BUTTERFLY GARDENING:
USING VOLUNTEERS TO PROVIDE DATA ON FLOWER USE

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by
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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

BUTTERFLY GARDENING:
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presented by Donna Brunet,

a candidate for the degree of master of science,

and hereby certify that, in their opinion, it is worthy of acceptance.

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Introduction

Butterflies are the group of invertebrates most noticed by the general public and are popular as art subjects as well as being important ecological subjects.

In the eastern U.S., the area between 35° and 40° north latitude has the most species (Opler and Krizek 1984). Of the approximately 750 species in North America north of Mexico, approximately 60 are normally expected in mid-Missouri (Appendix 1, Heitzman and Heitzman 1987). Butterflies are more common in sunny, biologically complex habitats but are "reasonably abundant and diverse" in a variety of urban settings" (Opler and Krizek 1984). Whereas many butterflies in a region can be attracted to residential habitats by planting good sources of nectar, some butterflies, including Red Admirals (*Vanessa atalanta*) and Red-Spotted Purples (*Limenitis arthemis*) prefer sap, rotting fruit, and animal droppings to flowers (Nabhan 1998, Sutton and Sutton 1999).

There have been a number of studies of urban butterflies in natural areas within cities. Those studies generally began at rural areas surrounding the city and progressed along the urban gradient to the center city. In Porto Alegre, Brazil, highly mobile species normally associated with open areas and which have caterpillars that can use both native and exotic vegetation are the most common species within the city. Fragments of native vegetation within the city increased species richness (Ruszczyk and Araujo 1992). Studies in Staten Island, New York, and in Japan revealed similar patterns, with mobile species adapted

to open areas dominating the urban butterfly fauna. Both species and individuals declined as distance to the central city decreased (Ruszczyk 1986).

Butterflies are considered to be good indicators of a healthy environment (Harding, Asher and Yates 1995, Kocher and Williams 2000) and reflect the environmental impact of urban development (Singer and Gilbert 1978, Shetler 1998). In addition, because butterflies are conspicuous and easy to identify they are a good selection as an indicator species (New 1997). The popularity of butterflies with the general public (Ruszczyk 1986, Wood and Samways 1991, New 1997) and declining butterfly populations (New 1997), combined with the fact that lawns now occupy more than 12 million hectares in the United States (Wasowski and Wasowski 2000), make a compelling case for a systematic survey of garden butterflies.

During the last decade, there have been numerous books and articles published on butterfly gardening (Stokes et al. 1991, Xerces Society 1998, Schneck 2001), new butterfly field guides (Glassberg 1993, 1999, 2001, Bouseman and Sternburg 2001, Brock and Kaufman 2003), and numerous popular books on natural history and butterfly watching (Wilson 1991, Sutton and Sutton 1999, Mikula 2000). In 1992, the North American Butterfly Association was incorporated with 300 members. The membership roster has now grown to approximately 5000 members in 33 local chapters (J. Glassberg, personal communication, March 8, 2006). The number of butterfly houses has also increased tremendously since the opening of the first in Dorset, England, in 1978. Ten years later "record-breaking crowds" welcomed the opening of the first two in the U.S.: Cecil B. Day Butterfly Center in Pine Mt., Georgia, and Butterfly World in Coconut Creek, Florida. By 1996, there were 150 butterfly houses in the world, and 24 in the U.S. (Ross 1996). The Sophia M. Sachs Butterfly House near St. Louis, Missouri, opened in 1998 and

averages 150,000 visitors annually (D. Dupske, personal communication, March 8, 2006). Most of the organized research on butterfly gardens has been done in Great Britain.

During the 1980s and early 1990s a variety of organizations began laying the groundwork for butterfly research using volunteers. The Royal Society for Nature Conservation's junior group, WATCH, conducted counts from July through September 1981. However, spring butterflies were missed and most butterflies were only identified to family. From spring through fall 1985, 24 rural and urban gardens in Dorset, England, were surveyed in a comparison of butterflies present in gardens and nearby natural habitats. From April through September 1991, the Essex Wildlife Trust conducted weekly butterfly counts in 460 yards, also recording which flowers butterflies were observed on and indicating presence of caterpillar host plants and caterpillars. The Young Ornithologists Club, part of the Royal Society for the Protection of Birds, counted butterflies from July through August 1992 in 288 yards; their data also included behavior and nectar sources (Vickery 1995). Since the early 1990s, the Butterfly Conservation Society has conducted two garden butterfly surveys simultaneously in Great Britain. One survey is simply a list of butterfly species that were noticed in the garden each year (over 700 gardens in 2000). The other survey, conducted by members of the Butterfly Conservation Society, makes weekly counts between 1 April and 30 September (approximately 50 gardens in 2000). The length of the count is not standardized; individuals walk through their gardens once without stopping; the length of the count varies with garden size. The counts have been used to create range maps and to determine whether populations are decreasing (M. Vickery, personal communication 10 February 2002).

The organization of the Xerces Society in 1971 and their 4th of July butterfly counts begun in 1975 marked the beginning of North American butterfly conservation (Swengel 1990, Opler 1995). The North American Butterfly Association currently organizes the 4th of July counts; in 2001, 500 counts were conducted in 47 states, seven Canadian provinces and three Mexican states (NABA 2001).

There is considerable interest in landscaping for wildlife, including butterflies. The National Wildlife Federation's backyard wildlife campaign began in 1973. Since that time over 60,000 yards have been certified as backyard habitats, with 878 in Missouri including 21 in Boone County (L. Grant, personal communication, March 8, 2006). Although some individuals may have collected before and after information on the wildlife habitats that they have created in their yards, the National Wildlife Federation has no information on the success of their certified habitats.

Creation of wildlife habitat in yards is generally assumed to result in more wildlife in the yard. However, gardens are small habitat fragments and can not be expected to attract the entire faunal spectrum of a geographic region or area (Nabhan 1998). In the preface to the Xerces Society's second edition of Butterfly Gardening, Society president Allen claims "the secret to success is a simple one: grow nectar and larval plants, and butterflies will come" (Allen 1998). Even if her statement is true, there are limits as to which species can be attracted to a suburban lawn; it is impossible to recreate the complexity of natural habitats in a suburban development. For example, *Asterocampa* spp. are common in the rural areas surrounding Austin, Texas; but despite the fact that their larval host (*Celtis* spp.) is relatively common within the city limits of Austin and the adults are opportunistic feeders at flowers, fruit, and sap found within suburbs, *Asterocampa* are scarce within the city (Singer and Gilbert 1978).

Homeowners' goals for butterfly gardening are to have more butterflies where they can easily watch them, to increase populations, and to help threatened species survive (Winter 2000). Although Winter recognizes that the last goal is highly unlikely, he claims that by replacing exotic plants in typical suburban yards with native plants it is possible to "invite displaced butterfly species back to their former habitats." A further benefit of butterfly gardening is the potential to educate friends, relatives, and neighbors.

Objectives

This study was intended to begin the process of determining just how effective high-quality nectar sources are in increasing both butterfly species richness and abundance in a residential setting. In addition, drawing participants' attention to the various species of butterflies in their yards and providing them with the ability to identify butterflies was expected to increase their desire to provide better butterfly habitat.

This project attempted to answer several questions concerning butterflies in mid-Missouri, including:

1) Which butterfly species can be attracted to yards in Columbia, Missouri?

2) What nectar sources are most frequently used by butterflies?

3) What are the predominant attitudes towards butterflies, other insects, and lawn care of people interested in residential wildlife observations?

It is hoped that answers to these questions will shed light on the reasons some yards have more butterflies than others and will help determine whether people can increase the number of butterflies in their yards by altering their lawn management.

Methods

Volunteers were recruited beginning in the winter of 2001-2002. Flyers about the project were posted in various locations in the city, including the University of Missouri campus, downtown kiosks, and city parks. The flyers mentioned the project and advertised two free workshops on butterfly identification on the University of Missouri - Columbia campus. Notices also appeared in the calendar sections of two local newspapers (the *Columbia Daily Tribune* and the *Missourian*) and in the University Administration's newspaper delivered to faculty and staff (*Mizzou*). The project was also mentioned in the newsletters of several environmental organizations (the Sierra Club, Audubon, Missouri Native Plant Society) and I was able to attend a meeting and give a short presentation on the upcoming project at both Sierra and Audubon. I also gave a presentation for the Westside Kiwanis Club.

In addition to the workshops conducted before the start of the counts in May 2002, volunteers received materials to help with identification: a CD containing a slide show of the PowerPoint presentation given at the workshops, additional butterfly photos on CD, an identification key pointing out distinctions between similar butterflies, a 2-page color printout with photographs of 25 common butterfly species, a list of web sites (along with a reminder that anyone without web access could view these pages at the public library), and a video on butterfly identification.

The videos, slide shows, and color handouts included the species thought most likely to be observed in residential areas based on my personal viewing in previous years. I created a series of questions designed to lead volunteers through the identification process, focusing their attention on a series of field

marks (overall color, eyespots, lines, etc.). The key was provided as a text-only printout to be used in the field and was provided with illustrations on the CD and web page in order to provide an interactive learning experience with feedback on correct and incorrect choices. Many volunteers also had access to other sources including field guides. Netting of butterflies in order to identify them was discouraged because it may alter behavior.

All materials on the CD were also available on the project web site. They were also provided with a count protocol (Appendices 2 and 3). Three newsletters were provided on the web page throughout the duration of the project, which reported what butterfly species had been seen and provided a list of recommended plants for attracting butterflies.

Volunteers, especially those with limited nectar sources, were encouraged to enhance their landscaping to provide better butterfly habitat. During the winter of 2002-2003, a list of recommended plants for butterfly gardening was made available on the project web site, and participants were notified by email of its existence. Those individuals that had not provided me with an email contact received the plant list by regular mail.

Three attitude surveys were given to participants in order to gather information about their attitudes toward insects and their landscaping and yard maintenance strategies. Other questions asked about their experiences with the project. Surveys were conducted prior to the start of butterfly counts in 2002 and after each of the two field seasons. The University of Missouri - Columbia Campus Institutional Review Board (IRB) approved the use of volunteers for this project under Campus IRB Docket Number 02 - 02 - 121. Requirements for the use of volunteers included their ability to withdraw at any time throughout the duration of the project.

Eighty-six individuals (plus several of their spouses) either attended a workshop or otherwise contacted me to express an interest in participating in the project. Of the original group, 66 people ended up participating in the project in some way. Six of them limited their participation to only completing the first of three attitude surveys. Sixty volunteers turned in count data for at least one year of the 2-year project (23 counted in both 2002 and 2003; 30 counted only in 2002; seven counted only in 2003).

Butterfly Species, Number, and Activity in Yards

Methods

Count Protocol

The count protocol followed by volunteers (Appendices 2 and 3) instructed them to count for 15-minutes once a week (Monday through Sunday) from 13 May through 15 September 2002 and 11 May through 29 September 2003 between 10 am and 3 pm CDT on mostly sunny days without excessive wind. During 2003, the time period was extended to 4 pm to better accommodate volunteers' schedules since it was not expected to affect butterfly numbers. Butterflies that were suspected of leaving the yard and then returning to the yard were counted again since it was a separate visit to the yard. Volunteers were instructed to select a specific portion of their yard to use as a consistent count site. In general, they selected flowerbeds.

In 2002, I collected yard data myself. I tried to visit at a time when I could observe a count to determine whether the protocol was being followed, how observant the volunteers were of butterflies visiting the yard, and their identification skills. During this time I was able to provide identification assistance with the butterflies observed. Many volunteers commented that my visit during a count made them more confident of their identification abilities.

Since many of the volunteers were employed, these yard visits were mostly restricted to weekends. Volunteer schedules, weather, and time constraints meant that I was able to visit only a small number of yards each week. As a result, the 2002 yard data were not collected in a timely fashion, or as frequently as I had intended. Only 50 of the 53 sites were surveyed, since some volunteers only participated in the project for a few weeks.

In addition, volunteers preferred having more flexibility in their counting schedule than was possible when a joint count had been scheduled. If I had made an appointment to count with them, they were no longer free to conduct a count whenever the opportunity to take a break from their daily schedule presented itself.

In 2003, I provided yard data sheets for volunteers to complete, providing a monthly look at all yards within a 1-week time period. Volunteers at 27 of the 30 sites submitted yard data sheets. Fourteen volunteers submitted a yard data sheet for week 1, 18 for week 4, 19 for weeks 9, 13 and 17. In addition, the 2003 butterfly count data sheet was modified to include numbers of blooms in the yard during each count.

Flowers were recorded by common names. In most cases, the common names provided could be matched to a family and genus. Genera were then categorized as either "recommended" or "not recommended" based on whether they were normally recommended for use in butterfly gardens or not. Plants were assigned to categories based on the recommendations in *Butterflies and Moths of Missouri* (Heitzman and Heitzman 1987), *Butterfly Gardening and Conservation* (Tylka 1990), *Butterflies: How to Identify and Attract them to your Garden* (Schneck

2001), *The Family Butterfly Book* (Mikula 2000), *Regional Butterfly Gardening brochure for Greater Kansas City: Kansas-Missouri* (Branhagan 1999), and *Butterfly Gardening: Creating Summer Magic in your Garden* (Xerces Society 1998). A plant list consisting of 94 flower genera in 39 plant families was created from these sources. Most of the genera were in two families, Asteraceae (46 genera) and Lamiaceae (21 genera).

Volunteers were instructed to identify individual butterflies only to the level at which they were confident of their identification. Butterflies could be recorded as a member of a butterfly family, as one of two closely related species (i.e., Painted Lady (*Vanessa cardui*) and American Lady (*V. virginiensis*) could be identified as "lady"), or recorded to species level. In an effort to determine species richness in spite of identification gaps, I asked volunteers to record the minimum number of species seen per count, taking into consideration unidentified species. If they saw a small blue unknown and a large orange unknown, for example, they were instructed to report two species on the total species row of the data sheet, even if they could not identify either species. Due to the difficulty of identifying Hesperiidae (skippers), they were only identified to the family level.

During the counts, volunteers recorded not only the butterflies, but also what the butterfly was perched on when observed. Flowers on which butterflies landed were identified when possible. In 2002, 1491 butterflies were observed on flowers; 1270 (85.2%) of the flowers were identified to genus while 129 (8.7%) of the flowers were identified only to family. In 2003, 1418 butterflies were observed on flowers. Of those, 1296 (91.4%) of the flowers were identified to genus with 90 (6.3%) identified to family.

A variety of objects landed on by butterflies were grouped together as "other." This category included dirt or mud, lawn, man-made structures (including houses, fences, chairs, compost bin), rocks, pavement, or leaves and stems of plants. Butterflies that just passed through the count area without landing were recorded as "flyovers."

Volunteers did not hunt for caterpillars in yards nor were host plants used by caterpillars recorded in yard data unless they also provided nectar in the area of the yard used during the butterfly counts.

Since the sites were not randomly selected, but instead were homes of volunteers, a species-area curve was constructed using PC-ORD to estimate how thorough the coverage was.

Results

In 2002, 54 volunteers conducted 652 butterfly counts; 30 volunteers completed 369 counts in 2003. Some of the counts were not usable due to counting either more or less than 15 minutes or counting before or after the time frame specified in the protocol. One volunteer who lived in an apartment counted in a public garden during 2002. Results of those counts are not included here since the site was different from the residential sites.

In 2002, volunteers at 53 sites conducted 608 usable 15-minute butterfly counts for a total of 152 hours. The count period included 18 weeks between 13 May and 15 September although a few individuals opted to count beyond the end of the count period because they were still seeing butterflies. Those 12 counts during week 19 and five during week 20 have been included here since the 2003 counts continued until 28 September.

The number of counts completed by the 53 volunteers ranged from two to 20. The mean number of counts turned in was 11.5. Thirty-eight (71.7%) individuals completed at least half of the counts.

In 2003, individuals at 30 sites conducted 350 usable 15-minute butterfly counts for a total of 87.5 hours. The count period consisted of 20 weeks from 11 May through 28 September. The number of counts completed by those 30 ranged from one to 20. The mean number of counts turned in was 11.7. Twenty (66.7%) individuals completed at least half of the counts.

The number of counts per week in 2002 ranged from a low of 20 during week 18 (9-15 September to a high of 43 during week five (10-16 June). The mean number of counts per week was 30.4. During 2003, there was a low of nine counts during week 16 (25-31 August) and a high of 24 counts during week three (26 May - 1 June) with a mean of 17.5 counts per week (Figure 1).

Site Characteristics

2002

Yards ranged in size from 9.3 m^2 to 4645.2 m^2, with a mean of 256.0 m^2 (Appendix 4). Shade was estimated at or near noon and ranged from 0% to 100% with a mean of 31.9% shade at midday. Volunteers were instructed to conduct their counts at a time when the portion of the yard counted was not in the shade. Distance from the Boone County Courthouse located in downtown Columbia ranged from 0.5 km to 19.0 km.

Sites had between one genus and 38 genera of flowers with a mean of 12.3 plant genera. Plant genera typically recommended for butterfly gardens were found in 49 of 50 sites; those sites had between one

and 24 recommended genera. The 12 most frequently grown genera in 2002 were *Echinacea* (26 yards, 52.0%), *Chrysanthemum* and *Coreopsis* (each 21, 42.0%), *Rudbeckia* (19, 38.0%), *Tagetes*, *Zinnia and Hemerocallis* (each 18, 36.0%), *Petunia* (17, 34.0%), *Phlox* (16, 32.0%), *Salvia* (11, 22.0%), *Asclepias* and *Liatris* (both 9, 18.0%). All are typically recommended for butterfly gardens.

2003

Sites ranged in size from 9.3 m^2 to 929.0 m^2, with a mean of 99.0 m^2 (Appendix 5). Shade was estimated at or near noon and ranged from 0% to 59% with a mean of 16.0% shade. Sites were from 1.4 km to 24.0 km from the Boone County Courthouse, although only three sites were farther than 10 km.

Plant genera typically recommended for butterfly gardens were found in all 27 sites that completed yard data sheets; sites had from two to 33 of the recommended genera with a mean of 12.6 and a mode of 8. The most frequently grown genera in 2003 were *Chrysanthemum* (17, 56.7%), *Coreopsis* (16, 53.3%), Echinacea (15, 50.0%), *Zinnia* (14, 46.7%), *Rudbeckia, Salvia* (11, 36.7% each), *Petunia, Asclepias* (10, 33.3% each), and *Liatris* (9, 30,0%). All are normally recommended for butterfly gardens.

Information on flowers present in yards and other site characteristics such as shade was available for 27 of the 30 sites counted in 2003. Butterflies per count and species per count do not show a strong relationship with flowers, shade, distance from downtown, or the size of the count area (Figures 2 - 9).

Species and Numbers

In 2002, 37 butterfly species were identified in addition to skippers; in 2003, that number was 32 (Appendix 1). The only two species that were grouped and always counted as a single species were Spring Azure (*Celastrina ladon*) and Summer Azure (*C. neglecta*). Summer Azure was considered a subspecies of *C. ladon* until recently (Layberry et al. 1998; Wright et al. 2003). Thirty species were identified in both 2002 and 2003 for a combined project list of 39 butterfly species plus skippers.

2002

In 2002, 2600 individual butterflies were observed with 2454 (94.4%) identified to family (Figure 10) and 2020 (77.7%) identified to species. Few of the volunteers had an extensive background in butterfly identification prior to beginning the project. This may have impacted the species list.

All six expected species of Papilionidae (swallowtails) were identified (Appendix 1). Six species of Pieridae (whites & sulphurs) were recorded. Eight species of Lycaenidae (blues and hairstreaks) were observed, while no species of Riodinidae (metalmarks) were seen during either year of the project. Seventeen species of Nymphalidae (brushfoots) were identified in 2002. Lycaenidae were the family least likely to be identified to species in both years, possibly because they are small and very similar to each other.

A species-area curve constructed using PC-ORD indicated that the species list compiled from the volunteers' counts was fairly thorough. PC-ORD provided an estimate of 41.9 to 42.9 species actually present at the 53 sites; 38 were actually identified. Four species were observed at only one site each; all were Lycaenidae. None of the four (Juniper Hairstreak

(*Callophrys gryneus*), American Copper (*Lycaenia phlaeas*), Banded Hairstreak (*Satyrium calanus*), and Southern Hairstreak (*S. favonius*) were on the provided photo sheet handouts that included only the most common species.

Pieridae were observed at more sites (49) than any other family. Cabbage White (*Pieris rapae*), an introduced species, was observed at 38 (71.7%) sites, more than any other species. Nymphalidae were at 45 sites, Lycaenidae at 40, and Hesperiidae at 33. Papilionidae were observed at the fewest sites (32).

Within the city limits, 44 volunteers conducted 500 counts; 108 counts were at nine sites outside of the city limits. As a group, sites located outside of the city limits had more butterflies per count (7.9) than sites located inside of the city limits (3.5) (Figures 11-15). The mean number of butterflies per count at sites inside of the city limits ranged from 0.0 to 12.5. Sites outside of the city had from 4.0 to 11.9 butterflies per count.

Mean number of butterflies per count inside and outside of the city limits varied by family. The largest difference occurred in Papilionidae, with 0.2 individuals per count in the city limits and 0.8 individuals outside of the city limits.

The number of butterflies per count peaked at the end of the count season with 11.3 per count during week 19 (16-22 September) (Figure 16). The number of individuals per count varied throughout the flight season by family. Papilionidae per count peaked with a high of 0.8 during week 14 (3-9 June). Individuals per count in all other families peaked at the end of the count season, with Lycaenidae and Nymphalidae more evenly observed throughout the count season (Figures 17-21).

2003

The 30 volunteers reported 2057 individual butterflies in 2003, with 1991 (96.8%) identified to family and 1806 (87.8%) identified to species.

There was a higher proportion of Nymphalidae and a lower proportion of Pieridae observed in 2003 compared to 2002 (Figure 22). The same six species of Papilionidae were recorded. The six species of Pieridae observed in 2002 were observed in 2003, with the addition of Dainty Sulphur (*Nathalis iole*). Only four of the eight species of Lycaenidae from 2002 were identified in 2003. Fourteen of the 19 species of Nymphalidae seen in 2002 were recorded again, with the addition of an unusually far north Gulf Fritillary (*Agraulis vanillae*). Papilionidae were at 17 of the 30 sites. Pieridae and Lycaenidae were observed at 26 sites with Nymphalidae at 29 sites and Hesperiidae at 21 sites.

The species area curve for 2003 data also indicated that the volunteers' counts provided a fairly complete species list given the number of sites. With 32 species plus skippers observed at 30 sites, PC-ORD estimated a total of 36.9 to 39.7 species present in the area covered. Four species were identified at a single site each: Sleepy Orange (*Eurema nicippe*), Dainty Sulphur (*Nathalis iole*), Gulf Fritillary (*Agraulis vanillae*), and Hackberry Emperor (*Asterocampa celtis*).

There were 268 counts at 23 sites inside of the city limits. Volunteers at seven sites outside of the city limits conducted 82 counts. Sites located outside of the city limits had more butterflies per count (12.4) than sites located inside of the city limits (3.9). The biggest difference occurred in Pieridae, with 0.4 per count in the city limits and 2.7 per count outside of the city limits. Papilionidae, with the largest difference inside and outside

the city in 2002, had 0.1 individuals per count in the city limits and 1.1 individuals outside of the city limits (Figures 23-27).

The number of butterflies per count increased at the end of the season, peaking at 10.8 per count on week 15 (18-24 August) (Figure 28). Papilionidae peaked during weeks 12 through 16 (28 July - 31 August). Nymphalidae and Hesperiidae peaked during the second half of the count period. Pieridae and Lycaenidae were more consistently observed throughout the count period (Figures 29-33).

Butterfly use of Flowers

2002

The most frequent activity recorded was landing on a flower (1491, 57.3%). There were 756 (29.1%) flyovers; 352 (13.6%) of butterflies were recorded landing on something other than a flower (Figure 34).

During the first eight weeks of 2002, butterflies were almost evenly divided between flying through yards and stopping on flowers. During weeks nine through 20 (8 July - 28 September), butterflies were most frequently observed at flowers (Figure 35). Of the 1491 butterflies observed on flowers in 2002, 1286 (85.5%) were on plant genera recommended as good nectar sources for butterflies (Figure 36).

Butterflies were at *Zinnia* (299, 20.1%) far more frequently than at any other single flower genus (Appendix 6). *Verbena* was the next most frequently visited flower with 115 (7.7%) of the butterflies that visited flowers. The volunteers recorded butterfly visits at 111 flower genera (64 recommended, 47 not recommended) in 48 plant families. The twelve flower genera that had at least 2% of the butterflies were all typically recommended for use in butterfly gardens.

Swallowtails were most frequently observed on *Zinnia* (24.1%). They were more likely to be observed on *Phlox* (7.2%) than other butterflies (0.3%). Eastern Tiger Swallowtails (*Papilio glaucus*) were more likely to land on *Hesperis* (14.3%), *Echinacea* (9.5%), and *Lonicera* (9.5%), than were other swallowtails (7.2%, 2.4% and 3.6%, respectively). Also, no Eastern Tiger Swallowtails were recorded on *Zinnia*. Giant Swallowtails (*Papilio cresphontes*) were most likely to be observed on *Verbena* (23.8%) while swallowtails as a group occurred on *Verbena* only 7.2% of the time (Appendix 7).

About one-third of the whites and sulphurs were observed on two genera of asters: *Zinnia* (23.2%) and *Coreopsis* (9.6%). Cabbage Whites (*Pieris rapae*) were less likely to be on *Coreopsis* (4.4%) than other pierids. Cloudless Sulphurs (*Phoebis sennae*) were more likely to land on *Petunia* (11.8%) than were other whites and sulphurs. Clouded (*Colias philodice*) and Orange Sulphurs (*C. eurytheme*) were frequently not separated by volunteers. These two species were more likely to use *Coreopsis* (32.6%) and clovers (13.0%) and less likely to use *Zinnia* (8.7%) than all sulphurs (Appendix 8).

Blues and hairstreaks were far more likely to land on clovers (*Trifolium, Melilotus* and *Medicago*) than were butterflies as a group (45.1% vs. 7.0%). While butterflies were more likely to be on *Zinnia* than any other flower, none of the Lycaenidae observed in 2002 were on *Zinnia*. Gray Hairstreaks (*Strymon melinus*) used a wide variety of nectar sources. They were more frequently at *Chrysanthemum* (18.8%), *Echinacea* and *Achillia* (both 12.5%) than blues and hairstreaks as a group (2.1%, 3.5%, and 1.4%, respectively) (Appendix 9).

In 2002, brushfooted butterflies were more likely to use *Echinacea* (9.7%) and less likely to use *Zinnia* (7.8%) than other butterflies (5.8% and 20.1%, respectively). Great Spangled Fritillaries (*Speyeria cybele*) were more often observed on *Asclepias* (18.9% vs. 9.2%) than other brushfoots. Pearl Crescents (*Phyciodes tharos*) were most frequently observed on *Coreopsis* (18.2% vs. 7.8%) and *Ageratum* (12.7% vs. 4.4%) than brushfoots (Appendix 10).

Use of flowers by skippers was similar to the recorded use of all butterflies considered together (Appendix 11).

2003

Of the 2057 butterflies observed, 1418 (68.9%) landed on flowers, 1262 of those on recommended butterfly garden plants. Approximately 10% (202) of the butterflies landed on some "other" object, while 437 (21.2%) flew through yards without stopping (Figure 37).

The distribution of activity in 2003 was similar to that in 2002, with butterflies more often at flowers during the second half of the count period (Figure 38). Data sheets used in 2003 had space for recording the number of flowers in bloom at the time of the count. Blooms were not more abundant during the second half of the count period when butterflies were more frequently observed at flowers (Figure 39).

Butterflies were at *Zinnia* (413, 29.1%) far more frequently than at any other single flower genus. In 2003, *Liatris* was the next most frequently visited flower genus with 86 (6.1%) of the butterflies, followed by *Verbena*, which had been second in 2002, with 67 (4.7%) of the butterflies that visited flowers (Appendix 6). The volunteers recorded butterfly visits at 91 flower genera (55 recommended, 36 not recommended) in 39 plant

families. The fourteen flower genera that had at least 2% of the butterflies were all typically recommended for use in butterfly gardens.

Swallowtails were not observed on *Liatris* in 2003, compared to 6.1% of all butterflies. All species of swallowtails were most frequently at *Zinnia* Appendix 7).

In 2003, whites and sulphurs were again most frequently observed on *Zinnia* (28.8%). Basil (*Ocimum*) had 5.1% of all members of the family, but all of the butterflies were Cabbage Whites. Cloudless, Clouded, and Orange Sulphurs were all most likely to be on *Zinnia*, similar to other members of the family. Compared to the family as a group, *Colias* spp. were more likely to be on *Liatris* (14.8% vs. 2.8%), *Coreopsis* (7.4% vs. 2.3%), and *Daucus* (7.4% vs. 1.1%) (Appendix 8).

In 2003, a few Lycaenidae were observed on *Zinnia*, but far less than all butterflies (1.7% vs. 29.1%). Once again, blues and hairstreaks were more likely to be found on *Trifolium*, *Melilotus* and *Medicago* (17.4%) than all butterflies (2.6%). They were also more likely to use *Eryngium* (7.8% vs. 0.8%). Gray Hairstreaks were more likely to be on *Gomphrena* (17.4% vs. 3.5%) and *Verbena* (13.0% vs. 5.2%) and less likely to be on clovers (4.3% vs. 17.4%) than other members of the gossamer-wings (Appendix 9).

In contrast to the 2002 results, in 2003, brushfoots were most likely to be recorded on *Zinnia* (37.2% vs. 7.8%). Pearl Crescents once again used *Coreopsis* at a much higher rate than did the other brushfoots (16.9% vs. 2.9%). Great Spangled Fritillaries used *Asclepias* more frequently than brushfooted butterflies as a whole (26.3% vs. 10.1%) (Appendix 10).

Skippers used flower genera in roughly the same proportions as butterflies as a group; however, true butterflies (4.4%) were slightly more likely to be recorded on *Asclepias* than were skippers (1.3%) (Appendix 11).

Discussion

Of the approximately 60 butterflies expected in mid-Missouri (Heitzman and Heitzman1987), 40 were identified in either or both 2002 and 2003. The species area curves indicate that, based on the number of sites each year, volunteers identified approximately the number of species expected.

A limited number of the species in a region normally occur in suburban and urban developed areas (New 1997). Urban areas in Great Britain generally experienced loss rates of 0.7-0.9 species with every 10% per hectare increase in urban cover such as residences, commercial and industrial uses, and roads (Dennis and Hardy 2001). In an analysis of 4th of July butterfly counts, Kocher and Williams (2000) discovered that human disturbance of habitat did not necessarily reduce the number of individual butterflies, but, instead, the number of species present was reduced. Often the increased numbers were due to an increase of two introduced species: Cabbage White (*Pieris rapae)* and European Skipper (*Thymelicus lineola*). Most of the butterflies expected in Boone County are still found within the city limits of Columbia, though many of them are not expected in yards and are not as common within the city as in rural areas.

Urban areas frequently have a high number of species present in spite of habitat disturbance in part because researchers are examining

presence-absence data instead of population size (Dennis 1992). Individual butterflies in a city are not necessarily part of a breeding population in a natural area within the city (Hardy 1994). British butterflies have been shown to fly 5-10 km from breeding habitat (Hardy and Dennis 1999).

Pieris rapae were the most frequently identified species in 2002 and one of the most frequently observed in 2003. In this study, even the sites outside of the city limits were not natural habitat, but residential. *P. rapae* can benefit from habitat modification because they breed on food plants common in gardens (Owen 1991).

Providing nectar sources in yards can be crucial in maintaining butterflies in urban areas. The availability of nectar may allow higher species density in urban than rural areas (Singer and Gilbert 1978) because nectar increases the fecundity of butterflies (Vickery 1995, Erhardt and Rusterholz 1998, Fischer et al. 2004).

Flowers recorded as used in this study were not reported as a function of availability. Availability of resources needed by wildlife can be difficult to ascertain. In addition to needing to know the number of flowers of a particular genus, it would be necessary to know the stage of nectar production of each of those flowers.

However, in order to gain insight into the attractiveness of a particular flower genus, a few comments are appropriate. Only a small percent of butterflies (1.6% in 2002 and 4.4% in 2003) were recorded on *Asclepias*. However, only five sites reported growing *Asclepias* in 2002 and seven in 2003. *Zinnia* appears to be overwhelmingly favored with 20.1% of butterflies observed on *Zinnia* in 2002 and 29.1% in 2003. But 18 sites grew *Zinnia* in 2002 and 14 in 2003. In addition, Zinnia blooms all the way to the end

of the growing season in Missouri. Zinnias may have had such a high recorded use because it blooms at the end of the flight season when many of the other flowers have finished blooming for the year and at a time of year when the populations of butterflies are peaking.

Vickery (1995) suggested the most significant value of gardens to butterflies is the provision of nectar sources that can increase reproductive output. This is particularly important during late summer and fall when natural sources of nectar are often scarce. The lack of natural sources of nectar at the end of the flight season may be the reason for more butterflies stopping at flowers in yards rather than flying through during the second half of each count period.

Attitudes Toward Insects, Lawn Care, and Project Participation

Methods

Survey Design

The attitude surveys were designed to determine basic demographic data about the volunteers, their attitudes toward lawn care and insects, and their experiences with the project. I developed three surveys. The first survey (Appendix 12) was given to participants when they joined the project. The second survey (Appendix 13), conducted in February 2003, was given to volunteers who participated in the first year of butterfly counts. The final survey (Appendix 14) was conducted in February 2004.

Each survey included an identifying number that allowed the respondent's questions on all three surveys to be linked to each other. In addition, butterfly count data could also be linked to a respondent's survey answers.

The basic demographic questions only appeared on the first survey. Questions about their wildlife-oriented recreation provided information on their motives for volunteering for the project.

Lawn care questions were asked on all three surveys. It is expected that different lawn care regimes affect insect habitat within a yard. In particular, lawns that are weedier generally provide better habitat (Plant 1994). In addition to questions on insecticide and herbicide use, the first

and final surveys asked volunteers about their attitudes toward insects and any accompanying plant damage and their opinion on collecting butterflies.

All three surveys contained questions on the identification skills of the volunteers. The surveys also looked at volunteers' use of the identification materials provided by the project, and problems encountered during the counts.

Most questions had volunteers select from provided answers, with the option to choose "other" and write in an answer. Some questions were open-ended, such as suggestions for improving identification materials.

The following results include all survey responses except where noted. 12 people completed the first survey and then dropped out of the project.

Results

Demographic characteristics of volunteers

The volunteers for the most part were white, well educated, and 35 years of age or older. The breakdown between men and women based on the survey was 14 (23.7%, n=59) and 45 (76.2%), respectively (1Q21: first survey, Question 21). Ages of participants ranged from one (1.6%, n=61) in the 18-24 age group to 11 (18.0%) 66 or older (1Q22). Fifty-six individuals (100%) indicated they were white (1Q23). Twenty-one (33.9%, n=62) reported four years of college whereas 33 (53.2%) reported five or more years of college (1Q27). Most of the volunteers (57, 91.9%) owned their home (1Q24).

Participants' involvement in wildlife related activities

Of the 62 individuals who answered the question "Do you participate in any of the following activities?" only one (1.6%) answered no for all seven activities listed. Forty (64.5%) reported participating in four of the seven activities: observing wildlife at home, feeding birds or other wildlife, maintaining plantings or natural areas, and observing wildlife on public land (1Q28). Thirty-five (56.5%) reported that they had visited a butterfly house (Figure 40).

In answer to the question "What types of wildlife do you watch in your yard?" 19 (31.7%; n=60) said yes to all (birds, large mammals, small mammals, reptiles and amphibians, and insects). Birds were the most commonly watched backyard wildlife; 60 (100%) reported watching birds. Forty-five (75.0%) reported watching insects in their yards prior to their involvement in this project (1Q29) (Figure 41).

Thirty individuals (48.4%; n=62) indicated they belonged to an environmental group (1Q25). National Audubon Society and the local Audubon chapter (15, 51.7%, n=29) and Sierra Club (13, 44.8%) were the most frequently cited groups (1Q26). A total of 28 groups were listed. No one reported a membership in the North American Butterfly Association or the Xerces Society. Membership in environmental groups ranged from those belonging to a single group (8, 27.6%, n=29) to nine environmental groups (1, 3.4%). Most common was belonging to either two or three groups (6, 20.7% each).

A total of 18 (29.0%, n=62) indicated having participated in other data collection activities. The National Audubon Society organizes the Christmas Bird Counts and 11 of the 15 individuals who reported being a

member of either National Audubon or the local chapter also indicated having previously "participated in other data collection activities such as a Christmas Bird Count."

Participants' Motivations to Volunteer

Learning to identify butterflies (25, 42.4%, n=59) was the choice most frequently cited as the primary motivating factor for volunteering to conduct weekly butterfly counts (1Q19). Participating "in an interesting and fun diversion from normal activities" was only ranked number one by six (10.2%) individuals (Figure 42).

Participants' Enjoyment of Yards

Second Survey

Thirty-four (85.0%, n=40) volunteers who counted in 2002 reported that conducting the counts increased their satisfaction and enjoyment of their yards (2Q27).

The two most commonly cited factors in increasing enjoyment of their yards (2Q29) were seeing which butterflies were in the yard each day (34, 94.4%, n=36) and learning how to identify butterflies (33, 91.7%). Twenty-nine (80.6%) selected being outside. Twelve individuals (33.3%) listed additional factors that increased their enjoyment of their yard: seeing the flowers they had planted (2), noticing which of those flowers were being used by butterflies (5), noticing other insects (2) and other things they would have missed (1), becoming more aware at all times (1), having better records of their yard observations (1), and sharing their observations with family (2).

In response to whether conducting the counts had increased their appreciation of butterflies and the habitats they use (2Q30), the vast majority responded "yes" (37, 94.9%, n=39).

Final Survey

After the 2003 count season, 30 (88.2%, n=34) volunteers agreed that their enjoyment and satisfaction of their yards increased with project participation (3Q13). Twenty-nine (85.3%) reported noticing butterflies more frequently after participation in the butterfly counts (3Q18).

The final survey repeated the question on whether participating in the project had increased their appreciation of butterflies and butterfly habitat (3Q15); in addition to yes, no, and no opinion, they also had the option of answering that they had already had a significant appreciation of butterflies and their habitats prior to the counts. Six people chose that new answer (20.0%, n=30) while 23 (76.7%) responded that their appreciation of butterflies and habitats had increased as a result of their participation in the project. Fifteen of the 23 volunteers who answered the question on both surveys responded "yes" each time.

Participants' Attitudes Toward Insects

Collecting

The North American Butterfly Association is strongly opposed to butterfly collecting (2Q31). Although no one indicated a membership in NABA, I asked for volunteers' opinions on collecting. Thirty-four (89.5%, n=38) supported collecting for scientific research although 19 (50.0%) thought there should be "severe restrictions on numbers collected and purpose." A personal collection was not as acceptable, with 10 (26.3%)

believing it was acceptable for children and eight (21.0%) believing it was acceptable for adults. Only one (2.6%) individual agreed with the statement that collecting was "not acceptable under any conditions."

General Attitudes Toward Insects

The first survey questioned volunteers about their attitudes toward stinging and non-stinging insects. Participants were almost evenly split between tolerating (31, 50.1%) and enjoying seeing (27, 44.3%) wasps and bees (1Q6). Only one (1.6%) reported experiencing fear. Six people separated their answers for wasps and bees, with less tolerance for wasps. Those individuals are characterized here by the least tolerant category indicated.

Participants were more likely to appreciate insects that they did not perceive as a hazard. No one reported killing or fearing non-stinging insects. The number of people who enjoyed seeing them rose to 44 (70.1%, n=62) (1Q7).

Caterpillars and Other Insects on Plants

Both the first and final surveys sought to determine whether desire for adult butterflies in their yards affected attitudes toward caterpillars. Questions concerning tolerance for plant damage were asked for caterpillars and for all other insects to determine whether desire for adult butterflies increased tolerance for caterpillars. Questions separated answers for ornamental and food plants. In spring 2002, 17 (27.9%, n=61) participants said they did not grow plants for their own consumption. Seven (21.2%, n=33) did not grow food plants during the summer of 2003. Those individuals are not included in the results for the questions concerning food plants.

First Survey

On the first survey, 37 (61.7%) reported that they enjoyed seeing caterpillars on plants in their yard (1Q8). Four (6.7%) responded that they killed caterpillars in their yard.

Ten (22.2%) of the 45 individuals who grew plants for their own consumption prior to their participation in the project, removed or killed insects as soon as they were noticed feeding on plants (1Q10). Ten (22.7%, n=44) had the same reaction even if the insects were caterpillars (1Q9). Ten (22.7%) were tolerant of any amount of caterpillar damage, while nine (20.0%) were willing to tolerate any amount of damage from insects other than caterpillars. The majority of volunteers were willing to tolerate a "moderate" amount of plant damage from caterpillars (24, 54.5%) and from other insects 26 (57.8%).

Everyone grew ornamental plants in their yards, although some had put more effort into landscaping than others. Individuals were more tolerant of plant damage on ornamentals, with 21 (34.4%) tolerant of any amount of damage by caterpillars (1Q11) and 19 (31.7%) tolerant of any amount of damage from other insects (1Q12). Only three (5.0%) reported removing or killing insects from ornamental plants, while five (8.2%) gave that answer regarding caterpillars.

Final Survey

Of the 26 individuals who grew plants for their own consumption prior to their participation in the project, nine (23.1%) removed or killed insects as soon as they were noticed feeding on plants (3Q12). Ten (38.5%) had the same reaction even if the insects were caterpillars (3Q10). Four (15.4%) were willing to tolerate any amount of damage from insects other

than caterpillars, while four were tolerant of any amount of caterpillar damage. The majority of volunteers were willing to tolerate a "moderate" amount of plant damage from caterpillars (12, 46.2%) and from other insects (13, 50.0%).

Individuals were more tolerant of plant damage on ornamentals, with 11 (32.4%) tolerant of any amount of damage by caterpillars (3Q9) and 10 (29.4%) tolerant of any amount of damage from other insects (3Q11). Only three (8.8%) reported removing or killing insects from ornamental plants, while one (2.9%) gave that answer regarding caterpillars.

Participants' Identification Skills

First Survey

Volunteers estimated their butterfly identification skills prior to beginning the project (1Q14). Most (38, 60.3%, n=63) reported being able to identify only one to five species and five (7.9%) reported not being able to identify any (Figure 43).

Second Survey

After conducting butterfly counts between May and September 2002, volunteers again evaluated their identification skills (2Q26). Whereas 16 (41.0%) still thought they were capable of identifying only one to five species, everyone could identify at least one species (Figure 44).

Final Survey

Butterfly identification skills slightly increased following the 2003 counting season (3Q16). The number of volunteers who reported being able to identify only one to five species dropped to nine (27.3%, n=33) (Figure 45).

Participants' Use of Butterfly Identification Materials

Second Survey

Fewer than half (20, 45.5%, n=44) of the respondents attended a butterfly workshop in spring 2002 (2Q5). Most volunteers (40, 90.9%, n=44) read the count protocol (2Q6). Thirty-nine (88.6%, n=44) watched the butterfly identification video (2Q10), with 35 (89.7%, n=39) watching the entire video (2Q11).

The volunteers were asked to rate each of the provided materials with how helpful they were in learning butterfly identification (2Q12). Volunteers were almost uniformly in agreement that the two-page handout of color butterfly photos was the most helpful identification aid provided, with 42 (95.5%, n=44) reporting it useful. An identification key containing field marks was ranked second (33, 75.0%) in helping volunteers learn to recognize butterfly species. Thirty-one (70.5%) reported the video was useful in improving their identification skills.

Open-ended questions asked for ways in which they found the identification materials useful (2Q13) and for any suggestions for improvement (2Q14). Volunteers reported their preference for the two-page color handout and the identification key was based on the ability to refer to those during the counts, unlike the video and materials on CD (18, 52.9%, n=20). Seven (35.0%) volunteers suggested that more butterflies be added to the handout.

In addition to the provided materials, 34 (79.1%, n=43) of the individuals counting butterflies indicated they had access to at least one field guide during the first year of the project, with seven (16.3%) individuals planning to purchase a field guide before the start of the 2003 field sea-

son (2Q16). The most commonly owned field guide (16, 64.0%, n=25) was *Butterflies and Moths of Missouri* (2Q17) (Heitzman and Heitzman 1987).

In February 2003, 29 (65.9%, n=44) reported that they would like to see more newsletters (2Q8), although only 21 (47.7%, n=44) read all three newsletters (2Q7). Thirty-five specified the type of information they were most interested in receiving in the future (2Q9). Gardening information was the most desired (18, 51.4%); this was broken down with 15 (42.9%) wanting more information on nectar sources, 12 (34.3%) wanting more information on host plants for caterpillars and one (2.9%) interested in learning how to attract butterflies and where to get affordable plants. Behavior and natural history information was also highly desired with 14 (40.0%) mentioning behavior (12, 34.3%), biology (3. 8.6%), natural history (1, 2.3%), life cycle (1, 2.3%), or reproduction (1, 2.3%).

Thirty (73.2%, n=41) said that they would be interested in participating in an outdoor identification workshop (2Q15). The following June, when I scheduled a workshop at the butterfly garden at Rock Bridge Memorial State Park, only a few people planned to go and only one person actually attended. That person was also one of the twelve volunteers able to identify more than 10 species prior to her project participation.

Final Survey

On the final survey, respondents were asked which of the butterfly identification materials they had used in 2003 (3Q20). Twenty-nine (90.6%, n=32) reported using the two-page handout of color butterfly photos, with 22 (68.8%) using the identification key. Eleven (34.4%) individuals watched the video in 2003; nine of the 11 had watched the video in 2002 as well.

Participants' Experiences with the Project

Second Survey

Forty volunteers (90.9%, n=44) read the count protocol in 2002 (2Q6). When asked what they found most difficult about conducting the counts (2Q18), 29 (74.4%) gave some variation of not being able to get a good enough look, including difficulty seeing field marks on a moving butterfly and not being able to get close enough. The second most commonly cited problem was separating similar species (7, 18.0%).

Participants who missed four or more of the 2002 counts were asked to indicate reasons for missed counts. The highest single response was "not at home between 10 and 4" with nine (56.3%, n=16) indicating this as a factor limiting their participation (2Q18). Six (37.5%) reported that they simply forgot to conduct four or more of the counts.

In response to whether or not they wanted to count butterflies for the project for a second summer (2Q1), 33 (75.0%, n=44) responded yes while four (9.1%) had not decided yet. However, when counts began in May 2003, only one undecided person conducted counts, and nine people who had indicated they wanted to count again decided not to count. Seven new participants volunteered for the second year of field-work.

Final Survey

Twenty-six (76.5%) volunteers read the 2003 count protocol (3Q19). The most frequently cited problems encountered when conducting a count (3Q21) were getting a good look at a moving butterfly (22, 66.7%, n=33), identification questions (6, 18.2%), time to count (5, 15.2%), estimat-

ing the number of blooms (4, 12.1%) and working around cloudy weather (3, 9.1%).

Participants' Lawn Care Practices

First Survey

Fifty-one (82.3%, n=62) of the volunteers did not use a professional lawn care service. Those who did were more likely to use fertilizer and herbicides than insecticides (1Q1). Only 12 (19.7%, n=61) reported insecticide use with or without a lawn care service (1Q3). Herbicide use was a bit higher with 32 (52.5%, n=61) using weed-killers (1Q21).

Twenty-five (41.7%, n=60) reported tolerating any amount of weeds in their lawn, while four (6.7%) reported that "no weeds" was their goal (1Q5). Thirty (50.9%, n=59) reported mowing the grass and trimming tall vegetation around fence lines and trees. This style of lawn care differed greatly from those who had a portion of their yard that was rarely mowed (12, 20.3%) (1Q4).

Final Survey

Twenty-nine (85.3%, n=34) individuals did not use a professional lawn care service (3Q1). Insecticides were applied to six (17.6%, n=34) lawns either by a lawn care service or a homeowner (3Q3) at least once a year. Herbicides were applied to 19 (55.9%, n=34) yards at least annually (3Q2).

Thirteen (39.4%, n=33) tolerated a weedy yard, with 32 (97.0%, n=33) willing to accept at least some weeds (3Q5).

Sixteen (47.1%, n=34) respondents considered the welfare of insects in their yards prior to beginning their participation in the project (3Q4).

Eleven (32.4%) reported that project participation had made them more aware of the impact of their yard management practices on insects.

Plants in Yards

Second Survey

Thirty-three (75.0%, n=44) volunteers were interested in adding plants specifically to attract butterflies prior to the 2003 count season (2Q2).

Twenty-three (60.5%, n=38) respondents wanted to plant both nectar sources and host plants in their yards (2Q3). Ten volunteers (26.3%) expressed an interest only in nectar sources.

Participants were questioned about the type of plants in which they were interested. Twenty-five (64.1%, n=39) expressed an interest in native plants, 10 (25.6%) of those restricted their interest to only native plants. Eighteen (46.2%) were interested in container gardening and 35 (89.7%) were interested in flowerbeds. Fifteen (38.5%) expressed an interest in having both beds and flowerpots.

Final Survey

Six individuals did not remember seeing or hearing about the list of recommended plants while one knew the list existed but chose not to look at it (3Q7). Twenty (64.5%, n=31) respondents had at least some of the recommended flowers, but their decision to plant them was made without reference to the project plant list. Four (12.9%) people chose plants from the list for their yards in 2003 and would not have had them without the recommendation. Twenty-four (72.7%, n=33) of the volunteers had selected plants specifically to attract butterflies to their yards before beginning participation in the project (3Q6).

Discussion

The vast majority of volunteers owned their home. The design of the project almost necessitated this. While ruling out apartment dwellers, individuals living in duplexes and rental houses would have been eligible to participate. Several reasons are probably behind this: homeowners have more control over their landscaping and are probably more interested in the impact of that landscaping, homeowners as a group tend to be older (Callis and Cavenaugh 2006) and individuals younger than 34 tend to participate in residential wildlife viewing at a lower rate (U.S. Department of the Interior 2001).

The age breakdown of project volunteers was similar to the U.S. Department of the Interior's (USDI) estimates of residential wildlife participants by age. The educational background of the volunteers in this project was much higher than the USDI's estimated education level of residential wildlife participants. Rather than matching the USDI's estimates of 19% with four years of college and 14% with five or more years of college, 34% of project volunteers had four years of college and 53% had five or more years of college. According to the U.S. Census, Boone County has the highest percentage of residents with a bachelor's degree or higher of any Missouri County; 41.7% of Boone County adults have at least one college degree compared to 26.6% of Missouri residents (U.S. Census Bureau 2006).

Project volunteers were also more likely than the average residential wildlife recreation participant to engage in a variety of different wildlife-oriented activities (Figure 46). Seventy-five percent of the volunteers (compared to 14% of residential wildlife viewers nationwide) maintained plantings or natural areas for wildlife. While 17% of U.S. residential wildlife

participants traveled to public land more than one mile from home to observe wildlife, 87% of project volunteers did so.

Project volunteers were also already attuned to observing insects more than the typical wildlife observer, with 75% of project volunteers watching insects in their yards prior to project participation compared to 33% of U.S. residential wildlife viewers (U.S. Department of the Interior 2001).

Learning to identify butterflies was most frequently cited as the primary motivating factor for volunteering to participate in the project. According to the survey questions concerning butterfly identification skills, virtually everyone met this goal, although some individuals improved more than others. Of the 45 volunteers who responded to the identification questions at least twice, 32 (71.1%) either increased their abilities or had selected the highest skill level as their first response (Figure 47).

Twenty-nine volunteers who turned in usable butterfly counts also estimated their butterfly identification skills on the second survey. Twenty (69.0%) kept their species identifications within their reported identification capabilities (Figure 48). Of the 20 volunteers who counted in 2003 and estimated their identification abilities on the final survey, 17 (85.0%) kept their actual identifications during the counts within their estimated limits (Figure 49). These results support confidence in the reported identifications, since no one reported drastically more species on their data sheets than they thought they could identify. The nine (31.0%) individuals in 2002 and three (21.4%) in 2003 who identified more species during a season than their self-assessment either were overly ambitious in the field or underestimated their abilities when completing the surveys.

Attitudes toward caterpillars in yards generally did not differ from attitudes toward other insects, particularly where plant damage was concerned. I had expected more tolerance for caterpillars than for other insects, however, it is possible that individuals who volunteered to count had high appreciation for all insects since they were far more likely than average to watch insects in their yards prior to project participation.

A few people killed caterpillars observed in their yards (4, 6.7% (1Q8) and 1, 2.9% (3Q8)). Three of the four people from the first survey who answered this question on the final survey changed their answer from "kill them" to "tolerate them." Four of the 13 people who responded "tolerate" on the first survey and answered the question on the final survey changed their answer to "enjoy seeing them." Three of the 18 individuals who answered enjoy on the first survey changed their answer to "tolerate them" and one changed to "kill them."

Responses to the questions on using herbicides, insecticides, or a professional lawn care service did not vary much from the survey before the project to the final survey. While the percent of volunteers who never used insecticides in their yards was slightly higher than the percent in a survey for the Center for Ecological Technology (80% vs. 70%, respectively), the percent that used herbicides at least once was much higher (52% vs. 21%, respectively) (Penner 2003). At least some of the volunteers used herbicides to spot treat exotics in yards consisting mostly of native plants. That situation has a different effect on maintaining insect habitat in yards than does the application of herbicides to maintain a monoculture of a non-native grass.

Tolerance for weeds in lawns in this project was higher than that reported in a lawn care survey from Minnesota in which the respondents "indicated a 10% weed tolerance was acceptable but 25% was not (Carpenter and Meyer 1999)." 41.7% of volunteers responded "as long as my lawn is green, it's okay" (1Q5).

Singer and Gilbert (1978) report that "pathological weed control" can reduce insect populations and species diversity. The Missouri Department of Conservation recommends leaving part of the yard not mowed in order to attract butterflies (Calabrese 1996). Differences in lawn care management schemes became evident in butterfly counts. The average number of individuals and the average species richness in yards that were either mowed or mowed with edges trimmed were similar. The yards with a section not normally mowed during the growing season had 1.8 times the number of individuals and butterfly species than the yards that were mowed and trimmed. The same trend was obvious when comparing tolerance for weeds in yards with the average number of individual butterflies and species.

There were no differences between insecticide use levels and average numbers of individuals or species, however, that may have been due to sample size, since only nine of the 12 survey respondents who indicated using insecticides turned in butterfly counts. Another possibility is that adult butterflies visited yards sprayed with insecticides, but caterpillars and other insects were rare in those yards. These yards may have been harming the butterfly population since insecticides can contaminate nectar (Wilson 1992).

CONCLUSIONS

Funding issues frequently make the use of volunteers a necessity and the number of individuals interested in conducting conservation work makes it relatively easy to recruit volunteers (New 1998). Volunteers are often the only way to get sufficient coverage of a study area (Swengel 1990, Plant 1994, Veling 1996, Kocher and Williams 2000).

Using volunteers for surveys has a long history of use with birds and has been used with butterflies in the 4th of July butterfly counts coordinated by the North American Butterfly Association (Swengel 1990) and in both the Lepidoptera Recording Scheme and the Butterfly Monitoring Scheme in Great Britain (Pollard and Yates 1993, Harding, Asher and Yates 1995). A thorough study of the Lepidoptera found in London combined historical records, museum collections, trapping, and butterfly surveys throughout the city, enlisting the aid of residents (Plant 1994). Use of volunteers to monitor populations provides an amount of coverage of time and space that is virtually unobtainable otherwise (Kocher and Williams 2000).

Although there may be questions about accuracy of identifications, inconsistent adherence to count protocol, and inconsistent coverage with data provided by volunteers, in many cases, data collection would not have been possible without them. Some problems that occurred with 4th

of July counts are not applicable to yard counts: people can not search for rare species and count days are more easily shifted to another day when weather is poor for butterfly observation (Swengel 1990).

Evans and Hammond (2004) suggested that volunteers be rigorously trained and selected from qualified volunteers and that researchers should not hesitate to discard data that is suspect. Working with volunteers requires the project coordinator to sacrifice quantity of volunteers for quality and to discard data when any questions of accuracy arise. Photographs or descriptions may be a good idea for supporting identifications. (Evans and Hammond 2004) Christmas Bird Count data requires completion of a rare bird form when an unexpected species is reported (Swengel 1990).

According to Pollard (1991), the varying levels of identification and observation skills of volunteers can introduce errors into count results and is a weakness in the Butterfly Monitoring Scheme. But he qualified it by stating that having the same recorder at a site allowed year-to-year comparisons within a site (New 1997).

The most serious problem encountered with the data gathered by volunteers conducting butterfly counts was their inexperience with butterfly watching. At the beginning of the project, only 12 (19.1%) volunteers were able to identify at least 10 butterfly species with most individuals only able to identify between one and five species. Skill level generally increases with experience (Swengel 1990, Evans and Hammond 2004). Twenty-three of the 30 volunteers in 2003 had conducted counts in 2002. Of the 2600 butterflies observed in 2002, 2020 (77.7%) were identified to species. During the second year of the project, a larger percent of butter-

flies seen were identified. In 2003, 1806 (87.8%) of a total of 2057 butterflies were identified to species.

Ehrlich (1984) suggested that volunteers be used for more rigorous fieldwork than for simply compiling a list of species present. The design of this study was suitable for compiling a checklist of butterfly species in the study area. This type of study is easy for amateurs to participate in but the effort and area covered are variable. Transects are better for long-term monitoring projects because statistical analysis can estimate population density (Royer et al. 1998).

In Great Britain, members of the Butterfly Conservation Society conduct weekly counts in which volunteers walk through their gardens once without stopping. The time required for each count varies with garden size. The counts have been used to create range maps and to determine whether populations are decreasing (M. Vickery, personal communication 10 February 2002).

I asked if volunteers would prefer transect counts to 15-minute counts (2Q20). Seventeen (47.2%, n=36) indicated a preference for transect counts, with eight (22.2%) likely to count more than once a week and nine (25.0%) believing they would count the same number of times but would find it more enjoyable. Sixteen (44.4%) indicated a preference for 15-minute counts.

Studies using volunteers should include a strong educational component. Attitude surveys in this project showed a strong interest in learning more about all aspects of butterfly natural history and conservation. In a survey of Midwestern 4th of July Butterfly Count compilers, Swengel reported that most compilers participate "because it is a way to study butter-

flies and help conserve them." The fact that they have fun is secondary (Swengel 1990). This was also true in this study; volunteers reported that having fun was not an important factor in their participation. Volunteers not only provide count data, but also promote "invertebrate conservation" (Swengel 1990). Comments by volunteers in this project indicated that many of them were sharing their observations with family and friends.

Insect conservation is essential in maintaining "life on earth" (Samways 1994). Despite its importance, insect conservation is not given much attention. The popularity of butterflies can lead to more concern for all insects (Morris 1987) and can make it easier for researchers to recruit volunteers (Ehrlich 1984).

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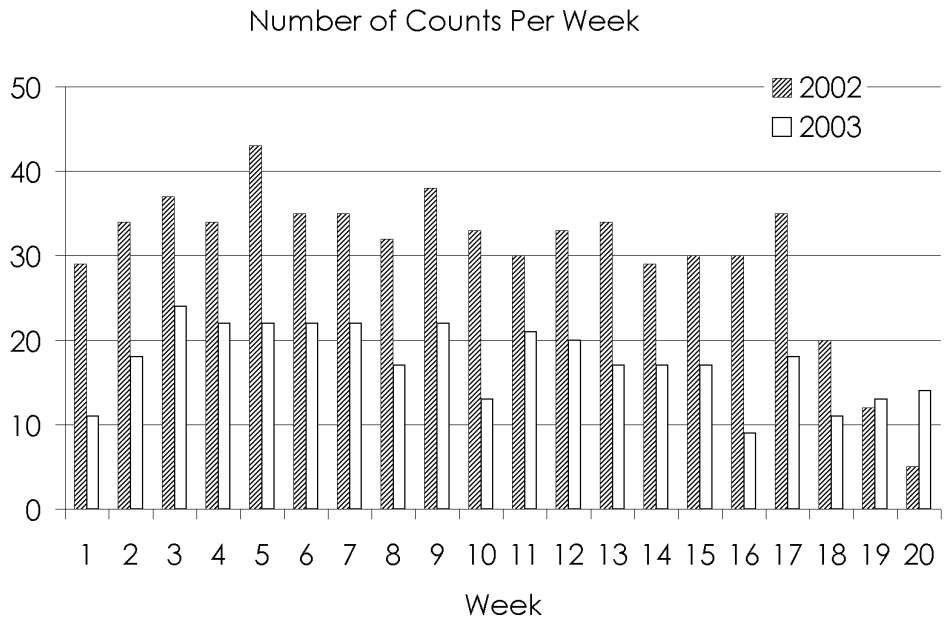

Figure 1. Number of counts conducted each week by volunteers during the 2002 and 2003 count periods.

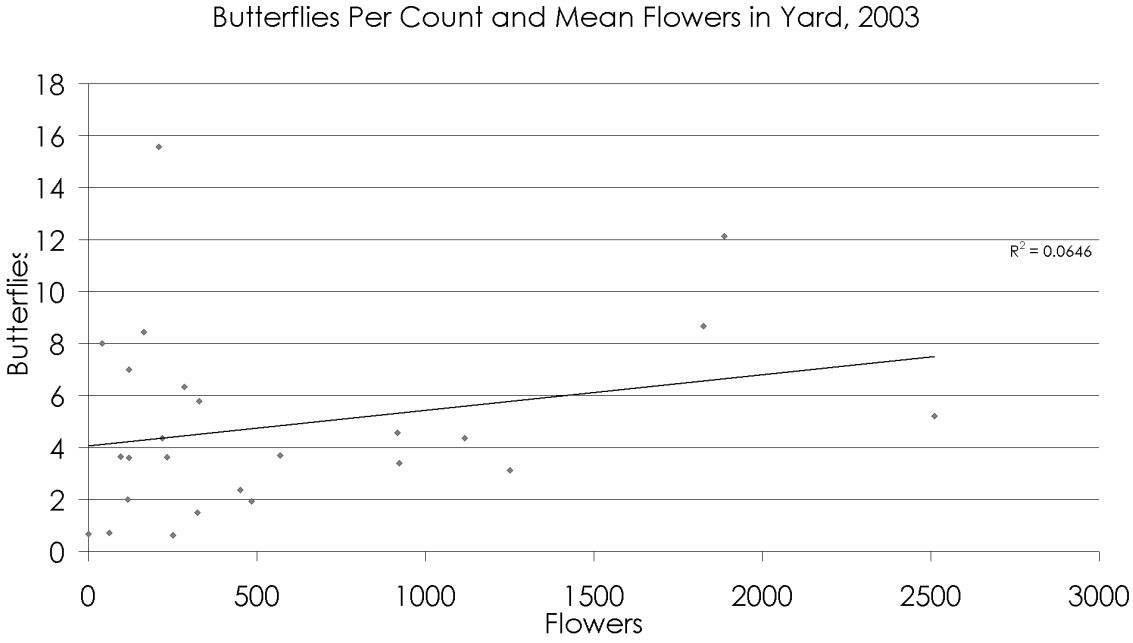

Figure 2. Butterflies per count plotted against mean number of flowers in bloom, 11 May - 29 September 2003

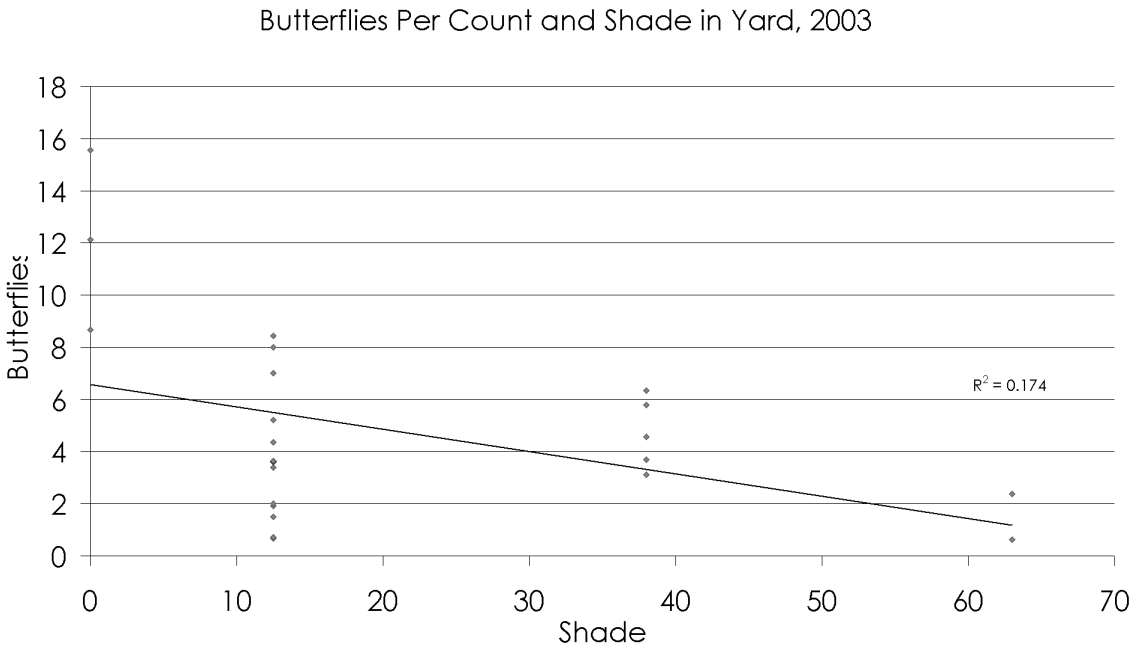

Figure 3. Butterflies per count plotted against percent shade at midday, 11 May - 29 September 2003

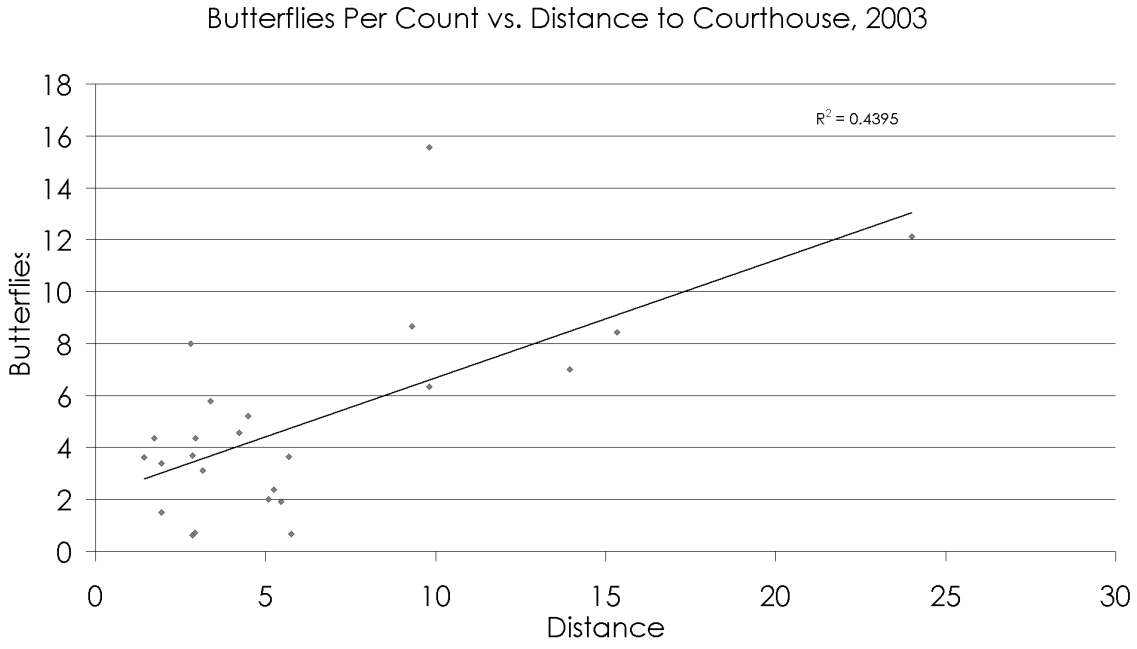

Figure 4. Butterflies per count plotted against distance from downtown Columbia, Missouri, 11 May - 29 September 2003

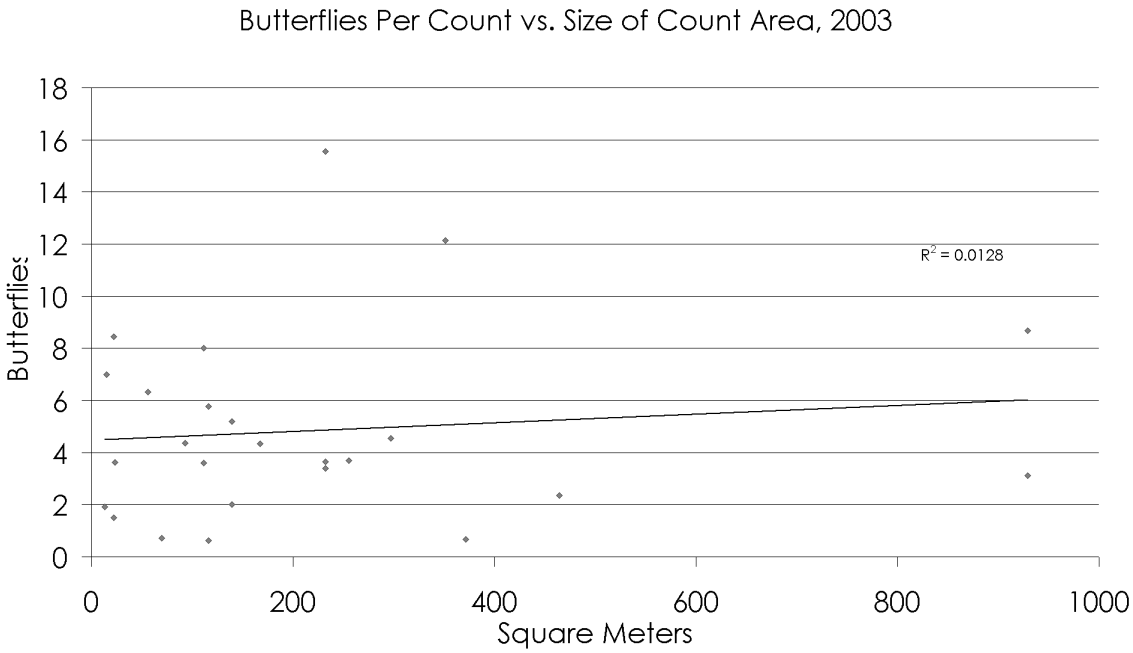

Figure 5. Butterflies per count plotted against size of count area, 11 May - 29 September 2003

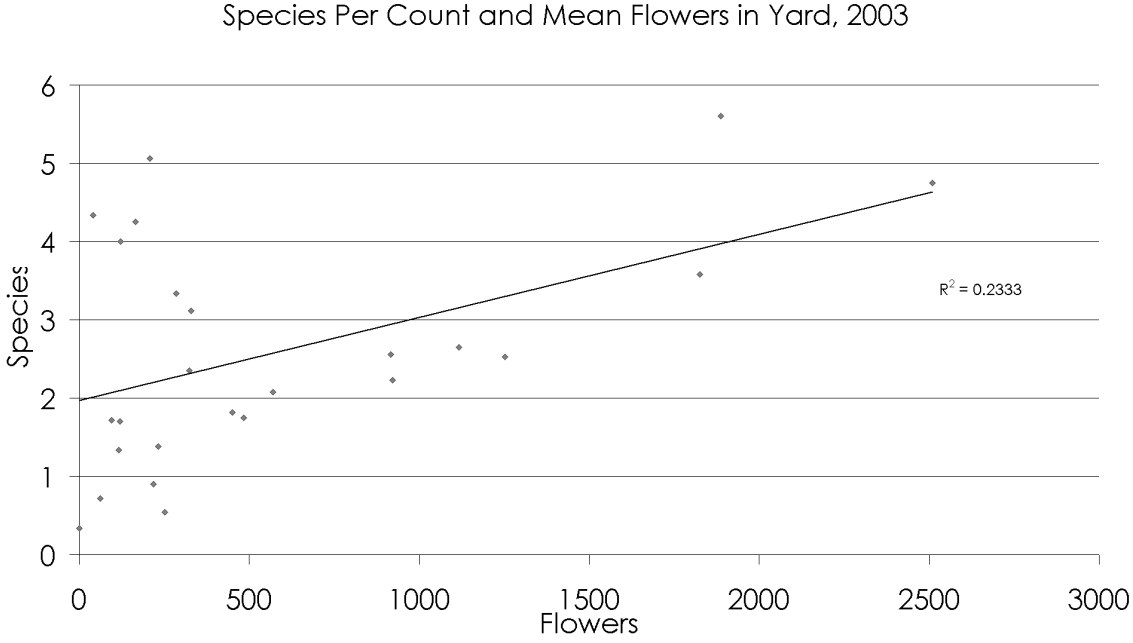

Figure 6. Species per count plotted against mean number of flowers in bloom, 11 May - 29 September 2003

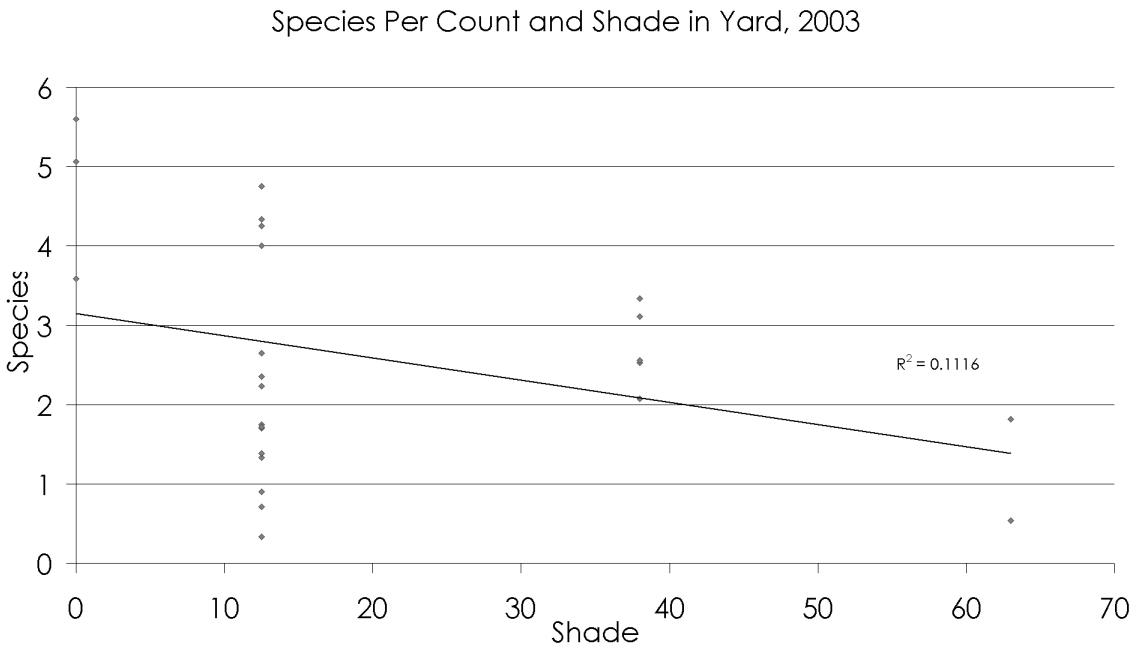

Figure 7. Species per count plotted against percent shade at midday, 11 May - 29 September 2003

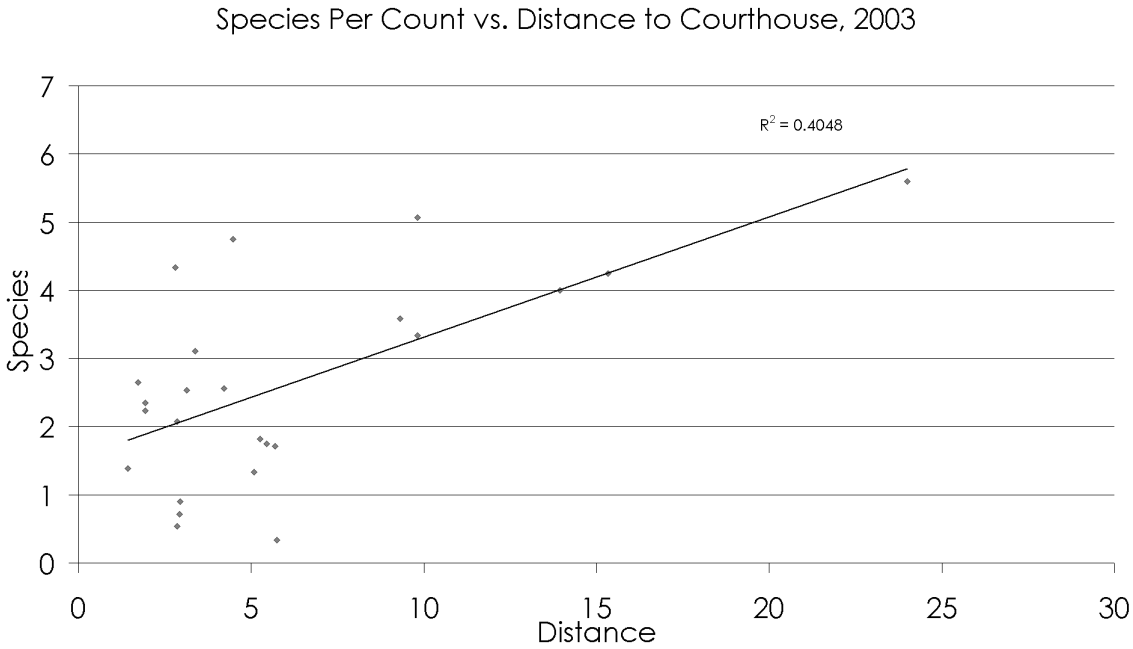

Figure 8. Species per count plotted against distance from downtown Columbia, Missouri, 11 May - 29 September 2003

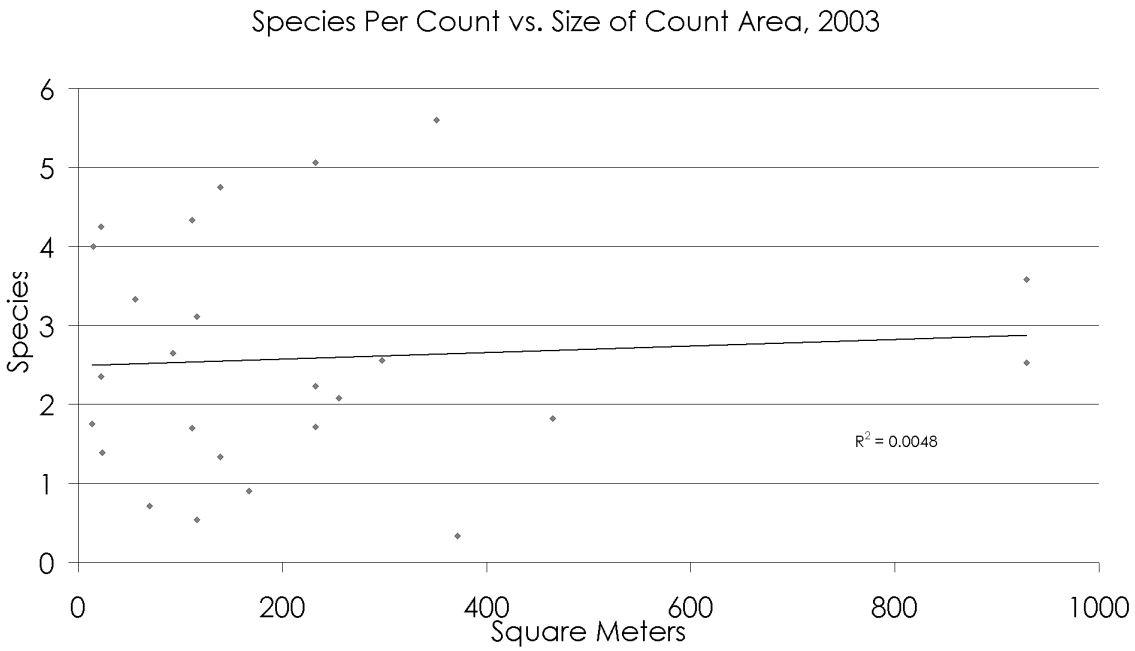

Figure 9. Species per count plotted against size of count area, 11 May - 29 September 2003

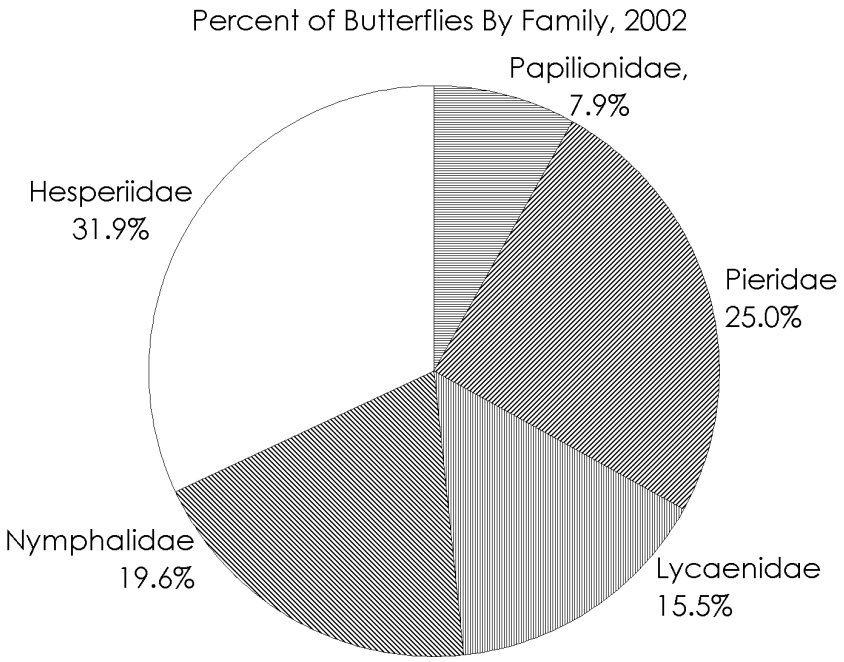

Figure 10. Percent by family of the 2454 butterflies identified to family during 2002.

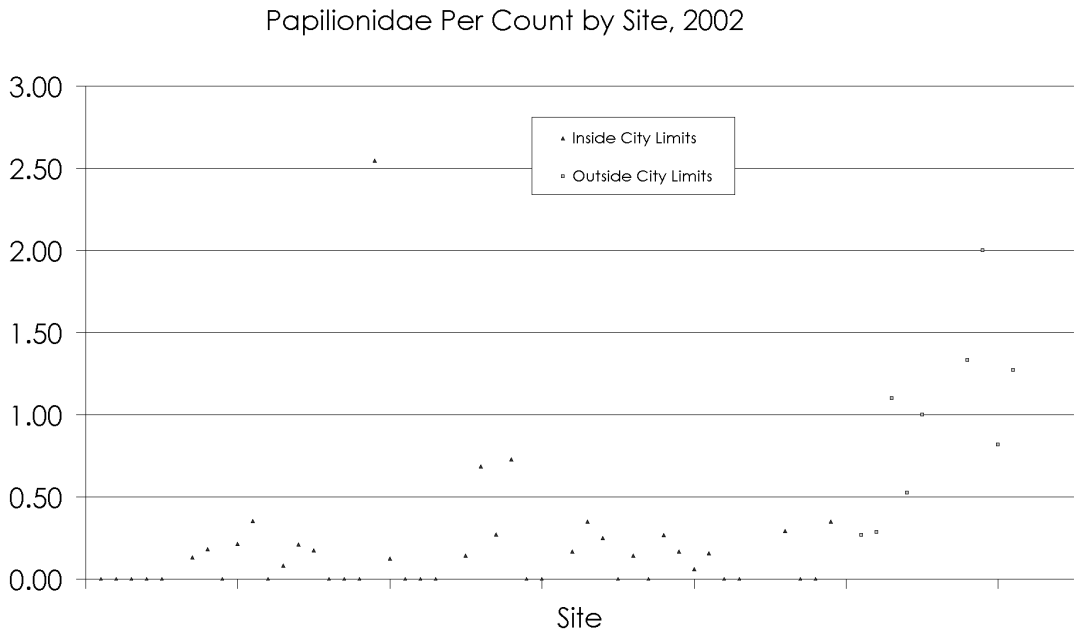

Figure 11. Number of Papilionidae per count, 13 May through 28 September, 2002, at sites inside and outside of the city limits.

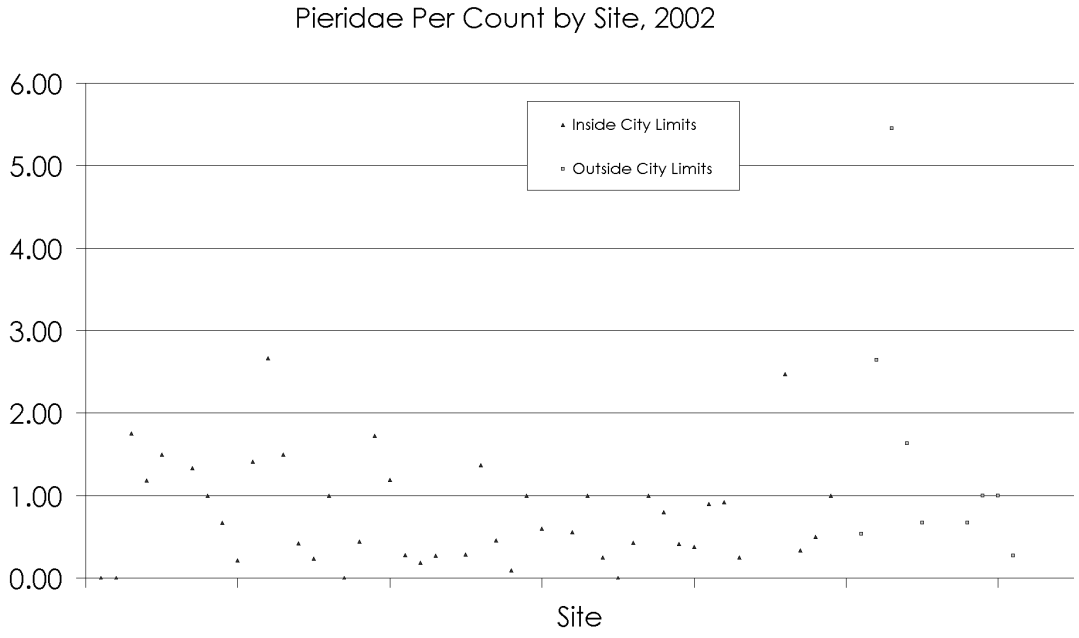

Figure 12. Number of Pieridae per count, 13 May through 28 September, 2002, at sites inside and outside of the city limits.

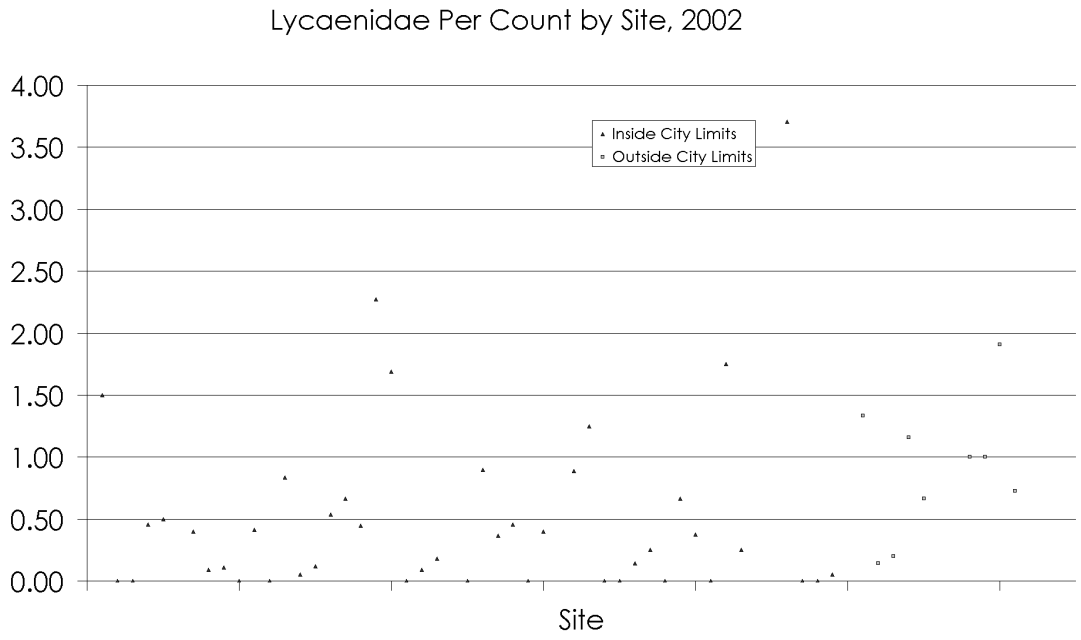

Figure 13. Number of Lycaenidae per count, 13 May through 28 September, 2002, at sites inside and outside of the city limits.

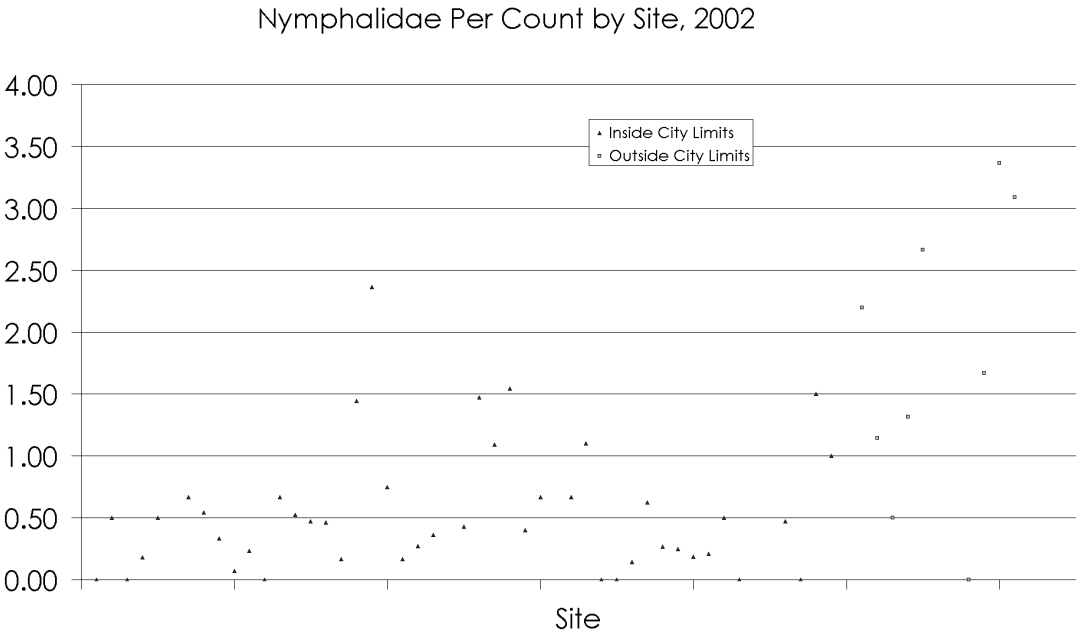

Figure 14. Number of Nymphalidae per count, 13 May through 28 September, 2002, at sites inside and outside of the city limits.

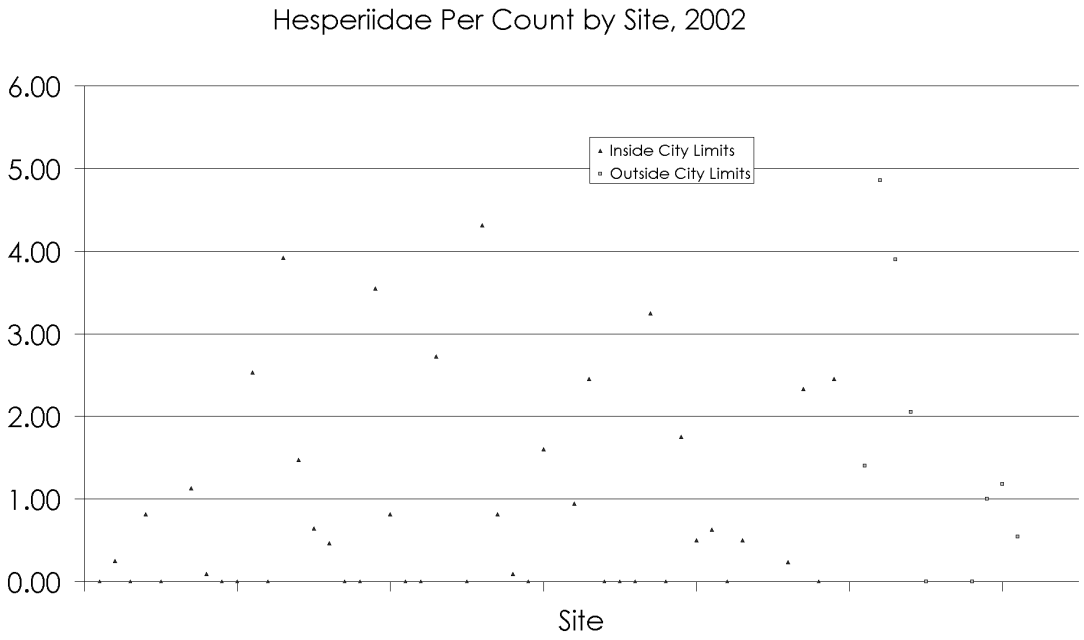

Figure 15. Number of Hesperiidae per count, 13 May through 28 September, 2002, at sites inside and outside of the city limits.

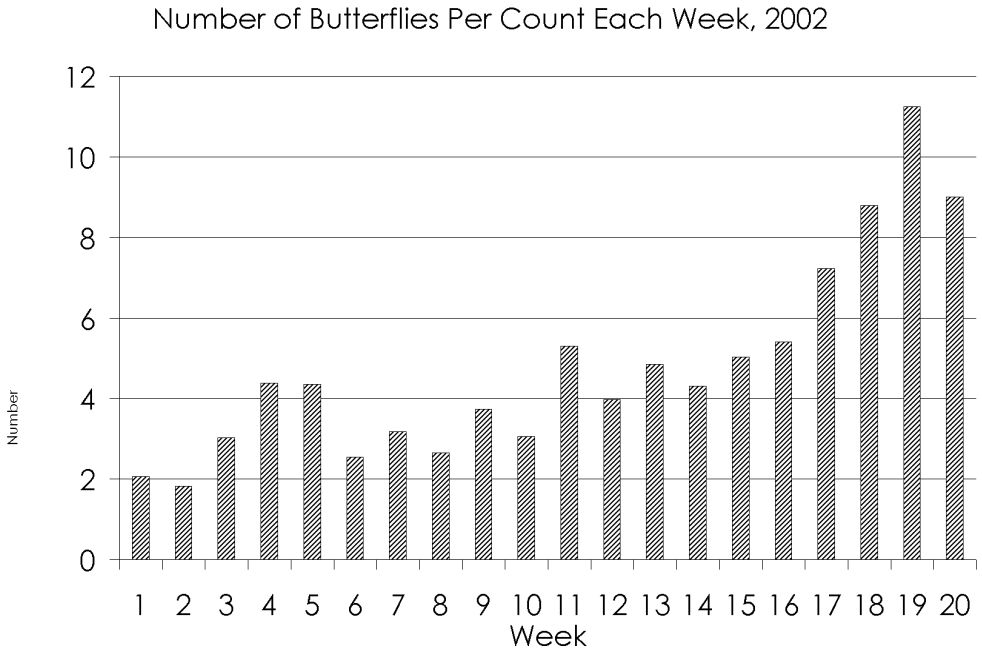

Figure 16. Number of butterflies per count by week, 13 May - 28 September, 2002.

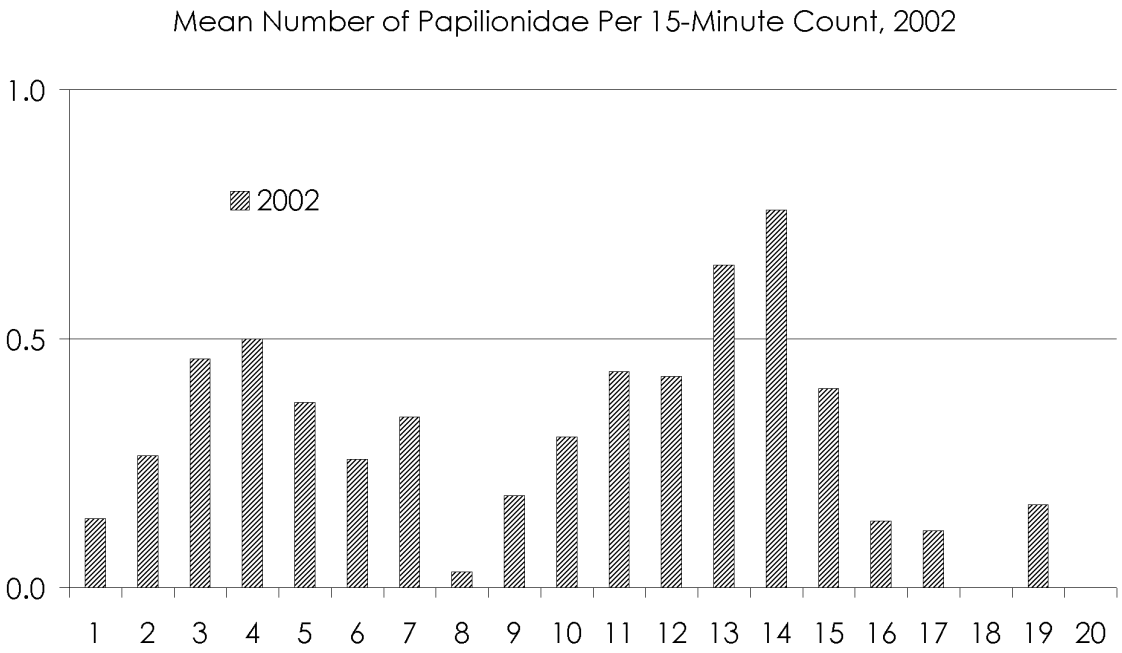

Figure 17. Number of Papilionidae per count, 2002.

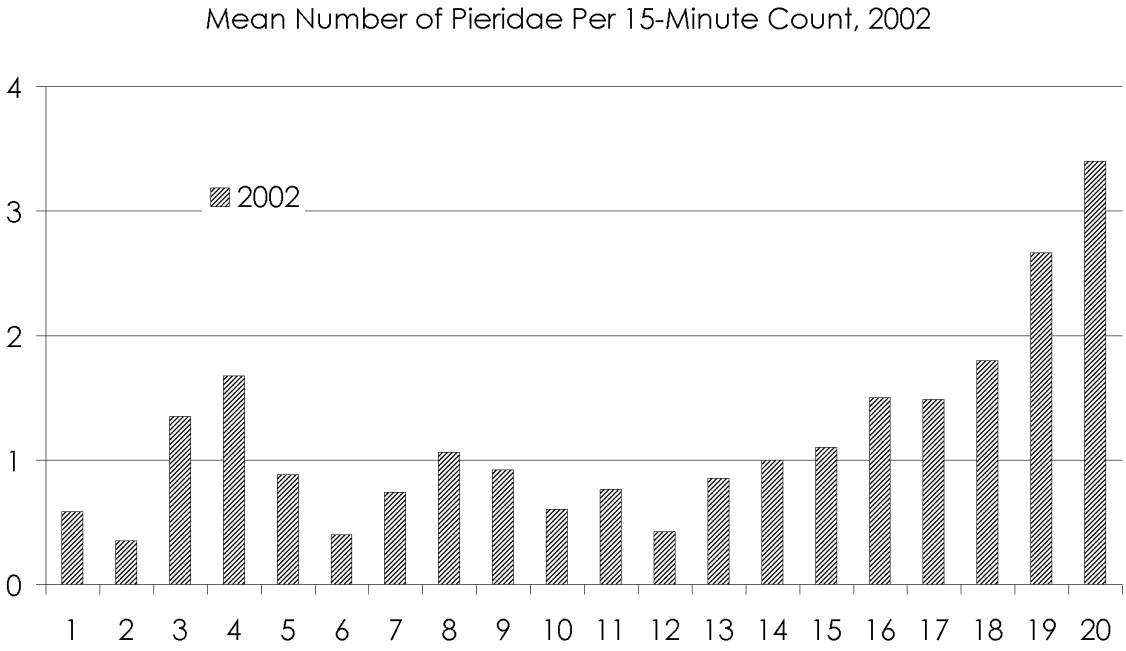

Figure 18. Number of Pieridae per count, 2002.

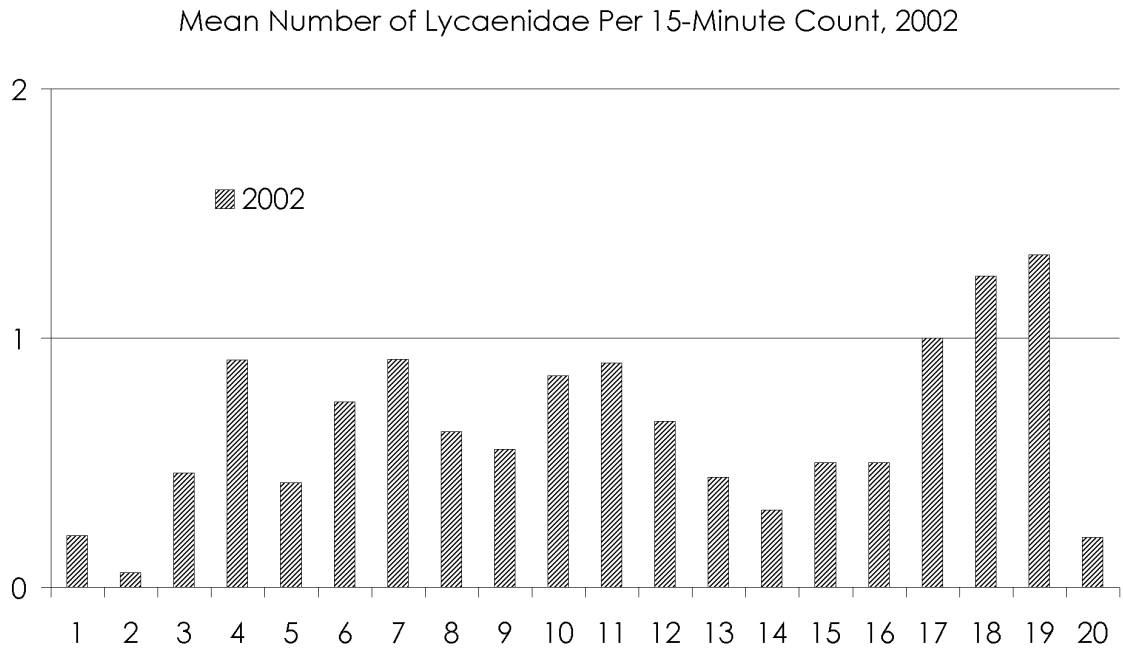

Figure 19. Number of Lycaenidae per count, 2002.

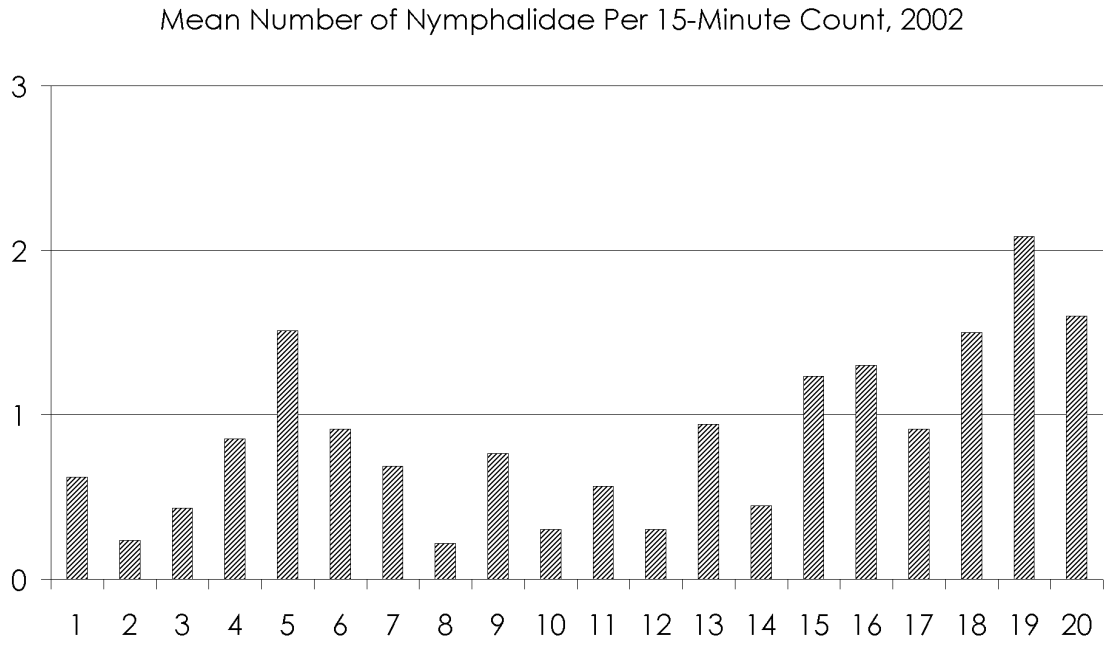

Figure 20. Number of Nymphalidae per count, 2002.

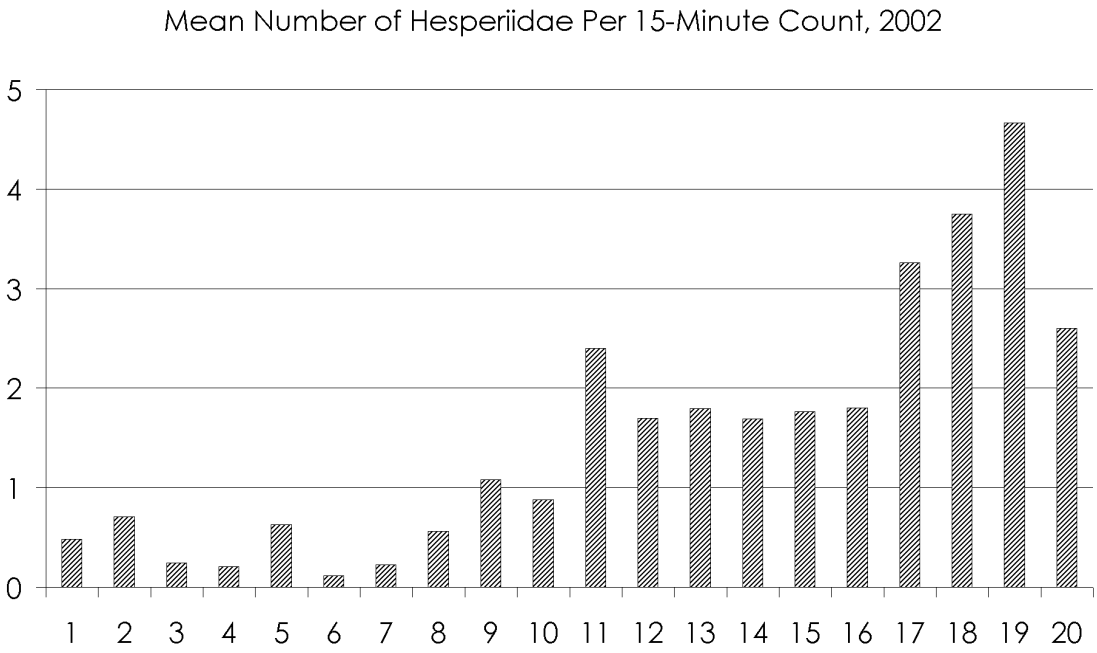

Figure 21. Number of Hesperiidae per counts, 2002.

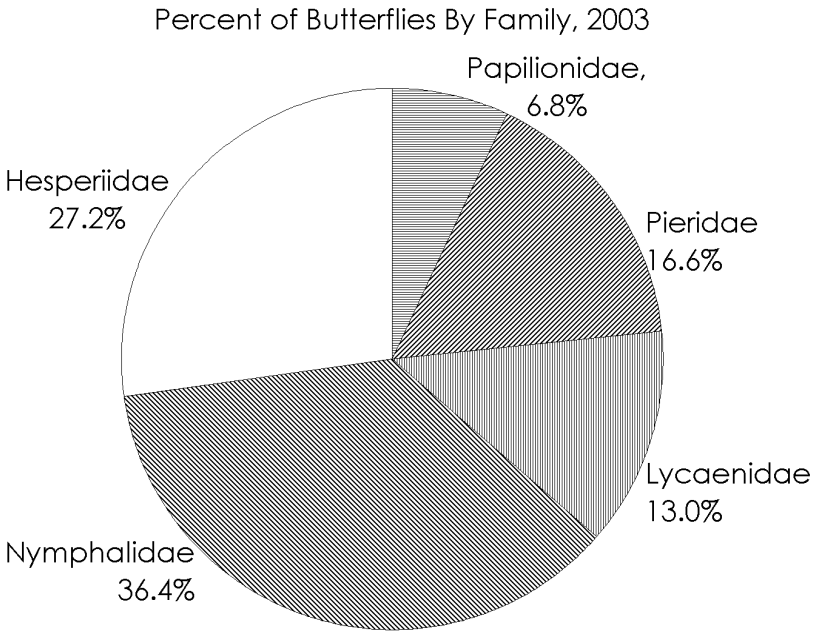

Figure 22. Percent by family of the 1991 butterflies identified to family during 2003.

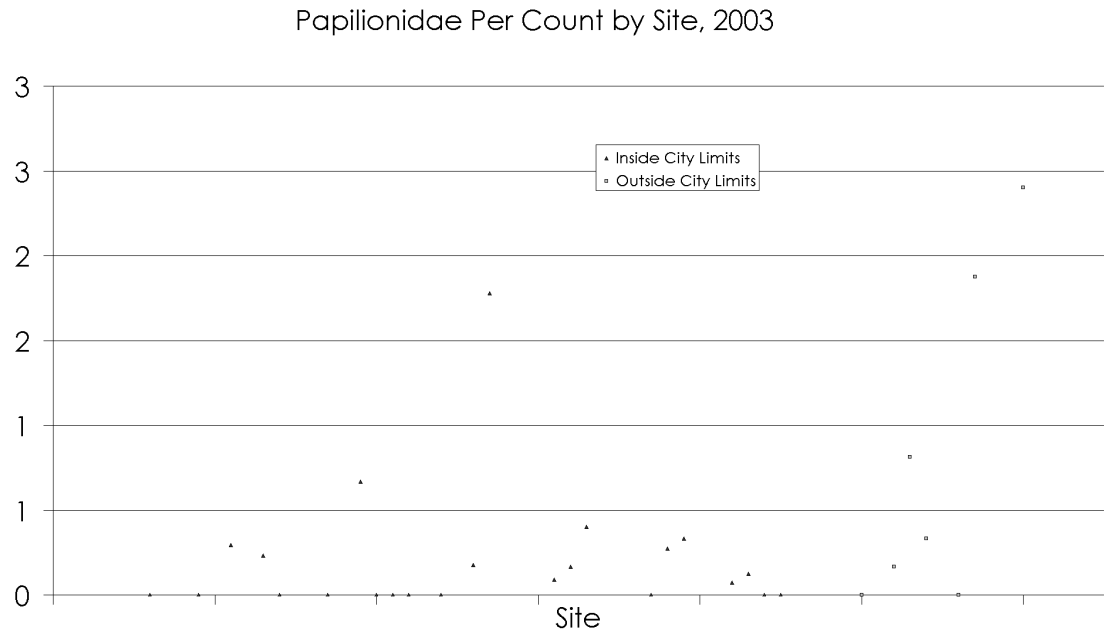

Figure 23. Number of Papilionidae per count, 11 May through 29 September, 2003, at sites inside and outside of the city limits.

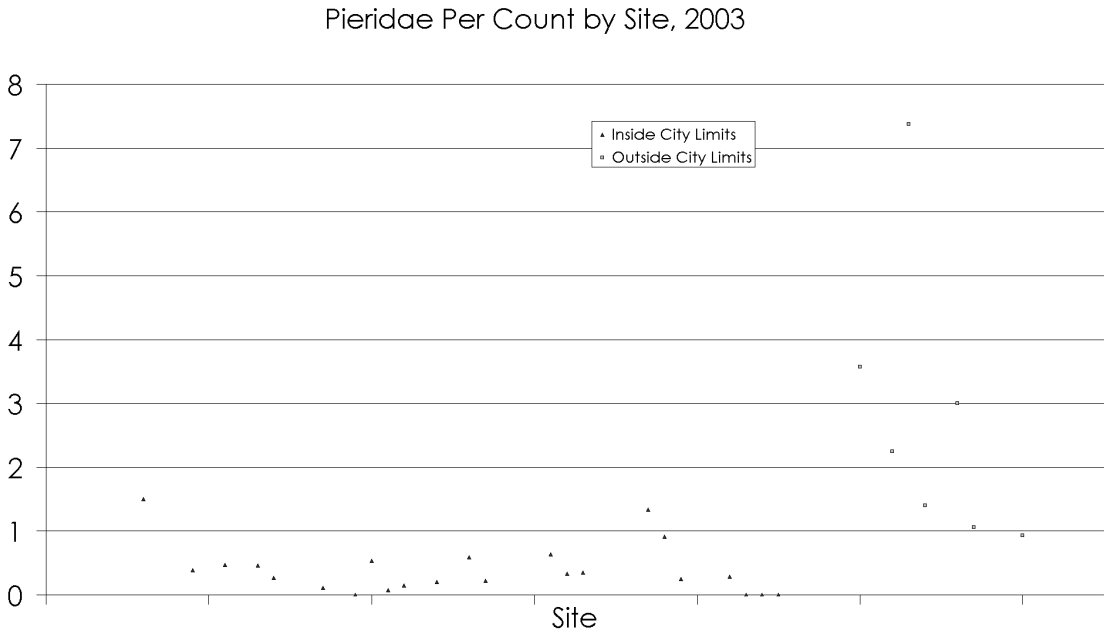

Figure 24. Number of Pieridae per count, 11 May through 29 September, 2003, at sites inside and outside of the city limits.

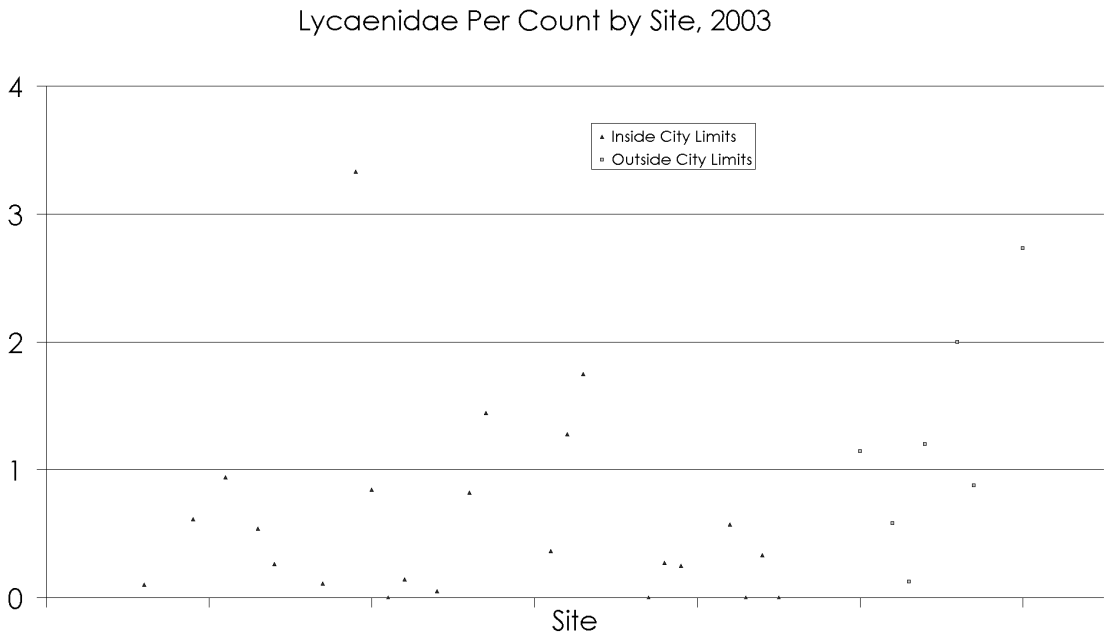

Figure 25. Number of Lycaenidae per count, 11 May through 29 September, 2003, at sites inside and outside of the city limits.

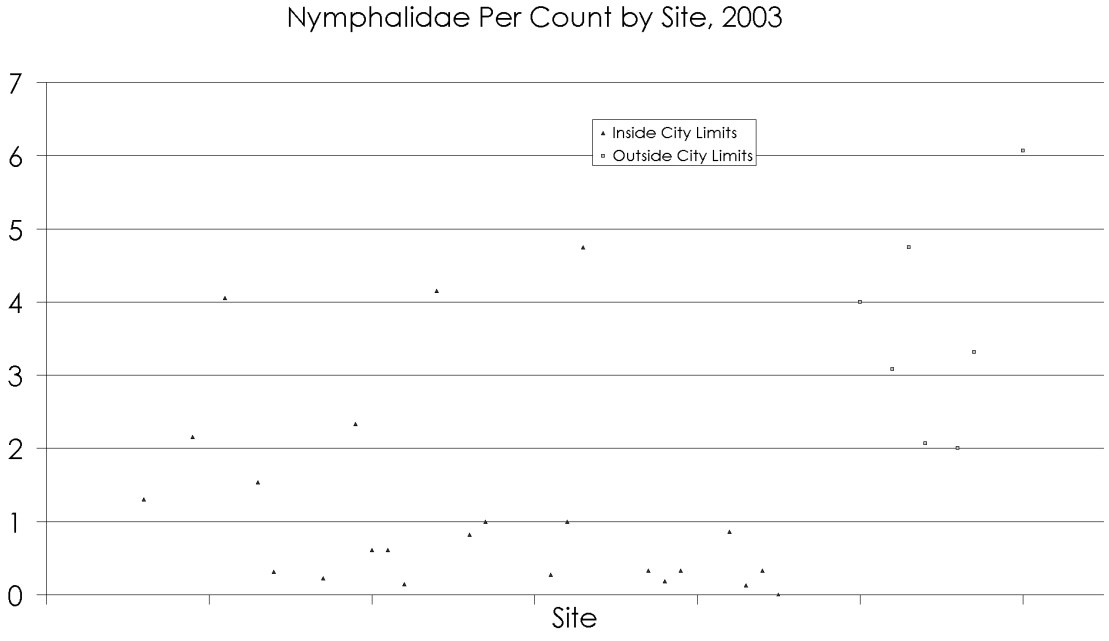

Figure 26. Number of Nymphalidae per count, 11 May through 29 September, 2003, at sites inside and outside of the city limits.

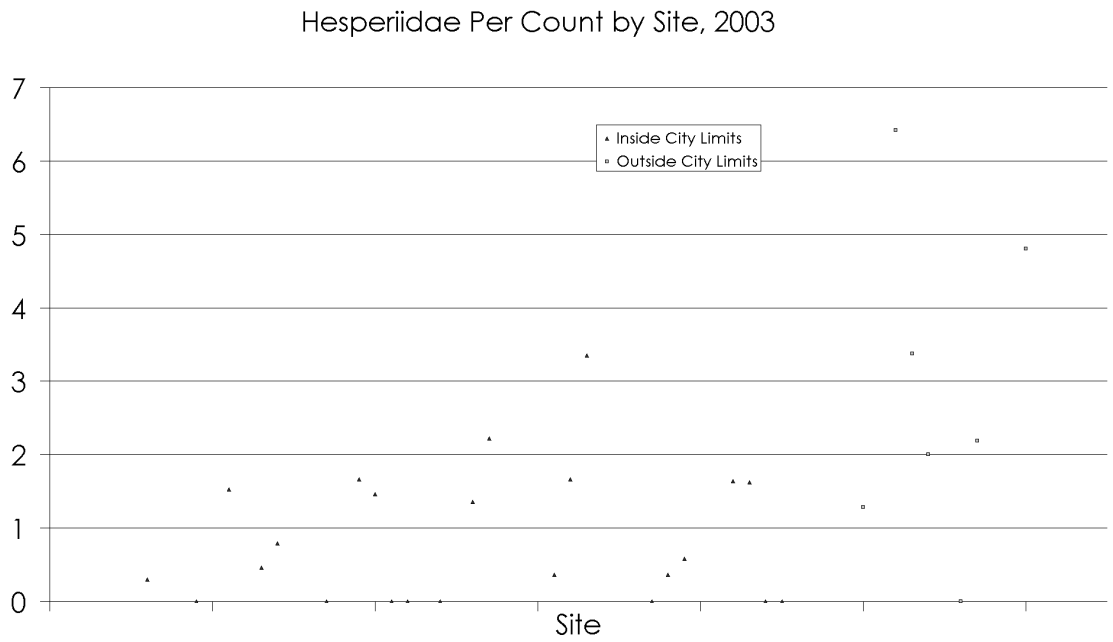

Figure 27. Number of Hesperiidae per count, 11 May through 29 September, 2003, at sites inside and outside of the city limits.

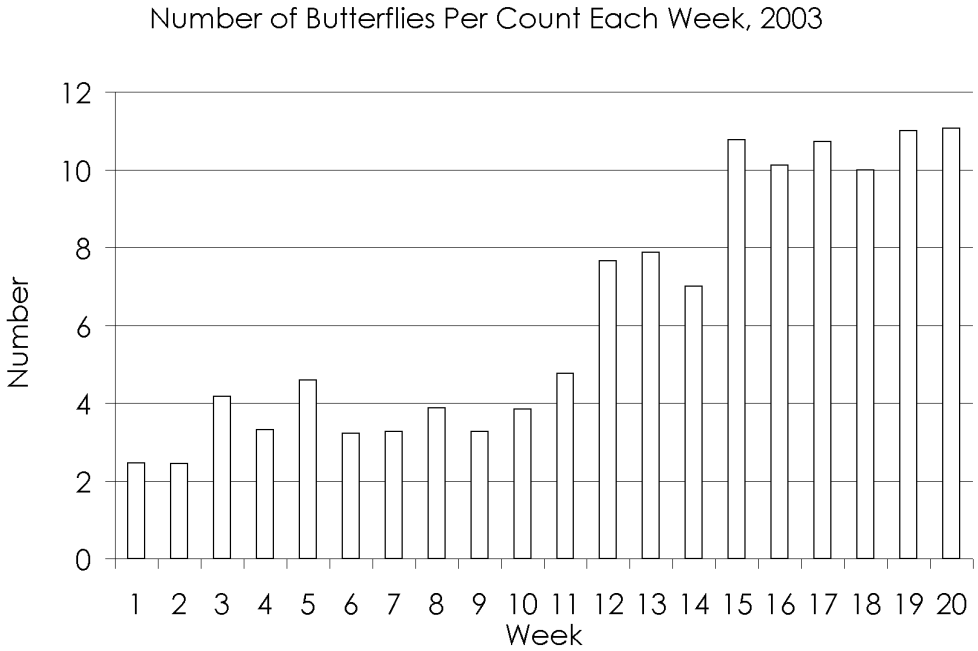

Figure 28. Number of butterflies per count each week, 11 May - 29 September, 2003.

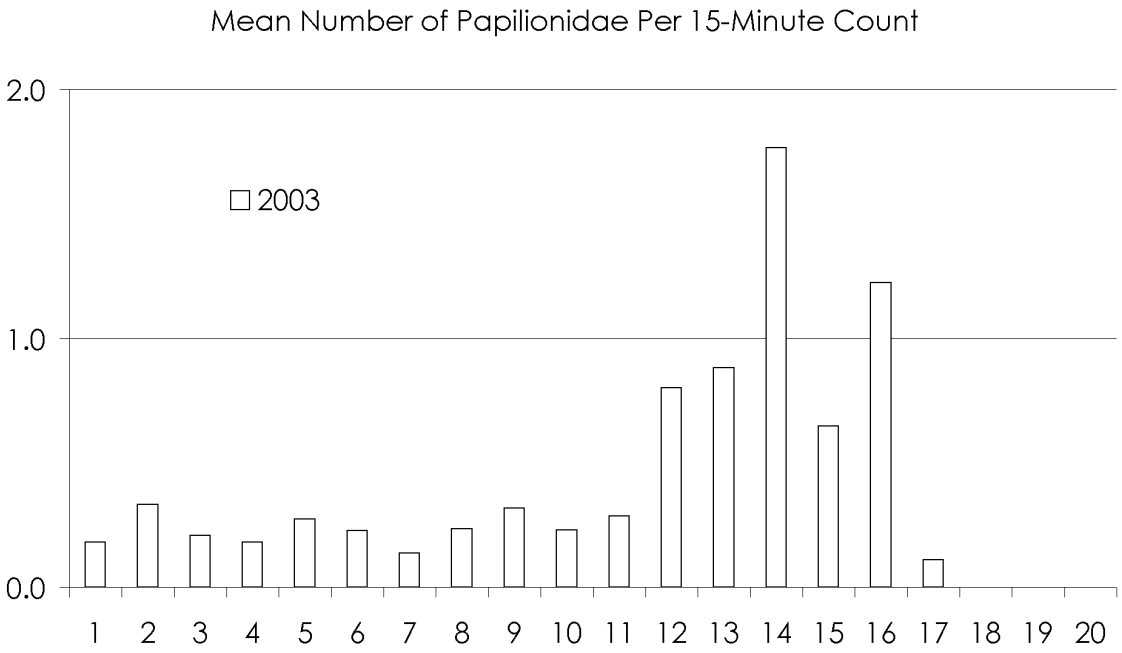

Figure 29. Number of Papilionidae per count by week, 13 May - 29 September, 2003.

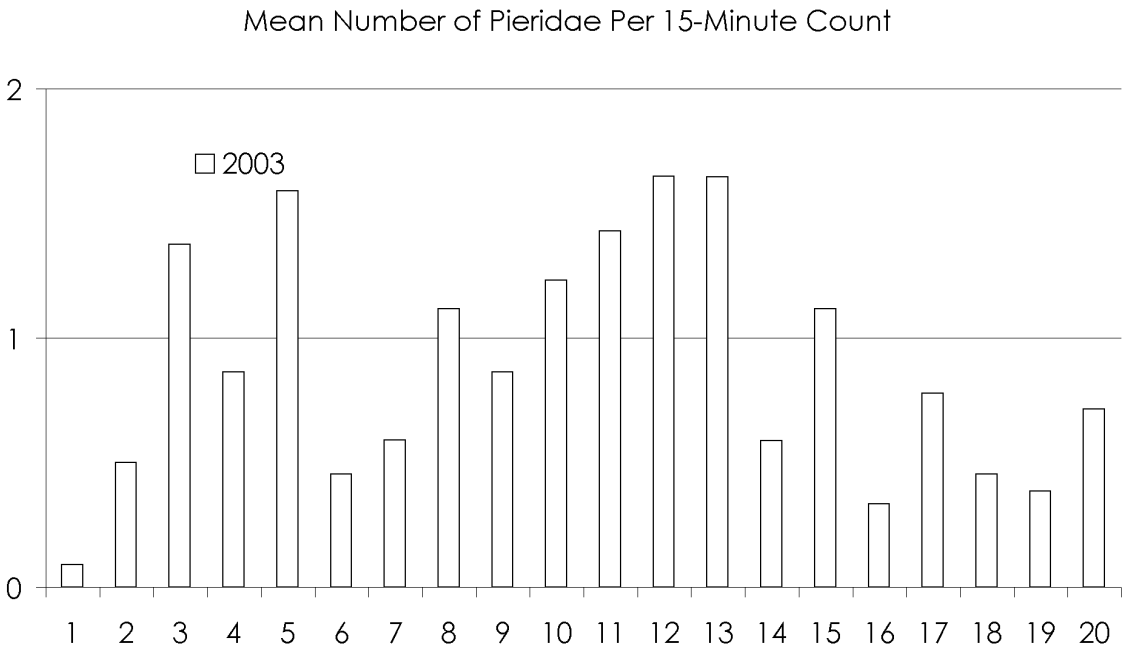

Figure 30. Number of Papilionidae per count by week, 13 May - 29 September, 2003.

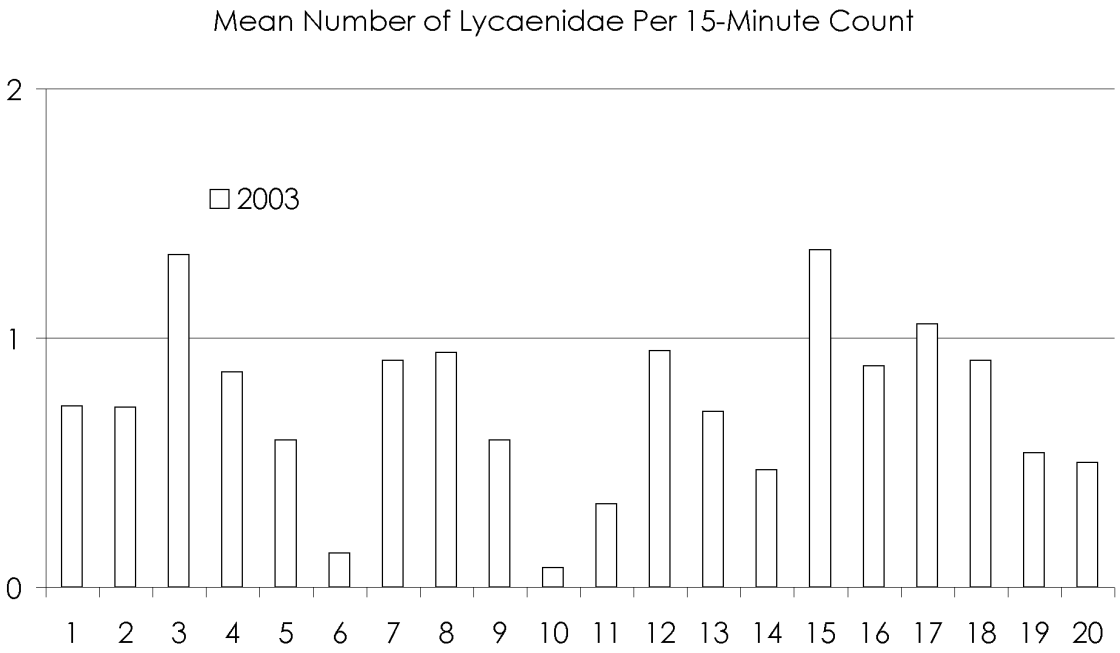

Figure 31. Number of Lycaenidae per count by week, 13 May - 29 September, 2003.

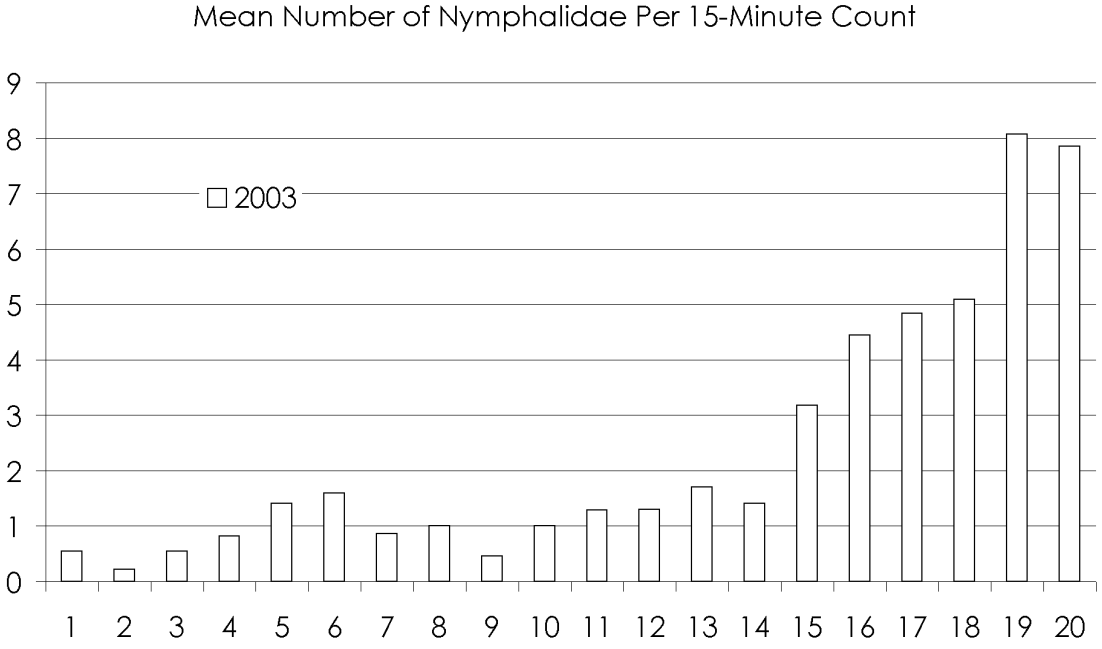

Figure 32. Number of Nymphalidae per count by week, 13 May - 29 September, 2003.

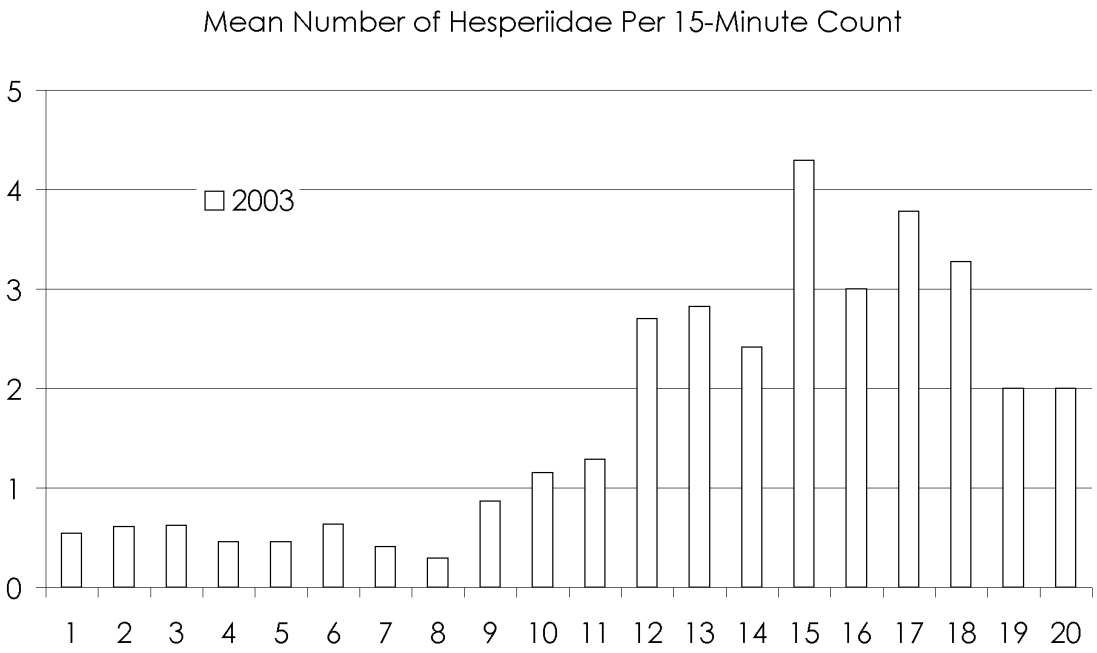

Figure 33. Number of Hesperiidae per count by week, 13 May - 29 September, 2003.

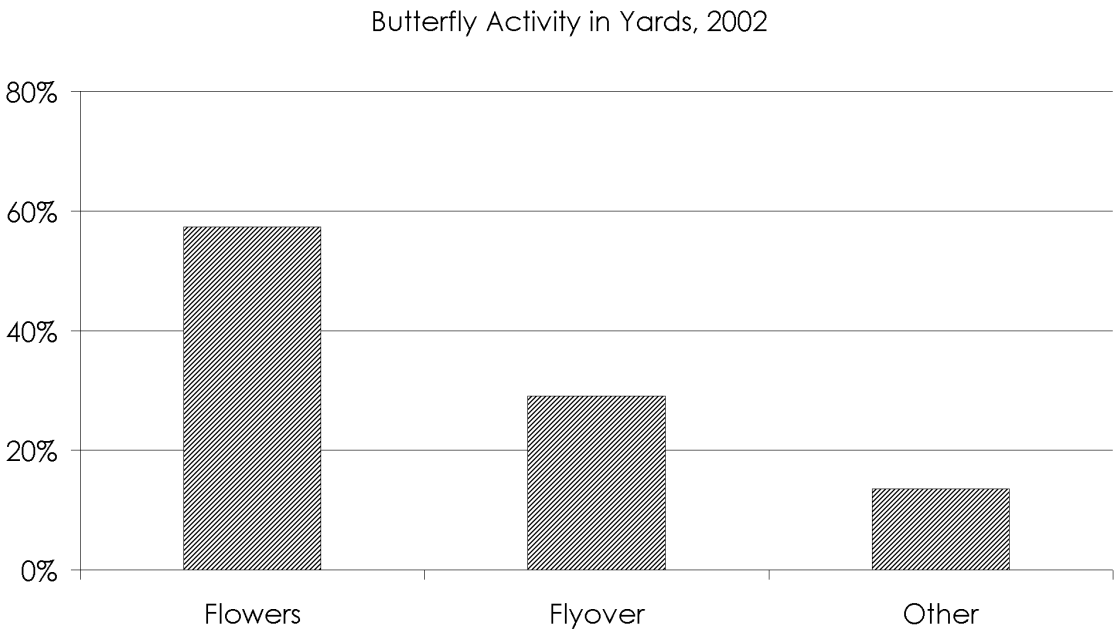

Figure 34. Activity of butterflies, 2002.

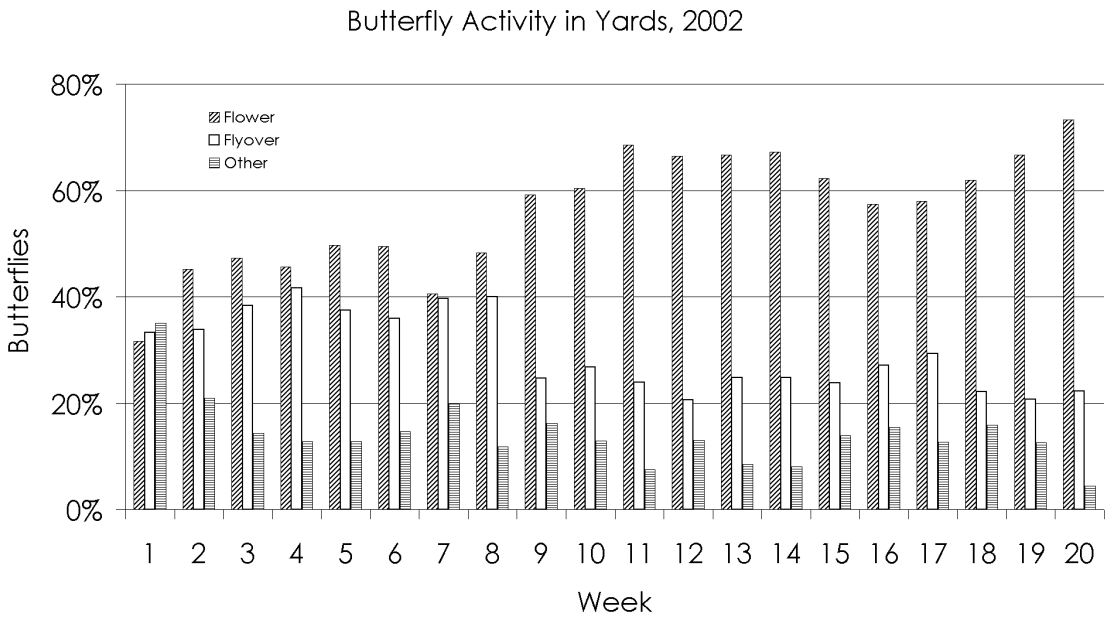

Figure 35. Activity of butterflies summarized by week, 2002.

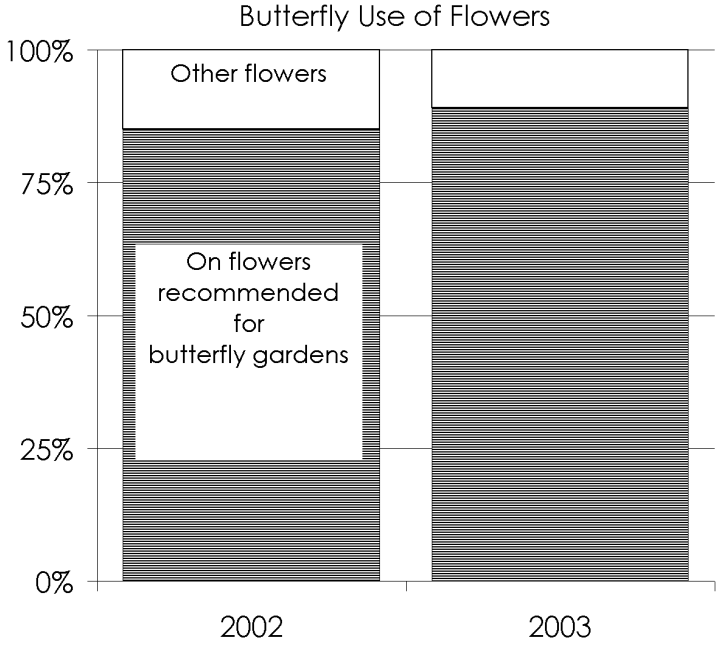

Figure 36. Percent of butterflies during 2002 and 2003 landing on flowers either typically recommended or not recommended for use in butterfly gardens.

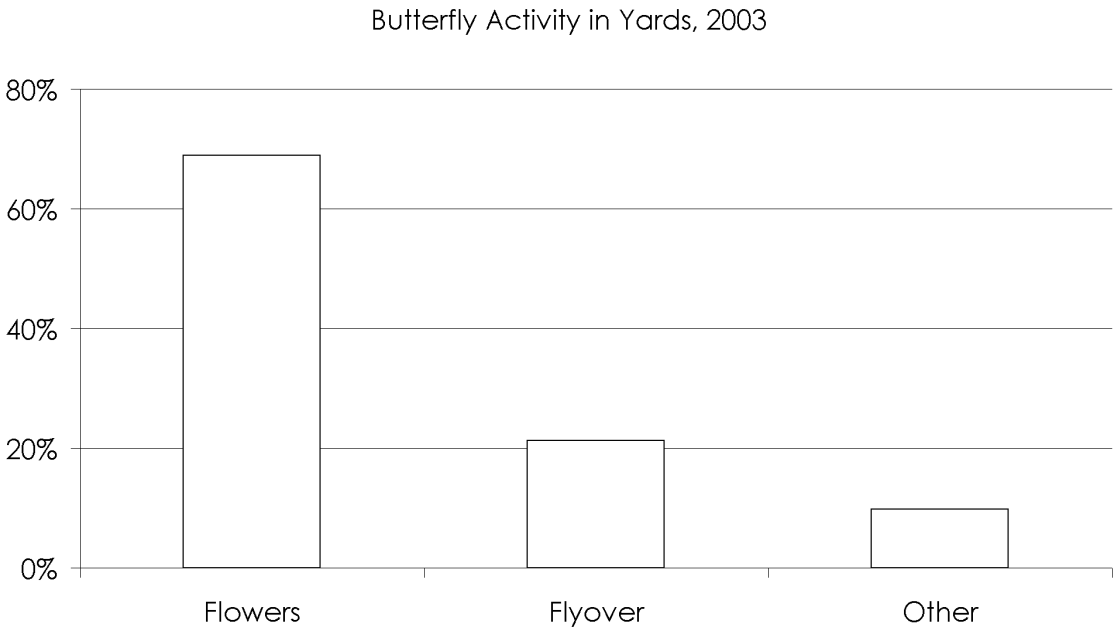

Figure 37. Activity of butterflies, 2003.

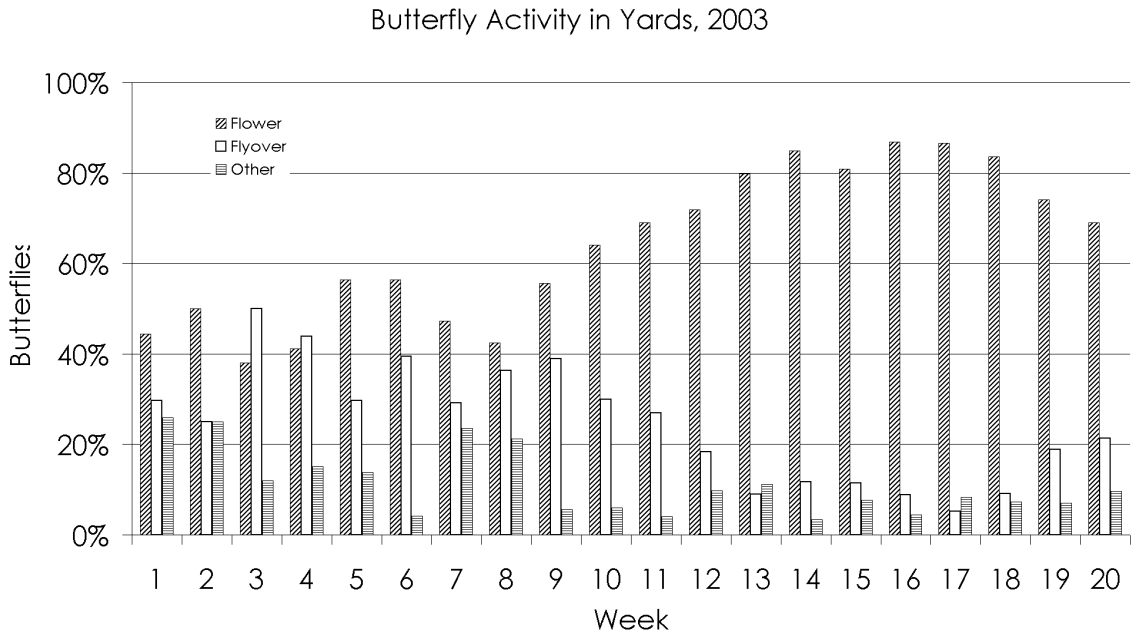

Figure 38. Activity of butterflies summarized by week, 2003.

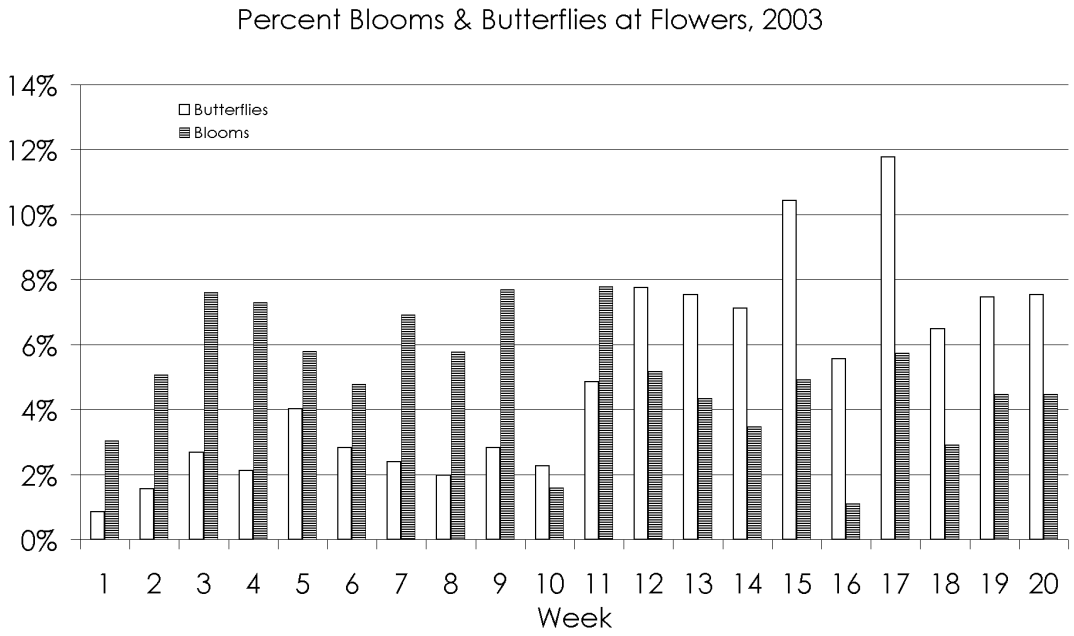

Figure 39. The percent of butterflies seen each week and the percent of flowers blooming each week during the 2003 count season.

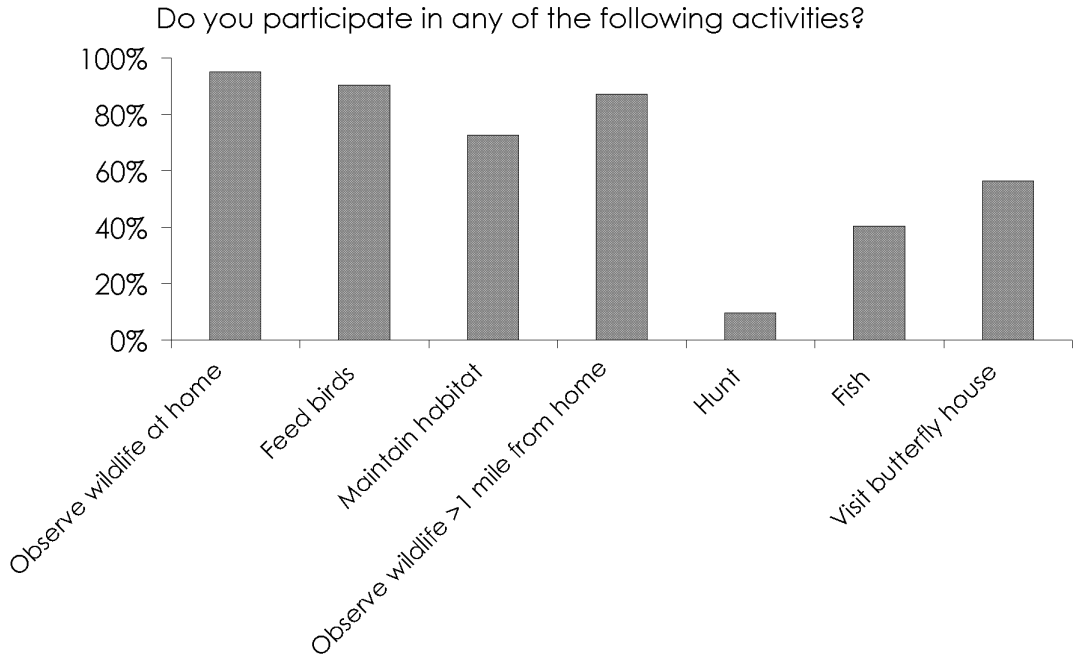

Figure 40. Reported participation of volunteers in various wildlife-oriented recreation.

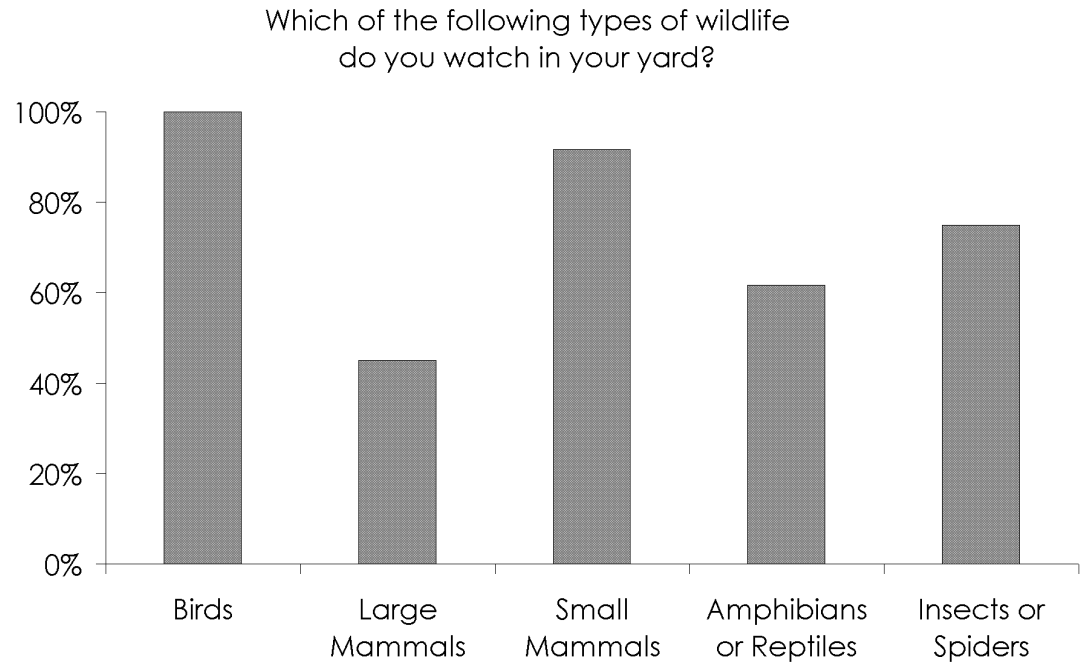

Figure 41. Backyard wildlife viewing engaged in by project volunteers.

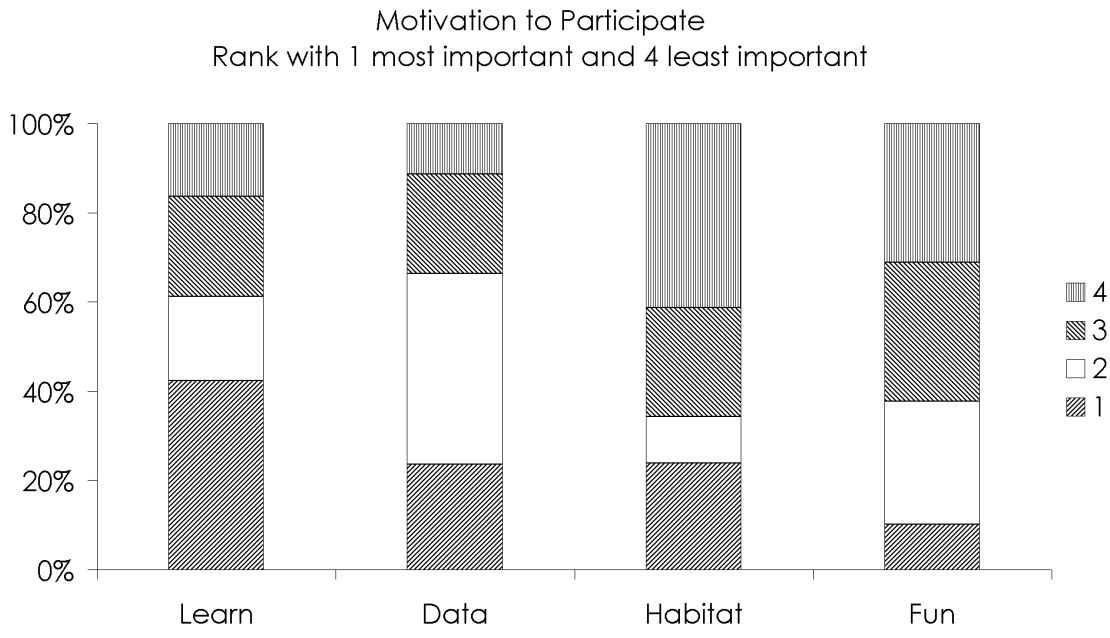

Figure 42. Factors involved in volunteers' decision to participate in the project.

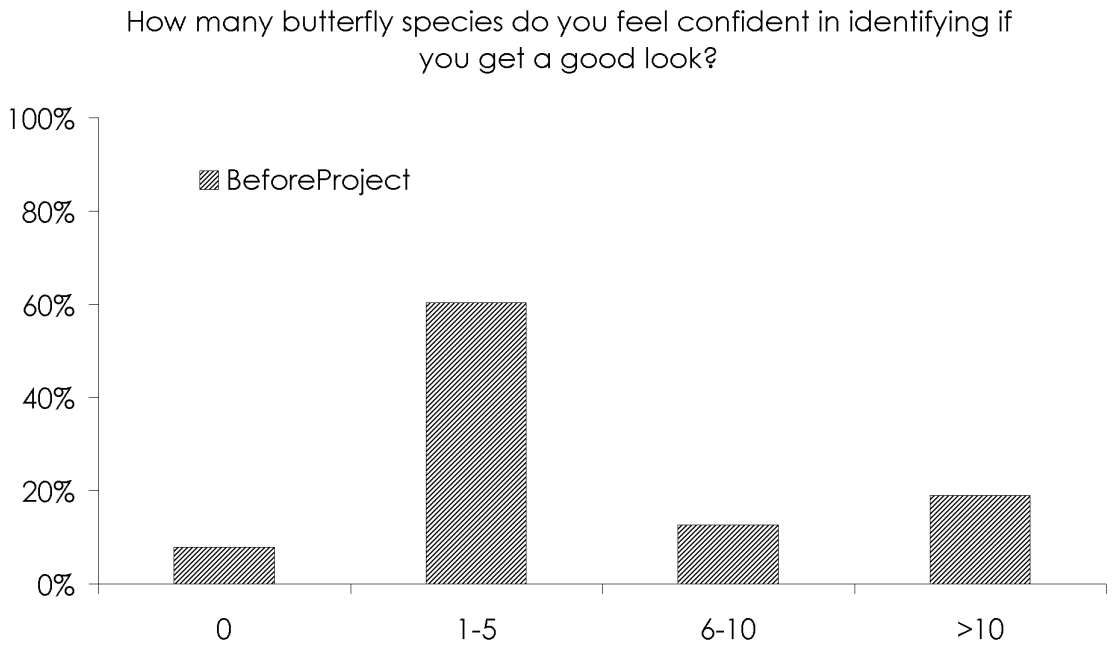

Figure 43. Self-assessment of identification capabilities of volunteers at the beginning of their project participation.

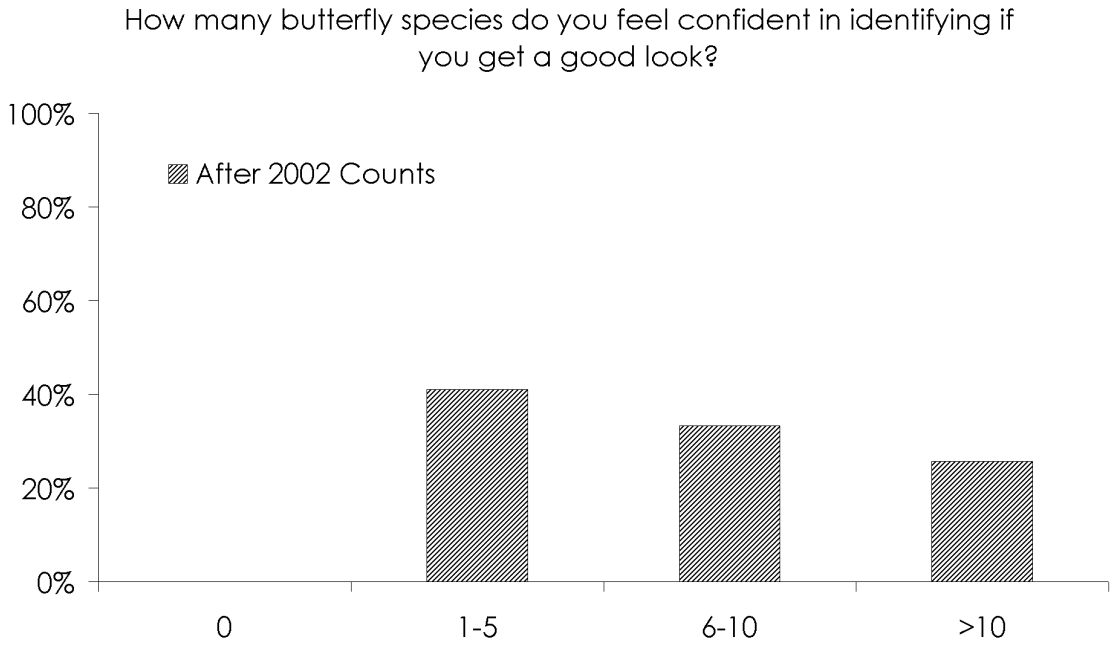

Figure 44. Self-assessment of identification capabilities of volunteers after the 2002 butterfly count period.

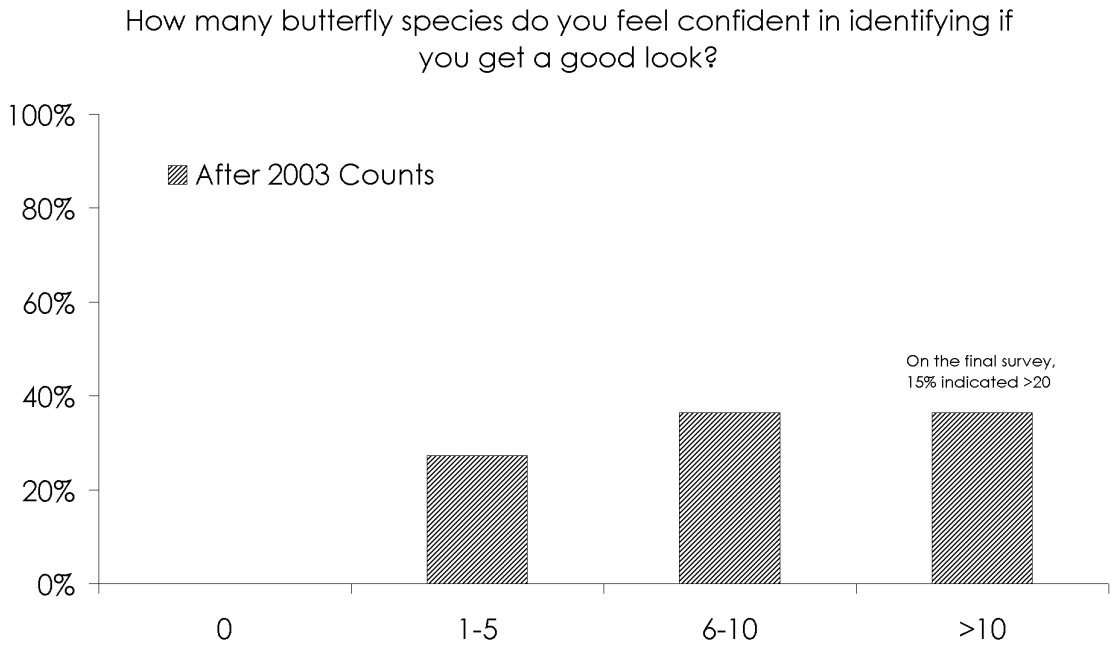

Figure 45. Self-assessment of identification capabilities of volunteers after the 2003 butterfly count period.

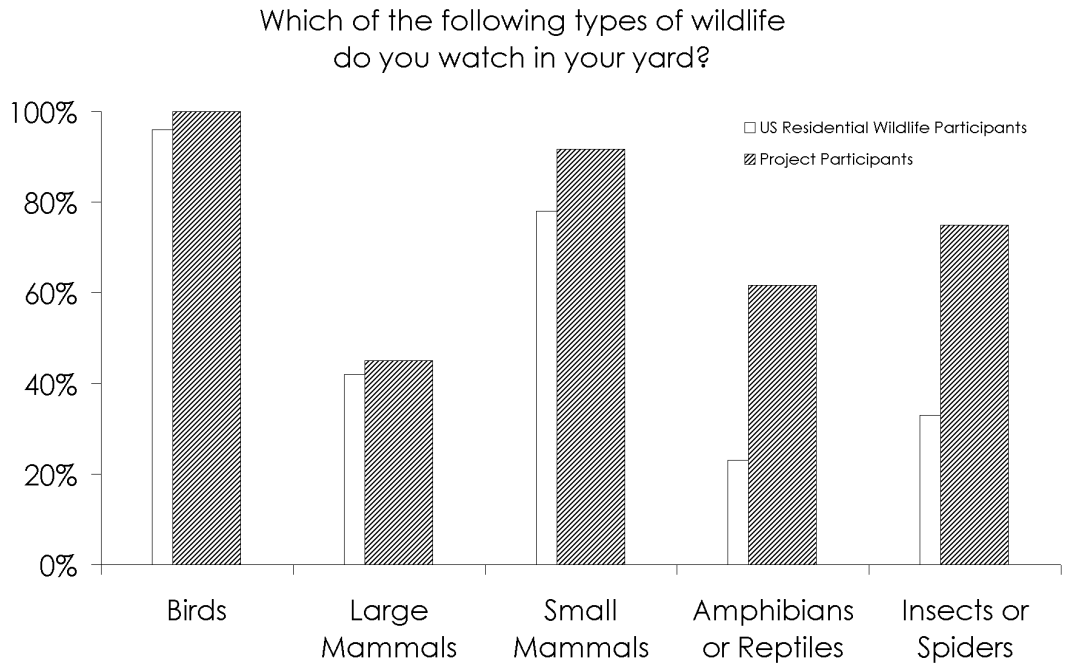

Figure 46. Backyard wildlife viewing engaged in by project volunteers compared to all U.S. residential wildlife viewers.

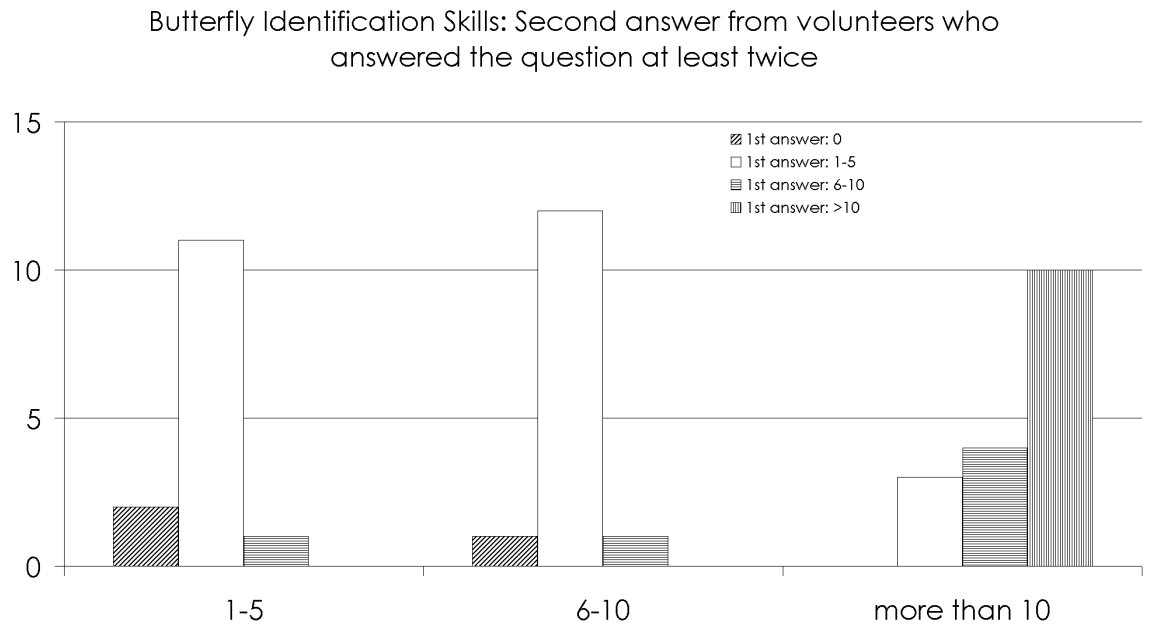

Figure 47. Increase in identification skills by those who estimated their identification skills on at least two of the surveys.

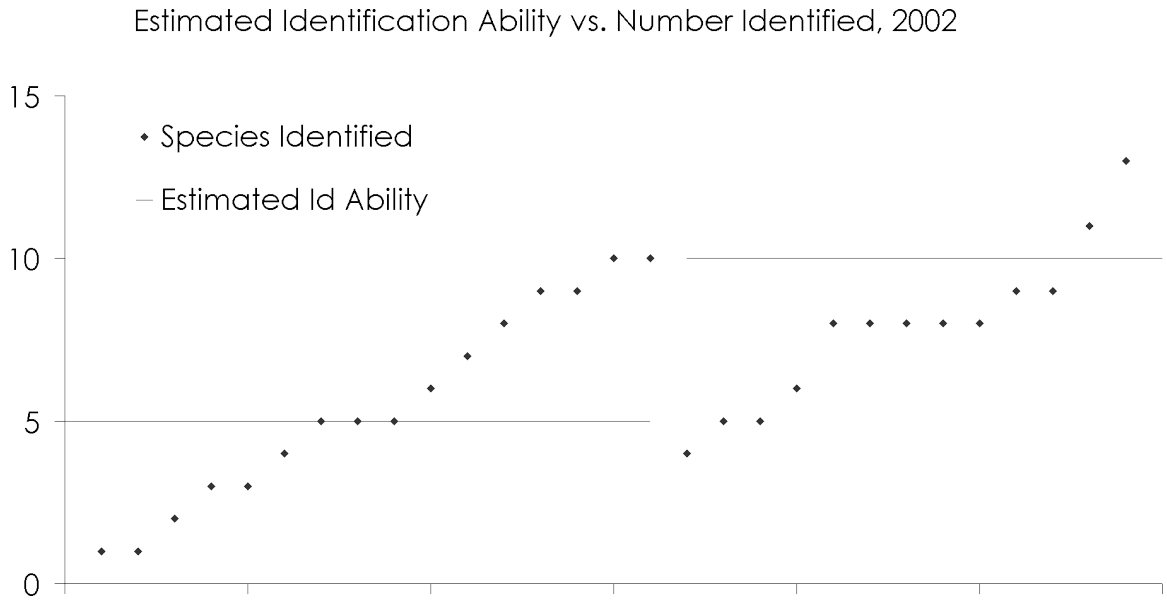

Figure 48. Number of species identified during 2002 by individual volunteers. The horizontal lines represent their estimated identification capabilities.

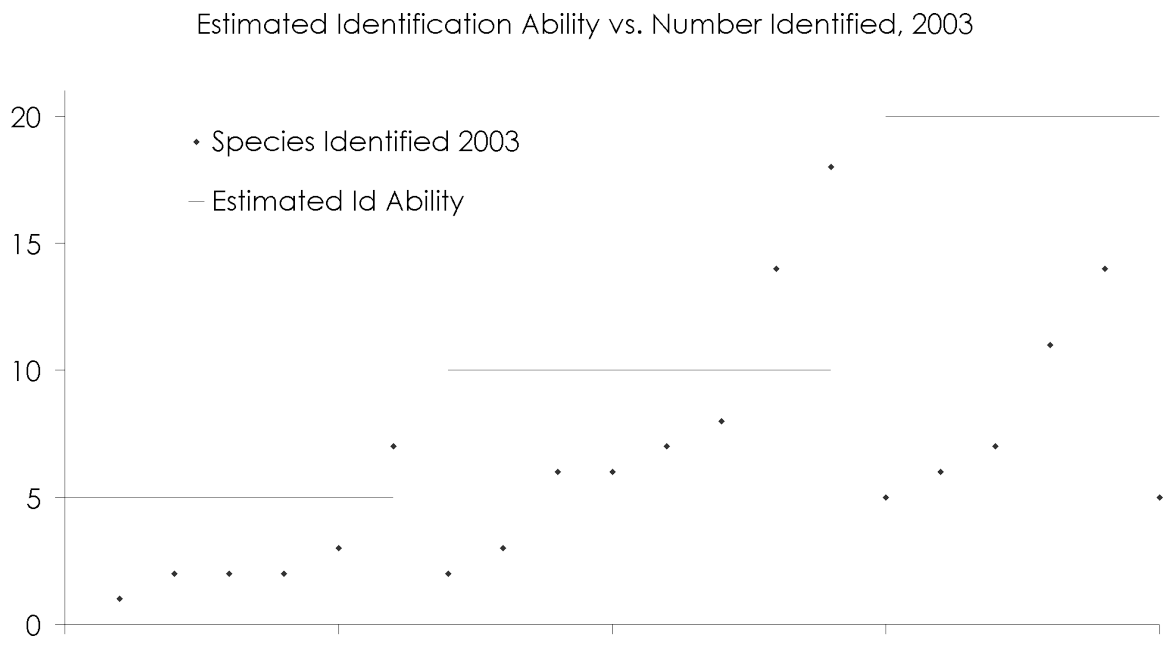

Figure 49. Number of species identified during 2003 by individual volunteers. The horizontal lines represent their estimated identification capabilities.

Appendix 1. List of butterfly species normally expected in mid-Missouri based on Heitzman and Heitzman (1997) with numbers of individual butterflies and number of sites at which the species was recorded.

Common Name	Scientific Name	2002		2003	
		#	Sites	#	Sites
Papilionidae					
Pipevine Swallowtail	*Battus philenor*	6	3	35	3
Zebra Swallowtail	*Eurytides marcellus*	9	7	12	5
Black Swallowtail	*Papilio polyxenes*	15	9	17	7
Giant Swallowtail	*Papilio cresphontes*	33	12	25	7
Eastern Tiger Swallowtail	*Papilio glaucus*	72	22	24	11
Spicebush Swallowtail	*Papilio troilus*	30	8	13	4
unidentified swallowtail		30		10	
Total		**195**	**32**	**136**	**17**
Pieridae					
Checkered White	*Pontia protodice*	-	-	-	-
Cabbage White	*Pieris rapae*	261	38	198	20
Falcate Orangetip	*Anthocharis midea*	-	-	-	-
Clouded Sulphur	*Colias philodice*	58	13	17	8
Orange Sulphur	*Colias eurytheme*	7	5	18	4
Clouded/Orange Sulphur	*Colias* sp.	25		3	
Southern Dogface	*Zerene cesonia*	-	-	-	-
Cloudless Sulphur	*Phoebis sennae*	116	35	14	7
Little Yellow	*Eurema lisa*	7	4	5	3
Sleepy Orange	*Eurema nicippe*	3	2	3	1
Dainty Sulphur	*Nathalis iole*	-	-	2	1
unidentified white		16		35	
unidentified sulphur		120		36	
Total		**613**	**49**	**331**	**26**
Lycaenidae					
Harvester	*Feniseca tarquinius*	-	-	-	-
American Copper	*Lycaena phlaeas*	2	1	-	-
Bronze Copper	*Lycaena hyllus*	-	-	-	-
Coral Hairstreak	*Satyrium titus*	-	-	-	-
Banded Hairstreak	*Satryium calanus*	2	1	-	-
Southern Hairstreak	*Satyrium favonius*	3	1	-	-
Juniper Hairstreak	*Callophrys gryneus*	1	1	-	-
Gray Hairstreak	*Strymon melinus*	22	11	30	11
Red-Banded Hairstreak	*Calycopis cecrops*	3	3	5	3
Eastern Tailed-Blue	*Everes comyntas*	157	25	107	14
Spring / Summer Azure	*Celastrina neglecta / C. ladon*	38	13	54	13

Common Name	Scientific Name	2002		2003	
		#	Sites	#	Sites
unidentified blue / hairstreak		153		62	
Total		**381**	**40**	**258**	**26**
Riodinidae					
Northern Metalmark	*Calephelis borealis*	-	-	-	-
Swamp Metalmark	*Calephelis mutica*	-	-	-	-
Nymphalidae					
American Snout	*Libytheana carinenta*	6	5	4	4
Gulf Fritillary *	*Agraulis vanillae*	-	-	1	1
Variegated Fritillary	*Euptoieta claudia*	-	-	-	-
Great Spangled Fritillary	*Speyeria cybele*	135	25	118	18
Gorgone Checkerspot	*Chylosyne gorgone*	-	-	-	-
Silvery Checkerspot	*Chlosyne nycteis*	10	6	18	3
Pearl Crescent	*Phyciodes tharos*	109	25	85	13
Baltimore Checkerspot	*Euphydryas phaeton*	-	-	-	-
unidentified checkerspot / crescent		1		18	
Question Mark	*Polygonia interrogationis*	6	3	-	-
Eastern / Gray Comma	*Polygonia* sp.	3		-	-
unidentified anglewing	*Polygonia* sp.	-	-	2	
American Lady	*Vanessa virginiensis*	5	5	14	3
Painted Lady	*Vanessa cardui*	23	11	199	16
Red Admiral	*Vanessa atalanta*	5	5	15	6
Lady / Admiral	*Vanessa* sp.	2		3	
Common Buckeye	*Junonia coenia*	26	11	11	5
Red-Spotted Purple	*Limenitis arthemis astyanax*	17	9	4	3
Viceroy	*Limenitis archippus*	3	2	-	-
Goatweed Leafwing	*Anaea andria*	4	3	2	2
Hackberry Emperor	*Asterocampa celtis*	3	3	1	1
Northern Pearly-Eye	*Enodia anthedon*	3	3	-	-
Little Wood-Satyr	*Megisto cymela*	10	5	12	5
Common Wood-Nymph	*Cercyonis pegala*	7	2	5	4
Monarch	*Danaus plexippus*	57	22	196	18
unidentified brushfoot		46		16	
Total		**481**	**45**	**724**	**29**
Hesperiidae					
unidentified skipper		784	33	542	21

* Occasionally seen, not normally expected in mid-Missouri.

Appendix 2. Count Protocol given to participants prior to the start of counts in May 2002.

Count once each week, Monday, May 13, 2002, through Sunday, September 15, 2002. Since many people will be counting on weekends, weeks will start on Mondays so Saturday and Sunday are included in the same week.

Have one person, preferably the same person each week, responsible for searching the yard for butterflies.

Please do not have children be responsible for the count.

Use a watch, count for exactly 15 minutes.

If you do not see any butterflies during a 15-minute count, it is important to turn in a data sheet indicating zero butterflies.

If, for any reason, you count more than once during a week, turn in a data sheet for each count.

Count between 10 am and 3 pm.

Count only on days that are mostly sunny; if there are some clouds, estimate how much of the sky is covered by clouds.

Avoid counting on extremely windy days.

Always count the same section of your yard. The section of your yard that you choose to count should be small enough so that part of it is not blocked from view or too far from you for an accurate count.

Count when that section of yard is not in the shade.

Each butterfly should be identified to species, if possible. Otherwise record family identification or write a short description of what it looked like.

All butterflies should be recorded on the count, even if you think it is possible that an individual butterfly left your yard and then returned.

Unidentified butterflies should be counted as a distinct species if you are certain it is not a previously identified species.

Skippers need to be identified only as skippers and counted as 1 species. If you prefer to identify Silver-spotted Skippers and separate the others into subfamilies, do so.

Flowers on which a butterfly perched should be identified and recorded, if known.

Appendix 3. Count Protocol given to participants prior to the start of counts in May 2003.

Count once each week, Monday, May 12, 2003, through Sunday, September 28, 2003; starting weeks on Monday places Saturday and Sunday in the same week. [This is 20 weeks instead of 18. Last year, a number of people said it was frustrating to stop just when the numbers of butterflies began increasing.]

Use a watch, count for exactly 15 minutes.

Turn in a data sheet for each count, even if you do not see any butterflies – zeros are important.

Count between 10 am and 4 pm.

Count only on days that are mostly sunny.

Avoid counting on extremely windy days, unless necessary to fit into your schedule.

Always count the same section of your yard. The section of your yard that you choose to count should be small enough so that none of it is blocked from view or too far from you for an accurate count.

Count when that section of your yard is not in the shade.

Have one person, preferably the same person each week, responsible for searching the yard for butterflies.

Please do not have children be responsible for the count.

Record all butterflies & skippers seen even if they are unidentified or you think it is the same butterfly that flew out of your yard and too far to see and returned. If you can't identify the butterfly, write a short description and try to identify it to family. Skippers only need to be identified as skippers and are counted as a single species.

Flowers on which a butterfly perched should be identified and recorded, if known.

If, for any reason, you count more than once during a week, turn in a data sheet for each count.

Appendix 4. Characteristics of sites (flowers, size, shade, location) listed in order of the number of butterflies per count, 2002

Butterflies / Count	Species / Count	Counts	Recommended		Not Recommended		m^2	% Shade	Km from Courthouse	City Limits
			Genera	Flowers	Genera	Flowers				
42.25	3.85	20	38	882	17	119	139.4	1-25	4.5	inside the city limits
31.56	3.55	20	3	565	0	0	232.3	0	9.8	outside the city limits
28.11	4.26	19	80	680	26	326	929.0	1-25	3.1	inside the city limits
27.20	2.94	17	13	285	7	318	371.6	1-25	6.2	inside the city limits
17.18	3.29	14	27	1160	26	413	743.2	1-25	9.3	outside the city limits
13.00	3.07	13	15	1046	7	45	232.3		1.9	inside the city limits
9.69	2.71	17	20	410	4	46	371.6	1-25	2.9	inside the city limits
8.47	6.17	11	16	71	28	283	111.5	1-25	2.8	inside the city limits
8.27	2.47	17	44	879	12	103	92.9	26-50	1.7	inside the city limits
4.33	0.64	11	5	24	3	12	69.7	1-25	2.9	inside the city limits
3.74	2.67	11	13	244	10	206	116.1	1-25	3.4	inside the city limits
2.94	3.60	19	19	104	2	6	55.7	0	9.8	outside the city limits
2.79	2.17	12	7	123	6	58	232.3	26-50	5.7	inside the city limits
2.50	2.00	11	15	272	11	53	111.5	1-25	1.0	inside the city limits
2.40	2.33	18	25	676	3	7	297.3	26-50	4.2	inside the city limits
2.09	2.05	20	45	725	24	558	594.6	1-25	7.3	inside the city limits
1.93	1.74	19	28	497	17	111	55.7	1-25	1.9	inside the city limits
1.93	0.90	9	14	135	2	21	23.2	26-50	1.4	inside the city limits
1.67	1.20	16	10	269	1	3	148.6	26-50	5.5	inside the city limits
1.58	4.06	15	39	1441	16	259	668.9	26-50	9.1	inside the city limits
1.53	2.38	8	22	137	11	291	139.4	1-25	5.1	inside the city limits
1.47	2.00	12	16	368	12	131	13.4	1-25	5.5	inside the city limits
1.23	2.00	15	1	0	1	7	520.3	1-25	3.7	inside the city limits
1.14	1.50	4	14	1228	6	727	111.5	26-50	0.9	inside the city limits

Butterflies / Count	Species / Count	Counts	Recommended		Not Recommended		m^2	% Shade	Km from Courthouse	City Limits
			Genera	Flowers	Genera	Flowers				
1.10	2.27	15	19	165	9	41	74.3	1-25	1.4	inside the city limits
1.06	1.65	17	10	62	2	14	41.8	51-75	1.9	inside the city limits
0.95	1.73	11	11	75	7	20	74.3	26-50	1.4	inside the city limits
0.91	1.20	15	30	327	11	97	464.5	26-50	5.2	inside the city limits
0.78	1.37	19	16	50	12	179	223.0	1-25	5.5	inside the city limits
0.74	2.14	14	16	116	3	74	111.5	1-25	13.1	outside the city limits
0.74	0.44	18	12	141	13	139	223.0	76-100	2.9	inside the city limits
0.62	3.09	11	6	37	9	24	223.0	76-100	3.4	inside the city limits
0.55	1.20	9	12	1322	4	61	139.4	1-25	2.2	inside the city limits
0.49	1.18	11	16	352	2	8	185.8	1-25	2.9	inside the city limits
0.49	2.15	13	15	2610	3	60	139.4	1-25	2.1	inside the city limits
0.40	5.33	3	3	861	1	60	55.7	0	19.0	outside the city limits
0.26	1.00	10	1	40	4	83	223.0	26-50	3.5	inside the city limits
0.25	0.50	4	25	869	29	960	55.7	26-50	5.7	inside the city limits
0.16	2.67	3	5	192	3	52	4645.2	1-25	15.9	outside the city limits
0.15	0.71	14	14	257	2	3	20.9	1-25	1.7	inside the city limits
0.13	0.63	8	7	33	6	37	92.9	76-100	3.1	inside the city limits
0.11	1.50	2	20	502	10	87	111.5		6.5	outside the city limits
0.10	1.25	4	2	250	0	0	232.3	26-50	0.5	inside the city limits
0.09	0.86	7	2	1003	1	1	139.4	51-75	5.0	inside the city limits
0.08	1.00	4	18	244	5	73	223.0	51-75	4.7	inside the city limits
0.07	1.50	2	8	601	2	6	260.1	1-25	1.2	inside the city limits
0.05	1.25	4	2	31	2	11	111.5	26-50	0.7	inside the city limits
0.00	0.00	7	3	420	1	2	74.3	26-50	4.9	inside the city limits

Appendix 5. Characteristics of sites (flowers, size, shade, location) listed in order of the number of butterflies per count, 2003

Butterflies / Count	Species / Count	# Counts	# Yard Surveys	Recommended		Not Recommended		m^2	% Shade	Km from Courthouse	City Limits
				Genera*	Flowers	Genera	Flowers				
15.56	5.06	16	2	4.0	208.0	3.5	278.0	232.3	0	9.8	outside city limits
12.13	5.60	15	4	11.8	1886.5	2.5	262.8	351.2	0	24	outside city limits
8.67	3.58	12	3	12.7	1825.3	8.7	591.7	929.0	0	9.3	outside city limits
8.44	4.25	16	5	3.8	164.6	2.0	122.4	22.3	1-25	15.3	outside city limits
8.00	4.33	3	2	3.5	41.0	1.0	5.0	111.5	1-25	2.8	inside city limits
7.00	4.00	1	1	8.0	121.0	5.0	44.0	14.9	1-25	13.9	outside city limits
6.33	3.33	15	4	8.0	284.3	3.8	68.3	55.7	0	9.8	outside city limits
5.78	3.11	9	4	7.5	329.0	3.0	155.3	116.1	26-50	3.4	inside city limits
5.20	4.75	20	5	16.4	2509.8	7.8	643.8	139.4	1-25	4.5	inside city limits
4.56	2.56	18	5	9.0	916.6	1.8	49.4	297.3	26-50	4.2	inside city limits
4.35	0.90	20	5	9.0	218.4	4.2	53.2	167.2	1-25	2.9	inside city limits
4.35	2.65	17	4	10.5	1116.0	4.5	60.3	92.9	1-25	1.7	inside city limits
3.69	2.08	13	3	4.3	569.0	2.0	224.3	255.5	26-50	2.9	inside city limits
3.64	1.71	14	2	1.5	95.5	2.0	77.0	232.3	1-25	5.7	inside city limits
3.62	1.38	13	4	2.3	232.8	2.0	408.3	23.2	1-25	1.4	inside city limits
3.60	1.70	10	2	5.0	120.0	1.0	5.0	111.5	1-25	1.3	inside city limits
3.38	2.23	13	5	8.4	921.8	2.6	263.6	232.3	1-25	1.9	inside city limits
3.12	2.53	17	4	17.5	1251.5	6.3	366.5	929.0	26-50	3.1	inside city limits
2.36	1.82	11	2	11.0	450.5	4.0	77.5	464.5	51-75	5.2	inside city limits
2.00	1.33	3	1	8.0	116.0	5.0	115.0	139.4	1-25	5.1	inside city limits
1.92	1.75	12	2	8.5	484.0	2.5	255.0	13.4	1-25	5.5	inside city limits
1.50	2.35	20	4	8.8	323.0	1.5	9.8	22.3	1-25	1.9	inside city limits
0.71	0.71	7	2	4.0	61.0	2.0	10.0	69.7	1-25	2.9	inside city limits
0.67	0.33	6	1	2.0	0.0	3.0	395.0	371.6	1-25	5.7	inside city limits
0.62	0.54	13	4	3.0	251.3	5.0	123.8	116.1	51-75	2.9	inside city limits

Appendix 6. Number and percent of butterflies recorded at flower genera, 2002 and 2003.

Family	Genus	2002		2003	
		Butterflies	Percent	Butterflies	Percent
Amaranthaceae	*Celosia*	1	0.1%	1	0.1%
	Gomphrena	5	0.3%	14	1.0%
Amaryllidaceae	*Zephyranthes* *	1	0.1%	-	-
Apiaceae	*Anethum* *	1	0.1%	-	-
	Daucus	9	0.6%	5	0.4%
	Eryngium *	-	-	12	0.8%
Apocynaceae	*Vinca* *	2	0.1%	1	0.1%
Asclepiadaceae	*Asclepias*	24	1.6%	63	4.4%
Asteraceae	*Achillea*	3	0.2%	2	0.1%
	Ageratum	18	1.2%	5	0.4%
	Aster	7	0.5%	10	0.7%
	Bidens	3	0.2%	-	-
	Centaurea	6	0.4%	4	0.3%
	Chichorium	2	0.1%	-	-
	Chrysanthemum	25	1.7%	13	0.9%
	Coreopsis	86	5.8%	38	2.7%
	Cosmos	13	0.9%	32	2.3%
	Dahlia *	3	0.2%	3	0.2%
	Echinacea	87	5.8%	40	2.8%
	Echinacea / Rudbeckia / Ratibida	11	0.7%	28	2.0%
	Eupatorium	9	0.6%	40	2.8%
	Gaillardia	-	-	11	0.8%
	Helianthus	2	0.1%	-	-
	Heliopsis	2	0.1%	3	0.2%
	Liatris	12	0.8%	86	6.1%
	Melampodium *	7	0.5%	9	0.6%
	Ratibida	2	0.1%	2	0.1%
	Rudbeckia	40	2.7%	26	1.8%
	Solidago	6	0.4%	7	0.5%
	Tagetes	44	3.0%	27	1.9%
	Taraxacum	2	0.1%	3	0.2%
	Tithonia	-	-	9	0.6%
	Vernonia	21	1.4%	21	1.5%
	Zinnia	299	20.1%	413	29.1%
	unidentified	-	-	15	1.1%
Berberidaceae	*Berberis* *	1	0.1%	-	-
Brassicaceae	*Brassica*	16	1.1%	9	0.6%
	Hesperis	8	0.5%	1	0.1%
	Raphanus	1	0.1%	-	-
Buddlejaceae	*Buddleja*	45	3.0%	36	2.5%

* Not typically recommended for use in butterfly gardens.

Family	Genus	2002		2003	
		Butterflies	Percent	Butterflies	Percent
Campanulaceae	*Campanula* *	2	0.1%	-	-
Cannaceae	*Canna* *	1	0.1%	-	-
Capparaceae	*Cleome* *	9	0.6%	3	0.2%
Caprifoliacae	*Sambucus* *	-	-	2	0.1%
	Lonicera	3	0.2%	1	0.1%
	Viburnam	1	0.1%	-	-
Caryophyllaceae	*Dianthus*	19	1.3%	9	0.6%
	Silene *	-	-	1	0.1%
Chenopodiaceae	*Chenopodium* *	-	-	1	0.1%
Commelinaceae	*Tradescantia* *	-	-	1	0.1%
Convolvulaceae	*Ipomoea* *	2	0.1%	2	0.1%
Cornaceae	*Cornus* *	4	0.3%	-	-
Crassulaceae	*Sedum*	37	2.5%	50	3.5%
Cucurbitaceae	*Cucumis* *	1	0.1%	1	0.1%
	Cucurbita *	1	0.1%	3	0.2%
Dipsacaceae	*Scabiosa*	2	0.1%	2	0.1%
Elaeagnaceae	*Elaeagnus* *	-	-	1	0.1%
Ericaceae	*Vaccinium*	1	0.1%	-	-
Euphorbiaceae	*Croton* *	1	0.1%	-	-
Fabaceae	*Albizia* *	1	0.1%	-	-
	Cassia *	1	0.1%	-	-
	Coronilla	-	-	3	0.2%
	Lespedeza *	1	0.1%	10	0.7%
	Phaseolus *	4	0.3%	5	0.4%
	Pisum *	7	0.5%	7	0.5%
	Trifolium	-	-	8	0.6%
	Trifolium / Melilotus / Medicago	104	7.0%	37	2.6%
	Vicia / Coronilla / Astragalus	-	-	1	0.1%
Geraniaceae	*Geranium / Pelargonium* *	1	0.1%	6	0.4%
	Pelargonium *	2	0.1%	-	-
Hemerocallidaceae	*Hemerocallis*	6	0.4%	-	-
Hydrangeaceae	*Hydrangea* *	-	-	1	0.1%
Iridaceae	*Gladiolus* *	1	0.1%	-	-
	Iris *	-	-	1	0.1%
Lamiaceae	*Ajuga* *	-	-	3	0.2%
	Blephilia	4	0.3%	-	-
	Lavandula	3	0.2%	-	-
	Melissa *	2	0.1%	-	-
	Mentha	-	-	3	0.2%
	Monarda	3	0.2%	7	0.5%
	Nepeta	9	0.6%	3	0.2%
	Ocimum *	2	0.1%	10	0.7%
	Origanum *	6	0.4%	1	0.1%
	Perovskia *	3	0.2%	-	-

Family	Genus	2002		2003	
		Butterflies	Percent	Butterflies	Percent
	Physostegia *	-	-	1	0.1%
	Plectranthus *	1	0.1%	1	0.1%
	Pycnanthemum	5	0.3%	1	0.1%
	Salvia	55	3.7%	26	1.8%
	Teucrium *	2	0.1%	-	-
	Thymus	5	0.3%	-	-
	unidentified	13	0.9%	3	0.2%
Lauraceae	*Lindera*	-	-	1	0.1%
Liliaceae	*Allium*	8	0.5%	7	0.5%
	Hosta *	2	0.1%	1	0.1%
	Lilium *	2	0.1%	1	0.1%
Lobeliaceae	*Lobelia*	1	0.1%	-	-
Lythraceae	*Lagerstroemia* *	3	0.2%	-	-
Malvaceae	*Abelmoscus* *	2	0.1%	1	0.1%
	Alcea *	1	0.1%	-	-
	Callirhoe *	2	0.1%	-	-
	Hibiscus	3	0.2%	22	1.6%
Oleaceae	*Ligustrum*	14	0.9%	-	-
Onagraceae	*Oenothera*	4	0.3%	-	-
Oxalidaceae	*Oxalis*	-	-	1	0.1%
Paeoniaceae	*Paeonia* *	-	-	2	0.1%
Papilionaceae	*Vigna* *	1	0.1%	-	-
Phytolaccaceae	*Phytolacca* *	1	0.1%	-	-
Plumbaginaceae	*Plumbago*	1	0.1%	-	-
Polemoniaceae	*Phlox*	19	1.3%	4	0.3%
Polygonaceae	*Rumex* *	-	-	1	0.1%
Portulacaceae	*Portulaca* *	6	0.4%	-	-
Primulaceae	*Lysimachia* *	3	0.2%	2	0.1%
Ranunculaceae	*Clematis*	4	0.3%	20	1.4%
Rhamnaceae	*Ceanothus*	1	0.1%	-	-
Rosaceae	*Fragaria*	2	0.1%	-	-
	Rosa *	9	0.6%	1	0.1%
	Rubus	3	0.2%	9	0.6%
	Spirea	1	0.1%	-	-
Rubiaceae	*Cephalanthus*	2	0.1%	1	0.1%
	Pentas	2	0.1%	4	0.3%
Rutaceae	*Ruta* *	-	-	1	0.1%
Saxifragaceae	*Astilbe* *	1	0.1%	-	-
	Itea *	1	0.1%	1	0.1%
Scrophulariaceae	*Antirrhinum* *	1	0.1%	-	-
	Penstemon	3	0.2%	10	0.7%
	Veronica *	-	-	2	0.1%
	Veronicastrum	-	-	1	0.1%

Family	Genus	2002		2003	
		Butterflies	Percent	Butterflies	Percent
Solanaceae	*Calibrachoa* *	3	0.2%	-	-
	Capsicum *	-	-	1	0.1%
	Lycopersicon *	3	0.2%	7	0.5%
	Nicotiana	1	0.1%	-	-
	Petunia	12	0.8%	1	0.1%
	Solanum *	1	0.1%	-	-
Urticaceae	*Boehmeria* *	1	0.1%	-	-
Valerianaceae	*Valerianella* *	4	0.3%	-	-
Verbenaceae	*Lantana*	7	0.5%	14	1.0%
	Verbena	115	7.7%	67	4.7%
unidentified	unidentified	92	6.2%	32	2.3%

Appendix 7. Number and percent of Papilionidae recorded at flower genera, 2002 and 2003.

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Pipevine Swallowtail (*Battus philenor*)					
Apiaceae	*Daucus*	-	-	1	5.0%
Asteraceae	*Ratibida*	1	20.0%	-	-
	Rudbeckia	-	-	1	5.0%
	Zinnia	-	-	13	65.0%
Capparaceae	*Cleome* *	2	40.0%	-	-
Caprifoliaceae	*Lonicera*	1	20.0%	-	-
Lamiaceae	*Salvia*	1	20.0%	-	-
Malvaceae	*Hibiscus*	-	-	3	15.0%
Scrophulariaceae	*Penstemon*	-	-	2	10.0%
Total *B. philenor*		**5**		**20**	
Zebra Swallowtail (*Eurytides marcellus*)					
Asclepiadaceae	*Asclepias*	1	50.0%	-	-
Buddlejaceae	*Buddleja*		-	1	100.0%
Capparaceae	*Cleome* *	1	50.0%	-	-
Lamiaceae	*Salvia*	1	50.0%	-	-
Total *E. marcellus*		**2**		**1**	
Black Swallowtail (*Papilio polyxenes*)					
Apiaceae	*Daucus*	1	20.0%	1	7.7%
Asteraceae	*Echinacea / Rudbeckia / Ratibida*	-	-	1	7.7%
	Helianthus	1	20.0%	-	-
	Zinnia	2	40.0%	7	53.8%
Buddlejaceae	*Buddleja*	-	-	2	15.4%
Caryophyllaceae	*Dianthus*	-	-	1	7.7%
Verbenaceae	*Verbena*	1	20.0%	1	7.7%
Total *P. polyxenes*		**5**		**13**	
Giant Swallowtail (*Papilio cresphontes*)					
Asclepiadaceae	*Asclepias*	1	4.8%	1	4.5%
Asteraceae	*Coreopsis*	1	4.8%	-	-
	Echinacea	-	-	1	4.5%
	Rudbeckia	1	4.8%	-	-
	Zinnia	1	4.8%	17	77.3%
Brassicaceae	*Hesperis*	2	9.5%	-	-
Buddlejaceae	*Buddleja*	2	9.5%	1	4.5%
Capparaceae	*Cleome* *	1	4.8%	-	-
Caryophyllaceae	*Dianthus*	1	4.8%	-	-

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Hemerocallidaceae	*Hemerocallis*	1	4.8%	-	-
Oleaceae	*Ligustrum*	3	14.3%	-	-
Polemoniaceae	*Phlox*	1	4.8%	1	4.5%
Rutaceae	*Ruta* *	-	-	1	4.5%
Solanaceae	*Petunia*	1	4.8%	-	-
Verbenaceae	*Verbena*	5	23.8%	-	-
Total *P. cresphontes*		**21**		**22**	
Eastern Tiger Swallowtail (*Papilio glaucus*)					
Asclepiadaceae	*Asclepias*	-	-	2	15.4%
Asteraceae	*Cosmos*	1	4.8%	1	7.7%
	Echinacea	2	9.5%	-	-
	Eupatorium	-	-	1	7.7%
	Tagetes	-	-	1	7.7%
	Vernonia	1	4.8%	-	-
	Zinnia	1	4.8%	4	30.8%
Brassicaceae	*Hesperis*	3	14.3%	-	-
Buddlejaceae	*Buddleja*	-	-	1	7.7%
Caprifoliaceae	*Lonicera*	2	9.5%	1	7.7%
Fabaceae	*Albizia* *	1	4.8%	-	-
	Trifolium / Melilotus / Medicago	1	4.8%	-	-
Geraniaceae	*Geranium / Pelargonium* *	1	4.8%	1	7.7%
	Pelargonium *	1	4.8%	-	-
Hemerocallidaceae	*Hemerocallis*	1	4.8%	-	-
Lamiaceae	*Salvia*	1	4.8%	-	-
Polemoniaceae	*Phlox*	2	9.5%	-	-
Portulacaceae	*Portulaca* *	1	4.8%	-	-
Rubiaceae	*Cephalanthus*	1	4.8%	-	-
Scrophulariaceae	*Veronicastrum*	-	-	1	7.7%
Valerianaceae	*Valerianella* *	1	4.8%	-	-
Total *P. glaucus*		**21**		**13**	
Spicebush Swallowtail (*Papilio troilus*)					
Asteraceae	*Tagetes*	-	-	1	11.1%
	Vernonia	1	4.5%	-	-
	Zinnia	14	63.6%	6	66.7%
Caryophyllaceae	*Dianthus*	1	4.5%	-	-
Hemerocallidaceae	*Hemerocallis*	1	4.5%	-	-
Liliaceae	*Lilium* *	2	9.1%	-	-
Malvaceae	*Hibiscus*	-	-	1	11.1%
Polemoniaceae	*Phlox*	2	9.1%	-	-

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Saxifragaceae	*Itea* *	-	-	1	11.1%
Solanaceae	*Petunia*	1	4.5%	-	-
Total *P. troilus*		**22**		**9**	

Appendix 8. Number and percent of Pieridae recorded at flower genera, 2002 and 2003.

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Cabbage White (*Pieris rapae*)					
Asteraceae	*Achillea*	1	0.9%	-	-
	Centaurea	-	-	1	1.0%
	Chichorium	1	0.9%	-	-
	Chrysanthemum	1	0.9%	3	3.0%
	Coreopsis	5	4.4%	-	-
	Cosmos	1	0.9%	3	3.0%
	Echinacea	3	2.6%	-	-
	Eupatorium	1	0.9%	3	3.0%
	Gaillardia	-	-	2	2.0%
	Liatris	-	-	1	1.0%
	Rudbeckia	1	0.9%	2	2.0%
	Tagetes	3	2.6%	3	3.0%
	Taraxacum	1	0.9%	1	1.0%
	Vernonia	4	3.5%	1	1.0%
	Zinnia	28	24.6%	19	19.0%
Brassicaceae	*Brassica*	11	9.6%	5	5.0%
	Hesperis	1	0.9%	1	1.0%
Buddlejaceae	*Buddleja*	-	-	4	4.0%
Capparaceae	*Cleome* *	3	2.6%	1	1.0%
Caprifoliacae	*Sambucus* *	-	-	1	1.0%
Caryophyllaceae	*Dianthus*	1	0.9%	-	-
Crassulaceae	*Sedum*	1	0.9%	-	-
Cucurbitaceae	*Cucumis* *	1	0.9%	-	-
	Cucurbita *	1	0.9%	2	2.0%
Fabaceae	*Coronilla*	-	-	2	2.0%
	Phaseolus *	4	3.5%	5	5.0%
	Pisum *	1	0.9%	4	4.0%
	Trifolium / Melilotus / Medicago	1	0.9%	4	4.0%
	Vicia / Coronilla / Astragalus	-	-	1	1.0%
Lamiaceae	*Ajuga* *	-	-	2	2.0%
	Lavandula	1	0.9%	-	-
	Melissa *	1	0.9%	-	-
	Monarda	-	-	1	1.0%
	Nepeta	1	0.9%	1	1.0%
	Ocimum *	-	-	9	9.0%
	Origanum *	3	2.6%	1	1.0%
	Perovskia *	1	0.9%	-	-
	Plectranthus *	-	-	1	1.0%
	Pycnanthemum	3	2.6%	-	-
	Salvia	5	4.4%	-	-
	Teucrium *	1	0.9%	-	-

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Liliaceae	*Allium*	1	0.9%	1	1.0%
Malvaceae	*Abelmoscus* *	-	-	1	1.0%
Papilionaceae	*Vigna* *	1	0.9%	-	-
Polemoniaceae	*Phlox*	3	2.6%	-	-
Ranunculaceae	*Clematis*	1	0.9%	-	-
Rosaceae	*Rubus*	3	2.6%	6	6.0%
Solanaceae	*Capsicum* *	-	-	1	1.0%
	Lycopersicon *	1	0.9%	4	4.0%
	Nicotiana	1	0.9%	-	-
	Solanum *	1	0.9%	-	-
Verbenaceae	*Verbena*	11	9.6%	3	3.0%
Total *P. rapae*		**114**		**100**	
Clouded / Orange Sulphur (*Colias* spp.)					
Apiaceae	*Daucus*	-	-	2	7.4%
Asteraceae	*Bidens*	1	2.2%	-	-
	Centaurea	2	4.3%	-	-
	Chrysanthemum	1	2.2%	-	-
	Coreopsis	15	32.6%	2	7.4%
	Cosmos	-	-	1	3.7%
	Echinacea	2	4.3%	-	-
	Eupatorium	2	4.3%	-	-
	Liatris	2	4.3%	4	14.8%
	Rudbeckia	3	6.5%	-	-
	Vernonia	2	4.3%	-	-
	Zinnia	4	8.7%	15	55.6%
Fabaceae	*Trifolium / Melilotus / Medicago*	6	13.0%	-	-
Hemerocallidaceae	*Hemerocallis*	1	2.2%	-	-
Malvaceae	*Hibiscus*	1	2.2%	1	3.7%
Onagraceae	*Oenothera*	1	2.2%	-	-
Polygonaceae	*Rumex* *	-	-	1	3.7%
Rosaceae	*Rosa* *	1	2.2%	-	-
Verbenaceae	*Verbena*	2	4.3%	1	3.7%
Total *Colias* spp.		**46**		**27**	
Cloudless Sulphur (*Phoebis sennae*)					
Asteraceae	*Coreopsis*	6	11.8%	-	-
	Cosmos	2	3.9%	-	-
	Dahlia *	1	2.0%	-	-
	Solidago	1	2.0%	-	-
	Tagetes	3	5.9%	1	10.0%
	Taraxacum	1	2.0%	-	-
	Zinnia	10	19.6%	6	60.0%
Cannaceae	*Canna* *	1	2.0%	-	-

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Caryophyllaceae	*Dianthus*	1	2.0%	-	-
	Silene *	1	2.0%	-	-
Fabaceae	*Trifolium / Melilotus / Medicago*	1	2.0%	1	10.0%
Lamiaceae	*Salvia*	4	7.8%	-	-
Lobeliaceae	*Lobelia*	1	2.0%	-	-
Malvaceae	*Hibiscus*	1	2.0%	2	20.0%
Plumbaginaceae	*Plumbago*	1	2.0%	-	-
Polemoniaceae	*Phlox*	3	5.9%	-	-
Primulaceae	*Lysimachia* *	1	2.0%	-	-
Rosaceae	*Spirea*	1	2.0%	-	-
Rubiaceae	*Pentas*	1	2.0%	-	-
Scrophulariaceae	*Antirrhinum* *	1	2.0%	-	-
Solanaceae	*Calibrachoa* *	2	3.9%	-	-
	Petunia	6	11.8%	-	-
Verbenaceae	*Verbena*	1	2.0%	-	-
Total *P. sennae*		**51**		**10**	
Little Yellow (*Eurema lisa*)					
Asteraceae	*Melampodium* *	1	33.3%	-	-
	Zinnia	-	-	2	100.0%
Fabaceae	*Trifolium / Melilotus / Medicago*	2	66.7%	-	-
Total *E. lisa*		**3**		**2**	
Sleepy Orange (*Eurema nicippe*)					
Asteraceae	*Cosmos*	1	50.0%	-	-
Fabaceae	*Trifolium / Melilotus / Medicago*	1	50.0%	-	-
Malvaceae	*Hibiscus*	-	-	2	100.0%
Total *E. nicippe*		**2**		**2**	
Dainty Sulphur (*Nathalis iole*)					
Oxalidaceae	*Oxalis*	-	-	1	100.0%
Total *N. iole*				**1**	

Appendix 9. Number and percent of Lycaenidae recorded at flower genera, 2002 and 2003.

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Banded Hairstreak (*Satyrium calanus*)					
Lamiaceae	*Salvia*	1	100.0%	-	-
Total *S. calanus*		**1**			
Southern Hairstreak (*Satyrium favonius*)					
Portulacaceae	*Portulaca* *	2	100.0%	**-**	-
Total *S. favonius*		**2**			
Juniper Hairstreak (*Callophrys gryneus*)					
Apiaceae	*Daucus*	1	100.0%	**-**	-
Total *C. gryneus*		**1**			
Gray Hairstreak (*Strymon melinus*)					
Amaranthaceae	*Gomphrena*	-	-	4	17.4%
Asteraceae	*Achillea*	2	12.5%	-	-
	Ageratum	1	6.3%	-	-
	Aster	-	-	1	4.3%
	Chrysanthemum	3	18.8%	-	-
	Coreopsis	-	-	1	4.3%
	Echinacea	2	12.5%	-	-
	Echinacea / Rudbeckia / Ratibida	-	-	1	4.3%
	Eupatorium	1	6.3%	3	13.0%
	Liatris	1	6.3%	-	-
	Rudbeckia	1	6.3%	-	-
	Solidago	-	-	1	4.3%
Buddlejaceae	*Buddleja*	-	-	2	8.7%
Crassulaceae	*Sedum*	-	-	2	8.7%
Fabaceae	*Trifolium / Melilotus / Medicago*	-	-	1	4.3%
Lamiaceae	*Nepeta*	1	6.3%	-	-
	Physostegia *	-	-	1	4.3%
	Salvia	1	6.3%	-	-
Malvaceae	*Hibiscus*	-	-	1	4.3%
Scrophulariaceae	*Penstemon*	1	6.3%	-	-
Valerianaceae	*Valerianella* *	1	6.3%	-	-
Verbenaceae	*Lantana*	-	-	2	8.7%
	Verbena	1	6.3%	3	13.0%
Total *S. melinus*		**16**		**23**	

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Red-Banded Hairstreak (*Calycopis cecrops*)					
Asteraceae	*Coreopsis*	-	-	1	50.0%
Lamiaceae	*Salvia*	-	-	1	50.0%
Total *C. cecrops*				**2**	
Eastern Tailed-Blue (*Everes comyntas*)					
Apiaceae	*Eryngium* *	-	-	8	14.3%
Asteraceae	*Ageratum*	1	1.4%	1	1.8%
	Aster	2	2.8%	1	1.8%
	Coreopsis	3	4.2%	1	1.8%
	Dahlia *	1	1.4%	-	-
	Echinacea	1	1.4%	4	7.1%
	Echinacea / Rudbeckia / Ratibida	2	2.8%	1	1.8%
	Eupatorium	-	-	5	8.9%
	Liatris	-	-	1	1.8%
	Melampodium *	1	1.4%	3	5.4%
	Rudbeckia	8	11.3%	1	1.8%
	Solidago	3	4.2%	1	1.8%
	Vernonia	-	-	1	1.8%
	Zinnia	-	-	1	1.8%
Campanulaceae	*Campanula* *	1	1.4%	-	-
Chenopodiaceae	*Chenopodium* *	-	-	1	1.8%
Elaeagnaceae	*Elaeagnus* *	-	-	1	1.8%
Fabaceae	*Lespedeza* *	-	-	6	10.7%
	Trifolium	-	-	6	10.7%
	Trifolium / Melilotus / Medicago	33	46.5%	9	16.1%
Hydrangeaceae	*Hydrangea* *	-	-	1	1.8%
Lamiaceae	*Melissa* *	1	1.4%	-	-
	Nepeta	-	-	1	1.8%
	Salvia	8	11.3%	-	-
	Thymus	1	1.4%	-	-
Malvaceae	*Hibiscus*	1	1.4%	-	-
Verbenaceae	*Verbena*	4	5.6%	2	3.6%
Total		**71**		**56**	
Spring / Summer Azure (*Celastrina* spp.)					
Apiaceae	*Daucus*	2	22.2%	-	-
	Eryngium *	-	-	1	5.0%
Asteraceae	*Chrysanthemum*	-	-	1	5.0%
	Coreopsis	-	-	1	5.0%
	Echinacea / Rudbeckia / Ratibida	1	11.1%	1	5.0%

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
	Rudbeckia	1	11.1%	-	-
Fabaceae	*Lespedeza* *	-	-	2	10.0%
	Trifolium / Melilotus / Medicago	3	33.3%	5	25.0%
Geraniaceae	*Geranium / Pelargonium* *	-	-	1	5.0%
Lamiaceae	*Monarda*	-	-	1	5.0%
	Thymus	2	22.2%	-	-
Lauraceae	*Lindera*	-	-	1	5.0%
Scrophulariaceae	*Penstemon*	-	-	5	25.0%
Verbenaceae	*Verbena*	-	-	1	5.0%
Total		**9**		**20**	

Appendix 10. Number and percent of Nymphalidae recorded at flower genera, 2002 and 2003.

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
American Snout (*Libytheana carinenta*)					
Asteraceae	*Zinnia*	**-**	**-**	1	50.0%
Oleaceae	*Ligustrum*	1	100.0%	-	-
Primulaceae	*Lysimachia* *	**-**	**-**	1	50.0%
Total *L. carinenta*		**1**		**2**	
Gulf Fritillary (*Agraulis vanillae*)					
Verbenaceae	*Verbena*	-	-	1	100.0%
Total *A. vanillae*				**1**	
Great Spangled Fritillary (*Speyeria cybele*)					
Apocynaceae	*Vinca* *	1	1.9%	-	-
Asclepiadaceae	*Asclepias*	10	18.9%	20	26.3%
Asteraceae	*Chrysanthemum*	-	-	1	1.3%
	Coreopsis	3	5.7%	2	2.6%
	Echinacea	9	17.0%	6	7.9%
	Echinacea / Rudbeckia / Ratibida	1	1.9%	6	7.9%
	Gaillardia	-	-	4	5.3%
	Helianthus	1	1.9%	-	-
	Ratibida	1	1.9%	1	1.3%
	Rudbeckia	1	1.9%	5	6.6%
	Tagetes	-	-	3	3.9%
	Taraxacum	-	-	2	2.6%
	Vernonia	-	-	1	1.3%
	Zinnia	1	1.9%	18	23.7%
Buddlejaceae	*Buddleja*	2	3.8%	1	1.3%
Capparaceae	*Cleome* *	1	1.9%	-	-
Caryophyllaceae	*Dianthus*	4	7.5%	5	6.6%
Lamiaceae	*Lavandula*	1	1.9%	-	-
	Monarda	1	1.9%	-	-
Malvaceae	*Alcea* *	1	1.9%	-	-
Oleaceae	*Ligustrum*	7	13.2%	-	-
Polemoniaceae	*Phlox*	2	3.8%	-	-
Portulacaceae	*Portulaca* *	1	1.9%	-	-
Ranunculaceae	*Clematis*	-	-	1	1.3%
Verbenaceae	*Verbena*	5	9.4%	-	-
Total *S. cybele*		**53**		**76**	

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
unidentified fritillary					
Asclepiadaceae	*Asclepias*	7	29.2%	-	-
Asteraceae	*Coreopsis*	1	4.2%	-	-
	Echinacea	1	4.2%	-	-
	Tagetes	1	4.2%	-	-
	Zinnia	8	33.3%	-	-
Brassicaceae	*Hesperis*	1	4.2%	-	-
Lamiaceae	*Blephilia*	2	8.3%	-	-
Liliaceae	*Hosta* *	1	4.2%	-	-
Onagraceae	*Oenothera*	1	4.2%	-	-
Solanaceae	*Petunia*	1	4.2%	-	-
Total unidentified fritillary		**24**			
Silvery Checkerspot (*Chlosyne nycteis*)					
Apiaceae	*Eryngium* *	-	-	1	6.7%
Asclepiadaceae	*Asclepias*	-	-	2	13.3%
Asteraceae	*Echinacea*	3	50.0%	7	46.7%
	Eupatorium	-	-	1	6.7%
	Liatris	-	-	1	6.7%
	Rudbeckia	2	33.3%	1	6.7%
Crassulaceae	*Sedum*	1	16.7%	-	-
Fabaceae	*Lespedeza* *	-	-	1	6.7%
Polemoniaceae	*Phlox*	-	-	1	6.7%
Total *C. nycteis*		**6**		**15**	
Pearl Crescent (*Phyciodes tharos*)					
Apiaceae	*Daucus*	1	1.8%	-	-
Asteraceae	*Ageratum*	7	12.7%	1	1.7%
	Aster	3	5.5%	1	1.7%
	Centaurea	3	5.5%	-	-
	Coreopsis	10	18.2%	10	16.9%
	Echinacea	5	9.1%	-	-
	Echinacea / Rudbeckia / Ratibida	2	3.6%	-	-
	Eupatorium	1	1.8%	2	3.4%
	Gaillardia	-	-	1	1.7%
	Heliopsis	1	1.8%	2	3.4%
	Melampodium *	5	9.1%	2	3.4%
	Ratibida	-	-	1	1.7%
	Rudbeckia	1	1.8%	3	5.1%
	Tagetes	1	1.8%	-	-
	Zinnia	2	3.6%	25	42.4%
Buddlejaceae	*Buddleja*	2	3.6%	-	-
Convolvulaceae	*Ipomoea* *	1	1.8%	-	-
Crassulaceae	*Sedum*	-	-	1	1.7%

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Fabaceae	*Trifolium*	-	-	1	1.7%
	Trifolium / Melilotus / Medicago	6	10.9%	1	1.7%
Lamiaceae	*Lavandula*	1	1.8%	-	-
	Mentha	-	-	3	5.1%
	Salvia	1	1.8%	-	-
Malvaceae	*Hibiscus*	-	-	2	3.4%
Primulaceae	*Lysimachia* *	-	-	1	1.7%
Rosaceae	*Fragaria*	1	1.8%	-	-
Saxifragaceae	*Astilbe* *	1	1.8%	-	-
Verbenaceae	*Lantana*	-	-	1	1.7%
	Verbena	-	-	1	1.7%
Total *P. tharos*		**55**		**59**	
unidentified checkerspot / crescent					
Asteraceae	*Cosmos*	-	-	1	6.3%
	Tagetes	-	-	2	12.5%
	Zinnia	-	-	12	75.0%
Fabaceae	*Trifolium*	-	-	1	6.3%
Total unidentified checkerspot / crescent				**16**	
American Lady (*Vanessa virginiensis*)					
Asteraceae	*Coreopsis*	-	-	1	8.3%
	Liatris	-	-	1	8.3%
	Zinnia	-	-	9	75.0%
Buddlejaceae	*Buddleja*	-	-	1	8.3%
Rubiaceae	*Pentas*	1	100.0%	-	-
Total *V. virginiensis*		**1**		**12**	
Painted Lady (*Vanessa cardui*)					
Amaranthaceae	*Gomphrena*	-	-	3	1.8%
Asclepiadaceae	*Asclepias*	-	-	1	0.6%
Asteraceae	*Aster*	-	-	6	3.6%
	Coreopsis	-	-	1	0.6%
	Cosmos	1	33.3%	11	6.6%
	Dahlia *	-	-	1	0.6%
	Echinacea / Rudbeckia / Ratibida	-	-	1	0.6%
	Liatris	-	-	20	12.0%
	Melampodium *	-	-	1	0.6%
	Rudbeckia	-	-	2	1.2%
	Solidago	-	-	3	1.8%
	Tagetes	-	-	1	0.6%
	Tithonia	-	-	2	1.2%
	Zinnia	-	-	63	37.7%

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Buddlejaceae	*Buddleja*	-	-	3	1.8%
Capparaceae	*Cleome* *	-	-	1	0.6%
Crassulaceae	*Sedum*	-	-	26	15.6%
Lamiaceae	*Salvia*	-	-	3	1.8%
Primulaceae	*Lysimachia* *	1	33.3%	-	-
Ranunculaceae	*Clematis*	-	-	6	3.6%
Rosaceae	*Rosa* *	1	33.3%	-	-
Verbenaceae	*Lantana*	-	-	4	2.4%
	Verbena	-	-	8	4.8%
Total *V. cardui*		**3**		**167**	
Red Admiral (*Vanessa atalanta*)					
Asteraceae	*Ageratum*	1	33.3%	-	-
	Cosmos	-	-	1	14.3%
	Tithonia	-	-	3	42.9%
	Zinnia	-	-	3	42.9%
Oleaceae	*Ligustrum*	1	33.3%	-	-
Valerianaceae	*Valerianella* *	1	33.3%	-	-
Total *V. atalanta*		**3**		**7**	
unidentified lady (Vanessa sp.)					
Asteraceae	*Cosmos*	-	-	1	50.0%
Liliaceae	*Hosta* *	-	-	1	50.0%
Rosaceae	*Fragaria*	1	100.0%	-	-
Total *Vanessa* spp.		**1**		**2**	
Common Buckeye (*Junonia coenia*)					
Asteraceae	*Centaurea*	1	6.7%	-	-
	Dahlia *	-	-	1	10.0%
	Echinacea	1	6.7%	-	-
	Echinacea / Rudbeckia / Ratibida	-	-	1	10.0%
	Eupatorium	-	-	1	10.0%
	Zinnia	1	6.7%	3	30.0%
Buddlejaceae	*Buddleja*	4	26.7%	1	10.0%
Crassulaceae	*Sedum*	2	13.3%	-	-
Dipsacaceae	*Scabiosa*	2	13.3%	-	-
Fabaceae	*Trifolium / Melilotus / Medicago*	2	13.3%	1	10.0%
Lamiaceae	*Salvia*	1	6.7%	-	-
Liliaceae	*Allium*	-	-	1	10.0%
Verbenaceae	*Lantana*	1	6.7%	1	10.0%
Total *J. coenia*		**15**		**10**	

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Red-Spotted Purple (*Limenitis arthemis astyanax*)					
Asteraceae	*Zinnia*	1	25.0%	-	-
Cornaceae	*Cornus* *	1	25.0%	-	-
Geraniaceae	*Geranium / Pelargonium* *	-	-	1	100.0%
Ranunculaceae	*Clematis*	1	25.0%	-	-
Solanaceae	*Petunia*	1	25.0%	-	-
Total *L. arthemis*		**4**		**1**	
Goatweed Leafwing (*Anaea andria*)					
Euphorbiaceae	*Croton* *	1	100.0%	-	-
Total *A. andria*		**1**			
Northern Pearly-Eye (*Enodia anthedon*)					
Rhamnaceae	*Ceanothus*	1	100.0%	-	-
Total *E. anthedon*		**1**			
Common Wood-Nymph (*Cercyonis pegala*)					
Asteraceae	*Echinacea*	-	-	1	50.0%
	Echinacea / Rudbeckia / Ratibida	-	-	1	50.0%
Lamiaceae	*Salvia*	1	100.0%	-	-
Total *C. pegala*		**1**		**2**	
Monarch (*Danaus plexippus*)					
Amaranthaceae	*Gomphrena*	1	4.3%	-	-
Asclepiadaceae	*Asclepias*	2	8.7%	30	20.5%
Asteraceae	*Ageratum*	1	4.3%	-	-
	Coreopsis	-	-	1	0.7%
	Cosmos	1	4.3%	4	2.7%
	Echinacea	1	4.3%	2	1.4%
	Echinacea / Rudbeckia / Ratibida	-	-	4	2.7%
	Eupatorium	2	8.7%	2	1.4%
	Liatris	2	8.7%	12	8.2%
	Rudbeckia	2	8.7%	-	-
	Tagetes	1	4.3%	1	0.7%
	Tithonia	-	-	3	2.1%
	Zinnia	3	13.0%	60	41.1%
Buddlejaceae	*Buddleja*	2	8.7%	1	0.7%
Campanulaceae	*Campanula* *	1	4.3%	-	-
Capparaceae	*Cleome* *	-	-	1	0.7%
Convolvulaceae	*Ipomoea* *	-	-	2	1.4%
Crassulaceae	*Sedum*	1	4.3%	-	-
Geraniaceae	*Geranium / Pelargonium* *	-	-	1	0.7%

		2002		2003	
		Butterflies	**Percent**	**Butterflies**	**Percent**
Lamiaceae	*Monarda*	-	-	1	0.7%
	Salvia	-	-	1	0.7%
Liliaceae	*Hosta* *	1	4.3%	-	-
Lythraceae	*Lagerstroemia* *	1	4.3%	-	-
Malvaceae	*Hibiscus*	-	-	2	1.4%
Ranunculaceae	*Clematis*	-	-	12	8.2%
Rosaceae	*Rosa* *	-	-	1	0.7%
Rubiaceae	*Pentas*	-	-	4	2.7%
Verbenaceae	*Verbena*	1	4.3%	1	0.7%
Total *D. plexippus*		**23**		**146**	

Appendix 11. Number and percent of Hesperiidae recorded at flower genera, 2002 and 2003.

		2002		2003	
Skippers (Hesperiidae)		**Skippers**	**Percent**	**Skippers**	**Percent**
Amaranthaceae	*Celosia*	1	0.2%	-	-
	Gomphrena	3	0.5%	7	1.6%
Amaryllidaceae	*Zephyranthes* *	1	0.2%	-	-
Apiaceae	*Daucus*	3	0.5%	1	0.2%
	Eryngium *	-	-	2	0.4%
Apocynaceae	*Vinca* *	1	0.2%	-	-
Asclepiadaceae	*Asclepias*	3	0.5%	6	1.3%
Asteraceae	*Achillea*	-	-	1	0.2%
	Ageratum	6	0.9%	3	0.7%
	Aster	2	0.3%	1	0.2%
	Bidens	2	0.3%	-	-
	Centaurea	-	-	2	0.4%
	Chrysanthemum	19	3.0%	6	1.3%
	Coreopsis	40	6.2%	13	2.9%
	Cosmos	1	0.2%	6	1.3%
	Dahlia *	1	0.2%	1	0.2%
	Echinacea	54	8.4%	16	3.5%
	Echinacea / Rudbeckia / Ratibida	5	0.8%	10	2.2%
	Eupatorium	1	0.2%	22	4.9%
	Gaillardia	-	-	3	0.7%
	Heliopsis	1	0.2%	1	0.2%
	Liatris	7	1.1%	46	10.2%
	Melampodium *	-	-	3	0.7%
	Rudbeckia	18	2.8%	11	2.4%
	Solidago	2	0.3%	2	0.4%
	Tagetes	29	4.5%	11	2.4%
	Tithonia	-	-	1	0.2%
	Vernonia	12	1.9%	19	4.2%
	Zinnia	190	29.6%	114	25.3%
Berberidaceae	*Berberis* *	1	0.2%	-	-
Buddlejaceae	*Buddleja*	25	3.9%	13	2.9%
Capparaceae	*Cleome* *	1	0.2%	-	-
Caryophyllaceae	*Dianthus*	9	1.4%	2	0.4%
Commelinaceae	*Tradescantia* *	-	-	1	0.2%
Convolvulaceae	*Ipomoea* *	1	0.2%	-	-
Crassulaceae	*Sedum*	30	4.7%	21	4.7%
Dipsacaceae	*Scabiosa*	-	-	2	0.4%
Ericaceae	*Vaccinium*	1	0.2%	-	-
Fabaceae	*Cassia* *	1	0.2%	-	-
	Coronilla	-	-	1	0.2%
	Lespedeza *	-	-	1	0.2%
	Trifolium / Melilotus / Medicago	3	0.5%	8	1.8%

Skippers (Hesperiidae)		2002		2003	
		Skippers	**Percent**	**Skippers**	**Percent**
Geraniaceae	*Geranium / Pelargonium* *	-	-	2	0.4%
	Pelargonium *	1	0.2%	-	-
Hemerocallidaceae	*Hemerocallis*	1	0.2%	-	-
Lamiaceae	*Ajuga* *	-	-	1	0.2%
	Blephilia	2	0.3%	-	-
	Monarda	1	0.2%	4	0.9%
	Nepeta	6	0.9%	1	0.2%
	Ocimum *	2	0.3%	1	0.2%
	Origanum *	2	0.3%	-	-
	Perovskia *	2	0.3%	-	-
	Plectranthus *	1	0.2%	-	-
	Pycnanthemum	2	0.3%	1	0.2%
	Salvia	28	4.4%	13	2.9%
	Teucrium *	1	0.2%	-	-
	Thymus	2	0.3%	-	-
Liliaceae	*Allium*	6	0.9%	4	0.9%
	Lilium *	-	-	1	0.2%
Lythraceae	*Lagerstroemia* *	2	0.3%	-	-
Malvaceae	*Callirhoe* *	2	0.3%	-	-
	Hibiscus	-	-	7	1.6%
Onagraceae	*Oenothera*	1	0.2%	-	-
Paeoniaceae	*Paeonia* *	-	-	2	0.4%
Phytolaccaceae	*Phytolacca* *	1	0.2%	-	-
Polemoniaceae	*Phlox*	4	0.6%	1	0.2%
Portulacaceae	*Portulaca* *	2	0.3%	-	-
Primulaceae	*Lysimachia* *	1	0.2%	-	-
Ranunculaceae	*Clematis*	2	0.3%	1	0.2%
Rosaceae	*Rosa* *	4	0.6%	-	-
Rubiaceae	*Cephalanthus*	1	0.2%	1	0.2%
Scrophulariaceae	*Penstemon*	2	0.3%	3	0.7%
Solanaceae	*Calibrachoa* *	1	0.2%	-	-
	Petunia	2	0.3%	1	0.2%
Verbenaceae	*Lantana*	6	0.9%	6	1.3%
	Verbena	79	12.3%	44	9.8%
Total		**641**		**451**	

Appendix 12. Survey given to volunteers prior to their participation in the project.

Survey instructions: Names and addresses will not be released to anyone. Although a completed survey is the most helpful, your participation is voluntary and you are free to skip any questions you do not feel comfortable answering. Please have the individual primarily responsible for the counts complete the survey.

The following questions deal with lawn care.

1. For which of the following do you use a professional lawn care service? (circle all that apply) n =62

fertilizer 9 (14.5%)

weed-killer 9 (14.5%)

insecticides 6 (9.7%)

I do not use a professional lawn care service. 51 (82.3%)

2. How often are weed-killers applied to your yard, either by a lawn service or yourself? n=61

never 29 (47.5%)

once per year 15 (24.6%)

more than once per year 17 (27.9%)

3. How often are insecticides applied to your yard, either by a lawn service or yourself? n=61

never 49 (80.3%)

once per year 3 (4.9%)

more than once per year 9 (14.8%)

4. How would you describe your style of lawn care? n=59

I mow my grass and almost always trim around trees and fence lines. 30 (50.9%)

I keep my grass mowed, but never or rarely trim around trees and fence lines. 17 (28.8%)

I have part of my lawn that is rarely mowed. 12 (20.3%)

5. What is your opinion of weeds? n=60

No weeds are my goal. 4 (6.7%)

Some weeds (10%) are okay in my lawn. 22 (36.7%)

More weeds (25%) are okay in my lawn. 9 (15.0%)

As long as my lawn is green, it's okay. 25 (41.7%)

The following questions deal with attitudes toward insects.

6. What is your reaction to wasps and bees seen in your yard? n=61

kill them 2 (3.3%)

fear them 1 (1.6%)

tolerate them 31 (50.1%)

enjoy seeing them 27 (44.3%)

7. What is your reaction to insects which pose no threat of biting or stinging seen in your yard? n=62

kill them 0

fear them 0

tolerate them 18 (29.0%)

enjoy seeing them 44 (70.1%)

8. What is your reaction to caterpillars on plants in your yard? n=60

kill them 4 (6.7%)

fear them 0

tolerate them 19 (39.7%)

enjoy seeing them 37 (61.7%)

9. What is your opinion of damage caused by caterpillars on food plants in your yard? n=61

I tolerate any amount of damage. 10 (16.4%)

I tolerate a moderate amount of damage. 24 (39.3%)

I remove or kill the caterpillars as soon as they are observed feeding on the plants. 10 (16.4%)

I do not grow food plants in my yard. 17 (27.9%)

10. What is your opinion of damage caused by insects other than caterpillars on food plants in your yard? n=62

I tolerate any amount of damage. 9 (14.5%)

I tolerate a moderate amount of damage. 26 (41.9%)

I remove or kill the insect or insects as soon as they are observed feeding on the plants 10 (16.1%)

I do not grow food plants in my yard. 17 (27.4%)

11. What is your opinion of damage caused by caterpillars on ornamental plants in your yard? n=61

I tolerate any amount of cosmetic damage. 21 (34.4%)

I tolerate a moderate amount of cosmetic damage. 35 (57.4%)

I remove or kill caterpillars as soon as they are observed feeding on the plants. 5 (8.2%)

12. What is your opinion of damage caused by insects other than caterpillars on ornamental plants in your yard? n=61

I tolerate any amount of cosmetic damage. 19 (31.7%)

I tolerate a moderate amount of cosmetic damage. 38 (63.3%)

I remove or kill the insect or insects as soon as they are observed feeding on the plants..... 3 (5.0%)

The following questions deal with your expectations for the project.

13. How often did you see butterflies in your yard last year? n=63

never 1 (1.6%)

occasionally 20 (31.8%)

often 34 (54.0%)

don't know 8 (12.7%)

14. Before your involvement with this project, how many butterflies could you identify? n=63

none 5 (7.9%)

1-5 ..... 38 (60.3%)

6-10 ..... 8 (12.7%)

more than 10 12 (19.1%)

15. Keeping in mind that butterfly numbers and species diversity increases during the summer, how many different kinds of butterflies do you expect to see in your yard in 2002? n=62

none 0

1-5 ..... 11 (17.7%)

6-10 ..... 32 (51.6%)

11-20 ..... 16 (25.8%)

more than 20 ..... 3 (4.8%)

16. Do you think the above number of species is: n=59

not enough, I'd prefer to see more.....38 (64.4%)

about the right amount 21 (35.6%)

too many 0

17. As butterfly numbers and species diversity increases during the summer, how many individual butterflies do you expect to see in your yard during a 15-minute count? n=61

none 1 (1.6%)

1-5.....32 (52.5%)

6-10.....17 (27.9%)

11-20.....8 (13.1%)

more than 20.....3 (4.9%)

18. Do you think the above number of individuals is: n=57

not enough, I'd prefer to see more.....42 (73.7%)

about the right amount 15 (26.3%)

too many 0

19. Please rank the following from 1 to 4 with #1 being the primary motivation for your decision to participate in the project and #4 being the least important.

	1	2	3	4
to learn to identify the butterflies found in your yard	25 (42.4%)	11 (18.6%)	13 (22.0%)	10 (16.9%)
to provide data to a scientific study	14 (23.7%)	25 (42.4%)	13 (22.0%)	7 (11.9%)
to see whether your yard provides good habitat for at least some types of urban wildlife	14 (23.7%)	6 (10.2%)	14 (23.7%)	25 (42.4%)
to participate in an interesting and fun diversion from normal activities	16 (27.1%)	18 (30.5%)	19 (32.2%)	6 (10.2%)

20. Have you participated in other data collection activities such as a Christmas Bird Count? n=62

yes 18 (29.0%)

no 44 (71.0%)

The following questions will be used to categorize your answers with others. Remember that although a completed survey is most helpful, you can skip any questions you do not feel comfortable answering.

21. What is your sex? n=59

male 14 (23.7%)

female 45 (76.3%)

22. What is your age? n=61

18 – 24 ..... 1 (1.6%)

25 – 34 ..... 6 (9.8%)

35 – 44 ..... 11 (18.0%)

45 – 54 ..... 24 (39.3%)

55 – 65 ..... 9 (14.8%)

66 or older 11 (18.0%)

23. What is your race? n=56

white / Caucasian 56 (100%)

24. Do you own your home? n=62

yes 57 (92.0%)

no 5 (8.0%)

25. Do you belong to any environmental groups such as the Audubon Society, Sierra Club? n=62

yes 30 (48.4%)

no 32 (51.6%)

26. If so, which ones?

		% of those who belong to an environmental group	% of survey respondents
		n=30	n=62
National Audubon Society / Columbia chapter	15	50.00%	24.19%
Sierra Club	13	43.33%	20.97%
The Nature Conservancy	9	30.00%	14.52%
Missouri Native Plant Society	6	20.00%	9.68%
Greenbelt Coalition	5	16.67%	8.06%
Missouri Stream Team	3	10.00%	4.84%
National Wildlife Federation	3	10.00%	4.84%
Audubon Society of Missouri	2	6.67%	3.23%
Defenders of Wildlife	2	6.67%	3.23%
Friends of Rock Bridge	2	6.67%	3.23%
Garden Club	2	6.67%	3.23%
Wild Ones	2	6.67%	3.23%
American Fisheries Society	1	3.33%	1.61%
American Rivers	1	3.33%	1.61%
Connecticut Audubon Society	1	3.33%	1.61%
Ducks Unlimited	1	3.33%	1.61%
Lakes of Missouri	1	3.33%	1.61%
Missouri Association of Professional Soil Scientists	1	3.33%	1.61%
National Association of Conservation Districts	1	3.33%	1.61%
National Parks Conservation Association	1	3.33%	1.61%
Save the Manatee Club	1	3.33%	1.61%
Scenic Missouri	1	3.33%	1.61%
Show-Me Clean Streams	1	3.33%	1.61%
Society of Environmental Toxicology and Chemistry	1	3.33%	1.61%
Soil & Water Conservation District Society	1	3.33%	1.61%
Women in the Outdoors	1	3.33%	1.61%
World Wildlife Federation	1	3.33%	1.61%

27. How many years of formal education have you had? n=62

8 years or less.....0

9 to 11 years 1 (1.6%)

12 years.....2 (3.2%)

1 to 3 years college 5 (8.1%)

4 years college.....21 (33.9%)

5 years or more college 33 (53.2%)

28. Do you participate in any of the following activities? Answer yes or no to each. n=62

observing wildlife in your yard.....59 (95.2%)

feeding birds or other wildlife in your yard 56 (90.3%)

maintaining plantings or natural areas for wildlife 45 (75.6%)

observing wildlife on public land more than 1 mile from your home.....54 (87.1%)

hunting.....6 (9.7%)

fishing 25 (40.3%)

visiting a butterfly house 35 (56.5%)

29. Which of the following types of wildlife do you watch in your yard? (please do not include insects unless you watched them in your yard prior to your participation in this project). (circle all that apply) n=60

birds.....60 (100%)

large mammals.....27 (45.0%)

small mammals 55 (91.7%)

amphibians or reptiles.....37 (61.7%)

insects or spiders 45 (75.0%)

Appendix 13. Survey given to volunteers following the 2002 field season.

Survey instructions: Names and addresses will not be released to anyone. Although a completed survey is the most helpful, your participation is voluntary and you are free to skip any questions you do not feel comfortable answering. Please have the individual primarily responsible for the counts complete the survey.

Only questions 1 and 2 which deal with participation in 2003 will be matched back to your name through the survey identification number. Since part of the study is an attitude study, your response is appreciated and helpful for the study even if you decided not to count.

1. Do you want to count butterflies for this project next year? n=44

   yes 33 (75.0%)

   no 7 (15.9%)

   haven't decided yet 4 (9.1%)

2. Are you interested in adding or replacing plants in your yard with plants attractive to butterflies in 2003? n=44

   yes (go to question #3) 33 (75.0%)

   no (go to question #5) 7 (15.9%)

   haven't decided yet (go to question #3) 4 (9.1%)

3. Which of the following types of plants are you interested in planting? n=38

   planting nectar sources for butterflies 10 (26.3%)

   planting host plants for caterpillars 1 (2.6%)

   planting both nectar sources and host plants 23 (60.5%)

   haven't decided yet 4 (10.5%)

4. What types of plants are you interested in having in your yard? (please circle all that apply) n=39

flowering plants native to Missouri in pots.....8 (20.5%)

flowering plants in pots (either native or not native to Missouri). 6 (41.0%)

flowering plants native to Missouri in flower beds.....(23 (59.0%)

flowering plants in flower beds (either native or not native to Missouri) ....

.....23 (59.0%)

no preference.....2 (5.1%)

other.....4 (10.3%)

The following questions deal with your use of the identification materials provided and your experiences with the project.

5. Were you able to attend one of the butterfly workshops? n=44

yes 20 (45.5%)

no 24 (54.6%)

not sure 0

6. Did you read the count protocol? n=44

yes 40 (90.9%)

no 3 (6.8%)

not sure 1 (2.3%)

7. Did you read the 3 newsletters (June, October and January)? n=44

I did not read any of the newsletters 5 (11.4%)

I read one newsletter 6 (13.6%)

I read two newsletters.....6 (13.6%)

I read all three newsletters .....21(47.7%)

other 6 (13.6%)

8. Would you like to see additional newsletters reporting results from the counts and short features on butterflies? n=44

yes ..... 29(65.9%)

no 7 (15.9%)

no opinion 8 (18.2%)

9. What type of information would you like to learn about butterflies (for example: good nectar sources, larval host plants, basic biology, behavior, etc.)? n=35

nectar 15 (42.86%)

host 12 (34.29%)

behavior 12 (34.29%)

biology / natural history / reproduction 6 (17.14%)

all 6 (17.14%)

seasonal patterns / migration 5 (14.29%)

population trends 2 (5.71%)

how to attract 1 (2.86%)

where to get affordable plants 1 (2.86%)

common species 1 (2.86%)

species ranges 1 (2.86%)

identification 1 (2.86%)

where to find rare butterflies 1 (2.86%)

butterfly caterpillars from "destructive moths" 1 (2.86%)

have enough information 1 (2.86%)

10. Did you watch the butterfly identification video? n=44

yes (go to question #11) 39 (88.6%)

no (go to question #12) 4 (9.1%)

not sure (go to question #12) 1 (2.3%)

11. If you watched the video, please indicate which of the following statements most applies to you. n=39

I watched part, but not all, of the video 4 (10.3%)

I watched the entire video 35 (89.7%)

other 0

A number of materials on butterfly identification were provided. Please circle the number that corresponds to your level of agreement or disagreement with the following statement for each item.

12. The following items were useful in helping me learn to identify butterflies. n=44

	strongly agree	agree	neither agree nor disagree	disagree	strongly disagree	did not use	no response
slide show at workshop	6 (13.6%)	9 (20.5%)	1 (2.3%)	3 (6.8%)	0	19 (43.2%)	6 (13.6%)
slide show on CD	8 (18.2%)	12 (27.3%)	4 (9.1%)	0	0	8 (18.2%)	11 (25.0%)
photos of butterflies on CD	8 (18.2%)	17 (38.6%)	6 (13.6%)	0	0	5 (11.4%)	8 (18.2%)
identification key	16 (36.4%)	17 (38.6%)	2 (4.6%)	1 (2.3%)	0	4 (9.1%)	4 (9.1%)
2 page color butterfly photos	29 (65.9%)	13 (29.6%)	1 (2.3%)	0	0	0	1 (2.3%)
links to other web pages	0	3 (6.8%)	7 (15.9%)	1 (2.3%)	0	26 (59.1%)	7 (15.9%)
video	8 (18.2%)	23 (52.3%)	7 (15.9%)	1 (2.3%)	0	1 (2.3%)	4 (9.1%)

13. If any of the above items were useful, how and in what ways? n=34

able to take printed handouts outside 16 (47.1%)

in general, helped with identification 14 (41.2%)

preferred printed materials because not able to use computer . 1 (2.9%)

printed materials a quicker reference than computer or video .. 1 (2.9%)

video provided a look at the butterfly in flight 1 (2.9%)

photos with another object provided a size reference 1 (2.9%)

14. Do you have any suggestions for improving the identification workshop, any of the handouts (video, CD-ROM, color butterfly handout, etc.) or suggestions for additional materials or activities you would have found useful? n=13

more species included in materials 7 (53.8%)

more workshops or field trips 2 (15.4%)

fewer species in workshop and video 1 (7.7%)

photographs life-size 1 (7.7%)

handouts to follow along with at workshop 1 (7.7%)

side-by-side comparisons of similar species 1 (7.7%)

15. Would you be interested in participating in outdoor identification workshops next June at areas such as Twin Lakes, Rock Bridge Memorial State Park, etc? n=41

yes 30 (73.2%)

no 11 (26.8%)

no opinion 0

16. Which of the following statements most applies to you? n=43

I owned a field guide to butterflies before learning of this project. 21 (48.8%)

I bought a field guide to butterflies after involvement with this project 13 (30.2%)

I do not own a field guide to butterflies but intend to get one. . 7 (16.3%)

I do not own a field guide to butterflies and do not intend to get one. ... 6 (14.0%)

other (don't own, undecided on future purchase) 1 (2.3%)

17. If you currently own a field guide(s), please indicate which one(s) you own. n=25

Heitzman. *Butterflies and Moths of Missouri* * 16 (64.0%)

Glassberg. *Butterflies Through Binoculars* 8 (32.0%)

Peterson. Various titles and editions ** 8 (32.0%)

Golden Guide. Various titles and editions 6 (24.0%)

National Audubon Society. *Field Guide to North American Butterflies* 6 (24.0%)

Other 3 (12.0%)

Unknown 3 (12.0%)

Schneck. *Butterflies: How to Identify & Attract Them to Your Garden* 1 (4.0%)

Brock and Kaufman. *North American Butterflies* 1 (4.0%)

Peterson. *Caterpillars*. 1 (4.0%)

Stokes. *Butterfly Book* 1 (4.0%)

Weed. *Butterflies Worth Knowing* 1 (4.0%)

* Full citations not provided here since many of these books have gone through several editions and it was impossible to know which one(s) were used.

** Respondents mentioned *Butterflies East of the Great Plains*, *Eastern Butterflies*, and *First Guides*, with some only recording "Peterson." Since it was impossible to separate these, they were all grouped together.

18. What did you find most difficult about conducting the counts (for example, identification, not getting good enough looks, etc.)? n=39

not able to get close enough / get a good look 15 (38.46%)
butterflies moving 14 (35.90%)
identification of similar looking species 7 (17.95%)
finding time to count / weather 3 (7.69%)
boredom when not seeing butterflies 2 (5.13%)
seeing more than 1 butterfly at a time 1 (2.56%)
being able to see entire count area 1 (2.56%)
remembering the count area boundaries 1 (2.56%)
deer eating flowers 1 (2.56%)
trying to keep track of whether seeing the same butterfly 1 (2.56%)

19. If you stopped counting before September or missed more than 4 of the 16 weeks, please circle all applicable reasons. n=16

not at home between 10 and 4 ..... 9 (56.3%)
not seeing enough butterflies to want to continue 2 (12.5%)
unable to identify butterflies 2 (12.5%)
often too busy to be outside for 15 minutes 2 (12.5%)
got bored during 15 minutes 2 (12.5%)
lost interest in project 1 (6.3%)
forgot 6 (37.5%)
other 8 (50.0%)

20. If, instead of watching your yard for 15 minutes, you slowly walked a path through your yard and recorded how long it took (which would, in most cases, probably take 5 minutes or less), which of the following statements would most apply to you? n=36

I would be likely to count more than once a week 8 (22.2%)

I would have to skip fewer weeks 0

I would probably count the same number of times, but would enjoy the project more 9 (25.0%)

I would probably count the same number of times, but would enjoy the project less 10 (27.8%)

other 9 (25.0%)

21. How many butterfly counts did you complete? n=41

none (you can skip the rest of the survey) 1 (2.4%)

1 – 4 ..... 1 (2.4%)

5 – 8 ..... 4 (9.8%)

9 – 12 ..... 12 (29.3%)

13 – 16 ..... 18 (43.9%)

don't know 5 (12.2%)

22. How many different kinds of butterflies did you see in your yard in 2002? n=41

none 0

1-5 ..... 10 (24.4%)

6-10 ..... 12 (29.3%)

more than 10 ..... 15 (36.6%)

don't know 4 (9.8%)

23. Do you think the above number of species is: n=38

not enough, I'd prefer to see more 27 (72.1%)

about the right amount 8 (21.1%)

too many 0

don't know 3 (8.0%)

24. On average, how many individual butterflies did you see in your yard during a 15-minute count? n=40

none 1 (2.5%)

1-5 ..... 28 (70.0%)

6-10 ..... 9 (22.5%)

more than 10 ..... 1 (2.5%)

don't know 1 (2.5%)

25. Do you think the above number of individuals is: n=38

not enough, I'd prefer to see more 32 (84.2%)

about the right amount 5 (13.2%)

too many 0

don't know 1 (2.6%)

26. How many butterfly species do you feel confident in identifying if you get a good look? n=39

none 0

1-5 ..... 16 (41.0%)

6-10 ..... 13 (33.3%)

more than 10 ..... 10 (25.6%)

27. Did conducting the counts increase your satisfaction and enjoyment of your yard? n=40

yes 34 (85.0%)

no (go to question #30) 3 (7.5%)

no opinion (go to question #30) 3 (7.5%)

28. How much of an increase in satisfaction and enjoyment of your yard did participating in the project bring? Please circle your answer on a scale of 1 to 5 (with 5 being the greatest increase). n=34

Somewhat Increased				Greatly Increased
1	2	3	4	5
3 (8.8%)	7 (20.6%)	11 (32.4%)	11 (32.4%)	2 (5.9%)

29. Which of the following increased your satisfaction and enjoyment of your yard (please circle all that apply). n=36

enjoyed being outside 29 (80.6%)

enjoyed seeing which butterflies were in the yard that day 34 (94.4%)

enjoyed learning how to put a name on the butterflies that I saw 33 (91.6%)

other 12 (33.3%)

30. Did conducting the counts increase your appreciation of butterflies and the habitats they use? n=39

yes 37 (94.9%)

no 1 (2.6%)

no opinion 1 (2.6%)

31. What is your opinion of butterfly collecting? (please circle all statements with which you agree) n=38

acceptable for scientific research with severe restrictions on numbers collected and purpose 19 (50.0%)

acceptable for scientific research 17 (44.7%)

acceptable for adults interested in maintaining a collection 8 (21.0%)

acceptable for children interested in collecting insects 10 (26.3%)

not acceptable under any conditions 1 (2.6%)

no opinion 1 (2.6%)

other 1 (2.6%)

32. Do you have any additional comments on your experiences with the project?

Appendix 14. Survey given to volunteers after the 2003 field season.

Survey instructions: Names and addresses will not be released to anyone. Although a completed survey is the most helpful, your participation is voluntary and you are free to skip any questions you do not feel comfortable answering. Please have the individual primarily responsible for the counts complete the survey.

Since part of the study is an attitude study, your response is appreciated and helpful for the study even if you decided not to count.

1. For which of the following do you use a professional lawn care service? (Please circle all that apply) n=34

   fertilizer 5 (14.7%)

   weed-killer 5 (14.7%)

   insecticides 4 (11.8%)

   I do not use a professional lawn care service. 29 (85.3%)

2. How often are weed-killers applied to your yard, either by a lawn service or yourself? n=34

   never 15 (44.1%)

   once per year 11 (32.4%)

   more than once per year 8 (23.5%)

3. How often are insecticides applied to your yard, either by a lawn service or yourself? n=34

   never 28 (82.4%)

   once per year 4 (11.8%)

   more than once per year 2 (5.9%)

4. Did counting butterflies make you more aware of the impact of your yard management practices on insects? n=34

yes 11 (32.4%)

I considered the welfare of insects in my yard prior to my participation in the project. 16 (47.1%)

no 7 (20.6%)

5. What is your opinion of weeds? n=33

No weeds are my goal. 1 (3.0%)

Some weeds (10%) are okay in my lawn. 10 (30.3%)

More weeds (25%) are okay in my lawn. 9 (27.3%)

As long as my lawn is green, it's okay. 13 (39.4%)

6. In which of the following summers did you select plants specifically to attract butterflies to your yard? (Please circle all that apply) n=33

before participating in the butterfly count project 24 (72.7%)

2002 (first year of butterfly counts) 9 (27.3%)

2003 (second year of butterfly counts) 13 (39.4%)

7. In 2003, did you select plants from the list provided in the February newsletter on the project web page? n=31

I don't remember seeing or hearing about the plant list. 6 (19.4%)

I never checked the web page, even though I knew the plant list was there. 1 (3.2%)

I saw the plant list, but did not choose any of the plants for my yard. 0

I had several of the recommended flowers, but would have had them even without the recommendation. 20 (64.5%)

I had some flower species in my yard only because of the recommendations. 4 (12.9%)

8. What is your reaction to caterpillars on plants in your yard? n=34

kill them 1 (2.9%)

fear them 0

tolerate them 14 (41.2%)

enjoy seeing them 19 (55.9%)

9. What is your opinion of damage caused by caterpillars on ornamental plants in your yard? n=34

I tolerate any amount of cosmetic damage. 11 (32.4%)

I tolerate a moderate amount of cosmetic damage. 22 (64.7%)

I remove or kill caterpillars as soon as they are observed feeding on the plants. 1 (2.9%)

10. What is your opinion of damage caused by caterpillars on food plants in your yard? n=33

I tolerate any amount of damage. 4 (12.1%)

I tolerate a moderate amount of damage. 12 (36.4%)

I remove or kill the caterpillars as soon as they are observed feeding on the plants. 10 (30.3%)

I do not grow food plants in my yard. 7 (21.2%)

11. What is your opinion of damage caused by insects other than caterpillars on ornamental plants in your yard? n=34

I tolerate any amount of cosmetic damage. 10 (29.4%)

I tolerate a moderate amount of cosmetic damage. 21 (61.8%)

I remove or kill the insect or insects as soon as they are observed feeding on the plants 3 (8.8%)

12. What is your opinion of damage caused by insects other than caterpillars on food plants in your yard? n=33

I tolerate any amount of damage. 4 (12.1%)

I tolerate a moderate amount of damage. 13 (39.4%)

I remove or kill the insect or insects as soon as they are observed feeding on the plants..... 9 (27.3%)

I do not grow food plants in my yard..... 7 (21.2%)

13. Did conducting the counts increase your satisfaction and enjoyment of your yard? n=34

yes (go to question #14) 30 (88.2%)

no (go to question #15) 1 (2.9%)

no opinion (go to question #15) 3 (8.8%)

14. How much of an increase in satisfaction and enjoyment of your yard did participating in the project bring? Please circle your answer on a scale of 1 to 5 (with 5 being the greatest increase). n=29

Somewhat Increased				Greatly Increased
1	2	3	4	5
4 (13.8%)	2 (6.9%)	12 (41.4%)	7 (24.1%)	4 (13.8%)

15. Did conducting the counts increase your appreciation of butterflies and the habitats they use? n=30

yes 23 (76.7%)

no 1 (3.3%)

no opinion 0

significant appreciation of butterflies and their habitats prior to counts... ..... 6 (20.0%)

16. How many butterfly species do you feel confident in identifying if you get a good look? n=33

none	0
1-5	9 (27.3%)
6-10	12 (36.4%)
more than 10	7 (21.2%)
more than 20	5 (15.2%)

17. Before your involvement with this project, how many butterflies could you identify? n=34

none	3 (9.1%)
1-5	21 (63.6%)
6-10	5 (15.2%)
more than 10	3 (9.1%)
more than 20	2 (6.1%)

18. Do you notice butterflies more frequently now than before? n=34

yes	29 (85.3%)
no	5 (14.7%)

19. Did you read the count protocol in 2003? n=34

yes	26 (76.5%)
no	3 (8.8%)
not sure	5 (14.7%)

20. Which of the butterfly id materials did you use in 2003? (Please circle all that apply) n=32

slide show at workshop 7 (21.9%)

slide show on CD 13 (40.6%)

photos of butterflies on CD..... 14 (43.8%)

identification key 22 (68.8%)

2-page color butterfly photos 29 (90.6%)

links to other web pages..... 3 (9.4%)

video 11 (34.4%)

21. What did you find most difficult about conducting the counts (for example, identification, not getting good enough looks, etc.)

22. What would you have liked to gain from your participation in the project that you feel you did not get? n=30

more information on butterfly biology 4 (13.3%)

more information on butterfly gardening..... 5 (16.7%)

more feedback on the data being collected..... 16 (53.3%)

other..... 9 (30.0%)

24. Do you have any additional comments on your experiences with the project?