

`Alalā or Hawaiian Crow
(*Corvus hawaiiensis*)

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: `Alalā or Hawaiian Crow (*Corvus hawaiiensis*)

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5-YEAR REVIEW
`Alalā or Hawaiian Crow (*Corvus hawaiiensis*)

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 draft and final [USFWS 2009] Revised Recovery Plan for the `Alalā (*Corvus hawaiiensis*) were the primary sources of information for this five-year review. However, updates on the status and biology of the species were also obtained from other sources. The evaluation of the status of the species was prepared by the lead PIFWO biologist and reviewed by the Vertebrate 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 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. Federal Register 32(48):4001.

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:

None

1.3.4 Review History:

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

Captivity

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

2C

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: Revised Recovery Plan for the 'Alalā (*Corvus hawaiiensis*)

Date issued: January 27, 2009

Dates of previous revisions, if applicable: October 28, 1982 (original recovery plan); December 22, 2003 (draft revised recovery plan)

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

Yes
 No

2.1.2 Is the species under review listed as a DPS?

Yes
 No

2.1.3 Was the DPS listed prior to 1996?

Yes
 No

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

Yes

No

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

Yes

No

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

Yes

No

2.2 Recovery Criteria

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

Yes

No

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

Yes

No

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

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 affecting this species (Factors A, C, D and E) is presented in section 2.4. Factor B (overutilization for commercial, recreational, scientific, or educational purposes) is not known to be a threat at this time.

The revised recovery plan (USFWS 2009) does not specify downlisting and delisting recovery criteria, but instead sets out interim objectives. The ultimate recovery objective is to restore multiple self-sustaining populations within the historical range, and subsequently to delist the `alaĀ. The interim objectives over

the next 5 years are to minimize loss of genetic variability in captivity, restore suitable habitat, and begin reestablishment of `alalā populations in the wild.

Given that much of the biological and demographic data necessary to determine the population size and parameters needed for recovery of the species do not exist at this time, it is only possible to establish general recovery criteria. The population sizes and parameters necessary to consider downlisting or delisting will be determined when necessary biological and demographic data become available. Recovery criteria may change as additional data become available. In general, the species will be considered recovered when:

1. The genetic diversity present in the `alala population in 2003 has been preserved to the maximum extent possible;
2. The population as a whole is demographically stable;
3. Two or more subpopulations exist in the wild;
4. Persistence of wild subpopulations does not require supplementation from a captive flock;
5. Peer-reviewed population models yield a probability of extinction of less than five percent within 100 years; and
6. Threats in suitable habitat have been managed so that `alala subpopulations in the wild are growing or stable in landscapes that include areas managed for native biodiversity.

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:

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:

The `alalā is believed to have become extirpated in the wild by 2003 and is now found only in captivity. The total population (captive and wild) remained between 30 and 40 individuals from 1993 to 2003. Since 2003, the captive population has grown from 40 to 68 birds. Approximately 15 pairs are used for breeding each year.

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

The current captive population originated from nine founders, some of which were probably related (Fleischer 2003). Based on pedigree analysis, the genetically effective population size (N_e) of the captive population is 35, and the estimated mean inbreeding coefficient (F) is currently 0.112 (ZSSD 2008). This inbreeding coefficient is relatively high and is expected to rise with time due to the small size of the captive population and limited pairing options. Current estimated gene diversity is 81 percent and is projected to drop to 79 percent gene diversity in 10 years if the population grows to 75 individuals (ZSSD 2008).

2.3.1.4 Taxonomic classification or changes in nomenclature:

None

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.):

This species is believed to have been extirpated in the wild since 2003. The captive flock is maintained at the Maui Bird Conservation Center at Olinda, Maui, and at the Keauhou Bird Conservation Center at Volcano, Hawai'i. While some reports of wild `alalā have been made over the past several years, no sightings have been confirmed and many have been explainable as other species. While cursory visits have been made to apparent habitat in the area of some potential sightings, immediate and intensive field searches and appropriate documentation would be needed to determine the veracity of reported sightings.

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

The quantity and quality of potential `alalā habitat on Hawai'i island in general is declining. Residential development and agriculture are continuing in low- and mid-elevations in historical `alalā habitat. All native forest within historic habitat that is unfenced is assumed to be declining in quality due to the effects of nonnative species, including rodents (*Mus musculus*, *Rattus exulans*, *Rattus rattus*), feral pigs (*Sus scrofa*), cattle (*Bos taurus*), sheep (*Ovis aries*) and mouflon (*Ovis musimon*) (Cuddihy and Stone 1990). Fencing and local eradication of ungulates has recently occurred in limited areas, some of which may be considered as reintroduction sites for `alalā, but subsequent increases in

habitat quality have not yet been quantified. Nonnative mammalian predators and mosquito-borne avian diseases are not controlled within any historical habitat.

Some areas of former `alalā habitat are being, or soon will be, managed to stop forest degradation and increase vegetation quality, including 1,652 acres of state land at Pu`u Wa`awa`a, 5,000 acres of Federal land at the Kona Forest Unit of Hakalau Forest National Wildlife Refuge, over 3,000 acres of private land at Honomalino, and more than 2,500 acres of private, State and Federal land in the Ola`a-Kilauea area.

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:

Habitat alteration on Hawai`i island has been large-scale and is continuing. Remaining forest within the historical range of the `alalā has been substantially altered from its pre-European condition (Cuddihy and Stone 1990), as well as from its condition prior to human colonization of the islands. The `alalā evolved in pre-human Hawai`i, where closed-canopy forest was the dominant vegetation type. Extensive grasslands were absent, understory vegetation was dense, grazing mammals were absent, fires were rare and localized, and many plants were dependent on birds for pollination and seed dispersal. Major changes in vegetation followed the arrival of Polynesians (Cuddihy and Stone 1990; Athens 1997; Burney *et al.* 2002), and these changes were greatly accelerated after European contact. Habitat changes include complete and partial deforestation, selective species loss, and invasion or replacement by nonnative plants. These changes are the result of a variety of processes linked to human activities. Aside from the obvious case of outright deforestation, the individual and collective impacts of forest changes to `alalā are conjectural, but probably have played a role in the species' range reduction and extirpation from the wild. Because of the landscape-scale movements that allowed historical populations of `alalā to exploit patchy food resources and escape harsh weather, alteration of small but crucial parts of their range and reduction in some food plants (*e.g.*, clearing low-elevation forest for agriculture and vegetation changes throughout the species' range) may have reduced the `alalā's ability to persist over large areas. In addition, opening of the forest structure through grazing and tree cutting may have made `alalā more vulnerable to predation by `io

(Hawaiian hawk; *Buteo solitarius*).

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

The `alalā today is not used for commercial or recreational purposes, and scientific action and educational uses are designed promote recovery.

2.3.2.3 Disease or predation:

Avian diseases known to affect native forest birds, including the `alalā, arrived with European settlement. Avian malaria and avian pox probably arrived in Hawai`i in the early 1800s and became highly transmissible when mosquitoes were introduced (Atkinson *et al.* 1993a,b). The apparent sharp decline in the `alalā population between 1890 and 1910 coincided with a decline of other native birds in mid-elevation forests and may have resulted from a malaria outbreak (Munro 1944). The lethality of avian malaria for `alalā in the wild is unknown (Jenkins *et al.* 1989). Juvenile captive-reared `alalā are able to survive malaria and pox infection with supportive care.

Recent studies have shown that `alalā are highly susceptible to toxoplasmosis, a disease caused by a parasite (*Toxoplasma gondii*) that is spread by feral cats, which now occur throughout historical `alalā habitat (Work *et al.* 2000). Whether this pathogen played any role in the decline of the wild population is unknown, but it has caused mortality of young `alalā released into the wild. The potential establishment of a mosquito-borne pathogen, West Nile virus, could be devastating to `alalā in the future; this disease has proved highly lethal to corvids (Komar *et al.* 2003).

Other than two bat species, pre-human Hawai`i had no terrestrial mammals, and no ground-dwelling predators. The only potential native predators of the `alalā or any other large Hawaiian bird were the `io and other, now-extinct, raptors. As a result, over evolutionary time `alalā appear to have lost behavioral adaptations that provide protection from mammalian predators, and fledgling `alalā are extremely vulnerable to feral cats (*Felis catus*), mongooses (*Herpestes javanicus*), dogs (*Canis familiaris*), and other mammals. Feral cats have spread into all forested areas of the main islands since their introduction in the early 19th century. Mongooses were introduced to the island of Hawai`i in 1883 (Tomich 1969), and are now common throughout the historical `alalā range. Mammalian predators are strongly implicated in the endangerment and extinction of many Hawaiian birds (Atkinson 1977, 1989; VanderWerf and Smith 2002), are known to kill `alalā (USFWS unpubl. data), and undoubtedly have affected the `alalā population.

Predation on `alalā by `io was not reported prior to 1992. However, intensive study began in connection with the `alalā reintroduction program initiated in 1993. Evidence from recovered carcasses suggested that juvenile and adult `alalā can be killed and eaten by `io in the wild; however, no actual predation by `io on released birds was observed. Wild adult `alalā were also observed being harassed and struck by `io, and some individuals may have been killed. `Io depredation may be linked to altered forest structure, unnaturally high `io densities, low `alalā numbers, behavioral traits of released birds, or some combination of factors. No data exist to determine the role, if any, of `io in the historical decline of the wild population.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

The `alalā is listed as an endangered species under the Federal and Hawai`i State Endangered Species Acts, and is thus fully protected by law. Hunting and incidental shooting of `alalā has occurred (Munro 1944), although the level of hunting and its effects on the `alalā were never measured. Anecdotal reports of shooting in the 20th century suggest that legal protection of the `alalā by the Territory of Hawai`i beginning in 1931 was not fully effective. High mortality of adults, noted as the proximate cause of recent population loss in a National Research Council (NRC) 1992 report, may have been partly due to illicit shooting of the conspicuous and relatively fearless `alalā as late as the 1980s and 1990s. Because the `alalā has a relatively low reproductive rate, population persistence and growth depends upon high adult survivorship (NRC 1992).

State and Federal regulations controlling shipment of poultry and game birds to Hawai`i via first class mail, quarantine of birds shipped to Hawai`i, and cargo inspection programs may not be adequate to prevent the inadvertent importation of new diseases such as West Nile virus and the transfer of disease strains among islands that could seriously reduce the potential to recover the `alalā (Kilpatrick *et al.* 2004).

To the degree that habitat loss and degradation has played a role in the loss of wild `alalā, regulations that allow or promote logging and the maintenance of domestic and feral ungulates in forest within the species' historical range have been inadequate to protect the species.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

In addition to the extrinsic factors of habitat loss and degradation, disease, and predation that increased `alalā mortality rates and decreased their reproduction, factors intrinsic to small populations may have played a role

in the decline of the species. Fragmentation of the formerly contiguous population could have limited genetic exchange and increased the risk of inbreeding and genetic drift. Small populations of monogamous species are especially subject to demographic accidents, such as the development of an unequal sex ratio, which can further reduce the number of breeding pairs, or increase disruption of breeding pairs by unmated birds (USFWS, unpubl. data). Over the past several years, it appears that lethal abnormalities are occurring at a higher than normal rate in the captive flock, compared to other avian species captive breeding programs, suggesting inbreeding depression (ZSSD, unpubl. data).

2.4 Synthesis

The `alalā or Hawaiian crow is endemic to the island of Hawai`i and was extirpated from the wild by 2003. Currently a captive population of 67 individuals in two captive propagation facilities in Hawaii and one individual at the San Diego Wild Animal Park are believed to constitute the entire species. The captive population has increased steadily since its initial inception in 1978. However, the captive population will not be large enough (approximately 75 birds) to generate surplus individuals for reintroduction to the wild until at least 2012. Potential reintroduction sites have been selected but extensive threat reduction, including predator control, will be required before releases can begin. Large tracts of former habitat must be protected from ungulates if the forest vegetation is to recover enough to sustain wild populations of `alalā. Because the `alalā is found only in captivity, and most of the remaining habitat on Hawai`i is threatened by ungulates and other pest species, the general recovery goals for this species have not been met. Therefore the `alalā meets the definition of endangered as it remains in danger of extinction throughout its range.

3.0 RESULTS

3.1 Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No change is needed

3.2 New Recovery Priority Number: 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 efforts to increase the captive population to a size sufficient to initiate and maintain an active reintroduction program.
- Conduct surveys of potential habitat of any wild `alalā reported by credible observers, and incorporate any wild `alalā located into the captive breeding program.
- Implement mammalian predator control efforts in native forest areas suitable for reintroduction.
- Initiate or expand ungulate control to support native forest regeneration in areas suitable for reintroduction.
- Develop reintroduction plan for the `alalā.
- Reintroduce `alalā to multiple sites on Hawai`i.

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Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of the `Alalā (*Corvus hawaiiensis*)

Current Classification: E

Recommendation resulting from the 5-Year Review:

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

Appropriate Listing/Reclassification Priority Number, if applicable:

Review Conducted By:

Jeff Burgett, 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