CHAPTER 1: SPECIES SPECIFIC GOALS

1.1 INTRODUCTION SPECIES SPECIFIC GOALS

The rare plant monitoring programs and the rare animal survey and monitoring programs are designed to provide information that will lead towards an increased understanding of the species at PTA. The information gained from these programs is incorporated into the management actions identified for Intensive Management Units (IMU) with the goal of improved management of the species and habitat.

1.2 INTRODUCTION – RARE PLANT MONITORING

Due to PTA's land use history and isolation, access to the area has been limited. As a result PTA harbors unique ecosystems and vegetation. For example, PTA is one of the largest intact sub-alpine dryland forests remaining in the state. Not only is the ecosystem itself rare but so are many of its components. For example, at PTA there are eleven endangered species, one threatened species, and eleven species of concern, including one undescribed species. Six of these plant species are found only at PTA and two species are found at PTA and one or two other locations in the state.

A Priority Species (PS) list was developed to prioritize monitoring and management actions. *Schiedea hawaiiensis* and *Tetramolopium* sp. 1 are the only PS-1 plants, which are not federally listed. These species of concern are included because *S. hawaiiensis* has less than 20 naturally occurring individuals and *T.* sp. 1 has less than 100 known individuals. Therefore, they receive the highest priority for management actions. The Priority Species list has been defined and species assigned as follows.

Priority Species of Pōhakuloa Training Area

Priority Species-1 (PS-1) – Plant species with fewer than 500 individuals and/or 5 or fewer populations remaining statewide.

- *Hedyotis coriacea* (E)
- *Neraudia ovata* (E)
- *Solanum incompletum* (E)
- *Schiedea hawaiiensis* (SOC)
- *Tetramolopium arenarium* ssp. *arenarium* (E)
- *Tetramolopium* sp. 1 (SOC)

Priority Species-2 (PS-2) – Plant species with 500 - 1,000 individuals and/or 6 - 10 populations remaining statewide.

- *Asplenium fragile* var. *insulare* (E)
- *Silene lanceolata* (E)
- *Zanthoxylum hawaiiense* (E)

Priority Species-3 (PS-3) – Plant species with 1,000 – 2,000 individuals and/or 10 - 20 populations remaining statewide.

- *Festuca hawaiiensis* (SOC)
- *Portulaca sclerocarpa* (E)

Priority Species-4 (PS-4) – Plant species with 2,000 – 5,000 individuals and/or 20 - 40 populations remaining statewide.

- *Eragrostis deflexa* (SOC)

Priority Species-5 (PS-5) – Plant species with more than 5,000 individuals and/or more than 40 populations remaining state wide.

- *Chamaesyce olowaluana* (SOC)
- *Cystopteris douglasii* (SOC)
- *Dubautia arborea* (SOC)
- *Exocarpos gaudichaudii* (SOC)
- *Haplostachys haplostachya* (E)
- *Melicope hawaiiensis* (SOC)
- *Portulaca villosa* (SOC)
- *Silene hawaiiensis* (T)
- *Spermolepis hawaiiensis* (E)
- *Stenogyne angustifolia* (E)
- *Tetramolopium consanguineum ssp. leptophyllum* (SOC)

The term population is one that is often difficult to define in practical terms. Several of the species at PTA are found in isolated clusters of plants, which occupy only a fraction of the species' historic range. Other species' distributions are restricted to PTA; although there are a large absolute number of individuals. Due to the differences in the distribution of species, they cannot easily be broken into populations on spatial terms. The most effective means of defining a population is through genetic information that is largely lacking for the species found at PTA. Therefore, the term population is used infrequently in the following text. The term "site" is used to roughly identify aggregations of plants as being associated for biotic, abiotic, and management reasons. The term "location" is used to describe the individual plants or clusters of plants within a site. The location is the unit that is used for mapping purposes and each has a coordinate associated with it. The term "individual" describes a single representative of a particular species. There is one to many individuals at a given location and one to many locations in a site.

MONITORING METHODS

Monitoring units are belt transects with a base stake and end stake identifying the beginning and end of the plot. Extending a measuring tape between the base and end stakes delineates the centerline of the plot. The belt is typically five meters wide, two and a half meters on either side of the centerline. The length of the belt varies depending on the distribution of the plants at the site being monitored. However, it is typically 10 meters long.

Once laid out, the locations of all rare plants within the belt are mapped. This is accomplished using an x- and y-coordinate system. The distance along (y-axis) and out (x-axis) from the meter tape is determined and recorded in meters.

Information collected on each plant consists of height, phenological state, age class, reproductive structure count, vigor, and presence of animal damage. The height or length of the longest stem of the plant is measured in centimeters or meters and is measured from the base of the plant to the apical meristem of the longest portion of the plant.

The phenological state is classified as: Vegetative, not currently flowering or fruiting; Reproductive, viable flowers are present on the plant; Fruiting, fruit is present on the plant from the most recent flowering event.

A seedling is a plant with apparently functional cotyledons present. A juvenile is classified as a plant that has lost its cotyledons or if present they are apparently non-functional and it has not flowered. An adult is a plant that has flowered in its lifetime, regardless of its current phenological state.

The vigor of the plant is classified as healthy when the plant is producing new leaves, most living leaves are green, and the plant is generally robust and thriving. The vigor is moderate when the plant is producing fewer new leaves, the living leaves are not quite as green as compared to a healthy plant, and the plant is viable but not as robust or thriving to the extent that a healthy plant is. The vigor is poor when the plant is producing few, if any, new leaves. Those leaves present may be pale green and/or the edges are brown. In some species the leaves may have little chlorophyll and be red with photo-protective pigments.

Browse is classified as no browse when no parts of the plant have been consumed by ungulates. Browse is indicated by portions of the plant showing signs of being consumed by ungulates. Browse is further classified as recent browse when the browsed portions of the plant have not healed over. In addition, the browsed portions may be white and there is no new growth above the browsed portions. The browsed portion of the plant having healed over indicates old browse and there is new growth above the browsed portions.

1.2.1 - *Asplenium peruviana* var. *insulare*, Fragile fern

INTRODUCTION

Asplenium peruviana var. insulare (PS-2) is federally listed as endangered and is found throughout PTA in caves and skylights. There are 39 known locations with varying numbers of individuals at each. Many of the locations were mapped by CSU botanists and some have never been revisited to verify location accuracy and presence or absence of *A. p. var. insulare*.

METHODS

PTA staff has revisited *A. p. var. insulare* IMU's in training area 23 and 21 to check on population health and to survey for additional populations. Additional surveys have identified more populations in other IMU's. Caves with suitable conditions for *A. p. var. insulare* were recorded for possible outplanting. The criteria used for cave selection was suitable temperature, light and humidity. Regardless of the surface vegetation and climatic conditions, caves often have distinct microclimates compared to the surface. Twenty five suitable caves were found and recorded. No monitoring is being conducted for this species.

RESULTS

No monitoring was conducted during the reporting period. Population estimates for *A. p. var. insulare* have increased over early surveys conducted in the early 1990's but that is due in part to the increased surveys conducted by PTA Natural Resources Staff. This has resulted in the discovery of previously unrecorded populations throughout PTA. Recent wetter than average years may also have contributed to the increase in the population and it remains to be seen if the current population can sustain itself through drier periods.

MANAGEMENT RECOMMENDATIONS

Monitoring should be conducted to assess the health of known populations and determine the impact of non-native weeds increasing in caves. There are numerous recorded locations that have not been visited in years some of them old CSU points. These sites should be revisited to get a current picture of the population at PTA.

1.2.2 - *Honohono*, *Haplostachys haplostachya*, Hawaiian mint

INTRODUCTION

Haplostachys haplostachya (PS-5) is federally listed as endangered and is considered one of the more abundant listed species found at PTA. In the past, no systematic monitoring has been initiated for this species. In 2005, the goal was to monitor the populations identified in the Implementation Plan as a first step in implementing a PVA monitoring program for the species. There are six different IMU's that contain *H. haplostachya* populations. Six sites were monitored in IMU's 4, 6, 10, 17 and 44.

METHODS

Base stake points were randomly selected from the GIS. Most transects were from 10-30 meters long. For each IMU, the goal was to have at least five transects with and five transects without plants. The reproductive status, age class, vigor and if the plant showed signs of browse were recorded.

METHODS

Monitoring followed the Population Viability Analysis (PVA) protocols.

RESULTS

Table 1.2.2-1. Monitoring results for *Haplostachys haplostachya.*

Site	IMU	Transects	Hours	Juveniles	Adults	Browse
04	6	20	12.0	234	94	0%
05	10	10	28.5	12	16	19%
07	4	15	44.0	197	42	36%
13	44	30	41.5	147	225	1%

DISCUSSION

This was the first year of data collection utilizing PVA protocols. No population trends will be available until another monitoring cycle is completed. The data collection this year is the first step in determining the amount and type of data necessary to build a reliable PVA model for this species. It is anticipated that

additional monitoring plots will need to be established in following years to have enough data for the PVA to function properly.

Monitoring results do provide information on beneficial effects of large-scale fencing. Sites 04 (IMU 6) and 13 (IMU 44) are found within the Pu`u Ka Pele and Kīpuka Kālawamauna Fence Units respectively. These fence units have been protecting *H. haplostachya* since 1981 and 1998 respectively. Little to no browse was recorded on these plants. Sites 05 (IMU 10) and 07 (IMU 04) are unprotected. Site 07 is located in an area that is heavily used by goats and browse recorded on 36% of plants monitored.

MANAGEMENT RECOMMENDATIONS

Controlling *Pennisetum setaceum,* a species that increase fuel loads, is important to preserve the diversity of native communities and would allow for population expansion. Monitoring data indicate that ungulates negatively impact this species. The fencing identified in the 2003 Biological Opinion will be important in preventing negative impacts to the species from ungulates.

1.2.3 - *Kio`ele*, *Hedyotis coriacea*, Leather-leaf sweet-ear

INTRODUCTION

H. coriacea (PS-1) is federally listed as endangered with only 153 individuals known. Other than the sites at PTA there is only a single plant known from Maui, unfortunately, that plant may have died in recent years.

There are nine sites of *H. coriacea* identified at PTA. Since the December 2002 Annual Report, site names have changed from a letter to a numbering system (site A is now site 1, site B is now site 2, etc.)

Habitat management, comprehensive monitoring and new surveys have been the major focus of effort in regard to *H. coriacea* for the past two and a half years. Surveys were conducted in areas of suitable habitat based on existing known plants to locate previously unrecorded individuals. Monitoring occurred for all previously and newly recorded individuals in 2005. New plants, not already within a large-scale fence unit, were protected by emergency exclosures.

METHODS

Each *H. coriacea* is monitored individually without the use of monitoring transects. Monitoring follows PVA protocols.

RESULTS

There are currently 153 live *H. coriacea* plants at PTA. Ninety-four new plants have been recorded since July 1, 2003. Monitoring results are summarized in Table 1.2.3-1. The largest population currently consists of 87 individuals located in IMU 30 along the northern boundary of the Kīpuka `Alalā-1 Fence Unit. The smallest population consists of a single isolated individual. Over the course of 2.5 years, 15 individuals have been recorded as ‘dead’. Reproductive individuals account for 59.9% of the total plants. Recent ungulate browse was not recorded on any plants, which were all protected by emergency exclosures. In 2003 and 2004, hours spent monitoring were not tracked in the management action log.

Table 1.2.3-1. Monitoring results for *Hedyotis coriacea* conducted in 2003-2004.

Site	IMU	Juveniles	Adults
01	18	0	4
02	11	1	22
03	21	2	7
04	22	0	5
05	29	2	6
06	12	0	1
07	19/20	0	3
09	29	0	1
10	30	11	19

In 2005, one plant in population 01 was observed with rodent damage to the foliage. One new plant was found in population 05 with recent browse damage. Two new plants were found in population 10 with recent browse damage. All known plants within the emergency exclosures did not have recent browse damage from ungulates.

Table 1.2.3-2. Monitoring results for *Hedyotis coriacea* conducted in 2005.

Site	IMU	Hours	Juveniles	Adults
01	18	5	0	5
02	11	22	4	23
03	21	14	0	10
04	22	8	0	5
05	29	0.75	0	12
06	12	-	0	1
07	19/20	2	0	8
09	29	0.75	0	1
10	30	21	2	84

DISCUSSION

Site 07 consisted of three plants in two locations when the IMU's were identified. The two locations were placed in IMU's 19 and 20. Surveys and monitoring recorded new locations that shows the plants of Sites 02 and 07 (IMU's 11, 19, and 20) form a continuous distribution. Three of the 31 individuals are protected by the Kīpuka Kālawamauna Fence Unit; the remaining individuals are protected by emergency exclosures.

Site 08 consists of a single location identified by CSU personnel in the 1990's. Attempts to re-identify this location have not been successful. The habitat is markedly different from that of other *H. coriacea* locations and there may have been an error in the original data. This location will be removed from the database.

Data indicates an increase in the number of plants; however this is a result of increased survey efforts rather than natural recruitment. In 2005 the first seedling of *H. coriacea* was recorded since this species was discovered at PTA in the early 1990's. The lack of natural recruitment is troublesome. It indicates that the species is not sustaining itself. In addition, propagation efforts have produced limited results. Collected seed seems to have low viability and many propagated seedlings do not attain size suitable for outplanting. The low seed viability may be due to a loss of an insect pollinator.

MANAGEMENT RECOMMENDATIONS

Recommendations include large-scale fencing of all known populations, surveying areas with suitable habitat, investigate techniques to improve natural recruitment, and monitor invasive weeds around known populations and control as needed.

1.2.4 - *Neraudia ovata*, Spotted nettle bush

INTRODUCTION

Neraudia ovata (PS-1) is federally listed as endangered and occurs at two sites (Site 01 in IMU 24 and Site 02 in IMU 14/15) at PTA. General habitat for this species includes *Metrosideros* Treeland on `a`ā flows and *Myoporum* Shrubland on pāhoehoe.

METHODS

Monitoring follows the Population Viability Analysis (PVA) protocols. Plants were individually monitored without the use of transects due to the low number of individuals.

RESULTS

A total of 31.5 personnel hours were spent monitoring *N. ovata* individuals. Fourteen new locations of *N. ovata* at Site 01 and two new locations at Site 02 were recorded within this reporting period. Live individuals of *N. ovata* at PTA total 136. Of this total, 14 are adult plants. Nine of the 14 adult individuals were recorded at new sites during this reporting period. See Table 1.2.4-1 below for a current population status summary for *N. ovata.* Because all plants are within emergency exclosures, no ungulate browse was observed on the plants.

Table 1.2.4-1. Monitoring results for *Neraudia ovata*.

Site	IMU	Juveniles	Adults	Site	IMU	Juveniles	Adults
0101	24	4	0	0115*	24	0	0
0102	24	0	0	0116*	24	1	0
0103	24	8	0	0117*	24	0	1
0104	24	5	1	0118*	24	1	0
0105	24	3	1	0119*	24	12	0
0106	24	0	0	0120*	24	1	0
0107	24	1	0	0121*	24	1	0
0108	24	11	1	0122*	24	1	0
0109	24	0	1	0123*	24	1	0
0110*	24	43	0	0201	15	0	0
0111*	24	3	1	0202	15	0	1
0112*	24	8	3	0203*	14	6	1
0113*	24	1	0	0204*	Outside 14	0	0
0114*	24	1	0	0205*	Outside 14	10	3
				Totals		122	14

*New locations recorded during reporting period.

DISCUSSION

The number of *Neraudia ovata* adults has increased from six at the last reporting period to a current total of fourteen. The number of juveniles at each site fluctuates based on changes in seasonal precipitation. For example, one juvenile was recorded at new site 0115 in February of 2005 and was found dead during monitoring in September of 2005. Little to no regeneration had been recorded prior to fall of 2004. The recording of new individuals during surveys and the regeneration taking place has been extremely encouraging. These positive results come at a time when plants at other sites on the Island have

disappeared and plants at PTA are aging. Most exciting was the regeneration from the seed bank under mother plants that have been dead for five to seven years.

In 2004 rodents were found to be chewing the stems of the juvenile *N. ovata*. It appeared that they were doing so to obtain water within the plants. To address this impact, snap traps and a rodent control grid was put in place (See Section 2.3.24).

All known individuals of *N. ovata* are currently protected with emergency enclosures and have active weed and rodent control. In the absence of large-scale fence units, feral ungulates continue to degrade the habitat of this species.

MANAGEMENT RECOMMENDATIONS

Recommendation is for continued monitoring of all current and former *Neraudia ovata* locations to determine recruitment activity. Continued weed and rodent control is also recommended.

The construction of large-scale fence units and the subsequent removal of ungulates are essential for the protection of habitat for this species.

1.2.5 - *Po`e, Portulaca sclerocarpa*, Hard-fruit purslane

INTRODUCTION

The relative abundance of *Portulaca sclerocarpa* (PS-3) is greater outside of PTA. Sixteen locations have been re-identified from old CSU data or newly recorded at PTA. Three locations previously recorded by CSU have not been re-identified despite survey efforts. A comprehensive monitoring of all known locations was implemented in 2005.

RESULTS

Monitoring specifically for *P. sclerocarpa* was not initiated until 2005 because it is a PS-5 species and other species with higher rankings have taken priority. Population monitoring occurred when biologists were working in proximity to the plants. In 2003, three sites were visited and a total of 5 plants were monitored (Table 1.2.5-1). In 2004, two populations were visited and a total of three plants were monitored. In 2005, an attempt to locate all previously known locations was made. Because of confusion in assignments, population 08 was the only population that was partially monitored. No browse was seen on any of the plants during monitoring during the contract period.

Table 1.2.5-1. Monitoring results for *Portulaca sclerocarpa*.

	Site	Hours	Juveniles	Adults
2003	06	-	0	2
	08	-	0	1
	14	-	0	2
2004	08	-	0	1
	12	-	1	2
2005	01	3	0	0
	04	1	3	4
	05	1	0	0
	06	5	0	5
	08	-	0	2
	10	4	2	3
	12	2	0	3
	14	-	0	2

DISCUSSION

Evans *et al.* (2002) reported 26 known individuals found at eight locations with four unconfirmed locations still to visit. These data represented known individuals but monitoring for all locations had not been implemented. Monitoring in 2005 was the first comprehensive monitoring of all known sites. Because all known sites were not visited each year, it is difficult to determine how the population has responded during the reporting period. Browse has not been recorded for any of the plants monitored, so the cause of the low numbers is unknown at this point.

MANAGEMENT RECOMMENDATIONS

Monitoring of known locations will continue annually.

1.2.6 - *Schiedea hawaiiensis*

INTRODUCTION

Although *Schiedea hawaiiensis* (PS-1) is not federally listed, the extremely low numbers of this species makes its protection critical. Presently there is only one known natural population. The natural population is in IMU 41 and there are two outplanted populations in IMU 18. The natural population is found in a *Metrosideros* Treeland on `a`ā substrate. Primary threats to this species include browsing impacts by ungulates, rodents, and possibly birds. The plants in this population are surrounded by a razor wire barricade two rolls deep to prevent ungulates from reaching the plants. In addition a two-acre rodent bait grid was established around the plants to control the rodent population. Smaller, wire mesh cages have also been constructed and placed around individual plants to prevent further rodent impacts.

METHODS

Plants are monitored individually using PVA protocols.

RESULTS

The number of naturally occurring individuals has increased marginally in recent years. Plants have continued to be impacted by rodents. It is thought that the rodents are seeking water from the stems of the plants.

Table 1.2.6-1. Monitoring results for *Schiedea hawaiiensis.*

	Hours	Juveniles	Adults	Rodent Damage
2005	1	7	3	60%

DISCUSSION

Recent monitoring indicates that the number of individuals has increased since the last monitoring in 2002; although population numbers are increasing they remain extremely low. The addition of new juveniles indicates that recruitment is still occurring at the site. However, priority should be placed on the continued propagation and outplanting of this species. Signs of recent browse continue to be recorded; the cause is believed to be rodents. A two-acre rodent control grid was established to reduce rodent impacts on the surviving plants.

MANAGEMENT RECOMMENDATIONS

Monitoring is necessary to assess the population and ensure that threats are detected and addressed. Surveys should be conducted to locate unrecorded individuals. Maintenance of the rodent bait grid is also necessary to prevent rodents from damaging plants. A large-scale fence unit should be constructed to protect the only remaining natural population.

1.2.7 - *Silene hawaiiensis*, Hawaiian catchfly

INTRODUCTION

In 2005, a PVA monitoring program was established for *Silene hawaiiensis* (PS-5). Five sites in five IMU's were selected to be monitored. Because *S. hawaiiensis* has a population of greater than 500 hundred individuals, random sampling techniques were used to assess the population.

METHODS

To establish monitoring plots within the selected populations, 15% of the known plant points in the GIS database were randomly selected for sampling. If there were less than five plants within 13 meters of the GPS location, a plot was established and each individual plant tagged and mapped for identification. If there were more than five plants located within 13 meters from the GPS location, two to five 30-meter long transects were established for each plot. For each plant the height, age class, reproductive status, vigor and the presence of browse was recorded as well as its location along the transects.

RESULTS

In 2005, a total of five populations were visited. Over 167 hours were spent to establish and monitor 73 transects. A total of 549 adults and 283 juveniles were monitored.

Table 1.2.7-1. Monitoring results for *Silene hawaiiensis*.

IMU	Site	Transects	Hours	Juveniles	Adults	Browse
2	Silhaw 03	34	75	213	147	83%
3	Silhaw 17	25	51	43	347	0%*
12	Silhaw 26	0	6	0	0	-
29	Silhaw 29	7	25	27	26	0%
37 (Range 8)	Silhaw 01	7	10	4	29	2.5%

* Population is fenced.

DISCUSSION

Because 2005 was the first year of data collection for the PVA, no population trends will be available until another monitoring cycle is completed. The data collection this year is the first step in determining the amount and type of data necessary to build a good PVA model for this species. It is anticipated that additional monitoring plots will need to be established in following years to have enough data for the PVA to function properly.

MANAGEMENT RECOMMENDATION

Continue developing PVA model for *S. hawaiiensis* and establish additional monitoring plots as needed. Because individuals in population 26 in IMU 12 can no longer be located, a new population should be selected and monitored during the next monitoring cycle.

Plants are consistently observed to have been browsed by ungulates. Little regeneration is recorded when monitored. Large scale fence units are necessary to prevent this species and its habitat from being degraded by ungulates.

INTRODUCTION – RANGE 8

The *S. hawaiiensis* population in IMU 37 (Range 8) was monitored as required by a Section 7 consultation with the U.S. Fish and Wildlife Service. This population has been monitored annually since 1997. The Army is required to protect known locations of *S. hawaiiensis* on Range 8 from damage resulting from maintenance and use of the range.

METHODS

Each known location was monitored using PVA protocols and searched for new individuals.

RESULTS

There has been a steady decline in the number of individuals at Range 8 since monitoring began in 1997 (Table 1.2.7-2). Only 31 individuals were located during this year's monitoring representing 31% of the population from 1997. Although there are fewer individuals, the average height of plants that have been present since 1997 has increased (Table 1.2.7-2). Damage from ungulate browse has decreased from 1997 (Table 1.2.7-2).

Table 1.2.7-2 Monitoring results for *Silene hawaiiensis* at Range 8.

	1997	1999	2000	2001	2002	2003	2005
Average Height (cm)*	17.6	14.5	14.4	9.8	12.7	6.1	23.8
Number of Individuals**	101	105	96	61	61	31	31
Percent Damage***	75.3	87.0	71.9	75.0	6.0	0	3.0

* The average height of plants present during all four years.
** Total number of individuals present during that year's monitoring.
***Percentage of plants with signs of being damaged.

DISCUSSION

Past work by Evans *et al.* (2002) has shown a steady decline in average plant height in relation to presence of Mouflon and feral sheep near Range 8. The average plant height declined through 2003 despite a slight increase in 2002. The average height decreased 65% between 1997 and 2003. The PTA Range Maintenance division constructed wire cages to protect individual plants on the range in 2004. As a possible result, monitoring in 2005 indicated a change in a trend that had been observed. The average height of plants, which had been declining dramatically between 1997 and 203, showed a 74% increase in the average height. The protective cages may have allowed the individuals to increase in height.

Although, on average, individual plants are taller than in pervious years, the total number of individuals remains low. A total of 31 individuals were monitored in 2005, which is only 31% of the plants present in 1997. The PTA Range Maintenance division also constructed rock berms around each grouping or individual plant locations to protect the plants from bullet strikes as required by the 1996 Biological Opinion. The likelihood of damage to plants from bullet strikes was discussed and dismissed by Schnell *et al.* (2003). By constructing these berms, suitable habitat was covered and is no longer available for seedling recruitment and population expansion. With the protection from the browsing pressure, the plants may be able to grow larger, but the long term stability of this population will depend on the number of individuals increasing.

MANAGEMENT RECOMMENDATIONS

Continue to monitor the population at Range 8 as required by the Biological Opinion issued in 1996. Continue to search for new plants and protect them as needed. Examine the wire cages and determine if another fencing design would work better for the plants and allow the military a realistic training environment. Reposition the berms, over time, so they do not fall within the plant locations and occupy less of the area the plants need for expansion. Continue to monitor the populations identified and select another population to replace IMU 12 where no plants were found. The monitoring data should be assessed to determine the number of monitoring plots necessary to achieve the proper power for reliable statistical analysis.

Unprotected plants continue to be impacted by ungulates. Large-scale fencing is the most appropriate measure to protect individual plants and the habitat in which they are found.

1.2.8 - *Silene lanceolata*, Lance-leaf catchfly

INTRODUCTION

Silene lanceolata (PS-2) has several sites throughout northern and western PTA in several IMU's and plant communities. Sites are found within IMU's 5, 8, 11, 12, 13, 16, 17, 18, 25, 27, 30 and 31. Included plant communities are: *Dodonaea* Mixed Shrubland, Dense *Dodonaea* Shrubland, Open *Dodonaea* Shrubland, Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub understory, Intermediate *Metrosideros* Mixed Treeland, Sparse *Metrosideros* Treeland, *Myoporum-Sophora* Mixed Shrubland and *Styphelia* Mixed Shrubland (Shaw and Castillo 1997). The species occurs on both `a`ā and pāhoehoe flows of varying ages. The extent of the *S. lanceolata* population has been determined through rare plant surveys and rare plant monitoring. Surveying provides a fairly accurate count depending on the size of the population discovered (larger populations are estimated due to time constraints), while monitoring provides a very accurate count. Rare plant monitoring is conducted annually on selected populations.

METHODS

Transects have been established to record and monitor individual plants over an extended period. Monitoring follows the Population Viability Analysis (PVA) protocols.

RESULTS

Table 1.2.8-1. Monitoring results for *Silene lanceolata.*

	Transects	Effort Hours	Juveniles	Adults	Browse
2004	41	3	1633	163	.0002%
2005	44	2	2535	431	.0005%

DISCUSSION

Survey and monitoring data suggest the population is flourishing. Known numbers have quadrupled since the early 1990's (Shaw 1997). Many factors contribute to these increases. Higher precipitation over the past two years that followed six years of drought, and is believed to be part of a long-term trend of wet and dry years. Intensive surveys of rare plant habitat have increased the number of recorded locations. Fencing, weed control, and ungulate control activities have helped the species recover. Low browsing totals suggests large-scale fence units have prevented ungulate browse within monitored sites.

Although the number of *S. lanceolata* locations and individuals are high and the species appears to be viable and healthy, this it will remain a species of high priority. Continued monitoring is necessary to track the health of the population. The main concern is how the population will react to drier weather. The 2005 precipitation levels are reduced and higher mortality of seedlings and juveniles has resulted. This will likely be reported during monitoring in the next reporting period. If long-term weather trends continue to provide higher precipitation the population may continue to flourish, but if dry weather returns, management becomes even more crucial to sustaining a healthy population.

Over half of the IMU's where this species exists remain unprotected by large-scale fence units and ungulates are a serious threat. Emergency exclosures are erected around plant locations in these IMU's, while proven effective; they offer only limited and short-term protection. Furthermore, our emergency exclosures offer no protection to surrounding habitat necessary for the long-term survival of the species.

MANAGEMENT RECOMMENDATIONS

In addition, surveys to record new locations in areas of northern and western PTA should be conducted. Specifically south and southeast of IMU 13 and west and southwest of IMU 5 where locations have been previously recorded but new surveys have not yet been conducted.

Large-scale fence units followed by ungulate removal across northern and western PTA are essential as *S. lanceolata* is "very palatable to feral ungulates, which have decimated populations of this species" (Shaw

1997). This species is also negatively impacted by fire. Therefore, the completion and implementation of a fire management plan is necessary to minimize this threat.

1.2.9 - *Pōpolo kū mai, Solanum incompletum*

INTRODUCTION

Solanum incompletum (PS-1) is federally listed as endangered. This plant occurs at two sites; Site 01 in IMU 24 and Site 02 in IMU 13. General habitat for this species includes Open *Metrosideros* Treeland on `a`ā flows and *Myoporum* Shrubland on pāhoehoe flows.

METHODS

Monitoring of each *S. incompletum* within Sites 01 and 02 occurs on an annual basis. Data collected follows the monitoring guidelines outlined in Section 1.2.

RESULTS

A total of 14.5 personnel hours were spent monitoring *S. incompletum* sites. Eight of the 42 adult individuals were recorded at new locations during the reporting period. Table 1.2.9-1 summarizes the monitoring results of *S. incompletum.* All known plants are protected by emergency exclosures and no recent ungulate browse was recorded.

Table 1.2.9-1. Monitoring results for *Solanum incompletum*.

Site	IMU	Juveniles	Adults	Total Plants
0101	24	22	16	38
0102	24	1	1	2
0103	24	0	6	6
0104	24	0	1	1
0105	24	0	1	1
0106	24	0	5	5
0107	24	0	1	1
0108*	24	1	1	2
0109*	24	12	7	19
0201	13	1	3	4
Totals		37	42	79

* New locations found during reporting period.

DISCUSSION

Site 0109 was a significant find during surveys in February 2005. There are currently nineteen individuals at this location.

All known individuals of *S. incompletum* are currently protected with emergency enclosures and have active weed and rodent control. In the absence of large-scale fence units, feral ungulates continue to degrade the habitat for this species.

MANAGEMENT RECOMMENDATIONS

Rodent and weed control will continue for *Solanum incompletum* Site 01 and Site 02 to reduce these introduced species' impacts. The last monitoring of Site 02 in September 2005 indicated all live plants were stressed and required water. Recommendation is for continued monitoring of these plants during weed control activities to determine if supplemental water is needed.

Ungulates heavily impact individuals of this species in the absence of the emergency exclosures. The construction of large-scale fence units and the subsequent removal of ungulates are essential for the protection and recovery of this species and its habitat.

1.2.10 - *Spermolepis hawaiiensis*, Hawaiian parsley

INTRODUCTION

Spermolepis hawaiiensis is categorized as a PS-5. The life cycle of this annual species seems to be dependent upon favorable weather conditions. The species has not been detected at PTA in large numbers for its status to be properly assessed until 2004. Surveys were conducted in the spring of 2004 to roughly determine its abundance and distribution.

METHODS

PVA protocols will not be used to monitor this annual species. Due to its annual life cycle a monitoring technique that relies on following individuals through time will not be appropriate. Locations recorded in IMU 32, in 2004 were revisited quarterly to determine if conditions had been favorable for germination and the continuation of its life cycle.

RESULTS

Previously recorded points were revisited on a quarterly basis in 2005 and no individuals were found.

DISCUSSION

Weather conditions may not have been adequate for germination and regeneration.

MANAGEMENT RECOMMENDATIONS

Revisit previously recorded locations to assess presence/absence. If plants are detected then surveys are to be conducted in adjacent, unsurveyed areas to further determine distribution of the species. There is the need for weed control for this species. It is recommended that it be implemented in accordance with its PS-5 ranking.

1.2.11 - *Stenogyne angustifolia*, Creeping mint

INTRODUCTION

Stenogyne angustifolia (PS-5) is federally listed as endangered and is widely distributed throughout PTA in various habitats. Although considered one of the more abundant listed species, its distribution is believed to be restricted to PTA (Wagner *et al.* 1990).

METHODS

No monitoring program has been established for *S. angustifolia*. Plants are recorded during rare plant surveys of the IMU's.

RESULTS

There are currently more than 1300 *S. angustifolia* at over 400 different locations known at PTA. It is one of the most abundant listed plant species found at PTA. Over 900 new plants at more than 300 new locations were identified during surveys conducted since July 1, 2003. Additionally, surveys conducted in 2004 and 2005 reconfirmed healthy plants at 28 previously recorded locations.

Locations of *S. angustifolia* are distributed throughout western PTA in Training Areas 17, 18, 19, 22, and 23. The densest concentrations of plants lie in IMU's 10, 12, and 18 in Training Area 22. *S. angustifolia* are most closely associated with *Dodonaea* Mixed Shrubland and Open *Metrosideros* Treeland Sparse with dense shrub understory.

DISCUSSION

It was previously thought that plants were little affected by ungulates due to a lack of browse being recorded when plants were found during surveys and other management actions. Field observations in recent years may indicate a greater impact by ungulates than previously believed. Field observations suggest that browse is not observed because plants are completely consumed by ungulates. These conclusions may be supported by the abundance of plants found within large-scale fence units and relative scarcity of plants found outside of fence units.

MANAGEMENT RECOMMENDATIONS

It is recommended that monitoring for this species be initiated to establish baseline data for tracking changes.

Large-scale fence units, such as those required by the 2003 Biological Opinion, will have positive impacts to the species.

1.2.12 - *Mauna Kea pamakani, Tetramolopium arenarium* ssp. *arenarium*

INTRODUCTION

Tetramolopium arenarium ssp. *arenarium* is categorized as PS-1. This endangered species is found within the Kīpuka Kālawamauna Endangered Plant Habitat. The population is restricted to IMU 8 and single individual in IMU 12. Plant locations are protected by emergency exclosures.

METHODS

Monitoring transects are spaced five meters apart and are designed to monitor every plant within the site. PVA protocols are used in monitoring this species.

RESULTS

The number of plants monitored increased between 2004 and 2005 (Table 1.2.12-1). There was a decrease in the amount of browse recorded.

Table 1.2.12-1. Monitoring results for *Tetramolopium arenarium* ssp. *arenarium*.

	Transects	Hours	Juveniles	Adults	Browse
2004	28	39	3	14	11%
2005	28	123	526	73	3%

DISCUSSION

The rains of the past two years have had positive effects on this species. There was a large population increase between 2004 and 2005. The intensive monitoring, utilizing PVA protocols, accounts for the increase in effort over 2004. The monitoring in 2005 represent a more than eight fold increase in the number of individual plants monitored. PVA protocols are still in development. No conclusions about the viability of the population can be reached at this time.

New plants continue to be found outside the fenced areas, but within the weed control buffers. As these new plants are discovered they are protected emergency exclosures. It is likely that plants have sprouted beyond the weed control buffers especially in locations where adults once existed but haven't been protected yet.

Browse decreased between monitoring cycles due to the construction of emergency exclosures around unprotected plants. Browse damage to this species is relatively uncommon but does occur. The two IMU where the species is found are unprotected. There is a herd of feral goats that are consistently found within IMU 8 and, more importantly, within the weed control perimeters. The goats continue to have detrimental affects on the habitat of *T. a. ssp. arenarium*. In addition, the emergency exclosures provide limited protection and no protection of the habitat necessary for the long-term survival of the species. Therefore, it is essential for the survival of the species that its habitat is protected by large-scale fence units and the ungulates removed.

MANAGEMENT RECOMMENDATIONS

The monitoring will continue on an annual basis. Protect new plants found within the established weed control perimeters with emergency exclosures and incorporate them into annual monitoring as appropriate. Survey a 10m band around the control perimeters, to ensure as many plants as possible are protected. Construct large-scale fence units and remove ungulates.

1.2.13 - *Tetramolopium* sp. 1, Tooth-leaf *pamakani*

INTRODUCTION

Although *Tetramolopium* sp. 1 (PS-1) is not listed it is only known from two sites at PTA. The site in IMU 11, in Training Area 22, is found in the Open *Metrosideros* Treeland. The site in IMU 31, in Training Area 23, is described as a mix of three distinct vegetation types, *Myoporum-Sophora* Mixed Shrubland, *Styphelia* Mixed Shrubland, and Dense *Dodonaea* shrubland (Shaw and Castillo 1997). Although this species is not browsed by ungulates the sites are protected by an emergency exclosure and the Kīpuka `Alalā Fence Unit, respectively, to prevent damage from trampling. The other major threats to *T.* sp. 1 are competition with alien plant species, primarily *Pennisetum setaceum* and *Senecio madagascariensis*.

METHODS

All individuals are monitored along transects spaced five meters apart. Data is collected according to PVA protocols.

RESULTS

Table 1.2.13-1. Monitoring results for *Tetramolopium* sp. 1.

	Site	Hours	Juveniles	Adults	Browse
2004	3	15	829	5	0%
2005	3	28.5	687	60	0%
2005	4	13	222	52	4%

DISCUSSION

Conclusions about population trends for this species are difficult to make due to inconsistent monitoring. The number of plants at Site 04 increased between monitoring but there was a four-year span between monitoring while site 03 was monitored in 2004 and 2005 and showed a decline in numbers. It is possible that if site 04 was monitored in 2004 it would have shown a decline in 2005.

MANAGEMENT RECOMMENDATIONS

Consistent monitoring is necessary to get an accurate picture of population trends. Weed control should be continued to prevent competition with non-native plant species and reduce fuel loads within and outside exclosures.

1.2.14 - *A`e, Zanthoxylum hawaiiense*, Hawaiian yellow wood

INTRODUCTION

Zanthoxylum hawaiiense (PS-2) is federally listed as endangered. The population is scattered throughout west-central to northwestern PTA. The species is found in IMU's 07, 09, 11, 13, 14, 15, 23, 24, 25, 26, 27, 29, 30 and many areas in between. Plant communities in which it is found are Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub understory, Sparse *Metrosideros* Treeland, *Myoporum-Dodonaea* Shrubland and *Myoporum* Shrubland (Shaw and Castillo 1997). The species occurs on both `a`ā and pāhoehoe flows of varying ages.

METHODS

Monitoring has not been implemented for this species. An understanding of the distribution of this species is incomplete. Accurately determining the distribution through surveys was a higher priority. Once completed a comprehensive monitoring program will be implemented.

RESULTS

Surveys have resulted in an increase in the number of known individuals to 465; though it is certain that more exist in areas not yet surveyed. The population is widely scattered with approximately 80% of plant locations as solitary individuals.

DISCUSSION

Plant locations previously recorded by CSU are inaccurate serving only as distributional information, making the use of the locations for monitoring of the species impractical. These distributions identify suitable habitat in which surveys are conducted to update and obtain more accurate location information. The extent of the population has been identified through rare plant surveys. Once the distribution of the species is better known management actions can be implemented, including weed, rodent, and ungulate control as well as monitoring.

The biggest concern in the management of this species is its lack of reproduction. Aside from only a few known juveniles, the population consists of mature adults. This is of concern for the future of this species. Several factors are hypothesized, including ungulate browse, seed predation by rodents and insects, and to a lesser extent invasive weed competition. Thus, the population, though much larger than previously estimated, is not considered healthy and viable.

MANAGEMENT RECOMMENDATIONS

There is relatively little known about this species other than its habit and characteristics. Therefore increased research is needed to find answers to best manage this species. Two projects are in the planning phase. One involves determining the sex of individual of *Z. hawaiiense* individuals, which is a dioecious species. The sex can only be determined during reproductive and fruiting phases. Surveying existing individuals at the appropriate time of year will enable us to sex individuals to determine likely areas where regeneration will be possible.

The second will be a research project to determine impediments to regeneration and determine what management actions will be required to promote regeneration. Combinations of fencing, weed and rodent control will be investigated. An insect study will be initiated to determine their impacts on the seed bank. In addition, increased focus on seed collection and propagation in the greenhouse to promote higher success rates will be highly beneficial.

The large-scale fence units required by the 2003 Biological Opinion will be of great benefit to the species. It will remove one of the factors believed to be preventing the species from regenerating (i.e. ungulate browse).

The current management strategy is to continue surveying appropriate plant communities where surveys have not yet occurred. This will determine the extent of the population. Then a density analysis will be performed to best determine population centers and where efforts are to be focused to control the many threats to this species and conduct research projects.

1.3 INTRODUCTION TO RARE ANIMAL SURVEYS AND MONITORING

The rare and endangered animals surveys are designed to provide basic understandings of which species are present and if present which habitats they occupy and utilize. Information gathered will be utilized to determine and guide management strategies for enhancing habitats and populations of these species. Because each species requires different monitoring techniques, the specific method uses is found with each species. Generally, monitoring and surveying for rare or birds with low population numbers are conducted using electronic calls broadcast over an amplifier (bullhorn). These calls are played for a predetermined time and distances. Visual and auditory surveys were conducted for the Hawaiian hoary bat.

1.3.1 - `Elepaio, *Chasiempis sandwichensis*

INTRODUCTION

Two pairs of `Elepaio are known from Kīpuka ´Alalā in Training Area 23 at PTA. The pairs are both located in *Mamane/Naio* Forest. The two territories are separated by approximately one kilometer. These are the last two pairs known from PTA. This is down from 35 birds banded in 1996 and 1998. Only one bird of the two remaining pairs was banded, therefore there was a 97% decrease of banded birds in 2005.

METHODS

Birds were located using recorded `elepaio calls broadcast over a speaker. Electronic calls were used as little as possible to avoid undue agitation to the breeding birds. Once the birds were found they were visually followed for as long as possible. Observations regarding nesting, mating, and young were noted.

RESULTS

Fledging birds were seen with each pair during the 2004 breeding season. Approximately 24 hours were spent tracking the adult birds in Sites 1 and 3 while restocking the rodenticide in the rodent control grids. In 2005 a juvenile was observed in Site 3. Approximately seven hours were spent tracking the adult birds in Sites 1 and 3 while restocking the rodenticide in the rodent grid. There was no response to broadcast calls in Site 2 in 2004 and 2005. Site 02 has not been occupied since 2001.

Table 1.3.1-1. Monitoring results for `Elepaio juveniles.

	2004	2005
Site 1	1	0
Site 3	1-2	1

DISCUSSION

The 2004 breeding season was the first confirmed successful `elepaio reproduction at PTA. It is unclear how many offspring the pair at Site 3 produced. In Site 3, a fledging bird was seen on June 4, 2004. The observer was unclear if two juveniles were present. On July 12, 2004 adults were again observed feeding a juvenile. This juvenile had downy plumage, indicating a much younger bird than was previously seen supporting the assumption of two juveniles in Site 3. The juveniles in Site 3 were not observed again in 2004.

The pair at Site 1 also produced a juvenile that was observed once on June 19, 2004. Subsequent attempts to locate the juvenile in 2005 failed. The juvenile may have moved from the parental territory edge or the bird did not have a strong response to the adult male call that was used for sampling.

In 2005, an adult at Site 3 was observed feeding a fledging bird on July 7. The young bird was able to fly but was still downy. The juveniles from 2004 were not seen in 2005 in or around the edges of the Site 3 territory.

Juveniles were not seen within Site 1 in 2005. Because birds fledged in 2004, it was possible they were still near the adult breeding territory. Therefore, approximately three hours were spent searching for 2005 hatch years and young from 2004 on the southern edge of the Site 1 territory. No juveniles were found.

It is difficult to assess the `elepaio population because only one of the four remaining birds is banded. It is assumed that the birds found on the same territories over the past three years are the same birds. With the addition of offspring from these pairs over the past two years, it will become more difficult to determine the identity of the birds, because of a lack of identification bands.

MANAGEMENT RECOMMENDATIONS

Because the last two breeding seasons have produced young birds, it is recommended that surveys at the edges of the territories take place in 2006. Continue rodent and cat control in and around nesting areas. If possible, coordinate banding the remaining birds for identification purposes.

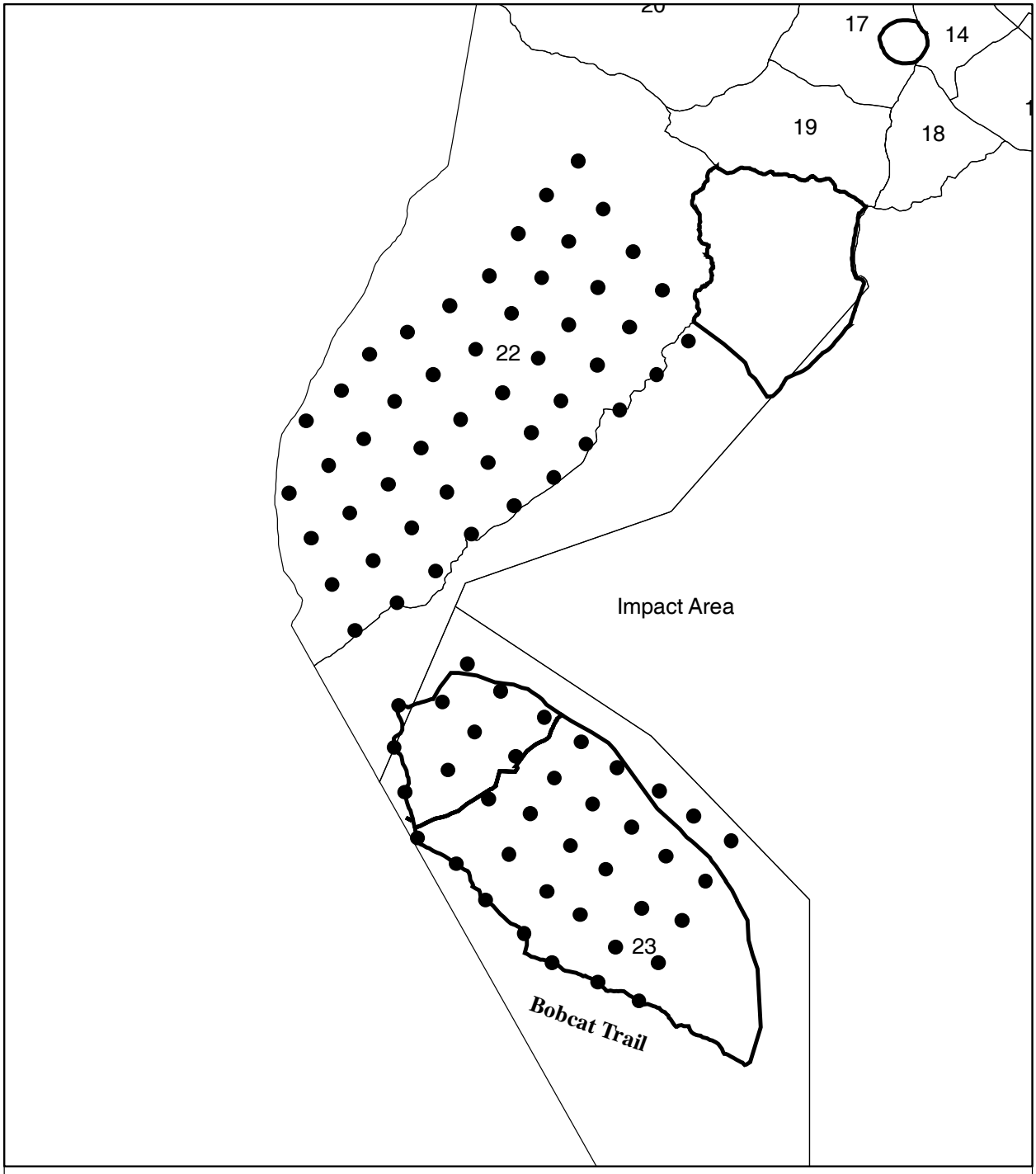
1.3.2 - `Io, Hawaiian Hawk, *Buteo solitarius*

INTRODUCTION

Historically the `io has been sighted at PTA; however no nests have been recorded. The `io breeding season begins in late March and continues through early October. `Io tend to respond well to recorded call play backs during pre-breeding and breeding periods (Klavitter 2000). Playbacks have been successful in many different habitats across the island from December through March and June (Klavitter 2000). Surveys were conducted quarterly to locate any resident birds and determine the periods of `io use at PTA.

METHODS

Transects were established 800 meters apart with station spaced at 800-meter intervals (Figure 1.3.2-1). This maximizes the amount of territory surveyed as well as prevents surveyor overlap of `io territories (Klavitter, 2000). Surveys were conducted under clear skies and low wind conditions to maximize sound transmission and detection. During the surveys wind speed, cloud cover and rain were recorded. Juvenile and adult calls were broadcasted for a total of 10 minutes at each survey station. The survey station, location, time, approximate distance from the bird, weather conditions, and type of activity (soaring, perched etc.) were recorded when birds were detected.



Io Surveys

- Io survey point
- Fence Units

Figure 1.3.2-1

Io Survey Points

Scale 1 : 100,000

2,000 1,000 0 2,000

Meters

N

RESULTS

An `In December 2003, and ´io was seen for 3 consecutive days in Training Area 23. Survey transects were created in Training Area 23 to document presence and absence of `io in compliance with the 2003 Biological Opinion.

No birds were observed during quarterly surveys in Training Area 23 during 2005. A total of 133 personnel hours over 17 survey days were conducted. In Training Area 23, a juvenile hawk was seen in November 2005 perching in a tree. This sighting was not made during the formal survey. The bird was unbanded and had light colored (light phase) plumage.

Table 1.3.2-1. ´Io sightings during reporting period.

Date	TA	Birds
2003	23	1
2005	23	1

MANAGEMENT RECOMMENDATIONS

Establish and survey transects in Training Areas 1-4 and 22 in 2006 in attempts to detect the sporadic use of the area. Create a rare animal sighting database and include a GIS component to analyze any potential `io habitat preferences. To increase the confidence of inferring ´io absence from the study areas use statistical probability tests.

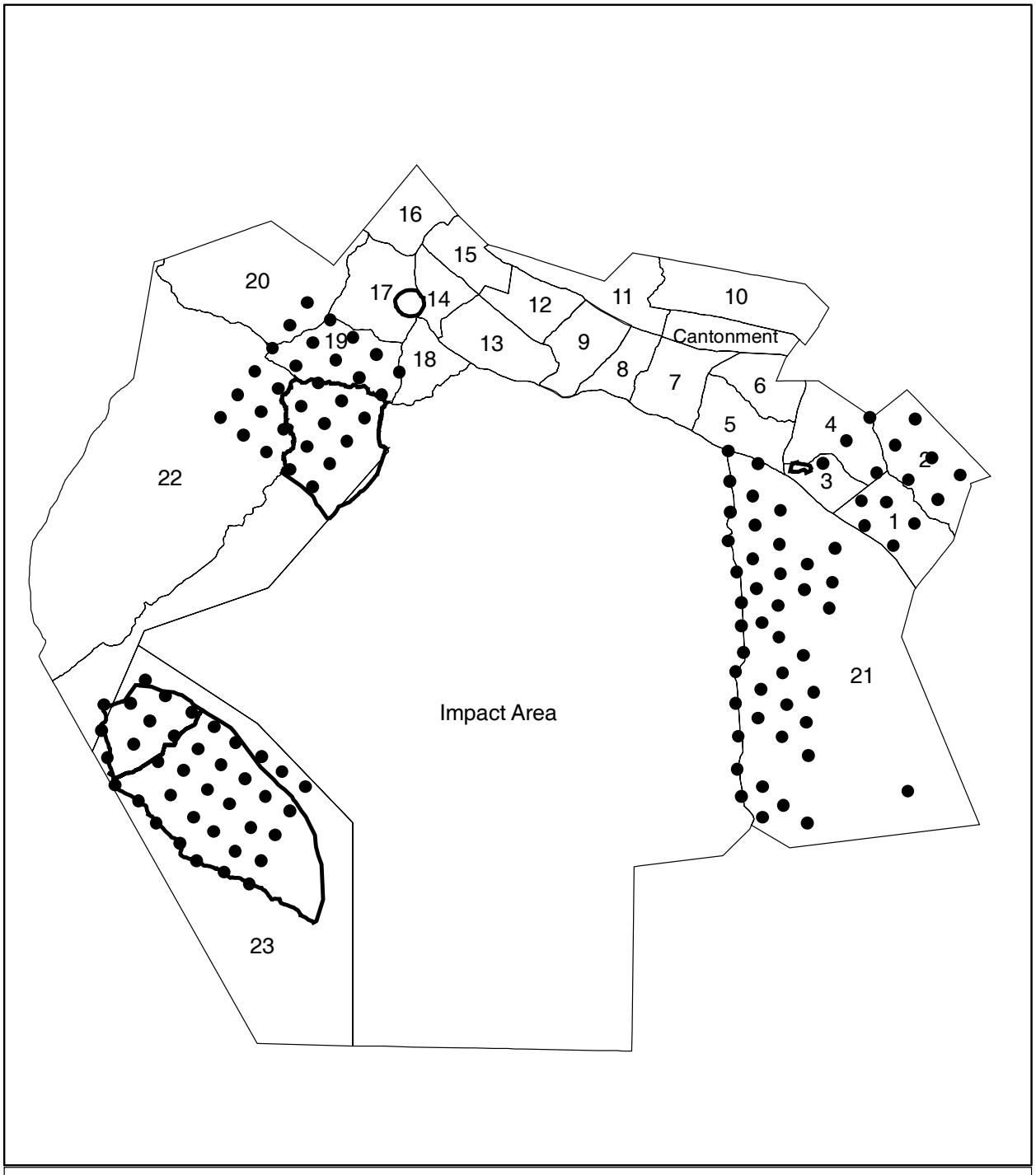
1.3.3 - Nēnē, Hawaiian Goose, *Branta sandvicensis*

INTRODUCTION

The Hawaiian goose (Nēnē), *Branta sandvicensis* has no known resident populations at PTA. Infrequent sightings have been reported on PTA, including banded birds indicating they are from one of the managed populations outside of PTA. Nēnē are known to use habitat types that occur on PTA including high-elevation sparsely vegetated lava flows and open native alpine shrubland and woodlands. Surveys to evaluate nēnē use on PTA are required in the PTA Biological Opinion (USFWS 2003).

METHODS

Nēnē surveys were conducted in four study areas where the majority of nēnē sighting have historically occurred (Training Areas 1-4, 19, 21, 22 and 23). Nēnē flocking activity increases during the pre-breeding season (October to November) and the post-breeding season (May to July). Timing of the surveys coincided with these seasons and surveys began in the spring of 2005. A two-method approach was used to determine nēnē locations. The first method placed observers on high vantage points to observe nēnē departing or returning to roosting locations. The second method incorporated transects spaced 800 meters apart with stations positioned at 800 meter intervals. Observers broadcasted recorded nēnē calls for three minutes followed by two minutes of observation with and without binoculars. The cycle was then repeated once for a total of ten minutes of observation. Data on weather conditions, sightings or calls heard were recorded.



Nene Surveys

- Nene survey point
- Fence Units

Figure 1.3.3-1

Nene Survey Points

Scale 1 : 165,000

3,000 1,500 0 3,000

Meters

N

RESULTS

Approximately 166 personnel hours were expended over 20 days to complete two cycles of the nēnē surveys. Survey results are reported in Table 1.3.3-1.

Table 1.3.3-1. Survey results for Nēnē.

	Hours	Nēnē
B. sandvicensis	166	0

More than 59 nēnē birds were sighted at PTA or near the eastern boundary during the report period, despite no nēnē being detected during surveys. Most of the sightings took place from May to October.

Table 1.3.3-2 Summary of Nēnē sighting at PTA.

Date	Training Area	Number of Nēnē
June, 2004	22	6
July, 2004	23	4
August, 2004	21	5
February, 2005	22	4
February 18, 2005	5	1
May 23, 2005	19	10
June 4, 2005	Cantonment	*
June 9, 2005**	-	4
July 9, 2005**	-	6
August 10, 2005	23	6-7
August 30, 2005	23	2
September 21, 2005	21	5
October 22, 2005	21	3
October 25, 2005	21	5

* The birds were heard and not seen
** These sightings took place just east of PTA, near the boundary.

Table 1.3.3-3. Leg-band combinations recorded from Nēnē sightings.

Date	Training Area	Band Color	Band Letters
July, 2004	23	White	NP
		Red	LU
February 18, 2005	5	Red	XY
October 22, 2005	21	Red	ZY
		Black	LL
		Black	DL
October 25, 2005	21	Green	121
		Green	122
		Green	123
		White	JB

DISCUSSION

It is unclear how nēnē are using PTA. Birds have been seen at PTA in a variety of habitats. In February 2005, a young male that hatched at Hakalau National Wildlife Refuge (HNWR), was found in a grassy kīpuka near the Saddle Road in Training Area 5. The bird stayed in the general area for about two weeks. PTA NRS has not been able to obtain information whether this bird has been sighted back at HNWR. Band combinations have been obtained for other individuals, but information on the birds has been difficult to obtain because the State database of nēnē band combinations is disorganized. It would be beneficial to develop a relationship with the HNWR biologist to collaborate on band and bird information.

It is clear from comparing survey results to incidental sightings that the surveys are inadequate. The numbers of birds utilizing PTA are unknown. The number is assumed to be small and the survey methods may not be able to pick up low numbers of birds that sporadically utilize the area. It appears from the survey results that there is not a resident or breeding population of nēnē at PTA.

MANAGEMENT RECOMMENDATIONS

Surveys over broad landscapes have not yielded any beneficial information for management of nēnē at PTA. Examine survey protocols to determine if adjusting sampling frequency may result in positive detections. To better understand how nēnē birds are utilizing PTA, preferred habitat use, frequency, and times of year is essential. From the sightings data it appears that nēnē frequent specific training areas, but the training areas are geographically large and it is unclear if they frequent the same locations within the training areas. Using radio transmitters and radio receivers to track nēnē movements may be useful to begin to understand how nēnē birds are using PTA's resources. This method would be more efficient because personnel time is focused on the birds instead of surveying large areas that are sporadically used. Also, the data generated would begin to illuminate how nēnē birds are using PTA, which is the first step in understanding how to manage the habitat for this endangered species.

Create a database for rare animal sightings and incorporate nēnē sightings into GIS to determine if there are usage patterns. Partner with the PTA Range Maintenance and Range Control divisions to make reporting nēnē sightings easy and reliable. Try to get more reliable band combinations and find the most expedient method for obtaining information on those birds. Join the nēnē working group and begin to establish working relationships with the nēnē managers on the island. Begin to set the ground work for a possible joint nēnē radio telemetry study with the nēnē working group.

1.3.4- `Ua`u, Petrel, *Petrodroma phaeopygia sandwichensis*

INTRODUCTION

In 1995, Cooper *et al*. conducted a marine radar survey for sea birds and bats at PTA. This was the first formal survey for `ua`u at PTA and covered most of the installation. Three of the survey points on the eastern side of PTA were sampled again in 2000. In 1997, 1998, 2003, over-night surveys were conducted for `ua`u in the southern portion of Training Area 23 above 7,500 foot elevation. Each survey was conducted over two nights and three days.

The 2003 Biological Opinion requires that surveys for `ua`u using marine radar be initiated at PTA, in conjunction with U.S. Fish and Wildlife Service, by 2005. However, marine radar is not suitable for use at PTA due to the low density of birds.

MANAGEMENT RECOMMENDATIONS

Additional ground based surveys, if required, should focus on suitable habitat. Night vision equipment should be used to survey for nesting birds. During the daylight surveys suitable blisters, cracks, and caves should be examined for bones and carcasses

Discuss with monitoring experts and the USFWS the efficacy of using marine radar in the surveys for `ua`u at PTA. This may not be the most effective and appropriate method considering the density of birds, limited resources, and high cost of employing marine radar.

1.3.5 - Forest Bird Population Monitoring

INTRODUCTION

PTA NRS has been conducting annual avian surveys since 1998. This data set is designed to identify trends in bird populations and to be compatible with state-wide efforts. Protocols used and data collection follow guidelines set forth by the Hawaii Forest Bird Interagency Database Project (HFBIDP) (Web site http://biology.usgs.gov/pierc/HFBIDPSite/HFBIDPHome.htm).

METHODS

A total of 15 bird population monitoring transects have been established in Kīpuka `Alalā, the Palila Critical Habitat and Training Area 22 (Figure 1.3.5-1). Counting stations are located along the transects every 150 meters. The counting method is based on the U.S. Fish and Wildlife Service Hawaiian Forest Bird variable circular-plot (VCP) survey methods (Scott et al. 1986). Counts at each station are conducted for six minutes between 0545 and 1100 hours. Every bird of each species heard or seen is recorded. The distance to every bird detected is recorded in meters. Weather conditions are also noted.

Surveys were conducted in December 2003, 2004 and 2005. Four primary counters, Lena Schnell, Darryl York, Lance Tominaga and Aubrey Kelly conducted the surveys. Counts were not conducted on days when the weather was not within established guidelines.

RESULTS

No trend results are available at this time for the 2003 to 2005 data.

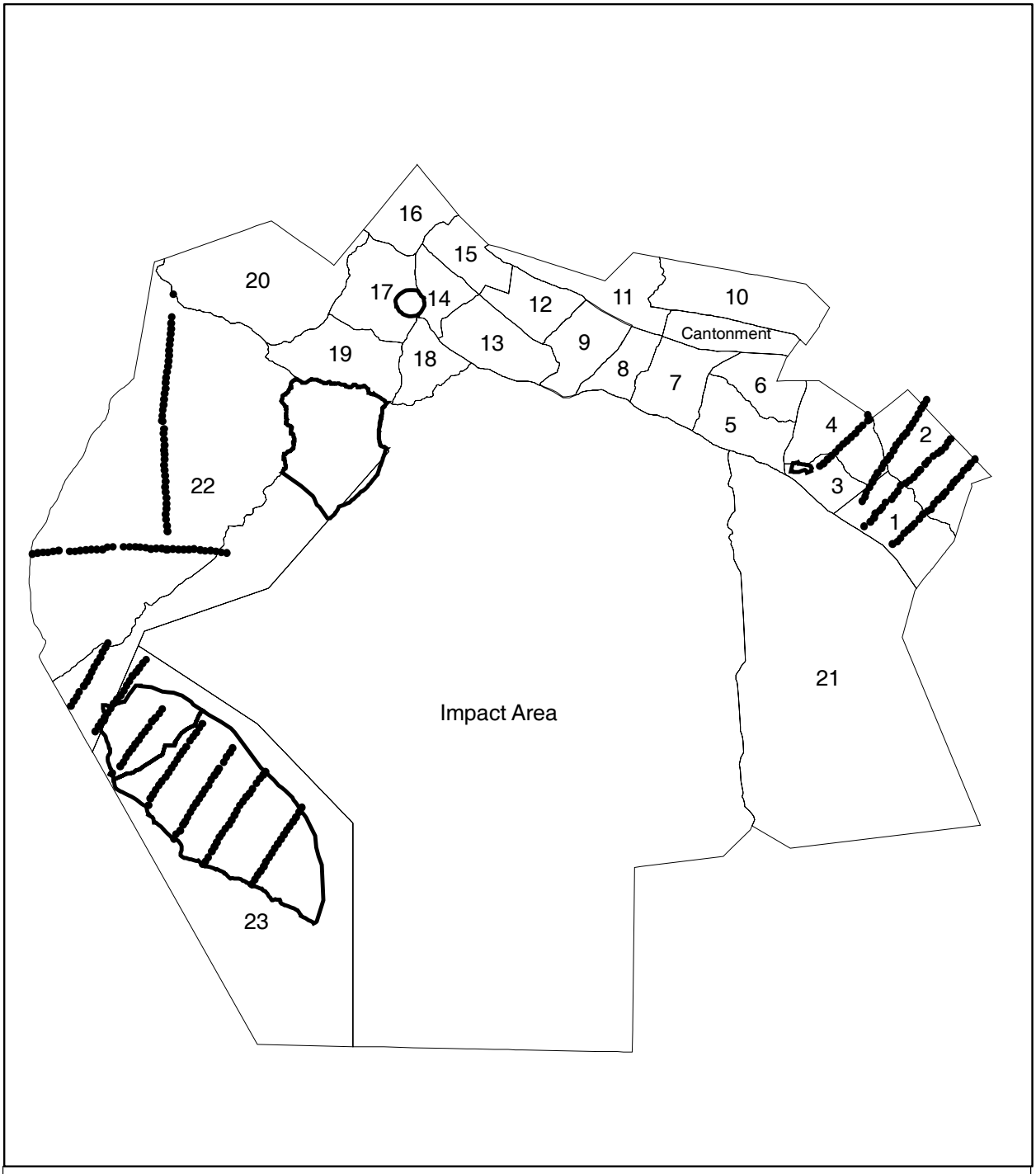
DISCUSSION

The data collected in 2003 was entered into a database that only runs on Windows 1995 and no machines with that operating system are functional to run the analysis. Following direction from the HFBIDP, data collected in 2004 and 2005 was not entered into the old database. A new database was developed in 2006 and 75% of the data from 2004 and 2005 has been entered into the new database. Ninety-five percent of the data from 1998 to 2003 has been converted to the new database.

Biologists that have experience with the statistical program “Distance” have recently been hired and tasked with providing a trend analysis which will be ready by 2006.

MANAGEMENT RECOMMENDATIONS

Finish entering data and converting old data to into the new HFBIDP database format. Conduct trend analysis using “Distance” on data from 1998 to 2005.



Annual Bird Surveys

- Bird survey transect station
- Fence Units

Figure 1.3.5-1

Annual Bird Survey Points

Scale 1 : 165,000

3,000 1,500 0 3,000

Meters

N

1.3.6 - `Ōpe`ape`a, Hawaiian Hoary Bat, *Lasiurus cinereus semotus*

INTRODUCTION

The Hawaiian Hoary Bat is endemic to the State of Hawai`i where it is the only extant, native terrestrial mammal. It has been documented historically on the islands of Hawai`i, Maui, Moloka`i, O`ahu, Kaua`i, and possibly Kaho`olawe. It is now resident only on Hawai`i, Maui, and Kaua`i. Current and historical population numbers are unknown for the bat, but the species is believed to have declined over the past 100 years. The bat population at PTA is an unknown proportion of the subspecies' distribution, for which there are no abundance estimates. The primary factor limiting recovery is thought to be habitat loss, primarily the availability of roosting sites; suitable roosting habitat is particularly important to pregnant and lactating females and non-volant young.

The goal of this project was to make a preliminary assessment of presence or absence of Hawaiian Hoary bats in various habitat types throughout PTA. Data collected during these surveys will help to develop standardized survey and monitoring techniques for the determination of bat abundance, distribution, and roosting habitat associations as required by the 2003 Biological Opinion.

METHODS

Presence/absence surveys were conducted at 50 predetermined locations from May-June 2005 and again from November-December 2005. Vegetation types at PTA were grouped into 5 broad categories (i.e., grassland, open shrubland, dense shrubland, open woodland, and dense woodland). The number of survey locations in a vegetation grouping is proportional to the total area of PTA that is composed of each vegetation grouping.

During the 2.5-hour detection period (one hour before sunset to 1.5 hours after sunset) observers visually scanned the sky and simultaneously listened for auditory detections with a bat detector. Auditory detections consisted of bat calls, (i.e., the ultrasonic train of licks emitted by bats as they forage or commute).

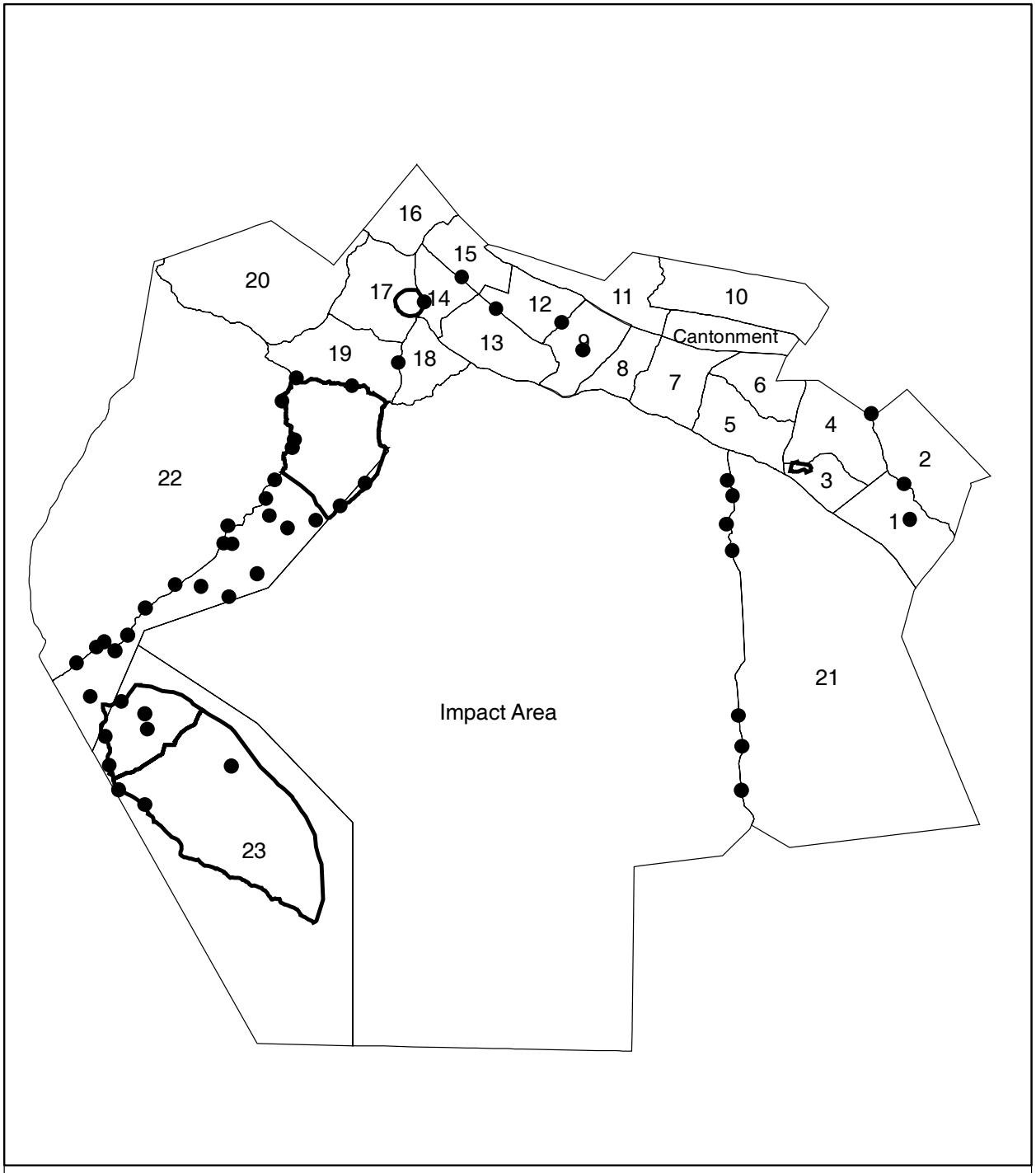
The frequency of observations within the five vegetation grouping was calculated to determine use of each. Preference was demonstrated for a vegetation grouping when bats were detected in greater proportion than the vegetation grouping is available throughout PTA. Four categories of preference were defined: 1) selection; habitat used more than expected by chance, 2) proportional use; habitat used in proportion to its availability, 3) low use; habitat used less than expected by chance, and 4) avoidance; habitat not used.

RESULTS

Results from the summer survey demonstrated a preference for dense woodland habitat types that occur on PTA, as was expected from previous survey results. The data from the winter survey did not detect a significant difference in habitat preference. Woodlands comprise 53% of PTA and degradation of this habitat by ungulates, invasive weed species, and wildfire could be detrimental to the long-term survival of bats at PTA. Pregnant or lactating females and non-volant young would be especially vulnerable to habitat degradation. In the future, woodland habitat will be the focus of survey and monitoring efforts. We will continue to monitor for bat activity on a semi-annual basis and it is hoped we can determine if the bat population on PTA is stable over the long-term.

MANAGEMENT RECOMMENDATIONS

Develop more statistically rigorous techniques to collect information regarding habitat use. Automating data collection equipment and techniques will be incorporated into the project.



Bat Surveys

- Bat survey point
- Fence Units

Figure 1.3.6-1

Hawaiian Hoary Bat Surveys

Scale 1 : 165,000

3,000 1,500 0 3,000

Meters

N

1.3.7 - *Rhyncogonus stellaris*

INTRODUCTION

The genus, *Rhyncogonus* is restricted to the Pacific (Polynesia) region and no longer exists on adjacent continental areas (G.A. Samuelson 2003). All species are flightless; therefore, it is probable they were transported here via migratory birds. Since they lack wings they may be more vulnerable to alien predators. Adults are leaf chewers while larvae are associated with the roots of their host plant. They are robust, heavy-bodied insects ranging from 10-18 millimeters long (G.A. Samuelson 2003). They tend to associate with a narrow range of plants, usually confined to specific plant communities such as *Chenopodium oahuense* dominated communities.

Rhyncogonus stellaris was first collected in 1939 (G.A. Samuelson 2003). Historically the native weevil was found in the North Kona and South Kohala districts along the coastal lowlands. Alien predators and habitat disturbances may have been detrimental to the species. Currently, their range seems to be restricted to PTA. *Rhyncogonus* species are typically active throughout the day and night. However, Hawaiian species seem a little more elusive (Claridge 2004). In 2002, Peter Oboyski found two individuals in Training Area 22. In 2004, Jon Giffin found an individual on *Chenopodium oahuensis* in Training Area 19. Little is known about its habitat requirements and distribution at PTA or other areas. Other potential host-plants and ecological use patterns for *R. stellaris* are unknown (Hawai`i Natural Heritage Program 1998).

The limited distribution and risk of fire are management concerns *R. stellaris*. The species is currently only known from the Kīpuka Kālawamauna Endangered Plant Habitat. This is a fire prone habitat that portions of are manage for rare plant species.

METHODS

Eight study sites were established within the *Dodonaea* Mixed Shrubland at 1580 meters elevation. These are similar characteristics to those in which an individual of *R. stellaris* was collected in 2004. All individual *C. oahuensis* and *Dodonaea viscosa* within a 150 meter radius of the road at each study site were surveyed. All surveys were conducted during early morning hours or at dusk. Each site was visited 1-2 times per month. The collections were made using cotton beat sheets and a collection net. A sieve was used to sample the vegetation, leaf litter and soil. Surveys were conducted from March 2004 to September 2005.

RESULTS

A total of 18 individuals were found in August 2004 through September 2004 at Site 2 (Table 1.3.7-1). The weevils were observed in the crown of *C. oahuensis* during early morning hours between 8:30 and 9:30 am.

On August 16, 2004, one male *R. stellaris* was found in Training Area 19 inside gate two near Kona highway. On August 24, 2004, one female, one male, and one mating pair were recorded between 8:30 and 9:30 am. All weevils were found amongst the crown of the *C. oahuensis* exposed and easily visible. What appeared to be one male and one female were collected for closer examination. The male measured 0.9 centimeters and the female 1.1 centimeters. S*ida falax*, *D. viscosa, C. oahuensis,* and moist cotton balls were placed inside an observation container with the weevils. They were observed eating the *Chenopodium oahuensis*. On August 30, 2004 four more individuals were found. On September 9, 2004 one mating pair and six individuals were found. On October 10, 2004, one more single *R. stellaris* was found. These were the last observed individuals and or mating pairs. A sample was sent to G.A. Samuelson and the identification as *R. stellaris* was confirmed.

Table 1.3.7-1. Survey results for *Rhyncogonus stellaris*.

Site	Training Area	Mating Pairs	Females	Males
1	19	0	0	0
2	19	4	6	2
3	9	0	0	0
4	13	0	0	0
5	17	0	0	0
6	17	0	0	0
7	19	0	0	0
8	19	0	0	0

DISCUSSION

There are several possible reasons for why the weevil has not been collected at the other seven sites and or why they have not been observed since last year in Site 2. First, the other sites exhibit increased signs of habitat disturbance. Such as, the invasion of fountain grass, *Pennisetum setaceum*, and *Tagetes minuta*. Second, the native shrubs in the other seven sites, particularly the *C. oahuensis,* have a smaller leaf surface potentially from water stress. As a result of taking monthly rain gauge data for a year from each site; Site 2 received the highest monthly average of 0.3 centimeters.

A potential threat or competitor, *Asynonychus godmanii*, was observed at all of the study sites on the same host plant, *C. oahuensis*. *A. godmanii* is an introduced weevil species. *A. godmanii* may out-compete *R. stellaris* for resources since both species share host plants. This additional stressor could be detrimental to the *R. stellaris* population at PTA. Non-native insects tend to be opportunistic and exhibit a "weed like quality in such that, they have the ability to generate large populations in a short amount of time and are efficient at gathering scarce resources, as a result, it makes them better competitors than their native counterparts" (Oboyski *et al.* 2001).

MANAGEMENT RECOMMENDATIONS

Increase the sampling to include more sites with in the *Chenopodium oahuense* vegetation type. Continue to sample different potential host plants to gain more knowledge on *R. stellaris'* habitat distribution within PTA. Expand survey range of known population site with hopes of discovering insights on its habits and /or life cycle. Survey and control for other potentially devastating predators such as the Argentine Ant, *Linepithema humile*. Control for invasive weeds by creating a buffer around Site 2. Construct firebreak to protect habitat as required by 2003 Biological Opinion.