

CALLIPPE SILVERSPOT BUTTERFLY

Speyeria callippe callippe

USFWS: Endangered

CDFG: None

Species Account

Status and Description. The callippe silverspot butterfly was federally listed as endangered on December 5, 1997 (62 FR 64306). The callippe silverspot butterfly is a member of the brush foot family (Nymphalidae). It was described by J.A. Boisduval from specimens collected during June by Peter Lorquin in San Francisco, California (dos Passos and Grey 1947).

The callippe silverspot is a relatively large butterfly with a wingspan of approximately 2-2.5 inches. The upper wings are a dull yellowish-brown with a sooty coloration at their base. They also have extensive black spots and lines. The under side of the wings are brown, orange-brown, and tan with black lines and distinctive black and silver spots. Basal areas of the wings and body are densely hairy.

The discal area on the upper hind wings of the callippe silverspot butterfly is a darker and more extensive yellow than on the related Lilian's silverspot butterfly (*Speyeria callippe liliana*). The callippe silverspot butterfly is larger and has a darker ground color than Comstock's silverspot butterfly (*Speyeria callippe comstocki*).



Range, Populations, and Activity. The callippe silverspot butterfly is known from 14 historic populations in the San Francisco Bay region of which only 2 are still extant. The historic range of the callippe silverspot butterfly includes the inner Coast Ranges on the eastern shore of San Francisco Bay from northwestern Contra Costa County south to the Castro Valley area in Alameda County. On the west side of the Bay, it ranged from San Francisco south to the vicinity of La Honda in San Mateo County. Currently, extant colonies are known only from San Bruno Mountain in San Mateo County and a city park in the Oakland Hills in Alameda County.

The taxonomic status of the overall group of silverspot butterflies in the western portions of Solano County is unclear. Some specialists, Matoon, (pers comm.), consider the Solano County populations to be hybrids between the callippe silverspot and Lilian's and/or Comstock's silverspots while others (Arnold 1981 and 1985) consider the Solano County population to be the callippe subspecies. This controversy regarding the presence of callippe hybrids or pure subspecies in Solano County resulted in the USFWS first considering genetically pure callippe silverspot absent from the county (USFWS 1997). However, the USFWS has subsequently recognized the possibility that this subspecies may occur in Solano County and treats silverspot in the western portions of the county as listed subspecies until more formal population studies have been completed.

The adult flight period is from mid May to the end of July, depending on environmental conditions. The females lay eggs on the dried stems and leaves of the wild violet (also known as wild pansy or Johnny-jump-up; *Viola pedunculata*). After hatching, the larvae (caterpillar) immediately spin a silk pad on which they remain through the summer and into the winter. After the late winter rains have begun and the wild violet plants have started to grow, the larvae become active and feed on the new plant growth. Following this activity, the larvae, which are dark-colored and have branched spines covering their backs, soon pupate and then emerge as adult butterflies in May and June. The adult individuals then only live for approximately 3 weeks.

The adult butterflies are strong fliers and to encounter mates, males wait at the tops of hills for female butterflies. To search for females, the males fly back and forth over the tops of the hills. Once a female arrives at the top of a hill, courtship and then mating occurs. After mating the female flies in search of host plants for oviposition and the male waits for another female. This behavior is called hilltopping and is a mechanism by which the males and females find each other for the purpose of reproduction.

Courtship seems to entail a joint flight by the male and female in which they fly in an ascending or spiral fashion or an otherwise circular flight pattern. Copulation is initiated in the air, perched on a shrub or grass, or on the ground. Copulation was observed to last from 4 minutes to over an hour (TRA 1982). At the end of copulation, the pair either separate and fly off or fly off together and then separate. Along with the spermatophore, or packet containing the sperm, the male leaves a plug that hardens and provides a barrier to additional insemination by other males.

Callippe silverspot butterflies have been observed to lay eggs on the drying remains of violet or on bare ground or vegetation near the violet including dry grass, dry filaree (*Erodium* spp.), or other mixed plant debris. On San Bruno Mountain, the eggs were usually laid within three inches of a violet, but none were observed to be laid directly on the violets (TRA 1982). TRA (1982) provides the following account of the typical oviposition behavior of the callippe silverspot butterfly.

"The gravid female slowly searches a suitable site through a series of low (2 inches to 1 foot) erratic but determined "hopping" flights. She lands repeatedly on the ground, walking and crawling between, over, and under shrubs, grasses, and weeds, as well as exploring patches of soil and holes in the ground. She often trembles in a distinctive manner and walks deliberately about probing the substrate repeatedly with her abdomen. She may not deposit an egg in this location before continuing with her search. The buff colored eggs are laid singly, and are always somewhat hidden under plant debris so that they are difficult to find. Sunning, pumping and/or resting may also occur during this sequence, but nectaring was never observed during an egg laying sequence."

Habitat Use. Habitat for this species is grassland often with a significant component of native grasses and characterized by shallow rocky soils or numerous rock outcrops. Suitable grassland habitat may also include ridgelines and hilltops. For grasslands to be considered habitat, the larval host plant, wild violet (*Viola pedunculata*) needs to be present in sufficient density to support a population of butterflies. The wild violet is a low-growing plant with yellow flowers which blooms from early January through April. By mid-summer, the flowers and the leaves are dried up and difficult to either find or identify.

The wild violet grows in many grasslands, but in Solano County the densest stands appear to be most abundant on shallow, rocky or thin soils where the annual introduced grasses are less dense. However, Larry Seeman Associates (now LSA Associates), in a study on San Bruno Mountain, did not find any strong relationships between the abundance of the violet and total soil depth, total soil moisture storage capacity or the soil moisture storage capacity in the top nine inches, soil acidity, or clay content (LSA 1981). Relationships between the distribution of the violet and micro climatic measurements were also not found. Similarly, Orsak attempted to correlate aspects of the violet's growth and distribution with habitat characteristics. He found no correlation between the violet's cover, size, and insect damage with grass height, exposure, slope, and occurrence of other plant species (TRA 1982).

The wild violet provides the substrate on which eggs are laid and also provides the necessary food for the developing larvae. Once the eggs are laid, they take approximately a week to hatch. After hatching, the larvae eat their egg shells, spin a silken pad on which they rest, and then enter into a long summer and winter diapause. The highest mortality rate occurs during this time. In the spring, when the violets begin to produce new growth and flower, the first instar larvae exit their diapause and begin to feed. At first they feed on the violet petals and later various other parts of the plant. Feeding occurs in the late afternoon and evening to avoid daytime predation. During the day they crawl off of the violets. The larvae go through five instars before pupating in May. The pupal stage lasts about two weeks (Arnold 1981).

The callippe silverspot butterfly is flexible in its nectaring requirements. It is able to change from one suitable flower to another depending on availability. A wide variety of plants are used for nectaring, including native and exotic species although members of the Asteraceae are preferred. The most frequently used nectar plants on San Bruno Mountain included thistles (*Cirsium* spp.), Italian thistle (*Carduus* spp.), milk thistle (*Silybum* spp.), and coyote mint (*Monardella villosa*) (TRA 1982).

Nectaring time varies throughout the day and is affected by weather conditions. Under average conditions nectaring takes place all day, but on hot days, it is reduced while the silverspots remain in shady areas. During windy or cold weather, nectaring is greatly reduced. The butterflies nectar in conjunction with a variety of activities such as hilltopping, traveling, and sunning. They do not, however, nectar while laying eggs.

Population Levels and Occurrence in the Project Area. As discussed above, the status, distribution and population levels of the callippe silverspot in Solano County is unknown. Butterfly populations that either appear to be the callippe silverspot butterfly or hybrids that are very closely related to pure callippe silverspot butterflies are known from a several site in the Tri-City and County planning area (a triangular area roughly bounded by Interstate Highways 80, 680, and 780). Additional areas of potential occurrence include the Potrero Hills, Nelson Hill in Cordelia, and the Rockville Hills area.

Dispersal. The callippe silverspot is a relatively large butterfly and is a strong flyer. Their flight is usually fast and direct (from one place to another as opposed to erratic or a non-directional, wandering flight that zig-zags, goes between and around shrubs, or returns to the location where the flight started) and 1-3 meters above the ground or brush.

Thomas Reid Associates did a mark-recapture study of callippe silverspot butterflies on San Bruno Mountain (TRA 1982). They discovered that approximately 95% of the recaptures were made within 4,000 feet of the first capture. They concluded that this 5% was a relatively high proportion of the population and maintained genetic interchange between colonies.

Callippe silverspot butterflies exhibit a preference for relatively clear corridors that are at least 20 feet wide. Large residential areas are a nearly total barrier because callippe silverspot butterflies do not fly beyond the first lots at the edge of habitat areas (TRA 1982). Dense plantings of tall trees also pose a strong barrier because the callippe silverspots rarely penetrate them. Partial barriers are posed by burned areas and major roads four lanes or more wide because some butterflies will cross them while others will not. Dense brush or scattered trees posed a minor hindrance to butterfly travel because the callippe silverspots would rarely turn back but fly over, around, or through them.

Threats to the Species. The primary causes of the decline in the callippe silverspot butterfly is the loss and degradation of habitat from human activities, including loss of habitat, off-road vehicle use, trampling by hikers and equestrians, inappropriate levels of livestock grazing, and invasive exotic vegetation. Off-road vehicles and uncontrolled off-trail foot traffic pose a threat to the callippe silverspot butterfly. These activities could harass, injure, or kill individuals by trampling or crushing the early life stages, the foodplants of the larvae, or the adult's nectar sources.

The callippe silverspot butterfly was once considerably more widespread in the San Francisco Bay area, and at least five populations of this species have been eliminated by urban development and other causes. The species was known historically from 14 sites in San Mateo, Alameda, Sonoma, and Solano counties, only two of which are still extant. One of the known extant populations of the callippe silverspot butterfly is located in a city park in Alameda County. This colony is small and likely to be imperiled by anthropogenic and natural causes. The population at San Bruno Mountain in San Mateo County is largely protected against further loss of habitat, which will remain undeveloped in perpetuity by virtue of the San Bruno Mountain HCP (TRA 1982). However, overcollection of specimens by lepidopterists at San Bruno Mountain and at sites where hybrids can be found in Solano County continues to pose a threat.

The callippe silverspot butterfly is highly prized by insect collectors and an extensive commercial trade has been documented for the callippe silverspot butterfly, as well as for other imperiled and rare butterflies (U.S. Attorney's Office 1994, *United States v. Richard J. Skalski, Thomas W. Kral, and Marc L. Grinnell*, Case No. CR932013, 1993). Although no studies specifically document the impact of the removal of individuals on natural populations of this species, the USFWS considers the callippe silverspot to be vulnerable to impacts from collection due to their isolated, possibly small populations based on studies of another endangered nymphalid butterfly (Gall, 1984a and 1984b) and a lycaenid butterfly (Duffey 1968). Prior to listing, butterfly collectors have been observed on San Bruno Mountain (S. Stern, in litt., June 21, 1994). Some of these specimens were traded for other butterfly taxa or were held by the collectors in anticipation of their greater value after listing. Both collecting from small colonies and scientific studies that repeatedly handle and mark individuals (particularly of females and in years of low abundance) could seriously damage the populations through loss of individuals and the resulting loss of genetic variability within the population (Singer and Wedlake 1981, Gall 1984b, Murphy 1988). Collection of females dispersing from a colony also can reduce the probability that new colonies will be founded. Collectors pose a threat because they may be unable to recognize when they are depleting butterfly colonies below the thresholds of

survival or recovery, especially when they lack appropriate biological training or when they visit the area for a short period of time (Collins and Morris 1985).

The use of insecticides would threaten the callippe silverspot butterfly if use occurred in proximity to occupied habitat. Silverspot butterfly larvae are extremely sensitive to pesticides, and even the accumulation of runoff in the soil after spraying has proven lethal to the larvae of members of the genus *Speyeria* (Mattoon *et al.* 1971).

Livestock grazing could threaten the callippe silverspot butterfly if it occurs at harmful levels, such that the vegetation is overgrazed and the foodplants and nectar sources of these butterflies are eliminated or greatly reduced in abundance. Grazing animals can also trample the larval foodplants and adult nectar sources. Significant reduction or loss of these food sources could threaten the population viability of the callippe silverspot butterfly. However, some livestock grazing may be advantageous to keep other plants, primarily non-native annual grasses from out-competing the butterfly's host plants.

The invasion of California's native grassland and coastal prairie by alien plants has adversely affected native flora and fauna. Numerous non-native species have invaded these plant communities (Heady 1988, Heady *et al.* 1988). Introduced alien plants, such as various nonnative annual grasses, iceplant (*Carprobrotus* spp.), gum trees (*Eucalyptus* spp.), and gorse (*Ulex europaeus*), often outcompete and supplant native vegetation. In the absence of control and eradication programs, invasive alien plants may eliminate the remaining native plants, including the host plants of the callippe silverspot butterfly. Adequate levels of *Viola* species are especially critical for the long term survival of populations of silverspot butterflies.

Periodic fires can be an important factor in maintaining the grassland and coastal prairie habitat of the callippe silverspot butterfly. Without fire or grazing, succession might eliminate the foodplants of the larvae of this butterfly (Orsak 1980, Hammond and McCorkle 1984). Periodic cool, fast-moving fires appear important for the maintenance of the habitat of the callippe silverspot. Dead grass and other vegetation from previous years may not decay quickly enough and may gradually accumulate to form a thick layer of thatch that smothers violets. The larvae of silverspot butterflies may survive fires that move rapidly through grassland habitats, whereas hotter, slow-moving brush and woodland fires may kill them (Orsak 1980, Hammond and McCorkle 1984). In addition, under windy conditions, fast-moving grassland fires burn in patches that leave "islands" of unburned habitat where any butterflies present are not harmed. In the absence of fire or in areas where fire is not practicable, livestock grazing provides an alternative for control of exotic and invasive species.

The breeding of closely related individuals can cause genetic problems in small populations, particularly the expression of deleterious genes (known as inbreeding depression). The callippe silverspot butterfly appears to exist only as very small, isolated populations (S. Mattoon, in litt., August 4, 1989, and November 22, 1992). Individuals and populations possessing deleterious genetic material are less able to adapt to changes in environmental conditions, even relatively minor changes. Further, small populations are vulnerable to the effects of genetic drift (the loss of genetic variability). This phenomenon also reduces the ability of individuals and populations to successfully respond to environmental stresses. Overall, these factors influence the survivability of smaller, genetically isolated populations of each of the three species listed herein.

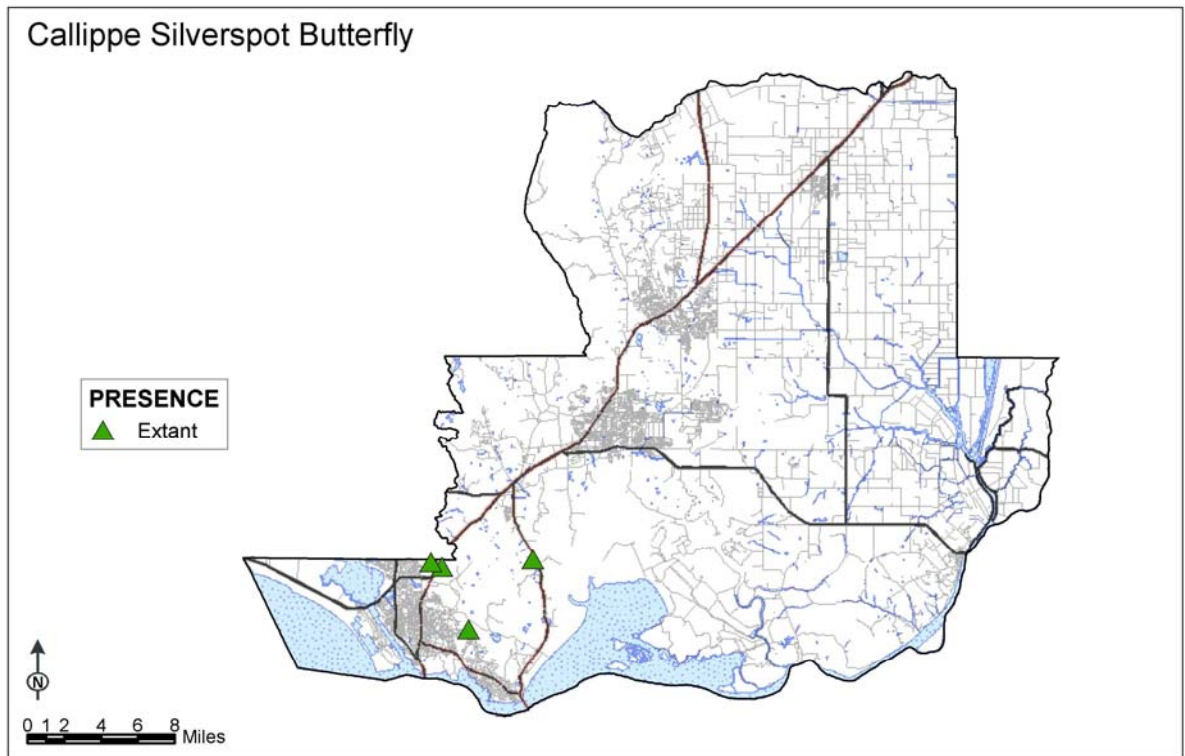
The callippe silverspot butterfly is also vulnerable to the effects of habitat fragmentation. Subdivision of natural land into smaller blocks of suitable habitat is often the result of human activities such as urban development, road construction, fire management policies, and inappropriate livestock grazing practices. Further reduction of population size and genetic interchange among populations through isolation, genetic drift, and inbreeding depression, may result in less vigorous and adaptable populations of the callippe silverspot butterfly. Small isolated populations are vulnerable to extinction from random fluctuations in population size or variations in population characteristics (e.g., sex ratios) caused by annual weather patterns, food availability, and other factors. Because most of the populations of these species are isolated from other conspecific populations, natural recolonization from other populations is unlikely or impossible, and the vulnerability of each population to natural events is high.

Conservation Issues. The primary threats to the Callippe silverspot in the County are urban development and potential conversion of grasslands to agricultural uses other than livestock grazing (i.e., hillside vineyard development). Suitable habitat exists through the western portions of the County within Fairfield and Vallejo urban limits. The area of known populations of the butterfly are within the Tri-City and County Planning area.

The primary consideration for conservation is protecting the *Speyeria* butterfly populations where they occur in the County (primarily through avoidance and minimization), minimizing activities that could lead to expansion of invasive plant species, and providing appropriate land management to maintain and where possible improve the distribution and abundance of the larval host plant.

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