Cyanea grimesiana ssp. *obatae* (Haha)

5-Year Review
Summary and Evaluation

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii

3. **Adequacy of recovery criteria.**

a. **Do the recovery criteria reflect the best available (i.e., most up-to-date) information on the biology of the species and its habitat?**

__X__ *Yes*

____ *No*

b. **Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and there is no new information to consider regarding existing or new threats)?**

__X__ *Yes*

____ *No*

4. **List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors* are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.**

The threats (Factors A, C, and E) affecting this species are discussed in detail in section II.D. Factors B and D are not considered a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the Recovery Plan for Oahu Plants (Service 1998), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Cyanea grimesiana* ssp. *obatae* is a short-lived perennial, and to be considered stable, this species must be managed to control threats (e.g. fenced) (Factors A, C, and E) and be represented in an *ex situ* collection. In addition, a minimum of three populations should be documented on the island of Oahu where the species now occurs or occurred historically. Each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Cyanea grimesiana* ssp. *obatae* should be documented on the island of Oahu where it now occurs or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats (Factors A, C, and E), with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of 5 consecutive years before downlisting is considered.

This recovery objective has not been met.

A)Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadqequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

For delisting, a total of 8 to 10 populations of *Cyanea grimesiana* ssp. *obatae* should be documented on the island of Oahu where it now occurs or occurred historically. Each of these populations must be naturally reproducing, stable, or increasing in number, and secure from threats (Factors A, C, and E), with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of 5 consecutive years before delisting is considered.

This recovery objective has not been met.

C. Synthesis

Cyanea grimesiana ssp. *obatae* is endemic to the Waianae mountains of Oahu. The species includes one other subspecies, ssp. *grimesiana*, which is endemic to the Waianae and Koolau mountains. Historically, *C. grimesiana* ssp. *obatae* was known from 3 small populations of 16 individuals. In 1994, at the time *C. grimesiana* ssp. *obatae* was listed, there were 3 populations of 18 individuals in the southern Waianae mountains. In 1998, when the recovery plan was published, the populations were reduced to 13 individuals in the same areas. These populations are located in South Palawai Gulch, South Kaluaa Gulch, Central Kaluaa Gulch, Pahole Gulch, West Makaleha Valley, Makaha Valley, and Palikea Gulch (U.S. Army 2006). The Palikea Gulch population consisting of a single immature plant is included here, even though its subspecific identity is yet to be determined since the two subspecies of *C. grimesiana* can only be distinguished upon examination of the flowers or fruit (Makua Implementation Team 2003). The population of *C. grimesiana* ssp. *obatae* in Ekahanui Gulch became extirpated in 2002. However, plants originating from the Ekahanui Gulch stock are in cultivation and some cultivated individuals have been outplanted back into Ekahanui Gulch (U.S. Army 2005a). As of 2005, the Army has outplanted individuals of *C. grimesiana* ssp. *obatae* at South Palawai Gulch (10 mature and 12 immature wild plants with 12 immature augmented plants), and Central Kaluaa (1 mature wild plant and 70 immature augmented plants), and has monitored these areas regularly. The plant at South Kaluaa, the holotype for the species, is fenced, along with 14 outplanted individuals that are still immature. Seedlings from this individual will be outplanted in Central Kaluaa in 2006 or 2007 (U.S.Army 2005a). A reintroduction totaling 305 individuals of *C. grimesiana* ssp. *obatae* was established in The Nature Conservancy's Honouliuli Preserve in Ekahanui Gulch, where a population had been extirpated in 2002 (The Nature Conservancy of Hawaii, Oahu Program 2006). Another augmentation outplanting of 19 mature and 9 immature plants was established in Pahole Gulch in the state-owned Pahole Natural Area Reserve. The current numbers for *C. grimesiana* ssp. *obatae*, including reintroductions, are 8 populations with a total 41 mature and 401 immature individuals.

Habitat degradation and predation by feral pigs (*Sus scrofa*) and goats (*Capra hircus*) are considered the primary threats to *Cyanea grimesiana* ssp. *obatae* (Service 1998, 2003; U.S. Army 2005a) (Factors A and C). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. The pig is originally native to Europe, northern Africa, Asia Minor, and Asia. European pigs became feral and invaded forested areas, especially wet and mesic forests

and dry areas at high elevations. They are currently present on Oahu and inhabit both rain forest and grassland. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Feral pigs are a primary vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al.* 1986; Scott *et al.* 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al.* 1999a). The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, and Hawaii. Feral goats eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al.* 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). The *C. grimesiana* ssp. *obatae* at Ekahanui was extirpated; the specific cause is unknown but likely due to one or more of the described threats. Goat browse and scat were discovered within the fenced exclosure protecting the plants at West Makaleha Valley in May of 2005. Improvements were made to the fence in July 2005, and are believed to be sufficient to keep goats out of the exclosure. The State of Hawaii's Division of Forestry and Wildlife fenced the Pahole Gulch portion of the species' range in 1996 and this unit has been ungulate free since 1998 (Division of Forestry and Wildlife 1996). Also encompassed within large exclosures are plants in Central Kaluaa Gulch and South Palawai Gulch, and the reintroduced population in Ekahanui Gulch. A small fenced exclosure was constructed to protect an immature plant (whose subspecific identity is undetermined) at Palikea Gulch, and an individual plant in Makaha Valley will be included in a fenced exclosure scheduled for construction by the Army in 2007 (Makua Implementation Team 2003; K. Kawelo, U.S. Army Environmental, *in litt*, 2006).

Competition from and habitat degradation by invasive nonnative plant species is a major threat to *Cyanea grimesiana* ssp. *obatae* (Factors A and E). At the time of listing, the primary invasive nonnative plant species impacting *C. grimesiana* ssp. *obatae* were *Clidemia hirta* (Koster's curse) and *Schinus terebinthifolius* (Christmas berry) (59 FR 32932). Currently the nonnative plants *Ageratina riparia* (Hamakua pamakani), *Blechnum appendiculatum*, *Buddleia asiatica* (dog tail), *Christella parasitica*, *Lantana camara* (lantana), *Morella faya* (firetree), *Psidium cattleianum* (strawberry guava), *Rubus rosifolius* (thimbleberry), *Setaria palmifolia* (palm grass), and *Toona ciliata* (Australian red cedar), in addition to those previously indicated, are threats (68 FR 35949). Weed control is conducted at all of the extant wild populations and outplantings (U.S. Army 2005a).

Fire is considered a potential threat to *Cyanea grimesiana* ssp. *obatae*, as this species occurs in mesic forests, which often become very dry in the summer months, and *C. grimesiana* ssp. *obatae* is not considered fire tolerant (Service 2004) (Factors A and E). One potential cause of fire is from military training activities on the Makua Military Reservation. The Army has addressed the threat of fire from their training actions by developing and implementing a fire management plan to minimize the number of ignitions in the reservation, to respond rapidly to any ignitions, and to maintain fire breaks to help contain any ignitions away from the endangered

species locations (U.S. Army 2003). *Cyanea grimesiana* ssp. *obatae* is also threatened by fires ignited through arson (Makua Implementation Team 2003).

Rats (*Rattus* spp.) are considered a major threat to *Cyanea grimesiana* ssp. *obatae* (Factor C) (Service 1998, 2003; U.S. Army 2005a). Rats are known to eat the fruit and strip the bark of some native plants, including plants in the bellflower (Campanulaceae) family with fleshy stems and fruits (Tomich 1986; Cuddihy and Stone 1990; Wagner *et al.* 1995). After Army staff discovered significant rat damage to the *C. grimesiana* ssp. *obatae* plants in West Makaleha in May of 2002, a rat control program was implemented at the site. Rat control is ongoing, at least during fruiting season, at all of the *C. grimesiana* ssp. *obatae* locations except at Pahole Gulch and Palikea Gulch (U.S. Army 2005a).

Introduced slugs also pose a threat to seedlings and young plants of *Cyanea* species (Factor C). Field experiments conducted by Alvin Yoshinaga and Curt Daehler demonstrated that slugs could reduce the survival of *Cyanea* spp. seedlings by as much as 80 percent (A. Yoshinaga, unpublished). Graduate student Stephanie Joe has been recently been hired by the Army as a Natural Resources Research Specialist, and included among her duties is the investigation of control of slug herbivory. Her research on slug impacts on *C. grimesiana* ssp. *obatae* seedlings has revealed similar levels of mortality; a decrease in mean seedling survival by as much as 53 percent (Joe 2006)

The two-spotted leafhopper (*Sophonia rufofascia*) was identified as a threat to *Cyanea grimesiana* ssp. *obatae* in the 1998 Recovery Plan (Factor C). This insect was introduced to Hawaii in the late 1980s and is found on all the major Hawaiian Islands. It appears to feed on almost all plant species, and injects toxins while feeding that causes yellowing and wilting at the feeding site. Funding for research into biocontrol for this insect is not anticipated by the Hawaii Department of Agriculture, and currently there are no management tools for this species (Service 1998; U.S. Army 2005b).

In addition to all of the other threats, species like *Cyanea grimesiana* ssp. *obatae* that are endemic to a portion of a single small 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 and disease outbreaks (Factor E).

Under the terms of the 1999, 2001, and 2004 U.S. Fish and Wildlife Service's Biological Opinions for Routine Military Training at U.S. Army installations on the island of Oahu and the subsequent 2003 Makua Implementation Plan, the Army is addressing the threat to this species from the small number of populations and the small population sizes through genetic storage and propagation for eventual reintroduction (Service 2003; Makua Implementation Team 2003). The University of Hawaii's Lyon Arboretum Micropropagation and Seed Storage Laboratories, the National Tropical Botanical Garden, the State of Hawaii's Division of Forestry and Wildlife's Pahole Rare Plant Facility, and the Audubon Society's Waimea Valley Park are working together to store genetic material long-term against stochastic events and to supply the Army with plants for reintroductions (U.S. Army 2005a; Service 2005). Propagation is also conducted at the Army's base yard (U.S. Army 2005a). The Army's goal for genetic storage of *C. grimesiana*

ssp. *obatae* is to collect seeds from up to 50 individuals from each population (Makua Implementation Team 2003). This goal has been partially met (U.S. Army 2005a).

The goals for genetic storage of *Cyanea grimesiana* ssp. *obatae* have been partially met for two populations. The stabilization, downlisting, and recovery goals for this species have not been met and, therefore, *C. grimesiana* ssp. *obatae* meets the definition of endangered as it remains in danger of extinction throughout all of its range.

III. RESULTS

A. Recommended Classification:

____ Yes, downlist to Threatened
____ Yes, uplist to Endangered
____ Yes, delist
__X__ No, no change is needed

B. New Recovery Priority Number __N/A___

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

- Study the taxonomic relationship or distinctiveness of the two currently recognized subspecies of *Cyanea grimesiana*.

- Study *Cyanea grimesiana* ssp. *obatae* 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.

- Manage habitat in order to continue reintroduction/augmentation efforts and expand populations of *Cyanea grimesiana* ssp. *obatae* throughout its historical range.

V. REFERENCES

Clarke, G. and L.W. Cuddihy. 1980. A botanical reconnaissance of the Na Pali coast trail: Kee Beach to Kalalau Valley (April 9-11, 1980). Division of Forestry and Wildlife, Department of Land and Natural Resources, Hilo, Hawaii.

Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian Vegetation: Effects of Humans, their Activities and Introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.

Culliney, J.L. 1988. Islands in a Far Sea: Nature and Man in Hawaii. Sierra Club Books, San Francisco. 410 pp.

Hawaii Division of Forestry and Wildlife. 1996. Statewide Endangered Plant Program, Surveys and Inventories - Monitoring and Germplasm Collection Statewide. January 1996 Revision. Prepared for the U.S. Fish and Wildlife Service for section 6 funding.

Joe, Stephanie. 2006. Impact of Alien Slugs on Native Plant Seedlings in a Diverse Mesic Forest, Oahu, Hawaii, and a Study of Slug Food Plant Preferences. Thesis for Master of Science in Botanical Sciences (Botany-Ecology, Evolution, and Conservation Biology), University of Hawaii, May 2006. 87 pp.

Makua Implementation Team. 2003. Implementation Plan for the Makua Military Reservation, Island of Oahu. Prepared for U.S. Army Garrison, Hawaii, May 2003.

Scott, J.M. *et al.* 1986. Forest Bird Communities of the Hawaiian Islands: Their Dyanamics, Ecology, and Conservation. Studies in Avian Biology 9:1-429. Cooper Ornithological Society, Los Angeles.

The Nature Conservancy of Hawaii, Oahu Program. 2006. Honouliuli Preserve rare plant database, March 23, 2006. Unpublished, Honolulu.

Tomich, P.Q. 1986. Mammals in Hawaii: A Synopsis and Notational Bibliography. Bishop Museum Press, Honolulu. 375 pp.

U.S. Army Garrison, Hawaii. 2003. Integrated Wildland Fire Management Plan, Oahu & Pohakuloa Training Areas, 25th Infantry Division (Light) and United States Army, Hawaii. 213 pp. + appendices

U.S. Army Garrison, Hawaii. 2005a. 2005 Status Report, Makua Implementation Plan, Island of Oahu. September 2005.

U.S. Army Garrison, Hawaii. 2005b. Draft Implementation Plan for Oahu Training Areas: Schofield Barracks Military Reservation, Schofield Barracks East Range, Kawailoa Training Area, and Kahuku Training Area. June 2005. Directorate of Public Works Environmental Division, Schofield Barracks, HI

U.S. Army Garrison, Hawaii. 2006. Rare plant database, Mar. 23, 2006. Unpublished.

U.S. Fish and Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Three Plants from the Waianae Mountains, Island of Oahu, Hawaii. Federal Register 59(122): 32932-32938.

U.S. Fish and Wildlife Service. 1998. Recovery Plan for the Oahu Plants. U.S. Fish and Wildlife Service, Portland, Oregon. 207 pp., plus appendices.

U.S. Fish and Wildlife Service. 2003. Biological Opinion of the U.S. Fish and Wildlife Service for Routine Military Training and Transformation of the 2nd Bridgade 25th Infantry (Light), U.S. Army Installations, Island of Oahu. 356 pp.

U.S. Fish and Wildlife Service. 2004. Reinitiation of the 1999 Biological Opinion of the U.S. Fish and Wildlife Service for Routine Military Training at Makua Military Reservation. Honolulu, Hawaii. 193 pp.

U.S. Fish and Wildlife Service. 2005. Captive propagation database, unpublished.

van Riper, S. G., and C. van Riper III. 1982. A Field Guide to the Mammals in Hawaii. The Oriental Publishing Company, Honolulu. 68 pp.

Wagner, W.L., *et al.* 1995. Status of the native flowering plants of the Hawaiian Islands. In Stone, C.P., and J.M. Scott, (eds.), Hawaii's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, University of Hawaii, Honolulu. pp. 23-74.

EXPERTS CONSULTED

Kawelo, K. 2006. U.S. Army Environmental Division, *in litt.*

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Cyanea grimesiana* ssp. *obatae* (Haha)

Current Classification __Endangered__

Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**
____ **Uplist to Endangered**
____ **Delist**
__X__ **No change is needed**

Appropriate Listing/Reclassification Priority Number _N/A_

Review Conducted By

Gina Shultz, Assistant Field Supervisor for Endangered Species
Marilet A. Zablan, Recovery Program Leader
Marie Bruegmann, Plant Recovery Coordinator
Cheryl Phillipson, Fish and Wildlife Biologist

_____ Date JUL - 3 2007
Field Supervisor, Fish and Wildlife Service

Approve _____ Date Aug 2 2007
Regional Director, Fish and Wildlife Service