NIHOA ISLAND TRIP REPORT, 21-29 SEPTEMBER 2013

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

From: Sheldon Plentovich, Chris Farmer, Joshua Fisher, Holly Freifeld, and Rachel Rounds

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EXECUTIVE SUMMARY

We conducted Variable Circular Plot surveys for Nihoa Millerbird (*Acrocephalus familiaris*) and the Nihoa Finch (*Telespiza ultima*) 23-28 September 2013 at 60 points. There were 270 Millerbird and 569 Nihoa Finch detections, with a range of 0 - 6 and 1 - 9 respectively. The detection rate of Millerbirds increased sharply between 2012 and 2013, suggesting there might have been an increase in this species. Conversely, the detection rate of Nihoa Finches declined, suggesting this species might have declined. The U.S. Geological Survey Biological Resources Division is completing a report that will compare population estimates from the distance-based strip-transect and variable circular plot methods performed in 2012. Six banded Nihoa Millerbirds were resighted. Fourteen seabird species were observed on Nihoa and 13 of the 14 were nesting or had fledglings. Three species of migratory shorebirds were observed. Fifteen native plant species were found and appeared healthy. A total of 25 grey bird locusts (*Schistocerca nitens*) were observed during passerine surveys. A single non-native sandbur (*Cenchrus echinatus*) was detected and removed. The plant was located down slope from Cluster 2, about 100 meters above our campsite, with a little bit of green growth still present. Weed cloth was placed at the new location and replaced at an older cluster to minimize sprouting of any remaining seeds. In addition, six individuals of New Zealand spinach (*Tetragonia tetragonioides*) were removed at the bottom of Devil's Slide.

ITINERARY

20 September. Searcher departs Honolulu with all personnel aboard (see personnel list below).

21 September. Searcher arrives at Nihoa Island. Disembark personnel and gear before 1430. Begin setting up camp. All personnel camp on island.

22 September. All personnel finish setting up camp and practice visual and aural bird identification and practice using rangefinders and estimating distance in preparation for passerine surveys.

23 - 28 September. In the morning, Farmer, Rounds and Freifeld conduct passerine point counts at newly established points and Fisher initiates invasive plant surveys and control. In the afternoon, personnel search for and control invasive plants, search for Nihoa Finch nests, sample invasive ants, and record observations on abundance and nesting phenology of seabirds and migratory birds and status of native and alien plants and invertebrates.

29 September. Searcher departs Nihoa Island at approximately 1400. All camp materials and refuse is removed from island.

1 October. Arrive in Honolulu at approximately 0030 hrs. Freifeld and Farmer slept on the Searcher. All other personnel disembarked.

PERSONNEL (Figure 1, left to right):

- Holly Freifeld: American Bird Conservancy
- Josh Fisher: USFWS
- Sheldon Plentovich: USFWS
- Rachel Rounds: USFWS
- Chris Farmer: American Bird Conservancy

Figure 1. Nihoa passerine survey and invasive species control team 2013 (Photo by J. Fisher).

Objectives:

- Conduct Nihoa Millerbird and Nihoa Finch population survey using distance sampling techniques at 60 points throughout the island.
- Resight previously banded Nihoa Millerbirds to collect data for demographic analyses.

- Search for and control the invasive grass *Cenchrus echinatus*.
- Remove all individuals of the invasive plant *Tetragonia tetragonioides*.
- Observe and record phenology and abundance of seabird and shorebird populations.
- Observe and record phenology and abundance of native and invasive flora.
- Observe and record phenology and abundance of native and invasive terrestrial arthropods.
- Sample invasive ants at likely introduction points.
- Opportunistic beach counts of Hawaiian Monk Seals.

NIHOA MILLERBIRD AND NIHOA FINCH POPULATION SURVEYS AND OBSERVATIONS

Methods. We surveyed a set of 60 stations 2 - 4 times with variable circular plots (VCP) to determine the density and calculate the abundance of Nihoa passerines. This was the first year that strip-transects were not used (e.g., Conant 1981, Marshall et al. 2012). All stakeholders met on 28 March 2013 and came to a general consensus that point transect methods using 6-minute VCP counts were preferred for Millerbirds. The VCP method permits improved population estimates with reduced variability for populations of each of the two passerine species. Gorresen et al. (2012) inspected contemporary satellite imagery of Nihoa Island, and calculated the vegetated area of the island suitable for passerine habitat as 61.9 ha (6,663,000 square feet). This value will be used to calculate the abundance once the density is calculated in Program DISTANCE. We selected the points before departure based upon 3-m resolution Quickbird2 satellite imagery (taken 17 April 2008). The points were dispersed across the entire vegetated area of the island (Figure 2), with each point separated by 80 - 100 m. The 90% detection probability in 2010 - 2011 was 40 m for Millerbirds and 34 m for Nihoa Finches (Gorresen et al. 2012), so this separation was chosen to minimize double-counting birds.

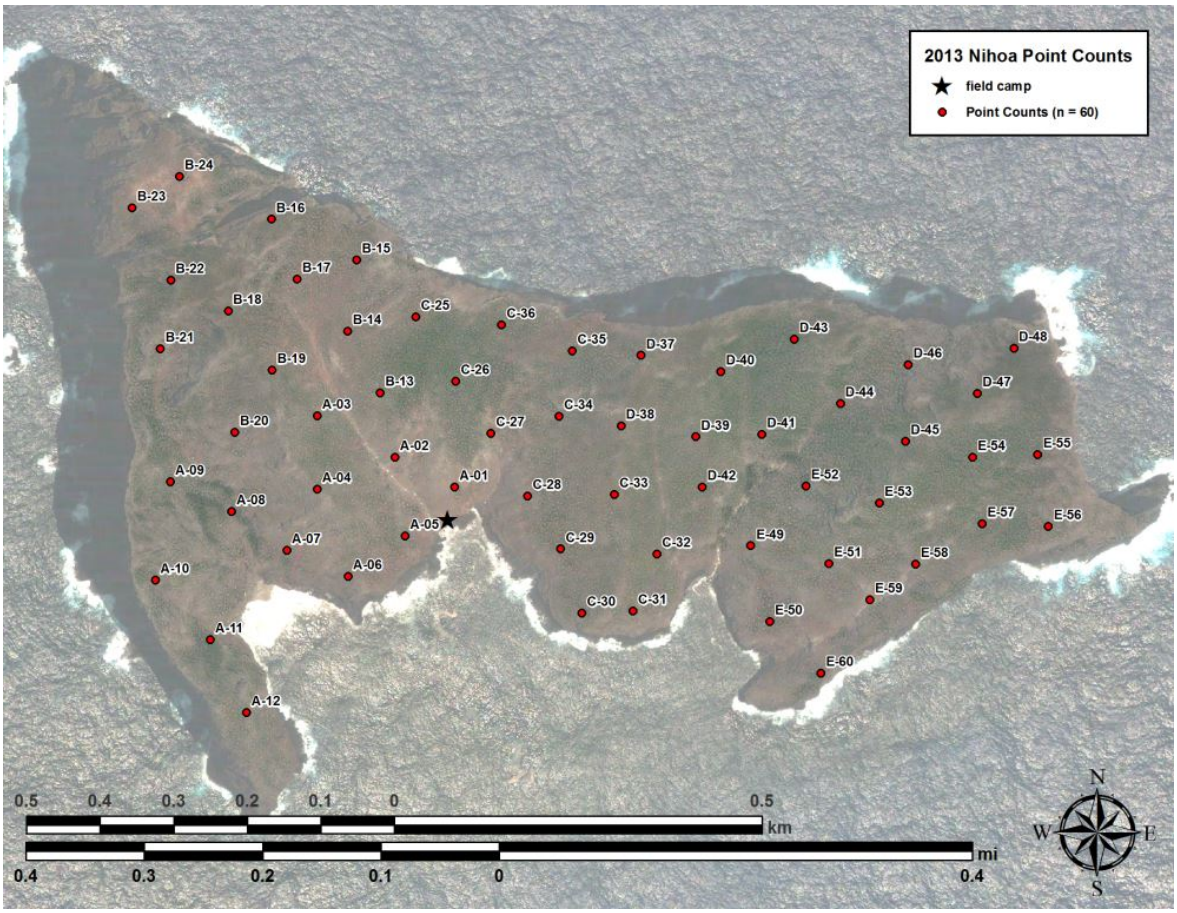

Figure 2. Location of the 60 VCP stations on Nihoa.

Each observer stood at the survey station and recorded the horizontal distance to every Nihoa Finch and Millerbird detected by sight or sound. The time and a habitat descriptor were recorded for each detection. A digital range finder was used to measure the distance to each bird, with distances <10 m (below the range finder's operational range) estimated by the observer. Each observer also recorded percent cloud cover, precipitation, wind, dominant plant species, and percent cover. Precipitation did not occur during the surveys, but high winds were a frequent problem. Only surveys with winds ≤17 mph were analyzed (0 - 4 on the Beaufort scale; surveys at 5 or higher were excluded). All counts were started between 0645 and 1054 HST. We attempted to survey each station at least three times, but high wind conditions and travel time resulted in three stations being surveyed only twice (Appendix I).

During the VCP surveys any banded Millerbirds were noted. After the VCP surveys were completed, the surveyors attempted to resight additional banded birds as they returned to camp. The surveyors also searched for nests, particularly of the Nihoa Finch, in the vegetation during the afternoon return to camp.

Results. Each of the 60 stations was surveyed 2 - 4 times between 23 - 28 September 2013 by C. Farmer, H. Freifeld, S. Plentovich, and R. Rounds for a total of 180 surveys (Appendix I). There were 270 Nihoa Millerbird and 569 Nihoa Finch detections, with a range of 0 - 6 and 1 - 9 for each species detected per

survey, respectively. Localities and number of stations surveyed in previous years were substantially different (Marshall et al. 2012, VanderWerf et al. 2011), so the mean detections per effort are not directly comparable (Table 1). The formal DISTANCE-based estimates of the population density are being produced by USGS-BRD/HCSU, and should be ready shortly.

Table 1. Number of Millerbirds and Nihoa Finches detected on point counts in 2013, compared with previous years effort. 2010 - 2012 data from Marshall et al. 2012.

Species	Year	# Stations	Survey Effort	Detections	Detections/Effort
Nihoa Millerbird	2013	60	180	270	1.50
	2012	108	263	116	0.44
	2011	108	200	284	1.42
	2010	90	91	197	2.16
Nihoa Finch	2013	60	180	569	3.16
	2012	108	263	1447	5.50
	2011	108	200	681	3.41
	2010	90	91	373	4.10

Every station surveyed had at least one Nihoa Finch detected (Figure 3). They seemed to be slightly more common at the mid-elevations of Tanager Peak, and less common between Middle and East Palm Valleys. They were also less common, or at least less detected, at the more exposed and lower altitude sites (e.g., A-12, E-50, E-60). Millerbirds were also distributed across the island (Figure 4), although there were no detections at three stations (A-06, A-12, E-52). They seemed to be less common east of East Palm Valley, with the notable exception of E-58, which had the most detections of any station. The plateau between Miller's and Middle Valley, where most of the birds translocated to Laysan were captured, did not show an obviously different detection rate compared to other areas.

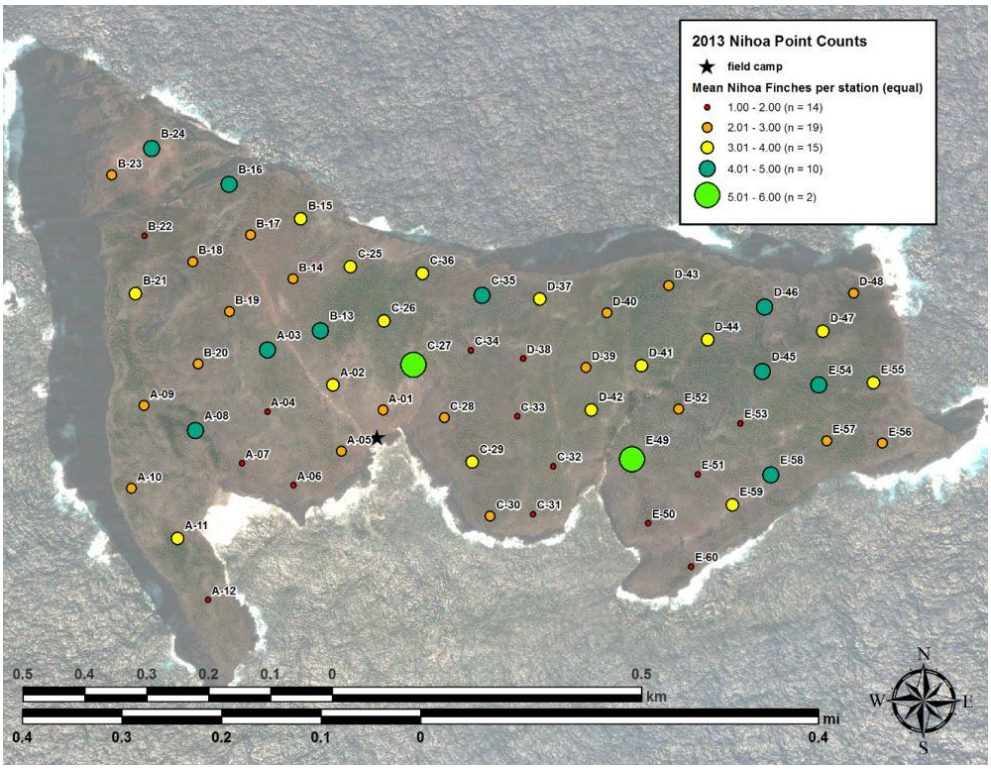

Figure 3. Mean detections of Nihoa Finches at the 60 VCP stations in 2013.

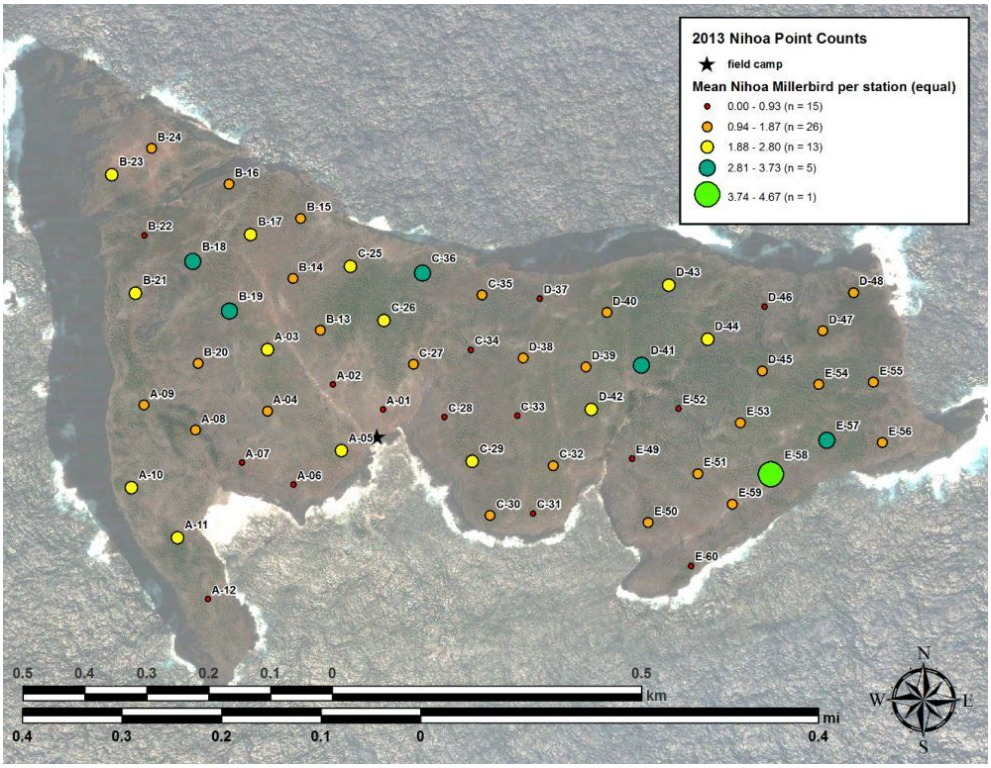

Figure 4. Mean detections of Nihoa Millerbirds at the 60 VCP stations in 2013.

The detection pattern was quite different between the two species. The finches were easier to detect visually, but less vocal; while the Millerbirds showed the opposite behavior (Table 2).

Table 2. Detection types for Nihoa Finches and Millerbirds, 2013.

Detection type	Nihoa Finch	Nihoa Millerbird
Heard, not seen during count (type 1)	130	206
Heard first, later seen during count (type 4)	384	27
Seen first during count (type 2)	47	22

This behavior resulted in differences in the detection distance for each species, with approximately twice the proportion of finches detected in <10 m category compared to Millerbirds (Figure 5). This could also be a result of the finches' inquisitive behavior and known propensity for investigating surveyors (Conant et al. 1981, Gorresen et al 2012). Freifeld and Rounds noted this frequently.

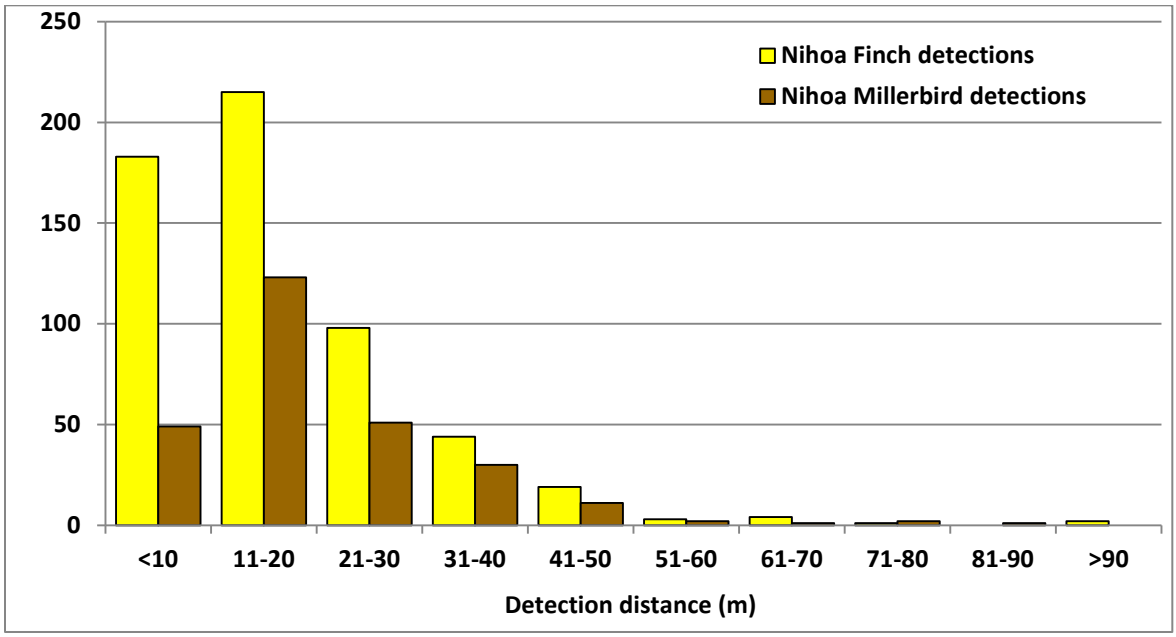

Figure 5. Detection distances for Nihoa Finches and Millerbirds in the 180 surveys in 2013.

Each surveyor estimated the percent cover of each dominant plant species and of bare rock or soil at each VCP stations. Averaging these estimates provided a rough qualitative assessment of the habitat throughout the island. The majority of the stations were dominated by bare rock or no vegetation (Figure 6). *Sida fallax* and *Solanum nelsonii* were the most common plants, although *Eragrostis variabilis* was the dominant plant on some stations on the slopes of Tanager and Miller's Peak. *Chamaesyce celastorides* was a significant component of the vegetation only at the two stations on the exposed southern tips, and *Pritchardia remota* was common in West Palm Valley. *Chenopodium oahuense* and *Sesbania tomentosa* had low representation at a few sites on the western half of the island.

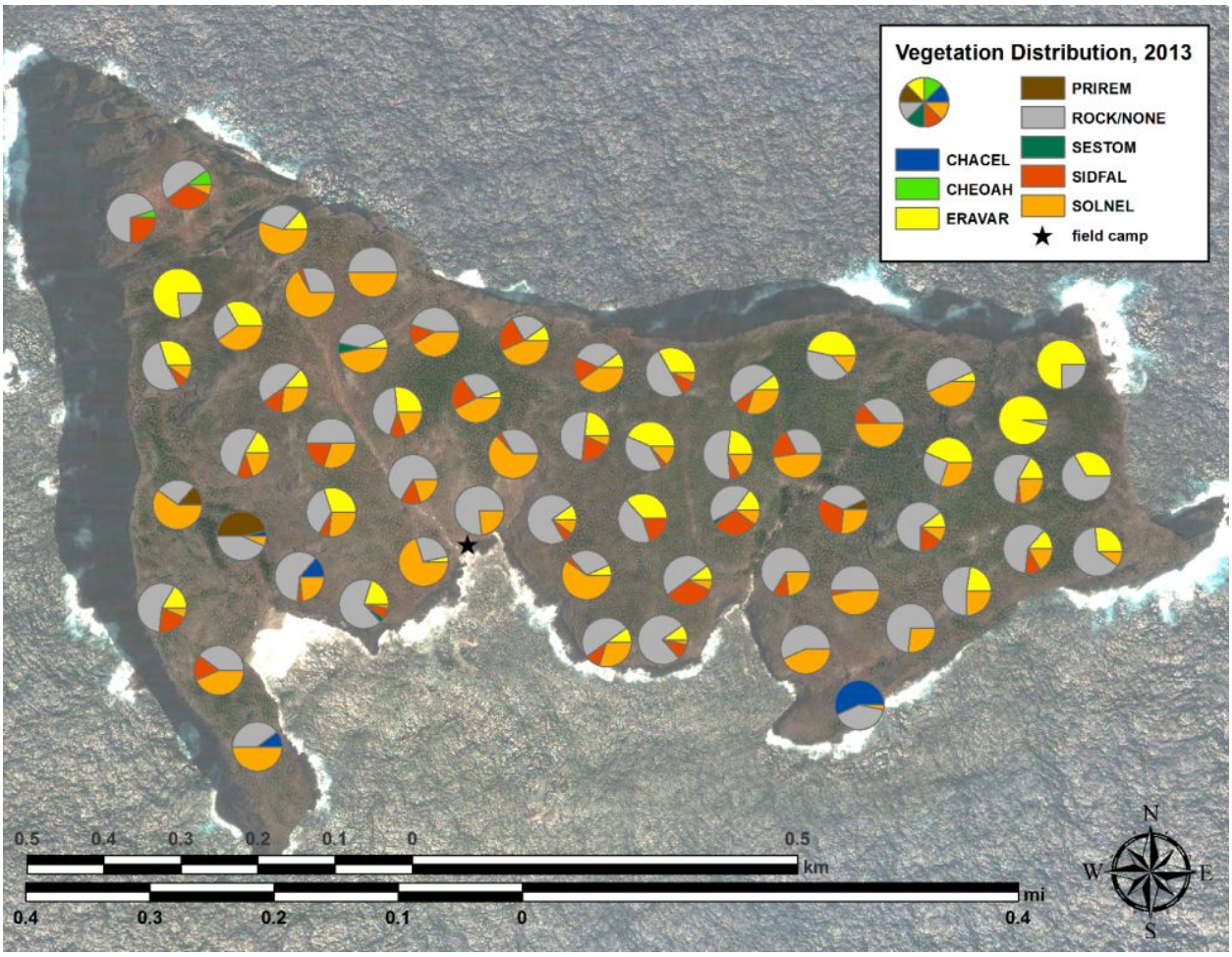

Figure 6. The mean proportion of the different vegetation at the 60 VCP stations in 2013. The vegetation codes are: CHACEL = *Chamaesyce celastroides*; CHEOAH = *Chenopodium oahuense*; ERAVAR = *Eragrostis variabilis*; PRIREM = *Pritchardia remota*; ROCK/NONE = rock, barren, or no vegetation; SESTOM = *Sesbania tomentosa*; SIDFAL = *Sida fallax*; SOLNEL = *Solanum nelsonii*.

The majority of Millerbirds were unbanded, with only six resights of banded birds collected in 2013 (Table 3). Although no morning hours were devoted to resights, observers were focused on determining if birds were banded during the afternoon return to camp, and these were the only banded individuals observed. Observers, especially S. Plentovich and C. Farmer, spent the afternoons searching for Nihoa Finch nests in the vegetation. One nest was found along the cliff faces (Figure 7), but none were found in the vegetation. The proposed finch translocation sites (Lisianski and Kure) do not have natural rocky substrate and therefore determining the plasticity of the species' nesting requirements is a high priority for planning translocation of Nihoa Finches. All previously described Nihoa Finch nests occurred in rocks, cliffs, rubble, or other similar substrate (Amerson 1971, Berger 1981, Conant 1983, Morin and Conant

2002, Richardson 1954, Sincock and Kridler 1977, Vanderbilt and de Schauensee 1941). Two inactive Millerbird nests were also found (Figure 8).

Farmer found a dead, unbanded Millerbird above the palms in East Palm Valley (23.06054° North, -161.91884° West; Figure 8). The bird seemed to be in good condition and the cause of death was not apparent. The carcass was salvaged and will be necropsied by Theirry Work (US Geological Survey National Wildlife Health Center-Honolulu Field Station) when possible.

Table 3. Resights of color banded Millerbirds in 2013.

Date	Time	Obs[1]	Color combo[2]	Latitude (N)	Longitude (W)	Comments
9/23/13	06:56	CAF	R/W:G/S	23.05988	-161.92298	
9/24/13	07:15	SMP	W/W:G/S	23.06119	-161.92299	Looked healthy and robust with both feet
9/26/13	10:30	SMP	Y/O:G/S	23.06316	-161.92788	Singing with another bird, presumably a female
9/26/13	15:41	SMP	Y/B:G/S	23.06211	-161.92599	Hanging out with unbanded female
9/26/13	16:41	SMP	W/Bk:S/B	23.06120	-161.92465	Not 100% sure of band combo
9/26/13	16:41	SMP	Y/G:G/S	23.06120	-161.92465	hanging out with W/Bk:S/B

[1] observer: SMP = Sheldon Plentovich; CAF = Chris Farmer

[2] color bands: B = blue; Bk = black; G = green; O = orange; S = silver; W = white; Y = yellow

Figure 7. Inactive Nihoa Finch nest found in the cliff face along the coastline east of camp (Photo: S. Plentovich)

Figure 7. Inactive Millerbird nest in *Solanum nelsonii*, near VCP station A-07 (Photo: C. Farmer).

Figure 8. Dead Millerbird discovered near count D-41, at the top of East Palm Valley (Photo: C. Farmer). The specimen was submitted to Dr. Thierry Work (USGS National Wildlife Health Center) for necropsy and results are pending.

***Miscellaneous Behavioral Observations*:** Nihoa Finches were observed scavenging parts of flying fish regurgitated by nesting seabirds and eating leaves (new growth) of *Sesbania tomentosa* and *Solanum nelsonii*. A Nihoa Millerbird was observed vigorously shaking the decayed and stiff carcass of a seabird and then eating all the larval and adult insects (mostly Order Coleoptera) that fell out.

SEABIRDS

Table 4 provides a summary of the presence, order-of-magnitude abundance, and stage in breeding chronology of Nihoa's seabirds. Summary notes on each species are presented below.

Wedge-tailed Shearwater or *`Ua`u* (*Puffinus pacificus*). Abundant throughout the island in most habitats that provide crevices or opportunity for burrow excavation. High numbers of non-breeders were attending the island and calling through the night and early morning. We observed mass departures at first light. Chicks were mainly in their second down coat, approximately 6 weeks old.

Christmas Shearwater (*Puffinus nativitatus*). Chicks near fledging were present in low numbers throughout the island and were concentrated in the areas dominated by *Eragrostis* habitat below Miller

Peak. Adults were observed singly and in couples during the day and were seen returning to the island in low numbers at dusk and were heard calling at night.

Bulwer's Petrel or *`Ou* (*Bulweria bulwerii*). Fully feathered chicks very near fledging were abundant in rocky crevices and caves throughout the island. We observed numerous[1] dead chicks/fledglings, nearly all out in the open, face-down with splayed wings. We assume that some oceanographic event restricted food resources for adults provisioning chicks and that most of these birds died of starvation. In hindsight, we should have collected a fresh carcass or two for necropsy. Low numbers of adults were observed returning to the island at dusk.

Red-footed Booby or *`A* (*Sula sula*). Common and widely distributed where woody shrubs and palms provided suitable nesting and roosting substrate. Young of the year were represented mostly by fledglings, but some (low hundreds) large downy or partly feathered chicks were present.

Brown Booby or *`A* (*Sula leucogaster*). Brown Boobies were most numerous on steep slopes, cliffs and cliff-edges around Miller's Peak, Tanager Peak, and the edges of the island generally, and along the rocky ridges of the island. Many fledged juveniles were seen and several nests were observed with downy and partly-feathered chicks.

Masked Booby or *`A* (*Sula dactylatra*). Nests and young were most abundant on Miller's Plateau, but individual nests and pairs of adults were scattered around the island. Most young were fledged or nearly so.

Great Frigatebird or *`Iwa* (*Fregata minor*). Roosting adults, fledglings, and nests were abundant throughout the island in areas where woody shrubs provided suitable substrate. Young of the year ranged from chicks with little down remaining to fledglings. No eggs or small chicks were seen.

Red-tailed Tropicbird or *Koa`e Ula* (*Phaethon rubricauda*). Low numbers of adults in aerial courtship were seen and heard around the island. Five large chicks (including one recently dead chick) were seen in nest sites.

Sooty Tern or *`Ewa`ewa* (*Sterna fuscata*). Low numbers of adults and chicks were heard vocalizing in flight over the island (e.g., at night, from camp), and seen flying along cliffs. Fewer were observed roosting on the island. The greatest concentration of Sooty Terns (adults, fewer fledglings) was observed on Miller's Plateau.

Gray-backed Tern or *Pakalakala* (*Sterna lunata*). Widely distributed at low density around the island. Chicks at all stages but newly hatched were often observed in exposed areas. Eggs were observed, but no incubating adults; we assume these eggs were abandoned.

Brown Noddy or *Noio Koha* (*Anous stolidus*). Arguably the most abundant seabird on Nihoa. Adults, juveniles, and nests at all stages were present throughout the island. Most chicks were well feathered;

hatchlings and nests were least common. Eggs were observed, but no incubating adults; we assume these eggs were abandoned.

Black Noddy or *Noio* (*Anous minutus*). Observed flying along sheer cliffs of the northern and western sides of the island and perched on the rocky ledges over the cliffs. Rarely observed flying over the island. Because Black Noddies are restricted to these cliff habitats, abundance and phenology were difficult to determine for this species.

Blue-gray Noddy (*Procelsterna cerulea*). Especially numerous on the sheer cliffs of the northern side of the island, though also commonly observed flying near the shoreline and landing in rocky caves and on ledges throughout the island. One nest with an egg was found; otherwise, no nesting activity was observed. Because Blue-gray Noddy nesting apparently is concentrated in these cliff habitats, abundance and phenology were difficult to determine for this species.

White Tern or *Manu-o-ku* (*Gygis alba*). Observed flying along sheer cliffs of the northern and western sides of the island and perched on the rocky ledges protruding from cliff faces. Rarely observed flying over the island. Because White Terns are restricted to these cliff habitats, abundance and phenology were difficult to determine for this species. Partially feathers chicks observed at the bottom of Devil's Slide.

Table 4. Approximate order of magnitude for seabird abundance and nesting phenology on Nihoa Island, 21-28 September 2013.

Species	**Relative Abundance, Order of Magnitude**[1]	**Nesting**	**Chicks Present**
Laysan Albatross	0	No - absent	No - absent
Bulwer's Petrel	1000s-10,000	Yes	Yes - near fledging
Wedge-tailed Shearwater	10,000s-50,000+	Yes	Yes - all half grown/downy
Christmas Shearwater	1000s	Yes	Yes - near fledging
Tristram's Storm-petrel	0	No - absent	No - absent
Red-footed Booby	10,000s	Yes	Yes - some grown/downy to partly feathered
Brown Booby	100s-1000	Near-finished	Fledged; few half grown/downy
Masked Booby	100s-1000	Yes	Yes, many fledged
Great Frigatebird	10,000s-50,000+	Yes	Yes, many fledged
Red-tailed Tropicbird	100s	Near-finished	Very few fully-feathered chicks
Sooty Tern	100s	Finished	Fledged
Gray-backed Tern	1000s	Yes	Yes, all stages but egg & hatchling
Brown Noddy	>50,000	Yes	Yes, all stages but egg
Black Noddy	Common on sheer cliffs	Unknown	Unknown
Blue-gray Noddy	1000s, maybe more	Unknown	Unknown
White Tern	Common on sheer cliffs	Unknown	Some partially feathered

[1]These numbers are coarse order-of-magnitude estimates, based on qualitative assessment of the relative abundance of these species during this trip.

INDIGENOUS MIGRATORY BIRDS

Pacific Golden-Plover or **Kolea** (*Pluvialis fulva*). Scattered individuals were seen in uplands and on the rocky shoreline. Estimated 10-15 individuals observed.

Ruddy Turnstone or **'Akekeke** (*Arenaria interpres*). This species was common, with individuals observed foraging on the rocky shoreline and small flocks seen in the uplands. Estimated 10-20 individuals observed.

Wandering Tattler or **'Ulili** (*Heteroscelus incanus*). A flock of about 11 birds was observed flying away from the landing site, and scattered individuals were also seen in the uplands and on the rocky shoreline.

Bristle-thighed Curlew or **Kioea** (*Numenius tahitiensis*). None observed

Sanderling or **Hunakai** (*Calidris alba*)**.** None observed.

NON-NATIVE BIRDS

Cattle Egret (*Bubulcus ibis*): While monitoring birds, a deceased Cattle Egret was found on top of the plateau (Fig 9). Cattle Egrets were introduced to Hawai'i and it is on the realm of possibilities for them to fly out to Nihoa. In 2011, Cattle Egrets were observed being mobbed by other birds. This was likely the case for this one as there is a tern colony in proximity to this deceased cattle egret. No other egrets were observed.

Figure 9. Dead Cattle Egret 26 September 2013 (Photo: J. Fisher).

Northern Mockingbird (*Mimus polyglottos*). None were seen this year. A single individual was seen and photographed in Devil's Slide by Brinck in 2012 which was the 3rd record.

MONK SEAL OBSERVATIONS

Endangered Hawaiian Monk seals (*Monachus schauinslandi*) were observed on a daily basis on the rocky shoreline and in the water. Two to four monk seals were typically hauled out below the lua (to the west of the landing site and tidepools), one to three monk seals were typically hauled out around the tidepools and landing site, and one to two dozen monk seals hauled out on Forbidden Beach. Many monk seals were in the process of molting, and appeared very grumpy.

On September 23 Plentovich and Rounds walked the coastal route to East Palm Valley. At about 0730 they observed an estimated 10-15 monk seals in waters approximately 50 meters off the coast. Three large monk seals appeared to be fighting or breeding, repeatedly coming partially out of the water, opening mouths wide, and landing on the other seals. At one point a spray of blood was seen on the monk seals and in the water. The three larger monk seals were in the middle of the scrum, surrounded by smaller seals, with juveniles swimming around the outside of the circle. The activity was observed for

at least 10 minutes, and most likely continued for longer. No sharks were seen despite the presence of numerous monk seals and blood.

TURTLES

Juvenile and adult green sea turtles (*Chelonia mydas*) were observed in the waters off the landing site, the cove below East Palm Valley and Forbidden Beach. The maximum number of sea turtles seen at one time was three.

NATIVE ARTHROPODS

Nihoa Trap-door Spider (*Nihoa mahina*). On 25 September 2013 Fisher observed a single individual in Devil's Slide that was exposed as Fisher pulled New Zealand Spinach. On 26 September 2013, Plentovich observed and photographed two individuals near the middle and bottom of Devils Slide (Figure 10).

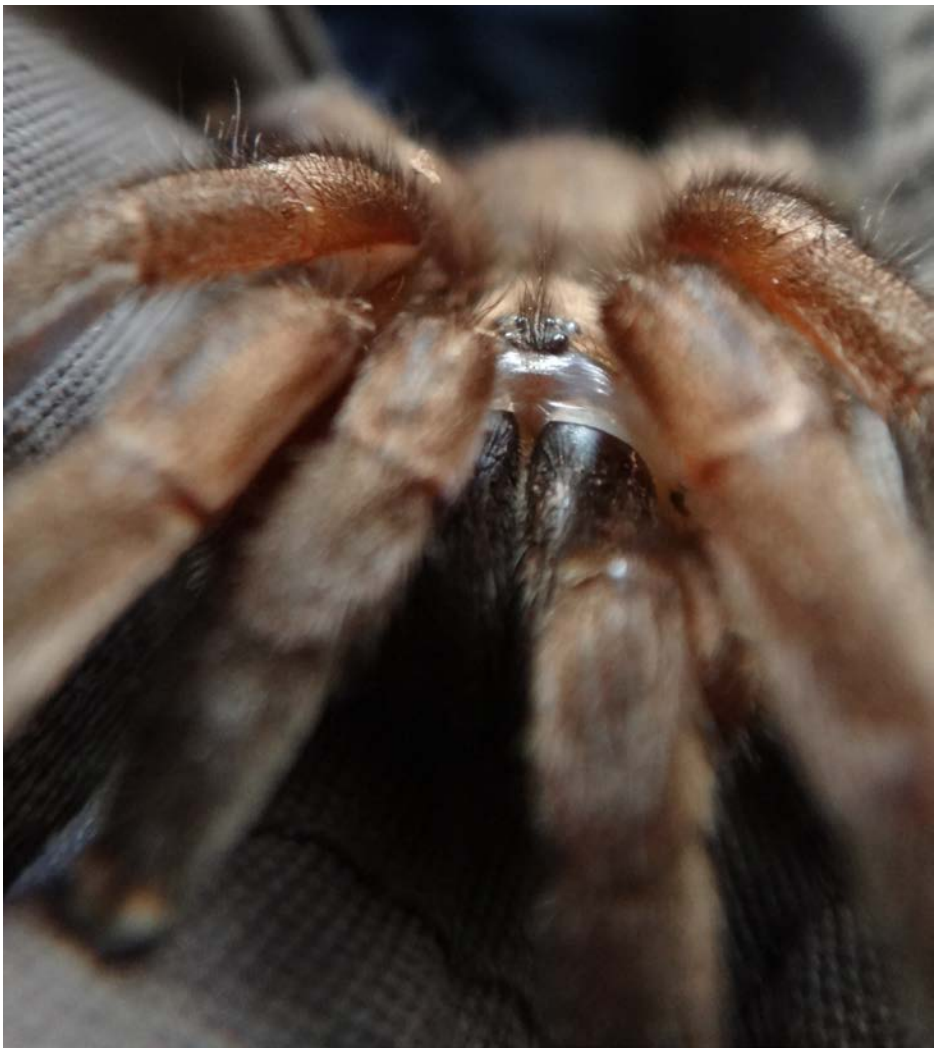

Figure 10. Nihoa Trapdoor Spider (*Nihoa mahina*) captured and photographed near the bottom of Devil's Slide (Photo: S. Plentovich).

Nihoa Conehead Katydid (*Banza nihoa*). Rounds found the exoskeletons of two adult individuals in the main wash above camp on 27 and 28 September 2013.

Unknown Lycosid (Family Lycosidae). This spider was fairly common in Devil's Slide and it is unknown if it is native or introduced (Figure 11). Pictures of species were sent to Rosie Gillespie (Professor, University of California Berkley) for species identification on 10 April 2014 but she was unfamiliar with the species.

Figure 11. Unknown spider (Family Lycosidae) found near the bottom of Devil's Slide (Photo: S. Plentovich).

Perkin's Yellow-faced Bee (*Hylaeus perkinsianus*). One female and two males of this species were observed on 23 and 27 September 2013 along the eastern edge of the island and in camp, respectively. The individuals were photographed and later identified by Karl Magnacca (Entomologist, Oahu Army Natural Resources Program).

ALIEN ARTHROPODS

Gray Bird Grasshopper (*Schistocerca nitens*). A total of 25 grasshoppers were observed on the passerine bird survey transects.

Invasive ants (Family Formicidae). Four species were collected during surveys at 13 stations. Surveys involved placing centrifuge tubes baited with peanut butter, honey, and Vienna sausage in the shade for approximately one to two hours. The survey was conducted on 27 Sept 2013 and stations were established in camp (Point 1) and then moving north up the main wash. Stations were separated by approximately 20 m. *Paratrechina longicornis* was the most commonly observed species at bait stations followed by *Tetramorium bicarinatum*, and then *Monomorium floricola* and *Tapinoma melanocephala* (Table 5). *Cardiocondyla kagutsuchi/venustula* was hand-collected on the beach below West Palm Valley. All ants were identified by S. Plentovich and then verified by P. Krushalnycky (University of Hawaii).

Table 5. Numbers of invasive ants identified at thirteen survey points at camp and along the wash above camp.

Point	*Paratrechina longicornis*	*Tetramorium bicarinatum*	*Monomorium floricoloa*	*Tapinoma melanocephala*
1	80	0	0	4
2	200	0	0	0
3	0	150	0	0
4	50	0	0	0
5	180	0	0	0
6	0	0	150	0
7	0	130	0	0
8	100	1	0	0
9	18	0	0	0
10	5	130	0	0
11	0	200	0	0
12	0	300	0	0
13	30	0	0	0

NATIVE PLANTS

ʻEmoloa (*Eragrostis variabilis*). Observed in abundance throughout the island, particularly on the south-facing slopes of Millers Peak and Tanager Peak where this plant is dominant. Most plants consisted of more than 50% dry matter with empty seed heads, though some plants still displayed ripe seed.

Kakonakona (*Panicum torridum*). This native bunch grass was common and widespread over much of the island, but all plants observed had senesced and were brown and withered.

Kīpūkai (*Heliotropium curassavicum*). A few individuals were found at base of West Palm Valley.

Loʻulu (*Pritchardia remota*). Loʻulu stands in West Palm Valley and East Palm Valley remain healthy. Fruit and flowers were present.

Rumex albescens. A few hundred healthy plants were observed in the lower section of Devil's Slide (Figure 11). No fresh flowers or seeds were observed. The plant was doing well, but remains limited to the rich soil and semi-shaded areas in this locale.

Figure 11. *Rumex albescens* and *Chenopodium oahuense* in the Devil's Slide area (Photo: S. Plentovich).

'Āweoweo (*Chenopodium oahuense*). This species was sparsely distributed on steeper slopes and ridges, and more common on Miller's Plateau, Devils Slide, and Dog's Head. Several plants were observed with seeds.

Schiedea verticillata. Like *Rumex albescens*, this endemic species was mostly found in the lower section of Devil's Slide, though it is also found on other areas of the island during spring and winter months. A few hundred plants were observed which is comparable to last year's numbers. Most plants were small (less than 7.5 cm).

'**Ohai** (*Sesbania tomentosa*). 'Ohai was common over much of the island. Small plants (less than 0.6 m) were healthy and abundant throughout the island, and much more numerous than 2011. This plant, though apparently perennial, seems to have a pattern of senescence on Nihoa, with large (up to 1 m) 'skeletons' of dead individuals common over the island, and new seedlings emerging around this time of year.

Nohu (*Tribulus cistoides*). A few individuals were noted on the rocky ridges of the eastern end of the island. No seeds or flowers were observed.

Amaranthus brownii. Not observed.

'Akoko (*Chamaesyce celastroides*). This species was abundant on the rocky ridges on the eastern and western ends of the island, where it often formed thick stands. Plants were observed with flowers and seeds.

'Ilima (*Sida fallax*). 'Ilima was very abundant on the island. This species exhibited a large range of characteristics; from long, nearly leafless stems, to leafy verdant shrubs. Many plants had both flowers and seeds.

Ipomoea indica. Not observed

Pōpolo (*Solanum nelsoni*). One of the most abundant plant species on Nihoa, the pōpolo on Nihoa displays a large range of characteristics and leaf-shapes. While some plants exhibited sparse, fuzzy, silver-green foliage, other plants had large leaves (10 cm), with a waxy appearance. This variance does not seem to be phenological, but reflective of the substrate in which the plant grows. The plants were heavy with fruit, though not as prolific as last year, ranging in color from light orange or red to purple or black.

Sicyos pachycarpos. This species was observed in a small patch on the northeast face of Miller's Peak where it is commonly present, and at the top and throughout Devil's Slide. Plants were observed with flowers and seedpods.

Portulaca lutea and Portulaca villosa. Both *Portulaca* species were common in steep rocky areas and were especially common on Dog's Head. *P. lutea* was observed with flowers, but no flowers or seed were observed on *P. villosa*.

NON-NATIVE PLANTS

***Portulaca oleracea*.** This species was commonly observed in less rocky areas with substantial amounts of soil. The species was observed along the trail from the landing to camp.

Sandbur (*Cenchrus echinatus*). This species was recorded on Nihoa in 1961, 26 August 1968, May 1969, and a single plant was pulled on the slope above the camp area in 1981. It was not seen again until September 2011 when six small patches were observed in two distinct areas. The first area (Cluster 1) was located in Miller's Valley and consisted of four plants, and the second area (Cluster 2) was observed in the lower part of Middle Valley and consisted of two plants. Though the plants were almost completely yellow and dry, the remaining plant matter and the fallen seeds were collected and removed. Areas with the highest concentration of fallen seeds were covered with black plastic trash bags.

In 2012 four *Cenchrus* plants were observed and pulled from two areas (one known from 2011 and one new). Two plants were completely dry and two had some green growth at the base of the plants; one of these had three green seeds. Of the four plants observed, just one was outside of the two areas where *Cenchrus* had been documented in 2011; this single individual was found and pulled by D. Tsukayama on the western ridge above Miller's Valley, constituting a third distinct area where *Cenchrus* has been found recently. The other three plants were found within Cluster 1, very near to where plants had been observed in 2011. No additional *Cenchrus* plants were observed in the area around Cluster 2.

The 2013 trip proved to be very encouraging for the eradication of *Cenchrus* from Nihoa. Recent locations of *Cenchrus* were re-visited, but no evidence of any recruitment, plants, or plant material was

found at those locations. Expanded surveys of 50-m concentric circles were conducted around each recent species' point, and no plants were observed. The previous control work from 2011 seemed to have been very effective, both in the plant and seed removal to the laying down of the ground cover. The ground cover (heavy duty contractor bags) at an older cluster was shredded and deteriorated. This cover was bagged for disposal and a new type of ground-cloth laid down (Figure 12).

During the field stay, one plant was detected during opportunistic surveying (Table 6). It was not within the 50-m buffer radius of any of the recent clusters. It, however, was located down slope from Cluster 2 and was about 100 meters above our campsite. The characteristic corkscrew made this plant stand out from the rest (Figure 14). The plant, which still had a little bit of green in it was located directly outside the entrance of a shearwater burrow, was removed. The area was very rocky with very little soil, but a ground cloth was laid down to prevent future recruitment in the immediate vicinity of this pulled plant. A good amount of time was spent picking up seed casings, many of which were cracked open and devoid of seeds. One feather was observed with a seed attached (Figure 13).

Identifying this weed once it has senesced is extremely difficult, since it can be mistaken for the native *Panicum torridum*, which was also in senescence and entirely composed of dry leaf matter. The plant that was discovered and pulled provided a great example of the corkscrew stalk and was displayed as a visual aid back at the base camp (Figure 14). Armed with this visual key, recent points were resurveyed to ensure that we were not missing plants. This validated our initial null surveys. The characteristic corkscrew stalk made distinguishing the *Cenchrus* possible, however, future efforts to search for *Cenchrus* on Nihoa should coincide with Spring when *Cenchrus* is vegetative, but before it has seeded.

Excluding opportunistic searching during passerine surveys, approximately 6 hours were spent in efforts to eradicate *Cenchrus* from Nihoa. The majority of this time was spent on surveying.

To reiterate previous trip reports, "The presence of *Cenchrus echinatus* on Nihoa Island should be a 'red flag' in the management plan of the Monument. Considering the history of *Cenchrus* in the archipelago, the relatively pristine nature of Nihoa, and the now limited occurrence of this weed, *immediate and aggressive measures should be taken to eradicate this species from the island.*"

Table 6. Localities where *Cenchrus* has been found on Nihoa Island. See VanderWerf *et al.* 2011 and Marshall *et al.* 2012 for more details.

Number	Year Found	North_Lat.	West_Long.	Comments
1	2011 & 2012	23.061253	161.924272	Area covered with weed cloth, no plants in 2013
2	2011	23.060213	161.922736	No *Cenchrus* obs. in 2012, 2013
3	2011 & 2012	23.061154	161.924321	Area covered with weed cloth
4	2011	23.060872	161.924461	No *Cenchrus* obs. in 2012, 2013
5	2011	23.061153	161.92432	No *Cenchrus* obs. in 2012, 2013
6	2011	23.06021	161.922386	No *Cenchrus* obs. in 2012, 2013
7	2011 & 2012	23.060907	161.924258	Area covered with weed cloth
8	2012	23.06097	161.92461	New point within Cluster 1. Covered with weed cloth. No plants in 2013

9	2012	23.06017	161.92522	New point = Cluster 3, no plants 2013
10	2013	23.05992	161.92317	New point, 1 seeded plant removed and area covered in weed cloth in 2013.

Figure 12. Replacement of weed cloth (Photo: J. Fisher).

Figure 13. *Cenchrus* seed pod attached to seabird feather (Photo: J. Fisher).

Figure 14. Visual key of *Cenchrus* culm compared to the common bunchgrass *Eragrastis variabilis*. Notice the corkscrew shaped culm visible once seeds are gone (Photo: J. Fisher)

New Zealand spinach (*Tetragonia tetragonioides*). This alien species was detected in a small section of Devil's Slide, where it has been observed for several years. Plants had flowers but no seeds. On 27 September, Fisher removed five plants and hung them to dry out. The next day, Plentovich removed one additional plant for a total of six plants removed. The entirety of Devil's Slide's walkable area was surveyed, and it is believed all plants were removed. This represents a dramatic decrease in numbers from prior visits. In lieu of the density of endemic species in the small area of Devil's Slide and the invasive nature of this species, continued monitoring and removal of this alien plant should remain a priority for future trips to Nihoa.

RECOMMENDATIONS

- Develop a simple, standardized method for indexing abundance of seabirds, by species.
- Obtain and use staging protocols for seabird chicks from Beth Flint. These staging protocols vary among taxa.
- If a seabird mortality event is suspected, collect carcasses for necropsy by Thierry Work.
- Contact David Hyrenbach at Hawaii Pacific University and discuss utility of collecting carcasses or samples for plastics analysis.
- Inspect the distribution and relative abundance of Millerbirds and Finches with respect to vegetation data collected at each VCP point and assess whether patterns exist that warrant adjustment or refinement of vegetation data protocol. Alternatively, review vegetation data protocol to yield the most useful information for monitoring the status of the island's vegetation.
- Continue monitoring invasive ants at likely introduction points (camp and the beach) to ensure new introductions are detected as early as possible.
- Develop a clearer, more useful way to refer to and describe locations where *Cenchrus* has been controlled or is actively invading.

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Appendix I. Point count locations and mean detections of Nihoa Finches (NIFI) and Nihoa Millerbirds (NIMI).

Station	Latitude (North)	Longitude (West)	Num. of Surveys	mean NIFI detected	mean NIMI detected
A-01	23.059884	-161.922977	3	3.00	0.67
A-02	23.060235	-161.923772	3	4.00	0.67
A-03	23.060727	-161.924819	3	4.67	2.67
A-04	23.059829	-161.924798	3	2.00	1.33
A-05	23.059271	-161.923621	3	2.33	2.00
A-06	23.058761	-161.924362	3	2.00	0.00
A-07	23.059066	-161.925183	3	1.33	0.67
A-08	23.059529	-161.925925	3	4.67	1.00
A-09	23.059880	-161.926745	3	3.00	1.00
A-10	23.058669	-161.926917	3	2.67	2.00
A-11	23.057950	-161.926178	3	4.00	2.00
A-12	23.057064	-161.925675	2	1.50	0.00
B-13	23.061023	-161.923989	3	4.67	1.67
B-14	23.061771	-161.924439	3	2.33	1.67
B-15	23.062653	-161.924333	3	3.67	1.33
B-16	23.063130	-161.925479	3	4.67	1.33
B-17	23.062399	-161.925122	3	2.33	2.00
B-18	23.061994	-161.926026	3	2.33	3.33
B-19	23.061278	-161.925431	3	3.00	3.00
B-20	23.060503	-161.925908	3	2.67	1.00
B-21	23.061512	-161.926916	3	3.33	2.00
B-22	23.062359	-161.926797	3	2.00	0.67
B-23	23.063234	-161.927326	2	2.50	2.50
B-24	23.063631	-161.926709	3	4.33	1.33
C-25	23.061965	-161.923537	3	3.33	2.33
C-26	23.061187	-161.922993	4	3.50	2.75
C-27	23.060555	-161.922512	3	5.33	1.33
C-28	23.059791	-161.922007	3	3.00	0.67
C-29	23.059152	-161.921554	3	4.00	2.33
C-30	23.058369	-161.921254	3	2.67	1.67
C-31	23.058410	-161.920577	3	1.33	0.33
C-32	23.059116	-161.920275	3	1.67	1.33
C-33	23.059832	-161.920860	3	1.33	0.33
C-34	23.060782	-161.921611	3	1.33	0.33
C-35	23.061587	-161.921451	3	4.33	1.00
Station	**Latitude (North)**	**Longitude (West)**	**Num. of Surveys**	**mean NIFI detected**	**mean NIMI detected**

C-36	23.061887	-161.922400	3	4.00	3.33
D-37	23.061549	-161.920541	3	3.67	0.33
D-38	23.060676	-161.920787	3	1.00	1.00
D-39	23.060563	-161.919795	3	2.33	1.00
D-40	23.061367	-161.919478	3	3.00	1.33
D-41	23.060606	-161.918919	4	3.75	3.00
D-42	23.059947	-161.919693	4	4.00	2.25
D-43	23.061783	-161.918514	3	3.00	2.00
D-44	23.061006	-161.917886	3	3.67	2.33
D-45	23.060559	-161.917011	3	5.00	1.67
D-46	23.061502	-161.916997	3	5.00	0.67
D-47	23.061164	-161.916070	3	3.33	1.00
D-48	23.061731	-161.915600	4	2.67	1.00
E-49	23.059238	-161.919034	3	6.00	0.33
E-50	23.058311	-161.918764	3	2.00	1.00
E-51	23.059039	-161.917999	3	1.67	1.00
E-52	23.059983	-161.918321	3	2.33	0.00
E-53	23.059796	-161.917340	2	2.00	1.00
E-54	23.060379	-161.916116	3	5.00	1.67
E-55	23.060428	-161.915255	3	3.67	1.00
E-56	23.059548	-161.915095	3	2.67	1.33
E-57	23.059566	-161.915977	3	3.00	3.33
E-58	23.059052	-161.916847	4	4.33	4.67
E-59	23.058606	-161.917440	3	4.00	1.33
E-60	23.057693	-161.918071	3	2.00	0.67