

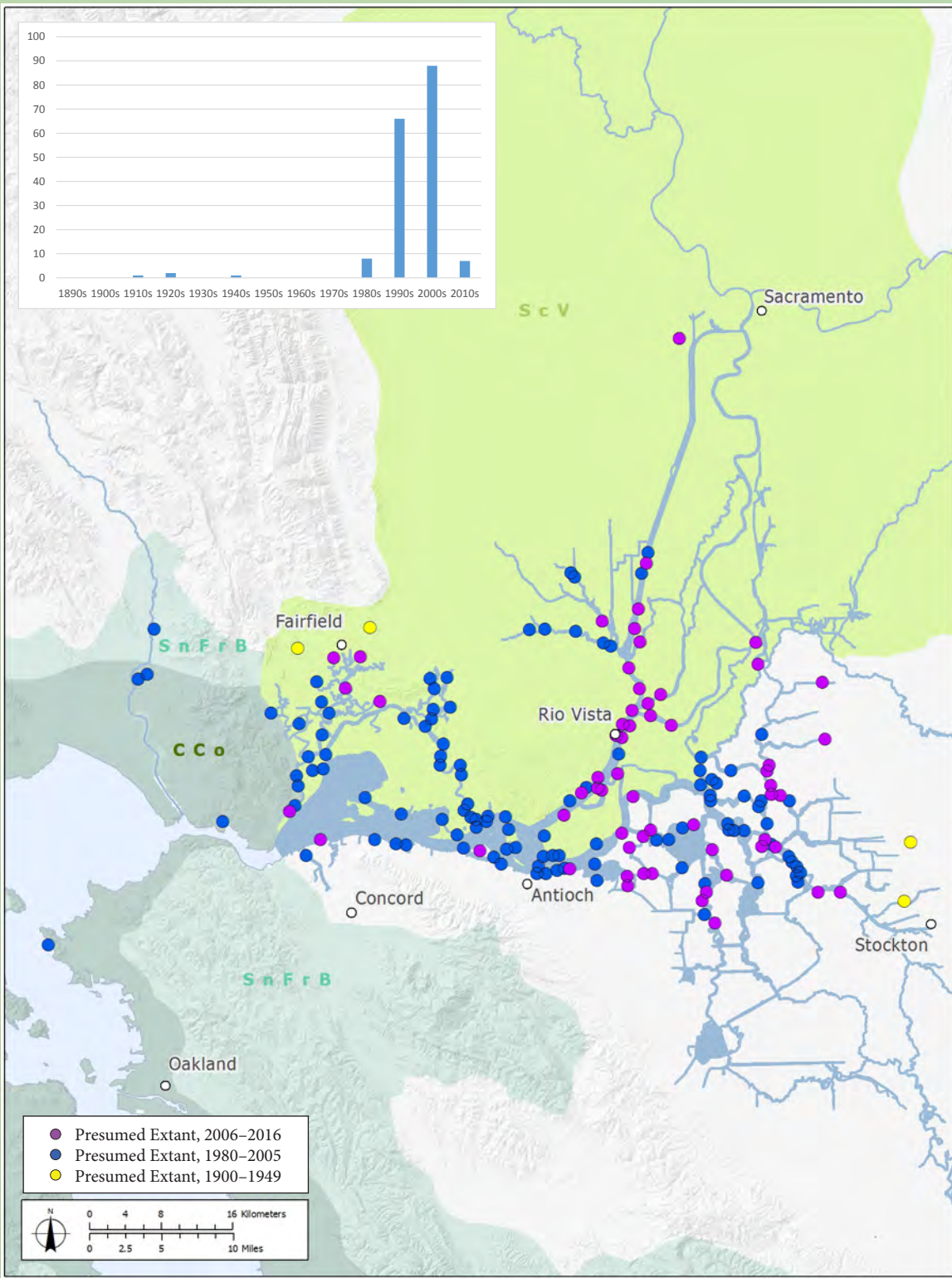
PLANT RARITY IN THE BAY-DELTA: A STATUS UPDATE ON FIVE SPECIAL-STATUS PLANTS

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OVERVIEW

The Sacramento-San Joaquin Delta covers over 1,150 square miles and receives approximately 50 percent of California's stream flow, with its waterways and wetlands forming the West Coast's largest estuary. The Delta provides critical habitat for many plant, fish, and wildlife species; however, as a result of the massive reclamation that began in the late 1800s, the physical transformation of the Delta has resulted in a loss of 98% of freshwater emergent marsh habitats (SFEI 2014). Due to continued threats including increasing water diversions, loss of habitat, invasive species, and impaired water quality, over a third of the Delta's indigenous fish species are extinct or are threatened with extinction. A variety of endemic special-status plant species are similarly threatened; baseline data on existing populations is essential to understanding future population declines of these species. We focus on five rare plants that are endemic to Sacramento-San Joaquin Delta and surrounding regions.



MASON'S LILAEOPSIS

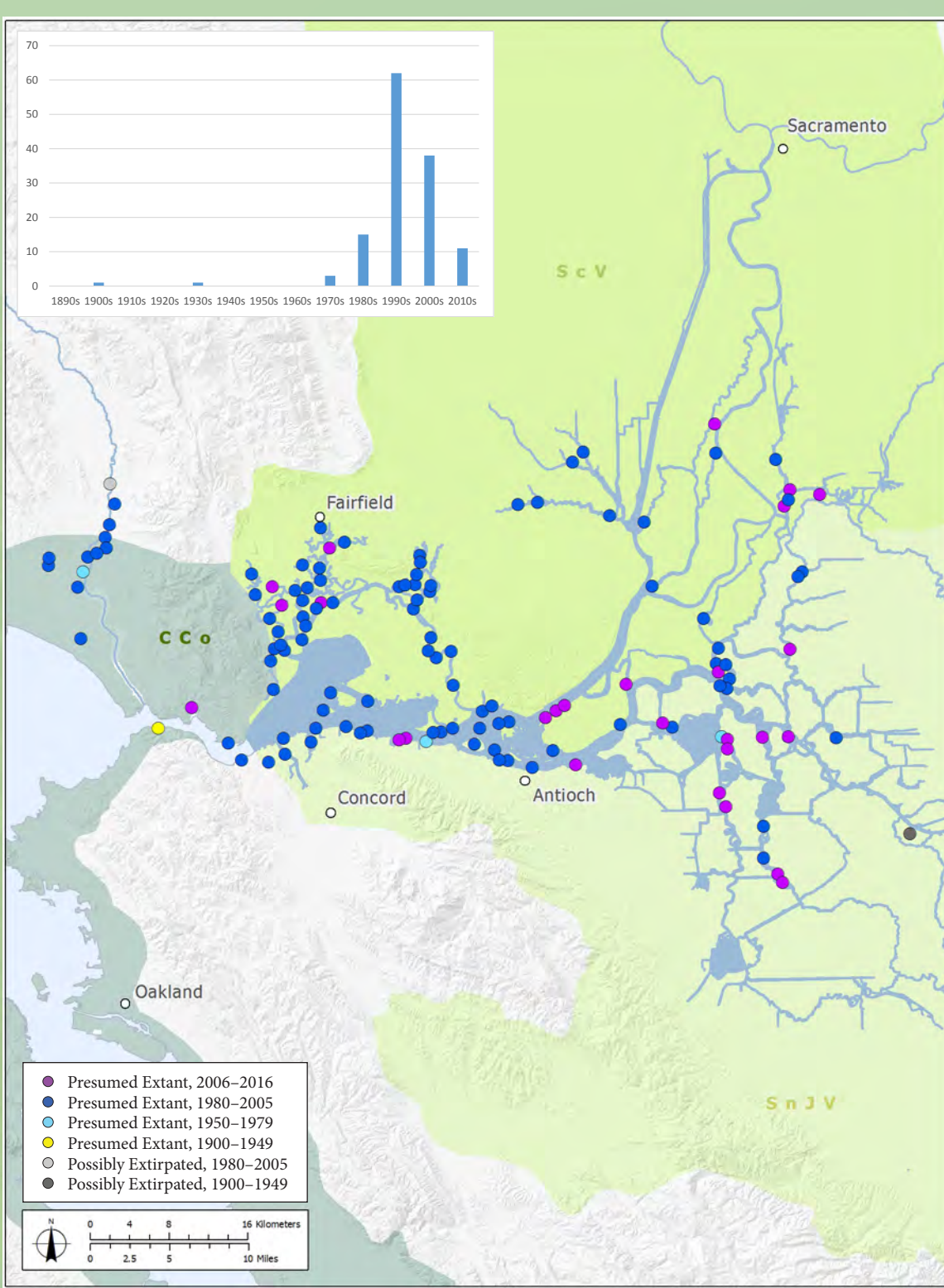
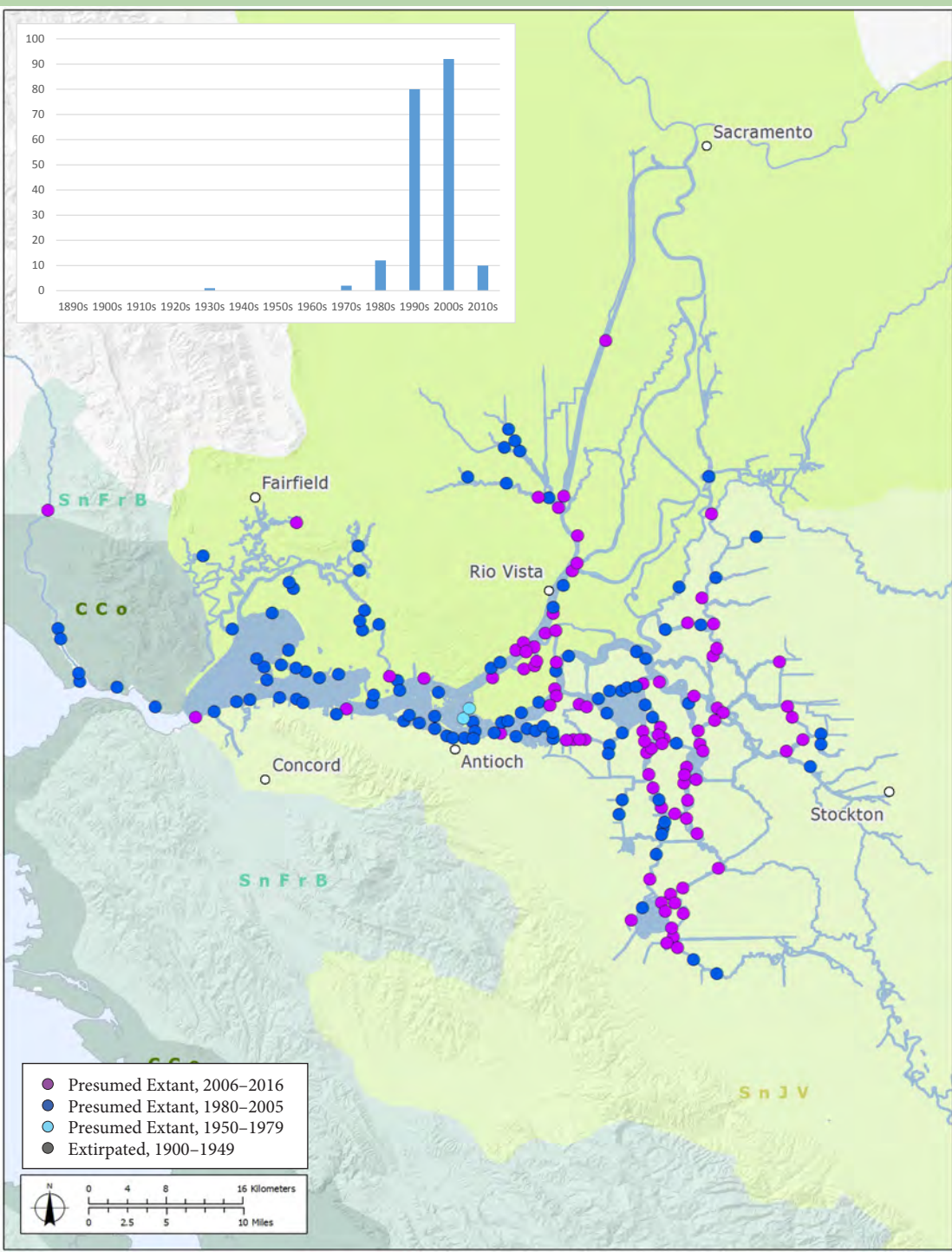
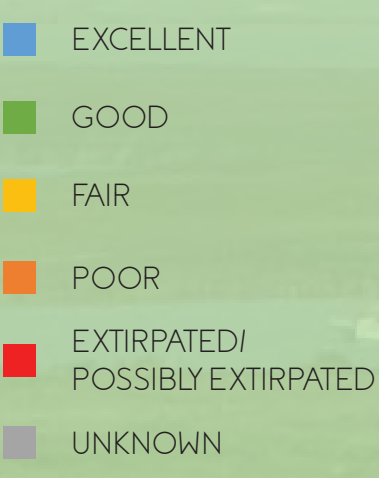
Lilaeopsis masonii
Apiaceae

CA endemic
perennial rhizomatous herb (1B.1 & State Rare)
blooms April–November

- Taxonomy:**
 - ▶ Leaf cylindric, 0.4–1.2 mm wide, leaf internal cross-walls 3–8, obscure.
 - ▶ Two species, *L. occidentalis* and *L. masonii*, occur on Pacific Coast. *Lilaeopsis masonii* considered restricted to inland brackish or freshwater habitats of the Golden Gate Estuary; *L. occidentalis* considered characteristic of salt- and brackish-marshes from Marin north to British Columbia.
 - ▶ Difficult to distinguish morphologically due to vegetative simplicity (Affolter 1985).
 - ▶ Recent genetic work indicates *L. masonii* is an inland ecotype of and not distinct from the widespread *L. occidentalis*, suggesting it should be subsumed and no longer receive formal state protection (Fiedler et al. 2011).
- Synonyms:** None.
- Habitat:** Usually on mud banks in fresh or brackish marshes and swamps or riparian scrub, below mean high water. Limited by salinity, no growth at 24 ppt (Zebell and Fiedler 1996).
- Rarity pattern:** Narrowly distributed and abundant where found.

- Current distribution:** Sacramento Valley, San Joaquin Valley, Central Coast, and San Francisco Bay regions (TJM2).
 - ▶ 197 occurrences; 32% with unknown condition and one extirpated. Of the occurrences with the condition reported, 34% are in fair or poor condition.
 - ▶ Mostly documented in the 1990s and 2000s, 44% of the occurrences have been reported in the last 10 years. The oldest occurrence is from 1936.
- Historical distribution:** Originally described in 1977, not well known.
- Threats:** Threatened by erosion, channel stabilization, development, flood control projects, recreation, agriculture, shading resulting from marsh succession, and competition with non-native water hyacinth (*Eichhornia crassipes*).

CONDITION OF DOCUMENTED OCCURRENCES



SUISUN MARSH ASTER

Symphotrichum lentum
Asteraceae

CA endemic
perennial rhizomatous herb (1B.2)
blooms April–November

- Taxonomy:**
 - ▶ Outer phyllaries pale-margined > 1/2 length, length generally 3+ × width (TJM2).
 - ▶ J. Struthers (supersedes TJM2): Stems usually glabrous or glabrate throughout; cauline leaves usually linear or narrowly lanceolate, 40–80 by 5–8 (–15) mm, margins entire, faces glabrous.
 - ▶ Can be confused with *S. chilense*, with which it overlaps geographically and can intergrade.
 - ▶ Comparison of specimens at Jepson Herbarium: the leaves of *S. lentum* tend to be narrower and mostly entire and the stems tend to be hairless.
- Synonyms:** *Aster chilensis* var. *lentus* (USFWS; still in use); *Aster lentus* (TJM1); *Aster chilensis* var. *lentus* (Munz).
- Habitat:** Fresh or brackish marshes and swamps, generally near mean high water.
- Rarity pattern:** Narrowly distributed and never abundant where found.
- Current distribution:** Sacramento Valley, Central Coast, and San Francisco Bay regions; however, a large portion of the CNDDB records also occur in San Joaquin Valley (TJM2).
 - ▶ 173 occurrences; nearly half with unknown condition. Of the occurrences with the condition reported, 69% are in fair or poor condition.
 - ▶ Mostly documented in the 1990s and 2000s, only 35% of the occurrences have been reported in the last 10 years. The oldest occurrence is from 1917.
- Historical distribution:** Originally described in 1894. Greene (1894): plentiful along tidal streams in western part of Suisun Marsh. Jepson (1925): very common and conspicuous in Suisun Marsh.
- Threats:** Seriously threatened by marsh habitat alteration and loss, and erosion. Possibly threatened by herbicide application.

CONDITION OF DOCUMENTED OCCURRENCES



Stillwater Sciences



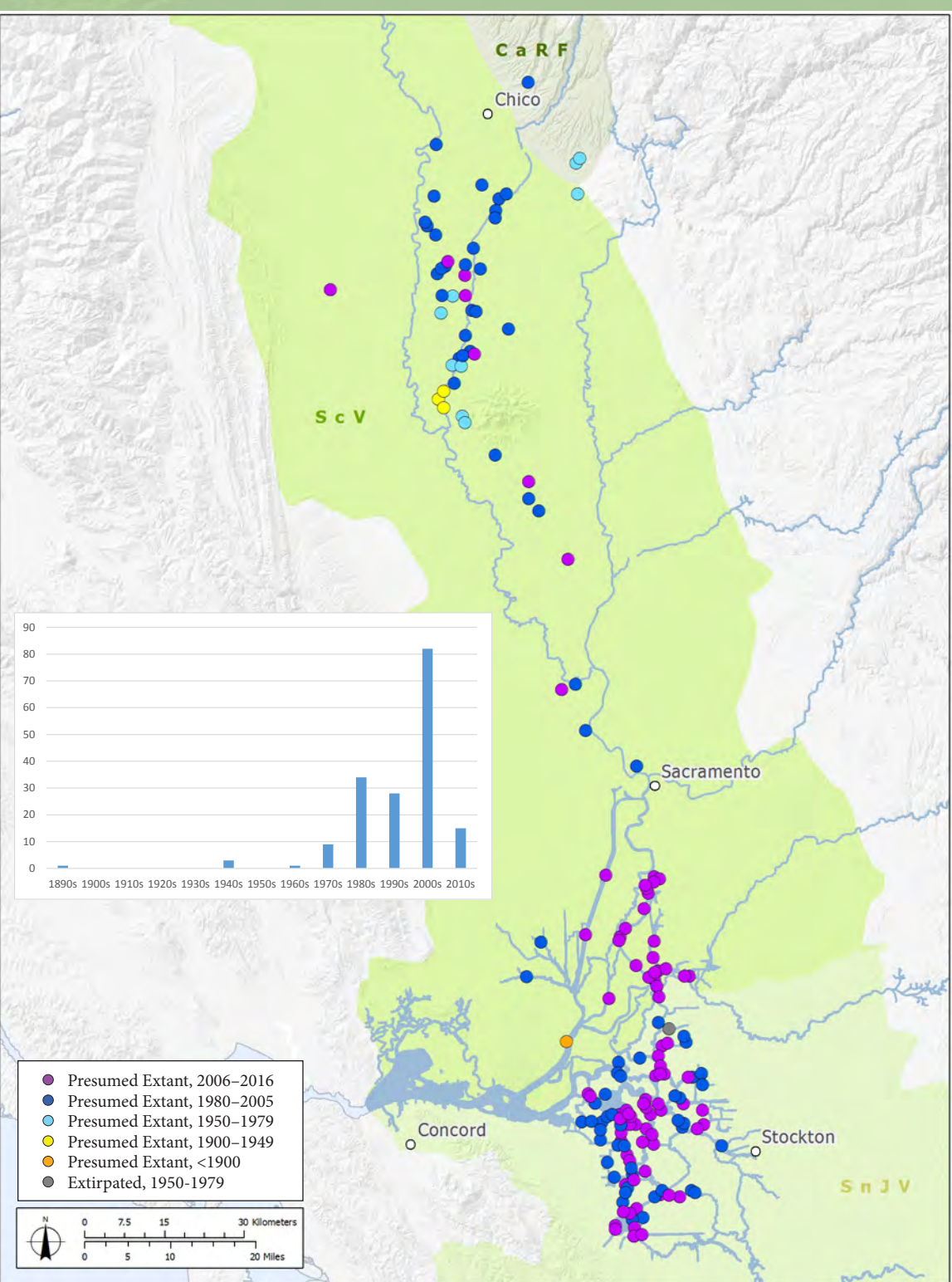
DELTA TULE PEA

Lathyrus jepsonii var. *jepsonii*
Fabaceae

CA endemic
perennial rhizomatous herb (1B.2)
blooms May–September

- Taxonomy:**
 - ▶ Plant generally glabrous and more robust; Great Central Valley (especially Solano Co., nearby Central Coast) (TJM2).
 - ▶ Closest cognor is the more common sister variety, *L. j.* var. *californicus*.
- Synonyms:** None.
- Habitat:** Fresh or brackish marshes and swamps, generally several feet above mean high water. Abundance varies with salinity (high salinity → low growth/reduced flowering/emergence failure; low salinity → robust/prolific flowering & seeding) (Raabe et al. 2012).
- Rarity pattern:** Narrowly distributed and never abundant where found.
- Current distribution:** Sacramento Valley, San Joaquin Valley, and Central Coast regions; however, a few occurrences also occur in the San Francisco Bay (Napa Co; TJM2).
 - ▶ 131 occurrences; 58% with unknown condition and two possibly extirpated. Of the occurrences with the condition reported, 57% are in fair or poor condition.
 - ▶ Mostly documented in the 1990s and 2000s, only 21% of the occurrences have been reported in the last 10 years. The oldest occurrence is from 1903.
- Historical distribution:** Originally described in 1890. Greene (1894): along muddy margins of sloughs, within reach of tide-water in Suisun Marsh. Jepson (1925): deltas or marshes (Suisun Marsh, lower Sacramento islands). Formerly more abundant as more tidal creeks pre-levees (Raabe et al. 2012). In addition to the Delta and Suisun Marsh, formerly documented in the Tamalpais region (presumably upper reaches of tidal sloughs in the SF Bay Marin shoreline) and Santa Clara County (USFWS 2013).
- Threats:** Most populations small. Threatened by agriculture, water diversions, and erosion.

CONDITION OF DOCUMENTED OCCURRENCES



WOOLLY ROSE-MALLOW

Hibiscus lasiocarpus var. *occidentalis*
Malvaceae

CA endemic
perennial rhizomatous herb (1B.2)
blooms June–September

- Taxonomy:**
 - ▶ Distinctive; no closely related taxa with overlapping habitat/distribution.
 - ▶ Leaf blade 6–10 cm, cordate; flowers near stem tip; flower stalk 1–8 cm; sepals fused 1/2; petals 6–10 cm; seed glabrous; wet habitats.
- Synonyms:** *Hibiscus lasiocarpus* (TJM1), *Hibiscus californicus* (Munz).
- Habitat:** Freshwater marshes and swamps (often in riprap on sides of levees), generally near mean high water.
- Rarity pattern:** Broadly distributed but never abundant where found.
- Current distribution:** Sacramento Valley, San Joaquin Valley, and Cascade Range Foothills regions (TJM2).
 - ▶ 173 occurrences; 24% with unknown condition and one possibly extirpated. Of the occurrences with the condition reported, 37% are in fair or poor condition.
 - ▶ Mostly documented in the 1980s–2000s, 47% of the occurrences have been reported in the last 10 years. The oldest occurrence is from 1891.
- Historical distribution:** Originally described in 1873. Greene (1894): in swampy places along the lower San Joaquin. Jepson (1925): in swamps and deltas, lower Sacramento and San Joaquin rivers. Once common in fresher water areas of the Sacramento-San Joaquin Delta and Sacramento River (between upper San Joaquin Delta and Chico) (USFWS 2013).
- Threats:** Seriously threatened by habitat disturbance, development, agriculture, recreational activities, and channelization of the Sacramento River and its tributaries. Also threatened by weed control measures and erosion. Possibly threatened by trail maintenance.

CONDITION OF DOCUMENTED OCCURRENCES



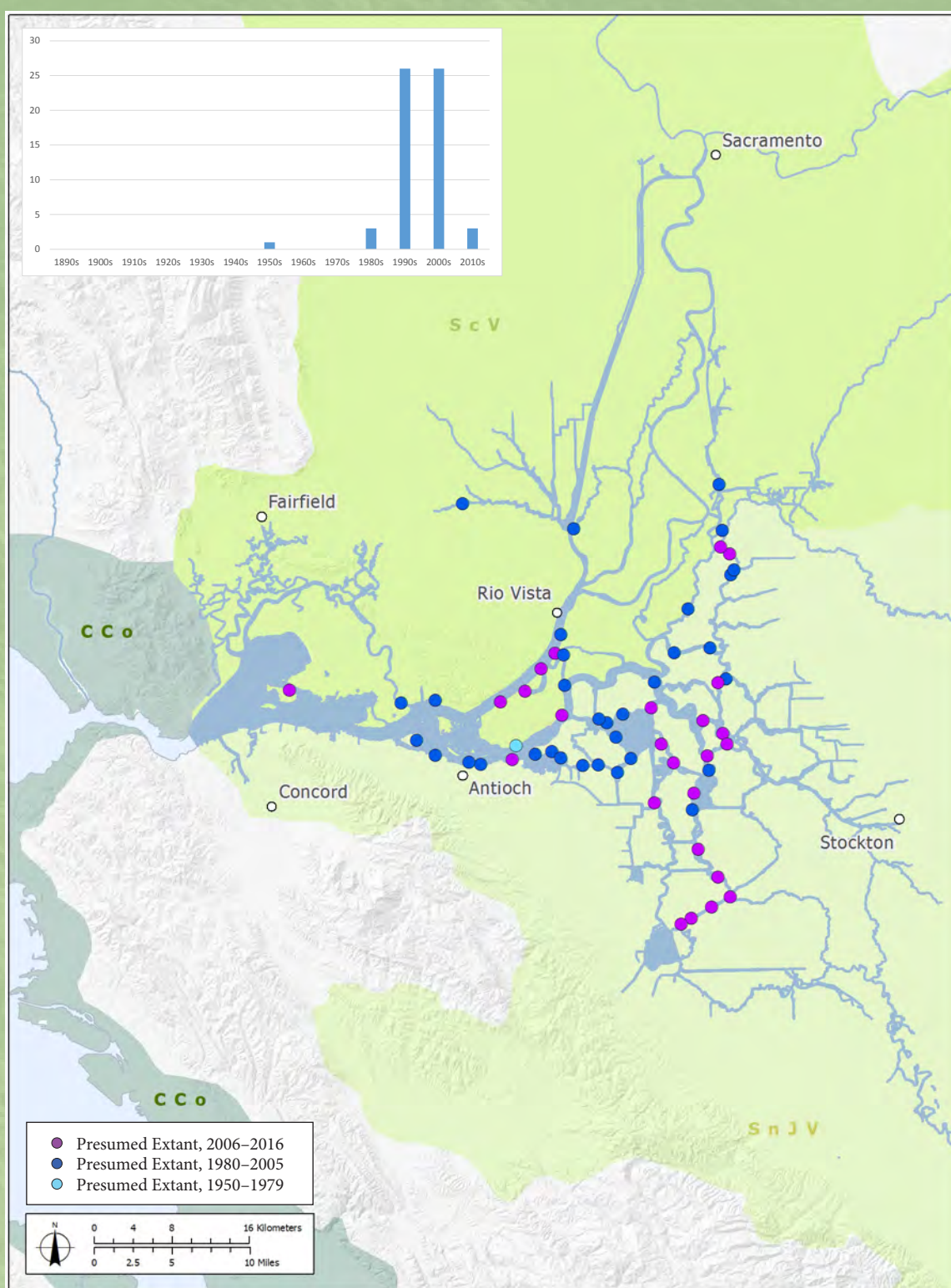
DELTA MUDWORT

Limosella australis
Scrophulariaceae

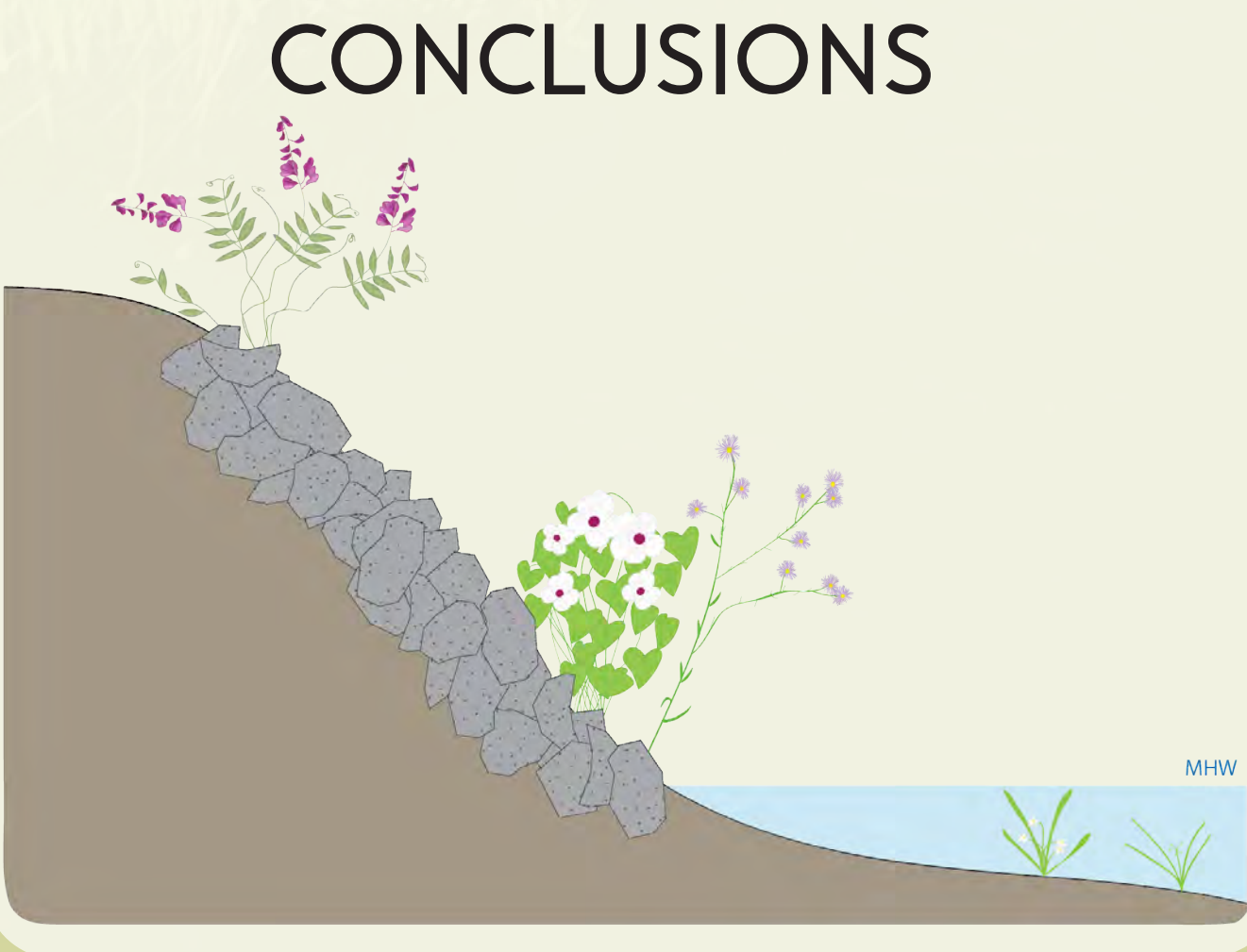
perennial stoloniferous herb (2B.1)
blooms May–August

- Taxonomy:**
 - ▶ Leaves awl-like, cylindric; style > ovary.
 - ▶ Native status inconclusive (CNPS 2016), treated as naturalized in both TJM1 and TJM2.
- Synonyms:** *Limosella subulata* (TJM1), *Limosella aquatica* var. *tenuifolia*.
- Habitat:** Usually on mud banks in fresh or brackish marshes and swamps or riparian scrub, below mean high water.
- Rarity pattern:** Narrowly distributed and abundant where found.
- Current distribution:** Sacramento Valley, San Joaquin Valley, and Central Coast regions; however, no occurrences are documented in the Central Coast (TJM2).
 - ▶ 59 occurrences; 19% with unknown condition. Of the occurrences with the condition reported, 27% are in fair or poor condition.
 - ▶ Mostly documented in the 1990s and 2000s, 42% of the occurrences have been reported in the last 10 years. The oldest occurrence is from 1955.
- Historical distribution:** Originally described in 1810. Taxonomic changes make it difficult to determine. Jepson (1925) included only one *Limosella* species (*L. aquatica*) and said it occurs on "muddy shores of lakes and ponds, mostly near the coast, from Marin Co. to Kern Co. and San Jacinto Mountains. It is found in all continents, the most widely distributed species of the family" with the variety *L. a.* var. *tenuifolia* in the San Bernardino Mountains.
- Threats:** Threatened by stream bank alteration, levee maintenance, erosion, recreational activities, and foot traffic.

CONDITION OF DOCUMENTED OCCURRENCES



CONCLUSIONS



- Occurrence data and species' condition:**
 - ▶ All species have a high percentage of occurrences with an unknown condition (19%–58%) and most of the populations were documented prior to the last decade (53%–79%), highlighting the need for follow-up surveys.
 - ▶ A significant portion of the species occurrences (where the condition is known) are in either fair or poor condition (27%–69%), which underlines the severity of the threats and thus heightened potential for extinction.
- Threats to species' persistence:**
 - ▶ According to CNPS (2016), the primary threat to all five species is marsh habitat alteration and loss which is largely due to land conversion (e.g., agriculture) but also due to management activities (e.g., levee maintenance, weed control) and biotic forces (e.g., erosion, shading resulting from marsh succession, and competition with invasives).

- Management implications of predicted future sea level rise and salinity changes:**
 - ▶ Tidal wetland ecosystems are narrowly distributed and highly sensitive to fine-scale changes in elevation and salinity.
 - ▶ A central threat to all of these narrow endemics is sea level rise and the associated habitat loss by submergence (3.3–4.6 feet [Heberger et al. 2009] by 2100; could be much higher), as it threatens the long-term survival of California's tidal marshes and is difficult to ameliorate at a local level (Stralberg et al. 2011, USFWS 2013).
 - ▶ Sediment input (to create a higher marsh plain) is in decline (Cloern et al. 2011); geographically variable subsidence and accretion rates exacerbate the ability of marshes to keep pace with sea-level rise rates (Thorne 2012).
 - ▶ Modeled responses to sea level rise predict losses of most high marsh habitat by 2050 and most mid-marsh habitat by 2040–2060 (Thorne 2012).
 - ▶ Salt-water intrusion is predicted further inland in the delta (USFWS 2013) which threatens Delta plant species with specific salinity tolerances.
 - ▶ If the extirpation rate of local populations outpaces the species' ability to establish new colonies, a species is at risk of extinction. Gradual migration may be difficult if constrained by dispersal ability, genetic diversity, or habitat.
 - ▶ Maximizing the likelihood of local population persistence depends on availability of adjacent habitat for colonization (including slope, substrate integrity, and amount of shade) (Grewell et al. 2013).

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