

Palmate-bracted bird's-beak
(*Cordylanthus palmatus* = *Chloropyron palmatum*)

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



Photo by Joe Silveira, US Fish and Wildlife Service, Sacramento National Wildlife Refuge Complex (June 4, 2004; Delevan National Wildlife Refuge, California)

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

June 2009

5-YEAR REVIEW
Palmate-bracted bird's-beak
(Cordylanthus palmatus = Chloropyron palmatum)

TABLE OF CONTENTS

I.	General Information	1
	A. Methodology	1
	B. Contacts	1
	C. Background	1
II.	Review Analysis	2
	A. Application of the 1996 Distinct Population Segment (DPS) Policy	3
	B. Recovery Criteria	3
	C. Updated Information and Current Species Status	14
	1. Biology and Habitat	14
	2. Five-Factor Analysis	22
	D. Synthesis	36
III.	Results	36
IV.	Recommendations for Future Actions	37
V.	References	39
	Appendix 1	51
	Approval Form	53

List of Tables

Table 1. Reported localities known to be occupied by the palmate-bracted bird's-beak, landowner or management agency, size, and protected status of lands. **9**

Table 2. Survey results (number of individuals; multiple surveys reported separately with source) for the palmate-bracted bird's-beak at the several reported separate populations known in the Sacramento and San Joaquin Valleys, California, 1974-2007. **17**

List of Figures

Figure 1. Geographic distribution of the palmate-bracted bird's-beak (*Chloropyron palmatum*) in California. This region roughly falls within the confines of the Great Central Valley Floristic Region and includes the Sacramento Valley and the San Joaquin Valley Provinces. **6**

Figure 2. Palmate-bracted bird's-beak (*Chloropyron palmatum*) is known from four locations in the northern portion of its range. **7**

Figure 3. Palmate-bracted bird's-beak (*Chloropyron palmatum*) is known from three locations in the western and southern portions of its range. **8**

Site Name Glossary

Over the years, several names have been used to identify the sites historically occupied by the palmate-bracted bird's-beak. Given that many of those sites now are State or Federal lands with formal names, it was decided to use the formal names in this review. The following list indicates the historical site names (in part; not all historical sites are presently occupied by the species), as well as the site names used in the text.

Historical Site Names (in part)	County	Site Names Used in Text (arranged from north to south)
Sacramento (introduced)	Glenn	Sacramento National Wildlife Refuge
Delevan	Colusa	Delevan National Wildlife Refuge
Colusa	Colusa	Colusa National Wildlife Refuge
Woodland	Yolo	Alkali Grasslands Preserve
Livermore	Alameda	Springtown Alkali Sink
Western Madera County	Madera	Western Madera County (undefined boundary)
Mendota	Fresno	Mendota Wildlife Area
Mendota	Fresno	Alkali Sink Ecological Reserve

5-YEAR REVIEW
Palmate-bracted bird's-beak
(*Cordylanthus palmatus* = *Chloropyron palmatum*)

I. GENERAL INFORMATION

I.A. Methodology used to complete the review: This review was conducted by a staff biologist within the Sacramento Fish and Wildlife Office (SFWO) of the U.S. Fish and Wildlife Service (Service) using the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (Recovery Plan; Service 1998), as well as published literature, agency reports, biological opinions, draft and completed Habitat Conservation Plans (HCPs), unpublished data, interviews with species experts, and maps of the current distribution of the species. No previous status reviews for this species have been conducted. The California Department of Fish and Game (CDFG) through the California Natural Diversity Database (CNDDDB), however, has compiled and tracked changes to the known species locations since it was listed.¹

I.B. Contacts

Lead Regional or Headquarters Office -- Contact name(s) and phone numbers: Pacific Southwest Regional Office; Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, (916) 414-6464; and Jenness McBride, Fish and Wildlife Biologist, (916) 414-6464.

Lead Field Office -- Contact name(s) and phone numbers: Sacramento Fish and Wildlife Office; Kirsten Tarp, Recovery Branch, (916) 414-6600.

I.C. Background

I.C.1. FR Notice citation announcing initiation of this review: 72 FR 7064-7068, February 14, 2007 (Service 2007a)

I.C.2. Listing History

Original Listing

FR notice: 51 FR 23765 (Service 1986)

Date listed: July 31, 1986

Entity listed: Species – Palmate-bracted bird's-beak (*Cordylanthus palmatus* = *Chloropyron palmatum*)

Classification: Endangered

¹ CNDDDB occurrence records and summary reports are based on forms submitted voluntarily by biologists. These forms document the presence or absence of plant and animal species and are based on field observations by knowledgeable individuals. The information reported includes: observation date, location, ecological characteristics of the site, and comments about relevant threats.

I.C.3. Associated Rulemakings: None (e.g., no critical habitat has been designated for this species).

I.C.4. Species' Recovery Priority Number at start of review: The Recovery Priority Number (RPN) – 2C – reflects a high degree of threat, a high recovery potential, a taxonomic rank of full species, and that the species may be in conflict with construction or other development projects or other forms of economic activity (Service 1983a,b).

I.C.5. Recovery Plan or Outline

Name of plan: *Recovery Plan for Upland Species of the San Joaquin Valley, California*

Date issued: September 1998

II. REVIEW ANALYSIS

Species overview: Palmate-bracted bird's-beak is an annual herb in the broomrape family (Orobanchaceae) (Olmstead *et al.* 2001). The plants are 4-12 inches tall and highly branched. The stems and leaves are grayish green and sometimes are covered with salt crystals excreted by glandular hairs. Small pale whitish flowers, up to 1-inch long, are arranged in dense clusters (spikes) and are densely surrounded by herbaceous leaf-like bracts. The petals are divided into two lips. The upper one is shaped like a bird's-beak, leading to the common name of the genus. Seedlings grow in late March or April, while flowers bloom from late spring through summer. Like other members of this family, palmate-bracted bird's-beak is partially parasitic on the roots of other plants (Chuang and Heckard 1971). The palmate-bracted bird's-beak is a hemi-parasite (it manufactures its own food but obtains water and nutrients from the roots of other [host] plants (Endangered Species Recovery Program [ESRP] 2007). Palmate-bracted bird's-beak grows on seasonally-flooded, saline-alkali soils in lowland plains and basins at elevations of less than 500 feet (Coats *et al.* 1993). Historically, the species is known from scattered locations in the Sacramento and San Joaquin Valleys (Bittman 1985, 1986; Center for Conservation Biology 1991, 1992, 1993, 1994). Saline-alkali soils and alkali sink scrub habitats were historically rare in central California and have been greatly reduced in size and number. The rarity of saline-alkali soils with natural vegetation and the intensive agricultural and urban development within the species' range make the likelihood of finding additional populations remote. The pollinators of palmate-bracted bird's beak include 3 species of bumble bees (*Bombus californicus*, *B. vosnesenskii*, and *B. occidentalis*), sweat bees (family *Lasioglossum*), semi-social and solitary bees (families *Halictidae*, *Anthophoridae*, *Magachilidae*, and *Colletidae*), and bee flies (family *Bombyliidae*), with the western bumble bee (*B. vosnesenskii*) and sweat bees as the most common visitors to the flowers of palmate-bracted bird's beak (Saul-Gershenz *et al.* 2004). Population fluctuations are common in the palmate-bracted bird's-beak and may be a result of changes in pollination success, rainfall patterns, freshwater influence (e.g., hydrology patterns), and marsh pollution (e.g., herbicides for vegetation control and

pesticides for mosquito control; Skinner and Pavlik 1994; Endangered ESRP 2007; Service 2007c).

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

II.A.1. Is the species under review listed as a DPS?

Yes
 No

The Federal Endangered Species Act of 1973, as amended (ESA), defines species as including any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate wildlife. This definition limits listings as distinct population segments only to vertebrate species of fish and wildlife. Because the species under review is a plant and the DPS policy is not applicable, the application of the DPS policy to the species listing is not addressed further in this review.

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes
 No

In the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (Service 1998), the narrative discusses a recovery strategy and presents tables describing downlisting and delisting criteria with a step-down narrative.

II.B.2. Adequacy of recovery criteria.

II.B.2.a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

Yes
 No

The recovery criteria focus on parcel ownership (public ownership preferred), distinct populations in both the Sacramento and San Joaquin Valleys, the development and implementation of management plans for the parcels of occupied habitats, and the creation of other factors or conditions that lead to stable or increasing palmate-bracted bird's-beak populations.

II.B.2.b. Are all of the 5 listing factors² that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

 Yes
 X No

II.B.3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here. The 5-listing factors include the following:

Downlisting Criteria (Addresses Listing Factor A)

Reclassification to threatened status will be evaluated when the species is protected in specified recovery areas from incompatible uses, management plans have been approved and implemented for recovery areas that include survival of the species as an objective, and population monitoring indicates that the species is stable. Downlisting criteria include:

- 1) *Protection of occupied habitat*
 - A) *95 percent of occupied habitat on public lands is secured and protected, and*
 - B) *75 percent or more of the population at Springtown Alkali Sink and 75 percent or more of the occupied area and upland habitat for pollinators within 300 meters (984 feet) of the population margins is secured and protected, and*
 - C) *Two or more populations are secured and protected in the San Joaquin Valley.*
- 2) *A management plan that includes the survival of palmate-bracted bird's-beak as an objective has been approved and implemented for all protected areas identified as important to continued survival.*
- 3) *The populations are stable or increasing through a precipitation cycle.*

1. Protection of Occupied Habitat

The location, land ownership, size, and protected status of palmate-bracted bird's beak localities are summarized in Table 1. Figures 1 – 3 illustrate the location of known palmate-bracted bird's-beak occurrences reported in the CNDDDB (CNDDDB 2007a) (CDFG 2007a).

² Listing Factors:

- A) Present or threatened destruction, modification or curtailment of its habitat or range;
- B) Over-utilization for commercial, recreational, scientific, or educational purposes;
- C) Disease or predation;
- D) Inadequacy of existing regulatory mechanisms;
- E) Other natural or manmade factors affecting its continued existence.

Three subcriteria must be met with respect to occupied habitat in order to meet the downlisting criteria:

1A. Secure and protect from incompatible uses 95 percent of occupied habitat on public land.

Public lands constitute only an estimated 50 to 75 percent of occupied palmate-bracted bird's-beak habitat (data unavailable for western Madera County (Table 1). Several public agencies own or manage palmate-bracted bird's-beak habitat (Table 1). Details of palmate-bracted bird's-beak recovery in specific recovery areas are presented in Appendix I.

1B. Secure and protect from incompatible uses at least 75 percent of the population and occupied habitat, as well as the upland habitat for pollinators within 300 meters (984 feet) of preserve margins at Springtown Alkali Sink..

Springtown Alkali Sink comprises 300 acres. To date, approximately 24 percent of the sink has been secured and protected (M.A. Showers, in litt., 2007). Although the size and location of pollinator upland habitat have not been determined, a study on the pollinator assemblage has been conducted (for additional information, see Saul-Gershenz *et al.* 2004). Therefore, the protection for population, occupied habitat, and upland nesting habitat for pollinators at Springtown Alkali Sink does not yet meet the 75 percent criterion for downlisting.

1C. Secure and protect from incompatible uses two or more populations in the San Joaquin Valley.

To date, a single population has been secured and protected: the Mendota Wildlife Area and Alkali Sink Ecological Reserve (CDFG 2007b). Given their proximity to one another and their management by CDFG, these sites collectively are considered a single unit for this review. This population – in part -- has been secured and protected, but some road grading occurs through the palmate-bracted bird's-beak due to a pre-existing easement. The establishment of a second population in the San Joaquin Valley, however, has not been resolved. For years, occupied sites in western Madera County have been identified and suggested for acquisition to benefit the palmate-bracted bird's-beak, but no action has been taken to purchase these lands or to secure conservation easements. Therefore, the requirement for multiple populations of the palmate-bracted bird's-beak in the San Joaquin Valley does not yet meet the criterion for at least two or more populations.

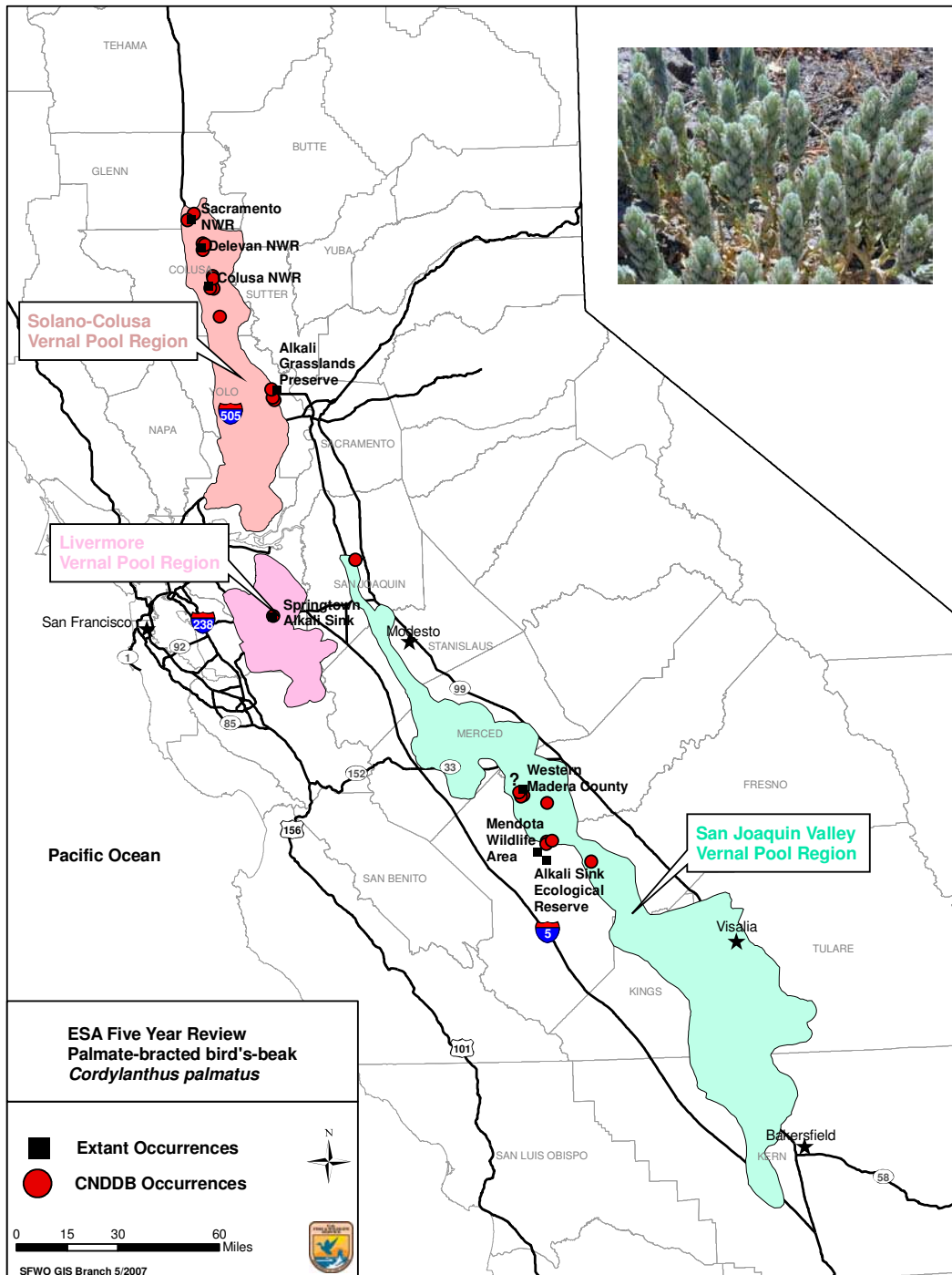


Figure 1. Geographic distribution of the palmate-bracted bird's-beak (*Chloropyron palmatum*) in California. Extant known populations are described in this review (black square). Historical occurrences are also indicated (red circle), but may not be extant. This region roughly falls within the confines of the Solano-Colusa (peach color), Livermore (pink), and San Joaquin Valley (aqua blue) Vernal Pool Regions (see State of California, 1998).

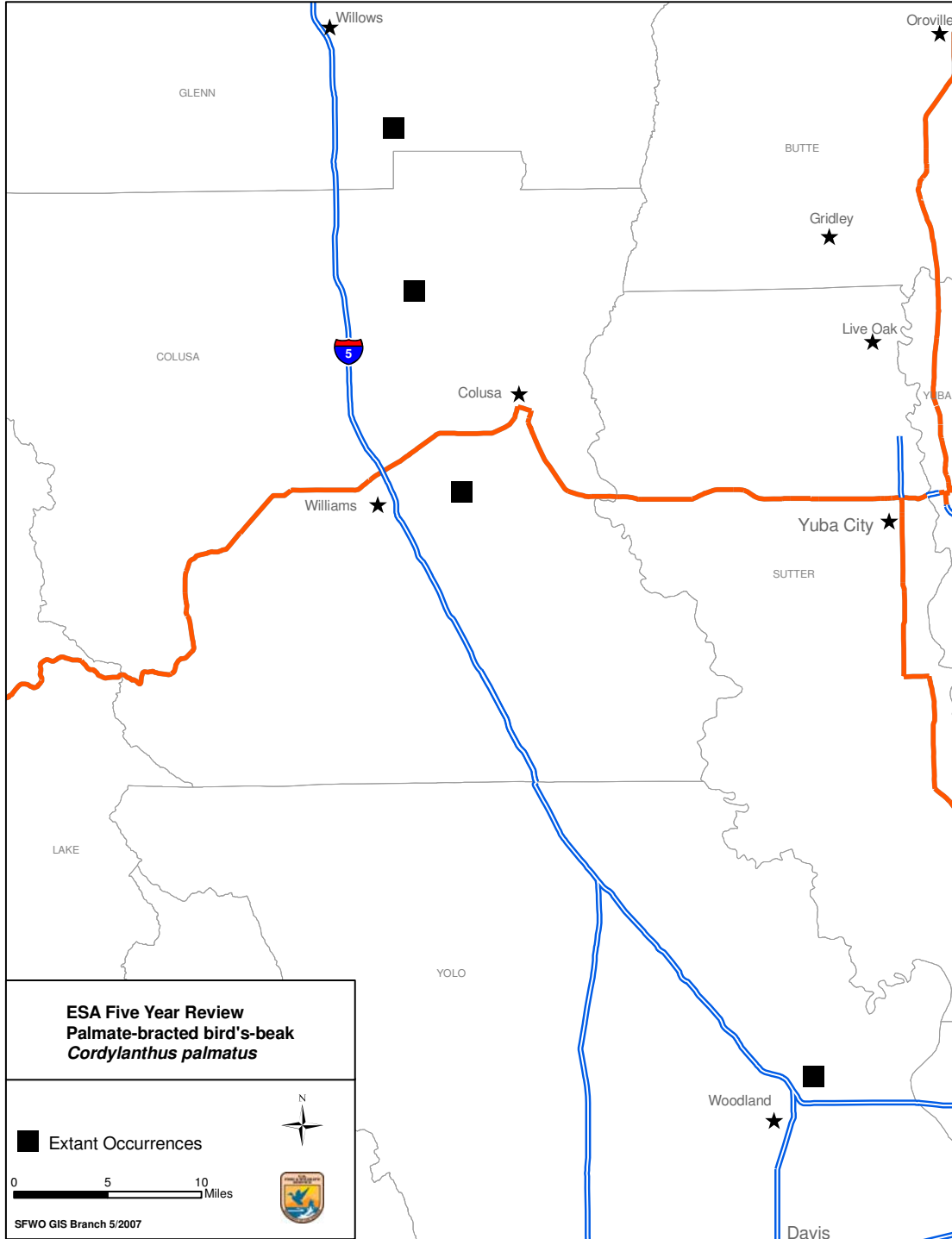


Figure 2. Palmate-bracted bird's-beak (*Chloropyron palmatum*) is known from four locations in the northern portion of its range.

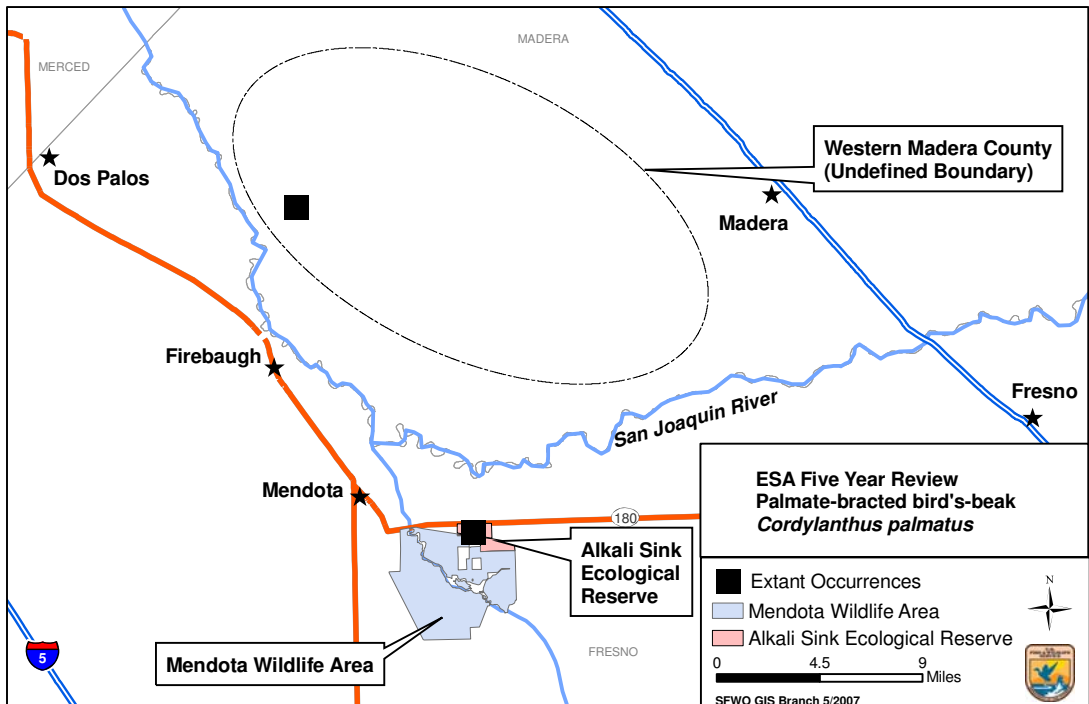
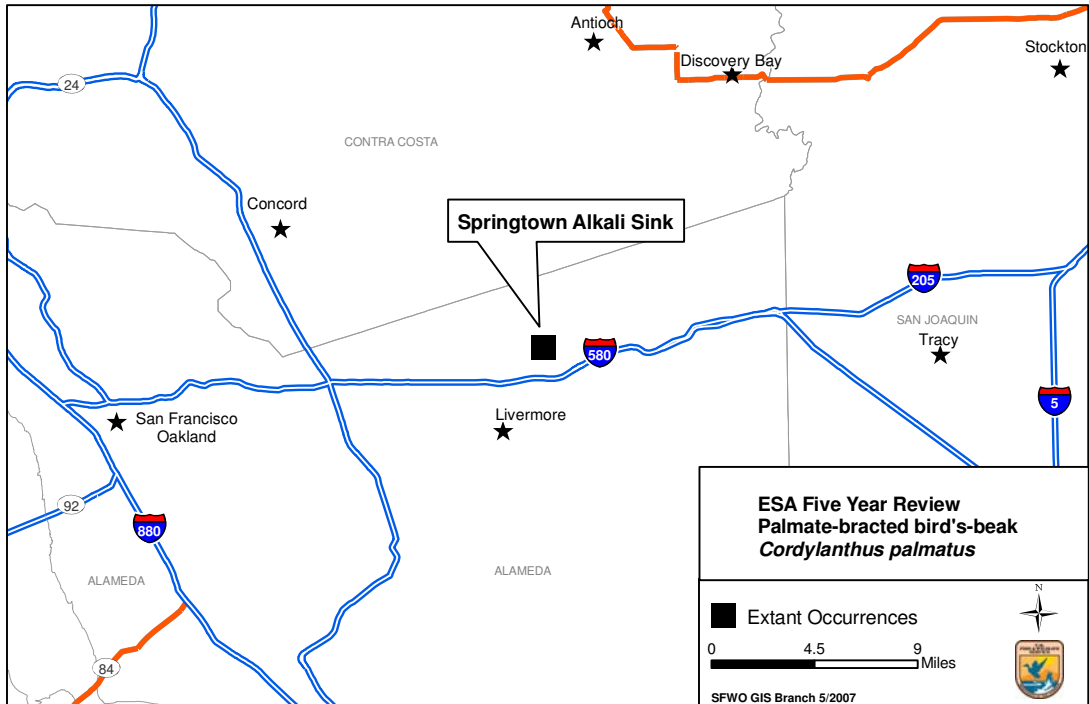


Figure 3. Palmate-bracted bird's-beak (*Chloropyron palmatum*) is known from three locations in the western and southern portions of its range.

Table 1.

Reported localities known to be occupied by the palmate-bracted bird's-beak, landowner or management agency, size, and protected status of lands.

Locality	County	Landowner/ Management Agency	Approx. Size (acres)	Year Acquired	Gross Occupied Habitat (acres)	Net Occupied Habitat (acres)	Percent Protected Habitat	Comments/Notes (2008)
Sacramento National Wildlife Refuge	Glenn & Colusa	Service	10,783		715	0.25	100	Four localities; alkali meadows = 693 acres; vernal pools = 42 acres; introduced population
Delevan National Wildlife Refuge	Colusa	Service	5,797		197	59	100	Nine localities; alkali meadows = 193 acres; vernal pools = 4 acres; natural population; source of seeds and plants introduced at Sacramento NWR
Colusa National Wildlife Refuge	Colusa	Service	4,626		369 ^a	62	100	Ten locations ^a ; alkali meadows = 349 acres; vernal pools = 20 acres; natural and introduced populations
Alkali Grasslands Preserve ^b	Yolo	City of Woodland and Dan Dowling	180	2005	8	1	100	Two localities (eight locations known in 1980s); site managed

Table 1.

Reported localities known to be occupied by the palmate-bracted bird's-beak, landowner or management agency, size, and protected status of lands.

Locality	County	Landowner/ Management Agency	Approx. Size (acres)	Year Acquired	Gross Occupied Habitat (acres)	Net Occupied Habitat (acres)	Percent Protected Habitat	Comments/Notes (2008)
								by the Center for Natural Lands Management; natural population
Springtown Alkali Sink ^{b,d}	Alameda	City of Livermore; Federal Communications Commission; private	300				24	Multiple tracts and owners at a single site; includes a 73.3 acre conservation bank for Springtown Natural Community Reserve; natural population
Western Madera County	Madera	Private	?		11.8 ^d			Sites not specifically identified; natural population
Mendota Wildlife Area	Fresno	CDFG	11,794	1952-1967	0 ^e		100	Natural population; currently occupied by palmate-bracted bird's-beak?
Alkali Sink Ecological Reserve	Fresno	CDFG	945	1978-1985	46.8 ^{d,f}	5	100	Natural population

Table 1.

Reported localities known to be occupied by the palmate-bracted bird's-beak, landowner or management agency, size, and protected status of lands.

Locality	County	Landowner/ Management Agency	Approx. Size (acres)	Year Acquired	Gross Occupied Habitat (acres)	Net Occupied Habitat (acres)	Percent Protected Habitat	Comments/Notes (2008)
-----------------	---------------	---	-------------------------------------	--------------------------	---	---	--	----------------------------------

^a There has been a recent land acquisition at Colusa NWR: T25 which has been restored to 115 acres of vernal pool/alkali meadow complex (palmate-bracted bird's-beak habitat); and, T26, a 61-acre fallow rice field, which likely will be restored to vernal pool/alkali meadow complex habitat. This would change the Gross Occupied Habitat acres only, since no palmate-bracted bird's-beak currently occupy these areas (J. Silveira, in litt., 2007). A previously undocumented locality (making the total 10 localities) was found in 2008, but acreage has yet to be determined, survey results should be available in December, 2008 (J. Silveira, in litt., 2008).

^b The Alkali Sink Ecological Reserve and the Alkali Grasslands Preserve are fenced and signed.

^c Protection at Springtown Alkali Sink is poor, but the site is partially fenced along main routes of travel. Access is not controlled, however, and motorcycles, bicycles, and the public in general can enter the site. Springtown Alkali Sink is subject to trash dumping, excavation, herbicide spraying along property lines, and construction of bike jumps and courses (E. Fleishman, in litt., 2007; M.A. Showers, California Department of Fish and Game, in litt. 2007).

^d California Natural Diversity Database (2007a).

^e According to E. Cypher, in litt., 2007, this site may no longer be occupied.

^f According to E. Cypher, in litt., 2007, less than 5 acres are occupied.

2. Management Plans

A management plan for all populations of palmate-bracted bird's-beak has not been developed. A plan is being prepared for the Alkali Grassland Preserve in Yolo County, while on-going research is contributing to a plan for populations on Service refuge lands in the northern Sacramento Valley. A management plan prepared by Coats *et al.* (1988) for Springtown Alkali Sink has never been implemented and no specific management actions have been implemented on occupied habitat on CDFG lands (M.A. Showers, in litt., 2007). Therefore, this criterion has not been met.

3. Population Stability

The third criterion for downlisting the palmate-bracted bird's-beak is that the population be stable or increasing through a precipitation cycle³ in the Sacramento and San Joaquin Valleys:

- At Sacramento National Wildlife Refuge Complex (i.e., Sacramento, Delevan, and Colusa NWR), the total number of individuals surveyed ranged from 210 to 2,465 individuals during 1993-2006, but has increased steadily since 2000 (from 81,410 [1998] to 608,823 [2003] (Silveira 2006; Table 2).
- At Alkali Grasslands Preserve (described as the Woodland site by Service 1985, 1986), the earliest known population, according to species experts and local neighbors, occupied about 10 acres. About 100 to 200 individuals remained on 2 acres in 1986 after 8 acres were plowed. Fewer than 50 individuals were found in 2005. Currently between 350 and 1,000 plants are located on a 1 acre site (C. Feldheim, in litt., 2007).
- At Springtown Alkali Sink, about 2,000-5,000 individuals were first reported in the early 1980s on a site of about 250 to 350 acres. Approximately 90 acres of that site were bulldozed in 1983 (prior to the original listing). Population estimates after that date ranged from 20,000 to 50,000 individuals (CNDDDB 2007a). It is unclear, however, whether those estimates reflect natural population size variation, the identification of new patches, or more-accurate censuses.
- No recent population estimates or trends are available for western Madera County. Four CNDDDB occurrences were reported for 1993: # 23 with three plants; # 24 with fewer than 60 plants; # 25 with one plant; and # 26 with one plant (CNDDDB 2007a).
- Several plants were transplanted into Mendota Wildlife Area by Dr. Larry Heckard in 1973. Ten plants were reported in 1975 and 10 plants were found in 1993. An unspecified number of plants were still present in 1997 although the site was flooded at that time. No plants have been reported from this site since that date (CNDDDB 2007a).
- At Alkali Sink Ecological Reserve, about 1,600 individuals were reported in 1998, while about 1,000 individuals were reported in 2004 (E. Cypher, in litt., 2005).

³ The Service defines the phrase "precipitation cycle" as "... a period when annual rainfall includes average to 35 percent above-average through greater than 35 percent below-average and back to average or greater" (Service 1998:179).

Summary: The criterion for population stability has not been met. In general, the populations of palmate-bracted bird's-beak are decreasing throughout the Central and Livermore Valleys in California. While translocations at Sacramento NWR may increase the population locally, the long-term status of those individuals is uncertain. Likewise, the discovery of additional locations reflects better survey techniques and likely not an increase in the spatial distribution of the species.

Delisting Criteria (Addresses Listing Factor A)

Delisting will be considered when, in addition to the criteria for downlisting, all of the following conditions have been met:

- 1) *Eight or more distinct populations, including two or more in the San Joaquin Valley are secured and protected (as defined in the downlisting criteria), and*
- 2) *95 percent or more of the occupied habitat [under Service ownership] of Colusa National Wildlife Refuge, Delevan National Wildlife Refuge, and Sacramento National Wildlife Refuge is secured and protected, and*
- 3) *95 percent or more of the occupied habitat [under CDFG ownership] of the Alkali Sink Ecological Reserve-Mendota Wildlife Area (San Joaquin Valley) is secured and protected, and*
- 4) *260 hectares (640 acres) or more of any occupied habitat [under any ownership] elsewhere in the San Joaquin Valley, including western Madera County, is secured and protected, and*
- 5) *90 percent or more of the plants and occupied habitat [under ownership by City of Livermore, Federal Communications Commission, or private] of the Springtown Alkali Sink is secured and protected, and*
- 6) *Two or more distinct populations each about 260 hectares (640 acres) [under any ownership] in the Sacramento Valley are protected, and*
- 7) *A management plan has been approved and implemented for all protected areas identified as important to the continued survival of the species, and*
- 8) *There is no decline after downlisting. If the population is declining, then the Service should determine the cause and reverse the trend.*

Protection of Occupied Habitat

Current habitat protection efforts are discussed above. As a result of conservation actions by landowners and management agencies, delisting criteria numbers (2) and (3) have mostly been attained. Habitat protection levels have been achieved by the Service (100 percent at Sacramento National Wildlife Refuge Complex [Sacramento, Delevan, and Colusa National Wildlife Refuges]) and by the CDFG (100 percent at Alkali Sink Ecological Reserve-Mendota Wildlife Area on the preserves themselves, but not with regard to the 500 foot buffers). For protection of occupied habitat, delisting criteria numbers (1), (4), (5), and (6), however, have not yet been attained.

Management Plans

The status of the development of management plans is discussed above under *Downlisting Criteria*. The development and implementation of effective management plans are hindered due to a lack of knowledge about the basic life history of the species and how this plant would respond to management actions (C. Feldheim, in litt., 2007). This criterion (7) essentially has not yet been met.

Population Stability

Population status for each of the known populations was discussed above under *Downlisting Criteria*.

II.C. Updated Information and Current Species Status

During 1986-1998 (dates of original listing and of Recovery Plan, respectively), several studies were conducted to update our knowledge of the palmate-bracted bird's-beak and to establish the baseline that will be used here to assess the current status of the species. While recent research has focused on topics such as genetics and ecology (including pollination, germination, and effects of burning and grazing), most of the earlier research that was conducted prior to original listing was focused on subjects such as geographic distribution, taxonomy, and root parasitism.

II.C.1. Biology and Habitat

II.C.1.a. Abundance, population trends

At the time of listing, only two natural colonies and one transplanted population of the species were extant. In the final listing rule, we reported 100 – 200 plants from Woodland, Yolo County; 2,000 to 5,000 plants from lands near Livermore, Alameda County; and, 20 to 30 plants from the transplant site in the Mendota State Wildlife Area, Fresno County.

Since the original listing in 1986, much information has become available regarding abundance and population trends of the palmate-bracted bird's-beak. However, it has also become apparent that much information – perhaps a great deal of knowledge – will never be known to science because all signs of those populations have been eliminated. Several palmate-bracted bird's-beak species experts have suggested that (a) except, perhaps, for Sacramento National Wildlife Refuge Complex there are fewer palmate-bracted bird's-beak today than when the species was originally listed and (b) population trends are down, but definitive conclusions about specific sites generally are not available (see: E. Fleishman, in litt., 2007; M.A. Showers, in litt., 2007; J. Silveira, in litt., 2007). The most complete data set is available for Sacramento NWR Complex. At Sacramento NWR, overall abundances and trends are up, but total population size is small

(about 2,000 individuals) (Table 2). At Delevan and Colusa NWR, total population sizes are much greater (about 200,000 to 300,000 individuals each), but sizes can vary by 200 to 300 percent from year to year. Abundances and trends at Alkali Grasslands Preserve mirror those of Sacramento NWR (i.e., small total population size [up to 2,000 individuals] and large between year variation in numbers). At Springtown Alkali Sink, 20,000 to 50,000 individuals were reported as recently as 2004, but reports for other years generally are not available. There are no numerical estimates for western Madera County, while the populations at Alkali Sink Ecological Reserve may be reduced to a few small patches and those at Mendota Wildlife Area may no longer be extant. In sum, the few remaining palmate-bracted bird's-beak populations vary widely in number and are decreasing in number and total population size.

The correct interpretation of abundance and population trend information depends on many demographic factors, including percent survival, reproductive success, and the density of ungerminated seeds in the soil. While preliminary results are available for Alkali Sink Ecological Reserve, it is not known if the other sites are similar or the nature of any variation between sites or between years (see E. Cypher, in litt., 2005; M. Wall, Rancho Santa Ana Botanic Garden, in litt., 2005).

Palmate-bracted bird's-beak restoration, management, and translocation activities were also discussed at the 15 March 2005 meeting of the "*Cordylanthus palmatus* Consortium" (E. Fleishman, in litt., 2006). In brief:

- At Woodland, there are two sub-populations separated by 500 meters (identified as city population and Maupin population).⁴ Also, adaptive management rather than research may be a less constrained way to characterize activities at the preserve.
- At Sacramento-Delevan-Colusa National Wildlife Refuges:
 - Delevan NWR and Colusa NWR are two of the largest remaining palmate-bracted bird's-beak populations.
 - There are no natural populations of the palmate-bracted bird's-beak at Sacramento NWR. Introduced populations, as indicated elsewhere, may require additional efforts to survive over the long-term.
 - Due to its large size, research experiments can be conducted at Sacramento NWR Complex (potentially including herbicides, burning, grazing, and local reintroductions at alkali meadow restoration sites at Colusa NWR and Delevan NWR).
 - Grazing within the context of adaptive management is a high priority.
- At Springtown Alkali Sink:
 - Since the several tracts at the site are owned by different owners with different goals and objectives, management for conservation purposes for palmate-bracted bird's-beak is difficult.

⁴ It was later determined that there are no genetic differences between these two sites (D. Ayres *et al.*, in litt., 2007).

- At Mendota Wildlife Area:
 - The lack of overland water flow and lack of seed transport may explain why several sites with apparent habitat no longer support the palmate-bracted bird's-beak.

Summary:

In conclusion, a fair amount of research on abundance and population trends of the palmate-bracted bird's-beak is underway and much information has been produced, but additional work must be completed and an adaptive management program must be developed and implemented in order to achieve the recovery of the palmate-bracted bird's-beak.

II.C.1.b. Genetics, genetic variation, or trends in genetic variation

The Recovery Plan (Service 1998) calls for research to characterize the nature and extent of genetic variation between and among palmate-bracted bird's-beak populations, especially in western Madera County and at the Alkali Grasslands Preserve (near the City of Woodland, Yolo County). The conventional wisdom among biologists is that larger sites and larger populations are more diverse genetically than smaller sites or populations. Thus, it follows that natural resource managers often dedicate greater resources to the conservation of larger sites and populations (Center for Plant Conservation 1991). That strategy, however, may not always be appropriate with respect to the palmate-bracted bird's-beak. Two recent studies characterize the genetics of several known palmate-bracted bird's-beak sites and provide insight about genetic variation and trends in genetic variation at those locations:

Fleishman *et al.* (2001) studied the Springtown Alkali Sink (Alameda County), Alkali Sink Ecological Reserve/Mendota Wildlife Area (Fresno County), Colusa NWR, and Delevan NWR populations. They determined that the two largest populations (Colusa and Delevan) were relatively invariable (similar numbers and types of alleles) and genetically similar, and that neither contained any unique alleles (any of the alternative forms of a gene that may occur at a locus or specific location on a chromosome). No spatial structure with respect to genetic variation was detected (Fleishman *et al.* 2001; but see discussion of D. Ayres *et al.* 2007, below, at additional sites). The genetic variability of the relatively small Springtown site, however, is higher than the observed heterozygosity at the Colusa and Delevan sites. This suggests that the Springtown site is an important target for conservation activities and that resources used to address the many threats to the population will be well-spent (Fleishman *et al.*, 2001:51).

- Ayres *et al.* (submitted 2007) analyzed genetic variation at five sites from throughout the geographic range of the species: Delevan NWR, Colusa

Table 2.

Survey results (number of individuals; multiple surveys reported separately with source) for the palmate-bracted bird's-beak at the several reported separate populations known in the Sacramento and San Joaquin Valleys, California, 1974-2007.

Year	Sacramento NWR	Delevan NWR	Colusa NWR	Alkali Grasslands Preserve	Springtown Alkali Sink	Western Madera County	Mendota Wildlife Area	Alkali Sink Ecological Reserve
1974	-- ^a			1 ^{DA}				
1979				20 ^{DA}				
1981								
1982				5,000 ^{DA} <50 ^{MAS}				
1984				1 ^{DA}				
1985				225 ^{DA} <150 ^{MAS}				
1986				800 ^{DA} 800 ^{MAS}	2,000-5,000		20-30 ^b	
1987			500 ^{DA}	800 ^{DA} 400 ^{MAS}		Present ^c (site a)	800 ^{DA}	
1988				1,400 ^{MAS}	10,000 ^{DA}		40 ^{DA}	
1989		2,500 ^{DA}					40 ^{DA}	
1990		1,000 ^{DA}	300 ^{DA}		9,000 ^{DA}		1 ^{DA}	
1991		10,000 ^{DA}	5,000 ^{DA}		10,000 ^{DA}		1 ^{DA}	
1992		100,000 ^{DA} 75,300- 125,500 ^{JS}	50,000 ^{DA} 36,000- 70,000 ^{JS}	2,660 ^{MAS}	36,000 ^{DA}		450 ^{DA}	
1993	441 ^{JS}	100,000 ^{DA} 32,000- 201,000 ^{JS}	50,000 ^{DA} 15,000- 41,000 ^{JS}	262 ^{MAS}	12,000 ^{DA}	65 ^c (site b; 4 localities)	450 ^{DA}	
1994			>100,000 ^{JS}					
1995	296 ^{JS}	154,600 ^{JS}		400 ^{MAS}				
1996	300 ^{JS}			1,660 ^{MAS}				

Table 2.

Survey results (number of individuals; multiple surveys reported separately with source) for the palmate-bracted bird's-beak at the several reported separate populations known in the Sacramento and San Joaquin Valleys, California, 1974-2007.

Year	Sacramento NWR	Delevan NWR	Colusa NWR	Alkali Grasslands Preserve	Springtown Alkali Sink	Western Madera County	Mendota Wildlife Area	Alkali Sink Ecological Reserve
1997	320 ^{JS}	126,250 ^{JS}	35,500-46,700 ^{JS}					
1998	210 ^{JS}	85,900 ^{JS}	6,200 ^{JS}	2,010 1,500-2,000 ^{MAS}				1,600
1999	205 ^{JS}	40,000 ^{JS}	41,200 ^{JS}					
2000	1,410 ^{JS}	18,354 ^{JS}	68,882 ^{JS}					
2001	1,460 ^{JS}	80,070 ^{JS}	62,040 ^{JS}	200 ^{MAS}				
2002	1,155 ^{JS}	27,022 ^{JS}	9,077 ^{JS}					
2003	2,000 ^{JS}	423,435 ^{JS}	183,388 ^{JS}	325				
2004	1,486 ^{JS}	100,000 ^{DA} 147,010 ^{JS} "tens of thousands" ^{EF}	50,000 ^{DA} 69,693 ^{JS} 6,500-15,500 ^{EF}	150 ^{DA} 175-200 & 125 ^{EF}	15,000 ^{DA} 20,000-50,000 ^{EF}		185 ^{DA}	1,000 ^{EC} 465 & "hundreds" ^{EF}
2005	2,465 ^{JS}		119,248 ^{JS}	50-125 < 100 ^{MAS}			5,000 ^{DA} 1,000 ^{EC}	
2006	1,630 ^{JS}	257,415 ^{JS}	95,501 ^{JS}	374			5,000 ^{EC}	
2007				300 ^{TE/CF} 350-1,000		-- ^d	0 ^{EC} Extant? ^e	

^a A blank cell indicates no report.

^b From seeds planted in 1972.

^c Based on CNDDDB occurrence records

^d Nature and extent of population unknown.

^e Failure to germinate due to extreme drought in area.

CF/TE: Cliff Feldheim and Tracey Erwin

DA: Debra Ayres

EC: Ellen Chipre

EF: Erica Fleishman

JS: Joe Silveria

MAS: Mary Ann Showers

NWR, Alkali Grasslands Preserve, Springtown Alkali Sink, and Alkali Sink Ecological Reserve. She observed:

- No hybridization between *C. palmatum* and *C. mollis* ssp. *hispidus* at Springtown Alkali Sink.
- A roadside population at Delevan NWR was genetically different from other nearby populations and may represent a remnant population.
- Based on observed differences in the genetic variation of different sites, it appears that some populations of the palmate-bracted bird's-beak may have evolved in "vernal pools," while others may have evolved in "alkali sinks."

The Alkali Sink Ecological Reserve is considered by some to be crucial to the recovery of the palmate-bracted bird's-beak because it may exhibit genetic information not found elsewhere (ESRP 2006). Other species experts suggest that since the importance of unusual genes and the overall genetic diversity of the several palmate-bracted bird's-beak sites are poorly known, additional information may change our perception of palmate-bracted bird's-beak genetics (e.g., E. Fleishman, UC Santa Barbara-National Center for Ecological Analysis and Synthesis, in litt., 2007).

Overall, the pattern of genetic variation within palmate-bracted bird's-beak populations support the hypothesis that the historical frequency and extent of seed dispersal by overland flooding has influenced population genetic structure strongly. In brief: (1) sites that are more-frequently flooded or that have more-extensive floods (leading to enhanced seed dispersal), for example, are more diverse; (2) plants within a common flood pool are more similar genetically with each other than with plants in other pools; and (3) plants in adjacent pools that do not mix during flooding may be genetically diverse. In addition, despite population bottlenecks, small populations maintained levels of genetic variation comparable to large populations. These two studies (Fleishman *et al.*, 2001; Ayres *et al.*, 2007), however, used different methods that could account for these dissimilar and somewhat contradictory results. Additional studies of the genetics of the palmate-bracted bird's-beak are indicated to identify the causes and ecological consequences of genetic variability, as well as to inform conservation strategies for this species.

II.C.1.c. Taxonomic classification or changes in nomenclature

At the time of listing, the scientifically accepted name for palmate-bracted bird's beak was *Cordylanthus palmatus*, which was included in the snapdragon family (Scrophulariaceae) (Chuang and Heckard 1973, 1993). In 2001, all *Cordylanthus* taxa were moved from the Scrophulariaceae to the Orobanchaceae (broomrape) family (Olmstead *et al.* 2001). Recently, Tank *et al.* (2009) studied the taxonomy of a group of genera within Orobanchaceae using molecular systematic analysis.

They determined the molecular systematic research showed that some of the generic boundaries within the Orobanchaceae should be revised and presented a formal reclassification of some of the major lineages in the Orobanchaceae. The genus *Cordylanthus* was split into three separate genera. The plants that had been within the genus *Cordylanthus* that are adapted to living in a saline or alkaline habitats are now included in the genus *Chloropyron*. The scientific name for palmate-bracted bird's-beak is now *Chloropyron palmatum*. This new generic assignment is not relevant to the species' conservation status, as *Chloropyron palmatum* has exactly the same circumscription as *Cordylanthus palmatus*.

II.C.1.d. Spatial distribution, trends in spatial distribution

Our knowledge about the spatial distribution and trends in spatial distribution has increased over the years, but no new scientific findings have occurred since the Recovery Plan was published (Service 1998). Nine natural populations of the palmate-bracted bird's-beak were documented between 1916 and 1982 (in Alameda, Colusa, Fresno, Madera, San Joaquin, and Yolo Counties), but only two were known to be extant at the time the species was listed in 1986 (Springtown Alkali Sink and southeast of Woodland) (Service 1985, 1986). As a result of intensive survey efforts and additional introductions, the species was determined to be present in 1998 at seven localities comprising about 1500 acres:

- Sacramento NWR in Glenn County
- Delevan NWR in Colusa County
- Colusa NWR in Colusa County
- An area near the City of Woodland in Yolo County (Alkali Grasslands Preserve, under conservation easement by the Center for Natural Lands Management)
- Springtown Alkali Sink near the City of Livermore in Alameda County
- Western Madera County
- Combined Alkali Sink Ecological Reserve-Mendota Wildlife Area in Fresno County (Service 1998)

The current range of the palmate-bracted bird's-beak is disjunct. The species ranges from the northern Sacramento Valley south to the San Joaquin Valley with a large population in Alameda County at Springtown Alkali Sink (Figures 1-3). This region roughly falls within the confines of the Solano-Colusa (peach color; total surface area is approximately 922,000 acres [ca. 373,000 hectares]), Livermore (pink; total surface area is approximately 485,000 acres [ca. 196,000 hectares]), and San Joaquin Valley (aqua blue; total surface area is approximately 2,449,000 acres [ca. 991,000 hectares]) Vernal Pool Regions (see State of California, 1998). More precisely, the species is restricted to seasonally-flooded, saline-alkali soils in lowland plains and basins at elevations of less than 155 meters (about 500 feet) (Showers 1988; ESRP 2006). Within these areas, the species grows primarily along the edges of channels and drainages, alkali scalds, and grassy areas. The current estimate of approximately 1,500 acres of occupied habitat is based on field surveys and site analyses conducted by site managers and

species experts, and has changed significantly since listing in 1986 or the publication of the Recovery Plan (Table 1). Within this “occupied habitat,” however, palmate-bracted bird’s-beak distributions are not continuous. Instead, palmate-bracted bird’s-beak occur in a mosaic pattern of small and isolated patches. As a result, the net occupied habitat is much less than either the gross size of the occupied habitat or the approximate size of the site (e.g., reserve size; J. Silveira, Service, Sacramento NWR Complex, in litt., 2007).

The palmate-bracted bird’s-beak occurs in the Valley Sink Scrub and Alkali Meadow natural communities, in association with other halophytes (Bittman 1985, 1986; Holland 1986; Coats *et al.* 1993; CDFG 1995; Silveira 2000). The suitability of microhabitats for the palmate-bracted bird’s-beak depends primarily on soil pH and to a lesser extent on soil layering, salinity, and moisture (Service 1998).

As indicated above, for years, occupied sites in western Madera County have been proposed for acquisition to benefit the palmate-bracted bird’s-beak and to secure additional populations, but action has not been taken. Given the increased tendency to convert natural habitats to urban areas or agriculture uses in the Central Valley (Coats *et al.* 1989; Silveira 2000; Huddleston 2001; National Wildlife Federation 2001), the acquisition of additional sites, especially in the San Joaquin Valley, takes on greater urgency than before. To conclude, there is very little habitat remaining where this plant could possibly occur making future discoveries unlikely (K. Lazar, California Native Plant Society, in litt., 2007). At the same time, the potential for re-introduction becomes more limited as suitable habitat continues to disappear (C. Martz, California Native Plant Society, in litt., 1985).

II.C.1.e. Other

The palmate-bracted bird’s-beak is known to occur in association with other sensitive species of plants and animals. According to Service (1998), at least six federally-listed species of plants and five federally-listed species of animals are characteristic of the San Joaquin Valley. Another 23 State-listed species also occur in that area. These species share several biological requirements that can be used to guide the preparation of regional recovery plans for the conservation of these plants and animals.

The status of the palmate-bracted bird’s-beak has also been evaluated by the CNDDDB and the California Native Plant Society (CNPS). According to CNDDDB (2007b:ii-iv, vi, 23), the palmate-bracted bird’s-beak has a Global Ranking of G1 (“Less than 6 viable occurrences [Eos] OR less than 1,000 individuals OR less than 2,000 acres” [text and capitalization quoted from CNDDDB]). The palmate-bracted bird’s-beak has a State Ranking of S1.1 (“Less the 6 Eos OR less than 1,000 individuals OR less than 2,000 acres; S1.1 = very threatened”). According to CNPS, the palmate-bracted bird’s-beak is a List 1B.1 species. The plants of

List 1B are rare throughout their range. All of these species are judged to be vulnerable under present circumstances. Most of these species, including the palmate-bracted bird's-beak, have declined significantly over the past century. The “.1” threat code extension means that the palmate-bracted bird's-beak is seriously endangered in California (over 80 percent of occurrences threatened; high degree and immediacy of threat).

II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

II.C.2.a. Factor A, Present or threatened destruction, modification or curtailment of its habitat or range

At the time of listing, habitat loss was identified as the main reason for the historical decline of the palmate-bracted bird's-beak (Service 1986:23767). Eight specific conservation threats to survival – mostly relevant to this factor -- were subsequently identified in the Recovery Plan (Service 1998:33-35): urban expansion, changes in the hydrologic regime, random or catastrophic events (discussed in Factor E), road maintenance, unauthorized fill of wetlands, encroachment by exotic plants (discussed in Factor E), resulting in competition with palmate-bracted bird's-beak individuals as well as habitat modification, off-road vehicle use, and livestock wallowing in seasonal ponds. While the Recovery Plan (Service 1998) is not a formal review of the status of the species, it does provide relevant information that can inform this analysis. Currently, the eight specific threats identified in the Recovery Plan persist and the habitat of the palmate-bracted bird's-beak throughout its range in general continues to be converted or destroyed. Given the projected human population increase projected for the State of California, these threats are expected to continue (National Wildlife Federation 2001). Due to its restricted range and current threat levels, any degradation, fragmentation, or loss of palmate-bracted bird's-beak habitat could be significant (K. Lazar, in litt., 2007).

Since 1998, for example, about 20 projects involving the palmate-bracted bird's-beak have been reviewed by the Service in the context of consultation under the ESA leading to the preparation of a biological opinion. Primarily issued for large habitat restoration, transmission line, and water delivery projects, these projects and corresponding biological opinions, however, have all identified potential negative effects to the palmate-bracted bird's-beak. In a generic sense, urban sprawl and associated human activities have also been identified as the leading cause of species imperilment – including the palmate-bracted bird's-beak -- in the State (National Wildlife Federation 2001). Sprawl (low density, automobile-dependent development into natural areas outside of cities and towns) results in habitat loss, habitat degradation (including the disruption of natural processes, wildfire suppression, noise pollution, and high-impact outdoor recreation), habitat fragmentation (including blocking wildlife movement and edge effect), and loss

of species diversity (including an increase in exotic species and changing ecosystem dynamics). Development at Springtown, for example, has been categorized by several people as urban sprawl and is relevant here due to the destruction or modification of palmate-bracted bird's-beak habitat at the site. Development in the immediate vicinity of Sacramento NWR, Delevan NWR, Colusa NWR, Alkali Grasslands Preserve, western Madera County, and Alkali Sink Ecological Reserve – while not categorized as urban sprawl -- also threatens palmate-bracted bird's-beak populations at those sites as a result of the destruction, modification or curtailment of palmate-bracted bird's-beak habitat or range (e.g., agriculture and urbanization). While not all of these sites – sites reviewed by the Service where sprawl may be a factor -- were suitable for palmate-bracted bird's-beak, more than 99 percent of the alkali sink scrub in southern California has been lost, as have 66 to 88 percent of the vernal pools in the Central Valley (National Wildlife Federation 2001:Table 3). These lands, including those that potentially were suitable habitat for palmate-bracted bird's-beak, likely will never be recovered or restored (M.A. Showers, in litt., 2007).

At the state/regional level, several projects may result in negative impacts to the palmate-bracted bird's-beak, for example:

- CALFED Bay-Delta Program - Multi-species Conservation Strategy. This large project proposes to improve water supplies in California and the health of the San Francisco Bay/Sacramento-San Joaquin River Delta. These activities will occur in the Bay-Delta area, as well as on and along the Sacramento River and the San Joaquin River. All of the extant populations of the palmate-bracted bird's-beak occur in the immediate vicinity of these areas. The nature and extent of impacts to the palmate-bracted bird's-beak have yet to be determined, but -- unless appropriate avoidance and minimization measures are incorporated into the project design – potentially could include changes in hydrological regime, random or catastrophic events (as envisioned in the Recovery Plan [1998:35]), road maintenance, encroachment by exotic plants, and off-road vehicle use. Unregulated, these activities could adversely affect the plant and mitigation will be required (CALFED Bay-Delta Program 2000). The Service will have to be especially diligent to ensure that appropriate conservation measures for the palmate-bracted bird's-beak are developed and implemented.
- Pacific Gas & Electric Company/Operations and Maintenance Activities HCPs.— for the San Joaquin Valley, San Francisco Bay Area, and Sacramento Valley. Several known palmate-bracted bird's-beak occurrences are located in each of these plan areas.
 - The December 14, 2007 incidental take permit for the PG&E San Joaquin Valley Operations and Maintenance HCP (PG&E San Joaquin Valley HCP) went into effect on April 10, 2008. At the time of permit issuance, there were 6 extant occurrences of palmate-bracted bird's-beak within the nine-county HCP planning area, with three extant occurrences within 200 feet of an existing

PG&E facility, gas pipeline right-of-way, or electrical line right-of-way. All occurrences are in the central portion of the 9-county HCP Planning Area. The PG&E San Joaquin HCP designated palmate-bracted birds beak as an HCP Narrowly Endemic Plant Species, which requires PG&E staff to survey and map all palmate-bracted bird's-beak known occurrences in or near facility right-of-ways. All PG&E covered activities (even very small activities) will avoid all known occurrences of palmate-bracted bird's-beak using identified avoidance measures. (Service 2004, 2006a, 2007b). If a Pacific Gas & Electric covered activity cannot completely avoid palmate-bracted bird's-beak occupied habitat, PG&E will first confer with the Service to discuss type and amount of species effects appropriate minimization measures, and if compensatory mitigation for this species is available. The amount of direct and indirect effects to the palmate-bracted bird's-beak for the PG&E San Joaquin Valley HCP allows a total of 0.04 acres of palmate-bracted bird's-beak to be affected over the 30-year permit term.

- The San Francisco Bay Area Pacific Gas & Electric Operations and Maintenance HCP (PG&E Bay Area HCP) proposes to cover Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, San Mateo, and Sacramento Counties and is in the early planning stages. While the amount of any specific direct and indirect effects to the palmate-bracted bird's-beak have yet to be determined, the draft PG&E Bay Area HCP lists palmate-bracted bird's beak as a Category 4 covered plant indicating a low likelihood of impact. PG&E proposes to minimize and mitigate effects to the palmate-bracted bird's-beak as the result of operation and maintenance covered activities included in the Plan (Service 2006b), however the conservation benefits to palmate-bracted bird's-beak provided by the HCP are also not yet determined
- The Pacific Gas & Electric Operation, Maintenance, and Minor New Construction HCP (also known as the PG&E Stacked HCP) proposes to cover California planning areas outside of the Bay Area and San Joaquin Valley and is also in the early planning stages. The Plan Area includes the network of PG&E facilities in 36 counties, including 18 counties within the Sacramento Valley region, 20 counties within the Sierra region (of which 12 overlap with Sacramento Valley), 6 counties within the Central Coast region, and 4 counties within the North Coast region. Palmate-bracted bird's beak occurs within Yolo and Colusa Counties in the Sacramento Valley region. The palmate-bracted bird's-beak is to be included in the NEPA Notice of Intent for the PG&E Stacked HCP, which was published November 25, 2008.
- Yolo County Natural Community Conservation Plan (NCCP) and HCP.— Initiated in 1992, the project size is 465,908 acres (National Resource

Projects Inventory 2007). Nine entities are involved: County of Yolo, City of Davis, City of West Sacramento, City of Winters, Department of Fish and Game, Resource Conservation District--Yolo County, University of California (Davis), and Service. The palmate-bracted bird's-beak is one of approximately 30 species targeted for protection. A draft HCP was published in 1995, but set aside (see Service reference 1-1-95-HP-1041). That draft is being substantially revised. For example, the HCP will now be an HCP/NCCP. As of 9 November 2004, a Planning Agreement had been prepared to guide and coordinate actions leading to the finalization and implementation of the Yolo County Natural Community Conservation Plan and Habitat Conservation Plan (Yolo County 2004). According to this agreement, the covered activities are generally anticipated to include the following: urban development, reserve management and conservation activities, and on-going agricultural operations. These covered activities, however, may be modified throughout the NCCP/HCP process. The Yolo County Habitat JPA (Joint Powers Agency) launched the Yolo Natural Heritage Program in March 2007.

- California High-Speed Train.—This proposed project will link several cities in California, including Sacramento, San Francisco, Merced, Fresno, Bakersfield, Los Angeles, and San Diego, by 700 miles of high-speed rail (California High-Speed Rail Authority 2007). Although the precise route has yet to be defined, the two proposed routes pass through or immediately adjacent to occupied palmate-bracted bird's-beak habitat, especially the Bay Area to Merced Route (potentially impacting the western Madera County population and the Mendota/Alkali Sink Ecological Reserve population (California High Speed Rail Authority 2004). As currently designed (e.g., stations, rail alignment, right-of-way, overpasses, underpasses, and potential need to relocate power lines), this proposed project likely will have significant direct, as well as indirect impacts to the palmate-bracted bird's-beak and its habitat through construction of the rail corridor (50 to 200 feet wide) and by increasing residential development in areas previously beyond the normal commuting distance between home and work. For example, people could work in San Francisco, but reside in western Fresno, Merced, or Madera Counties (commute time of 60 to 90 minutes -- each way -- by train). These new growth patterns likely would negatively impact palmate-bracted bird's-beak populations in the area.

At the local level, several projects may result in negative impacts to the palmate-bracted bird's-beak, for example:

- North Livermore Intensive Agriculture Program.—This proposed project aims to develop intensive agriculture on 11,820 acres immediately north of the City of Livermore. The project site includes, in part, the Springtown Alkali Sink, the only extant palmate-bracted bird's-beak site in the Livermore Valley. According to the County of Alameda (2003), the project will result in several impacts, including:

- Direct loss of native vegetation at Springtown Alkali Sink;
- Indirect impacts on native vegetation at Springtown Alkali Sink; and
- Disturbance or loss of palmate-bracted bird's-beak populations. Approximately 225 acres of the western extent of the sink would be developed (about 20 percent of the total remaining extent of the sink (County of Alameda 2003 [page 5-58]).

Several mitigation measures are recommended to reduce project impacts to the palmate-bracted bird's-beak, including (County of Alameda 2003):¹

- Exclude all lands within the Springtown Alkali Sink from the density bonus provisions of the program (details of the program are unknown to the Service); and
 - Reduce impacts to the local hydrology by the creation of three controlled management zones and the development and implementation of several plans to control, for example, erosion, sedimentation, and stormwater.
- Proposed Sunol and Ohlone Regional Wilderness Preserves.—These projects aim to create two regional wilderness preserves immediately south of the City of Livermore. One of the proposed habitat management tools is grazing. The use of grazing and its impacts on the palmate-bracted bird's-beak is controversial, however, and the Service has yet to take a position in this matter.
 - According to Hoffman (2003:1), cattle grazing “will cause significant adverse environmental impacts, including significant adverse cumulative impacts.” While the main interest of Hoffman and the Alameda Creek Alliance is fisheries restoration, they also promote land management, wildlife protection, and the appropriate regulation of cattle grazing as a land management tool. According to Hoffman (2003:11), there is substantial evidence that the proposed cattle grazing program will cause significant adverse impacts to native plant species, including the palmate-bracted bird's-beak. While specific negative impacts due to improperly controlled grazing were not specifically identified by Hoffman, they likely include encroachment by exotic plants, off-road vehicle use, and livestock wallowing in seasonal ponds. Hoffman did not indicate how cattle grazing could be appropriately regulated at the site.
 - The impacts of grazing on the palmate-bracted bird's-beak may not always be negative. At another site -- Colusa NWR -- Wingo-Tussing *et al.* (2005) see no evidence of adverse impacts to palmate-bracted bird's-beak in their experimental cattle grazing plots. Cattle at low densities and under controlled conditions at Colusa NWR apparently are effectively removing *Lolium multiflorum* biomass, but the study has not yet been completed, and the larger issue of grazing impacts on palmate-bracted bird's-beak

¹ The Service has not evaluated the efficacy of these proposed measures.

- remains open to debate.
- The use of grazing at the proposed Sunol and Ohlone Regional Wilderness Preserves, however, may not be a relevant issue after all. According to Fleishman, the palmate-bracted bird's-beak does not occur at that site [S. Bainbridge, in litt., 2007]. Surveys by trained botanists are needed to determine if the palmate-bracted bird's-beak actually occurs on the proposed Sunol and Ohlone Regional Wilderness Preserves.
 - Given these questions, the Service may wish to request additional information from the several parties involved.
 - Colusa NWR Restoration Project.—There is a large restoration project underway at Colusa NWR to restore alkaline vernal pools (J. Silveira, in litt., 2007). This project is a work in progress and success with respect to palmate-bracted bird's-beak restoration can not be guaranteed.
 - Burning and other habitat restoration activities such as grazing can have positive as well as negative effects to the landscape. While burning and restoration activities ultimately may benefit the palmate-bracted bird's-beak, their initial implementation may adversely affect the species for several years until the best methods can be developed. As a result of recent Service decisions in the context of other species, though, there are now funds available to monitor populations of the palmate-bracted bird's-beak that burned, as briefly mentioned in section II.C.1.a, in the context of management activities. It remains to be seen, however, how long it will take to develop effective restoration actions or how the local palmate-bracted bird's-beak population will fare in the meantime.
 - On a positive note, with funds from the U.S. Bureau of Reclamation – Central Valley Improvement Act, Habitat Conservation Program, Sacramento NWR Complex is acquiring in-holdings at Colusa NWR to reduce threats to, and increase habitat for, endangered and threatened species, migratory birds, and native plants and plant communities, as well as to protect Sacramento NWR vernal pool and alkali meadow habitats from adjacent rice-field run-off during the growing season (J. Silveira, in litt., 2006).
 - Sacramento International Airport.—As a part of the Master Plan Study (Sacramento County Airport System 2004), potential protected species issues in the vicinity of the airport were identified. The palmate-bracted bird's-beak was categorized as a “special-status plant species” based on the identification of a local population within 5 miles (i.e., City of Woodland). A total of 11 plant species, 20 animal species, and 5 habitats were categorized as special status. No specific links between the palmate-bracted bird's-beak and the airport were cited, but the report identified several risks, including: flooding, air quality, hazardous materials, surface water quality, and hydrology and water quality. Growth at the airport will continue – as will direct and indirect negative impacts to the palmate-

- Springtown Alkali Sink.—Past threats include expansion of urban development that has already eliminated substantial areas of valuable wetland habitat (K. Lazar, in litt., 2007). Hydrological alteration due to construction at the site and in the surrounding areas, off-road vehicles, and discing also increasingly threaten the palmate-bracted bird's-beak (Coats *et al.*, 1989; Questa Engineering Corporation 1997).² The site, while partially fenced, is also subject to trash dumping, excavation, herbicide spraying along property lines, and construction of bike jumps and courses (E. Fleishman, in litt., 2007; M.A. Showers, California Department of Fish and Game, in litt., 2007). Depending on the magnitude of the specific event, these threats may affect individual palmate-bracted bird's-beak, as well as the habitat where they occur. Likewise, these threats may be of limited duration (e.g., ranging from an instantaneous event up to something lasting a few days) or they may be more long-term (e.g., ranging from seasonal to several years). Future growth threatens to cause additional losses (P. Bontadelli, California Department of Fish and Game, in litt., 1988).
- Western Madera County.—A large dairy facility has been proposed adjacent to a site with palmate-bracted bird's-beak (E. Cypher, in litt., 2007). This facility could negatively impact palmate-bracted bird's-beak by changing the local hydrology (resulting in reduced seed dispersal), as well as by introducing contaminants to the water (resulting in increased mortality).
- Alkali Sink Ecological Reserve.—Roadside maintenance and grading of areas occupied by the palmate-bracted bird's-beak increasingly threaten the species (D. Taylor, BioSystems Analysis, Inc., in litt., 1986). In addition, non-native invasive plants have reduced the quality of much of the habitat used by the palmate-bracted bird's-beak at Alkali Sink Ecological Reserve. Finally, the flood during 2004-2005 likely resulted in the deaths of many palmate-bracted bird's-beak, as well as reduced seed dispersal.

Several other specific threats to palmate-bracted bird's-beak habitat or range that are identified in the Recovery Plan and linked by species experts to known palmate-bracted bird's-beak sites have also been identified. These widespread and ongoing threats include: the conversion of native habitat into irrigated agricultural fields (e.g., palmate-bracted bird's-beak sites at Woodland,

² The Recovery Plan specifically cites unauthorized fill of wetlands as a threat (Service:1998:35), however, authorized but poorly planned/implemented projects can also have negative effects on wetlands.

Sacramento Valley, San Joaquin Valley); installation of pipelines and transmissions lines (Woodland); drainage facilities (Springtown residential development); gas and water pipelines (Springtown); and off-road vehicle use (Springtown). These threats are also addressed collectively at times in this analysis because these activities frequently occur simultaneously or are related to one another. Routine maintenance, for example, including the application of herbicides, has been identified as a specific threat along roadsides and drainage channels at Alkali Sink Ecological Reserve (M.A. Showers, in litt., 2007), while off-road vehicle use is especially serious at Springtown Alkali Sink (M.A. Showers, in litt., 2007). The initial threats that were identified in the Recovery Plan, as well as those described by species experts, continue to apply pressure to palmate-bracted bird's-beak populations today.

As mentioned earlier, in an attempt to reduce or eliminate habitat destruction, the Service has developed or approved several HCPs that include the palmate-bracted bird's-beak. In addition to the HCPs in preparation, the Service has also established the Conservation Bank Program to facilitate mitigation and compensation obligations under the ESA, as well as to promote the conservation status of federally-listed species. To date, however, no conservation bank has been established for the palmate-bracted bird's-beak. According to the National Wetland Mitigation Banking Study (Institute for Water Resources 1994), though, a mitigation bank was established at Springtown Alkali Sink. Named the Springtown Natural Communities Reserve and sponsored by the Environmental Mitigation Exchange company, the original bank had a capacity of 92.57 acres, but had the potential to expand to approximately 400 acres. The banking agreement was executed in 1997. The bank was officially established for wetland creation credits (including the vernal pool fairy shrimp [*Branchinecta lynchi*] and California tiger salamander [*Ambystoma californiense*]), as well as for wet swale, alkali meadow, and scald habitats known to support the palmate-bracted bird's-beak (Stratus Consulting, Inc., 2003). Finally, the palmate-bracted bird's-beak has benefited thorough the establishment in 2005 of the Alkali Grasslands Preserve by the Center for Natural Lands Management. This 180-acre preserve was acquired – in part – to promote the conservation of the palmate-bracted bird's-beak via the protection of habitat (Table 1; Figure 2).

In conclusion, present or threatened destruction, as well as modification or curtailment of habitat or range continue. Currently there are 18 occurrences over 8 localities. Six of these localities (Sacramento, Delevan, and Colusa National Wildlife Refuges, Alkali Grasslands Preserve, Mendota Wildlife Area, and the Alkali Sink Ecological Reserve), which contain 12 occurrences, are protected at the federal, state, or county level. The Springtown Alkali Sink locality contains one occurrence that is only partially protected by a conservation bank and the Western Madera County locality contains 4 occurrences that are on privately owned land and are not protected. While the Service is working with project proponents at the state, regional, and local levels to avoid or minimize loss of the palmate-bracted bird's-beak, declines continue where habitat is lost or converted.

HCPs, conservation banks, and private preserves, however, are providing opportunities to enhance the conservation status of the species.

II.C.2.b. Factor B, Overutilization for commercial, recreational, scientific, or educational purposes

Overutilization was not identified as a threat to survival when the species was listed (Service 1986:23767). Overutilization does not appear to be a threat at this time.

II.C.2.c. Factor C, Disease or predation

At the time of listing, cattle grazing was identified as a major factor (Service 1986:23767). Cattle grazing has undoubtedly altered the plant species composition of the areas occupied by the palmate-bracted bird's-beak, but the specific effects and mechanisms were not indicated. Existing grazing levels, at that time, did not appear to threaten those areas still supporting the palmate-bracted bird's-beak.

Cattle grazing as a management tool, it now appears, can be beneficial as well as harmful to the palmate-bracted bird's-beak. Grazing can enhance the conservation status of the palmate-bracted bird's-beak through the removal of invasive non-native plants that compete with the palmate-bracted bird's-beak for resources or displace host plants (Wingo-Tussing *et al.*, 2005; Wingo-Tussing 2006). When poorly used, however, grazing can also impact the conservation status of the palmate-bracted bird's-beak through physical destruction of habitat (e.g., soil compaction or wallowing in seasonal ponds; Service 1998:35). Given these contradictory results and our poor understanding of the underlying ecological circumstances of the sites occupied by the palmate-bracted bird's-beak, species experts need to conduct additional research in order to develop suitable guidelines leading to the appropriate use of grazing as an effective management tool.

Many areas occupied by palmate-bracted bird's-beak have been grazed by cattle over the years with mixed results (M.A. Showers, in litt., 2007). At Springtown Alkali Sink, for example, cattle grazing was intensive during the 1980s on City of Livermore property. Removal of grazing animals in the 1980s allowed the native alkali sacaton (*Sporobolus airoides*), pickleweed (*Salicornia subterminalis*), and iodine bush (*Allenrolfea occidentalis*) to recover. This action also promoted the partial recovery of the palmate-bracted bird's-beak. Due to continued habitat disturbance in the surrounding area, some grazing currently is needed to control weeds at this site. At Alkali Grassland Preserve, goats were used during 2005 to reduce the ryegrass (*Lolium* spp.; a competitor). The one-time grazing wasn't adequate to eliminate all of the ryegrass, but reduced it sufficiently so that saltgrass (*Distichlis* spp.; a palmate-bracted bird's-beak host plant) cover increased throughout the area. This action also promoted the partial recovery of

the palmate-bracted bird's-beak. At Alkali Sink Ecological Reserve, cattle routinely grazed the site prior to acquisition by CDFG. Subsequent to acquisition, grazing was terminated; weed cover then increased significantly, while palmate-bracted bird's-beak numbers decreased. These results suggest that grazing is a tool that can be helpful, as well as harmful to the palmate-bracted bird's-beak if misapplied, and that short-term results may differ from long-term results after grazing has ended. In conclusion, if controlled and properly managed, grazing may be helpful for management of palmate-bracted bird's-beak.

II.C.2.d. Factor D, Inadequacy of existing regulatory mechanisms

At the time of listing (Service 1986), the Service – except for a generic reference to the plant having “endangered status” by the “State of California” -- identified only a single regulatory mechanism that was relevant to the palmate-bracted bird's-beak: the State of California's Native Plant Protection Act (NPPA). According to the Service, the NPPA did not provide adequate protection to the palmate-bracted bird's-beak. Under that act, individual property owners were required to notify State officials if a change in land use would affect the plant so that the State could salvage the plant. There was no guarantee, however, that salvage by the State would occur within the 10-day time period. The Service also indicated a need for additional protection with regard to State research and land acquisition measures, but did not provide any further explanation. Loss of individuals and habitat by changing land use, despite the NPPA, remains a problem today.

The following regulatory mechanisms also pertain to this factor, but were not discussed at the time the palmate-bracted bird's-beak was federally listed (USFWS 1986b):

- California Endangered Species Act (CESA).--The CESA (California Fish and Game Code, Section 2050 et seq.) prohibits the unauthorized take of state-listed threatened or endangered species. The palmate-bracted bird's-beak was listed in 1984 by the State of California as endangered. Unlike the take prohibition in the ESA, the State prohibition includes plants, although in some instances landowners may be exempt from this prohibition for plants taken via habitat modification such as for agricultural activities. When properly implemented, the CESA should enhance the conservation status of the palmate-bracted bird's-beak, but by itself may not be sufficient to ensure the survival of the species.
- California Environmental Quality Act of 1970 (CEQA).--The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant effects are identified, the lead agency has the option of (a) requiring mitigation to offset project effects, (b) requiring changes in the project to reduce the impacts to a level of insignificance, or to (c) decide that overriding considerations make mitigation infeasible [CEQA Sec. 21081(b)]. In the latter case, a public agency must find that specific overriding economic,

legal, social, technological, or other benefits of the project outweigh the significant environmental effects on the environment. Destruction of listed species and their habitat would not be considered insignificant and a take permit would be required from CDFG; such a project would still be subject to CESA (M.A. Showers, in litt., 2007). A finding of overriding considerations, however, does not release the project proponent from the provisions of CESA. When properly implemented, the CEQA should enhance the conservation status of the palmate-bracted bird's-beak, but by itself may not be sufficient to ensure the survival of the species.

- Clean Water Act of 1977 and 1987 (CWA).--Given the proximity of this species to wetlands, vernal pools, and other “waters of the United States,” fill, dredging, or other construction activities at these sites may require a section 404 permit by the U.S. Corps of Engineers (Corps), as well as trigger consultation under section 7 of the ESA between the Service and the Corps. The Corps interprets “the waters of the United States” expansively to include not only traditional navigable waters, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. Before issuing a section 404 permit to a project applicant that may affect federally-listed species, the Corps is required under section 7 of the ESA to consult with the Service. The ESA is the primary Federal law that provides protection of the palmate-bracted bird's-beak since its listing as an endangered species in 1986.

Given recent court decisions, however, the definition of “waters of the United States” and how that definition may relate to section 404 of the Clean Water Act is under review by Corps and the U.S. Environmental Protection Agency (EPA). On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving “isolated” wetlands. On June 5, 2007, however, the EPA and the Corps issued joint guidance to sustain wetlands protections in light of the Supreme Court decision (EPA 2007a,b). Currently the Corps regulatory oversight of vernal pools is being clarified on a case-by-case basis because of their “isolated” nature. If the Corps loses its regulatory authority over vernal pools – including adjacent palmate-bracted bird's-beak habitat – unmitigated destruction of potential habitat for palmate-bracted bird's-beak may increase over the range of the species. When broadly interpreted to include ponds, pools, and drainages occupied by the palmate-bracted bird's-beak, the CWA should enhance the conservation status of the species, but it does not specifically protect plant species.

A new regulatory mechanism that was not available at the time of original listing now exists: (State of California) Natural Community Conservation Planning Act (1991). The purpose of this act is to promote land acquisition and conservation planning. Working with numerous private and public partners, this effort takes a broad-based ecosystem approach to planning for the protection and perpetuation

of biological resources. There are 32 active NCCPs covering more than 7 million acres of which 10 have been approved and permitted (NCCP CDFG 2007). The palmate-bracted bird's-beak is one of the species identified in the planning agreement for the Yolo County NCCP/HCP (2005). When broadly interpreted to include ecosystems and natural communities occupied by the palmate-bracted bird's-beak, the NCCP should enhance the conservation status of the species, but by itself may not be sufficient to ensure the survival of the palmate-bracted bird's-beak.

Finally, the land tenure situation at Springtown Alkali Sink poses several administrative or regulatory challenges that highlight an inadequacy with existing regulatory mechanisms in Alameda County. This threat was not addressed in the original listing (Service 1986), but was discussed in the Recovery Plan (Service 1998:36). Private land owners, as well as public agencies own land at this site. These entities have several goals that range from total conservation to total commercial/residential development. These goals, while otherwise legal, are not compatible given the small size of the site (300 acres) and the negative impacts of these activities that can reach across property boundaries (e.g., dust and changes in the hydrological regime). Currently, the status of this palmate-bracted bird's-beak population is not secured due to human activities (L. Naumovich, California Native Plant Society [East Bay Chapter, Berkeley], in litt., 2007). A solution to this problem will require the cooperation of all parties.

II.C.2.e. Factor E, Other natural or human made factors affecting its continued existence

Low population numbers, genetic depletion, and reduced reproductive potential were identified as threats under factor E in the final rule (Service 1986). New threats to palmate-bracted bird's-beak have been identified since the listing. These new threats include invasive non-native plants, loss of pollinators, climate change, ozone, and excessive dust.

Invasive non-native plants: Invasive non-native plant species are a potential threat to palmate-bracted bird's-beak and associated native host plants at Colusa NWR and Delevan NWR (Wight 2000; Wingo-Tussing *et al.* 2005; Wingo-Tussing 2006). Populations of the annual ryegrass (*Lolium multiflorum*), tall wheatgrass (*Elytrigia pontica* ssp. *pontica*), broad-leaved pepperweed (*Lepidium latifolium*), and fleshy-leaved Russian-thistle (*Salsola soda*) have been increasing in habitat occupied by palmate-bracted bird's-beak, and associated (host) plants such as Great Valley gum plant (*Grindelia camporum* var. *camporum*), pappose spikeweed (*Hemizonia parryi* spp. *rudis*), alkali heath (*Frankenia salina*), and saltgrass (*Distichlis spicata*; host plant). These plants compete with the palmate-bracted bird's-beak for resources (e.g., space, water, and nutrients) and can displace host plants. Sacramento NWR Complex is making efforts through a combination of prescribed cattle and sheep grazing (target = annual ryegrass), prescribed fire (target = annual ryegrass), and herbicide application treatments

(target = broad-leaved pepperweed, tall wheatgrass) to control the invasive non-native plants.³

The Alkali Grassland Preserve population is threatened by non-native invasive plants (especially *Lolium* spp. and annual grasses), as well as a lack of knowledge about the basic life history needs of the plants and how palmate-bracted bird's-beak responds to management (C. Feldheim, Center for Natural Lands Management, in litt., 2007). Near-term action to conserve the palmate-bracted bird's-beak is indicated.

Accidental flooding of palmate-bracted bird's-beak during the dry period (June-September) from rice field run-off has also impacted one palmate-bracted bird's-beak patch at Colusa NWR (J. Silveira, in litt., 2006). Extensive and unseasonal flooding can kill palmate-bracted bird's-beak plants, as well as allow other plants to invade after the waters recede. Deep flooding that persists over several weeks can kill individual plants.

Pollinators: Another widespread threat to palmate-bracted bird's-beak is the loss of pollinators through the spraying of malathion and other pesticides. Bees are important pollinators of the palmate-bracted bird's-beak in California (Saul-Gershenz *et al.*, 2004). Malathion application to bees and the vegetation where they occur may be a specific threat to the genetic diversity of palmate-bracted bird's-beak by reducing pollination. The effects of malathion application are extremely local given that bees typically range only about 300-400 meters (about 980-1300 feet) from the nest to a flower (Kroodsma 1975; Keasar *et al.*, 1996; Capaldi *et al.*, 2000; Kwak 2002). A recent report from the Xerces Society of Invertebrate Conservation (Evans *et al.* 2008) described the population status of three species of bumble bee, including the western bumble bee (*Bombus occidentalis*), a species which has been observed as a primary visitor and presumably pollinator for palmate-bracted bird's beak flowers. Evans *et al.* (2008) stated that the western bumble bee has almost completely disappeared from central California, likely due to non-native pathogen exposure and pesticide application, as well as habitat loss and fragmentation from agricultural and grazing practices and urban development. These threats have affected bumble bee access to food, shelter, and nesting sites and have had significantly negative effects on bumble bee population success. Whether due to introduced parasites, pesticide application, or habitat degradation and loss, a decline in palmate-bracted bird's-beak pollinators, will reduce the species' genetic diversity and result in long-term negative consequences (e.g., reduced seed production and viability).

The Sacramento/Yolo Mosquito Vector Control District (Undated) also has an ongoing program to control the West Nile virus through the aerial application of pyrethroids and other insecticides that may affect palmate-bracted bird's-beak

³ A 3-year study is underway at Sacramento NWR Complex (see Wingo *et al.* 2005; K. Schierenbeck, in litt., 2007a,b; S. Wingo-Tussing, in litt., 2007). Final results about the effectiveness of these measures will be available after 2009.

pollinators. It is not clear if sites with palmate-bracted bird's-beak are being sprayed or if palmate-bracted bird's-beak pollinators are being affected. The aerial application of these insecticides is controversial, however, due to potential public health issues. Opponents of aerial spraying in Sacramento have expressed concern, for example, that such chemicals can have long-term consequences for people and animals, can kill other insects, and can affect waterways (McGhee 2007; for health issues, see: California Department of Health Issues, 2005a,b, 2006; Morbidity and Mortality Weekly Report [Centers for Disease Control and Prevention], 2003). Proponents of aerial spraying and the use of insecticides to control mosquitoes counter, however, that the demonstrated health risks from West Nile Virus are greater than potential risks associated with mosquito control activities (Centers for Disease Control and Prevention, 2004; California Department of Health Services, 2005a,b; Peterson *et al.*, 2006).

Climate Change: Due to the highly restricted range of palmate-bracted bird's-beak, climate change in the Central Valley could have a particularly negative effect on the species. As stated previously, the palmate-bracted bird's-beak is restricted to the Sacramento Valley and the San Joaquin Valley under a unique set of geographic (flat) and climatic (hot and dry) conditions (Figures 1-3). The range of palmate-bracted bird's-beak is restricted by soil type (alkaline-saline). Some climate change models predict for California an overall warming of 1.7 degrees Centigrade – 5.8 degrees Centigrade (3.0 degrees Fahrenheit – 10.4 degrees F) by 2100 (Cayan *et al.* 2006), but they vary in their predictions for precipitation. VanRheenen *et al.* (2004) predict a decrease in precipitation in the San Joaquin Valley. Changes in annual precipitation have a large effect on the abundance of palmate-bracted bird's-beak, as typical of desert annuals (Germano *et al.* 2005; Warrick 2006). Evidence from field (Kelly and Goulden 2008) and modeling (Loarie *et al.* 2008) efforts indicates that population range shifts and redistribution of plant communities may result from climate change, such that species with constrained dispersal abilities will be in particular danger of extirpation. If the predicted climate changes occur, the palmate-bracted bird's-beak, with its highly constrained dispersal abilities, will likely be extirpated with no available refugia, as has been predicted in the southern portion of the San Joaquin Valley for the Kern mallow (*Eremalche kernensis*; Leonelli 1986; Service 1998).

Ozone: Another potential threat to palmate-bracted bird's-beak is ozone due to photochemical smog. Numerous studies have documented the negative effects of ozone on plants, such as pronounced foliar injury and growth reduction (e.g., Miller 1992; Grantz and Yang 1996; Bytnerowicz 2002), but no studies have been performed specifically on palmate-bracted bird's-beak. The California Air Resources Board (2006) reported for southern portions of the San Joaquin Valley as many as 26 days per year above the national 1-hour ozone standard and as many as 116 days per year above the national 8-hour ozone standard during the period 2002 - 2005.

Excessive Dust: An additional potential threat to the palmate-bracted bird's-beak is excessive dust. Dust may affect photosynthesis, respiration, and transpiration, as well as allow the penetration of phytotoxic gaseous pollutants (Farmer 1993). No research, however, has analyzed the effects of dust specifically on palmate-bracted bird's-beak. From 1996 – 2005, Bakersfield – in the southern portion of the San Joaquin Valley – on average surpassed the State of California 24-hour PM10 (particulate matter with an aerodynamic diameter of 10 microns or less) standard 170 days per year and surpassed the national 24-hour PM2.5 (particulate matter with an aerodynamic diameter of 2.5 microns or less) standard 16 days per year (California Air Resources Board 2006). In 2005, the primary sources of particulate matter (PM10 and PM2.5) in Kern County, for example, were farming operations, road dust, and fugitive windblown dust (California Air Resources Board 2006).

II.D. Synthesis

When *Chloropyron palmatum* was originally listed as endangered in 1986 (Service 1986), the primary threat to its survival and recovery was habitat loss. Eight additional threats that further define or subdivide “habitat loss” have been identified since listing, including: urban expansion, changes in the hydrologic regime, random or catastrophic events (e.g., uncontrolled burns or unseasonable floods), road maintenance, unauthorized fill of wetlands, encroachment by exotic plants, off-road vehicle use, and livestock wallowing in seasonal ponds (Service 1998). Of the eight known occurrences (up to 10 populations reported historically), five are located on public lands and are protected from development. This species and its seasonally-flooded saline-alkaline soils are still threatened by at least four current or potential new threats: invasive non-native plants, climate change, ozone, and excessive dust. In summary, based on the highly restricted range of the palmate-bracted bird's-beak, the continuation of habitat loss/conversion, the continuation of threats and the identification of new threats, the current protection of only 50 to 75 percent of palmate-bracted bird's-beak habitat, the distribution of small populations in highly isolated fragments, and the inadequacy of existing regulatory mechanisms, we conclude that the palmate-bracted bird's-beak continues to meet the definition of endangered.

III. RESULTS

III.A. Recommended Classification: Given your responses to previous sections, particularly Section II.D. Synthesis, make a recommendation with regard to the listing classification of the species (briefly summarize the reasons for this recommendation). Also refer to 50 CFR 424.11 Factors for listing, delisting, or reclassifying species:

_____ **Downlist to Threatened**

_____ **Uplist to Endangered**

_____ **Delist (*Indicate reasons for delisting per 50 CFR 424.11*):**

_____ *Extinction*

- Recovery
- Original data for classification in error
- No change is needed**

III.B. New Recovery Priority Number: 2C

No change in the Recovery Priority Number is necessary. The degree of threat remains high, as does the recovery potential, a taxonomic rank of full species is retained, and the species is, or may be, in conflict with construction or other development projects or other forms of economic activity” [Service 1983a:43104]).

IV. RECOMMENDATIONS FOR FUTURE ACTIONS⁴

Within the context of the broad habitat conservation and ecological research recommendations mentioned generally throughout this review, we propose several specific tasks or activities. While some of these tasks or activities have already been specified in the Recovery Plan [Service 1998], newly-developed research techniques and insights suggest new ways to accomplish or undertake these tasks or activities (see Silveira and Wolder 2002; E. Fleishman, in litt., 2004, 2005, and 2006; M.A. Showers, in litt., 2007):

- ***Protection of Palmate-bracted Bird’s-beak Habitat on Private Lands.--***One of the most important goals for the conservation of this species is the protection of occupied palmate-bracted bird’s-beak habitat primarily at three sites. The Springtown Alkali Sink perhaps is the most important of the three sites to be protected given the severity of the threats at the site, as well as its geographic location in the Livermore Valley. Protection by acquisition or through a conservation easement would also be important at the Alkali Grassland Preserve given the interests of private conservation organizations in the area. Finally, palmate-bracted bird’s-beak sites in western Madera County also need to be identified and characterized (e.g., population size and land ownership status). Over the next 5 years, an analysis should be completed that identifies and prioritizes these three sites, as well as additional sites that should be protected via conservation easements. The Yolo NCCP/HCP should also be finalized.
- ***General and Applied Ecological Research of Palmate-bracted Bird’s-beak.--***Little is known about the basic biology of this species or how it responds to management practices (C. Feldheim, in litt., 2007). The importance of periodic

⁴ The *Cordylanthus palmatus* (*Chloropyron palmatum*) Consortium met on August 14, 2007, and provided informal comments on these proposed recommendations (D. Ayres, University of California, Davis, in litt., 2007). The arrangement suggested by consortium members has four categories and indicates specific sites where activities should be implemented: habitat acquisition and protection, habitat restoration, long-term habitat management (weed control and hydrology), and research (genetics and ecology). Not all actions need to be implemented at all sites. A site-activity ranking system was discussed, but no action was taken in this regard. While these two approaches use different terminologies and action elements, they are compatible and both would enhance the conservation status of the palmate-bracted bird’s-beak.

flooding to seed dispersal and the negative effects of invasions by non-native plant species have yet to be characterized. Likewise, reintroduction techniques have yet to be developed and tested. Over the next 5 years, species experts and preserve managers – taking into account existing management plans and proposals (e.g., Coats *et al.* 1993; Service 1998) – should develop a comprehensive research and management plan for the palmate-bracted bird's-beak. An evaluation of habitat management tools (e.g., burning, grazing, herbicides), as well as an evaluation of re-introduction methods should play a prominent role in that plan. Single species conservation efforts can also lend collateral protection to fragmented ecosystems (Pavlik 2003:723). The occurrence of palmate-bracted bird's-beak within the Valley Sink Scrub ecosystem, for example, protected the bottom of a hydrological basin near Livermore from flood control projects and further urbanization (Coats *et al.*, 1993).

- ***Genetic Variation.***—As mentioned above, the conventional wisdom among biologists is that larger sites and larger populations are more diverse genetically than smaller sites or populations. Thus, it follows that natural resource managers often dedicate greater resources to the conservation of larger sites and populations (Center for Plant Conservation 1991). That strategy, however, may not always be appropriate with respect to the palmate-bracted bird's-beak. Fleishman *et al.* (2001) and Ayres *et al.* (2007) have characterized genetic variation at several sites, but have generated several additional research questions important to the development of a management plan. Over the next 5 years, genetic variation at the remaining sites should be characterized and synthesized with existing knowledge. The genetic variation at all sites should then be compared leading to a ranking of sites to guide conservation efforts according to the nature and extent of differences, as well as the importance of rare or unique alleles. A seed collection, based on the site rankings, should also be completed.
- ***Invasive Non-native Species.***—As suggested above, non-native species may outcompete the palmate-bracted bird's-beak for resources (Ayres *et al.* 2004; Fellows and Zedler 2005; K. Schierenbeck, in litt., 2007a,b). As a result, the palmate-bracted bird's-beak could become extirpated from an area with negative consequences to the taxon, as well as to local ecosystems. This suggests that natural resource managers should consider the negative impacts of invasive non-native species in order to enhance conservation and restoration programs for the palmate-bracted bird's-beak. Controlled grazing (see Wingo-Tussing *et al.* 2005; Wingo-Tussing 2006) and controlled burns (see Wight 2000) may enhance the conservation status of the palmate-bracted bird's-beak. An outline for future actions that establishes recommended values or parameters for selected population/demographic variables for invasive non-native species at sites occupied by the palmate-bracted bird's-beak should be established. Over the next 5 years and building on the research indicated above, at least one study should be initiated to characterize the efficiency/efficacy of grazing to control invasive non-

native species. A second study should be initiated to investigate the effects of controlled burns on these species.

- **Demographic Monitoring.**—The continued survival of the palmate-bracted bird's-beak depends on many demographic factors. The natural variation of these factors, though, is poorly understood (Fleishman *et al.*, 1994, 1996). An outline for future actions that incorporates demographic monitoring of the several populations and minimum levels of demographic parameters maintained should be established. Over the next 5 years, at least one long-term study – building on efforts by Cypher (2002) and others -- should be initiated to monitor demographic variables.
- **Formally Change Name.**— The scientific name should formally be changed in the Code of Federal Regulations from *Cordylanthus palmatus* to *Choropyron palmatum*.

If resources are available, two additional tasks/research projects are also recommended: (a) Host Ecology and Host-Hemi-parasite Relationships and (b) Pollinator Assemblages.

V. REFERENCES

- Ayres, D., E. Fleishman, A. Launer, A. Lee, and D. Zippin. In press. Development of demographic and genetic conservation strategies for maintenance of an endangered annual. Plant. Genetica [submitted 3 May 2007].
- Ayres, D.R. K. Zaremba, and D.R. Strong. 2004. Extinction of a common native species by hybridization with an invasive congener. *Wood Technology* 18:1288-1291.
- Bittman, R. 1985. Classification of biotic themes. Unpublished report. National Natural Landmarks Program. South Pacific Border Program. The Nature Conservancy, San Francisco, California.
- Bittman, R. 1986. Element preservation plan for *Cordylanthus palmatus*. Unpublished. report. National Natural Landmarks Program. South Pacific Border Program. The Nature Conservancy, San Francisco, California.
- Bytnerowicz, A. 2002. Physiological/ecological interactions between ozone and nitrogen deposition in forest ecosystems. *Phyton* (Austria).
- CALFED Bay-Delta Program. 2000. Multi-species conservation strategy. CALFED, Sacramento, California. 83 pp. (see Chapter 4: Effects of CALFED Actions and Conservation Measures, July 2000: Table 4-5, 4-10, and 4-11).
- California Air Resources Board. 2006. 2005 Estimated Annual Average Emissions. Available on the internet at <<http://www.arb.ca.gov/maps/maps.htm>>. Accessed June 1, 2007.

- California Department of Fish and Game (CDFG). 1995. California Natural Diversity Database. Sacramento. Electronic form.
- California Department of Fish and Game (CDFG; Habitat Conservation Planning Branch). 2007a. California's plants and animals: palmate-bracted bird's-beak (*Cordylanthus palmatus*). Available on the internet at <http://www.dfg.ca.gov/hcpb/cgi-bin/more_info.asp?idKey=ssc_tespp&specy=plants&quesry=Cordylanthuspercent20palmatus>. Accessed on April 23, 2007.
- California Department of Fish and Game (CDFG). 2007b. Mendota Wildlife Area, Alkali Sink Ecological Reserve, and Kerman Ecological Reserve, Fresno County. map; 1 p.. Available on the internet at http://www.dfg.ca.gov/lands/er/region4/maps/Mendota_AlkaliSink_Kerman.jpg. Accessed on May 4, 2007
- California Department of Fish and Game Natural Diversity Database (CNDDDB). 2007a. Palmate-bracted bird's-beak (*Cordylanthus palmatus*). [Occurrence numbers 1, 3-14, 18-27, and 29; report printed on 25 January 2007]
- California Department of Fish and Game (Natural Diversity Database; CNDDDB). 2007b. Special vascular plants, bryophytes, and lichens list. Quarterly Publication (April 2007). California Department of Fish and Game, Sacramento. 69 pp.
- California Department of Health Services. 2005a. Safety of pesticides used to control adult mosquitoes (pyrethrins, pyrethroids, and piperonyl butoxide): Questions and answers for public health professionals. California Department of Health Services, Division of Communicable Disease Control, Division of Environmental and Occupational Disease Control, Sacramento. 14 pp. Available on the internet at <www.cdpr.ca.gov/docs/dept/factshts/safety_of_pesticide.pdf>. Accessed on June 1, 2009.
- California Department of Health Services. 2005b. Overview of mosquito control practices in California. California Department of Health Services, Vector-Borne Disease Section, Sacramento. 30 pp. Available on the internet at www.cdpr.ca.gov/docs/dept/westnile/. Accessed on June 1, 2009.
- California Department of Health Services. 2006. What you should know about mosquito control pesticides. California Department of Health Services, Vector-Borne Disease Section, Sacramento. 4 pp. Available on the internet at www.cdpr.ca.gov/docs/dept/westnile/. Accessed on June 1, 2009.
- California High-Speed Rail Authority. 2004. California High-Speed Train; program environmental impact report/environmental impact statement. Bay Area to Merced: Biological resources technical evaluation. US Department of Transportation and Federal Railroad Administration, Washington.

- California High-Speed Rail Authority. 2007. California High-Speed Rail – Biological resources evaluation of the Sacramento to Lodi segment. Prepared by DMJM Harris and CH2M Hill Team, DMJM Harris/AECOM and CH2MHILL. 9 pp. + tables + appendices.
- Capaldi, E.A., A.D. Smith, J.L. Osborne, S.E. Fahrbach, S.M. Farris, D.R. Reynolds, A.S. Edwards, A. Martin, G.E. Robinson, G.M. Poppy, and J.R. Riley. 2000. Ontogeny of orientation flight in the honeybee revealed by harmonic radar. *Nature* 403 (3 February 2000):537-540.
- Cayan, D., A.L. Luers, M. Hanemann, G. Franco, and B. Croes. 2006. Scenarios of Climate Change in California: An Overview. California Energy Commission, PIER Energy-Related Environmental Research. CEC-500-2005-186-SF. Available on the internet at <<http://www.energy.ca.gov/2005publications/CEC-500-2005-186/CEC-500-2005-186-SF.PDF>>. Accessed June 1, 2009.
- Center for Conservation Biology. 1991. Conservation of the palmate-bracted bird's beak: a most unusual endangered annual. *Center for Conservation Biology Update* 5(2)1-2.
- Center for Conservation Biology. 1992. Studies of the *Cordylanthus palmatus* at the Springtown Alkali Sink, Livermore, California. Stanford University, Stanford, California, 79 pp.
- Center for Conservation Biology. 1993. Conservation of the *Cordylanthus palmatus* at the Springtown Alkali Sink, Livermore, California. Stanford University, Stanford, California, 56 pp.
- Center for Conservation Biology. 1994. Studies of *Cordylanthus palmatus* at the Springtown Alkali Sink, Livermore, California. Stanford University, Stanford, California, 71 pp. + appendices.
- Center for Natural Lands Management (CNLM). 2000-2004. Preserve – Alkali Grasslands. Center for Natural Lands Management, Falbrook, California. 3 pp. Available on the internet at <http://www.cnlm.org/cms/index.php?option=com_content&task=view&id=99&Itemid=133>. Accessed on April 24, 2007.
- Center for Plant Conservation. 1991. Appendix. Genetic sampling guidelines for conservation collections of endangered plants. Pp. 225-238, in *Genetics and conservation of rare plants* (D.A. Falk and K.E. Holsinger, eds.). Oxford University Press, New York. 283 pp.
- Centers for Disease Control and Prevention (CDC). 2004. CDC: West Nile Virus – QA: Pesticides for Mosquito Control. 3 pp. Available on the internet at: <<http://www.cdc.gov/ncidod/dvbid/westnile/qa/pesticides.htm>>. Accessed on September 18, 2007.

- Chuang, T.I., and L.R. Heckard. 1971. Observations on root parasitism in *Cordylanthus* (Scrophulariaceae). *American Journal of Botany* 58(3):218-228.
- Chuang, T.I., and L.R. Heckard. 1973. Taxonomy of *Cordylanthus* subgenus *Hemistegia* (Scrophulariaceae). *Brittonia* 25:135-158.
- Chuang, T.I., and L.R. Heckard. 1993. *Cordylanthus*. Pp. 1027-1031, in *The Jepson Manual: higher plants of California* (J.C. Hickman, ed.) University of California Press, Berkeley. 1400 pp.
- Coats, R., M.A. Showers, and B. Pavlik. 1989. The Springtown Alkali Sink: an endangered ecosystem. *Fremontia* 17(1):20-23.
- Coats, R., M.A. Showers, and B. Pavlik. 1993. Management plan for an alkali sink and its endangered plant *Cordylanthus palmatus*. *Environmental Management* 17:115-127.
- Coats, Robert, M.A. Showers, and B. Pavlik. 1988. A management plan for the Springtown alkali sink wetlands and the endangered plant *Cordylanthus palmatus*. California Department of Fish and Game, Unpublished report 131 pp.
- County of Alameda. 2003. North Livermore Intensive Agriculture Program: draft EIR. Prepared by Lamphier – Gregory, Inc., in association with Jones & Stokes and Todd Engineers and Geostage, Inc. Livermore, California. 9 chapters, tables, figures, appendices. Available on the internet at <<http://www.acgov.org/cda/planning/deir2.htm>>. Accessed on May 9, 2007.
- Cypher, E. 2002. Demographic monitoring of palmate-bracted bird's-beak (*Cordylanthus palmatus*) at Alkali Sink Ecological Reserve, Fresno County, California. Research proposal for fiscal years 2003-2004; Submitted to Central Valley Project Conservation Program, Sacramento, California. 14 pp.
- Endangered Species Recovery Program (ESRP). 2006. Ecology of palmate-bracted bird's-beak (*Cordylanthus palmatus*) at Alkali Sink Ecological Reserve, Fresno County. Available on the internet at <http://esrpweb.csustan.edu/projects/projdesc.php?doc=aserpbbb.html>. Accessed on April 23, 2007.
- Endangered Species Recovery Program (ESRP). 2007. Species Profile: Palmate-bracted bird's beak (*Cordylanthus palmatus*). By N.L. Brown and E.A. Cypher. Available on the internet at <<http://esrp.csustan.edu/speciesprofiles/profile.php?sp=copa>>. Accessed on April 20, 2007.
- Evans, E., R. Thorp, S. Jepsen, and S.H. Black. 2008. Status review of three formerly common species of Bumble Bee in the subgenus *Bombus*: *Bombus affinis* (the rusty patched bumble bee), *B. terricola* (the yellowbanded bumble bee), and *B. occidentalis* (the western bumble bee). Report for The Xerces Society for Invertebrate Conservation.

- Farmer, A. M. 1993. The effects of dust on vegetation - a review. *Environmental Pollution* 79:63-75.
- Fellows, M.Q.N., and J.B. Zedler. 2005. Effects of the non-native grass, *Parapholis incurva* (Poaceae), on the rare and endangered hemiparasite *Cordylanthus miritimus* subsp. *maritimus* (Scrophulariaceae). *Madroño* 52(2):91-98.
- Fleishman, E., A.E. Launer, K.R. Switky, and S.B. Weiss. 1994. Multi-level monitoring of the endangered plant *Cordylanthus palmatus* at the Springtown Alkali Sink. Pp. 20-32 in D.M. Kent, and J.J. Zentner, eds. *Selected Proceedings of the 1993 Conference of the Society of Wetland Scientists, Western Chapter*.
- Fleishman, E., A.E. Launer, K.R. Switky, and U. Yandell. 1996. Development of a long-term monitoring plan for the endangered plant *Cordylanthus palmatus*. Pp. 45 – 57 in D.M. Kent, J.J. Zentner, and K.D. Whitney, eds. *Selected Proceedings of the 1994 Conference of the Society of Wetland Scientists, Western Chapter*.
- Fleishman, E., A.E. Launer, K. Rehm Switky, U. Yandell, J. Heywood, D.D. Murphy. 2001. Rules and exceptions in conservation genetics: genetic assessment of the endangered plant *Cordylanthus palmatus* and its implications for management planning. *Biological Conservation* 98:45-53.
- Germano, D.J., G.B. Rathbun, E. Cypher, L.R. Saslaw, and S. Fitton. 2005. Effects of livestock grazing on a community of species at risk of extinction in the San Joaquin Valley, California. 2005 annual report. The Lokern grazing study project. Bureau of Land Management, Bakersfield, California. Available on the internet at <<http://www.csub.edu/~dgermano/GrazingWebSite.htm>>. Accessed on June 1, 2009.
- Grantz, D.A., and S. Yang. 1996. Effect of ozone on hydraulic architecture in Pima cotton. I. Carbon allocation and water transport capacity of roots and shoots. *Plant Physiology* 112:1649-1657.
- Hoffman, Jeff D. (Law Office of). 2003. Comments of Alameda Creek Alliance regarding the initial study and proposed mitigated negative declaration for the draft land use plan for sunol and ohlone regional wilderness preserves. Law Office of Jeff D. Hoffman, San Francisco, California. 27 pp.
- Holland, R.F. 1986. Preliminary descriptions of the terrestrial natural communities of California. California Department of Fish and Game, Sacramento, California. 156 pp.
- Huddleston, R.J. 2001. Mendota wildlife area: a key habitat in the San Joaquin Valley. *Outdoor California* July-August:12-14.
- Institute for Water Resources. 1994. National wetland mitigation banking study: wetland mitigation banking; resource document. IWR Report 94-WMB-2 (prepared by Environmental Law Institute, Washington, D.C., and The Institute for Water Resources

- [Water Resources Support Center, U.S. Army Corps of Engineers], Alexandria, Virginia). 139 pp. (See pp. 24-27 for information about Springtown Natural Communities Reserve Mitigation Program, California).
- Keasar, T., A. Shmida, and U. Moto. 1996. Innate movement rules in foraging bees: flight distances are affected by recent rewards and are correlated with choice of flower type. *Behavioral Ecology and Sociobiology* 39:381-388.
- Kelly, A. E and M.L. Goulden. 2008. Rapid shifts in plant distribution with recent climate change. *Proceedings of the National Academy of Sciences* 105: 11823-6.
- Kroodsma, D.E. 1975. Flight distances of male euglossine bees in orchid pollination. *Biotropica* 7(1):71-72.
- Kwak, M.W. 2002. Flight distances of bumblebees in relation to pollen. CAB Abstracts. Available on the internet at <<http://www.cababstractsplus.org/google/abstract.asp?AcNo=20053161518>>. Accessed on July 24, 2007.
- Leonelli, S. 1986. An investigation of the taxonomic status of *Eremalche kernensis* C. B. Wolf (Malvaceaea). M.S. thesis, Univ. California, Long Beach, 65 pp.
- Scott R. Loarie, S.R., B.E. Carter, K. Hayhoe, S. McMahon, R. Moe, C.A. Knight, and D. Ackerly. 2008. Climate change and the future of California's Endemic Flora. *PLoS ONE* 3(6): e2502: 1-10.
- McGhee, L. 2007. Mosquito spraying set tonight; aerial treatments are ordered amid concern about local W. Nile virus cases. *Sacramento Bee* (July 30, 2007; story appeared in Metro section, page B3).
- Miller, P.R. 1992. Mixed conifer forests of the San Bernardino Mountains, California. *in* (Olson, R.K., Binkley D., and Böhm M, eds.) *The responses of western forests to air pollution*. Springer – Verlag, New York, pp 461-467.
- Morbidity and Mortality Weekly Report (MMWR; Centers for Disease Control and Prevention). 2003. Surveillance for acute insecticide-related illnesses associated with mosquito-control efforts – nine states, 1999-2002. *MMWR Weekly* (July 11,2003) 52(27):629-634.
- National Wildlife Federation. 2001. Paving paradise: sprawl's impact on wildlife and wild places in California: a smart growth and wildlife campaign; California white paper; February 2001. National Wildlife Federation, Washington, DC. 22 pp.
- Natural Community Conservation Planning (California Department of Fish and Game). 2007. Natural Community Conservation Planning. Available on the internet at <<http://www.dfg.ca.gov/nccp/index.html>>. Accessed on July 24, 2007.

- NRPI (National Resource Projects Inventory). 2007. Yolo county habitat conservation plan. Available on the internet at <<http://gis.ca.gov/catalog/BrowseRecord.epl?id=24030>>. Accessed on April 25, 2007.
- Olmstead, Richard G., Claude W. dePamphilis, Andrea D. Wolfe, Nelson D. Young, Wayne J. Elisons and Patrick A. Reeves. 2001. Disintegration of the scrophulariaceae. *American Journal of Botany*. 88:348-361.
- Pavlik, B. 2003. Plants that protect ecosystems: a survey from California. *Biodiversity and Conservation* 12:717-729.
- Peterson, R.K.D., P.A. Macedo, and R.S. Davis. 2006. A human-health risk assessment for West Nile Virus and insecticides used in mosquito management. *Environmental Health Perspectives* 114(3):366-372.
- Questa Engineering Corporation. 1997. Hydrology: existing conditions and planning recommendations for the north Livermore planning area, Alameda County, California. Prepared for Alameda County Planning Department and the City of Livermore, 22 pp. + Appendices.
- Regents of the University of California. 1993. Jepson Flora Project: Jepson Interchange (Scrophulariaceae, *Cordylanthus*, *Cordylanthus palmatus*, and Distribution of *Cordylanthus palmatus*). University of California Press and Jepson Herbaria, Berkeley, California. 5 pp. Available on the internet at <http://ucjeps.berkeley.edu/cgi-bin/get_JM_treatment.pl?7177,7295>. Accessed on October 22, 2008.
- Sacramento County Airport System. 2004. Sacramento International Airport: Master Plan Study. PB Aviation February 17, 2004.
- Sacramento/Yolo Mosquito & Vector Control District. Undated. Endangered and threatened species: Ferris' bird's-beak. 2 pp.
- Saul-Gershenz, L, P. Fiedler, M. Barlow, and D. Rokich. 2004. Pollinator assemblage of the endangered plant *Cordylanthus palmatus* at Springtown Wetlands Reserve, Livermore, California. Symposium: Expanding the ark: The emerging science and practice of invertebrate conservation (March 25-26, 2004). American Museum of Natural History, Center for Biodiversity and Conservation, New York. 33 pp.
- Showers, M.A. 1988. *Cordylanthus palmatus* site characterization and aerial photography interpretation. Unpublished report prepared for the California Department of Fish and Game. 56 pp.
- Silveira, J. 2006. COPA surveys (revised February 1998, February 2000, December 2001, November 2002, November 2003, November 2004, December 2005, and November

- 2006). II. Survey results for *Cordylanthus palmatus* at Sacramento National Wildlife Refuge Complex. U.S. Fish and Wildlife Service, Willows, California. 7 pp + 3 figures.
- Silveira, J.G. 2000. Alkali vernal pools at Sacramento National Wildlife Refuge. *Fremontia* 27(4) and 28(1):10-18.
- Silveira, J., and M. Wolder. 2002. Gross and net occupied area for *Cordylanthus palmatus* (COPA) at Sacramento National Wildlife Refuge Complex. U.S. Fish and Wildlife Service, Willows, California. 2 pp.
- Skinner, M.W., and B.M. Pavlik, eds. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. Fifth edition. Special Publication Number 1, California Native Plant Society, Sacramento, California. 338 pp.
- State of California. 1998. California vernal pool assessment: preliminary report (May 1998). State of California, The Resources Agency, Department of Fish and Game, Sacramento.
- Stratus Consulting, Inc. 2003. A nationwide survey of conservation banks. Final report. Prepared by: Stratus Consulting, Inc., PO Box 4059, Boulder, CO 80306-4059 (Tel 303-381-8000; Contact: Diana Lane, David Mills, David Chapman). Prepared for: Northwest Fisheries Science Center, NOAA Fisheries, 2725 Montlake Boulevard East, Seattle, Washington 98112. December 19, 2003; SC10381; 131 pp.
- Tank, D.C. , J.M. Eggers, and R. G. Olmstead. 2009. Phylogenetic Classification of Subtribe Castillejinae (Orobanchaceae). *Systematic Botany* 34(1): pp. 182–197.
- U.S. Environmental Protection Agency (EPA). 2007a. EPA, Army Corps issue joint guidance to sustain wetlands protection under Supreme Court decision. EPA Newsroom. Release date: 06/05/2007. Available on the internet at <<http://yosemite.epa.gov/opa/admpress.nsf/e87e8bc7fd0c11f1852572a000650c05/e7240f5d30236d2b852572f1005e1809!OpenDocument>>. Accessed on July 30, 2007.
- U.S. Environmental Protection Agency (EPA). 2007b. EPA and Army Corps of Engineers guidance regarding Clean Water Act jurisdiction after Rapanos. *Federal Register* 72(110):31824-31825.
- U.S. Fish and Wildlife Service (Service). 1983a. Endangered and threatened listing and recovery priority guidelines: notice. *Federal Register* 48(184):43098-43105.
- U.S. Fish and Wildlife Service (Service). 1983b. Endangered and threatened listing and recovery priority guidelines: correction. *Federal Register* 48(221):51985.
- U.S. Fish and Wildlife Service (Service). 1985. Endangered and threatened wildlife and plants; proposed endangered status for *Cordylanthus palmatus* (Palmate-Bracted Bird's-Beak; proposed rule). *Federal Register* 50(136):28870-28873.

- U.S. Fish and Wildlife Service (Service). 1986. Endangered and threatened wildlife and plants; determination of endangered status for *Cordylanthus palmatus* (Palmate-Bracted Bird's-Beak; final rule). Federal Register 51(126):23765-23769.
- U.S. Fish and Wildlife Service (Service). 1998. Recovery plan for upland species of the San Joaquin Valley, California, Region 1, Portland, OR. 319 pp.
- U.S. Fish and Wildlife Service (Service). 2004. Preparation of an environmental impact statement for issuance of an incidental take permit associated with a habitat conservation plan for Pacific Gas & Electric Company's operation and maintenance activities in the San Joaquin Valley, California: notice of intent. Federal Register 69(58):15363-15364.
- U.S. Fish and Wildlife Service (Service). 2006a. Notice of availability of a draft environmental impact statement/environmental impact report and receipt of an application for an incidental take permit for Pacific Gas & Electric Company's operations and maintenance habitat conservation plan. Federal Register 71(121):36132-36135.
- U.S. Fish and Wildlife Service (Service). 2006b. Preparation of an environmental impact statement for issuance of an incidental take permit associated with a habitat conservation plan for Pacific Gas & Electric Company's operation, maintenance, and minor new construction activities in the San Francisco Bay Area, California: notice of intent. Federal Register 71(215):65123-65125.
- U.S. Fish and Wildlife Service (Service). 2007a. 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(30):7064-7068.
- U.S. Fish and Wildlife Service (Service). 2007b. Notice of availability of a final environmental impact statement/environmental impact report for the Pacific Gas & Electric Company San Joaquin Valley Operations and Maintenance Program Habitat Conservation Plan, San Joaquin Valley, CA. Federal Register 72(56):13818-13820.
- U.S. Fish and Wildlife Service (Service). 2007c. Species Profile: Palmate-bracted bird's-beak (*Cordylanthus palmatus*). Available on the internet at <<http://ecos.fws.gov/speciesProfile/SpeciesReport.do?spcode=Q1UT>>. Accessed on April 23, 2007.
- VanRheenen, N.T., A.W. Wood, R.N. Palmer, and D.P. Lettenmaier. 2004. Potential implications of PCM climate change scenarios for Sacramento-San Joaquin River Basin hydrology and water resources. Climatic Change 62: 257-281.
- Warrick, G.D. 2006. Lokern and Semitropic Ridge Preserves (C002). FY 2005 Annual Report. Center for Natural Lands Management.

- Wight, N.K. 2000. Effects of prescribed burning on rare alkali plants at the Sacramento National Wildlife Refuge Complex. M.Sc. thesis. California State University, Chico, California. xiv + 61 pp.
- Wingo-Tussing, S. 2006. Investigations of the restoration and management of *Cordylanthus palmatus* at Sacramento National Wildlife Refuge Complex; 2006 Annual Report. California State University, Chico, California, 4 pp.
- Wingo-Tussing, S., K. Schierenbeck, J. Silveira, and D. Ayres. 2005. Investigations of the restoration and management of *Cordylanthus palmatus* at Sacramento National Wildlife Refuge Complex (Proposal #06-270). Research proposal for fiscal years 2006-2009; Submitted to: Central Valley Project Conservation Program; By: The California State University, Chico Research Foundation, Chico, California 95929. 28 pp.
- Yolo County. 2004. Planning Agreement No. 2810-2003-003-02; by and among The Yolo County Habitat Conservation Plan/Natural Community Conservation Plan Joint Powers Agency, the California Department of Fish and Game, and the United States Fish and Wildlife Service; regarding the Yolo County Natural Community Conservation Plan and Habitat Conservation Plan; November 9, 2004. NCCP Planning Agreement No. 2810-2003-003-02, November 9, 2004. 27 pp.
- Yolo County Habitat/Natural Community Conservation Plan (Joint Powers Agency). 2005. Yolo County Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP); Administrative Working Draft; Ecological Baseline Report (Project No. 2406-01; July 19, 2005). Yolo County Habitat/Natural Community Conservation Plan (Joint Powers Agency), Woodland, CA. 74 pp. + tables and figures (= 104 pp).
- In Litteris***
- Ayres, D. 2007. *Cordylanthus palmatus* meeting Aug. 14, 2007. DRAFT Notes compiled by Debra Ayres. 8 pp. From Dr. Debra Ayres, University of California, Davis, to Jeffrey P. Jorgenson, Service/SFWO, regarding meeting of COPA Consortium.
- Bainbridge, S. 2007. E-mail with comments and suggested changes dated May 9 & 30, 2007, from Dr. Susan Bainbridge, University of California, Berkeley, to Jeffrey P. Jorgenson, Service/SFWO, regarding 5-Year Review for *Cordylanthus palmatus*.
- Bontadelli, P. 1988. Letter dated December 27, 1988, from Pete Bontadelli, Director, California Department of Fish and Game, and from David L. Harlow, Acting Field Supervisor, Sacramento Endangered Species Office, to Robert Brown, Planning Director, City of Livermore, regarding Management plan for the Springtown Alkali Sink Wetlands and the endangered plant *Cordylanthus palmatus* (palmate-bracted bird's beak). 3 pp.
- Cypher, E.A. 2005. Letter dated February 17, 2005, from Dr. Ellen A. Cypher, California Department of Fish and Game, Bakersfield, to Service/Recovery Permit Coordinator, regarding Annual report for recovery permit TE-080297-0. 16 pp.

- Cypher, E.A. 2007. E-mail with comments and suggested changes dated May 29, 2007, from Dr. Ellen A. Cypher, California Department of Fish and Game, Bakersfield, to Jeffrey P. Jorgenson, Service/SFWO, regarding 5-Year Review for *Cordylanthus palmatus*.
- Feldheim, C. 2007. E-mail with comments and suggested changes dated June 6 29, 2007, from Cliff Feldheim, Center for Natural Lands Management, Fallbrook, CA, to Jeffrey P. Jorgenson, Service/SFWO, regarding 5-Year Review for *Cordylanthus palmatus*.
- Fleishman, E. 2004. Letter dated January 27, 2004, from Dr. Erica Fleishman, Center for Conservation Biology, Stanford, CA, to Service, regarding activities under recovery permit TE-077753-0 (1 p.).
- Fleishman, E. 2005. Letter dated January 19, 2005, from Dr. Erica Fleishman, Center for Conservation Biology, Stanford, CA, to Service, regarding activities under recovery permit TE-077753-0 (13 p.).
- Fleishman, E. 2006. Letter dated January 31, 2006, from Dr. Erica Fleishman, Center for Conservation Biology, Stanford, CA, to Service, regarding activities under recovery permit TE-077753-0 (6 p.).
- Fleishman, E. 2007. E-mail with comments and suggested changes dated May 19, 2007, from Dr. Erica Fleishman, University of California Santa Barbara-National Center for Ecological Analysis and Synthesis, to Jeffrey P. Jorgenson, Service/SFWO, regarding 5-Year Review for *Cordylanthus palmatus*.
- Lazar, K. 2007. E-mail with comments and suggested changes dated May 16, 2007, from Kristi Lazar, California Native Plant Society, Sacramento, to Jeffrey P. Jorgenson, Service/SFWO, regarding 5-Year Review for *Cordylanthus palmatus*.
- Martz, C. 1985. Letter dated November 20, 1985, from Craig P. Martz, California Native Plant Society (Sacramento Valley Chapter), to Richard Myshak, Regional Director of Service, Portland, OR. 2 pp. [transcript of testimony favoring the listing of the species]
- Naumovich, L. 2007. Letter dated April 16, 2007, from Lech Naumovich, California Native Plant Society (East Bay Chapter), Berkeley, CA, to Susan Moore and Craig Aubrey, Service/SFWO, Sacramento, regarding 5-Year Review of *Cordylanthus palmatus* and other species.
- Schierenbeck, K. 2007a. Web page for Kristina A. Schierenbeck, California State University, Chico (see: <http://www.csuchico.edu/~kschiere/> [consulted on April 23, 2007]).
- Schierenbeck, K. 2007b. Web: Inside Chico State, Achievements (see: http://www.csuchico.edu/pub/inside/06_09_07/achievements.shtml; consulted April 24, 2007).

- Showers, M.A. 2007. E-mail with comments and suggested changes dated May 16, 2007, from Mary Ann Showers, California Department of Fish and Game, Sacramento, to Jeffrey P. Jorgenson, Service/SFWO, regarding 5-Year Review for *Cordylanthus palmatus*.
- Silveira, J.G. 2007. E-mails with comments and suggested changes dated May 23 & 24, 2007, from Joe Silveira and Mike Wolder, Service/Sacramento National Wildlife Refuge Complex, Willow, to Jeffrey P. Jorgenson, Service/SFWO, regarding 5-Year Review for *Cordylanthus palmatus*.
- Silveira, J.G. 2008. E-mails with total number of populations updated dated Septemebr 30, 2008, from Joe Silveira, Service/Sacramento National Wildlife Refuge Complex, Willow, to Hilary Swarts, Service/SFWO, regarding 5-Year Review for *Cordylanthus palmatus*.
- Taylor, D. 1986. California Native Species Field Survey Form dated June 30, 1986, by Dean Wm. Taylor, BioSystems Analysis, Inc., 303 Potrero, Suite 29-201, Santa Cruz, CA 95060. This form documents the presence of *Cordylanthus palmatus* at a site in Fresno County. 1 p.
- Wall, M. 2005. Letter dated April 23, 2005, from Michael Wall, Seed Program Manager, Rancho Santa Ana botanic Garden, to Ellen Cypher, Endangered Species Recovery Program, Bakersfield, regarding seed storage). 5 pp.
- Wingo-Tussing, S. 2007. Research proposal for Fiscal Years 2006-2009 dated December 15, 2005, by Sheli Wingo-Tussing, Kristina Schierenbeck, Joe Silveira, and Debra Ayres. [Investigations of the restoration and management of *Cordylanthus palmatus* at Sacramento National Wildlife Refuge Complex, Proposal #06-270 (28 pp.).

APPENDIX 1

Protection of Occupied Habitat (expanded)

Service.--- The Service administers the Sacramento National Wildlife Refuge (NWR) Complex, which is occupied by the palmate-bracted bird's-beak. Three individual refuges in the complex have management plans that include the palmate-bracted bird's-beak as a target species (J. Silveira, in litt., 2007).⁵ Sacramento National Wildlife Refuge (this site comprises 10,783 acres) has several small patches occupied by the palmate-bracted bird's-beak (Table 1; discussed in Section II.C.1, Biology and Habitat). Delevan National Wildlife Refuge (5,797 acres) and Colusa National Wildlife Refuge (4,626 acres) also have several small patches. These sites are secured and protected by Service personnel in the context of normal refuge activities, but the palmate-bracted bird's-beak patches are vulnerable to natural and human threats (discussed in Section II.C.2, Five Factor Analysis).

CDFG.--- CDFG administers two sites occupied by the palmate-bracted bird's-beak: Mendota Wildlife Area (about 11,794 acres) and Alkali Sink Ecological Reserve (945 acres) (Table 1; discussed in Section II.C.1). As is the case with Federal lands managed by the Service, these sites are secured and protected by CDFG personnel in the context of normal preserve activities (e.g., waterfowl management), but these palmate-bracted bird's-beak patches are vulnerable to natural and human threats (e.g., road maintenance and vehicle traffic; discussed in Section II.C.2).

City of Woodland and Mr. Dan Dowling (private landowner).--- The Alkali Grasslands Preserve comprises 180 acres (Table 1; discussed in Section II.C.1). Managed by the Center for Natural Lands Management, the site has a conservation easement and is managed – in part—for the benefit of the palmate-bracted bird's-beak (CNLM 2000-4). The palmate-bracted bird's-beak patches, however, are vulnerable to natural (e.g., non-native invasive plants) and human threats (e.g., lack of knowledge about the basic life history needs of the plant and how palmate-bracted bird's-beak responds to management [C. Feldheim, Center for Natural Lands Management, in litt., 2007]); discussed in Section II.C.2.

City of Livermore.⁶--- The Springtown Alkali Sink comprises 300 acres and is managed -- in part—for the benefit of the palmate-bracted bird's-beak (Table 1). The southern part of Springtown Alkali Sink is owned privately, although a portion of this site (73.3 acres) is managed as a mitigation bank (Springtown Natural Communities Reserve). The northern part of the alkali sink is owned by the City of Livermore. The multiple parcels are owned by several property owners with conflicting goals (e.g.,

⁵ The refuges were not created specifically to include the palmate-bracted bird's-beak nor were the refuge boundaries established to account for the biological needs of the plant.

⁶ Some reports suggest two administratively separate units for this site, but for all intents and purposes, this is one site ecologically speaking, not two (E. Fleishman, in litt., 2007).

commercial use vs. conservation). The palmate-bracted bird's-beak patches, however, are vulnerable to natural and human threats (discussed in Section II.C.2).

As discussed in Factor E (section 11.C.1.e Other), the level of protection at these public sites is poor to good. The palmate-bracted bird's-beak populations at Sacramento NWR and Mendota Wildlife Area were created through the introduction of seeds or plants. No palmate-bracted bird's-beak have been located at the Mendota site recently – within the past few years – and it appears that the population is no longer extant (E. Cypher, in litt., 2007).⁷ Therefore, the protection for the palmate-bracted bird's beak on public lands does not yet meet the 95 percent criterion for downlisting.

⁷ Introduced palmate-bracted bird's-beak populations may require additional management efforts – more so than natural populations – to be sustainable over the long-term (K. Lazar, in litt., 2007).

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Cordylanthus palmatus* = *Chloropyron palmatum*

Current Classification Endangered

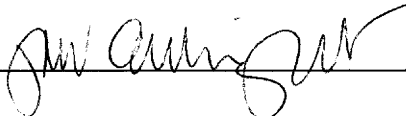
Recommendation resulting from the 5-Year Review

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Review Conducted By Sacramento Fish and Wildlife Office staff

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve , Date 15 June 2009