5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Schiedea kealiae* (maʻoliʻoli)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawaiʻi

Name of Reviewer:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Conservation & Restoration Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) beginning in October 2018. The review was based on a review of current, available information since the last 5-year review for *Schiedea kealiae* (USFWS 2013). The evaluation completed by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Conservation and Restoration Team Manager.

Background:

For information regarding the species' listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (*http://ecos.fws.gov/tess_public*).

Review Analysis:

Please refer to the previous 5-year reviews for *Schiedea kealiae* published in the Federal Register on August 21, 2010 and August 13, 2013 (available at *https://ecos.fws.gov/docs/five_year_review/doc3320.pdf* and *https://ecos.fws.gov/docs/five_year_review/doc4237.pdf*) for a complete review of the species' status, threats, and management efforts. We are not aware of any significant new information regarding the species' biological status since listing to warrant a change in the Federal listing status of *S. kealiae*.

This short-lived perennial subshrub in the Caryophyllaceae (carnation) family is endangered and endemic to Oʻahu. The current status and trends for *Schiedea kealiae* are provided in the tables below.

New Status Information:

- Currently there are approximately 150 mature and 100 immature individuals of *Schiedea kealiae* in one population (Keālia) in the Wai‘anae mountains of O‘ahu. Seedlings have been observed, though the majority tend to die during the dry season. Additionally, there are several small satellite populations of 1 to 10 plants scattered in both directions from the main Keālia population. (Keir *et al.* 2016, Loomis 2019, in litt.).
- In 2012, 10 critical habitat units were designated in two ecosystems (coastal and lowland dry) in the Wai‘anae mountains on O‘ahu (1,495 acres, 605 hectares) (77 FR 57648, September 18, 2010).

New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this species. Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini *et al.* (2013) concluded that *Schiedea kealiae* is extremely vulnerable to the impacts of climate change, with a vulnerability score of 0.933 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions may be needed to conserve this taxon into the future, such as locating key microsites that overlap with current and future climate envelopes for outplanting efforts.
- Invertebrate predation and herbivory— Giant African Snails (*Achatina fulica*) have been observed eating plants, particularly plants at early life stages. Snails are abundant at Keālia Trail during and after heavy precipitation events. This could exacerbate the impacts of climate change, particularly with projections that include more high precipitation storms in dry areas and convective downpours during otherwise drier times when seedlings are already under water stress (Loomis 2019, in litt.).

New Management Actions:

- Captive propagation for genetic storage and reintroduction—
    - The Army Natural Resources Program-O‘ahu (ANRP) reports collection and storage of 2,586 seeds from one population representing 10 individuals (U.S. Army 2018).
    - The Lyon Seed Conservation Laboratory reports 7,408 seeds in storage collected in 2014 representing 22 individuals from one population (Lyon Arboretum 2018).
    - Waimea Arboretum reports nine plants in refugia representing two wild individuals in 2013, 60 plants representing two wild individuals in 2014, four plants representing one wild individual in 2015, and 2 plants representing one wild individual in 2017 (Waimea Arboreum 2013, 2014, 2015, 2017).
    - Pahole Rare Plant Facility (PRPF) reports seven plants in refugia representing one individual from Keālia (PRPF 2018).

Synthesis:
Currently there are at least 150 mature and 100 immature individuals of *Schiedea kealiae* in the Waiʻanae mountains of Oʻahu. A landscape-based assessment of climate change vulnerability for native plants of Hawaiʻi using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *S. kealiae* is extremely vulnerable to the effects of climate change. Predation by Giant African Snails is a threat to seedlings. Collection and propagation for storage is ongoing.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Oʻahu Plants (USFWS 1998), and have been updated according to the draft revised recovery objective guidelines developed by the Hawaiʻi and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Schiedea kealiae is a short-lived perennial subshrub. To prevent extinction, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g*., fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections. In addition, a minimum of three populations should be documented on Oʻahu where they now occur or occurred historically and each of these populations must be naturally reproducing (*i.e.,* viable seeds, seedlings, saplings) and increasing in number, with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. There is only one population of at least 50 mature individuals, genetic representation is incomplete and not all threats are managed (Table 1, Table 2). Therefore, *S. kealiae* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
We are not aware of any new threats except for additional data on this taxon's vulnerability to climate change and predation and herbivory by Giant African Snails. There is no significant new information regarding the species' biological status since the last 5-year review in 2013. Thus, the following recommendations for future actions are added or reiterated for the 5-year review for 2019.

- Surveys and inventories—Survey geographical and historical range for a thorough assessment of the species' status.

- Ungulate monitoring and control—Fence the remaining population to protect plants from impacts of feral ungulates.
- Invasive plant monitoring and control—Control established ecosystem-altering nonnative invasive plant species, and those that compete with *Schiedea kealiae* at the remaining population.
- Fire protection—Develop and implement fire prevention plans to protect the most vulnerable populations.
- Drought remediation—Protect populations from competition by nonnative plants and fence and remove feral ungulates to prevent further effects of drought such as erosion.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for the recovery of the species.
- Invertebrate control and research—Implement effective slug and nonnative snail control at all populations, focusing especially on the Giant African snails at Keālia.
- Captive propagation for genetic storage and reintroduction—Continue seed collection for genetic storage and propagation for reintroduction. Investigate effective propagation methods.
- Reintroduction—Establish new populations and augment existing populations, keeping close track of maternal source used for *ex situ* propagation.
- Population biology research—
    - Continue to conduct genetic studies to assess the genetic variability and the viability of remaining population.
    - Continue to investigate the causes of reproductive failure and implement techniques to improve natural recruitment.
- Alliance and partnership development—Initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

Table 1. Status and trends of *Schiedea kealiae* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	300–500	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1998 (recovery plan)	300–500	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2003 (critical habitat)	265–315	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2010 (5-year review)	Unknown	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2012 (critical habitat)	50–100	0	All threats managed in all three populations	No
			Complete genetic storage	Partially

			Three populations with 50 mature individuals each	No
2013 (5-year review)	Unknown	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2019 (5-year review)	>150 mature; 100 immature	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Reproduction (*i.e.* viable seeds, seedlings) at all three populations	Yes, at the main population
			Three populations with 50 mature individuals each	No, one population >50

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second after Preventing Extinction).

Table 2. Threats to *Schiedea kealiae* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate destruction and degradation of habitat	A	Ongoing	None
Degradation of habitat by established ecosystem-altering invasive plant species	A	Ongoing	None
Fire destruction and degradation of habitat	A	Ongoing	None
Drought	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Ungulate predation and herbivory	C	Ongoing	None
Invertebrate predation and herbivory	C	Ongoing	None
Competition with established invasive plant species	E	Ongoing	None
Low numbers	E	Ongoing	Partial, seed collection and propagation

References:

See previous 5-year reviews for a full list of references (USFWS 2010, 2013). Only references for new information are provided below.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 134 pp.

[HPPRCC] Hawai‘i and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

Keir, M., V.L. Caraway, L. Weisenberger, M. Sporck-Koehler, S.M. Gon, N. Sugii, and J. Kwon. 2016. *Schiedea kealiae.* The IUCN Red List of Threatened Species 2016: e.T80218288A115506982. *http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T80218288A80218292.en*.

Loomis, A. 2019, in litt. Email regarding the current status of *Schiedea kealiae*. 9 SEP 2019.

Lyon Arboretum. 2018. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[PRPF] Pahole Rare Plant Facility. 2018. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[U.S. Army] U.S. Army, Environmental Division. 2018. Report to the U.S. Fish and Wildlife Service for Oahu Army Natural Resource Program, Permit: TES-043638, Reporting period January 1, 2018-December 31, 2018. 16 pp.

[USFWS] U.S. Fish and Wildlife Service. 2012. Endangered and threatened wildlife and plants; Endangered status for 23 species on Oahu and designation of critical habitat for 124 species; final rule. Department of the Interior, Federal Register 77 (181): 57648–57862, September 18, 2012.

[USFWS] 2013. *Schiedea kealiae* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc4237.pdf.*

[USFWS] 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

Waimea Arboretum. 2013. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Waimea Arboretum. 2014. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Waimea Arboretum. 2015. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

Waimea Arboretum. 2017. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

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SIGNATURE PAGE for 5-YEAR REVIEW of *Schiedea kealiae* (ma‘oli‘oli)

Pre-1996 DPS listing still considered a listable entity? N/A

Recommendation resulting from the 5-year review:

_____ Delisting
_____ Reclassify from Endangered to Threatened status
_____ Reclassify from Threatened to Endangered status
_X____ No Change in listing status

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

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