

*Pleomele forbesii*  
(hala pepe)

**5-Year Review  
Summary and Evaluation**

**U.S. Fish and Wildlife Service  
Pacific Islands Fish and Wildlife Office  
Honolulu, Hawai'i**

**5-YEAR REVIEW**  
Species reviewed: *Pleomele forbesii* (hala pepe)

**TABLE OF CONTENTS**

<b>1.0</b>	<b>GENERAL INFORMATION</b> .....	<b>3</b>
1.1	Reviewers:.....	3
1.2	Methodology used to complete the review:.....	3
1.3	Background: .....	3
<b>2.0</b>	<b>REVIEW ANALYSIS</b> .....	<b>4</b>
2.1	Application of the 1996 Distinct Population Segment (DPS) policy .....	4
2.2	Recovery Criteria.....	5
2.3	Updated Information and Current Species Status .....	8
2.4	Synthesis.....	14
<b>3.0</b>	<b>RESULTS</b> .....	<b>14</b>
3.1	Recommended Classification:.....	14
3.2	New Recovery Priority Number: .....	14
3.3	Listing and Reclassification Priority Number: .....	15
<b>4.0</b>	<b>RECOMMENDATIONS FOR FUTURE ACTIONS</b> .....	<b>15</b>
<b>5.0</b>	<b>REFERENCES</b> .....	<b>15</b>

## **5-YEAR REVIEW**

### ***Pleomele forbesii* (hala pepe)**

#### **1.0 GENERAL INFORMATION**

##### **1.1 Reviewers:**

Cheryl Phillipson, Biologist, Pacific Islands Fish and Wildlife Office (PIFWO)  
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO  
Megan Laut, Conservation and Restoration Team Manager, PIFWO

##### **Lead Regional Office:**

Region 1, Endangered Species Program, Division of Recovery, (503) 231-6868

##### **Lead Field Office:**

Pacific Islands Fish and Wildlife Office, (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 in October 2018. The review was based on the final rule listing this species; the final critical habitat designation; peer reviewed scientific publications; unpublished field observations by the USFWS, State of Hawai‘i, and other experienced biologists; unpublished survey reports; notes and communications from other qualified biologists; as well as a review of current, available information. The evaluation completed by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Conservation and Restoration Team Manager.

##### **1.3 Background:**

###### **1.3.1 FR Notice citation announcing initiation of this review:**

[USFWS] U.S. Fish and Wildlife Service. 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665-18668, April 20, 2017.

###### **1.3.2 Listing history:**

###### Original Listing

**FR notice:** [USFWS] U.S. Fish and Wildlife Service. 2012. Endangered and threatened wildlife and plants; Endangered status for 23 species on Oahu and

designation of critical habitat for 124 species; final rule. Department of the Interior, Federal Register 77 (181): 57648–57862, September 18, 2012.

**Date listed:** September 18, 2012  
**Entity listed:** *Pleomele forbesii*  
**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:**

N/A

**1.3.4 Review History:**

This is the first 5-year review for this species. *Pleomele forbesii* is a perennial tree listed as endangered on September 18, 2012 (77 FR 57648). Critical habitat was designated on O‘ahu for *P. forbesii* at the same time, totaling 17 critical habitat units in the lowland dry, lowland mesic, and dry cliff ecosystems of the Wai‘anae and Ko‘olau mountains (9,400 ac, 2,007 ha). The draft recovery plan for this species is in preparation.

**1.3.5 Species’ Recovery Priority Number at start of this 5-year review:**

5

**1.3.6 Current Recovery Plan or Outline:**

**Name of plan or outline:** Recovery Outline for the Island of O‘ahu  
**Date issued:** July 2018  
**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  
 No

**2.1.2 Is the species under review listed as a DPS?**

Yes  
 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  
 No

## **2.2 Recovery Criteria**

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

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?**

Yes  
 No

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

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.

The recovery plan is currently being drafted. However, the Hawai'i and Pacific Plants Recovery Coordinating Committee (HPPRCC) has outlined the actions and goals for stages leading towards recovery (2011). These stages are described below.

Current information is lacking for many Hawaiian plant species on the status of the species and their habitats, breeding systems, genetics, and propagule storage options. The following downlisting and delisting criteria for plants have therefore been adopted from the revised recovery objective guidelines developed by the HPPRCC (2011). Many of the Hawaiian plant species are at very low numbers, so the USFWS also developed criteria for avoiding imminent extinction and an interim stage before downlisting, based on the recommendations of the HPPRCC, to assist in tracking progress toward the ultimate goal of recovery. These criteria are assessed on a species-by-species basis, especially as additional information becomes available.

In general, long-lived perennials are those taxa either known or believed to have life spans greater than 10 years; short-lived perennials are those known or believed to have life spans greater than one year but less than 10 years; and annuals are those known or believed to have life spans less than or equal to one year. When it is unknown whether a species is long- or short-lived, the USFWS has erred on the side of caution and considered the species short-lived. This will be revised as more is learned about the life histories of these species. Narrow extant range and broad contiguous range are recognized as not needing different numbers of individuals or populations, but that the populations will be distributed more narrowly or more broadly, respectively, across the landscape. Obligate outcrossers are those species that either have male and female flowers on separate plants or otherwise require cross-pollination to fertilize seeds, and therefore require equal numbers of individuals contributing to reproduction as males and females, doubling the number of mature individuals. Species that reproduce vegetatively may reproduce sexually only on occasion, resulting in the majority of the genetic variation being between populations, therefore requiring additional populations. Species that have a tendency to fluctuate in number from year to year require a larger number of mature individuals on average to allow for decline in years of extreme habitat conditions and recuperation in numbers in years of more normal conditions.

### **Preventing Extinction**

Stabilizing (interim), downlisting, and delisting objectives have been updated according to the draft revised recovery objective guidelines developed by the HPPRCC (2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage

remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

*Pleomele forbesii* is a short-lived perennial tree. To prevent extinction, which is the first step in recovering the species, the taxon must be managed to control threats (e.g., fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections. In addition, a minimum of three populations should be documented on O‘ahu where they now occur or occurred historically. Each of these populations must be naturally reproducing (i.e., viable seeds, seedlings, saplings) and increasing in number, with a minimum of 50 mature, reproducing individuals per population.

This recovery objective has not been met (see Table 1).

### **Interim Stage**

To meet the interim stage of recovery of *Pleomele forbesii*, 300 mature, reproducing individuals are needed in each of three populations and all major threats must be controlled around the populations designated for recovery at this stage. There should also be demonstrated regeneration of seedlings and growth to at least sapling stage for woody species and documented replacement regeneration within each of the target populations. The populations must be adequately represented in an *ex situ* collection as defined in the Center for Plant Conservation’s guidelines (Guerrant *et al.* 2004). Adequate monitoring must be in place and conducted to assess individual plant survival, population trends, trends of major limiting factors, and response of major limiting factors to management.

This recovery objective has not been met (see Table 1).

### **Downlisting Criteria**

In addition to achieving 5 to 10 populations with 500 mature, reproducing individuals per population and all of the goals of the interim stage, all target populations must be stable, secure, and naturally reproducing for a minimum of 10 years. Species-specific management actions are not ruled out. Downlisting should not be considered until an adequate population viability analysis (PVA) has been conducted to assess needed numbers more accurately based on current management and monitoring data collected at regular intervals determined by demographic parameters of the species, although they should only be one of the factors used in making a decision to downlist. Information necessary for the PVA that should be available through monitoring (ideally annually) includes major limiting factors, breeding system, population structure and density, and proven management methods for major threats.

This recovery objective has not been met (see Table 1).

### **Delisting Criteria**

In addition to achieving 5 to 10 populations with 500 mature, reproducing individuals per population and all of the goals of the interim and downlisting stages, all target populations must be stable, secure, naturally reproducing, and within secure and viable habitats for a minimum of 20 years. Species-specific management actions must no longer be necessary, but ecosystem-wide management actions are not ruled out if there are long-term agreements in place to continue management. These numbers are initial targets, but may be revised upward as additional information is available, including adequate PVAs for individual species based on current management and monitoring data collected at regular intervals determined by demographic parameters of the species, although they should only be one of the factors used in making a decision to delist. Genetic analyses should be conducted to ensure that adequate genetic representation is present within and among populations compared to the initial variation assessed in the interim stage. Numbers need to be considered on a species-by-species basis.

This recovery objective has not been met (see Table 1).

## **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:**

Little is known about the life history of *Pleomele forbesii*. Its flowering cycles, pollination vectors, seed dispersal agents, specific environmental requirements, and limiting factors are largely unknown.

*Pleomele forbesii*, a member of the asparagus family (Asparagaceae), is a tree 9.8 to 23 feet (ft) (3 to 7 meters (m)) tall, usually few-branched. Leaves are spirally clustered toward the ends of branches and are somewhat tough but flexible, 9 to 14.6 inches (in) (24 to 37 centimeters (cm)) long, 0.2 to 0.5 in (0.5 to 1.2 cm) wide, gradually tapering from near middle. Panicles (branched inflorescences with hanging flowers on the second branches) are narrow, slightly waxy, about 6 to 14 in (15 to 35 cm) long, the lower lateral branches about 1.2 to 3 in (3 to 8 cm) long, stalks 2.8 to 5 in (7 to 12 cm) long, and abruptly recurved. Flower petals are greenish-yellow and 2 to 2.3 in (52 to 60 millimeters (mm)) long. Berries are red, about 0.4 to 0.43 in (10 to 11 mm) long containing 1 to 3 seeds (Wagner *et al.* 1999).

**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:**

Historical data for this species shows that it was wide-ranging from the summit ridges of the Wai‘anae mountains, and from the most northern and southern Ko‘olau range (Hawai‘i Biodiversity and Mapping Program (HBMP) 2010). At the time of listing in 2012, *Pleomele forbesii* was known from 19 occurrences in the Wai‘anae mountains, and one occurrence in the Ko‘olau mountains, totaling between 290 and 310 individuals (77 FR 57648, September 18, 2012). Currently, the Army Natural Resources Program tracks populations while conducting management actions for other listed species in the Wai‘anae mountains, and there are at least 11 occurrences totaling fewer than 150 individuals. Some Wai‘anae occurrences have not been monitored since the early 2000s and their current status is unknown (U.S. Army 2018, Army Natural Resources Program- O‘ahu (ARNP) 2018). The population in the southern Ko‘olau mountains at Kului gulch likely persists since its last observation in 2005 (Ching 2019, in litt.; Lau, 2008 pers. comm.).

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

N/A

**2.3.1.4 Taxonomic classification or changes in nomenclature:**

*Pleomele forbesii* was described by Degener in 1946 and was recognized as such when listed as Endangered (Degener 1946; USFWS 2012). In 2014, Lu and Morden conducted a phylogenetic analysis of dracaenoid plant genera and found that the Hawaiian *Pleomele* species are morphologically and phylogenetically distinct from other dracaenoids and should be recognized as a distinct genus, *Chrysodracon* (from the Greek “chryso,” golden and “dracon,” dragon, referring to the unique yellow flowers), and therefore new species combinations were made. The new combination for this species is *Chrysodracon forbesii* in the most recent taxonomic treatment in the checklist of Hawaiian flora (Smithsonian 2019). This taxonomic change does not affect the range or endangered status of this species. We will refer to this species as *Chrysodracon forbesii* throughout the following sections of this document.

When listed in 2012, *Chrysodracon forbesii* was classified as a member of the Agavaceae family. Since that time, Wagner *et al.* (2012) recognized the placement of *C. forbesii* into the Asparagaceae family, following the analysis by Chase *et al.* (2009).

**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 section 2.3.1.2 above for spatial distribution of the species.

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

Typical habitat for this species is lowland dry and mesic *Diospyros* (lama)-*Metrosideros* (‘ōhi‘a)-*Acacia* (koa) forest, *Dodonaea* shrubland, and cliffs, 800 to 2,920 ft (243 to 890 m) elevation in the Wai‘anae mountains of O‘ahu. Associated native species include *Alyxia stellata* (maile), *Antidesma pulvinatum* (hame), *Claoxylon sandwicense* (po‘olā), *Dodonaea viscosa* (‘a‘ali‘i), *Erythrina sandwicensis* (wiliwili), *Euphorbia* sp. (‘akoko), *Myoporum sandwicense* (naio), *Nestegis sandwicensis* (olopua), *Nothocestrum longifolium* (‘aiea), *Pisonia* sp. (pāpala kēpau), *Polyscias sandwicensis* (‘ohe), *Psydrax odorata* (alaha‘e), *Rauwolfia sandwicensis* (hao), *Santalum freycinetianum* (‘iliahi), *Sapindus oahuensis* (lonomea), *Urera* sp. (ōpuhe), and *Zanthoxylum dipetalum* (kāwa‘u) (St. John 1985; HBMP 2010).

The individuals in the Ko‘olau mountains are found in lowland mesic mixed shrubland at 800 ft (243 m) with the associate native species *Polyscias sandwicensis* and *Psydrax odorata* (HBMP 2010; Lau 2008, pers. comm.).

## **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 (Factor A):**

Ungulate degradation of habitat—Feral pigs and the effects of their activities have been observed at the occurrences at Kaluakauila, Kolekole, Pālāwai, Mākua, Hālonā, ‘Ēkahanui, Wai‘anae Kai, and the Mākaha ridges (HBMP 2010). Goats and the effects of their activities have been observed at the occurrences at Mākua, Pu‘ukaua, Kolekole-Pu‘uhapapa, Kea‘au, and Wai‘anae Kai (HBMP 2010). Feral ungulates modify and degrade habitat by disturbing and destroying vegetative cover, trampling plants and seedlings, reducing or eliminating plant regeneration by damaging seeds and seedlings, and increasing erosion by creating large areas of bare soil (Loope 1998; van Riper and van Riper 1982).

Degradation of habitat by established ecosystem-altering invasive plant species—Nonnative plant species impact all locations where *Chrysodracon forbesii* occurs (HBMP 2010). The nonnative species with the greatest impacts to this species and its habitat are *Acacia confusa* (Formosa koa), *Ageratina riparia* (Hāmākua pāmākani), *Aleurites moluccana* (kukui), *Chrysophyllum oliviforme* (satin leaf), *Clidemia hirta* (Koster’s curse), *Ficus microcarpa* (Chinese banyan), *Grevillea robusta* (silk oak), *Kalanchoe pinnata* (air plant), *Lantana camara* (lantana), *Leucana leucocephala* (koa haole), *Melinis minutiflora* (molasses grass), *Passiflora suberosa* (huehue haole), *Pimenta dioica* (allspice), *Psidium*

*cattleianum* (strawberry guava), *P. guajava* (common guava), *Schefflera actinophylla* (octopus tree), *Schinus terebinthifolius* (Christmasberry), *Toona ciliata* (Australian red cedar), and *Urochloa maxima* (guinea grass) (HBMP 2010). Invasive nonnative plant species modify habitats occupied by native plant species by changing the availability of light, altering soil-water regimes, modifying nutrient cycling, and by changing the fire characteristics of the native plant community (Cuddihy and Stone 1990).

Climate change loss or degradation of habitat—Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawai‘i using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment concluded that *Chrysodracon forbesii* is highly vulnerable to the impacts of climate change with a vulnerability score of 0.796 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). Therefore, additional management actions are needed to conserve this taxon into the future, such as identifying suitable microsites where climate change is anticipated to occur more slowly and considering suitable habitat outside of its known range.

#### **2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes (Factor B):**

Not a threat.

#### **2.3.2.3 Disease or predation (Factor C):**

Invertebrate predation or herbivory—Two-spotted leafhopper—Herbivory or predation by the leafhopper (*Sophonia rufofascia*) is reported to be a threat to *Chrysodracon forbesii* at the Kolekole and Puu Hapapa occurrences, as the yellowing syndrome associated with its infestation has been observed (HBMP 2010). Adult leafhoppers infest plants and lay eggs within plant tissue. The leafhoppers use piercing mouthparts to inject saliva and break down plant tissue for consumption. Plant pathogens in the saliva cause damage to the plants, and possibly plant death (Extension Entomology UH-CTAHR 2009). Leafhoppers are more abundant at elevations below 1,219 m (4,000 ft) (Fukada 2007, in litt.).

#### **2.3.2.4 Inadequacy of existing regulatory mechanisms (Factor D):**

Not a threat.

#### **2.3.2.5 Other natural or manmade factors affecting its continued existence (Factor E):**

Invasive species—Established invasive plant species competition—*Acacia confusa*, *Ageratina riparia*, *Aleurites moluccana*, *Chrysophyllum oliviforme*, *Clidemia hirta*, *Ficus microcarpa*, *Grevillea robusta*,

*Kalanchoe pinnata*, *Lantana camara*, *Leucana leucocephala*, *Melinis minutiflora*, *Passiflora suberosa*, *Pimenta dioica*, *Psidium cattleianum*, *P. guajava*, *Schefflera actinophylla*, *Schinus terebinthifolius*, *Toona ciliata*, and *Urochloa maxima* compete with *Chrysodracon forbesii* for water, light, and nutrients, and prevent the establishment of seedlings (Cuddihy and Stone 1990; HBMP 2010).

Lack of regeneration—Small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species' capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence (Barrett and Kohn 1991; Newman and Pilson 1997). The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats, such as anthropogenic impacts like habitat loss from human development or predation by nonnative species. Very small plant populations may experience reduced reproductive vigor due to ineffective pollination or inbreeding depression. Lack of regeneration is noted as a cause of loss of reproductive vigor of *Chrysodracon forbesii* in the southern Ko'olau mountains (Lau 2008, pers. comm.).

#### Current Management Actions:

- Ungulate management and control—Approximately 100 individuals of *Chrysodracon forbesii* occur within seven of the Army Natural Resources Program's (ANRP) management units for other listed species in the Wai'anae mountains and could benefit from fencing for exclusion of feral ungulates and nonnative plant management (U.S. Army Garrison 2010; ANRP 2018).
- Captive propagation for genetic storage and reintroduction—
  - Propagules from five individuals from Mākua are in micropropagation to provide material for research on cryopreservation storage techniques for this species (Lyon Arboretum 2018, in litt.).
  - Waimea Arboretum reported propagation and storage of one individual in 2013, but no plants since then have been in their collection (Waimea Arboretum 2013, in litt., 2018, in litt.).

**Table 1. Status and trends of *Chrysodracon forbesii* from listing through 5-year review.**

Date	No. wild individuals	No. outplanted	Preventing Extinction Criteria identified by HPPRCC	Preventing Extinction Criteria Completed?
2012 (listing and critical habitat)	290–307	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2019 (5-year review)	< 150	0	All threats managed in all three populations	No
			Complete genetic storage	Partial, collection and research
			Three populations with 50 mature individuals each	No

**Table 2. Threats to *Chrysodracon forbesii* and ongoing conservation efforts.**

Threat	Listing Factor	Current Status	Conservation/Management Efforts
Ungulate degradation of habitat	A	Ongoing	Partial, some individuals may benefit from fencing
Degradation of habitat by established ecosystem-altering invasive plant species	A	Ongoing	Partial, some individuals may benefit from nonnative plant control in management areas
Climate change degradation or loss of habitat	A	Ongoing	None
Invertebrate predation or herbivory	C	Ongoing	None
Established invasive plant species competition	E	Ongoing	Partial, some individuals may benefit from nonnative plant control in management areas
Stochastic events—Lack of regeneration	E	Ongoing	Partial, a few individuals in storage

## 2.4 Synthesis

Numbers of *Chrysodracon forbesii* are reported to be fewer than 150, and is a decline in total population size since the time of listing. A landscape-based assessment of climate change vulnerability for native plants of Hawai'i using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *C. forbesii* is highly vulnerable to the effects of climate change. Only a few propagules are in storage, and research is being conducted on cryopreservation techniques for long-term germplasm storage.

Preventing extinction, interim stabilization, downlisting, and delisting objectives are provided in HPPRCC's Revised Recovery Objective Guidelines (2011). To prevent extinction, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g.*, fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in 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 O'ahu where they now occur or occurred historically and each of these populations must be naturally reproducing (*i.e.*, viable seeds, seedlings, or saplings) with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. There are no populations totaling over 50 individuals. Few individuals are represented in genetic storage (Table 1) and all threats are not being sufficiently managed throughout the range of the species (Table 2). Therefore, *Chrysodracon forbesii* meets the definition of endangered as it remains in danger of extinction throughout its range.

## 3.0 RESULTS

### 3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist

*Extinction*

*Recovery*

*Original data for classification in error*

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

- Surveys and inventories—Survey for *Chrysodracon forbesii* in historical locations and potentially suitable habitat. Monitor all known occurrences.
- Ungulate monitoring and control—Continue to construct and maintain fenced enclosures to protect individuals from the negative impacts of feral ungulates.
- Invasive plant monitoring and control—Continue to control established ecosystem-altering nonnative invasive plant species around all populations.
- Insect predation or herbivory—Develop and implement control methods for the two-spotted leafhopper.
- Captive propagation for genetic storage and reintroduction—Increase collection of seeds for storage and propagation efforts for maintenance of genetic stock.
- Reintroduction and translocation—Reintroduce individuals to suitable habitat within historic range that is being managed for known threats to this species to build resiliency and redundancy and promote regeneration at populations.
- Climate change adaptation strategy—Research the suitability of habitat in the future due to the impacts of climate change
- Alliance and partnership development—Contribute to implementation of ecosystem-level restoration and management to benefit this taxon.
- Update the listed entity on 50 CFR 17 to match the currently recognized taxonomy and change of plant family classification.

## 5.0 REFERENCES

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**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of *Chrysodracon forbesii* (hala pepe)**

**Current Classification:** Endangered

**Recommendation resulting from the 5-Year Review:**

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:** \_\_\_\_\_

**Review Conducted By:**

Cheryl Phillipson, Fish and Wildlife Biologist, PIFWO  
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO  
Megan Laut, Conservation and Restoration Team Manager, PIFWO

**FIELD OFFICE APPROVAL:**

for

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**Field Supervisor, Pacific Islands Fish and Wildlife Office**