

## *Cyanea grimesiana* subsp. *obatae*

- **Scientific name:** *Cyanea grimesiana* Gaud. subsp. *obatae* (St. John) Lammers
- **Hawaiian name:** *Haha, ohawai*
- **Family:** Campanulaceae (Bellflower family)
- **Federal status:** Listed endangered July 27, 1994
- **Requirements for Stability**
  - 4 Population Units (PUs) (4 due to presence in two action areas)
  - 100 reproducing individuals in each PU (short-lived perennial with large fluctuations in population size and recent history of decline)
  - Stable population structure
  - Threats controlled
  - Complete genetic representation of all PUs in storage
- **Description and biology:** *Cyanea grimesiana* subsp. *obatae* is a shrub 1-3.2 m tall, and is either single-stemmed or sparingly branched. The leaves are pinnately divided, measure 27-58 cm long, and are clustered towards the tips of the stems. The six to 12 flowered inflorescences are borne among the leaves. The corollas are curved, usually yellowish white with purple and measure 55-80 mm long. The berries are orange at maturity, and measure 18-30 mm long.
 

As with other *Cyaneas* with their long tubular flowers, this taxon is thought to have been pollinated by nectar-feeding birds. It is capable of self-pollination, evidenced by the fact that isolated plants produce viable seeds. The taxon's orange berries are indicative of seed dispersal by fruit-eating birds. *Cyanea grimesiana* subsp. *obatae* presumably lives for less than 10 years like other *Cyaneas* of its size, and is thus a short-lived taxon for the purposes of the Implementation Plan. (MIT 2003)

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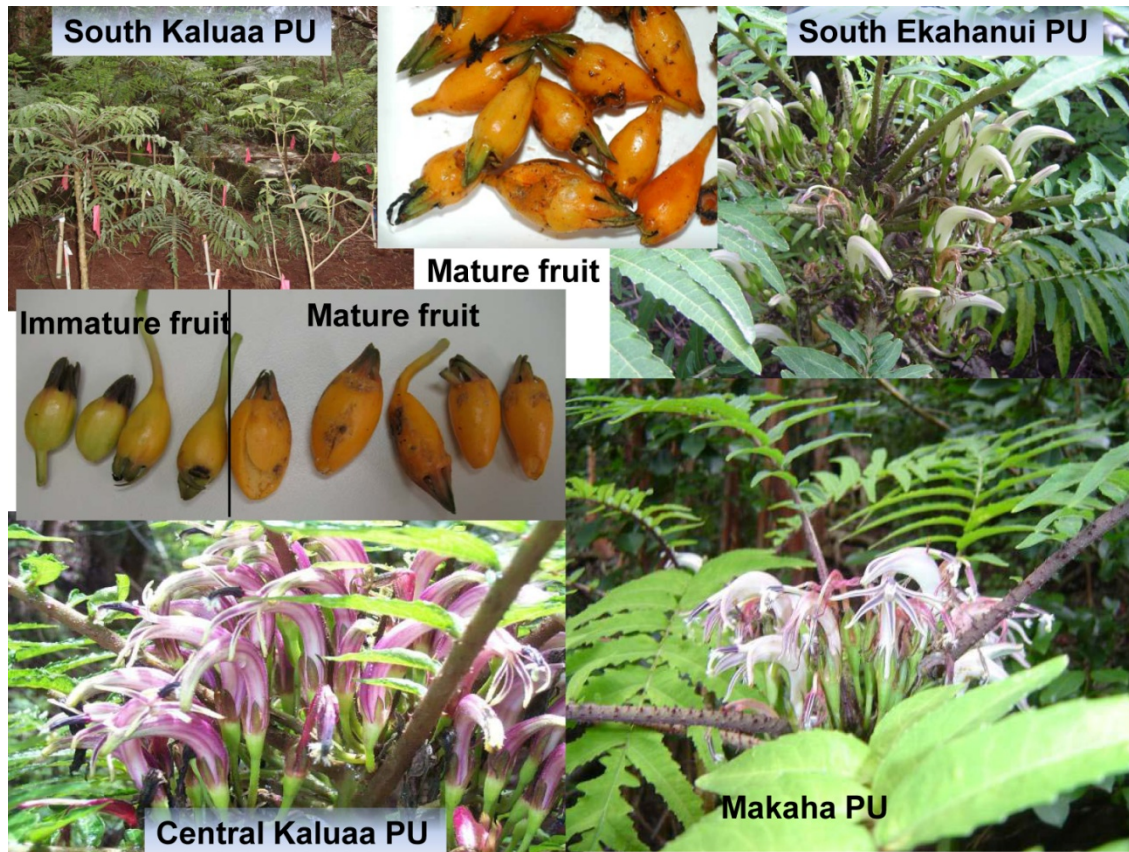
- **Known distribution:** *C. grimesiana* subsp. *obatae* was discovered in 1965 and until the 1990s, was known only from the southern and central Waianae Mountains. The species is now also known from the Mokuleia region of the northern Waianae Mountains and from Makaha Valley. It ranges from 550-670 meters in elevation.
- **Population trends:** Most of the *C. grimesiana* subsp. *obatae* population units have not been known for very long, but those that have been tracked for at least 15 or 20 years have either died out or declined markedly. The known Ekahanui plants had died by 2004. The wild population at the Palikea (South Palawai) site has grown significantly from 18 individuals in 1999 to 52 in 2009. The plant in Central Kaluaa was discovered in 2004 and an immature plant was observed there in 2009. The South Kaluaa plant died in 2005. The Makaha plant was discovered in 2005. The Palikea Gulch PU was discovered in 1999 and has not yet matured.
- **Habitat:** *Cyanea grimesiana* subsp. *obatae* grows in mesic forests, usually in partly sunny to shady locations in gulch bottoms or on gulch slopes. The plants often grow on steep to vertical embankments consisting of rock or a mix of rock and soil.
- **Taxonomic background:** *Cyanea grimesiana* includes two subspecies; *obatae* and *grimesiana* subsp. *grimesiana*, has been recorded primarily in the Koolau Mountains of Oahu, but has also been found in the northern and central Waianae Mountains and on Molokai. The two subspecies are distinguished by the size and shape of their calyx lobes. Certain *Cyanea* populations on Molokai, Maui, Lanai, and Hawaii formerly included in *C. grimesiana* have recently been recognized as constituting three separate species (Lammers 1998).

# Reproductive Biology Table

Population Unit	Observed Phenology			Reproductive Biology		Seeds	
	Flower	Immature Fruit	Mature Fruit	Breeding System	Suspected Pollinator	Average # Per Fruit	Dormancy
Central Kaluaa	Mar-Aug	July-Aug	July-Aug	hermaphroditic	Bird*	186 ± 225	Not Dormant
Palikea (South Palawai)	July-Oct	Oct-Dec	Nov-Jan	hermaphroditic	Bird*	236 ± 150	Not Dormant
Makaha	July-Oct	Sept-Nov	Oct-Dec	hermaphroditic	Bird*	94 ± 18	Not Dormant
Pahole to West Makaleha	July-Oct	Sept-Nov	Oct-Dec	hermaphroditic	Bird*	355 ± 146	Not Dormant
North branch of South Ekahanui	May-Aug	May-Feb	Feb? (range TBD)	hermaphroditic	Bird*	430 ± 111	Not Dormant
Palikea Gulch	Plant is immature	TBD	TBD	hermaphroditic	Bird*	236 ± 150	Not Dormant
South Kaluaa	May-Aug	July-Sept	Aug-Sept	hermaphroditic	Bird*	236 ± 150	Not Dormant

\*Smith, T.B. L.A. Freed, J.K. Lepson, J.H. Carothers. 1995. Evolutionary Consequences of Extinctions in Populations of a Hawaiian Honeycreeper. *Conservation Biology* 9: 1, 107-113.

\*Lammers, T.G. & C.E. Freeman. 1986. Ornithophily among the Hawaiian Lobelioideae (Campanulaceae): evidence from nectar sugar compositions. *American Journal of Botany* 73: 1613-1619.



**Map removed,  
available upon request**

## Population Units

Manage For Stability Population Units	PU Type	Which Action Area is the PU inside?	Management Units for Threat Control
Central Kaluaa	Both in situ and augmentation	None	Kaluaa and Waieli
Palikea (South Palawai)	Both in situ and augmentation	None	Palikea
Makaha	Both in situ and augmentation	None	Makaha
Pahole to West Makaleha	Both in situ and augmentation	MMR	Pahole and West Makaleha
Genetic Storage Population Units			
North branch of South Ekahanui	Reintroduction	None	Ekahanui
Palikea Gulch	in situ	SBMR	None
South Kaluaa	Reintroduction	None	Kaluaa and Waieli

## Population Structure

- Regeneration of seedlings has been observed at a few wild sites since 1999, (West Makaleha, Palikea (South Palawai), and Central Kaluaa), but not from any outplantings. Planted individuals have matured and produced viable fruit at sites in Pahole, Ekahanui, Kaluaa and Palikea (South Palawai) but no regeneration has been observed. It may be that seedlings are too difficult to distinguish until several true leaves emerge and are being depredated by slugs. Therefore, significant numbers of seedlings and immature plants may be needed to maintain population stability goals. All PUs will need augmentation or reintroductions to establish the population structure to meet and maintain stability goals.
- Slugs are thought to depredate seedlings of *C. grimesiana* subsp. *obatae* and may limit regeneration of seedlings at most PUs. Slug control may be needed at all PUs before seedlings and immature plants are able to become established.
- Plants are observed to grow slowly and have high mortality rates in all size classes. However, due to limited observations of natural regeneration, little data is available on growth rates and survivorship of young plants. The immature plant was discovered in Palikea Gulch in 2000, when the plant was less than 10 cm tall. This plant has been monitored regularly since, but has not yet been observed to have flowered.
- At Palikea (South Palawai), the developing population structure is being closely monitored as it is the only site with significant recruitment. Seedlings have been observed to survive to be immature plants. Data on stage class distribution and survivorship will be collected and management adapted accordingly.
- OANRP will develop techniques to increase seedling establishment at all sites. Particularly at sites where slug control with Sluggo may not be possible due to the presence of rare snails, trials may include collecting mature fruit and applying fruit to adjacent substrates. Potential sites to be considered include Central Kaluaa and Makaha.
- Mature fruits have been removed from in situ plants and smeared on adjacent slopes and cliffs. Immature plants were observed to emerge from this effort, but died before maturing. Additional fruit smears at Kaluaa and Pahole did not result in any surviving plants and results at Palikea (South Palawai) were inconclusive.
- OANRP will continue to pursue a new label for Sluggo so that it can be applied at sites without rare snails. The sites in West Makaleha may be good candidates for slug control trials since *Achatinella* are not observed within the PU.

## Population Estimate History

Manage for Stability Population Unit	2003 (IP) Mat/Imm/Seedling	2003 Mat/Imm/Seedling	2004 Mat/Imm/Seedling	2005 Mat/Imm/Seedling	2006 Mat/Imm/Seedling	2007 Mat/Imm/Seedling	2008 Mat/Imm/Seedling	2009 Mat/Imm/Seedling
Central Kaluaa in situ	0	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0	1/1/0
Central Kaluaa outplanted	0	0	0	0/70/0	26/40/0	18/30/0	10/45/0	11/45/0
Palikea (S. Palawai) in situ	3/25/0	8/7/0	8/7/15	8/7/10	10/12/20	7/11/10	10/35/0	13/36/0
Palikea (S. Palawai) outplanted	0	0/35/0	0/35/0	12/18/0	44/18/0	64/14/0	78/4/0	79/1/0
Makaha in situ	0	0	0	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0
Pahole to West Makaleha in situ	8/5/1	7/3/0	7/3/0	7/3/0	7/1/8	6/0/9	6/6/4	5/6/4
Pahole to West Makaleha outplanted	0	14/19/0	15/15/0	15/15/0	24/2/0	19/18/0	28/9/0	27/12/0
<b>Genetic Storage Population Units</b>								
North branch of South Ekahanui in situ	5/0/0	0	0	0	0	0	0	0
North branch of South Ekahanui outplanted	0	0	0	0	21/18/0	23/14/0	30/0/0	30/0/0
Palikea Gulch in situ	0/1/0	0/1/0	0/1/0	0/1/0	0/1/0	0/1/0	0/1/0	0/1/0
South Kaluaa in situ	2/0/0	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0
South Kaluaa outplanted	0	0	0	0	0	9/0/0	5/14/0	4/10/0

## Monitoring Plan

- All PUs will be monitored annually for population structure, trends and threats. Reintroduced and wild plants will be monitored twice annually for reproductive status, vigor and growth.
- All sites with reproductive plants will be monitored in order to time the installation of rodent protection as the fruit develops. Sites with reproductive plants will be protected from rodent impacts as feasible and monitored to ensure fruit development.
- Sites with reproductive plants will also be monitored in the spring for new seedlings. Monitoring will focus on areas under fruiting plants. Seedlings at all sites will be counted and areas with seedlings will be delineated on sketch maps. New immature plants at all sites will be tagged and monitored for vigor and growth.
- Sites with seedlings will be examined and a profile of micro-site requirements will begin to be developed.
- Seedlings will be monitored to track survivorship and growth. Slug impacts will be documented as another focus of the searches.

## Genetic Storage Plan

What propagule type is used for meeting genetic storage goal?	What is the source for the propagules?	What is the Genetic Storage Method used to meet the goal?	What is the proposed re-collection interval for seed storage?	Is seed storage testing ongoing?	Plan for maintaining genetic storage.
Seeds	Wild plants and Reintroductions	Seed banking (5C or -80C / 20% RH)	5+ yrs.	Yes	Collections will be made from reintroductions as needed.

**Genetic Storage Plan Comments:** As many of the wild founder plants have died, a number of collections are made from reintroductions. Founders are tracked and collections made appropriately. When F1s at wild sites become reproductive, collections will be made to represent these individuals as they may represent new mixes and have undergone selective pressures at the seed, seedling, and immature stages. The re-collection interval will likely be increased to 10 years pending 10 year storage results and results from newly tested storage conditions.

## Reintroduction Plan for MFS PUs

Manage for Stability Population Unit	Reintroduction Site(s)	Number of Plants to be planted *	Propagule Type	Propagule Population(s) Source	Number of Founders in Source Population.	Plant Size	Pot Size
Central Kaluaa	KAL-D	100 (218%)	Immature plants	Central Kaluaa	1	> 20 cm	1 gallon
Pahole to West Makaleha	Pahole: PAH-C	50**	Immature plants	Pahole: PAH-A, B	5	> 20 cm	1 gallon
Pahole to West Makaleha	Pahole: PAH-D	50 (274%)	Immature plants	Pahole: PAH-A, B	5	> 20 cm	1 gallon
Pahole to West Makaleha	West Makaleha: LEH- B	50 (162%)	Immature plants	West Makaleha	5	> 20 cm	1 gallon
Makaha	MAK- B (Not established yet)	50 (162%)	Immature plants	Makaha MAK-A	1	> 20 cm	1 gallon
Makaha	MAK- C (Not established yet)	50 (162%)	Immature plants	Makaha & West Makleha	6	> 20 cm	1 gallon
Palikea (South Palawai)	PAK-B	100 (116%)	Immature plants	Palikea (South Palawai)	19+	> 20 cm	1 gallon
Palikea (South Palawai)	PAK-C (not established yet)	100 (116%)	Immature plants	Palikea (South Palawai)	19+	> 20 cm	1 gallon

\*Number of Plants to be Planted: The target number for each site is listed followed by a percentage. For sites with existing plantings, the total number planted (adjusted for time to mature after planting) was divided by the number of these plants that are mature. The percentage displayed is the multiplier needed to compensate for the survivorship of mature plants calculated for each site. The target number is multiplied by this percentage to get the number of plants to be planted. For sites with no or few existing plants, an averaged percentage (162%) from across all reintroductions is multiplied by the target. Percent survival varies significantly between PUs.

\*\*The PAH-C reintroduction is space limited. Therefore, only 50 plants total were planted at this site, and the remaining plants will be planted at PAH-D.

+More founders may be collected from this site

## Reintroduction Plan for Genetic Storage Population & Other Units


Genetic Storage Population Unit	Reintroduction Site(s)	Number of Plants to be planted *	Propagule Type	Propagule Population(s) Source	Number of Founders in Source Population.	Plant Size	Pot Size
North branch of South Ekahanui	EKA-C	100 (117%)	Immature plants	South Ekahanui	2	>20 cm	1 gallon
South Kaluaa	KAL-E	100 (162%)	Immature plants	South Kaluaa	1	>20 cm	1 gallon
N/A	KAL-C	0*	Immature plants	South Kaluaa	1	>20 cm	1 gallon
N/A	EKA-B	0*	Immature plants	South Kaluaa & Ekahanui	2	>20 cm	1 gallon

\*These are older TNC outplantings with a few individuals left. They will be monitored but OANRP will not add any additional plants.

# Reintroduction Plan Comments

- There are a total of seven established outplanting sites (one each in Central Kaluaa, South Kaluaa, West Makaleha, Palikea (South Palawai) and South Ekahanui and two in Pahole). There are plans for three more; two in Makaha and another in Palikea (South Palawai). All MFS PUs will require outplantings to reach goals.
- Reintroduction techniques are still being refined. Recent field observations indicate that reintroductions have done better in partly sunny areas compared with more shady areas as plants receiving more sunlight may be able to outpace slug damage with faster leaf production.
- Central Kaluaa: There is one reintroduction site (KAL-D) to represent the single founder from the KAL-B in situ site. These plants are grown from seed collected from the wild plant. Additional planting will continue.
- Pahole to West Makaleha: There are two sites in Pahole to represent the 5 available founders. Each will have XXX plants and planting will continue until founders are balanced. The West Makaleha site will be augmented on an adjacent slope with plants grown from seed collected from all available founders at that site.
- Makaha PU: Two augmentations will be established beginning in 2011. The first will be into Subunit I and will use stock from the single founder from Makaha. The second will be into Subunit II and will use plants grown from the Makaha plant mixed with all available founders from the West Makaleha site.
- Palikea (South Palawai): One augmentation (PAK-B) began in 2004. The goal is to have 2 plants from each of the available founders (19+) planted here by MIP Year 8. Another augmentation planting will be planned for the larger Palikea MU fence using stock grown from the wild plants.
- North branch of South Ekahanui: Two founders are available from the extirpated stock. Both are represented at the reintroduction at EKA-D and planting will continue there until founders are balanced. The EKA-C site is an older TNC outplanting of stock from Ekahanui mixed with plants grown from South Kaluaa. This site will be monitored and collected from to represent those PUs but not used for additional plantings.
- South Kaluaa: There is one reintroduction site in this PU to represent the single available founder. Planting began in 2007 and will likely continue until MIP Year 9.

## 5 Year Action Plan

	 Proposed Actions for the following years:				
Manage for Stability Population Unit	MIP YEAR 6 October 1, 2009 – September 31, 2010	MIP YEAR 7 October 1, 2010 – September 31, 2011	MIP YEAR 8 October 1, 2011 – September 31, 2012	MIP YEAR 9 October 1, 2012 – September 31, 2013	MIP YEAR 10 October 1, 2013 – September 31, 2014
Central Kaluaa	•Reintroduce •Monitor & Collect	•Reintroduce •Monitor & Collect	•Reintroduce •Monitor & Collect	•Monitor & Collect	•Monitor & Collect
Palikea (South Palawai)	•Reintroduce •Monitor & Collect	•Reintroduce •Monitor & Collect	•Reintroduce •Monitor & Collect	•Begin new reintroduction •Monitor & Collect	•Reintroduce •Monitor & Collect
Makaha	•Monitor & Collect	•Reintroduce •Monitor & Collect •Begin slug control	•Reintroduce •Monitor & Collect •Slug control	•Reintroduce •Monitor & Collect •Slug control	•Reintroduce •Monitor & Collect •Slug Control
Pahole to West Makaleha	•Reintroduce •Monitor & Collect	•Reintroduce •Monitor & Collect •Begin slug control at West Makaleha	•Reintroduce •Monitor & Collect •Slug control at West Makaleha	•Reintroduce •Monitor & Collect •Slug control at West Makaleha	•Monitor & Collect •Slug control at West Makaleha
<b>Genetic Storage Population Units</b>					
South Kaluaa	•Reintroduce •Monitor	•Reintroduce •Monitor	•Reintroduce •Monitor	•Reintroduce •Monitor	•Monitor
North branch of South Ekahanui	•Reintroduce •Monitor	•Reintroduce •Monitor & Collect	•Reintroduce •Monitor & Collect	•Reintroduce •Monitor & Collect	•Reintroduce •Monitor
Palikea Gulch	•Monitor & Collect	•Monitor & Collect	•Monitor & Collect	•Monitor & Collect	•Monitor & Collect

## 2008-2009 Stabilization Goals Update

Manage for Stability Population Units	PU Stability Target		MU Threat Control						Genetic Storage
	Has the Stability Target for mature plants been met?	Does the PU have observed structure to support the stability target in the long-term?	Ungulates	Weeds	Rodents	Fire	Slugs	Black Twig Borer	Are there enough propagules in Genetic Storage?
Central Kaluaa	NO	NO	YES	YES	NO	NO	NO	NO	YES
Pahole to West Makaleha	NO	NO	YES	YES	PARTIAL	NO	NO	NO	YES
Makaha	NO	NO	YES	YES	YES	NO	NO	NO	YES
Palikeya (South Palawai)	NO	NO	YES	YES	NO	NO	NO	NO	YES
Genetic Storage PU									
North branch of South Ekahanui	N/A	N/A	YES	YES	PARTIAL	NO	NO	NO	YES
Palikeya Gulch	N/A	N/A	YES	NO	NO	NO	NO	NO	NO
South Kaluaa	N/A	N/A	YES	PARTIAL	NO	NO	NO	NO	YES

## 2008-2009 Highlights

### Major Highlights/Issues MIP Year 5

- The Palikeya (South Palawai) PU is close to the goal of 100 reproducing individuals (95 including augmentation). Other Manage for Stability (MFS) PUs are far below the goal.
- The Central Kaluaa PU reintroduction continues to decline despite supplemental plantings (33% survivorship since 2004, 50 plants remain). Slug damage has been documented as a common cause of death at this site.
- Large MU fences at three of the four MFS sites (Central Kaluaa, Makaha, Palikeya (South Palawai)) are complete and pig free. All plants at the Pahole to West Makaleha PU are protected from pigs, however the larger West Makaleha MU fence is still being planned.
- Collections continued at the Makaha PU, Palikeya (South Palawai) PU, and Pahole to West Makaleha PU. All available founders from the Makaha PU, Central Kaluaa PU, South Kaluaa PU, South Ekahanui PU, Pahole to West Makaleha PU are now represented in genetic storage. Collections continue from Makaha and Pahole to West Makaleha PUs because although storage goals are met, survivorship is low when plants are germinated. The single plant at Palikeya Gulch has not yet matured.
- OANRP began outplanting at the West Makaleha PU with 3 individuals. Although reintroduction goals are higher, only three were large enough to plant due to low survivorship of the seedlings grown from this PU. Reintroductions continued at South Ekahanui, Pahole, and Central and South Kaluaa.
- A new immature plant was noted below the single mature plant in the Central Kaluaa PU





# 2008-2009 Plans

## Plans for MIP Year 6

- Conduct census monitoring and seedling/immature searches at all sites in the spring and fall of 2010
- Finalize plans and agreements for the West Makaleha MU fence
- Supplement reintroductions at Pahole to West Makaleha, Palikea (South Palawai), Central and South Kaluaa, and South Ekahanui and continue propagation for the new reintroduction at Makaha scheduled to begin in 2010.
- Continue to collect for genetic storage from new and unrepresented founders
- Expand rodent control to unprotected sites as feasible (4 of 7 active sites have year round rodent control).
- Pursue SLN label for Sluggo
- Determine what is limiting seedling at sites where viable fruit is known to be readily available on mature plants. Studies to determine if the fruit is being naturally dispersed and trials to identify sites with conditions favorable for germination will be considered.

## 2008-2009 Taxon Status Table

Action Area: In														
TaxonName: <i>Cyanea grimesiana</i> subsp. <i>obatae</i> TaxonCode: CyaGriOba														
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2008	NRS Immature 2008	NRS Seedling 2008	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Pahole to West Makaleha	Manage for stability	5	6	4	27	12	0	34	15	4	32	18	4	New seedlings and immature plants were noted in the W. Makaleha wild site. More plants were added to all existing outplantings and a few outplanted plants died.
Total for Taxon:		5	6	4	27	12	0	34	15	4	32	18	4	
Action Area: Out														
TaxonName: <i>Cyanea grimesiana</i> subsp. <i>obatae</i> TaxonCode: CyaGriOba														
Population Unit Name	Management Designation	Current Mature (Wild)	Current Immature (Wild)	Current Seedling (Wild)	Current Augmented Mature	Current Augmented Immature	Current Augmented Seedling	NRS Mature 2008	NRS Immature 2008	NRS Seedling 2008	Total Mature	Total Immature	Total Seedling	Population Trend Notes
Central Kaluaa	Manage for stability	1	1	0	28	22	0	11	45	0	29	23	0	In the outplanting, many of the immature plants matured in the last year. At the wild site, a small immature plant was observed under the single wild individual.
Makaha	Manage for stability	1	0	0	0	0	0	1	0	0	1	0	0	Monitoring showed no change
North branch of South Ekahanui	Genetic Storage	0	0	0	31	0	0	30	0	0	31	0	0	Population counts were revised after updating old observations
Palikea (South Palawai)	Manage for stability	13	36	0	79	1	0	88	39	0	92	37	0	In the reintroduction site two immature plants died and one matured. In the wild site, three new mature and one new immature plant were noted.
Palikea Gulch	Genetic Storage	0	1	0	0	0	0	0	1	0	0	1	0	This plant has been observed in the last year
South Kaluaa	Genetic Storage	0	0	0	4	10	0	5	14	0	4	10	0	In the reintroduction sites, two mature and three immature plants have died and an immature plant flowered for the first time.
Total for Taxon:		15	38	0	142	33	0	135	99	0	157	71	0	

## 2008-2009 Genetic Storage Table

Population Unit Name	# of Potential Founders			Partial Storage Status			Storage Goals Met
	Current Mature	Current Imm.	Num/Wild Dead	# Plants >= 10 in Seedbank	# Plants >=1 Microprop	# Plants >=1 Army Nursery	# Plants that Met Goal
<i>Cyanea grimesiana</i> subsp. <i>obatae</i>							
Central Kaluaa	1	1	0	1	0	1	1
Makaha	1	0	0	1	0	1	1
North branch of South Ekahanui	0	0	2	1	2	2	2
Pahole to West Makaleha	5	6	5	10	0	9	10
Palikea (South Palawai)	13	36	5	13	5	9	13
Palikea Gulch	0	1	0	0	0	0	0
South Kaluaa	0	0	1	1	0	1	1
				Total # Plants w/ >=10 Seeds in Seedbank	Total # Plants w/ >=1 Microprop	Total # Plants w/ >=1 Army Nursery	Total # Plants that Met Goal
				27	7	23	28