Behren's Silverspot Butterfly
(*Speyeria zerene behrensii*)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Arcata Fish and Wildlife Office
Arcata, California

July 2012

5-YEAR REVIEW
Behren's Silverspot Butterfly (*Speyeria zerene behrensii)*

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

As summarized in the draft Recovery Plan for this species (Service 2003), the Behren's silverspot butterfly is a medium-sized butterfly with a wingspan of approximately 2.2 inches (in) (5.5 centimeters (cm)). The upper surfaces are golden brown with numerous black spots and lines. Wing undersides are brown, orange-brown, and tan with black lines and distinctive silver and black spots. This species was historically recorded from several coastal locations from central Sonoma County north to near the City of Mendocino, Mendocino County, California. Within the past decade, the species has been observed at only three areas: two highly localized sites in Sonoma County, and a cluster of observations, perhaps representing a metapopulation, in southern Mendocino County in the vicinity of Point Arena. The butterfly is associated with grasslands on coastal terraces and stabilized dunes, where its larval host plant, the early blue violet (*Viola adunca*) occurs. Disturbance is probably important in maintaining suitable habitat for the species; in the absence of disturbance, shrubs and coastal pines can colonize coastal prairies and degrade or eliminate habitat. Key resources for the species include sufficient violets to support larval development for a population, as well as nectar sources for the adult butterflies. In other *Speyeria*, the amount and quality of available nectar affect fecundity (Boggs and Ross 1993; Boggs 1997), and has been implicated in the decline and loss of populations (Dunford 2009).

Methodology Used to Complete This Review:

This review was prepared by the Arcata Fish and Wildlife Office (AFWO), following U.S. Fish and Wildlife Service Region 8 guidance. We used information from the draft Recovery Plan, survey information from experts, who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game. The Recovery Plan and personal communications with experts were our primary sources of information used to update the species' status and threats. We received no information from the public in response to our Federal Notice initiating this 5-year review. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provides an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

Lead Regional Office: Larry Rabin, Deputy Division Chief for Listing, Recovery, and Environmental Contaminants, and Lisa Ellis, Fish and Wildlife Biologist, Region 8, California and Nevada; (916) 414-6464.

Lead Field Office: Gary Falxa, Fish and Wildlife Biologist, Arcata Fish and Wildlife Office (AFWO); (707) 822-7201.

Cooperating Field Office(s): Josh Hull, Sacramento Fish and Wildlife Office; (916) 414-6600.

Federal Register (FR) Notice Citation Announcing Initiation of this Review: A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the Federal Register on May 25, 2011 (76 FR 30377). No information was received from the public in response to this notice.

Listing History:

Original Listing
FR Notice: 62 FR 64306
Date of Final Listing Rule: December 5, 1997
Entity Listed: Subspecies – Behren's Silverspot Butterfly (*Speyeria zerene behrensii*)
Classification: Endangered

Associated Rulemakings: No associated rulemakings have been completed for this species.

Review History:

A previous 5-year review was completed in March 2008. That review recommended no change in status from the current classification.

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for Behren's silverspot butterfly is 3C according to the Service's 2011 Recovery Data Call for the Arcata Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a subspecies that faces a high degree of threat and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

Recovery Plan or Outline

> **Name of Plan or Outline:** Draft Recovery Plan for Behren's Silverspot Butterfly (*Speyeria zerene behrensii*)
>
> **Date Issued:** Draft released for public review on January 20, 2004 (69 FR 2725)

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) policy

The Endangered Species Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. Because the species under review is an invertebrate, the DPS policy is not applicable, and the application of the DPS policy to the species' listing is not addressed further in this review.

Information on the Species and its Status

Taxonomic Classification or Nomenclature

The Oregon silverspot is a fritillary butterfly in the genus *Speyeria*. While recent work proposed merging *Speyeria* into the genus *Argynnis* (Simonsen *et al.* 2006), for this review we treat the Oregon silverspot butterfly as a *Speyeria*. About 14 species of *Speyeria* occur in North America (Scott 1986). The genus *Speyeria* encompasses a complex group of species, often with multiple subspecies. Within *Speyeria zerene*, subspecies are clustered into five major groups that are genetically distinct but not genetically isolated, and some interbreeding likely occurs. The Behren's silverspot butterfly is one of eight subspecies in the *bremnerii* group, which occurs in the Pacific northwest, west of the Cascade Range and on the California Coast (Service 2003). W. H. Edwards described the Behren's silverspot butterfly in 1869 based on an adult female and adult male collected at Mendocino, California (Edwards 1869).

Given the large number of subspecies in close proximity to each other and geographic variation, the taxonomy of the *Speyeria zerene* subspecies is complex. This complexity, along with the potential for interbreeding among subspecies, has led to difficulties in accurate identifications and range boundaries for taxonomic subspecies, such as are detailed below for the Behren's silverspot, in the "Spatial Distribution" section. Taxonomic decisions to date have been based on morphological differences, and additional analysis, including genetic analysis, could lead to a better understanding of the differences and geographic boundaries of the subspecies of the *Speyeria zerene* complex.

Species Biology and Life History

As was the case at the time of listing and the first 5-year review, there is scant published information for the Behren's silverspot butterfly. Thus, the best available information on life history of the Behren's silverspot comes from studies of another taxonomically-close coastal subspecies, the Oregon silverspot butterfly (*S. z. hippolyta*). This information is summarized in the draft recovery plan for the Behren's silverspot butterfly (Service 2003), and in the recovery plans for two other listed subspecies, the Oregon silverspot and Myrtle's silverspot (*S. z. myrtleae*) butterflies (Service 1998, 2001). Studies of the Oregon silverspot found that females lay their eggs in the debris and dried stems of the larval food plant, the early blue violet (*Viola adunca*) (McCorkle 1980; McCorkle and Hammond 1988). Other violets (*Viola* spp.) may be used as well, although Arnold (2006) suggested that *Viola adunca* is the sole larval food plant for the Behren's silverspot. Arnold based this conclusion on a review of botanical literature, herbarium records, a habitat assessment, and his observation of only this violet species at historical and all currently known Behren's sites. *Viola adunca* is a small, native, perennial herb with pale to deep violet flowers, which typically blooms in late spring to early summer. Leaves generally die back to the perennial rhizome during winter, re-sprouting in the early spring. Early blue violets have a widespread distribution in western North America, but within the Behren's silverspot range this violet species is associated with coastal grasslands (Holland 1986; Sawyer and Keeler-Wolf 1995).

Life history stages of the Behren's silverspot butterfly are described in the draft recovery plan (Service 2003) and summarized here. The species is univoltine, having a single brood per year. Eggs are laid in mid to late summer, and hatch soon after. Upon hatching, the caterpillars (larvae), which are dark-colored with many branching sharp spines on their back, eat the eggshell. The larvae then wander a short distance and spin a silk pad upon which they pass the fall and winter in diapause (a period of physical dormancy). Upon termination of diapause in the spring, the larvae immediately seek out the violet food plant. During the spring and early summer, they pass through six instars (stages of larval development) as they grow, before forming a pupa (a nonfeeding stage between larva and adult) within a chamber of leaves that they draw together with silk. The adults emerge in about two weeks and live for approximately three weeks. Adult males likely emerge one to several weeks earlier than females, as in other *Speyeria* (Scott 1986; Service 2001).

In a given year, the timing of the period when adult butterflies are present (referred to as "flight period") will depend upon environmental conditions, but typically ranges from about mid-June to mid-September, with peak numbers around mid-July to mid-August, based on monitoring surveys conducted since 2006 (Service, unpubl. data 2012a; Arnold 2006). In the Point Arena

area, adults have been observed as early as June 5 (Pratt 2004) and as late as September 27 (Service, unpubl. data 2012a). The flight period for the Behren's silverspot butterfly is slightly longer, both at the beginning and at the end, than for the southernmost population of the closely-related Oregon silverspot butterfly, located in Del Norte County, California, about 200 miles (mi) (320 kilometers (km)) north of the northernmost Behren's silverspot site. Larval development may be faster in the Behren's subspecies; both the earlier flight period and increased larval development rate in the Behren's silverspot may be a response to generally warmer temperatures at more southerly latitudes.

Adults may feed on nectar (referred to as "nectaring") as long as 5 minutes, returning to the same plant repeatedly. Observations of nectaring by adult Behren's silverspot butterflies are scant, but plant species used include thistles (*Cirsium* spp.), false dandelion (*Hypochaeris radicata*), gumplant (*Grindelia stricta*), and reportedly lupines (*Lupinus* spp.). There is more known about nectar sources for two other closely-related coastal subspecies, the Oregon and Myrtle silverspot butterflies (Service 1998, 2001, 2003; G. Falxa, Service, pers. observation 2006). It is reasonable to assume that those nectar sources would also be used by the Behren's subspecies, when available. Nectar plants most frequently used by those subspecies include: members of the Asteraceae, including goldenrods (*Solidago* spp.), tansy ragwort (*Senecio jacobaea*), California aster (*Aster chilensis*), pearly everlasting (*Anaphalis margaritacea*), thistles *(Cirsium* spp., including *C. vulgare* and *C. arvense*), gumplant, seaside daisy (*Erigeron glaucus*), mule-ears (*Wyethia* sp.), and yarrow (*Achillea millefolium*). Reported nectar species from other plant families include: yellow sand verbena (*Abronia latifolia*), sea-pink (*Armeria maritima*) and western pennyroyal (*Monardella undulata*). Species used less frequently by Oregon silverspots include coyote bush (*Baccharis pilularis*), woolly sunflower (*Eriophyllum lanatum*), smooth hawksbeard (*Crepis capillaris*), and false dandelion (Service 1998, 2001, 2003; Service, unpubl. data 2012b). Since the previous 5-year review, biologists have observed Behren's silverspot butterflies nectaring on bull thistle (*Cirsium vulgare*), false dandelion, and self-heal (*Prunella vulgaris*) (Liebenberg 2011a; Service, unpubl. data 2012b).

Behren's silverspot butterfly flight behavior is moderately erratic and fairly strong. They tend to fly fairly low, usually within about 6.6 feet (ft) (2 meters (m)) above ground surface. During periods with light or no wind, flight is sometimes gentle and relaxed (J. Ebner, consultant, pers. comm. 1998). Strong winds can limit flight, though tall vegetation and topographic features can provide enough shelter to allow adults to fly when wind speeds are moderate (Service 2001). Males often patrol low over grasses (Arnold 2006); this behavior is probably associated with seeking females (Scott 1986; Service 2001). Flight usually occurs by late morning when temperatures are above 60 degrees Fahrenheit (16 degrees Celsius). As with most butterflies (Scott 1986), adults fly mainly when the sun shines, and often roost on or near the ground in low vegetation when overcast and cooler. Butterflies may rest on bare ground, in grasses, or on other foliage. Adults may rest with their wings closed, or hold them spread horizontally when basking; the latter is common (Ebner, pers. comm. 1998), perhaps because of the cool maritime climate that dominates the flight season.

As is typical for *Speyeria* (Scott 1986), including other *Speyeria zerene* subspecies (McCorkle and Hammond 1988; Service 2001), Behren's females presumably oviposit (lay eggs) on or near early blue violets (*Viola adunca*), during the July to September period. Based on studies of the

Oregon silverspot butterfly (Pickering *et al.* 1992; Service 2001; Damiani 2011), Behren's females likely selectively oviposit in areas of higher violet density and lower vegetation height.

Spatial Distribution

The historical range of Behren's silverspot butterfly is based on known locations, which extended from near the City of Mendocino, Mendocino County, south to the area of Salt Point State Park, Sonoma County (Service 2003). The historic locations, from north to south, are: (1) Mendocino headlands, (2) Point Arena and nearby in the vicinity of the town of Manchester, (3) headlands south of Anchor Bay, (4) Sea Ranch, (5) coastal terrace of Stewarts Point and to immediate north, and (6) Salt Point. In addition to these locations, there are several records that are questionable for various reasons and are discussed below.

The CNDDB (2011) includes records from Orick, in northwest Humboldt County (1930s, 1940s, and into the 1970s). Based on the current knowledge of the distribution of *Speyeria zerene* subspecies, these records are most likely *S. z. gloriosa*, representing individuals from a population that exhibits a range of phenotypic (physically observable) variation overlapping with *S. z. behrensii* (Service 2003). Although these records could be interpreted to indicate that *S. z. behrensii* extended as far north as Orick, Humboldt County, California, we do not currently consider these records to be *S. z. behrensii*, nor do we include this area as part of the Behren's silverspot butterfly distribution.

The CNDDB (2011) also includes a record from Comptche, Mendocino County. The Comptche record is a single 1973 specimen, from an area within the outer coast range about 10 mi (16 km) inland from the coast and about 200-300 ft (61-91 m) in elevation. This site is well inland from confirmed records of Behren's. The taxonomic status of the Comptche specimen needs to be confirmed; it may represent an inland range extension of Behren's, a range extension for a different subspecies (*S. z. zerene*), which occurs further inland in the coast range, or possibly a misidentification. To our knowledge, the distribution of *Speyeria zerene* has not been described to include the outer coast range in Mendocino County. However, *Speyeria zerene* individuals, thought to be of the *S. z. zerene* subspecies, were found at Cahto Peak, Mendocino County, in 1993 (K. Hansen, amateur lepidopterist, pers. comm. 2012); this peak is located about 30 mi (48 km) north of Comptche and 10 mi (16 km) inland from the coast, at an elevation of about 4,000 ft (1219 m). Therefore, we do not currently consider the Comptche record to be *S. z. behrensii* or include this area as part of the Behren's silverspot distribution, although this specimen and area merit further evaluation.

Additionally, specimens sometimes attributed to *S. z. behrensii* have been collected between about Salt Point and Jenner, Sonoma County, including near Fort Ross and Jenner (Service 1998). However, the taxonomic status of these specimens is uncertain, as some have characteristics of both the Behren's silverspot and the Myrtle's silverspot, which occurred historically in coastal areas immediately south of the Behren's range (Service 1998). Launer *et al.* (1992) considered the subspecies near Jenner as most closely related to the Myrtle's silverspot (*S. z. myrtleae*). More recently, Emmel and Emmel (1998) considered the "Myrtle's" populations in coastal Marin and southern coastal Sonoma counties to differ sufficiently from Myrtle's specimens from San Mateo County to be treated as a distinct, new subspecies, *Speyeria zerene puntareyes*. Although the Jenner population is sometimes considered to have some

characteristics of the Behren's silverspot butterfly, it is likely more closely aligned with the Myrtle's silverspot (or "*S. z. puntareyes*") (Launer *et al.* 1992). Therefore, we do not currently consider these records from south of Salt Point to be *S. z. behrensii*. However, the coastal area south of Salt Point is within the area considered to be the historic distribution of the Myrtle's silverspot (Service 1998).

Surveys conducted during 2004-2006 and 2006 (Pratt 2004; Arnold 2006) and subsequent population monitoring surveys (Liebenberg 2011a, b) indicate that the current range of the Behren's silverspot butterfly extends from near the town of Manchester in the Point Arena area south to Salt Point State Park. The species occurs at several known locations near Point Arena, which together may represent a metapopulation: Manchester State Park (two sites), Stornetta Public Lands, and on at least two sites on private lands northeast and south of Point Arena (Pratt 2004; Arnold 2006; Liebenberg 2011a, b). Other populations occur at Stewarts Point and Salt Point State Park, both located in Sonoma County. These sites were occupied at listing (Service 1997), and Stewarts Point was occupied in 2005 (Arnold 2006), and Salt Point in 2011 (Liebenberg 2011b).

In 2010 and 2011, surveys for the species were conducted on previously unsurveyed sites on private lands between extreme northern Sonoma County (Sea Ranch) and the Point Arena area, in areas where aerial imagery indicated the potential presence of suitable habitat. Twelve properties were visited from 1 to 4 times; a single Behren's silverspot was observed during these surveys, on a private parcel about 1 mi (1.6 km) south of the City of Point Arena (Liebenberg 2011b).

Abundance

Although individual butterflies have been observed at Salt Point, Stewarts Point, and in the Point Arena-Manchester area in the past 5-10 years, the size and viability of populations are unknown (Arnold 2006). Regular monitoring, such as along established transects, is required to determine population and range-wide trends. Transects designed to help address these questions were established in the Point Arena area on Stornetta Public Lands and Manchester State Park in 2006, and at Salt Point in 2010, as a result of cooperative efforts from staff at California State Parks, Bureau of Land Management (BLM), and the Arcata Fish and Wildlife Office. In total, there have been 1.8 mi (2.95 km) of 30 m-wide fixed-width transects established near Point Arena on Stornetta Public Lands and Manchester State Park, and 1.2 mi (1.95 km) of similar transects established in Salt Point State Park; these have been surveyed annually since being established. The survey protocol is adapted from a standardized method (Pollard and Yates 1993) and has been used for monitoring Oregon silverspot butterfly populations since 1990 (Pickering *et al.* 1992). The protocol calls for weekly surveys of all transects throughout the Behren's flight season, conducted under weather conditions favorable to butterfly flight.

Since the last 5-year review, results from those monitoring surveys are available. A standard way to present results from this survey protocol is an annual index of abundance, which is the total number of Behren's silverspot butterflies observed during all the weekly surveys for that year, within a given population. This annual index of abundance does not represent a population estimate; the survey method is not designed to estimate population size, but rather samples a portion of habitat and provides an index to compare relative abundance across years. The annual

index for the Point Arena area (Manchester State Park plus Stornetta Publics Lands) from 2006 through 2011, when adjusted for missing surveys, has ranged from 0 to 39, with a mean of 15.7 observed per year (standard deviation = 15.3; Service, unpubl. data 2012a). At Salt Point, the data are less complete, because poor weather and other factors resulted in many weeks without usable survey data. Interpolation was needed to estimate numbers for those weeks, as the annual index is based on summing of weekly survey counts throughout an entire flight season, so having weeks with missing data would result in an underestimate. The resulting Salt Point annual index was 7 for 2010, and 13 for 2011 (Service, unpubl. data 2012a). Because of the interpolation, these annual index estimates are higher than the actual number of butterflies observed at Salt Point (2 in 2010 and 3 in 2011; Liebenberg 2011b).

An index of butterfly density can be derived by dividing the adjusted annual index by the area surveyed by transects. At both Point Arena and Salt Point, the average annual density is roughly 2 butterflies per hectare (ha) (slightly under 1 per acre (ac)) for both sites. These are the first estimates of this type for Behren's, and suggest a relatively low density, compared to the Oregon silverspot butterfly, where densities based on the same methods are typically considerably higher, averaging about 30 per ha for the Oregon silverspot butterfly population in Del Norte County, California (Service, unpubl. data 2012a; Falxa and Imper 2012). While the number of weeks with missing data argues for caution in interpreting the Salt Point data, it is apparent that densities are low compared to those observed for the closely-related Oregon silverspot butterfly.

No clear population trend is apparent to date for Point Arena, with the highest counts observed in 2006, 2010, and 2011. Perhaps coincidentally, these three years had the wettest springs for the period, based on March-June precipitation data from Fort Ross, about 35 mi (56 km) to the south on the coast. In 2008, the year when no butterflies were detected on surveys, the March-June period was extremely low at 0.9 in. (2.3 cm), compared to the 2006-2011 average of 9.6 in. (24.3 cm) for this period. While the highest annual index occurred in the most recent year (2011), the high variability between years suggests that more years of data are needed to determine population trends for the Point Arena area.

For the other known populations, similar data do not exist, with no monitoring to date at Stewarts Point, and only 2 years of data for Salt Point, too little to evaluate trend.

Habitat or Ecosystem

The Behren's silverspot butterfly inhabits coastal terrace prairie habitat west of the Coast Range in southern Mendocino and northern Sonoma counties, California. Additionally, the species inhabits grasslands on a stabilized coastal dune system on Manchester State Park. Both of these habitats are strongly influenced by proximity to the ocean, with mild temperatures, moderate rainfall, and frequent summer fog. An occupied or potential site must have two key resources: (1) caterpillar host plants; and (2) adult nectar sources, as well as other suitable environmental conditions. Distribution of the Behren's silverspot butterfly is highly dependent on these resources (Service 1997). Depending on the patchiness and spatial distribution of suitable habitat, a location may have a single butterfly population or several subpopulations that function as a metapopulation. In this context, a metapopulation is a group of populations existing at a spatial scale where individuals can occasionally disperse among different populations or patches, but these movements are not frequent because habitat patches are separated by substantial

expanses of unsuitable habitat; patches may go extinct and be recolonized by migrants from other populations within the metapopulation (*e.g.*, Harrison *et al.* 1988).

In many if not most areas, the grassland habitats that the butterfly requires will tend to succeed to habitats characterized by taller, denser vegetation dominated by shrubs and conifers, such as shore pine (*Pinus contorta*). Three factors likely limit succession in coastal prairie habitats: soil conditions, salt spray and mist from breaking waves and prevailing onshore winds, and disturbance regimes (Service 2003). Most extant sites include at least some areas close enough to ocean to be subject to salt spray (Salt Point, Stewarts Point, and Stornetta Public Lands). Grazing has been an ongoing source of disturbance at Stornetta Public Lands and Stewarts Point. On Manchester State Park, the butterfly occurs on stabilized dunes, where soils, as well as salt spray may limit succession.

Holland (1986) describes coastal terrace prairie as dense, tall grassland (to 1 m or 3.3 ft tall) dominated by both sod- and tussock-forming perennial grasses. Soils are sandy loams on marine terraces below 213.5 to 305 m (700 to 1000 ft) and within the zone of coastal fog. Vegetation is typically quite patchy and variable in composition, reflecting local differences in available soil moisture capacity. Plant species associated with coastal terrace prairie include: alta fescue (*Festuca arundinacea*), blackberry (*Rubus vitifolius*), bracken (*Pteridium aquilinum*), coast mugwort (*Artemisia suksdorfii*), coyote brush (*Baccharis pilularis*), red alder (*Alnus rubra*), salal (*Gaultheria shallon*), tufted hairgrass (*Deschampsia cespitosa*), and yellow bush lupine (*Lupinus arboreus*) (Sawyer and Keeler-Wolf 1995). Within the coastal terrace prairie, violets (*Viola* spp.) need to be a component of the vegetative composition of the site, as they are the butterfly's larval host plant. Nectar sources need to be available to foraging adults during the summer flight period. Violets occur primarily in relatively isolated patches at the Stornetta Public Lands location (Sander 2004), possibly a result of soil moisture and cattle grazing (J. Watkins, Service, pers. observation 2002).

In addition to availability of violets and nectar plants, a third habitat characteristic, cover in the form of shelter from wind, may also affect habitat suitability. The coastal prairies within the species' range are frequently windy during the butterfly flight season, with most strong winds from the northwest. Trees and large shrubs, as well as topographic features, can provide sheltered pockets, where microclimates are more favorable to butterfly flight and essential activities during windy periods. Shelter from coastal winds has been identified as important for coastal silverspot butterflies, including the Myrtle's (Service 1998), Oregon (Service 2001), and Behren's (Arnold 2006), but data is lacking on how the amount and configuration of shelter affect habitat quality.

Genetics

No genetics data are available for the Behren's silverspot butterfly. Scientists from the U.S. Geological Survey are beginning a genetics study on the population structure of the Oregon silverspot butterfly in 2012. If genetic samples are available from Behren's, the study may include a preliminary analysis of the relationship between Behren's and Oregon silverspot butterflies.

Species-specific Research and/or Grant-supported Activities

Since the last review was completed in 2008, several projects have been initiated or continued, which are discussed elsewhere in this review:

1. A 5-year study of the effects of grazing on key habitat resources was initiated in 2008 on the Stornetta Public Lands. This project will continue through 2013 with support from the Service (Arcata Fish and Wildlife Office and Regional Office funds). The study is being conducted by:

   RT Navratil Consulting
   Palo Alto, California
   Phone: (414) 736-2783
   Contact: Ryan Navratil

2. Conifer removal from 210 ac (85 ha) of Behren's habitat on Stornetta Public Lands, conducted from October 2007 through 2010. This work is being conducted with support from Service's Arcata Fish and Wildlife Office by:

   Bureau of Land Management
   Ukiah Field Office, Ukiah, California
   Phone: (707) 468-4000
   Contact: Pardee Bardwell

3. Outreach to private landowners, to obtain access for butterfly surveys and to promote conservation actions on private lands to benefit Behren's silverspot butterfly. This work is being conducted with support from the Service's Arcata Fish and Wildlife Office by:

   Redwood Coast Land Conservancy
   Gualala, California
   Phone: (707) 884-4426
   Contact: Nancy Trissell or Louisa Morris

4. Surveys of cooperating landowners by staff from California Department of Parks and Recreation, Mendocino District. Contact: Renee Pasquinelli, Senior Environmental Scientist: (707) 937-5721.

5. Continued population monitoring on Stornetta Public Lands and Manchester State Park, and, in 2010, initiated population monitoring at Salt Point State Park. This work is being conducted by the BLM and California Department of Parks and Recreation (contact information same as above, for conifer removal and outreach projects).

6. An assessment of the status of Behren's silverspot butterfly habitat and population near Point Arena, California, with a focus on the approximately 530-ac Cypress Abbey property. Funded in April 2012, field work will begin during summer 2012, conducted by RT Navratil Consulting (contact information same as above, for the grazing study).

Five-Factor Analysis

The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification or Curtailment of Habitat or Range

Residential and agricultural development result in habitat loss and fragmentation, and habitat succession further reduces the amount and quality of remaining habitat. The listing rule and draft recovery plan state that agriculture and its associated pesticide use have reduced the amount and quality of remaining silverspot butterfly habitat (Service 1997, 2003). Development pressures have increased in northern Sonoma and Mendocino counties, California, since listing, and disturbance mechanisms (such as wildfire) that maintain grassland butterfly habitat continue to be suppressed (Service 1997).

Habitat disturbance, such as fire and grazing, helps prevent succession, in which trees and shrubs encroach on and ultimately replace coastal prairies. In some cases, disturbance may also reduce the spread of nonnative vegetation. Housing developments, such as Sea Ranch in Sonoma County, not only remove habitat for buildings and supportive infrastructure, but also require fire suppression and pre-suppression actions to protect property. Consequently, shore pine (*Pinus contorta*) and other native and nonnative plants are able to colonize and expand into butterfly habitat, further reducing the open grassland space required by the butterflies and their host plants (Hammond 1994; Sawyer and Keeler-Wolf 1995). Succession and the spread of nonnative vegetation can also degrade silverspot butterfly habitat quality by making it difficult for butterflies to access the larval host plants and nectar plants needed for ovipositing and adult feeding, respectively.

The threat posed by grazing appears to vary. Poor grazing practices could result in erosion, especially on slopes, and in some areas grazing has clearly altered vegetation communities so that the key violet and nectar resources are lacking or too scarce to support Behren's silverspot butterflies. However, well-managed livestock grazing likely serves to reduce the effects of succession and nonnative vegetation by decreasing thatch and density of woody plants. The species has persisted on the historic Point Arena site in an area that has been grazed, and formerly farmed, since at least the early 1900s (L. Stornetta, rancher, pers. comm. 2007), and on Stewarts Point, which has also been a working ranch for many decades. Grazing may have helped maintain habitat on these sites, by preventing or slowing the succession from coastal grassland to scrub and forested habitats; at the least, Behren's populations have persisted under some grazing regimes. Monitoring surveys indicate higher densities of the butterfly on the grazed Stornetta Public Lands than on the nearby Manchester State Park, where grazing has been excluded for decades; factors other than grazing, such as marine terrace versus dune substrate, may account for this difference. In one area of Manchester State Park, where the California Department of Parks and Recreation acquired unbuilt parcels of a subdivision, activities associated with the subdivision, such as roadside mowing, may have been a past source of disturbance that prevented succession. Succession in this area, resulting from a lack of recent

disturbance, may have contributed to fewer silverspot observations in this area in recent years (R. Arnold, Entomological Consultants, Ltd., pers. comm. 2011).

The historical Point Arena site has been partially protected by purchase and associated Federal management. The BLM now manages a large part of this site as the Stornetta Public Lands, and does so in a multiple-use context. Due to BLM being the primary manager, Federal actions on the property are subject to section 7 consultation (refer to the Factor D section below). At purchase, an agricultural easement was provided to the seller allowing continued grazing at historical levels through 2013. As a consequence, cattle grazing continues on much of the Point Arena site.

The above summarizes the state of this threat as of the last 5-year review. Since that review, several actions have occurred to help reduce Factor A threats:

1. To address the expansion of shore pines and other conifers into habitat, the BLM has removed pines and other conifers from 210 ac (85 ha) of Stornetta Public Lands since 2007. Manchester State Park has removed about 200 Monterey pines and Monterey cypress, both non-native conifers, from grasslands where Behren's silverspot had been documented, since 2005. These actions have resulted in a reduction, for a period of time, of this threat in those areas.

2. The BLM and Service initiated a 5-year study on Stornetta Public Lands of grazing effects on early blue violet density, nectar plants, and vegetation structure. This study, which will be completed in 2013, looks at the response of habitat to two grazing regimes as well as to removal of grazing (RT Navratil Consulting 2012). The results will help evaluate the effects of grazing on these key habitat characteristics, and will inform future management of Stornetta Public Lands, where the BLM has an opportunity to modify or cease grazing following 2014, when the current grazing rights will expire.

3. In 2010 and 2011, the Redwood Coast Land Conservancy, in partnership with the Service's Arcata Fish and Wildlife Office and the California Department of Parks and Recreation, conducted an outreach project to private landowners whose property likely contained habitat for the Behren's silverspot. The purposes of this outreach were to obtain landowner permission to survey private lands for the butterfly, and to identify suitable private partners for land conservation efforts to benefit this species. To date, this project obtained access to 20 properties to conduct surveys, and has conducted initial surveys on 8 of those. This project has located one additional occupied area to date, and has the potential to result in actions on private lands to benefit Behren's silverspot butterfly.

4. In 2010, the Stewarts Point Ranch in Sonoma County was purchased by the Pacific Forest Trust and transferred to interim ownership by Save the Redwoods League. This 871-ac (352 ha) property is largely forested, but includes more than a mile of coastal bluffs and associated coastal grasslands that may be suitable habitat for Behren's silverspot, and where a small number of individuals were observed in 2005.

5. In January 2012, about 126 ac (51 ha) of private lands in the Point Arena area, part of the Cypress Abbey property, was acquired by the Trust for Public Lands, and was then transferred to the BLM for management. While this property has not been surveyed for Behren's silverspot butterfly, it includes extensive coastal grassland habitat, and early blue violets occur widely on the site (G. Falxa, pers. observation 2011). Behren's have been observed on contiguous parcels which remain in Cypress Abbey ownership, in 1998 and 2005 (Ebner, pers. comm. 1998; Arnold 2006).

In summary, some Factor A threats persist at same level as first 5-year review while others have declined. The loss and modification of coastal prairie habitats continue to be the primary known threat to the Behren's silverspot butterfly. In addition to the loss and fragmentation of remaining coastal prairie habitat due to development, fire suppression becomes increasingly necessary when homes and other infrastructure are built in coastal habitats. The lack of disturbance, for example by fire, continues as a threat by allowing succession to occur. Disturbance by grazing may help maintain coastal grasslands in some areas, but in other areas likely degrades habitat to a condition that cannot support the species. The purchase over the last decade of substantial, occupied and suitable habitats on the Stornetta Public Lands, Cypress Abbey property, and Stewarts Point Ranch precludes the threat of future development at those sites, and provides opportunity for management activities to conserve the Behren's silverspot butterfly.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Butterfly collection continues to be a concern, as it was when the species was listed (Service 1997). We believe that the Behren's silverspot is particularly vulnerable to the collection trade because of its endangered status, limited distribution, and presumed small population size. Although the extent of collection is unknown, it is our intent to not enable illegal collection. As a result, we have declined to designate critical habitat for the subspecies, and have refrained from identifying specific butterfly locations in the draft recovery plan. Research activities that may result in take of butterflies are managed under the Service's 10(a)(1)(A) recovery permit program. At this time, two permits have been issued for the take of Behren's silverspot for scientific research or activities to enhance the species propagation: one permit is for photography of the species, and one (to the Service) is to capture and release a limited number of individuals for nonlethal collection of tissue samples for the purposes of population genetics studies.

FACTOR C: Disease or Predation

Disease or predation was not identified as a threat in the original listing (Service 1997). As noted in the previous 5-year review, we do not know what effect, if any, disease and predation may have on the Behren's silverspot butterfly populations. Birds and other predators likely consume individual butterflies on an opportunistic basis. Caterpillars of the conspecific Oregon silverspot butterfly were observed being predated upon by ants (Bierzychudek *et al.* 2009), and a large spider was observed eating Oregon silverspot butterfly adults (Service 2011).

Other animal species can threaten listed butterflies through predation, parasitism, and possibly competition. Non-native sow bugs, ground beetles, and earwigs are predators on eggs, larvae,

and pupae of butterflies or other insects (Edney *et al.* 1974; Langston and Powell 1975; Mattoni *et al.* 2003; Shibata and Imafuku 2010; LaBonte 2011). No instances of parasitism or competition are known, nor have they been investigated.

A potential threat not addressed previously is the potential for the species to be infected with bacteria of the genus *Wolbachia*. *Wolbachia* parasitizes its host by infecting the reproductive cells of insect host species. The *Wolbachia* infection adversely affects the reproductive biology of the host in a way that favors its spread through host populations (Russell *et al.* 2009). Up to 65 percent of invertebrate species are thought to carry a strain of *Wolbachia* (Nice et. al. 2009). The infection is passed down to offspring maternally through the egg. In some cases, male and female butterflies with different strains of *Wolbachia* cannot produce viable offspring. The endangered Karner blue butterfly is now known to harbor different strains of *Wolbachia* within different populations, potentially limiting options for reintroductions or population augmentations. Demographic models have predicted lower invertebrate adult numbers in infected populations, and the infection increased the potential for extirpation, particularly in small populations. Whether Behren's silverspot butterfly populations carry *Wolbachia* or different strains of *Wolbachia* is not known, but *Wolbachia* has been reported from the Oregon silverspot butterfly (A. Truitt, Portland State University, pers. comm. 2012).

In summary, we do not know if disease or predation threatens Behren's silverspot populations. These have not been investigated, and could be difficult to study in a rare species with relatively cryptic eggs and larvae.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

At the time of listing, regulatory mechanisms thought to have some potential to protect Behren's silverspot butterfly included the California Environmental Quality Act (CEQA), and the California Endangered Species Act (CESA), but the CESA does not provide protection to insects. The listing rule (Service 1997) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain currently valid.

There are several State and Federal laws and regulations that are pertinent to federally listed species, each of which may contribute in varying degrees to the conservation of federally listed and non-listed species. These laws, most of which have been enacted in the past 30 to 40 years, have greatly reduced or eliminated the threat of wholesale habitat destruction.

State Protections

California Environmental Quality Act (CEQA): The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

California Coastal Act: The California Coastal Commission considers the presence of listed species in determining environmentally sensitive habitat lands subject to section 30240 of the California Coastal Act of 1976, which requires their protection. Certain local jurisdictions have developed their own Local Coastal Programs or Land Use Plans that have been approved by the Coastal Commission. Some of the major accomplishments of this act include reduction in overall development, acquisition of prime habitat along the coast, restoration of coastal streams and rivers, and a reduction in the rate of wetland loss. However, the act does not address the injury or death of butterflies, and only reduces loss or degradation of habitat.

Federal Protections

National Environmental Policy Act (NEPA): NEPA (42 U.S.C. 4371 *et seq*.) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 C.F.R. 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(19) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (50 CFR 17.3) define "harm" to include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 CFR 402.02).

Since listing, the Service has analyzed the potential effects of Federal projects on Behren's silverspot butterfly under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Since its acquisition in 2006, the BLM has managed the Stornetta Public Lands (which includes the largest known population in the Point Arena area) under an interim plan that allows for resource conservation, limited recreational access (primarily hiking and equestrian), and cattle grazing. Cattle grazing was allowed to continue as a condition of the ranch's acquisition (BLM 2006). In January 2012, additional lands in the Point Arena area, part of the Cypress Abbey property, were acquired and also came under BLM management. BLM's management is subject to section 7 review under the Act, and public review under NEPA.

For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related Natural Community Conservation Planning program.

To date one incidental take permit has been issued for Behren's silverspot butterfly in association with an HCP. The permit was issued in December 2007 for the Fisher Family Property HCP, for construction of a single family dwelling and associated improvements near Point Arena. Construction was expected to remove up to 30 early blue violet plants on 0.10 ac (0.04 ha) of breeding habitat. The HCP established 6.75 ac (2.7 ha) on the property as a conservation area, to be conserved and managed in perpetuity as potential foraging habitat for the butterfly.

Federal Land Policy and Management Act of 1976 (FLPMA): FLPMA (43 U.S.C. *1701 et seq.*) is the primary Federal law governing land uses on BLM lands. FLPMA directs the development and implementation of resource management plans (RMPs), including coordinated resource management plans (CRMPs). RMPs authorize and establish allowable resource uses, resource condition goals and objectives to be attained, program constraints, general management practices and sequences, intervals and standards for monitoring and evaluating RMPs to determine effectiveness, and the need for amendment or revision (43 CFR 1601.0–5(k)). The Stornetta Public Lands currently have an interim Management Plan, dated 2006 and updated in 2009, which includes actions to benefit Behren's silverspot butterfly (see Factor A). This interim plan was the subject of a consultation with the Service in 2007, under section 7 of the Act. BLM plans to complete a CRMP by the end of 2015, at which time the current grazing agreement will have expired, the ongoing butterfly-grazing study will be completed (see Species-specific Research and/or Grant-supported Activities above), and BLM can re-evaluate grazing as a potential habitat management tool, including for Behren's silverspot butterfly habitat. A management plan for the Cypress Abbey property, part of which came under BLM management in January 2012, is currently in development.

In summary, the Endangered Species Act is the primary Federal law that provides protection for this species since its listing as endangered in 1976. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Act.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

The original listing rule (Service 1997) did not address other natural or manmade factors. Collision with vehicles (road-kill) is identified as a threat for the closely-related Oregon silverspot butterfly (Service 2001). The magnitude of road-kill as a threat to the Behren's silverspot is not documented, but road-kill is a potential threat due to the proximity of occupied habitat to Highway 1 and other well-traveled public roads. In the previous 5-year review, we concluded that any such threat has likely increased since listing, due to increased development and traffic within the historical range. That conclusion remains valid.

Impacts to the species under predicted future climate change are unclear. The most recent literature on climate change includes predictions of hydrological changes, higher temperatures, and expansion of drought areas, resulting in a northward and/or upward elevation shift in range for many species (IPCC 2007). For the coastal zone that the species inhabits, some studies have predicted increases in coastal upwelling and associated coastal fog frequency in the region (Bakun 1990; Snyder *et al.* 2003). However, a more recent evaluation of historic climate data from coastal northern California found that summer conditions have become warmer and drier, with less fog, since the early 20th century, suggesting increased drought stress for vegetation (Johnstone and Dawson 2010). Warmer average temperatures associated with climate change may result in extended flight periods, or could result in a change in the Behren's range.

In summary, while it appears reasonable to assume that the Behren's silverspot butterfly may be affected by climate change, we lack sufficient certainty of those changes to predict the extent to which climate change will affect particular species at this time. Road-kill may also be a threat that has increased since listing, due to increased development and traffic near occupied habitat.

III. RECOVERY CRITERIA

The species has a draft recovery plan (Service 2003), which is being updated for finalization and approval.

IV. SYNTHESIS

We have no new information to suggest that threats to the species have substantially changed since the time of listing and of our previous 5-year review in 2008. The primary threats continue to be potential destruction and modification of habitat. Regulatory mechanisms do not prevent development of coastal grassland areas. Conversion of potential habitat by development, and

succession due to altered disturbance regimes continue to result in the loss of habitat. Development likely increases the modification of habitat caused by vegetation succession, by reducing fire frequency through increased suppression, and perhaps by reducing grazing, which can help maintain coastal grasslands. The threat posed by destruction of habitat has diminished since the time of listing, where occupied sites have been conserved through land purchases, including two large purchases of occupied areas since the last review. We anticipate that future management of these areas will reduce and perhaps eventually reverse the negative effects from succession and other threats that could reduce the suitability of butterfly habitat.

While no known occupied sites are being managed primarily for Behren's silverspot butterfly conservation, management actions at Stornetta Public Lands and Manchester State Park have helped to maintain habitat for the species, and will likely occur on 126 ac (51 ha) near Point Arena which was transferred in January 2012 to BLM management. Some aspects of BLM's management of the Stornetta Public lands, such as cattle grazing, may result in incidental take of butterflies, but may also benefit the species by limiting succession. Other BLM management actions there have helped restore habitat, notably removal of conifers encroaching into butterfly habitat.

Service-funded surveys conducted between 2004 and 2011 observed Behren's silverspot butterflies at historical sites in Sonoma County and, in one case, at a new location near Point Arena, Mendocino County. However, the extent and viability of those populations remain unknown. Extant populations remain at historical sites located at Salt Point, Stewarts Point, and Point Arena/Manchester, which were documented at the time of listing. Additionally, more intensive surveys will need to be conducted to determine if other Behren's silverspot butterfly populations exist within the range of the species.

Populations of the species are likely sensitive to the effects of climatic variation on important vegetation resources and on thermal regime and other climatic characteristics, which can affect survival and reproduction. While climate change has the potential to affect the species, the nature of any effects cannot be predicted at this time.

Therefore, based on the information presented in this review, we find that the Behren's silverspot butterfly continues to meet the definition of endangered. We recommend no change in the species' status at this time.

V. RESULTS

Recommended Classification

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (Indicate reasons for delisting per 50 CFR 424.11):
    ____ Extinction
    ____ Recovery
    ____ Original data for classification in error
_X__ No change is needed

New Recovery Priority Number and Brief Rationale: 3C (no change)

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

These recommendations are based in part on the recovery goals in the species' draft recovery plan, and on the 5-year Spotlight Species Action Plan for the Behren's silverspot butterfly (Service 2009).

1. Finalize the draft recovery plan, with updates to incorporate new information.

2. Support, by available means, acquisition of the approximately 405 ac (164 ha) of private lands (Cypress Abbey "Phase 2") located directly south of the Stornetta Public lands. The Trust for Public Lands has already acquired 126 ac (51 ha) of this property, and has a purchase contract to obtain additional funds and purchase the remaining 405 ac (164 ha) by September 30, 2013. These lands have high recovery value for the species because: (a) Behren's silverspot butterflies are present; (b) they contain significant areas of coastal grassland habitat; and (c) habitat is contiguous with occupied habitat on Stornetta Public Lands.

3. Work with partners to conduct surveys to:

    a. Evaluate the conservation status (population size and distribution, threats, habitat conditions) of all known extant populations. This will help determine their status with respect to recovery criteria;
    b. locate new populations and occupied sites; and
    c. continue the annual index counts to monitor population levels along established transects.

4. Continue the collaborative outreach effort targeting private lands. Landowners/managers should be contacted to initiate conservation planning and implement recovery actions, and to remove threats that may limit population expansion or recovery.

5. Develop a habitat conservation strategy for the Point Arena metapopulation.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

Behren's Silverspot Butterfly (*Speyeria zerene behrensii*)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist

__X__ No change needed

Review Conducted By: Gary Falxa, Fish and Wildlife Biologist

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Arcata Fish and Wildlife Office, U.S. Fish and Wildlife Service

Approve _____ Date 6-5-12

Cooperating Field Supervisor, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service

__✓__ Concur _____ Do Not Concur

Signature Susan C Moore Date 6/13/12

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 8

Approve _____ Date 7/23/12