

**Western Riverside County
Multiple Species Habitat Conservation Plan (MSHCP)
Biological Monitoring Program**

**Quino Checkerspot Butterfly (*Euphydryas editha quino*)
Survey Report 2010**



23 March 2011

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NOTE TO READER:

This report is an account of survey activities conducted by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. The Monitoring Program monitors the distribution and status of the 146 Covered Species within the Conservation Area to provide information to Permittees, land managers, the public, and the Wildlife Agencies (i.e., the California Department of Fish and Game and the U.S. Fish and Wildlife Service). Monitoring Program activities are guided by the MSHCP species objectives for each Covered Species, the information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

MSHCP reserve assembly is ongoing and it is expected to take 20 or more years to assemble the final Conservation Area. The Conservation Area includes lands acquired for conservation under the terms of the MSHCP and other lands that have conservation value in the Plan Area (called public or quasi-public lands in the MSHCP). In this report, the term “Conservation Area” refers to the Conservation Area as understood by the Monitoring Program at the time the surveys were planned and conducted.

We would like to thank and acknowledge the land managers in the MSHCP Plan Area, who in the interest of conservation and stewardship facilitate Monitoring Program activities on the lands for which they are responsible. A list of the lands where data collection activities were conducted in 2010 is included in Section 7.0 of the Western Riverside County Regional Conservation Authority (RCA) Annual Report to the Wildlife Agencies. Partnering organizations and individuals contributing data to our projects are acknowledged in the text of appropriate reports.

While we have made every effort to accurately represent our data and results, it should be recognized that data management and analysis are ongoing activities. Any reader wishing to make further use of the information or data provided in this report should contact the Monitoring Program to ensure that they have access to the best available or most current data.

The primary preparers of this report were Biological Monitoring Program Administrator Adam Malisch and Project Lead Nate Zalik. If there are any questions about the information provided in this report, please contact the Monitoring Program Administrator. If you have questions about the MSHCP, please contact the Executive Director of the RCA. Further information on the MSHCP and the RCA can be found at www.wrc-rca.org.

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INTRODUCTION

The Quino checkerspot butterfly (*Euphydryas editha quino*; Quino) is federally listed as endangered and is sparsely distributed within the Western Riverside County MSHCP Plan Area. Species-specific conservation objective 4 for Quino states that “within the MSHCP Conservation Area, Reserve Managers will document the distribution of Quino checkerspot on an annual basis” (Dudek & Associates 2003).

The Biological Monitoring Program began developing a survey protocol in 2005 to determine the distribution of Quino across the Conservation Area. Additional goals were to estimate the detection probability of adult Quino, to calculate the proportion of area occupied by Quino (MacKenzie et al. 2006), and to gather data regarding Quino resource selection, important distribution covariates, and potentially important covariates affecting detection probability (e.g., temperature, wind speed, etc.). As a result of conducting surveys for Quino since 2005 we have accumulated meaningful representations of the broad-scale (Conservation Area-wide) distribution of Quino and the results of surveys in 2009 served to better delineate the fine-scale (reserve-level) distribution of Quino at particular survey areas. We have also gained insight into the relative stability of various Quino populations within the Conservation Area (i.e., which locations regularly support adult Quino and which locations appear to produce observable Quino only in years with presumably favorable environmental and/or habitat conditions).

In 2010, our survey effort was reduced compared to previous years due to limited personnel availability. The relatively intensive survey effort employed in 2008 and 2009 was postponed in favor of a more efficient survey aimed specifically at meeting the species-specific objective described above. In 2010 we prioritized continued monitoring of established sentinel sites, as understanding within- and among-year differences in the timing and duration of the Quino flight season will be essential to most efficiently direct future survey efforts. We also opportunistically monitored recently occupied locations, as well as areas that were either adjacent to known occupied locations or that contained apparently suitable habitat.

The goals and objectives for 2010 Quino surveys were as follows:

Goals and Objectives

1. Monitor Quino populations at established sentinel sites.
 - a. Conduct weekly surveys at sentinel sites to determine presence/absence of Quino larvae and adults, relative abundance, and available species-specific resources.
2. Monitor recently occupied locations and conduct surveys in areas with apparently suitable habitat, with priority given to locations that are adjacent to known occupied habitat.

- a. Identify survey areas by mapping Quino observations, including incidental observations, from the last 10 years and identifying locations with apparently suitable habitat.
- b. Divide survey areas into 250 m x 250 m sampling stations and assign unique IDs to each sampling station.
- c. Conduct multiple presence/absence surveys within sampling stations at survey areas, unless adult Quino are detected during the first visit to a sampling station.
- d. Map occupied locations to demonstrate distribution of Quino within the Conservation Area.

METHODS

Sentinel Site Visits

To determine when the flight season in a given area began, Monitoring Program biologists visited previously established sentinel sites at 3 locations across the Conservation Area known to support populations of Quino. We believe these sites are representative of the currently known distribution of Quino within the existing Conservation Area. Sentinel sites were located at the Southwestern Riverside County Multi-Species Reserve (MSR), Oak Mountain, and Silverado Ranch (Figure 1). Christine Moen, MSR Reserve Manager, conducted the majority of sentinel site visits at MSR, and Monitoring Program biologists conducted all surveys at Oak Mountain and Silverado Ranch.

The primary purpose of sentinel site monitoring was to document adult Quino in flight at a given location so that monitoring in nearby areas could be conducted, assuming that Quino flight status at the sentinel site was indicative of flight status in nearby areas. Secondary purposes were to determine gross abundance estimates from year-to-year, to track Quino habitat conditions on site including available nectar plants and host plant distribution and abundance, and to document presence of larvae at sentinel sites.

Sentinel site visits commenced when spring conditions developed (i.e., sunny days with temperatures above 16 °C). Unless vegetation conditions or larvae size indicated that the flight season was several weeks away, surveyors visited each sentinel site approximately once per week to monitor the status of Quino at those sites. Surveyors recorded Quino host plant status, available nectar resources, number of Quino larvae and adults seen, co-occurring butterflies, start and end time, and weather conditions during each sentinel site visit.

Sentinel sites were defined by a single GPS waypoint, but surveyors were expected to visit several surrounding hilltops or areas with the most apparently appropriate Quino habitat. We conducted surveys between the hours of 0930 and 1430, when temperatures in the shade at ground level were > 16 °C on a clear, sunny day,

or $> 21^{\circ}\text{C}$ on an overcast or cloudy day, and sustained wind speeds were < 15 km per hour measured 1.2 - 1.8 m above ground level. We did not conduct surveys outside of these hours or weather conditions, nor when there was fog or precipitation on-site.

Unless the above conditions precluded a sentinel site survey, the surveyor spent at least 2 hours searching a sentinel site before concluding the survey with no Quino observations. During the 2-hour survey, surveyors thoroughly covered the area immediately surrounding the sentinel site waypoint, using their knowledge of Quino ecology to maximize opportunities for detection (e.g., visiting hilltops, watching other butterflies, scanning vegetation with open flowers). If Quino were observed, and adequate habitat data were recorded, the surveyor could conclude the survey before 2 hours expired. Because Quino is a federally-listed endangered species and because these sentinel sites represent some of the best remaining habitat, surveyors were instructed to be extremely careful to avoid trampling larvae or host plants, disturbing cryptogamic crusts, or otherwise adversely impacting the resources on site. Surveyors were instructed to walk on existing roads, trails, and rocks when possible and to use extreme caution in placing their feet. Additionally, sentinel site visits were limited to 1 per week to minimize impacts on the resources.

Sentinel site surveys continued throughout the flight season until 2 consecutive visits returned no Quino observations. This indicated the approximate end of the flight season in a given area. Sentinel site survey methods are more completely described in the *Western Riverside County MSHCP Biological Monitoring Program Quino Checkerspot Butterfly Sentinel Site Survey Protocol* (Appendix A).

Adult Quino Surveys

We conducted presence/absence surveys for adult Quino at 12 locations in 2010: Harford Springs Park, Multi-Species Reserve (approx. 2 km north/northeast of the established sentinel site), Winchester 700A, Winchester 700B, Winchester 700C, El Sol, Wilson Valley, Brown Canyon, Magee Hills, Horse Creek, San Bernardino National Forest (approximately halfway between Cahuilla Mountain and Thomas Mountain), and the McElhinney-Stimmel property (Figure 2). We selected survey areas because they contained apparently suitable habitat and either had historical records of Quino or were relatively close to known occupied habitat. The El Sol, Winchester 700B, and Winchester 700C sites were surveyed because of their close proximity to known Quino populations. All other sites were chosen because of recent or historical Quino observations.

For each of the above survey areas, we overlaid a grid with adjacent 250 m x 250 m sampling stations over the extent of the area using Arc GIS v 9.1 software (ESRI 2006). When survey areas were large enough to prohibit thorough coverage (e.g, San Bernardino National Forest) and we had coordinates for recently observed Quino within that area, we only selected the sampling station which included the recent-observation coordinates, and the 8 immediately surrounding sampling stations.

Before departing for the field, surveyors uploaded a series of waypoints delineating the corners and center-point for each sampling station at an assigned survey area into their handheld GPS unit. Surveyors also printed out a corresponding map of the survey area to take into the field.

Once assigned a given survey area by the Quino Project Lead, surveyors were free to select sampling stations that they assumed more likely to be occupied by Quino based on a visual overview of the area. Surveyors searched for adult Quino within sampling stations in a methodical manner using meandering transects and giving preference to portions of the sampling station that either appeared more likely to support Quino (e.g., with host plants and/or nectaring plants) or that facilitated observation (e.g., hilltops). These surveys were not time-constrained but surveyors spent as much time as required to search all potentially suitable habitat within a given sampling station. Survey methods are more completely described in the *Western Riverside County MSHCP Biological Monitoring Program Quino Checkerspot Butterfly Survey Protocol* (Appendix B).

Adult Quino surveys occurred between the hours of 0930 and 1430 under the same weather conditions as the sentinel site surveys. Weather conditions were recorded at the beginning of the survey period.

Each survey area was targeted for survey a minimum of 2 times during the flight season. Not all sampling stations within survey areas were visited in 2010 due to either the large size of some survey areas or the habitat being assessed as apparently unsuitable or inaccessible during the initial visit. When possible, we made additional visits to survey areas with confirmed Quino observations to attempt to expand the area documented as occupied. Sampling stations without Quino observations during the initial visit were resurveyed depending on the size of the survey area and the relative quality of the habitat within the survey area. Sampling stations confirmed as occupied by Quino in 2010 were not resurveyed.

Personnel and Training

All surveyors passed the USFWS Quino identification exam and observed live adult Quino in the field with experienced Quino surveyors before conducting surveys. Biological Monitoring Program personnel were funded by the California Department of Fish and Game or the Regional Conservation Authority; volunteers are noted.

Biologists conducting Quino surveys in 2010 included:

- Nate Zalik (Project Lead, Biological Monitoring Program)
- Ashley Ragsdale (Biological Monitoring Program)
- Lynn Miller (Biological Monitoring Program)
- Christine Moen (volunteer, Multi-Species Reserve Manager)

Data Analysis

Due to limited personnel availability and subsequently reduced survey effort the 2010 Quino dataset is not appropriate for statistical analysis. Data from 2010 will be used to track Quino populations at sentinel sites and determine Quino presence at recently occupied locations or areas with apparently suitable habitat that are relatively near known occupied habitat within the existing Conservation Area.

RESULTS

Sentinel Site Visits

Adult Quino were observed at all sentinel sites in 2010, with the majority of individuals at Oak Mountain (Table 1). The first adult Quino of 2010 were observed at Oak Mountain on 28 February and the last adult Quino were observed at Silverado Ranch on 15 June, the latest that adult Quino have been observed by Monitoring Program biologists in western Riverside County since surveys began in 2005.

Table 1. Quino checkerspot butterfly sentinel site survey results in 2010.

Sentinel Site Location	Date First Adults Observed	Date Last Adults Observed	Total Number of Visits	Approximate Total Adult Quino Observed
Multi-Species Reserve	3/1/2010	4/23/2010	10	11
Oak Mountain	2/28/2010	5/4/2010	12	>1,000
Silverado Ranch	4/14/2010	6/15/2010	14	23

Adult Quino Surveys

Monitoring Program biologists surveyed 12 areas for adult Quino (with multiple sampling stations per location) in western Riverside County in 2010 (Table 2). We observed adult Quino at Brown Canyon, Horse Creek, Magee Hills, Multi-Species Reserve (approx. 2 km north/northeast of the established sentinel site), San Bernardino National Forest (approx. halfway between Cahuilla Mountain and Thomas Mountain), Wilson Valley, and Winchester 700C, thus confirming occupation of these sites (Figure 2). No Quino were observed at El Sol, Harford Springs Park, McElhinney-Stimmel, Winchester 700A, or Winchester 700B.

We confirmed that adult Quino were present at 7 out of 12 survey areas (58%) in 2010, with the distribution of occupied areas limited to the eastern and southeastern portions of the Plan Area (Figure 2). Quino's 2010 distribution within the Plan Area was bounded by the Multi-Species Reserve to the west, Brown Canyon to the north, and the San Bernardino National Forest to the east. Quino is known to occupy several areas to the

south in San Diego County. A total of 34 out of 117 sampling stations (29%) were occupied by Quino in 2010.

Table 2. Adult Quino survey results from 250 m x 250 m sampling stations at listed survey areas in 2010.

Survey Area	Number of visits	Number of stations surveyed	Number of stations with Quino
Brown Canyon	2	4	1
Horse Creek	2	4	2
Magee Hills	1	6	4
Multi-Species Reserve (North of sentinel site)	2	7	5
San Bernardino National Forest	2	8	7
Wilson Valley	3	17	5
Winchester 700C	2	15	10
El Sol	2	9	0
Harford Springs Park	2	9	0
McElhinney-Stimmel	1	6	0
Winchester 700A	3	25	0
Winchester 700B	1	7	0

The number of sampling stations surveyed per area varied due to the amount of accessible land (i.e., extent of the Conservation Area), the apparent suitability of habitat within sampling stations, and the number of surveyor days available. The Magee Hills survey area was only surveyed once in 2010 because thorough coverage of the site was achievable with just one visit, and several sampling stations were confirmed as occupied during the initial visit. Although no Quino were observed at the Winchester 700B and McElhinney-Stimmel properties, only one survey of these locations was possible due to limited staff availability.

Several adult Quino were incidentally observed while walking to and from sampling stations in 2010. All incidental observations were made in areas already known to be occupied by Quino.

No standardized vegetation or habitat data were collected at Quino survey areas in 2010 but surveyors were asked to note host plant species and general nectar plant availability, and to assess habitat suitability in general when visiting survey locations. All survey areas with or without Quino observations supported at least one Quino host plant species, contained appropriate nectar plants, and at least some portion of the site had habitat conditions that appeared to be suitable for Quino.

Although not reported here for the purposes of brevity, weather data collected during surveys with and without Quino detections were similar within a given survey area. There were no apparent observer-effects on survey success as most observers had approximately the same ratio of sampling stations surveyed with Quino detections versus without detections.

DISCUSSION

It was encouraging that we observed Quino at locations where they were not observed in 2009 (e.g., Magee Hills). Since we began monitoring Quino's distribution within the Conservation Area in 2005, the population at Magee Hills has not been as dependably detectable nor as apparently abundant as those at the other survey sites, although we have never focused on abundance as a target metric. Data collected thus far show that locations known to be historically occupied but lacking observable Quino in a given year can support easily observable Quino populations in subsequent years.

While the protocol for monitoring sentinel sites is not directed at determining abundance, the extreme difference in approximate total number of observed adult Quino at Oak Mountain compared to other sentinel sites is supported by anecdotal reports from surveyors in the field (Table 1). Although not as extreme, a similarly obvious difference in adult Quino abundance was recorded in 2009 when monitoring sentinel sites (~11 Quino observed at Multi-Species Reserve, >200 Quino observed at Oak Mountain, ~25 Quino observed at Silverado Ranch). Abundance estimates may be strongly affected due to observers spending varying amounts of time searching for adult Quino across sentinel sites and occasionally halting surveys after the first adult Quino was confirmed. However, observers returning from the field overwhelmingly reported a significantly greater number of adult Quino flying at the Oak Mountain sentinel site in the past 2 years compared with any other location in western Riverside County. The Oak Mountain sentinel site is owned and managed by the Bureau of Land Management (BLM). The Monitoring Program has provided recent Quino location coordinates and maps to the BLM and has worked with BLM officials to both prevent and prepare for potential damage to this extremely valuable site due to threats such as wildfire and off-highway vehicles.

The goal to survey each independent location multiple times if Quino were not detected on the initial visit(s) was not achieved due to scarcity of trained survey staff. Anecdotal evidence suggested that the detection probability for adult Quino was high in 2010 as they were generally found easily at occupied locations. However, because the 2010 dataset was not complete enough to calculate quantitative detection probabilities for survey areas, true absence can not be confirmed from areas lacking observations in 2010.

When Quino were present at a survey location, they were typically relatively well-distributed (mean percentage of sampling stations with Quino at occupied locations = 56%, ranged from 25% at Brown Canyon to 88% at San Bernardino National Forest). This strongly suggests that the true extent of the occupied area extends beyond the sampling stations with documented Quino observations, and that if additional sampling stations in the immediate vicinity of the occupied area were surveyed that some stations would have been occupied. However, given the limitations of available personnel, the goals of the 2010 survey effort were to determine the distribution of Quino across the Conservation Area as a whole and thus effort at each independent survey location was limited.

Both the extent of occupied area within each survey location and the number of occupied areas across the Conservation Area vary from year-to-year. Mapping the extent of occupied area within each survey location is more time-consuming, while determining the distribution of Quino across the Conservation Area as a whole is likely the more important goal when monitoring this species. When possible, we will monitor at both spatial scales (reserve and Conservation Area levels). However, when both efforts are not possible due to staff availability, we will prioritize monitoring at the scale of the Conservation Area as a whole.

Vegetation and habitat data collected to date by the Monitoring Program have not been sufficient to develop a statistically valid model of areas more likely to support Quino populations. There is continuing need for a quantitative multi-year dataset of habitat attributes at locations regularly used by Quino in order to build a well-supported model of suitable Quino habitat. However, because the study design for Quino surveys in 2010 did not allow for estimation of confidence in non-detections, and because personnel availability was limited, no standardized vegetation sampling was conducted in Quino survey areas in 2010.

Recommendations for Future Surveys

It is likely that there are important differences in vegetation and habitat conditions at locations occupied by Quino compared to unoccupied locations. It is also possible that some areas with habitat that is entirely suitable for Quino are not occupied due to barriers to dispersal, predator abundance, or other factors preventing Quino from occupying the site. More research is necessary to determine whether: 1) Quino are very patchily distributed throughout the landscape and do not occupy large patches of suitable habitat, or 2) our understanding of what constitutes suitable habitat is overly inclusive and

inaccurate. At this point we are unable to consistently identify variables that are different at locations with Quino detections versus locations without detections.

The life cycle of this species includes distinct larval and adult phases that have separate requirements for site suitability. For example, Quino larvae have a relatively short list of host plant species which they require as food sources, while adults require plants with open flowers to feed on (USFWS 2003). Future research should focus on determining if the currently accepted determinants of Quino habitat suitability are accurate, and the most relevant spatial scale at which to characterize habitat in order to classify suitability for Quino.

Previous habitat attributes of interest include the presence, abundance, and phenology of host plants, the composition of the vegetation community (e.g., percent cover of vegetative functional groups including native and non-native shrubs, herbs, grasses, and associated amount of bare ground), soil type, slope, aspect, and distance from nearest area where Quino are known to reproduce regularly. Exploration of the effects of host plant phenology should continue in order to examine the relation between the timing of host plant senescence and Quino site occupancy in future years.

Survey efforts during the 2011 flight season will depend upon available personnel. Given sufficient staff, we plan to continue with the study design employed in 2009, expanding the intensive survey effort to include all areas documented as occupied in 2010. The existing plots at MSR, Oak Mountain, and Silverado Ranch may also be expanded to include sampling stations at the edges of the documented distributions at these reserves. If sufficient staff are not available for the intensive study design employed in 2009, we will prioritize continued monitoring of established sentinel sites. We will also monitor recently occupied locations and areas with apparently suitable habitat or that are adjacent to known occupied habitat with the same survey protocol employed in 2010.

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Appendix A. Western Riverside County MSHCP Biological Monitoring Program Quino Checkerspot Butterfly Sentinel Site Survey Protocol, January 2010

The Biological Monitoring Program's Quino checkerspot butterfly (QCB) survey strategy relies on conducting surveys for adult butterflies only after the flight season in a given year has begun and including surveys during the peak flight season (i.e., the portion of the flight season when butterflies are most abundant and have the highest detection probability). To determine when the flight season in a given area has begun, Monitoring Program biologists visit previously established "sentinel sites" at 3 locations across the Conservation Area known to support populations of QCB. We believe these sites are representative of the currently known distribution of QCB within the MSHCP Conservation Area. Sentinel sites are located at the Southwestern Riverside County Multi-Species Reserve (MSR), Oak Mountain, and Silverado Ranch (Figure 1).

The primary purpose of sentinel site monitoring is to document adult QCB in flight in a given area so that larger scale monitoring in nearby areas can be conducted with the assumption that if adult QCB are flying at a given site, they are also available for detection in nearby areas. Secondary purposes are to determine gross abundance estimates from year-to-year, to track QCB habitat conditions on site including host plant distribution and abundance, and available nectar plants, and to document presence of larvae at sentinel sites.

METHODS

When spring conditions begin to develop (i.e., sunny days with temperatures above 16 °C), a Monitoring Program biologist visits each sentinel site to assess vegetation conditions and surveys the site for adult QCB. QCB typically fly first at the 2 westernmost sentinel sites (MSR and Oak Mountain). Unless vegetation conditions or larvae size indicate that the flight season is several weeks away, surveyors visit each sentinel site approximately once per week to monitor the status of QCB at those sites. Observers record QCB host plant status on-site, available nectar resources, number of

QCB larvae and adults seen, co-occurring butterflies, start and end time, and weather conditions during each sentinel site visit.

Sentinel sites are defined by a single GPS waypoint, but surveyors are expected to visit several surrounding hilltops or areas with the most appropriate QCB habitat.

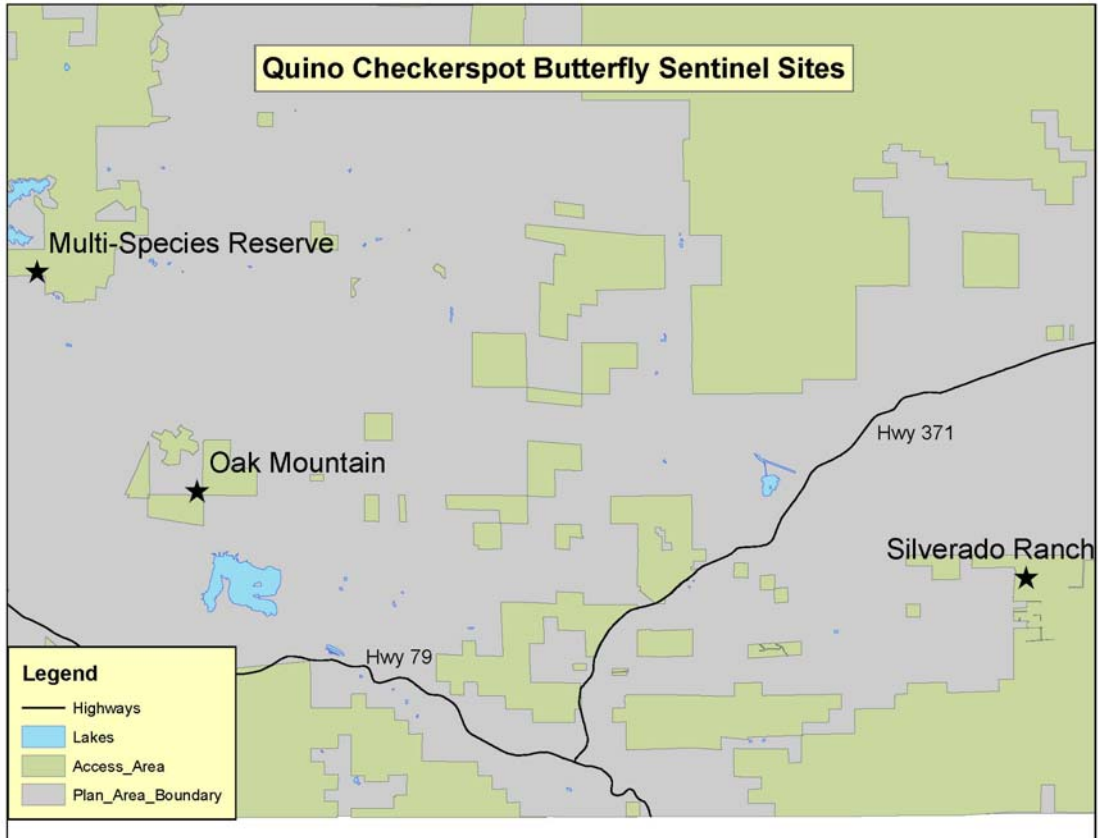
Sentinel site surveys occur under the following conditions:

- between the hours of 0930 and 1430;
- when temperatures in the shade at ground level are $> 16^{\circ}\text{C}$ on a clear, sunny day, or $> 21^{\circ}\text{C}$ on an overcast or cloudy day;
- with sustained wind speeds < 15 km per hour measured 1.2 - 1.8 m above ground level;
- no fog or precipitation on-site.

Unless the above conditions preclude a sentinel site survey in a given day, the surveyor will spend at least 2 hours searching a sentinel site before concluding the survey with no QCB observations. During the 2 hour survey the surveyor should thoroughly cover the area immediately surrounding the waypoint for that sentinel site, and should use their knowledge of QCB ecology to maximize opportunities for detection (e.g., visiting hilltops, watching other butterflies, scanning vegetation with open flowers). If QCB are observed, and adequate habitat data are recorded, the surveyor may conclude the survey before 2 hours have expired. Because QCB is a federally-listed endangered species, and because these sentinel sites represent some of the best remaining sites, surveyors should be extremely careful to avoid trampling larvae or host plants, disturbing cryptogamic crusts, or otherwise adversely impacting the resources on site. To the fullest extent possible, surveyors should use existing roads, trails, and rocks when walking and should pay extreme caution to where their feet fall. Sentinel site visits can also be made by representatives of partnering organizations or private individuals. When this occurs, sufficient communication should transpire so that no more than 1 total visit per week is made to any given sentinel site. This will help minimize the impact on sentinel sites.

Sentinel site surveys should continue throughout the flight season until 2 consecutive visits return no QCB observations. This will indicate the approximate end of the flight season.

Figure 1. QCB Sentinel Site Locations



Emailed to Allison Anderson? (Y / N)

Entered By: _____

Emailed to Christine Moen? (Y / N) (only if at Skinner)

Checked By: _____

Quino Checkerspot Butterfly Sentinel Site Survey Datasheet

Date: _____ **Site:** _____ **Surveyors:** _____

Arrival: Time: _____ **Temp. (°C):** _____ **Avg. Wind Speed (mph):** _____

Weather (circle one): Clear, Partly Cloudy, Cloudy, Raining

Departure: Time: _____ **Temp. (°C):** _____ **Avg. Wind Speed (mph):** _____

Weather (circle one): Clear, Partly Cloudy, Cloudy, Raining

of Quino Larvae observed (tally): _____ **Avg. Larval length (mm):**

of Quino Adults observed (tally): _____

Host Plants Observed	Host Plant Condition: Green, Flowering or Senesced	Describe plant patch conditions (size of patch(es), height, etc.)
<i>Plantago erecta</i>	G F S	
<i>Plantago patagonica</i>	G F S	
<i>Castilleja exserta</i>	G F S	
<i>Antirrhinum coulterianum</i>	G F S	
<i>Cordylanthus rigidus</i>	G F S	

General Habitat Description: _____

Nectar Plants In Bloom (list): _____

Photos Taken (photo names): _____

Additional Notes: _____

Co-occurring butterfly detections on other side

Co-occurring butterfly species:

(Check box if present. Number observed is not necessary.)

Butterflies Observed		Butterflies Observed	
Swallowtails:		Brush-footed Butterflies (cont.):	
Pale Swallowtail (<i>Papilio eurymedon</i>)		California Patch (<i>Chlosyne californica</i>)	
Anise Swallowtail (<i>P. zelicaon</i>)		Mourning Cloak (<i>Nymphalis antiopa</i>)	
West Tiger Swallowtail (<i>P. rutulus</i>)		California Sister (<i>Adelpha bredowii</i>)	
Whites Oranges:		Satyr Anglewing (<i>Polygonia satyrus</i>)	
Sara Orangetip (<i>Anthocaris sara</i>)		Lorquin's Admiral (<i>Basilarchia lorquini</i>)	
Felder's Orangetip (<i>A. cethura</i>)		Blues, Metal Marks, Coppers:	
Cabbage White (<i>Peiris rapae rapae</i>)		Western Tailed Blue (<i>Everes amyntula</i>)	
Sleepy Orange (<i>Eurema nicippe</i>)		Southern (Silvery) Blue (<i>Glaucopsyche lygdamus australis</i>)	
Common (Checkered) White (<i>Pontia protodice</i>)		Ceraunus Blue (<i>Hemiarqus ceraunus</i>)	
California (Spring) White (<i>Pieris rapae rapae</i>)		Echo Blue (<i>Celastrina ladon echo</i>)	
California Dogface (<i>Zerene eurydice</i>)		Sonoran Blue (<i>Philotes sonorensis</i>)	
Alfalfa Butterfly (<i>Colia eurytheme</i>)		Marine Blue (<i>Leptotes marina</i>)	
Dainty Sulphur (<i>Nathalis iole</i>)		Acmon Blue (<i>Icaricia acmon</i>)	
Harford's Sulfur (<i>C. Harfordi</i>)		Pygmy Blue (<i>Brephidium exilis</i>)	
Brush-footed Butterflies:		Gray Hairstreak (<i>Strymon melinus</i>)	
California Ringlet (<i>Coenonympha californiaca</i>)		Brown Elfin (<i>Incisalia augustinus</i>)	
Monarch (<i>Danaus plexipus</i>)		Perplexing Hairstreak (<i>Callohyrys perplexa</i>)	
Queen (<i>D. gilippus</i>)		Great Purple Hairstreak (<i>Atlides halesus</i>)	
Henne's Checkerspot (<i>Euphydryas chalcedona hennei</i>)		Behr's Metalmark (<i>Apodemia moro virgulti</i>)	
Chalcedon Checkerspot (<i>E. chalcedona chalcedona</i>)		Wright's Metalmark (<i>Calephelis wrightii</i>)	
Gabb's Checkerspot (<i>Charidryas gabbi</i>)		Skippers:	
Leanira Checkerspot (<i>Thessalia leanira wrightii</i>)		Common Skipper (<i>Pyrgus communis</i>)	
California Tortoiseshell (<i>Nymphallis californica</i>)		Firery Skipper (<i>Hylephila phyleus</i>)	
Mylitta Crescent (<i>Phyciodes mylitta</i>)		Funeral Dusky Wing (<i>Erynnis funeralis</i>)	
Painted Lady (<i>Vannessa cardui</i>)		Other:	
West Coast Lady (<i>V. amabella</i>)		Unknown Blue (Lycaenidae)	
Virginia Lady (<i>V. virginensis</i>)		Unknown White (Pieridae)	
Red Admiral (<i>V. atalanta</i>)		Unknown Yellow/Sulphur	
Buckeye (<i>Junonia coenia</i>)		Unknown Lady	

Appendix B. Western Riverside County MSHCP Biological Monitoring Program Quino Checkerspot Butterfly Survey Protocol, January 2010

INTRODUCTION

Species-specific conservation objective 4 for Quino states that “within the MSHCP Conservation Area, Reserve Managers will document the distribution of Quino checkerspot on an annual basis” (Dudek & Associates 2003). As a result of conducting surveys for Quino since 2005 we have accumulated meaningful representations of the broad-scale (i.e., Conservation Area-wide) distribution of Quino and the results of surveys in 2009 serve to better delineate the fine-scale (i.e., reserve-level) distribution of Quino at particular survey areas. We are also gaining insight into the relative stability of the various Quino populations within the Conservation Area (i.e., which locations regularly support adult Quino and which locations appear to produce observable Quino only in years with presumably favorable environmental and/or habitat conditions).

The 2010 survey effort will be minimal due to limited personnel availability. Therefore, the relatively intensive survey effort employed in 2008 and 2009 will be postponed in favor of a more efficient survey aimed at meeting the species-specific objective described above. In 2010 we will prioritize continued monitoring of established sentinel sites as understanding within- and among-year differences in the timing and duration of the Quino flight season will be essential to most efficiently direct future survey efforts. We will also monitor recently occupied locations and areas with apparently suitable habitat or that are adjacent to known occupied habitat with an opportunistic study design.

Survey Goals and Objectives:

1. Monitor Quino populations at established sentinel sites.
 - a. Conduct weekly surveys at sentinel sites to determine presence/absence of Quino larvae and adults, relative abundance, and habitat status.
2. Monitor recently occupied locations and conduct surveys in areas with apparently suitable habitat, with priority to locations that are adjacent to known occupied habitat.
 - a. Identify survey areas by mapping Quino observations from within the last 10 years, and identifying locations with apparently suitable habitat.
 - b. Divide survey areas into 250 m x 250 m sampling stations and assign unique IDs to each sampling station.
 - c. Conduct multiple presence/absence surveys within sampling stations at survey areas, unless adult Quino are detected during the first visit to a sampling station.

- d. Map surveyed sampling stations and occupied sampling stations to demonstrate distribution of occupied area at a given survey area.

METHODS

Sentinel Site Visits

To determine when the flight season in a given area has begun, Monitoring Program biologists will visit previously established sentinel sites at 3 locations across the Conservation Area known to support populations of QCB. We believe these sites are representative of the currently known distribution of QCB within the MSHCP Conservation Area. Sentinel sites are located at the Southwestern Riverside County Multi-Species Reserve (MSR), Oak Mountain, and Silverado Ranch.

When spring conditions begin to develop (i.e., sunny days with temperatures above 16 °C), a Monitoring Program biologist visits each sentinel site to assess vegetation conditions and surveys the site for adult QCB. Unless vegetation conditions or larvae size indicate that the flight season is several weeks away, surveyors visit each sentinel site approximately once per week to monitor the status of QCB at those sites. Observers record QCB host plant status on-site, available nectar resources, number of QCB larvae and adults seen, co-occurring butterflies, start and end time, and weather conditions during each sentinel site visit (Appendix A).

The primary purpose of sentinel site monitoring is to document adult QCB in flight at a given location so that monitoring in nearby areas can be conducted with the assumption that if adult QCB are flying at a given sentinel site, they are also available for detection in nearby areas. Secondary purposes are to determine gross abundance estimates from year-to-year, to track QCB habitat conditions on site including host plant distribution and abundance, and available nectar plants, and to document presence of larvae at sentinel sites.

Sentinel sites are defined by a single GPS waypoint, but surveyors are expected to visit several surrounding hilltops or areas with the most apparently appropriate QCB habitat. Sentinel site surveys occur under the following conditions:

- between the hours of 0930 and 1430;
- when temperatures in the shade at ground level are > 15.5 °C on a clear, sunny day, or > 21 °C on an overcast or cloudy day;
- with sustained wind speeds < 15 km per hour measured 1.2 - 1.8 m above ground level;
- no fog or precipitation on-site.

Unless the above conditions preclude a sentinel site survey in a given day, the surveyor will spend at least 2 hours searching a sentinel site before concluding the survey with no QCB observations. During the 2-hour survey the surveyor should thoroughly cover the area immediately surrounding the waypoint for that sentinel site, and should use

their knowledge of Quino ecology to maximize opportunities for detection (e.g., visiting hilltops, watching other butterflies, scanning vegetation with open flowers). If Quino are observed, and adequate habitat data are recorded, the surveyor may conclude the survey before 2 hours have expired. Because Quino is a federally-listed endangered species and because these sentinel sites represent some of the best remaining sites, surveyors should be extremely careful to avoid trampling larvae or host plants, disturbing cryptogamic crusts, or otherwise adversely impacting the resources on site. To the fullest extent possible, surveyors should use existing roads, trails, and rocks when walking and should pay extreme caution to where their feet fall. Sentinel site visits can also be made by partnering organizations or individuals (e.g., Reserve Managers). When this occurs, sufficient communication should occur so that no more than 1 total visit per week is made to any given sentinel site. This will help minimize the impact on sentinel sites.

Sentinel site surveys will continue throughout the flight season until 2 consecutive visits return no Quino observations. This will indicate the approximate end of the flight season in a given area.

Adult Quino Surveys

We will conduct presence/absence surveys for adult Quino at 12 locations in 2010: Harford Springs Park, Multi-Species Reserve (north of the established sentinel site), Winchester 700A, Winchester 700B, Winchester 700C, El Sol, Wilson Valley, Brown Canyon, Magee Hills, Horse Creek, San Bernardino National Forest (approx. halfway between Cahuilla Mountain and Thomas Mountain), and the McElhinney-Stimmel property. We selected survey areas because they contain apparently suitable habitat and either have historical records of Quino or are relatively close to known occupied habitat. The El Sol, Winchester 700B, and Winchester 700C sites were surveyed because of their close proximity to known Quino populations.

For each of the above survey areas, we overlaid a grid with adjacent 250 m x 250 m sampling stations over the extent of the area (Figure 1). When survey areas were large enough to prohibit thorough coverage (e.g, San Bernardino National Forest) and we had coordinates for recently observed Quino within that area, we only selected the sampling station which included the recent-observation coordinates, and the 8 immediately surrounding sampling stations.

Before departing for the field, surveyors will upload a series of waypoints delineating the corners and center-point for each sampling station at an assigned survey area (S:\Projects\Invertebrates\Quino\Plots\2010). Surveyors will also print out a corresponding map of the survey area to take into the field (S:\Projects\Invertebrates\Quino\Maps\2010).

Once assigned a given survey area by the Quino Project Lead, surveyors are free to select sampling stations that they expect are more likely to be occupied by Quino based on a brief visual overview of the area. Surveyors will search for adult Quino within

sampling stations at assigned survey areas in a methodical manner using meandering transects and giving preference to portions of the sampling station that are either more likely to support Quino (e.g., with host plants, and/or nectaring plants) or that facilitate observation (e.g, hilltops). These surveys are not time-constrained but surveyors should spend as much time as required to search all potentially suitable habitat within a given sampling station.



Figure 1. Example of a map of a Quino checkerspot butterfly survey area in 2010. Uniquely-numbered squares are 250 m x 250 m. The light green area indicates the shape of the boundaries of the survey area (El Sol).

Adult Quino surveys will occur under the same conditions as the sentinel site surveys:

- between the hours of 0930 and 1430;
- when temperatures in the shade at ground level are $> 15.5^{\circ}\text{C}$ on a clear, sunny day, or $> 21^{\circ}\text{C}$ on an overcast or cloudy day;
- with sustained wind speeds < 15 km per hour measured 1.2 - 1.8 m above ground level;
- no fog or precipitation on-site.

Surveyors should:

- move carefully to minimize trampling or otherwise harming QCB larvae and their host plants;
- walk slowly and stop occasionally to look around – surveyors standing still are more likely to see a moving butterfly;
- use binoculars to scan the surrounding areas and to help identify butterflies from a distance;
- pay special attention to areas with a high potential for QCB use, such as patches of nectar sources, ridgelines and hilltops, and bare or sparsely vegetated areas between shrubs;
- follow the movements of other butterflies. QCB males are aggressive, can spot other butterflies from a distance, and will chase them.

Each survey area will be visited a minimum of 2 times during the flight season, unless Quino are observed during the first visit. Sampling stations within a given survey area may be surveyed once or multiple times, depending on the size of the survey area, previous results, and the relative quality of the habitat within the survey area. Additional visits to survey areas with confirmed Quino observations during the initial visit will depend on the size of the survey area and the extent of documented area (i.e., additional surveys will be conducted if they might substantially expand the area documented as occupied).

Survey Equipment:

- | | |
|--|-----------------------------|
| - Handheld GPS with uploaded waypoints | - Binoculars |
| - Handheld weather station (e.g., Kestrel) | - Clipboard with datasheets |
| - Digital camera | - Pen |
| - Extra batteries | - Map of survey area |

Vegetation Sampling

Vegetation and habitat data collected to date by the Monitoring Program have not been sufficient to develop a statistically-supported model of areas more likely to support Quino populations. There is continuing need for a quantitative multi-year dataset of

habitat attributes at locations regularly used by Quino in order to build a well supported model of suitable Quino habitat.

However, because the study design for Quino surveys in 2010 does not allow for estimation of confidence in non-detections, and because personnel availability is limited, no standardized vegetation sampling will occur in Quino survey areas in 2010. Monitoring of host plant phenology at sentinel sites will continue, in order to examine the relationship between the timing of host plant senescence and Quino occupancy in future years.

Personnel Training

Before field crew conduct surveys for adult Quino within the Conservation Area they are required to complete extensive office- and field-based training. Office-based training consists of reviewing professional butterfly field guides, Monitoring Program-prepared powerpoint study guides with photos and discussion of diagnostic characteristics for Quino and co-occurring butterflies, a display box with pinned specimen of identified co-occurring butterflies, and video of flying adult Quino and co-occurring butterflies. Quino surveyors-in-training also visit the U.C. Riverside Entomology Museum which has display boxes of Quino specimen and other co-occurring butterflies, including other checkerspot species and species with similar morphology and coloring [e.g. Behr's metalmark (*Apodemia virgulti*)]. We require all surveyors to pass the U.S. Fish and Wildlife Service (USFWS) Quino identification exam before conducting surveys, although we are not strictly required to do so by the Wildlife Agencies.

The field survey protocol is also discussed in-office before surveys begin, and the Project Lead or experienced Quino surveyors may accompany new surveyors on mock surveys in the field if necessary. Finally, Monitoring Program biologists preparing for Quino surveys must be able to identify the 6 plant species currently accepted as host plants (*Plantago erecta*, *P. patagonica*, *Antirrhinum coulterianum*, *Cordylanthus rigidus*, *Castilleja exserta*, and *Castilleja exserta*) (USFWS 2003). There is a Monitoring Program-prepared study guide focusing on host plants available for study.

Quino surveyors-in-training observe live Quino in the field with experienced Quino surveyors before conducting surveys. This is typically achieved by accompanying experienced observers to established sentinel sites. Experienced surveyors should also indicate the presence of any host plants present during these training field visits to surveyors-in-training.

After completing training, Quino surveyors are capable of:

- distinguishing Quino larvae from all other co-occurring butterfly larvae;
- distinguishing adult Quino from all other co-occurring butterflies;
- identifying Quino host plant species;
- properly conducting the established protocol;

- using a handheld GPS unit to navigate to downloaded waypoints, mark new waypoints in the field, and upload waypoints to a database;
- filing completed datasheets and digital photos.

Timeline

- Late January - early February: Training
- Late February: Begin monitoring sentinel sites (dates depend upon weather and related phenology of vegetation at sentinel sites)
- Early March: Begin sampling station surveys for adult Quino at selected survey areas
- Late April - May: End monitoring at sentinel sites when surveys in consecutive weeks return no Quino observations (occurs first in the western sentinel sites)
- April – May: End sampling station surveys at a given survey area when either desired information at survey area has been collected, or surveys at nearby sentinel sites return no Quino observations in consecutive weeks

Data Management and Analysis

After surveyors return from either sentinel site monitoring or sampling station surveys, they update tracking spreadsheets at: S:\Projects\Invertebrates\Quino\Data\2010 within 24 hours of field work. These tracking spreadsheets allow the Project Lead to most efficiently and appropriately direct future survey efforts. Paper datasheets are stored in labeled folders in the Monitoring Program office. Any waypoints taken in the field are uploaded to: S:\Projects\Invertebrates\Quino\Data\2010\2010 Quino Waypoints. Digital photos taken as data (e.g., photos of adult Quino taken as evidence of presence at a given site) are stored as JPEG images at: S:\Projects\Data_Photos\Quino\2010 and are named according to the following convention: date photo was taken (yyyymmdd), observer initials, JPEG number (e.g., “20100324_AJM_043”). Digital photos that are not official data associated with a given survey (e.g., general survey area photos, surveyors in the field) are stored at: S:\Projects\Invertebrates\Quino\Non-Data_Photos\2010 and should follow the same naming convention. Note that it is critical that the exact name of each photo also appears on the appropriate datasheet.

Data from sentinel site monitoring and sampling station surveys are entered into an MS Access database at: S:\Databases when personnel are available and not needed for immediate field work. The study design for Quino surveys in 2010 does not allow for estimation of detection probability or proportion of area occupied. However, data collected in 2010 will be used to map surveyed and occupied sampling stations to demonstrate distribution of occupied area at a given survey area.

LITERATURE CITED

Dudek & Associates. 2003. Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Final MSHCP, Volumes I and II. Prepared for

County of Riverside Transportation and Lands Management Agency. Prepared by Dudek & Associates, Inc. Approved June 17, 2003.

[USFWS] U.S. Fish and Wildlife Service. 2003. Recovery Plan for the Quino Checkerspot Butterfly (*Euphydryas editha quino*). Portland, Oregon. 179 pp.

Quino Checkerspot Butterfly 2010 Survey Datasheet

Emailed to Allison Anderson? (Y / N) _____ Emailed to Christine Moen? (Y / N) (only if at MSR) _____
Entered By: _____ Checked By: _____

Date: _____ **Site:** _____ **250m Square ID:** _____ **Surveyor:** _____

Arrival: Time: _____ **Temp. (°C):** _____ **Avg. Wind Speed (mph):** _____

Weather (circle one): Clear, Partly Cloudy, Cloudy, Raining

Host Plants Observed	Host Plant Condition: Green, Flowering, Senesced	Briefly describe plant patch conditions (size of patch(es), height, etc.)
<i>Plantago erecta</i>	G F S	
<i>P. patagonica</i>	G F S	
<i>Castilleja exserta</i>	G F S	
<i>Antirrhinum coulterianum</i>	G F S	
<i>Collinsia concolor</i>	G F S	
<i>Cordylanthus rigidus</i>	G F S	

General Habitat/Vegetation Description: _____

Nectar Plants In Bloom (list): _____

Photos Taken (photo names): _____

Is there suitable habitat within this 250m square?:

of Quino Larvae observed (tally): _____ **Avg. Larval length (mm):** _____

of Quino Adults observed (tally): _____

Quino Waypoints (NAD83):	<u>Name</u>	<u>UTM E</u>	<u>UTM N</u>
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

Additional Notes: _____

Co-occurring butterfly detections on other side

Co-occurring butterfly species:
(Check box if present. Number observed is not necessary.)

Butterflies Observed		Butterflies Observed	
Swallowtails:		Brush-footed Butterflies (cont.):	
Pale Swallowtail (<i>Papilo eurymedon</i>)		California Patch (<i>Chlosyne californica</i>)	
Anise Swallowtail (<i>P. zelicaon</i>)		Mourning Cloak (<i>Nymphalis antiopa</i>)	
West Tiger Swallowtail (<i>P. rutulus</i>)		California Sister (<i>Adelpha bredowii</i>)	
Whites Oranges:		Satyr Anglewing (<i>Polygonia satyrus</i>)	
Sara Orangetip (<i>Anthocaris sara</i>)		Lorquin's Admiral (<i>Basilarchia lorquini</i>)	
Felder's Orangetip (<i>A. cethura</i>)		Blues, Metal Marks, Coppers:	
Cabbage White (<i>Peiris rapae rapae</i>)		Western Tailed Blue (<i>Everes amyntula</i>)	
Sleepy Orange (<i>Eurema nicippe</i>)		Southern (Silvery) Blue (<i>Glaucopsyche lygdamus australis</i>)	
Common (Checkered) White (<i>Pontia protodice</i>)		Ceraunus Blue (<i>Hemiarqus ceraunus</i>)	
California (Spring) White (<i>Pieris rapae rapae</i>)		Echo Blue (<i>Celastrina ladon echo</i>)	
California Dogface (<i>Zerene eurydice</i>)		Sonoran Blue (<i>Philotes sonorensis</i>)	
Alfalfa Butterfly (<i>Colia eurytheme</i>)		Marine Blue (<i>Leptotes marina</i>)	
Dainty Sulphur (<i>Nathalis iole</i>)		Acmon Blue (<i>Icaricia acmon</i>)	
Harford's Sulfur (<i>C. harfordi</i>)		Pygmy Blue (<i>Brephidium exilis</i>)	
Brush-footed Butterflies:		Gray Hairstreak (<i>Strymon melinus</i>)	
California Ringlet (<i>Coenonympha californiaca</i>)		Brown Elfin (<i>Incisalia augustinus</i>)	
Monarch (<i>Danaus plexipus</i>)		Perplexing Hairstreak (<i>Callohyrys perplexa</i>)	
Queen (<i>D. gilippus</i>)		Great Purple Hairstreak (<i>Atlides halesus</i>)	
Henne's Checkerspot (<i>Euphydryas chalcedona hennei</i>)		Behr's Metalmark (<i>Apodemia moro virgulti</i>)	
Chalcedon Checkerspot (<i>E. chalcedona chalcedona</i>)		Wright's Metalmark (<i>Calephelis wrightii</i>)	
Gabb's Checkerspot (<i>Charidryas gabbi</i>)		Skippers:	
Leanira Checkerspot (<i>Thessalia leanira wrightii</i>)		Common Skipper (<i>Pyrgus communis</i>)	
California Tortoiseshell (<i>Nymphallis californica</i>)		Firery Skipper (<i>Hylephila phyleus</i>)	
Mylitta Crescent (<i>Phyciodes mylitta</i>)		Funeral Dusky Wing (<i>Erynnis funeralis</i>)	
Painted Lady (<i>Vannessa cardui</i>)		Other:	
West Coast Lady (<i>V. amabella</i>)		Unknown Blue (Lycaenidae)	
Virginia Lady (<i>V. virginensis</i>)		Unknown White (Pieridae)	
Red Admiral (<i>V. atalanta</i>)		Unknown Yellow/Sulphur	
Buckeye (<i>Junonia coenia</i>)		Unknown Lady	