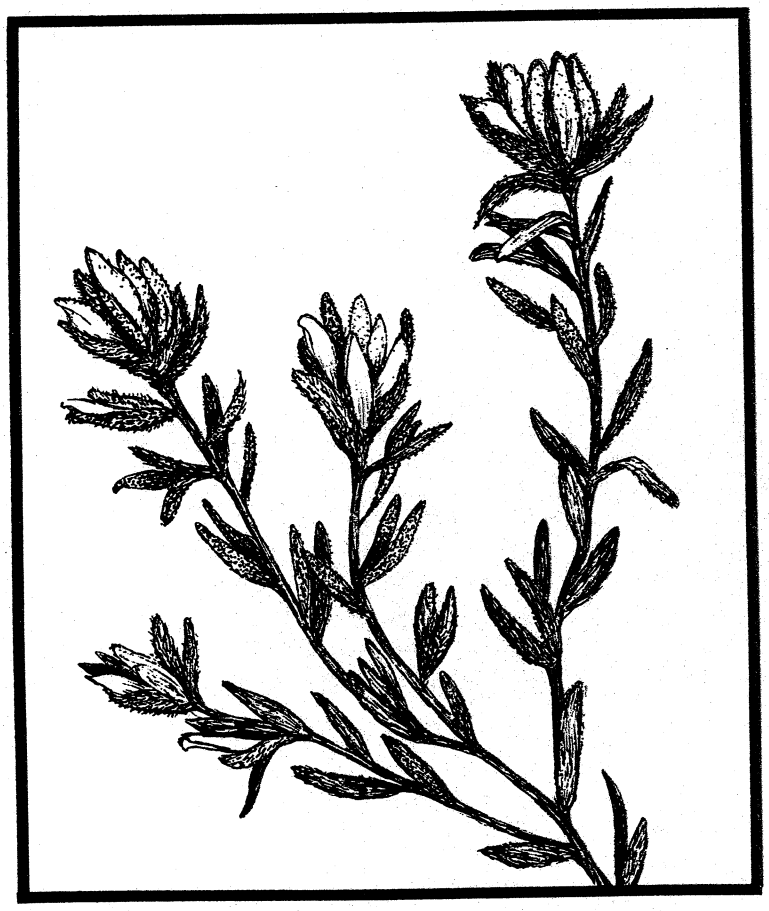
SALT MARSH BIRD'S-BEAK RECOVERY PLAN



U.S. Fish & Wildlife Service
Portland, Oregon

Salt Marsh Bird's-Beak

(*Cordylanthus maritimus* subsp. *maritimus*)

Recovery Plan

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Salt Marsh Bird's-Beak

Recovery Plan Summary

1. Point or condition when the species can be considered recovered.

   When 12 major marshes within the United States and the historic range of the bird's-beak containing salt march bird's-beak (SMBB) populations are protected for a period of at least 10 years, the subspecies may be delisted provided that the protected area within each secure marsh totals at least twenty acres of high marsh habitat at appropriate elevations for the plant.

2. What must be done to reach recovery?

   Protect and enhance twelve populations of salt marsh bird's-beak, establish populations as necessary, and ensure that each population is self-maintaining and secure for at least 10 years.

3. What specifically must be done to meet the needs of #2?

   Each of the colonies must be secure from development, off-road vehicle use, hydrologic change, etc. and each marsh must be at least 20 acres in size. These 12 marshes must harbor self-maintaining populations for at least 10 years; consequently monitoring will be necessary.

4. What management/maintenence needs have been identified to keep the species recovered?

The continued maintenance of the 12 colonies of the bird's-beak via the protection of marshes through the Section 404 of the Clean Water Act will keep the species recovered. This will involve maintenance of adequate fresh water and tidal influence in these largely upper marsh habitats. This need may require coordination and cooperation of several Federal, State, and local agencies, as well as the Mexican government. Protection of pollinators and watershed, too, have been identified in the plan.

Table of Contents

Table of Contents (cont.)

PART I

INTRODUCTION

Brief Overview

The salt marsh bird's-beak (Cordylanthus maritimus Nutt. ex Benth. subsp. maritimus) is currently classified as an endangered plant by both the Federal (43 FR 44801-44812, September 28, 1978) and State (California Fish and Game Commission, October 5, 1979) governments. This plan summarizes current knowledge of the ecology, life history, taxonomy, distribution, and extent of known colonies. Suggestions are presented for a program to restore this endangered subspecies to threatened status and subsequently to delist the species.

Taxonomy

Cordylanthus maritimus (Scrophulariaceae), which consists of three subspecies, grows within saline marshes of the western United States and adjacent Baja California. The salt marsh bird's-beak (Cordylanthus maritimus subsp. maritimus) is found in the coastal marshes of northern Baja California and southern California from San Diego to Santa Barbara Counties; while the Pt. Reyes bird's-beak [Cordylanthus maritimus subsp. palustris (Behr) Chuang & Heckard] occupies similar coastal marshes from Morro Bay, California, north to Coos Bay, Oregon. The segregation of these taxa, proposed by Chuang and Heckard (1973), was based on differences in branching pattern,

corolla color, and seed size. A third subspecies, the alkali bird's-beak [Cordylanthus maritimus subsp. canescens (Jepson) Chuang & Heckard], of Great Basin salt marshes, has been variously treated in the past [C. canescens Gray (Mason 1957, Munz 1959) and C. maritimus var. canescens (Gray) Jepson (Jepson 1925)].

Growth Form and Appearance

Cordylanthus maritimus subsp. maritimus, a branched annual, often has an abundance of purple pigment in its tissues. The leaves typically are purplish; although some plants are predominantly light green and lack the purplish coloration.

Morphological and ecological differences between southern and northern colonies of the subspecies show large variability and overlap. Two growth forms of the plant can be recognized: a large profusely branched form and an erect and compact, scarcely branched form. The colonies in the north (Santa Barbara, Point Mugu) generally are more dense and larger than those in the southern (Tijuana) marshes.

The dates of flowering also vary. In the north, salt marsh bird's-beak plants flower from May to October, while at Tijuana River Estuary, plants flower as early as April and some plants continue as late as December (Ferguson* pers. comm.).

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* Howard Ferguson, previously with the U.S. Navy, North Island Naval Air Station.

Each plant bears terminal indeterminant inflorescences and appears to continue to flower as long as conditions are appropriate. The plants at Point Mugu, Ventura County Game Preserve, Ormond Beach, and Carpinteria Marsh have flowers with conspicuous purple tri-lobed floral bracts. In contrast, the plants further south bare pale cream flowers with faint purple lines. Flower color also varies within marshes having many isolated colonies (Dow* pers. comm.).

Historic and Current Distribution

Colonies of the salt marsh bird's-beak are found in scattered salt marsh habitats along coastal southern California and northern Baja California, Mexico (Figure 1). Historical records showed that the plants occurred in eighteen sites of southern California including Baja, California (Table 1). Three collections were from inland marshes whose precise locations are not known. Colonies in Baja California are known only from the San Quintin-Laguna-Mormona marshes, over 200 km south of localities at Tijuana River Estuary. Since 1975, salt marsh bird's-beak has been verified as extant in six general areas** in the United States (Table 1). In addition, it has been reported from a new site, Ormond Beach,

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* Ron Dow, U.S. Navy, Pacific Missile Test Center, Point Mugu.

** We consider Ormund Beach, Ventura County game preserve and Mugu Lagoon to fall within the same general area.

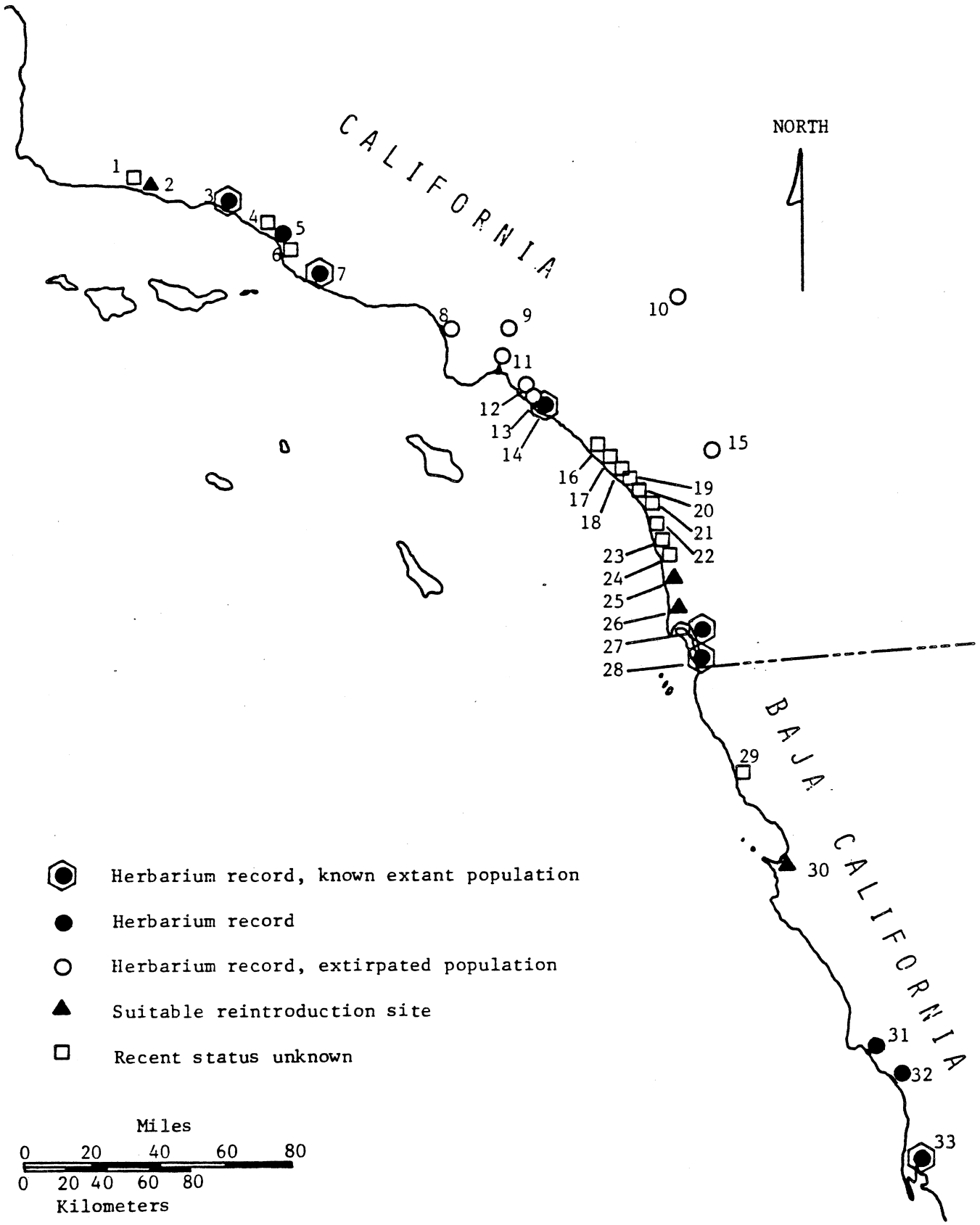

Figure 1. Records of Cordylanthus maritimus subsp. maritimus from coastal areas of southern California and northern Baja California.

Figure 1 Attachment

1. Deveraux Slough
2. Goleta Slough
3. Carpinteria Marsh
4. Ventura River Mouth
5. Santa Clara River Mouth
6. McGrath Lake
7. Mugu Lagoon and Ormond Beach
8. Ballona Wetlands
9. Artesia
10. San Bernardino Valley
11. Terminal Island
12. Alamitos Bay (Los Cerritos Marsh)
13. Anaheim Bay - Bolsa Chica Bay - Santa Ana River Mouth
14. Newport Bay
15. Oak Grove
16. San Mateo Marsh
17. Las Flores Marsh
18. Santa Margarita River Marsh
19. San Luis Rey River Marsh
20. Buena Vista Lagoon
21. Agua Hedionda Lagoon
22. Batiquitos Lagoon
23. San Elijo Lagoon
24. San Dieguito Lagoon
25. Los Penasquitos Lagoon
26. Mission Bay
27. Sweetwater Marsh and "E" Street Marsh
28. Tijuana River Estuary
29. La Mision - La Salina
30. Ensenada - El Estero
31. San Telmo
32. Bahia de San Ramon
33. Laguna Mormon - San Quintin

Table 1
Marshes Within Historical Distributional Limits
of *Cordylanthus maritimus* subsp. *maritimus*

Marshes	Historical Observation	Field Survey[1] 1980	1982	1983	Notes
		Santa Barbara County			
Deveraux Slough		NS	NS	NS	
Goleta Slough		NS	NS	NS	Surveyed in 1984 by Wayne Ferren none observed
Carpinteria Marsh	X	+	+	+	Observed by Newman and Millette, 1981 Every year thereafter by Newman and Vanderwier
		Ventura County			
Ventura River		NS	NS	NS	
Santa Clara River Mouth	X	NS	-	NS	Plant extant in 1960 Surveyed by Newman, 1981
McGrath Lake		NS	NS	NS	Newman in 1984 surveyed and found no plants
Ormond Beach	X	+	+	+	Heavily impacted by visitor use. Recent obs. by Howard Ferguson 1981
Ventura Co. Game Preserve		+	+	+	Vanderwier 1983
Mugu Lagoon	X	+	+	+	Vigorous colonies

Table 1 (cont.)
Marshes Within Historical Distributional Limits
of *Cordylanthus maritimus* subsp. *maritimus*

Marshes	Historical Observation	Field Survey[1] 1980	1982	1983	Notes
		Los Angeles County			
Ballona Wetlands (Del Rey Lagoon, Ballona Marsh, and Ballona Lagoon)	X	-	-	-	Presumed extirpated
Artesia	X	-	NS	NS	Extirpated
Alamitos Bay (Los Cerritos Marsh)		NS	NS	NS	Historical presence not recorded
		Orange County			
Anaheim Bay, 1 mile south of Landing Hill	X	NS	NS	+	Reintroduced in 1982
Huntington Harbor/ Sunset Aquatic Park		NS	NS	NS	
Huntington Beach		NS	NS	NS	
Bolsa Chica	X	-	-	-	Presumed extirpated
Upper Newport Bay	X	+	+	+	Vigorous colonies

Table 1 (cont.)
Marshes Within Historical Distributional Limits
of *Cordylanthus maritimus* subsp. *maritimus*

Marshes	Historical Observation	Field Survey[1] 1980	1982	1983	Notes
		San Bernardino County			
San Bernardino Valley (inland)	X	NS	NS	NS	
		San Diego County			
Oak Grove (inland)	X	NS	NS	NS	Presumed extirpated
Las Flores Marsh		NS	NS	NS	
San Mateo Marsh		NS	NS	NS	
Santa Margarita River Estuary		-	-	NS	Ferguson Survey 1980, 1981
San Luis Rey River Marsh		NS	NS	NS	
Buena Vista Lagoon		NS	NS	NS	
Aqua Hediondo Lagoon		NS	NS	NS	
Batiquitos Lagoon		NS	NS	NS	
San Elijo Lagoon		NS	NS	NS	

Table 1 (cont.)
Marshes Within Historical Distributional Limits
of *Cordylanthus maritimus* subsp. *maritimus*

Marshes	Historical Observation	Field Survey[1] 1980	1982	1983	Notes
		San Diego County			
San Dieguito Lagoon		NS	NS	NS	
Los Penasquitos Lagoon		-	NS	NS	
(Kendall-Frost Reserve) Mission Bay Marsh		-	NS	NS	
Formosa Slough		NS	NS	NS	
San Diego River Flood		-	-	NS	Fersuson survey 1980, 1981
Sweetwater Marsh	X	+	+	+	
Paradise Creek Marsh		NS	NS	NS	
"E" Street Marsh	X	NS	NS	NS	Extant in 1960
"F" Street Marsh		NS	NS	NS	
"J" Street Marsh		NS	NS	NS	
South San Diego Bay Salt Works		NS	NS	NS	

Table 1 (cont.)
Marshes Within Historical Distributional Limits
of *Cordylanthus maritimus* subsp. *maritimus*

Marshes	Historical Observation	Field Survey[1] 1980	1982	1983	Notes
		San Diego County			
South Bay Marine Biology Study Area		-	-	NS	Ferguson, Jorgensen Survey 1980, 1981
Tijuana River Estuary	X	+	+	+	
		Mexico-Baja California			
Salinas - Mission		NS	NS	NS	
Ensenada, El Estero		-	NS	NS	
San Telmo	X	NS	NS	NS	
San Ramon	X	NS	NS	NS	
San Quintin	X	+	+	NS	Pat Dunn Survey
Laguna-Mormona	X	NS	NS	NS	Extant in 1960

Field survey results: + = plants observed, - = plants not observed,
NS = site not surveyed.

X Present at some previous time.

near Point Mugu (Fox* pers. obs.). Whether the plants exist in other historical localities seems unlikely judging from the extent of alteration and modification in the marshes, but each case needs investigation.

Life History and Habitat Requirements

Salt marsh bird's-beak is an unusual component of the salt marsh ecosystem, because the plant is an annual and hemiparasitic. Major gaps in our knowledge detailing pollination, seed production, dispersal mechanisms, and growth requirements of the subspecies exist today.

Germination -- Germination of the bird's-beak received little study until 1980 when a series of germination studies were initiated at Point Mugu (Newman 1981). A similar study was undertaken at Tijuana River Estuary by Dunn (1981). In contrast to Spartina, salt marsh bird's-beak does not show absolute afterripening requirements. In September 1981, Dunn (1981) germinated seeds collected the same year. Because dry storage of the seeds for two years enhanced germination by 230 percent over germination numbers of fresh seeds, some afterripening must take place (Dow pers. comm.). Seeds as old as three years continued to be viable (Dunn 1981). Reduced salinity of tidewater, soil water, or rain

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* Dr. Linda Fox, University of California, Berkeley.

water seems to be needed for successful germination. Salinity of the water at the time of germination usually cannot exceed 12 parts per thousand (Newman 1981). Fresh water is commonly needed for the germination of salt marsh plants (Ranwell 1972, Reimold and Queen (1974). Consequently, it would appear that winter germination would occur, however, the bird's beak at Point Mugu germinates in late spring. Newman (1981) also demonstrated increased germination with scarification or vernalization.

Flowering and Pollination -- The reproductive biology of Cordylanthus maritimus subsp. maritimus is not well known, but fluctuations in its populations suggest that variable reproductive output may be related to the tenuous existence of the subspecies. Factors considered important to the reproductive status of the salt marsh bird's-beak are the small numbers of individuals remaining in the genetic pool, the isolation of the colonies, vigor of individual plants, pollination, herbivory, seed production, seed dispersal, and seed dormancy.

An understanding of the pollination ecology of salt marsh bird's-beak is vital to the recovery of the species. Heckard believes that the subspecies may be self-incompatible based on the biology of other Cordylanthus species (Chuang and Heckard 1973). Therefore, Cordylanthus likely requires a means of cross-pollination. Large bumblebees (Bombus sp.) are able to pry open and successfully pollinate plants of non-halophytic Cordylanthus (Heckard* pers. comm.).

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* Dr. L. Heckard, Botany Department, University of California, Berkeley.

Bombus sonorus is an abundant and widespread species at Point Mugu (Dow pers. comm.). Small native bees (Halictus sp., Lasioglossum sp. and Anthidium sp.) have been observed visiting the flowers of bird's-beak plants at Ormond Beach (Dow, pers. comm.). The halictine bees seemed especially adept at opening the corolla and climbing down into the flower throat. Preliminary work by Drs. Patricia Lincoln (Coker College) and John Neff (Central Texas Melittological Institute) indicate that four species of bees and two species of flies visited the bird's-beak at Point Mugu. It is important to know if pollinators inhabit upland sites surrounding the marsh where encroachment by urbanization and other developments have occurred. This loss of upland habitat may have significant effects on the types and numbers of pollinators available to Cordylanthus.

Seed Production -- Seed output averages between 15 to 20 seeds per capsule (Chuang and Heckard 1973), however, no information is available on the variation of seed output throughout the range of this subspecies. Information on seed production by individual plants is necessary to estimate seed production in isolated colonies. From this information, yearly seed production can be estimated from the average number of flowers per plant, the average number of seeds per flower, and the number of plants at each site. Many factors may locally reduce seed set. Judy Newman* (pers. comm.) observed at Point Mugu that the very early flowers often fail to set seed. This may be the result of an absence of or too few pollinators early in the year. She

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* Judy Newman, biologist, formerly at Point Mugu

also observed that when a certain pathogenic fungus infects a plant in late spring and early summer, it can eliminate seed production from that individual. Also at Point Mugu (Newman pers. comm.), leaf roller moth larvae (Platynota stultana) feed on the ovary walls or the developing seed capsule as a primary food source. Leaf roller moth infestations could significantly affect population numbers. Newman (pers. comm.) also observed deleterious impacts from lepidopteran larvae and locusts.

Dispersal and Establishment -- The salt marsh bird's-beak is an unusual component of the salt marsh community, in that yearly population numbers depend directly on seed dispersal and establishment in "safe sites"*. Conversely, most other salt marsh plants are perennial and yearly populations do not show such dramatic yearly fluctuations. Typically perennial saltmarsh plants depend on vegetative propagation and seldom establish by seedlings (Ranwell 1972).

Two major mechanisms are probably responsible for the dispersal of salt marsh bird's-beak seeds. Physical factors such as currents, tides, wave action, and sheet erosion are the primary vectors by which the seeds are moved around within the marsh. These vectors may also be instrumental in movement of seeds to other marshes, because the seeds have been shown to float for up to 50 days (newman 1981).

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* A safe site is defined by Harper (1977) as a site that provides the precise conditions required by a particular seed.

Animals, especially birds, may also carry the seeds on their feet, or in their fur, feathers, or digestive systems. Such animal vectors can be an important factor for between marsh dispersal (van der Pijl 1969).

The observed occurrence of Cordylanthus along a narrow elevational band within each marsh (Fox pers. obs., Dunn 1981) probably results from several factors. Probably these sites represent "safe sites" (Harper 1977) where germination and seedling establishment are possible. These "safe" sites are not the only areas which receive dispersed seeds. The absence of Cordylanthus from lower marsh areas may be a result of intolerance to constant flooding by tidewater. Salt marsh bird's-beak does not have large air spaces (aerenchyma) in its roots (Purer 1942), an important adaptation for air transport in oxygen depleted sediments (Armstrong and Boatman 1976). Moreover, formation of haustorial connections to other plants may also be inhibited by the hydrogen sulfide in the more reduced* sediments of the low marsh (Armstrong and Boatman 1976). Constant flooding by tides may also prevent germination because salinities remain too high.

The actual distribution of the plant varies both spatially and temporally. Populations seem to show large fluctuations from year to year. This fluctuation may reflect variation in annual seed production, the number of seeds reaching "safe sites", or environmental influences

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* In this context, "reduced" connotes low oxygen availability and the use of electron acceptors other than oxygen by soil microorganisms (Armstrong and Boatman 1976).

on germination and establishment. Presence of the plant in certain areas does not necessarily indicate exclusive repositories of seed. Perennial vegetation may trap seeds under unfavorable cover or canopy. Seed may be buried in sediments, travel through the marsh on high spring tides, or be washed to suitable sites by winter rains. In some marshes, such as Tijuana River Estuary and Point Mugu, the existence of a seed bank has been demonstrated by the result of severe flooding and changes in the tidal regime. At Tijuana, five populations were destroyed in the floods of 1980, however, four of the five populations were reestablished in 1981 (Ferguson pers. comm.). At Point Mugu, disappearance and reappearance of Cordylanthus in different areas occurred when an arm of the lagoon, previously closed to tidal action by a raised levee, was reopened to allow tidal circulation.

Habitat Requirements -- Salt marsh bird's-beak occurs in variable habitats throughout its range. The major marshes of southern California typically harbor the species in low lying areas. Salt marsh bird'sbeak is also found in freshwater seeps at Point Mugu. Colonies infrequently grow behind barrier dunes, and on dunes, mounds, and old oyster shell dredge spoils. Most areas, however, harbor well-drained and well-aerated soils that dry during the summer. The subspecies occasionally occurs in areas with no tidal influence and where the only fresh water input is from winter rainfall. The populations generally occur, however, in areas that have low salinity in the spring and generally low vegetative cover (Newman 1981, Ferguson pers. comm., Dunn 1981).

The subspecies occurs primarily in upper marsh elevations that are inundated by tides on a regular basis, but above areas which receive daily salt water flooding. Salt marsh bird's-beak habitat is classified as middle littoral by Purer (1942), who placed bird's-beak specifically toward the upper end of this region. The middle littoral zone is defined as the marshland located above the level of the vegetation bathed by the twice-daily high tides, but below the upper littoral zone, where the ground is covered by water only during very high tides and storm tides. More recent classifications list this habitat as high marsh (Macdonald 1977), and place the boundaries between mean higher high water (the average level reached by the higher of the two daily high tides) and the extreme high water (the highest level reached by high tides). Defined in this way, Cordylanthus appears to favor the middle to high marsh zone but may range toward upper and lower extremes in some cases. Cordylanthus is often found growing with pickleweed (Salicornia spp.), salt-cedar (Monanthochloe littoralis), salt grass (Distichlis spicata), alkali-heath (Frankenia grandifolia), and sea-lavender (Limonium californicum). Cordylanthus is not found with cord grass (Spartina foliosa), a species associated with lower marsh elevations receiving frequent inundation (Dunn 1981, Newman 1981).

Hemiparasitic Habit and Host Requirements -- Members of the genus Cordylanthus are hemiparasitic on the roots of other flowering plants, deriving water and perhaps nutrients through haustorial root connections with other species. It is not known for certain to what degree individuals of this subspecies are dependent upon their hosts.

Vanderwier and Newman (1984) recently published a small paper on the necessity of haustoria and host preference in Cordylanthus. According to them, several marsh taxa are commonly associated with the bird's-beak: pickleweed (Salicornia virginica), fleshy jaumea (Jaumea carnosa), alkali-heath (Frankenria grandifolia), sea-lavender (Limonium californicum), alkali weed (Cressa truxillensis), and salt grass (Distichlis spicata). Vanderwier and Newman (1984) reported several less common associates: goldfields (Lasthenia chrysostoma), salt-cedar grass (Monanthochoe littoralis), alkali dodder (Cuscuta salina), alkali bulrush (Scirpus maritimus), spiny rush (Juncus acutus), cattail (Typha latifolia), marsh salt bush (Atriplex patula subsp. hastata), arrow-grass (Triglochin concinnum), and beard grass (Polypogon monospeliensis). In the laboratory, Vandewier and Newman (1984) observed haustorial connections between bird's-beak and salt grass, beard grass, pickleweed, fleshy jaunea, and common sunflower (Helianthus annus), a non-marsh species. In the field, Cordylanthus formed haustorial connections between salt grass, alkali bulrush, cattail, and other individuals of its own subspecies.

In the laboratory, Vanderwier and Newman (1984) did not observe any "increase in vigor" as a result of haustorial connections to individual Cordylanthus plants. Chuang and Heckard (1971), and Newman (1981) earlier reported that the haustorial connections do not seem to be essential for plant growth under greenhouse conditions but are probably beneficial. Vanderwier and Newman (1984) concluded that hemiparasitism "permits salt marsh bird's-beak to flourish in the hot, dry conditions of summer when most other annuals have completed their life cycles."

Although seedlings may vary genetically in their ability to survive without a host, like the genus Orthocarpus (Atsatt 1970), the importance of haustoria and the hemiparasitic habit remain uncertain to some degree.

In some cases substances exuded by the host species stimulate and facilitate the formation of haustoria (Richards 1972). Whether this chemical interaction occurs between Cordylanthus and its putative hosts has not been determined.

For an unknown period of time during the early growth phase following germination, the seedlings live independently. As in all hemiparasites, the plants have chlorophyll throughout their lives and need sunlight for photosynthesis. A number of field observers (Newman, Ferguson, Dow, pers. comm.) observed that Cordylanthus maritimus subsp. maritimus is associated with sparse or moderate vegetation cover. The taxon is not generally expected in heavy vegetation cover (Ferguson pers. comm., Newman 1981). Possibly the presence of a dense, shaded canopy of associated vegetation inhibits early and later seedling growth either via shading or reduced water availability. From experiments performed at Point Mugu, removal of perennial vegetation appeared to dramatically promote an increase bird's-beak populations (Vanderwier* pers. comm.).

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* Julie Vanderwier, botanist, U.S. Navy, Pacific Missile Test Center, Point Mugu, California.

Limiting Factors

The extremely restricted amount of available and suitable marshland limits the distribution of the bird's-beak. Salt marsh habitat, although never extensive in southern California, has recently been used for marina and industrial development, beach recreational facilities, and housing (Speth 1971). Consequently, salt marshes are restricted to relatively small lagoon and estuary systems along the coast.

The filling and diking of many marshes for construction occurs predominantly in the upper portion. In addition, the drier portions of marshes accessible to foot traffic and vehicles, typically the upper reaches, suffer severe impacts from trampling and vehicle traffic. Traffic compacts soils and destroys vegetation cover. Even a moderate amount of foot and vehicle traffic can damage the fragile seedlings of Cordylanthus.

Competition and shading by other species may also limit salt marsh bird's-beak because of the general absence of the plant in dense vegetative cover. Light disturbances of the vegetative cover, whether from natural deposition of sand or silt, or activities such as small-scale berm or mound building, seems to enhance the likelihood of the presence of the bird's-beak. This may be a result of an increase in available habitat or reduced competition allowing for the germination of seeds in the sediments.

Preliminary evidence based on the distribution of the subspecies suggests that frequent tidal flooding may also limit the plant. A well-established colony at Point Mugu disappeared when tidal inundation was reestablished. Possibly the loss resulted from a combination of smothering by increased amounts of debris deposited about and on the vegetation at high tide and from the change in tidal inundation which effectively altered the former high marsh habitat to lower marsh (Newman pers. comm.).

The distribution of Cordylanthus maritimus subsp. maritimus may be limited by the availability of fresh water. Lowered soil salinities, which result from fresh water flooding, leaching of salts by rain, or temporary ponding, appear to be important in the germination and establishment of the plants. The influence of fresh water can also result in adverse impacts to the Cordylanthus in certain marshes. An excess input of fresh water into salt marsh areas without tidal inundation to influence the salinity may result in fresh water marsh conditions dominated by rushes and cattails and rarely inhabited by Cordylanthus. Scouring by fresh water flooding has resulted in the loss of small populations, for example, at Tijuana River Estuary in 1980. Nonetheless, four out of five of these colonies recovered the following year (Ferguson pers. comm., Dunn 1981). However, it is not known how reestablishment of salt marsh bird's-beak occurred. Maybe sufficient seed existed in the soil to enable the reestablishment of the extirpated populations. Perhaps the transport of seed within the marsh or seed from other populations reestablished plants in the disturbed areas.

Pests and diseases may limit the subspecies in the marshes of Point Mugu and at other sites. Beetles and caterpillars observed at Point Mugu appear to feed on the floral parts and may limit plant size and seed productivity. Several kinds of fungal diseases attack the plants at Point Mugu, and one kind seemed to seriously impact seed production (Newman 1981). Viability of affected seed and the relative vigor of seedlings following germination from affected seed undoubtedly limits recruitment. More research on the effects of these factors on population size and success is needed.

The application of herbicides along railroad rights-of-way may impact the bird's-beak. Many rail lines run through or near the high marsh habitat along the California coastline. Possibly herbicide treatment of these areas negatively affected these populations.

Previous Research

Investigations into germination requirements, autecology, and taxonomy, dispersal mechanisms, and host specificity have been undertaken at Point Mugu (Newman 1981, Vanderwier pers. comm., Vanderwier and Newman 1984). Populations have been mapped yearly and quantified (Dow pers. comm). Population parameters such as distribution and abundance are being investigated at Tijuana River Estuary. These data have also been recorded for the Carpinteria and Sweetwater complex. Environmental factors (i.e., elevation, tidal inundation, and soil salinity) and autecological data are being gathered at these complexes (Dunn 1981). Colonies at Upper Newport Bay have been mapped for two years and plant

densities recorded, although an overall population count has not been undertaken (Ferguson pers. comm.). Nevertheless, more studies are needed on all aspects of the biology of this subspecies throughout its range before an adequate management program can be established.

Present Status

There is little reference to the historical abundance of Cordylanthus maritimus subsp. maritimus in the literature. Purer (1942), one of the few authors to describe the abundance of this plant, classified Cordylanthus as one of about a dozen characteristic coastal salt marsh plants (based on work done only in San Diego County), but gave no estimate of salt marsh bird's-beak population size and extent. Several of the marshes and their watersheds within the range of this plant have experienced extensive sedimentation and alteration between 1850 and the early-1900's. The most detailed information on the previous distribution of this plant, therefore, must be derived from herbarium records, as summarized in Table 1.

Coastal salt marshes are dynamic ecosystems, subject to erosion and deposition of sediments, migration of stream channels, flooding, and constantly changing soil salinities. These processes are greatly influenced by human activities. Throughout the range of this subspecies, recurrent shifting of sandy barriers at the mouths of estuaries periodically closes off tidal action to specific marshes, creating conditions unfavorable for Cordylanthus. Often, this tidal restriction persists longer than expected because of changes in

upstream flows. The smaller marshes often have insufficient streamflow to breach sandy barriers. Consequently, these smaller marshes seldom have well-developed marsh lands and extant populations of salt marsh bird's-beak.

The legacy of human-caused marsh changes between Santa Barbara County and San Quintin in Baja California has undoubtedly contributed to the decline of this subspecies. All of the sizable marshes between Morro Bay and Ensenada have been modified, ten of them drastically and three completely destroyed (USFWS 1972). The remaining marshes, supporting only remnants of the former vegetation, lack diversity. Destruction and alteration of upland sites near and in the watershed of the marsh is also an important factor. The removal of vegetation and construction near the marsh seriously changes hydraulic and sedimentation patterns as well as destroys habitat that may support Cordylanthus pollinators. On a broader scale away from the marsh, destruction of vegetation and construction of houses and industries also affects marsh processes. Sedimentation rates, runoff rates, water diversion, and channelization as well as ground water pumping all have had effects on both the composition of salt marsh vegetation and the processes occurring within the marsh. That Cordylanthus maritimus subsp. maritimus has been especially susceptible to these changes is reflected by a limited occurrence at all sites and extirpation from a number of former sites.

Other Endangered Species

Two other endangered species are found in the same marshes inhabited by *Cordylanthus*. These are the California least tern (*Sterna antillarum browni*) and light-footed clapper rail (*Rallus longirostris levipes*), both listed as by Federal and State governments. Other species of concern are the salt marsh skipper (*Panoquina panoquinoides errans*), Belding's savannah sparrow (*Passerculus sandwichenesis beldingi*), tidewater goby (*Eucyclogobius newberryi*), and salt marsh yellowthroat (*Geothylpis trichas sinuosa*).

PART II RECOVERY

Objectives

The prime objective of this recovery plan is to delist the species by protecting, securing and managing sufficient salt marsh bird's-beak colonies in 12 major marshes within the historic range of the plant in the United States. When twenty acres of high marsh habitat at appropriate elevations for salt marsh bird's-beak are secured and protected in each of the 12 marshes, including an associated self-maintaining population of the plant, for a period of 10 consecutive years, the subspecies may be delisted.

As an interim goal for reclassification to threatened status, fifteen acres of secured and protected high marsh habitat at appropriate elevations for salt marsh bird's-beak, including an associated self-maintaining colony, will be required in a minimum of eight marshes for a period of at least five consecutive years. These requirements may be revised as more information becomes available through our recovery efforts.

Step-down Outline

The prime objective of this recovery plan is to delist the species by protecting, securing, and managing sufficient salt marsh bird's-beak colonies within 12 major marshes within the historic range of the plant in the United States. Twenty acres of high marsh habitat at appropriate elevations for salt marsh bird's-beak would be required to be secured and protected in each of the 12 marshes for a period of 10 consecutive years.

As an interim goal for reclassification to threatened status, fifteen acres of secured and protected high marsh habitat at appropriate elevations for salt marsh bird's-beak, including the self-maintaining population, will be required in a minimum of eight marshes for a period of at least five consecutive years. These requirements may be revised as more information becomes available through our recovery efforts.

1. Secure, protect, and manage existing colonies and habitats of salt marsh bird's beak.
    11. Develop and implement marsh management plans to protect salt marsh bird's-beak colonies and habitat on U.S. Fish and Wildlife Service lands.
        111. Provide permanent on-site caretakers.
        112. Protect existing high marsh habitat.
            1121. Exclude unauthorized vehicles.
            1122. Implement visitor use restrictions.

1123. Avoid conversion of high marsh to low marsh.

113. Maintain fresh water and tidal influence in the marsh.

1131. Prevent excessive, unseasonal, or destructive flooding of marshes.

11311. Monitor upstream changes in Mexico for runoff potentials.

11312. Examine alternatives for moderation of destructive flooding.

1132. Alleviate deleterious effects of sewage effluent on the marsh.

1133. Prevent channelization of streams, ditches or sloughs passing through the marsh.

1134. Prevent salt water intrusion into ground water supplies of the marsh.

1135. Protect the hydrologic integrity of ponds, catchment basins, and other shallow impoundment systems within the marsh.

12. Develop and implement marsh management programs to protect existing salt marsh bird's-beak colonies and habitat on military lands.

121. Point Mugu.

122. Other military lands.

13. Develop and implement marsh management plans to protect salt marsh bird's-beak colonies and habitat on State lands.

131. Upper Newport Bay.

132. Tijuana River Estuary.

133. Carpinteria Marsh.

134. Bolsa Chica.

14. Develop and implement management programs for the protection of bird's-beak colonies on County, City or private lands.

141. Ormond Beach.

142. Santa Clara River Estuary.

143. Sweetwater Marsh.

144. Carpinteria Marsh.

145. Ventura County Game Preserve.

15. Protect and manage bird's-beak colonies in the Laguna-Mormona/San Quintin Marshes of Baja California, Mexico.

151. Identify threats to the colonies.

152. Develop and implement marsh management plan(s).

16. Institute emergency actions to maintain colonies when appropriate.

161. Determine feasibility and implement a plan for collecting and storing supply of seed from each extant population.

162. Identify and treat exotic insect infestations or other diseases, if appropriate.

163. Reestablish colonies that have suffered catastrophic seed or plant losses.

2. Revise amount of habitat necessary to reclassify and/or delist the plant as needed.

21. Assess importance of genetic exchange between populations of the bird's-beak.

22. Determine host requirements for maintenance of bird's-beak vigor.

23. Investigate factors influencing dispersal/establishment.

    231. Examine dynamics of seed production and loss.

    232. Examine seed germination and dormancy.

    233. Investigate dispersal mechanisms.

24. Determine watershed boundaries and management zones for each marsh.

    241. Point Mugu.

    242. Carpinteria Marsh.

    243. Santa Clara River Estuary.

    244. Ventura County Game Preserve.

    245. Upper Newport Bay.

    246. Tijuana River Estuary.

    247. Sweetwater Marsh.

    248. Ormond Beach.

    249. Baja California, Mexico.

25. Investigate the hydrology and evaluate the effect of tidal and fresh water influence on salt marsh bird's-beak colonies in representatives marshes.

    251. Point Mugu.

    252. Upper Newport Bay.

    253. Tijuana River Estuary.

    254. Mexican marshes (San Quintin/Laguna-Mormona).

26. Examine pollination and herbivory with regard to salt marsh bird's-beak.

27. Undertake autecological studies of associated species important to the survival of the salt marsh bird's-beak.

3. Reestablish bird's-beak colonies in suitable marshes within its historic range.

31. Select marshes for reestablishment of bird's-beak.

311. Survey marshes within historical range and evaluate potential for reestablishment of salt marsh bird's-beak.

3111. Goleta Slough.

3112. Santa Clara River Mouth.

3113. Ormond Beach

3114. Bolsa Chica.

3115. Los Penasquitos Lagoon.

3116. San Diego River Estuary.

3117. Mission Bay Marsh Reserve.

3118. Santa Margarita River Estuary.

312. Survey marshes within historical range for the salt marsh bird's-beak in Baja California, Mexico.

313. Document marsh acreage, delimit marsh boundaries, and determine ownership(s) for each marsh surveyed.

32. Obtain management authority and/or protection guarantees for selected marshes for reintroduction sites.

33. Select and gather appropriate seed source for reintroductions.

34. Select experimental areas to reestablish salt marsh bird's beak.

35. Sow selected marshes with seed.

4. Monitor populations and habitats.

41. Monitor changes in distribution and abundance of the plant and its habitat using standardized monitoring procedures within the United States.

411. Point Mugu.

412. Carpinteria Marsh.

413. Tijuana River Estuary.

414. Upper Newport Bay.

415. Sweetwater Marsh.

416. Ormond Beach.

417. Ventura County Game Preserve.

418. Anaheim Bay.

42. Monitor changes biennially in salt marshes within historic range not presently supporting colonies of salt marsh bird's-beak in the United States.

43. Monitor changes in salt marshes within historic range of bird's-beak in Mexico.

44. Monitor implementation of recovery plan.

5. Enforce existing laws, regulations and policies that protect the salt marsh bird's-beak and its habitat.

51. Evaluate success of law enforcement efforts.

52. Propose new regulations or revisions of existing codes.

53. Evaluate compliance with Section 7 consultations concerning the salt marsh bird's-beak.

6. Develop and implement a public education and awareness program for the preservation of the salt marsh bird's-beak and its coastal salt marsh ecosystem.

61. Provide audio-visual programs for public display.

62. Conduct informational meetings.

63. Conduct interpretive tours of the area(s).

64. Erect interpretive signs on State Park, FWS, and CDFG lands.

Narrative

1. Secure, protect, and manage existing colonies and habitat of salt marsh birds-beak.

Existing colonies and potential habitat of the salt marsh bird's-beak must be protected and maintained. This is the most certain way to conserve the species and maintain its evolutionary and genetic integrity and potential (Thompson et al. 1981, Holmgren 1979, Raven 1976, Goodwin 1973, Franklin 1980). Because many California marshes have been so severely altered, management activities are needed to protect the integrity of bird's-beak populations.

11. Develop and implement marsh management plans to protect salt marsh bird's-beak colonies and habitat on U.S. Fish and Wildlife Service lands.

Recovery of the salt marsh bird's-beak will require that existing colonies on refuge lands be protected and properly managed. The Tijuana River Estuary should be carefully managed by the U.S Fish and Wildlife Service, U.S. Navy, and California Department of Parks and Recreation. The existing Memorandum of Understanding (MOU) between the FWS and the Navy should be modified to include a provision that these colonies and their accompanying marsh habitats will be protected and properly managed. The management may serve as a model for marsh management at other sites. The management should assist not only the salt marsh bird's-beak, but the full complement

of native species found in the marsh, including other listed and candidate species. To protect and properly manage the Tijuana marsh, a number of management activities must be undertaken immediately.

111. Provide permanent on-site caretakers.

The size and vulnerability of the Tijuana Marsh immediately necessitates permanent on-site personnel. At least two permanent staff should be assigned full-time to the refuge. Without on-site personnel, protection of this marsh would be difficult. This area is important to the maintenance and recovery of a number of endangered or threatened species and is a primary site for recovery actions for these species.

112. Protect existing high marsh habitat.

High marsh sites that contain high quality salt marsh bird's-beak habitat must be protected and properly managed. Other sites that are potentially bird's-beak habitat should be improved to provide habitat for the plant.

1121. Exclude unauthorized vehicles.

Unauthorized vehicle access must be prevented to maintain marsh quality. The pond area of the refuge has been severely degraded by off-road vehicles (ORV). Unless appropriate

restrictions are made on ORV activities, the habitat will continue to deteriorate.

1122. Implement visitor use restrictions.

Visitor use may have to be curtailed or restricted to prevent degradation of the habitat and resources. A possible alternative to restriction of visitor use is the utilization of boardwalks and other features to provide easy, directed and appropriate use of the marshes.

1123. Avoid conversion of high marsh to low marsh.

Conversion of high marsh to low marsh is sometimes undertaken to enhance habitat for wildlife species, notably the light-footed clapper rail. This procedure, however, is deleterious to the salt marsh bird's-beak, because the procedure modifies and reduces the high marsh habitat necessary to the plant. Such conversion must be carefully evaluated with regard to potential adverse impacts to high marsh species and undertaken only in an absence of alternatives.

113. Maintain fresh water and tidal influence in the marsh.

Maintenance of favorable and balanced interactions between the fresh and salt water inputs in Tijuana marsh

is considered essential to maintaining colonies and the integrity of the system.

1131. Prevent excessive, unseasonal, or destructive flooding of the marsh.

Excessive or unseasonal flooding is detrimental to seed crops of the salt marsh bird's-beak as well as other salt marsh organisms and should, therefore, be controlled or prevented. An area can be scoured during flooding, removing plants as well as seeds, thus adversely altering the habitat.

11311. Monitor upstream changes in Mexico for runoff potentials.

Changes in land use along the Tijuana River in Mexico can have a large effect on the timing and volume of fresh water entering the Tijuana River Estuary. These runoff potentials should be monitored to understand the functioning of the hydrologic system in the marsh.

11312. Examine alternatives for moderation of destructive flooding.

Unseasonal releases from the dam in Mexico upstream in the Tijuana River

often come at times that prove very destructive to the salt marsh bird's-beak. There should be close cooperation between the Fish and Wildlife Service and Fauna Silvestre in Mexico to examine ways and alternatives to prevent or moderate untimely releases of water from the dam.

1132. Alleviate deleterious effects of sewage effluent on the marsh.

Raw sewage from the City of Tijuana and its environs are a serious problem in the maintenance of water quality and health standards at Tijuana River Estuary. Plans are now underway for a Regional Sewage Treatment Plant to help alleviate this problem. The effect of fresh water effluent discharge to the Tijuana River System should be carefully examined and a direct ocean outfall seriously considered.

1133. Prevent channelization of streams, ditches or sloughs passing through the marsh.

Channelization of waterways passing through the marsh can significantly alter the hydrology of the salt marsh system and thus influence marsh

vegetation. This usually results in adverse modification of salt marsh bird's-beak habitat and should be avoided.

1134. Prevent salt water intrusion into ground water supplies of the marsh.

Contamination of ground water by salt water intrusion will alter habitat conditions within the marsh and may reduce the habitat quality for the salt marsh bird's-beak. Activities that would increase salt water intrusion should therefore be avoided.

1135. Protect the hydrologic integrity of ponds, catchment basins, and other shallow impoundment systems within the marsh.

If the hydrologic integrity of the system is not maintained, adverse changes in soil salinities may result. Such changes would likely have adverse effects on bird's-beak populations and should be prevented.

12. Develop and implement marsh management programs to protect existing salt marsh bird's-beak colonies and habitat on military lands.

U.S. Navy property at Point Mugu historically supported large vigorous colonies of the bird's-beak. Other Navy lands may

support salt marsh bird's beak colonies, or these lands may be used for expanding the population during recovery, for example at the Santa Margarita River Estuary on Camp Pendleton.

121. Point Mugu.

The marshes at Point Mugu have several extensive colonies of salt marsh bird's-beak. Several studies have been undertaken in these colonies to better understand the biology and ecology of the plant.

122. Other military lands.

Other Navy lands, for example Anaheim Bay and Camp Pendleton, may be able to provide secure habitat for introduction/reintroduction of salt marsh bird's-beak.

13. Develop and implement marsh management plans to protect salt marsh bird's-beak colonies and habitat on State lands.

On State lands, salt marsh bird'-beak colonies are known from State Park land at Tijuana River Estuary and California Department of Fish and Game land at Upper Newport Bay. To insure protection of bird's-beak colonies at these sites, the recovery plan recommends developing and implementing marsh management plans for each site. Such plans should include specific provisions for protecting the bird's-beak. New bird's-beak colonies may be found or reestablished on other State lands, in which case management plans for each new site must be developed and implemented.

131. Upper Newport Bay.

It is especially important to develop a management plan for Upper Newport Bay that takes into account the habitat needs for the endangered plant species as well as those of the endangered bird species in this marsh.

132. Tijuana River Estuary.

Tijuana River Estuary should be cooperatively managed by the Fish and Wildlife Service for endangered species and the restoration and maintenance of a healthy salt marsh system.

133. Carpinteria Marsh .

Salt marsh bird's-beak does not occur now at this site on University of California lands. However, suitable habitat is available in which salt marsh bird's-beak could be reintroduced. The plant does occur in other portions of this particular marsh. A comprehensive management plan is needed for this marsh because of the diverse ownership pattern and conflicting management of the marsh. Flood control projects upstream and in portions of the marsh not controlled by the State jeopardize the health of the entire salt marsh system.

134. Bolsa Chica.

Bolsa Chica and several other marshes in the Los Angeles area previously harbored salt marsh bird's-beak. It may be possible to reestablish the plant in the California Department of Fish and Game's preserve at Bolsa Chica.

14. Develop and implement management programs for the protection of salt marsh bird's-beak on County, City, or private lands. Several colonies are known from private and local government lands. To insure protection of salt marsh bird's-beak at these sites, the recovery plan recommends developing and implementing marsh management plans for each site. Such plans should include specific provisions for protecting the salt marsh bird's-beak. New salt marsh bird's-beak colonies may be found or established on other County, City, or private lands, in which case management plans for each new site must be developed and implemented.

141. Ormond Beach.

Ownership at Ormond Beach is a patchwork of City of Oxnard and privately owned lands. The private lands at this site are zoned for endangered species.

142. Santa Clara River Estuary.

The ownership of this area is a confusing

conglomeration of City and private lands. There are State Parks lands nearby as well. To secure these areas, a determination of ownership must be made and management plans developed and implemented for the area.

143. Sweetwater River.

A management plan should be developed and implemented for the Sweetwater Marsh area to protect wetland values as well as endangered species habitats.

144. Carpinteria Marsh.

Salt marsh bird's-beak presently occurs in the marsh on private lands. A comprehensive management plan is needed for this marsh to preserve the integrity of the salt marsh system and to provide for restoration of degraded areas.

145. Ventura County Game Preserve.

A management agreement should be developed to protect the endangered species that occur here.

15. Protect and manage salt marsh bird's-beak colonies in Laguna-Mormona/San Quintin marshes of Baja California, Mexico.

At least one marsh outside of the United States also supports bird's-beak colonies: the San Quintin area of Baja

California, Mexico. Protection of this area will require development of an international cooperative program between the United States and Mexico. It will also be necessary to identify and evaluate the threats to the population there and develop and implement marsh management plans to protect it.

In cooperation with the State Department and Fauna Silvestre in Mexico, agreements concerning the management of the marshes should be developed.

151. Identify threats to colonies.

Little is known about the threats to populations of salt marsh bird's-beak in Baja. Threats should be assessed before a management program is undertaken.

152. Develop and implement marsh management plan(s).

In the event that the marshes in this area are in need of management, a program should be implemented that would identify actions needed to ensure the continued health and vigor of salt marsh bird's-beak colonies.

16. Institute emergency actions to maintain colonies when appropriate.

To insure that existing colonies will remain intact and continue to thrive in presently occupied habitats, it may be necessary to take emergency actions on a site-by-site basis.

161. Determine feasibility and implement a plan for collecting and storing a supply of seed from each extant population.

An emergency supply of seed for each site should be established, if possible. Each colony should be evaluated for the possibility of collecting seed for storage as some colonies may already be suffering from poor seed crops and additional losses could be detrimental. Determinations of the collectable seed should be made on a colony-by-colony basis. Collections should not exceed 5 percent of the estimated seed yield at any locality in any one year.

162. Identify and treat exotic insect infestations or other diseases, if appropriate.

In those cases where exotic insects or disease present significant threats to a given colony over several years time, it may be necessary to treat such threats. However, insecticides should be avoided unless necessary to save the colony.

163. Reestablish colonies that have suffered catastrophic seed or plant losses.

Because the plant is an annual, colonies are maintained between the growing seasons as seed stored in the substrate. In some instances, colonies that suffer catastrophic seed losses may require re-seeding in the next growing season.

2. Revise amount of habitat necessary to reclassify and/or delist the plant as needed.

A continuing objective for this recovery plan is to determine the population level necessary to delist the bird's-beak. This determination will require a much greater understanding of the coastal salt marsh ecosystem than we now have, especially with respect to structure, function, and species composition. Salt marsh bird's-beak populations must be maintained in "balance" with each marsh system. Needed ecological studies will determine the appropriate bird's-beak population levels for each marsh given existing marsh conditions (e.g., physical parameters, reduced fresh water flows, reduced acreages, etc.).

21. Assess importance of genetic exchange between populations of bird's-beak.

Seed set and viability of seed may be affected by the genetic "closeness" of neighboring plants. Maintenance of vigorous populations may depend on the genetic variability of plants within a colony. Consequently, research will be necessary to determine the degree of inter-colony genetic exchange to maintain a minimum required level of genetic diversity.

22. Determine host requirements for maintenance of salt marsh bird's-beak vigor.

Because the bird's-beak is hemiparasitic, it will be necessary to know more about its host requirements. The

importance of the hemiparasitic habit and the conditions under which hemiparasitism benefits salt marsh bird's-beak need thorough investigation. Connections to the vascular system of halophytes by bird's-beak may enable the plant to escape unfavorable conditions (e.g., competition, high soil salinities) by providing access to a water source of decreased salinity.

Formation of haustoria and the soil conditions that favor such connections may also be important to the management of the subspecies, especially in the event that seed is used to reintroduce the subspecies into new habitat.

23. Investigate factors influencing dispersal/establishment.

A number of studies are recommended below. Details on seed production, dispersal, germination, and establishment will be used in developing specific management recommendations for maximizing survival of the plants.

231. Examine dynamics of seed production and loss.

An examination of the effect of herbivory and pathogens on plant growth and seed production is important. The unknown effects of vertebrate herbivores such as birds, mice, and squirrels on the subspecies need investigation, including invertebrate herbivore studies. The effects of vegetative and reproductive loss from larval and adult invertebrate

depredations need assessment. The identity and effect of fungal or viral pathogens needs examination because of reduced seed production reported at Point Mugu (Newman 1981).

232. Examine seed germination and dormancy.

Several germination studies investigating light intensity and quality requirements are desirable to determine the necessity of low vegetative cover for seed germination. The timing of germination in the field would also be useful information for management of the populations.

233. Investigate dispersal mechanisms.

Studies of dispersal should be undertaken to determine the major vectors of dispersal within and between marshes.

24. Determine watershed boundaries and management zones for each marsh.

Fresh water influences inextricably affect the dynamics and health of the salt marsh system. These influences are a function of many factors affecting the watershed (i.e., development, land use, watershed size). Until this information is developed, marsh management can be pursued only from a provincial perspective.

Many salt marshes have undergone significant transformation from urbanization and agricultural destruction of native habitat. The effects of these transformations are seen in increased flooding frequencies, changes in runoff potential and patterns, and have resulted in significant alteration of historic salt marsh processes.

241. Point Mugu.

Watershed boundaries and the precise area which can be managed to benefit the salt marsh birds'-beak at this marsh should be identified and recommendations for the management of the area included in the management plan.

242. Carpinteria Marsh.

See narrative for task 241.

243. Santa Clara River Estuary.

See narrative for task 241.

244. Ventura County Game Preserve.

See narrative for task 241.

245. Upper Newport Bay.

See narrative for task 241.

246. Tijuana River Estuary.

See narrative for task 241.

247. Sweetwater Marsh.

See narrative for task 241.

248. Ormond Beach.

See narrative for task 241.

249. Baja California, Mexico

Baja California has several important existing or historical colonies of salt marsh bird's-beak at San Quintin and Laguna-Mormona. Urbanization and agricultural conversion have significantly transformed and destroyed much of the native habitat in the watershed. Consequently, the salt marsh has been significantly altered by increased and unnatural flooding and changes in runoff patterns.

25. Investigate the hydrology and evaluate the effect of tidal and fresh water influence on salt marsh bird's-beak colonies in representative marshes. Salt marsh bird's-beak depends on a precise ratio and timing of fresh water and salt water influences. These data are needed for the marshes harboring the plant.

251. Point Mugu.

Navy biologists have studied and continue studying the salt marsh bird's-beak at Pt. Mugu and other nearby marshes. Further studies of the effects of fresh salt

water on long term vegetation changes should be investigated at the site.

252. Upper Newport Bay.

The marsh at Upper Newport Bay contains highly modified areas. Tidal gates, levees, and channels have been constructed and/or are proposed. In addition, the development or alteration of high marsh for non-wetland use reduced the size of the marsh. The effects of breaching levees and removing tidal gates must be examined before initiating these changes.

253. Tijuana River Estuary.

Several scientists from San Diego State University are studying the effects of fresh and salt water on long term vegetation changes. In light of the proposed sewage treatment facility for the Tijuana Region, this study should continue.

254. Mexican Marshes (San Quintin/Laguna-Mormona).

Some of these areas remain largely unchanged. These marshes may provide information about the nature of pristine marshes in the southern California region.

26. Examine pollination and herbivory with regard to the salt marsh bird's-beak.

Herbivore and pollinator studies are required to understand the needs of the salt marsh bird's-beak in the natural system.

27. Undertake autecological studies of associated species important to the survival of the salt marsh bird's-beak.

The autecology of certain associated species may be needed to recover the salt marsh bird's-beak. For example, salinity may variously effect the associated species of the salt marsh system, thus impacting the Cordylanthus.

3. Reestablish bird's-beak colonies in suitable marshes within its historic range.

To reach recovery, salt marsh bird's-beak must be reestablished in many of its previously known localities. Los Angeles County is especially targeted for reestablishment because of the long distances between extant colonies in Orange and Ventura Counties.

31. Select marshes for reestablishment of bird's-beak.

Marshes should be selected for reestablishment on the basis of several criteria: 1) importance of the population in a regional context, 2) availability of suitable high marsh habitat, 3) protectability of site. Other criteria will be determined as more information becomes available.

311. Survey marshes within historical range and evaluate potential for reestablishment of salt marsh bird's-beak within the United States.

Because the plant is an annual, and therefore subject to wide population fluctuations, historic site surveys should be made once a year during a five year period.

3111. Goleta Slough

Goleta Slough has not been recently surveyed for the salt marsh bird's-beak, and it is unknown if SMBB ever occurred in this particular site.

3112. Santa Clara River Mouth.

This area should be surveyed for salt marsh bird's-beak to determine whether suitable habitat exists for the plant. An assessment should be made of the relative suitability of the site for reintroduction of the bird's-beak.

3113. Ormond Beach.

See narrative for task 3112.

3114. Bolsa Chica.

The effect of a recent (1982-83) oil spill on the potential of this area for bird's-beak should be investigated. High marsh habitat

should be evaluated for its potential as salt marsh bird's-beak habitat.

3115. Los Penasquitos Lagoon.

See narrative for task 3112.

3116. San Diego River Estuary.

See narrative for task 3112.

3117. Mission Bay Marsh Reserve.

See narrative for task 3112.

3118. Santa Margarita River Estuary.

See narrative for task 3112.

312. Survey marshes within historical range for the salt marsh bird's-beak in Baja California, Mexico.

Because the plant is an annual and, therefore, subject to wide population fluctuations, surveys should be made of these historical sites once a year during a five year period. However, due to logistics, this sampling probably won't occur every year. These marshes include Ensenada, Laguna-Mormona, San Telmo and San Ramon.

313. Document marsh acreage, delimit marsh boundaries, and determine ownership(s) for each marsh surveyed.

The potential for securing marsh areas depends on their ownership and, thus, their availability. The size and extent of the marsh plays an important role in the quality of high marsh habitat available for salt marsh bird's-beak reestablishment.

32. Obtain management authority and/or protection guarantees for selected marshes for reintroduction sites.

Management authority over essential marshes must be obtained. Many means exist to accomplish this authority, such as memoranda of understanding, conservation easements, and habitat conservation plans.

33. Select and gather appropriate seed source for reintroductions.

Seed source is critical to the maintenance of ecotypic variation existing within and between populations. Seed should come from an area as close as possible to the reintroduction site. Seed should then be gathered from selected populations at levels that would not significantly affect populations.

34. Select experimental areas to reestablish salt marsh bird's-beak.

Reestablishment of salt marsh bird's-beak remains largely experimental. To make a determination as to the success or

failure of a reestablishment effort, specific trial areas with controlled introduction procedures should be established and monitored in a reproducible fashion.

35. Sow selected marshes with seed.

After marshes have been selected and secured, seed gathered from appropriate sources should be reintroduced/sown into these marshes. Seed should be sown at the appropriate time of the year.

4. Monitor populations and habitats.

To determine the success of the recovery effort, an ongoing monitoring program is needed. Because the plant is an annual and, therefore, subject to significant yearly population fluctuations, analysis of the recovery effort should be based on areas of secured marsh and population trends over an extended period of time.

41. Monitor changes in distribution and abundance of the plant and its habitat using standardized monitoring procedures within the United States.

Standardized survey and monitoring techniques are needed to determine changes in distribution and abundance of salt marsh bird's-beak.

411. Point Mugu.

Point Mugu has maintained a monitoring program for several years and this effort should continue. The monitoring techniques, however, should be standardized throughout the range of the plant to facilitate comparisons of colonies and sampling year to year.

412. Carpinteria Marsh.

The yearly monitoring in recent years of the Carpinteria Marsh populations should continue. The monitoring techniques should be standardized throughout the range of the plant to facilitate comparisons of colonies and to ensure that sampling is comparable from year to year.

413. Tijuana River Estuary.

These known colonies should be monitored annually in a consistent manner by appropriate personnel.

414. Upper Newport Bay

See narrative for task 413.

415. Sweetwater Marsh.

See narrative for task 413.

416. Ormond Beach.

See narrative for task 413.

417. Ventura County Game Preserve.

See narrative for task 413.

418. Anaheim Bay.

See narrative for task 413.

42. Monitor changes biennially in salt marshes within historic range not presently supporting colonies of salt marsh bird's-beak in the United States.

Several other marshes need monitoring on a long term basis to determine their suitability for salt marsh bird's-beak reestablishment. These marshes will be determined later by the Service and California Department of Fish and Game.

43. Monitor changes in salt marshes within historic range of bird's-beak in Mexico.

Several marshes in Mexico need to be monitored on a long term basis to determine the status of any existing populations and suitability for bird's-beak reestablishment.

44. Monitor implementation of recovery plan.

Because of the complexity of salt marsh issues and the number of agencies with tasks assigned to them, monitoring the implementation of the recovery plan is essential. Recovery of saltmarsh bird's-beak can only be effected through the concerted actions of all cooperating agencies.

5. Enforce existing laws, regulations and policies that protect the salt marsh bird's-beak and its habitat.

There are many laws and regulations from many areas of government, Federal, State and local that could be utilized to protect these salt marsh habitats. Government agencies, as well as the private sector, should insure that these protections for salt marshes, and wetlands in general are effectively enforced and implemented. This action is an integral part of recovery of this species.

51. Evaluate success of law enforcement efforts.

Much of the thrust of the law enforcement efforts should be aimed at illegal trespass by off-road vehicle traffic. The success of these efforts should be analyzed for each site and steps taken to increase the effectiveness of the law enforcement activities.

52. Propose new regulations or revisions of existing codes.

Revisions of regulations and codes may help strengthen recovery efforts for this subspecies and all endangered and threatened species.

53. Evaluate compliance with Section 7 consultations concerning the salt marsh bird's beak.

Many Section 7 consultations are issued in relation to salt marsh species. To determine the compliance with these recommendations, the resultant actions must be monitored.

Serious consequences to the species may result from disregard of these biological opinions and recommendations for the conservation of the species.

6. Develop and implement a public education and awareness program for the preservation of the salt marsh bird's-beak and its coastal salt marsh ecosystem.

Clearly a need exists to educate the general public about the plight of the endangered salt marsh bird's-beak. Such a program will not only benefit this recovery effort, but will serve to increase the public's awareness of the common cause of species endangerment and biotic impoverishment. Unless the public is made aware of the ecological, historical, and aesthetic importance of saving endangered species, protection and recovery will be difficult. An educational program would include interpretive signs, pamphlets, and displays as well as slide shows for school and use at public meetings.

61. Provide audio-visual programs for public display.

These are useful for use in the local school systems and also in several public forums, including meetings, fairs, hearings, and workshops.

62. Conduct informational meetings.

Meetings can be an effective method for rapid dissemination of information about the salt marsh bird's-beak in particular, and endangered species in general.

63. Conduct interpretive tours of the area(s).

Interpretive tours of Tijuana River Estuary and Upper Newport Bay could be coordinated through local conservation groups such as the California Native Plant Society and Audubon Society as well as local natural history museums, colleges, and universities.

64. Erect interpretive signs on State Park, FWS, and CDFG lands.

To increase public cooperation and inform them of recovery actions, interpretive signing should be placed at trail heads to approved marsh access points.

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PART III

IMPLEMENTATION SCHEDULE

The table that follows is a summary of scheduled actions and costs for the Salt Marsh Bird's-beak Recovery Plan. It is a guide to meet the objectives of this plan, as elaborated upon in Part II, Narrative. This table indicates the tasks to meet the objectives, the agencies that are responsible to perform these tasks, a time-table for accomplishing these tasks, and finally, the estimated costs to accomplish these tasks. Implementing Part III is the action of the recovery plan, that when accomplished, will bring about the recovery of this endangered species.

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES

Information Gathering - I or R (research

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee Title
7. Other

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor
5. Depredation control
6. Disease control
7. Other management

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

RECOVERY ACTION PRIORITIES

1 = An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

2 = An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.

3 = All other actions necessary to provide for full recovery of the species.

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1] (Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
M7	Provide on-site caretakers for Tijuana River Estuary	111	2	Ongoing	1	RE*		40	40	40	
							NAV	5	5	5	
							CDFG	20	20	20	
							CDPR	5	5	5	
M7	Exclude unauthorized vehicles.	1121	2	Ongoing	1	RE*		5	5	5	
						LE		10	10	10	
							NAV	5	5	5	
							CDFG	5	5	5	
M7	Implement visitor use restrictions	1122	2	Ongoing	1	RE*		3	3	3	
						LE		3	3	3	
							NAV	3	3	3	
							CDFG	3	3	3	
M7	Avoid conversion of high marsh to low marsh.	1123	2	Ongoing	1	SE*		24	24	1	FY-85 PA 3,5f, & 5e#13 Study #13 cover both light-footed clapper rail and salt marsh birds-beak.
							CDFG				
							CDPR*				
							CCC				
I4	Monitor upstream changes in Mexico for runoff potentials.	11311	2	Continuous	1	SE		3	3	3	Fauna Silvestre costs are unknown.
						RE*		3	3	3	
							INT	5	5	5	
							FS	-	-	-	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Responsible Agency* Duration[2] (Yrs.)	Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
I14	Examine alternatives for moderation of destructive flooding.	11312	2	3	1	SE RE* INT FS		1 5 2 -	1 5 2 -	1 5 2 -	Fauna Silvestre costs are unknown
114	Alleviate deleterious effects of sewage effluent on the marsh.	1132	2	Continuous	1	SE	EPA*	To Be Determined			
M3	Prevent channelization of stream ditches or sloughs passing through the marsh.	1133	2	Ongoing	1	SE RE*		1 2	1 2	1 2	FY-85 PA (3&5f)
M3	Prevent salt water intrusion into ground water supplies of the marsh.	1134	2	Continuous	1	RE	CDFG CDPR	To Be Determined			Responsibility will vary with particular site.
M3	Protect the hydrologic integrity of ponds, catchment basins, and other shallow impoundment systems within the marsh.	1135	2	Ongoing	1	RE*	CDFG	2 1	2 1	2 1	
M3	Develop and implement marsh management program at Point Mugu.	121	2	Continuous	1	SE	CDFG NAV*	1 0 10	1 0 10	1 0 10	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
M3	Develop and implement marsh management plan on other military lands.	122	2	2	1	RE*		0	5	5	
							NAV	0	2	2	
							MAR	0	2	2	
M3	Develop and implement marsh management plans at Upper Newport Bay.	131	2	Ongoing			CDFG*	4	4	4	
M3	Develop and implement marsh management plan at Tijuana River Estuary.	132	2	Ongoing	1	RE*		2	2	2	
							CDPR	2	2	2	
M3	Develop and implement marsh management plan at Carpinteria Marsh.	133	2	Continuous	1	SE		1	1	1	
							UC*	2	2	2	
							CDFG	2	2	2	
							CaCCon	2	2	2	
M3	Develop and implement marsh management plan at Bolsa Chica.	134	2	Ongoing			CDFG*	0	5	5	
M3	Develop and implement management programs at Ormond Beach.	141	2	Continuous	1	SE		0	1	1	
							Oxnard*	0	5	5	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
M3	Develop and implement marsh management program at Santa Clara River Estuary.	142	2	Continuous	1	SE	CDPR*	0 0	3 5	3 5	
M3	Develop and implement management programs at Sweetwater Marsh.	143	2	Continuous	1	SE*	CDFG	5 2	5 2	5 2	
M3	Develop and implement management programs for Carpinteria Marsh.	144	2	3	1	SE	CaCCon*	0 0	1 3	1 3	
M3	Develop and implement management programs at Ventura County Game Preserve.	145	2	Continuous	1	SE	Ventura*	.5 1	.5 1	.5 1	
114	Identify threats to Laguna/Mormona/San Quintin Colonies.	151	2	2	1	SE*	FS	0 To Be Determined	3	3	
M3	Develop and implement management plans for Laguna/Mormona/San Quintin Marshes.	152	2	2	1	SE*	FS	0 To Be Determined	3	3	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency*			Fiscal Year Costs[1] (Est.) (in $1,000's)			Comments/Notes
					Region	FWS Program	Other Agencies	FY1	FY2	FY3	
I13	Determine feasibility of collecting and storing an emergency supply of seed from each extant population.	161	2	3	1	SE*		0	1	1	To Be Completed
						RE		0	1	1	
							NAV	0	1	1	
							CDFG	0	1	1	
M5	Identify and treat exotic insect infestations or other diseases if appropriate.	162	2	Continuous	1	SE*		To Be Determined			SE would identify need for pesticide control; other agencies would treat.
						RE					
							NAV				
							CDFG				
M2	Reestablish colonies that have suffered caststropic seed or plant losses.	163	2	Continuous	1	SE*		To Be Determined			
						RE					
							CDFG				
							NAV				
I14	Assess importance of genetic exchange between populations of bird's-beak.	21	2	2	1	SE		To Be Determined			To begin FY-2
							UC				
I14	Determine host requirements for maintenance of salt marsh bird's-beak vigor.	22	2	2	1	SE		2	2	0	
						RE		2	2	0	
							NAV	2	2	0	
							CDFG	2	2	0	
							UC*	1	1	0	
I14	Examine dynamics of seed production and loss.	231	2	3	1	SE		0	0	1	Lead agency varies with site.
							UC	0	0	1	
							NAV	0	0	1	
							CDFG	0	0	1	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
I14	Examine seed germination and dormancy.	232	2	2			NAV	5	5	0	
I14	Investigate dispersal mechanisms.	233	2	1	1	SE		0	2	0	
							CDFG	0	2	0	
							NAV*	0	2	0	
I14	Determine watershed boundaries and management zones for Point Mugu.	241	2	1	1	SE		0	2	0	
							NAV*	0	2	0	
I14	Determine watershed boundaries and management zones for Carpinteria Marsh.	242	2	1			CaCCon*	4	0	0	
I14	Determine watershed boundaries and management zones for Santa Clara River Estuary.	243	2	1	1	SE*		0	0	1	
							CaCCon	0	0	1	
I14	Determine watershed boundaries and management zones for Ventura County Game Preserve.	244	2	1			Ventura*	0	0	1	
I14	Determine watershed boundaries and management zones for Upper Newport Bay.	245	2	1	1	SE		0	1	0	
							CDFG*	0	1	0	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency*			Fiscal Year Costs[1] (Est.) (in $1,000's)			Comments/Notes
					Region	FWS Program	Other Agencies	FY1	FY2	FY3	
I2	Determine watershed boundaries and management zones for Tijuana River Estuary.	246	2	2	1	SE		0	1	1	
						RE		0	1	1	
							CDFG	0	1	1	
							CDPR*	0	1	1	
							CCC	1	1	1	
							CDFG	2	2	2	
I2	Determine watershed boundaries and management zones for Sweetwater Marsh.	247	2	1	1	SE*		0.5	0	0	
							CDFG	0.5	0	0	
							CCC	0.5	0	0	
I14	Determine watershed boundaries and management zones for Ormond Beach.	248	3	1	1	SE*		0	0	3	
							Ventura	0	0	1	
I14	Determine watershed boundaries and management zones for Baja California, Mexico.	249	3	1	1	SE		0	0	0.5	
							FS*	0	0	5	
R3	Investigate the hydrology and evaulate the effect of tidal and fresh water influence on salt marsh bird's-beak colonies at Point Mugu.	251	2	3	1	SE		To Be Determined			To begin FY4
							NAV*				

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
R3	Investigate the hydrology and evaluate the effect of tidal and fresh water influence on salt marsh bird's-beak colonies at Upper Newport Bay.	252	2	3	1	SE		0	0	0	
							CDFG*	0	8	8	To end FY4
I14	Investigate the hydrology and evaluate the effect of tidal and fresh water influence on salt marsh bird's-beak colonies at Tijuana River Estuary.	253	2	3	1	SE		0	0	3	To end FY5
							CDFG	0	0	3	
							CaCCon	0	0	3	
							CDPR	0	0	2	
I14	Investigate the hydrology and evaluate the effect of tidal and fresh water influence on salt marsh bird's-beak in Mexican marshes.	254	3	3	1	SE					To begin FY3
							FS*	To Be Determined			
I14	Investigate primary plant/animal interactions regarding the bird's-beak.	26	2	3	1	SE		2	2	2	
						RE*		2	2	2	
							NAV	2	2	2	
							CDFG	2	2	2	
I4	Undertake autecological studies of associated species important to the survival of salt marsh bird's-beak.	27	2	4	1	SE*		2	2	2	To be completed FY4.
						RE		2	2	2	
							CDFG	2	2	2	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency*			Fiscal Year Costs[1] (Est.) (in $1,000's)			Comments/Notes
					Region	FWS Program	Other Agencies	FY1	FY2	FY3	
I13	Evaluate potential for reestablishment of salt marsh bird's-beak in Goleta Slough.	3111	3	2	1	SE		0	0	1	
							CDFG*	0	0	1	
I13	Evaluate potential for reestablishment of salt marsh bird's-beak at the Santa Clara River Mouth.	3112	3	2	2	SE*		5	5	0	FY-85 PA (5e #18) Combined with task 3113.
							NAV	0.5	0	0	
I13	Evaluate potential for reestablishment of salt marsh bird's-beak at Ormond Beach.	3113	3	2	2	SE*		5	5	0	FY-85 PA (5e #18) Combined with task 3112.
							NAV	0.5	0	0	
I13	Evaluate potential for reestablishment of salt marsh bird's-beak in Bolsa Chica.	3114	3	2	1	SE		0	2	0	
							CDFG*	0	2	0	
I13	Evaluate potential for reestablishment of salt marsh bird's-beak in Los Penasquitos.	3115	3	2	1	SE*		0	0	3	
							CaCCon	0	0	2	
							CDFG	0	0	2	
I13	Evaluate potential for reestablishment of salt marsh bird's-beak in San Diego River Estuary.	3116	3	2	1	SE*		0	0	2	
							CDFG	0	0	2	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
I13	Evaluate potential for reestablishment of salt marsh bird's-beak in Mission Bay Marsh Reserve.	3117	3	2	1	SE		0	2	0	
							CDFG*	0	2	0	
I13	Evaluate potential for reintroduction of salt marsh bird's-beak in Santa Margarita River Estuary.	3118	3	2	1	SE*		0	0	2	
							CDFG	0	0	2	
							MAR	0	0	2	
I13	Evaluate potential for reintroduction of salt marsh bird's-beak in Baja California, Mexico.	312	3	2	1	SE*		0	0	10	
							FS	0	0	5	
I4	Document marsh acreage, delimit boundaries, and determine ownership(s) for each marsh surveyed.	313	3	3	1	SE	CDFG	To Be Determined			Lead will vary with marsh
A3	Obtain management authority and/or protection guarantees for selected marshes for reintroduction sites.	32	3	Continuous	1	SE ACQ	CDFG	To Be Determined			Lead will vary with marsh
M2	Select and gather appropriate sources for reintroductions	33	3	Continuous	1	SE		To Be Determined			Lead will vary with marsh.

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
M2	Select experimental areas to reestablish salt marsh	34	3	Continuous	1	SE	CDFG	To Be Determined			Lead depends on site.
I13	Sow selected marshes with seed	35	3	Continuous	1	SE* CDFG		1 1	1 1	1 1	
M3	Monitor changes in distribution and abundance of the plant and its habitat using standardized monitoring annual procedures at Point Mugu.	411	2	Ongoing			NAV*	4	4	4	
M3	Monitor changes in Distribution and abundance of the plant and its habitat using standardized monitoring procedures at Carpinteria Marsh.	412	2	Continuous	1	SE	 NAV* CDFG CaCCon UC	1 1 1 1 1	1 1 1 1 1	1 1 1 1 1	
I2	Monitor changes in distribution and abundance of the plant and its habitat using standardized monitoring procedures at Tijuana River Estuary.	413	2	Continuous	1	SE	 CDFG CDPR*	1 1 1	1 1 1	1 1 1	
I2	Monitor changes in distribution and abundance habitat using standardized monitoring procedures at Upper Newport Bay.	414	2	Continuous	1	SE	CDFG*	0.5 0.5	0.5 0.5	0.5 0.5	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1] (Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
I2	Monitor changes in distribution and abundance of the plant and its habitat using standardized monitoring procedures at Sweetwater Marsh.	415	2	Continuous	1	SE	CDFG*	0.5 0.5	0.5 0.5	0.5 0.5	
I2	Monitor changes in distribution and abundance of the plant and its habitat using standardized monitoring procedures at Ormond Beach.	416	2	Continuous	1	SE*	CDFG	0.5 0.5	0.5 0.5	0.5 0.5	
M3	Monitor changes in distribution and abundance of the plant and its habitat using standardized monitoring procedures at Ventura County Game Preserve.	417	2	Continuous	1	SE	CDFG*	0.5 0.5	0.5 0.5	0.5 0.5	
M3	Monitor changes in distribution and abundances of the plant and its habitat using standardized monitoring procedures at Anaheim Bay.	418	2	Continuous	1	SE*		0.5	0.5	0.5	

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1	FY2	FY3	Comments/Notes
M3	Monitor changes biennially in salt marshes within historic range not presently supporting colonies of bird's-beak.	42	3	Continuous	1	SE	CDFG*	0.5 0.5	0 0	0.5 0.5	
M3	Monitor changes in salt marshes within historic range of salt marsh bird's-beak in Mexico.	43	3	Continuous	1	SE	FS*	0.5 0.5	0.5 0.5	0.5 0.5	
M3	Monitor implementation of recovery plan.	44	2	Ongoing	1	SE		0.5	0.5	0.5	FY-85 PA (5f2)
04	Evaluate success of law enforcement efforts.	51	3	Continuous	1	SE		To Be Determined			
04	Propose new regulations or revisions of existing code.	52	3	Continuous	1	SE LE*		To Be Determined			
04	Evaluate compliance with Section 7 consultations concerning salt marsh bird's-beak.	53	2	Ongoing	1	SE*		3	3	3	FY-85 PA (3a)
01	Provide audio-visual program for public display.	61	3	Continuous	1	SE*		To Be Determined			

PART III
Implementation Schedule - Salt Marsh Bird's-Beak

General Category	Plan Task	Task Number	Task Priority	Task Duration[2] (Yrs.)	Responsible Agency* Region	FWS Program	Other Agencies	Fiscal Year Costs[1](Est.) (in $1,000's) FY1 FY2 FY3	Comments/Notes
01	Conduct informational meetings	62	3	Continuous	1	SE*		To Be Determined	
01	Conduct interpretive tours of the areas.	63	3	Continuous	1	SE	AUD CNPS	Volunteer effort will vary with site.	
01	Erect intepretive signs on State Park, FWS, and CDFG lands.	64	3	Continuous	1	SE		To Be Determined	

* denotes responsible agency
1 FY1 = 1985
2 Ongoing = currently underway
Continuous = once action has begun it will continue indefinitely
U.S. Fish and Wildife Service (SE = Endangered Species, RE = Refuges, LE = Law Enforcement, RES = Research, INT = International Affairs)
UC = University of California
CDFG = California Department of Fish and Game
Oxnard = City of Oxnard
NAV = Navy
CCC = California Coastal Commission
Ventura = Ventura County
FS = Fauna Silvestre (Mexico)
AUD = Audubon Society
CNPS = California Native Plant Society
CaCCon = California Coastal Conservancy
EPA = Environmental Protection Agency
CDPR = California Department of Parks and Recreation
MAR = Marine Corps

APPENDIX 1

ESSENTIAL HABITAT

Essential habitat for Cordylanthus maritimus ssp. maritimus is based on current distribution and habitat quality. Class I habitats support known extant colonies, while Class II habitats appear to provide suitable habitat but are not known to contain existing colonies of Cordylanthus.

1. Carpinteria Marsh, same area as proposed for the clapper rail, Class I.
2. Santa Clara River mouth, area as determined from field surveys, Class I.
3. Ormond Beach, Class I.
4. Point Mugu, area including more of high marsh than for clapper rails, Class I.
5. Anaheim Bay, same area as proposed for rail, Class II.
6. Bolsa Chica Marsh, Class II.
7. Upper Newport Bay, Class I.
8. Los Penasquitos Lagoon, Class I.
9. Mission Bay:

   Kendall-Frost Mission Bay Reserve, Class II.

   San Diego River Flood Channel, Class II.
10. San Diego Bay:

    Sweetwater River Complex, Class I.

    South San Diego Bay, Class II.

11. Tijuana Estuary, Class I.

12. Baja California marshes:

    San Quintin. Class I.

    Laguna-Mormona. Class II.

    El Estero, Ensenada. Class II.

Los Angeles County:

Cordylanthus seems to have disappeared from the county, despite collection records from three marsh sites. Because the high level of development has eradicated not only most of the former marsh areas but also destroyed the seed source, there is little hope that Cordylanthus might persist in remnant marshes. For example, according to Speth (1971), marsh acreage in the Los Angeles-Long Beach area has been reduced from 6,800 to 70 acres. Cordylanthus was once recorded from Santa Monica, Terminal Island and from a site 2 miles south of Artesia (on the San Gabriel River). Estuarine conditions persist at Playa del Rey and Cerritos Channel, but these have not been checked for Cordylanthus.

Because of the extinctions in Los Angeles County, over 50 miles of coast now separate known populations of Cordylanthus between Mugu Lagoon and Orange County. This is a large barrier to natural dispersal and thus gene exchange between northern and southern populations of the subspecies may contribute to inbreeding in both the northern and southern ends of the range.

Orange County

Anaheim Bay: Class II

This area contains about 500 acres of salt marsh, tidal flats, and water (Wilbur et al. 1977). Herbarium records indicate that Cordylanthus once grew in this marsh, however, field surveys in 1969,

1970 and 1980 failed to locate Cordylanthus. A reintroduction of the plant was made in 1981 and appears to have persisted.

Bolsa Chica: Class II

Cordylanthus was not observed despite a careful survey in June 1980 of Inner and Outer Bolsa Bays and the interior wetlands. Only Inner and Outer Bolsa Bays are subject to tidal influence. The remaining wetlands have been highly altered by the lack of tidal waters, diking, filling, subsidence, oil extraction, human disturbance, urban encroachment and changes in the freshwater input. Freeman Creek and the interior wetlands no longer are maintained by freshwater aquifers or tidal waters but rather from saline ground-water, precipitation and urban runoff. The vegetation of the interior Bolsa Chica wetlands includes many species commonly associated with Cordylanthus. The vegetation cover grows densely, possibly too dense for Cordylanthus, except in barren flats and slough remnants. The vegetation of Inner Bolsa Bay has undergone a transition primarily from a high marsh assemblage to the full array of salt marsh communities since restoration of tidal influence in 1978.

Outer Bolsa Chica contains a narrow strip of intertidal marsh with sandy substrate. The beach rises rapidly to bluffs, preventing development of a rich high-marsh assemblage. Above the Salicornia grow small patches of Monanthochloe and scattered Limonium plants. This is the location of a pre-1945 record of Cordylanthus; however, no evidence of the subspecies was found, and little area affording promising environmental conditions remains.

Upper Newport Bay: Class I

A number of small, dense populations, or subpopulations exist here. Although the general locations are consistent from year to year, their exact perimeters and numbers show annual fluctuations. In 1978, two specimens of Cordylanthus were collected by Flanagan, who reported an extensive stand circling shell mounds on the bayside of Back Bay Drive. The associated plants included Limonium and Monanthochloe. A map was prepared of the extent of Cordylanthus between May and July, 1979 (Frazier). This map does not match 1980 maps, but it does indicate generally similar distribution. A more careful mapping on a more detailed scale was done by J. Fancher USFWS (1980). This map missed some plants reported by Zembal on Middle Island in the same year (Zembal, pers. comm.).

Cordylanthus at Newport Bay has light colored flowers, predominantly creamy white with a yellow tip and faint purple lines on the lower lip.

The most extensive population grows along the side of a road stretching from a parking lot near the crew house to the other end of Shellmaker Island. In 1980, this population was not continuous, although in other years it has been continuous along this stretch of road (Zembal, pers. comm.). Halfway along the island and at the other end of the road, subpopulations grow around old shell mounds, forming distinct bands at more or less constant elevation. The associated vegetation includes Limonium, Monanthochloe, Frankenia, Distichlis and

Salicornia. Another cluster of plants grew in sparse vegetation around a bare spot in sandy substrate near the crew house entrance road.

The small group of Cordylanthus on Middle Island occurs at a high spot where a dense bed of Monanthochloe thins out. On Upper Island, a berm exists which may be a potential site for Cordylanthus, but this area has not been checked.

Several small populations grow along roads and shell mounds in other parts of Upper Newport Bay. One of these shell mounds had a cluster of Cordylanthus with a maximum density of 172 plants/m^2 (Zembal, 1980). Although maximum densities have been recorded from several sites, no record has been published of the total estimated population count, nor of total counts for the individual populations as of this writing.

San Diego County

Los Penasquitos Lagoon area. Class II

In northern San Diego County, there are a series of marshes that periodically are closed off from tidal influence, forming lagoons behind sandy barriers. Probably the most promising of these marshes as Cordylanthus habitat is Los Penasquitos Lagoon, since it has a relatively large freshwater input, sandy substrate, and high-marsh

vegetation, and tidal influence through a man-made inlet below the highway. The marshy area is estimated at more than 230 acres (Wilbur et al., 1977).

Mission Bay-San Diego River: Class II

All that remains of the once-extensive Mission Bay marsh is the tiny Kendall-Frost Mission Bay Ecological Reserve, a change from 2,400 acres to 21 acres (Speth, 1971). Very little high marsh exists there, since a large percentage of the highest marsh surface is covered by salt flats lacking vegetation, and by weedy introduced species. No Cordylanthus has been observed at Mission Bay in recent years, and no herbarium records exist from Mission Bay.

Additional marshland vegetation has developed within the San Diego River Flood Control Channel (at least 40 acres). Some possibility remains that the environmental conditions in the flood channel marshland may be suitable for Cordylanthus. The comparatively sparse vegetation in many areas, freshwater and tidal input, and the relatively sparse substrate provide the favorable environmental conditions.

San Diego Bay: Class I, Class II as shown.

Like Mission Bay, San Diego Bay has suffered a large loss in marshland habitat, from 2,450 acres to about 360 acres (Speth, 1971). There are several small areas of discontinuous marshland within the bay. These

include remnants of marsh at "E" and "F" Streets, Paradise Marsh, and the mouth of the Sweetwater River, all of which comprise the Sweetwater River Complex, as well as small areas in southern San Diego Bay at Telegraph Creek, a marshy peninsula near Emory Channel along the Silver Strand, and small remnants along the Otay River Channel. Purer (1942) reported Cordylanthus from San Diego Bay, where it was a frequent member of the high-marsh assemblage, her "Middle Littoral" zone.

Cordylanthus was found in Sweetwater Marsh in both 1979 and 1980. A small population of between 100 and 150 individuals occurred in an area 25 meters across. The group grew in a high area in the center of the marsh near a branch slough which empties into the main channel. The associated vegetation included Salicornia subterminalis, Limonium, Monanthochloe, Atriplex semibaccatta, and Frankenia.

Cordylanthus may occur in the "E" Street marsh, but has not been reported recently from either the "E" Street or "F" Street remnants. A check of Paradise marsh in 1980 did not reveal any Cordylanthus. It has not been reported recently from the Telegraph Creek Marsh just north of the salt ponds, nor from the Otay River Channel, nor the site near Emory Channel.

Tijuana Estuary (and Oneonta Slough)

The estuary system for Tijuana River lies behind sand dunes, so the marsh soils close to the ocean contain sand while inland soils contain

finer sediment. The Tijuana River provides freshwater input and winter flooding. About 570 acres have been classified as open water, tidal flats, and salt marsh vegetation within the Tijuana marshland area, while adjacent undeveloped upland acreage totals more.

As in other sites, Cordylanthus is associated with vehicular tracks, roads and paths. It also grows in several depressions which are flooded with freshwater during rainstorms, as well as in high, flat areas.

The vegetation associated with Cordylanthus includes Monanthochloe sp., Limonium sp., Distichlis sp., Salicornia virginica and S. subterminalis, Triglochin sp., Juncus sp., and Frankenia sp. The subspecies tends to be located in high marsh areas above the relatively pure stands of Salicornia virginica found at lower elevations.

In this marsh, Cordylanthus plants are large with wide branches, very purple stems, and whitish or cream-colored flowers. The corollas have fine lines of faint purple pigment on the lower lip. The plant blooms from March until mid-August in Tijuana Estuary (Ferguson pers. comm.).

Purer (1942) reported Cordylanthus in this estuary during her survey of San Diego marshes in the early 1940's. She commented that the plant was frequently found in the high marsh areas. More recently, (about 1969), Cordylanthus was observed in Tijuana Estuary (Beauchamp as reported in Chuang and Heckard, 1973), particularly in one

large area near the south arm of the estuary. In both 1979 and 1980, Cordylanthus was mapped and counted, which was invaluable for comparing population changes following a destructive storm and flooding in February, 1980 (Ferguson and Jorgensen, pers. comm.). In 1979, about 3,260 plants were recorded, of which 2,250 were distributed in 12 subpopulations in the northern arm of the slough, and 1,010 were distributed in 8 subpopulations in the southern arm of the slough. In 1980, only about 1,788 plants were reported, of which 1,748 were distributed in 21 groups in the northern end of the marsh, while only 40 plants remained in just one group in the southern arm of the slough. (The counts of the subpopulations include some amount of error from estimation; however, the numbers accurately reflect the magnitude of change.) The loss from the marsh as a whole was 45 percent, 1,472 plants more or less, but it should be underlined that the loss from the southern arm of the slough was a devastating 96 percent, wiping out seven out of eight population clusters, and reducing the numbers of the remaining one (Ferguson and Jorgensen, pers. comm.).

It is probable that the storm washed away seeds and seedlings of Cordylanthus, and that heavy sedimentation and erosion changed the contours of the marsh surface in many areas, especially near the channel. With time, the old sites and perhaps some new ones may be recolonized by seed dispersed from surviving plants, nearby populations or dormant seed, if any exist.

Loss of just a few subpopulations, including one large one near the main channel of the Tijuana River, accounted for the net loss in numbers in the northern arm of the estuary. At the same time, some new colonies appeared in the northern arm of the estuary, and in fact there were numerical gains in the northernmost part, the Oneonta Slough area, so that the effects of the flooding were inconsistent.

Baja California

Class I: Cordylanthus maritimus subsp. maritimus has been collected from several estuaries along the Pacific coast of Baja California, Mexico. Herbaria records reveal populations at Bahia de San Ramon, San Telmo, San Quintin, and Laguna-Mormona, all of which are south of Cabo Colnett, some 200 kilometers south of San Diego, the nearest known population of Cordylanthus. Some Cordylanthus plants were located at San Quintin in a brief field check of high marsh vegetation in 1980. Other Baja marsh sites were not checked.

Class II: Between Tijuana Slough and Cabo Colnett are several other notable estuaries, including El Estero at Ensenada and the La Salina-La Mision area, the most likely candidates for additional populations of Cordylanthus. El Estero was checked in 1980, but no Cordylanthus was found despite numerous sites with apparently favorable conditions. Flood damage was extensive in this marsh in February 1980 from the same storms that affected Tijuana Estuary.

APPENDIX
AGENCIES REQUESTED TO REVIEW THE DRAFT PLAN

Director,
California Department of
Fish and Game
1416 Ninth street
Sacramento, California 95814

Land, Air, Water Resources
Preserve Committee
c/o Biology Department
University of California - Santa Barbara
Santa Barbara, California 93106

State Coastal Conservancy
Attention: Scott McCreary
1330 Broadway Ave., Suite 1100
Oakland, California 94612

Director
City Planning Department
305 West 3rd
Oxnard, California 93030

County Planning Commission
County Planning Department
County Government Center
Ventura, California 93001

Regional Commissioner
South Central Coast Regional Commission
1224 Coast Village Circle, Suite 36
Santa Barbara, California 93108

Regional Commissioner
South Coast Regional Commission
666 East Ocean Blvd., Room 3107
Long Beach, California 90801

Commanding Officer
U.S. Navy
Pacific Missile Test Center
Point Mugu, California 93042