NIHOA ISLAND TRIP REPORT, 2-16 SEPTEMBER 2011

To: U.S. Fish and Wildlife Service, Hawaiian Islands National Wildlife Refuge, Honolulu, Hawaii.

From: Eric VanderWerf, Daniel Tsukayama, Fred Amidon, and Walterbea Aldeguer.

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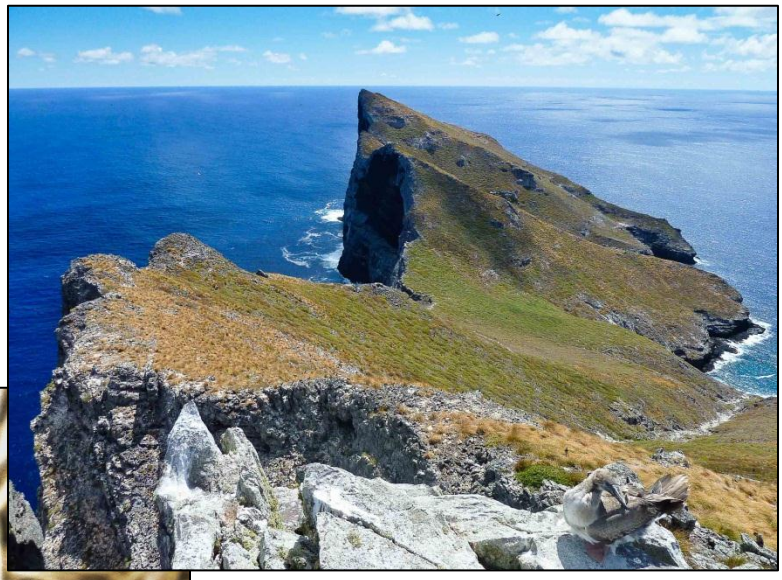
Note: This report does not include activities associated with the translocation of Millerbirds (*Acrocephalus familiaris*) from Nihoa to Laysan, which will be covered in a separate report. This report focuses on biological monitoring and management activities conducted after the M/V Searcher departed Nihoa on 7 September.



Upper right: Nihoa from Miller's Peak.
Left: Millerbird eating Nihoa trap-door spider.
Lower right: alien *Cenchrus echinatus* discovered in Sept. 2011.
Photos by Eric VanderWerf.

Executive Summary:

Thirty-two Nihoa Millerbirds (*Acrocephalus familiaris*) were captured in mist nets, banded, and temporarily housed on Nihoa from 4-7 September. Twenty-four of them were safely transferred to the M/V Searcher on 7 September for translocation to Laysan. The rest were released at their point of capture on Nihoa. Details of the translocation are provided elsewhere. Surveys were conducted for the Nihoa Millerbird and the Nihoa Finch (*Telespiza ultima*) in September 2011 using two methods. The traditional strip-transect method resulted in population estimates of 775±298 Millerbirds and 2907±827 Nihoa Finches. Although the confidence intervals were large, the estimated number of Millerbirds was >50% higher than in 2010 and was the second highest estimate since surveys began in 1967. The estimate of Nihoa Finches has been stable over the past three years. Population estimates from the recently developed variable circular plot method must await data analyses by the U.S. Geological Survey Biological Resources Division. A total of 52 resights were obtained of 34 individual color-banded Millerbirds in September 2011, including five birds that were banded in August 2007, making them at least four years old. Fourteen seabird species were observed on Nihoa in September 2011, of which 13 were actively nesting. Five species of migratory shorebird and one species of migratory waterfowl were observed, including the first records from Nihoa of Semipalmated Plover (*Charadrius semipalmatus*) and Spotted Sandpiper (*Actitis maculata*). Single individuals of four non-native birds species were observed: Cattle Egret (*Bubulcus ibis*), a dead racing pigeon (*Columba livia*), the first record from Nihoa of a Mourning Dove (*Zenaida macroura*), and the second record from Nihoa of a Northern Mockingbird (*Mimus polyglottos*). Native plant populations appeared to be healthy, though apparent damage from the non-native grasshopper *Schistocerca nitens* was evident, particularly on ʻohai (*Sesbania tomentosa*). About 60 plants of the non-native New Zealand spinach (*Tetragonia tetragonioides*) were removed from Devil's Slide. Seven small patches of the alien sandbur plant (*Cenchrus echinatus*) were discovered in Miller's Valley and Middle Valley. All but one patch was removed and disposed of off-island, along with most of the soil and seeds beneath them, but additional seeds undoubtedly remain. This plant is highly invasive on other islands and could seriously damage the habitat on Nihoa. It is imperative that aggressive management of this alien continue in 2012.

Itinerary:

2 September. M/V Searcher departs Honolulu with all personnel aboard (see personnel list below).

3 September. Voyage to Nihoa, arriving at 17:30 hrs. Anchored in lee on southwest side of Nihoa. All personnel remained on the Searcher for the night.

4-6 September. All personnel disembarked the Searcher to assist with capture and care of Nihoa Millerbirds in preparation for translocation to Laysan. Tsukayama, Aldeguer, Luscomb, Kohley, and Farmer camped on the island at night, but all other personnel returned to the Searcher each evening. See Millerbird Translocation Report for details.

7 September: Searcher departed Nihoa at 11:30 hrs with 24 Nihoa Millerbirds, accompanied by Farmer, Freifeld, Kohley, Luscomb, Rounds, Rutt, Wallace, and Work. Amidon, Aldeguer, Tsukayama, and

VanderWerf remained on Nihoa to conduct biological monitoring and management and await the return of the Searcher.

8-14 September. VanderWerf, Tsukayama, and Amidon conduct biological monitoring and management, including surveys for Nihoa Millerbirds and Nihoa Finches, observations on abundance and nesting phenology of seabirds, numbers of migratory birds, status of native and alien plants, and removal of alien plants.

14 September. Searcher arrives at Nihoa at 18:00 hrs, and Amidon, Aldeguer, Tsukayama, and VanderWerf embark, removing all camp materials and refuse from the island.

16 September. Arrive in Honolulu 04:00 hrs, all personnel disembark the Searcher at 07:30.

Personnel:

- Walterbea Aldeguer: Office of Hawaiian Affairs/Papahānaumokuākea Marine National Monument cultural monitor (USFWS volunteer)
- Fred Amidon: USFWS biologist
- Chris Farmer: American Bird Conservancy biologist
- Holly Freifeld: USFWS biologist
- Robby Kohley: American Bird Conservancy contractor
- Peter Luscomb: Pacific Rim Conservation avicultural specialist contractor
- Rachel Rounds: USFWS biologist
- Cameron Rutt: American Bird Conservancy contractor
- Daniel Tsukayama: American Bird Conservancy contractor
- Eric VanderWerf: Pacific Rim Conservation contractor
- George Wallace: American Bird Conservancy biologist
- Thierry Work: USGS veterinarian

Objectives:

- Capture, band, and temporarily house and care for up to 32 Millerbirds as candidates for translocation to Laysan.
- Identify 12 male and 12 female Millerbirds that are best candidates for translocation, and safely transport them to the Searcher.
- Conduct Nihoa Millerbird and Nihoa Finch population survey using traditional transect methods.
- Conduct Nihoa Millerbird and Nihoa Finch population survey using new point count methods developed by USGS.
- Resight previously banded Millerbirds to collect data for demographic analyses.
- Observe and record abundance and nesting phenology of seabird populations.
- Observe and record abundance of migratory shorebirds.
- Observe and record phenology and abundance of native and invasive flora.
- Observe and record abundance of native and invasive terrestrial arthropods.
- Opportunistic beach counts of Hawaiian monk seals.
- Remove all individuals of the invasive plant *Tetragonia tetragonioides*.

NIHOA MILLERBIRD AND NIHOA FINCH POPULATION SURVEYS

Methods. Two survey methods were used to estimate abundance of the Nihoa Millerbird (*Acrocephalus familiaris*) and Nihoa Finch (*Telespiza ultima*). The first method used the traditional fixed-width strip transects measuring 16.5 x 250 feet (5 x 76.2 meters) that were developed by Eddinger in 1967 and have been used for many years (Conant et al. 1981). In this method, an observer walked at a slow and steady pace along each transect while counting Nihoa Millerbirds and Nihoa Finches within 8.25 feet (2.5 meters, 0.5 rods) on either side. Transects were located using GPS points recorded in the field in 2008 by Tsukayama, which were based on an aerial photograph on which the transects had been hand drawn (Figure 1). Previously 54 transects have been surveyed, but GPS points for some transects were off the island and could not be used. Some replacement points were created in 2010, and a new transect (D) was established in 2011 in the upper section of East Valley to improve coverage in that part of the island and increase sample size (Appendix 1).

The second method was a variable circular plot (VCP) developed by USGS to improve population estimates and reduce variability (Camp et al. in review). In this method, an observer stood at a survey point for 6 minutes and recorded the horizontal distance to all millerbirds and finches detected by sight or sound. Survey points were located at the beginning and end of each transect (Figure 1). A digital range finder was used to measure the distance to each bird to increase accuracy. During each count the cloud cover, rain, wind, wind gust, and dominant plants species were also recorded.

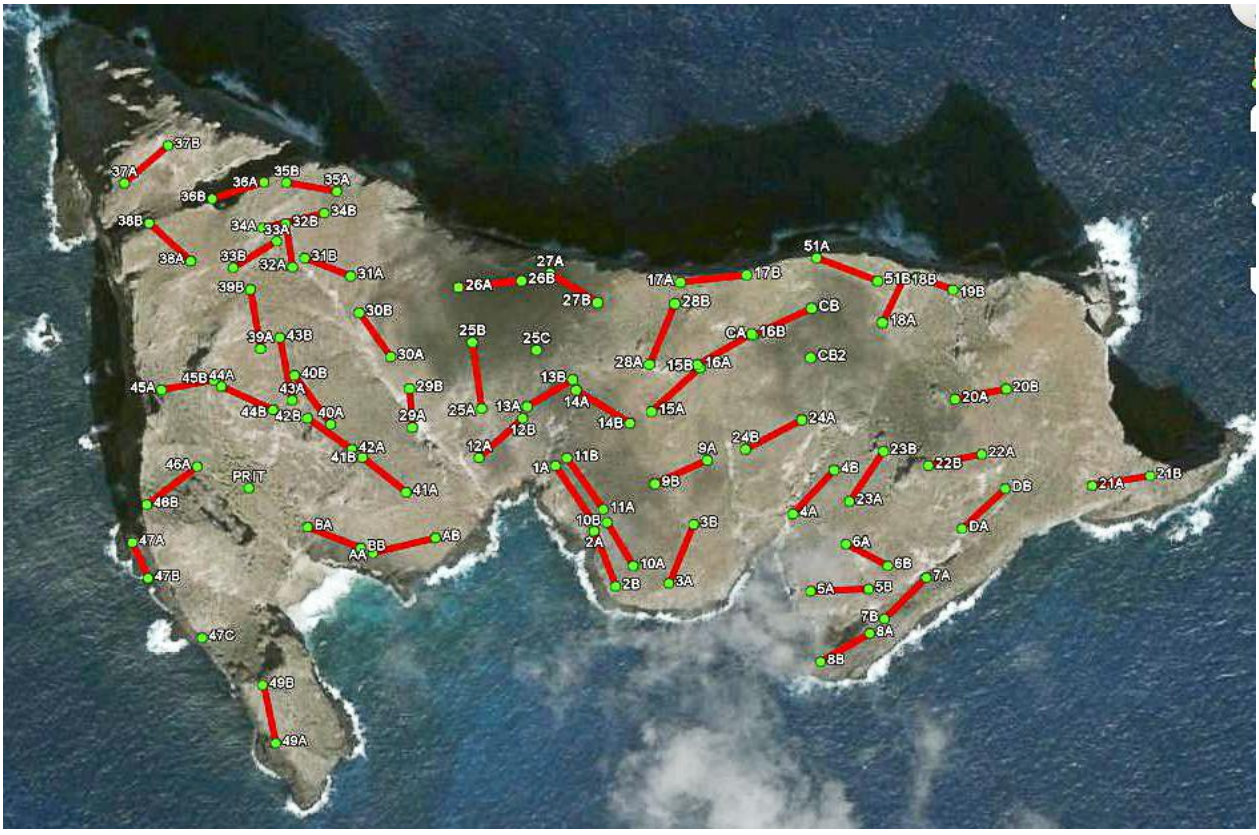


Figure 1. Locations of transects and points used in population surveys of Nihoa Millerbirds and Nihoa Finches in September 2011.

Results. A total of 51 strip transect surveys were conducted from 8-12 September 2011, during which 24 millerbirds and 90 finches were detected (Table 1). Transects 15 and 16 were skipped by accident, but one transect was added (TDXTRA), resulting in one less transect than in 2010. Based on the area surveyed within the 51 strip transects (250 ft x 16.5 ft x 51 = 210,375 sq. ft.) and the total vegetated area of Nihoa in which passerine birds can be expected to occur (6,795,360 sq. ft.), the estimated population of Nihoa Millerbirds was 775±298 birds and the estimated population of Nihoa Finches was 2907±827 birds. The confidence intervals were large and the results should be interpreted with caution, but the estimated number of Nihoa Millerbirds was >50% higher than in 2010 and was the second highest estimate since surveys began in 1967 (Figure 2). Only in 2007 was the Millerbird population estimate higher. The estimated number of Nihoa Finches was roughly four times higher than the number of Millerbirds, and has been stable over the past three years (Figure 3).

Point counts were conducted twice at all but a few stations. All stations were surveyed once from 8-10 September in conjunction with the strip transects, and most stations were surveyed again from 11-13 September. Estimates of population density and size based on the VCP survey must await data analyses by the USGS-BRD.

Table 1. Results of September 2011 Nihoa Passerine bird survey.

Date	Total Time (min)	Transect #	# of finches	finches/ ft^2	# of Miller-birds	Millerbirds/ ft^2	Observer[1]	# grasshoppers[2]
08-Sep-11	0:07	1	6	0.001455	0	0	DHT	0 Grasshoppers
08-Sep-11	0:08	2	8	0.001939	0	0	DHT	1 Grasshopper
08-Sep-11	0:05	3	1	0.000242	0	0	DHT	1 Grasshopper
10-Sep-11	0:06	4	6	0.001455	1	0.000242	DHT	1 Grasshopper
10-Sep-11	0:07	5	1	0.000242	0	0	EAV	1 Grasshopper
10-Sep-11	0:04	6	0	0	2	0.000485	EAV	0 Grasshoppers
10-Sep-11	0:06	7	1	0.000242	0	0	EAV	0 Grasshoppers
10-Sep-11	0:05	8	1	0.000242	0	0	EAV	0 Grasshoppers
12-Sep-11	0:05	9	1	0.000242	0	0	FAA	0 Grasshoppers
08-Sep-11	0:05	10	3	0.000727	0	0	DHT	1 Grasshopper
08-Sep-11	0:06	11	1	0.000242	1	0.000242	DHT	1 Grasshopper
09-Sep-11	0:05	12	3	0.000727	0	0	DHT	0 Grasshoppers
09-Sep-11	0:06	13	1	0.000242	1	0.000242	DHT	0 Grasshopper
09-Sep-11	0:06	14	3	0.000727	1	0.000242	DHT	2 Grasshoppers
		15						skipped by accident
		16						skipped by accident
09-Sep-11	0:09	17	2	0.000485	1	0.000242	DHT	5 Grasshoppers
10-Sep-11	0:08	18	3	0.000727	1	0.000242	FAA	1 Grasshopper
10-Sep-11	0:05	19	0	0	0	0	FAA	0 Grasshoppers
10-Sep-11	0:06	20	2	0.000485	0	0	DHT	2 Grasshoppers
10-Sep-11	0:08	21	0	0	0	0	EAV	1 Grasshopper
10-Sep-11	0:05	22	3	0.000727	1	0.000242	DHT	2 Grasshoppers
10-Sep-11	0:05	23	1	0.000242	0	0	DHT	1 Grasshopper
10-Sep-11	0:05	24	1	0.000242	0	0	DHT	3 Grasshoppers
10-Sep-11	0:09	25	4	0.00097	2	0.000485	FAA	0 Grasshoppers
09-Sep-11	0:04	26	2	0.000485	0	0	DHT	0 Grasshoppers
09-Sep-11	0:08	27	2	0.000485	1	0.000242	DHT	5 Grasshoppers.
11-Sep-11	0:08	28	1	0.000242	1	0.000242	EAV	0 Grasshoppers
08-Sep-11	0:08	29	5	0.001212	0	0	FAA	0 Grasshoppers
08-Sep-11	0:07	30	2	0.000485	1	0.000242	FAA	0 Grasshoppers
08-Sep-11	0:07	31	1	0.000242	0	0	FAA	0 Grasshoppers
08-Sep-11	0:08	32	1	0.000242	0	0	FAA	0 Grasshoppers
09-Sep-11	0:06	33	1	0.000242	0	0	FAA	0 Grasshoppers
09-Sep-11	0:07	34	0	0	0	0	FAA	0 Grasshoppers
09-Sep-11	0:06	35	1	0.000242	0	0	FAA	0 Grasshoppers
09-Sep-11	0:04	36	0	0	0	0	FAA	0 Grasshoppers
09-Sep-11	0:06	37	1	0.000242	0	0	EAV	3 Grasshoppers
09-Sep-11	0:06	38	1	0.000242	0	0	EAV	1 Grasshopper
09-Sep-11	0:08	39	0	0	1	0.000242	FAA	1 Grasshopper
09-Sep-11	0:11	40	3	0.000727	2	0.000485	FAA	0 Grasshoppers
09-Sep-11	0:06	41	0	0	0	0	EAV	0 Grasshoppers
09-Sep-11	0:05	42	0	0	0	0	EAV	0 Grasshoppers
09-Sep-11	0:06	43	1	0.000242	2	0.000485	FAA	0 Grasshoppers
09-Sep-11	0:08	44	3	0.000727	1	0.000242	EAV	1 Grasshopper
09-Sep-11	0:09	45	1	0.000242	0	0	EAV	0 Grasshoppers
08-Sep-11	0:10	46	1	0.000242	0	0	EAV	0 Grasshoppers
08-Sep-11	0:06	47	0	0	0	0	EAV	1 Grasshopper
		48						not done-GPS points in ocean
08-Sep-11	0:08	49	3	0.000727	1	0.000242	EAV	0 Grasshoppers
		50						not done-GPS points in ocean
10-Sep-11	0:07	51	0	0	0	0	FAA	0 Grasshoppers
08-Sep-11	0:06	A	0	0	1	0.000242	EAV	0 Grasshoppers
08-Sep-11	0:13	B	5	0.001212	0	0	EAV	0 Grasshoppers
11-Sep-11	0:05	C	1	0.000242	1	0.000242	EAV	0 Grasshoppers
10-Sep-11	0:10	D	2	0.000485	1	0.000242	EAV	0 Grasshoppers. New transect
Total			**90**		**24**			**35 Grasshoppers**

[1]Observers: FAA = Fred Amidon, DHT = Daniel Tsukayama, EAV = Eric VanderWerf

[2] Alien *Schistocerca nitens*, see later for details.

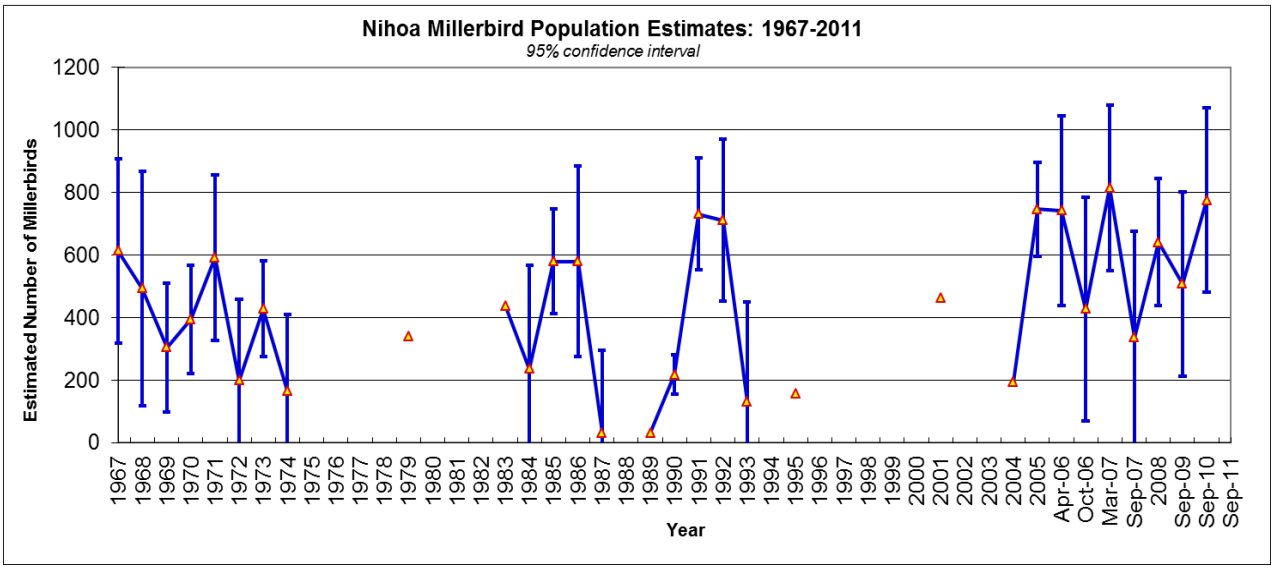


Figure 2. Nihoa Millerbird population estimates based on strip transect surveys from 1967 to 2011. Note that scale of the y-axis differs from that in Figure 2 for Nihoa Finch population estimates.

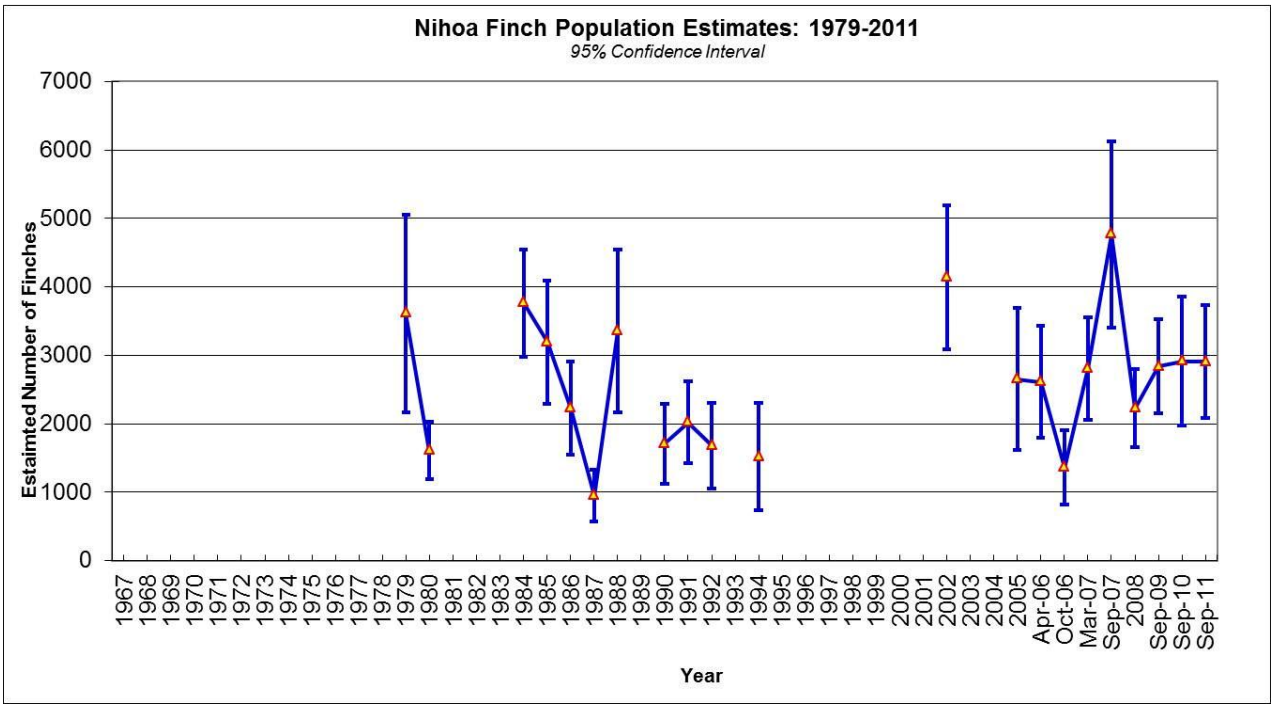


Figure 3. Nihoa Finch population estimates based on strip transect surveys from 1979 to 2011. Note that scale of the y-axis differs from that in Figure 2 for Nihoa Millerbird population estimates.

NIHOA MILLERBIRD RESIGHTING

In addition to mist-netting and banding Millerbirds in September 2011, an effort was made to resight previously banded Millerbirds. This information can be used for several purposes: 1) to help assess the status of individual birds that were captured in 2011 but not selected for translocation to Laysan; 2) to help assess the status of birds used in captive feeding trials in 2009 and 2010 and then released; 3) to measure site fidelity by comparing the location of resights of the same individuals in previous years; and 4) for use in mark-recapture analyses that can be used to estimate annual survival and possibly population size; and 5) to measure longevity. In addition to being alert for color-banded Millerbirds during the population surveys, time was spent after the surveys specifically searching for banded birds, sometimes using playbacks to help locate birds and made them easier to observe. More time was spent searching on the Middle Plateau and in Miller's Valley because more birds have been banded in those areas, but resighting efforts were also conducted in East Palm Valley, West Palm Valley, East Valley, and Miller's Plateau.

A total of 52 resights were obtained of 34 individual color-banded Millerbirds in September 2011 (Table 2). Most resights were on the Middle Plateau, Miller's Valley, and the adjacent slopes, but four banded birds were resighted on Miller's Plateau and two in East Palm Valley. Five of the birds resighted were banded in August 2007 by M. MacDonald, making them at least four years old. One of the birds from 2007 was missing a band and it was not possible to identify which individual it was, but it was located on Miller's Plateau, which may help to identify it. In two other birds from 2007, the bands were so faded that one of the colors appeared white, which resulted in erroneous band combinations that were not used, but in both cases the band must have been either Pink or Light Blue based on the combinations that were used.

Of the eight birds captured in 2011 but not selected for translocation to Laysan, five were subsequently resighted after release. On future visits additional effort should be made to relocate the remaining three birds, whose color combinations were BKSOR, RYOS, and GBGS.

Table 2. Results of Millerbird resighting efforts on Nihoa in September 2011.

Date	Time	Observer[1]	color combo[2]	North_Lat.	West_Long.	Date banded	Comments
09/13/11	1705	EAV	BBKGS	23 03.574	161 55.406	10-Sep-09	Gully above camp
09/12/11	1737	EAV	BBKOS	23 03.712	161 55.424	30-Sep-10	Miller's Valley
09/12/11	1654	EAV	BBOS	23 03.665	161 55.453	30-Sep-10	Miller's Valley
09/09/11	715	EAV	BKBGS			10-Sep-09	Gully above camp
09/11/11	1635	EAV	BKBGS	23 03.570	161 55.405	10-Sep-09	Slope west of camp
09/12/11	1645	FAA	BKBGS	23 03.571	161 55.397	10-Sep-09	Camp Area
09/11/11	1650	EAV	BKGGS	23 03.615	161 55.414	22-Sep-10	Gully above camp
09/12/11	658	EAV	BKGGS	23 03.603	161 55.396	22-Sep-10	Gully above camp
09/12/11	1350	EAV	BKGGS	23 03.618	161 55.410	22-Sep-10	Gully above camp
09/13/11	1720	EAV	BKGGS	23 03.621	161 55.407	22-Sep-10	Gully above camp
09/12/11	1700	FAA	BKOGS	23 03.577	161 55.415	9-Sep-09	Camp Area
09/11/11	1757	EAV	BKSBKR	23 03.655	161 55.399	5-Sep-11	Miller's Valley
09/08/11	1724	FAA	BKSBKR	23 03.632	161 55.405	5-Sep-11	Miller's Valley
09/13/11	1737	EAV	BKSBKR	23 03.648	161 55.346	5-Sep-11	Miller's Valley
09/12/11	1753	EAV	BKSBKY	23 03.678	161 55.403	5-Sep-11	Miller's Valley
09/09/11	739	EAV	BKWGS			30-Sep-10	At T41A
9/11/2011	802	DHT	BKWGS	23 03.564	161 55.434	30-Sep-10	West flank of valley above camp
09/11/11	1210	EAV	BSOG	23 03.712	161 55.388	5-Sep-11	Middle Plateau
09/12/11	750	EAV	BSOG	23 03.711	161 55.388	5-Sep-11	Middle Plateau
09/12/11	1720	EAV	BSOG	23 03.686	161 55.465	5-Sep-11	Miller's Valley
9/9/2011	959	DHT	BSOG	23 03.713	161 55.388	5-Sep-11	Saddle area, near cliff
09/14/11	755	EAV	GGOS	23 03.615	161 55.483	28-Sep-10	Slope west of Miller's Valley
9/12/2011	9:00	DHT	GGOS	23 63.612	161 55.486	28-Sep-10	West flank of valley above camp
09/14/11	816	FAA	GGOS	23 03.617	161 55.469	28-Sep-10	Miller's Valley
9/11/2011	11:22	DHT	GOGS	23 03.630	161 55.432	13-Sep-09	Base of Middle Valley
9/12/2011	7:49	DHT	GOGS			13-Sep-09	Didn't get lat/long. Base of Middle Valley, near camp
09/08/11	1640	FAA	GRGS	23 03.630	161 55.444	13-Sep-09	Miller's Valley
09/14/11	825	EAV	GROS	23 03.631	161 55.500	28-Sep-10	Miller's Valley
09/11/11	1244	EAV	GSBR	23 03.627	161 55.403	16-Sep-09	Gully above camp
09/11/11	1801	EAV	GSBR	23 03.649	161 55.400	16-Sep-09	Gully above camp
09/14/11	745	FAA	GWOS	23 0.3590	161 55.455	30-Sep-10	Miller's Valley

09/13/11	1800	EAV	LBYYS	23 03.674	161 55.352	21-Aug-07	Middle Plateau
09/11/11	1703	EAV	RBOS	23 03.640	161 55.369	22-Sep-10	Middle Plateau
09/12/11	1724	FAA	RWGS	23 03.538	161 55.431	12-Sep-09	West of Camp
09/09/11	1110	EAV	RYBS	23 03.787	161 55.655	1-Aug-07	Miller's Plateau, bands faded
09/12/11	1104	EAV	RYBS	23 03.790	161 55.655	1-Aug-07	Miller's Plateau
9/11/2011	842	DHT	W(?)Y(?)BKS	23 03.621	161 55.509		Didn't note order of W & Y. West flank of valley above camp
09/12/11	725	EAV	WBBKS	23 03.644	161 55.378	17-Sep-09	Middle Plateau
09/13/11	1230	EAV	WBBKS	23 03.617	161 55.367	17-Sep-09	Middle Plateau
09/13/11	1750	EAV	WBKBKS	23 03.671	161 55.355	17-Sep-09	Middle Plateau
09/11/11	1130	FAA	WGOS	23 03.536	161 55.437	29-Sep-10	East of West Palm Valley
09/09/11	1140	EAV	WLBS	23 03.821	161 55.638	2007	Miller's Plateau. Missing 1 band on left leg, can't id bird, but all with LBS on right were banded in Jul or Aug 2007
09/13/11	1145	EAV	WOGS	23 03.602	161 55.228	14-Sep-09	Ridge between Middle Valley and East Palm Valley
09/13/11	937	EAV	WRLBS	23 03.595	161 55.132	Aug-07	East Palm Valley. WRLBS doesn't exist, W must be P or LB, both banded Aug 2007
09/13/11	945	EAV	WRYS	23 03.595	161 55.132	Aug-07	East Palm Valley. WRYS doesn't exist, W must be P or LB, both banded Aug 2007
09/11/11	1727	EAV	WWGS	23 03.650	161 55.363	22-Sep-10	Middle Plateau
09/13/11	1810	EAV	WWGS	23 03.666	161 55.359	16-Sep-09	Middle Plateau
09/14/11	807	EAV	WYBKS	23 03.632	161 55.490	17-Sep-09	Slope west of Miller's Valley
09/12/11	1159	EAV	YOGS	23 03.800	161 55.675	12-Sep-09	Miller's Plateau
09/11/11	1750	EAV	YOWS	23 03.659	161 55.413	4-Sep-11	Miller's Valley
09/12/11	1730	EAV	YRGS	23 03.701	161 55.456	15-Sep-09	Miller's Valley
09/12/11	1142	EAV	YWGS	23 03.804	161 55.664	12-Sep-09	Miller's Plateau

[1] Observer: FAA = Fred Amidon, DHT = Daniel Tsukayama, EAV = Eric VanderWerf.

[2] Color combination read in following order: left upper, left lower, right upper, right lower.

SEABIRDS

Wedge-tailed Shearwater (*Puffinus pacificus*). Wedgies were common over most of the island, and were especially numerous in the *Eragrostis* tussocks on the southern faces of the summits and under the *Pritchardia* canopy in West Palm and East Palm Valleys, where there was extensive soil for burrowing. Most nests were in burrows, but some nests were also observed in rocky caves and crevices. Nests were at a generally earlier stage than other seabirds, with most nests containing a small to medium-sized downy chick.

Christmas Shearwater (*Puffinus nativitatus*). This all-dark shearwater was common on the slopes and valleys, among the *Eragrostis* tussocks on the southern faces of the summits, and under the *Pritchardia* canopy in West Palm and East Palm Valleys, where there was extensive soil for burrowing. Nests contained chicks that ranged from half-downy to fully-feathered with just wisps of down remaining of the head. Some adults were present on the island all day, but many more returned at dusk. In the early morning pairs of adults were sometimes observed flying low over the island and calling.

Bulwer's Petrel (*Bulweria bulwerii*). This small petrel was abundant in rocky crevices and caves over much of the island. Nests contained chicks that ranged from half-downy to fully-feathered. Some adults were present on the island during the day, but many more were observed returning to the island at dusk, presumably to feed their chicks.

Red-footed Booby (*Sula sula*). This species was common and widely distributed over much of the island, with concentrations of roosting birds and nests on the valley slopes and bottoms where the vegetation was tallest. Most nests were placed in dense *Solanum* thickets. Many adults and fledglings roosted on tall *Sesbania* stems and *Pritchardia*, but few nests were observed on those plants. Nest contents ranged from an egg (a single nest) to small downy chicks (a few), and large fully-feathered chicks. Many flighted, independent juveniles were also seen. The total number of active nests was estimated to be at least several hundred. Almost all adults observed were of the white phase; only two brown phase adults were seen, which were golden brown on the head , body, and wings, with a white tail and lower back.

Brown Booby (*Sula leucogaster*). Brown Boobies were most numerous on the steep slopes and cliffs on the southern face of Miller's Peak and along the rocky ridges on the eastern and western ends of the island. About 30 active nests were observed, but many more volant juveniles were seen flying over many parts of the island, indicating the peak in nesting for this species had passed. One nest was observed with a small naked chick on the eastern end of the island, and several large downy chicks were present on the southern side of Miller's Peak. A male Brown Booby with a metal band on the right leg was observed on Miller's Peak by VanderWerf on 12 September, but only a few digits of the band number were

Figure 4. Brown Booby family, Nihoa. Note band on right leg of male (circled in red). Photo. E. VanderWerf.

visible (Figure 4) and it was not possible to identify the bird. A single Brewster's Brown Booby (*S. l. brewsteri*) was observed flying south of Miller's Peak by VanderWerf on 12 September. This form was once considered a separate species, but is now regarded as a subspecies. It nests on islands in the eastern Pacific off Mexico south to the Galapagos and is a rare visitor to the Hawaiian Islands, with about 20 previous records (VanderWerf et al. 2008). A Brewster's Brown Booby was also seen from the Searcher on 3 September, about 40 miles east of Nihoa (Figure 5), possibly the same individual.

Figure 5. Brewster's Brown Booby east of Nihoa. Note whitish head. Photo. E. VanderWerf.

Masked Booby (*Sula dactylatra*). This species was not numerous, but it was conspicuous because of its large size and white color. The largest concentration, of 40 adults and 24 juveniles, was observed on Miller's Plateau, with a smaller cluster of adults and several juveniles on the upper portion of Middle Plateau, and a few more at scattered locations around the island. A large downy chick was seen on Miller's Plateau, but all other young were fully feathered and appeared capable of flight.

Great Frigatebird (*Fregata minor*). Roosting adults and nests were common in many areas of the island with dense vegetation. They seemed to prefer dense *Solanum* for nesting, but adults often roosted on dead sticks and tall *Sesbania* stems. Nest contents ranged from small mostly downy chicks to large chicks that were mostly or completely feathered. No nests with eggs were seen. The number of active nests was estimated to be at least several hundred.

Red-tailed Tropicbird (*Phaethon rubricauda*). A total of five nests were seen, each of which contained a large fully-feathered chick. One nest was on a ledge visible from the bottom of Devil's Slide, one was in a small cave on Dog's Head, two were in East Palm Valley, and one was in the rocky lower section of Middle Valley. One of the chicks in East Palm Valley was under the *Pritchardia* canopy, an unusual location for this species (Figure 6). Adults were also seen flying over various parts of the island, particularly the sheer cliffs on the northern side of the island, and it is likely that more nests were present in that area. Pairs of adults were occasionally seen engaged in courtship displays, but given the lateness of the season it seems likely that these were young birds prospecting for mates in future years.

Figure 6. Red-tailed Tropicbird chick on *Pritchardia* leaves. Photo. E. VanderWerf.

Sooty Tern (*Onychoprion fuscata*). Sooty Terns were present and conspicuous in many parts of the island, but the nesting season was almost over and only a few hundred birds remained. A few partly

downy chicks were seen being attended by a parent, and juveniles were commonly seen flying around the island and begging from adults.

Gray-backed Tern (*Onychoprion lunata*). This species was common over much of the island, and the nesting season was at a slightly earlier stage than in the Sooty Tern. A few hundred partly downy chicks were seen, and there were also several hundred volant juveniles.

Brown Noddy (*Anous stolidus*). Brown Noddies were the most common and conspicuous bird on Nihoa during this visit. Hundreds of adults and volant juveniles were seen standing on the rocky ridges, and nests containing eggs and chicks of all sizes were present throughout the island.

Black Noddy (*Anous minutus*). As with the White Tern, this species appeared to be abundant on the sheer cliffs on the northern side of the island, but the number of birds present and their breeding phenology were difficult to determine. Several volant juveniles were seen at the bottom of Devil's Slide, where the cliffs were more readily visible. From this vantage point several areas of "golden guano" were visible at close range, and in most cases there was a nest with sticks within or directly above them (Figure 7), indicating they were made by Black Noddies, and not White Terns, which make no nest.

Figure 7. "Golden guano" under Black Noddy nest, Nihoa. Photo. E. VanderWerf.

Blue-gray Noddy (*Procelsterna cerulea*). Adults were commonly observed flying near the shoreline and landing in rocky caves and ledges in many parts of the island, and were especially numerous on the sheer cliffs of the northern side of the island. No nests, eggs, or juveniles were observed.

White Tern (*Gygis alba*). White Terns were abundant on the sheer cliffs on the northern, eastern, and western sides of the island, but the number of birds present and their breeding phenology were difficult to determine because the nesting areas were hard to see. At the bottom end of Devil's Slide several fully feathered chicks and a single partly downy chick were visible. Several volant juveniles with tan markings on the wings and back were seen in different parts of the island, and adults were often observed flying all over the island.

Table 3. Summary of seabird presence and nesting phenology on Nihoa, 4-14 September 2011. Numbers indicate approximate abundance, and X indicates the species was present but abundance was not estimated.

Species	Adults Present	Eggs	Chicks	Fledglings
Laysan Albatross	0	0	0	0
Black-footed Albatross	0	0	0	0
Bonin Petrel	0	0	0	0
Bulwer's Petrel	1000s	0	10,000s	0
Tristram's Storm Petrel	0	0	0	0

Wedge-tailed Shearwater	1000s	-	1000s	-
Christmas Shearwater	1000s	0	1000s	0
Red-footed Booby	1000s	1	100s	X
Brown Booby	100	0	30	X
Masked Booby	50	0	1	30
Great Frigatebird	100s	0	X	X
Red-tailed Tropicbird	X	0	X	X
Sooty Tern	100s	0	X	X
Gray-backed Tern	1000s	0	X	X
Brown Noddy	10,000s	X	X	X
Black Noddy	X	0	X	X
Blue-gray Noddy	X	0	0	0
White Tern	X	0	X	X

INDIGENOUS MIGRATORY BIRDS

Northern Pintail (*Anas acuta*). A female Northern Pintail was seen in the ocean just off the landing area near camp on 5 September at 07:15 hrs. It did not attempt to fly away as the zodiac approached, but retreated by swimming away along the rocks. It was occasionally washed close to the rocks by waves and appeared uncomfortable in the surf (Figure 8).

Figure 8. Female Northern Pintail, Nihoa, 5 September 2011. Photo. E. VanderWerf.

Pacific Golden Plover or **Kolea** (*Pluvialis fulva*). This species was seen daily in small numbers, most often on the shoreline near camp, but a few individuals were observed higher on the slopes and rocky cliffs of the island. A maximum of 28 birds was seen simultaneously on 8 September along the shoreline near camp. On 11 September flocks of 30, 20, 110, and 40 plovers were observed from camp flying eastward off the southern shoreline without stopping on the island. This coincided with a line of rain squalls skirting the southern shore, and it is possible these flocks were attempting to avoid the rain.

Semipalmated Plover (*Charadrius semipalmatus*). This species is an uncommon migrant and winter visitor to the Hawaiian Islands. A single juvenile was observed and photographed at the beach on 10 and 11 September. It was identified as a juvenile by the pale fringing to feathers on the upperparts (Figure 9). This is the first record of Semipalmated Plover from Nihoa (P. Pyle, pers. comm.).

Figure 9. Semipalmated Plover, Nihoa, 10 Sept 2011. Photo. E. VanderWerf.

Ruddy Turnstone or **'Akekeke** (*Arenaria interpres*). This species was seen daily, with most individuals foraging and roosting along the rocky shoreline near camp. A maximum of 37 birds was seen simultaneously near camp on 8 September. A few birds were also seen frequently at scattered locations higher on the island.

Wandering Tattler or **'Ulili (***Heteroscelus incanus***).** A maximum of two Wandering Tattlers was seen along the rocky shoreline near camp on several occasions. At least one individual was still in alternate (breeding) plumage and one was in basic (non-breeding) plumage.

Spotted Sandpiper (*Actitis maculata*). This species is a rare visitor to the Hawaiian Islands. A single bird was seen and photographed on 8 September foraging along the shoreline immediately below camp and on 10, 11, 12, and 13 September on the beach. On 8 September it was first detected by its shrill call, after which it was seen flying westward, and then landing on the rocks. At the beach it foraged among boulders and occasionally caught flies off sleeping monk seals. It was in non-breeding plumage and

Figure 10. Spotted Sandpiper, Nihoa, 10 Sept. 2011. Photo. E. VanderWerf.

lacked the spots for which this species is named (Figure 10). This is the first record of Spotted Sandpiper from Nihoa (P. Pyle, pers. comm.).

NON-NATIVE BIRDS

Cattle Egret (*Bubulcus ibis*). A single Cattle Egret was first seen from the Searcher on 3 September at 17:30 hrs as it was being mobbed by noddies, terns, and boobies. It landed on the bow railing of the Searcher at dusk and was still present in the morning on 4 September (Figure 11). Crew of the Searcher reported that it spent most of the day on the boat. A single Cattle Egret, presumably the same bird, was seen on the island on 4 and 9 September. On each occasion it was continuously mobbed and chased by many seabirds (Figure 12). On 9 September it landed briefly on the rocky shoreline east of camp. The behavior of seabirds toward the Cattle Egret suggests that they view it as a threat, perhaps because it has eaten small seabird chicks.

Figure 11. Cattle Egret on Searcher, 3 Sept. 2011. Photo. E. VanderWerf.

Figure 12. Cattle Egret mobbed by Brown Noddies, Nihoa, 4 Sept. 2011. Photo. E. VanderWerf.

Mourning Dove (*Zenaida macroura*). A single Mourning Dove was seen and photographed by VanderWerf on 10 September in East Valley (Figure 13). Single unidentified doves were seen briefly from camp on 4 and 9 September and presumably were the same bird. This is the first record of Mourning Dove from Nihoa (P. Pyle, pers. comm.).

Figure 13. Mourning Dove, Nihoa, 10 Sept 2011. Photo. E. VanderWerf.

Domestic Pigeon or Rock Pigeon (*Columba livia*). On 13 September, Tsukayama found the desiccated remains of a bird on the beach with an orange band on one leg. He retrieved the band, which was marked "AU 2011 WSCI 74." VanderWerf returned to the beach to examine the bird, which appeared to be a domestic pigeon, perhaps a homing pigeon. An on-line search using the band number confirmed that the bird was a racing pigeon, and that it was registered to a local chapter of the American Racing Pigeon Union based in Pacific Palisades, Oahu. This is the third record of a Rock Pigeon from Nihoa (P. Pyle, pers. comm.).

Northern Mockingbird (*Mimus polyglottos*). A single individual was seen and photographed in Devil's Slide on 9 September (Figure 14). It was first seen perched on a rock in the bottom of the slide, and it then flew onto the cliffs on the northern side. This is the second record of a Northern Mockingbird from Nihoa (P. Pyle, pers. comm.).

Figure 14. Northern Mockingbird, Nihoa, 9 Sept. 2011. Photo. E. VanderWerf.

NATIVE ARTHROPODS

Nihoa Trap-door Spider (*Nihoa mahina*). On 11 September, Tsukayama, Aldeguer, and Amidon observed a small individual of the endemic Nihoa trap-door spider in camp at about 12:00pm. Shortly afterwards, VanderWerf, Tsukayama, and Amidon watched a Nihoa Millerbird catch and eat the spider (Figure 15). The Millerbird grasped the spider's body in its bill and shook it violently several times, which caused the legs to come off. It dropped the spider a couple of times and then picked it up again, perhaps to shift its grip and avoid being bitten by the spider. It then beat the body on the ground several times and swallowed the body whole. After eating the body it searched for and ate all the fragments of the spider that had become detached during the scuffle.

Figure 15. Millerbird eating Nihoa trap-door spider, 11 Sept 2011. Photo. E. VanderWerf.

Nihoa Conehead Katydid (*Banza nihoa*). On 11 September, VanderWerf found a dead katydid near transect station 17B amid *Eragrostis* tussocks. It was yellow and dry and had been dead for some time.

NON-NATIVE ARTHROPODS

Schistocerca nitens. A total of 35 grasshoppers were observed on the passerine bird survey transects. The majority of these (25) were observed by Tsukayama, and it is possible that other observers either did not record all grasshoppers or were less aware of them, particularly on the first day. It is notable that the grasshoppers are likely to be observed only when flushed from the vegetation, therefore a quantitative assessment of grasshopper abundance on Nihoa is best determined by strip transect methods and not a point count method. Grasshoppers were observed from small juveniles (<3 cm) to large adults. In general, D. Tsukayama noted no general increase or decrease in the prevalence of *Schistocerca nitens* compared to 2010. *Schistocerca* density seems to vary greatly throughout the island; while the grasshoppers seem completely absent in some areas, it is not uncommon to flush several individuals while traversing other parts of the island. It seems that this variance is a mark of vegetation type; higher

Figure 16. *Sesbania* with possible damage from *Schistocerca* grasshopper, Sept 2011. Photo. E. VanderWerf.

Schistocerca densities were observed in stands of vegetation where either *Sida fallax* or *Sesbania tomentosa* were dominant, particularly on the eastern side of the island. It was also observed that new growth on many *Sesbania tomentosa* appeared insect-eaten (Figure 16), though this pattern was not ubiquitous. While it seems likely that damage to these plants is attributable to the alien grasshoppers, this herbivory has not been directly observed.

HAWAIIAN MONK SEALS

Hawaiian Monk Seals (*Monachus schauinslandi*) were observed daily on the beach and on the rocky shoreline near camp. Daily counts ranged from 24 to a maximum of 31. Several individuals were observed with flipper tags, including a weaner with orange tag K06/07 near camp, and weaners tagged orange K18/19 and K20 on the beach. A single nursing pup was present on the beach.

NATIVE PLANTS

'Emoloa or **kāwelu** (*Eragrostis variabilis*). Observed in abundance throughout the island, particularly on the south-facing slope of Miller's peak, where the vegetation consists almost exclusively of this plant. Most plants consisted of more than 50% dry matter with empty seed heads. Relative to previous years, no notable variance was noted in regard to this species.

Kakonakona (*Panicum torridum*). This native bunch grass was common and widespread over much of the island, but most plants were brown and withered. Only a few green plants were observed in shady sections of Devil's Slide. It appears to have been quite abundant this year, perhaps due to the wet winter.

Figure 17. Loulu with fruit, West Palm Valley, 11 Sept 2011. Photo. E. VanderWerf.

Loulu (*Pritchardia remota***)**. In West Palm Valley many trees had flowers or fruits, with some individuals having up to 5 separate fruiting stalks (Figure 17). Fruits ranged from unripe to ripe. Two seedlings were found in the lower section of Miller's Valley directly above camp, where seeds were scattered in 2010. Four trees were present in the lower part of Middle Valley, which grew from seeds scattered by MacDonald and Tsukayama in 2007 and have now reached a height of about one meter. A single seedling was found by VanderWerf in the lower part of West Valley. Based on its size (<30 cm tall), it was probably 1 year old. Per request from Laysan personnel, seeds were collected (enough to fill half of a 5 gallon bucket) to be transported to Laysan Island for subsequent cultivation. The fruit was soaked in a bleach solution in transit to Laysan according to PMNM quarantine procedures.

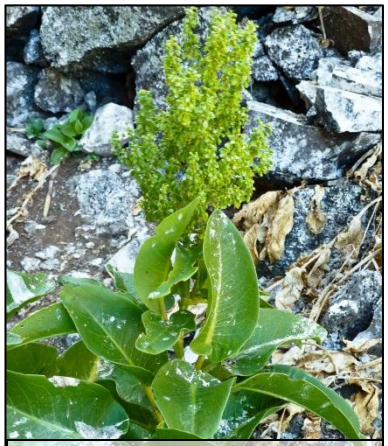


Figure 18. *Rumex* in flower, Sept 2011. Photo. E. VanderWerf.

Rumex albescens. Healthy plants were observed to be fairly common in the lower section of Devil's Slide. A single plant had a tall flower stalk (Figure 18). Tsukayama noted that this species appeared more abundant, and with larger individuals, than what had been observed during both the 2009 and 2010 trips.

'Aweoweo (*Chenopodium oahuense***)**. This species was sparsely distributed on steeper slopes and ridges, but was fairly common on Miller's Plateau, Dog's Head, and in Devil's Slide. Several large plants on Miller's Plateau and in Devil's Slide were in flower.

Figure 19. *Schiedea* in flower, Sept 2011. Photo. E. VanderWerf.

Schiedea verticillata. This endemic species was fairly common in the lower section of Devil's Slide, where there were approximately 200 plants. Most plants were small seedlings only a few cm tall, but some were up to about 25 cm tall, and a single

plant was in flower (Figure 19). Two small individuals were observed by VanderWerf near the summit of Dog's Head, on the northeast side.

'**Ohai** (*Sesbania tomentosa*). 'Ohai was common over much of the island. Many plants appeared to have been chewed on and were missing most of their leaves, perhaps from herbivory by the alien grasshopper *Schistocerca nitens*, especially on Miller's Plateau.

Nohu (*Tribulus cistoides*). Two individuals were noted on the rocky ridge at the eastern end of the island. Yellow petals were seen on the ground under the larger of the two plants, but no intact blooms were present (Figure 20).


Figure 20. Nohu, Sept 2011. Photo. E. VanderWerf.

Amaranthus brownii. Not observed.

***Boerhavia repens*.** Tsukayama observed two individuals with seeds growing in the sand between rocks on the upper part of Adam's Bay.

'Akoko (*Chamaesyce celastroides*). This species was largely confined to the rocky ridges on the eastern and western ends of the island, where it sometimes formed largely monotypic stands, especially at the eastern end. Plants were observed with flowers and seeds.

'Ilima (*Sida fallax*). 'Ilima is abundant throughout the island, and along with *Solanum* is one of the two dominant species in the vegetation on Nihoa. This species exhibits a large range of characteristics; from long, nearly leafless stems, to leafy verdant shrubs. Many plants had both flowers and seeds. Per request from Laysan personnel, approximately 200 seed pods were collected for transport to Laysan Island for subsequent cultivation.

Ipomoea indica. A single small patch was observed on the north face of Miller's Peak. No flowers were observed (Figure 21).


Figure 21. *Ipomoea indica*, Sept. 2011. Photo. E. VanderWerf.

Popolo (*Solanum nelsoni*). This was one of the three dominant plants on Nihoa, along with *Sida* and *Eragrostis*. Some parts of the island were covered in dense thickets of *Solanum* up to a meter high, particularly the Middle Plateau. The popolo on Nihoa displays a large range of characteristics and leaf-shape. While some plants may exhibit sparse, fuzzy, silver-green foliage, other plants might have large leaves (4 in), with a waxy complexion. This variance does not seem to be phenological, but reflective of the substrate in which the plant grows. The plants exhibited a large abundance of fruit, ranging in color from light orange or red to purple or black. D. Tsukayama noted that this was by far the most *Solanum* fruit he had seen on Nihoa. Per request from Laysan personnel, approximately 300 fruits were collected for transport to Laysan Island for subsequent cultivation.

Sicyos pachycarpos. This species was observed in Devil's Slide, where it was fairly common. Many plants were yellow and withered, but some plants in the shadier sections of Devil's Slide were still green. Several plants were observed with flowers and seed pods (Figure 22). A single patch of *Sicyos* about 7x7 meters in size was observed by VanderWerf on the northeast side of Dog's Head near the summit, but all plants were yellow and withered.

Figure 22. *Sicyos* in flower, Sept 2011. Photo. E. VanderWerf.

NON-NATIVE PLANTS

Portulaca spp. *Portulaca* was common over much of the island. Three species are present on Nihoa (*P. lutea, P. villosa,* and *P. oleracea*), but no attempt was made to distinguish them or estimate the abundance of each.

Sandbur (*Cenchrus echinatus*). Seven small patches of *Cenchrus* were observed on Nihoa in September 2011 (Figure 23). Six were located in Miller's Valley, and one small patch was separate from the others in the lower part of Middle Valley (Figure 24). The largest patch, which was the first one discovered, by Tsukayama on 4 September, was highest on the slope, and the next highest patch was the second largest, suggesting *Cenchrus* has been present for more than one year and has spread by seeds that fell or were washed downhill. All plants were almost completely yellow and dry, though some green growth remained at the base of a few plants. Most of the seeds had already dropped to the ground.

On 14 September, Tsukayama, Aldeguer, Amidon, and VanderWerf removed all plants from six patches (five in Miller's Valley and one in Middle Valley) and placed them in plastic garbage bags for disposal off-island. We also scooped up as much soil and seeds from the base of the plants as possible and put it in the bags too. However, it is unlikely that all seeds were removed, particularly from the larger patches. In addition, Tsukayama and VanderWerf used split plastic garbage bags to cover the areas of ground where the two largest patches of *Cenchrus* had been removed, in hopes of preventing any remaining seeds from growing. The edges of the bags were weighted down with rocks, but it is likely that the bags eventually will be torn open by the wind. One of the *Cenchrus* patches in Miller's Valley was discovered late in the afternoon on 14 September, and there was not enough time to remove it before the

Figure 23. *Cenchrus* patch in Miller's Valley, Sept 2011. Photo. E. VanderWerf.

Searcher arrived. Similarly, the *Cenchrus* patch in Middle Valley was removed late in the afternoon on 14 September, but there was not enough time to thoroughly collect the fallen seeds before the Searcher arrived.

The presence of *Cenchrus echinatus* on Nihoa Island should be considered a "red flag" finding for the Monument. Control and eradication of *Cenchrus* is explicitly listed in the PMNM Management Plan as a targeted weed (Activity MB-1.1, pg. 174, and Activity AS 6.2, pg. 210). Considering the history of *Cenchrus* in the archipelago (Flint and Rehkemper 2002, Papahānaumokuākea Marine National Monument 2008), the relatively pristine nature of Nihoa, and the limited occurrence of this weed on the island, ***immediate and aggressive measures should be taken to eradicate this species from the island, and it is imperative that efforts be made to assess and remove Cenchrus in 2012.*** It would be best if this occurred earlier in the year in order to treat the plants with herbicide before the seeds have matured and fallen to the ground, with a pre-emergent herbicide if at all possible. A single plant of this species was found on Nihoa in 1981 and removed, and it was also found in 1928 and the 1960s, but failed to become established (Conant 1985). Discovery of the *Cenchrus* was incidental to work being done on Millerbirds, and we did not search specifically for *Cenchrus* outside the immediate area where the plants were found. Dedicated searches for additional patches of *Cenchrus* therefore should be conducted as soon as possible. At a distance the *Cenchrus* could be confused with the native bunchgrass *Panicum torridum*, but up closer the *Cenchrus* was easy to identify by its spiny seeds and twisted corkscrew-like seeds stalks.

Figure 24. Locations of *Cenchrus echinatus* patches discovered on Nihoa in September 2011. Red dot indicates a patch that was not removed because of time constraints.

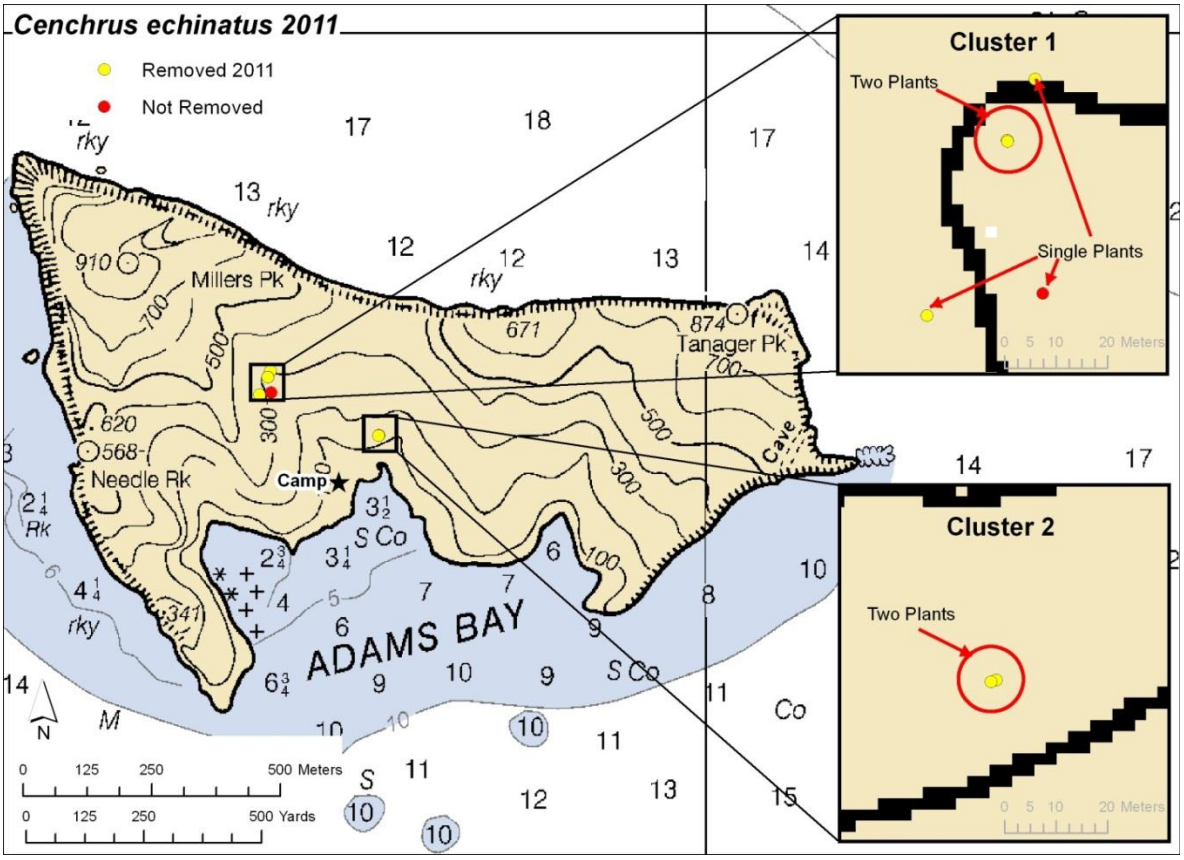


Table 4. Locations and status of *Cenchrus echinatus* patches discovered on Nihoa in September 2011. Easting and Northing are in UTM Zone 4N, WGS 1984.

Patch #	Latitude (N)	Longitude (W)	Easting	Northing	Status
1	23.061253	161.924272	200362.2	2553297	Removed
2	23.060213	161.922736	200554.2	2553178	Removed
3	23.061154	161.924321	200357	2553286	Removed
4	23.060872	161.924461	200342	2553255	Removed
5	23.061153	161.92432	200357.1	2553286	Removed
6	23.06021	161.922386	200553.3	2553178	Removed
7	23.060907	161.924258	200362.9	2553259	Not Removed

New Zealand spinach (*Tetragonia tetragonioides*). This alien species was observed only in a small section of Devil's Slide, where it has been observed previously. Plants were observed with both flowers and seeds. On 9 September, Tsukayama, Amidon, and VanderWerf removed a total of about 60 plants, placed them in a garbage bag, and carried them back to camp for disposal off-island. Tsukayama noted numbers to be more than what had been observed in 2010, but less than in 2009. The occurrence and

location of these plants remains localized relative to previous years (since 2007). In view of the density of endemic species in the small area of Devil's Slide, continued removal of this alien plant should remain a priority for future trips to Nihoa.

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Appendix 1. Summary of the locations of bird survey stations on the island of Nihoa. Easting and Northing are in UTM Zone 4N, WGS 1984 and elevation is in meters.

Station	Waypoint	Latitude	Longitude	Easting	Northing	Elevation	Created
1A	T1A	23.059791	-161.92201	200589.7	2553130.8	47	Oct 2008
1B	T1B	23.059152	-161.92155	200634.8	2553059.1	32	Oct 2008
2A	T2A	23.059024	-161.92153	200637.2	2553044.9	43	Oct 2008
2B	T2B	23.058369	-161.92125	200663.8	2552971.8	46	Oct 2008
3A	T3A	23.05841	-161.92058	200733.3	2552974.9	48	Oct 2008
3B	T3B	23.059116	-161.92028	200765.8	2553052.5	62	Oct 2008
4A	T04	23.059238	-161.91903	200893.3	2553063.5	58	Oct 2008
4B	T04B CAF	23.059747	-161.91855	200944.2	2553118.9	92	Sept 2010
5A	T05A	23.058311	-161.91876	200919	2552960.2	53	Oct 2008
5B	T05B	23.058327	-161.918	200996.9	2552960.4	66	Oct 2008
6A	T06A	23.058876	-161.91834	200964.1	2553022	90	Oct 2008
6B	T06B	23.05861	-161.91778	201020.9	2552991.3	93	Oct 2008
7A	T07A	23.058458	-161.91726	201073.7	2552973.5	108	Oct 2008
7B	T07B	23.057965	-161.91779	201018.3	2552919.9	79	Oct 2008
8A	T08A	23.05779	-161.91798	200998.7	2552900.9	72	Oct 2008
8B	T08B	23.05745	-161.9186	200933.4	2552864.6	46	Oct 2008
9A	T9A	23.059861	-161.92012	200783.2	2553134.8	97	Oct 2008
9B	T9B	23.059589	-161.92076	200717.3	2553105.9	93	Oct 2008
10A	T10A	23.058618	-161.92103	200687.2	2552998.9	75	Oct 2008
10B	T10B	23.059129	-161.92136	200654.2	2553056.2	80	Oct 2008
11A	T11A	23.059283	-161.92141	200650	2553073.4	72	Oct 2008
11B	T11B	23.059881	-161.92186	200604.9	2553140.6	68	Oct 2008
12A	T12A	23.059884	-161.92298	200490.5	2553143.2	43	Oct 2008
12B	T12B	23.060337	-161.92241	200550	2553192.1	67	Oct 2008
13A	T13A	23.060471	-161.92234	200556.7	2553206.9	73	Oct 2008
13B	T13B	23.060766	-161.92177	200616.4	2553238.4	109	Oct 2008
14A	T14A	23.060649	-161.92172	200620.6	2553225.3	105	Oct 2008
14B	T14B	23.060278	-161.92107	200686.8	2553182.9	121	Oct 2008
15A	T15A	23.060406	-161.92081	200714.2	2553196.6	131	Oct 2008
15B	T15B	23.060878	-161.92024	200773.7	2553247.7	142	Oct 2008
16A	T16A	23.060909	-161.92027	200770.5	2553251.2	141	Oct 2008
16B	T16B	23.061235	-161.91963	200836.1	2553286	161	Oct 2008
17A	T17	23.061805	-161.92047	200751.9	2553350.9	204	Oct 2008
17B	T17B	23.061902	-161.91967	200833.9	2553360	204	Oct 2008
18A	T18A	23.061383	-161.91804	201000.1	2553299.2	161	Oct 2008
18B	T18B	23.06195	-161.91766	201040	2553361.1	190	Oct 2008
19A	T19A	23.061975	-161.91749	201058	2553363.6	189	Oct 2008
19B	T19B	23.061839	-161.91699	201108.6	2553347.5	231	Oct 2008
20A	T20A	23.060559	-161.91701	201103.7	2553205.8	187	Oct 2008

20B	T20B	23.060685	-161.9163	201176.7	2553218.2	200	Oct 2008
21A	T21A	23.059548	-161.91509	201297.9	2553089.7	176	Oct 2008
21B	T21B	23.059665	-161.91435	201374.9	2553101.3	129	Oct 2008
22A	T22A	23.059925	-161.91662	201142.3	2553134.7	164	Oct 2008
22B	T22B	23.059796	-161.91734	201068.3	2553121.9	155	Oct 2008
23A	T23A	23.059383	-161.91833	200966.3	2553078.1	109	Oct 2008
23B	T23B CAF	23.05996	-161.91794	201007	2553141.2	137	Sept 2010
24A	T24	23.060312	-161.91898	200901.1	2553182.4	97	Oct 2008
24B	T24B CAF	23.059984	-161.91966	200831.3	2553147.4	100	Sept 2010
25A	T25A	23.060451	-161.92292	200498	2553205.9	81	Oct 2008
25B	T25B	23.061187	-161.92299	200491.8	2553287.5	104	Oct 2008
25C	T25C FAA	23.061095	-161.9222	200572.5	2553275.7	97	Sept 2011
26A	T26A	23.061804	-161.92316	200476	2553356.3	119	Oct 2008
26B	T26B	23.061887	-161.9224	200554.1	2553364	123	Oct 2008
27A	T27A	23.061983	-161.92205	200589.8	2553373.8	135	Oct 2008
27B	T27B	23.061587	-161.92145	200650.7	2553328.7	146	Oct 2008
28A	T28A	23.060917	-161.92083	200712.5	2553253.2	158	Oct 2008
28B	T28B CAF	23.061549	-161.92054	200743.9	2553322.6	188	Sept 2010
29A	T29A	23.060235	-161.92377	200409.7	2553183.7	63	Oct 2008
29B	T29B	23.060671	-161.92379	200409.3	2553232	90	Oct 2008
30A	T30A	23.061023	-161.92399	200389.3	2553271.4	107	Oct 2008
30B	T30B	23.06151	-161.92436	200352.4	2553326.2	127	Oct 2008
31A	T31A	23.061925	-161.92447	200342.1	2553372.3	142	Oct 2008
31B	T31B	23.062172	-161.92512	200276.2	2553401	160	Oct 2008
32A	T32A	23.062082	-161.92529	200258	2553391.4	175	Oct 2008
32B	T32B	23.062613	-161.92543	200244.6	2553450.6	202	Oct 2008
33A	T33A	23.0624	-161.92553	200234.2	2553427.2	216	Oct 2008
33B	T33B	23.062104	-161.92611	200174.6	2553395.6	210	Oct 2008
34A	T34A	23.062569	-161.92573	200213.7	2553446.4	207	Oct 2008
34B	T34B	23.06272	-161.92492	200297.3	2553461.4	197	Oct 2008
35A	T35A	23.063001	-161.9248	200310.5	2553492.3	229	Oct 2008
35B	T35B	23.06313	-161.92548	200241.2	2553507.9	225	Oct 2008
36A	T36A	23.063137	-161.92577	200211.2	2553509.4	239	Oct 2008
36B	T36B	23.062945	-161.92644	200141.9	2553489.5	254	Oct 2008
37A	T37A	23.063151	-161.92761	200022.5	2553514.7	269	Oct 2008
37B	T37B	23.063597	-161.92705	200081.6	2553562.9	262	Oct 2008
38A	T38A	23.062196	-161.92669	200115.2	2553407	234	Oct 2008
38B	T38B	23.062665	-161.92727	200056.2	2553460.1	269	Oct 2008
39A	T39A	23.061144	-161.92571	200213.2	2553288.4	159	Oct 2008
39B	T39B	23.061838	-161.92586	200199.2	2553365.6	183	Oct 2008
40A	T40A	23.060269	-161.9248	200304.6	2553189.5	91	Oct 2008
40B	T40B	23.060832	-161.92526	200258.6	2553252.9	138	Oct 2008
41A	T41A	23.059485	-161.92389	200395.6	2553100.8	72	Oct 2008

41B	T41B	23.059889	-161.92441	200343.6	2553146.6	98	Oct 2008
42A	T42A	23.05998	-161.92454	200330.3	2553157	102	Oct 2008
42B	T42B	23.060339	-161.9251	200273.5	2553198	126	Oct 2008
43A	T43A	23.060548	-161.9253	200253.3	2553221.6	147	Oct 2008
43B	T43B	23.061267	-161.92544	200240.7	2553301.5	177	Oct 2008
44A	T44IA	23.060714	-161.92625	200156.5	2553241.9	152	Oct 2008
44B	T44IB	23.060438	-161.92556	200226.6	2553209.9	145	Oct 2008
45A	T45HA	23.060681	-161.92706	200073.4	2553239.9	141	Oct 2008
45B	T45HB	23.060788	-161.92635	200146.3	2553250.3	150	Oct 2008
46A	T46GA	23.059777	-161.92662	200117.2	2553138.8	0	Oct 2008
46B	T46GB	23.059324	-161.9273	200045.7	2553090	169	Oct 2008
47A	T47FA	23.058872	-161.9275	200024.2	2553040.3	153	Oct 2008
47B	T47FB	23.058446	-161.92731	200043.5	2552992.8	121	Oct 2008
47C	T47FC	23.057736	-161.92661	200113.2	2552912.6	97	Sept 2011
49A	T49A_new2011	23.056481	-161.92567	200207.9	2552771.3	77	Sept 2011
49B	T49CB	23.05717	-161.92583	200192.2	2552848.3	60	Oct 2008
51A	T51A	23.062174	-161.91875	200929.1	2553388.2	198	Oct 2008
51B	T51B	23.061868	-161.91806	200999.4	2553352.9	196	Oct 2008
AA	TAEXTRAA	23.058761	-161.92436	200346	2553021.6	46	Oct 2008
AB	TAEXTRAB	23.058935	-161.92357	200428.1	2553039.2	35	Oct 2008
BA	TBEXTRAA	23.059066	-161.92518	200262.5	2553057.1	60	Oct 2008
BB	TBEXTRAB	23.05882	-161.92452	200330.3	2553028.4	52	Oct 2008
CA	TCXTRAA	23.061224	-161.91963	200838	2553284.4	157	Oct 2008
CB	TCXTRAB_new2011	23.061507	-161.91896	200907.7	2553314.3	153	Sept 2011
CB2	TCXTRAB CAF	23.060986	-161.91892	200908.8	2553256.9	135	Sept 2010
DA	TDXTRAA_new2011	23.059052	-161.91685	201118.6	2553038.1	127	Sept 2011
DB	TDXTRAB_new2011	23.059523	-161.9163	201176.1	2553089.1	154	Sept 2011
PRIT	PRIT FAA	23.059529	-161.92593	200187.4	2553109.9	67	Sept 2011