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
Classification: Endangered

BACKGROUND:

Most recent status review:

[USFWS]. 2009. *Carex albida (*White sedge*), Lilium pardalinum* ssp. *pitkinense* (Pitkin marsh lily*)* 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento, California. 24pp. [CLICK HERE TO VIEW DOCUMENT]

FR Notice citation announcing this status review:

[USFWS] U.S. Fish and Wildlife Service. 2018. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews for 50 Species in California, Nevada, and the Klamath Basin of Oregon. Federal Register 83:28251 – 28254. [CLICK HERE TO VIEW DOCUMENT]

ASSESSMENT:

Information acquired since the last status review: This 5-year review was conducted by the U.S. Fish and Wildlife Service's (USFWS) Sacramento Fish and Wildlife Office. Data for this review were solicited from interested parties through a Federal Register notice announcing this review on June 18, 2018, but we did not receive any information regarding this species. We contacted the California Department of Fish and Wildlife (CDFW) and the members of the Milo Baker Chapter of the California Native Plant Society (CNPS) for the latest information regarding the status of the species. Site visits by USFWS employees helped informed our most current capsule count information. We used survey data from the California Natural Diversity Database (CNDDB 2018), maintained by CDFW. Additionally, we conducted a literature search and review of information from our own files.

The Pitkin Marsh lily (*Lilium pardalinum* ssp. *pitkinense*) is an herbaceous, rhizomatous (possesses an underground stem) perennial in the lily family (Liliaceae) (USFWS 2009). It is a narrow-range endemic, originally reported from an area of a few square miles (CNDDB 2018). Three occurrences are reported for the Pitkin Marsh lily in Sonoma County, California (USFWS 1997). The species appears to grow in shaded, riparian areas that are seasonally inundated by water (USFWS 2009).

To date, there is a single, confirmed population of the Pitkin Marsh lily at Cunningham Marsh (CNDDB 2018). This site is on shared, private land protected by a 19-acre conservation easement held by CDFW (Baye 2005). Members of the Milo Baker chapter of CNPS have been stewards of the conservation easement for over 25 years (B. Young, *in litt*. 2018). The two other occurrences are documented on two parcels of private land several miles north of Cunningham Marsh. Access for botanical surveys have been denied at these northern properties since the 1980s and it is unknown if these populations are still extant (CNDDB 2018).

Within the conservation easement at Cunningham Marsh, there are ten small, scattered exclosures over a three-acre area, protecting the known, extant Pitkin Marsh lilies from ungulate browsing (USFWS 2009). At one time, all the exclosures protected Pitkin Marsh lilies, including some out-planted individuals from a nursery in 2009 (USFWS 2009). In the fall of 2018, Pitkin Marsh lilies were located in just three of the structures (K. Symonds, *in litt*. 2018a). Over the past 15 years, numbers at the site have fluctuated from as many as 489 to as few as 87 (K. Symonds, *in litt*. 2018b). Surveys at Cunningham Marsh show a decline in annual abundance (Appendix A). Of the 87 extant plants, only 15 produced capsules in the fall of 2018 (Appendix B). The number of stems producing capsules has also declined in recent years (Appendix C).

At the time of listing, effects due to small population size, urban development, changes in hydrology (i.e., lowering of the water table), lack of self-pollination (decline of pollinators), invasion of habitat by non-native plants, and browsing by ungulates were considered threats to the survival of the Pitkin Marsh lily (USFWS 1997). During the 2009 five-year review for the species, browsing by ungulates and urban development were no longer considered threats acting on the species, as all known, remaining individuals were protected by fenced exclosures at Cunningham Marsh. However, the implementation of conservation measures and the amount of available funding have lapsed for the Cunningham Marsh site since 2009, and it is possible that ungulate browsing at this location could occur if fencing is not maintained and/or the species occurs outside of the exclosures. In addition, the status of the species on the two, northern private properties is unknown, and if the species does still continue to occur at these locations, they are likely threatened by ungulate browsing. Likewise, if these two populations are still extant, both properties are not secured and protected, and therefore, could be threatened by future urban development. Therefore, the threats to Pitkin Marsh lily outlined in the final listing rule remain relevant.

Recent abundance surveys have seen herbivory on lilies increase within exclosures (K. Symonds, pers. comm. 2018) as evidenced by the increase of stems without seed capsules (Appendix C). The fences protecting lily populations are composed of large-gauge wire mesh. Rabbits or small rodents can access the exclosed area through the mesh or by burrowing underneath it, and are likely the cause of increased browsing (K. Symonds, pers. comm. 2018). The CNPS in Sacramento, California, has applied for a grant to install small-mesh fencing on the exclosures at Cunningham Marsh (B. Young, *in litt* 2018). Until this happens, small-mammal browsing remains a significant threat to the viability of the Pitkin Marsh lily.

The Pitkin Marsh lily is threatened by changing hydrology and climate in the region (USFWS 2009). Significant declines in Pitkin Marsh lily abundance appear to be somewhat correlated with reductions in early winter rainfall (K. Symonds, *in litt.* 2018a). The Pitkin Marsh lily thrive

best when they are seasonally inundated by water (K. Symonds, pers. comm. 2018) and changes in hydrology appear to be affecting the community structure at Cunningham Marsh. There are several large pines (*Pinus* spp.) and oaks (*Quercus* spp.), which beneficially shade the understory of the marsh (Baye 2005). In recent years, several of these large trees have fallen, possibly due to low soil-moisture in the summer (K. Symonds, pers. comm. 2018). Falling trees could present a potential threat to the remaining Pitkin Marsh lilies; trunks and branches could physically crush individual plants. Additionally, opening the canopy and exposing the lilies to direct sunlight could prove fatal as well, as lilies seem to thrive in shade (K. Symonds, pers. comm. 2018). Additionally, if falling trees break exclosure fencing, the threat from deer browsing would increase.

Due to its extremely narrow range and specific habitat requirements, the Pitkin Marsh lily is susceptible to random, environmental effects such as tree felling, fire, changes in climate, etc. Although many threats remain the same, others have intensified since they were last assessed (USFWS 2009). However, our understanding of the major threats influencing the viability of the Pitkin Marsh lily has not changed dramatically since the previous status review (USFWS 2009).

Conclusions:

At the time of listing in 1997, three populations of the Pitkin Marsh lily were known to exist. Today there is a single, confirmed occurrence and the status of the two populations on private land remains unknown. Because of low population numbers and the narrow range of the Pitkin Marsh lily, it might be susceptible to a variety of natural or manmade random effects on the population.

The recovery priority number for the Pitkin Marsh lily is 6C (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48, FR 43098, 1983). This number indicates that the taxon is a subspecies, and faces a high degree of threat and a low potential for recovery. The "C" indicates that some degree of conflict exists with urban development.

After reviewing the best available information, we conclude that the Pitkin Marsh lily remains an endangered species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and analysis of the status of the species in the last 5-year review (USFWS 2009) remains an accurate reflection of the species' current status.

RECOMMENDATIONS FOR FUTURE ACTIONS

Installation of small-mesh fencing. In recent years, browsing by small-mammals within exclosures has significantly decreased the number of reproducing Pitkin Marsh lilies (K. Symonds, pers. comm. 2018; Appendix B). The California Native Plant Society has applied for a grant to install small-mesh fencing, which would protect Pitkin Marsh lilies from browsing. This action could significantly increase the viability of the Pitkin Marsh lily in the near-future.

Manage invasive species. Invasive, non-native plants currently grow in the exclosures protecting the Pitkin Marsh lily (K. Symonds, pers. comm. 2018). Himalayan blackberry (*Rubus armeniacus*) and velvet grass (*Holcus lanthus*) grow densely, outcompeting the Pitkin Marsh lily

for light and space (Baye 2005). Continuous management of both species will allow Pitkin Marsh lily numbers to rebound.

Propagation and out-planting. Pitkin Marsh lilies mature after three growing seasons (Baye 2005). In 2009, mature plants were out-planted in exclosures at Cunningham Marsh. Today, only a few of the out-plantings survive. More propagation efforts would increase our ability to establish Pitkin Marsh lilies at additional locations and to supplement extant colonies. These techniques might be essential to ensure the long-term viability of the species.

Maintenance and construction of browsing exclosures. There are currently 10 exclosures protecting Pitkin Marsh lily colonies from browsing by ungulates. However, many do not appear to contain Pitkin Marsh lilies any longer. Moving these structures, and/or establishing new ones along with refined propagation and out-planting techniques might be needed to establish new colonies and/or populations, which would increase redundancy for this species.

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ **Date** 5/2/2019

LITERATURE CITED

Baye, P. 2005. Vegetation Management Plan: California Department of Fish and Game "Cunningham marsh" Conservation Easement Site, Sonoma County, California. Annapolis Field Station. 70 pp.

[CNDDB] California Natural Diversity Database. 2018. Natural Heritage Division. California Department of Fish and Wildlife, State of California. Element Occurrence Reports for *Lilium pardalinum* ssp. *pitkinense*. Unpublished cumulative data current to 2018.

[USFWS]. 2018. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews for 50 Species in California, Nevada, and the Klamath Basin of Oregon. Federal Register 83:28251 – 28254.

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In Litteris

Symonds, Kate. 2018a. U.S. Fish and Wildlife Service (Retired, 2014). Pitkin Marsh lily (*Lilium pardalinum* ssp. *pitkinense*) capsule count data at Cunningham Marsh, Sonoma Co. 2010-2018. Unpublished data.

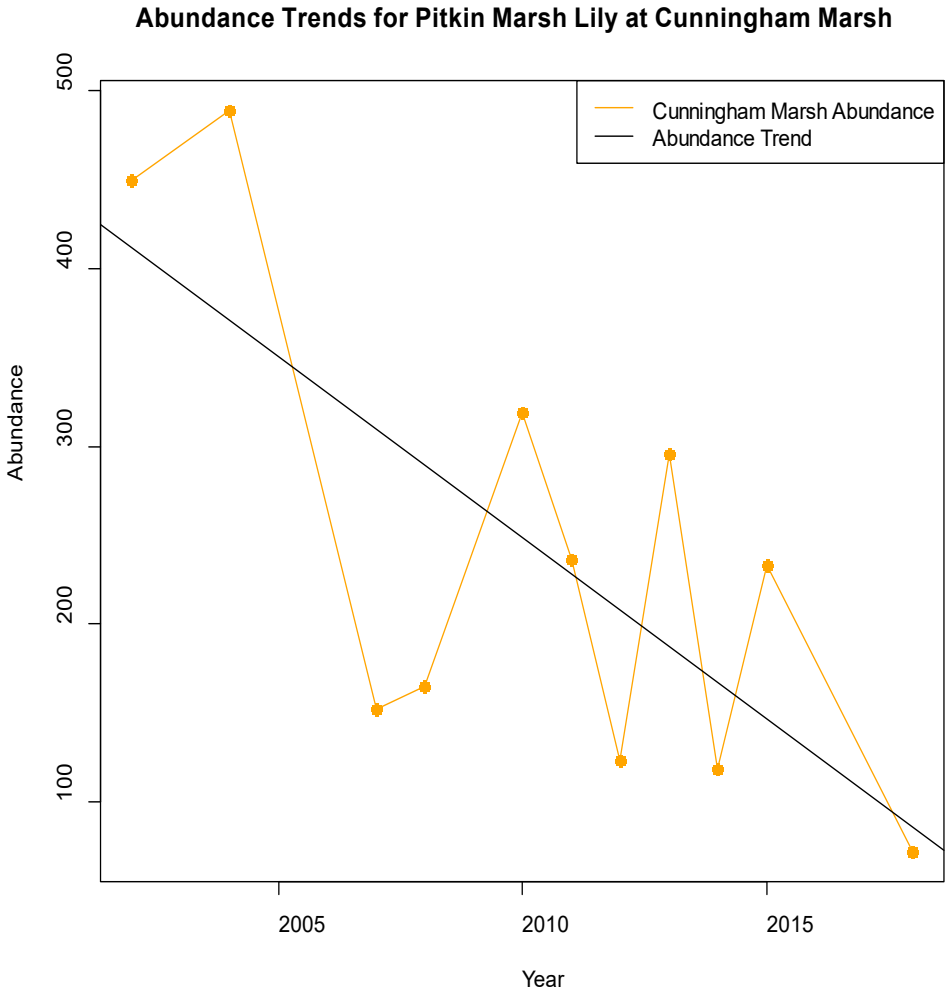
_____. 2018b. U.S. Fish and Wildlife Service (Retired, 2014). Electronic mail correspondence to Elizabeth Bainbridge of the Sacramento Fish and Wildlife Office dated October 24, 2018. Subject: Work Day at Cunningham Marsh

Young, Betty. 2018. California Native Plant Society, Milo Baker Chapter, Director Nursery and Garden Tour. Electronic mail correspondence to Elizabeth Bainbridge of the Sacramento fish and wildlife office dated October 31, 2018. Subject: Work Day at Cunningham Marsh.

Personal Communication

Symonds, Kate. 2018. U.S. Fish and Wildlife Service (Retired, 2014). Conversation with Elizabeth Bainbridge of the Sacramento Fish and Wildlife Office. July 10, 2018. Subject: The status of the Pitkin Marsh Lily at Cunningham Marsh.

Appendix A. Annual abundance trends for the Pitkin Marsh lily over the past 15 years (2003-2018). These data show a decline of this species at the Cunningham Marsh conservation easement where they are found.



Appendix B. Pitkin Marsh lily (*Lilium pardalinum* ssp. *pitkinense*) capsule count data at Cunningham Marsh, Sonoma Co. 2010-2018.

Conducted by Kate Symonds, USFWS Biologist (thru 2014) (Retired 2015)

Notes:
October 31, 2010 lily capsule count (heavy rains week previous which may have downed and obscured some capsules)
October 24, 2011 lily capsule count (two light rains early in Oct., otherwise mild weather)
October 18, 2012 lily capsule count (No appreciable rain to date, mild weather)
October 22, 2013 lily capsule count (driest calendar year on record, Sept. 0.48" of rain)
October 22, 2014 lily capsule count (one of the driest calendar years on record, few showers to date, mild weather)
October 18, 2015 lily capsule count (4 years of drought, recent exclosure weeding, mild weather)
No data were collected in 2016 or 2017
October 22, 2018 lily capsule count (severe rabbit browsing of stems in summer, 1 rain to date, last 3 years had more "normal" precipitation)

	2010	2011		2012			2013			2014			2015			2018		
Exclosure ID	#Capsules	#Capsules	#Stems with Capsules	#Capsules	#Stems with Capsules	#Stems w/o Capsules	#Capsules	#Stems with Capsules	Stems w/o Capsules	#Capsules	#Stems with capsule	#Stems w/o capsules	#Capsules	#Stems with Capsules	#Stems w/o Capsules	#Capsules	#Stems with Capsules	#Stems w/o Capsules
1/3	17	6	2	12	5	2	3	2	0	0	0	0	1	1	7	0	0	0
2	0	0	0	1	1	9	1	1	0	0	0	0	0	0	0	0	0	0
4/5	128	316	184	35	15	19	208	138	93	60	53	22	93	79	89	16	13	67
6	4	41	31	39	17	7	11	9	18	18	9	5	25	16	17	0	0	0
7	3	11	6	0	0	0	5	2	0	0	0	0	2	1	0	1	1	0
8	23	50	0	0	0	0	11	5	8	3	2	12	7	3	1	1	1	2
9*	1	7	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10*	28	9	3	32	11	0	0	0	0	1	1	1	5	4	4	0	0	3
11*	7	9	4	15	13	3	2	2	18	5	5	8	3	8	0	0	0	0
"A"*	N/A	0	0	0	0	0	0	0	0	0	0	0	N/A			N/A		
"B"*	0	0	0	0	0	0	0	0	0	0	0	0	N/A			N/A		
"C"*	N/A	0	0	0	0	0	0	0	0	0	0	0	N/A			N/A		
"D"*	2	0	0	0	0	0	0	0	0	0	0	0	N/A			N/A		
Total	213	449	236	162	79	44	241	159	137	87	70	48	136	107	126	18	15	72

Notes:
*Established in 2009
2010: Stems "with" or "without" capsules were not counted. Vegetative stems in 2010 seemed to be fewer than in previous years'.
2018: Conducted count with USFWS biologists Betsy Bainbridge, Ellie DeMarse, and CDFW biologist Jeb Bjerke. Similar to prior years, most lilies were found in one enclosure.

Appendix C. Stem and capsule abundance at Cunningham Marsh over the past eight years (2010-2018). The number of capsules, as well as the number of stems bearing capsules, has significantly declined while stems without capsules have increased.