Pacific Bird Conservation

Mariana Avifauna Conservation Program

2018 Progress Report

The Mariana Avifauna Conservation Program 2018

Field Collection of Golden White-eye (*Cleptornis marchei*) and Rufous Fantail (*Rhipidura rufifrons saipanensis*) from Saipan for Translocation to Alamagan, CNMI

Golden White-eye (*Cleptornis marchei*) **Photo Credit: Ellen Gorrell**

Trip Report

The Mariana Avifauna Conservation Program 2018 Field Collection of Golden White-eye (*Cleptornis marchei*) and Rufous Fantail (*Rhipidura rufifrons saipanensis*) from Saipan for Translocation to Alamagan, CNMI

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Objectives of MAC Program 2018

1. Collect fifty Golden White-eyes and fifty Rufous Fantails on Saipan and prepare them for translocation to Alamagan, with a target date for departure to Alamagan of 1 May 2018.
2. Assist Commonwealth of the Northern Marianas (CNMI) Department of Fish and Wildlife (DFW) with transport and release of birds on to Alamagan.
3. Collect fecal samples from collected Golden White-eyes and Rufous Fantails for Disney's Animal Kingdom (DAK) to study stress hormones.
4. Conduct two-day Educator Workshops for local teachers.
5. Host an educational booth at the Annual Flame Tree Festival.
6. Provide public presentations of MAC Program activities.
7. Host an educational booth at the 2018 Environmental Expo in Saipan.

Itinerary

11 April:	MAC Education Team arrives on Saipan
13 April:	Education Team hosts Educators Workshop
14 April:	Education Team presents at Joeten-Kiyu Public Library
15 April:	MAC Startup Team arrives, set-up of fly collection stations
16 April:	Pick up field equipment, set up Bird Holding Room and set-up of Collection Site
18 April:	Start GOWE collection
20 April:	MAC Closing Team Arrives
23 April:	Start RUFA collection
24 April:	Dr. Fontenot (DAK) conducts blood draw training with DFW employees
25 April:	Combined Team members hosted education booth Environmental Expo
	MAC presentation (Monica Blackwell, Toledo Zoo) at American Memorial Park Museum
26 April:	Team members worked at Environmental Expo (2-day event)
27 April:	Educator Workshop conducted at Collection Site and Bird Room
28 April:	Team members hosted MAC educational booth at 2018 Flame Tree Festival

30 April:	GOWE/RUFA collection complete
	Collection site closed, field gear transferred to hotel for inventory and repair
	Startup Team departs Saipan
1 May:	Team members present MAC program at Grace Christian Academy
4 May:	Net repairs and field gear inventoried and transferred to storage container on Saipan
6 May:	All birds transferred in transport crates for translocation
7 May:	Birds depart Saipan for Alamagan with Translocation Team (DFW staff and one MAC participant)
	Majority of Closing Team departs Saipan
8 May:	Birds Released on Alamagan
9 May:	Bird Room closed, supplies inventoried and transferred to storage container
	Translocation Team returns from Alamagan
10 May:	Necropsy and blood samples sent out via FedEx
11 May:	Remaining Team members depart Saipan

Background

Guam's avifauna rapidly disappeared with the introduction of the brown tree snake in the last half of the twentieth century via cargo ships. The snake is believed to be solely responsible for the extirpation or severe reduction of Guam's 25 bird species. Based on roadside surveys conducted on Guam over a 20-year period, most species experienced a 90% decline within nine years. Ten of the twelve native Guam bird species were driven to local extinction. Two of these species, the Guam Kingfisher (*Todiramphus cinnamominus*) and the Guam Rail (*Gallirallus owstoni*), were found only on Guam and now only exist in captive and managed populations.

The populated islands of Saipan, Tinian, and Rota, part of the Commonwealth of the Northern Mariana Islands (CNMI), are all close neighbors to Guam and are recognized as having the greatest risk from introduction of the brown tree snake. Recovery Plans published by the U. S. Fish and Wildlife Service for the currently listed species all cite the establishment of the brown tree snake as a major threat. To date there have been over 90 sightings of brown tree snakes on Saipan.

The Mariana Islands all have avifauna with limited distribution, with most forest bird species found only in the CNMI. Several species have extremely limited distribution such as the Tinian Monarch (*Monarcha takatsukasae*), found only on Tinian; the Golden White-eye (*Cleptornis marchei*), found only on Saipan and Aguiguan; the Nightingale Reed-warbler (*Acrocephalus luscinia*), found only on Saipan and Alamagan; and the Mariana Fruit Dove (*Ptilinopus roseicapilla*), found only on four CNMI islands and numbering less than 10 on some islands.

The CNMI government has requested long-term assistance of Pacific Bird Conservation and zoological institutions to aid with the following objectives:

- Develop techniques to capture, acclimate to captive conditions, hold, transport, and breed in captivity all bird species found in CNMI,
- Establish captive populations of select species that can be used as a source population for possible reintroduction back to Guam or islands in the CNMI which can control the brown tree snake,
- Translocate birds to islands where the brown tree snake is not present,
- Develop public education programs that will assist the conservation of their avifauna,
- Develop fund-raising programs to assist *in situ* conservation efforts, and
- Provide training to local biologists upon request.

Building on successive conservation programs in the CNMI, the Mariana Avifauna Conservation (MAC) Program is a partnership between the CNMI Division of Fish and Wildlife (DFW), U.S. Fish and Wildlife Service, Pacific Bird Conservation, and annually over a dozen accredited zoos from the Association of Zoos and Aquariums (AZA). The MAC Program began in 2004, with the first avian translocations taking place in 2006. The translocation program is forecast to be complete by 2032.

For more information, please visit the Pacific Bird Conservation home page at www.pacificbirdconservation.org, or our social media page at www.facebook.com/PacificBirdConservation.

Trip Overview

A total of 24 individuals from 14 zoos along with PBC and CNMI DFW participated in this year's translocation. MAC team members were in the CNMI from 11 April 2018 through 11 May 2018. Peter Luscomb, Herb Roberts, Hannah Bailey, and Scott Newland were the MAC management team. The majority of the field team came for two-week periods and made up two crews; the Startup team and Closing team. Additional team members arrived as they could to assist with the overall program.

The Startup crew arrived between 15-16 April and was responsible for set-up of the "bird room" (rented room at hotel where birds are held prior to translocation) and the field trapping or "collection" site. Trapping of Golden White-eyes began 18 April. The Closing crew arrived 20 April and began assisting the Startup crew with collection of birds. Trapping of Rufous Fantails began on 23 April. Once all birds were collected, both teams prepared the birds for translocation. All birds received a physical exam to ensure that they were healthy and appropriate for translocation. Each bird also received a metal band and a unique combination of color bands on their legs for future identification in the field. A single MAC team member assisted in the transport and release on Alamagan. The staff that remained on Saipan broke down the collection site and bird room and prepared and stored all field equipment in the MAC storage container located at the CNMI DFW base yard and provided by DFW.

During our time on Saipan we once again stayed at the Summer Holiday Hotel in Garapan. The Summer Holiday rents the MAC team rooms for all team members in addition to a large room to house the birds while in our care. This bird room this year met all of our needs to provide optimum husbandry and veterinary care. Education and outreach missions in the community took place throughout our stay on Saipan.

Peter Luscomb and Herb Roberts were the overall project leaders for MAC 2018, with Hannah Bailey from the Houston Zoo overseeing activities associated with the management of birds in our care prior to translocation, and Scott Newland from the Sedgwick County Zoo managing trapping activities. On 22 April, Scott Newland departed and John Bender (Lincoln Park Zoo) and Ken Reininger (North Carolina Zoo) took over the oversight of trapping activities.

Field and husbandry protocols refined by Luscomb and Roberts and used successfully in 12 previous years of MAC translocations guided all activities with the capture, care, and transport of the birds.

Trapping, Translocation, and Research: Objectives 1-3

Methods and Results

Trapping Methods

All trapping activities were done at a single site in the Marpi region of Saipan. Trapping activities were conducted from 18 April – 30 April 2018. All trapping was done on public land with permission through our DFW partners. Site A (Figure 1) was the primary trapping site for both target species. Site A was an area of primarily forest with a few areas of open grass. A total of 27 net locations were utilized at Site A over the thirteen-day trapping period. Nets were in use for a total of 1520.00 net hours (Table 1).

All trapping was performed with the use of mist nets. Golden White-eyes and Rufous Fantails were collected using mist nets with a 24mm mesh size. Previous field experience demonstrated that 24mm mesh size is the optimal size for collecting both Golden White-eye and Rufous Fantail – these smaller species become less tangled with this size mesh, and net extractions can occur more quickly and with less stress on individual birds. MAC team members scouted the field at Site A and monitored activity of the target species to determine the best locations for the nets. Once a net lane was identified and a net array erected, the net site was marked using a GPS unit. Table 1 describes each net lane used and depicts the operating hours for each individual net. Table 2 contains the GPS coordinates for each net utilized at Site A.

At the trap site (Figures 1 and 2), the field team monitored the nets on a 30-minute schedule in the morning hours. As air temperatures rose, the time was shortened to 15-minute intervals. If nets were in direct sunlight, team members were stationed at the nets for immediate extraction of captured birds. All target species were removed from the nets and placed into a cloth bag specifically designed for short-term songbird holding. Birds were then transferred to our field bird holding stations. Birds were visually inspected, and then placed into a field holding box with food and water. Birds were transferred back to the hotel bird room within approximately 2.5 hours of capture. Non-target “bycatch” species were recorded and immediately released at the net site.

Trapping activities initially focused on collecting Golden White-eyes so the team would have time to trap an adequate supply of flies to feed the Rufous Fantails. Fantails typically eat aerial prey (e.g. flies) in the lower canopy but can be successfully transitioned to sedentary prey in captivity (e.g. mealworms). Fantail trapping began on 23 April 2018 when all fly traps were producing large amounts of flies. Fantails tend to be territorial; therefore, team members spent time observing the movement of birds and relocated net sets frequently to meet the collection goal of 50 individuals.

Figure 1: Site A, Marpi region, Saipan, CNMI

Site A MAC 2018																													
Net		Net hr value	18-Apr		19-Apr		20-Apr		21-Apr		22-Apr		23-Apr		24-Apr		25-Apr		26-Apr		27-Apr		28-Apr		
			Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	Hours Open	Net Hours	
1	12m X 24mm SNGL	1	9.25	9.25	11	11	11.25	11.25	10.75	10.75	9.25	9.25	11.00	11.00	5.75	5.75									68.25
2	12m X 24mm SNGL	1	9.25	9.25	11	11	11.25	11.25	10.75	10.75	9.25	9.25	11.00	11.00	10.25	10.25	7.75	7.75	10.50	10.50					91.00
3	12m X 24mm SNGL	1	9.25	9.25	11	11	11.25	11.25	10.75	10.75															42.25
4	12m X 24mm SNGL	1	9.25	9.25	11	11	11.25	11.25	10.75	10.75			11.00	11.00	10.25	10.25	7.75	7.75							71.25
5	12m X 24mm SNGL	1	9.25	9.25	11	11	11.25	11.25	10.75	10.75			11.00	11.00	10.25	10.25	7.75	7.75							71.25
6	12m X 24mm SNGL	1	9.25	9.25	11	11	11.25	11.25	6.25	6.25															37.75
7	12m X 24mm DBL	2			11	22	11.25	22.5	6.00	12.00															56.50
8	12m X 24mm DBL	2			11	22	11.25	22.5	10.75	21.50	9.25	18.50	11.00	22.00	10.25	20.50	6.25	12.50	8.00	16.00					155.50
9	12m X 24mm SNGL	1			11	11	11.25	11.25	10.75	10.75	9.25	9.25	11.00	11.00	10.25	10.25	7.75	7.75	11.75	11.75	3.25	3.25	8.75	8.75	95.00
10	12m X 24mm SNGL	1			11	11	11.25	11.25	10.75	10.75	9.25	9.25	11.00	11.00	10.25	10.25	7.75	7.75	11.75	11.75	3.25	3.25	8.75	8.75	95.00
11	12m X 24mm SNGL	1					11.25	11.25	10.75	10.75	9.25	9.25	11.00	11.00	10.25	10.25	7.75	7.75	11.75	11.75	3.25	3.25	8.75	8.75	84.00
12	12m X 24mm SNGL	1					11.25	11.25	10.75	10.75			9.75	9.75	10.25	10.25	7.75	7.75	11.75	11.75	2.25	2.25	8.75	8.75	72.50
14	12m X 24mm SNGL	1					11.25	11.25	10.75	10.75	9.25	9.25													31.25
15	12m X 24mm SNGL	1							10.75	10.75	9.25	9.25	11.00	11.00	10.25	10.25	6.25	6.25	11.75	11.75	3.25	3.25	8.75	8.75	71.25
16	12m X 24mm DBL	2							10.75	21.50	9.25	18.50	11.00	22.00	10.25	20.50									82.50
17	12m X 24mm SNGL	1									9.25	9.25	11.00	11.00	10.25	10.25	6.25	6.25	10.25	10.25					47.00
18	12m X 24mm SNGL	1									9.25	9.25	11.00	11.00	10.25	10.25	5.25	5.25							35.75
19	12m X 24mm DBL	1									9.25	9.25	11.00	11.00	10.25	10.25	7.75	7.75	11.75	11.75	2.25	2.25	8.75	8.75	61.00
20	12m X 24mm SNGL	2											11.00	22.00	10.25	20.50	7.75	15.50	11.75	23.50	2.25	4.5	8.75	17.5	103.50
21	12m X 24mm SNGL	1															7.75	7.75	11.75	11.75	3.25	3.25	8.75	8.75	31.50
22	12m X 24mm SNGL	1																	11.75	11.75	3.25	3.25	8.75	8.75	23.75
23	12m X 24mm SNGL	1																	11.75	11.75	3.25	3.25	8.75	8.75	23.75
24	12m X 24mm SNGL	1																	11.75	11.75	3.25	3.25	8.75	8.75	23.75
25	12m X 24mm DBL	2																			3.25	6.5	8.75	17.5	24.00
26	12m X 24mm SNGL	1																			3.25	3.25	8.75	8.75	12.00
27	12m X 24mm SNGL	1																					8.75	8.75	8.75
	Total Net hours			55.5		132		168.75		179.50		129.50		196.75		180.00		115.50		177.75		44.75		140	1520.00

Table 1: Net hours

Net	N	E	Description
1	15°14.838'	145°48.086'	24mm X 12m Single
2	15°14.847'	145°48.104'	24mm X 12m Single
3	15°14.851'	145°48.062'	24mm X 12m Single
4	15°14.804'	145°48.063'	24mm X 12m Single
5	15°14.802'	145°48.060'	24mm X 12m Single
6	15°14.776'	145°48.068'	24mm X 12m Single
7	15°14.810'	145°48.046'	24mm X 12m Double
8	15°14.831'	145°48.052'	24mm X 12m Double
9	15°14.834'	145°48.101	24mm X 12m Single
10	15°14.838'	145°48.114'	24mm X 12m Single
11	15°14.817'	145°48.104'	24mm X 12m Single
12	15°14.769'	145°48.059'	24mm X 12m Single
14	15°14.856'	145°48.069'	24mm X 12m Single
15	15°14.880'	145°48.075'	24mm X 12m Single
16	15°14.884'	145°48.069'	24mm X 12m Double
17	15°14.908'	145°48.072'	24mm X 12m Single
18	15°14.873'	145°48.010	24mm X 12m Single
19	15°14.910'	145°48.119'	24mm X 12m Double
20	15°14.886'	145°48.112'	24mm X 12m Single
21	15°14.831'	145°48.115'	24mm X 12m Single
22	15°14.757'	145°48.041'	24mm X 12m Single
23	15°14.779'	145°48.029'	24mm X 12m Single
24	15°14.821'	145°48.117'	24mm X 12m Single
25	15°14.827'	145°48.035'	24mm X 12m Double
26	15°14.817'	145°48.036'	24mm X 12m Single
27	15°14.860'	145°48.113'	24mm X 12m Single

Table 2: GPS data of net locations

Figure 2: P. Luscomb demonstrates double mist-net set up (Photo credit: Kasey Clarke)

Trapping Results

A total of 489 birds from 9 species were collected from Site A (Figure 3). The following birds were collected: 270 Bridled White-eyes, 61 Golden White-eyes, 105 Rufous Fantails, 3 Micronesian Honeyeaters, 18 Micronesian Starlings, 21 Collared Kingfishers, 1 Mariana Fruit Dove, 8 Philippine Collared Doves, and 2 White-throated Ground Doves (Table 3). The 61 GOWE were collected using 27 net sets across 1520 net hours. This resulted in a rate of 24.91 net hours to collect each GOWE. Using all 27 nets over a total of 1520 net hours, 105 RUFA were collected. This resulted in a collection rate of one RUFA every 14.47 net hours (Table 1).

Figure 3: Non-target Bridled White-eye and target Rufous Fantail captured in mist-nets at Site A (Photo credit: Carolyn Atherton)

	Species*										
Net Number	BRWE	GOWE	RUFA	MIHO	MIST	COKI	MAFD	PHDO	WTGD	Total	
1	12		1		2	1				16	
2	14	3	7			1				25	
3			4		1	2		2		9	
4	7		4		1	1				13	
5	8		4	1	1	1		1		16	
6	3	2		1	2			2	1	11	
7	19	1	3		1					24	
8	36	9	9		2	1	1	2		60	
9	17	2	3			2				24	
10	11	3	4			1				19	
11	9	5	3						1	18	
12	11	2	4			1				18	
14	1	3				1				5	
15	6	6	7			1				20	
16	6	6	9		2	2				25	
17	8	4	10			2		1		25	
18	4	1	4		1					10	
19	53	9	9		3	2				76	
20	15	5	5			1				26	
21	3		4							7	
22	7		3			1				11	
23	3		3							6	
24	3		1		1					5	
25	6		1							7	
26	4		2		1					7	
27	4		1	1						6	
Total Per Species	270	61	105	3	18	21	1	8	2	489	Total Birds Collected

*BRWE=Bridled White-eye, GOWE=Golden White-eye, RUFA=Rufous Fantails, MIHO=Micronesian Honeyeater, MIST=Micronesian Starlings, COKI=Collared Kingfisher, MAFD=Mariana Fruit Dove, PHDO=Philippine Collared Dove, WTGD=White-throated Ground Dove

Table 3: Species mist net collection summary at Site A, Saipan, CNMI

Husbandry and Research Sample Collection Methods

A total of 53 Golden White-eye (GOWE) and 53 Rufous Fantails (RUFA) were transported to the bird room at the Summer Holiday hotel for acclimatization and potential translocation. Once birds were collected in the field, they were transported back to the climate-controlled bird holding room. Both species were housed singly in individual holding boxes. Basic biological data were taken on each bird: capture weight, body condition index, fat stores, wing cord, tail length, and tarsus length (Figure 4). Weights were taken each day on all birds as a measure to monitor health status. All birds were banded with a numbered aluminum leg band and a unique combination of color bands to allow for identification in the field during future CNMI DFW surveys.

Fecal samples were collected during routine cleaning on all birds to determine potential parasite loads, as well as for further parasite testing and a stress hormone study conducted *ex situ* post-translocation (Figures 5-6). MAC colleagues at Disney's Animal Kingdom have been conducting a multi-year study of the stress hormone cortisol in the CNMI birds since 2011. These data will be used to better understand the effect our translocation methods have on the target species.

Staff rotated through the bird room to assist with husbandry (Figures 5-6). The daily schedule was as follows:

5:30 – 6:00 AM:

- In teams of 1 -2 people per species, weigh all birds in holding boxes (scales built in to holding boxes to eliminate the need for repeated handling). Record weights and note any significant changes.
- While birds are being weighed, prepare morning diets for GOWE and set aside special fly trays for RUFA. Obtain clean water dishes for all boxes.
- Clean all holding boxes
    - Collect fecals from each box (labeled to know which bird it came from) for parasite and endocrine studies as needed
    - Add fresh paper
    - Provide new water dish and fresh water
    - Add new tray of food
- After all boxes have been cleaned, add fresh flies to RUFA boxes using special collection trays
- For any birds with significant or continued weight loss, add additional food as needed (additional flies for RUFA, nectar for GOWE)

9:00 AM – 10:00 AM:

- Check all food for GOWE – refresh papaya as needed
- Check all food for RUFA – add mealworms as needed, provide new tray of flies

12:30 PM – 1:30 PM

- Check all food for GOWE – refresh papaya as needed
- Check all food for RUFA – add mealworms as needed, provide new tray of flies

3:30 PM – 4:30 PM

- Clean all GOWE boxes
- Clean RUFA boxes if fecals needed for endocrine study
- Check all food for GOWE – refresh papaya as needed
- Check all food for RUFA – add mealworms as needed, provide new tray of flies (4 total trays of flies daily)

5:30 PM – 6:30 PM

- Lights turned off in bird holding room
- Nightlights on in kitchen and exam room

Minimal changes were made to the captive husbandry of the birds from previous years. However, there are two changes worth noting to husbandry practices. First, veterinary exams were done in 2 pulses. For the first 25 birds that were captured of each species, exams (basic physical exam and blood draw) were completed on the day of capture at the time of processing (banding and basic data taken) in the bird room. The second 25 of each group received their physical exam on day 3 of holding to accommodate veterinary staffing.

The second major change to husbandry procedures was care of the mealworms. This year was the first year that the MAC team was required to submit information regarding our plan to prevent mealworms from accidental release/invasion in the islands. We changed the housing of the mealworms to prevent escape, however this may have led to other issues that potentially reduced mealworm survivability.

Previous Set-up: Mealworms were set-up as needed in open-top aluminum pans with *Repashy®* Superfoods insect gutloading formula as both substrate and food source. 1-2 Apple slices were placed in the substrate each day to provide moisture. Additional mealworms were held in shipment bags in refrigerated conditions and placed in the pans as needed for feeding.

2018 Set-up: To prevent escape, the mealworms were held in 3 different containers:

1. Large transparent plastic storage container with a screen lid for airflow (approximately 23" long x 16" wide x 12" high)
2. 2-3 drawer units with caster wheels (15" x 13" x 24"; each drawer approximately 10" x 13" x 7")
3. Small "shoebox" type transparent plastic containers with a screen lid for airflow (13" x 8" x 5")

All mealworms that were shipped at the beginning of the season were placed in the containers (i.e. none were stored for use toward the end of the holding period). *Repashy®* Superfoods insect gutload was used as substrate and food in each container. While apple slices were provided for moisture, these containers retained moisture more easily than the open-top pans; therefore, apple slices were used sparingly to prevent the substrate from clumping as well as causing increased moisture which can increase mealworm die-off. In the bird room, tape was placed at the floor boards to prevent mealworms from having access under the walls and into other rooms at the hotel. Care was taken when going in and out of the room to prevent live mealworms from escape.

Before trapping began, there was a die-off of approximately 15 – 20 % of the regular size mealworms in the large storage container. To prevent further die-off from the increased heat and moisture caused by the large number of mealworms being kept in a covered container, the regular size mealworms were separated out into one of the 3-drawer units. Daily care of the mealworms included adding substrate as needed, adding or discarding apple slices as needed, mixing substrate up to prevent moist areas and clumping, and general cleaning of dead mealworms from the enclosures.

GOWE

Golden White-eyes (GOWE) were targeted for collection first during trapping. Between 18 - 24 April 2018, 53 GOWE were trapped and transported to the bird room for holding. One GOWE was trapped on 23 April 2018 and released the same day. This bird was transported to the bird room but was discovered to have been previously banded by the Tropical Monitoring Avian Productivity and Survivorship project managed by CNMI DFW (band no. R 2741 40600 ABRE). After consultation with DFW personnel, the bird was transported back to the field and released at the capture location approximately 6 hours after capture. A second GOWE was found to have a large mass on its keel; veterinary staff removed the mass (see discussion below) and the bird was released on 28 April 2018 at the capture location. Therefore, only 51 GOWE were held for potential translocation.

Transport from field to holding is arranged to minimize time in the transport boxes and in the heat of the field. Average holding time in the field boxes for GOWE was 2 hours and 21 minutes. Based on tarsus length and other factors (weight 1-day post-capture, egg laying [as applicable]), 25 male and 28 female GOWE were captured and transported to bird holding. The average weights for GOWE were

16.8g at capture and 16.4g the first morning post-capture; max/min: 18.7g/18.1g for males and 15.1g/14.9g for hens. On the first morning post-capture, the average weight loss was 2.13%, however, 34% of the GOWE gained weight over their capture weight on the first day of holding. Over the holding period, the GOWE weight loss average was 5.28% weight loss from first morning weight post-capture. However, excluding two GOWE that laid eggs during the holding period, the average weight loss in holding was 4.59% from first morning weight post-capture.

In the past as well as this year, GOWE have been adaptable and relatively easy to transition to captive diets. GOWE were maintained on a mix of fresh local papaya and imported mealworms, *Zupreem®* fruit-blend pellets (using a mix of small and medium size parrot pellets), and *Nekton Plus®* nectar supplement if the birds were experiencing continued weight loss, lethargy, or a lack of fecal production. The basic diet provided once daily to the GOWE was ½ T. *Zupreem®*, 1" x ½" piece of fresh papaya, and 5-10 mealworms; fresh papaya and mealworms were added as needed.

Very few issues were encountered with the GOWE in holding other than the need to supplement some of the birds with nectar. Three birds (hens) were brought into holding from the field with enlarged abdominal areas; two of these birds subsequently laid eggs in the holding boxes. An additional bird was found to have a large hard mass on the right side of its keel. Upon veterinary exam, this was found to be a large feather cyst that was surgically removed on 24 April 2018. This bird was released back at the trapping site after recovering from the short procedure.

RUFA

Rufous Fantails (RUFA) were targeted for trapping after a majority of GOWE were captured. Therefore, RUFA were trapped from 23 - 30 April 2018. During this period, 53 RUFA (31 males, 21 females, and 1 unknown sex as determined by weight) were transported to the bird room for translocation. Trap-to-transport average holding time in the field boxes for RUFA was 2 hours and 34 minutes.

The average weights for RUFA were 7.5g at capture and 7.4g the first morning post-capture; max/min: 7.71g/7.64g for males and 7.20g/7.00g for hens. On the first morning post-capture, the average weight loss was 1.8%, however, 22 or 41.5% of the RUFA either lost no weight or gained weight from their capture weight on the first day of holding. Over the holding period, the RUFA weight loss average was 6.84% weight loss from first morning weight post-capture to 6 May 2018; prior to a shortage of mealworms caused by multiple unanticipated factors (mealworm rationing began 2 May 2018, further discussion below), the birds gained 2.28% of their body weight from the first AM weight.

Rufous Fantails have been challenging to maintain in captivity as they require a fully insectivorous diet and prey primarily on aerial insects in the wild. Past years have shown that feeding small mealworms post-capture increases the fantails' interest in mealworms as a food source. At capture in the field, fantails were provided with a dish of fresh flies. Once in the bird room, RUFA were maintained on 4 feedings per day of the following: ~30-40 flies per feeding, ½ T. mealworms (mix of small and large mealworms) per feeding. Additional fly and mealworm feeding were provided if the birds were experiencing continued weight loss, lethargy, or a lack of fecal production. Mixing the large and small mealworms increased the consumption of the mealworms by the fantails. After 2-3 days in holding, fantails will generally switch to consuming large mealworm readily (while still receiving fly feedings 4 times a day).

Holding mortality was low in 2018. One RUFA died day 3 post-capture. This bird was thin on the morning of death; it was observed eating and active the day prior to death. A second RUFA was found dead in the translocation box on the morning of translocation. Two additional birds were released at the capture locations. The first was found to have a wing droop after its initial exam. When investigated, vet staff found the wing had been accidently adhered to the site of the original blood draw by the small amount of superglue used to seal the site. The vets provided meloxicam to the bird for pain, freed the wing from the adhesion, and the bird was eventually released on day 10 of holding (4 May 2018) at its capture location. It was agreed that the procedural mistake could have compromised the successful translocation of this specific individual RUFA. A second bird was found to be lethargic on the morning of 7 May in the translocation box. The vet staff provided fluids to the bird; as there was a lack of significant improvement, this bird was released at its capture location on 7 May 2018. Therefore, a total of 49 RUFA were taken for transport to Alamagan.

This year, challenges arose as the birds were held for an additional week due to the delay in obtaining a boat contract; this delay, coupled with the die-off likely from newly required containment procedures, resulted in low supplies of mealworms available for the diets starting on 2 May 2018. This shortage proved to be especially challenging for the Rufous Fantails. The weight losses for the RUFA had stabilized prior to the shortage of mealworms. Despite having increased fly feedings starting on 2 May, the RUFA started a downward trend in weight once the mealworms were decreased. This trend in weights from 2018 points toward the likely hypothesis that mealworms, while only one component of the captive diet offered, may be the dietary supplement that helps maintain and increase weight in RUFA. The GOWE diet was unchanged after the rationing of mealworms began, as they are fed far fewer daily and feed in large part on fresh fruit.

The delay in shipment resulted in the RUFA being held for a longer period than any previous trip. The previous translocations had an average holding period of 7 days. The longest previous holding period (10 days) was also a year where transport for translocation was completed by helicopter, thus limiting the time and stress during translocation. The 2018 holding period was approximately 11 days (15 days for the first birds captured and 8 days for the last captured). This additional holding time and the shortage of mealworms left the RUFA in inferior body condition compared to past years prior to the translocation.

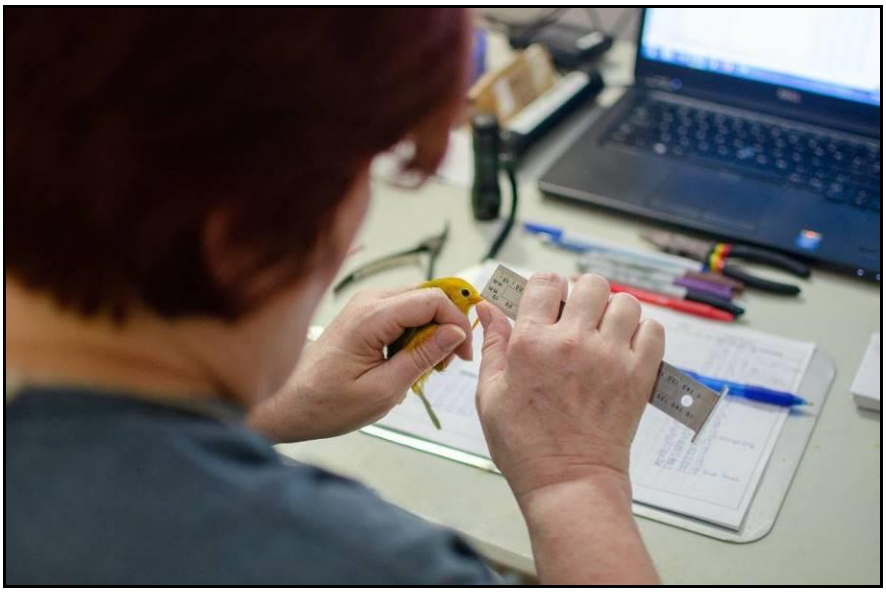


Figure 4: H. Bailey measures bill length in GOWE (Photo credit: Kasey Clarke)

Figures 5-6: S. Newland and H. Roberts custom cut paper linings for the bird holding boxes; D. Fontenot, DVM, collects fecal samples from transport crates for an endocrine study to assess stress hormone levels in birds translocated (Photo credit: Kasey Clarke)

Translocation

The CNMI DFW was able to contract the "Peregrine", a Coast Guard-approved vessel, to transport birds and staff to the island of Alamagan for this year's translocation effort (Figures 7-12). DFW and PBC staff

were able to inspect the Peregrine prior to translocation to identify how best to manage the birds during the trip to Alamagan. After a delay of one week while DFW managed contract negotiations for the vessel, on 7 May 2018 eight crates of birds (51 GOWE and 49 RUFA) were loaded onto the Peregrine for transport to Alamagan along with members of DFW staff and a single MAC team member (Emma Kaiser, DVM).

The overnight trip to Alamagan took approximately 17 hours. While the weather reports prior to the trip were for clear skies and acceptable ocean conditions, the vessel experienced unexpected rough seas for greater than 13 hours of the journey. As dawn broke on 8 May 2018, Dr. Kaiser was able to more thoroughly inspect the crates and how the birds had traveled. The GOWE all exhibited normal behavior and appeared ready for release. The RUFA, however, did not fare as well. Upon inspection at least six RUFA were deceased in the transport crates. The remaining RUFA were all perching quietly in the crates and had noticeable difference in activity level compared to the GOWE.

Upon arrival at Alamagan, the birds were offloaded from the Peregrine and onto a skiff to be transported to shore. The birds were secured onto cargo backpacks and carried by DFW porters approximately 100m up the slope to the release point. Once all birds were positioned at the release point, Dr. Kaiser visually inspected all individuals to ensure they were suitable for release. Dr. Kaiser attended to the RUFA first. At this point staff began to understand that a portion of the RUFA were compromised. Dr. Kaiser administered oral dextrose to birds that were strong enough to be given treatment. Some of these birds flew away, others remained on the ground just feet away from the release point. In the end a total of 31 of the 49 RUFA were deceased. A total of 51 GOWE and 18 RUFA were successfully released onto Alamagan.

Dr. Kaiser was able to perform 13 gross necropsies *in situ* once the team returned to Saipan. Tissues were saved for histopathology testing. Samples were sent to Idexx for analysis. Deidre Fontenot, DVM, oversaw the communication and results received from Idexx testing. Below is a summation of the testing results from Dr. Fontenot.

"Histopathology review of a percentage of the mortalities was submitted to a zoo and wildlife pathology service. Almost 100% (94%) of the reports indicated decreased body condition in combination with prolonged transport were key factors in the demise of these birds. There was no evidence of significant underlying disease. Hemosiderin pigments in the liver warrants investigation of the diet or environmental substrates."

The necropsies and testing results indicate that the body condition of the birds was less than ideal for a challenging, 17-hour translocation event. It is agreed amongst MAC team members including bird curators and veterinary staff that the RUFA were most likely in the compromised state from a combination of the following factors: increased holding time, the shortage of mealworms, and the increased stress of a long transport via boat on rough seas.

In the future, PBC plans to minimize boat transport for translocations when possible and return to the use of helicopter transport. Since 2015, no helicopter companies have been consistently working in the CNMI to allow for this more rapid transport. As of summer, 2018 a new company has begun offering services that may match the transport needs of PBC and DFW for future translocations. In addition, MAC team members will review and adjust feeding protocols as deemed appropriate, in particular for flycatcher species such as the Rufous Fantail, to ensure we will not have a repeat of this scenario from any factors we can control. This is the first large-scale mortality event the MAC team has ever

experienced during a translocation in ten years of this project. We will take any steps we can to mitigate factors leading up to what turned into the “perfect storm” of compromising factors for the translocated Rufous Fantails.

Figure 7: Loading the birds onto the vessel "Peregrine" (Photo credit: Anne Heitman)
Figure 8: Offloading birds for transport via dinghy onto Alamagan (Photo credit: Emma Kaiser, DVM)

Figures 9-12 (clockwise): Golden white-eye peers briefly out of the transport box before flying off; hiking transport crates back to shore; parting view of Alamagan Island; translocation field crew (Photo credits: Emma Kaiser, DVM)

Education and Outreach: Objectives 4-7

4. Conduct two-day Educator Workshops for teachers in the CNMI public school system to initiate curriculum and activities that support habitat conservation for local birds (Figures 13-15).

a. Kerri Lammering and Leanne Blinco host a teacher workshop for 11 local area teachers. A second workshop is held on 27-28 Apr. Topics discussed were:

i. Demonstrations of gardens that could be maintained at schools

ii. Local bird identification, including calls

iii. Conservation Video of MAC Program

iv. Visit to the Field Site and Bird Room

5. Host an educational booth at the Annual Flame Tree Festival.

b. On 28 April 2018, Peter Luscomb, Carolyn Atherton, and Jennifer Haverty hosted a MAC Program information booth at the Flame Tree Festival held at Garapan Fishing Base. The team spoke with festival goers about our continued work in CNMI and about the importance of conserving the natural history of the area. PBC with the assistance from Disney's Animal Kingdom developed bird "trading cards" for all terrestrial species of birds in the Islands including description and conservation information. We were fortunate to have the avian art work donated to the project by Dr. Doug Pratt, co-author of the field guide *Birds of Hawaii and the Tropical Pacific*. We had over 100 participants and all individuals received a bird species card.

6. Provide public presentations of MAC Program activities.

c. On 13 April 2018, MAC team members presented a program to local children at the Joeten-Kiyu Public Library. The program included a short movie on "CoCo the Coconut Crab" by Shelly Kremer. About 30 guests attended the presentation.

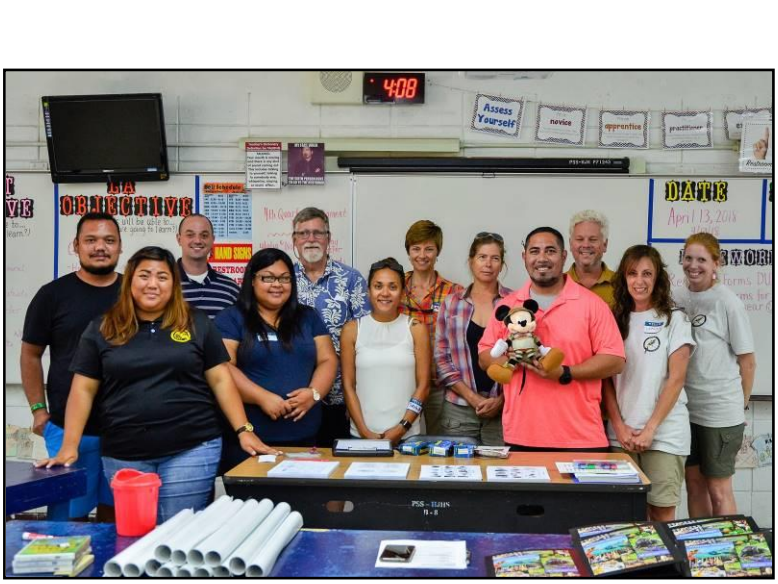
d. On 17 April 2018, Kerri Lammering and Leanne Blinco travel to the island of Tinian to provide a presentation for students at a local elementary level. Over 95 kids attended the presentation.

e. On 25 April 2018, Monica Blackwell presented a public program on MAC project activities at the auditorium of the National Park Service's American Memorial Park (Figure 16).

f. On 4 May 2018, Hannah Bailey presented a program to students at the Grace Christian Academy.

7. Host an educational booth at the 2018 Environmental Expo.

g. On 25-26 April 2018, team members hosted a MAC booth at the Environmental Expo held annually at American Memorial Park. The team spoke with Expo goers about our continued work in CNMI and about the importance of conserving the natural history of the area. Team members handed out bird trading cards, conducted a survey of the students to assess their knowledge of local avifauna and conservation efforts, and held mist net demonstrations.



Figures 13-15: Educator Workshop for teachers in the CNMI public schools (Photo credit: Kasey Clarke)

Figure 16: Public presentation on MAC Program at American Memorial Park (Photo credit: Herb Roberts)

MAC 2018 Project Support and Funding

Major Contributor: CNMI Department of Land and Natural Resources
Disney Conservation Fund: Grant Award for MAC 2018 totaling $25,000
St. Louis Zoo: $4915
Toledo: $2500
Arizona Center for Nature Conservation at Phoenix Zoo: $1000
Doug Pratt: Donation of all artwork for staff shirts and educational trading cards
Contributing/Participating Zoos:

Aquarium of the Pacific
Audubon Zoo
Como Park Zoo
Denver Zoo
Disney's Animal Kingdom
Fort Wayne Children's Zoo
Honolulu Zoo
Houston Zoo, Inc.
National Aviary
North Carolina Zoo
Saint Louis Zoo
Sedgwick County Zoo
Toledo Zoo

2018 MAC Program Team