State of California
Natural Resources Agency
Department of Fish and Wildlife

REPORT TO THE FISH AND GAME COMMISSION

EVALUATION OF A PETITION FROM THE CENTER FOR BIOLOGICAL DIVERSITY AND ENDANGERED HABITATS LEAGUE TO LIST THE QUINO CHECKERSPOT BUTTERFLY (*Euphydryas editha quino*) AS ENDANGERED UNDER THE CALIFORNIA ENDANGERED SPECIES ACT

Quino Checkerspot Butterfly (*Euphydryas editha quino*) (Photo by USFWS)

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EXECUTIVE SUMMARY

The Center for Biological Diversity and Endangered Habitats League (Petitioners) submitted a petition (Petition) to the Fish and Game Commission (Commission) to list the Quino Checkerspot Butterfly (*Euphydryas editha quino*) as endangered under the California Endangered Species Act (CESA).

The Commission referred the Petition to the Department of Fish and Wildlife (Department) in accordance with Fish and Game Code Section 2073 (Cal. Reg. Notice Register 2020, No. 30-Z, p. 1073). Pursuant to Fish and Game Code section 2073.5 and California Code of Regulations, title 14, section 670.1, the Department prepared this evaluation report (Petition Evaluation) of the Petition. The purpose of the Petition Evaluation is to assess the scientific information discussed and cited in the Petition in relation to other relevant and available scientific information possessed or received by the Department during the evaluation period and to recommend to the Commission whether the scientific information in the Petition is sufficient under the criteria prescribed by CESA to accept and consider the Petition to list the Quino Checkerspot Butterfly as endangered.

After reviewing the Petition and other relevant information, the Department determined the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. Specifically, the Department determined:

- *Population Trend*. The information in the Petition is sufficient to indicate the Quino Checkerspot Butterfly population in California has declined substantially from historical levels and has not seen significant upward or stable population trends since the species was federally listed in 1997.

- *Range and Distribution*. Information in the Petition and otherwise available to the Department indicates the geographic range and distribution of the Quino Checkerspot Butterfly in California has substantially contracted over time.

- *Abundance*. The Petition provides sufficient information to indicate substantial reductions in Quino Checkerspot Butterfly abundance have occurred within their range, and that the abundance has remained low since the species was federally listed in 1997.

- *Life History*. The Petition provides sufficient information on the life history of the Quino Checkerspot Butterfly.

- *Kind of Habitat Necessary for Survival*. The Petition presents sufficient information on Quino Checkerspot Butterfly habitat requirements.

- *Factors Affecting the Ability to Survive and Reproduce*. The Petition presents a list of the factors that affect Quino Checkerspot Butterfly populations, including urban sprawl/development, habitat fragmentation, construction of the border wall, Cannabis cultivation, grazing, recreation, pollution, invasive species, and climate change, including increased drought and fire frequency, and inadequacy of existing regulatory mechanisms.

- *Degree and Immediacy of Threat*. The Petition describes the degree and immediacy of threats to the continued existence of Quino Checkerspot Butterfly in California.

- *Impact of Existing Management Efforts*. The Petition describes numerous federal, state, and local planning and conservation efforts that are alleged to fall short of protecting Quino Checkerspot Butterfly across their range in California, particularly in Riverside and San Diego counties. The Petition provided sufficient information on the land management practices for the species' range.

- *Suggestions for Future Management*. The Petition includes research, management actions, and protective measures that would benefit Quino Checkerspot Butterfly populations.

- *Availability and Sources of Information*. Numerous scientific references were cited in the Petition.

- *A Detailed Distribution Map*. The Petition provides a distribution map for Quino Checkerspot Butterfly in California.

In completing its Petition Evaluation, the Department has determined the Petition provides sufficient scientific information to indicate that the petitioned action to list the Quino Checkerspot Butterfly as endangered may be warranted. Therefore, the Department recommends the Commission accept the Petition for further consideration under CESA.

INTRODUCTION

Candidacy Evaluation

The Commission has the authority to list certain “species” or “subspecies” as threatened or endangered under CESA. (Fish & G. Code, §§ 2062, 2067, 2070.) The listing process is the same for species and subspecies. (Fish & G. Code, §§ 2070-2079.1.)

CESA sets forth a two-step process for listing a species as threatened or endangered. First, the Commission determines whether to designate a species as a candidate for listing by evaluating whether the petition provides “sufficient information to indicate that the petitioned action may be warranted.” (Fish & G. Code, § 2074.2, subd. (e)(2).) If the petition is accepted for consideration, the second step requires the Department to produce, within 12 months of the Commission’s acceptance of the petition, a peer reviewed report based upon the best scientific information available that indicates whether the petitioned action is warranted. (Fish & G. Code, § 2074.6.) Finally, the Commission, based on that report and other information in the administrative record, determines whether the petitioned action to list the species as threatened or endangered is warranted. (Fish & G. Code, § 2075.5.)

A petition to list a species under CESA must include “information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and any other factors that the petitioner deems relevant.” (Fish & G. Code, § 2072.3; see also Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1).) The range of a species for the Department’s petition evaluation and recommendation is the species’ California range. (*Cal. Forestry Assn. v. Cal. Fish and Game Com.* (2007) 156 Cal.App.4th 1535, 1551.)

Within 10 days of receipt of a petition, the Commission must refer the petition to the Department for evaluation. (Fish & G. Code, § 2073.) The Commission must also publish notice of receipt of the petition in the California Regulatory Notice Register. (Fish & G. Code, § 2073.3.) Within 90 days of receipt of the petition (or 120 days if the Commission grants an extension), the Department must evaluate the petition on its face and in relation to other relevant information and submit to the Commission a written evaluation report with one of the following recommendations:

- Based upon the information contained in the petition, there is not sufficient information to indicate that the petitioned action may be warranted, and the petition should be rejected; or
- Based upon the information contained in the petition, there is sufficient information to indicate that the petitioned action may be warranted, and the petition should be accepted and considered.

(Fish & G. Code, § 2073.5, subds. (a)-(b).) The Department's candidacy recommendation to the Commission is based on an evaluation of whether the petition provides sufficient scientific information relevant to the petition components set forth in Fish and Game Code Section 2072.3 and the California Code of Regulations, Title 14, Section 670.1, subdivision (d)(1).

In *Center for Biological Diversity v. California Fish and Game Commission* (2008) 166 Cal.App.4th 597, the California Court of Appeals addressed the parameters of the Commission's determination of whether a petitioned action should be accepted for consideration pursuant to Fish and Game Code Section 2074.2, subdivision (e), resulting in the species being listed as a candidate species. The court began its discussion by describing the standard for accepting a petition for consideration previously set forth in *Natural Resources Defense Council v. California Fish and Game Commission* (1994) 28 Cal.App.4th 1104:

> As we explained in *Natural Resources Defense Council*, "the term 'sufficient information' in section 2074.2 means that amount of information, when considered with the Department's written report and the comments received, that would lead a reasonable person to conclude the petitioned action may be warranted." The phrase "may be warranted" "is appropriately characterized as a 'substantial possibility that listing could occur.'" "Substantial possibility," in turn, means something more than the one-sided "reasonable possibility" test for an environmental impact report but does not require that listing be more likely than not.

(*Center for Biological Diversity*, *supra*, 166 Cal.App.4th at pp. 609-10 [internal citations omitted].) The court acknowledged that "the Commission is the finder of fact in the first instance in evaluating the information in the record." (*Id.* at p. 611.) However, the court clarified:

> [T]he standard, at this threshold in the listing process, requires only that a substantial possibility of listing could be found by an objective, reasonable person. The Commission is not free to choose between conflicting inferences on subordinate issues and thereafter rely upon those choices in assessing how a reasonable person would view the listing decision. Its decision turns not on rationally based doubt about listing, but on the absence of any substantial possibility that the species could be listed after the requisite review of the status of the species by the Department under [Fish and Game Code] section 2074.6. (*Ibid*.)

CESA defines the "species" eligible for listing to include "species or subspecies" (Fish and G. Code, §§ 2062, 2067, and 2068), and courts have held that the term "species or subspecies" includes "evolutionarily significant units." (*Central Coast Forest Assn. v. Fish & Game Com.* (2018) 18 Cal.App.5th 1191, 1236, *citing Cal. Forestry Assn.*, *supra*, 156 Cal.App.4th at pp. 1542 and 1549.)

Quino Checkerspot Butterfly Taxonomy

As noted in the Petition, the Quino Checkerspot Butterfly (referred to hereafter as "Quino") is one of 26 subspecies of Edith's checkerspot butterfly (*Euphydryas editha*). The Quino is a member of the family Nymphalidae, the subfamily Nymphalinae, and tribe Melitaeinae.

Petition History

The Quino was listed as Endangered under the federal Endangered Species Act (ESA) in 1997.

On June 29, 2020, the Commission received a Petition from the Center for Biological Diversity and Endangered Habitats League to list the Quino as Endangered under CESA. On July 8, 2020, the Commission referred the Petition to the Department for evaluation. At its meeting on August 20, 2020, the Commission officially received the Petition and granted the Department's request for a 30-day extension of the period to review the Petition and prepare this Petition Evaluation.

The Department evaluated the scientific information presented in the Petition as well as other relevant information the Department possessed at the time of review. Pursuant to Fish and Game Code Section 2072.3 and Section 670.1, subdivision (d)(1), of Title 14 of the California Code of Regulations, the Department evaluated whether the Petition included sufficient scientific information regarding each of the following petition components to indicate that the petitioned action may be warranted:

- Population trend;
- Range;
- Distribution;
- Abundance;
- Life history;
- Kind of habitat necessary for survival;
- Factors affecting the ability to survive and reproduce;
- Degree and immediacy of threat;
- Impact of existing management efforts;
- Suggestions for future management;
- Availability and sources of information; and
- A detailed distribution map.

Overview of Quino Checkerspot Ecology

An adult Quino is a medium-sized butterfly with a wingspan of approximately 4 centimeters (1.5 inches). The top sides of its wings have a red, black, and cream checkered pattern, and the bottom a red and cream checkered pattern (USFWS 2003). The adult abdomen has red stripes across the top (USFWS 2003). Larvae hatch with a yellow coloration. After the first molt they change to gray with black markings, and after the second molt they take on dark black coloration with eight to nine orange tubercles. Pupae are mottled black on a gray background (USFWS 2003).

The Quino's historical range included much of non-montane southern California, including Los Angeles, San Diego, western Riverside, southwestern Ventura, and southwestern San Bernardino counties, as well as northern Baja California in Mexico. Figure 1 (USFWS 2003) shows Quino occurrences prior to 1990, and from 1990 through the mid- to late-1990s. Figure 2 includes more recent data, drawn from CNDDB and USFWS data, and provides an updated illustration of the Quino's historic and current range. Quino occurrence data in northern Baja California are not shown in Figure 2. Of note, the data shown in Figure 2 (Figure 3 in the Petition) represents variable sized polygons of CNDDB records. The polygons represent the level of certainty of CNDDB records, with larger polygons reflecting less certainty and smaller polygons reflecting greater certainty of observations. The size of the polygons does not equate to population size.

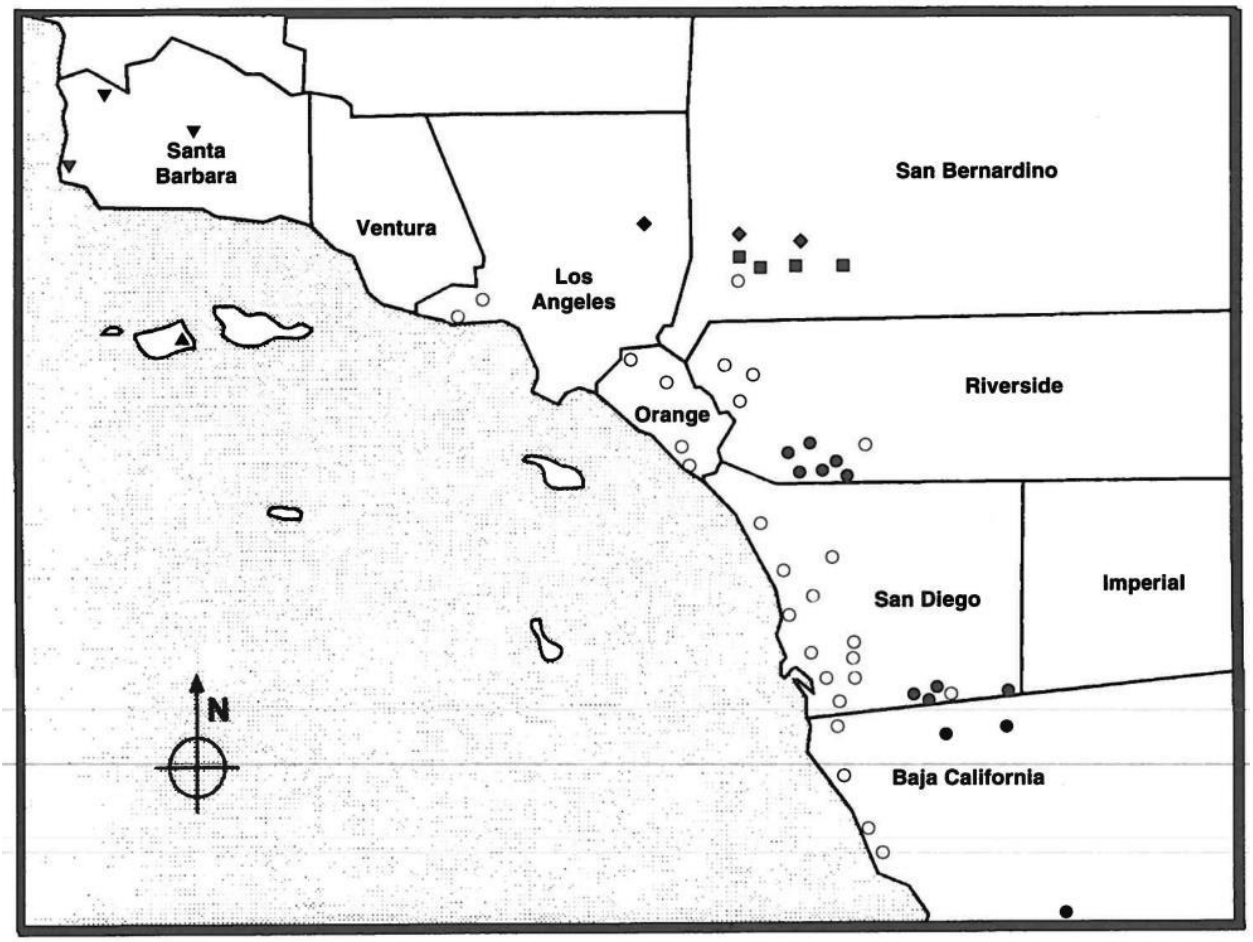

Fig. 1. Historic and current distribution of Quino checkerspot butterfly in southern California and Baja California, showing distribution of nearby subspecies of *Euphydryas editha*. Legend: ○ *quino* pre-1990, ● *quino* post-1990. ▲ *insularis*. ■ *augustina*. ◆ new subspecies. ▼ *editha*.

Figure 1. Distribution of Quino checkerspot butterfly in southern California (Santa Barbara to San Diego counties) and Baja California, denoting data points prior to 1990, and from 1990 through the mid- to late-1990s. This figure appears in Mattoni et al. (1997) and is reprinted in the Petition as Fig. 4.

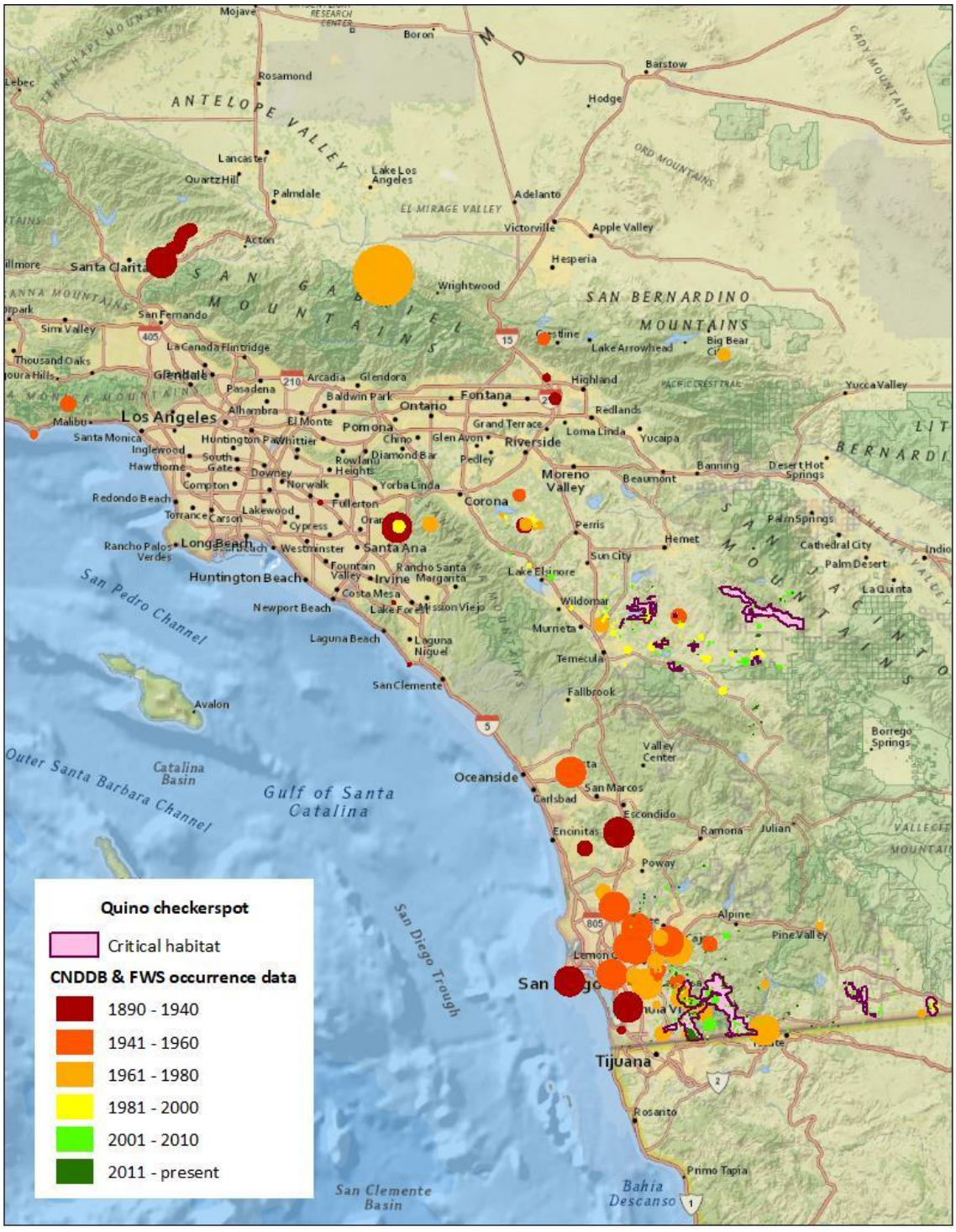

Figure 2. Historic and current occurrences of the Quino checkerspot butterfly from 1890 to present with current critical habitat. Data obtained from USFWS and the California Natural Diversity Database (CNDDB). The data for CNDDB records is presented as variable sized polygons. Larger circles equate to less certainty about the accuracy of an observation, not a larger population of Quino. This is Fig. 3 in the Petition.

The Quino is found up to 5,000 feet in elevation in grasslands, open chaparral, and coastal shrublands with sparse vegetation surrounded by bare patches (Mattoni et al. 1997; USFWS 1997; USFWS 2003). Its habitat is best characterized by the presence of larval host plants, nectar resources, microtopography, cryptobiotic crust made up of blue-green algae, lichens, mosses, fungi, and bacteria, and the presence of episodic disturbances (Mattoni et al. 1997). For nectar, Quino adults prefer flowers with landing platforms and short corollas less than 0.43 inches (USFWS 2009). Adult Quino have been documented to visit species in the following genera: *Cryptantha, Eriodictyon, Gilia, Lasthenia, Lomatium, Muilla,* and *Plagiobothrys* (Preston et al. 2012).

Quino may utilize different host plants in different proportions depending on microhabitat, annual climate conditions and soil type (Mattoni et al. 1997). Documented host plants include dwarf plantain (*Plantago erecta*), woolly plantain (*Plantago patagonica*), Coulter's snapdragon (*Antirrhinum coulterianum*) (USFWS 2009; Preston et al. 2012 p. 281), and possibly Nuttall's snapdragon (*Antirrhinum nuttallianum*) and Chinese houses (*Collinsia concolor*), at higher elevations where the plant is small (Pratt & Pierce 2010; Parmesan et al. 2015 p. 9). Owl's clover (*Castilleja exserta*) and stiff branch bird's beak (*Cordylandthus rigidus*) are possible secondary host plants if the primary host plants are not available or senesce before larval maturity (USFWS 2009).

A Quino's lifecycle includes four main stages: egg, larva, pupa, and winged adult butterfly. Research into the bay checkerspot butterfly (*Euphydryas editha bayensis*), a conspecific with a lifecycle presumably similar to the Quino, reveals that the butterflies spend most of their time (~80%) as a caterpillar (the larva stage), with the remaining time more evenly split between the adult, pupa, and egg stages (White 1986). Female Quino lay egg masses with an average of 120-180 eggs per mass, and a total of 400-800 eggs in a lifetime. The number of egg masses laid depends on the amount of nectar the female feeds on (Mattoni et al. 1997). The larvae hatch and undergo multiple molts, divided into five to seven growth stages, which are called instars. Due to the Mediterranean climate, Quino host plants often dry up in late-Spring before larvae can complete their full five to seven stage development. Larvae that survive up to this point in late-Spring enter diapause (e.g. suspended development) for the summer and fall. Quino larvae diapause in soil, leaf litter, under rocks, and potentially in native bunch grasses or shrub covered areas (Osborne & Redak 2000). Surviving larvae come out of diapause after the winter rains the following year and seek microclimates with low shade, bare ground, low grass and shrub cover, and presence of host plants (Osborne & Redak 2000). If food resources again become sparse, Quino larvae can reenter diapause. Over the course of the entire larva stage, in which Quino spend a majority of their life, Quino require heterogeneous habitat (e.g. sunny southern facing slopes, shaded areas, open areas with food resources, large vegetation) to promote larval growth and diapause. After diapause, Quino pupate under plants or rocks after several

instar stages (Mattoni et al. 1997). Adult butterflies emerge after approximately 10 days of pupation and live up to two weeks (Mattoni et al. 1997; USFWS 2002). Emergence is staggered, resulting in a four to six-week flight period for the species beginning between late February and early May, depending on weather conditions.

After adult Quino emerge, females seek nectar plants for feeding, then mate and lay eggs. In abundant populations, males fly out to search for females that wait on the ground or on low lying host plants. In more sparse populations with less resources, males perch on and defend high points (i.e. “hill topping”) and females move to find mates (Mattoni et al. 1997). After mating, males insert a plug into the female to prevent additional copulating and to ensure paternity (Mattoni et al. 1997).

Quino exist in a network of metapopulations, specifically as core and satellite metapopulations consisting of an interdependent network of populations on patches of suitable habitat that are geographically separated from each other by unsuitable habitat (USFWS 2009; Osborne & Ballmer 2019). Quino populations undergo colonization and extirpation between habitat patches, and the survival of each subpopulation is dependent on habitat resources and the movement of individuals between patches (Hanski & Gyllenberg 1993; USFWS 2002). Within a habitat patch, adult Quino have been found to move up to 200 meters (656 feet) between host plants and nectar sources and they generally avoid flying over objects taller than seven to eight feet (USFWS 2009; Greenwald et al. 2017; Peters et al. 2018). Adult dispersal varies between very little to high depending on available host plants, nectar resources and population size. Rainfall from the prior year impacts the density of post-diapause larvae and the availability of host plants, and current year rainfall impacts availability of host and nectar plants and thus adult movement (Murphy & White 1984). Adults exhibit greater dispersal behavior in warm and dry years when host plants dry up earlier (Murphy & White 1984; Osborne & Ballmer 2019). Greater dispersal can also occur during wet years due to high adult abundances, competition for oviposition sites, and host plant consumption by post-diapause larvae (Murphy & White 1984).

SUFFICIENCY OF SCIENTIFIC INFORMATION TO INDICATE THE PETITIONED ACTION FOR QUINO CHECKERSPOT BUTTERFLY MAY BE WARRANTED

The Petition components are evaluated below, pursuant to Fish and Game Code Section 2072.3 and Section 670.1, subdivision (d)(1), of Title 14 of the California Code of Regulations.

Population Trend

Scientific Information in the Petition

The Petition primarily addresses Quino population dynamics and trend in the metapopulation context in the section titled “Population Trend, Distribution, and Abundance” on pages 9 to 18 of the petition.

As noted above, Quino populations exist as core-satellite metapopulations—an interdependent network of populations on patches of suitable habitat that are geographically separated from each other by unsuitable habitat (USFWS 2009; Osborne & Ballmer 2019). As such, survival of each subpopulation is dependent on habitat resources and movement of individuals between patches (Hanski & Gyllenberg 1993; USFWS 2002). Core patches are thought to be source populations for other patches of suitable habitat (Murphy and White 1984; Mattoni et al. 1995).

Because of the ephemeral nature of Quino and due to changes in occupancy from year to year, population trends were described in the Petition by presenting long-term monitoring data of Quino subpopulations, part of the larger metapopulation. The Petition states, “Any snapshot of abundance is not a useful metric for Quino population occurrence, as the species can experience an order of magnitude change in abundance every 5-20 years, depending on rainfall and temperatures.” Given variable annual occupancy rates, the short life span of the adults, and the difficulty detecting larval and pupal life stages, population trends for Quino are better presented generally in terms of the metapopulation system. For this reason, Quino occupancy is defined in the Petition using population-scale occupancy (i.e. “occurrence complexes” or “areas used by adults during the persistence time of a population (years to decades))” (USFWS 2003; USFWS 2009).

The Petition describes Quino core populations, as defined by USFWS (USFWS 2009), having substantially decreased over time. Prior to 1990, Quino was found at approximately 40 sites across Los Angeles, San Bernardino, Riverside, Orange, and San Diego Counties in California and in northern Baja California, Mexico (Mattoni et al. 1997; see Figure 1 above). By the 1980s, over 75% of its historical range and up to 95% of its coastal bluff and mesa habitat had been destroyed by urban development, agriculture, grazing, and non-native, invasive species (Mattoni et al. 1997). The destruction of important habitat areas and core population sites for the species is thought to have led to severe population declines. In the federal action to list the species under the ESA in 1997, the decline was so severe that it was thought the species may be extinct. That same year, however, an extant population was found (USFWS 2009). By then Quino had been completely lost from Los Angeles, Orange, and San Bernardino counties, equating to an estimated 67.5% decrease in the

population (Mattoni et al. 1997). As noted by the USFWS, since federal listing Quino have only been found in approximately 15 sites (within six core occurrence complexes) in Riverside and San Diego counties (USFWS 1997; USFWS 2003, USFWS 2009). Across these two counties, densities varied among occurrence complexes, with the core "Otay occurrence complex" recognized as "an area of key landscape connectivity for all subpopulations in southwest San Diego County" (USFWS 2009).

By 2012 Quino were clustered in the foothills of southwestern Riverside County and southern San Diego County (Preston et al. 2012). The 2019 Draft Recovery Plan Amendment (USFWS 2019) lists known sites, their status, date last observed, location in Recovery Units, and current threats. Stable populations are sparsely distributed today (see Figure 3 and 4 below), potentially triggering metapopulation collapse and extinction (Preston et al. 2012). Together, the information presented in the Petition regarding habitat and occurrence complex loss over time demonstrates the downward population trend for Quino.

Conclusion

The Petition presented sufficient information to indicate the Quino population in California has declined substantially from historical levels and has not seen significant upward or stable population trends since it was listed as endangered under the federal ESA in 1997.

Geographic Range and Distribution

Scientific Information in the Petition

The Petition discusses geographic range and distribution of Quino on pages 9 to 18 within the section titled "Population Trend, Distribution, and Abundance".

As noted above, the Petition accounts for a large decrease in Quino sites and occurrence complexes across California. Historically, Quino may have more or less been continuously distributed across southern California from Point Dume to Ensenada and inland up to 60 miles (Murphy and White 1984, Mattoni et al. 1997). However, the Petition states that it has since been extirpated in Los Angeles, Orange, and San Bernardino Counties (see Figures 1 and 2 above). As noted recently by the USFWS (2019) Quino has been eliminated from over half of its historical range in Southern California and has only been observed in about 53% of identified extant sites in Riverside and San Diego counties since 2010. The distribution and distance between remaining populations today likely inhibits dispersal, a factor further inhibited by the fragmented landscape in southern California (Strahm 2018).

Other Relevant Scientific Information

The Petition used USFWS and CNDDB data to create Figure 2 above. Using data obtained from USFWS, CNDDB records, historical collection data from the California Academy of Sciences, and data from several reports generated from Department Scientific Collecting Permits (SCP), the Department developed Figure 3 and Figure 4 to represent a more thorough distribution map. These maps show similar representation of a reduced distribution in California, with most known occurrences in Riverside and San Diego counties.

There are four data records from the Cal Academy that were not included in the Petition, two in the Bakersfield area from 1927 and one from 1974, and one from the southeastern portion of San Bernardino County from 1979. Lastly, there were additional records in the southern portion of San Diego County, generated from Department SCP reports (Huffman Environmental 2019a; Huffman Environmental 2019b; Huffman Environmental 2019c).

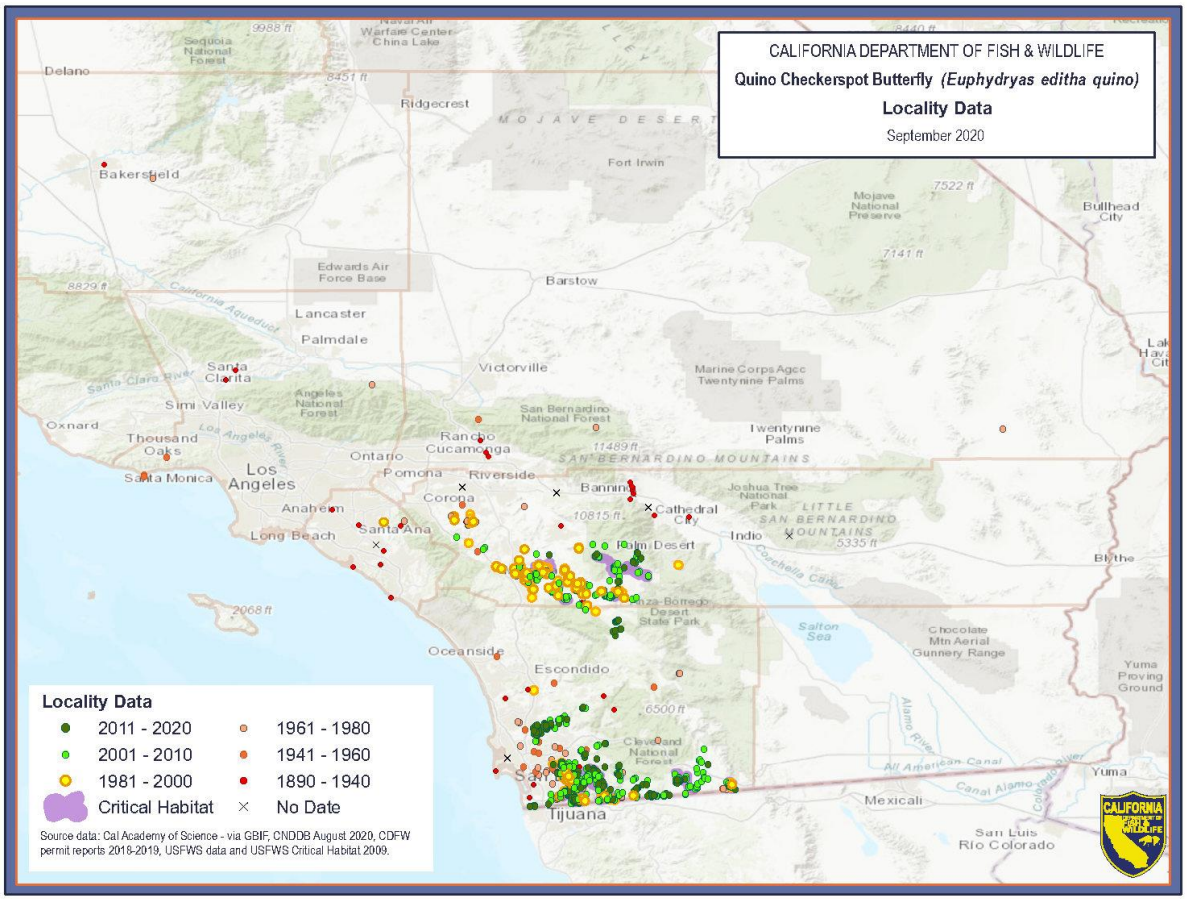

Figure 3. Map showing critical habitat designation (purple) and historic and current Quino Checkerspot Butterfly distribution based on occurrence data in San Diego, Riverside, Orange, San Bernardino, and Los Angeles Counties. Several points are shown in Kern County as well. Data used was from CNDDB, California Academy of Sciences, USFWS and Department permit reports.

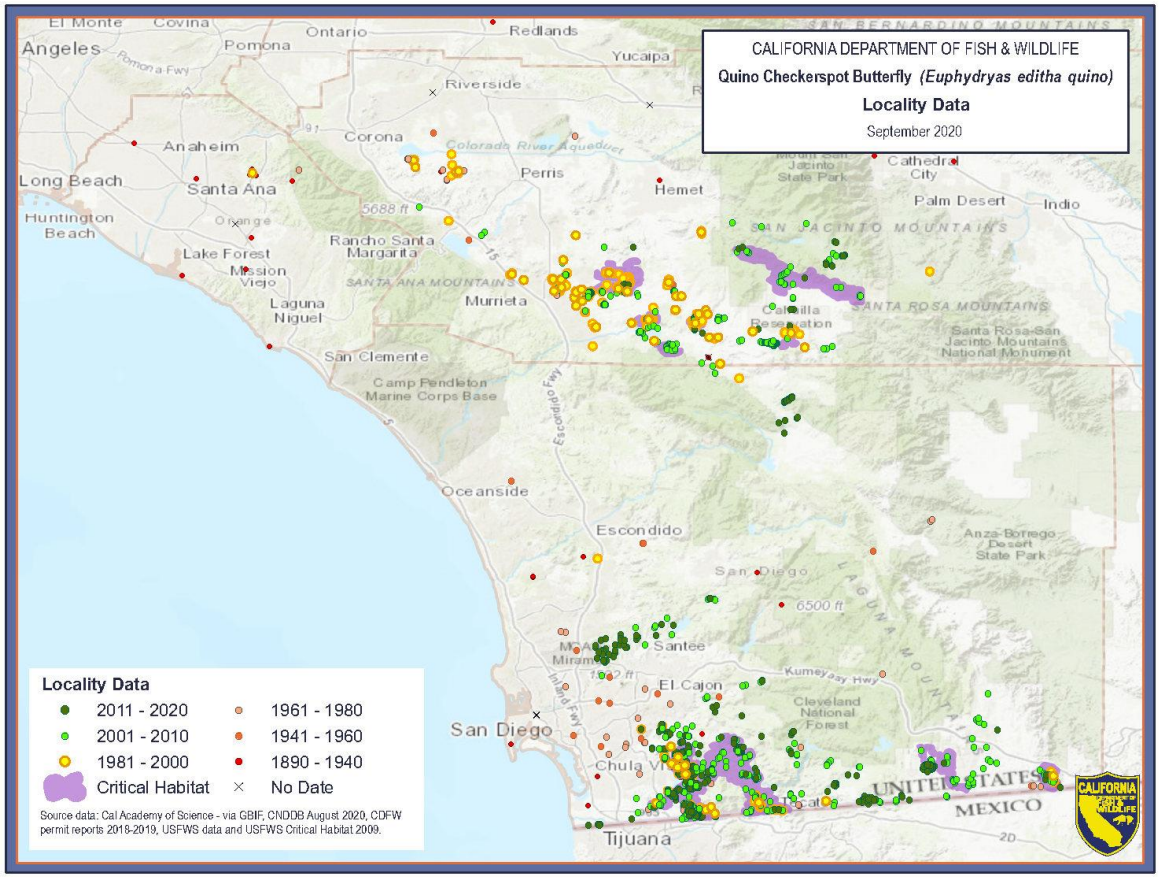

Figure 4. Map showing Quino Checkerspot Butterfly critical habitat designation (purple) and historic and current distribution based on occurrence data in San Diego, Riverside, and Orange Counties. Data used was from CNDDB, California Academy of Sciences, USFWS and Department permit reports.

Conclusion

Information available to the Department indicates that the Quino range has contracted substantially since it was first documented in the early 1900s. The Petition, along with other information the Department had, provides sufficient information to indicate a reduction in its distribution within the range has occurred.

Abundance

Scientific Information in the Petition

The Petition primarily discusses the abundance of Quino in the metapopulation context. This discussion is on pages 9 to 18 under the heading “Population Trend, Distribution, and Abundance.”

As discussed previously, Quino can have annual fluctuations in abundance over time depending on rainfall and temperatures, therefore abundance calculations based on a point in time are not very representative for this species (USFWS 2009; Preston et al. 2012; Strahm 2018). Monitoring data would have to have a multi-year component to appropriately capture ebbs and flows of abundance estimates and distribution, a component not regularly occurring for Quino to date (USFWS 2009). Even so, regular monitoring efforts using protocol-level surveys would likely fall short of detecting Quino given the propensity of larval stages entering and re-entering diapause over the course of multiple season (Osborne & Ballmer 2019). For these reasons, abundance estimates in terms of the specific number of the species are unfeasible for Quino and are not presented in the Petition.

Instead, the Petition presents abundance in the terms of metapopulations, loss of habitat, and loss of occurrence complexes. The Petition infers a reduction in Quino abundance over time by assessing extirpation and occupancy rates of known sites, and tracking “new” sites that have been colonized or found.

Historically, Quino were noted to occur in large numbers within their historic range (Murphy & White 1984). By the mid-1990s metapopulations in Los Angeles, Orange and San Bernardino counties were lost due to core habitat patch destruction (Mattoni et al. 1995; Hanski et al. 1996), which in turn create a “ripple effect of irreversible long-term extinctions” (Murphy & White 1984). As noted previously, numbers and range decreased so drastically that the species was thought to be extinct until a few surviving populations were found in 1997. Though additional sites have been found since the federal listing (Preston et al. 2012, USFWS 2019), few large core populations exist today that can act as source populations to other habitat patches, and this problem is exacerbated by dispersal barriers in the extremely fragmented landscape (Strahm 2018). Years with high population numbers now appear less frequently than in the past (Strahm 2018).

Other Relevant Scientific Information

The Department had four additional reports associated with Scientific Collecting Permits. One report summarized 2019 survey findings for a site in Potrero, San Diego. This site lies just north the U.S. border with Mexico. A total of 122 Quino adults were observed, of which eight individuals were recorded on hilltops adjacent to the survey area, and the rest were observed within the survey boundaries. A second report summarized 2018 and 2019 Quino survey results at a site in San Diego, California. A total of four Quino adults were observed in 2018, and approximately 35 in 2019. The third report summarized 2019 survey results at a site in southern San Diego County, north of Campo, California. A total of 165 Quino adults were detected within the survey

areas. Regarding these additional data, one cannot assume an increase in the overall abundance due to the multitude of factors affecting Quino numbers from year to year (e.g. rainfall and temperature). A true estimate of abundance would only be possible by knowing how many diapause larvae are present, something impractical to achieve for this species. Even with these additional detections, abundance numbers are far below historical levels.

Conclusion

The Petition provides sufficient information to indicate substantial reductions in Quino abundance have occurred in large areas of their range. Additionally, the Petition demonstrates that abundance of Quino, as estimated based on surveys for adults, has remained low since the species was federally listed in 1997.

Life History

Scientific Information in the Petition

The Petition discusses the life history of the Quino on pages 3 to 9.

The Petition provides an overview of the species' taxonomy, physical description, life cycle and behavior, larval diapause, adult dispersal, and metapopulation dynamics within California.

Conclusion

The Petition provides sufficient information on the life history of the Quino.

Kind of Habitat Necessary for Survival

Scientific Information in the Petition

The Petition discusses Quino habitat requirements on pages 4 to 6.

The Petition states the required elements of Quino habitat are:

- presence of larval host plants: dwarf plantain, woolly plantain, Coulter's snapdragon, Nuttall's snapdragon, Chinese houses, owl's clover, stiff branch bird's beak (UFWS 2009b; Pratt & Pierce 2010; Preston et al. 2012; Parmesan et al. 2015)
- nectar resources: *Cryptantha, Eriodictyon, Gilia, Lasthenia, Lomatium, Muilla,* and *Plagiobothrys* (Preston et al. 2012)
- microtopography: low shade, bare ground, low grass and shrub cover, and presence of *P. erecta* (Osborne & Redak 2000)

- cryptobiotic crust: soil crusts formed by blue-green algae, lichens, mosses, fungi, and bacteria (Mattoni et al. 1997)
- episodic disturbances: mosaic of fire climax communities (Mattoni et al. 1997)

The Petition restates the elements of Quino habitat as defined by the USFWS (2002) as:

- grassland and open-canopy woody plant communities, such as coastal sage scrub, open red shank chaparral, and open juniper woodland, with host plants or nectar plants
- undeveloped areas containing grassland or open-canopy woody plant communities, within and between habitat patches, utilized for Quino checkerspot butterfly mating, basking, and movement
- prominent topographic features, such as hills and/or ridges, with an open woody or herbaceous canopy at the top determined relative to other local topographic features.

Conclusion

The Petition presents sufficient information on the habitat requirements of the Quino.

Factors Affecting the Ability to Survive and Reproduce

Scientific Information in the Petition

The Petition discusses factors affecting the ability of Quino to survive and reproduce on pages 18 to 36.

The Petition identifies several threats to the Quino, which include urban sprawl/development, habitat fragmentation, the U.S. southern border wall, Cannabis cultivation, grazing, recreation, pollution, invasive species, and climate change, including increased drought and fire frequency, as well as the inadequacy of existing regulatory mechanisms (USFWS 2009). These factors work through various pathways to cause habitat loss/degradation/fragmentation, direct and indirect mortality of diapausing larvae, pupae, and adults, diminished connectivity between habitat patches, inhibition of reproduction, loss of genetic diversity, and extinction of core and satellite habitat patches. This may be manifested by altered microclimates, reduction of host and nectar plants, increase in invasive plant species within habitat patches, introduction of pesticides/fertilizers, reduced water availability, disturbance by human presence, soil erosion and compaction.

The Petition details numerous concerns surrounding urban and landscape-level planning projects (past and current) within Riverside and San Diego counties, and how these have or will impact Quino habitat patches within each county. According to the Petition and the project planning documentation provided, many of the important core habitat patches that act as source populations are at risk of habitat loss or degradation. The Petition also presents information on the overutilization of Quino directly from illegal insect collection, and indirectly when those collectors trample, compact, and destroy eggs, larvae, pupae and the sensitive soils.

Lastly, the Petition lists “Other Natural or Manmade Factors Affecting its Continued Existence”, including climate change, increased fire frequency, and phenological mismatch. Other checkerspot species are able to shift habitat to higher elevations/latitudes in response to climate change. For Quino, their ability to migrate in response to climate change is hampered due to their limited range and due to the highly fragmented habitat they exist in today. (Parmesan et al. 2015). Another impact of climate change is increased fire frequency due to drying conditions (Williams et al. 2019), and due to intentional or unintentional fire ignition caused by humans (Keeley et al. 1999; Keeley & Fotheringham 2003; Syphard et al. 2007, 2012, 2019; Bistinas et al. 2013; Balch et al. 2017; Keeley & Syphard 2018; Radeloff et al. 2018). This results in direct mortality, loss of habitat, and habitat degradation. Shifts in rainfall and temperature can also lead to asynchronous diapause with host plant growth, and premature host plant senescence reducing the amount of eggs laid by adults and larval starvation (Parmesan et al. 2015; Osborne and Ballmer 2019).

Other Relevant Scientific Information

The Petition did not fully expand on the threat of urban edges to Quino habitat. Commercial and residential development can often lead to ‘edge effects’ and further reduce habitat value cause by fragmentation. One example of edge effect is the expansion of Argentine ants into preserve habitat from adjacent urban areas. Though it is uncertain if these ants will take Quino larva, the available evidence suggests that Quino are not persisting at urban edges (Eric Porter, USFWS, pers comm. 2020).

Conclusion

The Petition provides sufficient information regarding the factors affecting the ability of Quino to survive and reproduce. These factors include urban sprawl/development, habitat fragmentation/destruction, pollution, invasive species, and increased drought and fire frequency, and the inadequacy of existing regulatory mechanisms.

Degree and Immediacy of Threat

Scientific Information in the Petition

The Petition discusses “Degree and Immediacy of Threat” pages 47 to 48.

The Petition demonstrates the immediacy of threats concisely by stating, “Despite being protected as endangered by the federal ESA for 23 years, the Quino checkerspot butterfly is at greater risk of extinction today due to continued habitat loss, habitat fragmentation, climate change, invasive species, and lack of enforced protections . . . The Quino checkerspot butterfly has been eliminated from over half of its historical range in Southern California, and Quino have only been observed in ~53% of identified extant sites in Riverside (12/28) and San Diego (21/34) Counties since 2010 (USFWS 2019). Continued land-use planning that allows for development within core critical habitat and the lack of adequate management continues to push this butterfly to the brink of extinction. Without state protections, California could lose Quino checkerspot butterflies permanently.” This statement is supported by numerous literature and reports stating the dire situation for the Quino if more protections are not enacted quickly, as well as multiple examples of presumed regulatory and landscape planning short-falls leading to further impacts to the species and its habitat.

Conclusion

The Petition provides sufficient information on the degree and immediacy of threats affecting the Quino.

Impact of Existing Management Efforts

Scientific Information in the Petition

The Petition discusses the impact of existing management efforts on Quino populations on pages 37 to 47 in the section titled, “The Inadequacy of Existing Regulatory Mechanisms and Impact of Existing Management Efforts.”

The Petition describes existing management efforts and the inadequacy of these efforts to conserve and restore Quino populations. As a federally listed species, Quino is protected by the ESA. The Petition identifies two management factors that have contributed to the loss of protections for Quino: 1) the lack of progress on recovery actions (e.g. conservation of habitat, propagation and reintroduction), and 2) amendments to the species’ critical habitat designation. Regarding critical habitat, the Petition describes events surrounding revision to this designation for Quino. In 2002 USFWS designated 97,030 acres (39,260 ha) in Riverside County and 74,575 acres (30,180 ha) in San Diego County, a designation that would “provide room for

metapopulation dynamics, which is considered essential for the conservation of the species, including dispersal corridors" (USFWS 2002). After a lawsuit, critical habitat was revised and reduced to 62,125 acres (a 63.8% reduction) in nine units based on economic, national security, and "other relevant impacts" (USFWS 2009).

Regarding recovery objectives, the Petition states that over the course of federal recovery planning for Quino, the number of recovery objectives has increased rather than decreased, showing a lack of progress. The Petition alleges that threats to the species have magnified rather than improved over time. Specifically, two main points are noted as shortfalls regarding progress towards recovery:

- Occurrence complexes, critical habitat, and habitat connectivity have not been permanently protected or adequately managed, restored, or enhanced; and
- Population resilience has not occurred and the Quino has been extirpated where additional populations were required by the Recovery Plan.

The Petition also describes other federal mechanisms that it alleges provide inadequate or unclear protections for various reasons: National Environmental Policy Act, National Forest Management Act, Federal Land Policy and Management Act, National Wildlife Refuge System Improvement Act, Sikes Act, Lacey Act, and pesticide regulations promulgated by the Environmental Protection Agency.

State mechanism described in the Petition are the California Environmental Quality Act (CEQA) and the Natural Community Conservation Planning Act. Regarding CEQA, the Petition contends that it is ineffective at providing adequate protection and conservation for Quino. The Petition also describes perceived shortcomings in several conservation planning efforts, including Natural Community Conservation Plans, where Quino is included as a covered species or where activities would be within Quino habitat/range.

Lastly, a captive propagation effort for Quino was summarized in the Petition. The effort successfully conducted captive rearing and reintroduction to augment the Quino population at the San Diego National Wildlife Refuge, part of the Otay metapopulation (Strahm 2018). These are only initial efforts and have not been implemented broadly.

Conclusion

The Petition describes numerous federal, state, and local planning and conservation efforts that are alleged to fall short of protecting Quino across their range in California, particularly in Riverside and San Diego counties. The Petition did not detail general patterns of land ownership but provided sufficient information on the land management practices in the species' range.

Suggestions for Future Management

Scientific Information in the Petition

The Petition provides suggestions for future management of Quino on pages 48 to 49, which include:

- Prepare a recovery plan pursuant to California Fish and Game Code section 2079.1, including management efforts to reduce habitat loss and degradation.
- Acquire and protect areas with suitable habitat to promote connectivity within and between metapopulation complexes.
- Protect habitat and connectivity at extirpated Quino occurrence complexes.
- Restore/enhance degraded habitat, including remediation of artificially elevated soil nitrogen.
- Continue experimental Quino reintroduction efforts.
- Buffer Quino habitat from impacts of off-road vehicle use.
- Protect known habitat and potential host plants.
- Acquire and protect higher elevation habitats to protect against climate change.
- Conserve areas with known Quino populations near water bodies.

Other Relevant Scientific Information

In addition to the above, another useful action would be to assess potential genetic differences at or among the core areas (or geographically separated areas).

Conclusion

The Petition provides sufficient information regarding suggestions for future management of Quino and its habitat.

Sources and Availability of Information

Scientific Information in the Petition

The Petition cites an extensive list of sources on pages 50 to 58.

Other Relevant Scientific Information

The Department relied on additional sources of scientific information in preparing this Petition Evaluation, which are cited throughout and included in the “Literature Cited” section below.

Conclusion

The Petition provides sufficient information on the sources and availability of information used in the Petition.

Detailed Distribution Map

Scientific Information in the Petition

The Petition used data from the USFWS and CNDDB to create a Quino distribution map, shown on page 10 of this Petition Evaluation. The Petition also includes a historic distribution map, which is reprinted on page 9 of this Petition Evaluation.

The Department created another map (Figure 3 above) that includes CNDDB and Cal Academy data. This map is otherwise consistent with the distribution map provided in the Petition.

Conclusion

The distribution maps in the Petition are sufficient.

RECOMMENDATION TO THE COMMISSION

Pursuant to Section 2073.5 of the Fish and Game Code, the Department has evaluated the Petition on its face and in relation to other relevant information the Department possessed. In completing its Petition Evaluation, the Department has determined that the Petition and other relevant information indicates there is sufficient scientific information to indicate that the petitioned action to list the Quino Checkerspot Butterfly as endangered may be warranted. Therefore, the Department recommends the Commission accept the Petition for further consideration under CESA.

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