5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Cyanea lobata* (hāhā)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; initiation of 5-year status reviews of 76 species in Hawaii, Oregon, Washington, Montana, and Idaho. Federal Register 81(29): 7571–7573.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawai‘i

Name of Reviewers:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Gregory Koob, 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 (USFWS) beginning in August 2017. The review was based on a review of current, available information since the last 5-year review for *Cyanea lobata* (USFWS 2014). The evaluation by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Gregory Koob, 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 *Cyanea lobata* published in the Federal Register on August 2, 2011 and March 12, 2014 (available at *http://ecos.fws.gov/docs/five_year_review/doc3821.pdf* and *https://ecos.fws.gov/docs/five_year_review/doc4389.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 *C. lobata*.

This short-lived perennial shrub in the Campanulaceae (bellflower) family is endangered and has two recognized subspecies: *Cyanea lobata* subsp. *baldwinii*, endemic to the island of Lāna‘i, and *C. lobata* subsp. *lobata*, endemic to the island of Maui. The current status and trends for *Cyanea lobata* are provided in the tables below.

New Status Information:

- As reported in the 5-year review in 2014, *Cyanea lobata* subsp. *baldwinii* was known from one population of two individuals at Lānaʻihale on Lānaʻi. Two individuals at another population at Hauola Gulch have not been observed since 2012. Currently, there are still only two individuals at Lānaʻihale (PEPP 2016, 2017a). Also in 2014, we reported two populations of *C. lobata* subsp. *lobata* on west Maui totaling three individuals. Currently, there are two individuals at Hāʻena Nui (Kapunakea Preserve) and one individual at Honokōhau Gulch (Puʻu Kukui Watershed Preserve) on west Maui (Oppenheimer 2018, in litt.; PEPP 2017a). Two individuals at a third population at Honokōwai have not been observed since 2016 and this population is considered to be extirpated (PEPP 2016).
- In 2012, the Service proposed revision of critical habitat for *Cyanea lobata* subsp. *baldwinii*, and the proposed rule identified one critical habitat unit on Lānaʻi in the montane wet ecosystem (238 ac, 101 ha) (77 FR 34464, July 11, 2012). In the final rule published in 2016, the Service excluded critical habitat for this subspecies on the island of Lānaʻi because, as demonstrated by the ongoing conservation activities by the private landowner, their commitment to develop the Lānaʻi Natural Resources Plan, and a memorandum of understanding with the Service, exclusion from critical habitat would provide greater long-term benefits to the subspecies than designation of critical habitat (USFWS 2015; 81 FR 17790, March 30, 2016). Also in 2016, 10 critical habitat units were designated in two ecosystems (lowland wet and wet cliff) on west Maui for *C. lobata* subsp. *lobata* (6,474 ac, 2,621 ha) (81 FR 17790, March 30, 2016).

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 Hawaiʻi 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) was conducted at the species level and concluded that *Cyanea lobata* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.644 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). *C. lobata* subsp. *lobata* and subsp. *baldwinii* are the only two subspecies in this taxon. Therefore, additional management actions are needed to conserve this taxon into the future.
- Fire destruction or degradation of habitat—Fire is reported to be a threat to *Cyanea lobata* subsp. *lobata* on west Maui (Spork-Koehler and Chau 2016). Fire can destroy dormant seeds as well as individual plants. Successive fires burn farther and farther into native habitat and alter microclimate conditions to further alter habitat conditions to favor nonnative plants. Nonnative plants convert native plant communities to nonnative dominated plant communities (D'Antonio and Vitousek 1992; Tunison *et al*. 2002). Increasing episodes of drought, expansion of

invasive grass cover, and temperature increases, have led to an increase in the number of wildfires on Maui (Trauernicht *et al.* 2015).

- Drought degradation of habitat—Drought is observed to be a threat to both subspecies of *Cyanea lobata* on Lānaʻi and Maui (Spork-Koehler and Chau 2016). Over the past 100 years, the Hawaiian Islands have experienced an annual decline in precipitation from just over 9 percent, increasing to as much as 15 percent within the last 20 years (US-NSTC 2008; Chu and Chen 2005; Diaz 2005). Drought affects plants directly by desiccation. The increase in drought frequency and intensity leads to a self-perpetuating cycle of increase in cover of nonnative plants, increase in the number of fires, and an increase of erosion (US-GCRP 2009; Warren 2011). Recent episodes of drought have also driven axis deer farther into urban and forested areas in search of food, increasing their negative impacts to native vegetation from herbivory and trampling (Waring 1996, in litt; Nishibayashi 2001, in litt.).

New Management Actions:

- Invasive plant monitoring and control—The Plant Extinction Prevention Program (PEPP) monitors both subspecies of *Cyanea lobata* on Lānaʻi and Maui, and conducts manual and chemical control of nonnative plants in areas around wild and reintroduced individuals (PEPP 2013, 2014, 2015, 2016, 2017b).
- Ungulate monitoring and control—The last wild individuals of *Cyanea lobata* subsp. *baldwinii* will be provided some protection from feral ungulates once the exclosure they are within is completed and all feral ungulates are removed (USFWS 2015). Surveys to assess the necessary repairs to the fence are ongoing (Donoho 2016, in litt.).
- Captive propagation for genetic storage and reintroduction—
    - The Lyon Seed Conservation Laboratory reports approximately 56,000 seeds in collection since 2013 from one founder in the Lānaʻi population of *Cyanea lobata* subsp. *baldwinii*, and over 8,000 seeds in collection from the Waikapū outplanting and Hāʻena Nui Gulch populations of *C. lobata* subsp. *lobata* on west Maui (Lyon Arboretum 2017). Two founders are represented by five outplants at Lānaʻihale on Lānaʻi, and four founders on west Maui are represented in *ex situ* collections (one from Waikapū, one from Honokōhau, and one from Hāʻena Nui Gulch) (PEPP 2017).
    - The Olinda Rare Plant Facility (ORPF) reports 15 *Cyanea lobata* subsp. *baldwinii* in propagation representing four founders from Hauola Gulch on Lānaʻi, and 31 *C. lobata* subsp. *lobata* in propagation representing at least nine founders from Hāʻena Nui Gulch, Kahakuloa, and Kapunakea on west Maui (ORPF 2013, 2014, 2017).
    - The Plant Extinction Prevention Program (PEPP) reports that two of the three reintroduced individuals remain at Puʻualiʻi and two of the five reintroduced individuals remain at Lānaʻihale on Lānaʻi (PEPP 2018).
    - Predator and herbivore monitoring and control—PEPP conducts rat control at wild and reintroduced populations of *Cyanea lobata* subsp. *baldwinii* on Lānaʻi (PEPP 2016, 2017b).

- Stochastic events—Build resiliency and redundancy—
    - PEPP surveys for new reintroduction sites and has reintroduced eight individuals of *Cyanea lobata* subsp. *lobata* at Waikapū, Maui, in 2013, 16 individuals at Honanana, Maui, in 2014, four individuals at ʻĪao, Maui, in 2014, and six individuals at Waiheʻe, Maui, in 2014, and has reintroduced nine individuals of *C. lobata* subsp. *baldwinii* at Puʻualiʻi, Lanai, in 2014, and five individuals (representing two founders) at Lānaʻihale, Lānaʻi. Of those nine at Puʻualiʻi, three survive as of 2016 (PEPP 2013, 2014, 2016, PEPP 2017a).
    - The ORPF propagates both subspecies, and has contributed at least 20 individuals of *Cyanea lobata* subsp. *lobata* for outplanting at Kahakuloa, three individuals for ʻĪao Valley, four individuals for Waikapū, and five individuals for Waiheʻe on Maui; and at least seven *C. lobata* subsp. *baldwinii* for reintroduction on Lānaʻi (ORPF 2014, 2015).

Synthesis:
Currently, there are two occurrences of *Cyanea lobata* subsp. *lobata* on west Maui (three total individuals), and one occurrence (two individuals) of *C. lobata* subsp. *baldwinii* on Lānaʻi. 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 *Cyanea lobata* is highly vulnerable to the effects of climate change, in that there will be a smaller area of suitable habitat available for the species in the near future. Seed collections from outplanted or greenhouse material are ongoing. Of the five extant founders, only one of them is not represented in *ex situ* genetic storage collections. Outplanting efforts are ongoing, with 34 individuals of *C. lobata* subsp. *lobata* reintroduced (28 remain), and 14 individuals of *C. lobata* subsp. *baldwinii* reintroduced (eight remain).

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Maui Plant Cluster (USFWS 1997), 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.

Cyanea lobata is a short-lived perennial shrub. 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 of each subspecies should be documented on the island where they now occur or occurred historically. 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 as there are no populations of at least 50 reproducing individuals, genetic representation is incomplete (Table 1), and all threats are not being sufficiently managed throughout the range of the subspecies (Table 2). Therefore, *Cyanea lobata* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
Drought and wildfire have been added as new threats; however, we are not aware of significant new information regarding the species' biological status since the last 5-year review in 2014. Thus, the following recommendations for future actions are added or reiterated for the 5-year review for 2018.

- Surveys and inventories—Continue to survey for additional populations of both subspecies of *Cyanea lobata* in areas of potentially suitable habitat.
- Ungulate monitoring and control—Continue to construct and maintain large-scale and small-scale fenced exclosures to protect individuals from the negative impacts of feral ungulates and to prevent imminent extinction in the wild.
- Invasive plant monitoring and control—
    - Continue to control established ecosystem-altering nonnative invasive plant species around all populations.
    - Continue to control invasive nonnative species that compete with the species around all populations.
    - Research and develop potential biological control agents for the nonnative plants *Clidemia hirta* and *Tibouchina herbacea* that modify and destroy habitat of, and outcompete, both subspecies of *Cyanea lobata*.
- Captive propagation for genetic storage and reintroduction—
    - Evaluate genetic resources currently in storage to determine the need to place additional genetic resource into long-term storage due to these subspecies' vulnerability to climate change.
    - Continue propagation efforts for maintenance of genetic stock.
- Reintroduction and translocation—Continue to reintroduce individuals into suitable habitat within historic range that is being managed for known threats to both subspecies.
- Fire monitoring and control—Develop and implement fire prevention management plans.
- Predator and herbivore monitoring and control—
    - Implement effective control methods for rodents at wild and reintroduced populations.
    - Develop and implement effective control methods for slugs.

- Stochastic events—Build resiliency and redundancy—Increase numbers of populations and individuals scattered through historic range to reduce impacts from erosion and drought.
- Climate change adaptation strategy—Research the suitability of habitat for reintroducing these subspecies in the future due to impacts from climate change.
- Alliance and partnership development—Continue to initiate, plan, and contribute to implementation of ecosystem-level restoration and management to benefit this taxon.

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1992 (listing)	4 (Maui)	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1997 (recovery plan)	Unknown	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2003 (critical habitat)	12 (Maui) 0 (Lānaʻi)	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2011 (5-year review)	4 (Maui) 3 (Lānaʻi)	4	All threats managed in all three populations	Partially
			Complete genetic storage	Partially

			Three populations with 50 mature individuals each	No
2014 (5-year review)	3 (Maui) 2 (Lānaʻi)	16	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2016 (critical habitat)	8 (Maui)** 4 (Lānaʻi)	40	All threats managed in all three populations	Partially
			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?**
2018 (5-year review)	3 (Maui) 2 (Lānaʻi)	36 remain	All threats managed in all three populations	Partially, nonnative plant and rat control
			Complete genetic storage	Partially
			Reproduction (*i.e.* viable seeds, seedlings) at all three populations	No
			Three populations with 50 mature individuals each	No

* 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).

** The number of individuals estimated on Maui during preparation of the critical habitat final rule between 2010-2012 was higher than previously provided for the 2014 review.

Table 2. Threats to *Cyanea lobata* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, fence construction ongoing
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, nonnative plant and rat control
Erosion and drought destruction or degradation of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Fire destruction or degradation of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	None
Rodent predation or herbivory	C	Ongoing	Partial, some rat control
Invertebrate predation or herbivory	C	Ongoing	None
Stochastic events—Drought mortality and reduced viability	E	Ongoing	None
Stochastic events—Reduced viability due to small populations	E	Ongoing	Partial, seed storage, propagation, and reintroduction efforts are ongoing

References:

See the previous 5-year reviews for a full list of references (USFWS 2011, 2014). Only references for new information are provided below.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Cyanea lobata* (hāhā)

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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