UC Santa Barbara
Reports

Title

Year 3 Establishment of the Endangered Salt Marsh Bird's Beak (Chloropyron maritimum ssp. maritimum) at North Campus Open Space, UCSB, CA

Permalink

https://escholarship.org/uc/item/9rj199cb

Authors

Chapman, Wayne
Wilhelm-Safian, Claire
Stratton, Lisa

Publication Date

2026-01-13

eScholarship.org Powered by the California Digital Library
University of California

Year 3 Establishment of the Endangered Salt Marsh Bird's Beak (*Chloropyron maritimum ssp. maritimum*) at North Campus Open Space, UCSB, CA



Wayne Chapman, Claire Wilhelm-Safian, Lisa Stratton

January 13, 2026

Introduction

Chloropyron maritimum ssp. maritimum is an annual halophytic plant that grows in coastal estuaries and salt marshes from California's south coast to northern Baja California. While it does possess chlorophyll and undergoes a modicum of photosynthesis, it is hemiparasitic, deploying haustoria to steal most of its required energy and nutrients from the root systems of its host plants. It is a decumbent herb with many distal purple branches and leaves which excrete salt crystals. It is listed as endangered by the USEPA, USFWS, and CDFW, as well as given threatened ("amenazada") status in Mexico, largely due to the historical destruction and fragmentation of coastal salt marsh habitat. The subspecies *C. maritimum ssp. palustre* occurs from Morro Bay north to Humboldt County, making NCOS the new northwestern limit of *Chloropyron maritimum ssp. maritimum*.

North Campus Open Space has been a successful restoration of intermittently tidal salt marsh in Goleta, California that has created opportunities to introduce regionally appropriate rare and endangered plants into areas where they were formerly absent or extirpated. A key plant of interest was *C. maritimum ssp. maritimum*. In the spring of 2023, the Cheadle Center obtained approximately 5,000 seeds from Carpinteria salt marsh via Tidal Influence, LLC with permits from the USFWS. The material from Carpinteria was deemed the closest ecotype of the species to UCSB and the Devereux Slough, and the most appropriate for the assisted migration. These seeds were experimentally placed across North Campus Open Space on March 27, 2023 in 96 half meter- square subplots, paired to test preferred host plant, soil type, elevation, and performance with or without supplemental watering. In the first year, 55 individuals reached adulthood. Germination only occurred in sandy soil with *Distichlis spicata* (saltgrass) as the host plant, and watering did not have a significant effect on germination, height, or plant productivity. In early 2024, two larger areas at low elevation in the intertidal zone between Plots 3 and 4 were seeded with an additional 50,000 seeds (referred to as the February Zone and March Zone in the Year 2 report, and renamed to Zones 9, 10, and 11 in this report). Another 9 zones were seeded in January of 2025 (Figures 2, 3, and 4 below). See the Year 1 and Year 2 reports for further details (Wilhelm-Safian et al., 2024 & 2025).

The most successful plots in Year 1 and 2 were in this low-elevation intertidal zone just northeast of Venoco bridge, in sandy soils with sub-surface soil moisture year-round. However, some locations produced healthy, reproductive *C. maritimum ssp. maritimum* in heavier soils without the abundant sub surface soil moisture when the main host plant, *Distichlis spicata* (saltgrass), was present at medium density. Salt marsh bird's beak individuals seemed to germinate in higher numbers and have more room to grow in these

areas of medium density saltgrass, or on the edges of thicker saltgrass mats. While sparser saltgrass allows ample space for germination, *C. maritimum ssp. maritimum* in these areas were apparently not provided with adequate host material and were therefore generally weak and small. Thicker saltgrass might yield better opportunities for parasitism, but it precludes both germination and recruitment, with less space for growth.

2025 Methods

In November of 2024, Tidal Influence, LLC provided the Cheadle Center with another batch of uncounted seeds. The total number of seeds was estimated by counting individual seeds in a dozen subsamples (each around 0.1 g), finding the average seeds per gram (1090.49), and multiplying by the total mass of the seeds provided (28.657 g). The total number of seeds was estimated to be 31,250 (Figure 1).

$$\frac{1090.49\ seeds}{1\ g} * 28.657\ g = 31{,}250\ seeds$$

Figure 1: The number of seeds received from Tidal Influence was estimated using the equation above.

Year 3 (2025) seeding was informed by the previous two years' successes, focusing most seeding in the sandy soils with perennial sub-surface moisture where the majority of salt marsh bird's beak already occurred. Since bird's beak had successfully established in some areas in heavier clay soils and what appeared to be significantly less sub-surface soil moisture when medium density saltgrass was present, the entire margin of the slough was walked again for these vegetation markers, in addition to soils and elevation. The estimated 31,250 seeds provided by Tidal Influence were divided into nine groups of equal weight, and each was sown at nine new seeding plots on North Campus Open Space, numbered Zones 12-20 (Figures 1, 2, and 3). These plots were selected for appropriate soil texture and elevation, with medium-density mats of *Distichlis spicata* to serve as host plants. The seed was sown on 1/23/2025.

Monitoring occurred on April 8 and 15, 2025, and again on October 21, 28, and November 5, 2025. In April, each plot received a full count of each individual. The denser plots were monitored with the methods developed in 2024, where linear subsections of plots were blocked out with transect tapes to avoid double counting, and the number of bird's beak was individually counted by two monitors, and their results averaged.

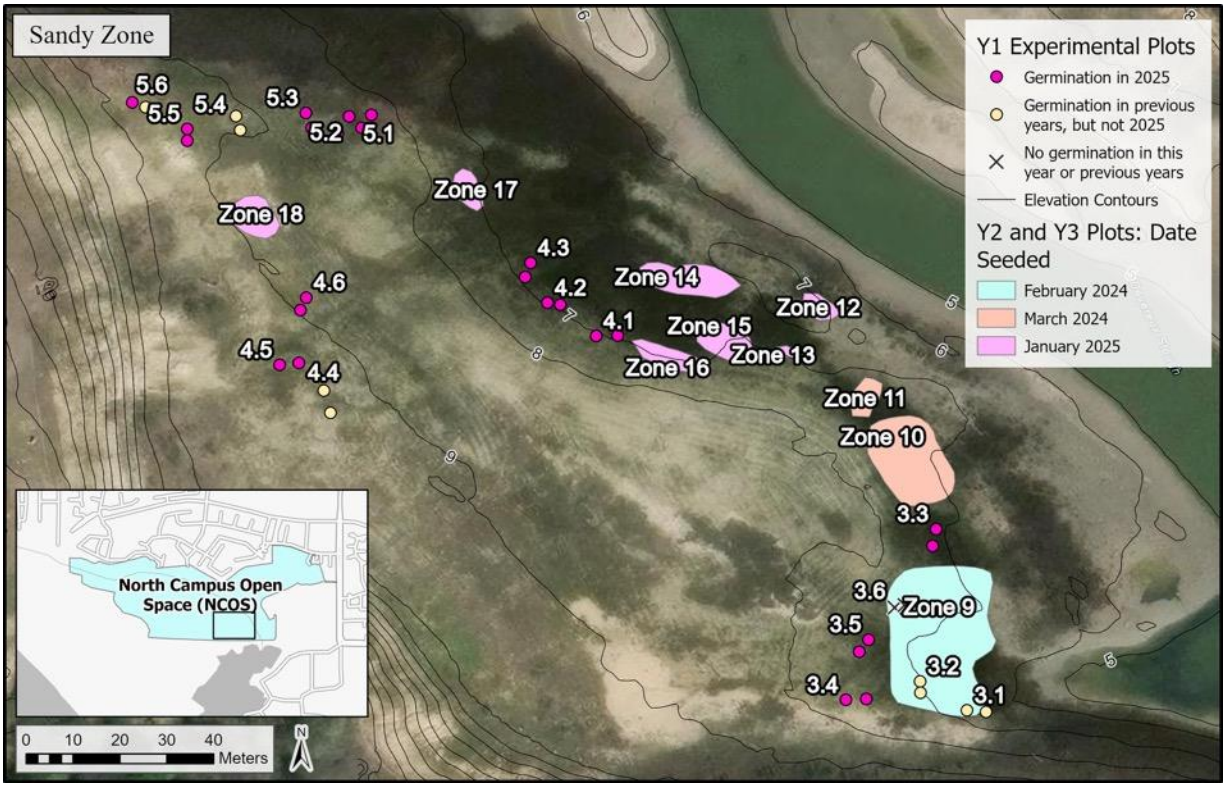


Figure 2: Map of the seeding plots in the sandy intertidal zone along Devereux Slough on North Campus Open Space. Year 1 experimental plots 3, 4, and 5 as well as Year 2/Year 3 seeding plots 9-18 are shown in this area.



Figure 3: Map of the seeding plots along the western arm of Devereux Slough on North Campus Open Space. Year 1 experimental plots 6, 7 and 8 as well as Year 3 seeding plot 20 are shown in this area. These areas were selected for the ideal density saltgrass, but lack year-round high soil moisture and sandy soils.

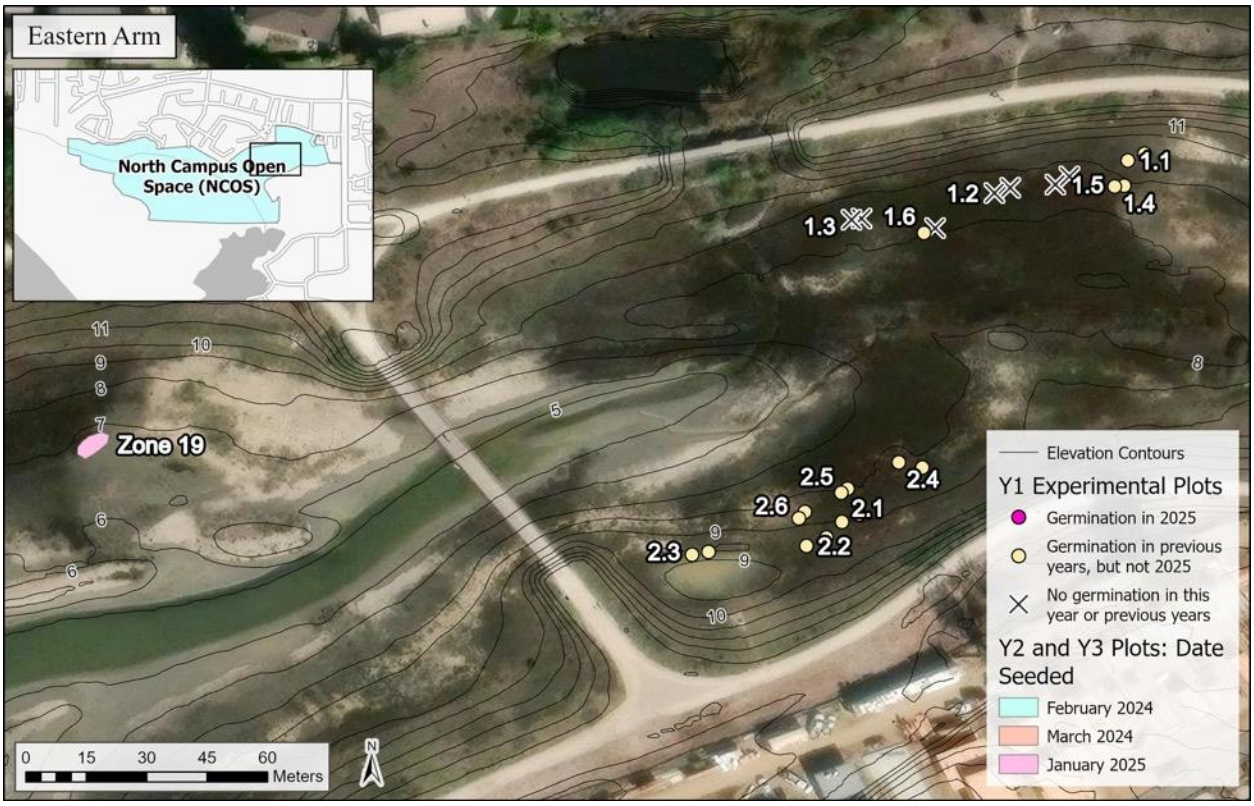


Figure 4: Map of the seeding plots along the eastern arm of Devereux Slough on North Campus Open Space. Year 1 experimental plots 1 and 2 as well as Year 3 seeding plot 19 are shown in this area. These areas were selected for the ideal density saltgrass, but lack year-round high soil moisture and sandy soils.

In October and November, a quadrat sampling method was adopted to estimate abundance within the large dense plots (Zones 9 - 17, as well as the area surrounding the Year 1 experimental seeding subplot 4.3). The extent of each zone was mapped to calculate the total area of the patch using a Juniper Geode GNS3S and ESRI Field Maps. At least three 1x1 meter quadrats were randomly placed within each zone, and the total number of bird's beak within each quadrat was counted, noting how many were reproductive (either flowering or fruiting). Figure 5 shows the results of the quadrats for each plot. Quadrats in subplot 4.3 had the greatest variation. The average number of bird's beak per square meter was then multiplied by the total area of the patch or zone to estimate the total abundance. Several smaller outlying patches or individuals were also mapped and counted, and these numbers were added to the density-based estimates of the closest zone.

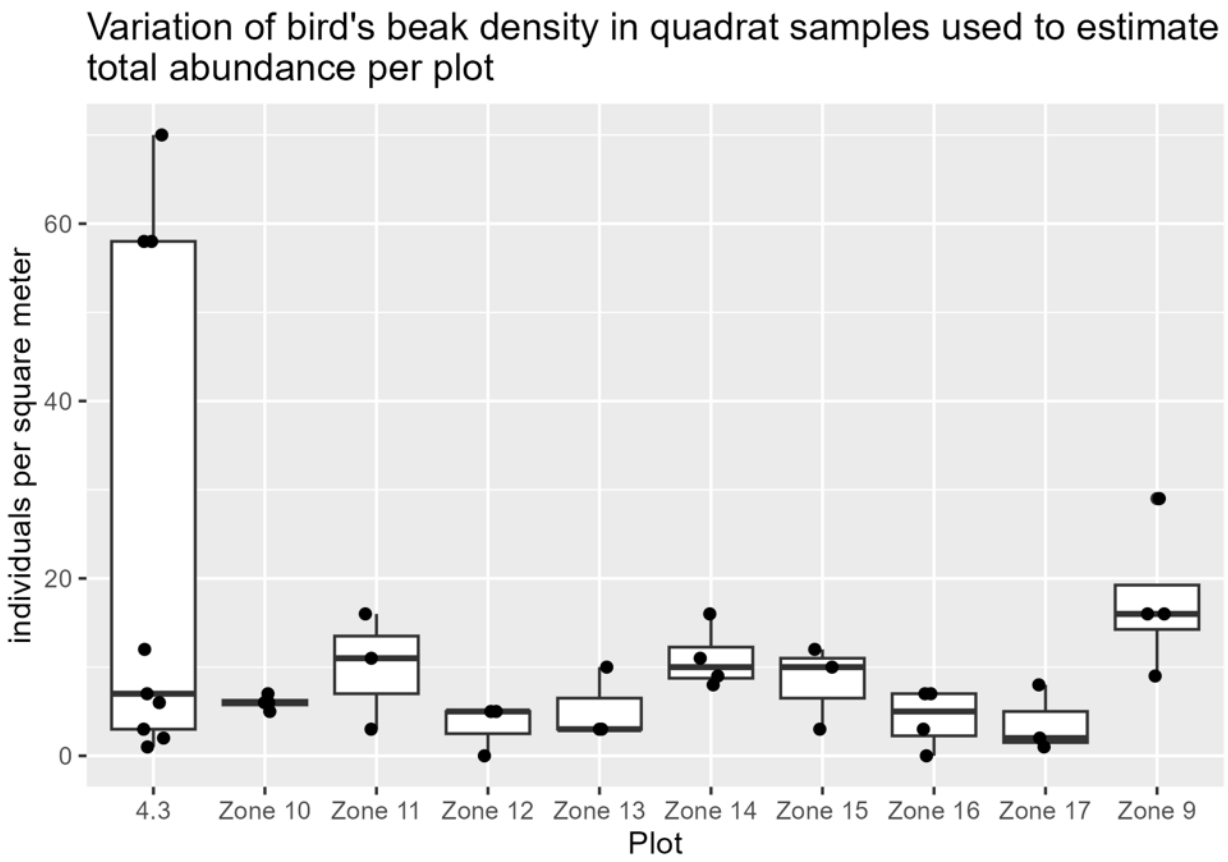


Figure 5: A box plot of the results from quadrat sampling within the larger, dense seeding zones.

Results

The abundance of *C. maritimum ssp. maritimum* on site increased twelvefold from 1,914 individuals in 2024 to approximately 23,828 in 2025 (Figure T). The vast majority of this population (88.6%) represents second or third generations germinating from seeds produced on site in the areas around the original experimental seeding plots and the two zones added in Year 2. There were 2,720 individuals recorded in the new zones 11-19 which were seeded in January 2025, an 8.8% germination rate of the estimated 31,250 seeds sown.

Of the original experimental seeding plots (1-8), plot 4 remains the most productive, especially in the lower-elevation subplots in the intertidal zone. Tidal action dispersed seeds from the original half-meter square subplots, creating dense occurrences of salt marsh bird's beak clustered around those points and scattered patches throughout the sandy floodplain. An estimated 95.2% of the 2025 population reached reproductive maturity (Figure 6 and 8). Although the Cheadle Center did not collect data on the number of seeds produced this year, we can expect this population to continue to grow provided

favorable conditions in 2026. There was also an increase in germination and reproductive individuals at plots 3 and 5, which are both adjacent to plot 4 within the sandy intertidal zone (Figure 7).

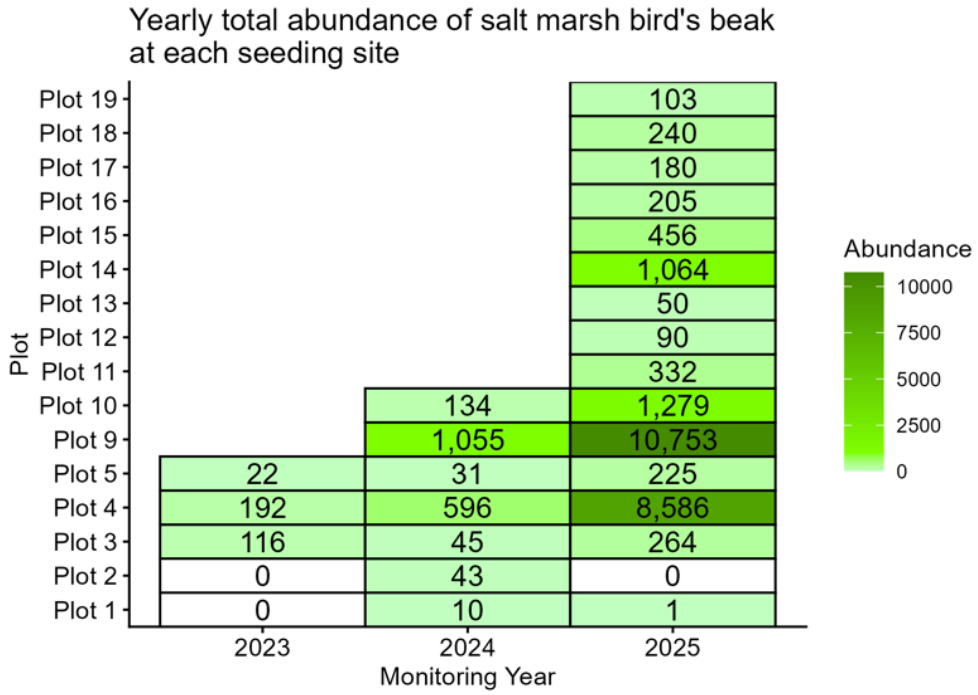


Figure 6: Heat plot showing the yearly total abundance of salt marsh bird's beak at each seeding plot.

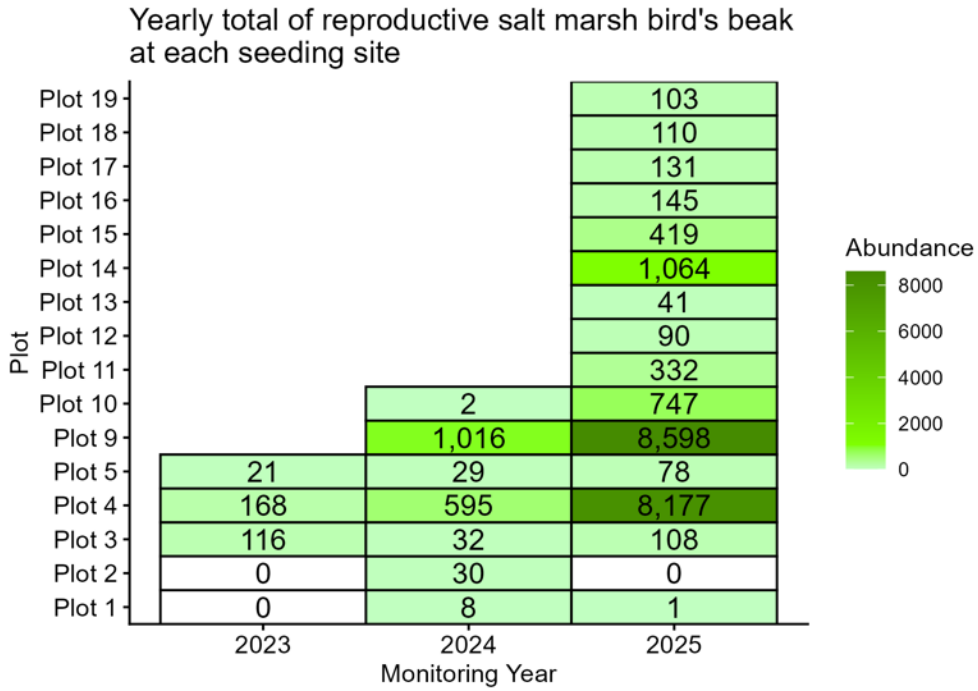


Figure 7: Heat plot showing the yearly total abundance of salt marsh bird's beak at each seeding plot.

Plots 1 and 2 are located at higher elevations along the eastern arm of the Devereux Slough, are dominated by either *Distichlis spicata* or mixed salt marsh vegetation, and have clay soils. There was no germination in either plot in the first year of the project, but in 2024 there were 10 and 43 individuals recorded in plots 1 and 2 respectively. Despite seed production in 2024, there was zero germination in plot 2 and only one individual recorded in plot 1 this year. It is possible that the comparatively low rainfall in 2025 was not conducive to bird's beak germination in these higher clay soils.

In all three years of the project, there has never been recorded germination at plots 6, 7, and 8 located along the western arm of the Devereux Slough. These plots are at higher elevation than the intertidal sandy zone where the bird's beak seems to thrive and are characterized by denser clay soils.

The three larger plots established in 2024, plots 9, 10, and 11 (referred to as "February Zone" and "March Zone" in the Year 2 report) are located between plots 3 and 4 in the intertidal sandy zone just north of Venoco Bridge. In their second year, germination increased around tenfold in these zones. Plot 9 had the highest estimated abundance of all plots in 2025, greater than the area around Plot 4.

Of the new plots seeded in January of 2025, plot 14 had the highest germination with 1,064 individuals, all of which were reproductive. Plots 12-18 were located in the sandy zone near the successful plots from Years 1 and 2. Plot 18 in particular was situated near the main population of Ventura marsh milk-vetch *(Astragalus pycnostachyus* var. *lanosissimus)*, another endangered plant species introduced to NCOS in 2019. As management for the disturbance-following milk-vetch, Cheadle Center staff had moved soil using a tractor in late 2024, creating berms and shallow ditches. Plot 18 was established around the edges of one of these shallow depressions, which ponded and held water after rain events for up to several weeks. 240 salt marsh bird's beak germinated along the edge of the depression.

Plots 19 and 20 were established on the northern bank of Devereux Slough in patches of *Distichlis spicata* in heavier soils. There was no germination in plot 20, which had thinner *D. spicata* cover than anticipated in 2025. On the other hand, 103 individuals were counted at plot 19, all of which were reproductive.

Abundance & Reproduction at Each Seeding Plot (2025)

	PLOT	TOTAL ABUNDANCE	# REPRODUCTIVE	% REPRODUCTIVE
	1	1	1	100%
	3	264	108	40.9%
	4	8 586	8 177	95.2%
	5	225	78	34.7%
	9	10 753	8 598	80%
	10	1 279	747	58.4%
	11	332	332	100%
	12	90	90	100%
	13	50	41	82%
	14	1 064	1 064	100%
	15	456	419	91.9%
	16	205	145	70.7%
	17	180	131	72.8%
	18	240	110	45.8%
	19	103	103	100%
TOTAL	—	23,828	20,144	—
AVG	—	—	—	78.2%

Figure 8: Table showing the peak abundance of salt marsh bird's beak at each plot, as well as the number and percentage of reproductive individuals.

Seed Dispersal and Lower Devereux Slough Survey

In the upper Devereux Slough at NCOS, *Chloropyron maritimum ssp. maritimum* has been observed recruiting most heavily in the immediate areas where seed was directly sown or reproductive plants occurred the previous year, however we have noted scattered recruitment throughout the sandy soils nearest the most successful populations, sometimes up to 25 meters away. Since the NCOS site produced an estimated 1.3-1.7 million seeds in 2024, it was assumed some of this seed made its way into the lower portion of Devereux Slough. To assess whether any *C. maritimum ssp. maritimum* had recruited into these areas south of Venoco Bridge, we conducted a survey in June of 2025 in the lower Devereux Slough, south of Venoco Road (Coal Oil Point Reserve) when *C. maritimum ssp. maritimum* should be relatively well-formed and flowering or beginning to flower.

On June 26, 2025, a ground survey was conducted by two surveyors, walking the margins of the slough in the most likely elevations, looking for any sign of *C. maritimum* ssp. *maritimum*. Due to the difficulty of accessing all portions of the lower slough in one visit due to the topography, and the limitations of surveying the southernmost portions due to snowy plover breeding season, only the northern portion of the slough was surveyed (Figure 9).

No bird's beak were observed. The lower Devereux Slough appeared to have several critical distinctions from the newly restored habitat north of Venoco Road (also shown as Ocean Bluff Drive on some maps). There appeared to be relatively little sandy soil, with the majority being clayey mud. In the northwestern section of the lower slough, there appeared to be soil and vegetation with the highest potential (Figure 10), however, no bird's beak were observed there. This location appeared to have the only alluvial soils, with some sandy characteristics, due to a culvert placed in Venoco Road to the north (Figure 11). This was the only location observed in the survey where there was not an abrupt demarcation between robust *Salicornia pacifica* and mudflat. The general lack of *Distichlis spicata,* gradual transitions of vegetation densities, and the almost universal occurrence of clayey mud that was extremely desiccated in June made the lower Devereux Slough look like an unlikely candidate for *C. maritimum* ssp. *maritimum*, highlighting the importance of the heterogenous habitats and ecotones just north of Venoco Road. However, as *C. maritimum* ssp. *maritimum* continues to expand and increase its annual seed production, future surveys are warranted in the lower slough.



Figure 9: Map showing the areas surveyed in June 2025 for bird's beak dispersal from the upper introduction sites, and the location (star) and direction (red arrow) of the image taken of what appeared to be the best habitat for *C. maritimum ssp. maritimum* (Figure 10).



Figure 10: Image depicting the only area *Distichlis spicata* was observed, as well as some alluvial deposits, in the surveyed areas of the lower Devereux Slough.



Figure 11: Culvert (star) flow path (blue arrows) and most promising soil types (alluvial fans, red lines) in the lower Devereux Slough that looked most suitable for *C. maritimum ssp. maritimum*. No plants were observed here, or anywhere else in the lower slough. This alluvium was deposited largely in 1969 after the grading of the area called South Parcel, after its grading for the filling of the upper Devereux Slough in 1965.

Future Conservation Outlook and Discussion

While the upper arm of the Devereux Slough at NCOS has received approximately 100,000 seeds from Tidal Influence via the Carpinteria Salt Marsh over the past 3 years, further introductions may not be necessary. Even with a modest rainy season in 2024-25, over 20,000 bird's beak flowered and seeded. Despite predictions of a cool, dry winter, precipitation has far exceeded expectations, beginning early, in mid-October, and continuing into November and December with large, well-spaced storms. Since recruitment success of *C. maritimum* ssp. *maritimum* is correlated with precipitation, and given the abundance of reproductive individuals in 2025, it is reasonable to expect the best year to date in 2026.

Threats to *C. maritimum* ssp. *maritimum* at NCOS appear to primarily stem from the encroachment of non-native, and to a lesser extent, incompatible native vegetation in the sandy soils where its stronghold occurs. *Polypogon monspeliensis* and *Parapholis incurva* both occur in the same elevations as *C. maritimum* ssp. *maritimum,* and their thickness and abundance are exacerbated by the spread of non-native nitrogen fixers, primarily

Melilotus albus and *indicus*. Native *Salix lasiolepis,* and to a lesser extent*, S. exigua,* are also spreading in the area. The ideal long-term management situation seems to be one with moderate N fixation limited to the endangered Ventura marsh milkvetch (*A. pycnostachyus* var *lanosissimus*), with *D. spicata*, rather than annual exotic grasses, reaping the benefits of the accumulated nitrogen. The control of *Melilotus sp*. is a crucial management concern.

Another rare and potential host plant (despite also being an annual) for *C. maritimum* ssp. *maritimum was* introduced to the site during 2025 as well, *Lasthenia glabrata ssp coulterii* (Figure 12). With the sandy soils, high sub-surface soil moisture, and increasing diversity of rare plants now occurring on this particular sub site within the slough, the importance of controlling nitrogen fixers and annual grasses here is especially clear, lest it transition into habitat that predominately supports these weeds and away from rare, native taxa.



Figure 12: The rare *Lasthenia glabrata ssp coulteri* was also introduced to the sandy soils at NCOS near where *C. maritimum ssp. maritimum* has occurred in the highest numbers.

Chloropyron maritimum ssp. maritimum expanded strongly in 2025, with new occurrences in seeded areas, plants recruiting from seed produced in Year 2, and an almost ten-fold increase in the most densely populated areas. With a strong precipitation year underway, there is every reason to expect a record year in 2026. Despite an unknown species of moth making the developing fruits of *C. maritimum* ssp. *maritimum* its larval host sites, it appears to be producing ample seed.

Pollination was noted this year, especially by *Bombus californicus*, of which sometimes 4 or more at a time could be observed visiting the large patches (Figure 18). These bees would zoom off to the west after visiting sufficient flowers. The site looks very bright for *C. maritimum* ssp. *maritimum*, assuming the sites' evolution and developing vegetation can be compatible with its long-term success there. Adequate weeding efforts which include removing exotic N fixers from the site will be ever important in 2026.

Photos



Figure 13: *C. maritimum ssp. maritimum* in mid-summer, 2025. Photo by Jeremiah Bender.



Figure 14: Aerial image of thousands of *C. maritimum ssp. maritimum* at NCOS, summer, 2025. Photo by Jeremiah Bender.



Figure 15: *C. maritimum ssp. maritimum* in August 2025.



Figure 16: *C. maritimum ssp. maritimum* in 2025 from one of the year 1 seeding plots.



Figure 17: Image of one of the larger patches near Venoco Bridge, visible in the background.



Figure 18: *Bombus californicus* on *C. maritimum ssp. maritimum* in June of 2025. Photo by Jeremiah Bender.

Works Cited

Wilhelm-Safian, C., Chapman, D., and Stratton, L. (2024). *Experimental Establishment of the Endangered Salt Marsh Bird's Beak (Chloropyron maritimum ssp maritimum) at North Campus Open Space, Santa Barbara, CA*. Cheadle Center for Biodiversity and Ecological Restoration, University of California Santa Barbara.

Wilhelm-Safian, C., Chapman, W., & Stratton, L. (2025). *Year 2 Establishment of the Endangered Salt Marsh Bird's Beak (Chloropyron maritimum ssp. maritimum) at North Campus Open Space, Santa Barbara, CA*. Cheadle Center for Biodiversity and Ecological Restoration, University of California Santa Barbara. Retrieved from https://escholarship.org/uc/item/3st086bm

Wetherwax, M. & Tank, D.C. (2012) *Chloropyron maritimum subsp. maritimum*, in Jepson Flora Project (eds.) *Jepson eFlora*, https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=93765, accessed on January 23, 2025

USFWS (2009). *Chloropyron maritimum subsp. maritimum 5-Year Review: Summary and Evaluation*. US Fish and Wildlife Service. https://sdmmp.com/upload/SDMMP_Repository/0/MP263_USFWS_2009_Chlorophyon%20maritimum5Yr.pdf