

Chloropyron maritimum subsp. *maritimum*
(*Cordylanthus maritimus* subsp. *maritimus*)
(salt marsh bird's-beak)

**5-Year Review:
Summary and Evaluation**



Photograph by Bob Sloan (SWCA Inc.). Used with permission.

**U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
Carlsbad, California**

August 13, 2009

5-YEAR REVIEW
Chloropyron maritimum* subsp. *maritimum
(*Cordylanthus maritimus* subsp. *maritimus*)
(salt marsh bird's-beak)

I. GENERAL INFORMATION

Purpose of 5-Year Review:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a 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:

Chloropyron maritimum subsp. *maritimum* (salt marsh bird's-beak) is a hemiparasitic annual plant found in disjunct coastal salt marshes of southern and central California and adjacent northern Baja California, Mexico. Plants have naturally patchy distributions in sites subject to only higher tidal influxes in coastal salt marshes. Historically, its range included inland salt marsh habitats in Los Angeles, San Bernardino, and San Diego Counties as well as more coastal salt marshes than it occupies today.

Chloropyron maritimum subsp. *maritimum* (as *Cordylanthus maritimus* subsp. *maritimus*) (salt marsh bird's-beak) was listed as endangered under the Endangered Species Act (Act) in 1978 and the State Endangered Species Act (CESA) in 1979.

Methodology Used to Complete This Review:

This review was conducted by Gary D. Wallace at the Carlsbad Fish and Wildlife Office (CFWO), following the Region 8 guidance issued in March 2008. We used information in the 1978 listing rule, the recovery plan, available literature, and reports and information in our files. We also relied upon information provided by experts familiar with the species, its habitat, and the associated processes. 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, since the last 5-year review, or since the last document containing a five-factor analysis.

We include information received from VFWO regarding occurrences in their jurisdiction. We focus on current threats to the species that are attributable to any of the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we include a prioritized list of conservation actions recommended to be completed or initiated within the next 5 years. These actions are designed to alleviate persisting threats to the taxon.

Contact Information:

Lead Regional Office: Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, and Jenness McBride, Fish and Wildlife Biologist, Region 8; (916) 414-6464.

Lead Field Office: Gary D. Wallace and Bradd Baskerville-Bridges, Carlsbad Fish and Wildlife Office; (760) 431-9440.

Cooperating Field Office: Connie Rutherford, Ventura Fish and Wildlife Office; (805) 644-1766. Review provided by Julie Vanderwier, June 2009.

Federal Register 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 was published in the Federal Register (FR) on February 14, 2007 (USFWS 2007 (72 FR 7064)). One response supporting preservation of species was received; however it included no information specific to the taxon being reviewed here and will not be considered further.

Listing History:

Original Federal Listing

FR notice: 43 FR 44810-44812.

Date listed: September 28, 1978.

Entity listed: *Chloropyron maritimum* subsp. *maritimum* (salt marsh bird's-beak) a plant subspecies was listed under the name *Cordylanthus maritimus* subsp. *maritimus* and at that time treated as a member of the Scrophulariaceae (figwort family). See discussion under "Taxonomic classification or changes in nomenclature," regarding current name and family classification.

Classification: Endangered.

State Listing

Chloropyron maritimum subsp. *maritimum* was listed as endangered by the State of California in 1979 under the name *Cordylanthus maritimus* subsp. *maritimus*.

Associated Rulemakings: None

Review History:

The Service initiated a 5-year review of *Chloropyron maritimum* subsp. *maritimum* under the name *Cordylanthus maritimus* subsp. *maritimus* on December 8, 1983 (USFWS 1983b, 48 FR 55100). The results of the review were published in the Federal Register on July 22, 1985 (USFWS 1985a, 50 FR 29900). No proposed change in status was recommended. No other 5-year reviews of this taxon have been initiated since 1983. All information and discussion in this 5-year review is based on the date of listing because of the lack of discussion in the 1985 5-year review.

Species' Recovery Priority Number at Start of This 5-year Review:

The recovery priority number for *Chloropyron maritimum* subsp. *maritimum* (as *Cordylanthus maritimus* subsp. *maritimus*) is 6 according to the 2008 Recovery Data Call for the Carlsbad Fish and Wildlife Office. This number indicates that the taxon is a subspecies that faces a high degree of threats and has a low potential for recovery. This number is based on a 1-18 ranking system that takes into account the degree of threat, the potential for recovery, and the taxonomic rank of the organism. According to this scale, 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983a, 48 FR 43098).

Recovery Plan (Draft or Final) or Recovery Outline:

Name of plan or outline: Salt marsh bird's-beak Recovery Plan. [Final] (USFWS 1985b).

Date issued: December 6, 1985

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Endangered Species Act of 1973, as amended (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 a plant the DPS policy is not applicable to the species' listing is not addressed further in this review.

Information on the Species and Its Status

Little background information was provided in the original listing rule. Therefore, the following sections on the biology and life history, distribution, abundance and population trends, genetics, and habitat conditions include information available at the time of listing as well as more recent information. We refer to information provided in references cited below as though it identifies salt marsh bird's-beak as *Chloropyron maritimum* subsp. *maritimum*. However, it is likely that references cited in this review do so under the name *Cordylanthus maritimus* subsp. *maritimus*. References to the genus *Cordylanthus* are taken to include the segregate genus *Chloropyron*.

Species Description

Chloropyron maritimum subsp. *maritimum* is a taxon of annual plants in the Orobanchaceae (broom rape family) (see discussion under Taxonomic classification or changes in nomenclature below). Specimens are branched and may be up to 16 inches (40 centimeters) tall with numerous flowers arranged on flower stalks termed spikes. The flowering period is between May and October (Munz 1974, p. 801; Naval Base Ventura County Point Mugu 2003, p. 1). Each flower may produce 10-40 seeds (Chuang and Heckard 1993, p. 1029).

Species Biology and Life History

Chloropyron maritimum subsp. *maritimum* plants are hemiparasitic (deriving some of their physiological needs from a host plant) halophytes (a plant tolerating or thriving in alkaline soils). Most plants are capable of manufacturing food in their green, photosynthetic tissues, while absorbing water and dissolved nutrients through their roots. Parasitic plants that require host plants to fulfill both of these functions are termed holoparasites while those that have green photosynthetic tissues and only require hosts to facilitate uptake of water and dissolved nutrients are termed hemiparasites. Species of *Chloropyron* fall into this latter category. Both holoparasites and hemiparasites secure their nutrition from their host plants through special structures called haustoria. The roots of *Chloropyron maritimum* subsp. *maritimum* seedlings establish haustorial connections to host plants to acquire water and dissolved nutrients from host plants.

Chuang and Heckard (1971, p. 227) demonstrated that under laboratory conditions most species of *Cordylanthus* were able to germinate, grow to maturity and produce flowers and fruits without host plants and thus are facultative hemiparasites similar to *Castilleja* (Indian paintbrush) taxa. The fact that *Chloropyron maritimum* subsp. *maritimum* was not included in Chuang and Heckard's study and the endangered status of the plant, prompted on-site investigations by staff of the Natural Resources Management Office, Pacific Missile Test Center, Point Mugu, in Ventura County. A considerable number of the plants have been found on this base, now Naval Base Ventura County Point Mugu.

All parasitic plants are inherently limited in their geographical and ecological distribution by the distribution of their host plants. Vanderwier and Newman (1984, p. 185) found *Chloropyron maritimum* subsp. *maritimum*, under laboratory conditions, capable of forming haustorial connections to *Distichlis spicata* (saltgrass), *Polypogon monspeliensis* (annual beard grass), *Salicornia virginica* (pickleweed), *Jaumea carnosa* (fleshy jaumea), and *Helianthus annuus* (sunflower) or of surviving without haustorial connections to a host plant. They examined field collected plants from Point Mugu and verified haustorial connections between plants of *Chloropyron maritimum* subsp. *maritimum* and *Distichlis spicata*, *Frankenia grandifolia* (now known as *F. salina*) (frankenian), *Scirpus robustus* (tule), and *Typha latifolia* (broad-leaved cattail) (Vanderwier and Newman (1984, p. 185). Other plant taxa may serve as hosts for *Chloropyron maritimum* subsp. *maritimum* at this and other sites. The capacity to survive without haustorial connections to a host found under laboratory conditions is unlikely to be encountered in the field (Tank, D., Peabody Museum, Yale University, pers. comm. 2007, p. 1).

Seeds germinate generally over a 3 to 5 week period in March or April and may be followed by a high mortality rate after 4 to 6 weeks (Dunn 1987, p. 74). Individual plants senesce in late July after flowering and setting seed (Dunn 1987, p. 65) thus like most plants termed “annuals” they complete their life cycle in substantially less than one year. A higher percentage of seeds of *Chloropyron maritimum* subsp. *maritimum* germinated in freshwater under conditions of 16 hours of light and 8 hours of dark (Dunn 1987, p. 71-72). This may indicate that germination in the halophytic taxa of *Cordylanthus* during dry cycles is limited by the amount of rainfall or surface flow of fresh water at seed bed sites. However, prolonged inundation may also inhibit germination as was noted at Point Mugu where ground water was impounded (Dunn 1987, p. 69). Timing of seed germination is likely associated with annual cycles of lower salinity associated with influx of freshwater from rainfall or runoff. Salinity at the time of germination was 0 to 10 parts per thousand and reached 10 to 20 parts per thousand by the end of the growing season (Dunn 1987 p. 53). Plants that germinated during the first three weeks of the germination period, under conditions of lower salinity, had a higher survivorship rate and produced more flowers, fruits, and seeds per individual; more seeds developed per capsule as well (Dunn 1987, p 78). Survivorship differed among three salt marsh sites surveyed, ranging from 38.5 percent at Newport Back Bay to 73.3 percent at Point Mugu (Dunn 1987, p. 74).

The flowers are self-compatible and are pollinated by various bees including *Bombus pennsylvanicus sonorous*, *Anthidium edwardsii*, and *Melissodes tepida timberlakei* (Lincoln 1985, p. 7). These are ground nesting bees (Lincoln 1985, p. 17) and as such require adequate nesting grounds. *Anthidium edwardsii* was determined to be the most effective pollinator of the plants at Point Mugu (Lincoln 1985, p. 14). Mean seed set per flower was 5.6 to 14.2 for three sites (Lincoln 1985, p. 31). Dunn (1987, p. 78) counted 7.6 to 22.8 seeds per fruit for nine cohorts from three different sites. The relationship to the number of ovules per ovary is unknown.

Local and long-distance dispersal of seeds dictates the pattern of colonization and distribution of plants. The seeds of *Chloropyron maritimum* subsp. *maritimum* reportedly float for up to 50 days (USFWS 1985b, p. 14). Although dispersal of seeds was not directly measured, a test of the dispersal pattern of small styrofoam pellets each the same weight as the seeds, revealed that tidal flows would indeed deposit the seeds at the upper limits of the debris line and would be coincident with the local distribution of *Chloropyron maritimum* subsp. *maritimum* (Dunn 1987, p. 69).

An explanation for the patchy nature and geographical shifts of the occurrences of *Chloropyron maritimum* subsp. *maritimum* may lie in the observations of Hopkins and Parker (1984, p. 354). The distribution of the seed bank of dominant taxa was found to be influenced by tidal movement and proximity to channels but also by local seed source.

Summary

Since listing, several aspects of the species biology and life history of *Chloropyron maritimum* subsp. *maritimum* have been investigated. These include host plant taxa, seed germination requirements, the breeding system, and pollinators. Knowledge of these features and the

vulnerabilities associated with them will assist in the design and implementation of conservation, restoration, and reintroduction efforts as well as assessments of new threats.

Spatial Distribution

At the time of listing, we considered the historical range of this salt marsh plant to extend from Santa Barbara County to San Diego County, California in the United States and south into northern Baja California, Mexico (Figures 1, 1A). We considered *Chloropyron maritimum* subsp. *maritimum* to be extant only at Point Mugu in Ventura County, Tijuana Estuary in San Diego County (Figures 1 and 1A), and in northern Baja California (USFWS 1978, 43 FR 44811).

Preserved herbarium specimens are permanent vouchers of current and historical plant occurrences and distribution. Specimens are verifiable and may be the only indication that the plant ever existed at a place where it has been extirpated since the specimens were collected. Herbarium vouchers for occurrences are shown in Appendix 1. Lack of recent vouchers may indicate lack of surveys or that the species is extirpated at the site. As shown in Appendix 1, *Chloropyron maritimum* subsp. *maritimum* has historically likely been extirpated from all five occurrences from Los Angeles County, five of the nine known from San Diego County, the only one known from San Bernardino County, three of the four from Orange County, and two of the six from Ventura County. Also evident is the fact that there were three occurrences in inland salt marshes, southeast of Artesia in Los Angeles County, San Bernardino Valley in San Bernardino County, and at Oak Grove in San Diego County. There are no known extant occurrences in inland salt marshes.

The element occurrence (EO) tracking system was initiated by The Nature Conservancy to identify specific locations and track site changes for rare taxa. This system, now embodied in the California Natural Diversity Data Base (CNDDDB), was initiated in 1979, one year after *Chloropyron maritimum* subsp. *maritimum* was federally listed. Consequently no element occurrences were identified at the time of listing. Sources for the range given in the final listing rule were not cited but were likely derived from accumulated herbarium records, published literature, available reports, and personal accounts. Information from these same sources was likely used to populate the original CNDDDB data fields for the element occurrences.

Since *Chloropyron maritimum* subsp. *maritimum* was listed, data reported to the CNDDDB has provided information on the location and the status of the plants and occurrences for 30 years. The CNDDDB currently recognizes 37 separate element occurrences (EOs) for this plant (CNDDDB 2008). Each EO is assigned a consecutive number based on the sequence in which data for a site was first reported to the CNDDDB. Some EOs have subsequently been merged because of proximity to an existing occurrence or deleted because of reinterpretation of specimens or locations upon which the record was based. However, in both of these cases, the associated EO numbers are not used again for the species. Data submitted to the CNDDDB that are referable to previously identified occurrences are added chronologically to existing EO reports. Older reports often have no or limited precision for locality data. Often dots indicating the location of plants were hand drawn on maps and submitted to CNDDDB. Current locations determined by GPS data are difficult to compare to these earlier data. The currently known element occurrences (EOs) are included in Appendix 1. All EOs attributable to a single salt marsh are

grouped together. Commonly CNDDDB assigns different EO numbers to occurrences that are more than a quarter mile (400 meters) apart, which is why some of the salt marshes in Appendix 1 include more than one EO.

Since it was listed, redetermination of specimens from Morro Bay, San Luis Obispo County, previously thought to represent *Cordylanthus maritimus* subsp. *palustris* and now considered to represent salt marsh bird's-beak, resulted in the extension of the known range of *C. maritimum* subsp. *maritimum* northward to Morro Bay in San Luis Obispo County, California. These occurrences are approximately 105 miles (169 kilometers) north of the next closest occurrences at Carpinteria Marsh in Santa Barbara County, California.

Chloropyron maritimum subsp. *maritimum* is currently known to persist in seven coastal salt marshes: San Diego County at Tijuana Estuary (separated into Border Field State Park and Tijuana Slough NWR), Naval Radar Receiving Facility (NRRF), and Sweetwater Marsh Unit of San Diego Bay NWR; Orange County at Upper Newport Bay (State) Ecological Reserve; Ventura County at Naval Base Ventura County, Point Mugu; Santa Barbara County at Carpinteria Salt Marsh; San Luis Obispo County at Morro Bay (Appendix 1).

Three life history characteristics affect the distribution of *Chloropyron maritimum* subsp. *maritimum*. These are its annual habit, its hemiparasitic mode of nutrition and the fact that it is a halophyte (a salt tolerant plant). Within a given marsh, the distribution of *C. maritimum* subsp. *maritimum* depends upon, and changes with, the local dispersal of its seeds, distribution of potential host plants, and annual environmental conditions. Spatial distribution of these plants is directly related to the distribution of suitable habitat described below. Combinations of these characteristics and annual environmental conditions may lead to apparent shifts in plant populations or occasional episodes where the plants are not present for a time.

Summary

The historical range of *Chloropyron maritimum* subsp. *maritimum* extended in coastal salt marshes from northern Baja California, Mexico to Morro Bay in San Luis Obispo County, California, and inland at salt marshes near Artesia in Los Angeles County, in San Bernardino Valley in San Bernardino County, and near Oak Grove in San Diego County. The known range of the taxon has remained nearly the same as it was at the time of listing, although extant plants at Sweetwater Marsh may all be derived from outplantings of seeds collected from Tijuana Slough NWR. The distribution of extant occurrences is that same as it was when the recovery plan was produced (USFWS 1985b, p. 4). The only change since listing is that the known range of *C. maritimum* subsp. *maritimum* has been extended northward to Morro Bay based on a redetermination of some collections from the area. The range of *C. maritimum* subsp. *maritimum* and distribution of extant and presumed extirpated occurrences are depicted in Figures 1 and 1A.



Figure 1. Distribution of *Chloropyron maritimum* subsp. *maritimum* (salt marsh bird's-beak) occurrences.

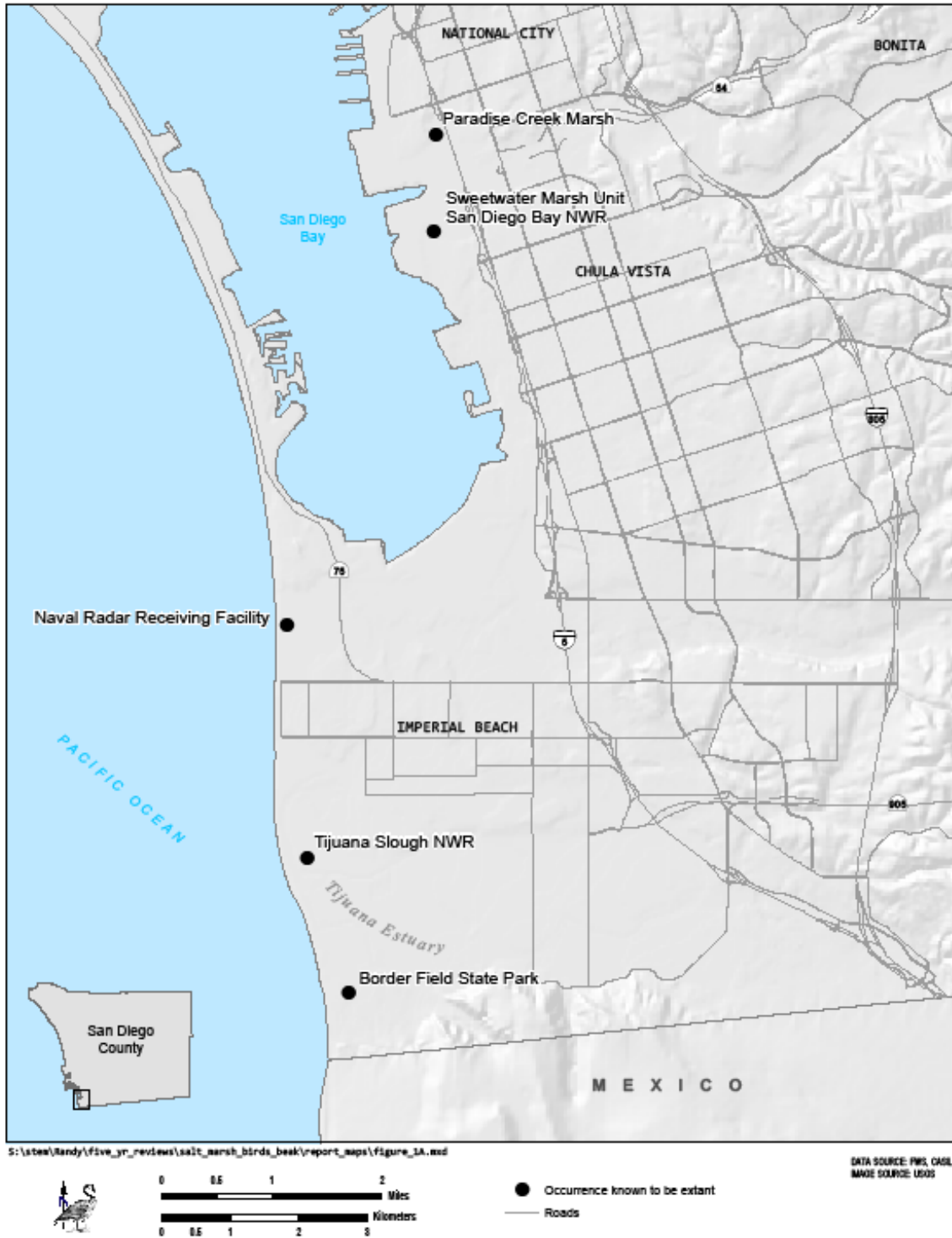


Figure 1A. Distribution of *Chloropyron maritimum* subsp. *maritimum* (salt marsh bird's-beak) occurrences in San Diego Bay and Tijuana Estuary.

Abundance

Although we stated in the listing rule that the species had been drastically reduced (USFWS 1978, p. 44811), this was likely associated with habitat loss rather than measured direct loss of numbers of standing plants. No estimate of numbers of plants was included in the listing rule.

The numbers of individuals of *Chloropyron maritimum* subsp. *maritimum* differs at any site for any year because it depends, in part, upon the number of seeds deposited to the seed bank and the survivorship of the annual seedling cohort. Local site conditions, rainfall, and the influx of fresh water also likely influence numbers of standing plants and their local distribution. The annual variation in numbers of individuals at a site is evident from data for some of the CNDDDB element occurrences (CNDDDB 2008). Because of the patchy nature of the species local occurrences, seeds may be more or less abundant in adjacent sites. The number of individuals at eight colonies in the northern portion of the Tijuana Estuary in 1981 ranged from 0 to 1,000 plants (Dunn and Zedler 1981, p. 4). The size, position, and configuration of local occurrences may also change over time (MEC Analytical Systems, Inc. 2003, p. 4). If suitable host plants are not present it is unlikely that any *C. maritimum* subsp. *maritimum* plants would occur, let alone persist to reproductive maturity.

Habitat or Ecosystem

Habitat Description and Occupancy

The local distribution of *Chloropyron maritimum* subsp. *maritimum* in a given salt marsh is dictated, in large part, by the distribution of suitable habitat. This, in turn, is based on the unique topographic and hydrological regimes at each estuary and is affected by coastal saline tidal flows as well as inland fresh-water stream and surface flows. Both types of flows contribute to the hydrological regime of the habitat and are affected by climate.

Chloropyron maritimum subsp. *maritimum* currently occurs in coastal salt marshes from northern Baja California, Mexico to San Luis Obispo County, California (Chuang and Heckard 1973, p. 146). Coastal salt marsh habitat is commonly divided into three or more zones based either on physical features, including tidal patterns, or based on the kinds of plants occurring in the different zones. The latter method may be more reliable because it reflects the long term patterns and processes that otherwise might not be observed during a monitoring study. We have no description of historical inland occurrences.

Chloropyron maritimum subsp. *maritimum* and most other species restricted to salt marsh habitats are potentially impacted by factors that alter the salinity and/or duration of inundation of their habitat. Daily and seasonal changes in salinity and inundation are associated with normal tidal flows. The marsh soils are predominantly clay and silt (Zedler et al. 1980, p. 237). The upper elevation of all salt marshes, where *C. maritimum* subsp. *maritimum* is often found, becomes desiccated in summer. Salinity is higher in the summer when there is less rainfall and surface runoff, compared to winter months (Zedler et al. 1980, p. 237). Salinity may be lower in those estuaries where the mouth is blocked from the ocean tides and fresh water builds up in the

marsh (Zedler et al. 1980, p. 237). The association of soil salinity with occurrences of *C. maritimum* subsp. *maritimum* at Tijuana Estuary, Newport Bay, and Point Mugu has been documented by Dunn (1987, p. 53). The trend in estuary restoration projects has been to create more open tidal areas (e.g. Bolsa Chica Lagoon in Orange County, Batiquitos Lagoon in San Diego County).

Vegetation zonation, and therefore plant distributions, in salt marshes is determined by the species' differential tolerances for inundation and salinity (Pennings and Callaway 1992, p. 689). *Chloropyron maritimum* subsp. *maritimum* was reported from the higher areas, identified as the middle littoral zone by Purer (1942, p. 84) growing with species of *Salicornia*, *Distichlis*, *Frankenia*, *Suaeda*, and *Atriplex*. Massey (1987, p. 12) also reported *Monanthochloe littoralis* and *Jaumea carnosa* as associated species at Seal Beach, Orange County. The middle littoral zone is distinguished as being between the lower littoral zone that is inundated twice daily with tidal flows and the upper littoral zone that is partially inundated only during high tides (Purer 1942, p. 93). Further refinement of the zone limits delimits the lower zone as being 3-4 feet (0.9-1.2 meters) above mean lower low water (MLLW), the middle zone as being 4-6 feet (1.2-1.8 meters) above MLLW, and the upper zone as being 6-7 feet (1.8-2.1 meters) above MLLW (Vogl 1966, Zedler 1982, p. 8). The vertical range for *C. maritimum* subsp. *maritimum* at the Tijuana Estuary in 1994 was 5.6-7.9 feet (1.7-2.4 meters) above MLLW (Parsons and Zedler 1997, p. 254). The habitat that supports the *C. maritimum* subsp. *maritimum* is considered somewhat variable across the range of the plants. Some sites are near freshwater seeps (e.g. Point Mugu), while others are behind barrier dunes (e.g. NRRF), on dunes or mounds (USFWS 1985b, p. 16). Most sites are dry in the summer months and some are not subject tidal influence. *Chloropyron maritimum* subsp. *maritimum* occurs within a 1.1 feet (3.4 decimeters) range in elevation, between 3.6 and 5 feet (9.3 and 12.7 decimeters) Mean Sea Level (MSL) at Tijuana Estuary (Dunn 1987, p. 82). Prior to that, Dunn and Zedler (1981, p. 3) found the elevational range to be within 8 inches (2.1 decimeters) (between 6.4 and 7.1 feet (19.6 and 21.5 decimeters) MLLW.

The hydrology of natural salt marshes is determined by the intertidal elevation of the site, the precipitation in the area, and stream flow (Kuhn and Zedler 1997, p. 391). Hydrological conditions described for the Tijuana Estuary are likely applicable to all of the known occurrences of *Chloropyron maritimum* subsp. *maritimum*. Generally there is low rainfall and high evaporation rates, with little or no summer rainfall and highly seasonal stream flows (Zedler et al. 1986, p. 76). *Chloropyron maritimum* subsp. *maritimum* occupies a zone that is generally above most tidal flows. Habitat may be affected by actions or conditions that cause changes in hydrological features of a site. These may include channelization, water diversion, freshwater inflow, or climate changes.

Amount of Habitat

In the final listing rule we stated that filling in of coastal salt marshes had either eliminated or drastically reduced this species in its known habitats (USFWS 1978, 43 FR 44811). The interior occurrences were not addressed in the listing rule. More recently, Callaway et al. (2007, p. 235) stated that over 90 percent of coastal salt marshes and tidal freshwater marshes have been affected by agriculture, the salt pond industry, airports, and urban development.

Distribution of Suitable Habitat

Suitable coastal habitat for *Chloropyron maritimum* subsp. *maritimum* occurs in a relatively narrow band generally subject to only high tides. This habitat may be broad and expansive (e.g., Carpinteria Salt Marsh, Santa Barbara County) where the local topography is relatively flat or it may be narrow (e.g., Newport Back Bay, Orange County) where the marsh occurs at the base of coastal bluffs. Changes in sea level will likely result in changes in the topographical distribution of saline tidal flows in coastal marshes where the *Chloropyron maritimum* subsp. *maritimum* and its host plants grow. *Chloropyron maritimum* subsp. *maritimum* plants tend to occur in areas where germination is likely tied to inflows of fresh water in the winter and early spring (see Species Biology and Life History section above). These two characteristics mean that it is likely that if sea level increases, suitable habitat for the taxon will shift inland and upward in topographic level.

Reintroductions

Reintroduction or translocation of listed plants has frequently been recommended; however, the literature concludes that few of the reintroduced populations appear to be self-sustaining (Hall 1987, p. 418). An initial effort to reintroduce *Chloropyron maritimum* subsp. *maritimum* into historically occupied habitat was undertaken in 1982 after the taxon was listed. Reestablishment at historical occurrences was included as a provision in the recovery plan (USFWS 1985b, p. 51). Consequently, efforts were undertaken to reestablish populations at a historical site, now Seal Beach National Wildlife Refuge in upper Anaheim Bay and as mitigation at Sweetwater Marsh in San Diego. Subsequently, Pavlik (1994, p. 341) made recommendations to improve the success of translocation efforts, including the use of more detailed and effective monitoring.

Seal Beach National Wildlife Refuge

Herbarium records indicate that *Chloropyron maritimum* subsp. *maritimum* was collected in 1930 and 1932 at Anaheim Bay (now included in Seal Beach National Wildlife Refuge (SBNWR)) in Orange County. Searches of the area in 1969, 1970, and 1980 failed to detect any extant plants (USFWS 1985b, p. 83). A draft version of the Integrated Natural Resources Management Plan for Naval Weapons Station Seal Beach that includes the refuge lands, also failed to detect any *Chloropyron maritimum* subsp. *maritimum* in a 1996 survey.

In an attempt to reestablish the species, seeds of *Chloropyron maritimum* subsp. *maritimum* collected from Upper Newport Bay were planted in March 1982 at three plots east of Kitts Highway along the northwest edge of the SBNWR (Massey 1985, p. 9). The seeds were planted among mats of *Monanthochloe littoralis* (shoregrass), a known host species. Massey noted that plants germinated that year (1982) and subsequent years, although monitoring was not carried out until between March and June 1985 (Massey 1985, p. 9). A total of 123 plants were reported from Plot A, a site within the reach of high tides. One plant was found in Plot B, a site subject to only extreme high tides and no plants were found in Plot C which was above the highest tides. Because there was no evidence that the plants had spread beyond the limits of the plots, it was decided to sow more seeds (Massey 1987, p. 4).

In 1985, two additional sets of three plots were established to test three different planting techniques. The first three plots were near the 1982 Plot A and in the same microhabitat. The second set was near 1982 Plot B subject to only the highest tides (7.0 MLLW). There was no sign of germination throughout the 1985 season. In 1986, an additional five plots were established in the vicinity of 1982 Plot A where several hundred seeds remaining from those collected at Newport Bay in 1981 were planted. All plots were analyzed on July 28, 1986.

Overall *Chloropyron maritimum* subsp. *maritimum* was found in 5 of the 9 plots subject to high tides. *Monanthochloe littoralis* was consistently present in all of the test plots but *Distichlis spicata* was almost always absent from sites supporting *C. maritimum* subsp. *maritimum*. After 1986 the population at SBNWR declined steadily and was considered extirpated by 1997 (Parsons and Zedler 1997, p. 254).

Sweetwater Marsh National Wildlife Refuge

The California Department of Transportation (Caltrans) was required to establish a self-sustaining population of *Chloropyron maritimum* subsp. *maritimum* at Sweetwater Marsh as part of mitigation for a freeway expansion project (Parsons and Zedler 1997, p. 254). The native population at the site was last seen in 1987 (Parsons and Zedler 1997, p. 254). Seeds for this project were collected annually from Tijuana Estuary and sown at Sweetwater Marsh each winter from 1990 to 1992 (Parsons and Zedler 1997, p. 254).

Seeds of *Chloropyron maritimum* subsp. *maritimum* were sown to create five clusters of small patches similar in elevation, canopy cover, and host plant species. *Monanthochloe littoralis*, *Salicornia subterminalis*, *Frankenia salina*, *Cressa truxillensis*, *Atriplex watsonii*, and *Limonium californicum* were prevalent at the reintroduction site. The estimated number of resultant individuals of *Chloropyron maritimum* subsp. *maritimum* was 5,000 in 1992, 5,700 in 1993, 14,300 in 1994, and 14,000 in 1995 (Parsons and Zedler 1997, p. 257). We have no updated information on the condition of this reestablishment effort.

Summary of Reintroduction Efforts

The lack of adequate, consistent monitoring, and management likely contributes to the apparently limited success and duration of reintroductions of *Chloropyron maritimum* subsp. *maritimum*. Additional attempts at reintroduction using up-to-date techniques may be useful. Care must be taken to establish protocols for selection of source populations and permanent records of origin and genetic profile of reintroduced plants.

Changes in Taxonomic Classification or Nomenclature

The taxonomic classification and nomenclature of *Cordylanthus maritimus* subsp. *maritimus* has changed since the taxon was listed in 1979.

At the time of listing the genus *Cordylanthus* was placed in the Scrophulariaceae (figwort family). However, based on molecular systematic studies using DNA sequences of three plastid

genes, Olmstead et al. (2001, p. 356) transferred the hemiparasitic group Castillejinae, including *Cordylanthus*, to the Orobanchaceae (Broomrape family). This systematic treatment will be followed in the upcoming revision of the Jepson Manual. Upon review and in agreement with available systematic and floristic literature and consultation with species experts, the Carlsbad Field Office submitted a proposal to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations to reflect the transfer of *Cordylanthus* taxa, including *C. maritimum* subsp. *maritimum*, from the family Scrophulariaceae to the family Orobanchaceae. This transfer would not alter the definition or distribution of the listed entity.

Since this 5-year review was initiated and the above mentioned amendment proposal was submitted, Tank et al. (2009) published an anticipated revision of the subtribe Castillejinae (Orobanchaceae) which includes the genus *Cordylanthus*. This work revises circumscription of several included genera. This molecular systematics research derives from previous work on the family realignments of the Scrophulariaceae *sensu lato*. (Olmstead et al 2001). We are submitting an additional proposal to amend 50 CFR 17.12 to change the name of the listed entity to *Chloropyron maritimum* (Nutt. ex Benth.) A. Heller subsp. *maritimum*. The transfer of this taxon to another multispecies genus does not alter the circumscription or distribution of the listed entity. Likewise, the recovery priority number is not affected by this transfer.

Genetics, genetic variation, or trends in genetic variation in *Chloropyron maritimum* subsp. *maritimum*

Genetic diversity in natural populations of *Chloropyron maritimum* subsp. *maritimum* is low (Helenurm and Parsons 1997, p. 238). The authors analyzed 21 enzyme loci from samples collected from 30 patches at four sites, Tijuana Estuary (San Diego County), Newport Bay (Orange County), Mugu Lagoon (Ventura County), and Carpinteria Marsh (Santa Barbara County). No material from Morro Bay was included in the study. Genetic variation was found only as a few rare alleles. Populations at Carpinteria and Newport Bay lacked any genetic variation at enzyme loci examined (Helenurm and Parsons 1997, p. 238). Populations at Tijuana Estuary and Mugu Lagoon had the highest percentages of polymorphic loci. Populations of *C. maritimum* subsp. *maritimum* are considered to be very susceptible to loss of rare alleles through genetic drift and therefore would be susceptible to the loss of the fitness advantages of heterozygosity (Helenurm and Parsons 1997, p. 241). To maintain the fitness advantages of heterozygosity it is important to maintain higher numbers of individuals to counteract natural genetic drift. This is especially true of reestablished populations. The frequency of rare alleles was less in the reintroduced populations at Sweetwater Marsh than the source populations at Tijuana Estuary (Helenurm and Parsons 1997, p. 241). The impact on the long term survival of this reestablished population is unknown. The fact that the highest genetic diversity in *Chloropyron maritimum* subsp. *maritimum* was found at the two largest populations indicates that care must be taken to insure adequate population sizes to overcome the potential negative impacts from genetic drift.

Vulnerability Factors

Species may be vulnerable to threats for a variety of reasons. Primack (2006, p.159) outlined five categories of species considered most vulnerable to extinction as:

- 1) Species with a very narrow geographical ranges;
- 2) species with only one or a few populations;
- 3) species in which population size is small (identified as one of the best predictors of species extinction rate);
- 4) species in which population size is declining; and
- 5) species that are hunted or harvested by people.

Consideration of these categories and its life history traits can provide a vulnerability profile for *Chloropyron maritimum* subsp. *maritimum*. Fiedler and Ahouse (1992, p. 32) considers ecology, biotic competition, population dynamics, reproductive biology, and genetics among the factors affecting the rarity of a plant taxon which would be reflected in numbers 2 and 3 above; few and small populations. *Chloropyron maritimum* subsp. *maritimum* exhibits several attributes that are applicable to a list of causes of intrinsic rarity in plants prepared by Fiedler and Ahouse (1992, p. 33), including:

- 1) The plants are restricted to upper tidal marshes;
- 2) the habitat is subject to hydrological fluctuations,
- 3) insect mediated pollination is required for adequate seed production;
- 4) plants are annuals that complete their life cycle in less than one year;
- 5) plants are hemiparasitic on associated salt marsh taxa; and
- 6) genetic diversity is represented only by rare alleles.

Life history and habitat specificity traits seem to comprise the most significant vulnerabilities of *Chloropyron maritimum* subsp. *maritimum*. The threats described below in the Five-Factor Analysis section likely have the greatest impacts on the traits above. The listing rules identified few specific threats. Therefore, nearly all of the specific threats to the taxon noted below are those attributed to the occurrences by subsequent surveys reported by CNDDDB (Appendix 1; CNDDDB 2008).

Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

FACTOR A: Present or threatened destruction, modification or curtailment of its habitat or range.

In the listing rule (USFWS 1978, 43 FR 44811) filling in of coastal salt marshes was cited as a threat to eliminate or diminish this species in its habitat. We specifically cited a proposal to restore “natural” tidal flow to the marshes of Point Mugu Lagoon that would eliminate a flourishing colony of the plants.

Habitat Loss

Historically, *Chloropyron maritimum* subsp. *maritimum* occurred in many more salt marshes than it did at the time of listing. The taxon was reported from interior salt marshes in San Diego, Los Angeles, and San Bernardino Counties, as well as coastal salt marshes from Baja California, Mexico to Santa Barbara County. Occurrences listed in Appendix 1 as, known at the time of

listing, include several now known to be extant, but were not detected at listing. Most of the reported occurrences are along the coast and no interior occurrences are thought to be currently extant. Also, as may be seen from Appendix 1, about half of the coastal occurrences in Orange County, all of the coastal occurrences in Los Angeles County, and some of the coastal occurrences in Ventura County have been extirpated. All of these habitat losses were historical, prior to listing. An exception is that the native population at Sweetwater Marsh apparently died out by 1987. The comparative acreages of these salt marshes and the numbers of plants they supported are unknown. Many of these salt marsh areas were either filled in for development (e.g. Artesia and Long Beach in Los Angeles County) or cleared for marinas (e.g. Mesmer near Santa Monica in Los Angeles County). Diversion of fresh water from the salt marsh areas may also have led to the habitat becoming unsuitable to sustain *C. maritimum* subsp. *maritimum* populations.

Since listing, the direct loss of coastal wetlands including coastal salt marsh habitat suitable for *Chloropyron maritimum* subsp. *maritimum* has been largely eliminated as a result of current laws and regulations protecting coastal habitats (see discussion under Five-Factor Analysis, Factor D below). The California Coastal Act and the Federal Clean Water Act have been the most effective mechanisms at protecting habitat for *Chloropyron maritimum* subsp. *maritimum*. Federal and State protections for *Chloropyron maritimum* subsp. *maritimum* do not, however, protect the Tijuana River estuary from proposed water-sewage treatment effluents entering the estuary from the headwaters and watershed of the Tijuana River in Baja California, Mexico. Major habitat loss due to development is now unlikely, though recent (e.g. Baticuitos Lagoon and Bolsa Chica wetlands) and ongoing (San Dieguito Lagoon at Del Mar) restoration projects have not focused on maintenance of terrain or hydrological characteristics conducive to the zone of coastal salt marsh to which *Chloropyron maritimum* subsp. *maritimum* belongs.

Off-highway Vehicles (OHVs)

Although not mentioned in the listing rule, impacts from OHVs have been reported for some occurrences of *Chloropyron maritimum* subsp. *maritimum* (CNDDDB 2008; Appendix 1). These occurrences are in San Diego County in an area of the Tijuana Slough NWR in the Tijuana Estuary where OHV activity is controlled by the Refuge managers; in Orange County at Upper Newport Bay where OHV activity is controlled by managers of the Upper Newport Bay State Ecological Reserve; in Ventura County at Ormond Beach where OHV activity is controlled to a degree by the Coastal Conservancy and The Nature Conservancy's Conservation Easement, and at the Ventura County Naval Base Point Mugu (CNDDDB 2008; Appendix 1). Potential impacts from OHVs are currently minimal and management measures are in place to minimize these impacts.

Hydrological Changes

Modification for natural tidal flow in Point Mugu Lagoon in Ventura County, noted as a threat in the listing rule, was completed in about 1980. As a result a portion of the populations at the occurrence were destroyed, but most remained. Since listing, increased tidal flow at one site in the Carpinteria Marsh in 1984 reportedly created wetter conditions (CNDDDB 2008, EO 17). However, there are no subsequent reports on the precise location of the site or condition of plants

in the area and occurrences in the area are presumed to be extant (CNDDDB 2008, EOs 17, 18, and 20). Hydrological alterations to promote populations of endangered birds (e.g., light-footed clapper rail) have taken place at historical occurrence sites of *Chloropyron maritimum* subsp. *maritimum*, though the impact on plant populations is unknown.

Factors that affect the hydrological regimes of coastal salt marshes directly impact the species restricted to these habitats. Global climate change, not known as a threat at the time of listing, may likewise affect these factors. According to the Intergovernmental Panel on Climate Change (IPCC) there has been a general but measured increase in global average temperatures since the turn of the century (IPCC WG I 2007, p. 6). This translates to the fact that the average temperature of the ocean has also risen. The same is true for global average sea level (IPCC WG I 2007, p. 6). The same report attributes the observed annual rate of sea level rise to thermal expansion of ocean waters and melting of glaciers and icecaps, the Greenland ice sheet, and the Antarctic ice sheet. The rate of sea level rise nearly doubled between 1993 and 2003 when compared to the entire period 1961 to 2003. Global average sea level rose at an average annual rate of 0.1 inches (3.1 millimeters) per year between 1993 and 2003 (IPCC WG I 2007, p. 7). The total rise in sea level during the 20th century is estimated to be about 0.56 feet (0.17 meters). As stated above under Habitat Description, the vertical distribution of *Chloropyron maritimum* subsp. *maritimum* is between 5.6 feet (1.7 meters) and 7.9 feet (2.4 meters) above Mean Lower Low Water, a range of 2.3 feet (0.7 meters). This means that the tidal flows will encroach further into all coastal marshes including those that support *C. m.* subsp. *maritimum*. The impact on distribution of associated vegetation and host plants is unknown. Although the degree of sensitivity *Chloropyron maritimum* subsp. *maritimum* to incremental changes in sea level is unknown, ultimately, it is likely that the full extent and distribution of populations will be affected and likely move inland or up the elevational gradient. The populations could potentially migrate inland in step with changes in the estuarine hydrology as long as the physiography of the site allowed. The physiography of each occurrence differs, which in turn dictates whether or not *C. maritimum* subsp. *maritimum* can naturally migrate to other suitable sites. The potential for adjacent habitats to become suitable for *C. maritimum* subsp. *maritimum* as the inundation regime changes also likely varies from occurrence to occurrence. Habitat for *C. maritimum* subsp. *maritimum* at generally broad open estuaries such as Tijuana Estuary in San Diego County and Point Mugu in Ventura County would persist more readily than that at Newport Bay in Orange County where the adjacent bluffs could preclude inland migration of the habitat. Sea level rise poses a significant rangewide threat to all extant occurrences of *C. maritimum* subsp. *maritimum* and coastal marsh areas under consideration for restoration and/or enhancement. Assessment of the occupied coastal marshes using the Service's Sea Level Affecting Marshes Model (SLAMM) will help identify the most vulnerable sites.

Since listing, erosion from storm drain runoff is listed as a threat to occurrences in Upper Newport Bay in Orange County (CNBBB 2008, EOs 37, 38; Appendix 1). This runoff is generated by neighborhoods on the bluffs above the bay. The upland areas are under the jurisdiction of the City of Newport Beach and efforts are being made to control this runoff. The Big Canyon Creek Restoration Project includes provisions to avoid the listed plant, control runoff, and monitor reference sites (City of Newport Beach 2009). Projections of precipitation as less snow and more rain (CEC 2006, p. 31) mean that there would likely be more runoff than is currently experienced. The amount and timing of runoff impacts coastal salt marsh habitat and

any changes due to climate change likely result in changes to the condition and distribution of suitable habitat for *Chloropyron maritimum* subsp. *maritimum*.

Summary of Factor A

Habitat loss noted as a threat in the listing rule is largely no longer a significant or widespread threat to *Chloropyron maritimum* subsp. *maritimum*. Habitat for this plant may still be threatened by local channelization, water diversion, or freshwater inflow. The potential impacts of sea level change associated with climate change constitute a significant rangewide threat to extant occurrences and to areas under consideration for restoration and/or enhancement. This threat is current and ongoing. Threats from OHVs are minimal under current site management (Appendix 1). Erosion is a management consideration at Upper Newport Bay State Reserve.

FACTOR B: Overutilization for commercial, recreational, scientific, or educational purposes.

In the listing rule (USFWS 1978, 43 FR 44811) we did not consider any threats attributable to this factor to apply. We believe that this assessment is still valid.

FACTOR C: Disease or predation.

In the listing rule (USFWS 1978, 43 FR 44811) we did not consider any threats attributable to this factor to apply. Since listing, insect predation has been reported as a threat to occurrences at Tijuana Slough NWR in San Diego County and Mugu Lagoon in Ventura County (CNDDDB 2008, EOs 2, 23, and 25; Appendix 1).

Since listing, herbivory by the microlepidopteran, salt marsh snout moth (*Lipographis fenestrella*) has been documented (Parsons and Zedler 1997, p. 259). This is listed in CNDDDB as insect damage for a few of the occurrences (Appendix 1). The larvae of the moth consume capsules and even unfertilized ovaries, however, a large number of capsules escape attack (Parsons and Zedler 1997, p. 259). These authors report that although there was more damage between mid-May and mid-June there was no correlation with environmental variables. The extent and impact of herbivory to populations of *Chloropyron maritimum* subsp. *maritimum* is unknown.

FACTOR D: Inadequacy of existing regulatory mechanisms.

At the time *Chloropyron maritimum* subsp. *maritimum* was listed as endangered under the Act, it was not protected by any other regulatory mechanisms. In the listing rule (USFWS 1978, 43 FR 44811) inference was made to potential protections under the California Native Plant Protection Act passed in 1977; however, this plant was not then recognized by the State as rare or endangered.

The following discussion describes State, Federal, and regional regulatory mechanisms either not in place or not addressed at the time *Chloropyron maritimum* subsp. *maritimum* was federally listed. Several State and Federal laws and regulations are relevant to conservation of *C.*

maritimum subsp. *maritimum* and contribute to its conservation. These measures, most enacted in the past 30 to 40 years, have greatly reduced or eliminated the threat of habitat destruction for this plant.

State Protections

State laws providing protection to *Chloropyron maritimum* subsp. *maritimum* include the Native Plant Protection Act (NPPA) enacted in 1977, California Endangered Species Act (CESA) enacted in 1984, California Environmental Quality Act (CEQA) enacted in 1970, and the Natural Communities Conservation Planning (NCCP) Act enacted in 1991.

Native Plant Protection Act (NPPA) and California Endangered Species Act (CESA): In 1979, the California Fish and Game Commission listed *Chloropyron maritimum* subsp. *maritimum* as endangered under the Native Plant Protection Act (NPPA) (Division 2, chapter 10, section 1900 *et seq.* of the California Fish and Game Code (CFG)) and the California Endangered Species Act (CESA) (Division 3, chapter 1.5, section 2050 *et seq.* of the CFG). Both the NPPA and CESA include prohibitions forbidding the “take” of *Chloropyron maritimum* subsp. *maritimum* (Chapter 10, Section 1908 and Chapter 1.5, Section 2080, CFG code). However, sections 2081(b) and (c) of CESA allow the California Department of Fish and Game (CDFG) to issue incidental take permits for State-listed threatened and endangered species if:

- 1) The authorized take is incidental to an otherwise lawful activity;
- 2) the impacts of the authorized take are minimized and fully mitigated;
- 3) the measures required to minimize and fully mitigate the impacts of the authorized take are roughly proportional in extent to the impact of the taking on the species, maintain the applicant’s objectives to the greatest extent possible, and are capable of successful implementation;
- 4) adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with and the effectiveness of the measures; and
- 5) issuance of the permit will not jeopardize the continued existence of a State-listed species.

The Natural Community Conservation Planning (NCCP) Act: The NCCP program is a cooperative effort between the State of California and numerous private and public partners with the goal of protecting habitats and species. An NCCP identifies and provides for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. The program began in 1991 under the State’s NCCP Act (CFG Code 2800-2835). The primary objective of the NCCP program is to conserve natural communities at the ecosystem scale while accommodating compatible land uses (<http://www.dfg.ca.gov/nccp/>). Regional NCCPs provide protection to federally listed species by conserving native habitats upon which the species depend. Many NCCPs are developed in conjunction with Habitat Conservation Plans (HCPs) prepared pursuant to the Endangered Species Act. The City of San Diego’s Multiple Species Conservation Plan (MSCP) is an example.

Chloropyron maritimum subsp. *maritimum* is a covered species under the MSCP (City of San Diego 1998, Table 3-5). Under this plan 100 percent of the major populations (Tijuana Estuary, the mouth of the Otay River, and Sweetwater Marsh) within the MSCP Plan area will be conserved and site specific monitoring for the three sites was expected. The occurrence at Naval Base Coronado above was identified as not being in the MSCP Plan area. One hundred percent of the occurrences covered by the City of Chula Vista MSCP Subarea Plan (2003, pp. 4–7 - 4–8) are considered protected because they are within the Sweetwater Marsh Unit of the San Diego Bay National Wildlife Refuge managed by the Service. Occurrences associated with the Tijuana River estuary are within the boundaries of either the Tijuana Slough NWR or the Border Field State Park.

California Environmental Quality Act (CEQA): The CEQA is the principal statute mandating environmental assessment of projects in California. The purpose of CEQA is to evaluate whether a proposed project may have an adverse affect on the environment and, if so, to determine whether that effect can be reduced or eliminated by pursuing an alternative course of action or through mitigation. CEQA applies to projects proposed to be undertaken or requiring approval by State and local public agencies (http://www.ceres.ca.gov/topic/env_law/ceqa/summary.html). The CEQA requires disclosure of potential environmental impacts and a determination of “significant” if a project has the potential to reduce the number or restrict the range of a rare or endangered plant or animal; however, projects may move forward if there is a statement of overriding consideration. 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 (CCC) considers the presence of listed species (*Chloropyron maritimum* subsp. *maritimum* was State listed as endangered in 1979) when defining Environmentally Sensitive Habitat Areas (ESHA) which are subject to section 30240 of the California Coastal Act of 1976. This section of the California Coastal Act states that ESHAs shall be protected against any significant disruption of habitat values. Certain local jurisdictions have developed their own Local Coastal Programs or Land Use Plans that have been approved by the CCC. Approximately 91 percent of California’s wetlands were lost prior to 1980, though there has been relatively little loss of wetlands in the California coastal areas over the last 30 years due to the extremely protective nature of section 30233 of the Coastal Act (California Coastal Commission 2006, p. 23). In addition to a reduction of wetland losses, there have been large and small restoration projects conducted by a variety of cooperators (California Coastal Commission 2006, p. 23).

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 mitigations that could 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.

Clean Water Act: Under section 404, the U.S. Army Corps of Engineers (Corps) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term “wetland” refers to areas meeting the Corps’ criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, NEPA, and the Endangered Species Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts. Because this is a coastal species, project impacts to watersheds may address *Chloropyron maritimum* subsp. *maritimum*.

Endangered Species Act of 1973, as amended (Act): Since listing, the Act is the primary Federal law that may provide protection for this species. The Service’s responsibilities include administering the Act, including sections 7, 9, and 10. Section 7(a)(2) of the Act requires Federal agencies, including the Service to ensure that actions they fund, authorize, or carry out do not “jeopardize” a listed species or result in the “destruction or adverse modification” of habitat in areas designated by the Service to be “critical.” Critical habitat has not been proposed for this taxon. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 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.

Under Section 9(a)(2) of the Act, with respect to endangered plant taxa, it is unlawful to remove and reduce to possession (i.e. collect) any such taxon from areas under Federal jurisdiction; maliciously damage or destroy any such taxon on any such area; or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law. As noted above *Chloropyron maritimum* subsp. *maritimum* is listed as endangered by the State of California. Therefore this species is afforded protections under section 9 of the act on non-Federal lands.

Under Section 10(a)(1)(A) of the Act there are provisions for collection of plants or plant parts for scientific purposes or to enhance the propagation and survival of the species. Under section 10(a)(1)(B) the Service may issue “incidental take” (take is defined in section 3(18) of the Act) permits for listed animal species to non-Federal applicants. Take and therefore incidental take protections are not extended to plants. “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). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to [avoid] minimize and mitigate the project’s adverse impacts to listed species

including listed plants. Issuance of an incidental take permit by the Service is subject to section 7 of the Act; thus, the Service is required to ensure that the actions proposed in the HCP are not likely to jeopardize the animal or plant species or result in the destruction or adverse modification of critical habitat. Therefore, HCPs may provide an additional layer of regulatory protection to animals as well as plants. Although Section 10(a)(1)(B) allows for exemptions to take prohibitions under section 9 for animals it does not allow for similar exemptions for plants. Habitat Conservation Plans (HCPs) are discussed below under Regional Planning Efforts. Section 10 of the Act affords no exemption to section 9 prohibitions regarding plants except in cases where the State issues an incidental take permit under section 2081(b) and (c) of CESA. Therefore, violation of take or other prohibitions afforded to State listed plants, including *Chloropyron maritimum* subsp. *maritimum*, constitutes violation of section 9 of the Federal Endangered Species Act as noted above.

Sikes Act: The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans with the Secretaries of Agriculture and the Interior for natural resources on public lands. The Sikes Act Improvement Act of 1997 requires Department of Defense (DOD) installations to prepare Integrated Natural Resource Management Plans (INRMPs) that provide for the conservation and rehabilitation of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. While the Sikes Act of 1960 was in effect at the time when *Chloropyron maritimum* subsp. *maritimum* was listed, it was not until the amendment of 1997 (Sikes Act Improvement Act) that DOD installations were required to prepare INRMPs. The INRMPs incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. While INRMPs are not technically a regulatory mechanism because their implementation is subject to funding availability, they can be an added conservation tool in promoting the recovery of endangered and threatened species on military lands.

In March 2002 the Navy completed an INRMP for Naval Base Ventura County (NBVC) Point Mugu (USD Navy 2002a). *Chloropyron maritimum* subsp. *maritimum* is addressed in this plan (USD Navy 2002a, pp. 2-54—2-57, figs 2-6 and 6-3). No special management for the species is indicated in the plan.

In May 2002 the Navy completed an INRMP for Naval Base Coronado (NBC) (USD Navy 2002b, p. F – 17). *Chloropyron maritimum* subsp. *maritimum* is known from the NRRF at Camp Surf at the southern edge of the base. The NRRF is covered in the INRMP. The INRMP includes objectives and strategies to contribute to the recovery of the population at Camp Surf (USD Navy 2002b, pp. F—17 to F—26)

Summary of Factor D

The above laws and regulations have greatly reduced the likelihood of destruction and alteration of coastal wetland habitat in California. The California Coastal Act has been beneficial to the *Chloropyron maritimum* subsp. *maritimum* and its habitat. The Act also provides protections to the species, by providing a mechanism for protection and management for the taxon on occupied Federal lands at refuges and military bases. Although the laws, regulations, and planning efforts

mentioned here have largely eliminated major habitat loss and alteration, it is uncertain how effective they will be at preventing smaller-scale losses.

FACTOR E: Other natural or manmade factors affecting its continued existence.

In the listing rule (USFWS 1978, 43 FR 44811) no threats attributable to this factor were discussed.

Since listing, new threats from trampling have been reported for occurrences at the Naval Radar Receiving Station (NRRF), San Diego County, Upper Newport Bay Ecological Reserve, Orange County, and at the south end of Morro Bay, San Luis Obispo County (Appendix 1). The extent and persistence of the threats from trampling is unknown.

Since listing nonnative plants (e.g. *Limonium* spp. (sea-lavender) and *Carpobrotus* spp. (sea-fig)) have been noted as a new threat to *Chloropyron maritimum* subsp. *maritimum* at occurrences in Santa Barbara County (e.g., Carpinteria) (CNDDDB 2008, EO 18, 19, 20) and San Luis Obispo County (e.g., Morro Bay) (CNDDDB 2008, EO 43, 44, 45, 46). No specific impacts were provided, thus the nature and magnitude of this threat can not be assessed at this time. These invasive plants may alter movement and availability of fresh water or otherwise preclude germination and growth of the *Chloropyron maritimum* subsp. *maritimum* and/or its hosts.

Any diminishment in host plant availability or vitality would likely negatively impact *Chloropyron maritimum* subsp. *maritimum*. Since listing it has become apparent that there is potential for threats to biota from ongoing accelerated climate change (IPCC 2007). The potential threats to *Chloropyron maritimum* subsp. *maritimum* habitat from sea level change associated with climate change are discussed above under Factor A. The impacts local climatic shifts to warmer and dryer conditions on pollinator populations, host plant biology, and interaction with other ongoing threats are as yet unmeasured. Interactions of threats from climate change with current or new threats can not yet be described or assessed. Habitat conditions altered due to climate change impacts may favor invasive nonnative plants of native plants unsuitable as hosts for *Chloropyron maritimum* subsp. *maritimum*.

Summary of Factor E

At the time of listing, no threats were attributed to this Factor. Since listing three new threats have been identified. Trampling tends to be incidental and local. The threat from invasive nonnative plants can be locally very significant to the species and marsh habitat in general. The ongoing impacts from climate change are rangewide and may affect more aspects of the species life history and habitat than are currently known.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one

or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise new information may change the extent that criteria need to be met for recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of the species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

Recovery Criteria are discussed as they appear in the Salt Marsh Bird's-Beak (*Cordylanthus maritimus* subsp. *maritimus*) Recovery Plan (USFWS 1985b).

Note: This recovery plan was prepared prior to guidance for writing recovery plans in a threats based format. The recovery plan did, however, include general but measurable objectives for downlisting and delisting (USFWS 1985b, p. 26). Where possible, topics addressed in the following sections are designated as relating to one of the five listing factors (A, B, C, D, or E) addressed below.

The recovery plan states that *Chloropyron maritimum* subsp. *maritimum* may be considered for downlisting to threatened when the following criteria or conditions (USFWS 1985b, p. 26) are met:

Fifteen acres [6 hectares] of secured and protected high marsh habitat at appropriate elevations is required at a minimum of eight marshes for a period of at least five consecutive years.

This recovery criterion has partially been met. *Chloropyron maritimum* subsp. *maritimum* habitat has been secured and protected at seven marshes on State lands at Border Field State Park and Upper Newport Bay Ecological Reserve and at Morro Bay, on Federal lands at Tijuana Slough National Wildlife Refuge, Sweetwater Marsh unit of San Diego Bay NWR, Naval Radar Receiving Facility at Naval Base Coronado and at Naval Base Ventura County, Point Mugu, and at the Carpinteria Salt Marsh, (Appendix 1). Acreage is secured and protected at all seven of the known extant occurrences of *Chloropyron maritimum* subsp. *maritimum*. The total acreage secured is considerably more than 15 acres (6 hectares); however no precise determinations of the amount of high marsh habitat have been made. Plants have persisted at these sites since the taxon was listed.

New threats associated with climate change and invasive nonnative plants discussed above affect assessment of recovery progress. Because of the ongoing change in sea level and rangewide impacts on extant occurrences of *Chloropyron maritimum* subsp. *maritimum* we do not consider its high marsh habitat sufficiently secure and protected. Therefore this recovery criterion is not

yet met. It is possible that monitoring and assessment by SLAMM in the next five years will identify enough suitable habitat to satisfy this recovery criterion.

The recovery plan states that *Chloropyron maritimum* subsp. *maritimum* may be considered for delisting when the following criteria or conditions (USFWS 1985b, p. 26) are met:

Twenty acres [8 hectares] of secured, protected, and managed high marsh habitat at appropriate elevations is required at each of the 12 major marshes within the historical range of the plant for a period of ten consecutive years.

This recovery criterion has not yet been met. Efforts to reestablish *Chloropyron maritimum* subsp. *maritimum* were unsuccessful at Seal Beach NWR and of limited success at Sweetwater Marsh. Apparently no other efforts have been made to reintroduce *Chloropyron maritimum* subsp. *maritimum* into historical but still suitable habitats in Los Angeles or Orange Counties.

IV. SYNTHESIS

There are seven extant coastal marsh areas that support *Chloropyron maritimum* subsp. *maritimum* in the United States (Tijuana River Estuary, Naval Radar Receiving Facility, Sweetwater Marsh, Upper Newport Bay, Mugu Lagoon, Carpinteria Marsh, and Morro Bay). All occurrences, extant at the time of listing, still support populations of the taxon, although the number of standing individuals at an occurrence may differ considerably from year to year, because it is an annual plant. The major threat at listing was habitat loss; however, State and Federal regulations since that time have greatly reduced this threat. Several threats associated with climate change, invasive nonnative plants, OHVs, trampling, and the taxon's genetics and breeding system have been identified since listing. Although the impacts of these threats have not been measured, the threat of ongoing sea level change to *C. maritimum* subsp. *maritimum* is rangewide. The recovery criteria have not yet been met. In recognition of the magnitude of current threats we recommend no change be made in the status of *Chloropyron maritimum* subsp. *maritimum* as endangered at this time.

V. RESULTS

Recommended Listing Action:

- Downlist to Threatened
- Uplist to Endangered
- Delist (indicate reason for delisting according to 50 CFR 424.11):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No Change

New Recovery Priority Number and Brief Rationale: 9

Chloropyron maritimum subsp. *maritimum* is a subspecies that faces moderate threats and has a high potential for recovery. The taxon has a fairly wide range and has persisted in all occurrences known at the time of listing 30 years ago. Habitat loss, the major threat identified in the listing rule, has largely been eliminated by State and Federal regulations of coastal zone impacts. However threats from sea level change associated with climate change are essentially rangewide. Threats associated with genetics or the breeding system of the taxon are also rangewide. Documented threats from invasive nonnative plants and trampling are more localized. The degree of threat is considered moderate. The high potential for recovery is based on the generally protected nature of the occurrence sites where the taxon persists.

VI. RECOMMENDATIONS FOR FUTURE ACTIONS

1. Resurvey historical and extant occurrences, especially inland salt marsh habitats, to detect presence and local distribution of plants. There is some potential for the inland occurrences to have persisted.
2. Develop a threats-based recovery plan to guide conservation actions for the species. Incorporate SLAMM assessments of sea level change.
3. Determine the distribution of genetic diversity at extant occurrences. This will assist us in identifying pollinators and pollen sources should pollen transfer among occurrences prove necessary. As part of this effort, verify the subspecific relationships of the occurrences in Morro Bay.
4. Prepare site specific monitoring protocols to determine, if possible, fine-scale habitat requirements and species fidelity to those habitat requirements. This will allow us to discriminate between lack of seed dispersal and unsuitable habitat as explanations for discontinuities in plant distributions.
5. Establish site and species monitoring protocols, based on those developed by VFWO at Point Mugu, to identify potential impacts of sea level changes associated with climate change. This will help detection of species responses to long term changes in sea level and associated vegetation.
6. Work with partners to help conserve *Chloropyron maritimum* subsp. *maritimum*. Identify opportunities through the Service's Partners for Fish and Wildlife and Coastal Programs to seek habitat restoration and enhancement opportunities.

VII. REFERENCES CITED

- California Coastal Commission (CCC). 2006. The 2006 updated assessment of the California Coastal Management Program (CCMP). Draft for public review and comment. Unpublished, 50 pp; web accessed November 17, 2008 at www.coastal.ca.gov?fedcd/ccmp2006assessment.pdf.
- California Department of Fish and Game, Natural Diversity Data Base (CNDDDB). 2008. Element Occurrence Reports for *Cordylanthus maritimum* subsp. *maritimum*. Unpublished cumulative data current to 2008. Sacramento, California.
- California Energy Commission (CEC). 2006. Climate scenarios for California. White paper from California Climate Change Center.
- Callaway, J., V.T. Parker, M.C. Vasey, and L.M. Schile. 2007. Emerging issues for the restoration of tidal marsh ecosystems in the context of predicted climate change. *Madrono* 54(3):234-248.
- Chuang, T.-I. and L.C. Heckard. 1971. Observations on root-parasitism in *Cordylanthus* (Scrophulariaceae). *American Journal of Botany* 58(3):218-228.
- Chuang, T.-I. and L.C. Heckard. 1973. Taxonomy of *Cordylanthus* subgenus *Hemistegia* (Scrophulariaceae). *Brittonia* 25:135-158.
- Chuang, T.I. and L.C. Heckard. 1993. *Cordylanthus* pp. 1027-1031. In Hickman, J.C., ed. The Jepson Manual: Higher Plants of California. Univ. of California Press; Berkeley, California.
- City of Newport Beach. 2009. Salt Marsh Bird's-beak (*Cordylanthus maritimum* subsp. *maritimum*) Avoidance and Monitoring Plan. Big Canyon, Newport Beach, Orange County California.
- City of Chula Vista. 2003. MSCP Subarea Plan. (Implemented January 11, 2005).
- City of San Diego. 1998. Multiple Species Conservation Plan.
- Dunn, P. and J. Zedler. 1981. Field observations of *Cordylanthus maritimum* Nuttall ssp. *maritimum* at Tijuana Estuary, California. Unpublished final report submitted to the U.S. Department of the Navy NASNI, San Diego, California.
- Dunn, P.V. 1987. The taxonomy and autecology of an endangered plant, salt marsh bird's-beak (*Cordylanthus maritimum*). Unpublished Masters Thesis, California State University, Los Angeles.

- Fiedler, P.L. and J.J. Ahouse. 1992. Hierarchies of cause: Toward an understanding of rarity in vascular plant species. pp. 23-47. In Fiedler, P.L. and S.K. Jain, eds. Conservation Biology. The Theory and Practice of Nature Conservation, Preservation, and Management. Chapman and Hall; New York, NY.
- Hall, L.A. 1987. Transplantation of sensitive plants as mitigation for environmental impacts. Pp. 413-420. In Elias, T., ed. Conservation and Management of Rare and Endangered Plants. The California Native Plant Society; Sacramento, California.
- Helenurm, K. and L.S. Parsons. 1997. Genetic variation and the reintroduction of *Cordylanthus maritimus* ssp. *maritimus* to Sweetwater Marsh, California. Restoration Ecology 5(3):236-244.
- Hopkins, D.R. and V.T. Parker. 1984. A study of the seed bank of a salt marsh in northern San Francisco Bay. American Journal of Botany 71(3):348-355.
- IPCC. 2007. Climate Change 2007: the physical science basis: summary for policymakers. Available online at www.ipcc.ch.
- Kuhn, N.L. and J.B. Zedler. 1997. Differential effects of salinity and soil saturation on native and exotic plants of a coastal salt marsh. Estuaries 20(2):391-403.
- Lincoln, P.G. 1985. Pollinator effectiveness and ecology of seed set in *Cordylanthus maritimus* subsp. *maritimus* at Point Mugu, California. Unpublished Report submitted to USFWS, Sacramento, California.
- Marine Corps Base Camp Pendleton (MCBCP). 2007. Integrated Natural Resources Management Plan.
- Massey, B.W. 1985. The status of the Light-Footed Clapper Rail and Salt Marsh Bird's-Beak in Anaheim Bay, Orange County, California, 1985. Unpublished Draft Final Report submitted to USFWS, Sacramento, California.
- Massey, B.W. 1987. The status of the Light-Footed Clapper Rail and Salt Marsh Bird's-Beak in Anaheim Bay, Orange County, California, 1986. Unpublished Draft Final Report submitted to USFWS, Sacramento, California.
- MEC Analytical Systems, Inc. 2003. Focused survey of Salt Marsh Bird's-Beak at Upper Newport Bay, California. Unpublished Report prepared for U.S. Army Corps of Engineers, Los Angeles District.
- Munz, P.A. 1974. A Flora of Southern California. U.C. Press, Berkeley California.

- Naval Base Ventura County, Point Mugu. 2003. Distribution and plant associations of Salt Marsh Bird's-Beak (*Cordylanthus maritimus* subsp. *maritimus*) at Naval Base Ventura County Point Mugu from 1996-2001. Unpublished, undated, unpaginated report; details attested to by M. Ruane, Naval Base Ventura County. Page numbers cited in this text are in brackets.
- Newman, J. 1981. A germination study of Salt Marsh Bird's-beak *Cordylanthus maritimus* subsp. *maritimus* (Scrophulariaceae). Unpublished Report.
- Olmstead, R.G., C.W. DePamphalis, A.D. Wolfe, N.D. Young, W.J. Elisons, and P.A. Reeves. 2001. Disintegration of the Scrophulariaceae. *American Journal of Botany* 88(2):348-361.
- Parsons, L.S. and J.B. Zedler. 1997. Factors affecting the reestablishment of an endangered annual plant at a California salt marsh. *Ecological Applications* 7(1):253-267.
- Pavlik, B. 1994. Demographic monitoring and the recovery of endangered plants. Chapter 13, pp. 322-350. In Bowles, M.L. and C.J. Whelan, eds. *Restoration of Endangered Species*. Cambridge University Press; London, England.
- Pennings, S.C. and R.M. Callaway. 1992. Salt Marsh zonation: The relative importance of competition and physical factors. *Ecology* 13:681-690.
- Primack, R.B. 2006. *Essentials of Conservation Biology*. 585 pp., Sinauer Assoc., Inc.; Sunderland, MA.
- Purer, E. 1942. Plant ecology of the coastal salt marshlands of San Diego County, California. *Ecological Monographs* 12:81-111.
- Tank, D. 2007. Peabody Museum, Yale University, New Haven, Connecticut. Phone conversation regarding *Cordylanthus* with Gary Wallace November 26, 2007.
- Tank, D.C., J.M. Eggar, and R.G. Olmstead. 2009. Phylogenetic classification of Subtribe Castillejinae (Orobanchaceae), *American Journal of Botany* 34(1):182-197.
- U.S. Department of the Navy (USD Navy). 2002a. Final Integrated Natural Resources Management Plan (INRMP). Naval Base Ventura County (NBVC) Point Mugu, California. March 2002.
- U.S. Department of the Navy (USD Navy). 2002b. Integrated Natural Resource Management Plan, Naval Base Coronado. May 2002.
- U.S. Fish and Wildlife Service (USFWS). 1978. Endangered and threatened wildlife and plants; determination of five plants as endangered species. *Federal Register* 43:44810-44812. September 28, 1978.

- U.S. Fish and Wildlife Service (USFWS). 1983a. Endangered and threatened species listing and recovery priority guidelines. Federal Register 48:43098-43105. September 21, 1983.
- U.S. Fish and Wildlife Service (USFWS). 1983b. Review for species classified as endangered or threatened in 1978. Federal Register 48:55100-55102. December 8, 1983.
- U.S. Fish and Wildlife Service (USFWS). 1985a. Endangered and threatened wildlife and plants; review completed for species classified as endangered or threatened in 1978. Federal Register 50:29900-29901. July 22, 1985.
- U.S. Fish and Wildlife Service (USFWS). 1985b. Salt Marsh Bird's-Beak (*Cordylanthus maritimus* subsp. *maritimus*) Recovery Plan. USFWS, Portland, Oregon.
- U.S. Fish and Wildlife Service (USFWS). 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 58 species in California and Nevada; availability of completed 5-year reviews in California and Nevada. Federal Register 72:7064-7068. February 14, 2007.
- Vanderwier, J. and J. Newman. 1984. Observations of haustoria and host preference in *Cordylanthus maritimus* subsp. *maritimus* (Scrophulariaceae) at Mugu Lagoon. Madrono 31(3): 185-186.
- Vogl, R. 1966. Salt-marsh vegetation of upper Newport Bay, California. Ecology 47(1):80-97.
- Zedler, J. 1982. The ecology of southern California coastal salt marshes: a community profile. USFWS FWS/OBS-81/54.
- Zedler, J.B., J. Covin, C. Nordby, P. Williams, J. Boland. 1986. Catastrophic events reveal the dynamic nature of salt-marsh vegetation in southern California. Estuaries 9(1):75-80.
- Zedler, J.B., T. Winfield, and P. Williams. 1980. Salt marsh productivity with natural and altered tidal circulation. Oecologia (Berl.) 44:236-240.

Appendix 1. *Chloropyron maritimum* subsp. *maritimum* Occurrences Status 2009.

AREA and OCCURRENCE	KNOWN AT LISTING Herbarium documentation	CURRENT STATUS AND THREATS	CURRENT CONSERVATION
SAN DIEGO COUNTY			
Tijuana Estuary Area		Extant	
Border Field State Park EO 1 EO 36 Boundary Monument 258	Extant at listing Gander 6152 July 25, 1938	Likely Extant	Border Field State Park (State)
N end of Border Field St. Pk. EO 35		Likely extant 1981	Border Field State Park (State)
Tijuana Slough NWR EO 2 EO 34 Imperial Beach Tijuana Slough Tijuana Marsh	Extant at listing Gander, F. 5997 June 15, 1938 Purer, E.A. 7887 Oct 28, 1938 Rose, L.S. 35329 July 12, 1935 Ferguson, H.L. 001 May 17, 1979 Howe, D. 285 July 7, 1935 Heckard, L. 2565 May 23, 1971 Beauchamp, R.M. 2306 May 1, 1971 [gen loc] Johnson, A, & Rutherford, J. 1084 Mearns 3914 [C&H 1973] Newman, J. s.n. July 1981	Presumed Extant 1988; OHV, insects 1981	Tijuana Slough NWR (Federal)
San Diego Bay Area		Extant	
Coronado Sand Spit			

EO 3 [too vague to map]	Chandler, H.P. 4003 Oct 3, 1903 [C&H 1973]	Location too vague; possibly extirpated	
Naval Radar Receiving Facility, Naval Base Coronado		Presumed Extant 2004; trampling	Naval Base Coronado (Federal)
Bay Shore salt flats EO 4 [too vague to map]	Engelmann, G. 6618 Nov 2, 1880 Kleeberger, G.R. 6619 Oct 1878 Orcutt, C.R. s.n. May 27, 1884 Brandege, T.S. s.n. October 3, 1903	Location too vague ; likely extirpated	
Sweetwater Marsh (W of Verner Pond; E of D St fill) EO 7	Gregory, J. 1135 August 21, 2004	Native occurrence apparently extirpated after 1987 Reseeded: 1990-1992 from Tijuana Slough 5,000 in 1992; 5,700 in 1993; 14,000 in 1994, 1995; 1,200 in 1996; likely extant	[noted in City Chula Vista Feb 2003 Subarea plan but says will be managed by SMNWR]
E Street Marsh EO 39	Considered extant in 1960 (USFWS 1985, p. 9)	Likely extirpated	Sweetwater Marsh Unit of San Diego Bay NWR (Federal)
Paradise Marsh (north of Sweetwater River)	ref to 1998 report (USFWS 2006 pp. 3-83)	status unknown	Sweetwater Marsh Unit of San Diego Bay NWR (Federal)
Interior San Diego County Area		Possibly Extirpated	
Oak Grove EO 11	Hall, H.M. 206 July 26, 1895 [C&H 1973; p. 145 note as intermediate with <i>C.m.</i> subsp. <i>canescens</i>]	Possibly Extirpated	
ORANGE COUNTY			
Upper Newport Bay Area		Extant	
Upper Newport Bay Ecological Reserve EO 37	Booth 1003 May 12, 1932 [C&H	Presumed Extant 2003; trails, OHVs,	Upper Newport Bay Ecological Reserve (State)

EO 38 Newport Bay Back Bay Jet Backbay Dr & San Joaquin Hills Dr.	1973] Schlising, R. 3017 May 1, 1972. Thorne, R.F. 45586 Apr 6, 1975 Tilforth, C. 1040 Sep 3, 1975 --- Booth, L.M. 1233 July 1, 1932 (RSA 412318) Atsatt, P.R. s.n. June 15, 1971 Marsh, G. 14209 May 29, 1974 Sanders, A. June 19, 1974 (UCR 20628) Taylor, D.14412a June 7, 1994 UC	erosion from storm drains, trampling	
Sunset Beach no EO number	Ackley, M.N. s.n. May 1929	Likely Extirpated	
Upper Anaheim Bay EO 5 Anaheim Creek	Fosberg, F.R. S3176 July 10, 1930 [C&H 1973] Booth, L.M. 1233 July 1, 1932 (JEPS 6032)	Likely Extirpated. Reseeded in 1980s likely no persistence.	Seal Beach NWR (Federal)
Bolsa Chica EO 6	Booth 1273 July 19, 1932 [C&H 1973]	Possibly Extirpated	
LOS ANGELES COUNTY AREA		Possibly Extirpated	
Los Cerritos Wetlands	Snow s.n. Spring 1932	Possibly Extirpated	
Long Beach EO 12	Davidson, A. s.n. May 23, 1893. McClatchie s.n. July 1896	Possibly Extirpated	
Terminal Island EO 13	Grant, G.B. 3124 May 25, 1901. Grant 22 Aug 1901 [C&H 1973] Parish, S.B. s.n. May 25, 1901	Possibly Extirpated	

Near Santa Monica EO 14 Mesmer	Hasse, H. s.n. [C&H 1973] --- Abrams, L.R. 1714 June 6, 1901 (Mesmer [6.5 mi N Manhattan B. City Hall])	Possibly Extirpated	
SE of Artesia EO 15	Johnston s.n. Aug 29, 1924. [not specific site] Peirson, F.W. 5098 Aug 29, 1924 [not specific site] [C&H 1973]	Possibly Extirpated	
SAN BERNARDINO COUNTY AREA		Possibly Extirpated	
San Bernardino Valley EO 16	Parish, S.B. s.n. July 1887 & July 1888 [C&H 1973 note Parish collections 1880-1889; p. 145 as intermediates to <i>C. m.</i> subsp. <i>canescens</i>]	Possibly Extirpated	
VENTURA COUNTY AREA		Presumed Extant	
Silver Strand, Port Hueneme EO 9	Craig 521 Aug 28, 1927	Possibly Extirpated	
Santa Clara River EO 10	Davy, J.B. 7606 Shreve, F. 7430 June 26, 1935 [C&H 9173]	Possibly Extirpated	
W of Mugu Lagoon EO 23	Considered extant at listing Abrams, L. 13692 June 26, 1935 [C&H 1973] Krasner s.n. Sep 5, 1979	Presumed Extant 2003; altered tidal flow, insects, nearby OHV use	Naval Base Ventura County Point Mugu (Federal)
Ormand Beach		Presumed extant	Conservation easement TNC

EO 24		1984; nearby OHV use	and Coastal Commission
W & SW side Mugu Lagoon EO 25	Zemba, R. s.n. May 21, 1977	Presumed Extant 1987; insects; military operations	Naval Base Ventura County Point Mugu (Federal)
McWane Rd EO 41		Presumed Extant 1980	
SANTA BARBARA COUNTY AREA		Extant	
Carpinteria Salt Marsh 0.3 mi SE Sandyland EO 17	Dearing, H.&M. 1760 Oct 30 1936. Grant, A.L. 1669 Aug 20, 1920 [C&H 1973] Patman, J. 1148 Aug 22, 1963	Presumed Extant 1984; increased tidal flow, nonnatives	University of California Santa Barbara Carpinteria Salt Marsh Nature Preserve
Carpinteria Salt Marsh E of Sandyland EO 18		Presumed Extant 1978; nonnatives	University of California Santa Barbara Carpinteria Salt Marsh Nature Preserve
Carpinteria Salt Marsh jct Hwy 101 & Carpinteria Rd. EO 19	Pollard s.n. Sept 21, 1956	Possibly extirpated 1956; nonnatives	
Carpinteria Salt Marsh along Apple Rd. EO 20	Patman, J. 1148 Aug 22, 1963	Presumed Extant 1984; increased tidal flow, nonnatives	University of California Santa Barbara Carpinteria Salt Marsh Nature Preserve
SAN LUIS OBISPO COUNTY AREA		Presumed Extant	
S end Morro Bay EO 42	Knudsen s.n. June 13, 1986	Presumed Extant 2004; road, development, trampling, nonnative plants	

Sweet Spring Marsh, S end Morro Bay EO 43		Presumed Extant 2004; nonnative plants	
N end Moro Spit EO 44	Meyer et al 102 August 23, 1979	Presumed Extant 1979; nonnative plants	
N end Morro Spit W of Fairbank Pt. EO 45		Presumed Extant 1987; nonnative plants	
N end Morro Spit opposite boat launch EO 46		Presumed Extant 2004; trampling, nonnative plants	
BAJA CALIFORNIA MEXICO			
San Telmo	Wiggins & Demaree 5055	unknown	
San Quintin	Brandege s.n.	unknown	
San Ramon	Orcutt, C.R. 1446	unknown	

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

Chloropyron maritimum subsp. *maritimum* (salt marsh bird's-beak)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

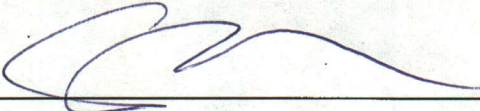
- Downlist to Threatened
 Uplist to Endangered
 Delist
 No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: 9

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

ACTING Lead Field Supervisor, Fish and Wildlife Service

Approve  Date **AUG 13 2009**

Ventura Fish and Wildlife Field Supervisor, U.S. Fish and Wildlife Service

Concur Do Not Concur

Signature  Date **8/13/09**