, Johnny Jump-up, in the wildlife plantings at SRSF. Emergent areas at for Regal butterflies at SRSF were also documented.

Natural History of the Regal Fritillary

The Regal fritillary is a large, strong flying member of the family Nymphalidae, or brush-footed butterflies. In the spring, larvae begin feeding on bird's foot violet (*Viola pedata* L.), arrow-leaved violet (*Viola sagittata* Air), and prairie violet (*Viola pedatifida* G. Don) (WDNR 2000). After completing six instars, they pupate (Scudder 1889, Wagner et al. 1997). Adult males emerge in early June and are followed by adult females approximately two weeks later (Scudder 1889; Kopper, et al. 2001). The flight dates of the Regal fritillary range from 4 June – 16 September (Sedman and Hess 1985; Wiker 2004, pers. com., LaGesse et. al., 2004).

Mating begins soon after females emerge. Males die after two weeks of mating and fertilized females enter reproductive diapause for the next two months (Nagel et al. 1991; Kopper et al. 2001). During this period females nectar on common milkweed (*Asclepias syriaca* L.), butterfly milkweed (*Asclepias tuberosa* L.), dogbane (*Apocynum spp.*), pasture thistle (*Cirsium pumilum* (Nutt.) Spreng.), boneset (*Eupatorium perfoliatum* L.) (Sedman and Hess 1985), and field thistle (*Cirsium discolor* (Nutt.) Spreng) (Zercher et al. 2002). The diapause period between mating and oviposition is the most precarious time in the life span of the Regal fritillary. If drought, disease, predation, parasitism, or other catastrophes occur, the entire brood for the following year

is at risk. By early September females begin oviposition, depositing over 1000 eggs in clusters on violets (Wagner et al. 1997; Kopper et al. 2001). The eggs hatch and larvae feed on egg cases before entering winter dormancy (Scudder 1889; Mattoon et al. 1971; Kopper et al. 2001; Zercher et al. 2002).

METHODS

Eleven transects were established in all areas identified by LaGesse et al. (2004) in which Regal fritillary butterflies were observed. The transects were established within several natural communities in SRSF including natural wildlife plantings, degraded sand prairie, timber, barrens, higher quality sand prairie, active dunes, and cool season grass plantings. Methods of observation followed Panzer (1992) and Zercher et al. (2002). Observers were trained to observe butterflies up to 10 meters on each side of the transect and to walk at a uniform pace. Teams of two walked each transect, with one person acting as the observer and one person recording data. Observers identified all butterflies to species and identified the sex of each Regal fritillary. Observers also identified behaviors of each individual fritillary along each transect segment. Teams walked transects once per week from 10:00 to 16:00 and ceased observations when temperatures rose over 100 degrees Fahrenheit. Occasionally, two days were needed to complete all eleven transects due to weather conditions. This occurred three times, twice due to high temperatures and once due to rain. Temperature and wind speed data were collected with a Kestrel ™ 3000 weather kit before and after each transect's survey. Cloud cover was estimated for each transect at the beginning of each walk. Time was recorded at the beginning and end of each transect's survey. Nectar plants were noted for each transect segment. Observations were

made through the growing season of 2005. Nomenclature for butterflies follows Miller and Brown 1981, and nomenclature for plants follows Mohlenbrock 2002.

RESULTS

Transects were sampled fifteen times between May 18th and September 20th at SRSF. Table 1 shows comprehensive detailed results of male and female Regal fritillaries found on each transect and on each date. Regal fritillaries were observed during every survey date, except for the first survey on May 18th, 2005. Table 2 provides a summary of the data and indicates the total number of sightings observed per each transect on each date. Males were observed from 27 May through 7 August 2005. The first observations of females did not occur until approximately two weeks after the first male sightings, on 14 June 2005. Females were observed through 20 September 2005. Observations of males peaked on 19 June with a total of 491 sightings on the eleven transects. Sightings of males declined rapidly through early August. Female sightings peaked on 3 July 2005 with a total of 83 individuals observed on the eleven transects. Figure 1 shows the total numbers of males and females observed on each date across all transects. Males, once their wings hardened, were observed flying, patrolling for females, and nectaring. Females were first observed to be resting in thick warm season grasses and small eastern cedars. Table 4 provides a comprehensive tally of observed behaviors. Later in the season females were observed nectaring and resting in shade in larger shrubs and cedars when temperatures were above 95 degrees Fahrenheit.

The wildlife plantings were observed to have the highest number of occurrences of Regal fritillary butterflies (61.8%) of all natural communities sampled. Even when looking at meters sampled by natural communities type, we documented 0.0389 Regal fritillary's (♂&♀) observed by meters sampled in the Wildlife Plantings. Degraded sand prairie exhibited the second most occurrences with 33% of all observations recorded and 0.029 Regal fritillary's per meter sampled

(see Table 5 and 5A). This may correlate with the abundance of Johnny Jump-up violets, one of the Regal fritillary's host plants that occur in these same areas (LaGesse et al. 2004).

The active dunes in Gleason Nature Preserve were found to be the hottest areas at SRSF. On several days, temperatures were 10-15 degrees Fahrenheit higher at Gleason than in surrounding sand prairies at SRSF. This may be due to the bowl shapes of the dune formations in the Nature Preserve. Very little butterfly activity was documented in these areas under those conditions.

Other butterfly species and blooming forbs that may have served as potential nectar sources were qualitatively monitored. Forbs in bloom observed along each transect were recorded. Table 6 shows the forb species in bloom observed on survey dates along all transects. Thirty-eight species of other butterflies were observed during the survey dates. Butterfly species observed and dates of observations are included in Table 7.

DISCUSSION

The highest number of observations of Regal fritillary activities were in the wildlife plantings and degraded sand prairie areas at SRSF. This is also where the highest numbers of *Viola rafinesquii*, Johnny Jump-up occur (LaGesse et. al. 2004). This and the location of degraded sand prairie and quality sand prairie near the wildlife plantings is one of the most important features that we need to expand on. These prairie areas are providing nectar sources that the wildlife planting currently do not provide. These small grassland areas and their future management are important for the continued survival of Regal fritillary butterflies.

We still do not know the effects of fire on the survival of Johnny Jump-up or on in-situ survival of the first instar of Regal fritillary caterpillars. These are important issues that need further study.

None of the areas documented in this study and LaGesse et al. 2004 as used by Regal fritillary butterflies has nectar sources that occur throughout the whole growing season. This likely causes Regal fritillaries to travel to find new nectar sources, increasing their vulnerability to predation, automobiles and/or getting lost in the vast systems of fire breaks at SRSF. Most nectar sources occur in prairies, field edges, along roads and/or firebreaks. Enhancing the degraded sand prairies and wildlife fields in favor of nectar sources could greatly benefit the Regal fritillary at SRSF.

One has to be very careful in interpreting population numbers from this type of observation data. We can assume population totals from a single day's data are more reliable than the overall season totals. We can assume that there were at least 491 males and 83 females present at SRSF. If so, this would be the largest population in Illinois according to the Nature Biotics 4 database at Illinois Department of Natural Resources in Springfield, Illinois. More study needs to be conducted to confirm the population size at SRSF and the status of other Regal occurrences in Illinois. Mark-Release-Recapture studies are the recommended way to document population estimates of these rare, mobile butterfly species and this should be considered for future studies of Regal fritillary butterflies at SRSF and elsewhere in Illinois.

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Volume II of the Final Environmental Impact Statement, Enhanced Training and Operations at the National Guard Training Center at Fort Indiantown Gap Prepared by Ogden Environmental and Energy Services. Cincinnati, OH.

Figure 1. Speyeria idalia Census Survey 2005

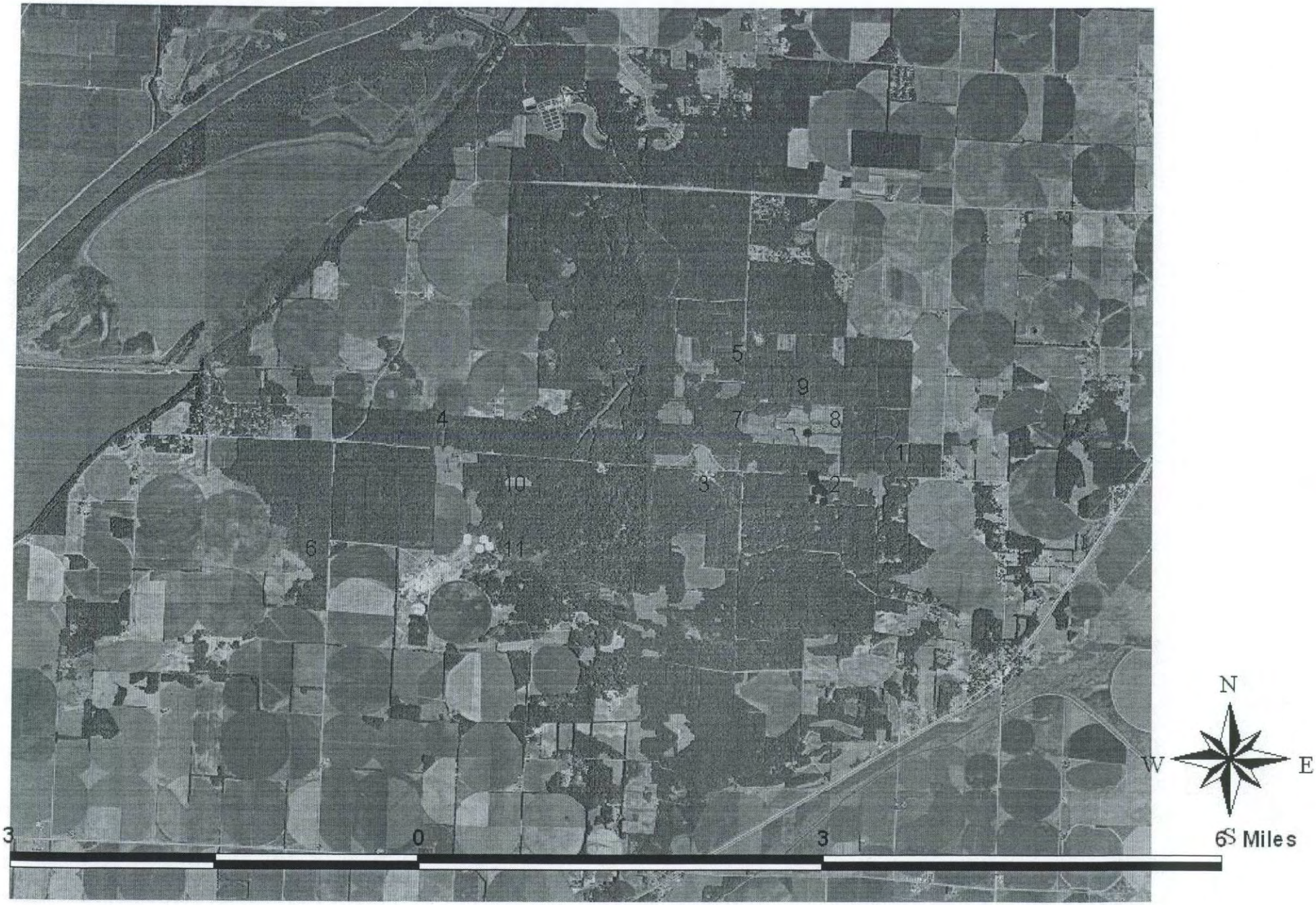


Figure 1. Total *Speyeria idalia* sightings per date

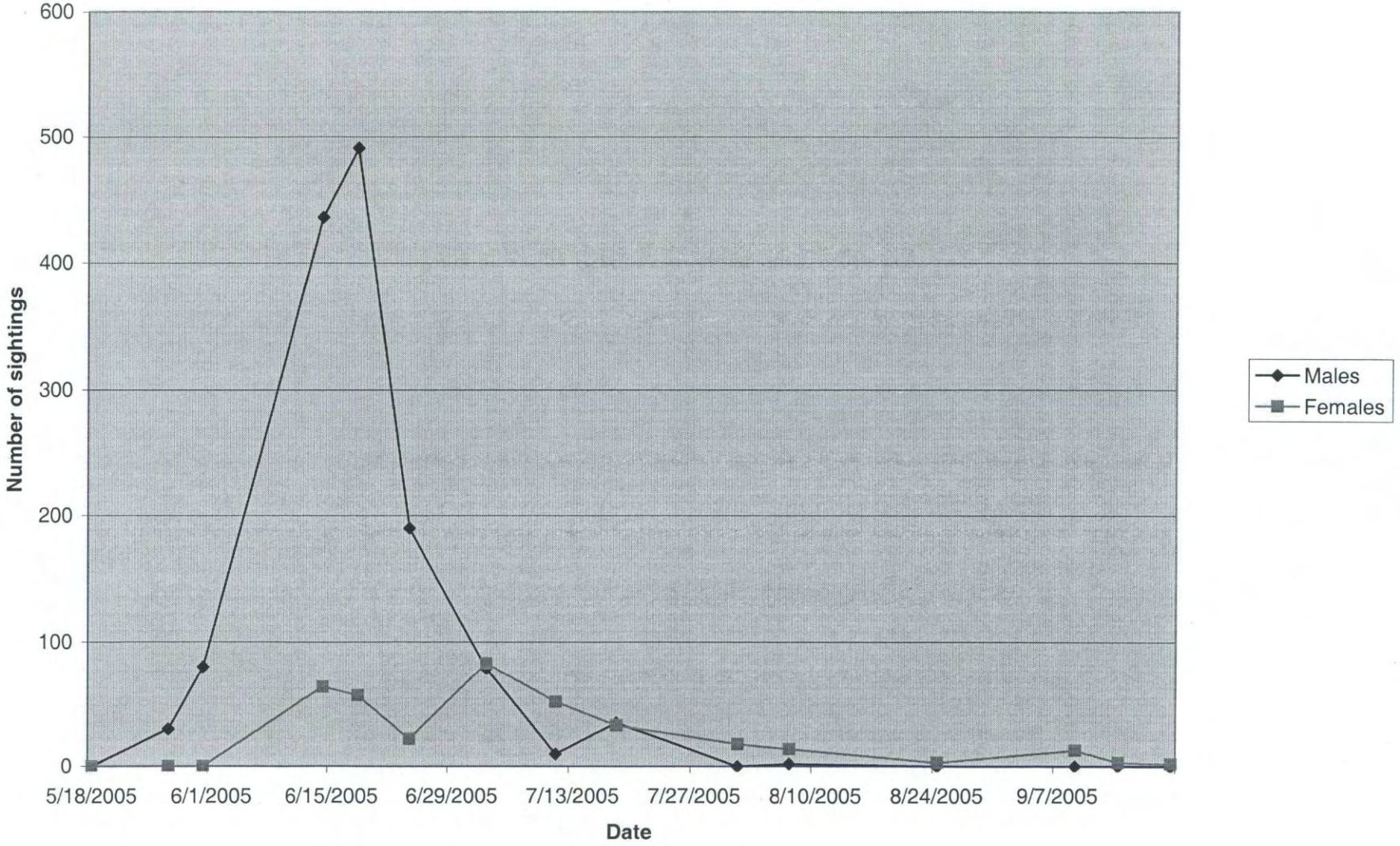


Table 1. Comprehensive Study Results: Male and Female *Speyeria idalia* sightings on each trans

Census Route	Census Segment	Segment Length (m)	Natural Community	18-May-05		27-May-05	
				Male	Female	Male	Female
Transect 1	AB	85.89	WP	0	0	0	0
	BC	41.99	WP	0	0	0	0
	CD	57.67	WP	0	0	0	0
	DE	40.15	WP	0	0	1	0
	EF	68.42	WP	0	0	1	0
	FG	55.16	WP	0	0	0	0
	GH	87.73	WP	0	0	0	0
Transect 1 Total				**0**	**0**	**2**	**0**
Transect 2	AB	82.50	DSP			1	0
	BC	125.66	DSP			1	0
	CD	98.96	DSP			1	0
	DE	125.89	DSP			2	0
	EF	117.47	DSP			0	0
	FG	63.30	DSP			0	0
	GH	96.46	DSP			1	0
	HI	76.57	DSP			9	0
Transect 2 Total						**15**	**0**
Transect 3	AB	77.25	DSP				
	BC	45.98	DSP				
	CD	55.00	T				
	DE	61.59	DSP				
	EF	48.05	T				
	FG	42.01	B				
	GH	72.20	B				
	HI	78.76	B				
	IJ	44.60	CSGP				
Transect 3 Total							
Transect 4	AB	72.63	WP				
	BC	53.85	WP				
	CD	48.83	WP				
	DE	46.34	WP				
	EF	69.94	DSP				
	FG	69.43	DSP				
	GH	67.66	DSP				
	HI	36.55	WP				
	IJ	51.39	WP				
	JK	59.11	WP				
	KL	59.93	WP				
	LM	55.62	DSP				
	MN	80.67	DSP				
	NO	57.16	DSP				
	OP	113.60	DSP				
	PQ	43.40	DSP				
	QR	125.82	WP				

Transect 4 Total						
Transect 5	AB	42.06	WP		0	0
	BC	26.74	WP		0	0
	CD	35.98	WP		0	0
	DE	34.07	WP		0	0
	EF	39.38	WP		0	0
	FG	71.65	WP		0	0
	GH	63.05	WP		0	0
	HI	46.59	WP		0	0
Transect 5 Total					**0**	**0**
Transect 6	AB	55.99	QSP		0	0
	BC	72.46	T		0	0
	CD	85.84	QSP		0	0
	DE	99.14	DSP		0	0
	EF	124.26	DSP		1	0
	FG	50.22	DSP		0	0
	GH	82.26	QSP		5	0
	HI	79.19	D		1	0
	IJ	256.37	CSGP		0	0
	JK	116.86	DSP		0	0
	KL	59.29	QSP		0	0
	LM	63.98	QSP		0	0
	MN	36.43	QSP		1	0
	NO	99.50	QSP		0	0
	OP	126.33	QSP			
Transect 6 Total					**8**	**0**
Transect 7 Total	AB	184.04	WP		1	0
Transect 8	AB	252.18	WP		3	0
	BC	252.04	DSP		1	0
Transect 8 Total					**4**	**0**
Transect 9	AB	48.05	QSP			
	BC	55.02	QSP			
	CD	55.17	QSP			
	DE	16.31	DSP			
	EF	54.57	DSP			
	FG	52.39	DSP			
	GH	82.46	DSP			
	HI	33.93	DSP			
	IJ	13.37	DSP			
	JK	82.76	DSP			
	KL	96.07	DSP			
	LM	24.81	DSP			
	MN	37.03	DSP			
	NO	43.17	DSP			
	OP	???	DSP			
Transect 9 Total						

Transect 10 Total	AB	316.76	DSP				
Transect 11	AB	189.72	DSP				
	BC	103.09	DSP				
	CD	117.74	DSP				
	DE	168.36	DSP				
Transect 11 Total							
TOTALS				0 Male	0 Female	30 Male	0 Female

Natural Community	Male	Female	Male	Female
WP	0	0	6	0
DSP	0	0	17	0
T	0	0	0	0
B	0	0	0	0
QSP	0	0	6	0
D	0	0	1	0
CSGP	0	0	0	0
Total	0	0	30	0

Notes:
WP = Wildlife Planting
DSP = Degraded Sand Prairie
T = Timber
B = Barrens
QSP = Quality Sand Prairie: Little Blue Stem/June Grass Prairie/Blowout
D = Active Dune
CSGP = Cool Season Grass Planting

Light blue shading indicates no data were collected.

;ect segment per survey date and by natural community

31-May-05		14-Jun-05		18-Jun-05		24-Jun-05		3-Ju
Male	Female	Male	Female	Male	Female	Male	Female	Male
		12	1	15	2	24	0	1
		3	2	9	4	8	0	1
		2	2	15	3	11	1	3
		18	0	9	2	11	0	2
		18	1	7	3	16	1	2
		21	0	23	1	12	1	3
		44	0	29	0	24	0	10
		118	**6**	**107**	**15**	**106**	**3**	**22**
		12	0	9	1	0	0	2
		21	4	13	0	8	0	1
		14	0	5	0	4	0	3
		22	0	8	0	4	0	1
		8	1	2	0	3	0	0
		1	0	4	1	1	0	0
		2	0	7	1	2	0	0
		3	2	13	1	3	0	1
		83	**7**	**61**	**4**	**25**	**0**	**8**
0	0	0	0	5	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	1	2	0	0	0	0
0	0	0	0	1	0	1	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0
2	0	1	0	0	0	0	0	0
0	0	5	0	1	0	2	0	0
0	0	3	0	0	0	0	0	0
2	**0**	**9**	**1**	**9**	**0**	**4**	**0**	**0**
0	0	3	2	10	1	2	1	7
1	0	4	2	5	2	1	0	12
2	0	8	0	5	1	2	4	4
0	0	4	1	13	0	0	0	7
2	0	3	1	5	2	3	0	3
0	0	4	3	6	1	0	0	0
0	0	7	0			3	0	0
0	0	3	3	2	0	0	2	0
1	0	0	1	7	2	4	0	0
0	0	0	2	8	0	3	0	0
0	0	7	3	10	1	3	0	0
2	0	4	1	5	1	0	0	0
1	0	4	0	4	1	3	0	0
1	0	10	2	1	0	0	0	0
0	0	4	0	2	1	0	1	0
0	0	1	0	0	1	0	1	0
2	0	6	0	18	0	1	0	1

12	**0**	**72**	**21**	**101**	**14**	**25**	**9**	**34**
0	0	5	0	19	0	6	1	0
1	0	8	0	6	0	0	0	1
1	0	5	0	5	0	0	1	1
2	0	5	0	10	0	0	0	1
2	0	4	0	12	0	2	0	1
4	0	4	0	8	2	0	1	0
4	0	6	3	5	2	0	0	4
4	0	2	0	7	0	0	1	0
18	**0**	**39**	**3**	**72**	**4**	**8**	**4**	**8**
		0	0	2	0	6	0	1
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
		0	0	1	0	0	0	0
		0	0	1	0	0	0	0
		0	0	1	0	5	0	0
		6	0	8	0	0	0	0
		1	0	0	0	1	0	0
		18	0	0	1	0	0	0
		7	1	2	3	0	1	0
		5	0	4	0	0	0	0
		0	0	2	0	0	0	0
		0	0	0	0	0	0	0
		2	2	0	0	1	0	0
				1	0	0	0	0
		39	**3**	**22**	**4**	**13**	**1**	**1**
8	0	18	7	30	3	4	1	1
8	0	7	3	7	2	0	2	1
4	0	5	1	4	0	1	0	0
12	**0**	**12**	**4**	**11**	**2**	**1**	**2**	**1**
2	0	0	0	1	0	0	0	
0	0	5	0	1	0	0	0	
0	0	1	0	2	0	1	0	
1	0	5	0	0	0	0	0	
0	0	0	0	0	0	0	0	
1	0		0	2	0			
0	0	5	0	0	0	1	1	
		4	0	0	1	0	0	
1	0	6	0	0	0	0	0	
1	0	0	0	2	0	0	0	
0	0	0	0	0	0	0	0	
1	0	2	0	3	0	0	1	
6	0	5	0	2	0	0	0	
6	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	
21	**0**	**33**	**0**	**13**	**1**	**2**	**2**	

5	0	6	6	47	4	0	0	4
1	0	2	2	2	2	0	0	0
0	0	4	0	6	0	0	0	0
1	0	1	4	7	1	1	0	0
0	0	0	0	3	3	1	0	0
2	**0**	**7**	**6**	**18**	**6**	**2**	**0**	**0**
80	0	436	64	491	57	190	22	79
Male	Female	Male	Female	Male	Female	Male	Female	Male

Total Sightings per Date and N

Male	Female	Male	Female	Male	Female	Male	Female	Male
40	0	217	33	294	31	134	17	63
36	0	172	28	173	25	44	5	15
0	0	0	1	2	0	0	0	0
2	0	6	0	1	0	3	0	0
2	0	19	2	21	0	8	0	1
0	0	1	0	0	0	1	0	0
0	0	21	0	0	1	0	0	0
80	0	436	64	491	57	190	22	79

	10-Jul-05		17-Jul-05					
ıl-05	11-Jul-05		18-Jul-05		1-Aug-05		7-Aug-05	
Female	Male	Female	Male	Female	Male	Female	Male	Female
0	2	2	3	3	0	0	0	1
8	0	6	2	4	0	0	0	1
2	0	6	6	7	0	0	0	1
4	1	3	3	1	0	0	0	0
3	1	3	2	2	0	0	0	1
1	0	1	3	1	0	0	0	1
3	1	0	2	2	0	0	0	3
21	**5**	**21**	**21**	**20**	**0**	**0**	**0**	**8**
1	0	0	1	0	0	1	0	0
1	0	0	4	0	0	0	0	0
0	1	0	2	1	0	0	0	0
1	0	0	0	0	0	0	0	1
0	0	1	0	1	0	0	0	0
0	0	0	0	0	0	3	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0			0	0
3	**1**	**1**	**7**	**2**	**0**	**4**	**0**	**1**
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**
3	0	1	0	0	0	0	0	0
3	0	5	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
14	0	2	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	1
3	0	1	1	1	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0

35	**1**	**10**	**1**	**1**	**0**	**0**	**0**	**1**
0	0	0	1	0	0	0	1	1
1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2	0	1	0	1	0	0	1	0
0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	2	0	0
5	0	4	1	1	0	1	0	0
0	1	0	1	0	0	2	0	2
9	**1**	**5**	**3**	**3**	**0**	**5**	**2**	**3**
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	1	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0
0	**1**	**1**	**0**	**0**	**0**	**3**	**0**	**1**
3	0	1	0	5	0	2	0	0
6	0	1	2	2	0	2	0	0
1	0	0	0	0	0	0	0	0
7	**0**	**1**	**2**	**2**	**0**	**2**	**0**	**0**
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**

2	1	11	1	0	0	1	0	0
1	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
3	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
83	10	52	35	33	0	18	2	14
Female	Male	Female	Male	Female	Male	Female	Male	Female

latural Community

Female	Male	Female	Male	Female	Male	Female	Male	Female
68	7	37	26	30	0	9	2	12
15	2	14	9	3	0	5	0	1
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0
0	1	1	0	0	0	1	0	1
0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	1	0	0
83	10	52	35	33	0	18	2	14

24-Aug-05		9-Sep-05		14-Sep-05		20-Sep-05		Total Males Per Segment
Male	Female	Male	Female	Male	Female	Male	Female	
0	0	0	2	0	0	0	0	57
0	0	0	2	0	0	0	0	23
0	0	0	2	0	0	0	0	37
0	0	0	1	0	0	0	1	45
0	1	0	0	0	1	0	0	47
0	0	0	0	0	0	0	0	62
0	0	0	3			0	0	110
0	**1**	**0**	**10**	**0**	**1**	**0**	**1**	381
0	0	0	0	0	0	0	0	25
0	0	0	1	0	0	0	0	48
0	0	0	0	0	0	0	0	30
0	1	0	0	0	0	0	0	37
0	0	0	0	0	0	0	0	13
0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	0	0	12
0	0	0	0	0	0			29
0	**1**	**0**	**1**	**0**	**0**	**0**	**0**	200
0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	8
0	0	0	0	0	0	0	0	3
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	24
0	0	0	0	0	0	0	0	22
0	0	0	0	0	0	0	0	23
0	0	0	0	0	0	0	0	21
0	0	0	0	0	0	0	0	24
0	0	0	0	0	0	0	0	16
0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	12
0	1	0	0	0	1	0	0	11
0	0	0	0	0	0	0	0	21
0	0	0	0	0	0	0	0	12
0	0	0	0	0	0	0	0	12
0	0	0	0	0	0	0	0	12
0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	28

0	**1**	**0**	**0**	**0**	**1**	**0**	**0**	246
0	0	0	0	0	0	0	0	32
0	0	0	0	0	0	0	0	16
0	0	0	0	0	0	0	0	12
0	0	0	0	0	0	0	0	19
0	0	0	0	0	0	0	0	21
0	0	0	0	0	0	0	0	16
0	0	0	0	0	0	0	0	20
0	0	0	0	0	0	0	0	15
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	151
0	0	0	0	0	1	0	0	9
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	6
0	0	0	1	0	0	0	0	19
0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	18
0	0	0	0	0	0	0	0	9
0	0	0	0	0	0	0	0	9
0	0	0	0	0	0	0	0	2
0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	3
				0	0			2
0	**0**	**0**	**1**	**0**	**1**	**0**	**0**	84
0	0	0	1	0	0	0	0	62
0	0	0	0	0	0	0	0	28
0	0	0	0	0	0	0	0	15
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	43
0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	9
0	0			0	0	0	0	0
0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	7
0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	0	0	13
0	0	0	0	0	0	0	0	6
0	0	0	0	0	0	0	0	2
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	69

0	0	0	0	0	0	0	0	64
0	0	0	0	0	0	0	0	5
0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	0	10
0	0	0	0	0	0	0	1	4
0	**0**	**0**	**0**	**0**	**0**	**0**	**1**	29
0	3	0	13	0	3	0	2	
Male	Female	Male	Female	Male	Female	Male	Female	

								Total Sightings
Male	Female	Male	Female	Male	Female	Male	Female	
0	2	0	11	0	2	0	1	1042
0	1	0	1	0	0	0	1	567
0	0	0	0	0	0	0	0	3
0	0	0	0	0	0	0	0	13
0	0	0	1	0	1	0	0	65
0	0	0	0	0	0	0	0	4
0	0	0	0	0	0	0	0	23
0	3	0	13	0	3	0	2	1717

Total Females Per Segment
11
27
24
12
16
6
11
107
3
6
1
3
3
4
1
3
24
0
0
1
0
0
1
0
0
0
2
8
12
11
17
6
4
0
5
7
4
5
7
1
2
2
2
0

93

2
1
1
4
0
7
16
5
36

2
0
2
0
0
0
1
1
2
5
0
0
0
2
0
15

23

18
2
20

0
0
0
0
0
1
0
1
0
0
0
1
0
0
0
3

24

5
1
6
5
17

Table 2. Total Speyeria idalia sightings per transect and survey date.

	18-May-05		27-May-05		31-May-05		14-Jun-05		18-Jun-05		24-Jun-05		3-Jul-05		11-Jul-05		18-Jı
Transect	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
1	0	0	2	0	0	0	118	6	107	15	106	3	22	21	5	21	21
2	0	0	15	0	0	0	83	7	61	4	25	0	8	3	1	1	7
3	0	0	0	0	2	0	9	1	9	0	4	0	0	0	0	0	0
4	0	0	0	0	12	0	72	21	101	14	25	9	34	35	1	10	1
5	0	0	0	0	18	0	39	3	72	4	8	4	8	9	1	5	3
6	0	0	8	0	0	0	39	3	22	4	13	1	1	0	1	1	0
7	0	0	1	0	8	0	18	7	30	3	4	1	1	3	0	1	0
8	0	0	4	0	12	0	12	4	11	2	1	2	1	7	0	1	2
9	0	0	0	0	21	0	33	0	13	1	2	2	0	0	0	0	0
10	0	0	0	0	5	0	6	6	47	4	0	0	4	2	1	11	1
11	0	0	0	0	2	0	7	6	18	6	2	0	0	3	0	1	0
TOTAL	0	0	30	0	80	0	436	64	491	57	190	22	79	83	10	52	35

ul-05		1-Aug-05		7-Aug-05		24-Aug-05		9-Sep-05		14-Sep-05		20-Sep-05		TOTAL TRANSECT SIGHTINGS
Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		(M and F)
20	0	0	0	8	0	1	0	10	0	1	0	1		488
2	0	4	0	1	0	1	0	1	0	0	0	0		224
0	0	1	0	0	0	0	0	0	0	0	0	0		26
1	0	0	0	1	0	1	0	0	0	1	0	0		339
3	0	5	2	3	0	0	0	0	0	0	0	0		187
0	0	3	0	1	0	0	0	1	0	1	0	0		99
5	0	2	0	0	0	0	0	1	0	0	0	0		85
2	0	2	0	0	0	0	0	0	0	0	0	0		63
0	0	0	0	0	0	0	0	0	0	0	0	0		72
0	0	1	0	0	0	0	0	0	0	0	0	0		88
0	0	0	0	0	0	0	0	0	0	0	0	1		46
33	0	18	2	14	0	3	0	13	0	3	0	2		1717
														1353 (males)
														364 (females)

Table 4. Observed behaviors of *Speyeria idalia* per transect and survey date

	Behavior	18-May-05		27-May-05		31-May-05		14-Jun-05		18-Jun-05	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Transect 1	Resting	0	0	0	0	ND	ND	0	0	0	0
	Flying	0	0	0	0	ND	ND	105	0	105	0
	Nectaring	0	0	0	0	ND	ND	0	0	1	0
	Puddling	0	0	0	0	ND	ND	0	0	0	0
	Flushed	0	0	2	0	ND	ND	5	5	1	15
	Ovipositioning	0	0	0	0	ND	ND	0	0	0	0
	Dead	0	0	0	0	ND	ND	1	0	0	0
	Mating	0	0	0	0	ND	ND	0	0	0	0
Transect 2	Resting	ND	ND	1	0	ND	ND	0	1	0	0
	Flying	ND	ND	3	0	ND	ND	75	0	52	0
	Nectaring	ND	ND	0	0	ND	ND	0	0	5	2
	Puddling	ND	ND	0	0	ND	ND	0	0	0	0
	Flushed	ND	ND	11	0	ND	ND	7	7	3	2
	Ovipositioning	ND	ND	0	0	ND	ND	0	0	0	0
	Dead	ND	ND	0	0	ND	ND	0	0	0	0
	Mating	ND	ND	0	0	ND	ND	0	0	0	0
Transect 3	Resting	ND	ND	ND	ND	0	0	0	0	0	0
	Flying	ND	ND	ND	ND	1	0	5	0	4	0
	Nectaring	ND	ND	ND	ND	0	0	4	0	5	0
	Puddling	ND	ND	ND	ND	0	0	0	0	0	0
	Flushed	ND	ND	ND	ND	1	0	0	1	0	0
	Ovipositioning	ND	ND	ND	ND	0	0	0	0	0	0
	Dead	ND	ND	ND	ND	0	0	0	0	0	0
	Mating	ND	ND	ND	ND	0	0	0	0	0	0
Transect 4	Resting	ND	ND	ND	ND	0	0	0	0	0	0
	Flying	ND	ND	ND	ND	6	0	49	4	89	0
	Nectaring	ND	ND	ND	ND	0	0	19	3	2	3
	Puddling	ND	ND	ND	ND	0	0	0	0	0	0
	Flushed	ND	ND	ND	ND	6	0	0	14	1	11

	Ovipositioning	ND	ND	ND	ND	0	0	0	0	0	0
	Dead	ND	ND	ND	ND	0	0	0	0	0	0
	Mating	ND	ND	ND	ND	0	0	0	0	0	0
Transect 5	Resting	ND	ND	0	0	0	0	0	0	0	0
	Flying	ND	ND	0	0	4	0	21	0	64	0
	Nectaring	ND	ND	0	0	0	0	8	0	9	0
	Puddling	ND	ND	0	0	0	0	0	0	0	0
	Flushed	ND	ND	0	0	14	0	3	3	0	4
	Ovipositioning	ND	ND	0	0	0	0	0	0	0	0
	Dead	ND	ND	0	0	0	0	0	0	0	0
	Mating	ND	ND	0	0	0	0	0	0	0	0
Transect 6	Resting	ND	ND	0	0	0	0	2	2	0	0
	Flying	ND	ND	2	0	0	0	26	0	22	0
	Nectaring	ND	ND	0	0	0	0	10	0	0	3
	Puddling	ND	ND	0	0	0	0	0	0	0	0
	Flushed	ND	ND	6	0	0	0	1	1	0	1
	Ovipositioning	ND	ND	0	0	0	0	0	0	0	0
	Dead	ND	ND	0	0	0	0	0	0	0	0
	Mating	ND	ND	0	0	0	0	0	0	0	0
Transect 7	Resting	ND	ND	0	0	0	0	0	0	0	0
	Flying	ND	ND	0	0	4	0	2	0	30	1
	Nectaring	ND	ND	0	0	0	0	0	0	0	0
	Puddling	ND	ND	0	0	0	0	0	0	0	0
	Flushed	ND	ND	1	0	4	0	15	7	0	2
	Ovipositioning	ND	ND	0	0	0	0	0	0	0	0
	Dead	ND	ND	0	0	0	0	1	0	0	0
	Mating	ND	ND	0	0	0	0	0	0	0	0
Transect 8	Resting	ND	ND	0	0	0	0	0	0	0	0
	Flying	ND	ND	0	0	12	0	10	0	11	0
	Nectaring	ND	ND	0	0	0	0	0	1	0	0
	Puddling	ND	ND	0	0	0	0	0	0	0	0
	Flushed	ND	ND	4	0	0	0	2	2	0	2
	Ovipositioning	ND	ND	0	0	0	0	0	0	0	0

	Dead	ND	ND	0	0	0	0	0	0	0	0
	Mating	ND	ND	0	0	0	0	0	0	0	0
Transect 9	Resting	ND	ND	ND	ND	0	0	0	0	0	0
	Flying	ND	ND	ND	ND	10	0	25	0	8	0
	Nectaring	ND	ND	ND	ND	4	0	0	0	4	1
	Puddling	ND	ND	ND	ND	0	0	0	0	0	0
	Flushed	ND	ND	ND	ND	7	0	8	0	0	0
	Ovipositioning	ND	ND	ND	ND	0	0	0	0	0	0
	Dead	ND	ND	ND	ND	0	0	0	0	0	0
	Mating	ND	ND	ND	ND	0	0	0	0	0	0
Transect 10	Resting	ND	ND	ND	ND	0	0	0	0	0	0
	Flying	ND	ND	ND	ND	1	0	5	0	47	0
	Nectaring	ND	ND	ND	ND	1	0	0	0	0	2
	Puddling	ND	ND	ND	ND	0	0	0	0	0	0
	Flushed	ND	ND	ND	ND	3	0	1	5	0	2
	Ovipositioning	ND	ND	ND	ND	0	0	0	0	0	0
	Dead	ND	ND	ND	ND	0	0	0	0	0	0
	Mating	ND	ND	ND	ND	0	0	0	0	0	0
Transect 11	Resting	ND	ND	ND	ND	0	0	0	0	0	0
	Flying	ND	ND	ND	ND	1	0	2	0	18	0
	Nectaring	ND	ND	ND	ND	0	0	1	0	0	3
	Puddling	ND	ND	ND	ND	0	0	0	0	0	0
	Flushed	ND	ND	ND	ND	1	0	4	6	0	3
	Ovipositioning	ND	ND	ND	ND	0	0	0	0	0	0
	Dead	ND	ND	ND	ND	0	0	0	0	0	0
	Mating	ND	ND	ND	ND	0	0	0	0	0	0
TOTALS		0	0	30	0	80	0	417	62	481	57

24-Jun-05		3-Jul-05		10-Jul-05 11-Jul-05		17-Jul-05 18-Jul-05		1-Aug-05		7-Aug-05		24-Au
Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
0	0	0	0	0	0	0	0	0	0	0	1	0
105	1	19	7	5	15	18	15	0	0	0	2	0
1	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	3	14	0	6	0	7	0	0	0	5	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	0
23	0	5	1	1	1	7	0	0	2	0	0	0
1	3	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	3	2	0	0	0	2	0	3	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
18	4	28	15	1	4	3	1	0	0	0	0	0
0	1	4	15	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0
7	5	2	5	0	6	0	2	0	0	0	0	0

0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
1	2	7	4	1	1	0	0	0	3	0	2	0
5	1	1	4	0	2	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	1	0	2	0	0	0	2	0	3	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0
12	0	1	0	1	1	0	0	0	2	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	1	0	0	0	0	0
3	0	1	2	0	0	0	2	0	1	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	1	0	3	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	2	0	0	0	2	2	0	2	0	0	0
2	0	1	5	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0

0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	nd	nd	0	0	0	0	0	0	0	0	0
1	2	nd	nd	0	0	0	0	0	0	0	0	0
0	0	nd	nd	0	0	0	0	0	0	0	0	0
0	0	nd	nd	0	0	0	0	0	0	0	0	0
1	0	nd	nd	0	0	0	0	0	0	0	0	0
0	0	nd	nd	0	0	0	0	0	0	0	0	0
0	0	nd	nd	0	0	0	0	0	0	0	0	0
0	0	nd	nd	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	4	1	0	4	1	0	0	1	0	0	0
0	0	0	0	0	2	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	5	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	2	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	2	0	1	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0
189	26	81	81	10	52	32	36	0	19	0	16	1

ıg-05	9-Sep-05		14-Sep-05		20-Sep-05	
Female	Male	Female	Male	Female	Male	Female
0	0	0	0	0	0	0
0	0	7	0	0	0	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0
0	0	0	0	1	0	0
0	0	3	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
1	0	1	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
1	0	0	0	0	0	0

0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0

0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0

0 0 0 0 0 0 0
0 0 0 0 1 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 1 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0

0 0 0 0 0 0 0
0 0 1 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0

0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0 0 0 0

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0
0	0	0	0	0	0	0
2	0	13	0	3	0	2

Table 5A. Total Speyeria idalia sightings per natural community and survey date

	18-May-05		27-May-05		31-May-05		14-Jun-05		18-Jun-05		24-Jun-05	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Natural Community												
WP	0	0	6	0	40	0	217	33	294	31	134	17
DSP	0	0	17	0	36	0	172	28	173	25	44	5
T	0	0	0	0	0	0	0	1	2	0	0	0
B	0	0	0	0	2	0	6	0	1	0	3	0
QSP	0	0	6	0	2	0	19	2	21	0	8	0
D	0	0	1	0	0	0	1	0	0	0	1	0
CSGP	0	0	0	0	0	0	21	0	0	1	0	0
Total	0	0	30	0	80	0	436	64	491	57	190	22

Notes:
WP = Wildlife Planting
DSP = Degraded Sand Prairie
T = Timber
B = Barrens
LBS = Little Blue Stem/June Grass Prairie
D = Active Dune
CSGP = Cool Season Grass Planting

3-Jul-05		11-Jul-05		18-Jul-05		1-Aug-05		7-Aug-05		24-Aug-05		9-Se
Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
63	68	7	37	26	30	0	9	2	12	0	2	0
15	15	2	14	9	3	0	5	0	1	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0
1	0	1	1	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0
79	83	10	52	35	33	0	18	2	14	0	3	0

p-05		14-Sep-05		20-Sep-05		
Female	Male	Female	Male	Female	**Total per Community**	
11	0	2	0	1	1042	
1	0	0	0	1	567	
0	0	0	0	0	3	
0	0	0	0	0	13	
1	0	1	0	0	65	
0	0	0	0	0	4	
0	0	0	0	0	23	
13	0	3	0	2		

Table 5. Total sightings per natural community and percent of sightings per natural community

Natural Community	♂	♀	Total Sightings	% Total	Sightings by meters sampled
WP	789	253	1042	61.8	.0389
DSP	468	99	567	33	.0296
T	2	1	3	0.01	.0011
B	12	1	13	0.07	.0045
QSP	58	7	65	3.8	.0056
D	3	1	4	0.02	.0033
CSGP	21	2	23	1.3	.0051
TOTALS	1309	363	1717	100	0.0881

WP	Wildlife Planting (Switch/Indian Grass)
DSP	Degraded Sand Prairie
T	Timber
B	Barrens
QSP	Quality Sand Prairie
D	Active Dune
CSGP	Cool Season Grass Planting

Table 6. Potential nectar plants in bloom during survey dates

Common Name	Scientific Name	18-May	27-May	31-May	14-Jun	18-Jun	24-Jun	3-Jul	10-Jul	11-Jul	17-Jul	1-Aug	7-Aug	24-Aug	9-Sep	14-Sep	20-Sep
Yellow Oxalis	*Oxalis dellenii*	x	x														
Johny Jump-up	*Viola rafinesquii*	x	x														
Common Yarrow	*Achillea mellefolium*	x	x	x	x	x	x										
False Dandelion	*Pyrrhopappus carolinianus*	x	x														
Toadflax	*Linaria spp.*	x	x														
Hoary Puccoon	*Lithospermum canescens*		x	x	x	x	x										
Venus-looking-glass	*Triodanis sp.*		x	x	x	x	x										
Hairy Vetch	*Vicia villosa*			x	x	x	x										
Western Wallflower	*Erysimum capitatum*			x													
Pale Beardstongue	*Penstemon pallidus*					x	x										
Goats Beard	*Tragopogon dubius*					x											
Daisy Fleabane	*Erigeron annuus*				x	x	x	x	x	x	x	x					
Hoary Vervain	*Verbena stricta*					x	x	x	x	x	x	x	x	x			
Horsemint	*Monarda punctata*							x	x		x	x	x	x	x	x	
Golden Aster	*Heterotheca villosa*			x	x	x	x	x	x	x	x	x	x	x	x	x	x
Wavy Leaved Milkweed	*Asclepias amplexicaulis*					x	x	x									
Eastern Prickly Pear Cactus	*Opuntia humifusa*				x	x	x	x	x	x	x	x					
Bouncing Bet	*Saponaria officinalis*							x	x	x	x	x	x	x			
Sand Primrose	*Oenothera rhombipetala*							x	x	x	x	x	x	x			
Black-eyed Susan	*Rudbeckia hirta*				x	x	x	x	x	x	x	x	x				
Day Flower	*Commelina sp.*					x	x	x	x	x	x	x	x	x			
Cotton Plant	*Froelichia floridana*							x	x	x	x	x	x	x			
Ohio Spiderwort	*Tradescantia ohiensis*		x	x	x	x	x	x									
New Jersey Tea	*Ceanothus americanus*				x	x	x	x	x								
Butterfly Milkweed	*Asclepias tuberosa*				x	x	x	x	x	x	x	x					
Goats Rue	*Tephrosia virginiana*		x	x	x	x	x	x	x								
Deptford Pink	*Dianthus armeria*				x	x	x	x	x	x	x	x					
Common Sunflower	*Helianthus annus*							x	x	x	x	x	x				
Whorled Milkweed	*Asclepias verticillata*							x	x	x	x	x	x	x			
Bush Clover	*Lespedeza capitata*							x	x	x	x	x	x	x			
Fragrant Summac	*Rhus aromatica*							x	x								
St Johnswort	*Hypericum sp.*						x	x	x								
Gray Goldenrod	*Solidago sp.*													x	x	x	
Flowering Spurge	*Euphorbia corollata*										x	x	x	x	x		
Partridge Pea	*Cassia fasciculata*											x	x	x			
Germander	*Teucrium canadense*												x				
Field Thistle	*Cirsium discolor*													x	x	x	x
Ironweed	*Vernonia fasciculata*													x			
False Boneset	*Brickellia eupatoriodes*													x	x	x	x
Rough Blazingstar	*Liatris aspera*														x	x	
Tall Goldenrod	*Solidago canadensis*														x	x	x
Frost Aster	*Aster parviceps*															x	x
Aromatic Aster	*Aster oblongifoliuos*																x

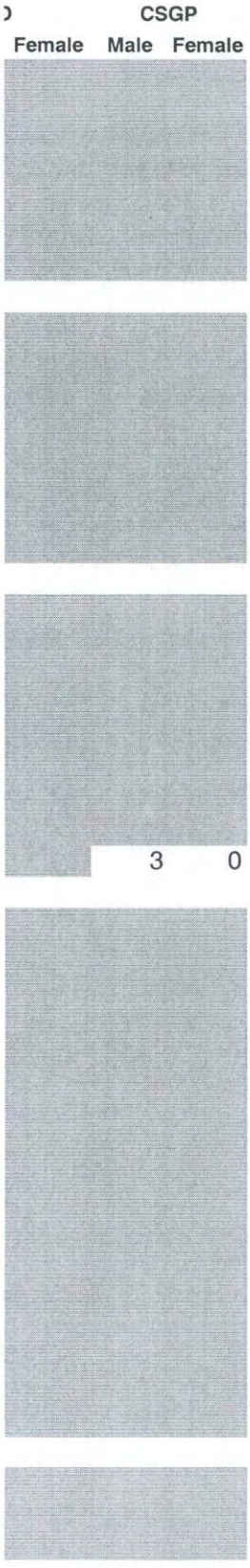
Table 7. Butterfly species observed during *Speyeria idalia* census

Scientific Name	Common Name	18-May-05	27-May-05	31-May-05	14-Jun-05	18-Jun-05	24-Jun-05	3-Jul-05	10-Jul-07	11-Jul-05	17-Jul-05	18-Jul-05	1-Aug-05	7-Aug-05	24-Aug-05	9-Sep-05	14-Sep-05	20-Sep-05
Eurytides marcellus	Zebra swallowtail																	
Pterourus troilus	Spicebush Swallowtail			x					x						x	x	x	x
Battus philenor	Pipe-vine Swallowtail											x	x		x			
Pterourus glaucus	Tiger Swallowtail	x	x	x			x	x	x		x		x	x	x			
Papilio polyxenes	Black Swallowtail														x	x		
Heraclides cresphontes	Giant Swallowtail		x	x					x		x			x				
Ponita protodice	Checkered White				x	x		x	x		x		x	x	x			
Artogeia rapae	Cabbage White			x	x	x			x	x	x	x	x			x	x	x
Colias philodice	Clouded Sulfur				x	x					x		x	x	x	x	x	x
Colias eurytheme	Orange Sulfur												x			x	x	x
Phoebis sennae	Cloudless Sulfur												x	x	x	x	x	x
Pyrisitia lisa	Little Sulfur										x			x		x	x	x
Strymon melinus	Gray Hairstreak																x	x
Harkenclenus titus	Coral Hairstreak					x		x										
Satyrium calanus	Banded Hairstreak					x			x									
Satyrium edwardsii	Edwards Hairstreak					x												
Everes comyntas	Eastern-Tailed Blue					x		x	x	x	x			x	x	x	x	x
Celastrina negecta	Summer Azure					x							x		x			
Feniseca tarquinius	Harvester					x												
Euptoieta claudia	Variegated Fritillary				x	x	x	x	x									
Speyeria idalia	Regal Fritillary		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Speyeria cybele	Great Spangled Fritillary		x	x	x	x	x	x	x		x		x	x	x	x	x	
Chandryas nyteis	Silvery Checkerspot															x		x
Phyciodes tharos	Pearl Crescent						x		x					x	x		x	x
Lycaena phlaeas	American Copper	x			x	x	x		x				x		x	x	x	x
Vanessa cardui	American Painted Lady					x							x					x
Vanessa virginiensis	Painted Lady		x				x				x		x	x	x	x	x	
Vanessa atalanta	Red Admiral		x	x		x			x									
Junonia coenia	Buckeye																	x
Basilarchia arthemis	Red Spotted Purple				x		x		x									
Basilarchia archippus	Viceroy														x			
Nymphalis antiopa	Mourning Cloak																	x
Astrocampa celits	Hackberry				x								x					
Megisto cymela	Little Wood Satyr						x	x		x								
Danaus plexippus	Monarch			x					x			x	x	x	x	x	x	x
Epargyreus clarus	Silver Spotted Skipper		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Thorybes pylades	Northern Cloudywing																	
Erynnis juvenalis	Juvenal's Duskywing																	
Erynnis horatius	Horace's Duskywing																	
Pyrgus communis	Checkered Skipper																	
Hylephila phyleus	Fiery Skipper																x	
Atryone logan	Delaware Skipper																	

Census Route	Census Segment	WP		DSP		T		B		QSP		D
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
T1	AB	57	11									
	BC	23	27									
	CD	37	24									
	DE	45	12									
	EF	47	16									
	FG	62	6									
	GH	110	11									
T2	AB			25	3							
	BC			48	6							
	CD			30	1							
	DE			37	3							
	EF			13	3							
	FG			6	4							
	GH			12	1							
	HI			29	3							
T3	AB			5	0							
	BC			0	0							
	CD					2	1					
	DE			2	0							
	EF					0	0					
	FG							1	1			
	GH							3	0			
	HI							8	0			
	IJ											
T4	AB	22	8									
	BC	23	12									
	CD	21	11									
	DE	24	17									
	EF			16	6							
	FG			10	4							
	GH			10	0							
	HI	5	5									
	IJ	12	7									
	JK	11	4									
	KL	21	5									
	LM			12	7							
	MN			12	1							
	NO			12	2							
	OP			6	2							
	PQ			1	2							
	QR	28	0									
T5	AB	32	2									
	BC	16	1									
	CD	12	1									

	DE	19	4									
	EF	21	0									
	FG	16	7									
	GH	20	16									
	HI	15	5									
T6	AB									9	2	
	BC					0	0					
	CD									0	2	
	DE			1	0							
	EF			2	0							
	FG			6	0							
	GH									19	1	
	HI											3
	IJ											
	JK			9	5							
	KL									9	0	
	LM									2	0	
	MN									1	0	
	NO									3	2	
	OP									2	0	
T7	AB	62	23									
T8	AB	28	18									
	BC			15	2							
T9	AB									3	0	
	BC									6	0	
	CD									4	0	
	DE			6	0							
	EF			0	0							
	FG			9	1							
	GH			0	0							
	HI			4	1							
	IJ			7	0							
	JK			3	0							
	KL			0	0							
	LM			6	1							
	MN			13	0							
	NO			6	0							
	OP			2	0							
T10	AB			64	24							
T11	AB			5	5							
	BC			10	1							
	CD			10	6							
	DE			4	5							
Totals		789	253	468	99	2	1	12	1	58	7	3

Notes:
WP = Wildlife Planting
DSP = Degraded Sand Prairie
T = Timber
B = Barrens
QSP = Little Blue Stem/June Grass Prairie Quality Sand Prairie
D = Active Dune
CSGP = Cool Season Grass Planting


CSGP
Female
Male
Female
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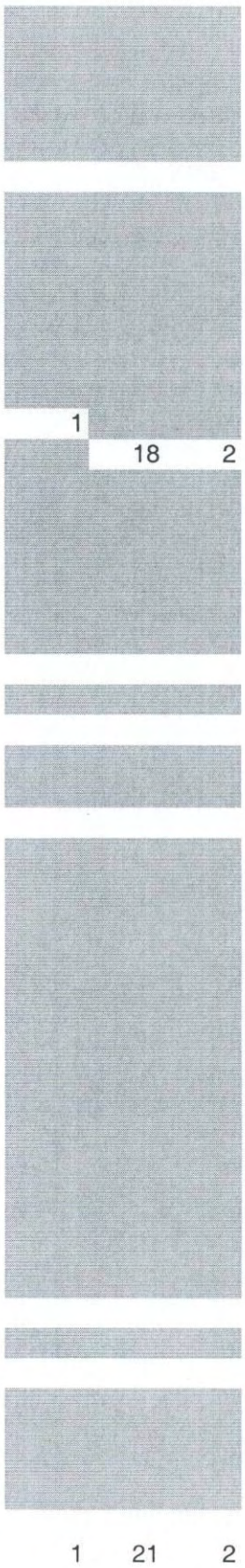
1
18
2
1
21
2

Census Route	Location of Census Route	Habitat	Total Length of Route	Route Segments
T1		Wildlife Planting		7
T2		Degraded Sand Prairie		8
T3	Park Headquarters	Quality Sand Prairie		9
T4	Cable Gate	Cool season grass planting		17
T5	Archery Range	Stable dune		8
T6	Gleason Nature Preserve	Quality Sand Prairie		15
T7		Quality Sand Prairie		1
T8		Barrens		2
T9		Timber		15
T10		Degraded Sand Prairie		1
T11		Degraded Sand Prairie		4