5-YEAR REVIEW
Pitkin Marsh Lily (*Lilium pardalinum* ssp. *pitkinense*)

GENERAL INFORMATION

Species: Pitkin Marsh lily (*Lilium pardalinum* ssp. *pitkinense*)
Date listed: October 22, 1997
FR citation: 62 FR 55791 (Service 1997)
Classification: Endangered

State listing: Pitkin Marsh lily was listed by the State of California as endangered in 1978.

BACKGROUND

Species overview:
Pitkin Marsh lily is an herbaceous, rhizomatous (possesses an underground stem) perennial in the lily family (Liliaceae). The species is a narrow-ranging endemic found only in Sonoma County, California. It has slender, erect stems which reach 1 to 2 meters (3 to 6 feet) in height and yellow-green linear leaves which are somewhat wider in the middle and up to 14 centimeters (5.5 inches) long and 1 to 2 centimeters (0.4 to 0.8 inch) wide. Leaves are scattered along the stems or occur in two or three whorls of three to six leaves near the middle of the stems. The inflorescence is a terminal raceme, meaning that the flower is at the end of the central axis of the plant. The flowers hang downwards, referred to as pendent flowers, with strongly reflexed (curved) petals. The petals are orange to red at the outer edge changing to yellow at the center with small, deep maroon dots, mostly within the yellow zone. Anthers (pollen-bearing part of the stamen) are magenta, with red or brown-orange pollen. The fruit is an elliptical capsule containing many flat seeds. Pitkin Marsh lily is generally distinguished from leopard lily (*Lilium pardalinum* ssp. *pardinalum*) by shorter petals and anthers. Pitkin marsh lily flowers from June to July and grows in marshy wetlands and edges of riparian area (Service 2024, pp. 7–9).

Most recent status review:
[Service] U.S. Fish and Wildlife Service. 2019. Pitkin Marsh lily (*Lilium pardalinum* ssp. *pitkinense*). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. 8 pp.

We did not recommend a status change in the 2019 status review.

Methodology used to complete the review:
In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a 5-year review is to assess each threatened species and endangered species to determine whether its status has changed, and it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service's (Service) Sacramento Fish and Wildlife Office conducted a Species Status Assessment (SSA) and developed an SSA report for the Pitkin Marsh lily (Service 2024, entire), which was used to inform this 5-year review and a draft recovery plan. The SSA report represents our evaluation of the best available scientific information, including the habitat and demographic needs and the current and future condition of the species. Independent peer reviewers and partner

representatives reviewed the SSA report. In addition to the SSA report, we used peer-reviewed publications and information from our files (obtained while writing the SSA report) to complete this review.

FR Notice citation announcing the species is under active review:

[Service] U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 47 Species in California, Nevada, and Oregon. Federal Register 88:56042–56044.

We did not receive information from the public regarding Pitkin Marsh lily in response to the notice.

REVIEW ANALYSIS

Updated Information and Species Status

A description of new biological and ecological information obtained since listing is included in the Pitkin marsh lily SSA report (Service 2024), primarily in Chapter 2. New information presented in the SSA report includes recent genetic research, monitoring data for the only confirmed extant population (Cunningham Marsh), updates on threats, and additional conservation actions. An evaluation of the species' needs at the individual, population, and species-level and how they relate to viability of the species is discussed in Chapter 3 of the SSA report. Chapter 4 of the SSA report provides a summary of the factors influencing the viability of the species, management and conservation measures, and the current condition of the Cunningham Marsh population. An analysis of the future condition of the species under three plausible future scenarios is presented in Chapter 5 and a summary of the overall species viability is presented in Chapter 6.

A recent genetic study (Givnish *et al.* 2020, entire) focusing on the evolution of the *Lilium* genus examined Pitkin Marsh lily alongside congeneric species. The study compared Pitkin Marsh lily with other *Lilium* species, examining the DNA sequences of 400 nuclear genes as well as the genome of a plastid, referred to as a plastome. Pitkin Marsh lily was placed as a sister to Wiggins' lily (*Lilium pardalinum* spp. *wigginsii*) in a plastome phylogeny but sister to coast lily (*Lilium maritimum*) in a nuclear phylogeny (Givnish *et al.* 2020, pp. 36, 39). These findings suggest a potential hybrid origin for Pitkin Marsh lily (Service 2024, p. 5). Additionally, hybrid (between species) and intercross (between subspecies) offspring are known to occur within the *Lilium* genus, and both Pitkin Marsh lily and leopard lily (*Lilium pardalinum* ssp. *pardinalum*) have been reported at Pitkin Marsh (Baye 2005, p. 35; Department 1993, p. 2). The Service is unaware of specific studies looking at population genetics at any Pitkin Marsh lily sites.

Distribution and Abundance

At the time of federal listing (Service 1997, p. 55794) the species was known from three occurrences at two freshwater marshes within 13 kilometers (8 miles) of each other in western Sonoma County, California. The current range of the species remains as described in the listing rule. The population in Cunningham Marsh is protected under a conservation easement, while the two populations in Pitkin Marsh (northern Pitkin Marsh and central Pitkin Marsh) are not protected and have not been surveyed since 2001 and 1977, respectively, due to lack of access to the private property where the populations occur. Historical records suggest that Pitkin Marsh

lily may have once extended into the southern portion of Pitkin Marsh (Diversity Database 2020), known as lower Pitkin Marsh. According to the Lower Pitkin Marsh Management Plan, the lilies in Lower Pitkin Marsh have characteristics intermediate in appearance between Pitkin Marsh lily and the leopard lily (Nelson 2010, p. 10). Lower Pitkin Marsh is less than one kilometer from the central Pitkin Marsh population. The close geographic proximity between Lower Pitkin Marsh and the central Pitkin Marsh population, and the potential for intercrossing between Pitkin Marsh lily and leopard lily, support the idea that the lilies in Lower Pitkin Marsh could add to the genetic representation of the species.

As described in Chapter 4 of the SSA report, the two populations in Pitkin Marsh (northern Pitkin Marsh and central Pitkin Marsh) have not been surveyed recently. However, satellite and aerial imagery (Google Earth, 2020) appears to show potentially suitable, undeveloped habitat within the vicinity of both populations. The last record of the central Pitkin Marsh population is from 1977. Periodic records from 1980–1996 of the northern Pitkin Marsh population report abundances ranging from 1 to 19 individuals of the species. The most recent record from 2001 described the northern Pitkin Marsh as "stable and increasing" (Department 2001, p. 12).

Chapter 4 of the SSA also describes the Cunningham Marsh population, which, between 1987 and 2008, has been reported to have between 30 and 489 individuals (Service 2024, p. 15). However, the definition of "individuals" has not always been consistent; in some years it includes clusters of stems thought to be an individual plant, while in other years it includes counts of each reproductive stem. Some years do not specify the methods used during monitoring. In addition to various population estimates since 1987, there have been consistent surveys or counts of the Cunningham Marsh population in most years since 2010. Surveys from 2010–2019 include counts of the number of stems with seed capsules, the number of seed capsules, and the number of stems without seeds capsules within each exclosure. Individual stems are counted rather than attempting to estimate the number of individual plants; because of the clonal nature of the species, the relationship between number of individual stems vs. individual plants is not known. The current extant population at Cunningham Marsh is scattered throughout eight small fenced exclosures over a 3-acre area; however, a few plants have been noted growing outside of the exclosures (Service 2024, p. 16). Fencing Pitkin Marsh lilies within exclosures began in 1987 to keep out both large and small herbivores and the species was later established or outplanted to seven additional exclosures in 2009. Surveys show a declining trend in abundance and the number of stems with seed capsules and the number of seed capsules has decreased since more detailed data collection began in 2010 (Service 2019a, p. 2; Service 2024, p. 25). Surveys from 2022 included the number of stems, number of buds, and number of flowers. Survey results from 2022 are presented in **Table 1**.

Table 1: Counts of Pitkin Marsh lily in exclosures at Cunningham Marsh on 6/17/2022. Exclosures 1 and 3 were combined in 2009. Data courtesy of the Laguna de Santa Rosa Foundation (Young unpublished data 2022).

Exclosure #	Stems	Buds	Flowers
1/3	1	2	0
2	0		
4	479	90	1
5	60	21	5
6	3	2	2
7	9	10	2
8	15	12	9
9	1	1	0
10	12	4	15
11	11	0	0
New cage north of Exclosure 7	1	1	2
Total	**592**	**143**	**36**

Threats

At the time of listing (Service 1997, p. 55798), the most serious threats to the Pitkin Marsh lily were habitat destruction and modification due to urbanization, land use changes, and alterations in hydrology. Additional threats at the time of listing included collection for horticultural use, herbivory pressure, and competition with other plant species (Service 1997, p. 55798). A subsequent status review added climate change as a threat to the species (Service 2009, p. 20). All of these threats remain as current threats to the Pitkin Marsh lily, with competition with other plant species and climate change emerging as primary threats to the monitored population at Cunningham Marsh. Additionally, a plant pathogen recently detected near Pitkin Marsh, *Phytophthora*, has the potential to negatively modify habitat in the future if it spreads into either of the marshes inhabited by Pitkin Marsh lily (Service 2024, p. 27).

As noted in the SSA Report, the Cunningham Marsh population is threatened by competition with other plant species such as native and non-native blackberries (*Rubus* spp.) and non-native grasses (Service 2024, p. 17–18). Non-native grasses including velvet grass (*Holcus lanatus*) occur throughout the footprint of the Pitkin Marsh lily population at Cunningham Marsh (Service

2024, pp. 10, 18). Dense velvet grass is widespread surrounding the marsh (Service 2024, p. 18). The survey of the Cunningham Marsh population in 2022 found that velvet grass was present in exclosures 8 and 10 (Laguna de Santa Rosa 2022). Another nonnative species, Monterey pine (*Pinus radiata*), has also increased in numbers at Cunningham Marsh and has the potential to invade Pitkin Marsh lily habitat (Service 2024, p. 21).

Recovery criteria
There currently is not a published recovery plan or recovery criteria for the Pitkin Marsh lily.

Synthesis
The Pitkin Marsh lily population at Cunningham Marsh, although protected under a conservation easement, is currently considered to be in low condition and the current conditions of the populations located at Pitkin Marsh are unknown. The species continues to face a variety of threats, including habitat destruction and modification due to urbanization, land use changes, alterations in hydrology, collection for horticultural use, herbivory pressure, competition with other plant species, climate change, and potentially the plant pathogen *Phytophthora.* The plausible future conditions for the species vary widely, largely due to the uncertainty regarding the Pitkin Marsh populations. Therefore, after reviewing the best available scientific information and comparing current and future condition for the species, we conclude that the Pitkin Marsh lily remains an endangered species.

RESULTS

Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
- ____ *Extinction*
- ____ *Recovery*
- ____ *Original data for classification in error*

__X__ No change needed

New Recovery Priority Number: No change
The Service has determined that the current recovery priority number (6C) should remain unchanged. The current recovery number, "6", indicates that the taxon is a subspecies with a high degree of threat and low recovery potential. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

RECOMMENDATIONS FOR FUTURE ACTIONS

- Conduct genetic analyses to better understand the species' taxonomy. Further genetic analyses may help resolve Pitkin Marsh lily's relationship with other *Lilium pardalinum* subspecies and potential hybrid origin. Additionally, specific studies of population genetics at Pitkin Marsh lily sites and of lilies in Lower Pitkin Marsh would help confirm the species genetic diversity, abundance, and distribution.

- Encourage conservation and coordination between private landowners to gain access to the Pitkin Marsh populations and conduct coordinated surveys. Gaining access to the private lands where no surveying and monitoring has occurred will provide more information on the species. It is also possible that there are additional populations that exist on private properties that we are currently unaware of, and that with outreach and/or community awareness, willing landowners may come forward that are aware of the plants' existence.

- Continue surveys of the Cunningham Marsh population. Continued surveys of the Cunningham Marsh population will assist with assessing status and trends for the species. Additional population data will help inform strategies to preserve and enhance populations.

- Continue management at Cunningham Marsh through coordination with partners including the Plant Society and the Laguna Foundation. Continued management at Cunningham Marsh, including fencing repair when necessary and removal of non-native plant species, is necessary to maintain and increase resiliency of this population.

- Collect and maintain a viable, protected seed collection from all populations and conduct seed germination tests on previously collected seeds. Pitkin Marsh lily seeds are currently stored at Rae Selling Berry Seed Bank, the California Botanic Garden, and the University of California Botanical Garden, which were collected in 1990, 2016, and 2019, respectively. Collecting a suitable seed bank can contribute to recovery strategies, such as outplanting to supplement existing populations or to establish new populations.

- Using the results of the genetic analysis described above, develop a propagation and outplanting plan for Pitkin Marsh lily. Begin outplanting Pitkin Marsh lilies to establish additional populations within the historical range of the species and augment existing populations. Implement monitoring and management to ensure these populations become established to increase ecological representation.

- Continue efforts to control and contain *Phytophthora* to limit the spread of the pathogen within and outside of Pitkin Marsh. In addition, research on more effective treatment options and control techniques is needed.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of PITKIN MARSH LILY

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__**X**__ No change needed

FIELD OFFICE APPROVAL:

Field Supervisor, Sacramento Fish and Wildlife Office

Approve MICHAEL FRIS Digitally signed by MICHAEL FRIS Date: 2024.07.12 15:52:01 -07'00' Date _____