Puaiohi
(*Myadestes palmeri*)

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: Puaiohi (*Myadestes palmeri*)

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5-YEAR REVIEW
Puaiohi *(Myadestes palmeri)*

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:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) beginning on March 8, 2007. The Revised Recovery Plan for Hawaiian Forest Birds (USFWS 2006) and recent puaiohi surveys provided most of the updated information on the current status of *Myadestes palmeri*. 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. 1967. Office of the Secretary; native fish and wildlife; endangered species; notices. Federal Register 37(32):4001.

Originally described as *Phaeornis palmeri*, Pratt (1982) offered convincing evidence that *Phaeornis* should be merged with the New World solitaire genus *Myadestes* (Snetsinger *et al.* 1999, page 3; USFWS 2006, page 2-31).
Date listed: March 11, 1967
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:
N/A

1.3.4 Review History:
Species status (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: Revised Recovery Plan for Hawaiian Forest Birds
Date issued: September 22, 2006
Dates of previous revisions, if applicable:
1984 (USFWS. 1984. Kauai Forest Birds Recovery Plan. U.S. Fish and Wildlife Service, Region 1, Portland, OR. 69 pages.)

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?

__X_ ***Yes***
__ __ ***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:

The puaiohi may be downlisted from endangered to threatened when all four of the following criteria have been met:

(1) Total population of 1,000 adults in at least 5 subpopulations (Mōhihi, Kawaikōī, Koai`e, Halehaha/Halepā`ākai, and Halekua drainages) in the Alaka`i Wilderness Preserve, Kaua`i, that constitute a single metapopulation, and criteria 2 and 3 apply over a 15-year period.

This criterion has not been met. The current population is estimated to be 300 to 500 individuals (USFWS 2006, page 2-35) .

(2) Either (a) quantitative surveys show that the number of individuals in each isolated population or in the metapopulation has been stable or increasing for 15 consecutive years, or (b) demographic monitoring shows that each population or the metapopulation exhibits an average growth rate (λ or lambda) not less than 1.0 over a period of at least 15 consecutive years; and total population size is not expected to decline by more than 20 percent within the next 15 consecutive years for any reason.

This criterion has not been met; although apparently stable at this time, adequate quantitative survey methods for puaiohi were only recently developed and applied from 2003 to 2005. Demographic monitoring has not been adequate to determine average growth rate for this species.

(3) Sufficient recovery area is protected and managed to achieve criteria 1 and 2 above.

Sufficient recovery area has a level of protected status (e.g., Wilderness Preserve); however, most of the area is not adequately managed.

(4) The threats that were responsible for the decline of the species have been identified and controlled.

Threats responsible for the decline of puaiohi have been identified, but are not adequately controlled.

Puaiohi may be delisted when all four of the criteria above have been met for a 30-year period and total population is 2,000 adults.

2.3 Updated Information and Current Species Status

The puaiohi or small Kaua`i thrush is a medium-sized (16.5 to 17.8 centimeters [6.5 to 7.0 inches] long; 37.0 to 43.0 grams [1.3 to 1.5 ounces]) solitaire, drab olive-brown above, and medium gray below on the throat, belly and under tail coverts (USFWS 2006, page 2-31). The legs are pink and relatively long and the tail is relatively short. The eyes are dark with a prominent white eye-ring. Puaiohi nest in cavities or ledges on cliff faces, using small vegetation-lined cavities concealed by mosses and ferns, or more rarely, in secondary cavities formed in trees (USFWS 2006, page 2-31). Puaiohi sing occasionally throughout the year, but with increased frequency immediately before and during the breeding season, with a peak from April to May. Recently fledged young are highly sedentary for 2 to 4 days after fledging, remaining within 2 meters (6 feet) of the ground, where they may be particularly vulnerable to predation by introduced mammalian predators (USFWS 2006, page 2-32). Females readily and quickly re-nest after success or failure of a nesting attempt. Adult and juvenile survival and dispersal are poorly known because of the difficulty of marking and following sufficient numbers of birds over successive years. Adult survival is estimated at about 74 percent and juvenile (first year) survival at approximately 25 percent (Snetsinger *et al.* 2005, page 81). Dispersal frequency and distances appear to be small, a fact that has important implications for the rate of natural recolonization of recovering habitat (USFWS 2006, page 2-33). The diet of the puaiohi includes fleshy native fruits, insects, snails, and other invertebrates (Snetsinger *et al.* 1999, page 5).

Puaiohi are permanent residents of stream valleys and associated ridges of the Alaka`i Wilderness Preserve and adjacent forest, the island of Kaua`i. Puaiohi historically occupied mesic (1 to 2 meters rainfall/year,

39 to 79 inches) habitat to extremely wet (2.5 to 13 meters rainfall/year, 98 to 512 inches) montane forest, with deeply dissected terrain containing steep-walled ravines above 1,000 meters (3,300 feet) in elevation (USFWS 2006, page 2-34). Its mesic forest habitat is dominated by koa (*Acacia koa*) and `ōhi`a (*Metrosideros* spp.), while the wet forest is dominated by `ōhi`a, with subdominant `ōhi`a ha and several species of `ōlapa (*Cheirodendron* spp.). Formerly occupied mesic forest is now dominated largely by introduced plant species, e.g., fire tree (*Myrica faya*), glory-bush (*Tibouchina urvilleana*), kahili ginger (*Hedychium gardnerianum*), silk oak (*Grevillea robusta*), strawberry guava (*Psidium cattleianum*), and black wattle (*Acacia mearnsii*). Puaiohi are now confined to wet montane forest, with greater than 6 meters rainfall/year (236 inches), at 1,050 (3,450 feet) to 1,300 meters (4,250 feet) elevation; and are associated with `ōlapa fruit and `ōhi`a ha (Snetsinger *et al.* 1999, page 3-4; USFWS 2006, page 2-34). Although a strong flier, the puaiohi seems to have specific habitat requirements that keep it within areas that provide a year-round food supply and nesting habitat (USFWS 2006, page 2-34). Prime nesting sites are found most readily on steep banks of small streams that drain the Alaka`i Wilderness Preserve to the south and west.

Information on the species' status and threats is also included in the revised recovery plan (USFWS 2006) and in section 2.4 ("Synthesis") below.

2.3.1 Biology and Habitat

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

No new information.

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

Even in the late 1800s, the puaiohi was considered exceedingly rare (USFWS 2006, page 2-35). It has been found in extremely limited numbers during the past half century. USFWS (1984, page 53) estimated the population at 176 ± 192 for the period 1968 to 1973, and Scott *et al.* (1986, page 101) estimated that there were only about 97 ± 129 puaiohi within their 25 square kilometers (9.5 square miles) study area in the heart of the

Alaka`i. Based on most recent field surveys (USFWS 2006, page 2-35), using focal stream drainage surveys, the total population of puaiohi is estimated to be approximately 300 to 500 individuals, in stream valleys and on associated ridges above 1,050 meters (3,450 feet) elevation on the southern and central plateau of the Alaka`i Wilderness Preserve. The breeding population is restricted to an area < 20 square kilometers (7.6 square miles) in size, and 75 percent of the breeding population occurs in only 10 square kilometers (3.8 square miles) (USFWS 2006, page 2-35). The puaiohi exists in high densities in three adjacent drainages, the Upper Mōhihi, Upper Waiakoali and the northeastern upper Kawaikōī. In the Mōhihi, where an intensive study of breeding biology took place, puaiohi can be found at a density of approximately 16 breeding pairs per square kilometer (0.621 square mile), plus an undetermined number of floaters and helpers at the nest (Snetsinger *et al.* 2005, page 76-77). The Mōhihi is contiguous with a relatively large area of habitat that probably supports medium to low densities along the Wai`alae Trail to the south and the forest reserve boundary to the north (USFWS 2006, page 2-37). The upper reaches of the Halehaha and Halepā`ākai drainages contain a medium-density population that probably continues in lower densities downstream, although the distributional limits of this population are unknown (USFWS 2006, page 2-37).

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

No new information, but also see section 2.3.2.5 below.

2.3.1.4 Taxonomic classification or changes in nomenclature:

No new information.

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.):

Species density is currently very low in some apparently suitable habitat. In recent years this included tracts directly east of

Kōke`e State Park that were chosen for experimental release of captive-bred birds in 1999, 2000, 2001, 2006, 2007, and 2008.

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

See section 2.3 above.

2.3.1.7 Other:

N/A

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

Habitat loss and modification, avian disease, and predation by introduced mammals are thought to be causes of puaiohi endangerment, and these factors continue to limit the puaiohi population today (USFWS 2006, pages 2-37 to 2-39).

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

Feral pigs, and goats to a lesser degree, have had a long-term damaging effect upon native forests in the remaining puaiohi range, opening space for weeds and transporting weed seeds into the forest (USFWS 2006, page 2-39). Soil erosion and disruption of seedling regeneration of beneficial plants is one of many forest management problems within puaiohi range. Habitat degradation resulting from the invasion of many non-native weeds has drastically changed the forest structure and integrity. Two hurricanes in 1982 and 1992 severely disturbed areas of native forest and made space for the germination and expansion of alien plants.

Perhaps less obvious, but potentially detrimental to the health of remaining puaiohi habitat, are additions of new exotic invertebrates to the forest ecosystem. New insects, such as the two-spotted leaf hopper (*Sophonia rufofascia*) are causing serious damage to many native and non-native plants (USFWS 2006, page 2-39). Many of the food producing plants used by puaiohi could be negatively affected, reducing their range, fruit set, and even survival. Other introduced predatory insects may reduce or eliminate specialized native insects that are necessary

for pollination of certain food plants. Introduced snails that prey on indigenous snails could reduce food resources of the puaiohi. On the other hand, the detrimental effects of some introduced insects could be offset if they are eaten by puaiohi.

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

Not a limiting factor at this time.

2.3.2.3 Disease or predation:

Avian diseases, including both pox (*Poxvirus avium*) and malaria (*Plasmodium relictum*), almost certainly limit puaiohi from the lower reaches of stream drainages with suitable nesting cliffs. Mist-netting of forest birds from 1994 to 1997 at three locations, Pihea/Alaka`i Swamp Trail, Tom's Camp, and Sincock's bog, documented 2 to 5 percent of individuals of all bird species with active malaria infections and up to 12 percent with malarial antibodies (USFWS 2006, pages 2-37 and 2-38). Malarial infection rates were highest in the west, at Pihea, and lowest in Sincock's Bog. Mosquitoes are present to the highest elevations on Kaua`i (USFWS 2006, page 2-38). Furthermore, two captive-reared puaiohi likely died from avian malaria shortly after their release in the Kawaikōī drainage in fall of 2007 (Atkinson 2007).

To date, only five wild puaiohi have been tested for disease. Of these, none had active infections, but one had antibodies to malaria, suggesting that at least some puaiohi may be able to survive malaria infection (USFWS 2006, page 2-38). However, it is impossible to tell from these data whether survival rates of infected puaiohi are high or low; low infection rates could reflect either low transmission rates or high mortality of infected birds. Because puaiohi are endangered, challenge experiments have not been used to determine survivorship of infected birds.

Predators such as rats (*Rattus* spp.) may be serious limiting factors on puaiohi nesting success. Although their habit of nesting on steep cliff faces may provide some protection from nest predation, data from 1998 and 1999 showed that 14 percent and 22 percent of nests, respectively, failed due to confirmed rat predation including a total of three females taken on their nests (USFWS 2006, p. 2-38). Moreover, the tendency of young

puaiohi to remain close to the ground for several days after fledging probably makes them particularly vulnerable to predation by feral cats.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Current regulatory mechanisms appear adequate. The puaiohi was federally listed as endangered on March 11, 1967 (USFWS 1967), and thus receives regulatory protection under the Federal Endangered Species Act. Species listed under the Federal Endangered Species Act are automatically added to the State of Hawai`i list of endangered species, and are thus also protected by State regulations.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

All of Kaua`i's endangered forest birds are so few in number that lack of genetic diversity poses potential problems. Some of these birds are highly specialized and are ill-adapted for rapid changes in their environment. The puaiohi, with a population size of 300 to 500 birds in a number of widely separated subpopulations, falls below the effective population size of 500 individuals recommended for long-term maintenance of genetic diversity (USFWS 2006, page 2-40). Species that are endemic to a single island and highly localized, such as the puaiohi, are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a single population by random demographic fluctuations and localized catastrophes such as fires, hurricanes, and disease outbreaks.

2.4 Synthesis

Based on recent field surveys (2003-2005), the total population of puaiohi is estimated to be approximately 300 to 500 individuals, in several subpopulations in stream valleys and on associated ridges above 1,050 meters (3,450 feet) elevation on the southern and central plateau of the Alaka`i Wilderness Preserve. There is additional apparently suitable (unoccupied) habitat available for puaiohi; however, avian disease, lack of suitable nesting sites, low species dispersal, or other factors may be preventing puaiohi from using these areas. Puaiohi are limited in both numbers and distribution and face currently unabated threats to their continued existence. For these reasons and those

elucidated above, the puaiohi 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

Habitat Protection. Prospects for recovery lie in maintaining and restoring forest habitat by developing, testing, and applying broad-scale habitat restoration measures, including: minimizing populations of feral ungulates through a combination of hunting, fencing, snaring, and possibly development of lethal non-toxicant devices for use in areas inaccessible to hunters, or in areas closed to hunters; controlling the encroachment of noxious weed plants and insects through tested bio-control, and where feasible, mechanical and chemical measures; and continuing enforcement of State and Federal laws that protect against destructive human activities and development.

Predator Control. A need exists to develop, test, register, and apply toxicants for control of feral cats and introduced rodents in remote forested habitat. Prevention of additional introductions of exotic plants, insects, mammals

(especially the mongoose [*Herpestes auropunctatus*], currently a resident on other Hawaiian islands), and alien birds that may act as predators on or competitors with native birds is necessary. In addition, continue the development and application of rodent-proof nest boxes to increase numbers of predator-safe nests.

Captive Propagation and Reintroduction Programs. Augmentation of natural dispersal and recolonization of recovering habitat through reintroduction of captive-bred puaiohi in selected areas may be desirable. Such reintroductions may increase the range of the species and the probability that the species will survive future catastrophes such as hurricanes or disease outbreaks.

Population Surveys and Monitoring. Continued monitoring of the status of forest bird populations and their habitats is necessary to measure the effectiveness of management actions such as those listed above.

5.0 REFERENCES

Atkinson, C.T. 2007. Smear Results – Puaiohi. E-mail communication to Alan Lieberman, December 18, 2007.

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Scott, J. M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: their dynamics, ecology, and conservation. Studies in Avian Biology 9.

Snetsinger, T.S., K.M. Wakelee, and S.G. Fancy. 1999. Puaiohi (*Myadestes palmeri*). In The Birds of North America, No. 461 (Poole A. and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

[USFWS] U.S. Fish and Wildlife Service. 1967. Office of the Secretary; native fish and wildlife; endangered species; notices. Federal Register 37(32):4001.

[USFWS] U.S. Fish and Wildlife Service. 1984. Kauai Forest Bird Recovery Plan. U.S. Fish and Wildlife Service, Region 1, Portland, OR. 69 pages.

[USFWS] U.S. Fish and Wildlife Service. 2006. Revised Recovery Plan for Hawaiian Forest Birds. U.S. Fish and Wildlife Service, Region 1, Portland, OR. 622 pages.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Puaiohi or Small Kaua`i Thrush (*Myadestes palmeri*)

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:
Jay Nelson, Fish and Wildlife Biologist,
Holly Freifeld, Vertebrate Recovery Coordinator
Marilet A. Zablan, Recovery Program Leader and acting Assistant Field Supervisor for Endangered Species
Gina Shultz, Deputy Field Supervisor

Approved: _____ Date 31 July 2009
Acting Field Supervisor, Pacific Islands Fish and Wildlife Office