Auwahi **Wind**

October 5, 2015

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Via Email SUBJECT: Auwahi Wind Farm Project Habitat Conservation Plan FY 2015 (Year 4) Annual Report- Edits

Dear Ms. Charrier and Ms. Amlin:

Please find the attached edited annual report for the Auwahi Wind Farm Project (Project) Habitat Conservation Plan (HCP), prepared in compliance with the conditions of U.S. Fish and Wildlife Service (USFWS) Incidental Take Permit (ITP) TE64153A-0 and Department of Land and Natural Resources (DLNR) Incidental Take License (ITL) ITL-17. This annual report covers monitoring and mitigation activities conducted from July 1, 2014 through June 30, 2015. This report was edited based on comments received from USFWS on September 16, 2015, it was originally submitted on August 31, 2015.

The report identifies each HCP requirement and ITP/ITL condition completed, ongoing requirements and conditions, compliance status, and basis for determining compliance. Also, in compliance with HCP monitoring requirements, a post-construction mortality monitoring (PCMM) update is included. This update summarizes the results of monitoring conducted July 1, 2014 – June 30, 2015. Detailed reports providing updates on Hawaiian petrel, Hawaiian hoary bat, and Blackburn's sphinx moth mitigation are included as attachments to this report. Nene mitigation has been completed.

Should you have any questions on this annual report, please feel free to contact me at (808) 495-5234 or via email at mvanzandt@AuwahiWind.com.

Sincerely,

Marie VanZandt
Project Biologist/Auwahi Wind Farm

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Auwahi Wind Farm Habitat Conservation Plan FY 15 Annual Report

Incidental Take Permit TE64153A-0/ Incidental Take License ITL-17

Prepared By:

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August 2015

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1.0 Introduction

In January 2012, Auwahi Wind Energy, LLC (Auwahi Wind) finalized a Habitat Conservation Plan (HCP) for the construction and operation of the 21-megawatt Auwahi Wind Farm Project (Project) in east Maui, Hawaii (Tetra Tech 2012). The HCP was developed to obtain incidental take permit (ITP) number TE64153A-0 from the U.S. Fish and Wildlife Service (USFWS), and incidental take license (ITL) number ITL-17 from the Hawaii Division of Forestry and Wildlife (DOFAW), both of which authorize incidental take for the Hawaiian petrel (*Pterodroma sandwichensis*), Hawaiian goose (*Branta sandvicensis*), Hawaiian hoary bat (*Lasiurus cinereus semotus*), and Blackburn's sphinx moth (*Manduca blackburni*), collectively Covered Species. DOFAW issued the ITL on February 9, 2012 and USFWS issued the ITP on February 24, 2012, each with a term of 25 years.

This report provides a summary of monitoring and mitigation activities that have occurred during Fiscal Year (FY) 2015 (from July 1, 2014 to June 30, 2015). The following subsections provide an overview of post - construction mortality monitoring (PCMM) and mitigation activities and address other required annual reporting items as identified in the HCP, an annual work plan for the upcoming year, and annual cost expenditures as required under the ITP/ITL. Auwahi Wind successfully met all permit conditions in FY 2015 (Table 1-1). Detailed reports providing updates on Hawaiian petrel Hawaiian hoary bat, and Blackburn's sphinx moth mitigation are included as attachments to this report. Completion of the nene mitigation was documented in the FY 2013 annual report.

Table 1-1. Summary of compliance status July 1, 2014 –June 30, 2015.

Requirement/Permit Condition	Document Source/Condition	Required Timeframe	Compliance Status	Actions Completed/Basis for Compliance
PCMM at the Project				
Project biologist	HCP, Section 4.2.1 and 7.1.1	To be on-staff during Project operations	In compliance; ongoing	Sempra Project Biologist has been on staff since June 2013, previously Tetra Tech acted as Project biologist.
PCMM	HCP, Section 7.1.1 & PCMM Plan	Intensive monitoring will occur years 1, 2, 7, 12, 17, and 22 (total of 6 years, includes carcass removal and searcher efficiency trials)	In compliance; ongoing	Monitoring commenced in December 2012 and is ongoing. PCMM results for FY 2015 are provided in section 2 of this report.
Wildlife education and incidental reporting program	HCP, Section 7.11	Prior to and throughout operations	In compliance; ongoing	A wildlife education and incidental reporting program was initiated during construction and is ongoing. Five fatalities were reported via this program in FY 2015.
Notification of DLNR and the USFWS whenever a species protected by the Migratory Bird Treaty Act (MBTA) or a listed species is found dead or injured, or if there are observations of seabirds attracted to construction lighting	ITP Conditions L(i)	Via telephone within 24 hours and in a written report within five calendar days	In compliance; ongoing	Five fatalities were listed species (four Hawaiian hoary bats, one Hawaiian petrel) and eight fatalities were MBTA in FY 2015.
Reporting to DLNR of any mortalities, injuries, or disease related to the Covered Species	ITP Condition L(iv)	Within 3 days		
Table summarizing fatalities documented during PCMM	ITP Condition L(iv)	Semi-annually	In compliance; ongoing	Semi-annual table submitted to USFWS/DOFAW January 15, 2014. Fatalities documented during FY 2015; provided in section 2 of this report, Table 2-3.
Semi-annual progress report	ITP Condition L(ii)	Annually in February	In compliance; ongoing	Semi-annual progress report submitted to USFWS/DOFAW January 15, 2015. The next semi-annual progress report will be submitted in February 2016.

Table 1-1. Summary of Compliance Status July 1, 2014-June 30, 2015.

Requirement/Permit Condition	Document Source/Condition	Required Timeframe	Compliance Status	Actions Completed/Basis for Compliance
Hawaiian Hoary Bat Mitigation				
Conservation easement for the Waihou Mitigation Area (Tier 1 mitigation)	HCP, Section 6.2.1	Within 210 days of ITP/ITL issuance or the initiation of vertical construction of the turbines, whichever comes sooner; easement extension granted by DOFAW	In compliance; completed	Recorded conservation easement with the Hawaiian Islands Land Trust to preserve the Waihou Mitigation Area in perpetuity on December 18, 2012.
Install new ungulate-proof fencing or retrofit cattle fencing around the Waihou Mitigation Area (Tier 1 mitigation)	HCP, Section 6.2.1	Initiate within first year of permit issuance and shall be completed within two years of permit issuance (February 9, 2014)	In compliance; completed	Installation complete September 2013.
Remove ungulates from within Waihou Mitigation Area fence line (Tier 1 mitigation)	HCP, Section 6.2.1	Initiate after ungulate proof fence is completed	In compliance; completed	Ungulates removed in March of 2014. Quarterly fence inspections continue to ensure fence stability and area remains ungulate free.
Conduct vegetative restoration activities, including removal of invasive species and native reforestation (Tier 1 mitigation)	HCP, Section 6.2.1, Table 6-3	Initiate after ungulate proof fence is completed	In compliance; ongoing	Semi-annual removal of target invasive species conducted in August 2014/February 2015. Nineteen acres of native trees and shrubs out-planted in Spring 2015.
Acoustic monitoring at the wind farm (Tier 1 mitigation)	HCP, Table 6-2	Years 1 and 2 of operation	In compliance; completed	Initiated July 2013, results of two years provided in section 3.2 of this report.
Hawaiian hoary bat research plan (Tier 2 mitigation)	HCP, Section 6.2.2	Draft research plan submitted to USFWS/DOFAW within 1 year of issuance of ITP; finalize within 2 years of ITP issuance and before the start of the study.	In compliance; ongoing	Final plan submitted in cooperation with USGS to USFWS/DOFAW in February 2014. Plan approved by USFWS/DOFAW in March 2014. Plan implemented March 2015.
Hawaiian hoary bat research continued (Tier 3 mitigation)	HCP, Section 6.2.3	Use research in Tier 2 to evaluate appropriate mitigation – additional area for bat habitat restoration or conduct additional research.	In compliance, ongoing	Initiate planning for Tier 3 bat mitigation, research proposal to be reviewed by USFWS/DOFAW the first quarter of FY 2016.

Table 1-1. Summary of Compliance Status July 1, 2014-June 30, 2015.

Requirement/Permit Condition	Document Source/Condition	Required Timeframe	Compliance Status	Actions Completed/Basis for Compliance
Hawaiian Petrel Mitigation				
Petrel burrow surveys (Tier 1 mitigation)	HCP, Section 6.3.6, Table 6-6	Burrow monitoring will occur annually for first 3 years, an additional 5 years of monitoring will occur at certain points during the life of the mitigation	In compliance; ongoing	Conducted petrel burrow surveys 2012 –2014; 2015 burrow surveys started in March and will continue through November 2015. Results from 2014 provided in Attachment 2.
Predator control at the Kahikinui Petrel Management Area (Tier 1 mitigation)	HCP, Section 6.3.5; Petrel Management Plan	Auwahi Wind will begin predator control within the first year of operation	In compliance; ongoing	Full implementation of predator control in February 2014. Results from 2014 provided in Attachment 2.
Blackburn's Sphinx Moth Mitigation				
Funding to the Leeward Haleakala Watershed Restoration Partnership (LHWRP) to restore 6 acres of dryland forest in the Auwahi Forest Restoration Project	HCP, Sections 4.2.3 & 6.5.1, Table 6-2	First payment to LHWRP within 30 days of obtaining permit and remainder of funds paid within 3 months	In compliance; completed	Full payment to LHWRP on April 17, 2012. A letter from LHWRP summarizing status of restoration is provided in Attachment 4.
Nene Mitigation				
Research or management funding ($25K) provided to Haleakala National Park Service (NPS)	HCP, Section 6.4, Table 6-2	Within 60 days of obtaining permit	In compliance; completed	Full payment to NPS April 17, 2012. A letter from the NPS summarizing the status and use of funds is provided in FY 2013 reporting.
***Abutilon menziesii* (red ilima)**				
'Ulupalakua Ranch will plant 10 red ilima (*Abutilon menziesii*) from its on-going conservation efforts. Report plant survival (3 years)	HCP, Section 4.2.3	After construction/site restoration is complete	In compliance; completed	Plants propagated at the 'Ulupalakua Ranch nursery in 2013. They were successfully out-planted and are thriving.
Fire Management Plan				
Invasive species surveys for fire prone grass	HCP, Section 4.2.4; Fire Management Plan	Annually; additional semi-annual surveys for 2 years where invasive species are found	In compliance; ongoing	Invasive fire prone grass survey conducted annually. Buffel grass (*Cenchrus ciliaris)* was already established Project wide prior to construction.

2.0 Post-construction Mortality Monitoring

Auwahi Wind's HCP lays out a long term monitoring approach consisting of two years of intensive monitoring followed by interim years of less intensive but systematic monitoring. PCMM was initiated in December 2012. During the commissioning period (December through mid-January) heavy construction equipment and operations in the near vicinity of the turbines limited the searching to pads and roads. Beginning January 25, 2013, standardized carcass searches beneath all eight turbines and the met tower, carcass persistence trials, and searcher efficiency trials began following the schedule and methods outlined in detail in the FY 2013 report (Attachment 1- Table 2-1). December 2014 marked the end of intensive monitoring across the entire plot. Systematic searches continue across pads and roads at a three day interval.

A Migratory Bird Special Purposes-Utility Permit (Permit No. MB92518A-0) for handling migratory bird carcasses was issued by USFWS on December 10, 2012. A State Protected Wildlife Permit (Permit No. WL14-03) for handling native bird and bat carcasses was issued by DOFAW on April 11, 2013. Permits are valid through March 31, 2018 and September 24, 2015, respectively.

Table 2-1. Post-construction mortality monitoring summary, FY 2015.

Variable	Standarized July - December 2014	Systematic January - June 2015
Study Metrics for Fatality Estimates		
Total number of Project turbines	8	8
Number of turbines searched	8	8
Large bird search plot size	200 meters x 200 meters (656 feet x 656 feet)	Pads and Roads within 100 meter (328 feet) radius of turbine
Bat search plot size	50 meter (164 feet) radius of turbine	Pads and Roads within 100 meter (328 feet) radius of turbine
Met tower search plot size	10 meters (33 feet) around the base of the met tower	10 meters (33 feet) around the base of the met tower
Search interval	3 days July-November, 6 days December	3 days
Fatalities of Covered Species		
Hawaiian Petrel		
Number of fatalities documented	1	0
Adjusted take	1 Juvenile	0
Hawaiian Goose		
Number of fatalities documented	0	0
Hawaiian Hoary Bat Fatalities		
Number of fatalities documented	3	1
Adjusted take	0 (sex of fatalities male or outside breeding season)	0 (take occurred outside of breeding season)
Fatalities of Other Species[1]		
Fatalities found during searches	8	7
Fatalities found incidentally	3	1

[1]Indudes eight MBTA species.

2.1 Standardized Carcass Searches

Standardized carcass searches were conducted at all eight turbines and the met tower July 1 – December 31, 2014. The turbine search plot for large birds extended 100 meters (328 feet) from the turbine on each side to create a square plot of 200 meters x 200 meters (656 feet x 656 feet) centered on the turbine. Linear transects, spaced approximately 6 meters (20 feet) apart, were established within the search plot, with searchers scanning out to 3 meters (10 feet) on each side of the transects. The turbine search plot for bats extended a 50-meter (164-foot) radius from the turbine. The actual search area for both plots was smaller than the entire plot due to some areas considered non-searchable for safety reasons. Searchers used a handheld Trimble Juno GPS unit to log searching efforts; all data collected were downloaded at the end of the day. Based on the amount of searchable area within each plot, the proportion of the bird and bat carcass distributions actually searched was calculated for each turbine and for the Project. These calculations were based on 25 publically available studies compiled by Tetra Tech and were consistent with recent carcass distribution modeling efforts (Hull and Muir 2010). A total of 91 percent of the large-bird distribution and 91 percent of the bat distribution were searched for the Project during standardized carcass searches, the first half of FY 2015. It was agreed between USFWS/DOFAW (December 12, 2014) that Auwahi Wind could begin systematic searches in January 2015. Systematic searches are conducted along all pads and roads within a 100 meter (328 foot) radius of turbine January 1 – June 30, 2015. Linear transects, spaced approximately 6 meters (20 feet) apart, with searchers scanning out to 3 meters (10 feet) on each side of the transects. Searches are conducted at an interval of three days. The search plot size and configuration varies among turbine pads. Based on an analysis of the search area, a total of 56 percent of the large-bird distribution and 76 percent of the bat distribution are currently searched for the Project during systematic searches.

The following search intervals were followed in FY 2015:

- Every three days July through November 2014, which includes the petrel fledging period (October – November) and peak bat activity.
- Weekly surveys in December 2014, when petrel and bat activity are expected to be low.
- Every three days January through June 2015.

Table 2-2 Average search interval between standardized carcass searches at the Auwahi Wind Project, FY 2015.

Month	Average Search Interval (days) [1]
July	3
August	3
September	3
October	3
November	3
December	6.1
January	3
February	3
March	3
April	3
May	3
June	3

[1] Includes all turbines and meteorological tower

Twenty-four fatalities were documented in FY 2015; nineteen of these fatalities were documented during standardized carcass searches (Table 2-3). Eight fatalities recorded were covered under the MBTA. Five fatalities were Covered Species, the Hawaiian hoary bat and the Hawaiian petrel. No fatalities have been observed at the met tower.

Table 2-3. Documented fatalities at the Auwahi Wind Project, FY 2015.

Species	Legal Status	Found Date	Location (Turbine)	Type of Detection
Great Frigatebird *(Fregata minor)*	MBTA	7/14/2014	6	Standardized Search
Great Frigatebird *(Fregata minor)*	MBTA	7/19/2014	2	Standardized Search
Wedge-tailed Shearwater *(Ardenna pacifica)*	MBTA	8/13/2014	7	Incidental
Great Frigatebird *(Fregata minor)*	MBTA	8/18/2014	7	Incidental
White-tailed Tropicbird *(Phaethon lepturus)*	MBTA	8/21/2014	5	Standardized Search
Hawaiian Hoary Bat *(Lasiurus cinereus semotus)*	T&E	8/30/2014	2	Standardized Search
Hawaiian Petrel *(Pterodroma sanwichensis)*	T&E	9/23/2014	3	Standardized Search
Great Frigatebird *(Fregata minor)*	MBTA	10/8/2014	5	Standardized Search
Hawaiian Hoary Bat *(Lasiurus cinereus semotus)*	T&E	10/14/2014	4	Incidental
Hawaiian Hoary Bat *(Lasiurus cinereus semotus)*	T&E	11/13/2014	6	Standardized Search
African Silverbill *(Lonchura cantanas)*	None	11/17/2014	6	Standardized Search
Skylark *(Alauda arvensis)*	MBTA	11/29/2014	6	Standardized Search
Skylark *(Alauda arvensis)*	MBTA	11/29/2014	3	Incidental
Grey Francolin *(Francolinus pondicerianus)*	None	12/15/2014	6	Standardized Search
House Sparrow *(Passer domesticus)*	None	12/29/2014	3	Standardized Search
Hawaiian Hoary Bat *(Lasiurus cinereus semotus)*	T&E	1/12/2015	3	Systematic Search
African Silverbill *(Lonchura cantanas)*	None	1/12/2015	2	Systematic Search
African Silverbill *(Lonchura cantanas)*	None	1/29/2015	2	Systematic Search
African Silverbill *(Lonchura cantanas)*	None	2/2/2015	2	Systematic Search
Grey Francolin *(Francolinus pondicerianus)*	None	2/19/2015	1	Incidental
House Sparrow *(Passer domesticus)*	None	3/10/2015	2	Systematic Search
Grey Francolin *(Francolinus pondicerianus)*	None	3/25/2015	1	Systematic Search
African Silverbill *(Lonchura cantanas)*	None	4/12/2015	4	Systematic Search
Zebra Dove *(Geopelia striata)*	None	5/18/2015	5	Systematic Search

2.2 Carcass Persistence Trials

Five carcass persistence trials were conducted during FY 2015, and are summarized together for each carcass size class in Table 2-4. Each trial had a minimum of fifteen carcasses per size class. Wedge-tailed shearwaters (*Ardenna pacificus*) were used as surrogates for large birds and medium sized black rats (*Rattus rattus*) were used as surrogates for bats. Beginning in January 2015, carcass persistence trials were discontinued for large birds

due to consistency in persistence and estimated persistence times far longer than the search interval, across the initial two years of PCMM. Trials continued for bats in the second half of FY 2015.

Carcasses were placed at randomly generated points within the turbine search plots, stratified by cover type to ensure that different types of terrain and vegetation, indicative of differing levels of visibility, were represented in proportion to their presence in the search plots. Carcasses were checked daily until they were no longer detectible or the 21-day trial period was complete. Changes in carcass condition were tracked and documented with photos. Detailed description of field and analytical methods are included in Attachment 1 of the 2013 HCP annual report. Bootstrap estimates of carcass persistence time and 95 percent confidence intervals were calculated, using 1,000 replicates, by carcass category.

The average probability of persistence is defined by Huso (2011) as:

$$\hat{r} = \frac{\hat{\bar{t}}\,(1 - e^{-I/\hat{\bar{t}}})}{min\,(\hat{\bar{I}}, I).}$$

where $\hat{\bar{t}}$ is the average carcass persistence time, I is the actual search interval and $\hat{\bar{I}}$ is the effective search interval (the length of time when 99 percent of the carcasses can be expected to be removed; $\hat{\bar{I}}$ = - log (0.01) * ($\hat{\bar{t}}$).

Auwahi Wind documented low carcass persistence during the dry season of FY 2013 and proactively put measures in place to reduce scavenger abundance. Predator control began on site in November 2013. Both large bird and bat surrogates now persist much longer with continual predator control on site. The average carcass persistence time for bats has remained relatively constant throughout the standardized and systematic search periods in FY 2015 (Table 2-4). The probability of persistence has increased slightly for bats due to a decrease in the amount of time between fatality searches. Most large birds persisted through the entire 21 day trial period resulting in a modeled probability of persistence greater than 100 days.

Table 2-4. Carcass persistence estimates for standardized (July – December 2014) and systematic (January –June 2015) Searches at the Auwahi Wind Project, FY 15.

Search	Carcass Size Class	N	Average Carcass Persistence Time (days)	95% CI	$\hat{r}$ value
Intense	Bats	31	5.84	3.54-9.61	0.67
Systematic	Bats	35	6.01	4.24-8.36	0.73
Intense	Large birds	27	>100	>100 days	0.99

2.3 Searcher Efficiency

Searcher efficiency trials were conducted during FY 2015. These trials incorporated the assessment of each member of the field staff and were conducted by the Project Biologist (tester) on site. All trials were conducted so that the searchers being assessed had no prior knowledge of the trial; every fatality search day was treated as if it had the potential to be a searcher efficiency trial day. Thirty-one searcher efficiency trial

days occurred during FY 2015, consisting of 96 individual trials. Wedge-tailed shearwaters were used as surrogates for large birds and medium sized black rats and rat decoys were used as surrogates for bats.

For all trials, turbines were randomly selected for trials. On each trial day, one to five carcasses were placed in the field. Carcasses were placed at randomly generated points within the selected turbines' search plots. During intense search efforts, the points were stratified by cover type to ensure they were represented in proportion to their presence within the study area. All trial carcasses were retrieved by the end of each trial day; if a trial carcass was not found by searchers the tester would go out to the location and attempt to retrieve the trial carcass. If not found by the searcher or the tester, the carcass was assumed to have been scavenged and thus unavailable to be found by searchers. Therefore, these carcasses were not included in the analysis.

Bootstrap estimates of searcher efficiency and 95 percent confidence intervals (CI) were calculated, using 1,000 replicates for each carcass category (large bird and bat).

The estimated searched efficiency is defined by Huso (2011) as:

$$\hat{p} = \frac{n_i}{k_i}$$

Where $\hat{p}$ is the proportion of trial carcasses available to be found and detected by searchers, n_i is the number of trial carcasses found for the ith carcass category, k_i is the number of trial carcasses found for the ith carcass category.

Searcher efficiency for large birds remained well above 70% in FY 15. Searcher efficiency increased for bats once fatality searches switched to a systematic approach, restricted to pads and roads. This was most likely due to a significant reduction of vegetation on pads and roads with scheduled manual/herbicide control.

Table 2-5. Searcher efficiency estimates for standardized (July – December 2014) and systematic (January –June 2015) searches at the Auwahi Wind Project, FY 15.

Search	Carcass Size Class	No. Placed[1]	No. Found	Average Searcher Efficiency (%)	95% CI
Intense	Bats	31	18	58	42-74
Systematic	Bats	35	27	77	63-89
Intense	Large birds	30	23	77	60-90

[1]Exdudes carcasses that were placed in the field but removed by scavengers prior to the survey (i.e., were not available to be found by searchers or tester)

2.4 Take

2.4.1 Direct Take

To ensure an accurate measurement of take and verify compliance under the ITL/ITP, fatality rates are adjusted based on the post-construction mortality monitoring. During the first two and a half years of monitoring at the Project, there were six fatalities of Covered Species (five Hawaiian hoary bats and one Hawaiian petrel). To account for unobserved fatalities statistical models or estimators are used for calculating fatality rates. The Huso estimator (Huso 2011; Huso et al. 2012) is currently the least biased method for

estimating the adjusted number of fatalities given a sufficient sample size. However, the Huso model and other fatality estimators should only be used to calculate adjusted fatality estimates for sample sizes of more than five and even then the accuracy in the estimated number of fatalities may be questionable with sample sizes less than 10 or 15 carcasses (M. Huso, personal comm., 2013 Bat and Wind Energy Workshop, Honolulu, HI). Given the limitations of the available statistical tools, Auwahi Wind and USFWS/DOFAW agreed to use the Evidence of Absence software (EoA; Dalthorp et al. 2014) in a meeting on April 17, 2015. EoA software was developed to provide an estimate of the probability, with a user-defined level of credibility, that the number of fatalities has not exceeded a given threshold. The level of credibility is analogous to statements of confidence in traditional parametric statistics. Interpretation of model output presents a regulatory challenge with respect to determining whether or not a take limit has been reached or exceeded because the EoA does not produce an exact estimated number of fatalities (i.e., a point estimate of take).

The agreed upon approach uses two pieces of information produced by the EoA to evaluate the likelihood that the number of fatalities has reached or exceeded the take limit. 1) The "maximum likelihood value" or where the probability of number of fatalities is greatest (2) The confidence interval surrounding the "most likely value" lowest and highest fatality values based on a credibility level of 80%.

Auwahi Wind used the EoA software and ran the model with PCMM data collected over the past 2.5 years for bats and 2 years for large birds (Table 2-6). We were able to estimate the probability of exceedance using an 80% credibility level for bats and large birds (Attachment 1).

Table 2-6. Summary of PCMM data at the Auwahi Wind Project, FY 2013 – FY 2015.

Year	Carcass Size Class	No. Fatalities Detected	Proportion of carcass distribution searched	Average Search Interval (days)	Probability of persistence- r	Average Searcher Efficiency (%)	Detection bias- g[a]
1	Bats	1	0.97	9	0.44	0.57	0.26
2	Bats	3	0.94	5	0.75	0.52	0.55
3	Bats	1	0.76	3	0.73	0.77	0.50
1	Large birds	1	0.91	9	0.79	0.74	0.67
2	Large birds	0	0.91	5	0.98	0.75	0.84

[a] Detection bias calculated using Evidence of Absence Software (Dalthorp et al. 2014)

Based on the five bat fatalities detected during 2.5 years of surveys, it is most likely that eleven collision-related fatalities occurred. It can be asserted with 80% certainty that the number of fatalities ranged from 5 to 17 over this survey period (Attachment 1). Auwahi Wind is 80% certain that no more than 17 fatalities have occurred. Examining the posterior distribution we see the "maximum likelihood value" is equal to eleven, although the probability that the total fatalities are exactly equal to eleven is only 9% (Figure 1).

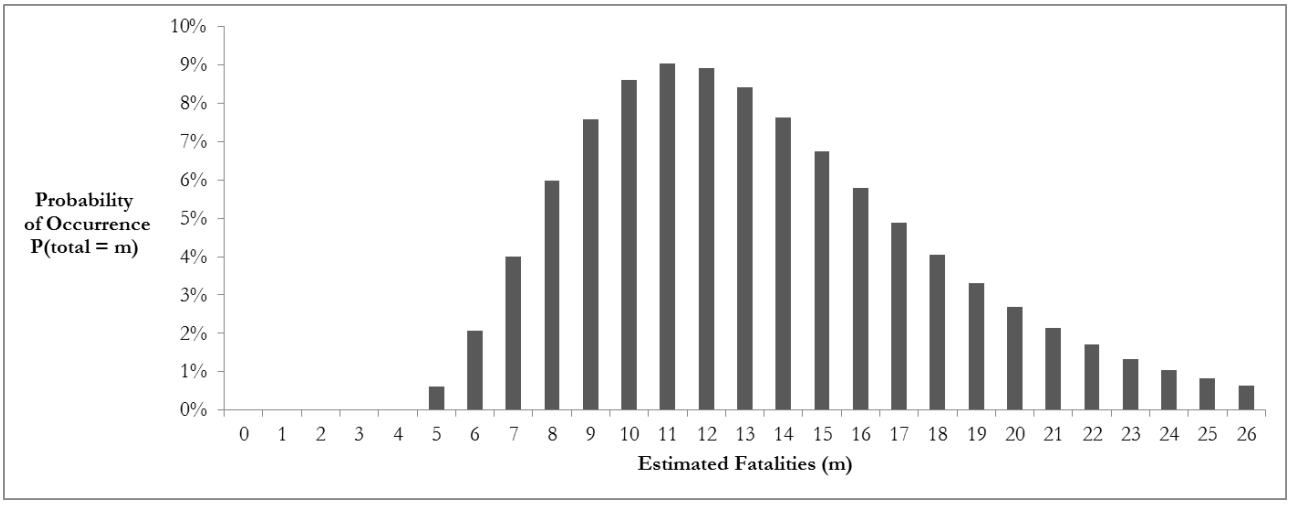

Figure 1. Posterior probability distribution for Hawaiian hoary bats with the maximum likelihood value outlined in black, using the Evidence of Absence software (Dalthorp et al. 2014).

Based on the one Hawaiian petrel fatality detected during 2 years of surveys it is most likely that one fatality occurred. It can be asserted with 80% certainty that the number of fatalities ranged from 1 to 2 over this survey period (Attachment 1). Auwahi Wind is 80% certain that no more than two fatalities have occurred. Examining the posterior distribution we see the "maximum likelihood value" is equal to 1 and the chance that total fatalities are exactly equal to 1 is 55% (Figure 2).

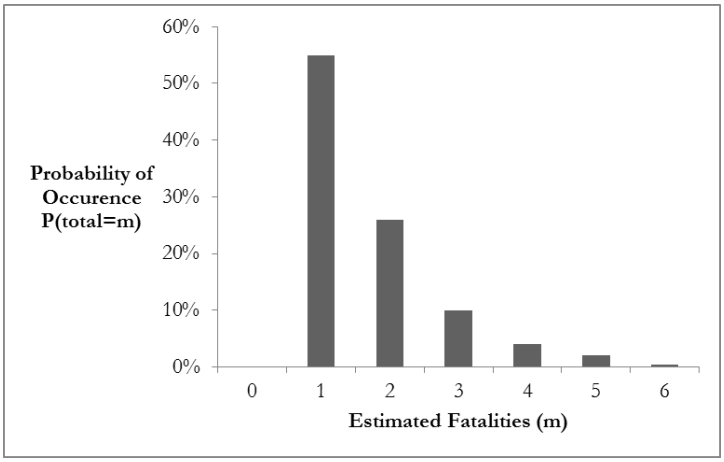

Figure 2. Posterior probability distribution for Hawaiian petrels with the maximum likelihood value outlined in black, using the Evidence of Absence software (Dalthorp et al. 2014).

2.4.2 Indirect Take

It is assumed that take of an adult bird or bat fatality during the breeding season may result in the indirect loss or take of a dependent young. Thus, for every seabird or bat carcass detected during the breeding season, modifiers are applied to estimate indirect take to account for the likelihood that a given adult is reproductively active, the likelihood that the loss of a reproductively active adult results in the loss of its young, and average reproductive success (Auwahi Wind HCP, Section 5.2).

There have been no observed female bat fatalities during the breeding period, and only a single fatality was observed at the very end of the breeding season (found August 30, 2013). The sex is unknown for the August 30, 2013 fatality, but samples have been submitted for genetic testing. Should genetic testing indicate the August 30, 2013 fatality was a female, Auwahi Wind will reevaluate the potential for the collision-related fatality to have resulted in indirect take.

There was one Project related fatality of an adult Hawaiian Petrel recorded during the breeding season (found September 23, 2014). By September, it is believed that only reproductively active adults are present at the colony (Simons and Hodges 1998) and the loss of one of the breeding pair will result in the loss of one chick (Auwahi Wind HCP, Table 5-3). The average reproductive success for petrels on Maui has been previously measured at 63% (Simons and Hodge 1998). Thus the indirect take associated with the adult Hawaiian Petrel fatality in September is equal to 0.63 juveniles, or rounded up equal to one juvenile petrel.

2.5 Wildlife Education and Incidental Reporting

Auwahi Wind implemented a Wildlife Education and Incidental Reporting program for contractors, Project staff members, and other ʻUlupalakua Ranch staff who are on site regularly. This annual training enables staff to identify the Covered Species that may occur in the Project area, record observations of these species, and take appropriate steps for documenting and reporting any species encountered during the operation of the Project. Twenty-seven staff and contractors have gone through this training in FY 2015 and five incidental fatalities were reported (Table 2-3).

2.6 Adaptive Management

2.6.1 Minimization Measures and Post-construction Mortality Monitoring Adaptive Management

Across North America, numerous operational adjustment experiments have been conducted at wind farms to assess the potential for reducing bat fatalities. During low wind speeds when turbine cut-in speeds were raised and turbine blades feathered, a significant reduction in bat fatalities was documented (Baerwald et al. 2009, Young et al 2010, Arnett et al. 2011, Good et al. 2011, Arnett et al 2013). In an effort to minimize negative hazards associated with operating turbines at low wind speeds, Auwahi Wind voluntarily implemented low wind speed curtailment. Initial efforts began on October 10, 2014, when blades were feathered until wind speeds were at cut-in speeds of 3.5 m/s (for one hour before sunset until one hour after sunrise). Beginning February 5, 2015, Auwahi Wind voluntarily began feathering turbine blades until winds equaled a cut-in speed of 5 m/s one hour before sunset until one hour after sunrise, year-round.

During the December quarterly coordination meeting (December 12, 2014), USFWS/DOFAW concurred with Auwahi Wind that fatality searches would shift to systematic searching in January 2015.Searcher efficiency and carcass persistence trials for bats continue within this area to better refine fatality estimations for the life of the Project.

Under the recommendation of USFWS/DOFAW, Auwahi Wind continues to implement scavenger control at the site through FY 2015. Feral cat and mongoose traps are deployed across all turbine plots and are activated year round. Mongoose traps consisted of two types of kill traps, DOC 250's and Goodnature A24's. Feral cat trapping focused on Belisle Super X traps with some experimental use of foothold traps, when cattle were not present. Kill traps are checked every three days, foothold traps are checked daily when deployed. All trap types were successful at removing predators, ninety-eight mongoose and thirteen feral cats were removed

from the site during FY 2015. Carcass persistence has increased across the site and predator control will continue at the Project in FY 2016.

Beginning January 2015, Auwahi Wind implemented quarterly vegetation management on pads and roads to increase visibility during fatality searches. Vegetation is cut back and maintained at 50-100 mm (2-4 inches) along pads and roads year round. Fatality searches are conducted the morning of scheduled vegetation management, prior to beginning mowing and herbiciding. These efforts have in turn increased detectability during searcher efficiency trials.

In April 2015, Auwahi Wind requested to have its authorized bat take, up to 19 adult and 8 juvenile bats, be converted to all adults. This request was to facilitate the calculation of adjusted take and be consistent with other operational wind farms. USFWS/DOFAW have addressed this issue at other wind farms in Hawaii and converted bats at a ratio of 2:1 (Kawailoa HCP, Year 2 FY 2014 Report, page 14). Within the Auwahi HCP the little brown bat is used as a surrogate for the Hawaiian hoary bat and estimated at a 3:1 juvenile to adult relationship. Auwahi Wind requested its 8 juvenile bats to be converted to 3 adult bats. USFWS/DOFAW denied the request and determined the intent of the Auwahi Wind HCP was a 4:1 conversion, resulting in approved take equal to 21 adult bats (email correspondence April 30, 2015).

2.6.2 Tier 2 & 3 Hawaiian Hoary Bat Mitigation

A three-tiered approach to take and mitigation was developed for the Hawaiian hoary bat. Each tier represents a level of take and is associated with outlined mitigation measures. Reaching Tier 1 take levels for a species triggers initiation of Tier 2 associated mitigation. There is a moderate probability that the number of bat fatalities has exceeded the Tier 2 take level of 10 bats, approximately 71 percent (Attachment 1). There is a low probability, approximately 12 percent, that the number of fatalities has exceeded the Tier 3 take level of 19 bats. To ensure that mitigation efforts precede the occurrence of take, Auwahi Wind has initiated Tier 2 mitigation and implemented the approved bat research plan. Auwahi Wind has also begun to initiate planning for Tier 3 bat mitigation and will have a proposal to USFWS/DOFAW in the first quarter of FY 2016. Tier 3 mitigation is expected to begin in FY 2016.

2.6.3 Blackburn's Sphinx Moth Avoidance and Minimization

Although incidental take for Blackburn's sphinx moth has been accounted for at the Project, Auwahi Wind continues to implement avoidance and minimization measures. Monthly surveys continue to be conducted for Blackburn's sphinx moth and manual removal of tree tobacco (*Nicotiana glauca*) is completed in addition to translocating any Blackburn's sphinx moth larvae and eggs found on host plants at the Project (USFWS/DOFAW email instructions February 7, 2014). Areas within 33 feet of roadsides and edges of turbine pads are targeted because they may present a hazard for the moth, due to exposure to dust, possible trampling and increased chance of collisions with vehicles. Over 169 plants were removed from the Project in FY 2015. Fifty-six larva and seven eggs were detected during visual surveys of tree tobacco in FY 2015. All eggs and larvae found were relocated following USFWS/DOFAW protocols.

3.0 Mitigation

3.1 Hawaiian Petrel Mitigation

Results from the 2014 petrel breeding season are summarized below. The 2014 Petrel Monitoring Report provides additional detail for the 2014 results and is included as Attachment 2. In February 2014, full implementation of the predator control strategy was applied across Kahikinui Petrel Management Area (Kahikinui). This included a predator assessment using tracking tunnels, grid spaced traps targeting areas

within a 200 meter (656 feet) buffer of Hawaiian petrel nesting burrows, and deployment of nineteen game cameras to monitor burrows for feral cat or other predator detections. Results of the 2015 breeding season and predator control will be included in the 2015 Petrel Monitoring Report and will be summarized in the 2016 annual report.

3.1.1 Petrel Burrow Monitoring

Petrel burrows within Kahikinui continued to be monitored during the 2014 breeding season to obtain an estimate of the number of active petrel burrows and reproductive (fledging) success. As in previous years, monitoring protocol follows methods used by the NPS (NPS 2012). Burrows were checked a minimum of once a month March –June, and every other week during the chick rearing and fledgling period, July –mid-November. All burrows were monitored during each check March – July; after July only active burrows were monitored. New burrows located in 2014 were marked, mapped, and added to the monitoring dataset. In the 2014 breeding season 63 petrel burrows were monitored, 39 showed signs of activity some time during the breeding season. Consistent activity through the breeding season was seen at 29 burrows. By the end of the breeding season 6 burrows had successfully fledged a chick. The number of burrows known to have fledged a chick/number of active burrows within the management area was 21 percent. We cannot confirm that all active nests were occupied by breeding birds, according to Simons (1985) 66 – 75% of the Hawaiian petrel burrows he determined to be active contained eggs. The percentage of chicks fledged/eggs laid within the management area was 21 – 75 percent. The range represents the difference between using only those nests with known fates versus including all potentially active nests (i.e., burrows classified as failed or occupied by a non-breeder). We were able to determine the known fates of eight burrows, six successfully fledged and two failed during the egg laying stage.

3.1.2 Predator Control

Auwahi Wind worked with Island Conservation and Tetra Tech to develop a predator control strategy for Kahikinui based on site-specific conditions and Island Conservation's expertise. The 2013 Petrel Monitoring Report, summarizes in detail the results of the initial phased approach to predator control in the 2013 breeding season. Using site- and trap-specific data on predator presence, activity and other logistic factors, Auwahi Wind was able to determine the most effective methods of predator control to be used at Kahikinui in the 2014 breeding season.

In the 2014 breeding season, Auwahi Wind continued to deploy tracking tunnels to assess rat and mongoose activity across the entire Kahikinui management area (324 Hectares) at the start and halfway through the season. A total of 138 traps were deployed across Kahikinui March – November 2014. All traps were checked and baited every two weeks. Baits were alternated between trap checks. All trap types were successful at removing predators. Traps were deployed for a total of 36 weeks. Trapping efforts over this time were able to remove 161 predators, including mongoose, Polynesian rat (*Rattus exulans*), black rat, and house mouse (*Mus musculus*). The 2014 Petrel Monitoring Report, summarizing in detail the results for 2014 predator control and is included in Attachment 2.

3.1.3 Benefits

To date, Auwahi Wind has measured baseline reproductive success of Hawaiian petrels within Kahikinui for the past three years as well as baseline predator activity levels for the past two years. Auwahi Wind is committed to predator control for the life of the Project, this should have a positive effect on the reproductive success of Hawaiian petrels not only within Kahikinui but possible have spillover effects in areas managed by NPS and the National Science Foundation - DKIST. Ongoing monitoring continues to benefit

the petrel colony by providing new information on the extent of the colony, reproductive success, and fledging activity which was previously unknown. Over the course of three years of continued monitoring, nine new burrows have been located, adding to the originally 54 burrows located with extensive surveys in 2012. Deployment of Reconyx cameras have given the scientific community unique insight into the activity and exact fledging dates of Hawaiian petrels within the East Maui population.

3.2 Hawaiian Hoary Bat Mitigation

Implementation of Tier 1 and Tier 2 bat mitigation is on-going at the Waihou Mitigation Area, located on Uluplalakua Ranch. Tier 1 mitigation consists of the restoration of native forest on approximately 130 acres of pastureland in the Waihou Mitigation Area (including installation of an ungulate proof fence, ungulate removal and native reforestation). This parcel was placed into a conservation easement held by the Hawaiian Islands Land Trust on December 18, 2012, and will be protected in perpetuity. Tier 2 mitigation consists of funding Hawaiian hoary bat research to contribute to the overall knowledge of the Hawaiian hoary bat on Maui.

Auwahi Wind has also installed two ground-based detectors (Wildlife Acoustics SM2-XBat) at the Project site to collect acoustic data for the first two years of operation.

3.2.1 Tier 1 Mitigation

The Puu Makua site is in its second year of restoration efforts. The installed 2.4 meter (8 feet) tall fence surrounding the 53-Hectare (130 acre) parcel, continues to be inspected and maintained ungulate free. Fence checks are conducted quarterly to ensure the integrity of the fence and detect any possible incursion. Biannual sweeps of the entire site are continued by Hawaii Vegetation Control, for the removal of invasive species including tropical ash (*Fraxinus uhdei*), bocconia (*Bocconia frutescens*), black wattle (*Acacia mearnsii*), and Monterey pine (*Pinus radiata*). Invasive species sweeps took place over the course of one week in August 2014 and February 2015; the next scheduled sweep is September 2015.

Auwahi Wind completed its first phase of native tree out plantings in spring 2015. A total of 19 acres were out planted in open pasture. Seven planting areas, between .25 – 2 Hectare (0.5 – 4.5 acres), were prepped with a weed trimmer and treated with herbicide prior to planting. Plants were spaced between 2-4m apart. Plants out planted this spring were predominately koa (*Acacia koa*), 'ohia lehua (*Metrosideros polymorpha*), a'a'ali'i (*Dodonea viscosa*), and pilo (*Coprosma foliosa)*. The current success rate of planted areas after 90 days has ranged between 93 – 99%. Native Nursery continues to grow a mix of native tree and shrub species collected from seed stock within the Puu Makua parcel and surrounding areas. We plan to have an additional 6 Hectares (15 acres) planted in the fall of 2015.

In February 2015, Auwahi Wind conducted its annual baseline vegetation monitoring, with the objective of establishing conditions prior to planting and other management activities. Baseline monitoring was conducted using line-intercept and plot based sampling along with permanent photo points (Tetra Tech 2014). Results of baseline monitoring will be compared to interim success criteria periodically after plantings are installed to track progress towards achieving long-term HCP success criteria.

3.2.2 Tier 2 Mitigation

Auwahi Wind worked with Tetra Tech and Dr. Frank Bonaccorso from the U.S. Geological Survey (USGS) to develop a research project combining radio telemetry and acoustic monitoring. The goal of this study is to contribute to the knowledge of the Hawaiian hoary bat on Maui and also to track the success of restoration

efforts in the Waihou Mitigation Area. The final research plan was approved by USFWS/DOFAW in March 2014 (Auwahi Wind HCP Annual Report FY 2014, Attachment 3).

Auwahi Wind began implementing the approved research plan in March of 2015. The first phase of implementation includes acoustic monitoring, used to establish a baseline of seasonal occupancy for bats within the mitigation area and to focus subsequent mist-netting and radio-telemetry efforts. In March of 2015, six acoustic detectors were deployed within the Puu Makua parcel and surrounding Waihou mitigation area. Monitoring will be conducted for a period of approximately one year. Acoustic data collection cards were rotated in June 2015. Research objectives completed in FY 2015 are summarized by USGS in Attachment 3.

3.2.3 Tier 3 Mitigation

Auwahi Wind has also begun to initiate planning for Tier 3 bat mitigation and will have a proposal to USFWS/DOFAW in the first quarter of FY 2016. Following guidance within the HCP (Auwahi Wind HCP, Section 6.2.3) and the Hawaii Endangered Species Recovery Committee (DOFAW Bat Workshop, April 14-15th, 2015), Auwahi Wind is pursuing a mitigation proposal that expands on research currently being conducted as Tier 2 mitigation. Tier 3 mitigation is expected to begin the third quarter of FY 2016.

3.2.4 Acoustic Monitoring

In July of 2013, two ground-based, solar powered, acoustic monitors (Wildlife Acoustics SM2Bat+) were placed within the Project area at WTG 1 and WTG 6. Units were placed on water containment units, 2- 2.5 meters (6 – 8 feet) above the ground. Settings for the units followed the recommendations of the USGS bat research team from the Kilauea Field Station, Hawaii (Auwahi Wind HCP Annual Report FY 2014, Section 3.2). Tetra Tech was contracted to review files collected and process vocalization data. A bat pass was defined as a call file containing one or more call pulses. When Tetra Tech detected multiple call files recorded in close, temporal succession, they were combined into a single bat pass for analysis. Survey efforts are presented as detector nights, which is defined as one detector unit operating for one complete night

Summary data provided in Table 3-1 includes the total number of bat passes, per unit, in the second year of data collection. A total of 160 bat passes, contained within 77 nights, were detected at the Project in FY 2015. This is double the number of nights bats were detected in FY 2014 (29 nights). Detector one, located near turbine 6, had five times the detection rate of detector two, located at near turbine 1, in FY 2015.

Table 3-1. Summary data for the two Wildlife Acoustic SM2Bat+ units at the Auwahi Wind Project, FY 15.

Detector ID	Deployment Dates	Detector Nights	Bat Passes	Total Detection Rate (detections/detector night)
1	7/1/2014 - 6/30/15	365	133	0.3644
2	7/1/2014 - 6/30/15	365	27	0.0740

Acoustic activity was observed at the site between 17:00 – 07:00 hours. A major peak in activity, from pooled results of both detectors in two years of monitoring, occurred between 19:00 – 01:00 (Figure 3). There was an unusually high number of bat passes at detector one on September 14, 2014, forty passes occurred between 21:11 – 23:09. These passes most likely do not represent 40 individual bats. With the current acoustic monitoring technology it is not possible to determine if multiple bat passes represent multiple bats or a single bat making multiple passes.

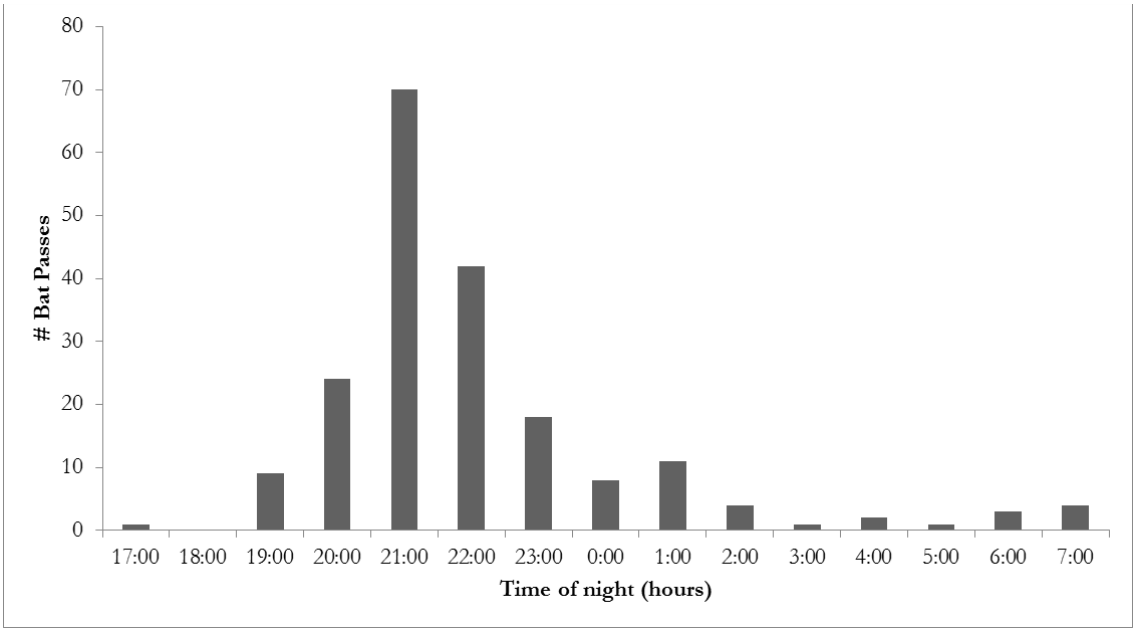

Figure 3. Timing of nightly bat passes at Auwahi Wind Project, combining both Wildlife Acoustic SM2Bat+ units 2013 -2015.

Monthly detection rates, combining both detectors indicate the highest rates of detection occurring August – November in FY 2015 (Figure 4), peaking in September. There is some overlap with peak activity in FY 2014 that was concentrated June –October, although overall activity was much lower. The bat acoustic activity at the Project shows similar trends to numerous projects across the Hawaiian Islands, including a five year study conducted on the island of Hawaii (Gorressen et al. 2013) and a recent study conducted at Kaloko-Honokōhau National Park, also on the island of Hawaii (Pinzari et al. 2014). Both studies observed highest detection in September. The peak August/September activity is composed of the bat fledging period, considered the annual maximum of the population (F. Bonaccorso, personal observation).

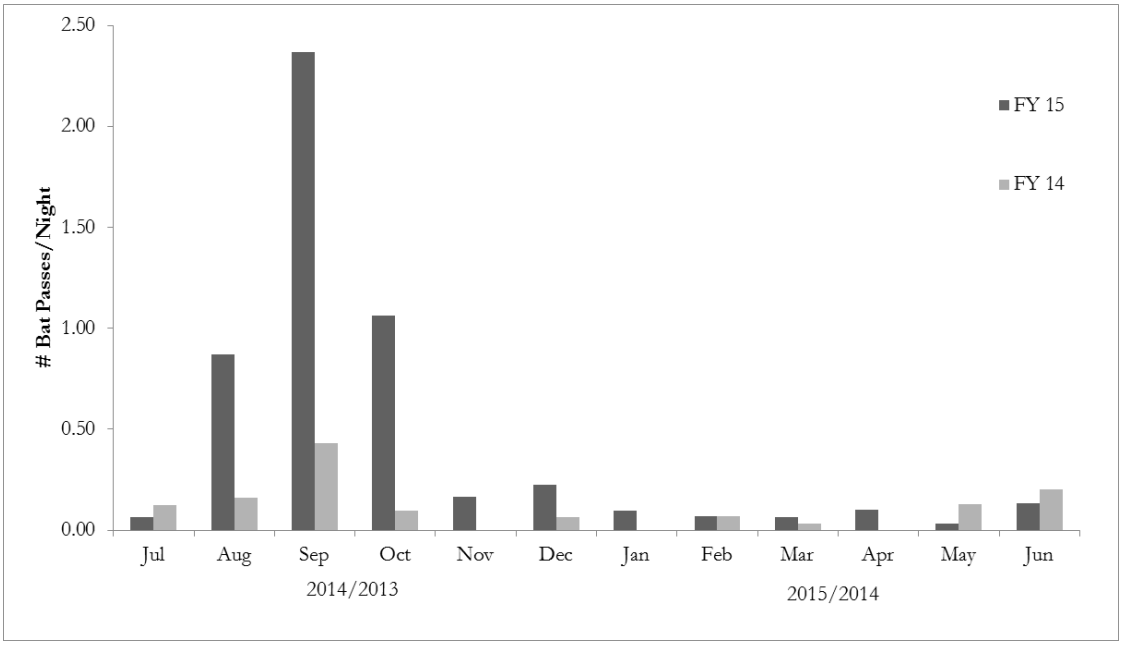

Figure 4. Monthly detection rates, combining both Wildlife Acoustic SM2Bat+ units at the Auwahi Wind Project 2013 -2015.

3.2.5 Benefits

Completion of the fence, removal of ungulates, and habitat restoration will benefit the Hawaiian hoary bat through the creation and protection of roosting and foraging habitat. Acoustic monitoring at the Project provides site specific information on activity patterns and could be used in conjunction with other monitoring projects to acquire an island wide understanding of Hawaiian hoary bat activity on Maui.

3.3 Blackburn's Sphinx Moth

As stated in the 2012 annual report, Auwahi Wind developed an MOU and made a one-time payment of $144,000 to the Leeward Haleakala Watershed Restoration Partnership (LHWRP) on April 17, 2012, to restore 6 acres of dryland forest at the Auwahi Forest Restoration Project. A letter from the LHWRP providing an update on use of funding during FY 2015 is provided in Attachment 4. A total of 788 of the proposed 1500 'aiea (*Nothocestrum latifolium*) have been out planted into 4.5 Hectares (11 acres). An additional 200 seedlings are growing at the nursery and are expected to be planted in the Fall of 2015. LHWRP is committed to fulfilling their MOU obligations over the next two years.

4.0 Changed or Unforseen Circumstances

The Project has seen higher than expected take of the Hawaiian hoary bat at its facility in the first 2.5 years of operations. On February 25, 2015, Auwahi Wind met with USFWS/ DOFAW to discuss its pursuit of a major amendment to their joint ITL/ITP. The proposed major amendment will exclusively be limited to address take of the federally listed Hawaiian hoary bat, incidental to activities associated with the operation, maintenance, and decommissioning of the Project. The amendment process is currently under way and expected to be finalized 2016.

5.0 Annual Workplan and Schedule

A work plan for FY 2016 is provided in Attachment 5 that identifies major monitoring and mitigation activities and their associated timelines.

6.0 Cost Expenditures and Budget

A summary of HCP-related expenditures for FY 2015 is provided in Attachment 6. This summary lists costs (including staff labor) that Auwahi Wind has expended toward fulfilling the terms of the HCP in in FY 2015, as well as cumulatively, and compares them against the budgeted amounts specified in Appendix 8 of the HCP.

7.0 References

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Attachment 1
Evidence of Absence Software Outputs – Fatality Estimation

Attachment 2
Kahikinui Management Area Hawaiian Petrel Monitoring Report

Attachment 3
Hawaiian Hoary Bat Tier 2 Mitigation

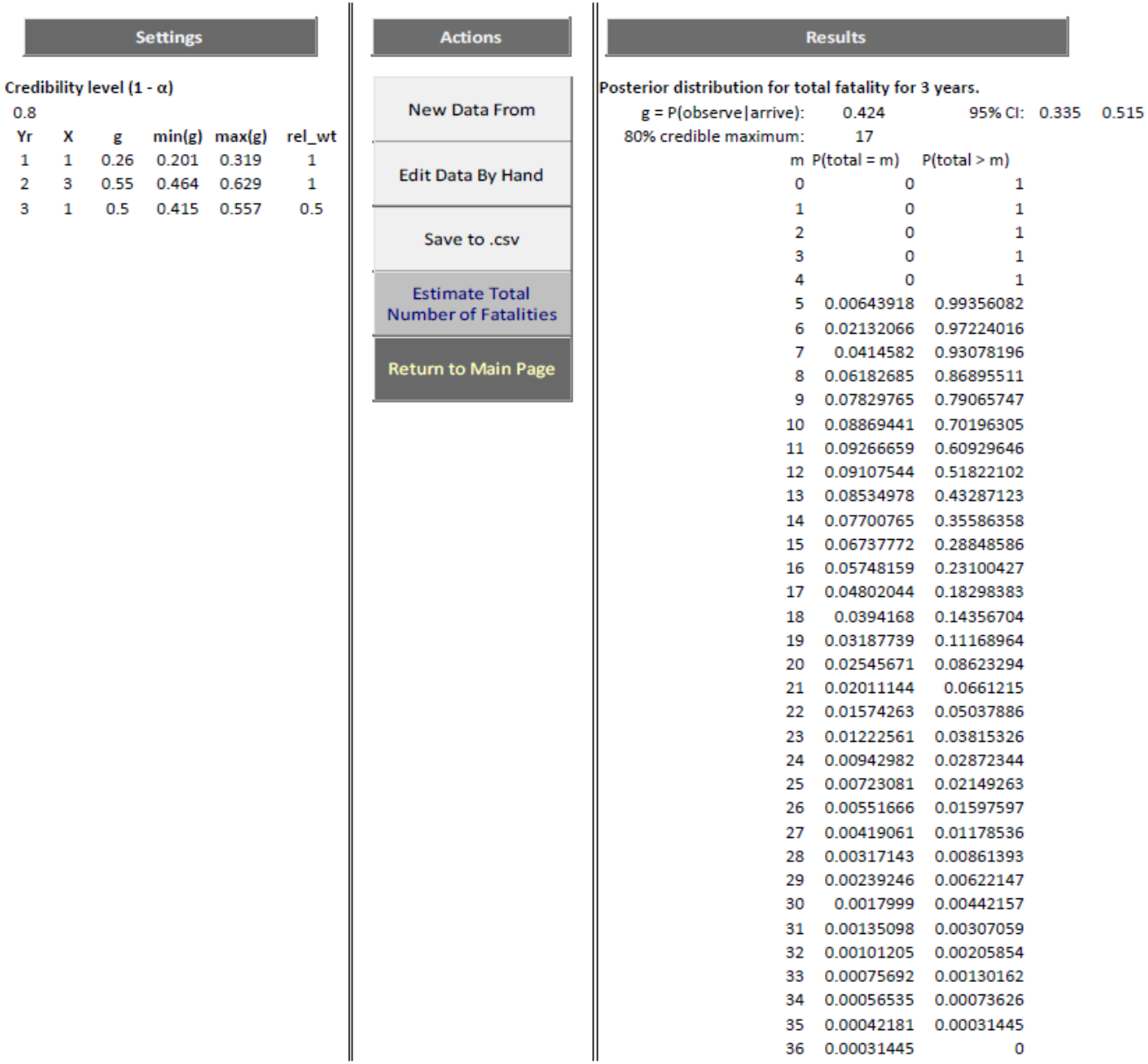
Attachment 4

Status Update from the Leeward Haleakala Watershed Restoration Partnership on Use of Funds for Blackburn's Sphinx Moth Mitigation

Attachment 5
FY 2016 Annual Work Plan and Timeline

Attachment 6
FY 2015 Expenditures for HCP Implementation

Attachment 1- Evidence of Absence Software Outputs – Fatality Estimation



Settings

Credibility level (1 - α)

0.8

Yr	X	g	min(g)	max(g)	rel_wt
1	1	0.26	0.201	0.319	1
2	3	0.55	0.464	0.629	1
3	1	0.5	0.415	0.557	0.5

Actions

New Data From

Edit Data By Hand

Save to .csv

Estimate Total Number of Fatalities

Return to Main Page

Results

Posterior distribution for total fatality for 3 years.

g = P(observe|arrive): 0.424 95% CI: 0.335 0.515

80% credible maximum: 17

m	P(total = m)	P(total > m)
0	0	1
1	0	1
2	0	1
3	0	1
4	0	1
5	0.00643918	0.99356082
6	0.02132066	0.97224016
7	0.0414582	0.93078196
8	0.06182685	0.86895511
9	0.07829765	0.79065747
10	0.08869441	0.70196305
11	0.09266659	0.60929646
12	0.09107544	0.51822102
13	0.08534978	0.43287123
14	0.07700765	0.35586358
15	0.06737772	0.28848586
16	0.05748159	0.23100427
17	0.04802044	0.18298383
18	0.0394168	0.14356704
19	0.03187739	0.11168964
20	0.02545671	0.08623294
21	0.02011144	0.0661215
22	0.01574263	0.05037886
23	0.01222561	0.03815326
24	0.00942982	0.02872344
25	0.00723081	0.02149263
26	0.00551666	0.01597597
27	0.00419061	0.01178536
28	0.00317143	0.00861393
29	0.00239246	0.00622147
30	0.0017999	0.00442157
31	0.00135098	0.00307059
32	0.00101205	0.00205854
33	0.00075692	0.00130162
34	0.00056535	0.00073626
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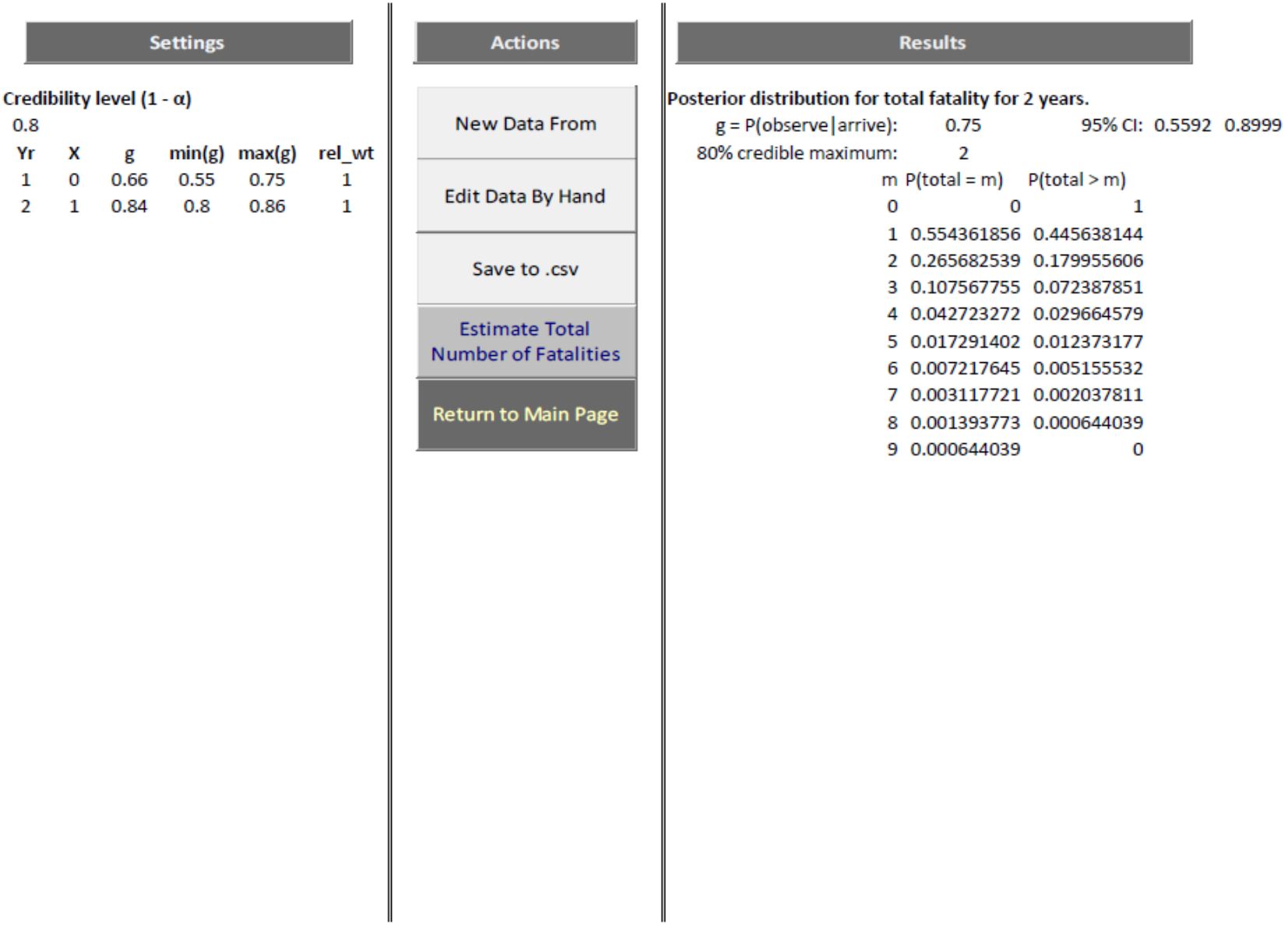
Figure 1. Evidence of Absence software output for Hawaiian Hoary Bats(EoA; Dalthorp et al. 2014).



Settings

Credibility level (1 - α)

0.8

Yr	X	g	min(g)	max(g)	rel_wt
1	0	0.66	0.55	0.75	1
2	1	0.84	0.8	0.86	1

Actions

New Data From

Edit Data By Hand

Save to .csv

Estimate Total Number of Fatalities

Return to Main Page

Results

Posterior distribution for total fatality for 2 years.

g = P(observe|arrive): 0.75 95% CI: 0.5592 0.8999

80% credible maximum: 2

m	P(total = m)	P(total > m)
0	0	1
1	0.554361856	0.445638144
2	0.265682539	0.179955606
3	0.107567755	0.072387851
4	0.042723272	0.029664579
5	0.017291402	0.012373177
6	0.007217645	0.005155532
7	0.003117721	0.002037811
8	0.001393773	0.000644039
9	0.000644039	0

Figure 2. Evidence of Absence software output for Hawaiian Petrels(EoA; Dalthorp et al. 2014).

Auwahi Wind Energy Project

2014 Auwahi Wind Energy Hawaiian Petrel Report

Kahikinui Management Area

Prepared by:

Auwahi Wind Energy, LLC
101 Ash Street, HQ 08B
San Diego, CA 92101-3017

August 2015

EXECUTIVE SUMMARY

In December 2012, Auwahi Wind Energy, LLC (Auwahi Wind) constructed and began commercial operations of the 8-turbine, 21-megawatt Auwahi Wind Farm (the Project) in east Maui, Hawaii. To address potential endangered species impacts associated with the Project, Auwahi Wind developed a Habitat Conservation Plan (HCP), which was finalized in January 2012. Based on the anticipated take levels provided in the HCP, Auwahi Wind obtained an incidental take license (ITL) from the Hawaii Department of Land and Natural Resources (DLNR) on February 9, 2012 and an incidental take permit (ITP) from U.S. Fish and Wildlife Service (USFWS) on February 24, 2012. To address the requirements under the HCP for Hawaiian petrels (*Pterodroma sandwichensis*), this report summarizes the 2014 Hawaiian petrel management activities executed in the Auwahi Wind Kahikinui petrel management area (Kahikinui).

As proposed in the HCP, take and mitigation are accounted for in tiers such that each tier has a higher take level and a correspondingly higher level of mitigation. For the initial tier (Tier 1), Auwahi Wind will mitigate potential impacts to petrels by implementing predator control within Kahikinui to increase the survival and reproductive success of Hawaiian petrels. Tier 1 mitigation requires predator control at 33 active burrows (see the HCP for additional details).

Several objectives were identified for the 2014 petrel management season. These objectives included 1) conduct a comprehensive predator assessment across Kahikinui prior to implementation of predator control (February). 2) Implement a full predator control strategy beginning in March. 3) Conduct routine petrel burrow monitoring to assess the number of active petrel burrows. 4) Determine reproductive success within the first year of implementing full predator control.

A total of 63 burrows were monitored within Kahikinui in 2014 (59 initially located prior to the 2014 season and 4 burrows located during 2014 surveys). Thirty-nine (62 percent) of the burrows showed signs of activity at some point during the breeding season and 24 burrows (38 percent) were inactive in 2014. Eggs were verified, using reproductive sign (egg shell, abandoned egg, chick down), to be laid in 8 of the active burrows. Reproductive success ranged between 21-75 percent. Nineteen game cameras were rotated between active burrows throughout the season to collect supplemental information on burrow activity.

Tracking tunnels were used to monitor the presence and distribution of small mammals (rodents and mongooses) within Kahikinui in February, prior to implementing predator control, and again in August/September, halfway through the trapping season. A one-day index was used for rodents and a three-day index for mongooses. The one-day tracking

index for rodents was calculated at 13.9 percent in February and increased slightly in to 15.8 percent in August. The three-day mongoose tracking index was calculated at 31.9 percent in February and decreased significantly to 5.0 percent in September. These results point to a decrease in mongoose activity as the trapping season progressed.

A full predator control strategy (Island Conservation and Tetra Tech 2013) consisting of traps targeting feral cats, mongoose and rats was initiated in March 2014 and implemented through November 2014. Control efforts were focused within a 200 meter buffer of the known petrel burrows, dividing Kahikinui into four main management units. The predator control grid was operational for 36 weeks for a total of 36,278 trap nights. Predator control removed 161 predators from Kahikinui. The catch per unit of effort (CPUE) for the season for all trap types combined was 0.44 percent.

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1. INTRODUCTION

1.1 BACKGROUND

In December 2012, Auwahi Wind Energy, LLC (Auwahi Wind) began commercial operations of the 8-turbine, 21-megawatt Auwahi Wind Farm (the Project) in east Maui, Hawaii. To address potential endangered species impacts associated with the Project, Auwahi Wind developed a Habitat Conservation Plan (HCP), which was finalized in January 2012 (Tetra Tech 2012a). Based on the anticipated take levels provided in the HCP, Auwahi Wind obtained an incidental take license (ITL) from the Hawaii Department of Land and Natural Resources (DLNR) on February 9, 2012 and an incidental take permit (ITP) from the U.S. Fish and Wildlife Service (USFWS) on February 24, 2012. To address the reporting requirements under the HCP for Hawaiian petrels (*Pterodroma sandwichensis*), here after "petrels", this report summarizes the 2014 petrel management activities executed in the Auwahi Wind Kahikinui Petrel Management Area (Kahikinui).

As proposed in the Auwahi Wind HCP, take and mitigation are accounted for in tiers such that each tier has a higher take level and a correspondingly higher level of mitigation. For the initial tier (Tier 1), Auwahi Wind will mitigate potential impacts to petrels by implementing predator control within Kahikinui to increase the survival and reproductive success of Hawaiian Petrels. Tier 1 mitigation requires predator control at 33 active burrows (see the HCP for additional details). Petrel management activities will be considered successful if predator control is implemented and mitigation efforts result in an increase in reproduction that offsets authorized take, as outlined in the Hawaiian Petrel Management Plan (Management Plan; Tetra Tech 2012b), approved by USFWS and the DLNR/Division of Fish and Wildlife (DOFAW).

In September 2013 Auwahi Wind initiated a pilot predator control program within the upper portion of Kahikinui, where the densest proportions of petrel burrows are located. The pilot predator control in the first year targeted mammalian predators including feral cats (*Felis catus*), mongoose (*Herpestes javanicus*), and rodents (predominantly black roof rats (*Rattus rattus*), Polynesian rats (*Rattus exulans*) and the common mouse (*Mus musculus*)). Lessons learned in the 2013 pilot predator control guided future placement of traps and types of baits used in the 2014 trapping season. In 2014, the full predator control strategy, developed in partnership with Tetra Tech and Island Conservation for Kahikinui (Island Conservation and Tetra Tech 2013) was implemented. This strategy continues to focuses on predator control of feral cats, mongooses and rats and expands efforts out into the all of Kahikinui.

1.2 KAHIKINUI

Kahikinui is located on the Department of Hawaiian Homelands (DHHL) portion of the Kahikinui Forest Reserve (Figure 1). The management area consists of approximately 356 hectares (ha) with petrel burrows scattered throughout. A 25-year License Agreement (License No. 772) was approved by the DHHL Commission on April 23, 2012, identifying Auwahi Wind as the responsible party for the management area within Kahikinui Forest Reserve. Petrel surveys were conducted in 2011 and 2012 by Tetra Tech, Inc. (Tetra Tech), to locate active burrows within the management area. Survey methods and results were outlined in the 2012 Hawaiian Petrel Report (HCP Annual Report FY13, Attachment 4)

Kahikinui is located on a south facing slope along the southwestern flank of Mount Haleakala. The elevation within Kahikinui ranges from 2,560 - 2,972 meters (m) above sea level. The area is subject to rapidly changing weather conditions and fluctuating temperatures. There are no roads or trails, the terrain is rocky, and the substrate varies from volcanic cinder to large rock outcrops, including numerous gullies. The slopes are very rugged and steep in some sections and are often consist of loose, sharp rock. A large cinder field occurs in the center Kahikinui. Vegetation is denser at the lower elevations than the higher elevations and consists mostly of native shrubs, primarily pukiawe (*Styphelia tameiameiae)* and ohelo (*Vaccinium reticulatum*).

1.3 OBJECTIVES OF 2014

The objectives of the 2014 management season were to continue petrel burrow monitoring to assess the number of active burrows in Kahikinui, determine petrel reproductive success, and begin implementation of the full predator control strategy. These objectives were met using four main components:

1. Burrow checks conducted at known burrows to obtain an estimate of the number of active burrows and their reproductive success.

2. Deployment of 19 game cameras at active burrows to further document activity of petrels and any predation events.

3. A comprehensive predator assessment conducted across Kahikinui prior to implementation of predator control (February) and in August/September (halfway through the year), using 1-day and 3-day tracking tunnel indexes for rodents and mongooses, respectively.

4. Initiation of full predator control strategy that included the deployment of 140 traps, while continuing to evaluate trap effectiveness and placement

2. METHODS

2.1 BURROW ACTIVITY AND REPRODUCTIVE SUCCESS

In the 2014 breeding season a total of 63 burrows were monitored within Kahikinui (59 initially located prior to the 2014 season and 4 burrows located during 2014 surveys). Burrows were monitored March 20 - November 10, 2014, at that time all of the burrows had ceased to be active. Burrow checks were conducted monthly from March to July 2014 and then bi-monthly during the chick rearing and fledgling period, from August to November 2014. During each survey, surveyors checked the status of known petrel burrows and opportunistically searched nearby suitable habitat for additional burrows. Any new burrows located in 2014 were marked, mapped, and added to the monitoring dataset. All known burrows were monitored during each check through July, after which only active burrows were monitored. Burrows were monitored following methods used by the Haleakala National Park Service (NPS 2012, HCP Annual Report FY13, Attachment 4). At the end of the breeding season, burrows were classified into one of five categories (Table 1) of seasonal status based on of the activity pattern observed during the monthly and bi-monthly burrow checks. The seasonal status of the burrow determined if it was included in the reproductive success calculations, seasonally inactive burrows were not included in any of the calculations.

Two metrics of reproductive success were utilized to allow for direct comparisons between previous monitoring years and other local petrel studies:

Chicks Fledged/Active Burrow—The percent of chicks fledged was the sum of the Successful Burrows and the Probably Successful Burrows divided by the number of burrows still active during the egg-laying season (July). This estimate assumes that each Successful and Probably Successful Burrow fledged one young.

Chicks Fledged /Egg Laid—The percent of chicks fledged was the sum of the Successful Burrows and the Probably Successful Burrows, and divided by the number of burrows with eggs laid. This estimate assumes a maximum of one egg or fledgling per burrow. For eggs laid, a range in values was used because the nest chambers could not be seen. The low end of the range for eggs laid included only those burrows where egg laying was confirmed (e.g., Failed, Probably Successful, and Successful burrows). The high end of the range for eggs laid included all burrows still active during the egg-laying season, which could possibly include those burrows Occupied by a Non-Breeder later in the season.

The trend in the total number of active burrows and reproductive success between the three years of monitoring (2012 - 2014) was investigated using a chi-square test. The number of chicks fledged to eggs laid, using the high end of the range (assuming all active burrows during the egg laying season have an egg) was used to compare reproductive

success across the three monitoring seasons. In 2013 and 2014 Auwahi was able to monitor reproductive success for the entire season (the 2012 monitoring season began in June/July). For both the 2013 and 2014 seasons, burrows that showed consistent activity throughout the start of the season (March – July) were included in calculations of reproductive success. Burrows that showed only prospecting behaviors (visiting burrow only one or two times) were excluded from the reproductive success calculations. A chi-square test was used to investigate if there was a relationship between reproductive success and the implementation of predator control.

2.2 GAME CAMERA MONITORING

Nineteen Reconyx Hyperfire™ cameras were used to add more detail for burrow activity and reproductive success during the 2014 breeding season. Cameras were left at burrows until petrel activity ceased, after which, the camera was moved to another burrow with petrel sign (Figure 2). Reproductive success using only burrows monitored by cameras was also calculated for the 2014 breeding season. Reproductive success was calculated using the percentage of chicks fledged/active burrow observed on the camera.

2.3 TRACKING TUNNELS

Tracking tunnels were used to monitor the presence and distribution of small mammals (rodents and mongooses) within Kahikinui (Brown et al. 1996, Blackwell et al. 2002, Gillies and Williams 2007, Speedy et al. 2007) in February and August/September 2014. This provided an indicator of relative abundance of small mammals prior to implementing predator control and halfway through the season under active predator control. Tracking tunnel and transect spacing methodology are laid out in the Auwahi Wind Energy 2013 Hawaiian Petrel Report. The tracking tunnel grid consists of 187 permanent tracking tunnel stations (Figure 3). Small mammal relative abundance was calculated as the mean percentage of tunnels with tracks per line (Gillies and Williams 2007). A paired-sample t-test was conducted to compare the relative abundance of pre and midseason predator control. These results were used to interprete predator trapping results.

2.4 PREDATOR CONTROL

All traps were placed within a 200 meter buffer of the petrel burrows using gridded spacing (Island Conservation and Tetra Tech 2013). Eleven Belisle SuperX kill traps were spaced 250 meters apart for the control of feral cats within the southern management unit. In addition, 58 Goodnature A24 kill traps and 53 DOC250 kill traps were deployed to control mongooses across all units; although designed to control mongooses, these traps also have the ability to trap rodents. The Goodnature traps and DOC250 traps were each spaced at 150 meter intervals. Eighteen Kamate traps, designed to kill rats, were deployed in the northern management unit, each spaced 50 meters apart. All trap types were housed in wooden boxes or plastic coverings to reduce the threat of seabird bicatch.

The trapping grid was operational by February 21, 2014 (Figure 4). All traps were visually checked by Auwahi Wind technicians, every two weeks from March 3, 2014 to November 15, 2014. Baits within DOC250, Belisile SuperX, and Kamate traps were rotated every check between tuna and peanut butter. Trap nights for each trap type were calculated based on the number of traps multiplied by the number of traps set in a given night. The catch per unit effort (CPUE) was calculated for each species and trap type. The simple formula used for CPUE equalled total number of individuals captured with a trap device/ total trap nights for that trap device. CPUE was used to compare the success of different traps types and to calculate overall trapping success in way that was comparable to other trapping projects.

3. RESULTS

3.1 BURROW ACTIVITY AND REPRODUCTIVE SUCCESS

Thirty-nine (62 percent) of the burrows showed signs of activity at some point during the 2014 breeding season and 24 burrows (38 percent) were seasonally inactive. Of the 39 active burrows, 29 were consistently active (burrows still active during the egg-laying season). Six burrows (15 percent) successfully produced a fledgling, two burrows (5 percent) showed clear signs of reproduction but failed, and 31 (49 percent) either failed or were occupied by a non-breeder. The cause of nest failures/abandonment is unclear. There were no clear documented signs of depredation observed at these 31 burrows, either by the biologist monitoring the burrows or captured on game cameras stationed at the burrows.

As in the previous two years of monitoring, burrow activity remained relatively constant April through August and sharply declined at the beginning of September (Figure 5). Seventeen burrows became inactive between August 15 and September 15, 2014 surveys. Twenty-nine active burrows were used to calculate reproductive success for Kahikinui in 2014. These burrows showed consistent signs of activity throughout the breeding season. Reproductive success in 2014 was between 21 - 75 percent. Based on the survey findings, eggs were assumed to be laid in 8 to 29 of the active burrows; the range represents the difference between using only those nests with known fates versus including all consistently active nests. The percentage of chicks fledged/active burrow within the Kahikinui was 21 percent. The percentage of chicks fledged/eggs laid was 21 – 75 percent.

The number of active nests monitored in the nesting season increases each year (July), although this number consistently decreases in September and remains between 10 – 12 by the fledging season. There was no significant difference in reproductive success in the three years of monitoring (χ^2=3.12, *df* =6, *P*=0.79). There was also no significant difference in the reproductive success after one year of predator control (χ^2=.92, *df* =3, *P*=0.82).

3.2 GAME CAMERA MONITORING

Game cameras were rotated between 20 burrows. Game cameras confirmed breeding activity at 19 burrows and capture successful fledging of six chicks. The percentage of chicks fledged/active burrow observed on camera within Kahikinui was 32 percent. Successful fledging was recorded between October 13 and November 2, 2014 (Table 2). Game cameras recorded four separate instances of a feral cat investigating a burrow (Figure 2). Cat activity was only recorded during the months of October and November. There were no clear signs of depredation at any of the burrows where cats were detected (visits occurred at already inactive burrows or chicks were observed fledging later in the season). Game cameras also captured visitation by goats, chukars, rats, and mice at the entrances of both active and inactive burrows.

3.3 TRACKING TUNNELS

In February rodents were detected along five of the eight transects (Figure 3), using the one day rodent index. All rodent detections occurred in the lower elevations of Kahikinui (<2700 m), and were concentrated in in the eastern half of Kahikinui. These areas offer denser vegetation than the northern sections. The one day tracking index was 13.9 percent (mean percentage of tunnels with tracks per line) for rodents in February. Halfway through the trapping season in August, rodents were detected along all transects and there was a visible shift in activity to the mid elevations (~2800 m). There was a slight increase from 13.9 to 15.8 percent in the tracking index for rodents in the August assessment but this was not significant ($t(7)=-1.38$, $P=0.89$). These results suggest that trapping efforts were able to maintain rodent activity despite a boom in the population.

Mongooses were initially detected in February along three of the four transects, with the three day index. Detections ranged from low to mid elevation (2700 -2800 m), and were concentrated in the center and eastern portion of Kahikinui. The three day tracking index was 31.9 percent for mongoose in February. Halfway through the trapping season, in September, mongooses were detected along only one transect (5 percent). There was a significant decrease ($t(4)=2.45$, $P=0.04$) in mongoose detection in the September assessment. These results suggest that trapping efforts for mongoose did have an effect on activity levels.

3.4 PREDATOR CONTROL

The predator control strategy was initiated in March 2014, following the relative abundance study. The predator control grid was operational for 36 weeks between March and November, with a total of 36,278 trap nights (Table 3). Predator control resulted in 161 targeted mammalian predators removed from Kahikinui, which included: 85 mice, 71 rats, and 5 mongooses. No feral cats were successfully trapped in 2014. Between March and August the number of rodents removed monthly ranged between 9 - 13 individuals. Beginning in September, the monthly average spiked to 31 rodents per month. The rodent

catch activity peaked in October with 42 rodents and eventually went down to a total of 20 rodents in November (Figure 7). The combined catch per unit of effort for the season was 0.44 percent (0.012 - 0.489 percent, depending on target species and trap used). Incidental captures were documented while conducting predator trapping and included 8 chuckar chicks.

All traps were successful at removing predators from Kahikinui, with Goodnature traps removing the highest number of predators and having the highest CPUE (Table 3). DOC250 traps were the most effective at removing rats and mongoose. The Belisle Bucket appeared to be the least effective, only removing one black rat (despite rats not being a target species for this trap type).

4. DISCUSSION

4.1 REPRODUCTIVE SUCCESS

Throughout 2014, 39 burrows showed signs of activity at some point during the breeding season. By September of each year the number of active burrows drops to 10 – 12 burrows, despite higher levels of active burrows earlier in the season. According to Simons et al 1985, September is the time when most failed or non-breeders leave the colony. The increase in active burrows within the Kahikinui colony may be an example of an increase in younger/non-breeding birds investigating, while the breeding population remains relatively similar throughout the three years of monitoring.

This was the first year full implementation of predator control was in effect throughout the entire breeding season. Even though there was not a significant difference in reproductive success compared with the 2013 breeding season there was an increase in the number of active burrows recorded within Kahikinui. Auwahi Wind will continue to measure reproductive success and determine how effective predator control is at increasing reproductive success in subsequent years.

The relative low reproductive success (21 - 50 percent, percent chicks fledged/active burrows) measured at Kahikinui compared with the nearby Haleakala National Park colony (42 - 61 percent, percent chicks fledged/active burrows – Natividad and Hodges 1994), may be reflective of the lower density of burrows across Kahikinui. Hawaiian petrels are known colonial breeding seabirds. As such, there is a relationship between individual fitness and population density, this relationship has been investigated and reviewed for several colonial breeding seabirds (Brown et al. 1990, Danchin and Wagner 1997, Stokes and Boersma 2000). For seabird species that do not have severe habitat limitations and are not considered cannibalistic, fitness is predicted to increase with increased density because of improved predation avoidance, foraging efficiency, and other cooperative behaviors (Schreiber and Burger 2001). Kahikinui is representative of spill-over from the denser

petrel colony within Haleakala National Park. Petrels within Kahikinui are not receiving the full benefits of a functional colonial breeding environment. As stated above, Kahikinui may be an example of a population of younger/non-breeding birds predominately investigating this site, as seen with the mass exodus of non-breeding birds every September during monitoring.

The relative low reproductive success measured at Kahikinui compared with the nearby Haleakala National Park, may also be reflective of changes that have occurred in the last 20 years. The NPS has not published recent petrel reproductive success data so it is difficult to have a direct yearly comparison. The nearby DIKIST site, managed by the National Science Foundation, reported reproductive success 2011 – 2014 that ranged between 10 – 26 percent (H. Chen presented at 2015 HAPE coordination meeting). The range at the DISKIST site is representative of what reproductive success has looked like in Kahikinui 2012 - 2014.

In 2013 - 2014 there was a slight decrease (although not statistically significant) from the 2012 baseline reproductive success of 33 percent. Reproductive success in 2012 was calculated using the NPS standardized toothpick method. This method is still used at Kahikinui, in order to have a comparable benchmark with other projects. In 2013 and 2014 reproductive success calculations were also calculated using only game camera data. Game camera data gives the project a more refined estimate of reproductive success. Estimates of active burrows without the use of game cameras have the potential to be higher than actual active burrows due to rodents, chukars and goats knocking over toothpicks in front of the burrows (Auwahi Wind Energy 2013 Hawaiian Petrel Report). A higher number of burrows mis-counted as active can result in a low metric for reproductive success. Using a combination of game camera data and traditional monitoring techniques, projects can determine a more accurate representation of the number of active burrows and have more confidence in fledgling success. This is turn reflects a more accurate measure of reproductive success than the toothpick method alone.

4.2 PREDATOR CONTROL AND INTERPETING PREDATOR ASSESSMENTS

The spike in rodents caught in traps September – November 2014 corresponded to what was seen in the predator assessments in August. This spike in activity may be a seasonal trend or an example of a population bloom that was seen across the island of Maui in the late summer 2014 (F. Duvall personal comm.).

Both Goodnature and DOC250 traps were successful at removing five mongooses from Kahikinui in 2014. The mongoose were trapped July – November in the lower elevations and eastern portion of Kahikinui. The February predator assessment detected mongoose in these same areas. The removal of four mongooses prior to the September predator assessment was reflective of a significant decrease in mongoose activity seen in the tracking tunnels.

The four feral cat camera detections within Kahikinui were 2 - 4 km apart. On careful inspection of the photos it appears to be three different cats, although with the lower resolution camera photos it is difficult to say for sure. All detections coincided with the end of the breeding season when chicks, were preparing to fledge. Despite feral cats being detected, Auwahi Wind was unable to remove any individuals with predator control efforts in 2014. During the 2015 season Auwahi Wind will increase the number of Belisle traps and use concealed foot-hold traps during the chick fledging period to increase the chances of successful cat trapping. In November 2014, Auwahi Wind technicians spent time shadowing Haleakala NPS staff on effective use of foothold traps. The effectiveness of foot-hold traps was tested at the Auwahi Wind Farm facility, where traps could be checked daily at ease. Testing of foothold traps showed to be very effective (removing 8 feral cats over the course of one month).

In February 2015, Auwahi Wind will focus predator control in areas where burrows have been active in one of the last three years of monitoring. Concentrating predator control efforts in areas with seasonally active burrows will reduce the safety hazards associated with traveling across uneven terrain and allow for more time to set and monitor concealed foot-hold traps.

4.3 SUMMARY AND RECOMMENDATIONS FOR 2015

- Since completion of comprehensive surveys in 2012, there has been a net increase of nine active burrows within the breeding colony.
- The use of game cameras for two consecutive years has allowed Auwahi Wind to have a more definitive understanding of activity and breeding success within Kahikinui; however, game cameras cannot separate the non-breeding birds from early season failures.
- Predator assessments (tracking tunnels) throughout the predator trapping season were helpful in interpreting predator trapping results. Predator assessments will continue in the 2015 trappings season
- The full implementation of the predator control strategy was completed in 2014. Auwahi Wind was successful at trapping mammalian predators using all of the recommended traps. Future trapping efforts will be concentrated around known active burrows.
- Feral cats were detected at Kahikinui during chick fledging (October – November). Belisle traps were unsuccessful at removing feral cats in 2014. During the 2015 season Auwahi Wind will be increasing the areas and number of Belisle traps used as well as use concealed foot-hold traps during the chick fledging period.

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6. TABLES AND FIGURES

Table 1. Seasonal status of Hawaiian petrel burrows at the end of the breeding season based on visit data.

Seasonal Status	Definition
Seasonally Inactive	No toothpick disturbance or activity sign[1] during any burrow checks.
Successful	Chick fledged, indicated on a game camera, no signs of predation.
Probably Successful	Toothpick disturbance and reproductive sign[2] present at active burrow entrance in October and no sign of depredation.
Failed	Observed depredation, or reproductive sign observed but ceased before fledging period in October.
Failed/Occupied by Non-breeder	Initially signs of activity, no reproductive sign observed and activity ceased before the before October fledging.

[1] Activity sign includes; droppings, tracks, feathers, and odor

[2] Reproductive sign includes; egg, eggshell, chick down, chick

Table 2: Game camera Hawaiian petrel burrow monitoring summary, 2014

Burrow #	Camera Deployment Date	Last Date of Activity	Sucessfully Fledged
3	6/12/2014	8/24/2014	No
6	6/12/2014	10/16/2014	10/16/2014
9	6/12/2014	8/15/2014	No
15	6/12/2014	8/19/2014	No
20	6/12/2014	7/31/2014	No
22	6/12/2014	7/31/2014	No
23	6/12/2014	8/1/2014	No
25	5/15/2014	10/17/2014	10/17/2014
29	6/12/2014	7/25/2014	No
31	6/12/2014	8/19/2014	No
32	5/15/2014	7/28/2014	No
33	5/15/2014	10/16/2014	10/16/2014
34	5/15/2014	8/14/2014	No
39	6/12/2014	8/14/2014	No
42	5/15/2014	10/21/2014	10/13/2014
52	6/12/2014	11/2/2014	11/2/2014
54	6/12/2014	10/23/2014	10/23/2014
55	6/12/2014	8/10/2014	No
58	6/12/2014	8/29/2014	No
66	9/16/2014	No Activity	No Activity

Table 3: Summary of trapping results and catch per unit effort (CPUE), 2014

Trap Type	Total Traps	Trap Nights	Mongoose		Rats		Mice		Cats	
			#	CPUE	#	CPUE	#	CPUE	#	CPUE
Belisle Buckets	11	2948	0	0	1	NA	0	NA	0	0
GoodNature	58	15544	2	0.013%	32	0.206%	76	0.489%	0	NA
DOC250	53	14204	3	0.021%	37	0.260%	1	NA	0	NA
Kamate	18	3582	0	NA	0	0	8	0.223%	0	NA
TOTAL	140									

Figure 1: Auwahi Wind Kahikinui petrel management area, divided into management units

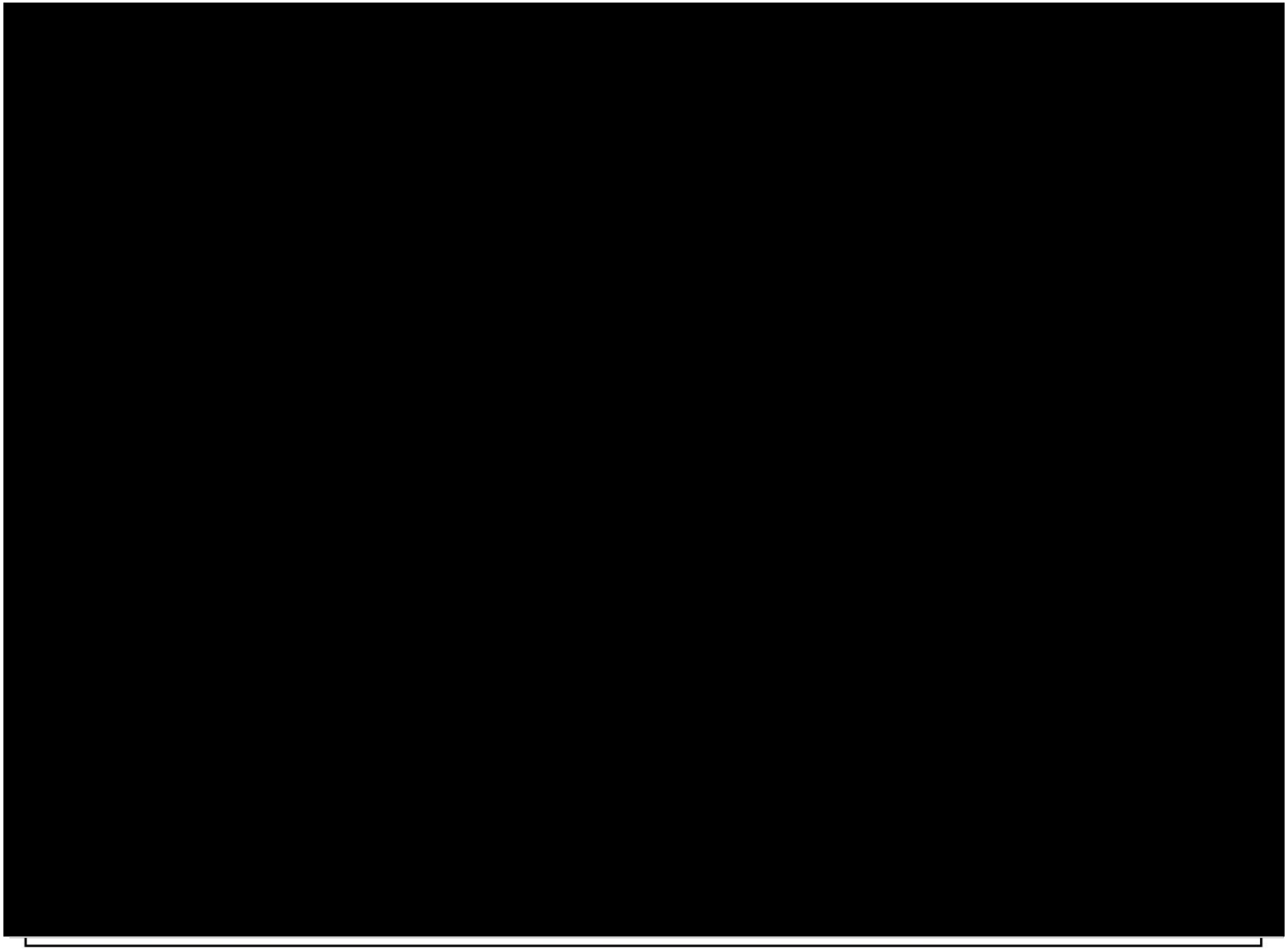

Figure 2: All petrel burrows monitored and including feral cat detections, 2014

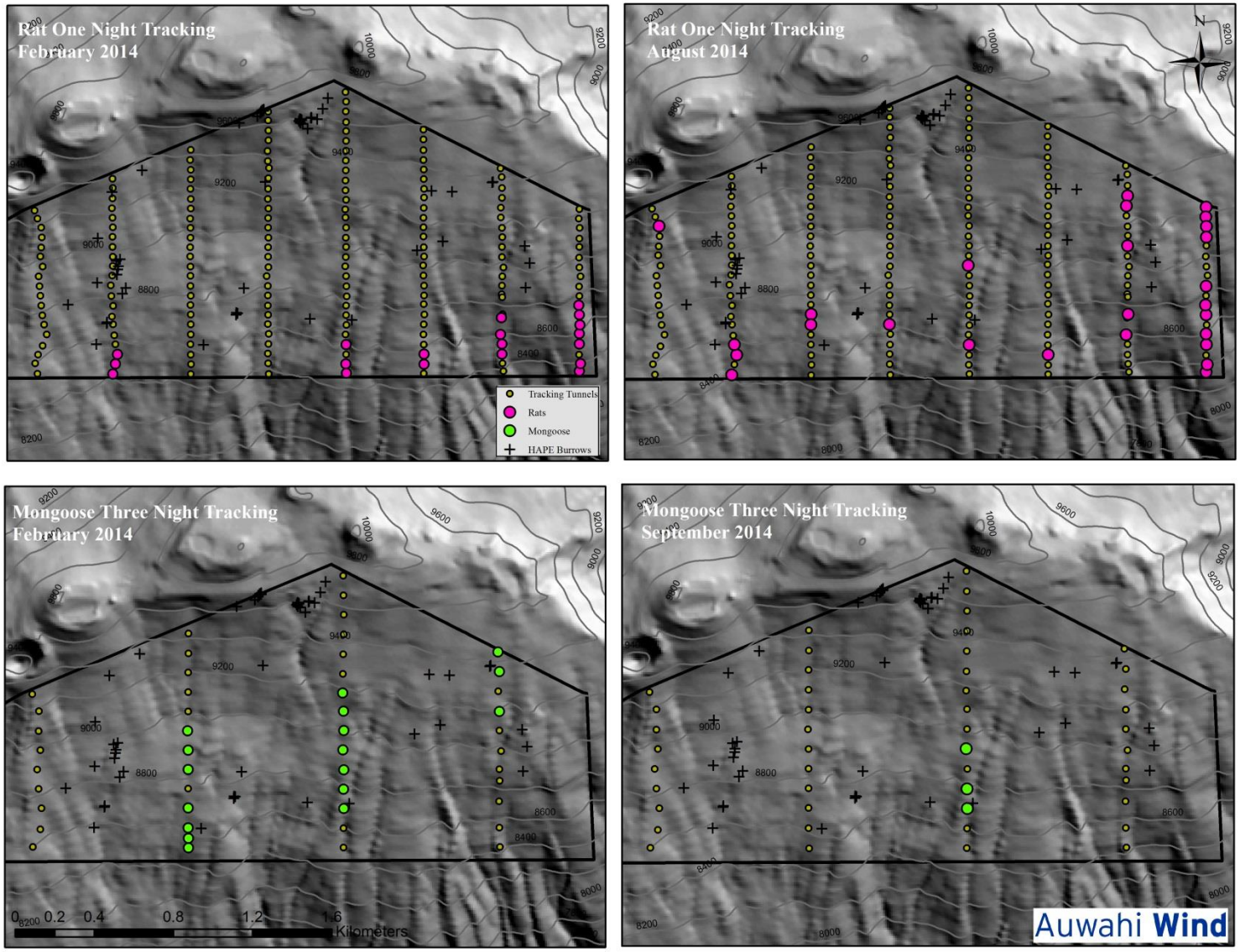

Figure 3: One/Three day tracking tunnel results Kahikinui, February and August/September 2014

Figure 4: Operational predator control grid within Kahikinui, 2014

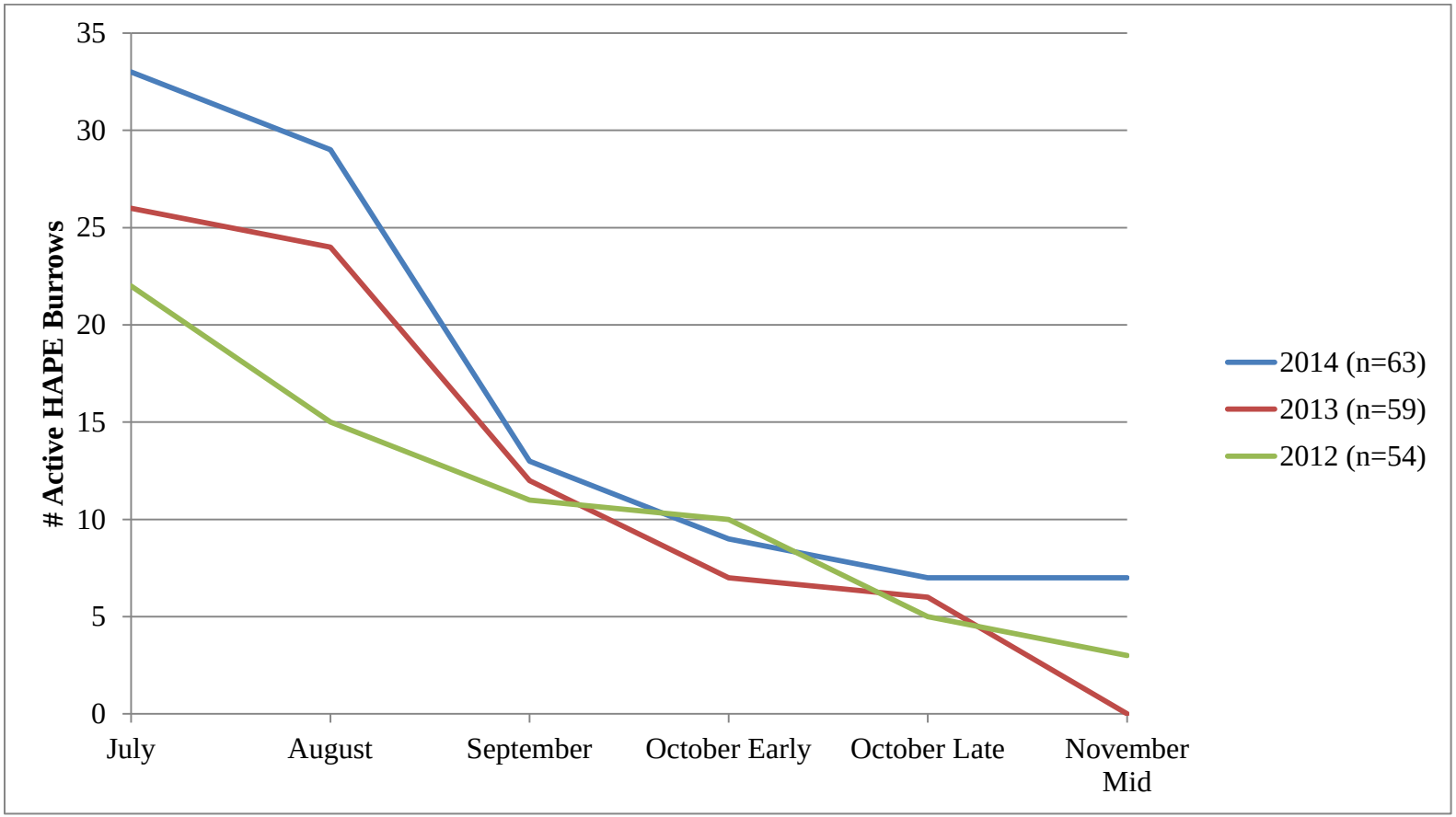

Figure 5: Seasonal petrel activity within Kahikinui, 2012 - 2014

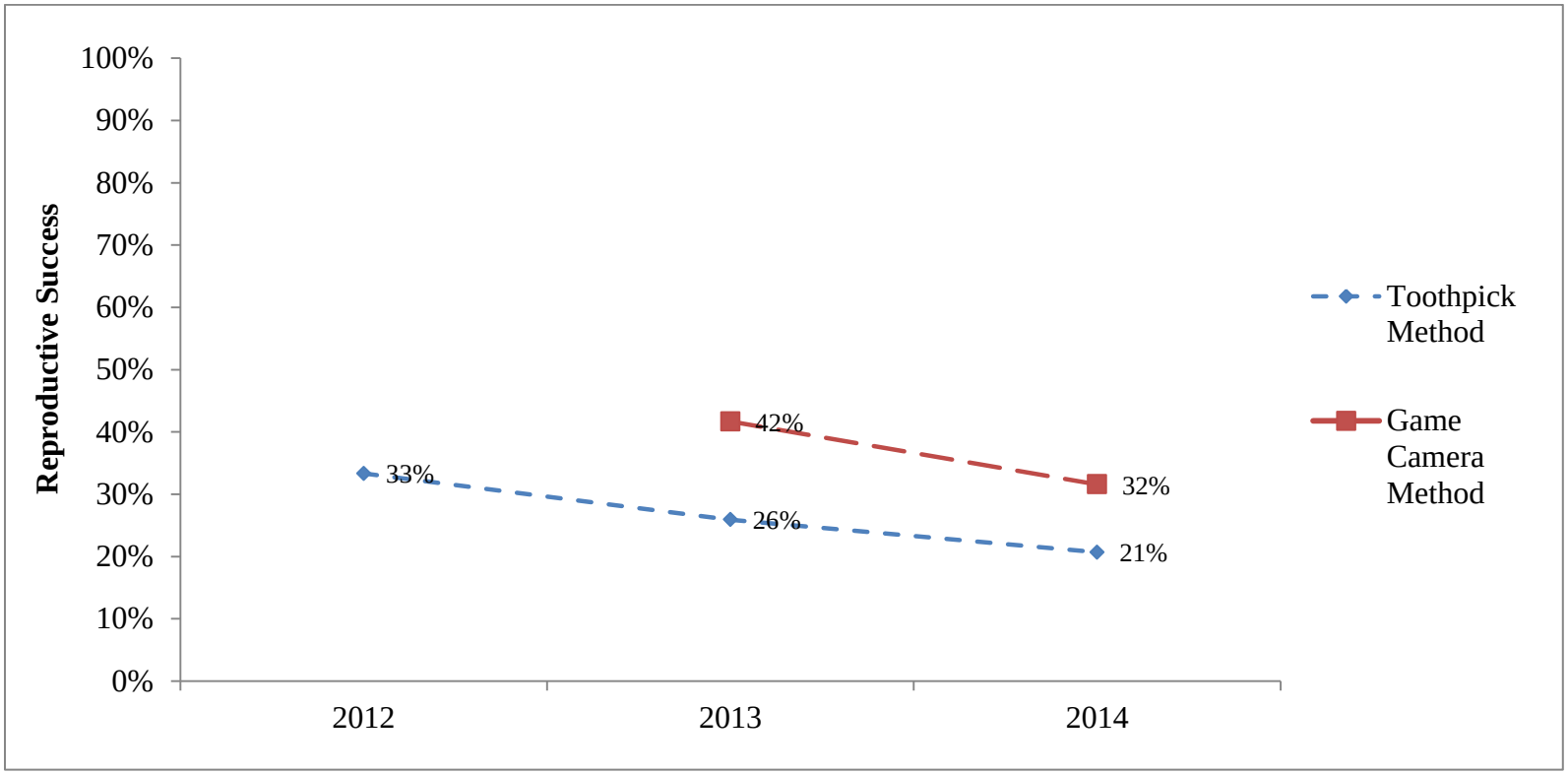

Figure 6: Reproductive success within Kahikinui, 2012-2014

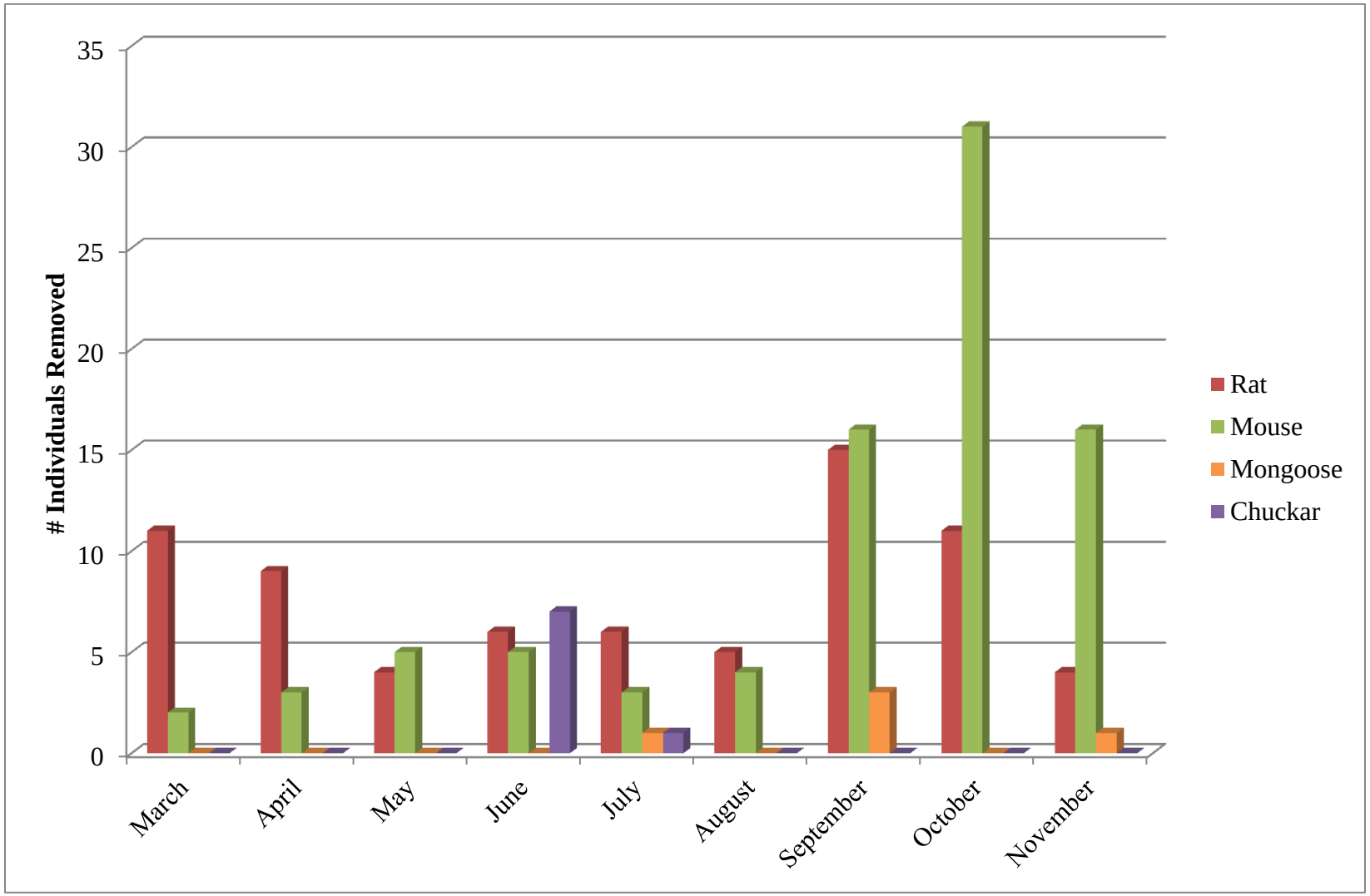

Figure 7: Monthly summary of predator trapping results, 2014

United States Department of the Interior
U.S. GEOLOGICAL SURVEY
Pacific Island Ecosystems Research Center
Inouye Regional Center
1845 Wasp Blvd, Bldg 176
Honolulu, HI 96818
808-690-9570 / Fax 808-690-9599

TAKE PRIDE IN AMERICA

July 13, 2015

Marie VanZandt
20100 Piilani Hwy
Kula, Hawaii 96790

Subject: Bill for Collection and Statement of Progress for Technical Assistance Agreement 15WSTAAZB004019

Dear Marie VanZandt,

Bill #90364212 was mailed to the following address on 7/13/15 in the amount of $8,307.98 for the Hawaiian Hoary Bat Research Plan.

Auwahi Wind Energy
c/o Sempra U.S. Gas & Power, LLC
Attn: Supply Management
488 8th Avenue, HQ10
San Diego, CA 92101

The following table provides a summary of billing for this agreement. Please process the unpaid bill for the payment as soon as possible. **Note: Invoices not paid within 30 days of receipt bear interest at the annual rate established by the U.S. Treasury (refer to Article 5c in the Collaborative Agreement).**

Billing Period	Bill Date	Bill Amount	Bill Number	Due Date	Bill Status
2/11/15-7/13/15	**7/13/2015**	**8,307.98**	**90364212**	**8/12/2015**	**unpaid**
To be billed		144,759.02			
Agreement Total		153,067.00			

For this billing period, the following progress has been made: In March, 2015 with assistance from Auwahi staff, USGS biologists deployed six Wildlife Acoustics Songmeter SM2BAT Ultrasonic Recorders with high frequency microphones at mutually agreed locations across the Auwahi mitigation area to record bat echolocation calls and associated date and time data. The recorders continue to operate as planned. Preliminary review of memory cards from a first download of data in June, 2015, indicates bat calls have been recorded at all six Auwahi locations. Acoustic data collection proceeds on schedule as per the Scope of Work document.

If you have any questions or concerns with the progress of our project, please contact me at 808-985-6444 or by email at fbonaccorso@usgs.gov. Please send any billing inquiries to Debbie Cobb, 808-690-9572, dcobb@usgs.gov.

Sincerely,

Frank Bonaccorso
Research Wildlife Biologist

Auwahi Forest Restoration Project annual report to Sempra
for forest restoration at Auwahi, ʻUlupalakua Ranch, Maui
Progress from May 16, 2014 through June 15, 2015

We are contacting you to update you on progress of the goals outlined for the Auwahi Forest Restoration Project to conduct primary restoration in 6 acres and plant 1500 *ʻaiea* (*Nothocestrum latifolium)* and 10 *ʻiliahi* (Santalum haleakalae var. lanaiense). Since we received funds in April of 2012, we have conducted initial forest restoration in 11acres of Auwahi III with dense plantings of *ʻa'aliʻi* (Dodonaea viscosa) to lock out weeds and create hospitable micro-sites for tree survival and recruitment. Within this restoration area we have planted a total of 788 *ʻaiea* and 20 *ʼiliahi*.

Auwahi experienced higher precipitation than average over the last 18 months which resulted in a good flower set this year. We sent our crew out to look for and gather seed from *ʻaiea* (Nothocestrum latifolium). Thanks to monthly seed collecting missions we were able to collect seeds and distribute those to our nurseries. Despite all this effort however, we were only able to collect a modest number of fruits that had a high proportion of germination success resulting in 200 seedlings. These seedlings should be available to plant this coming fall. We continue to monitor trees for fruit.

The holistic restoration goals of the Auwahi Forest Restoration Project are to ensure that forest restoration areas are as sustainable and perpetual as possible. Therefore we have been conducting routine invasive weed control in the Auwahi forest restoration exclosures to encourage optimal seedling surivival and recruitment. We were pleased to witness bird dispersed *ʻaiea* seedlings germinating in the recently restored Auwahi III exclosure this spring.

Status of required Endangered species plantings and acres restored:

	Deliverable	Total planted	Seedlings at nurseries	Remaining to be planted
ʻaiea (Nothocestrum latifolium)	1500	788	200	712
ʻiliahi (Santalum haleakalae var. lanaiense)	10	20	0	0
Primary restoration acreage	6	11	n/a	0

Figure 1. Aerial image of the 23-acre Auwahi III forest restoration exclosure.

FY 2016 Annual Work Plan and Timeline

		2015						2016					
		July	Aug	Sept	October	November	December	January	February	March	April	May	June
Post Construction Mortality Monitoring	Fatality Searches	*Three Day Interval Searches*						*Search Interval (to be determined)*					
	Searcher Efficiency Trials	*Monthly Trials*						*Trials (to be determined)*					
	Carcass Persistence Trials	*Quarterly Trials*						*Trials (to be determined)*					
Petrel Mitigation	HAPE Monitoring	*Burrow Monitoring*								*Burrow Monitoring*			
	Predator Control	*Traps Operational All Units*		*Predator Activity Assessment*	*Traps Operational All Units*				*Predator Activity Assessment*	*Traps Operational All Units*			
Bat Mitigation	Ungulate Control	*Quarterly Fence Inspection*			*Quarterly Fence Inspection*			*Quarterly Fence Inspection*			*Quarterly Fence Inspection*		
	Vegetation Monitoring and Invasive Species Control			*Semi-Annual Invasive Vegetation Management*				*Annual Vegetation Monitoring*		*Semi-Annual Invasive Vegetation Management*			
	Reforestation	*Site Preparation*			*Additional 15 Acres Outplanted*					*Retreat grasses around outplanting*			
	Tier 2 (Bat Research Plan I)	*Tier 2 Bat Research Plan with USGS- Acoustic Monitoring Year 1*											
	Tier 3 (Bat Research Plan II)			*Proposal Submitted*			*Proposal Approved*	*Tier 3 Initiated*					
Reporting	ITP & ITL Conditions	*Incidental Take Summary Tables Submitted*	*Annual HCP Report Submitted*					*Incidental Take Summary Tables Submitted*	*Semiannual Progress Report Submitted*				

	Tier, Ongoing, or One-time	Event	Proposed Cost	Total Costs Incurred to Date (up to July 2015)	Costs Incurred FY 15 (July 1, 2014 -June 30, 2015)
General Measures	Ongoing	Wildlife Education and Incidental Reporting Program	$5,000	$4,667	$167
	Ongoing	Downed Wildlife Post-Construction Monitoring and Reporting and Mitigation Monitoring	$1,810,000	$438,046	$152,901
	Ongoing	*DOFAW Compliance Monitoring (only if needed)	$200,000	$2,423	$2,423
		Subtotal General Measures	*$1,815,000*	*$445,136*	*$155,324*
Hawaiian Hoary Bat	Tier 1	Retrofit fencing and restoration measures at the Waihou Mitigation Project	$522,000	$506,484	$128,410
	Tier 1	Acoustic Monitoring onsite	$40,000	$28,354	$14,663
	Tier2	Monitoring Research	$250,000	$41,034	$8,308
Hawaiian Petrel		Subtotal Bats	*$812,000*	*$575,872*	*$151,381*
	Tier 1	Burrow Monitoring and Predator Control	$550,000	$396,315	$107,743
		Subtotal Petrels	*$550,000*	*$396,315*	*$107,743*
Nene	One-Time	Research and Management Funding	$25,000	$25,000	N/A
		Subtotal Nene	*$25,000*	*$25,000*	*N/A*
Backburn's Sphinx Moth	One-Time	Restoration of 6 acres of Dryland Forest	$144,000	$144,000	N/A
		Subtotal Moth	*$144,000*	*$144,000*	*N/A*
		Total HCP-related Expenditures	**$3,346,000**	**$1,586,323**	**$414,448**