

5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Cyanea longiflora* (Haha)

Current Classification: Endangered

Federal Register notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2007. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 71 species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and territory of Guam. Federal Register 72(45):10547-10550.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii

Name of Reviewer(s):

Christian Torres-Santana, Pacific Islands Fish and Wildlife Office, Student Trainee Biologist

Marie Bruegmann, Pacific Islands Fish and Wildlife Office, Plant Recovery Coordinator

Marilet A. Zablan, Pacific Islands Fish and Wildlife Office, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species

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) in fiscal year 2008. The review was based on the proposed rule and final critical habitat designation for *Cyanea longiflora* and other species from the island of Oahu (USFWS 2002, 2003), as well as a review of current, available information. The Bernice P. Bishop Museum provided an initial draft of portions of the 5-year review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of the lead PIFWO biologist was reviewed by the Plant Recovery Coordinator and these comments were incorporated into the draft five-year review. The document was then reviewed by the Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species before submission to the Field Supervisor for approval.

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).

Application of the 1996 Distinct Population Segment (DPS) Policy:

This Policy does not apply to plants.

Review Analysis:

Please refer to the final critical habitat designation for *Cyanea longiflora* published in the Federal Register on June 17, 2003 (USFWS 2003) for a complete review of the species' status (including biology and habitat), threats, and management efforts. No new threats and no significant new information regarding the species biological status have come to light since listing to warrant a change in the Federal listing status of *C. longiflora*.

Cyanea longifolia, endemic to Oahu, was historically known from five populations in the Waianae Mountain range and six populations in the Kooloau Mountains (USFWS 1996). It is usually found growing on steep slopes or ridge crest in mesic *Acacia koa*-*Metrosideros polymorpha* (koa-ohia) forest in the Waianae Mountains and on wet *M. polymorpha*-*Drycranopteris* (ohia-uluhe) forest in the Koolau Mountains at elevations ranging from 221 to 1,191 meters (725 to 3,906 feet) (USFWS 1996, 2003). At the time of Federal listing, the number of populations had declined to five, consisting of only 220 to 300 individuals (USFWS 1996). Population and individual numbers have continued to decline, with only three extant populations in the Waianae Mountains currently known, consisting of a total of 76 mature, 84 immature individuals, and 28 seedlings. The Kapuna to West Makaleha population consists of 23 mature, 16 immature wild individuals, and four seedlings. At Pahole, 50 mature, 63 immature, and 22 wild seedlings were observed in 2007. The Makaha to Waianae Kai population currently has 3 mature, 5 immature, and 2 seedlings. All populations have individuals of all size classes, with about 47 percent of existing plants being mature individuals (USFWS 2007). A few additional individuals have been found with recent surveys within the historical range and more individuals and populations of this species may be found with additional surveys (U.S. Army 2006, 2007). The Kapuna to West Makaleha population was augmented with 23 immature individuals in 2005, of which 20 were surviving in 2006, and 19 in 2007 (83 percent survivorship) (U.S. Army 2006, 2007; USFWS 2007).

It is likely that this species has a seed bank, since sites monitored in January 2007 had no living plants; but during subsequent surveys in August 2007, 60 stems representing an unknown number of genetic individuals were found (U.S. Army 2007). *Cyanea longiflora*, similar to other species of *Cyanea*, presumably lives less than 10 years. *Cyanea longiflora* likely was pollinated by nectar-feeding birds, and the orange berries suggest seed dispersal by birds. However, the species is likely capable of self-pollination, as evidenced by the fact that isolated plants produce viable seeds (USFWS 2007). Fruit progress from purple to red and are orange at maturity (U.S. Army 2006). Several *C. longiflora* individuals in Kapuna to West Makaleha seem to exhibit fluctuations of fruiting times. Past collection records show fruit maturing as early as June, and as late as the end of September. For high germination rates, fruit must be collected when fully mature. Seeds stored in refrigerated conditions (5 degrees Celsius) at 20 percent relative humidity show germination rates ranging from 68 to 100 percent on 1 percent water agar (U.S. Army 2006). No aging has been detected at these conditions after four years (U.S. Army 2007).

The major threats to *Cyanea longiflora* are degradation and loss of habitat from feral pigs (*Sus scrofa*) (Factors A, C, and D), potential impact from military activities (Factor E), potential predation by rats (*Rattus* spp.) (Factor C) (USFWS 1996, 1998, 2003, 2007; U.S. Army 2006, 2007). Although feral goats (*Capra hircus*) were not previously reported as a threat for this species, they are present at the Makaha population (U.S. Army 2007) and are likely causing habitat degradation (Factors A and D). The Pahole, Makaha to Waianae Kai, and part of the Kapuna to West Makaleha populations are fenced and partially protected from feral ungulates and the remainder of the latter population is proposed to be fenced (U.S. Army 2006, 2007). Competition from invasive introduced plant species (Factor E) is another major threat, competing for light, space and water resources. The most serious plant species impacting *C. longiflora* include *Psidium cattleianum* (strawberry guava), *Clidemia hirta* (Koster's curse) and *Rubus argutus* (prickly Florida blackberry) (USFWS 1996, 1998, 2003, 2007). Partial eradication of invasive plant species in vicinity of *C. longiflora* has taken place only for the Kapuna to West Makaleha and Pahole populations (U.S. Army 2007). Three West Makaleha individuals occur on a steep slope and are topographically protected from ungulates. In 2007, genetic representation of all three of these plants that are reached on rappel were achieved (U.S. Army 2007).

Predation by introduced slugs is presumed to occur for this taxon (Factor C), as it is also a limiting factor causing a significant mortality for the endangered *Cyanea superba* occurring in the same area (U.S. Army 2006, 2007; USFWS 2007; Joe and Daehler 2008). The population from Makaha to Waianae Kai occurs near a trail and vandalism of plants (Factor B) was reported for this population as plant heads were snapped off from two mature tagged plants. Tags were removed from plants and the U.S. Army outreach coordinators are working to educate the community about conservation (U.S. Army 2007).

Individuals growing on ridges are vulnerable to direct destruction by erosion, landslides, and rockslides (USFWS 2007). The Kapuna to West Makaleha and Pahole populations are located within low and very low fire risk zones for military training-related wildfire (Factor E), and the Makaha to Waianae Kai population unit is at risk of fire from illegal campfires (Factor E) (USFWS 2007).

In addition to all of the other threats, species like *Cyanea longiflora* that are endemic to small portions of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by random demographic fluctuations and localized catastrophes such as hurricanes, landslides, flooding and disease outbreaks (Factor E). When considered on their own, the natural processes associated with being a single island endemic do not affect *C. longiflora* to such a degree that it is threatened or endangered with extinction in the foreseeable future, but these natural processes can exacerbate the threat from anthropogenic factors, such as habitat loss for human development or predation by introduced species (Factor E) (USFWS 1998).

To safeguard existing genetic material, propagation for genetic storage and reintroduction is occurring at various botanical institutions in Hawaii. Currently, 2,335 seeds are in storage at the National Tropical Botanical Garden, 121,916 seeds from 78 accessions are at the Center for Conservation Research and Training Seed Storage Laboratory, and 17 micropropagation accessions from three populations and six separate genetic lines are represented in live collections at the Harold L. Lyon Arboretum Micropropagation Laboratory (Harold L. Lyon Arboretum Micropropagation Laboratory 2007; Center for Conservation Research and Training 2007; National Tropical Botanical Garden 2007; U.S. Army 2006, 2007).

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for plants from the island of Oahu (USFWS 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Cyanea longiflora* is a short-lived perennial, and to be considered stable, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (at other than the plant's natural location, such as a nursery or arboretum) collection. In addition, a minimum of three populations should be documented on the island of Oahu. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

The stabilization goals for this species have not been met as only one population has 50 mature individuals and not all threats have been managed (see Table 1). Therefore, *Cyanea longiflora* meets the definition of endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:

- Continue collecting mature fruit from wild individuals particularly for the augmentation of existing populations.
- Continue control of introduced invasive plant species around wild and reintroduced plants.
- Control rats around wild and outplanted individuals.
- Complete large-scale fences around all naturally occurring and reintroduced individuals to control feral ungulates.
- Continue outreach to the community groups near the Makaha population to reduce vandalism.
- Continue reintroducing individuals into protected suitable habitat within historical range and augmenting wild populations.
- Continue research for effective slug control methods.

- Survey historical distribution and habitat for additional populations.
- Assess genetic variability within the populations.
- Study *Cyanea longifolia* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.

References:

Center for Conservation Research and Training Seed Storage Laboratory. 2007. Database. Unpublished.

Harold L. Lyon Arboretum Micropropagation Laboratory. 2007. Micropropagation database. Unpublished.

Joe, S. and C.C. Daehler. 2008. Invasive slugs as under-appreciated obstacles to rare plant restoration: evidence from the Hawaiian Islands. *Biological Invasions* 10(2):245-155.

National Tropical Botanical Garden. 2007. Report on controlled propagation of listed and candidate species, as designated under the U.S. Endangered Species Act. Unpublished.

[U.S. Army] U.S. Army Garrison. 2006. 2006 Status reports for the Makua Implementation Plan and the draft Oahu Implementation Plan. U.S. Army Garrison, Directorate of Public Works, Environmental Division, Schofield Barracks, Hawaii. Unpublished.

[U.S. Army] U.S. Army Garrison. 2007. 2007 Status reports for the Makua Implementation Plan and the draft Oahu Implementation Plan. U.S. Army Garrison, Directorate of Public Works, Environmental Division, Schofield Barracks, Hawaii. Unpublished.

[USFWS] U.S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants; determination of endangered status for twenty-five plant species from the island of Oahu, Hawaii; final rule. *Federal Register* 62(198):53089-53108.

[USFWS] U.S. Fish and Wildlife Service. 1998. Recovery plan for the Oahu plants. U.S. Fish and Wildlife Service, Portland, OR. 270 + pages.

[USFWS] U.S. Fish and Wildlife Service. 2002. Endangered and threatened wildlife and plants; designations of critical habitat for plant species from the island of Oahu, HI; proposed rule concerning designation of critical habitat. *Federal Register* 67(102): 37108-37156.

[USFWS] U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants: final designation or nondesignation of critical habitat for 101 plant species from the island of Oahu, HI; final rule. Federal Register 68(116):35949-35998.

[USFWS] U.S. Fish and Wildlife Service. 2007. Reinitiation of the 1999 Biological Opinion of the U.S. Fish and Wildlife Service for U.S. Army military training at Makua Military Reservation, island of Oahu. 639 pages + appendices. Unpublished.

Table 1. Status of *Cyanea longiflora* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1996 (listing)	220-300	Unknown	All threats managed in all 3 populations	Unknown
			Complete genetic storage	Unknown
			3 populations with 50 mature individuals each	Unknown
1998 (recovery plan)	200-220	0	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Unknown
2003 (critical habitat)	< 217	unknown	All threats managed in all 3 populations	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Unknown
2008 (5-year review)	188	19	All threats managed	Partially
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	Partially

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SIGNATURE PAGE for 5-YEAR REVIEW of *Cyanea longiflora*

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
- No Change in listing status

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Patrick Leonard

Date 4/8/09

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