# POPULATION MONITORING FOR PRAIRIE BUTTERFLIES IN MINNESOTA

## FINAL REPORT

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by

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**ABSTRACT**

A project of population monitoring for three rare species of prairie butterflies (Dakota Skipper, Hesperia dacotae ; Poweshiek Skipper, Oarisma poweshiek; and Regal Fritillary, Speyeria idalia) was established at six prairie preserves in Minnesota. Each site was visited three times during the flight periods in 1995 and 1996. Qualitative comparison of data suggests that while population numbers for S. idalia and O. poweshiek changed little overall, H. dacotae may have fared somewhat better in 1996 at Prairie Coteau but were down at Bluestem Prairie.

Phenological differences among the three species made it difficult to insure that monitoring would include peak flight periods for all three species during each year. In addition, vagaries of weather shifted the phenologies of all three species among the two years. Further development will be necessary to establish the means by which comparability among years can be improved, but the similarity of data between years suggests that with slight adjustment, the established protocol provides a reasonable means for monitoring these prairie butterfly populations.

## INTRODUCTION

Tallgrass prairie once covered one-third of Minnesota, but less than one percent of the original area remains. These remaining sites are currently managed under regimes for the plant species on the site. As a result, its indigenous species are under great threat, and more than one-third of the species on the state's List of Endangered, Threatened, and Special Concern Species are limited to the prairie habitats. These include the Dakota Skipper (Hesperia dacotae), a state threatened species, the Poweshiek Skipper (Oarisma poweshiek) and the Regal Fritillary (Speyeria idalia), which are state species of special concern.

While many tracts of prairie are now in protected ownership in the state, their fragmented and isolated distribution makes management of constituent species difficult. Management practices (primarily fire with some mowing) that are utilized to maintain target plant components of the prairie ecosystem may or may not be beneficial to other components. Several studies have led to concerns about the effects of management practices on the long-term health of the prairie ecosystems. By tracking the population size and distribution of species that serve as indicators of a healthy, functioning ecosystem, and using appropriate experimental design, managers can evaluate the effects of existing management practices on elements of the ecosystem. In turn, the results of such

monitoring can be used to develop, refine, and implement improved management practices. This project was designed to implement a program for the long-term population monitoring of three species of prairie butterflies in Minnesota (although all species were counted). The results of this monitoring program are providing information necessary to insure that current prairie management practices do not inadvertently result in damage to these prairie ecosystems or their constituent species.

Ultimately we will need to determine minimum viable population sizes for these species and with that concept in mind determine the impacts of natural and human events. (Thomas 1990)

## METHODS

Preliminary work involved a review of the literature on the subject in a effort to see what methods might work on prairie sites. Pollard (1977, 1991) offers methods that are applicable to our task. The Minnesota Natural Heritage Database was consulted for species occurrences. Information from the surveys done by the principle investigator as well as Robert Dana's work at Hole-in-the-Mountain (Dana 1991) was used to determine phenology. The prairies were scouted for the three species and for habitat that is suitable for transects.

### Site Selection

The sites for this project were selected by Richard Baker and Robert Dana on six large Minnesota prairies which (1) were known to have the three target species, (2) contain large areas of intact prairie and (3) are owned and managed to preserve biodiversity.

Table 1. Prairie Sites for Monitoring Prairie Butterflies

| Name (Ownership*) | County | Location | Area (acres) |
|---|---|---|---|
| Prairie Coteau (SNA) | Pipestone | T108N, R44W | 329 |
| Hole-in-the-Mountain (TNC) | Lincoln | T109N, R45W | 299 |
| Chippewa (TNC) | Chippewa/Swift | T120N, R43W | 943 |
| Glacial Lakes S.P. (DNR) | Pope | T124N, R38/39W | 1940 |
| Bluestem Pr. (SNA/TNC) | Clay | T139N, R46W | 1296 |
| Felton complex (SNA/TNC) | Clay | T141N, R45W | 410 |

* Ownership
DNR = Minnesota Department of Natural Resources, Division of Parks and Recreation
SNA = Minnesota Department of Natural Resources, Scientific and Natural Areas Program
TNC = The Nature Convervancy

Transect Design

Once monitoring sites were selected, a field meeting was coordinated on June 28, 1995 to bring together knowledgeable persons and involved managers to discuss the design and implementation of the project. Attendees at the field meeting included Richard Baker (DNR), David Breyfogle (TNC), Robert Dana (DNR), Bob Djupstrom (DNR), Dennis Schlicht (Principle Investigator), Gerald Selby (TNC), and Brian Winter (TNC). Since the monitoring protocol was to be developed from the initial work of Gerald Selby (1990) at Prairie Coteau, the focus of the meeting was a discussion of modifications necessary to adapt Selby's monitoring protocol to the more general purposes of this project. Transect designs for Prairie Coteau SNA and Hole-in-the-Mountain Preserve were discussed.

Generally, transects were established in areas where populations of the target species had been observed, or where habitat appeared suitable for these species. In addition to habitat quality, topography and landscape patterns were taken into consideration (Pollard 1977, 1991, 1993). Transects on two units at Prairie Coteau SNA used routes established by Selby during his project (1988-90). Robert Dana, who has conducted previous research on the target species at Hole-in-the-Mountain Preserve (Dana 1991) provided guidance in establishing transects at that site. Transects were established in straight lines, or as a series of straight legs. In all cases, transect turns and ends were

established in relationship to a landscape feature to facilitate replication of the transect route. Several transects were altered between the two seasons.

Survey Protocol

Each transect at each of the six sites was surveyed three times during the flight periods of the target species. In 1995 the southern most site (Prairie Coteau) was monitored for emergence of the target species prior to beginning transect monitoring. Monitoring at each site was initiated as soon as possible after the beginning of the flight period of any of the target species and ended after each prairie was visited 3 times.

Transects were walked at a steady pace of 1-2 mph. Time was noted at the start and end of each transect. "On the clock" stops were taken for any of the three methods of verification: (1) visual identification through close-focus binoculars, (2) capture, identification, and release, and (3) capture and vouchering of specimens (Panzer 1988). Total time on the transect was recorded so that it might be related to the number of butterflies counted. Transect counts were continuous, even when crossing ravines or other areas of poor habitat quality.

The "window" of observation encompassed an area up to 5 meters ahead, 5 meters to each side of the observer and 5 meters above the ground. This follows the design of Selby (1990), but deviates

from the design of Pollard (1977) due to the open nature of the survey area. (Pollard was working along trails in clearings bounded by trees and shrubs.)

Monitoring was conducted within the following parameters:

1. between the hours of 10:00am to 6:00pm (Central Daylight Time)
2. cloud cover of up to 90%, as long as the temperature was warm (80+ F.) and the cloud cover was thin
3. temperatures between 70 F and 95 F
4. wind speeds of less than 15 mph, as determined by a Dwyer wind meter.

Field notes taken during the monitoring included the following data: (1) species and number observed; (2) condition of individuals of the target species; (3) cloud cover and type; (4) temperature; (5) wind direction and speed.

## RESULTS

### The Butterflies

Regal Fritillary *Speyeria idalia* (Figure 1-6)

Monitoring data for *S. idalia* indicate that the observations for population monitoring did not encompass the peak of the flight period for this species. In most cases, numbers of individuals counted were still increasing by the last observation period. This was true for both years at Hole-in-the-Mountain Preserve, and during at least one year at Bluestem and Prairie Coteau. At other sites, highest numbers observed were so low that it is impossible to distinguish between inherently low population numbers and observations made too early in the season. As a result it is impossible to make meaningful comparisons between the two years for this species.

Dakota Skipper *Hesperia dacotae* (Figures 7-12)

Data for *H. dacotae* indicate the timing of the counts was well suited to the phenology of this species. In at least half of the site-year data, the peak of the flight period was encompassed by the observations. Two years of observations is insufficient to draw conclusions about populations trends since the variability resulting from differences in observation weather, demographic stochasticity, and phenological variation.

Poweshiek Skipper Oarisma poweshiek (Figures 13-18)

Monitoring data for O. poweshiek indicate that the timing of the observations was fairly well suited to the phenology of this species, but that the species may have a less synchronous flight period among sites than would be ideal for this protocol. During the two years of observations, monitoring was conducted before the peak flight period at the two southern-most sites (Prairie Coteau and Hole-in-the-Mountain), but may have been done after the peak flight period at the more central, Chippewa Prairie and Bluestem Prairie in the north in 1995. Because the peak was observed at so few sites, nothing can be said about relative population size among the two years for this species.

The Arogos Skipper (Atrytone arogos) was seen on 4 of the prairies surveyed. The highest numbers (10) were seen at Glacial Lakes State Park on July 12, 1995. Discouraging however, are the results from Prairie Coteau SNA. Selby counted 24 in 1988, 211 in 1989 and 144 in 1990, but I found none in 1995 and 2 in 1996. The period of time covered was roughly the same but Selby had more total visits. This does not bode well for this species for whatever cause. It may well disappear from that site. It is possible that it will survive and continue to re-colonize the State managed prairie from the surrounding grazed pastures.

The Ottoe Skipper (Hesperia ottoe) was seen on Hole-in-the-

Mountain (7) and Prairie Coteau (1) in 1995. Unlike arogos the monitoring period was too early for ottoe. Therefore this data tells us little about the health of this species.

The Phlox Moth (Schinia indiana) was seen at Prairie Coteau on June 28, 1995. The early morning had been rainy cloudy and cool, and the vegetation was wet. The moths were on the top of the phlox inflorescence. When the sun emerged later they moved under the inflorescence. Despite many hours of observation and sweeping phlox plants no more were seen.

Table 2. Total Butterfly Contacts

| | 1995 | 1996 | Total |
|---|---|---|---|
| Hesperia dacotae | 136 | 212 | 348 |
| Oarisma poweshiek | 501 | 408 | 909 |
| Speyeria idalia | 62 | 43 | 105 |
| All Species | 1816 | 1861 | 3677 |

## DISCUSSION

### The Prairies

#### Hole-in-the-Mountain

In 1995 the season was late as judged by the butterfly fauna and the plant phenology. S. idalia emerged on about July 4 and did not peak by the last visit on July 10. H. dacotae was first seen and peaked on July 6. O. poweshiek was numerous on the last visit on July 10. All three species had strong numbers. In 1996 the season was late but butterfly populations were normal. It is interesting to note that on the same date (July 10) poweshiek populations were 2.4X lower in 1996. This is probably "normal" population variation. (Figures 19-20)

#### Prairie Coteau

In 1995 the season was late, with dacotae and idalia populations very weak throughout the monitoring cycle. Populations of all three species were much lower than on the nearby Hole-in-the-Mountain. In 1996 the season was late and dacotae populations were low. Most purple coneflowers still had upward pointing petals on July 15. Two male Atrytone arogos were sighted in Unit 3S on July 15, these were the first in the study. Selby counted as many as 211 in during the first half of July in 1989 with 52 on

or about July 15. (Figures 21-22)

Chippewa Prairie

The season in 1995 at Chippewa Prairie was normal but became cool and wet by the end of the survey. Populations of dacotae and poweshiek were out in force by July 1 but populations of idalia were low throughout the survey. On July 3-4, 1995 there was a 10 inch rain in the area which did not seem to effect the number of butterflies in flight on the 7th. In 1996 the season was late and all populations were low with dacotae being absent. Sweet clover is a serious problem in the quality dacotae habitat on this prairie. (Figures 23-24)

Glacial Lakes State Park

The 1995 season was normal to late and ended cool. Populations were normal but only one idalia was seen and that on the last visit. In 1996 there were no idalia and the other two species were fewer than 1995. Sumac growth is a serious threat to T-1 (the esker) were management will have to be the manual application of herbicides as fire stimulated more stem production on other units. (Figures 25-26)

Bluestem Prairie

The 1995 season was normal. H. dacotae was restricted and very weak, and idalia was present in reasonable numbers by the 13th. In 1996 the season was late, dacotae was very weak and idalia was

absent. Two new transects were added to transverse a large May 5 burn. Both had few butterflies and fewer prairie obligate species. (Figures 27-28)

Felton Complex of Prairies

In 1995 the seasonal phenology seemed normal but poweshiek and idalia were absent and dacotae was low in number. In 1996 the season was late and cool with poweshiek absent, idalia very weak but dacotae was out in high numbers on July 7. (Figure 29-30)

Timing of Observations and Butterfly Phenology

A late June or early July starting date is within the emergence period for Hesperia dacotae and Oarisma poweshiek but is usually early for Speyeria idalia. By July 15 the declining populations of H. dacotae and O. poweshiek are in poor physical condition. Populations of S. idalia should increase into August.

The results of this project point to the considerable difficulty of monitoring prairie butterflies at widely dispersed sites. Annual weather differences have a large effect on phenological characteristics such as emergence and peak flight dates for butterflies. These weather variations can cause differences in phenology for the same species for sites separated by as little as ten miles. However, not knowing the particular weather parameters at each site the dates chosen are usually within a week of the

brood emergence times for these species. In 1995 I monitored the southern sites first, under the assumption that the season would be further ahead there, then worked northward. However, the season had advanced faster in the north than the south in 1995.

In 1996, I started in the middle at Glacial Lakes State Park and worked southward. This strategy did not work on that site as the dacotae peak was at or before the first visit (July 1). Whereas the 1995 peak at that site was July 8. It did work for Hole-in-the-Mountain in the south and Felton in the North. This concurs with Pollard (1991) where "there was no tendency in either species (studied) for the flight period to be earlier in the south of England than in the north." Monitoring in 1996 was between June 30 and July 13. I again did not catch the peak flight period for any species at all sites.

The 1995 season was judged to be of normal phenology. Monitoring was conducted between June 27 and July 13. Purple coneflower (Echinacea angustifolia) and leadplant (Amorpha canescens) were just blooming and the general butterfly fauna was normal. However 1996 was late throughout, in fact leadplant was not blooming at Felton on the 13th of July and perennial garden flowers at Glyndon were 2 to 3 weeks late.

While the phenology problem cannot be solved to give an accurate count on any one calendar day (Disney 1986), a graph of each

season can be superimposed to match peak brood numbers. Therefore I believe that we now have a core of data that can be used to understand future population trends.

For any lepidopteran species with a relatively short flight period, successful population monitoring requires that the period of observation include the peak of the flight period, so that data among years can be compared based on this peak. At sites where a species was not found or was found in low numbers it is impossible to know if the flight period was missed, the species was missed due to the nature of the protocol or the species is endangered. Low population numbers resulting in the species being easily missed due to the monitoring protocol would be an acceptable outcome since the monitoring design will in no case allow the discovery of extremely rare and widespread individuals. Frank Preston (1948), discussed the concept of "ghost species", that is, on a species-area curve the number of species does not start at 0 at the intersection of the X-Y axis but it starts up the Y axis, which he calls the "veil line", leaving uncountable species to the left of the Y axis. In these cases, however guidance as to the presence or absence of a species can be taken from those sites where large counts were found. For a species like S. idalia in which the peak flight period was missed at each site, each year, the results suggest that a broader period of observation may be necessary.

The problem of maintaining minimum viable populations for these prairie obligate butterflies is that if they are to survive natural pressures long-term they must fulfill the following criteria:

Individual populations must be numerically large (1,000, Thomas 1990). They need to have highly resistant life stages, they do not. The whole population must not be in any one life stage at a time, they are. They must have a continual or a long breeding season, they are short. They must have adults that live through more than one breeding season, they do not. They must have migratory rates between populations that will insure recolonization. Most do not in the current insular island situation. They must not be subject to excess interspecific competition. We don't know about the effects of alien species (ie. insects) on these natives (Slobodkin 1986).

Summary of Recommendations for Improving the Monitoring Program

1. The period of monitoring should be broadened or shifted to encompass the peak of S. idalia. This may necessitate a fourth count beyond the flight of the two skippers in this study. There are other prairie obligate species of butterflies on these sites that are subject to the same pressures as the three species in this study. We have not monitored other species in different flight periods and this needs to be done to help understand the effects of management on these and other invertebrates. These should be in late-May to early-June, early-July (done), late-July

to early-August and early-September.

2. For the monitoring data to be amassed and continued into the future, multiple observers should be explored. This would allow closer dates by having more people in each region of the study to avoid the extensive travel time that must come out of each day (about 3,000 miles each year of this study).

3. We now have well placed transects that will give us the opportunity to monitor future relative changes in populations. We do however need to mark the ends of the transects with Global Positioning System units to avoid any confusion as to there location as several of the landmarks may not be permanent.

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