Pritchardia affinis
(Loulu)

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 affinis* (Loulu)

TABLE OF CONTENTS

5-YEAR REVIEW
Pritchardia affinis (Loulu)

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 April 8, 2010. The review was based on the designation of critical habitat for *Pritchardia affinis* and the Big Island plant cluster recovery plan (USFWS 2003, 1996), as well as a review of current, available information. The Bernice Pauahi Bishop Museum 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 a recovery biologist and the Plant Recovery Coordinator. The document was then reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species 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. 2010. Endangered and threatened wildlife and plants; 5-year review status of 69 species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. Federal Register 75(67):17947-17950.

1.3.2 Listing history

Original Listing
FR notice: USFWS. 1994. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 21 plants from the island of Hawaii, Hawaii. Federal Register 59(43):10305-10325.
Date listed: March 4, 1994
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; final designation and nondesignation of critical habitat for 46 plant species from the island of Hawaii, Hawaii; final rule. Federal Register 68(127):39624-39761.

Critical habitat designation was deemed not prudent for *Pritchardia affinis* when other plant species were given such designation, in part because the number of populations was then unknown and such designation likely would have increased vandalism or collection of the species and *P. schattaueri* for personal use or illegal trade.

1.3.4 Review History:

Species status review [FY 2011 Recovery Data Call (August 2011)]:
Declining

Recovery achieved:
1 (0-25%) (FY 2007 Recovery Data Call)

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: USFWS. 1996. Recovery plan for the Big Island plant cluster. U.S. Fish and Wildlife Service, Portland, Hawaii. 202+ pages. Available online at <http://www.fws.gov/pacificislands/recoveryplans.html>.
Date issued: September 26, 1996
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, B, C, D, and E) affecting this species is presented in Section 2.3.2 and Table 2.

Stabilizing, downlisting, and delisting objectives are provided in the recovery plan for the Big Island plant cluster (USFWS 1996), based on whether the species is an annual, a short-lived perennial (fewer than 10 years), or a long-lived perennial. *Pritchardia affinis* is a long-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) and be represented in an *ex situ* (off-site) collection. In addition, a minimum of three populations should be documented on the Big Island (Hawaii Island) 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 25 mature individuals per population.

This recovery objective has not been met.

For downlisting, a total of five to seven populations of *Pritchardia affinis* should be documented on the island of Hawaii. 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 *Pritchardia affinis* should be documented on the island of Hawaii. Each of these populations must be naturally reproducing, stable or increasing in number, and secure from threats, with 300 mature individuals per population. 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:

Chapin *et al*. (2007) reported on the biology of three species of *Pritchardia*, although the report did not specifically report on *P. affinis*. They reported that four developmental stages can be recognized for members of the genus, including seedling, juvenile (1 to 20 true-leaved stage), reproductively mature, and senescent (Chapin *et al*. 2007). More generally, Chapin *et al*. (2007) reported that regeneration among species of *Pritchardia* is low. In addition, Pérez *et al*. (2008) reported that the seeds of two species of *Pritchardia* can withstand some level of seed damage by rats (*Rattus* spp.); however this study did not include *P. affinis*.

Robert Read, who wrote the treatment of *Pritchardia* for Wagner *et al*. (1999), wrote a report for World Wildlife Fund that went unpublished. The report was transcribed by Clyde Imada of Bishop Museum for Melany Chapin, who studied *Pritchardia* (C. Imada pers. comm. 2003), and contains a summary of the known number of population and individuals. Of particular note in that summary, written by Read in 1987, was that none of the then-known populations, except possibly the site on the black sand beach at Punaluu, Hawaii Island, showed any signs of natural reproduction (Read 1987). However, it was also stated that the species was used occasionally in landscaping (C. Imada pers. comm. 2003).

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:

Pritchardia affinis is a long-lived perennial species. Its original geographical range on the island of Hawaii is believed to have been along dry coastal areas from Kalapana to Punaluu and the Kailua district of Kona, where at one time they occurred abundantly (Gemmill 1996; Bezona 2010).

At the time of listing (USFWS 1994) and when the recovery plan was written (USFWS 1996), approximately 50 to 65 individuals were thought to exist within 8 or more populations. At the time of listing, the areas included: Manuka Natural Area Reserve and Kipahoehoe Natural Area Reserve / South Kona Forest Reserve on Hawaii Island.

Chapin *et al*. (2004) indicated that fewer than 25 individuals of *Pritchardia affinis* were known within about seven populations, but that it was uncertain if any were original or planted by early Polynesian settlers. During a 30-day expedition across the state of Hawaii, Bacon and Griffith

(2008) reported a total of 60 individuals of *Pritchardia affinis* were known in a single population on Hawaii Island.

The most current estimate is a total of more than 50 individuals occurring in 4 populations reported for fiscal years 2009 and 2010 (Plant Extinction Prevention Program 2009, 2010).

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

Gemmill (1996) studied allelic diversity in members of *Pritchardia affinis* and other species of the genus. Her phenetic analysis of isozyme data alone grouped together all five sampled populations of *P. affinis* exclusive from the other species studied, which formed a basal grade among other species (Gemmill 1996). A majority-rule consensus tree based on parsimony using just morphological characters suggested that *P. affinis* is most closely related to *P. glabrata*. However, a strict consensus tree of the same data left an unresolved trichotomy of *P. affinis, P. glabrata,* and *P. lanaiensis*. Further, when the morphological data were analyzed with a bootstrap, *P. affinis* and most other species were unresolved in a large polytomy (Gemmill 1996). Other analyses suggested variable sister taxon relationships (Gemmill 1996). When isozyme and morphological data were combined, a polytomy resulted (based on a majority-rule consensus tree) that was unable to determine a sister taxon relationship (Gemmill 1996). Probably the most important finding regarding *P. affinis* was that it is an unambiguously distinct genetic entity among other species of *Pritchardia* from Hawaii (Gemmill 1996).

2.3.1.4 Taxonomic classification or changes in nomenclature:

Pritchardia affinis was first given the name by Rock but was fully described by Beccari and Rock (1921). Wagner *et al*. (1999) chose not to recognize the three varieties (*gracilis, halophila,* and *rhopalocarpa*) also named by Beccari on grounds that they probably represented ecological variation or genetic plasticity.

Hodel (2007) recently began using the name *Pritchardia maideniana* for this species; given that it is an earlier, valid name that applies to the same species. Hodel (2007) summarized in some detail the reasons for making the change, which included having seen type specimens and living material cultivated from the original plants. Dr. David Lorence of the National Tropical Botanical Garden on Kauai (pers. comm. 2011) also has seen the cultivated plants in Sydney, Australia, and indicated that he was unable to see any differences between *P. affinis* and *P. maideniana*. Dr. Warren Wagner (pers. comm. 2011) indicated that the Flora of the Hawaiian Islands website (Wagner *et al*. 2005) will soon adopt the name

P. maideniana. Christine Bacon (pers. comm. 2011), a doctoral candidate at Colorado State University who is presently studying *Pritchardia*, indicated that there is some molecular support for Hodel's decision to use the name *maideniana*, but also cautioned that further analysis might weaken that support.

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.):

No new information.

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

Pritchardia affinis is typically found from sea level to around 600 meters (0 to 1,969 feet) in leeward coastal sites and inland gulches (Wagner *et al*. 1999) in Puna, Kona, and Kau on the island of Hawaii. Some references indicate that it may occur in or near brackish water (*e.g*., USFWS 1996). At the time of listing (USFWS 1994) and thereafter, most individuals of *P. affinis* were found in areas of human habitation or development. Because all native vegetation in the known geographical range of *P. affinis* has been cleared, it is uncertain what the original associated native plant species were (USFWS 1996).

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:

- Agricultural and urban development – Commercial development (USFWS 1994, 1996, 2003).
- Established ecosystem-altering invasive plant species degradation of habitat (USFWS 1994, 1996, 2003).
- Lava flows degradation of habitat – Lava flows from Kilauea destroyed several individuals in 1989 (USFWS 1996), and volcanic tree molds suggest that individuals of *P. affinis* may have perished in earlier flows (Woodcock and Kalodimos 2005).

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

Threats:

- Collecting (USFWS 1994, 1996, 2003; Chapin *et al*. 2004)

2.3.2.3 Disease or predation:

Threats:

- Rodent predation or herbivory – Rats (*Rattus* spp.) (USFWS 1994, 1996, 2003)
- Ungulate predation or herbivory – Feral pigs (*Sus scrofa*) root and destroy seedlings, which prevents regeneration (USFWS 1994, 1996, 2003).
- Invertebrate predation or herbivory – Nelson and Wright (2005) reported on the damage caused to species of *Pritchardia* in Hawaii by the banana moth (*Opogona sacchari*), the females of which lay eggs in wounded or otherwise compromised tissues of *Pritchardia*. However, no mention was made of known damage to *P. affinis* by the moths (Nelson and Wright 2005).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Threats:

- Lack of adequate hunting regulation in areas with ungulates – The lack of adequate ungulate control and the existence of established hunting programs in areas where *Pritchardia affinis* occurs outside of the National Park Service continue to threaten this species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Threats:

- Wind damage (B. Bessach, Homeowner, Kona, pers. comm. 2001)
- Fire (USFWS 1996)
- Climate change may 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 (PICCC) has currently funded climate modeling that will help resolve these

spatial limitations. We anticipate high spatial resolution climate outputs by 2013.

Current conservation efforts:

- Captive propagation for genetic storage and reintroduction:
    - The National Tropical Botanical Garden on Kauai began developing a collection of palm trees, including *Pritchardia affinis*, since its inception in 1970 (Chapin *et al*. 2001). Read (C. Imada pers. comm. [2003]) indicated that seed was sent out in the spring of 1987 through the International Palm Society to "the several botanic collections in the Hawaiian Islands."
    - Seeds of *Pritchardia affinis* evidently were sent from Kona to Honolulu for cultivation in the early 1900s (Chapin *et al*. 2004).
    - Material propagated at Hawaii Volcanoes National Park was transferred to Amy Greenwell Ethnobotanical Garden for reintroduction and seed bank stock purposes (Hawaii Volcanoes National Park 2004).
    - Seed for propagation at the Montgomery Botanical Garden in Miami, Florida was collected from *P. affinis* in 2008 (Bacon and Griffith 2008).
    - Several nurseries were said to be cultivating the species prior to its listing in 1994 (USFWS 1996).
    - In 1990, Hawaii Volcanoes National Park had about 200 individuals growing in cultivation (USFWS 1996).
    - The Volcano Rare Plant Facility (2011) reported 7 individuals in captive propagation.
    - The Center for Conservation Research and Training Seed Storage Bank (2009) has 100 seeds in storage.
- Reintroduction / translocation implementation:
    - The Hawaii State Department of Land and Natural Resources, Division of Fish and Wildlife has cultivated the species and donated 20 seedlings to Hawaii State Parks for reintroduction at Kona Coast State Park (USFWS 1996).
    - In 2003, the Kiolakaa Ranger Station operated by the Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife contained more than 30 specimens of *P. affinis* for reintroduction purposes (Chapin *et al*. 2004).

- An unknown number of individuals of *P. affinis* were reintroduced at Puukohola Heiau National Historic Site (Else 2006); the status of the reintroduced individuals is unknown.
- In 2006, 20 individuals of *P. affinis* were reintroduced near the new building and visitor center at Puuhonua o Honaunau National Historical Park (National Park Service 2007).
- The Plant Extinction Prevention Program (2007) germinated six individuals of *P. affinis* for reintroduction purposes to restore habitat.

2.4 Synthesis

The interim stabilization goals for this species have not been met. The most current estimate is a total of more than 50 individuals occurring in 4 populations reported for fiscal years 2009 and 2010 (Plant Extinction Prevention Program 2009, 2010); the number of individuals per population was not reported. Thus, there are currently no known populations containing more than 25 mature individuals in the wild (Table 1), and all threats are not being managed (Table 2). Therefore, *Pritchardia affinis* meets the definition of endangered as it remains in danger of extinction throughout its range.

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

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1994 (listing)	50-65	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	No
			3 populations with 25 mature individuals each	No
1996 (recovery plan)	50-65	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2003 (critical habitat)	Unknown	Unknown	All threats managed in all 3 populations	No
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No
2012 (5-year review)	>50	~76	All threats managed in all 3 populations	No (see Table 2)
			Complete genetic storage	Partially
			3 populations with 25 mature individuals each	No

Table 2. Threats to *Pritchardia affinis* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Established ecosystem-altering invasive plant species degradation of habitat	A	Ongoing	No
Agricultural and urban development	A	Ongoing	No
Lava flows degradation of habitat	A	Ongoing	No
Collecting	B	Ongoing	No
Ungulate predation or herbivory	C, D	Ongoing	No
Rodent predation or herbivory – Rats	C	Ongoing	No
Invertebrate predation or herbivory	C	Ongoing	No
Wind damage	E	Ongoing	No
Fire	E	Ongoing	No
Climate change	A, E	Increasing	No

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

- Captive propagation for genetic storage and reintroduction:
    - Continue to collect seeds from all existing populations and send to at least two or three different venues for propagation.
    - Additional cultivation is needed *ex situ* to increase the number of individuals available for reintroductions.
- Reintroduction / translocation site identification:
    - Any remaining natural habitat should be given high priority for protected status.
    - Identify areas within the historical range of the species that are managed for threats.
- Reintroduction / translocation implementation:
    - Continue to reintroduce the species back into its known historical range.
    - Reintroduce at least 20 to 30 individuals in 10 areas to mimic natural populations in areas where survival is deemed likely.
- Predator / herbivore control – Control rodents around all existing populations.
- Ecosystem-altering invasive plant species control – Control invasive introduced plant species around all populations.
- Ungulate exclosures – Construct exclosure fences around all living individuals in the wild and newly established "populations" based on reintroduction activities.
- Ungulate control – Implement ungulate control to protect all populations against disturbances from feral ungulates.
- Site / area / habitat protection – Develop and implement effective measures to reduce the impacts of agricultural and urban development, wind damage, and lava flow.
- Surveys / inventories – Resurvey the historical range of the species to determine if previously unknown or newly reestablished populations exist.
- Threats research:
    - Develop and implement effective measures to reduce the impact of collection.
    - Assess the modeled effects of climate change on this species, and use to determine future landscape needed for the recovery of the species.
- Biosecurity legislation – The State of Hawaii should enact serious measures to keep yellow lethal disease out of the state for the benefit of all palm species, including *P. affinis*.
- Fire protection – Develop and implement a fire management plan for all populations.
- Habitat requirements research – Carry out greenhouse studies that test whether seedlings are able to survive or thrive in brackish habitats, as suggested by some field observations.

- Alliance and partnership development – Work with the National Park Service, Hawaii Division of Forestry and Wildlife, and other land managers to continue implementation of ecosystem-level restoration and management to benefit this species.

5.0 REFERENCES

Bacon, C., and M.P. Griffith. 2008. *Pritchardia* conservation expedition: Hawaiian archipelago. December 12, 2007 to January 24, 2008. Montgomery Botanical Center, expedition report. 3 pages. Unpublished.

Beccari, O., and J.F. Rock. 1921. A monographic study of the genus *Pritchardia*. Memoirs of the Bernice P. Bishop Museum 8:1-77.

Bezona, N. 2010. Landscape with native palms. West Hawaii Today (Newspaper article), dated 21 March 2010.

Center for Conservation Research and Training Seed Storage Facility. 2009. Seed conservation lab database. University of Hawaii at Manoa, Honolulu, Hawaii. Unpublished.

Chapin, M.H., D.H. Lorence, S. Perlman, and K.R. Wood. 2001. Support for the conservation of endemic Pacific palms through *ex situ* collections at the National Tropical Botanical Garden (NTBG), Hawaii, U.S.A. Botanic Gardens Conservation International. Botanical Gardens Conservation News 3(6). 4 pages.

Chapin, M.H., K.R. Wood, S.P. Perlman, and M. Maunder. 2004. A review of the conservation status of the endemic *Pritchardia* palms. Oryx 38(3):273-281.

Chapin, M.H., M. Maunder, and K.E. Horak. 2007. A preliminary study of regeneration in wild populations of threatened endemic Hawaiian palms (*Pritchardia*, Arecaceae). Pacific Conservation Biology 13(1):20-28.

Else, P. 2006. Appendix A: Puukohola Heiau National Historic Site resource overview. Pages 1-17 in L. HaySmith, F.L. Klasner, S.H. Stephens, and G.H. Dicus, Pacific Island Network vital signs monitoring plan. Natural Resource report NPS/PACN/NRR – 2006/003. National Park Service, Fort Collins, Colorado. Available online at <http://science.nature.nps.gov/im/units/pacn/monitoring/plan/PACN_MP_AppendixA_PUHE.pdf>.

Gemmill, C.E.C. 1996. Population genetics and systematics of the Hawaiian taxa *Pritchardia* (Arecaceae) and *Brighamia* (Campanulaceae). Ph.D. dissertation. University of Colorado, Boulder, Colorado. xii + 276 pages.

Hawaii Volcanoes National Park. 2004. Annual report: threatened and endangered plants of Hawaii Volcanoes National Park. 7 pages. Unpublished.

Hodel, D.R. 2007. A review of the genus *Pritchardia*. Palms 51(4):Special Supplement S-1-53.

National Park Service. 2007. Pacific Island Network – Featured Park, Puuhonua o Honaunau NHP – Hawaii. Pacific Island Network News 7 (Jan. to March):8.

Nelson, S. and M. Wright. 2005. Banana moth – a potentially fatal pest of *Pritchardia* and other palms. Cooperative Extension Service, College of Tropical Agriculture and Human Resources. University of Hawai'i at Manoa. 4 pages.

Pérez, H.E., A.B. Shiels, H.M. Zaleski, and D.R. Drake. 2008. Germination after simulated rat damage in seeds of two endemic Hawaiian palm species. Journal of Tropical Ecology 24:555-558.

Plant Extinction Prevention Program. 2007. Endangered plant restoration and enhancement - Oahu Plant Extinction Prevention (formerly Genetic Safety Net) Species (EPRE 12), July 1, 2006 to June 30, 2007. 65 pages. Unpublished.

Plant Extinction Prevention Program. 2009. Annual report for Plant Extinction Prevention Program, fiscal year 2009 (July 1, 2008-June 30, 2009). 118 pages. Unpublished.

Plant Extinction Prevention Program. 2010. Plant Extinction Prevention Program annual report, fiscal year 2010 (July 1, 2009-June 30, 2010). 122 pages. Unpublished.

Read, R.W. 1987. Pritchardia species situation report. Xeroxed copy of a draft prepared for the World Wildlife Fund, on file at Bishop Museum, Department of Natural Sciences and Botany. 10 pages. Unpublished.

[USFWS] U.S. Fish and Wildlife Service. 1994. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 21 plants from the island of Hawaii, Hawaii. Federal Register 59(43):10305-10325.

[USFWS] U.S. Fish and Wildlife Service. 1996. Recovery plan for the Big Island plant cluster. U.S. Fish and Wildlife Service, Portland, Hawaii. 202+ pages. Available online at <http://www.fws.gov/pacificislands/recoveryplans.html>.

[USFWS] U.S. Fish and Wildlife Service. 2002. Endangered and threatened wildlife and plants; designations of critical habitat for plant species from the Island of Hawaii, Hawaii; proposed rule. Federal Register 67(102):36968-37106.

[USFWS] U.S. Fish and Wildlife Service. 2003. Endangered and threatened wildlife and plants; final designation and nondesignation of critical habitat for 46 plant species from the Island of Hawaii, Hawaii; final rule. Federal Register 68(127):39624-39761.

Volcano Rare Plant Facility. 2011. Controlled propagation report to U.S. Fish and Wildlife Service. Volcano, Hawaii. Unpublished.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999. Manual of the flowering plants of Hawaii, revised edition. University of Hawaii and Bishop Museum Press, Honolulu, Hawaii. 1,918 pages.

Wagner, W.L., D.R. Herbst, and D.H. Lorence. 2005. Flora of the Hawaiian Islands website. Available online at <http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/>. Accessed 9 February 2011.

Woodcock, D., and N. Kalodimos. 2005. Tree mold evidence of loulu palm (*Pritchardia* sp.) forest on the Kona Coast, Hawai'i. Pacific Science 59(4):491-498.

Personal Communications:

Bacon, Christine. 2011. Doctoral candidate, Colorado State University, Fort Collins, Colorado. E-mail to Neil Snow, Bishop Museum, dated February 12, 2011. Subject: Nomenclature of *Pritchardia affinis*.

Bessach, Brett. 2001. Homeowner, Kona, Hawaii. Telephone conversation with Greg Koob, U. S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, dated June 27, 2001. Subject: *Pritchardia affinis*.

Imada, Clyde. 2003. Botanist, Bishop Museum, Honolulu, Hawaii. E-mail to Melany Chapin, Bishop Museum, dated October 20, 2003. Subject: "Original source" of initial conservation assessment of *Pritchardia affinis* by Bob Read.

Lorence, David H. 2011. Director of science, National Tropical Botanical Garden, Kalaheo, Hawaii. E-mail to Neil Snow, Bishop Museum, dated February 9, 2011. Subject: Nomenclature of *Pritchardia affinis*.

Wagner, Warren L. 2011. Curator of Pacific Botany, Department of Systematic Biology National Museum of Natural History, Smithsonian Institution. E-mail to Neil Snow, Bishop Museum, dated February 9, 2011. Subject: Nomenclature of *Pritchardia affinis*.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Pritchardia affinis* (Loulu)

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

Appropriate Listing/Reclassification Priority Number, if applicable:_____

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

Field Supervisor, Pacific Islands Fish and Wildlife Office

for

Jess Newton

Date 8/28/2012