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5-YEAR REVIEW
Kiwikiu (Maui Parrotbill) / (Psyeudonestor xanthophrys)

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 (PIFWO) of the U.S. Fish and Wildlife Service (USFWS) between March 2009 and March 2011. The Revised Recovery Plan for Hawaiian Forest Birds (USFWS 2006) and a recent summary and analysis of surveys of bird populations in Hawai‘i (Gorresen et al. 2009) provided most of the updated information on the current status of Psyeudonestor xanthophrys. The draft five-year review was reviewed by the Recovery Program Leader and the acting Assistant Field Supervisor for Endangered Species before submittal to the Field Supervisor for approval.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

1.3.2 Listing history

Original Listing
1.3.3 Associated rulemakings: None

1.3.4 Review History:
Species status review [FY 2010 Recovery Data Call]: Stable

Recovery achieved:
1 (0-25%) [FY 2010 Recovery Data Call]

1.3.5 Species’ Recovery Priority Number at start of this 5-year review: 1

1.3.6 Current Recovery Plan or Outline
Name of plan or outline: Revised Recovery Plan for Hawaiian Forest Birds. Region 1, Portland, OR. 622 pp.

Date issued: September 22, 2006

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?

_{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?
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 taxon may be downlisted from endangered to threatened when all four of the following criteria have been met.
1. The species occurs in two or more viable populations or a viable metapopulation that represent the ecological, morphological, behavioral, and genetic diversity of the species, and viable populations exist on Haleakalā Volcano and either West Maui or Moloka‘i, and criteria 2 and 3 apply over a 15-year period.

   *This criterion has not been met. There is only one viable population on Haleakalā.*

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 (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. The Haleakalā population appears to be stable, however there is no second population on West Maui and/or Moloka‘i.*

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

   *Sufficient recovery area is identified to have protection; however, habitat on the south and west slopes of Haleakalā is unmanaged or in early phases of habitat management/restoration.*

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

   *Threats responsible for the decline of kiwikiu have been identified, but have not been adequately controlled.*

   A taxon may be delisted when all four of the criteria above have been met for a 30-year period.

2.3 Updated Information and Current Species Status

The kiwikiu, or Maui parrotbill, is one of the larger (20 to 25 grams; 0.68 to 0.85 ounce) and more unique Hawaiian honeycreepers. It has a large head, powerful neck, a massive curved, parrot-like bill, stout legs, and short wings and tail. Adult kiwikiu of both sexes are olive-green on the crown, back, wings, and tail, yellow on the cheeks, breast, and belly, grading into paler yellowish and white towards
the vent, with a contrasting bright yellow supercilium (line above the eye). The hooked upper mandible is dark gray, and the chisel-like lower mandible is a pale ivory color. The sexes are clearly dimorphic in size; males are heavier, larger-billed, and longer-winged than females. Males also tend to be more brightly colored than females, but not all individuals of each sex can be safely distinguished by color (Mountainspring 1987, p. 27; Simon et al. 1997, p. 2; Berlin et al. 2001, p. 19). Juvenile plumage can be confused with some female plumages, but usually young are duller grayish-green above and light gray ventrally instead of the yellow like adults. The kiwikiu is a monotypic species with no known geographic variation in plumage or morphology.

2.3.2 Biology and Habitat

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

The kiwikiu is insectivorous and often feeds in a deliberate manner, using its massive hooked bill to dig, tear, crack, crush, and chisel the bark and softer woods on a variety of native shrubs and small- to medium-sized trees. Kiwikiu are associated with areas typified by large diameter trees and higher densities of understory, subcanopy, and canopy vegetation layers (Stein 2007, p. 3). Kiwikiu forage mainly on the woody portions of living native shrubs and small to medium-sized trees, especially koa (Acacia koa), ʻōlapa (Cheirodendron trigynum) ʻalani (Melicope spp.) ʻākala (Rubus hawaiensis) and kāwāʻu (Ilex anomala; Simon et al. 1997, p. 3; Stein 2007, pp. 3 and 28); historical accounts noted a preference for koa (Perkins 1903, p. 431). Kiwikiu also pluck and bite open fruit in search of insects, particularly kanawao (Broussaisia arguta), but do not eat the fruit. Especially preferred are larvae and pupae of various beetles and moths (Perkins 1903, p. 431; Mountainspring 1987, p. 32; Simon et al. 1997, p. 3).

Kiwikiu are socially monogamous, non-migratory, and defend year-round territories averaging 2.3 hectares (5.7 acres) in size (Pratt et al. 2001, p. 750). Kiwikiu frequently occur in family groups, due to the prolonged 5 to 8 month long dependency of fledglings on their parents (Simon et al. 1997, p. 9). Both sexes play a role in the selection of the nest site between November and June. The open cup nest composed mainly of lichens (Usnea sp.) and pukiawe (Styphelia tameiameiae) twigs is built by the female an average of 12 meters (40 feet) above ground in a forked branch just under the outer canopy foliage. Most nests are found high in mature ʻōhiʻa (Metrosideros polymorpha) trees, typically close to branch tips. Simon et al. (1997, p. 9) reported only single egg clutches, but reports of two-chick broods are known. Re-nesting occurs only after nest failures, and pairs will not raise more than one brood in a season. Only females
incubate and brood. The incubation period is 16 days, and the nestling period is approximately another 20 days. Males feed the nesting females, and females feed the nestlings with food obtained from the male. Once fledged, the young are frequently fed directly by the male. Development of the large bill and specialized feeding techniques proceed slowly, and fledgling dependency on parental care lasts 5 to 8 months. Average nest success is 34% ($n = 41$), with inclement weather resulting in most nest losses (Becker et al. 2010, p. 193). Renesting is common, and pair success (pairs observed with a fledgling / year) averages 55% (Maui Forest Bird Recovery Program, unpubl. Data). Based on mark-recapture data, adult and juvenile survival is $0.84 \pm 0.04$ and $0.76 \pm 0.09$, respectively (Garvin et al. 2008, p. 71).

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:

The population was estimated at $502 \pm SE 116$ individuals, based on the 1980 Hawai‘I Forest Bird Survey (HFBS) (Scott et al. 1986, p. 66). Surveys from 1995 to 1997 at Hanawa‘ī Natural Area Reserve (Hanawī NAR), a study site located in the core of the species’ range, showed that the kiwikiu occurred there at approximately the same density as in 1980; however, subsequent surveys across the species’ range have not conclusively shown that its densities are stable (Gorresen et al. 2009, p. 116).

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.

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.):

Currently the kiwikiu is found only on Haleakalā Volcano in East Maui, in 50 square kilometers (19 square miles) of wet montane forests from 1,200 to 2,350 meters elevation (4,000 to 7,700 feet; Scott et al. 1986, p. 115;
Mountainspring 1987, p. 29; Simon et al. 1997, p. 2). The current range forms an arc from the Waikamoi Drainage west of Koʻolau gap to Haleakalā National Park lands in Kīpahulu Valley and the Manawainui Valley. The current geographic range is much restricted compared to the known prehistoric range, which included dry leeward forests and low elevations (200 to 300 meters, 660 to 1,000 feet) on East Maui as well as Molokaʻi, based on collections of subfossil bones (James and Olson 1991, p. 80).

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

At present, kiwikiu survive in mid- to upper-elevation montane wet forest dominated by ʻōhiʻa, and in a few more mesic areas dominated by ʻōhiʻa and koa, with an intact, dense, diverse native understory and subcanopy of ferns, sedges, epiphytes, shrubs and small to medium sized trees. The topography in these areas generally is steep and highly dissected by deep gulches and narrow ridges. The climate is montane year-round, with frequent clouds, mist, and rain. Annual precipitation may reach as much as 8,500 millimeters/year (335 inches). Kiwikiu are sympatric with several other honeycreeper species, and their distribution is now limited to high elevation areas with relatively little alteration by feral ungulates (Mountainspring 1987, p. 37) or encroachment of non-native vegetation, and the absence of disease-carrying mosquitoes (Scott et al. 1986, p. 367).

2.3.1.7 Other:

N/A.

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:

Kiwikiu were reported to strongly favor koa for foraging (Perkins 1903, p. 431). Widespread habitat destruction from logging and ranching has greatly reduced the kiwikiu range, and has been particularly severe in more mesic areas that formerly supported high densities of koa. The current range is now restricted to wet forest areas in which koa densities are relatively low. Habitat within the current range thus may be suboptimal compared to portions of the former range. Within its current range, habitat damage by feral pigs to the understory vegetation may be a significant factor contributing to reduced food availability, large
territories, and low reproduction (Mountainspring 1987, p. 37). Similar
impacts in unoccupied potential habitat may make those areas unsuitable
for reestablishment of kiwikiu, and habitat degradation and marginal
suitability may exacerbate the negative effects of severe weather events
such as rainstorms, which are common in East Maui and have been linked
to failure of kiwikiu nests (Becker et al. 2010, p. 193).

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

Not considered a threat to this species.

2.3.2.3 *Disease or predation:*

Non-native disease likely limits the distribution of many native Hawaiian
forest birds (van Riper et al. 1986, p. 341; Atkinson et al. 1995, p. S63;
Atkinson and LaPointe 2009, p. 55) including the kiwikiu, and global
climate change threatens this species by increasing the elevation at which
regular transmission of avian malaria (a protozoan parasite, *Plasmodium
relictum*) and avian pox virus (*Avipoxvirus* spp.) occurs (Benning et al.
2002, p. 14428). Despite the availability of apparently suitable habitat, the
species is absent from most areas below 1,200 m, where mosquitoes are
common (Simon et al. 1997, p. 3). However, there have been no direct
tests linking kiwikiu distribution to the distribution of mosquitoes, and
although such a link is likely, it is based only on the correlation between
the presence of mosquitoes and the absence of kiwikiu. Current
information indicates that malaria transmission could occur periodically
across 20% of the kiwikiu’s current range while 80% remains free from
disease transmission (Benning et al. 2002, p. 14247). An increase in
temperature of 2° C, which is a conservative figure based on recent data
(IPCC 2007, p. 749), would decrease the area of disease-free forest within
the species current range from 40 km² to 9 km² (Hammond et al. 2009, p.
1). Loss of such a large proportion of suitable habitat would likely result
in extinction of the kiwikiu, because of the direct reduction in population
number due to less habitat available and observed declines of other species
in tropical montane forest environments due to effects of climate warming
(Pounds et al. 1999, p. 611; Still et al. 1999, p. 610).

West Nile virus and avian flu likely pose a risk to kiwikiu if these diseases
reach Hawai’i (LaDeau et al. 2007, p. 1; Causey and Edwards 2008, p.
S31). Hawai’i and Alaska are the only two States that have reported no
occurrences of West Nile virus to date (State of Hawaii 2006, p. 1), but it
is estimated that from 7-70 infectious mosquito individuals with West Nile
virus arrive in Hawai’i per year (Kilpatrick 2004, p. 207). Should this
disease become established in Hawai‘I, native birds may be particularly susceptible as they are likely to be immunologically naïve to arboviruses such as West Nile virus, because they evolved in the absence of biting insects (van Riper et al. 1986, p. 340); and there are a number of introduced birds (e.g., house sparrows and house finches) and mosquitoes (e.g., Culex quinquefasciatus) that could support West Nile virus amplification in Hawai‘I and transport it from low to middle and high elevations (Marra et al. 2004, p. 398).

Introduced predators are one of the most serious threats to Hawaiian forest birds, particularly during nesting (Atkinson 1977, p. 109; Scott et al. 1986, p. 363). Black (Rattus rattus) and Polynesian (R. exulans) rats are predators on adults and nests of Hawaiian forest birds (Lindsey et al. 2009, p. 283) and are abundant in kiwikiu habitat (Sugihara 1997, p. 194; Malcom et al. 2008, p. 209). Feral cats (Felis catus) and Barn Owls (Tyto alba) are known to prey on birds at Hanawā NAR (Kowalsky et al. 2002, p. 131). The remains of an ‘ākohekohe (Palmeria dolei) were found in a barn owl pellet from Hanawā, and feral cat scats contained remains of other native forest birds (Kowalsky et al. 2002, p. 131). Behavioral responses of kiwikiu and ‘apapane (Himatione sanguinea) at Hanawā NAR to pueo or Hawaiian short-eared owl (Asio Flammeus sandwichensis), the disappearance of one kiwikiu nestling, and observed predation on a young ‘apapane by pueo, show pueo also predate native forest birds (Mounce 2008, p. 19).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Current regulatory mechanisms are adequate: The kiwikiu was federally listed as endangered March 11, 1967 (USFWS 1967), and thus receives regulatory protection under the Endangered Species Act. Species listed under the Endangered Species Act are automatically added to the State of Hawai‘I list of endangered species, and thus are also protected by State regulations. The Service added 24 species in 2010 that belong to families covered by the Canadian and/or Mexican Conventions, but occur naturally in the United States only in Hawai‘I, to the List of Migratory Birds. Accordingly, these species, including the kiwikiu, receive protection under the Migratory Bird Treaty Act (USFWS 2010, p. 9285).

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Single island endemics like the kiwikiu 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, disease outbreaks, hurricanes (Wiley and Wunderle 1994, p. 319), and genetic issues (Keller and Waller 2002, p. 230; Brodie 2007, p. 288). The existing kiwikiu population is threatened with extinction because of its small size and restricted distribution making it vulnerable to a variety of natural processes, including reduced reproductive vigor caused by inbreeding depression, loss of genetic variability and evolutionary potential over time due to random genetic drift, stochastic fluctuations in population size and sex ratio. Climate change likely poses a threat to the kiwikiu because of movements of disease carrying mosquitoes into higher elevations. The effects of a 2°C temperature rise predicted by the end of this century would increase in the Hanawī NAR the area within the reserve from 40 to 63 percent where malarial infection is virtually certain (Benning et al. 2002, p. 14247), seriously reducing the extent of the high elevation relatively disease-free refugia for this species.

2.4 Synthesis

Recent surveys suggest that the kiwikiu population is likely stable, range wide. Nonetheless, although the species appears stable, because of its small population size, numbering only approximately 500 birds, and restricted distribution it remains vulnerable to a variety of natural processes, including reduced reproductive vigor caused by inbreeding depression, loss of genetic variability and evolutionary potential over time due to random genetic drift, stochastic fluctuations in population size and sex ratio, and natural disasters such as hurricanes and fires, thus the kiwikui still meets the definition of endangered.

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

The recovery strategy for the kiwikiu centers on protection, restoration, and management of native high elevation forests on East Maui (Haleakalā), West Maui, and East Molokaʻi, research to optimize efforts at mitigating threats from disease and predation; and captive propagation to produce birds for reestablishment of wild populations. Reestablishment of kiwikiu on West Maui or East Molokaʻi is needed to provide a minimum of two viable populations, or to allow for a single viable metapopulation, in order to reduce the risk of extinction due to catastrophes such as hurricanes and epizootics of disease. Reestablishment in southern or western areas of Haleakalā is needed to promote natural demographic and evolutionary processes.

**Habitat protection and restoration**: Kiwikiu are currently restricted to the windward forests of East Maui from Waikamoi to Kaupō. Interagency efforts and the East Maui Watershed Partnership have had landmark success in protection of this habitat for the kiwikiu. However, extensive work is still needed to fence and protect the lower elevation areas from Hanawai NAR to Waikamoi, which provide habitat within the current range of the kiwikiu and much potential habitat on the fringes of the current range. Additional fencing and ungulate eradication in this area will allow an intact and diverse native subcanopy vegetation to develop, thereby increasing food availability. This work may also help to reduce levels of mosquito vectors. On southern and western exposures of East Maui (Haleakalā), a continuous band of suitable forest should be reconnected around the mountain, especially at upper elevations where mosquitoes are rare. Although the current population is restricted to the wet ʻōhiʻa forests of windward East Maui, this likely represents a contraction of range into marginal habitat following widespread habitat loss and degradation (Simon et al. 1997, p. 3).

Habitat restoration and reestablishment of a population on the leeward or western exposures of East Maui is needed to promote natural demographic and evolutionary processes. Restoration of koa (*Acacia koa*) to these montane areas is a key element of habitat restoration. A small amount of unprotected, remnant mesic koa forests currently exists on State Forest Reserve and Department of Hawaiian Home Lands land in the Kahikinui region of southern Haleakalā. This area holds great potential to provide suitable habitat for the kiwikiu, and relative to other more degraded areas of East Maui, likely will be the most cost-effective area to begin restoration work. Fencing projects have been initiated in this area and programs to eradicate ungulates are needed to restore
the native canopy and understory. This work should proceed to the east and west, eventually relinking the remnant Kahikinui forest to other forests on East Maui, possibly including Manawainui, Kaupō, and remnant koa forests near Kula. Most of the remaining leeward montane forests on southern slopes, while believed to be largely mosquito-free, currently are more highly degraded by ungulates. These areas, in addition to fencing and ungulate control, will require more intensive, long-term restoration to become suitable for kiwikiu and other endangered forest birds.

Much of the potential kiwikiu habitat on West Maui and East Molokai is managed as native ecosystems mostly free of ungulates. However, the suitability of these areas with respect to the presence of introduced mosquito-borne diseases is not clear. Much of the potential habitat lies at elevations below 1,350 meters (4,500 feet), where mosquitoes may be common. Ongoing habitat management and removal of ungulates may reduce mosquito densities, but surveys of mosquitoes and disease prevalence are needed prior to the reintroduction of endangered forest birds in these areas. This work should be integrated into an evaluation of the amount of suitable habitat available, estimates of the size of the population that could be supported, and a population viability analysis of the hypothetical population that would aid plans to reestablish populations in those areas. In addition, control of mammalian predators is needed at a large enough geographic scale to protect new populations.

To help prevent West Nile virus and other avian diseases from spreading to Hawai‘i, the State’s Department of Agriculture has established a pre-arrival isolation requirement and a Poultry and Bird Import Permit issued through the Livestock Disease Control Branch for all birds entering the State. The Hawai‘i State Department of Health has an ongoing, multi-agency West Nile virus surveillance program in place on all of the main Hawaiian Islands, which involves surveillance for infected mosquitoes and dead birds, as well as live-bird surveillance at major ports of entry, equine surveillance, and human surveillance (State of Hawaii 2006, pp. 3-4). To date, no cases of West Nile virus have been reported in Hawai‘i; however, there is currently no certainty that we can prevent the disease from arriving and spreading. Recent budget cuts to the West Nile virus surveillance program has resulted in the State Laboratory Division stopping, beginning December 31, 2009, the testing of live and dead bird samples, and placing on hold the writing of a West Nile virus response plan (Gabela 2009). Also as a result of these budget cuts the U.S. Geological Survey, National Wildlife Health Center (USGS/NWHC), Honolulu, Hawai‘i, will no longer take blood samples from birds at the Honolulu airport. The USGS/NWHC will continue to look at dead native birds and unusual mortality events (10 or more birds) using other funding but will not be accepting non-native birds that otherwise would have been submitted to the State Laboratory Division for testing. These developments raise the concern that should West Nile virus arrive in Hawai‘i, it may not be detected early enough to be able to take measures to prevent its establishment.

**Predator Control and avian disease:** Control of small mammalian predators is needed throughout the species’ range. Predator control may be especially important for kiwikiu
populations, because this species has an intrinsically low reproductive rate and is particularly sensitive to unnaturally high rates of nest loss and adult mortality (Simon et al. 2000, p. 489). Currently, intensive control of rats is underway in a portion of Hanawai NAR. An important component of kiwikiu recovery is evaluation of the effect of rodent control on the species’ reproduction and survival, and expansion of the scale of this work if warranted. Broad scale aerial application of rodenticides is likely needed to protect kiwikiu from rodent predation and reduce habitat damage caused by rats. Identification of resistance or tolerance to avian diseases within the population is also an important recovery strategy. Resistance or tolerance to avian malaria appears to be evolving in populations of some honeycreeper species (Woodworth et al. 2005, p. 1535; Foster et al. 2007, p. 4743) and may exist for kiwikiu as well. Rodent control at middle elevation areas by promoting survival of possible disease resistant individuals may facilitate the evolution of resistance to malaria in some species of Hawaiian birds (Kilpatrick 2006, p. 483). Control of mosquitoes or their breeding sites may also be needed to render existing forest on West Maui and Moloka‘i suitable for endangered birds like kiwikiu and reduce incidence of mosquitoes within the lower reaches of the kiwikiu’s current range.

**Captive propagation and reintroduction:** Research on captive breeding for the kiwikiu was initiated in 1997, when eggs were removed to the Maui Forest Bird Conservation Center and the Keauhou Bird Conservation Center following the recommendations of Ellis et al. (1992, p. 23). Captive propagation may play a significant role in recovery of the kiwikiu once recovery area is managed, allowing for the release and reestablishment of additional populations of this species. To establish a second population, current efforts should continue to build a captive-breeding population for eventual reintroduction of kiwikiu to southern Haleakalā, and to West Maui or East Moloka‘i. Initial efforts at captive propagation of the kiwikiu have met with limited success, and efforts are underway to address these deficiencies. If it is not possible to breed sufficient numbers of kiwikiu in captivity for release, translocation of kiwikiu may need to be considered to reestablish the species in areas of its former range.

**Research:** Research and development of reintroduction techniques and evaluation of sites for experimental releases are needed for this species. Currently, areas on the fringe of the kiwikiu’s range in Waikamoi and Manawainui may provide suitable habitat for pilot releases. Work is needed presently to evaluate vegetation and kiwikiu densities in those areas in order to assess the suitability of those sites as pilot release areas. Other potential sites on southern Haleakalā to the west of Kaupo Gap, such as the Kahikenui remnant forests, will need evaluation of habitat suitability and likely will require restoration before they are able to support a kiwikiu population. Research to better understand threats and optimize management methods, particularly regarding rat predation and disease, remain important.
5.0 REFERENCES


Gabela, A. 2009. Electronic mail message from Ana Gabela, Avian Disease Coordinator, Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Honolulu, Hawaii (October 22, 2009).


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 T. Nelson, Fish and Wildlife Biologist
Jess Newton, Recovery Program Leader
Assistant Field Supervisor for Endangered Species

Approved

Field Supervisor, Pacific Islands Fish and Wildlife Office