Cyanea grimesiana subsp. *grimesiana* (haha)
5-Year Review
Summary and Evaluation

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

5-YEAR REVIEW
Species reviewed: *Cyanea grimesiana* subsp. *grimesiana*/ haha

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5-YEAR REVIEW
***Cyanea grimesiana* subsp. *grimesiana* (haha)**

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:
Region 1, Endangered Species Program, Division of Recovery, Jesse D`Elia, (503) 231-2071

Lead Field Office:
Pacific Islands Fish and Wildlife Office, Loyal Mehrhoff, Field Supervisor, (808) 792-9400

Cooperating Field Office(s):
N/A

Cooperating Regional Office(s):
N/A

1.2 Methodology used to complete the review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), beginning on March 16, 2009. The review was based on final critical habitat designations for *Cyanea grimesiana* subsp. *grimesiana* and other species from the islands of Lanai, Molokai, Maui, and Oahu (USFWS 2003a,b,c,d) as well as a review of current, available information. The National Tropical Botanical Garden provided an initial draft of portions of the review and recommendations for conservation actions needed prior to the next five-year review. The evaluation of Samuel Aruch, biological consultant, was reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before submittal to the Field Supervisor for approval.

1.3 Background:

1.3.1 Federal Register (FR) Notice citation announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2009. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 103 species in Hawaii. Federal Register 74(49):11130-11133.

1.3.2 Listing history

Original Listing
FR notice: USFWS. 1996. Endangered and threatened wildlife and plants; determination of threatened or endangered status for 14 plants from the Hawaiian Islands, Hawaii; final rule. Federal Register 61(198):52108-53124.

Date listed: October 10, 1996
Entity listed: Species
Classification: Endangered

Revised Listing, if applicable
FR notice: N/A
Date listed: N/A
Entity listed: N/A
Classification: N/A

1.3.3 Associated rulemakings:

USFWS. 2003a. Endangered and threatened wildlife and plants; final designations and nondesignations of critical habitat for 3 plant species from the island of Lanai, Hawaii; final rule. Federal Register 68(6):1219-1273.

USFWS. 2003b. Endangered and threatened wildlife and plants; final designations and nondesignations of critical habitat for 42 plant species from the island of Molokai, Hawaii; final rule. Federal Register 68(52):12982-13141.

USFWS. 2003c. Endangered and threatened wildlife and plants; final designations and nondesignations of critical habitat for 60 plant species from the islands of Maui and Kahoolawe, Hawaii; final rule. Federal Register 68(93):25934-26165.

USFWS. 2003d. Endangered and threatened wildlife and plants; final designation or nondesignation of critical habitat for 101 plant species from the island of Oahu, Hawaii; final rule. Federal Register 68(116):35949-35998.

Critical habitat was not designated for *Cyanea grimesiana* subsp. *grimesiana* on the island of Lanai (USFWS 2003a). Critical habitat was designated for *Cyanea grimesiana* subsp. *grimesiana* in 1 unit totaling 2,133 hectares (5,272 acres) on the island of Molokai. This designation

includes habitat on State, Federal, and private lands (USFWS 2003b). Critical habitat was designated for *Cyanea grimesiana* subsp. *grimesiana* in 1 unit totaling 921 hectares (2,273 acres) on the island of Maui. This designation includes habitat on State and private lands (USFWS 2003c). Critical habitat was designated for *Cyanea grimesiana* subsp. g*rimesiana* in 2 units totaling 2,964 hectares (7,320 acres) on the island of Oahu. This designation includes habitat on State and private lands (USFWS 2003d).

1.3.4 Review History:
Species status review [FY 2010 Recovery Data Call (September 2010)]: Declining

Recovery achieved:
1 (1-25%) (FY 2007 Recovery Data Call – most recent year reported)

1.3.5 Species' Recovery Priority Number at start of this 5-year review:
6

1.3.6 Current Recovery Plan or Outline
Name of plan or outline: U.S. Fish and Wildlife Service. 1999. Recovery plan for multi- island plants. U.S. Fish and Wildlife Service, Portland, Oregon. 206 pages + appendices.
Date issued: July 10, 1999.
Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?
_____ ***Yes***
__X__ ***No***

2.1.2 Is the species under review listed as a DPS?
____ ***Yes***
__X_ ***No***

2.1.3 Was the DPS listed prior to 1996?
____ ***Yes***
____ ***No***

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

____ ***Yes***
____ ***No***

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

____ ***Yes***
____ ***No***

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

____ ***Yes***
__X_ ***No***

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

__X_ ***Yes***
____ ***No***

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

_X_ ***Yes***
____ ***No***

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

__X_ ***Yes***
____ ***No***

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

A synthesis of the threats (Listing Factors A, C, D, and E) affecting this species is presented in section 2.3.2 and Table 2. Listing Factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not known to be a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the multi- island plant recovery plan (USFWS 1999), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Cyanea grimesiana* subsp. *grimesiana* is a short-lived perennial, and to be considered stabilized, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g*., fenced, weeding, etc.) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on islands where they now occur 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. There is no population of *Cyanea grimesiana* subsp. *grimesiana* containing more than 50 individuals and all threats are not being managed.

For downlisting, a total of five to seven populations of *Cyanea grimesiana* subsp. *grimesiana* should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with a minimum of 300 mature individuals per population. Each population should persist at this level for a minimum of five consecutive years before downlisting is considered.

This recovery objective has not been met.

For delisting, a total of eight to ten populations of *Cyanea grimesiana* subsp. *grimesiana* should be documented on islands where they now occur or occurred historically. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 300 mature individuals per population for short-lived perennials. Each population should persist at this level for a minimum of five consecutive years before delisting is considered.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

No new information.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

Due to taxonomic changes (see Section 2.3.1.4), the taxon originally listed as endangered in 1996 as *Cyanea grimesiana* subsp. *grimesiana* currently includes (1) *Cyanea grimesiana* subsp. *grimesiana*, (2) *Cyanea munroi*, (3) *Cyanea magnicalyx*, (4) *Cyanea mauiensis*, (5) *Cyanea cylindrocalyx*, and (6) *Cyanea grimesiana* subsp. *obatae* (Lammers 2004). The final taxon, *Cyanea grimesiana* subsp. *obatae*, was listed as a separate endangered species in 1994 and a 5-year review for this species was completed in 2007 (USFWS 2007b). The other five taxa are addressed individually below.

2.3.1.2.1 ***Cyanea grimesiana* subsp. *grimesiana***
On Oahu, *Cyanea grimesiana* subsp. *grimesiana* occurs in the Waianae Mountains. One population of three individuals and a single seedling was seen in 2000 in Mt. Kaala Natural Area Reserve, Puu Pane, on the north facing slopes of Mt. Kaala, in the Waianae Mountains at 671 meters (2,200 feet) elevation (Perlman 2009a; USFWS 1999). Another population of *Cyanea grimesiana* was reported from North Haleauau Gulch on the Schofield Barracks Military Reservation, last seen in 1992. In the back of Makaha Valley, in 2005, Steve Perlman of the National Tropical Botanical Garden, Ane Bakutis of the Plant Extinction Prevention Program, and Amy Tsuneyoshi of the Honolulu Board of Water Supply saw one individual without flowers or fruits at 689 meters (2,260 feet) elevation (Perlman 2009a).

Populations of *Cyanea grimesiana* subsp. *grimesiana* in Kaluaa Gulch and Pahole Gulch were last seen in 1992 to 1993 by Steve Perlman of the National Tropical Botanical Garden. In 2000, Perlman and Army Environmental personnel saw 10 individuals in West Makaleha Gulch (Perlman 2009a; USFWS 1999). However, since then, the populations of *Cyanea grimesiana* occurring at Kaluaa Gulch, Pahole Gulch, and West Makaleha as well as those at Palikea area have been identified as *Cyanea grimesiana* subsp. *obatae*, another listed taxon (USFWS 2007a).

Numerous historical occurrences were reported from the Koolau Mountains prior to 1969 (Hawaii Biodiversity and Mapping

Program 2009). Two populations comprising 10 individuals were seen in 1990 in Kului Gulch, but declined to a single individual last seen in 1994 (Perlman 2009a). In 2004, at Pia Gulch on the east side of Hawaiiloa Ridge, a single dying individual, about 2-meters (6.5-feet) in height containing a few leaves was observed at 616 meters (2,020 feet) elevation by Perlman, Susan Ching of the Plant Extinction Prevention Program, and Natalia Tangalin of the National Tropical Botanical Garden (Perlman 2009a). Three individuals were known from 1985 in Waialae Iki-Kapakahi on State and private land (Hawaii Biodiversity and Mapping Program 2009; USFWS 1999).

Lammers (2004) reported at least one population on Molokai that is still considered part of *Cyanea grimesiana* subsp. *grimesiana*, but its location and current status are unknown. Currently, no wild individuals of *Cyanea grimesiana* subsp. *grimesiana* are known to exist on Molokai (Plant Extinction Prevention Program 2009).

2.3.1.2.2 ***Cyanea munroi***

On Molokai, one population of five individuals previously identified as *Cyanea grimesiana* subsp. *grimesiana* was known from Kukuinui Ridge on State land and another population of two individuals is known within the State's Olokui Natural Area Reserve (USFWS 1999). The latter population, in Wailua Valley on the sea cliffs of Olokui, is now identified as *C. munroi* (see taxonomic discussion in 2.3.1.4 below). In 2001, Ken Wood revisited the Wailau individual located at 550 meters (2,050 feet) elevation (Wood 2009). In October 2009, Perlman and Hank Oppenheimer, Maui Nui Plant Extinction Prevention Coordinator, searched unsuccessfully for this species on these sea cliffs. Much of the understory was dense thickets of the invasive introduced species *Clidemia hirta* (Koster's curse) that are 3-meters (13-feet) tall (Oppenheimer 2009).

On Lanai, Perlman regularly observed two individuals of *Cyanea munroi* at Awehi Gulch, north of Puhielelu Ridge between 1991 and 2008 from 869 to 969 meters (2,850 to 3,180 feet) elevation (Perlman 2009b). Perlman also observed two individuals at Waiakeakua south of Puhielelu Ridge, in 1994, at 853 meters (2,800 feet) elevation (Hawaii Biodiversity and Mapping Program 2009). Two plants still occur in the Awehi Gulch headwaters, within a fenced exclosure (Oppenheimer 2009).

In total, there are no known individuals on Molokai and two individuals on Lanai.

2.3.1.2.3 ***Cyanea magnicalyx***
Two populations from West Maui which were formerly classified as *Cyanea grimesiana* subsp. *grimesiana* are now classified as *Cyanea magnicalyx* (see taxonomic discussion below in section 2.3.1.4). Perlman saw one individual at each of several elevations from 469 to 549 meters (1,540 to 1,800 feet) elevation between 2004 and 2008, at Kaluanui Stream, a subgulch of Honokohau Valley (Perlman 2009c), which were still there in 2009 (Oppenheimer 2009). In Iao Valley, in a gulch to the north of Iao Needle, Perlman observed up to four individuals between 2004 and 2009 at 442 to 518 meters (1,450 to 1,700 feet) elevation (Perlman 2009c). There were three individuals in Iao as of February 2009; one of which was a juvenile (Oppenheimer 2009). In 2006, Ken Wood observed a clump consisting of perhaps two individuals in West Maui at Puehuehunui, in a small drainage south of Kauaula Rim (Wood 2009). In 2009, one individual remained at Puehuehunui (Oppenheimer 2009). In total, there are seven individuals in three populations on West Maui (Plant Extinction Prevention Program 2009).

2.3.1.2.4 ***Cyanea mauiensis***
Historical collections from Olowalu, West Maui, listed as *Cyanea grimesiana* subsp. *grimesiana* were placed under *Cyanea mauiensis* in a 1998 taxonomic revision (see taxonomic discussion below in section 2.3.1.4). Populations from Makawao on East Maui formerly known as *Cyanea grimesiana* subsp. *grimesiana* were reassigned to *Cyanea mauiensis* (Lammers 1998). These populations have not been reported recently. One population from Makawao Forest Reserve on East Maui seen in 2000 was attributed to *Cyanea grimesiana* subsp. *grimesiana*, but was later tentatively identified as *Cyanea asplenifolia* (H. Oppenheimer, Plant Extinction Prevention Program, pers. comm. 2010; Oppenheimer 2009). Two other historical populations of *Cyanea grimesiana* subsp. *grimesiana* on East Maui, at Nahiku and Kipahulu, apparently have not been reevaluated taxonomically. Both *Cyanea mauiensis* and *C. magnicalyx* were known to occur in Olowalu Valley, but Perlman and Oppenheimer searched unsuccessfully for this species in 2008 (Oppenheimer 2009). No individuals of this species are currently known.

2.3.1.2.5 ***Cyanea cylindrocalyx*** from the island of Hawaii is now considered extinct (Bernice P. Bishop Museum 1999).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

No new information.

2.3.1.4 Taxonomic classification or changes in nomenclature:

In his 1990 treatment of Campanulaceae in the Manual of the Flowering Plants of Hawaii, Thomas Lammers considered *C. grimesiana* var. *lydgatei*, *C. grimesiana* var. *mauiensis*, *C. grimesiana* var. *munroi*, and *C. lobata* var. *hamakuae* synonymous with *Cyanea grimesiana* subsp. *grimesiana* (Wagner 1999). However, in a 1998 treatment, Lammers subsequently elevated these particular subspecies of *Cyanea grimesiana* except *C.* var. *lydgatei*, to the species level. Morphological differences between populations on Oahu, Molokai, Maui, and Lanai and previous assignment to species status by earlier botanists justified this revision. *Cyanea grimesiana* var. *cylindrocalyx* (considered extinct) from Waipio Valley, Hawaii Island, became *Cyanea cylindrocalyx*. *Cyanea grimesiana* var. *mauiensis* from Olowalu, Maui and *Cyanea grimesiana* var. *lydgatei* from East Maui both became *Cyanea mauiensis*. *Cyanea grimesiana* var. *munroi* from Molokai and Lanai became *Cyanea munroi*. The populations of *C. grimesiana* on Oahu remained divided into subspecies *grimesiana* and subspecies *obatae* (Lammers 1998). In 2004, Lammers further clarified *Cyanea grimesiana* as a species complex under which he grouped *Cyanea mauiensis*, *Cyanea munroi*, *Cyanea grimesiana* subsp. *grimesiana*, *Cyanea grimesiana* subsp. *obatae*, *Cyanea cylindrocalyx*, and *Cyanea magnicalyx* (Lammers 2004). *Cyanea grimesiana* subsp. *obatae* was listed as endangered as a separate species, and a 5-year review for this species was completed in 2007 (USFWS 2007b).

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g., corrections to the historical range, change in distribution of the species within its historic range, etc.):

See above section 2.3.1.2.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

In the Waianae Mountains of Oahu, the habitat of *Cyanea grimesiana* subsp. *grimesiana* is *Acacia koa* (koa) – *Metrosiderospolymorpha* (ohia) – *Dicranopteris linearis* (uluhe) lowland mesic forest (Puu Pane), with associated native species that include *Abutilon sandwicensis* (no common name [NCN]), *Antidesma pulvinatum* (hame), *Charpentiera ovata* (papala), *Cibotium* spp. (hapuu), *Clermontia kakeana* (haha), *C. persicifolia* (oha wai), *Coprosma foliosa* (pilo), *Cyanea angustifolia* (haha), *C. lanceolata* (haha), *Cyrtandra grandiflora* (kanawao keokeo), *Diospyros sandwicensis* (lama), *Diplazium sandwichianum* (hoio), *Flueggea neowawraea* (mehamehame), *Freycinetia arborea* (ie ie), *Gardenia mannii* (nanu), *Hibiscus arnottianus* (kokio keokeo), *Isodendrion longifolium* (aupaka), *Joinvillea ascendens* (ohe), *Labordia cyrtandrae* (kamakahala), *L. tinifolia* (kamakahala), *Leptecophylla tameiameiae* (pukiawe), *Melicope peduncularis* (alani), *Myrsine lessertiana* (kolea lau nui), *Nestegis sandwicensis* (olopua), *Ochrosia* sp. (holei), *Perrottetia sandwicensis* (olomea), *Pipturus albidus* (mamake), *Pisonia* sp. (papala kepau), *Pouteria sandwicensis* (alaa), *Psychotria hathewayi* (kopiko), *P. mariniana* (kopiko), *Psydrax odorata* (alahee), *Rauvolfia sandwicensis* (hao), *Sapindus oahuensis* (lonomea), *Scaevola gaudichaudiana* (naupaka kuahiwi), *Sicyos* sp. (anunu), *Syzygium sandwicensis* (ohia ha), *Tectaria gaudichaudii* (iwa iwa lau nui), *Urera glabra* (opuhe), *Viola chamissoniana* (pamakani), and *Xylosma hawaiiense* (maua) (National Tropical Botanical Garden 2009; Perlman 2009a).

In the Koolau Mountains of Oahu, the habitat where *Cyanea grimesiana* subsp. *grimesiana* occurs is *Acacia koa – Metrosideros polymorpha* mesic forest with *Abutilon sandwicensis*, *Antidesma pulvinatum*, *Charpentiera ovata*, *Cibotium* spp., *Clermontia kakeana*, *C. persicifolia*, *Coprosma foliosa*, *Cyanea angustifolia*, *C. lanceolata*, *Cyrtandra grandiflora*, *Dicranopteris linearis* (uluhe), *Diospyros sandwicensis*, *Diplazium sandwichianum*, *Flueggea neowawraea*, *Freycinetia arborea*, *Hibiscus arnottianus*, *Isodendrion longifolium*, *Joinvillea ascendens*, *Labordia tinifolia*, *Melicope* sp., *Myrsine lessertiana*, *Ochrosia*

sandwicensis, *Pipturus albidus*, *Pisonia* sp., *Psychotria hathewayi*, *Psydrax odorata*, *Rauvolfia sandwicensis*, *Sapindus oahuensis*, *Tectaria gaudichaudii*, *Viola chamissoniana*, and *Xylosma hawaiiense* (Perlman 2009a).

On Lanai at Awehi Gulch, the habitat for *Cyanea munroi* is *Metrosideros polymorpha* lowland mesic forest with associated native plants including *Alyxia stellata* (maile), *Antidesma platyphyllum* (hame), *Diplazium sandwichianum*, *Doodia* sp. (okupukupu), *Freycinetia arborea*, *Labordia tinifolia*, *Microlepia strigosa* (palapalai), *Myrsine* sp. (kolea), *Pipturus albidus*, *Pouteria sandwicensis*, *Syzygium sandwicensis*, *Viola lanaiensis* (NCN),and *Xylosma hawaiiense* (National Tropical Botanical Garden 2009; Oppenheimer 2009).

On Molokai in Wailau Valley; on the ridge to Olokui, on the slopes above Waiehu; west of Wailau Stream in *Metrosideros polymorpha* lowland mesic to wet forest the habitat includes native species such as *Alyxia stellata*, *Antidesma platyphyllum*, *Artemisia* sp. (hinahina), *Bidens* sp. (kookoolau), *Broussaisia arguta* (kanawao), *Cheirodendron trigynum* (olapa), *Cibotium glaucum* (hapuu), *Clermontia* sp., *Cyanea solenocalyx* (pua kala), *Cyrtandra grayi* (keokeo haiwale), *C. grayana* (keokeo haiwale), *C. lydgatei* (keokeo haiwale), *Deparia prolifera* (NCN), *Freycinetia arborea*, *Hibiscus arnottianus* subsp. *immaculatus* (kokio keokeo), *Ilex anomala* (kawau), *Kadua* sp., *Labordia hedyosmifolia* (kamakahala), *Lipochaeta* sp. (nehe), *Lysimachia* sp. (NCN), *Mecodium recurvum* (ohia ku), *Myrsine lessertiana*, *Nothocestrum longifolium* (aiea), *Psychotria mariniana*, *Tetraplasandra oahuensis* (ohe mauka), *Pneumatopteris sandwicensis* (hoio kula), *Touchardia latifolia* (olona), *Urera* sp., and *Vandenboschia davallioides* (palai hihi) (Oppenheimer 2009; Wood 2009).

Cyanea magnicalyx occurs in West Maui at Puehuehunui, a small drainage to the south of the Kauaula Valley Rim, in a mixed mesic forest habitat with rich fern understory and at Kaluanui Stream, a subgulch of Honokohau Valley in *Metrosideros polymorpha – Cibotium* spp. mesic forest associated with *Antidesma platyphyllum*, *Broussaisia arguta*, *Cheirodendron trigynum*, *Clermontia kakeana*, *Cyanea angustifolia*, *C. lobata* (haha), *Cyrtandra grayana*, *C. grayi*, *Dicranopteris linearis*, *Diplazium sandwichianum*, *Dodonaea viscosa*, *Freycinetia arborea*, *Ilex anomala*, *Kadua acuminata* (au), *Melicope hawaiiense* (mokihana kukae moa), *Myrsine*

lessertiana, *Nestegis sandwicensis*, *Syzygium sandwicense*, *Tetraplasandra hawaiensis* (ohe), and *Xylosma hawaiiense* (ae) (Wood 2009). In Iao Valley, West Maui, the natural community is *Pisonia* sp. forest with *Metrosideros polymorpha* and associated native species including *Antidesma platyphyllum*, *Asplenium nidus*, *Cyrtandra grayi*, *Charpentiera obovata*, *Cheirodendron trigynum*, *Claoxylon sandwicensis* (poola), *Freycinetia arborea*, *Kadua acuminata*, *K. affinis* (manono), *Nothocestrum longifolium*, *Perrottetia sandwicensis*, *Pisonia brunoniana* (papala kepau), *Pisonia sp*., *Pittosporum glabrum* (hoawa), *Pleomele auwahiensis* (hala pepe), *Pouteria sandwicensis*, *Psychotria mauiensis* (opiko), and *Xylosma hawaiiense* (Oppenheimer 2009; Wood 2009).

2.3.1.7 Other:

No new information.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Threats that modify habitat of these *Cyanea* species include feral ungulates that degrade the habitat, preventing natural regeneration. Pigs (*Sus scrofa*) and goats (*Capra hircus*) are a threat to *Cyanea grimesiana* subsp. *grimesiana* in the Waianae Mountains. Pigs are a threat in the Koolau Mountains of Oahu. Axis deer (*Axis axis*) pose a threat to *Cyanea magnicalyx* and *C. munroi* on Maui and Lanai (Perlman 2009c; Wood 2009). Deer, goats, and pigs are threats on Molokai (Wood 2009). Pigs are a threat to *Cyanea magnicalyx* on West Maui (Oppenheimer 2009).

Invasive introduced plant species that degrade habitat and compete with *Cyanea grimesiana* subsp. *grimesiana*, as listed, include *Ageratina adenophora* (sticky snakeroot), *Buddleia asiatica* (dog tail), *Bryophyllum pinnatum* (airplant), *Cinnamomum zeylanica* (cinnamon), *Clidemia hirta* (Koster's curse), *Grevillea robusta* (silk oak), *Lantana camara* (lantana), *Morella faya* (firetree), *Nephrolepis* sp. (NCN), *Psidium cattleianum* (strawberry guava) , *Psidium guajava* (common guava), *Rubus rosifolius* (thimbleberry), *Schinus terebinthifolius* (Christmasberry), and *Toona ciliata* (cedar) (National Tropical

Botanical Garden 2009; Perlman 2009c; USFWS 1999; Wood 2009).

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Not a threat.

2.3.2.3 Disease or predation:

Slugs and snails of various species and rats (*Rattus rattus*) are believed to eat leaves and seeds of this listed taxon (Perlman 2009a). Slugs killed at least one individual in Iao Valley, West Maui (Perlman 2009c).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

No new information.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

The introduced invasive plant species discussed in section 2.3.2.1 above are also a threat to *Cyanea grimesiana* subsp. *grimesiana* because they compete with the species for water, light, and nutrients.

Landslides are a threat to the Iao Valley population (Oppenheimer 2009). Fire is a threat to the Puehuehunui population. In early 2007, a fire came within a couple hundred meters of these plants (Oppenheimer 2009). Military training activity including troops, vehicles, and helicopter activity could impact this taxon on Oahu (USFWS 1999).

Climate change may also pose a threat to this species. However, current climate change analyses in the Pacific Islands lack sufficient spatial resolution to make predictions on impacts to this species. The Pacific Islands Climate Change Cooperative has currently funded climate modeling that will help resolve these spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

In addition to all of the other threats, species like *Cyanea grimesiana* subsp. *grimesiana* that are endemic to small portions of a few islands 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. The extent of these natural processes on this taxon with very low numbers are exacerbated by anthropogenic threats, such as habitat loss for human development or predation by introduced species.

Cyanea grimesiana subsp. *grimesiana*, *C. munroi, and C. magicalyx* are being monitored by the Plant Extinction Prevention Program. Their plan for this species is to continue to attempt to collect seeds for genetic storage and reintroduction, and propagate and reintroduce the species into protected areas within suitable habitat (Plant Extinction Prevention program 2009).

In 2009, one million dollars in funds from the Federal Department of Interior's Cooperative Endangered Species Conservation Fund is being used on Molokai to help acquire a perpetual conservation easement that is more than 248 hectares (614 acres) of strategic watershed on the eastern end of the island. This property has several federally listed threatened or endangered species as well as critical habitat in and around the proposed easement area. Other federally listed species benefiting from this protection are *Bidens wiebkei* (kookoolau), *Canavalia molokaiensis* (awikiwiki), *Canavalia molokaiensis* (kokio keokeo), *Brighamia rockii* (puaala), *Cyanea dunbariae* (haha), *Gardenia brighamii* (nanu), *Pritchardia munroi* (loulu), and *Phyllostegia hispida* (NCN) (USFWS 2009; C. Rowland, USFWS, pers. comm. 2010). This area may provide suitable habitat for the reintroduction of this taxon in the future.

The National Tropical Botanical Garden has over 800 seeds of *Cyanea grimesiana* subsp. *grimesiana* in storage (National Tropical Botanical Garden 2010). The Plant Extinction Prevention Program has outplanted individuals in Kupaua in the southern end of the Koolau Mountains, and as of 2010, three individuals remained. The site is fenced and weed control is ongoing (Plant Extinction Prevention Program 2010).

The Plant Extinction Prevention Program has outplanted *Cyanea magnicalyx* into three locations on West Maui. Slugs and rats killed many of these outplantings (despite trapping for rats), but about 20 individuals remain. A few have already begun to flower. Seeds have been collected from four of the five known

wild plants, but the fifth plant is still immature. Seeds are stored at Harold L. Lyon Arboretum. A small fenced exclosure was constructed around the Kaluanui individual in 2009. Pig control has been initiated there by Maui Land and Pineapple Company's Puu Kukui Preserve staff (Oppenheimer 2009). The Lyon Arboretum Micropropagation Laboratory has 5,010 seeds in storage from the Iao Valley population (Harold L. Lyon Arboretum Laboratory 2010).

Both individuals of *Cyanea munroi* on Lanai are in a fenced exclosure. The Plant Extinction Prevention Program inspects this annually, and repairs the fenced exclosure as necessary. Rat snap traps are reset when the site is visited. Seeds have been collected from both plants and are stored at the Harold L. Lyon Arboretum. One seedling is growing at the Olinda Rare Plant Nursery. Rat snap traps are also maintained at the Iao Valley population. Seeds have been collected from the individual at Puehuehunui and 299 seeds are in storage at the Harold L. Lyon Arboretum seed bank (Harold L. Lyon Arboretum Seed Bank 2010; Oppenheimer 2009).

2.4 Synthesis

Stabilizing, downlisting, and delisting objectives are provided in the multi-island plant recovery plan (USFWS 1999), based on whether the species is an annual, a short-lived perennial (fewer than ten years), or a long-lived perennial. *Cyanea grimesiana* subsp. *grimesiana* is a short-lived perennial, and to be considered for stabilization, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on islands where they now occur or occurred historically. For the species to be considered stable, each of these populations must be naturally reproducing and increasing in number, with a minimum of 50 mature individuals per population.

The interim stabilization goals for this species have not been met as there is no population of *Cyanea grimesiana* subsp. *grimesiana* (including *C. magnicalyx*, *C. mauiensis*, *C. munroi*) containing more than 50 individuals (Table 1) and all threats have not been managed (Table 2). Therefore, *Cyanea grimesiana* subsp. *grimesiana* meets the definition of endangered as it remains in danger of extinction throughout its range.

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

Date	No. wild indivs	No. outplanted	Stability Criteria identified in Recovery Plan	Stability Criteria Completed?
1996 (listing)	<50	0	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 50 mature individuals each	No
1999 (recovery plan)	<50	2	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No
2003 (critical habitat)	*Cyanea grimesiana* subsp. *grimesiana - 16* *Cyanea munroi - 10* *Cyanea magnicalyx- 6* *Cyanea mauiensis - 0* *Cyanea cylindrocalyx -0*	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Partially

			3 populations with 50 mature individuals each	No
2010 (5-year review)	*Cyanea grimesiana* subsp. *grimesiana - 0* *Cyanea munroi - 2* *Cyanea magnicalyx - 7* *Cyanea mauiensis - 0*	3 0 6 0	All threats managed in all 3 populations	Partially (Table 2)
			Complete genetic storage	Partially
			3 populations with 50 mature individuals each	No: no populations with over 10 individuals

Table 2. Threats to *Cyanea grimesiana* subsp. *grimesiana*.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulates – habitat modification	A, D	Ongoing	Partially, Fenced on Lanai, Ungulate control on Maui
Landslides	A, E	Ongoing	No
Rats – herbivory	C	Ongoing	No
Slugs – seed predation	C	Ongoing	No
Invasive introduced plants	A, E	Ongoing	No
Climate change	E	Increasing	No
Small population size	E	Ongoing	Seed collection and small scale reintroduction, species still declining

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X_ No change is needed

3.2 New Recovery Priority Number:

Brief Rationale:

3.3 Listing and Reclassification Priority Number:

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (regardless of current classification) Priority Number: ____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Monitor known populations and collect any available seed for genetic storage and reintroduction.
- Maintain or build fences around existing populations to protect them from the negative impacts of ungulates.
- Control invasive introduced species around known populations.
- Develop and implement methods to control rats and slugs.
- Propagate to augment the existing populations.
- Establish additional populations within protected suitable habitat.
- Survey historical locations and appropriate remaining habitat for new individuals.
- Work with Hawaii Division of Forestry and Wildlife and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.
- Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.

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SIGNATURE PAGE
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Cyanea grimesiana* subsp. *grimesiana* (haha)

Current Classification: E

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

Review Conducted By:
Chelsie Javar, Fish and Wildlife Biologist
Marie Bruegmann, Plant Recovery Coordinator
Jess Newton, Recovery Program Lead
Assistant Field Supervisor for Endangered Species

Approved _____ Date _____
Field Supervisor, Pacific Islands Fish and Wildlife Office