

**JOB PROGRESS REPORT
RESEARCH PROJECT SEGMENT**

STATE: Territory of Guam

PROJECT NO.: E-2-3

SUB-PROJECT: B

JOB NO.: 2

JOB TITLE: Mariana Crow Avicultural Support

PERIOD COVERED: October 1, 1999 to September 30, 2000

SUMMARY

No Mariana crow (*Corvus kubaryi*) eggs were produced in the wild on Guam this year. However, 11 eggs (from 4 clutches) and 7 chicks (from 6 broods) were translocated from Rota to Guam for artificial rearing at the Division of Aquatic and Wildlife Resources (DAWR) facility. Of this harvest, 11 chicks were hand-reared successfully.

BACKGROUND

Since the Brown treesnake (BTS), *Boiga irregularis*, invaded Guam in the 1940s, the island's avifauna has rapidly declined (Savidge 1987, Conry 1988, Jaffe 1994). Despite this, the Mariana crow continues to survive in the wild in very low numbers.

The Federal recovery plan for native forest birds on Guam and Rota makes an interim recovery objective for the Mariana crow as the maintenance "... of at least 700 crows on Rota and to restore the Guam population to at least 700..." (Beck and Savidge 1990). A recent study of the status of the Mariana crow by the National Research Council (NRC) stressed the importance of having multiple populations and recommended that an additional crow population be established on another island (NRC 1997). Translocation of Mariana crows from Rota to Guam, as outlined in the recovery plan, is currently the best avenue to achieve the above objectives. Recently, the Mariana Crow Recovery Team, a committee organized to oversee the preservation and recovery of the species, endorsed the translocation of a limited number of crows from Rota to Guam.

Techniques required to successfully conduct a translocation project have been tried by the DAWR and proven satisfactory, including protection of nest trees from BTS and hand-rearing of crow chicks. The development of an effective electrical snake barrier to protect crow nests from BTS predation resulted in 5 birds being fledged from wild nests between 1993 and 1995 (Aguon et al. 1998). In 1996, 2 crows were successfully hand-reared from eggs retrieved from protected nests and artificially incubated. These juveniles were hacked into the wild in 1997.

One of these birds died 219 days after its release due to unknown causes, while the status of the second bird remains unknown.

Avicultural techniques were first applied to the species in 1996, when 9 crow eggs from 3 clutches were pulled from a single breeding pair in the Munitions Storage Area (MSA), AAFB (DAWR 1996). After artificial incubation of the eggs, 2 chicks were successfully hatched, hand-reared, and released into the wild when they were 368 and 376 days old (DAWR 1997). Additionally, 6 adult crows captured on Rota in 1993 and sent to mainland zoos (National Zoo's Conservation and Research Center in Front Royal, Virginia and the Houston Zoo) were transferred to back Guam and released in the wild in 1997. Two of the birds currently remain alive and are interacting with wild Guam crows, while the remaining 6 are dead (3) or believed to be dead (3). Three birds died 3 - 219 d after their release. The causes of death are unknown, but the necropsies found no evidence of BTS predation. The decline of the population of crows on Guam will continue unabated without supplementation of birds from Rota.

OBJECTIVES

- 1) To develop and implement avicultural support program for the recovery of the Mariana crow.
- 2) Utilize recommendations in the Native Forest Bird Recovery Plan (Beck and Savidge 1990) and NRC (1997) reports.

PROCEDURES

- 1) Pull first and second clutches of eggs from nesting Guam Mariana crows after 7-10 days of incubation and artificially incubate. Hand-rear and release birds back into the wild after fledging in captivity, when they are at least 60-days old and are feeding independently.
- 2) Renew the endangered species sub-permit from the U.S. Fish and Wildlife Service (USFWS) to take Mariana crows from Rota and hold them in captivity on Guam beyond 45 d. Renew the annual scientific collection permit from the Commonwealth of the Northern Marianas Islands (CNMI).
- 3) Collect up to 18 eggs and chicks from nesting crows and 6 adults on Rota. Coordinate between all agencies. Entire clutches of eggs, or broods of chicks will be collected.
- 4) Check each crow egg collected on Guam and Rota for gross cracks or breaks immediately upon collection. Weigh and candle eggs to determine the following:
 - a) integrity, size, and location of air cell;
 - b) integrity of yolk;

- c) presence or absence of hairline cracks or toenail punctures in the egg shell;
- d) presence or absence of vascular tissues (indicating fertility and viability).

Place eggs in an incubator and assess viability and weight loss every 3 days. Eggs showing no signs of embryonic development, i.e., progressive development of blood vessels, will be removed from the incubator. Brood and hand-rear chicks using The Peregrine Foundation guidelines developed for the alala (*Corvus hawaiiensis*), with appropriate modifications in diet and feeding regime to fit Mariana crow requirements.

RESULTS

No eggs were collected from Mariana crows on Guam.

With the issuance of the USFWS sub-permit and CNMI permits for the harvest and translocation of adult crows, eggs and chicks, field activities to began on 22 October 1999.

Translocation of chicks and eggs

Four trips were made transporting eggs and chicks from Rota to Guam. The first chick was transported on September 29, 1999 with the assistance of Dr. John Morton, USFWS. A second single chick was transported on October 28. On 10 December, 3 chicks from 2 broods and 3 eggs from 1 clutch were transported to Guam. The last translocation on 21 December 1999, transported 1 chick and 8 eggs from 3 clutches. The location and size of each clutch or brood is summarized in Table 1 (see Figure 1 for the location of these nests).

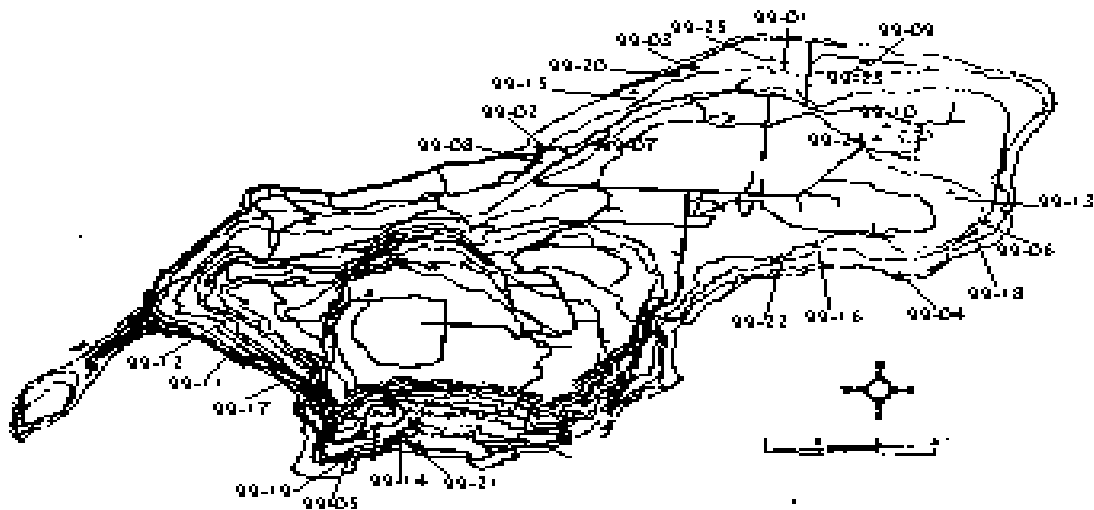


Figure 1. The location of Mariana crow nests found on Rota during the FY00 breeding season.

The first clutch of eggs was collected in Mochong. The eggs were candled and 2 were found to be in good condition and hatched on December 20 and 21. The third egg failed to hatch because it was cracked.

Fertility for all eggs collected was 100% while hatch success was 73% or 8 of the 11 eggs successfully hatched. The 3 eggs that failed to hatch came from separate 3-egg clutches and were taken from the Mochong, Gampapa and Taksunok areas of Rota, Table 2. The Mochong egg was pulled on December 9, 1999 and transported on December 10. This egg was the smallest of the clutch and was found to have a small toe nail hole surrounded by indentations of small cracks in the shell probably caused by one of the incubating adult birds. Though measures were taken to try and save the egg (the hole and cracks were covered with Elmer's glue) the embryo died on December 16th and was removed from the incubator on December 19th. The hole and cracks in the egg probably resulted in a significant lost of moisture, indicated by the abnormally large air cell in the egg compared to other eggs in the early stage of development. When the egg is cracked, weight loss is more rapid than the average 15% egg weight from date laid to date pipped and the embryo eventually runs out of energy and dies. The embryo could have had a bacterial infection however that would have been only secondary to the broken shell.

Table 1. Nests where eggs or chicks were collected. The location of these nests is shown in Figure 1. For the "Age Taken" column, the number of days old or the number of days eggs were incubated ("incub") at the time they were collected is given.

No.	Nest No.	Nest ID	Chick/Egg ID	Location taken	Date Taken	Taken As	Age taken.
1	99-01	Pekngasu	Pago	Pekngasu Rota	9/26/99	chick	18d
2	99-04	Lookout	Umumu	Sanctuary Lookout	10/28/99	chick	14-18d
3	99-03	I Batko	I Batko	I Batko	12/9/99	chick	3d
4	99-14	Okgok	Camacho	Okgok	12/10/99	chick	18d
5	99-14	Okgok	Okgok	Okgok	12/10/99	chick	18d
6	99-09	Mochong	Mochong	Mochong	12/9/99	egg	10d-incub
7	99-09	Mochong	Fagot	Mochong	12/9/99	egg	10d-incub
8	99-09	Mochong	Mochong Egg	Mochong	12/9/99	egg	10d-incub
9	99-10	West Duge	Duge	West Duge	12/20/99	egg	19d-incub
10	99-10	West Duge	Panao	West Duge	12/20/99	egg	19d-incub
11	99-13	Gampapa	Gampapa	Gampapa	12/20/99	egg	14d-incub
12	99-13	Gampapa	Ifit	Gampapa	12/20/99	egg	14d-incub
13	99-13	Gampapa	Egg 1C	Gampapa	12/20/99	egg	14d-incub

14	99-16	Taksunok	Taksunok	Taksunok	12/20/99	egg	13d-incub
15	99-16	Taksunok	Magas	Taksunok	12/20/99	egg	13d-incub
16	99-16	Taksunok	Egg 3A	Taksunok	12/20/99	egg	13d-incub
17	99-18	Sanctuary	Achok	Saguagaga Area	12/20/99	chick	18d
18	99-24	Duge	DugeII	Duge	12/21/00	chick	18d

The last 2 eggs came from Gampapa and Taksunok nests and were pulled on December 20, 1999, approximately 13-14 days into the incubation period, and transported to Guam on December 21, 1999. Two of the eggs from each clutch hatched successfully and artificial incubation continued through January 3, 2000, 5 days beyond the date the last chick had hatched for the remaining eggs. On January 3, 2000, both eggs were removed from the incubator.

Table 2. The list of chicks that died or eggs that failed to hatch after transport from Rota to Guam. See Table 1 for details of each nest.

No.	Nest No.	Nest ID	Chick/Egg ID	Location taken	Date Died	Additional comments
1	99-03	I Batko	I Batko	I Batko	12/13/99	Impacted ventriculus
2	99-09	Mochong	Mochong Egg	Mochong	FTH	Toe-nail hole with some other cracks
3	99-09	Mochong	Fagot	Mochong	12/28/99	Improper nutrition
4	99-10	West Duge	Duge	West Duge	12/29/99	Improper nutrition
5	99-10	West Duge	Panao	West Duge	12/31/99	Improper nutrition
6	99-13	Gampapa	Egg 1C	Gampapa	FTH	Malpositioned embryo
7	99-16	Taksunok	Egg 3A	Taksunok	FTH	Malpositioned embryo

Inspection of the unhatched eggs (2) revealed that the embryos were fully developed but malpositioned. The Taksunok embryo was breached, with its head at the small end of the egg, opposite the air-cell. The Gampapa embryo was fully developed but its left leg was positioned over its neck. Malpositioned embryos have difficulty in hatching and consequently most do not hatch.

Hand-rearing of Aga chicks

Of the 15 chicks hand-reared (8 were from eggs, 6 were taken as chicks), 11 chicks were successfully reared, and 4 died when a week or less old. The deaths of the 4 chicks were associated with their diet (Table 2). The first chick, known as I Batko was transported when about 3 days old, and died after 4 days of rearing. Necropsy indicated that the chick died of an impacted stomach related to the corn in the feed and was immediately removed from the diet of young chicks.

The 3 other chicks died when they were fed principally on a limited diet of moistened dog food and papaya. The chicks known as Fagot from the Mochong nest, Duge and Panao from the Duge nest, died on December 29, 29 and 31, 1999 respectively.

A comparison of growth rates of these nestlings to those of 2 Guam crow nestlings (hand-reared in 1995) indicated the nestlings were below the projected daily weight gains for chicks 4 days old and older. Fagot, Duge and Panao died 10.2, 13.1 and 18.9 grams below projected body weights, respectively.

Intervening measures were taken immediately when chicks showed signs of distress, such as when feeding responses declined and the nestlings were unable to swallow solid food. Stressed chicks were given a blended solution of Pedialyte-soaked dog food and papaya instead of solids. When conditions worsened, the chicks were given subcutaneous injections of ringer’s lactate (as prescribed in The Peregrine Fund and per Dr. April Romg’s, DVM, Avicultural Breeding and Research Center, Florida, advise). Despite all attempts to turn them around, each of the 3 nestlings died.

All 3 nestlings were immediately submitted to Dr. Kevin Malakooti, DVM, for necropsy and tissues samples were sent to the California Diagnostic Veterinary Laboratory for analysis. Gross examination revealed that the chicks were emaciated and dehydrated, which was apparently caused by diet. Histological results are pending.

Some of the prescribed food items were not available during the rearing of the 3 nestlings. The most important food item missing was pinkie mice, which was delayed in ordering and delivery. It was not readily apparent that the remaining prescribed food items alone were unbalanced or insufficient in caloric and fat content. With the arrival of the pinkie mice shipment the remaining chicks were resumed their prescribed diet. One chick had suffered abnormal toe development probably a result of this that survived the poor diet. The growth rates of the five remaining chicks that hatched at had exceeded projected growth rates with the prescribed diet (Figure 2).

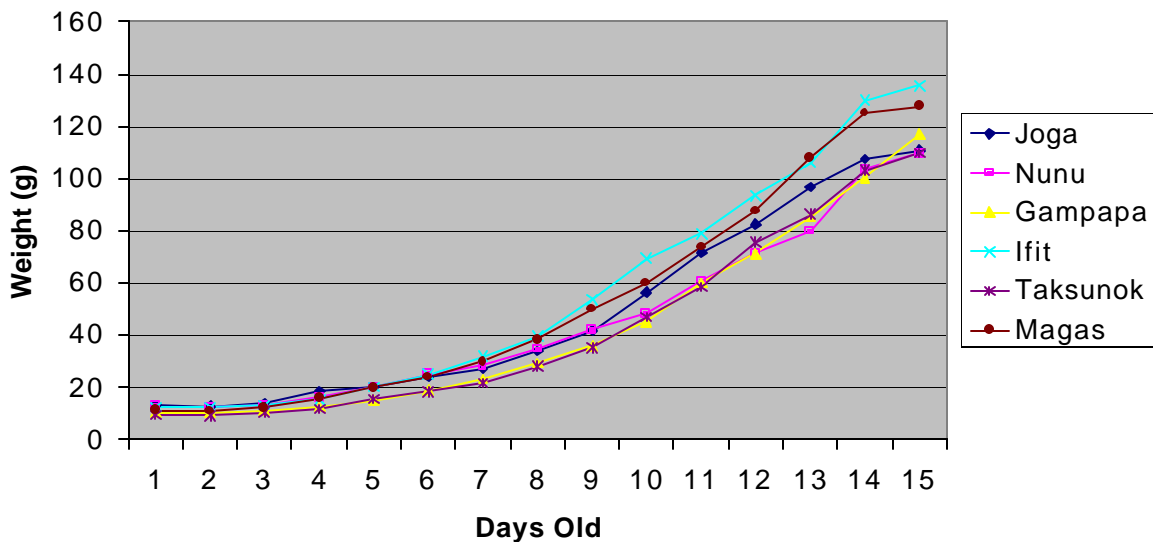


Figure 2. Growth rates of four chicks hand-reared in FY99 compared to chicks hand-reared in 1996 (Joga and Nunu).

Behaviorally, raising chicks with a crow model appears to be important in reducing habituation to humans. Two birds hand-reared as solitaires, known as Una and Joga, were more habituated to humans than birds hand-reared with a brood-mate or with a model. Birds reared with a live adult or broodmates were not easily approached and future efforts should ensure that chicks are hand-reared with broodmates or raised with live adults when possible.

Currently, 6 crows remain in captivity in outdoor aviaries and 5 were released in the Munitions Storage Area (MSA), AAFB (Figure 3). In addition to the 5 released captive-reared birds, 2 other wild crows from Rota were also released in the same area. Four of the hand-reared birds and 1 of the wild birds remain alive in the wild.

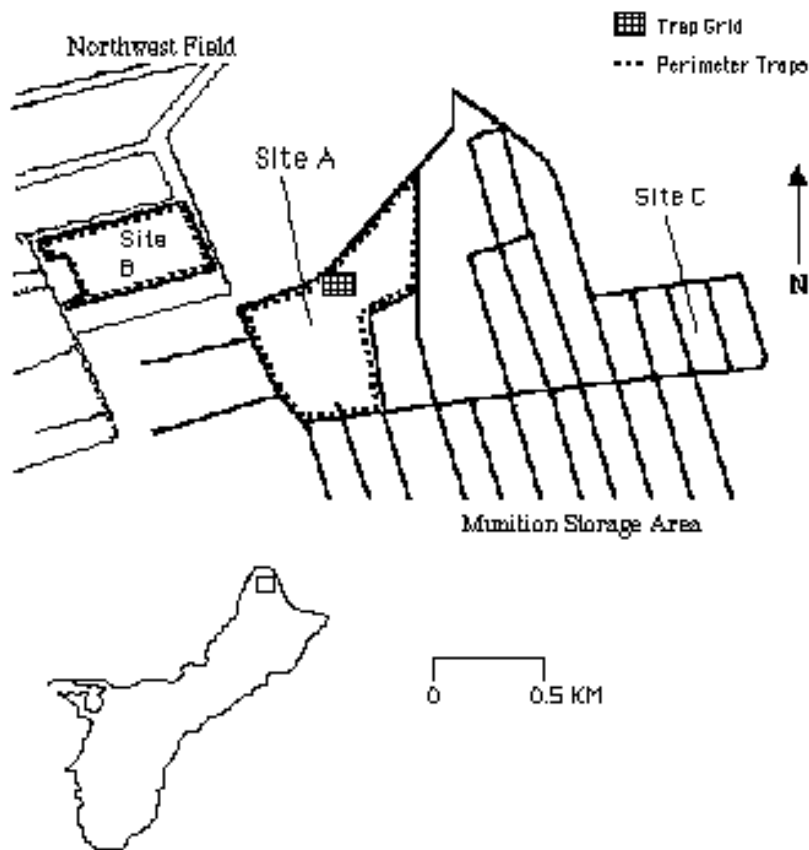


Figure 3. Location of 3 sites for Mariana crow releases. Site A, 42 hectares in size, is where a group of 5 hand-reared crows were released, as well as 2 wild Rota crows. Snake controls in Areas A (perimeter and grid trapping) and B, also known as Area 50, is ongoing. A static snake barrier attached to an existing cyclone chain-link fence encompassing Area B, a 24-hectare area, is also

in place. Koko or Guam Rails, *Gallirallus owstoni*, have been reintroduced into area B. Snake trapping is not being conducted in Area C (MSA-2).

RECOMMENDATIONS

- 1) Continue avicultural intervention of Mariana crows and efforts to increase the production of crows in the wild through snake proofing of crow nest sites.
- 2) Continue avicultural support for translocated crow nestlings and eggs from Rota.
- 3) Submit request for regional permits earlier in the year.
- 4) Maintain incubation protocols.
- 5) Maintain prescribed diet and order well in advance food items that must be purchased off-island.
- 6) When possible, raise chicks with live mentor.

PROGRAM COSTS

The estimated cost of this project is \$50,000.

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LITERATURE CITED

- Aguon, C.F., R.E. Beck, Jr., and M. W. Ritter. 1998. A method for protecting nests of the Mariana crow from the Brown Treesnake predation. *In* Rodda, Sawai, Chizar, and Tanaka (eds.), Problem Snake Management: Habu and Brown Treesnake Examples. Cornell Univ. Press, Ithaca, New York.
- Beck, R.E., Jr. and J.A. Savidge. 1990. Recovery plan for the native forest birds of Guam and Rota. U.S. Fish Wildl. Serv., Portland. 86 pp.
- Conry, P.J. 1998. High nest predation by Brown treesnakes on Guam. *Condor* 90:478-482.
- Division of Aquatic and Wildlife Resources (DAWR). 1974-1998. Job Progress Reports - Federal Aid to Fish and Wildlife Restoration. Guam Dept. of Agriculture.
- Jaffe, M. 1994. *And No Birds Sing*. Simon and Schuster, New York. 283 pp.

National Research Council (NRC). 1997. The scientific bases for preservation of the Mariana crow. National Academy Press, Wash., D.C. 91 pp.

Savidge, J.A. 1987. Extinction of an island forest avifauna by an introduced snake. *Ecology* 68:660-668.