

# Western Riverside County MSHCP Biological Monitoring Program Quino Checkerspot Butterfly 2022

## Survey Protocol

### INTRODUCTION

The Biological Monitoring Program's Quino checkerspot butterfly (*Euphydryas editha quino*: quino) survey strategy relies on conducting surveys for adult quino after the flight season in a given year has begun. Surveys then continue throughout the Conservation Area until quino are no longer observed, usually in May.

Species-Specific Conservation Objective 4 states that "within the MSHCP Conservation Area, Reserve Managers will document the distribution of Quino checkerspot on an annual basis" (Dudek & Associates 2003). We will focus surveys within six of the seven Core Areas identified in Conservation Objective 1: Warm Springs Creek, Johnson Ranch/Lake Skinner, Oak Mountain, Wilson Valley, Sage, and Silverado/Tule Peak (Fig. 1; Dudek & Associates 2003). The remaining core (Lake Mathews/Estelle Mountain/Harford Springs Core Area) will be excluded from 2022 surveys as quino have not been observed there by any biologists since 1998, and thus are believed to be extirpated (USFWS 2001). Additional surveys will be conducted in satellite (non-core) occurrence complexes where quino are known to currently or historically occur, such as the southwestern portions of the San Bernardino National Forest (SBNF), Cactus Valley, and Aguanga.

As a result of conducting annual surveys for quino since 2005 we have gained a better understanding of the overall distribution of the species in our Conservation Area. We are gaining insight into the habitat requirements necessary to sustain a healthy and stable population of quino and the factors that may be at play in the decline of certain populations. In 2022 we will continue sentinel site monitoring to determine the beginning of the flight season and to add to our understanding of within- and among-year differences in the timing and duration of the quino flight season. Once the presence of quino larvae and/or adults is confirmed at any of the sentinel sites we will begin to survey across a broader range in Core Areas and Satellite Occurrence Complexes to obtain a better understanding of the overall distribution of quino populations in western Riverside County.

### Goals and Objectives

1. Monitor quino populations at established sentinel sites.
  - a. Determine the flight season of quino by surveying sentinel sites within 250 m × 250 m sampling station(s) to confirm presence/absence of quino larvae and/or adults, and abundance.
  - b. Track habitat conditions and species-specific resources on-site.
2. Monitor quino populations in areas with suitable habitat, with priority given to locations that were recently occupied.
  - a. Conduct presence/absence surveys within 250 m × 250 m sampling stations at survey sites identified as having suitable habitat.

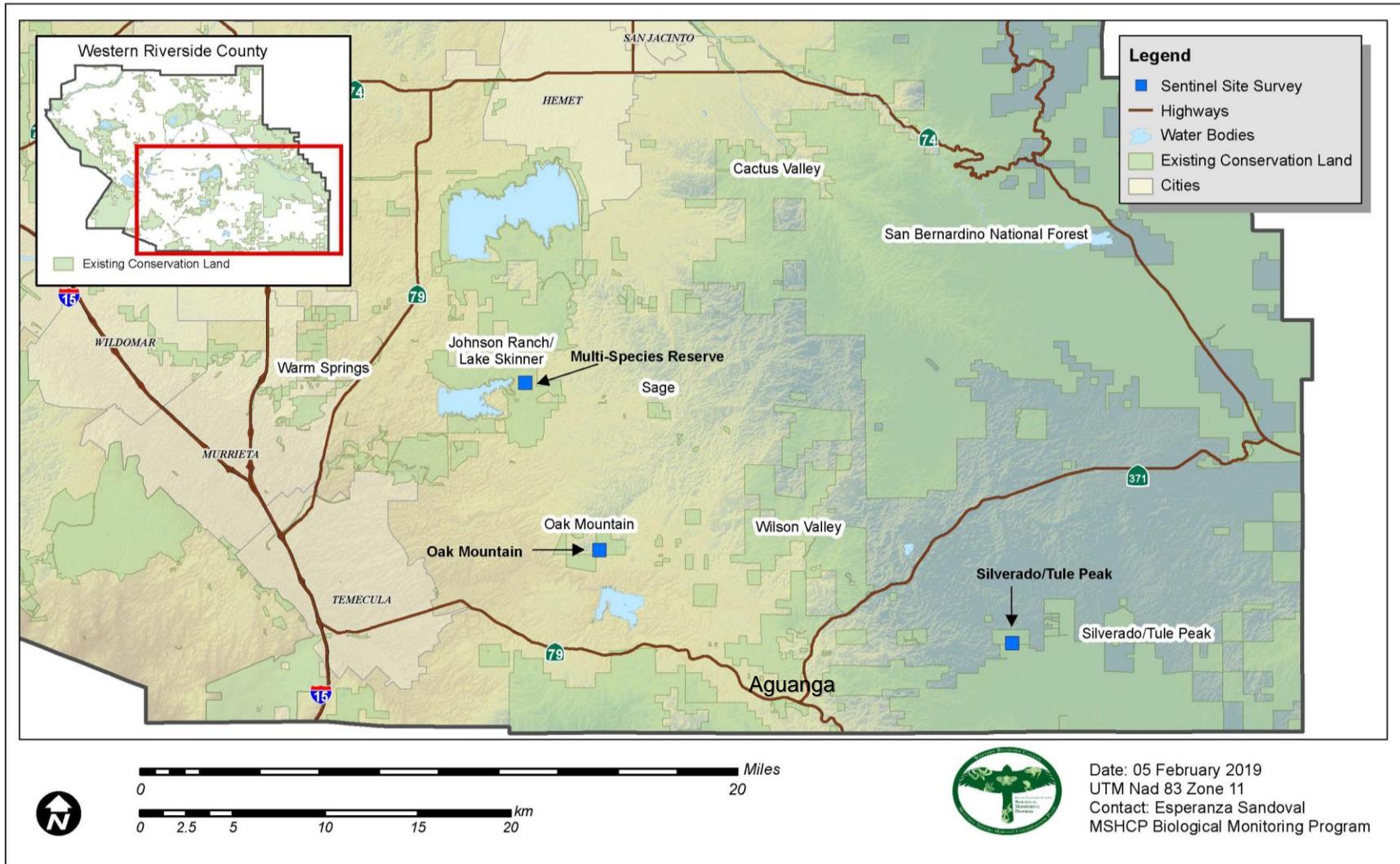


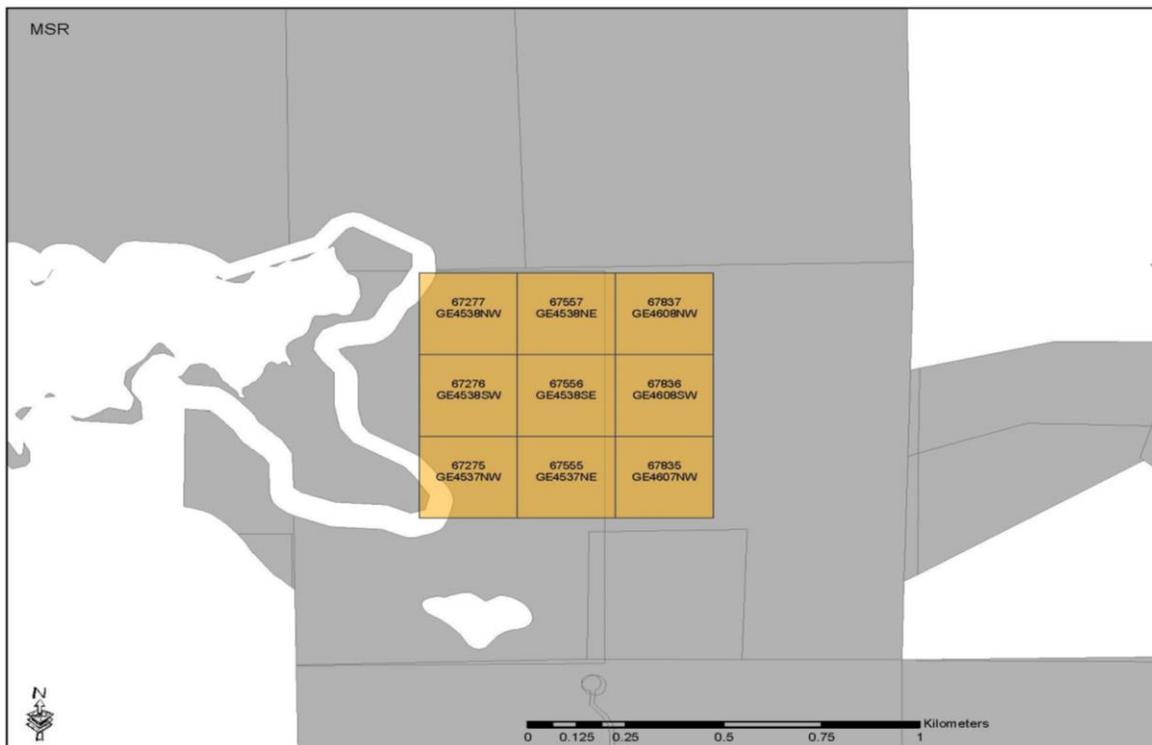
Figure 1. Quino Checkerspot butterfly Core Areas and sentinel site locations.

- b. Survey sites with known quino populations to determine if they are still occupied and the extent of occupation.
- c. Survey new areas with suitable habitat within designated critical habitat for quino and surrounding areas.
- d. Map observations to track distribution of quino within the Conservation Area.

## METHODS

### Survey Design

At the inception of our quino monitoring effort in 2008, potential study sites were chosen using GIS layers of USFWS-designated critical habitat for quino and lands accessible to the Monitoring Program. We used ArcGIS (ESRI 2009) to overlay a grid with adjacent 250 m × 250 m grid squares across the Plan Area (Fig. 2). We will use these grid squares to delineate the sampling stations where we will conduct focused area searches at the sentinel sites; these grid squares will also define our search efforts during surveys for adult quino. Our survey strategy relies on conducting surveys for adult quino only after the emergence of quino larvae or adults have been observed at the sentinel sites. Surveys then continue during the whole of the flight season, conducted between the hours of 0930 and 1600. To commence a survey in a chosen sampling station, temperatures in the shade at ground level shall be >12.0 °C on a clear, sunny day or > 16°C on an overcast or cloudy day, and with average wind speeds ≤ 24 km/hr as measured 1.2–1.8 m above ground level. Average wind speed is defined as the wind speed determined by averaging observed values over a one-minute period at the beginning of the survey. We do not conduct surveys when there is fog or precipitation.



**Figure 2.** Example of a grid of 250 m x 250 m sampling stations at MSR. Each square represents a sampling station and is assigned a unique identification number. Number of sampling stations vary by site.

### *Sentinel Site Visits*

The primary purpose of sentinel site visits is to determine the commencement of the adult flight season. Surveys for quino are conducted at the onset of quino larva or adult quino emergence and continue through the flight period, beginning from late January – early February through mid–late May (USFWS 2003). Flight start and end dates depend on the elevation of the site, temperature and rainfall. To determine when the flight season in a given area has begun, and thus inform the commencement of larger scale quino monitoring, Monitoring Program biologists visit sentinel sites at three locations across the Conservation Area known to support robust populations of quino: the Southwestern Riverside County Multi-Species Reserve (MSR), Oak Mountain, and the Silverado/Tule Peak area (Figure. 1). We believe these sites are geographically representative of the current distribution of quino within the existing Conservation Area. In the future, as quino populations shift, we may change the sentinel site locations.

### *Adult Quino Surveys*

The primary purpose of adult quino surveys is to monitor persistence of known populations and to ascertain the distribution of the species within the Conservation Area. This will be accomplished by surveying locations known to support quino in recent years and where quino historically occurred. We will also survey areas with suitable habitat and reasonably good potential for quino occupancy in hopes of discovering new populations. The secondary purpose of adult quino surveys is to collect sufficient environmental data that may contribute to a better understanding of any additional factors that influence the distribution, occurrence, and detectability of the species.

Survey areas vary in spatial extent depending on the heterogeneity of the landscape and suitability of the habitat for quino but generally are bounded by several sampling stations. For some very large survey areas, we will prioritize sampling stations where quino were recently observed and include the surrounding sampling stations if the habitat appears suitable for quino. We will then generate a list of grid cell center-points and maps of the sampling stations that the surveyors can reference while conducting surveys.

We will survey in six of the seven designated Core Areas: Warm Springs Creek Core Area, Sage Core Area, Johnson Ranch/Lake Skinner Core Area, Oak Mountain Core Area, Wilson Valley Core Area, and Silverado/Tule Peak Core Area. Additional areas that will be surveyed in 2022 are known as Satellite Occurrence Complexes (Dudek & Associates 2003) and are located outside of designated Core Areas. These locations are within the San Bernardino National Forest (SBNF), Cactus Valley, and Aguanga and are surveyed regularly due to known, persistent quino populations or historically occupied areas with highly suitable habitat. As time allows, we will survey additional areas to expand our knowledge and documentation of quino occupancy in designated critical habitat for quino.

### **Field Methods**

For all surveys, surveyors record start and end times, habitat type and dominant shrubs, weather conditions, condition of host plants present, *Plantago* spp. leaf length, presence of

flowering nectar sources, waypoints and data for any larvae and adults observed, co-occurring butterfly species, and habitat disturbances or changes.

When quino larvae or adults are observed, the surveyor will approach carefully, take a waypoint, record the number and lengths of larvae (to determine instar stage) or adults, record any observed activity, and take a photograph if possible. Any number of quino observed within a 10 m radius (or the approximate distance one can visually track an individual's movement) shall be counted together using one waypoint, providing they display the same behavior.

During surveys, biologists should walk slowly and attentively, stopping occasionally to search for any flying or stationary butterflies and pay special attention to areas with high potential for quino use. We will use binoculars to scan surrounding areas and aid in identification of distant butterflies; follow the movements of other butterflies as an aggressive quino male may chase them; stand still when a quino has been spotted as other quino may join it; and watch for quino behaviors, such as nectaring and ovipositing. Lastly, if it won't cause any disturbance to the butterfly, we may approach slowly to take a photograph. Surveyors should take care to avoid delicate cryptogamic soil crusts (Preston et al. 2012). Quino is a federally-listed endangered species and our survey locations contain some of the best remaining habitat so surveyors should be extremely careful to minimize their impacts on both the species and the sites.

#### *Sentinel Site Visits*

When spring conditions begin to develop, usually starting sometime in late January to February, Monitoring Program biologists visit each sentinel site to assess vegetative conditions and survey for larval and adult quino. Of particular importance is the development of quino host plants, especially California plantain (*Plantago erecta*). Sentinel sites are generally visited in order of increasing elevation, with higher elevation sites being surveyed later in the survey season corresponding with the development of favorable temperatures and conditions for quino. Surveyors thoroughly search the sampling station while using their knowledge of quino ecology to maximize the opportunity for detection, including scanning for flying and nectaring quino, and searching hilltops and ridgelines, which may be crucial for population survival (USFWS 2003). Surveyors will spend a minimum of one hour searching a sentinel site.

Initial surveys will occur approximately weekly or more often depending on growing conditions. Once vegetative conditions or larval size indicate that the flight season is imminent, surveys will occur regularly throughout the flight season as the availability of personnel allows. We will conclude surveys when we fail to detect quino in at least two visits to known quino-occupied areas, signaling the end of the flight season.

#### *Adult Quino Surveys*

We will begin adult surveys once the flight season is confirmed at the sentinel sites. Once in the field, the surveyor will selectively sample, from the list of assigned stations, those that they expect are most likely to be occupied by quino based on a brief visual overview of the area and any information on the assigned map. Previous detections in the sampling station and/or host plant locations will be indicated on the map and will also help prioritize the stations to sample. Surveyors will search bare ground, hilltops, ridgelines, gullies, pathways, and other open areas

(e.g., openings embedded in chaparral), focusing on patches of host plants and areas of abundant nectar sources that are more likely to support a population of quino.

Surveyors should spend approximately 45 minutes in each sampling station, less if it is decided that the habitat is not suitable for quino. On the other hand, if a station has an abundance of quino sightings, more time may be needed to cover it thoroughly. The objective is to cover as much territory as possible with the greatest chance of detecting quino in as many sampling stations as possible.

If quino are observed in a certain sampling station during a regular site visit, no further surveys are necessary and a “Q” is written in that station on the provided map to convey to future surveyors that quino were observed. For sites where quino are confirmed during the initial visit, an additional visit may be conducted if time allows and if additional observations in other sampling stations will contribute to our knowledge of the species (e.g., habitat characteristics, distribution in the area or across the whole Conservation Area). Three or more visits may be necessary depending on the size of the survey site (sites with more sampling stations may require more visits), previous survey results, and the relative quality of the habitat.

## Field Procedure

*During all quino surveys, surveyors collect the following information via a paper datasheet:*

1. Visit purpose (check the appropriate box), date, surveyor’s initials.
2. Sampling Station. The unique center-point identification number for the sampling station being surveyed.
3. Core Area where the sampling station is located.
4. Upon arriving and departing the survey location, the following information is recorded:
  - a. *Arrival / Departure time.*
  - b. *Temperature (°C).*
  - c. *Average sustained wind speed (km/h).* As measured over a 1-minute interval.
  - d. *Weather.* Circle one of the following options: clear, partly cloudy, mostly cloudy, or rain.
5. Habitat type. Check the box next to the two most dominant habitat types encountered within the grid using the following definitions (Dudek & Assoc. 2003):
  - a. **Chaparral.** Shrub-dominated vegetation community composed largely of evergreen species that range from 1 to 4 m in height. The most common and widespread species is chamise (*Adenostoma fasciculatum*) and red shank (*Adenostoma sparsifolium*); other common shrub species include manzanita (*Arctostaphylos* spp.), wild-lilac (*Ceanothus* spp.), oak (*Quercus* spp.), redberry (*Rhamnus* spp.), laurel sumac (*Malosma laurina*), mountain-mahogany (*Cercocarpus betuloides*), toyon (*Heteromeles arbutifolia*), and mission manzanita (*Xylococcus bicolor*). Soft-leaved subshrubs are less common in chaparral than in coastal sage scrub.
  - b. **Coastal Sage Scrub.** Dominated by a characteristic suite of low-statured, aromatic, drought-deciduous shrubs and subshrub species, including California sagebrush (*Artemisia californica*), California buckwheat (*Eriogonum fasciculatum*), laurel sumac (*Malosma laurina*), California encelia (*Encelia californica*), and several species of sage (e.g., *Salvia mellifera*, *S. apiana*). It can

be found in diverse vegetation community mosaics with other plant communities, particularly grassland and chaparral.

- c. **Desert Scrub.** Typically composed of shrubs such as big sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), rubber rabbitbrush (*Chrysothamus nauseosus*), yellow rabbitbrush (*C. viscidiflorous*), black bush (*Coleogyne ramosissima*), Mormon tea (*Ephedra viridis*), brittlebush (*Encelia farinosa*), and creosote bush (*Larrea tridentata*).
- d. **Grassland.** Two general types of grasslands occur in Southern California: (1) non-native dominated, primarily annual grassland (“nonnative grassland”); and (2) native dominated, perennial grassland (“valley and foothill grassland”). Valley and foothill grasslands typically contain the perennial bunch grasses *Nassella pulchra* and *Nassella lepida*. Non-native grasslands are likely to be dominated by several species of grasses that have evolved to persist in concert with human agricultural practices: slender oat (*Avena barbata*), wild oat (*A. fatua*), fox tail chess (*Bromus madritensis*), soft chess (*B. hordeaceus*), ripgut grass (*B. diandrus*), barley (*Hordeum* spp.), rye grass (*Lolium multiflorum*), English ryegrass (*L. perrene*), rat-tail fescue (*Vulpia myuros*), and Mediterranean schismus (*Schismus barbatus*).
- e. **Montane Coniferous Forest.** Montane coniferous forest is dominated by Jeffrey pine (*Pinus jeffreyi*), ponderosa pine (*Pinus ponderosa*), Coulter pine (*Pinus coulteri*), lodgepole pine (*Pinus contorta* subsp. *murrayanna*), limber pine (*Pinus flexilis*), bigcone Douglas-fir (*Pseudotsuga macrocarpa*), Pacific madrone (*Arbutus menziesii*), bigleaf maple (*Acer macrophyllum*), Rocky Mountain white fir (*Abies concolor* var. *concolor*), and sugar pine (*Pinus lambertiana*). Common understory shrubs include manzanita (*Arctostaphylos* spp.), and California lilac (*Ceanothus* spp.). The herbaceous layer is composed of morning glory (*Calystegia occidentalis* ssp. *fulcrata*), sedge (*Carex multicaulis*), clarkia (*Clarkia rhomboidea*), and mountain-heather (*Phyllodoce breweri*).
- f. **Playas and Vernal Pools.** Vernal pools are ephemeral wetlands that form in shallow depressions underlain by a substrate near the surface that restricts the downward percolation of water. Vernal pools are dominated by native annual plants, with low to moderate levels of perennial herbaceous cover. Common vernal pool plant species in Western Riverside County include woolly marbles (*Psilocarphus brevissimus*), toad rush (*Juncus bufonius*), and spike rush (*Eleocharis* spp.).
- g. **Riversidean Alluvial Fan Sage Scrub.** A Mediterranean shrubland type that occurs in washes and on gently sloping alluvial fans. Alluvial scrub is made up predominantly of drought deciduous soft-leaved shrubs, but with significant cover of larger perennial species typically found in chaparral. Alluvial scrub is typically composed of scalebroom (*Lepidospartum squamatum*), white sage (*Salvia apiana*), redberry (*Rhamnus crocea*), flat-top buckwheat (*Eriogonum fasciculatum*), our lord’s candle (*Yucca whipplei*), California croton (*Croton californicus*), cholla (*Opuntia* spp.), tarragon (*Artemisia dracuncululus*), yerba santa

(*Eriodictyon* spp.), mule fat (*Baccharis salicifolia*), and mountain mahogany (*Cercocarpus betuloides*).

- h. **Woodland & Forests.** Composed of black oak forest, broad-leaved upland forest, oak woodlands and peninsular juniper woodland vegetation communities. These communities are dominated by Englemann oak (*Quercus englemannii*), coast live oak (*Q. agrifolia*), canyon live oak (*Q. chrysolepis*), interior live oak (*Q. wislizenii*), and black oak (*Q. kelloggii*) in the canopy, which may be continuous to intermittent or savannah-like. Four-needle pinyon (*Pinus quadrifolia*), single-leaf pinyon pine (*Pinus monophylla*) and California juniper (*Juniperus californica*) are the canopy species of peninsular juniper woodland, forming a scattered canopy from 3 to 15 m tall.
6. Attributes. Check the box next to each habitat attribute encountered within the grid.
  7. List up to three of the most dominantly occurring shrub species within the sampling station in the order of their dominance using the 6-letter species code or full latin name.
  8. Host plants.
    - a. Circle the condition observed for each species (green, flowering, or senesced).
    - b. Record the leaf length (cm) of *Plantago* spp.
    - c. Indicate the coverage of each host plant by choosing the number of host plants seen: 1-100, 101-1000, or > 1000.
  9. Nectar plants in bloom. Check the box next to each species observed flowering.
  10. Take notes of any habitat changes or disturbance, other MSHCP covered species observed during the survey, and any photos taken of the habitat.
  11. When quino larvae or adults are observed, record the following information on the datasheet (or the supplemental datasheet when extra space is needed to record quino observation data):
    - a. *Waypoint coordinates.* Any number of quino observed within a 10 m radius (or the approximate distance one can visually track an individual's movement) shall be counted together using one waypoint, providing they display the same behavior.
    - b. *Count.* The number of individuals observed at any recorded waypoint.
    - c. *Age class* (larva or adult).
    - d. *Length* (mm) of larvae.
    - e. *Behavior.* Record the activity or behavior observed: feeding (larvae), crawling (larvae), flying, perching, basking, nectaring, agonistic, ovipositing, mating.
    - f. *Substrate.* The name or 6-letter plant code the individual/s was observed upon.
    - g. *Photo.* JPEG numbers of any photographs taken.
  12. Tallies of quino larvae and adults encountered during the survey.

## Equipment

- Handheld GPS unit with waypoints
- Timepiece
- Map of survey area
- Clipboard with survey datasheets
- Digital camera with zoom lens

- Binoculars
- Extra batteries
- Centimeter ruler
- Kestrel
- Butterfly field guide
- Plant field guide

## **TRAINING**

The Monitoring Program requires biologists to pass the USFWS's quino identification exam before conducting surveys. We provide biologists with a variety of materials to prepare for quino surveys including published butterfly field guides, an in-house study guide with diagnostic information for identifying quino and co-occurring butterflies, a display box with pinned and labelled specimens, photographs taken in the field by Program biologists, and a video of flying adult quino and co-occurring butterflies made by a quino expert. Biologists may also visit the U.C. Riverside Entomology Museum, if possible, which has display boxes of quino specimens including other checkerspot species and species with similar morphology and coloring (e.g. Behr's metalmark, *Apodemia virgulti*).

Surveyors must be able to identify the six plant species currently recognized as host plants: *Plantago erecta*, *P. patagonica*, *Castilleja exserta*, *Antirrhinum coulterianum*, *Collinsia concolor*, and *Cordylanthus rigidus* (USFWS 2003; G. Pratt, *personal communication*). A guide to host plants, prepared by Monitoring Program staff, is available for study as well as a variety of published plant guides.

Inexperienced biologists will accompany experienced quino surveyors for hands-on field training. Experienced surveyors will reinforce information covered by the training materials, including questions related to the survey protocol, and will emphasize plant identification skills.

### **Training Results**

Upon completion of 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, identifying nectar plants in bloom (either in the field or in the office, with assistance if needed from the Quino Survey Lead and other staff), and filing and entering the data from completed datasheets.

## **DATA MANAGEMENT**

Surveyors must complete a number of office tasks after conducting a survey. Immediately after returning from the field, or as soon as possible, they must update tracking spreadsheets ([Common\Projects\Invertebrates\Quino\Data\2022](#)), which allows the Survey Lead to efficiently direct subsequent survey efforts. Paper datasheets must be photographed or scanned and stored to the shared drive ([S:\Projects\Invertebrates\Quino\Datasheets\2022](#)). Digital photos should be uploaded to the shared drive as soon as possible. When possible, the completed paper datasheets must be placed in the file trays located in the office.

Photos taken as data (e.g., species or habitat photos) are stored to one folder ([Common\Projects\Data\\_Photos\Quino\2022](#)) and photos that are not strictly data photos, but

which may have other uses (e.g., general survey area photos, surveyors in the field), are uploaded to another (Common\Projects\Invertebrates\Quino\Photos). All photos should be uploaded as JPEG files and labeled according to our established convention [i.e., date photo was taken (yyyymmdd), observer initials, and JPEG number; for example, “20220324\_ESP\_043.JPG”]. Note that it is critical that the exact number of each photo also appears on the appropriate datasheet.

The Survey Lead reviews survey objectives and ensures datasheets accurately reflect those objectives. The Lead also coordinates with the Data Manager to develop the database forms where data will be entered from the field datasheets. The Data Manager ensures that database forms are updated and ready for data entry.

Data entry follows the standard protocol established by the Monitoring Program. Data are entered into the database using a form created for each project. Because biologists often participate in multiple surveys at any given time, data entry often occurs between other field responsibilities and as office time allows. One person enters data and a second person verifies the entries independently (i.e., quality control). Once completed, the Lead and Data Manager review the entries and correct errors. The Data Manager verifies/validates the data once all errors have been corrected.

## **DATA ANALYSIS**

These data will be used to map surveyed and occupied sampling stations to demonstrate distribution of occupied areas within the Conservation Area.

## **TIMELINE**

- Mid December – mid January: Training
- Late January – early February: Begin monitoring sentinel sites (dates depend upon weather and related phenology of vegetation at sentinel sites)
- Early February – early March: Begin surveys for adult quino within selected survey areas
- Early May – late May: End monitoring at sentinel sites
- Mid May – early June: End adult survey site visits when either desired information at survey area has been obtained or quino are no longer observed at nearby sentinel sites

## **LITERATURE CITED**

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## **DOCUMENT HISTORY**

2018 – The survey design for sentinel sites has changed. Instead of sentinel sites being defined as a single set of coordinates denoting the site’s center and surveying the immediate surrounding hilltops, we will now conduct focused area searches at the sentinel sites using 250 m x 250 m grid squares. The rest of the core area that does not fall in the grid square will be surveyed as an adult quino survey.

2019 – Survey temperature cutoffs have changed from >15.5 °C to >12.0 °C on a clear, sunny day and from > 21 °C to >16 °C on an overcast or cloudy day. Data from the past two years have revealed that quino are active at cooler temperatures than expected.

2021- The satellite occurrence complex Aguanga will be surveyed in 2021, in addition to all the other areas usually surveyed.

2021- Due to the detection of quino larvae seen crawling from one spot to another, crawling has been added to the datasheet to describe quino larvae behavior, in addition to feeding.

2022- Due to Covid-19, the steps taken to process the quino survey datasheets has been modified. Instead of collecting the datasheet(s) on a tray located in the office, Biological Monitoring staff photograph or scan the datasheet(s) at the end of the field day. The datasheet(s) are then stored on the shared drive.