

## MILLERBIRD TRANSLOCATION TRIP REPORT, 10–25 AUGUST 2012

**To:** Trip Report File, U.S. Fish and Wildlife Service, Hawaiian Islands National Wildlife Refuge, Honolulu, Hawai'i.

**From:** Chris Farmer, Sheldon Plentovich, Sheila Conant, Ryan Hagerty, Robby Kohley, Peter Luscomb, Michelle Wilcox, Thierry Work, Walterbea Aldeguer, Kevin Brinck, Annie Marshall, and Daniel Tsukayama.

**Citation:** Farmer, C, S. Plentovich, S. Conant, R. Hagerty, R. Kohley, P. Luscomb, M. Wilcox, T. Work, W. Aldeguer, K. Brinck, A. Marshall, and D. Tsukayama. 2012. Second Millerbird Translocation, 10–25 August 2012. Nihoa and Laysan Islands, Northwest Hawaiian Islands, Papahānaumokuākea Marine National Monument, Report to U.S. Fish and Wildlife Service, Honolulu, Hawai'i.

This trip report describes the second translocation of Nihoa Millerbirds (*Acrocephalus familiaris kingi*) from Nihoa to Laysan. The results of passerine surveys, invasive species control efforts and general information on Nihoa's species can be found in Brinck et al. (2012).

### Personnel:

Walterbea Aldeguer: Cultural Monitor, Office of Hawaiian Affairs/Papahānaumokuākea Marine National Monument

Kevin Brinck: Biostatistician, US Geological Survey-Hawaiian Cooperative Studies Unit

Toni Caldwell: Biologist, US Fish and Wildlife Service (*stationed on Laysan*)

Sheila Conant: Professor of Biology, University of Hawai'i-Manōa

Chris Farmer: Science Coordinator, American Bird Conservancy

Ryan Hagerty: Senior Field Producer and Videographer, US Fish and Wildlife Service

Robby Kohley: Millerbird Monitoring Leader, American Bird Conservancy contractor (*outbound only*)

Michele Kuter: Biologist and Field Camp Leader, US Fish and Wildlife Service (*stationed on Laysan*)

Peter Luscomb: Head Aviculturist, Pacific Bird Conservation

Annie Marshall: Biologist US Fish and Wildlife Service

Claudia Mischler: Biologist, US Fish and Wildlife Service (*stationed on Laysan*)

Amy Munes: Biologist, US Fish and Wildlife Service (*stationed on Laysan*)

Sheldon Plentovich: Coastal Program Coordinator, Nihoa Millerbird Translocation Project Lead, US Fish and Wildlife Service

Tawn Speetjens: Biologist, US Fish and Wildlife Service (*returning only*)

Daniel Tsukayama: Biologist and Field Camp Leader, American Bird Conservancy

John Vetter: Millerbird Monitor, American Bird Conservancy (*returning only*)

Michelle Wilcox: Millerbird Monitor, American Bird Conservancy (*outbound only*)

Thierry Work: Wildlife Disease Specialist and Veterinarian, US Geological Survey National Wildlife Health Center-Honolulu Field Station

## OBJECTIVES

- Capture at least 32 Millerbirds and select 26 birds most suitable for translocation to Laysan
- Safely transport 26 Millerbirds from Nihoa to Laysan
- Attach radio-transmitters to all birds prior to release and initiate post-release monitoring on Laysan
- Capture any adults on Laysan showing signs of band-related leg injuries
- Capture and band juvenile birds produced spring 2012 on Laysan, time permitting
- Document the translocation process using still photographs and high-quality video

## ITINERARY

**10 Aug 12:** All 12 Millerbird personnel (Aldeguer, Brinck, Conant, Farmer, Hagerty, Kohley, Luscomb, Marshall, Plentovich, Tsukayama, Wilcox, and Work) depart Honolulu on the M/V Searcher at approximately 17:00 HST, bound for Nihoa.

**12 Aug 12:** M/V Searcher arrives at Nihoa approximately 04:00, anchors at 07:00. All 12 personnel disembark, set-up camp and aviculture infrastructure. Millerbird capture occurs from 14:30–17:30. Brinck, Farmer, Hagerty, Marshall, Plentovich, Wilcox and Work spend days on Nihoa and nights aboard the M/V Searcher. Aldeguer, Conant, Kohley, Luscomb, and Tsukayama remain on Nihoa at all times.

**13 Aug 12:** Capture birds (09:00–17:30). Luscomb and Work care for birds in avicultural area.

**14 Aug 12:** Morning (09:00–11:00) capture period. Brinck, Farmer, Kohley, and Marshall continue capturing birds until 12:30. Plentovich, Tsukayama, and Wilcox go to West Palm Valley to collect *Pritchardia remota* seeds for outplanting on Laysan. Luscomb, Work, Aldeguer, and Conant maintain and care for birds. Pack-up camp and prepare for departure from 14:00–1600. Transfer 26 birds to M/V Searcher from 16:00–18:00. Translocation team (Conant, Farmer, Hagerty, Kohley, Luscomb, Plentovich, Wilcox, and Work) spend the night on M/V Searcher with birds secured in one of the cabins. Biological monitoring team (Aldeguer, Brinck, Marshall, and Tsukayama) spends the night on Nihoa, and remains on island until 24 August.

**15 Aug 12:** M/V Searcher departs Nihoa at approximately 10:00 with translocation team. Departure delayed due to broken anchor cable. Biological monitoring team begins passerine surveys, *Cenchrus* control, and other tasks (for details see Brinck et al. 2012).

**15-18 Aug 12:** voyage to Laysan.

**18 Aug 12:** arrive at Laysan approximately 10:00. Avicultural staging area set up by personnel on Laysan prior to arrival of translocation team. Translocation team unloads birds, assesses their health, and then activates and attaches transmitters. Three release sites established and releases occur from 14:45–17:30.

**19 Aug 12:** attempt to capture injured Millerbirds, track birds with radio-transmitters, assess habitat in southern portion of Laysan, and conduct opportunistic arthropod and botanical surveys.

**20 Aug 12:** attempt to capture injured Millerbirds and unbanded juveniles, track birds with radio-transmitters, videography and interviews, and conduct opportunistic arthropod and botanical surveys. Conant, Farmer, Hagerty, Luscomb, Plentovich, and Work depart Laysan at 18:15 on M/V Searcher; accompanied by Speetjens and Vetter from Laysan. Kohley and Wilcox remain behind on Laysan to monitor Millerbirds until mid-October and April, respectively.

**20–24 Aug 12:** voyage to Nihoa.

**24 Aug 12:** arrive at Nihoa at 07:00, Aldeguer, Brinck, Marshall, and Tsukayama embark (07:00–08:30). Retrieve M/V Searcher’s anchor from 09:00–11:15, depart from Nihoa at approximately 12:00.

**25 Aug 12:** voyage to Honolulu. M/V Searcher arrives in Honolulu at approximately 20:30, cargo off-loading occurs on 27 August.

## TRANSLOCATION



Figures 1A–C. Capture of Millerbirds on Nihoa. 1A) Aldeguer and Marshall searching for Millerbirds with mist-net circled in yellow (photograph by C. Farmer). 1B) mist net and transport cage (C. Farmer). Conant and Farmer searching and herding Millerbird (T. Work).

## CAPTURE

We captured 35 Millerbirds using mist-nets from 12–14 August 2012 (Figures 1A–C). Song playback was used to locate and attract Millerbirds. In most cases, birds were gently herded towards a single, modified mist-net (1.3 m tall, 3 m wide) by members of the capture team. Trekking poles were used to extend the potential herding area, thus minimizing damage to vegetation and landscape (for details of the methods see MacDonald 2008; Kohley et al. 2009, 2010). During monitoring of fly traps, one bird was observed inside a trap (Figure 2) near the avicultural area at 16:15 on 13 August. Fortunately, the trap was in the shade, and the bird had consumed all the flies in the trap so it was satiated and hydrated. This bird was removed without incident and showed no signs of distress. Thereafter, fly traps were checked every 15 minutes to minimize the chance of this occurring again. The bird captured in the fly trap was subsequently translocated to Laysan. There were seven recaptures (Table 1): one originally captured in 2007, three in 2009, two in 2010, and one that was caught in both 2009 and 2010. Five of these birds were translocated in 2012.

All birds were measured and banded with a numbered USGS band and unique color band combination (Figures 3A–B, Table 1). Millerbird banding efforts since 2007 have used a size 0A band (internal diameter 2.0 mm) as recommended by the North American Bird Banding lab (Bird Banding Lab 2011). However, seven birds on Laysan were observed with foot or leg injuries on the leg with the aluminum band in 2011–2012 (Vetter 2012). While no Nihoa birds have ever been recaptured or resighted with any leg or foot injuries, as a precaution 27 of 28 birds were banded with a size 0 (internal diameter 2.11 mm) in 2012 following evaluation of the birds' legs using a leg gauge. Size 0 seemed to fit all birds appropriately, however the teams' primary banders believed that band size 1C (internal diameter 2.3 mm) could also be used on some birds. Band sizes 0 and 1C will be included in all Millerbird banding kits starting in 2013. One bird was accidentally banded with a size 0A on Nihoa and translocated to Laysan. Because of the risk of injury, none of the size 0A aluminum bands on the recaptured birds were removed.



Figure 2. Work collecting flies from a trap. A Millerbird was accidentally captured in one of these traps (photograph by R. Hagerty).

All birds captured were sexed using a discriminant function based on tail and wing length (Figure 3B; MacDonald et al. 2010). One bird was released at the net site because it had a pronounced cloacal protuberance suggesting that it was reproductively active. A second bird sexed as a male by the discriminant function was released at the net site because of the preponderance of males being held in the avicultural area. The target sex ratio of the translocated birds was 14 females:12 males. Post-release behavioral observations on Laysan indicated that one “female” (Bk/B, S/Y) was mis-sexed by the

discriminant function, and is actually a male, resulting in an actual translocation cohort of 13 females and 13 males. There were also errors in the 2011 sexing (Rutt and Kohley 2012), indicating the need to improve the accuracy of the discriminant function analysis by incorporating all the banding, behavioral, and genetic sexing of Millerbirds from 2010–2012.

The other 33 birds were brought into captivity. Because there were only 32 spaces in the holding cages, one bird was exchanged on 14 August to achieve a more appropriate sex ratio. The birds were transported to the aviculture area in small individual transport cages (Figure 4). The birds were held and cared for according to the protocols, diet, and holding systems developed by Luscomb and documented in Kohley et al. (2009, 2010) until 14 August. On that day the birds were either transported to the M/V Searcher, or released at their capture site. Three capture teams of three people worked the afternoon of 12 August (14:30-17:30) and all day on 13 August (09:00-17:30). There were 1–2 teams of 3–4 people on the morning of 14 August (09:00-12:30), for a total of approximately 15 hrs, or 40 mist-net-hours. We captured Millerbirds from the slopes of Miller’s Valley, Middle Valley, and the plateau between these two valleys (Figure 5).

One Nihoa Finch was caught incidentally during the Millerbird netting, and was released without harm. The finch was neither measured nor banded.



Figures 3A–B. Banding and measuring Millerbird. 3A) Brinck, Farmer, Kohley, and Marshall processing a Millerbird (photograph by R. Hagerty). 3B) Kohley measuring tail length for sexing (R. Hagerty).



Figure 4. Marshall carrying a Millerbird in a transport box (photograph by T. Work).

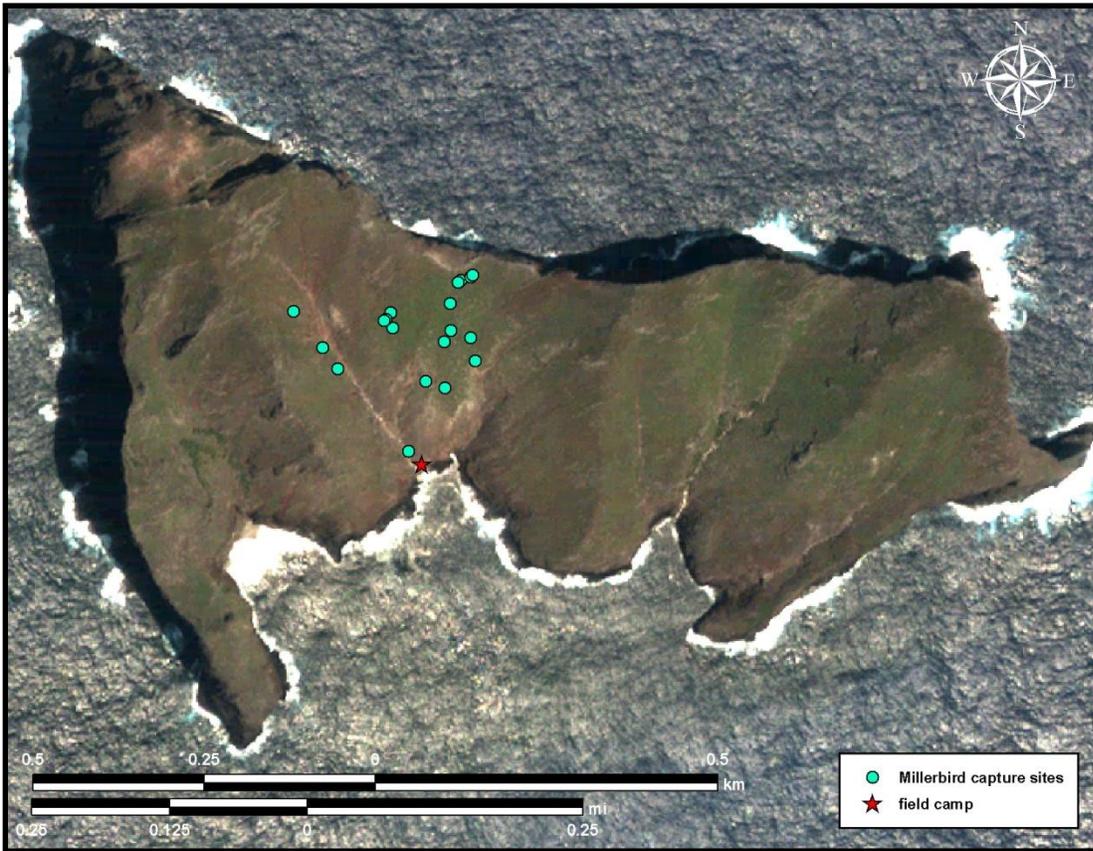


Figure 5. Millerbird capture sites, August 2012. Multiple birds were captured at some sites, so the 35 birds were captured at 19 locations.

Table 1. Banding data for the 35 Millerbirds captured August 2012, including the 26 birds translocated to Laysan. Radio-transmitters were attached to all 26 birds. All bands starting with “2520” are size 0A, and all bands starting with “2610” are size 0.

Band Number	Translocation & Radio-transmitter <sup>1</sup>	Disposition	Capture Date	Capture Time	Left Upper <sup>2</sup>	Left Lower <sup>2</sup>	Right Upper <sup>2</sup>	Right Lower <sup>2</sup>	Weight (g)	Sex	How Sexed <sup>3</sup>	Wing Chord (mm)	Tail (mm)	North Lat	West Long	Status <sup>4</sup>	BANDER <sup>5</sup>
2610-95742	YES/2X	new	12-Aug-12	14:42	BK	B	S	Y	24.0	F <sup>6</sup>	Z	64.0	61	23.06126	161.92268	225	CF
2520-81769	YES/2N	recapture	12-Aug-12	14:51	R	B	O	S	17.0	M	Z	65.0	61	23.06050	161.92275	225	SP
2520-81764	YES/2X	recapture	12-Aug-12	15:25	W	B	BK	S	17.0	F	Z	62.5	61	23.06050	161.92275	225	SP
2610-95721		new	12-Aug-12	15:58	S	R	G	BK	19.5	M	C	66.5	61	23.06050	161.92275	301	SP
2610-95701		new	12-Aug-12	16:21	R	W	S	R	18.0	M	Z	64.0	62	23.06139	161.92361	801	RK
2610-95743		new	12-Aug-12	16:25	B	B	S	Y	19.0	F	Z	64.0	61	23.06126	161.92268	801	CF
2520-81707	YES/2N	recapture	12-Aug-12	16:35	BK	B	G	S	18.0	M	Z	65.0	67	23.06126	161.92268	225	CF
2610-95722		new	12-Aug-12	16:38	W	R	S	W	20.0	M	Z	64.5	62	23.06058	161.92303	801	SP
2520-81752		recapture	12-Aug-12	16:55	G	S	B	R	20.0	M	C	66.5	66	23.06058	161.92303	801	SP
2610-95702	YES/2X	new	12-Aug-12	17:04	S	B	BK	G	20.0	F	Z	63.0	60	23.06137	161.92363	225	RK
2610-95741		destroyed	12-Aug-12	14:40												300	CF
2610-95703	YES/2N	new	13-Aug-12	9:15	S	B	O	O	19.0	M	Z	65.0	64	23.06162	161.92270	225	RK
2610-95723		new	13-Aug-12	9:30	Y	O	S	G	19.0	F	Z	63.5	63	23.06087	161.92233	801	SP
2610-95704	YES/2X	new	13-Aug-12	9:47	S	B	R	O	17.0	F	Z	63.0	60	23.06162	161.92270	225	RK
2610-95724	YES/2X	new	13-Aug-12	10:00	S	R	O	B	18.0	M	Z	65.5	63	23.06087	161.92233	225	SP
2520-81878	YES/2X	new	13-Aug-12	10:35	S	R	R	B	20.0	F	Z	63.0	61	23.06117	161.92240	225	SP
2610-95705	YES/2N	new	13-Aug-12	10:50	S	B	W	Y	18.0	M	Z	64.0	62	23.06192	161.92256	225	RK
2610-95725	YES/2N	new	13-Aug-12	11:11	W	B	S	Y	19.0	M	Z	65.5	65	23.06117	161.92240	225	SP
2610-95706	YES/2X	new	13-Aug-12	11:17	S	B	Y	G	16.0	F	Z	62.0	57	23.06190	161.92259	225	RK
2610-95726	YES/2N	new	13-Aug-12	11:50	Y	B	S	BK	19.0	F	Z	64.0	61	23.06117	161.92240	225	SP
2610-95707	YES/2N	new	13-Aug-12	12:13	S	BK	B	B	19.0	M	Z	64.0	65	23.06197	161.92242	225	RK

Band Number	Translocation & Radio-transmitter <sup>1</sup>	Disposition	Capture Date	Capture Time	Left Upper <sup>2</sup>	Left Lower <sup>2</sup>	Right Upper <sup>2</sup>	Right Lower <sup>2</sup>	Weight (g)	Sex	How Sexed <sup>3</sup>	Wing Chord (mm)	Tail (mm)	North Lat	West Long	Status <sup>4</sup>	BANDER <sup>5</sup>
2610-95708	YES/2N	new	13-Aug-12	13:55	S	BK	BK	O	21.0	M	Z	65.0	64	23.06200	161.92239	225	RK
2520-81747		recapture	13-Aug-12	14:08	W	W	G	S	19.5	M	Z	66.0	63	23.06111	161.92277	801	SP
2610-95727	YES/2X	new	13-Aug-12	14:25	S	W	O	BK	19.0	F	Z	63.5	58	23.06111	161.92277	225	SP
2610-95744	YES/2N	new	13-Aug-12	14:42	B	BK	S	W	18.5	M	Z	65.0	63	23.06128	161.92351	225	CF
2610-95745	YES/2X	new	13-Aug-12	16:09	B	G	S	O	17.5	F	Z	62.0	55	23.06128	161.92351	225	CF
2610-95709	YES/2X	new	13-Aug-12	16:15	S	G	R	W	20.8	F	Z	63.0	46	23.05966	161.92325	225	RK
2610-95728	YES/2X	new	13-Aug-12	16:43	S	Y	G	O	18.0	F	Z	61.5	55	23.06100	161.92450	225	SP
2610-95746	YES/2X	new	14-Aug-12	9:15	G	B	S	Y	19.5	F	Z	63.0	60	23.06148	161.92354	225	RK
2610-95747	YES/2X	new	14-Aug-12	9:38	B	R	S	BK	17.0	F	Z	62.0	61	23.06148	161.92354	225	CF
2610-95729	YES/2N	new	14-Aug-12	9:54	S	W	Y	B	19.5	M	Z	66.5	62	23.06073	161.92428	225	SP
2520-81804	YES/2N	recapture	14-Aug-12	9:54	B	B	O	S	19.0	M	Z	67.0	57	23.06073	161.92428	225	SP
2610-95748	YES/2X	new	14-Aug-12	10:02	G	G	S	R	18.5	F	Z	62.0	59	23.06148	161.92354	225	RK
2610-95730		new	14-Aug-12	11:14	W	BK	S	B	20.0	M	Z	66.0	64	23.06147	161.92492	301	SP
2520-81681	YES/2N	recapture	14-Aug-12	11:14	B	S	B	Y	18.0	M	Z	66.0	63	23.06148	161.92354	225	RK
2610-95749		new	14-Aug-12	12:02	O	B	S	BK	18.0	F	Z	62.0	61	23.06148	161.92354	301	CF

<sup>1</sup> Birds that were translocated to Laysan are indicated by a “YES”, and the Holohil radio-transmitter model indicated (LB-2X or LB-2N).

<sup>2</sup> Band colors:

BK = Black	R = Red
B = Blue (royal)	S = Silver (Aluminum)
G = Green	W = White
O = Orange	Y = Yellow

<sup>3</sup> Sex was determined through either a discriminant function using the wing chord and tail, and is indicated by a “Z”, or by a cloacal protuberance indicated by a “C”.

<sup>4</sup> Status is the three digit numerical code used by the USGS Bird Banding laboratory (<http://www.pwrc.usgs.gov/bbl/manual/status.cfm>):

225	Normal, wild bird, transported to a different 10 min. block. Two or more auxiliary markers used; e.g., translocated to Laysan with bands and transmitter.
300	Band destroyed on Nihoa; not applied to a bird.
301	Normal, wild bird, released in same 10 min. block. USGS and colored leg band(s); e.g., captured, banded, and released on Nihoa without transmitter.
801	Normal, wild bird, held in captivity longer than 24 hr, released in same 10 min block. USGS and colored leg band (s); e.g., captive-feeding trials.

<sup>5</sup> The person banding and measuring the bird: CF = Chris Farmer; RK = Robby Kohley; SP = Sheldon Plentovich

<sup>6</sup> This bird was mis-sexed by the discriminant function, and has exhibited singing male, territorial behavior on Laysan.



Figure 6. Farmer transferring Millerbird in transport cage to Luscomb and Work, the eight holding cages are visible in the metal frames (photograph by R. Hagerty).

### AVICULTURE AND TRANSPORT

**Nihoa.** A total of 33 Millerbirds were brought into captivity: nine during the afternoon of 12 August, 17 on 13 August, and seven during the morning of 14 August (Table 1). The transport procedures were basically the same as in 2011 (Farmer et al. 2011b). Once a bird was processed at its capture site (Figures 3A, 3B), it was carefully transported to the avicultural area using a specially constructed wooden transport box with a flap of cloth on the front to keep the birds as calm as possible (Figures 4, 6). The transport boxes were labeled with duct tape, on which was written the band number, capture time, putative sex, and field weight for each bird. As the bird left the capture site, the field team radioed the avicultural team that a bird was being transported to the avicultural area. This notification gave the avicultural team time to prepare the holding cage for the bird. The holding cages had four cells, and each bird was housed individually (Figure 6). All cages were provisioned with food and water prior to the birds' arrival and labeled 1 through 32. All birds were received at the avicultural area of the field camp in excellent condition, with no birds panting or showing any signs of distress or lethargy, even during the hottest part of the day. Luscomb and Work assessed the health of each bird upon arrival at the avicultural area. The health review consisted of determining if the bird was perching properly, and if its body conformation, respiration, and activity pattern were normal. Physical exams revealed birds with a good feather coat, and good body condition with no evident lesions or behavioral problems. Each bird was transferred to its holding cage in the avicultural area by placing the transport box next to the holding cage, and then opening both sliding doors allowing the bird access to the holding cage. This procedure took approximately 5–10 seconds. After the bird was transferred to its holding cage, the duct

tape with the field data was transferred to the top of the holding cage. This process minimized opportunities for confusing birds or losing data. All birds adapted well to captivity and no medical issues were noted.

The holding cages were supported on shelves underneath shade tarps and camouflage netting (Figures 6, 7), where the temperature averaged 29°C (84°F). All cages with birds were cleaned in the morning, and all birds were fed and watered between 07:00 and 07:45 HST. The morning meal was presented in a 4" plastic saucer, and consisted of: 1 tsp Kaytee Exact® hand feeding formula, ½ tsp of dried ground flies (*Musca domestica*) mix, five four-week old crickets (*Acheta domesticus*), 5–8 waxworms (*Galleria mellonella*), and Nekton® tonic sprinkled on top of the entire dish (Figure 8). The crickets and waxworms were kept frozen on-island, and thawed as needed. Fresh water was given daily in a plastic D-cup placed in the back of the cage. The cages were checked at 10:00, 13:00, and 17:00 hrs, and food added as needed. Live, wild flies (Order: Diptera) were trapped and provided to the birds at 09:00, 11:00, 14:00, and 18:00 hrs. The fly traps were deployed in the ravine between the avicultural area and camp, and baited with canned fruit or cat food. Flies were harvested at least three times per day (Figure 2). We placed moistened toilet tissue on top of traps to keep the flies alive in the hot, dry environment. These live, wild flies were the major food item consumed on Nihoa. Of the other food items provided, only waxworms were consumed at a level that would have sustained the birds during captivity. All of the birds were consuming wax worms by Day Two, while crickets were occasionally consumed. The Kaytee Exact® hand feeding formula and ground fly mix did not seem to be consumed at any significant level, but was ingested when consuming the other food items. Fly captures in the traps were initially much lower this year than in 2011. The top of each trap's interior cone had been dipped in black plastic to minimize fraying, but this served as a visual deterrent for flies, discouraging them from entering the traps. We therefore trimmed off the black plastic, and fly captures increased to levels seen last year.

We transported the 26 birds from Nihoa to the M/V Searcher on the afternoon of 14 August. Transferring the birds in the afternoon allowed them to be established on the boat, and provisioned with live food (e.g., mealworms (*Tenebrio molitor*), see below) prior to the morning departure. The first zodiac trip carried four Millerbird holding cages with four cells (16 birds), while the second had two holding cages (8 birds) and two transport cages (each with one bird), for 26 total birds transferred. The translocation team formed a human chain from the avicultural area down to the landing (Figures 9, 10), ensuring that no one had to walk through or climb over difficult terrain while carrying birds. Each relay began once the zodiac was near the landing, and staged the birds at the lower area in the shade with minimal noise or disturbance. Tsukayama, who has the most experience with landing on Nihoa, handed the birds off to Kenny Karas (Searcher crew) on the zodiac (Figure 11). He transferred the birds to Aldeguer, Brinck, Conant, and Wilcox who held and secured the cages in the zodiac. Noah Nugent (Searcher zodiac operator) supervised the landing and safe transfer of people and birds to and from the zodiac. Although there was some wave surge at the landing, overall the seas were relatively calm which greatly facilitated the transfer of birds from shore to zodiac. The zodiac operator's experience was a critical part of the project's success. Subsequent translocations should include personnel of similar skill and experience.

The six birds in captivity that were not translocated were released at their capture site prior to bringing any birds down to the landing.



Figure 7. Tsukayama carrying a transport cage from the avicultural area, showing shading by netting and tarps (photograph by S. Plentovich). Figure 8. Luscomb feeding Millerbirds (photograph by R. Hagerty).

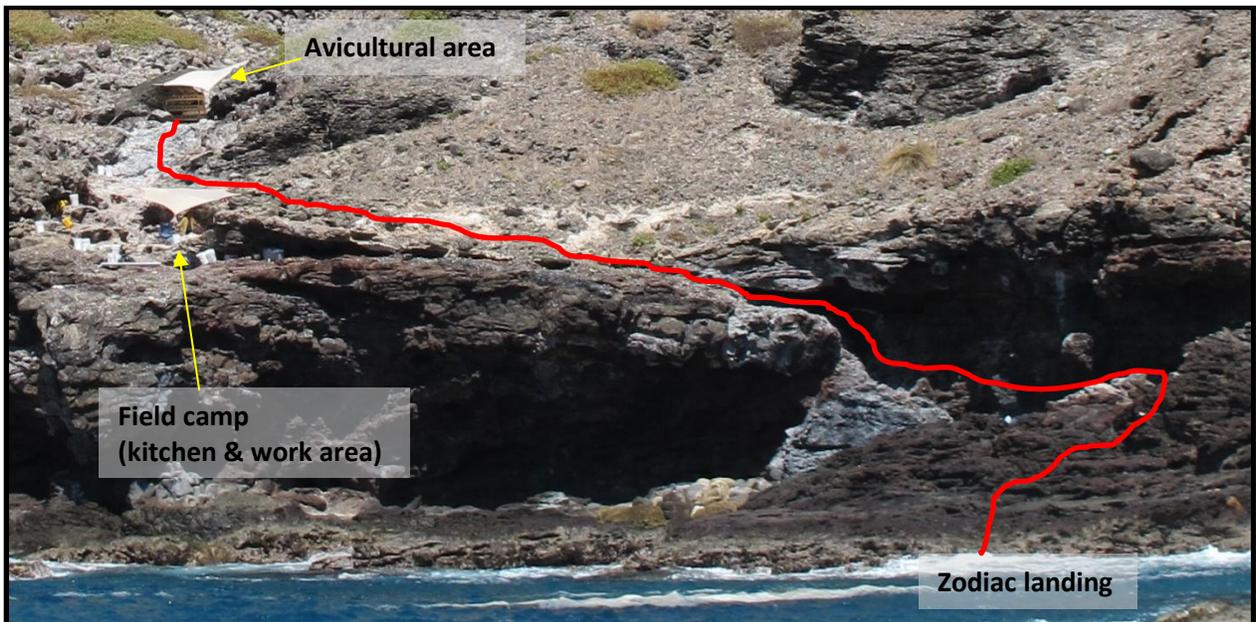


Figure 9. Route of hand-carried holding cages with Millerbirds on Nihoa, from avicultural area (top left) to zodiac landing (bottom right) (photograph by C. Farmer, 2011).



Figure 10. Farmer handing holding cage with four Millerbirds down to Work, with Plentovich spotting and assisting (photograph by R. Hagerty).



Figure 11. Tsukayama handing Millerbirds to Kenny Karas in the zodiac (photograph by R. Hagerty)

The eight people going to Laysan, and all gear not essential on Nihoa, were loaded onto the M/V Searcher by approximately 18:00 on 14 August. Aldeguer, Brinck, Marshall, and Tsukayama remained on Nihoa to conduct additional biological surveys and invasive species control on island (Brinck et al. 2012).

**M/V Searcher.** The avicultural diet and routine on the boat were similar to that on Nihoa, with the notable diet addition of live mealworms. Once the birds were offered this live food item, mealworms became nearly the only food consumed. We continued to offer the full diet (listed above) four times per day (Figure 12), but waxworms were rarely consumed and no other item was consumed at all. We brought 10,000 mealworms for the voyage, twice the 2011 supply, but ran out of mealworms after the three nights on the boat. If another translocation occurs, enough mealworms should be purchased so that each bird has access to at least 100 mealworms per day.



Figure 12. Luscomb caring for the Millerbirds while in the M/V Searcher cabin (photograph by C. Farmer).

The M/V Searcher left Nihoa at 10:00 on 15 August; departure was delayed due to a broken anchor cable. The anchor could not be quickly retrieved, so was left on the ocean floor and recovered upon the ship's return. The seas during this portion of the expedition were calm, which facilitated the care of the birds and minimized their stress. The M/V Searcher arrived at Laysan on the morning of 18 August, and we began off-loading the birds at approximately 12:30 (Figure 13). Off-loading the birds on Laysan's

sandy beach was considerably easier than loading them from Nihoa’s rocky, wave-washed marine terrace. All birds were off-loaded and installed in the shaded avicultural staging area structure (Figure 14) by approximately 13:30.



Figure 13. Work carrying birds onto Laysan (photograph by R. Hagerty).

#### **PREPARATION AND RELEASE AT LAYSAN**

Vetter and USFWS Refuge staff had prepared the avicultural staging area (approximately 60 m northwest of the USFWS cooking) before the arrival of the new Millerbirds and the translocation team. They erected a large shade-tarp, used cots and boards to support the bird cages (Figure 14), set up tables and chairs for the transmitter attachment station (Figures 14, 15A, 15B), and captured hundreds of moths collected from the Refuge’s hurricane shelter (Lepidoptera: Noctuidae) to provide live food for the birds.

Upon disembarking, members of the translocation team initially worked to finalize the staging area preparations and distribute three pairs of release cages in the northern naupaka patch which is the core Millerbird habitat. Kohley and Work transferred the Millerbirds into a new set of identical holding cages (in accordance with Papahānaumokuākea Marine National Monument bioquarantine protocols) once the on-island preparations were completed. The birds were then transported by zodiac to Laysan, where the translocation team and the USFWS Refuge staff assisted in off-loading the Millerbirds and carrying them to the staging area (Figure 13). The cages were placed on boards secured to cots, and Luscomb collected the final release weight for the birds, while other personnel began feeding the birds live moths (Figure 14). Other translocation team members began the transmitter activation and attachment process (Figures 15A, 15B). Transmitter activation involved soldering the last 1 mm of the power leads of each transmitter together to activate the battery and then subsequently water-proofing the new connection with wax, followed by superglue. The actual radio frequency was then determined and recorded. Chiffon cloth was cut and then superglued to the transmitter to increase surface area and improve adhesion (e.g., Fancy et al. 1993, Farmer et al. 2011b). Once the transmitter assembly was ready, 5–12 feathers in the interscapular area were trimmed, and the radio-transmitter attached to the

bird with OstoBond. Transmitters were attached to all 26 birds, with males receiving Holohil LB-2N (0.47 g, 21 day duration; Table 1) and females Holohil LB-2X (0.46 g, 35 day duration). Half of these birds (n = 13) were going through molt, 12 were molting body feathers, so the persistence of the transmitter attachment in 2012 could be less than in 2011 (mean was 21 days during the last translocation, Rutt and Kohley 2011). These transmitters were approximately 2.6% of the birds' release weight, which is below the highly conservative 3% guidelines from the translocation protocols (Farmer et al. 2011).



Figure 14. Preparations for release in the avicultural area, showing transmitter attachment table (left) and holding cages (photograph by C. Farmer).

Once the aviculturists determined the radio-tagged Millerbirds were healthy and suitable for release, personnel began walking the birds from the holding area to the three release sites (1.0 km, 0.6 mi). The Refuge staff (Caldwell, Kuter, Mischler, Munes, and Speetjens) were the primary transport personnel, and were invaluable in carrying the birds quickly and safely from the avicultural area to the release site, while minimizing impacts to breeding seabirds and Laysan's sensitive habitats. All birds were transported in individual transport cages (Figure 16), similar to those used on Nihoa to carry the birds from the capture site to the avicultural area.



Figures 15A–B. Attaching radio transmitters to Millerbirds. 15A) Tasks and personnel from the rear of the picture, Plentovich soldering and activating the transmitters, Wilcox testing radio frequencies, Work preparing chiffon and transmitter attachments, and Kohley gluing transmitters (photograph by R. Hagerty). 15B) Close-up of Kohley securing a radio transmitter to the back of a Millerbird (R. Hagerty).

The three release sites were within 265 m (870 ft) of one another in the core Millerbird habitat of the northern naupaka berm (Figure 17). We chose these sites because they were comprised of suitable habitat (Rutt and Kohley 2012), would not cause disturbance to active nests (Vetter 2012), they were adjacent to the current Millerbird distribution, and were easy to access. Each site contained a pair of release cages constructed with large mesh windows to allow observation of birds from a distance (Figures 18A–C). Some woody naupaka branches were placed in each release cage to serve as perches and provide a more natural environment (Figure 18C). A male and female bird were transferred to each pair of release cages, one bird per cage. The release cages were employed to aid observers in



Figure 16. Plentovich carrying two Millerbirds to the release sites, escorted by Vetter (photograph by R. Hagerty).

assessing the birds' health before the final release (Figures 18B–C). An experienced biologist watched each bird in the cage to ensure it was behaving normally and that no additional care was needed (Figure 18B). Throughout the release process, only one bird needed to be retrieved from the release cage to adjust the glue, feathers, and transmitter. After the adjustment, this bird behaved normally, so was released (Figure 18D). All 26 birds scurried or flew into the vegetation without incident.

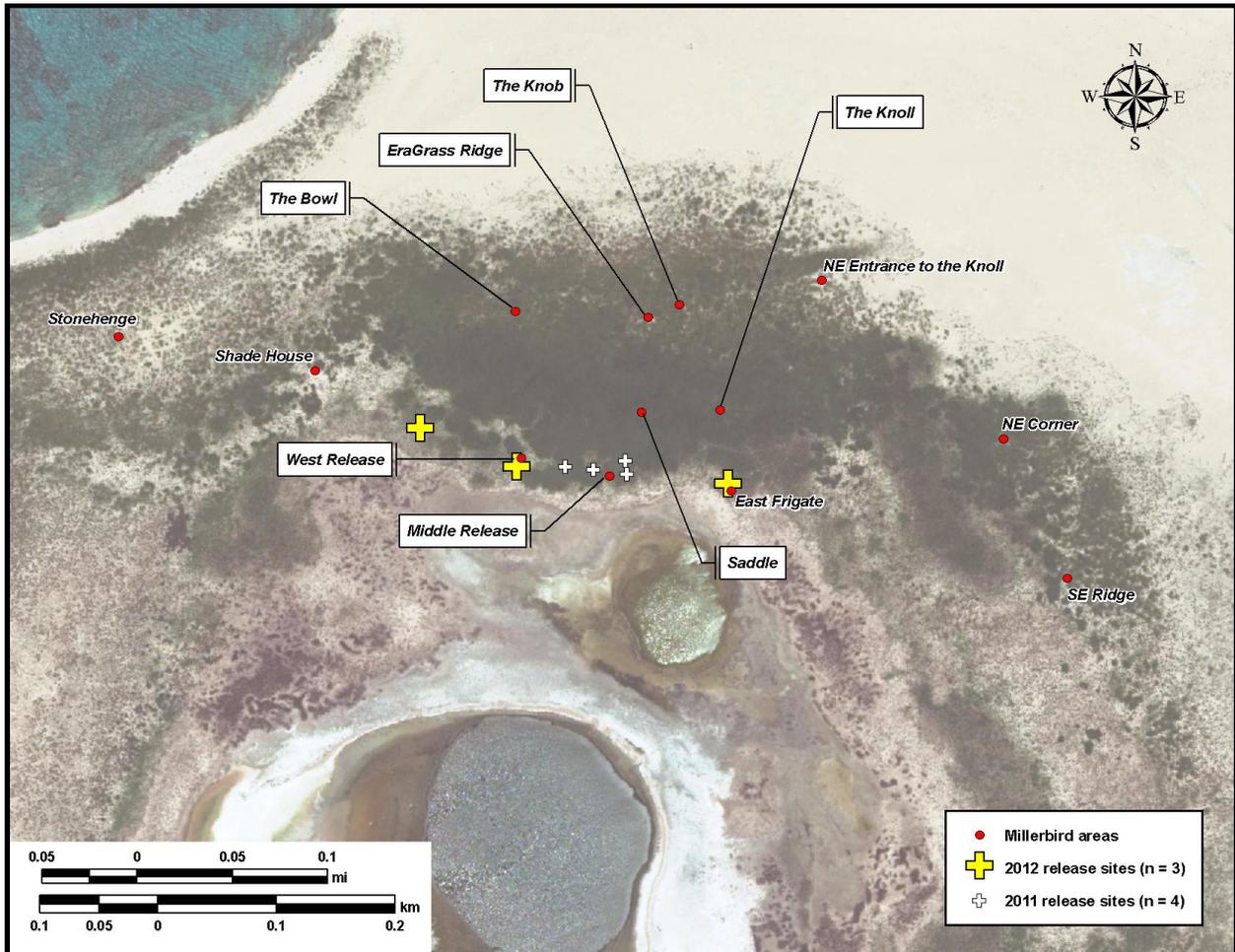


Figure 17. Millerbird release areas on Laysan in 2011 and 2012. The named locations used in fieldwork (Rutt and Kohley 2012, Vetter 2012) are included for reference.



Figures 18A–D. Release area and cages in the northern naupaka area on Laysan. 18A) Pair of release cages in the habitat (photograph by C. Farmer). 18B) Farmer monitoring a Millerbird before it is released. 18C) Millerbird in the release cage (R. Hagerty). 18D) Conant releasing the first Millerbird (R. Hagerty).

**Overall Avian Health and Condition.** Weight, behavior, and fecal output (Work et al. 1999) were used to monitor health of captive birds. Birds were weighed in the morning prior to feeding (<08:00), and then again in the late afternoon at approximately 17:00. Additionally, the health and behavior of the birds were monitored visually at least three times a day, typically after feeding. The observer would watch each bird from a distance and monitor its activity pattern and posture. Healthy birds were typically active and flitting back and forth on their perches. Each bird’s diet and food preferences were also monitored. Birds that were regularly consuming food had well-formed feces, that included large volume of solids with minimal urates. The feces on the first morning in captivity usually had a low volume of

solids and a lot of urates, indicating low food consumption. By the afternoon of the second day in captivity the birds were eating flies and starting to eat waxworms, so the feces were beginning to show larger volume of solids with fewer urates. Due to the movement of the vessel, we were unable to collect daily weights from the birds during the voyage, so while on the boat we monitored the birds' health by documenting food consumption, activity patterns, and fecal output. The birds quickly transitioned to eating live mealworms once offered, and the feces maintained excellent form and volume.

The mean weight of the 33 birds brought into captivity was 18.6 g (range: 16.0–21.0 g; Tables 1, 2). Seven of these birds were caught and brought into captivity on 14 August, the day of departure, so there was no first morning weight collected for them. However, their estimated weight change can be calculated using the 8.5% weight loss from the 26 birds that were held overnight. The mean measured ( $n = 26$  birds) first morning weight was 17.2 g, and 17.1 for the mean calculated weight ( $n = 33$  birds). The change in weight from capture to first morning ranged from +1.2% to -22.0%. These large, overnight differences could be partially due to using a Pesola® hanging spring scale in the field and a digital Ohaus® HH120 scale in captivity. We assessed the birds' condition based upon their weight the first morning in captivity because that is closer to its normative weight than the initial capture weight, which can be biased by recent foraging successes or failures (Farmer et al. 2011a). The 33 birds were held in captivity on Nihoa from 4–49 hrs, and the 26 translocated Millerbirds were in captivity from 99–147 hrs until their release on Laysan. The translocated birds gained a mean of 6.2% (range: -1.4 to +14.7%) from their first morning weight, with only one female showing weight loss. This result is very similar to the 2011 translocation, where the 24 birds showed a mean weight gain of 5.3% (range: -1.7 to +17.6%), and only two birds lost weight (Farmer et al. 2011b).

**Table 2.** Weight change of captive Millerbirds, August 2012.

	capture weight (g)	first morning weight (g)	change from capture to first morning (%)	18 Aug weight <sup>1</sup> (g)	change from first morning to 18 Aug (%)
sample size	33	26	26	26	26 <sup>2</sup>
mean	18.6	17.2	-8.5	18.0	+6.2
min	16.0	15.0	-22.0	16.6	+1.1
max	21.0	19.5	+1.2	19.8	+14.7

<sup>1</sup> Birds were transported to Laysan via zodiac then released on 18 August 2012.

<sup>2</sup> If limited to the 20 birds with measured morning weights, the mean, minimum, and maximum are the same as for the full cohort of 26 birds.

## POST-RELEASE ACTIVITIES

The translocation team spent three days and two nights on Laysan (18–20 August) focused on capturing birds on Laysan and radio-tracking the birds just released. Kohley, Rutt, and especially Vetter (2012, *unpublished data*) had observed seven birds with injured feet or legs, specifically abnormal swelling of the limb and digits distal to the metal band suggesting the band was constricting the limb and causing dependent edema. Injuries were all associated with the leg with the aluminum size 0A USGS band – the recommended size for this species (Bird Banding Lab 2011). During the August overlap, there were at least three birds displaying injuries, B/S, B/G (2520-81872), W/R, O/S (2520-81774), and O/O, O/S (2520-81798), the latter two a mated pair with eggs or nestlings in the nest. Because of the possibility that continued constriction could lead to loss of blood flow and sloughing of the limb, and the personnel available, especially Work as a veterinarian, we decided to attempt to capture these birds and remove the bands. The single male was caught relatively easily in the mist net, and the aluminum band safely and quickly removed. No sand or other foreign object that could have become lodged between the band

and leg thus explaining constriction was seen. This bird's new combination is B/-, B/G. The bird's foot and leg were swollen, but the leg was vascularized and much of the swelling was exfoliating epidermis. The consensus was that the prognosis for full recovery of the limb was good. Subsequent observations indicated this bird had regained full function of the leg and was behaving normally. Next, the capture team attempted to capture the paired male for several hours, but was unsuccessful (Figure 19). Capture efforts were delayed until the evening to alleviate stress and heat effects on the target birds. The evening's capture attempts were also unsuccessful. A final series of unsuccessful attempts were made the morning of 20 August. The vegetation on Laysan, primarily naupaka, is much thicker and more continuous than found on Nihoa (compare Figure 19 vs. 1A), and the Millerbirds were more likely to stay within the protection of the vegetation. This made coaxing birds into the nets with either playback or herding efforts substantially more difficult. The paired male did not move far from the nest (<5 m), as opposed to the behavior of non-nesting birds on Nihoa (which are often attracted at distances over 50 m), making capture more difficult. The thicker vegetation also greatly reduced the mobility of the capture team and their ability to herd the target bird into the net. The female was nearly completely unresponsive, stayed very near the nest, and was not close to being captured in any of the attempts.

Whatever the proximate cause of the injuries, it appears that the problem is restricted to Laysan because birds with similar sized bands (size 0A) have never been observed with leg problems on Nihoa. The problem also appears to wax and wane, with Kohley, Rutt, and Vetter (2012, *unpublished data*) observing several birds displaying a foot injury and then recovering. Additionally, Kohley and Wilcox have been recapturing and removing size 0A bands, and have found several birds with no current signs of injury showing evidence of previous, undetected leg swelling (Kohley and Wilcox *in prep.*). We currently have no explanation as to why this issue is limited to Laysan.



Figure 19. Farmer, Plentovich, and Wilcox attempting to capture Millerbirds in the thick naupaka habitat on Laysan (photograph by T. Work).

Vetter then provided a briefing to the core translocation team on current Millerbird breeding efforts (six nests were active; Vetter 2012) and territories after the morning’s capture efforts on 19 August. The afternoon was spent radio-tracking the 26 newly released birds in the northern core habitat, including teaching Wilcox how to conduct radio telemetry (Figures 20A, 20B). Signals from 24 birds were detected, although the signal strength (i.e., detection range) was relatively low. The naupaka patches in the south end of the island were also visited to listen for Millerbirds and provide the team a better understanding of available habitats on Laysan. No Millerbirds were detected outside the core, northern habitat.

After attempting to capture the injured adults on the morning of 20 August, the translocation team worked independently to complete a variety of tasks. Some people attempted to locate the independent juveniles and band them, but none of the 17 juveniles could be found. This team then resighted and searched for the 2012 translocated birds. The two birds not found on 19 August were not detected along the eastern edge of the lake, searching as far south as the lake gauge. Additional members resighted and confirmed the health of the birds in the core habitat. Other personnel conducted video interviews, searched for rare plants and arthropods, and discussed the habitat restoration efforts on Laysan with Refuge staff.

All translocation team personnel returned to camp by 14:00 on 20 August and prepared for departure. Conant, Farmer, Hagerty, Luscomb, Plentovich, and Work boarded the M/V Searcher by 16:00, along with Speetjens and Vetter. Kohley and Wilcox remained on Laysan to monitor the Millerbird population until mid-October and April, respectively.



Figures 20A–B. Radio-tracking Millerbirds on Laysan by Kohley (20A) and Wilcox (20B) (photographs by C. Farmer).

A full report of Kohley and Wilcox's results is beyond the scope of this document, but some of their preliminary observations are important in evaluating the August 2012 expedition. The majority (25/26) of birds were resighted by 1 September, and the last female was seen on 12 September. Nine breeding pairs have formed from the 26 birds translocated in 2012, and another pair with a male translocated in 2011 and female from 2012. These pairs have displayed reproductive activity such as nest building (n = 6 pairs) and egg laying (n = 4 pairs). These nests were mostly placed within naupaka, similar to the spring-summer 2012 nests, and unlike the fall 2011 nests (Rutt and Kohley 2012, Vetter 2012). All of the new territories are in the northern naupaka, core Millerbird habitat. At least four of the unbanded juveniles produced in summer 2012 have also started displaying territorial behavior, including one unbanded male observed carrying nesting material and feeding a female translocated in 2012 (this female subsequently paired with a male translocated in 2012). Four of the radio transmitters had fallen off, and six had stopped working as of 9 September. The male whose aluminum band was removed has been resighted, and is doing well. The other male (W/R, O/S) is no longer displaying any signs of swelling or injury. Unfortunately, the female's (O/O, O/S) foot is swollen and she is not using that leg. Because of her cryptic behavior and difficulty in capturing her, no additional attempts to remove the band will occur until her behavior changes (e.g., the nest finishes and she is more active and flying among vegetation patches).

## **INTERACTIONS WITH REFUGE STAFF**

The USFWS and PMNM staff were integral to the success of the translocation. Andrea Kristof and Cindy Rehkemper worked with Millerbird personnel on pre-trip logistics, ordering and procuring supplies, and the numerous details needed to support the Refuge staff and Millerbird monitoring team on Laysan. This coordination was particularly important because Wilcox will be spending 6 mo with that crew, but arrived on Laysan approximately 2 mo before they will arrive. The summer crew (M. Kuter, T. Caldwell, C. Mischler, A. Munes, and T. Speetjens) and Vetter helped construct the aviculture staging area and provided camp supplies and general support during the release. Both crews and Refuge management provided direct and indirect support throughout all phases of this project, and we are deeply grateful for their assistance and expertise.

## **INTERACTIONS WITH THE M/V SEARCHER**

The success of this expedition was reliant on the captain and crew of the M/V Searcher. We wish to recognize the great skill and extraordinary commitment and kindness of the six people who operated the vessel and zodiac and made the birds' voyage, as well as ours, more than comfortable throughout the trip. Additionally, they allowed us to modify their vessel for the security of the birds during transport and maintain live insect food on board. We strongly support engaging the M/V Searcher for all future voyages and research with an oceanic component. The M/V Searcher has a history of anchor troubles at Nihoa, and the crew and members of this project recommend that the Monument and Coast Guard consider the construction of a permanent boat mooring. This is the second time in three years that there has been a significant problem anchoring at Nihoa. These problems risk the safety of the boat's crew and passengers, as well as potentially increasing the damage to the ocean floor. The translocation team

will work with the M/V Searcher personnel on submitting a proposal to the Papahānaumokuākea Marine National Monument Management Board for a permanent mooring.

## **SUMMARY OF RECOMMENDATIONS**

Both the 2011 and 2012 Millerbird translocations went incredibly smoothly, with no significant problems. Although no further Millerbird translocations are currently planned, there are some minor recommendations to improve future biological research and general work in Papahānaumokuākea Marine National Monument.

- All future banding teams working with Millerbirds should have size 0 and 1C aluminum bands available.
- The discriminant function needs to be updated with new data from birds of known sex to improve the model. Every Millerbird captured, including those released on Nihoa, should be genetically sexed. Each year there were several birds that were mis-sexed, and including the data from 2010–2012 will improve the results for future research.
- If Millerbirds are held in captivity, in an area that is not subject to PMNM bioquarantine, then we recommend 100 mealworms/bird/day should be available.
- A proposal, and all the necessary supporting documents necessary, for a permanent mooring at Nihoa needs to be submitted to the PMNM Management Board before next September’s biological monitoring visit to Nihoa.

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