

Guam Micronesian Kingfisher
(Halcyon cinnamomina cinnamomina)

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: Guam Micronesian Kingfisher
(*Halcyon cinnamomina cinnamomina*)

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5-YEAR REVIEW
Guam Micronesian Kingfisher (*Halcyon cinnamomina cinnamomina*)

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office:

Region 1, Jesse D'Elia, Chief, Division of Recovery, (503) 231-2071

Lead Field Office:

Pacific Islands Fish and Wildlife Office, Gina Shultz, Assistant Field Supervisor for Endangered Species, (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 June 2006 and June 2007. The Draft Revised Recovery Plan for the Sihek or Guam Micronesian Kingfisher (*Halcyon cinnamomina cinnamomina*) was the primary source of information for this five-year review. However, updates on the status and biology of the subspecies were also obtained from the Guam Micronesian Kingfisher Species Survival Plan and other sources. The document was reviewed by the Recovery Program Leader and the Assistant Field Supervisor for Endangered Species before final approval.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

USFWS. 2006. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 70 species in Idaho, Oregon, Washington, Hawaii, and Guam; Final rule. Federal Register 71(69):18345-18348.

1.3.2 Listing history

Original Listing

FR notice: USFWS. 1984. Endangered and threatened wildlife and plants; determination of endangered status for seven birds and two bats on Guam and the Northern Mariana Islands. Federal Register 49:33881-33885.

Date listed: August 27, 1984

Entity listed: Subspecies

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. 2004. Endangered and threatened wildlife and plants; designation of critical habitat for the Mariana fruit bat and Guam Micronesian kingfisher on Guam and Mariana crow on Guam and in the Commonwealth of the Northern Mariana Islands; final rule. Federal Register 69:62944-62990.

Critical habitat was designated for the Guam Micronesian kingfisher in one unit totaling 152 hectares (376 acres) on the island of Guam. This designation includes on Federal lands.

1.3.4 Review History:

Species status review [FY 2006 Recovery Data Call (September 2006)]: stable

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

3

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: Draft Revised Recovery Plan for the Sihek or Guam Micronesian Kingfisher (*Halcyon cinnamomina cinnamomina*)

Date issued: April 28, 2004

Dates of previous revisions, if applicable: September 28, 1990

Indicate if plan is being used: Yes. Several of the recovery actions outlined in the revised recovery plan have been initiated and completed while others are ongoing.

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?

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, and E¹) is presented in section 2.4. Factors B and D (overutilization for commercial, recreational, scientific, or educational purposes; inadequacy of existing regulatory mechanisms) are not known to be threats at this time.

The 1990 recovery plan called only for the control and/or eradication of brown treesnakes (Factor C) on Guam, securing an adequate amount and quality of essential forest habitat to maintain a recovered population (Factor A), and reestablishing a population of 1,500 sihek on Guam (1,000 in northern and 500 in southern Guam; Factor E) as interim recovery criteria for the sihek. The 2004 draft revised recovery plan for the sihek included the following updated criteria for downlisting and delisting:

Downlisting Criteria: The sihek may be considered for downlisting from endangered to threatened status when all of the following criteria are met:

1. Sihek occur in 2 subpopulations (one in northern Guam and one in southern Guam) of at least 500 adults each (Factor E);
2. Both subpopulations are either stable or increasing based on quantitative surveys or demographic monitoring that demonstrates an average intrinsic growth rate (λ , or lambda) not less than 1.0 over a period of at least 5 consecutive years (Factors A, C, and E);
3. Sufficient sihek habitat, based on quantitative estimates of territory and home range size, is protected and managed to achieve criteria 1 and 2 above (Factor A); and
4. Brown treesnakes and other introduced predators are controlled over 5 consecutive years at a level sufficient to achieve criteria 1 and 2 above (Factor C).

Delisting Criteria: The sihek may be removed from the Federal list of endangered and threatened species when all of the following criteria are met:

1. Sihek occur in 2 subpopulations (one in northern Guam and one in southern Guam) of at least 1,000 adults each (Factor E);
2. Both subpopulations are either stable or increasing based on quantitative surveys or demographic monitoring that demonstrates an average intrinsic growth rate (λ , or

¹ Threats are classified as the following five factors:

- A. Present of threatened destruction, modification or curtailment of its habitat or range;
- B. Overutilization for commercial, recreational, scientific, or educational purposes;
- C. Disease or predation;
- D. Inadequacy of existing regulatory mechanisms;
- E. Other natural or manmade factors affecting its continued existence.

- lambda) not less than 1.0 over a period of at least 10 consecutive years (Factors A, C, and E);
3. Sufficient sihek habitat, based on quantitative estimates of territory and home range size, is protected and managed to achieve criteria 1 and 2 above (Factor A);
 4. Brown treesnakes and other introduced predators are controlled over 10 consecutive years at a level sufficient to achieve criteria 1 and 2 above (Factor C); and
 5. A monitoring plan has been developed and is ready for implementation, to cover a minimum of 5 years post-delisting, to ensure the ongoing recovery of the species and the continuing effectiveness of management actions.

At this time none of the recovery criteria from the 1990 recovery plan or the 2004 draft revised recovery plan have been met. First, the sihek is still extirpated from the wild (Bahner and Bier 2007); therefore, none of the population goals for downlisting or delisting have been met. Second, brown treesnakes, the primary factor in the extirpation and one of the largest obstacles to achieving their recovery, are still considered abundant and widespread on Guam (G. Rodda, U.S. Geological Survey, pers. comm., 2007). Finally, ongoing military expansion on Guam continues to threaten the remaining forests that could support a recovered sihek population. The ongoing and proposed expansion by the Air Force in northern Guam may impact up to 100 hectares (247 acres) of potential sihek habitat (Air Force 2006a,b) and the Navy is proposing to expand operations on Guam which could further reduce the available habitat (Navy 2007a,b).

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 sihek is believed to have been extirpated in the wild by 1988 (Wiles *et al.* 2003) and is now found only in captivity (Bahner and Bier 2007). Between 1984 and 1986, 29 sihek were translocated to several zoological institutions in the mainland United States to begin a captive propagation program. By 1990, the captive population reached 61 individuals and hovered around this number of individuals until 2003 ($\lambda = 1.00$) due to high mortality and poor reproductive success. However, increased population growth ($\lambda = 1.14$) since 2003 brought the population up to 95 individuals by the end of 2006. As of February 2007, the population consisted of 58 males and 37 females distributed among 13 captive

propagation institutions in the mainland United States and Guam (Bahner and Bier 2007).

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 only 17 of the 29 founders brought into captivity (Haig *et al.* 1995). The genetically effective population size (N_e) of the captive population is 29.5 and the estimated mean inbreeding coefficient (F) is currently 0.023 (Bahner and Bier 2007). This inbreeding coefficient is expected to rise with time due to the small size of the captive population and limited pairing options. Current estimated gene diversity is 89.8 percent and is projected to drop to 67 percent gene diversity in 100 years if the population does not exceed 100 individuals (Bahner and Bier 2007).

2.3.1.4 Taxonomic classification or changes in nomenclature:

The genus of sihek has been changed to *Todiramphus* spp., therefore the Guam sihek is now referred to as *Todiramphus cinnamominus cinnamominus* (Wiles 2005a). Wiles (2005a) notes that the Guam subspecies may be classified as a full species under future taxonomic revision.

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 subspecies has been extirpated in the wild since 1988 (Wiles *et al.* 2003). Therefore, no changes in its spatial distribution have occurred.

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 sihek habitat on Guam is believed to be declining. However, the extent of these changes are unknown at this time. The Air Force is in the process of removing approximately 46 hectares (114 acres) of potential habitat from the Northwest Field area of Andersen Air Force Base (Air Force 2006a; N. Mitton, Air Force, pers. comm. 2007) and has proposed clearing an additional 74 hectares (183 acres; Air Force 2006b). In addition, feral pig and deer populations are believed to be impacting the regeneration of native forest species and thus degrading the remaining sihek habitat. These impacts have not been quantified; however, surveys indicate that ungulate populations are extremely high (Knutson and Vogt, unpubl. manuscript 2003) and

ungulate impacts on native species regeneration have been noted (Wiles *et al.* 1999, Wiles 2005b). Therefore, we expect that as ungulate populations remain high, degradation of potential habitat will continue.

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:

While large stands of relatively intact native forest can still be found on military lands and in the rugged interior areas of northern and southern Guam, some of these areas may be further fragmented and degraded by development activities and road building in the coming years (Air Force 2006b, Daleno 2007, Navy 2007a). Much of the remaining forest has also been severely degraded by introduced Philippine deer (*Cervus mariannus*), feral pigs (*Sus scrofa*), and feral Asiatic water buffalo (*Bubalus bubalis*), which were introduced to Guam in the 1600s and 1700s (Conry 1988a, Wiles *et al.* 1999). These introduced ungulates are suspected of significantly impacting native floral communities on Guam by consuming seeds, fruits, and foliage, ingesting or trampling seedlings, and promoting the spread of introduced weeds (Wiles *et al.* 1999, Wiles 2005b). Philippine deer and feral pigs are found throughout Guam. On Andersen Air Force Base, densities of Philippine deer and feral pigs were estimated at 1.8 deer per hectare (0.8 deer per acre) and 0.4 pigs per hectare (0.2 pigs per acre), some of the highest densities recorded in the world (Knutson and Vogt, unpubl. manuscript 2003). Feral Asiatic water buffalo are found predominately on the Ordnance Annex and surrounding non-Navy lands in southern Guam, where the population is estimated to be at least 50-60 animals (A. Brooke, USFWS, pers. comm. 2007).

Efforts to control Asiatic water buffalo on Navy lands have been underway since 1996 and the population has been reduced from approximately 300 animals to 50-60 animals (A. Brooke, pers. comm. 2004). The Navy has also been working on developing a plan for the long-term sustained reduction of pig populations on their lands (A. Brooke, pers. comm. 2007). In addition, the Air Force is proposing to fence approximately 254 hectares (628 acres) from pig and deer incursions and to remove ungulates from these areas to offset impacts associated with two projects on Andersen Air Force Base (Air Force 2006a,b). However, additional work is still needed to help offset the impact of these species on the remaining forests.

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

No new information.

2.3.2.3 Disease or predation:

West Nile virus may pose a significant risk to sihek in the continental United States and on Guam if it reaches the Pacific rim. As of May, 2007, west Nile virus was detected in 284 bird species from 48 states and the District of Columbia (CDC 2007). West Nile virus was detected in one sihek that died at the National Zoological Park (B. Bahner, Philadelphia Zoo, pers. comm. 2003); as a result, three sihek at the Park were vaccinated (R. Junge, Saint Louis Zoo, pers. comm. 2002). As of May 2007, ribonucleic acid (RNA) of west Nile virus, the west Nile antigen, or the isolated virus was detected in 62 mosquito species from 10 genera (*Aedes*, *Anopheles*, *Coquilleltidia*, *Culiseta*, *Culex*, *Deinocerites*, *Ochlerotatus*, *Orthopodomyia*, *Psorophora*, and *Uranotaenia*) in the United States. Three of these mosquito genera that are potential carriers of the virus (*Aedes*, *Anopheles*, and *Culex*) have been reported in the Mariana Islands (Swezey 1942, Bohart 1956, Savage *et al.* 1993). In an effort to prevent the introduction of west Nile virus to the island, Guam's Department of Agriculture implemented testing and quarantine requirements for all avian importations (J. Burgett, USFWS, pers. comm. 2007).

By 1988, the brown treesnake had eliminated most of the native birds on the island (Wiles *et al.* 2003), as well as many other native and exotic animal species (Fritts and Rodda 1998). All but two of Guam's native bird species (the yellow bittern [*Ixobrychus sinensis*] and Mariana swiftlet) have shown patterns of decline coinciding with the expansion of the snake's range across the island. These patterns of decline indicated an inverse relationship between populations of snakes and birds (Savidge 1987), presumably due to nest predation by brown treesnakes. Conry (1988b) recorded daily egg and nestling mortality by brown treesnakes as high as 21.5 percent in Philippine turtle-doves (*Streptopelia bitorquata*) on Guam. The sihek's decline followed the same pattern as other forest birds on Guam, kingfishers having been first extirpated in the southern and central portions of the island, where the snake first colonized. The last wild sihek were observed in 1988 on Andersen Air Force Base in northern Guam (Wiles *et al.* 1995).

Brown treesnake densities peaked in the mid-1980s and have since declined, but remain at levels that threaten efforts to reestablish wild populations of sihek on Guam (Rodda *et al.* 1992, 1999a; Fritts and Rodda

1998; G. Rodda, pers. comm. 2007). Without efforts to control brown treesnakes on Guam the recovery of the sihek will not be possible. Current evidence suggests that snake populations in tangantangan (*Leucaena leucocephala*) on Guam range from 20 to 60 snakes per hectare (9 to 26 snakes per acre) (counting only larger snakes over 800 millimeters [31 inches] snout-vent length), while snakes in this size class occur at lower densities (10 to 20 snakes per hectare (4 to 9 snakes per acre) in grassland, ravine forest, or native forest vegetation types (Rodda *et al.* 1999b).

The persistence of high densities of brown treesnakes on Guam continues to hamper efforts to reestablish sihek populations in the wild. Reestablishing sihek on Guam requires successful reproduction in the wild. However, the level of brown treesnake predation on sihek eggs and nestlings is expected to be high if brown treesnake densities remain high. Therefore, large scale control and/or eradication of brown treesnakes on Guam are essential for sihek recovery in the wild.

In addition to the brown treesnake, other potential kingfisher predators persist on Guam and include feral cats, Polynesian rats (*Rattus exulans*), roof rats (*Rattus rattus*), Norway rats (*Rattus norvegicus*), and monitor lizards. The impact of each of these species on sihek and their current status on Guam is unknown. However, the negative impact of rat (Atkinson 1985, Robertson *et al.* 1994) and cat (Churcher and Lawton 1987) predation on bird populations has been well documented and may threaten recovery of the sihek. Control of brown treesnake populations could potentially increase predation pressure on kingfishers as rat, cat, and monitor lizard populations would undoubtedly increase.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

No new information.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

As long as the captive population size remains small, loss of genetic diversity will be accelerated. This loss can reduce fitness and evolutionary flexibility, and lead to an increasing probability of extinction. Since the captive breeding program began, one of its main goals has been to maintain or increase genetic diversity above 90 percent heterozygosity. However, maintaining genetic diversity will be difficult due to the inability to pair all individuals, low reproductive success, and high mortality rates. The current captive population originated from only 17 of the 29 founders brought into captivity (Haig *et al.* 1995). The genetically effective population size (N_e) of the captive population is 29.5 and the estimated mean inbreeding coefficient (F) is currently 0.023 (Bahner and

Bier 2007). This inbreeding coefficient is expected to rise with time due to the small size of the captive population and limited pairing options. Current estimated gene diversity is 89.8 percent and is projected to drop to 67 percent gene diversity in 100 years if the population does not exceed 100 individuals (Bahner and Bier 2007).

2.4 Synthesis

The sihek or Guam Micronesian kingfisher is endemic to the island of Guam and was extirpated from the wild in 1988. Currently, a captive population of 95 individuals in 13 captive propagation facilities is all that remain of the sihek. The captive population has increased since its initial inception in 1983 and reached almost 100 individuals in 2006, in large part to continued efforts to increase the population by the captive propagation program and research efforts. However, the sihek is still only found in captivity and there are no immediate plans for reintroducing the subspecies to Guam. One prominent barrier to this reintroduction effort is the lack of large-scale control of brown treesnakes. Another factor which is increasing threatening the long-term conservation of the sihek is the continued loss and degradation of potential recovery habitat on Guam. Ongoing and proposed plans by the Navy and Air Force to expand operations on Guam are threatening much of the remaining sihek habitat. In addition, the maintenance of large feral ungulate populations is likely further degrading the remaining forests, thus lowering their value for sihek recovery. The Air Force has proposed a large-scale ungulate eradication program as part of their expansion efforts. If fully implemented, these efforts are expected to increase the quality of some of the remaining native forest on Air Force lands. This in turn should benefit the sihek recovery program once reintroduction efforts are implemented.

Because sihek are only found in captivity, the remaining sihek habitat on Guam is still threatened by development and ungulate impacts, and the large-scale control of brown treesnakes has not been undertaken, the recovery goals for this species have not been met. Therefore, the sihek 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: 6

Brief Rationale: This priority ranking reflects that the prospects for recovery are relatively low due to the species status as an extirpated species and the high degree of threats. In addition, the Guam population is at present formally distinguished at the level of a subspecies, although ongoing taxonomic work may suggest the Guam population warrants species status.

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 size of the captive population to initiate and maintain an active reintroduction program.
- Continue efforts to develop and refine brown treesnake control techniques to support large-scale control and/or eradication efforts.
- Implement large-scale brown treesnake control and/or eradication efforts.
- Initiate efforts for large-scale ungulate control on Guam to support native forest regeneration.
- Develop reintroduction plan for sihek.
- Reintroduce sihek to Guam.
- Finalize revised recovery plan.
- Complete analysis of taxonomic status.

5.0 REFERENCES

Air Force. 2006a. Draft Environmental Assessment: Beddown of Training and Support Initiatives at Northwest Field, Andersen Air Force Base, Guam, March 2006. Department of the Air Force, Pacific Air Forces, Hickam Air Force Base, Hawaii. 241pp.

Air Force. 2006b. Draft Environmental Impact Statement: Establishment and Operation of an Intelligence, Surveillance, Reconnaissance, and Strike Capability, Andersen Air Force

- Base, Guam, April 2006. Department of the Air Force, Pacific Air Forces, Hickam Air Force Base, Hawaii. 309pp.
- Atkinson, I.A.E. 1985. The spread of commensal species of *Rattus* to oceanic islands and their effects on island avifaunas. Pages 35-81 in Conservation of Island Birds (P.J. Moors, editor). Technical Publication No. 3, International Council for Bird Preservation, Cambridge, England.
- Bahner, B., and L. Bier. 2007. Micronesian Kingfisher Species Survival Plan Population Analysis and Breeding Plan, 28 February 2007. Association of Zoos and Aquariums Association Population Management Center, Chicago, Illinois. 22 pp.
- Bahner, B., A. Baltz, and E. Diebold. 1998. Micronesian Kingfisher Species Survival Plan Husbandry Manual, First Edition. Zoological Society of Philadelphia, Philadelphia. 54 pp.
- Baltz, A.P. 1998. The assessment of reproductive potential in Micronesian kingfisher pairs. *Zoo Biology* 17:425-432.
- Bohart, R.M. 1956. Insects of Micronesia. Diptera: Culicidae. Voume 12. Bernice P. Bishop Museum, Honolulu, Hawaii. 85 pp.
- [CDC] Centers for Disease Control and Prevention. 2007. Website of the Centers of Disease Control and Prevention, U.S. Department of Health and Human Services, available online at <<http://www.cdc.gov>>.
- Churcher, P.B., and J.H. Lawton. 1987. Predation by domestic cat in an English village. *Journal of Zoology* 212:439-456.
- Conry, P.J. 1988a. Management of feral and exotic game species on Guam. *Transactions of the Western Section of the Wildlife Society* 24:26-30.
- Conry, P.J. 1988b. High nest predation by brown tree snakes on Guam. *Condor* 90:478-82.
- Daleno, G.D. 2007. \$1.25B road project detailed: Proposed highway would cut through Manengon. *Guam Pacific Daily News*, 31 May 2007.
- Fritts, T.H. and G.H. Rodda. 1998. The role of introduced species in the degradation of island ecosystems: a case history of Guam. *Annual Review of Ecology and Systematics* 29:113-140.
- Haig, S.M., J.D. Ballou, and N.J. Casna. 1995. Genetic identification of kin in Micronesian kingfishers. *Journal of Heredity* 86:423-431.
- Navy. 2007a. Notice of intent to prepare an Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for the relocation of U.S. Marine Corps forces

- to Guam, enhancement of infrastructure and logistic capabilities, improvement of pier/waterfront infrastructure for transient U.S. Navy Nuclear Aircraft Carrier (CVN) at Naval Base Guam, and placement of a U.S. Army Ballistic Missile Defense (BMD) Task Force in Guam; Notice. Federal Register 72:10186-10187.
- Navy. 2007b. Defense representative Guam, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia and Republic of Palau; notice of intent to prepare an Environmental Impact Statement/Overseas Environmental Impact Statement for the Mariana Islands Range Complex and to announce Public Scoping Meetings. Federal Register 72:30557-30559.
- Robertson, H.A., J.R. Hay, E.K. Saul, and G.V. McCormack. 1994. Recovery of the Kakerori: an endangered forest bird of the Cook Islands. *Conservation Biology* 8: 1078-1086.
- Rodda, G.H., T.H. Fritts, and P.J. Conry. 1992. Origin and population growth of the brown tree snake, *Boiga irregularis*, on Guam. *Pacific Science* 46:46-57.
- Rodda, G.H., M.J. McCoid, T.H. Fritts, and E.W. Campbell, III. 1999a. Population trends and limiting factors in *Boiga irregularis*. Pages 236-253 *in* Problem snake management: the habu and the brown treesnake (G. H. Rodda, Y. Sawai, D. Chiszar, and H. Tanaka, editors). Cornell University Press, Ithaca, New York. 534 pp.
- Rodda, G.H., T.H. Fritts, M.J. McCoid, and E.W. Campbell, III. 1999b. The feasibility of controlling the brown treesnake in small plots. Pages 468-477 *in* Problem snake management: the habu and the brown treesnake (G.H. Rodda, Y. Sawai, D. Chiszar, and H. Tanaka, editors). Cornell University Press, Ithaca, New York. 534 pp.
- Savage, H.M., C.J. Mitchell, M. Roppul, L.T. Castro, R.L. Kepple, and S.P. Flood. 1993. Mosquito faunal survey of Saipan, Mariana Islands (Diptera: Culicidae): taxonomy and larval ecology. *Mosquito Systematics* 25:17-24.
- Savidge, J.A. 1987. Extinction of an island avifauna by an introduced snake. *Ecology* 68:660-668.
- Swezey, O.H. 1942. Insects of Guam – 1. Culicidae of Guam. *Bernice P. Bishop Museum Bulletin* 172:199-200.
- USFWS. 1984. Endangered and threatened wildlife and plants; determination of endangered status for seven birds and two bats on Guam and the Northern Mariana Islands. Federal Register 49:33881-33885.
- USFWS. 2004. Endangered and threatened wildlife and plants; designation of critical habitat for the Mariana fruit bat and Guam Micronesian kingfisher on Guam and Mariana crow on Guam and in the Commonwealth of the Northern Mariana Islands; final rule. Federal Register 69:62944-62990.

- USFWS. 2006. Endangered and threatened wildlife and plants; initiation of 5-year reviews of 70 species in Idaho, Oregon, Washington, Hawaii, and Guam; Final rule. Federal Register 71:18345-18348.
- Wiles, G.J. 2005a. A checklist of the birds and mammals of Micronesia. *Micronesica* 38:141-189.
- Wiles, G.J. 2005b. Decline of a population of wild seeded breadfruit (*Artocarpus mariannensis*) on Guam, Mariana Islands. *Pacific Science* 59:509-522.
- Wiles, G.J., C.F. Aguon, G.W. Davis, and D.J. Grout. 1995. The status and distribution of endangered animals and plants in northern Guam. *Micronesica* 28:31-49.
- Wiles, G.J., D.W. Buden, and D.J. Worthington. 1999. History of introduction, population status, and management of Philippine deer (*Cervus mariannus*) on Micronesian islands. *Mammalia* 63:193-215.
- Wiles, G.J., J. Bart, R.E. Beck, Jr., and C.F. Aguon. 2003. Impacts of the brown tree snake: patterns of decline and species persistence in Guam's avifauna. *Conservation Biology* 17:1350-1360.

Personal Communications and Other References

- Bahner, Beth. 2003. Philadelphia Zoo, Philadelphia, Pennsylvania. Personal communication.
- Brooke, Anne P. 2007. U.S. Navy, Commander of Naval Forces in the Mariana Islands, Guam. Personal communication.
- Burgett, Jeff. 2007. U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii. Personal communication.
- Junge, Randy. 2002. Saint Louis Zoo, Saint Louis, Missouri. Personal communication.
- Knutson, Kelly, and Scott Vogt. 2003. U.S. Air Force, Andersen Air Force Base, Guam and U.S. Navy, Pearl Harbor, Hawaii. Unpublished Manuscript.
- Mitton, Nancy. 2007. U.S. Air Force, Andersen Air Force Base, Guam. Personal communication.
- Rodda, Gordon. 2007. U.S. Geological Survey, Fort Collins Science Center, Fort Collins, Colorado. Personal communication.

Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW
of the
Guam Micronesian Kingfisher (*Halcyon cinnamomina cinnamomina*)

Current Classification: Endangered

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:

Marilet A. Zablan, Recovery Program Leader and Acting Assistant Field Supervisor for
Endangered Species, June 27, 2007
Fred Amidon, Fish and Wildlife Biologist, June 7, 2007

Approve Patrick Date 4/15/07
Lead Field Supervisor, Fish and Wildlife Service