5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Cyanea dunbariae* (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 dunbariae* (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 dunbariae* published in the Federal Register on January 18, 2008, and on March 12, 2014 (available at *http://ecos.fws.gov/docs/five_year_review/doc1770.pdf* and *https://ecos.fws.gov/docs/five_year_review/doc4387.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. dunbariae*.

This short-lived perennial shrub in the Campanulaceae (bellflower) family is endangered and endemic to Moloka‘i. The current status and trends for *Cyanea dunbariae* are provided in the tables below.

New Status Information:

- The population of four individuals reported in the last 5-year review had as many as 10 individuals at the time of designation of critical habitat in 2016; however, currently this population has declined to only one individual (PEPP 2017a).
- In 2016, five critical habitat units were designated for *Cyanea dunbariae* in three ecosystems (lowland mesic, lowland wet, and montane mesic) on Molokaʻi (17,704 ac, 7,165 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) concluded that *Cyanea dunbariae* is highly vulnerable to the impacts of climate change, with a vulnerability score of 0.727 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future.
- Landslides and flooding destruction or degradation of habitat—Landslides have been reported as a threat to *Cyanea dunbariae*. The only known individuals of this species occur in a steep, rocky area along a stream. Landslides, including tree falls and erosion associated with them, can have a significant effect on small populations by destabilizing substrate, altering hydrological patterns, and by damaging and destroying individual plants (PEPP 2014; Stearns 1985).
- Lack of adequate hunting regulations—The only known wild population of *Cyanea dunbariae* on Molokaʻi occurs in a State hunting area in the Molokaʻi Forest Reserve (FR). Nonnative feral ungulates pose a major ongoing threat to native species through destruction and modification of habitat, and through direct herbivory or predation. In addition, public hunting areas are not fenced and game mammals have unrestricted access to most areas across the landscape, regardless of underlying land use designation; therefore, any unfenced populations are at risk (DLNR 2010). Only one reintroduced population is protected within an exclosure.

New Management Actions:

- Ungulate monitoring and control—
    - A few reintroduced individuals of *Cyanea dunbariae* within a fenced exclosure are provided protection from feral ungulates (PEPP 2014, 2015, 2016, 2017a).
    - In 2016, the Hawaiʻi Department of Land and Natural Resources, Division of Forestry and Wildlife, and The Nature Conservancy, for the East Molokaʻi Watershed Partnership, submitted a draft Environmental Assessment for the proposed Pākuʻi Watershed Project. The proposed project's goal is the construction of a 5.5-mile fence, which, in conjunction with the existing Kapualei Extension fence, will enclose the Pākuʻi Unit and protect 2,080 ac of vital watershed on southeast Molokaʻi

(TNC 2016). If completed, the fence would provide protection from ungulates to this lowland mesic habitat of *Cyanea dunbariae*.
    - In 2014, PEPP surveyed areas for expansion of the existing exclosure, and completed the fence expansion in April of that year (PEPP 2014).
- Captive propagation for genetic storage and reintroduction—
    - Currently, three founders (100 percent) are represented by reintroduction of 55 propagules into an exclosure and in seed collections (PEPP 2017b).
    - Lyon Arboretum Micropropagation Laboratory reports almost 5,000 containers of propagules of *Cyanea dunbariae* collected between 2002 and 2016. The Lyon Arboretum Seed Conservation Laboratory reports almost 10,000 seeds in storage from collections made between 2009 and 2014 (Lyon Arboretum 2017).
    - The National Tropical Botanical Garden (NTBG) reports over 15,000 seeds collected from 11 individuals from Mokomoko gulch from 1993 to 2002 (NTBG 2017).
    - The Olinda Rare Plant Facility (ORPF) reports 41 potted plants in storage, with 32 of those sent out for reintroduction (ORPF 2014, 2015, 2017). The ORPF also continues to store and propagate fruit from collections.
- Stochastic events—Build resiliency and redundancy—Reintroduction of individuals of *Cyanea dunbariae* at Kainalu are ongoing (PEPP 2014, 2015, 2016, 2017a).

Synthesis:
Surveys conducted since completion of the last 5-year review for this species confirm the loss of three of the four remaining wild individuals at Mokomoko. Seed collections from outplanted or greenhouse material are ongoing. A landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *Cyanea dunbariae* 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. The last four founder plants are well-represented in collections. Outplanting efforts are ongoing, with 28 of the 55 reintroduced individuals remaining.

Stabilizing (interim), downlisting, and delisting objectives were provided in Moloka‘i II: the Addendum to the Recovery Plan for the Moloka‘i Plant Cluster (USFWS 1998), and have been updated according to the draft revised recovery objective guidelines developed by the Hawai‘i 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 dunbariae 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 should be documented on Moloka‘i where they now occurs 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, although three founders are represented in collections and reintroductions, there is only one individual in the wild (Table 1), and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Cyanea dunbariae* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
Landslides have been reported as a threat to *Cyanea dunbariae*; 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—Survey for additional populations of *Cyanea dunbariae* in areas of potentially suitable habitat.
- Ungulate monitoring and control—Continue to construct fenced exclosures to protect individuals from the negative impacts of feral ungulates. Protect all occurrences against browsing and habitat disturbances from feral ungulates to prevent extinction.
- Invasive plant monitoring and control—
    - Control established ecosystem-altering nonnative invasive plant species around all populations.
    - Control invasive nonnative species that compete with the species around all populations.
- Captive propagation for genetic storage and reintroduction—
    - Continue to conduct research on seed storage techniques to increase seed viability for adequate genetic representation.
    - 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 this species.
- Predator and herbivore monitoring and control—
    - Implement effective control methods for rodents at the last known location.
    - Research 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 landslides.

- Climate change adaptation strategy—Assess the modeled effects of climate change on this species, and determine future landscape needed for the recovery of the species.
- Alliance and partnership development—Continue to work with partners in planning and implementation of ecosystem-level restoration and management to benefit this taxon.

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

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1996 (listing)	15–20	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1998 (recovery plan)	35–40	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2003 (critical habitat)	30	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2008 (5-year review)	3–16	0	All threats managed in all three populations	No
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No

2014 (5-year review)	4	32	All threats managed in all three populations	Partially, exclosure constructed
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2016 (critical habitat)	10**	56	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?**
2018 (5-year review)	1	28 remain	All threats managed in all three populations	No
			Complete genetic storage	Yes
			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 provided for preparation of the critical habitat final rule were actually provided between 2010-2012, showing a steady decline.

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

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, reintroduction within exclosure
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	None
Landslides and flooding destruction or degradation of habitat	A	Ongoing	None
Climate change degradation or loss of habitat	A	Ongoing	None
Ungulate predation or herbivory	C	Ongoing	Partial, reintroduction within exclosure
Rodent predation or herbivory	C	Ongoing	None
Invertebrate predation or herbivory	C	Ongoing	None
Lack of adequate hunting regulations	D	Ongoing	None
Stochastic events—Reduced viability due to low numbers	E	Ongoing	Partial, seed storage, propagation and reintroduction are ongoing

References:

See the previous 5-year reviews for a full list of references (USFWS 2008, 2014). Only references for new information are provided below.

[DLNR] Department of Land and Natural Resources. 2010. Hawai‘i administrative rules, title 13, subtitle 5, part 2, chapter 123, rules regulating game mammal hunting. 78 pp.

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. Hawai‘i Cooperative Studies Unit, University of Hawai‘i at Hilo, Hawai‘i. 134 pp.

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

Lyon Arboretum. 2017. Micropropagation and seed conservation laboratory databases.

[NTBG] National Tropical Botanical Garden. 2017. Controlled propagation report.

[ORPF] Olinda Rare Plant Facility. 2014. Controlled propagation report.

[ORPF] 2015. Controlled propagation report.

[ORPF] 2017. Controlled propagation report.

[PEPP] Plant Extinction Prevention Program. 2014. PEPP annual report fiscal year 2014 (July 1, 2013-June 30, 2014). 185 pp.

[PEPP] 2015. PEPP annual report fiscal year 2015 (July 1, 2014-June 30, 2015). 179 pp.

[PEPP] 2016. Plant Extinction Prevention Program FY 2016 Annual Report (Oct 1, 2015-Sep 30, 2016), US FWS CFDA Program #15.657; Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F14AC00174, December 24, 2016, UH Manoa, PCSU, PEPP. 237 pp.—

[PEPP] 2017a. Plant Extinction Prevention Program FY 2016 Annual Report (Oct 1, 2015-Sep 30, 2016), US FWS CFDA Program #15.657; Endangered Species Conservation-Recovery Implementation Funds, Coop Agreement F14AC00174, December 24, 2016, UH Manoa, PCSU, PEPP. 237 pp.

[PEPP] 2017b. Statewide species totals *ex situ*, Excel table.

Stearns, H.T. 1985. Chapter 4, Geology, and Chapter 15 Water. *In* Geology of the State of Hawai‘i, 2nd edition, Pacific Books, Palo Alto. Pp. 99–107; 291–305.

[TNC] The Nature Conservancy, Moloka‘i Program. 2016. Draft environmental assessment for the Pakui Watershed project. 553 pp.

[USFWS] U.S. Fish and Wildlife Service. 2014. *Cyanea dunbariae* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc4387.pdf.*

[USFWS] 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, February 12, 2016.

[USFWS] 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokai, Lanai, Maui, and Kahoolawe for 135 species; final rule. Federal Register 81 (61): 17790–18110, March 30, 2016.

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