Pritchardia remota
(Lo`ulu)

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: *Pritchardia remota* (Lo`ulu)

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5-YEAR REVIEW
Pritchardia remota (Lo`ulu)

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, Gina Shultz, Deputy 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:

Staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) conducted this review beginning on March 8, 2007. The Bernice P. Bishop Museum provided most of the updated information on the current status of *Pritchardia remota* and also provided recommendations for conservation actions needed prior to the next five-year review. The evaluation of the status of the species was prepared by the lead PIFWO biologist and reviewed by the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species, and Deputy Field Supervisor, before submission to the Field Supervisor for approval.

1.3 Background:

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

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

1.3.2 Listing history

Original Listing
FR notice: USFWS. 1996a. Endangered and threatened wildlife and plants; endangered status for three plants from the island of Nihoa, Hawaii; final rule. Federal Register 61(163):43178-43184.
Date listed: August 21, 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. 2003. Endangered and threatened wildlife and plants; designation of critical habitat for five plant species from the Northwestern Hawaiian Islands; final rule.

Critical habitat was designated for *Pritchardia remota* in one unit totaling 405 hectares (1,219 acres) or the entire island of Nihoa and one unit totaling 405 hectares (1,219 acres) or the entire island of Laysan (USFWS 2003). This designation includes habitat on Federal land.

1.3.4 Review History:

Species status review [FY 2008 Recovery Data Call (September 2008)]: Stable

Recovery achieved:
1 (0-25%) (FY 2008 Recovery Data Call)

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

2

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: USFWS. 1998. Final recovery plan for three plant species on Nihoa Island. USFWS, Portland, Oregon. 83 pages.
Date issued: March 31, 1998.
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?

____ ***Yes***
__*X*_ ***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 (Factors B, C, and E) affecting this species is presented in section 2.4. Factors A (present or threatened destruction, modification or curtailment of its habitat or range) and D (inadequacy of existing regulatory mechanisms) are not known to be a threat to this species.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the three species from Nihoa (USFWS 1998). Interim objectives include that population numbers remain stable, a monitoring program is established to monitor status and threats twice annually, the major threats to the taxon must be determined and controlled, and the taxon must be fully represented in *ex situ* (off-site) collections. *Ex situ* collections should maintain the maximum number of genetically distinct individuals practical.

This recovery objective has not been met.

For downlisting, interim objectives must be attained. In addition, a total of at least five colonies should exist on Nihoa and successful propagation and outplanting *ex situ* must be underway. Each of these must be stable, secure, and naturally reproducing. Colony sizes on Nihoa should be increased with caution, and only if there is good evidence that Nihoa can support additional colony growth without negative ecological impacts. This is a concern because of Nihoa's small size and its relatively intact, native ecosystem. Colony sizes will ultimately be determined by the carrying capacity of the site where they are grown. However, a preliminary target level for *Pritchardia remota* is a minimum of 100 mature individuals per colony. Each colony should be stable or increasing minimum of five consecutive years before downlisting is considered. The need for continued species-specific management actions should not preclude downlisting. As a component of threat control, a remote monitoring system should be installed on Nihoa to detect and record illegal landings and shipwrecks on the island and relay the information to National Wildlife Refuge staff in Honolulu.

This recovery objective has not been met.

To achieve delisting objectives, downlisting objectives must have been attained. In addition, delisting may be considered with the establishment of one to three additional colonies on an island other than Nihoa. In the case of *Pritchardia remota,* Laysan Island should be considered, since a palm that may have been this species formerly occurred there. Kilauea Point and Midway Atoll National Wildlife Refuges

should also be assessed for suitability since they are protected areas, have plant nursery facilities, and have full time staffs. Midway has a similar climate to Nihoa, and Kilauea Point also has north-facing cliffs similar to those on Nihoa. Should establishment of one to three colonies of this taxon on an island other than Nihoa occur, delisting may be considered when they have reached the same targets as those described for downlisting, including a minimum of 100 mature individuals per colony. Each colony should be stable or increasing for a minimum of five consecutive years. If the establishment of this taxon on a second island proves unfeasible, delisting may be considered if the downlisting objectives have been met and the colonies persist at target levels for a minimum of ten years. In order to initiate delisting in any of the above situations, there should no longer be a need for continued species-specific management actions, but delisting may proceed if there is a continuing need for ecosystem-wide management actions.

This recovery objective has not been met.

2.3 Updated Information and Current Species Status

In addition to the status summary table below, information on the species' status and threats was included in the final critical habitat rule referenced above in section 1.3.3 ("Associated Rulemakings") and in section 2.4 ("Synthesis") below, which also includes any new information about the status and threats of the species.

Table 1. Status of *Pritchardia remota* from listing through 5-year review.

Date	No. wild individuals	No. outplanted	Downlisting Criteria identified in Recovery Plan (preliminary)	Downlisting Criteria Completed?
1996 (listing)	680	0	5 colonies with minimum of 100 mature individuals for a minimum of 5 consecutive years	Partially
			Successful propagation and outplanting *ex situ*	Partially
			Remote monitoring system	No
1998 (recovery plan)	680	0	5 colonies with minimum of 100 mature individuals for a minimum of 5 consecutive years	Partially
			Successful propagation and outplanting *ex situ*	Partially
			Remote monitoring system	No
2003 (critical habitat)	> 1,072	11	5 colonies with minimum of 100 mature individuals for a minimum of 5 consecutive years	Partially
			Successful propagation and outplanting *ex situ*	Partially
			Remote monitoring system	No
2008 (5-year review)	~ 1,100	61	5 colonies with minimum of 100 mature individuals for a minimum of 5 consecutive years	Partially
			Successful propagation and outplanting *ex situ*	Partially
			Remote monitoring system	No

2.3.1 Biology and Habitat [see note in section 2.3]

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

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:

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

2.3.1.4 Taxonomic classification or changes in nomenclature:

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.):

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

2.3.1.7 Other:

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms) [see note in section 2.3]

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

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

2.3.2.3 Disease or predation:

2.3.2.4 Inadequacy of existing regulatory mechanisms:

2.3.2.4 Other natural or manmade factors affecting its continued existence:

2.4 Synthesis

Pritchardia remota is a long-lived perennial palm-tree endemic to the island of Nihoa as listed. Nihoa is part of the federally protected Hawaiian Islands National Wildlife Refuge (HINWR), also recently designated as part of the Papahanaumokuakea Marine National Monument (2008). Historically, population numbers seemed to be steadily increasing. At the time of its listing as federally endangered, it was known from two extant populations (populations are referred as colonies in the recovery plan and critical habitat designation) totaling 680 plants: 387 individuals in West Palm Valley, 293 in East Palm Valley (USFWS 1996a). In 2003, the species was known from two populations totaling at least 1,072 individuals, including 680 individuals in West Palm Valley and at least 392 individuals in East Palm Valley (USFWS 2003). Tangalin (2006) and Kropidlowski (2006) reported approximately 1,100 individuals on the island of Nihoa, including about 600 mature individuals in West Palm Valley, with numerous seedlings in the understory. Most adults had nearly full-sized immature fruit in April 2006. A pocket on the east side of the ridge between Tanager Peak and East Palm Valley had 12 mature individuals, one immature individual, and

25 seedlings. East Palm Valley had about 500 *P. remota* individuals, also in a stage with nearly mature fruit. Tangalin (2006) described a robust population structure with good regeneration, and signs of only old vagrant grasshopper (*Schistocerca nitens*) damage. A *Pritchardia*-like palm was observed on Laysan Island by several eighteenth century visitors (Evenhuis and Eldredge 2004). Unfortunately, since it was never collected, its identity remains a mystery. On that historical basis, and because it provides suitable habitat and is protected within the HINWR, Laysan was declared as unoccupied critical habitat suitable for the recovery of one to three additional populations of *P. remota* (USFWS 1998, 2003). Athens *et al.* (2007) confirmed, through pollen analysis of core samples taken in Laysan's hypersaline lake, the common presence of an unidentifiable *Pritchardia* on the island back to early Holocene times (5,150 to 7,000 years ago) and its disappearance in the pollen record by historical times.

Hodel (2007), in reviewing species concepts in the Pacific genus *Pritchardia,* could find no significant morphological differences between *P. remota* and *P. aylmer-robinsonii,* endemic to Niihau, and he synonymizes the latter name under *P. remota*. *Pritchardia aylmer-robinsonii* is federally listed as endangered and currently only two mature individuals remain on Niihau, on Kaali Cliff, in a seepage area on steep, rocky talus (USFWS 1996b). *Pritchardia aylmer-robinsonii* will be addressed as a separate five-year review.

Populations continue to be concentrated in two valleys (West Palm Valley and East Palm Valley) located on opposite sides of the island, approximately 0.6 km (0.4 mi) apart. The largest population is in West Palm Valley, with three smaller subpopulations in East Palm Valley, and scattered trees on steep outer walls of both valleys at the foot of basalt cliffs (Evenhuis and Eldredge 2004).

A recent major threat to the welfare of *Pritchardia remota* and its habitat include the vagrant grasshopper, an introduced insect normally occurring at more temperate latitudes in the northern hemisphere (Evenhuis and Eldredge 2004). The grasshopper was first reported on Nihoa in 1990, after having first been recorded in the main Hawaiian Islands in 1964. Populations on Nihoa were of minimal concern until 2002, and again in 2004, when a virtual plague of grasshoppers ravaged the vegetation on the island, denuding it (Factor C) (Gilmartin 2005). During the latter plague, an estimated six million grasshoppers were chewing vegetation at the rate of 1,200 pounds a day, removing practically all green foliage (Miller 2006). Tangalin (2006) saw an average of one or two a day while surveying Miller and Middle Valleys in April 2006. She noted no signs of fresh vagrant grasshopper damage on the leaves of *P. remota*. A scientific team visiting in October 2006 found the island fairly wet, the vegetation healthy, and the grasshopper population moderate at about 12,000 adults and twice as many nymphs (TenBruggencate 2006). The vagrant grasshopper's population explosions are apparently triggered by warm, dry conditions. Although the vegetation appears to recover following each episode, a continuation of this pattern does not bode well for the long-term survival of *P. remota* or the three other endangered plant species on Nihoa.

The introduction of rodents, especially rats (*e.g*., roof rat (*Rattus rattus*), Norway rat (*R. norvegicus*), Polynesian rat (*R. exulans*)), could be catastrophic for *Pritchardia remota* (Factor C) (USFWS 1998). Rats have been implicated in reducing reproductive capacity by eating other *Pritchardia* spp. seeds and seedlings, and damaging palm hearts (Chapin *et al.* 2004; Pérez *et al*. 2008b). Rats and mice (*Mus musculus*) are presently not found on Nihoa, and great care must be taken not to allow stowaway rodents from shipboards to gain access to the island. Another recent threat described for this species is an unknown fungus infecting seeds (Factor C) (Rehkemper *et al*. 2008).

Chapin *et al*. (2004) suggest this species is vulnerable to international trade of seeds as are other rare *Pritchardia* (Factor B). Palm seed dealers have offered $20 to $30 per ten seeds of *P. remota*. In considering creation of critical habitat for *Pritchardia remota*, USFWS (2003) first had to determine whether the designation of critical habitat would outweigh the potential increase in threats from vandalism or illegal collection and trade resulting from publicly disclosing the location of endangered populations. We determined that there was minimal threat because of HINWR permit requirement for access to the island, as well as the physically difficult and dangerous landing conditions.

In addition to all of the other threats, species like *Pritchardia remota* that are endemic to small portions of a single island are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations by random demographic fluctuations and localized catastrophes such as hurricanes, rockslides, flooding and disease outbreaks (Factor E). In the limited available habitat of the species supporting limited numbers of individuals, such events would cause severe habitat destruction and death of individual plants or entire populations. Fire and landslides are also continuing potential threats (Factor E).

The reefs and islets of the Northwestern Hawaiian chain from Nihoa through Kure Atoll are protected within Papahanaumokuakea Marine National Monument, co-managed by the USFWS, State of Hawaii, and National Oceanic and Atmospheric Administration. In addition, Nihoa is protected within the HINWR, which is managed in accordance with the National Wildlife Refuge System Administration Act of 1966. Access is strictly regulated through permitting because of the sensitivity of the organisms on these islands to human disturbance. Strict protocols for packing for field camps and moving between islands and atolls are upheld due to the high risk of importation of non-native plant and invertebrate species or pathogens. Papahanaumokuakea Marine National Monument (2008) managers plan to prepare the habitat on Laysan Island for establishment of a self-sustaining population of *Pritchardia remota* by 2012. Monitoring of plantings and weeding will be conducted in order to improve outplanting strategies. Seeds for this purpose should be collected from Nihoa and sterilized before transporting to Laysan to ensure they are free of pathogens. In order to protect *P. remota* from catastrophic events and archive recovery goals, the USFWS would continue to evaluate the potential of establishing one to three colonies outside of their historical range (Papahanaumokuakea Marine

National Monument 2008).

Specimens of *Pritchardia remota* can be found in several local botanical gardens, and the species is marketed worldwide in the commercial palm trade from cultivated sources. Seeds from ripe fruit are easily germinated, but do not store well and quickly lose their viability when desiccated. They can be refrigerated for only a few months before losing viability (Lilleeng-Rosenberger 2005). However, germination has been successful from excised embryos excision *in vitro* (Pérez 2005). Germination studies on *P. remota* sown on coral sand media suggest that seeds had greater germination rates when half buried or buried five centimeters (two inches) deep. No germination occurred for seeds sown directly on the soil surface. Germination was initiated after approximately five weeks and continued for the next 12 to 17 weeks under proper conditions (Pérez *et al*. 2008a). The study results suggest the removal of the fruit pericarp and/or operculum followed by incubation at high constant temperatures (25 to 35 degrees Celsius or 77 to 95 degrees Fahrenheit) and consistent moisture have the highest *ex situ* germination. The seeds were placed in a 5:1 by volume mixture of sand and distilled water; percent germination increased by allowing them to sit in the media for nine to 15 weeks.

Current plans are to outplant *P. remota* on Laysan Island, using nursery-grown material originating from Nihoa. At one time, 11 individuals reared from Nihoa seed were outplanted on Laysan, and they survived until flooded by high lake levels. In 2002, HINWR staff were growing 400 seedlings of *P. remota* from seed gathered on Nihoa in a shadehouse on Laysan Island, which were to be outplanted to suitable habitat on Laysan (USFWS 2003). However, finding suitable habitat on the island for outplanting has been a problem, since it is primarily limestone substrate, and outplantings have not met with great survival success (B. Flint, Fish and Wildlife Biologist, USFWS, HINWR, pers. comm. 2008).

Tangalin (2006) collected at least 230 seeds for storage and propagation at the National Tropical Botanical Garden for HINWR. The Center for Conservation Research and Training Seed Storage Laboratory (2008) has 13 seeds in storage from two wild individuals. Rowland *et al.* (2007) collected 170 seeds from eight trees for shipment to Laysan. However, 89 seeds were discarded when they became contaminated with mold (Rehkemper *et al*. 2008). More than 4,000 seeds were collected from 99 trees on September 2007. These seeds will be used for propagation and long-term storage at the U.S. National Center for Genetic Resources Preservation in Fort Collins, Colorado (Rehkemper *et al*. 2008).

The goals for genetic storage of *Pritchardia remota* have been partially met and only two populations on Nihoa can be considered stable (see Table 1), and therefore the downlisting and recovery goals for this species have not been met. In addition, a single catastrophic environmental event could threaten the species with extinction, since populations have not been successfully established on another island. Therefore, *P. remota* 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*
__X_ No change is needed

3.2 New Recovery Priority Number: N/A

Brief Rationale:

3.3 Listing and Reclassification Priority Number: N/A

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

- Continue seed collection for *ex situ* genetic storage and reintroduction.
- Continue to restrict human access.
- Prevent invasion of any introduced species on Nihoa.
- Determine and implement control methods for vagrant grasshopper.
- Determine identity of unknown fungus, the degree of impact to seeds, and if control methods are needed.
- Assess genetic variability within extant population and between species to determine taxonomic status of *Pritchardia remota* and *P. alymer-robinsonii*.
- Assess feasibility of outplanting *Pritchardia remota* on Laysan, Necker, and Lehua, which are the nearest islands, and are managed by the HINWR and State of Hawaii.
- Work with HINWR and State of Hawaii to provide ecosystem-level management of reintroduction sites.

- Study *Pritchardia remota* 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.

- Update the listed entity on 50 CFR 17 to include the two individuals from Niihau as *Pritchardia remota* and delist *P. aylmer-robinsonii* if genetic studies verify this taxonomic change.

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Personal Communications

Flint, Beth. Fish and Wildlife Biologist, USFWS, HINWR. Personal communication to Bernice P. Bishop Museum on January 11, 2008.

Signature Page

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Pritchardia remota* (Lo`ulu)

Current Classification: _____E_____

Recommendation resulting from the 5-Year Review:

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

Appropriate Listing/Reclassification Priority Number, if applicable:_____

Review Conducted By:

Christian Torres-Santana, Student Trainee Biologist
Marie Bruegmann, Plant Recovery Coordinator
Marilet A. Zablan, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species
Gina Shultz, Deputy Field Supervisor

Approved _____ Date 21 July 2009
Acting Field Supervisor, Pacific Islands Fish and Wildlife Office